Q2A

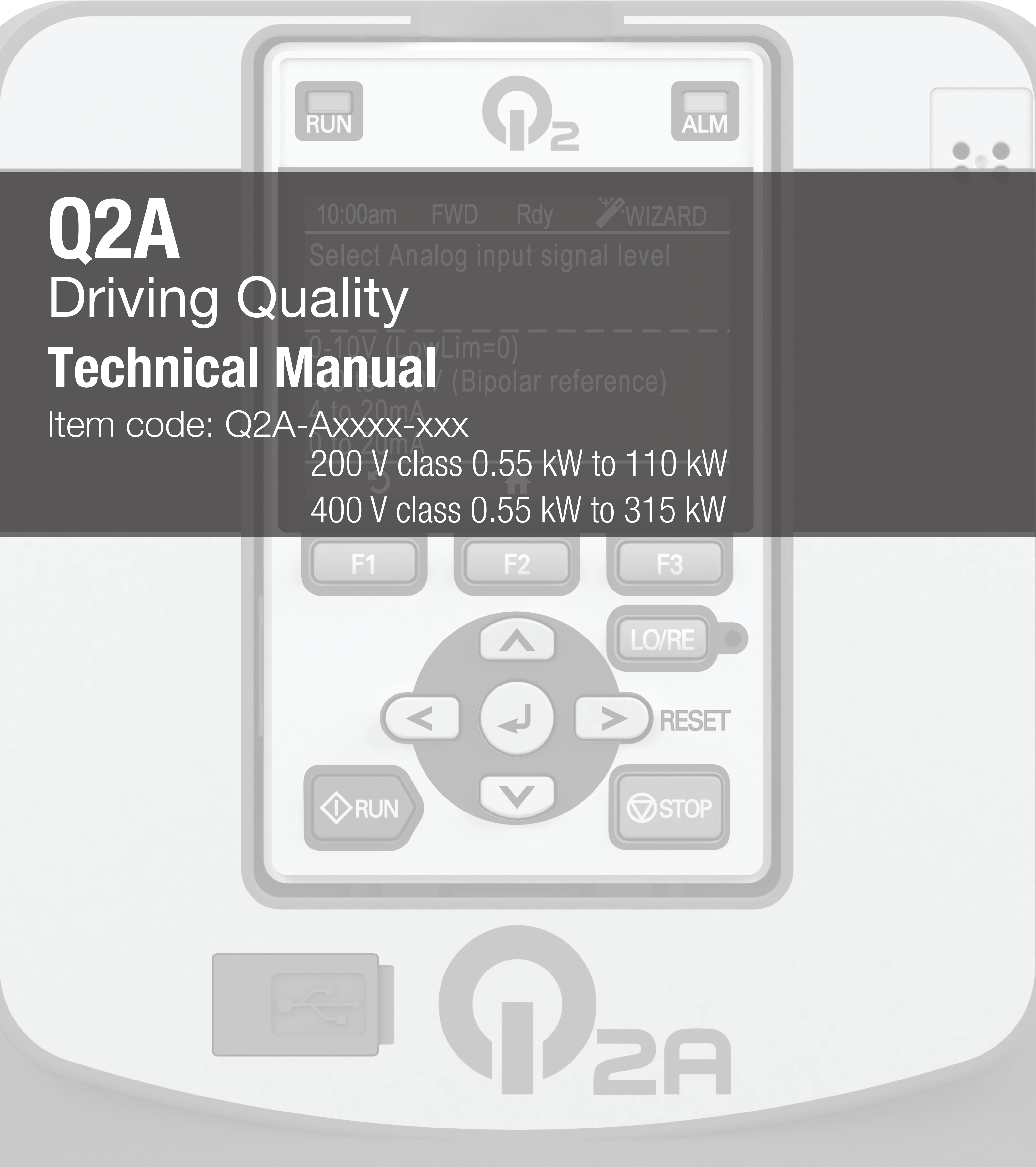
Driving Quality

Technical Manual

Item code: Q2A-Axxxx-xxx

200 V class 0.55 kW to 110 kW

400 V class 0.55 kW to 315 kW



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Preface and General Precautions

This chapter gives information about important safety precautions for the use of this product. Failure to obey these precautions can cause serious injury or death, or damage to the product or related devices and systems.

i.1 Safety Information

Read and understand this manual before you install, operate, or do maintenance on the drive. Install the drive as specified by this manual and local codes.

The symbol marks in this section identify safety messages in this manual. Failure to obey these safety messages can cause serious injury, death, or damage to the products and related equipment and systems.

These identifier words categorize and emphasize important safety precautions in these instructions.

⚠DANGER
Identifies a hazardous situation, which, if not avoided, will cause death or serious injury.

⚠WARNING
Identifies a hazardous situation, which, if not avoided, can cause death or serious injury.

⚠CAUTION
Identifies a hazardous situation, which, if not avoided, can cause minor or moderate injury.

NOTICE
Identifies a property damage message.

◆ General Safety Precautions

- Some figures in the instructions include options and drives without covers or safety shields to more clearly show the inside of the drive. Replace covers and shields before operation. Use options and drives only as specified by the instructions.
- The figures in this manual are examples only. All figures do not apply to all products included in this manual.
- The manufacturer can change the products, specifications, and content of the instructions without notice to make the product and/or the instructions better.
- If you damage or lose these instructions, contact a representative or the nearest sales office of the manufacturer on the rear cover of the manual, and tell them the document number to order new copies.

⚠DANGER

Do not ignore the safety messages in this manual. The operating company is responsible for injuries or equipment damage caused from ignoring the messages in this manual.

Failure to obey the safety messages will cause death or serious injury.

Electrical Shock Hazard

Electrical Shock Hazard. Do not examine, connect, or disconnect wiring on an energized drive. Before servicing, disconnect all power to the equipment and wait for the time specified on the warning label at a minimum. The internal capacitor stays charged after the drive is de-energized. The charge indicator LED extinguishes when the DC bus voltage decreases below 50 Vdc. When all indicators are OFF, measure for dangerous voltages to make sure that the drive is safe.

If you do work on the drive when it is energized, it will cause serious injury or death from electrical shock.

⚠WARNING

Crash Hazard

Test the system to make sure that the drive operates safely after you wire the drive and set parameters.

Failure to obey can cause injury or damage to equipment.

Sudden Movement Hazard

Make sure that the setting values for virtual input and output function parameters are correct before a test run. Virtual input and output functions can have different default settings and operation.

Failure to obey can cause injury or death.

Remove all persons and objects from the area around the drive, motor, and machine area and attach covers, couplings, shaft keys, and machine loads before energizing the drive.

Failure to obey can cause death or serious injury.

When you use Q2pack to make custom programming, the drive I/O terminal functions change from factory settings and the drive will not operate as written in this manual. Examine the I/O signals and internal sequence with the engineer who made the Q2pack program before operation.

Failure to obey can cause death or serious injury.

Electrical Shock Hazard

Do not make changes to the drive body or drive circuitry.

Failure to obey can cause death or serious injury and will void warranty. The manufacturer is not responsible for changes to the product made by the user.

Only let authorized persons install, wire, maintain, examine, replace parts, and repair the drive.

Failure to obey can cause death or serious injury.

Do not remove covers or touch circuit boards while the drive is energized.

Failure to obey can cause death or serious injury.

Do not immediately energize the drive or operate peripheral devices after the drive blows a fuse or trips an RCM/RCD. Wait for the time specified on the warning label at a minimum and make sure that all indicators are OFF. Then check the wiring and peripheral device ratings to find the cause of the problem. Contact the manufacturer before energizing the drive or peripheral devices if the cause is not known.

Failure to obey can cause death or serious injury and damage to the drive.

Fire Hazard

Do not use the main circuit power supply (Overcurrent Category III) at incorrect voltages. Make sure that the drive rated voltage aligns with the power supply voltage before energizing the drive.

Failure to obey can cause death or serious injury.

Install sufficient branch circuit short circuit protection as specified by applicable codes and this manual. The drive is suited for circuits that supply not more than 100,000 RMS symmetrical amperes, 240 Vac maximum (200 V Class), 480 Vac maximum (400 V Class).

Failure to obey can cause death or serious injury.

⚠CAUTION

Crush Hazard

Do not hold the drive by the front cover or terminal cover. Tighten the screws correctly before moving the drive.

Failure to obey can cause minor to moderate injury.

NOTICE

Use a motor that provides insulation correct for PWM drives.

Failure to obey can cause a short circuit or ground fault from insulation deterioration.

Observe correct electrostatic discharge (ESD) procedures when touching the drive and circuit boards.

Failure to obey can cause ESD damage to the drive circuitry.

Do not do a withstand voltage test or Megger test on the drive.

Failure to obey can cause damage to the drive.

Do not connect or operate damaged equipment or equipment with missing parts.

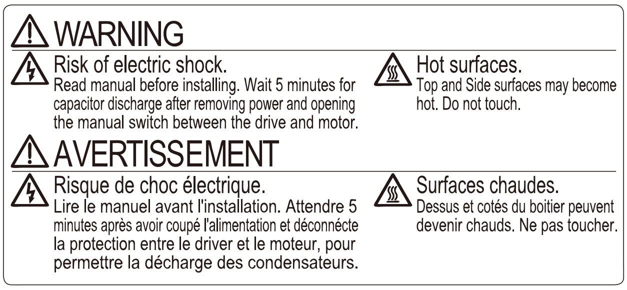
Failure to obey can cause damage to the drive and connected equipment.

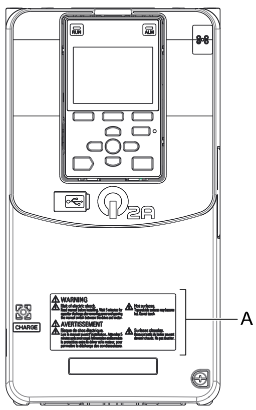
If it is necessary to use disinfectant or to debug wood material for packaging, use a method other than steam. Example: Heat treatment (core at 56 °C [133 °F] or higher for more than 30 minutes)

Gas steam from fumigated wooden packaging materials can cause damage to electrical components. Halogen disinfectants (fluorine, chlorine, bromine, and iodine) erode capacitors, and DOP gas (phthalic acid ester) cracks resin materials. Do all treatment procedures before packaging components.

◆ Warning Label Content and Location

Use the drive as specified by the warning label on the drive.





A - Warning label

Figure i.1 Warning Label Content and Location

i.2 Legal Information

◆ Warranty and Exclusion of Liability

- This product is not designed and manufactured for use in life-support machines or systems.
- Contact a representative or your sales representative of the manufacturer if you are considering the application of this product for special purposes, such as machines or systems used for passenger cars, medicine, airplanes and aerospace, nuclear power, electric power, or undersea relaying.

⚠WARNING

Injury to Personnel

This product was manufactured under strict quality-control guidelines. Install applicable safety devices to minimize the risk of accidents when installing the product where its failure could cause a life-or-death situation, loss of human life, or a serious accident or physical injury.

◆ About Registered Trademarks

- CANopen is a registered trademark of CAN in Automation (CIA).
- CC-Link is a registered trademark of CC-Link Partner Association.
- DeviceNet is a registered trademark of Open DeviceNet Vendor Association, Inc. (ODVA).
- EtherCAT is a registered trademark of Beckhoff Automation GmbH.
- EtherNet/IP is a registered trademark of Open DeviceNet Vendor Association, Inc. (ODVA).
- LonWorks and LonTalk are registered trademarks of Echelon Corporation.
- MECHATROLINK-I, MECHATROLINK-II, and MECHATROLINK-III are registered trademarks of MECHATROLINK Members Association (MMA).
- Modbus is a registered trademark of Schneider Electric SA.
- PROFIBUS-DP and PROFINET are registered trademarks of PROFIBUS International.
- Other company names and product names in this document are trademarks or registered trademarks of the respective companies.

1

Receiving

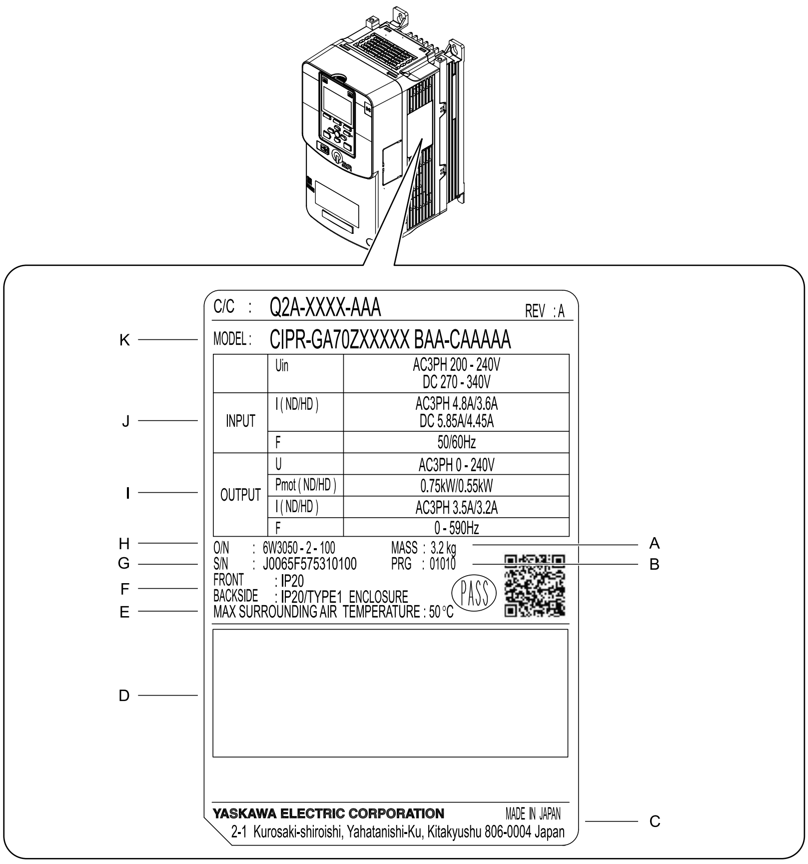
This chapter gives information about the different drive models and features, and how to examine the drive when you receive it.

1.1 Model Number and Nameplate Check

Please check these items after receiving the drive:

- Examine the drive for damage. Immediately contact the shipping company if the drive is damaged. The warranty does not cover damage from shipping.
- Verify the drive model number in the "MODEL" section of the drive nameplate to make sure that you received the correct model.
- Contact your supplier if you receive the incorrect drive model or if the drive does not operate correctly.

◆ Nameplate



A - Mass
B - Drive software version
C - The address of the head office of Yaskawa Electric Corporation
D - Accreditation standards
E - Surrounding air temperature
F - Protection design
G - Serial number
H - Lot number
I - Output specifications
J - Input specifications
K - Drive model

Figure 1.1 Nameplate Information Example

◆ How to Read Type Designations

Use the following information to read the drive type designations.

```
Q2A - A 4 002 - A A A
 1  2   3 4  5    6 7 8
```

Figure 1.2 Drive Type Designation

Table 1.1 Model Number Details

No.	Description
1	Q2 Series
2	A Series
3	IP Protection Class • A: IP20
4	Input Power Supply Voltage • 2: Three-Phase AC 200 V Class • 4: Three-Phase AC 400 V Class
5	Rated Output Current **Note:** Refer to the rated output current list for more information.
6	Specification • A: Standard
7	Coating Specification • A: Standard
8	Version

■ Rated Output Current

These output current values are applicable for drives that operate at standard specifications.

- These output current values are applicable for drives that operate at standard specifications.
- Derate the current in applications that:
  – Increase the carrier frequency
  – Have high ambient temperature
  – Install drives side-by-side.
- Use *C6-01 [ND/HD Duty Selection]* to select Normal Duty rating (ND) or Heavy Duty rating (HD).

Table 1.2 Three-Phase AC 200 V Class

Model	Heavy Duty Rating (HD) [C6-01 = 0] (Default)		Normal Duty Rating (ND) [C6-01 = 1]	
	Maximum Applicable Motor Output kW	Rated Output Current A	Maximum Applicable Motor Output kW	Rated Output Current A
2004	0.55	3.2	0.75	3.5
2006	0.75	5	1.1	6
2010	1.5	8	2.2	9.6
2012	2.2	11	3	12.2
2018	3	14	4	17.5
2021	4	17.5	5.5	21
2030	5.5	25	7.5	30
2042	7.5	33	11	42
2056	11	47	15	56
2070	15	60	18.5	70
2082	18.5	75	22	82
2110	22	88	30	110
2138	30	115	37	138
2169	37	145	45	169
2211	45	180	55	211
2257	55	215	75	257
2313	75	283	90	313
2360	90	346	110	360
2415	110	415	-	-

Table 1.3 Three-Phase AC 400 V Class (Input Voltage < 460 V)

Model	E1-01 [Input AC Supply Voltage] < 460			
	Heavy Duty Rating (HD) [C6-01 = 0] (Default)		Normal Duty Rating (ND) [C6-01 = 1]	
	Maximum Applicable Motor Output kW	Rated Output Current A	Maximum Applicable Motor Output kW	Rated Output Current A
4002	0.55	1.8	0.75	2.1
4004	1.1	3.4	1.5	4.1
4005	1.5	4.8	2.2	5.4
4007	2.2	5.5	3.0	7.1
4009	3.0	7.2	4.0	8.9
4012	4.0	9.2	5.5	11.9
4018	5.5	14.8	7.5	17.5
4023	7.5	18	11	23.4
4031	11	24	15	31
4038	15	31	18.5	38
4044	18.5	39	22	44
4060	22	45	30	59.6
4075	30	60	37	74.9
4089	37	75	45	89.2
4103	45	91	55	103
4140	55	112	75	140
4168	75	150	90	168
4208	90	180	110	208
4250	110	216	132	250
4296	132	260	160	296
4371	160	304	200	371
4389	200	371	220	389
4453	220	414	250	453
4568	250	453	315	568
4675	315	605	355	675

Table 1.4 Three-Phase AC 400 V Class (Input Voltage ≥ 460 V)

Model	E1-01 [Input AC Supply Voltage] ≥ 460			
	Heavy Duty Rating (HD) [C6-01 = 0] (Default)		Normal Duty Rating (ND) [C6-01 = 1]	
	Maximum Applicable Motor Output HP	Rated Output Current A	Maximum Applicable Motor Output HP	Rated Output Current A
4002	3/4	1.6	1	2.1
4004	1	2.1	2	3.4
4005	2	3.4	3	4.8
4007	3	4.8	4	6.9
4009	4	6.9	5	7.6
4012	5	7.6	7 1/2	11
4018	7 1/2	11	10	14
4023	10	14	15	21
4031	15	21	20	27
4038	20	27	25	34

Model	E1-01 [Input AC Supply Voltage] ≥ 460			
	Heavy Duty Rating (HD) [C6-01 = 0] (Default)		Normal Duty Rating (ND) [C6-01 = 1]	
	Maximum Applicable Motor Output HP	Rated Output Current A	Maximum Applicable Motor Output HP	Rated Output Current A
4044	25	34	30	40
4060	30	40	40	52
4075	40	52	50	65
4089	50	65	60	77
4103	60	77	75	96
4140	75	96	100	124
4168	100	124	125	156
4208	125	156	150	180
4250	150	180	200	240
4296	200	240	250	302
4371	250	302	300	361
4389	300	361	350	414
4453	350	414	400	477
4568	400	477	450	515
4675	-	-	-	-

1.2 Features and Advantages of Control Methods

This drive has 9 available control methods from which to select for different applications.

Table 1.5 V/f and CL-V/f Features and Advantages of Control Methods

Control Method Selection	Open Loop V/f Control (V/f)	Closed Loop V/f Control (CL-V/f)	Notes
Controlled Motor	**Induction Motor**		**-**
Parameter Settings	A1-02 = 0	A1-02 = 1	-
Basic Control	V/f	Closed loop V/f control with speed correction	-
Main Applications	General-purpose variable speed control to connect more than one motor to one drive.	High-precision speed control with encoders on machines	-
PG Option Card	Not necessary	Necessary (PG-B3 or PG-X3)	-
Maximum Output Frequency	590 Hz	400 Hz	-
Speed Control Range	1:40	1:40	This is the range of variable control. When you connect and operate motors in this method, think about the increase in motor temperature.
Starting Torque	150% / 3 Hz	150% / 3 Hz	This is the motor torque that the drive can supply at low speed during start-up and the related output frequency (rotation speed). You must think about drive capacity when a large quantity of torque is necessary at low speed.
Auto-Tuning *1	Rotational and Line-to-Line Resistance (usually not necessary)	Rotational and Line-to-Line Resistance (usually not necessary)	Automatically tunes electrical motor parameters.
Torque Limits *1	No	No	Controls maximum motor torque to prevent damage to machines and loads.
Torque Control *1	No	No	Directly controls motor torque to control tension and other parameters.
Droop Control *1	No	No	Sets load torque slip for motors. Distributes motor loads.
Zero Servo Control *1	No	No	Locks servos without an external position controller to prevent movement caused by external force.
Speed Search *1	Yes	-	Immediately estimates (or detects) motor speed and direction when coasting to a stop to quickly start-up the drive without stopping the motor. Not necessary when feedback is used.
Automatic Energy-saving Control *1	Yes	Yes	Automatically adjusts the voltage applied to motors to maximize motor efficiency for all load sizes.
High Slip Braking (HSB) *1	Yes	Yes	Increases motor loss to let the motor decelerate faster than usual without a braking resistor. Motor characteristics have an effect on this function.
Feed Forward Control *1	No	No	Compensates effects of the system inertia to increase the speed precision when the load changes.
KEB Ride-Thru Function *1	Yes	Yes	Quickly and safely stops the motor during power loss and automatically starts operation at the previous speed when restores power without coasting the motor.
Overexcitation Deceleration *1	Yes	Yes	Sets the V/f higher than the setting value during deceleration to increase motor loss and decrease deceleration time.
Overvoltage Suppression Function *1 *2	Yes	Yes	Adjusts speed during regeneration to prevent overvoltage.

*1 Note these points when you use this function:

- When you can decouple the motor and machine for a test run, use Rotational Auto-Tuning. You must make adjustments to the control in the range where there is no vibration in the machine after Rotational Auto-Tuning.
- Motor loss increases during overexcitation braking and high-slip braking. Use a maximum braking frequency of 5% ED and a maximum braking time of 90 seconds. After you start high-slip braking, you cannot restart the motor until it stops. Use overexcitation braking to decelerate over a shorter time at a pre-determined speed.

*2 Do not use this function with hoist application.

Table 1.6 OLV, CLV and AOLV Features and Advantages of Control Methods

Control Method Selection	Open Loop Vector Control (OLV)	Closed Loop Vector Control (CLV)	Advanced Open Loop Vector Control (AOLV)	Notes
Controlled Motor	**Induction Motor**			**-**
Parameter Settings	A1-02 = 2 (Default)	A1-02 = 3	A1-02 = 4	-
Basic Control	Open Loop Current Vector Control	Closed Loop Current Vector Control	Open Loop Current Vector Control	-
Main Applications	• General-purpose variable speed control • Applications in which high performance is necessary without machine encoders	Very high-performance control with motor encoders Example: High-precision speed control, torque control, torque limits	Sensorless vector control with speed control • General-purpose variable speed control • Applications in which high performance is necessary without machine encoders	-
PG Option Card	Not necessary	Necessary (PG-B3 or PG-X3)	Not necessary	-
Maximum Output Frequency	590 Hz	400 Hz	120 Hz	-
Speed Control Range	1:200	1:1500	1:200	This is the range of variable control. When you connect and operate motors in this mode, think about the increase in motor temperature.
Starting Torque	200% / 0.3 Hz *1	200% / 0 min^{-1} *1	200% / 0.3 Hz *1	This is the motor torque that the drive can supply at low speed during start-up and the related output frequency (rotation speed). You must think about drive capacity when a large quantity of torque is necessary at low speed.
Auto-Tuning *2	Rotational, Stationary, and Line-to-Line Resistance	Rotational, Stationary, and Line-to-Line Resistance	Rotational, Stationary, and Line-to-Line Resistance	Automatically tunes electrical motor parameters.
Torque Limits *2	Yes	Yes	Yes	Controls maximum motor torque to prevent damage to machines and loads.
Torque Control *2	No	Yes	Yes (Although NOT for speeds below 10% of rated value)	Directly controls motor torque to control tension and other parameters.
Droop Control *2	No	Yes	Yes	Sets load torque slip for motors. Distributes motor loads.
Zero Servo Control *2	No	Yes	No	Locks servos without an external position controller to prevent movement caused by external force.
Speed Search *2	Yes	-	Yes	Immediately estimates (or detects) motor speed and direction when coasting to a stop to quickly start-up the drive without stopping the motor. Not necessary when feedback is used.
Automatic Energy-saving Control *2	Yes	Yes	No	Automatically adjusts the voltage applied to motors to maximize motor efficiency for all load sizes.
High Slip Braking (HSB) *2	No	No	No	Increases motor loss to let the motor decelerate faster than usual without a braking resistor. Motor characteristics have an effect on this function.
Feed Forward Control *2	No	Yes	Yes	Compensates effects of the system inertia to increase the speed precision when the load changes.
KEB Ride-Thru Function *2	Yes	Yes	Yes	Quickly and safely stops the motor during power loss and automatically starts operation at the previous speed when restores power without coasting the motor.
Overexcitation Deceleration *2	Yes	Yes	Yes	Sets the V/f higher than the setting value during deceleration to increase motor loss and decrease deceleration time.
Overvoltage Suppression Function *2 *3	Yes	Yes	Yes	Adjusts speed during regeneration to prevent overvoltage.

*1 Select the drive capacity accordingly.

Receiving

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*2 Note these points when you use this function:

- When you can decouple the motor and machine for a test run, use Rotational Auto-Tuning. You must make adjustments to the control in the range where there is no vibration in the machine after Rotational Auto-Tuning.
- For vector control, use a 1:1 drive to motor ratio. You cannot use vector control when more than one motor is connected to one drive. Select a drive capacity so that the motor rated current is 50% to 100% of the drive rated current. If the carrier frequency is too high, the drive rated current is derated.
- Motor loss increases during overexcitation braking and high-slip braking. Use a maximum braking frequency of 5% ED and a maximum braking time of 90 seconds. After you start high-slip braking, you cannot restart the motor until it stops. Use overexcitation braking to decelerate over a shorter time at a pre-determined speed.
- Acceleration and deceleration have priority over torque limits in Open Loop Vector Control during acceleration and deceleration (soft start changes). The drive will not operate until the speed is at the minimum frequency or the reverse direction of motor rotation when the motor speed decreases because of torque limits during constant speed control. Set *L7-07 = 2 [TrqLimit@Acc/Decel= [I-ctrl@Ac/Dec]* to enable torque limits during acceleration/deceleration (for winding applications).

*3 Do not use this function with hoist application.

Table 1.7 OLV/PM, AOLV/PM, CLV/PM and EZOLV Features and Advantages of Control Methods

Control Method Selection	PM Open Loop Vector Control (OLV/PM)	PM Advanced Open Loop Vector Control (AOLV/PM)	PM Closed Loop Vector Control (CLV/PM)	EZ Open Loop Vector Control (EZOLV)	Notes
Controlled Motor	**PM Motor**			**Induction Motors/PM Motors/SynRM (Synchronous Reluctance Motors)**	**-**
Parameter Settings	A1-02 = 5	A1-02 = 6	A1-02 = 7	A1-02 = 8	-
Basic Control	PM Open Loop Vector Control (no speed controller)	PM Open Loop Current Vector Control (with speed controller)	PM Closed Loop Current Vector Control (with speed controller)	Open Loop Current Vector Control	-
Main Applications	• General-purpose variable speed control for PM motors • Applications in which a high level of responsiveness and accurate speed control are not necessary.	• General-purpose variable speed control for IPM motors • Applications in which high-precision speed control and torque limits are necessary.	Very high-performance PM motor control with motor encoders Example: Torque control and torque limits	Low-speed torque applications Example: Fans and pumps	-
PG Option Card	Not necessary	Not necessary	Necessary (PG-X3)	Not necessary	-
Maximum Output Frequency	590 Hz	400 Hz	400 Hz	120 Hz	-
Speed Control Range	1:20 AM	1:20 AM 1:100 *1 *2 *3	1:1500	1:100	This is the range of variable control. When you connect and operate motors in this mode, think about the increase in motor temperature.
Starting Torque	100% / 5% speed	100% / 5% speed 200% / 0 min^{-1} *1	200% / 0 min^{-1} *4	100% / 1% speed	This is the motor torque that the drive can supply at low speed during start-up and the related output frequency (rotation speed). You must think about drive capacity when a large quantity of torque is necessary at low speed.
Auto-Tuning *5	Stationary, Stator Resistance, Rotational	Stationary, Stator Resistance, Rotational	Stationary, Stator Resistance, Z-phase, Rotational	Line-to-Line Resistance	Automatically tunes electrical motor parameters.
Torque Limits *5	No	Yes	Yes	Yes	Controls maximum motor torque to prevent damage to machines and loads.
Torque Control *5	No	Yes *6	Yes	No	Directly controls motor torque to control tension and other parameters.
Droop Control *5	No	No	Yes	No	Sets load torque slip for motors. Distributes motor loads.
Zero Servo Control *5	No	No	Yes	No	Locks servos without an external position controller to prevent movement caused by external force.
Speed Search *5	Yes	Yes	Yes	Yes (Although NOT operation in the reverse direction of the Run command)	Immediately estimates (or detects) motor speed and direction when coasting to a stop to quickly start-up the drive without stopping the motor.
Automatic Energy-saving Control *5	No	Yes (IPM motors only)	Yes (IPM motors only)	Yes	Automatically adjusts the voltage applied to motors to maximize motor efficiency for all load sizes.

Control Method Selection	PM Open Loop Vector Control (OLV/PM)	PM Advanced Open Loop Vector Control (AOLV/PM)	PM Closed Loop Vector Control (CLV/PM)	EZ Open Loop Vector Control (EZOLV)	Notes
Controlled Motor	**PM Motor**			**Induction Motors/PM Motors/SynRM (Synchronous Reluctance Motors)**	**-**
High Slip Braking (HSB)	No (induction motor-specific function)	No (induction motor-specific function)	No (induction motor-specific function)	No	Increases motor loss to let the motor decelerate faster than usual without a braking resistor. Motor characteristics have an effect on this function.
Feed Forward Control *5	No	Yes	Yes	No	Compensates effects of the system inertia to increase the speed precision when the load changes.
KEB Ride-Thru Function *5	Yes	Yes	Yes	Yes	Quickly and safely stops the motor during power loss and automatically starts operation at the previous speed when restores power without coasting the motor.
Overexcitation Deceleration	No (induction motor-specific function)	No (induction motor-specific function)	No (induction motor-specific function)	No	Sets the V/f higher than the setting value during deceleration to increase motor loss and decrease deceleration time.
Overvoltage Suppression Function *5 *7	Yes	Yes	Yes	Yes	Adjusts speed during regeneration to prevent overvoltage.
Sensorless Zero Speed Control *5	No	Yes (IPM motors only)	-	No	Enabled with high frequency injection with IPM motors.

*1 Enabled when *n8-57 = 1 [High-Freq Injection = Enabled]*.
*2 Rotational Auto-Tuning is necessary.
*3 Contact the manufacturer or your nearest sales representative to drive non-Yaskawa PM motors (SSR1 and SST4 series standard specifications).
*4 Select the drive capacity accordingly.
*5 Note these points when you use this function:

- When you can decouple the motor and machine for a test run, use Rotational Auto-Tuning. You must make adjustments to the control in the range where there is no vibration in the machine after Rotational Auto-Tuning.
- For vector control, use a 1:1 drive to motor ratio. You cannot use vector control when more than one motor is connected to one drive. Select a drive capacity so that the motor rated current is 50% to 100% of the drive rated current. If the carrier frequency is too high, the drive rated current is derated.

*6 Torque control at zero speed is only available with IPM motors. To enable torque control with IPM motors at zero speed, set *n8-57 = 1*.
*7 Do not use this function with hoist application.

2

Mechanical Installation

This chapter explains how to properly mount and install the drive.

2.1 Safety Precautions

DANGER

Electrical Shock Hazard

Electrical Shock Hazard. Do not examine, connect, or disconnect wiring on an energized drive. Before servicing, disconnect all power to the equipment and wait for the time specified on the warning label at a minimum. The internal capacitor stays charged after the drive is de-energized. The charge indicator LED extinguishes when the DC bus voltage decreases below 50 Vdc. When all indicators are OFF, measure for dangerous voltages to make sure that the drive is safe.

If you do work on the drive when it is energized, it will cause serious injury or death from electrical shock.

WARNING

Electrical Shock Hazard

Do not operate equipment when covers are missing. Some figures in this section include drives without covers or safety shields to more clearly show the inside of the drive. Replace covers and shields before operation. Use drives only as specified by the instructions.

Failure to obey can cause death or serious injury.

Ground the neutral point on the power supply of drive models 2xxxB/C and 4xxxA/B/C to comply with the EMC Directive before turning on the EMC filter or if there is high resistance grounding.

If the EMC filter is switched ON without the neutral point being grounded or if there is high resistance grounding, it can cause death or serious injury.

The leakage current of the drive will be more than 3.5 mA in drive models 2xxxB, 2xxxC, 4002B to 4371B, 4002C to 4371C (with built-in EMC filter turned ON) and 4389 to 4675. The IEC/EN 61800-5-1: 2007 standard specifies that users must wire the power supply to automatically turn off when the protective ground wire disconnects. Users can also connect a protective ground wire that has a minimum cross-sectional area of 10 mm² (copper wire) or 16 mm² (aluminum wire).

Failure to obey these standards can cause death or serious injury.

Always use a type B Residual Current Monitor/Residual Current Device (RCM/RCD) where a residual current operated protective or monitoring device protects against direct or indirect contact as specified by IEC/EN 60755 The drive can cause a residual current with a DC component in the protective earthing conductor.

Failure to obey can cause death or serious injury.

Do not work on the drive or around the drive while wearing loose clothing or jewelry. Tighten loose clothing and remove all metal objects such as watches or rings.

Failure to obey can cause death or serious injury.

Do not remove covers or touch circuit boards while the drive is energized.

Failure to obey can cause death or serious injury.

Only let authorized persons install, wire, maintain, examine, replace parts, and repair the drive.

Failure to obey can cause death or serious injury.

Do not make changes to the drive body or drive circuitry.

Failure to obey can cause death or serious injury and will void warranty. The manufacturer is not responsible for changes to the product made by the user.

Fire Hazard

Tighten all terminal screws to the correct tightening torque.

Connections that are too loose or too tight can cause incorrect operation and damage to the drive. Incorrect connections can also cause death or serious injury from fire.

Tighten screws against the bit at an angle in the specified range shown in this manual.

If you tighten the screws at an angle not in the specified range, you can have loose connections that can cause damage to the terminal block or start a fire.

⚠WARNING

Do not put flammable or combustible materials on top of the drive and do not install the drive near flammable or combustible materials. Attach the drive to metal or other noncombustible material.

Failure to obey can cause death or serious injury.

Do not use the main circuit power supply (Overcurrent Category III) at incorrect voltages. Make sure that the drive rated voltage aligns with the power supply voltage before energizing the drive.

Failure to obey can cause death or serious injury.

When installing dynamic braking options, wire the components as specified by the wiring diagrams.

Failure to obey can result in fire, death or serious injury. Incorrect wiring can cause damage to braking components.

When installing the drive into a closed cabin or cabinet, use a cooling fan or cooler to decrease the temperature around the drive. Make sure that the intake air temperature to the drive is 50 °C (122 °F) or less for open chassis type drives, (IP20) and 40 °C (104 °F) or less for enclosed wall-mounted type (UL Type1) drives.

Failure to obey can cause the drive to overheat and cause fire, death or serious injury.

Crush Hazard

Only approved personnel can operate a crane or hoist to move the drive.

Failure to obey can cause death or serious injury from falling equipment.

Use screws to correctly attach the drive front cover, terminal blocks, and other drive components before hanging the drive vertically.

Failure to obey can cause serious injury or death from falling equipment.

Prevent more than 1.96 m/s² (0.2 G) vibration and impact to a hanging drive.

Failure to obey can cause death or serious injury from falling equipment.

Do not try to flip over a hanging drive or leave a hanging drive unattended.

Failure to obey can cause death or serious injury from falling equipment.

Use a lifting mechanism made to move large drives when necessary.

Failure to obey can cause death or serious injury from falling equipment.

⚠CAUTION

Crush Hazard

Do not hold the drive by the front cover or terminal cover. Tighten the screws correctly before moving the drive.

Failure to obey can cause minor to moderate injury.

NOTICE

Do not let unwanted objects, for example metal shavings or wire clippings, fall into the drive during drive installation and project construction. Put a temporary cover over the top of the drive during installation. Remove the temporary cover before start-up or the drive will overheat.

Failure to obey can cause damage to the drive.

Observe correct electrostatic discharge (ESD) procedures when touching the drive.

Failure to obey can cause ESD damage to the drive circuitry.

To use a standard blower-cooled motor, reduce the motor torque in the low-speed range. If 100% torque is continuously necessary at low speed, use a special motor or vector control motor. Select a motor that is compatible with the necessary load torque and operating speed range.

Operating the motor in the low speed range decreases the cooling effects, increases motor temperature, and can cause overheating and motor damage.

NOTICE

The speed range for continuous operation will be different depending on the lubrication method and motor manufacturer. To operate the motor at a speed higher than the rated speed, contact the manufacturer.

If you continuously operate an oil-lubricated motor in the low-speed range, it can cause burning.

When the input voltage is 440 V or higher or the wiring distance is more than 100 meters, pay special attention to the motor insulation voltage or use a drive-rated motor with reinforced insulation.

Failure to obey can cause motor winding failure.

If you operated a machine at constant speed and then operated the same machine in variable-speed mode, motor vibration will increase.

Install vibration-proof rubber on the motor base or use the frequency jump function to avoid the frequency that is resonating the machine.

The motor may require more acceleration torque with drive operation than with a commercial power supply. Check the load torque characteristics of the machine to be used with the motor.

The rated input current of submersible motors is higher than the rated input current of standard motors. Use the rated output current to select an applicable drive. When the distance between the motor and drive is long, use a wire that can connect the motor to the drive without a reduction in motor torque.

To use an explosion-proof motor, you must do an explosion-proof test with the drive. As the drive is not explosion-proof, make sure that you install it in a safe area.

Failure to obey could cause damage to the drive.

Do not lift the drive with the cover removed.

Failure to obey can cause damage to the drive board and terminal block.

Do not use unshielded wire for control wiring. Use shielded, twisted-pair wires and ground the shield to the ground terminal of the drive.

Failure to obey can cause electrical interference and unsatisfactory system performance.

Do not allow unqualified personnel to use the product. Before you connect a dynamic braking option to the drive, make sure that you review Braking Unit and Braking Resistor Unit Installation Manual TOBPC72060001.

Failure to obey can cause damage to the drive and braking circuit.

Do not change the drive circuitry.

Failure to obey can cause damage to the drive and will void warranty. The manufacturer is not responsible for modifications of the product made by the user.

Make sure that all connections are correct after you install the drive and connecting peripheral devices.

Failure to obey can cause damage to the drive.

2.2 Installation Environment

The installation environment is important for the lifespan of the product and to make sure that the drive performance is correct. Make sure that the installation environment agrees with these specifications.

Environment	Conditions
Area of Use	Indoors
Power Supply	Overvoltage Category III
Ambient Temperature Setting	Open chassis type (IP20): -10 °C to +60 °C (14 °F to 140 °F). Derate the output current and output voltage if the drive is installed in areas with ambient temperatures from +50 °C to +60 °C (122 °F to 140 °F). Enclosed wall-mounted type (UL Type 1): -10 °C to +40 °C (14 °F to 104 °F) • Drive reliability is better in environments that do not have wide temperature fluctuations. • When installing the drive in an enclosure, use a cooling fan or air conditioner to keep the internal air temperature in the permitted range.
Humidity	95% RH or less Do not let condensation form on the drive.
Storage Temperature	-20 °C to +70 °C (-4 °F to +158 °F) (short-term temperature during transportation)
Surrounding Area	Pollution degree 2 or less Install the drive in an area without: • Oil mist, corrosive or flammable gas, or dust • Metal powder, oil, water, or other unwanted materials • Radioactive materials or flammable materials, including wood • Harmful gas or fluids • Salt • Direct sunlight Keep wood and other flammable materials away from the drive.
Altitude	1000 m (3281 ft.) maximum **Note:** Derate the output current by 1% for each 100 m (328 ft.) to install the drive in altitudes between 1000 m to 4000 m (3281 ft. to 13123 ft.). It is not necessary to derate the rated voltage in these conditions: • Installing the drive at 2000 m (6562 ft.) or lower • Installing the drive between 2000 m to 4000 m (6562 ft. to 13123 ft.) and grounding the neutral point on the power supply. Contact the manufacturer or your nearest sales representative when not grounding the neutral point.
Vibration	• 10 Hz to 20 Hz: 1 G (9.8 m/s^2, 32.15 ft/s^2) • 20 Hz to 55 Hz: Models 2004 to 2211, 4002 to 4168: 0.6 G (5.9 m/s^2, 19.36 ft/s^2) Models 2257 to 2415, 4208 to 4675: 0.2 G (2.0 m/s^2, 6.56 ft/s^2)
Installation Position	Install the drive vertically for sufficient cooling airflow.

NOTICE: *Do not put drive peripheral devices, transformers, or other electronics near the drive. Shield the drive from electrical interference if components must be near the drive. Failure to obey can cause incorrect operation.*

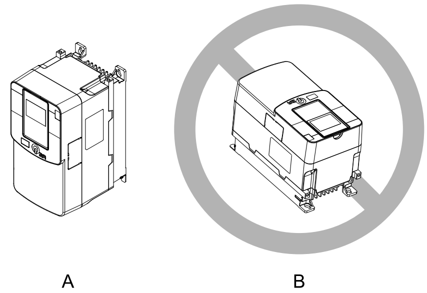
NOTICE: *Do not let unwanted objects, for example metal shavings or wire clippings, fall into the drive during drive installation and project construction. Put a temporary cover over the top of the drive during installation. Remove the temporary cover before start-up or the drive will overheat. Failure to obey can cause damage to the drive.*

2.3 Installation Position and Distance

Install the drive vertically for sufficient cooling airflow.

Note:

Contact the manufacturer or your sales representative for more information about installing drive models on their side.



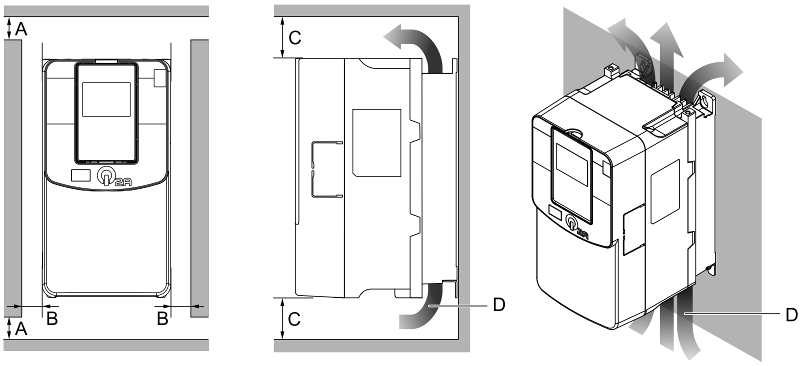
A - Vertical installation

B - Horizontal installation

Figure 2.1 Installation Position

◆ Single Drive Installation

Use the clearances specified to install the drive. Make sure that there is sufficient space for wiring and airflow.



A - 50 mm (2 in.) minimum

B - 30 mm (1.2 in.) minimum on both sides

C - 120 mm (4.7 in.) minimum above and below

D - Airflow direction

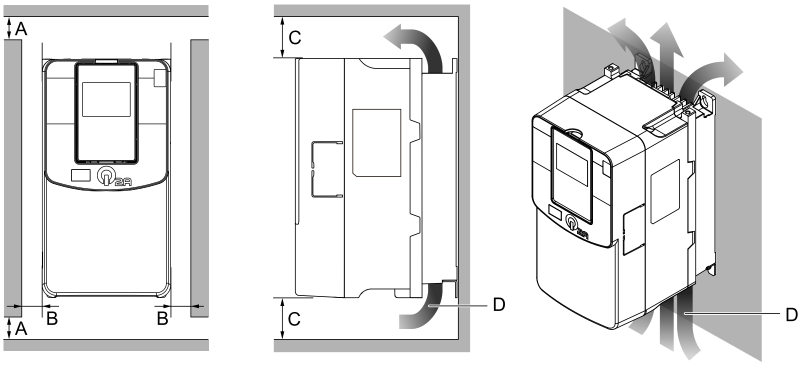
Figure 2.2 Installation Distances for One Drive

◆ Install Drives Side-by-Side

Users can install drive models 2004xB to 2082xB and 4002xB to 4044xB side-by-side.

Install the drives as specified by Figure 2.3. Set *L8-35 = 1 [Installation Selection = Side-by-Side Mounting]*.

Derate the output current to align with the ambient temperature.



A - **50 mm (2 in.) minimum**

B - **30 mm (1.2 in.) minimum on both sides**

C - **2 mm (0.08 in.) minimum between each drive**

D - **120 mm (4.7 in.) minimum above and below**

Figure 2.3 Installation Distances for Multiple Drives (Side-by-Side)

Note:
- Align the tops of drives that have different dimensions to help when replacing cooling fans.
- Remove the top protective covers of all drives when mounting UL Type 1 enclosure drives side-by-side.

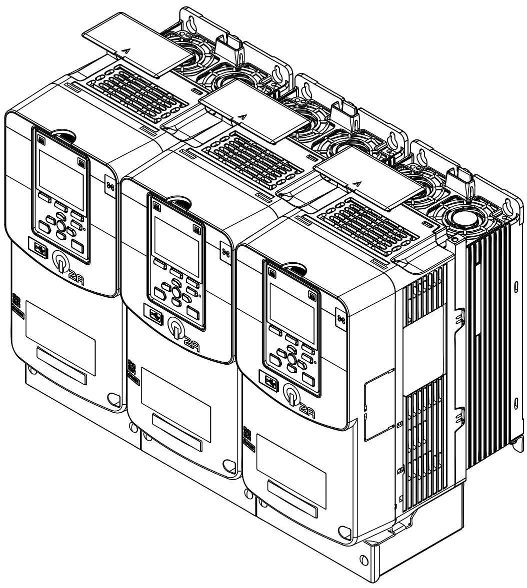


Figure 2.4 Enclosed Wall-Mounted Type (UL Type 1) Installed Side-by-Side

2.4 Moving the Drive

Obey local laws and regulations when moving and installing this product.

CAUTION! *Crush Hazard. Do not hold the drive by the front cover or terminal cover. Tighten the screws correctly before moving the drive. Failure to obey can cause minor to moderate injury.*

Drive Weight	Persons Necessary to Move the Drive
< 15 kg (33 lbs.)	1
≥ 15 kg (33 lbs.)	2 + using appropriate lifting equipment

Use the hanging brackets attached to the drive to temporarily lift the drive when you install the drive to a control panel or wall or when you replace the drive. Do not let the drive stay vertically or horizontally suspended or move the drive over a long distance while it is suspended.

◆ Vertical Suspension

To vertically suspend the drive with the hanging brackets, lift the drive with this procedure:

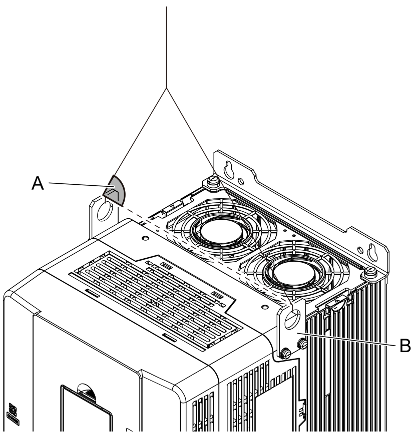
Model	Suspension Method
2110 to 2211, 4075 to 4168	Vertical Suspension

WARNING! *Crush Hazard. Use screws to correctly attach the drive front cover, terminal blocks, and other drive components before hanging the drive vertically. Failure to obey can cause serious injury or death from falling equipment.*

WARNING! *Crush Hazard. Prevent more than 1.96 m/s² (0.2 G) vibration and impact to a hanging drive. Failure to obey can cause death or serious injury from falling equipment.*

WARNING! *Crush Hazard. Do not try to flip over a hanging drive or leave a hanging drive unattended. Failure to obey can cause death or serious injury from falling equipment.*

1. Put wire through the 2 holes in the hanging brackets.



A - Suspension angle of at least 50 degrees **B - Hanging bracket (2)**

Figure 2.5 Vertical Suspension

2. Use a crane to gradually wind up the wire. Visually make sure that there is sufficient tension in the wire, then lift the drive to its correct location.
3. Prepare the control panel for installation, then lower the drive.

Note:
When lowering the drive, stop before the drive touches the floor, then slowly lower it the remaining distance.

◆ Horizontal Suspension

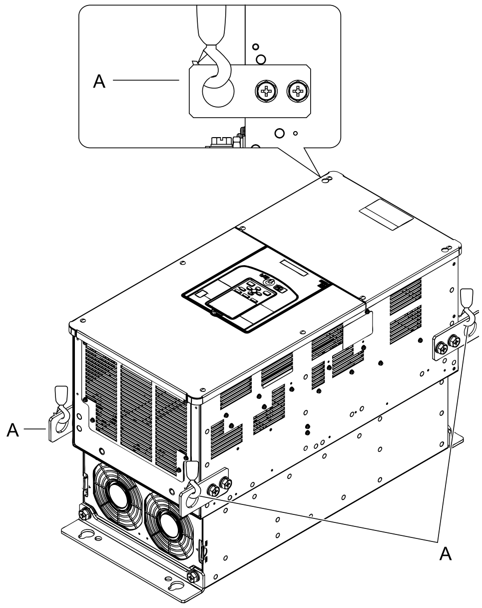
Put the drive on the ground horizontally. Connect wires to the 4 hanging brackets and use a crane to lift the drive.

Model	Suspension Method
2257 to 2415, 4208 to 4675	Horizontal Suspension

WARNING! *Crush Hazard. Prevent more than 1.96 m/s² (0.2 G) vibration and impact to a hanging drive. Failure to obey can cause death or serious injury from falling equipment.*

WARNING! *Crush Hazard. Do not try to flip over a hanging drive or leave a hanging drive unattended. Failure to obey can cause death or serious injury from falling equipment.*

NOTICE: *If you attach a horizontal wire to the drive, the wire can scratch and damage the drive if touches the drive. Use a jig or pad to prevent damage to the drive.*



A - Hanging bracket (4)

Figure 2.6 Horizontal Suspension

2.5 Remove and Reattach the Keypad

NOTICE: *You must remove the keypad before you remove or reattach the front cover. Before you reattach the keypad, make sure that you tightly fasten the front cover back into its position. If you keep the keypad connected to the drive when you remove the front cover, it can cause an unsatisfactory connection and incorrect operation.*

◆ Remove the Keypad

1. Push down the tab on the top of the keypad, then pull the keypad forward and remove it from the drive.

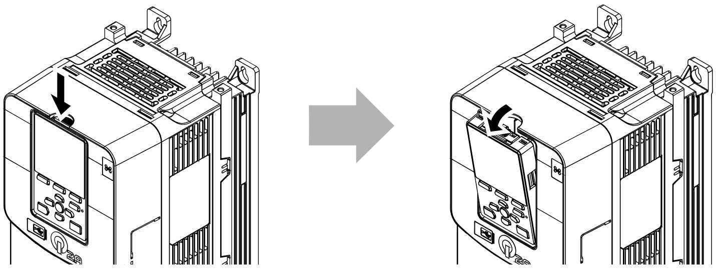
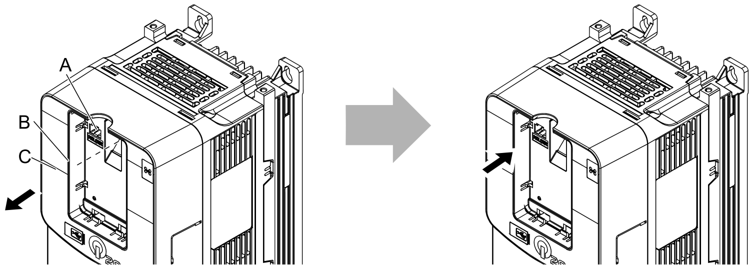


Figure 2.7 Remove the Keypad

2. Pull the keypad connector out from the drive horizontally, then put it in the holder.

Note:
Insert the end of the keypad connector that has the tab.



A - Holder
B - Hook
C - Keypad connector

Figure 2.8 Move the Keypad Connector to the Holder

◆ Reattach the Keypad

Insert the keypad connector to its initial position. Put the bottom of the keypad into position first, then carefully push on the top of the keypad until the hook clicks into place.

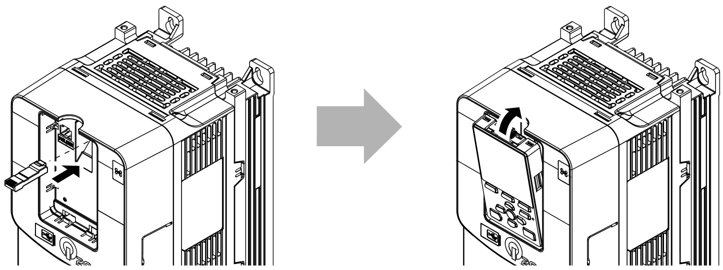


Figure 2.9 Reattach the Keypad

2.6 Install the Keypad to a Control Panel or Another Device

You can remove the keypad from the drive and connect it to a remote control extension cable 3 m (9.8 ft) long to make operation easier when you cannot access the drive. You can operate a drive that is in a control panel without opening or closing the control panel door. To order optional accessories, contact the manufacturer or your nearest sales representative.

◆ Connect the Keypad from a Remote Location

Use the information in following table to install the keypad in the best location for your application.

Table 2.1 Keypad Installation Method

Installation Method	Description	Required Tools and Installation Support Sets
Outside the control panel	Simplified installation is possible. Separately sold installation support sets are not necessary.	Phillips screwdriver #2 (M3)
Inside the control panel	Keypad does not extend farther than the front of the control panel.	• Phillips screwdriver #2 (M3, M4) • Installation support set A (for mounting with screws, model: 900-192-933-001)
		• Phillips screwdriver #2 (M3) • Wrench (M4) • Installation support set B (for mounting with nut clamp, model: 900-192-933-002)

Installation support sets are sold separately. If there are weld studs inside the control panel, use installation support set B.

NOTICE: *Do not let unwanted objects, for example metal shavings or wire clippings, fall into the drive during drive installation and project construction. Put a temporary cover over the top of the drive during installation. Remove the temporary cover before start-up or the drive will overheat. Failure to obey can cause damage to the drive.*

◆ Install Outside of Control Panel

1. Use the panel cut-out dimensions to cut an opening in the control panel for the keypad.

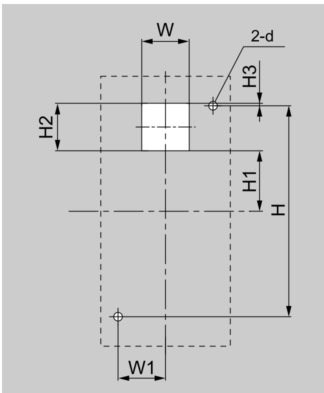


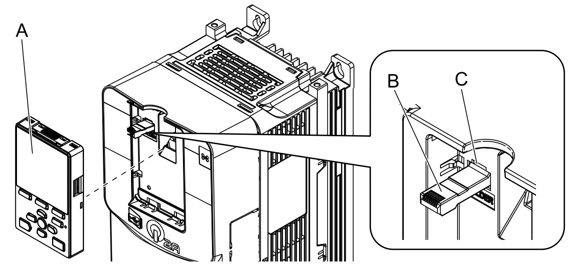
Figure 2.10 Panel Cut-Out Dimensions to Attach Outside of Control Panel

Table 2.2 Panel Cut-out Dimensions mm (in.)

W	H	W1	H1	H2	H3	d
22 (0.89)	78 (3.07)	22 (0.89)	29 (1.14)	22 (0.89)	1 (0.04)	3.6 (0.14)

2. Remove the keypad and put the keypad connector in the holder on the front cover.

Note:
Insert the end of the keypad connector that has the tab.

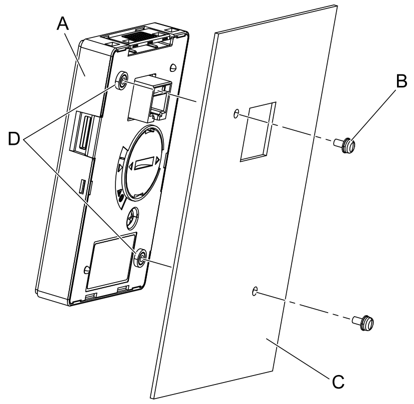


A - Keypad
B - Keypad connector
C - Holder

Figure 2.11 Remove the Keypad

3. Put the keypad on the outside of the control panel.

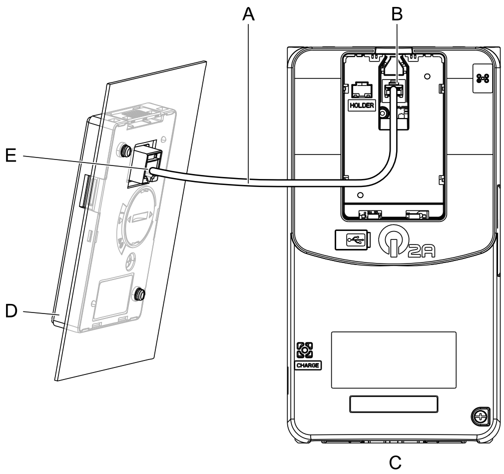
   Use M3 screws (6 mm (0.2 in.) depth cross-recessed pan head screws) to attach the keypad from the inside. Tighten the screws to a tightening torque of 0.49 N·m to 0.73 N·m (4.34 lb.·in. to 6.46 lb.·in.).



A - Keypad
B - M3 screws
C - Control panel

Figure 2.12 Mount to the Outside of Control Panel

4. Use the remote control extension cable to connect the keypad to the drive.



A - Remote control extension
B - Communications connector
C - Drive
D - Keypad
E - Cable connector

Figure 2.13 Connect the Drive and Keypad with the Remote Control Extension Cable

◆ Install Inside Control Panel

To attach the keypad inside of the control panel, you must purchase the installation support set, which is sold separately. Contact the manufacturer or your nearest sales representative to order mounting brackets and mounting hardware.

Note:
- The installation procedure and panel cut-out dimensions are the same for mounting brackets A and B.
- Use a gasket between the control panel and the keypad in environments with a large quantity of dust or other unwanted airborne material.

1. Use the panel cut-out dimensions to cut an opening in the control panel for the keypad.

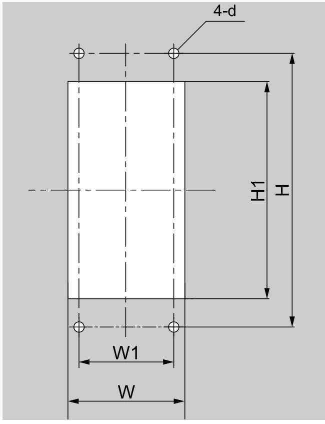


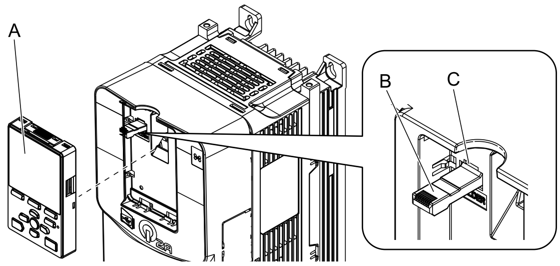
Figure 2.14 Panel Cut-Out Dimensions to Attach Inside Control Panel

Table 2.3 Panel Cut-out Dimensions mm (in.)

W	H	W1	H1	d
64 + 0.5 (2.52 + 0.02)	130 (5.12)	45 (1.77)	105 + 0.5 (4.13 + 0.02)	4.8 (0.12)

2. Remove the keypad and put the keypad connector in the holder on the front cover.

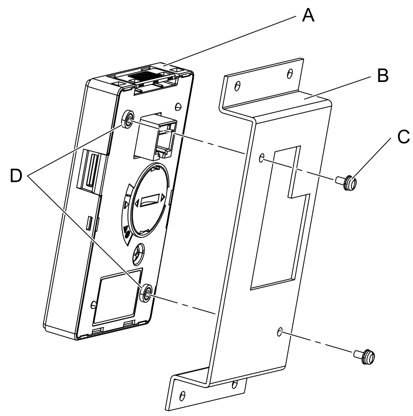
Note:
Insert the end of the keypad connector that has the tab.



A - Keypad
B - Keypad connector
C - Holder

Figure 2.15 Remove the Keypad

3. Use the screws supplied with the mounting bracket, and attach the keypad to the mounting bracket. Tighten the screws to a tightening torque of 0.49 to 0.73 N·m (4.34 to 6.46 lb.·in.).

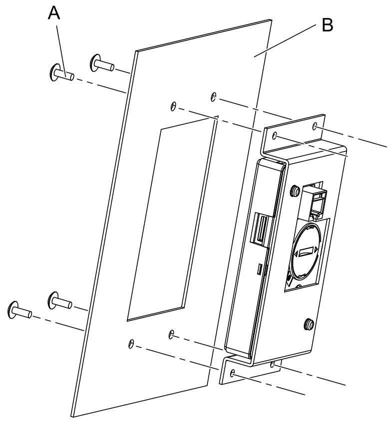


A - Keypad
B - Mounting bracket A
C - M3 screws

Figure 2.16 Attach Keypad to Mounting Bracket

4. Position the mounting bracket to which the keypad has been attached in the control panel, and mount it from the outside using the screws.

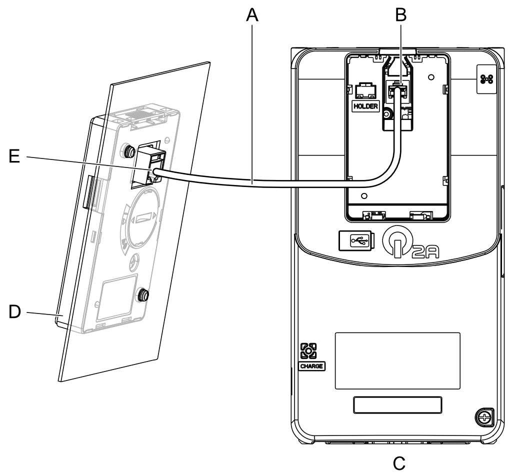
   Use the screws supplied with the installation support set, and tighten them to a tightening torque of 0.98 to 1.33 N·m (8.67 to 11.77 lb.·in.).



A - M4 screws **B - Control panel**

Figure 2.17 Mount Mounting Bracket to the Interior of the Control Panel

5. Connect the keypad with the drive using the remote control extension cable.



A - Remote control extension
B - Communications connector
C - Drive
D - Keypad
E - Cable connector

Figure 2.18 Connect the Drive and Keypad with the Remote Control Extension Cable

◆ External Dimensions of Keypad

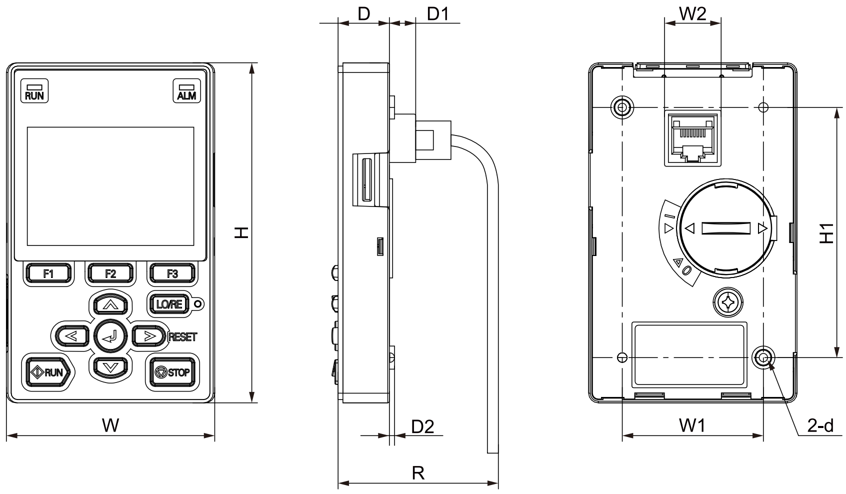


Figure 2.19 Exterior and Mounting Dimensions

Table 2.4 Exterior Dimensions (mm)

W	H	D	D1	D2	R *1	W1	W2	H1	d
65	106	16	8.2	1.6	53.8	44	15	78	M3

*1 Minimum bending radius

Mechanical Installation

2

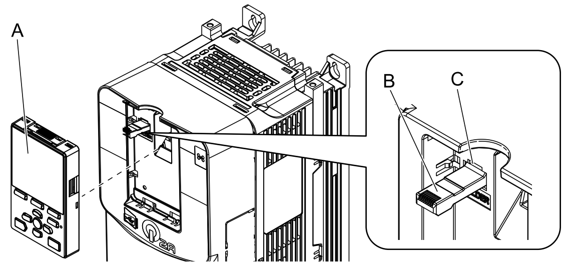
2.7 Removing/Reattaching Covers

This section gives information about how to remove and reattach the front cover and terminal cover for wiring and inspection.

◆ Remove the Front Cover of Drive Models 2004 - 2211, 4002 - 4168

DANGER! *Electrical Shock Hazard. Electrical Shock Hazard. Do not examine, connect, or disconnect wiring on an energized drive. Before servicing, disconnect all power to the equipment and wait for the time specified on the warning label at a minimum. The internal capacitor stays charged after the drive is de-energized. The charge indicator LED extinguishes when the DC bus voltage decreases below 50 Vdc. When all indicators are OFF, measure for dangerous voltages to make sure that the drive is safe. If you do work on the drive when it is energized, it will cause serious injury or death from electrical shock.*

1. Remove the keypad and remove the keypad connector, then insert the end of the keypad connector that has the tab into the keypad connector holder on the front cover.



A - Keypad
B - Keypad connector
C - Holder

Figure 2.20 Remove the Keypad and Keypad Connector

2. Loosen the front cover screw.

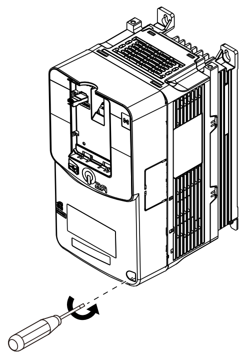


Figure 2.21 Loosen the Front Cover Screw

3. Push on the tab in the side of the front cover then pull the front cover forward to remove it from the drive.

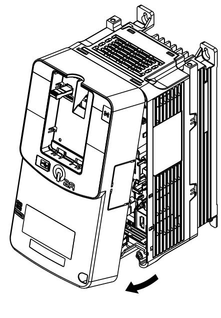


Figure 2.22 Remove the Front Cover

◆ Reattach the Front Cover of Drive Models 2004 - 2211, 4002 - 4168

DANGER! *Electrical Shock Hazard. Electrical Shock Hazard. Do not examine, connect, or disconnect wiring on an energized drive. Before servicing, disconnect all power to the equipment and wait for the time specified on the warning label at a minimum. The internal capacitor stays charged after the drive is de-energized. The charge indicator LED extinguishes when the DC bus voltage decreases below 50 Vdc. When all indicators are OFF, measure for dangerous voltages to make sure that the drive is safe. If you do work on the drive when it is energized, it will cause serious injury or death from electrical shock.*

1. Wire the drive and other peripheral devices.
2. Reverse the steps to reattach the cover.

Note:
- Wire the grounding terminals first, main circuit terminals next, and control circuit terminals last.
- Make sure that you do not pinch wires or signal lines between the front cover and the drive before you reattach the cover.
- Tighten the screws to a tightening torque of 0.98 N·m to 1.33 N·m (8.67 lb.·in. to 11.77 lb.·in.).

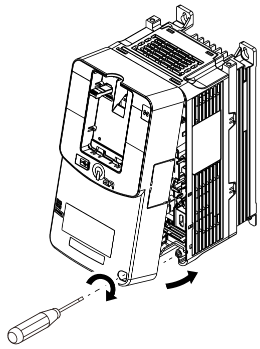


Figure 2.23 Reattach the Front Cover

3. Reattach the keypad to the original position.

◆ Remove the Front Cover of Drive Models 2257 - 2415, 4208 - 4675

DANGER! *Electrical Shock Hazard. Electrical Shock Hazard. Do not examine, connect, or disconnect wiring on an energized drive. Before servicing, disconnect all power to the equipment and wait for the time specified on the warning label at a minimum. The internal capacitor stays charged after the drive is de-energized. The charge indicator LED extinguishes when the DC bus voltage decreases below 50 Vdc. When all indicators are OFF, measure for dangerous voltages to make sure that the drive is safe. If you do work on the drive when it is energized, it will cause serious injury or death from electrical shock.*

1. Loosen the screws on the terminal cover, then pull down on the cover.

   CAUTION! *Crush Hazard. Only loosen the cover screws. Do not fully remove the cover screws. Make sure that the terminal covers for larger drives do not fall. Missing cover screws can cause the terminal cover to fall and cause injury.*

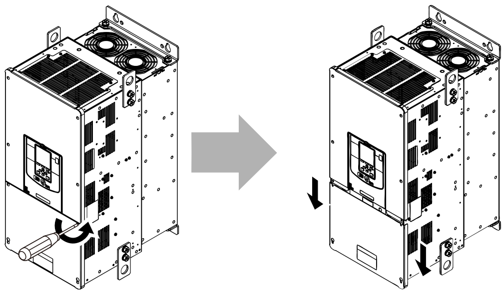
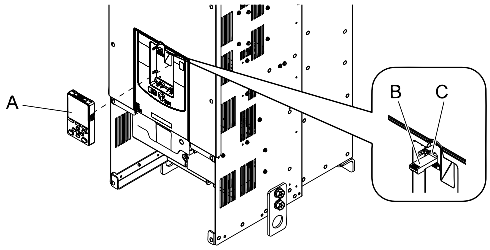


Figure 2.24 Loosen the Terminal Cover Mounting Screws

2. Pull the terminal cover away from the drive.
3. Remove the keypad, and keypad connector, then insert the end of the keypad connector that has the tab into the keypad connector holder on the front cover.



A - Keypad
B - Keypad connector
C - Connector holder

Figure 2.25 Remove the Terminal Cover, Keypad, and Keypad Connector

Mechanical Installation

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4. Loosen the front cover screws.

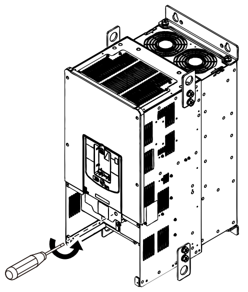
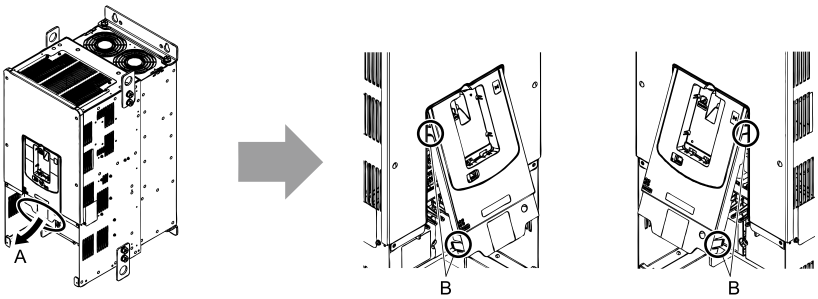


Figure 2.26 Loosen the Front Cover Screws

5. Push on the four tabs found on each side of the front cover, then pull the front cover forward to remove it from the drive.



A - Pull forward to remove the front cover.
B - Unhook the tabs found on the sides of the front cover.

Figure 2.27 Pull Forward to Remove the Front Cover

6. Remove the front cover from the drive.

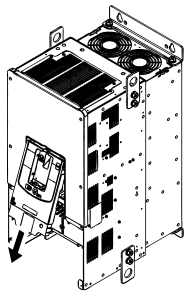


Figure 2.28 Remove the Front Cover

◆ Reattach the Front Cover of Drive Models 2257 - 2415, 4208 - 4675

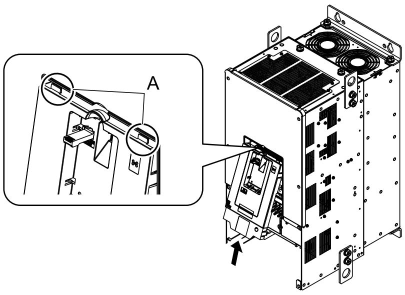
Wire the drive and other peripheral devices then reattach the front cover.

Note:

Wire the grounding terminals first, main circuit terminals next, and control circuit terminals last.

DANGER! *Electrical Shock Hazard. Electrical Shock Hazard. Do not examine, connect, or disconnect wiring on an energized drive. Before servicing, disconnect all power to the equipment and wait for the time specified on the warning label at a minimum. The internal capacitor stays charged after the drive is de-energized. The charge indicator LED extinguishes when the DC bus voltage decreases below 50 Vdc. When all indicators are OFF, measure for dangerous voltages to make sure that the drive is safe. If you do work on the drive when it is energized, it will cause serious injury or death from electrical shock.*

1. Move the front cover to connect the hooks at the top of the front cover to the drive.



A - Hooks

Figure 2.29 Reattach the Front Cover

2. Move the front cover until it clicks into position while pushing on the hooks on the left and right sides of the front cover.

Note:
Make sure that you do not pinch wires or signal lines between the front cover and the drive before you reattach the cover.

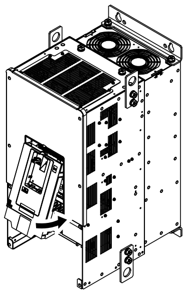


Figure 2.30 Reattach the Front Cover

3. Reattach the keypad to the original position.
4. Wire the drive and other peripheral devices then reattach the terminal cover.

Note:
- Wire the grounding terminals first, main circuit terminals next, and control circuit terminals last.
- Make sure that you do not pinch wires or signal lines between the wiring cover and the drive before you reattach the cover.
- Tighten the screws to a tightening torque of 0.98 N·m to 1.33 N·m (8.67 lb.·in. to 11.77 lb.·in.).

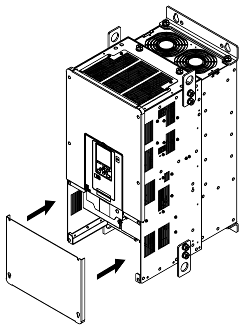


Figure 2.31 Reattach the Terminal Cover

Mechanical Installation

2

2.8 Change the Drive Enclosure Type

The enclosure type of the drive is open chassis type (IP20). This section gives information about how to install UL Type 1 protective covers to change the enclosure type to an enclosed wall-mounted type (UL Type 1).

Install the protective covers before you wire the drive.

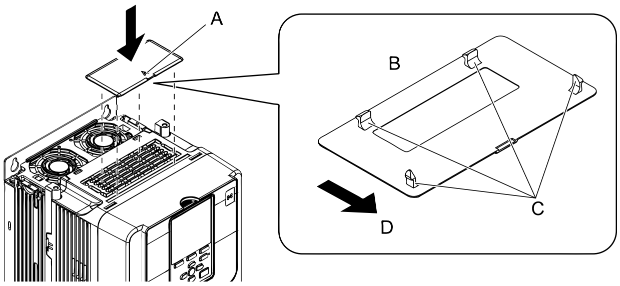
◆ Attach the Protective Cover of Drive Models 2004 - 2082, 4002 - 4060

■ Attach the Top Protective Cover

Align the hooks on the rear of top protective cover with the holes on the top of the drive to attach the top protective cover.

Note:

- Attach the top protective cover and point the (△) mark on the upper surface of the top protective cover away from the front of the drive.
- Put the two small hooks on the rear of the top protective cover into the mounting holes near the back of the drive. Then push down on the front side of the top protective cover to attach the cover.



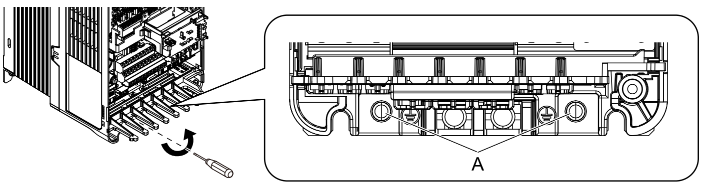
A - Mark
B - Rear of top protective cover
C - Hooks
D - Front of drive

Figure 2.32 Attach the Top Protective Cover

■ Attach the Conduit Bracket

Remove the front cover.

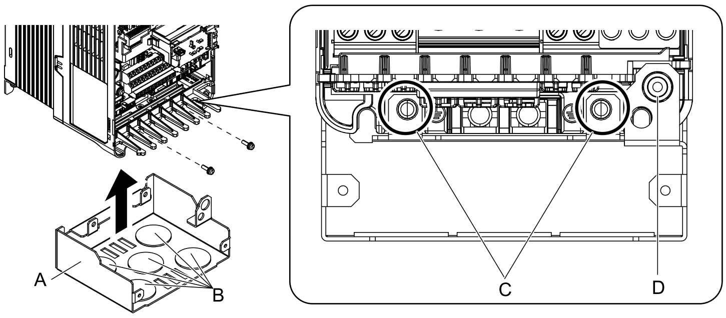
1. Remove the screws that attach the protective covers to the drive.



A - Screws that attach the protective cover

Figure 2.33 Remove the Screws that Attach the Protective Cover

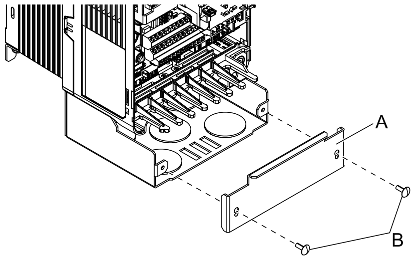
2. Align the screw holes on conduit bracket 1 with the screw holes on the drive and push the bracket into position. Use the screws to attach it.



A - Conduit bracket 1
B - Wiring holes
C - Screw holes
D - Screw hole

Figure 2.34 Attach Conduit Bracket 1

3. Align the screw holes on conduit bracket 2 with the screw holes on conduit bracket 1.
   Tighten the screws to a tightening torque of 0.98 N·m to 1.33 N·m (8.67 lb.·in. to 11.77 lb.·in.).



A - Conduit bracket 2

Figure 2.35 Attach Conduit Bracket 2

4. Attach the front cover.

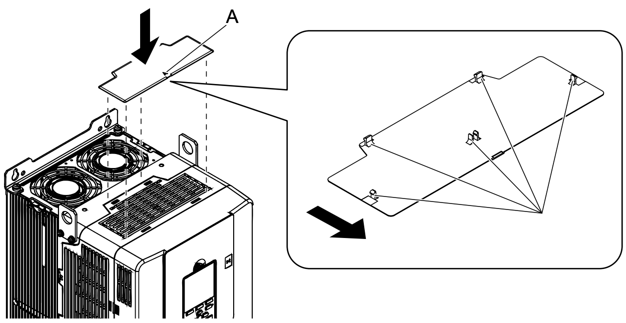
◆ Attach the Protective Cover of Drive Models 2110, 4075

■ Attach the Top Protective Cover

Align the hooks on the rear of top protective cover with the holes on the top of the drive to attach the top protective cover.

Note:

- Attach the top protective cover and point the (⩓) mark on the upper surface of the top protective cover away from the front of the drive.
- Put the two small hooks on the rear of the top protective cover into the mounting holes near the back of the drive. Then push down on the front side of the top protective cover to attach the cover.



A - Mark
B - Rear side of top protective cover
C - Hooks
D - Front of drive

Figure 2.36 Attach the Top Protective Cover

Mechanical Installation

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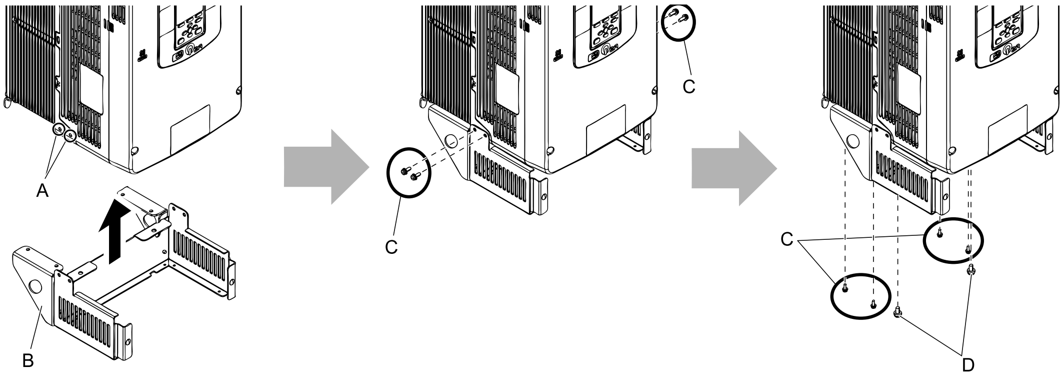
■ Attach the Conduit Bracket

1. Align the screw holes on conduit bracket 1 with the screw holes on the drive and push the bracket into position. Use the screws to attach it at the sides and the bottom.

   Tighten the screws to a correct tightening torque:

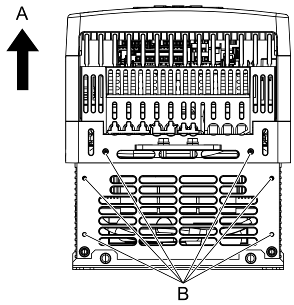
   - Screw A: 1.96 to 2.53 N·m (17.35 to 22.39 lb.·in.)
   - Screw B: 0.98 to 1.33 N·m (8.67 to 11.77 lb.·in.)



A - Screw holes on sides
B - Conduit bracket 1
C - Screws A
D - Screws B

Figure 2.37 Attach Conduit Bracket 1

Figure 2.38 shows the locations of the screw holes on the bottom of the drive.

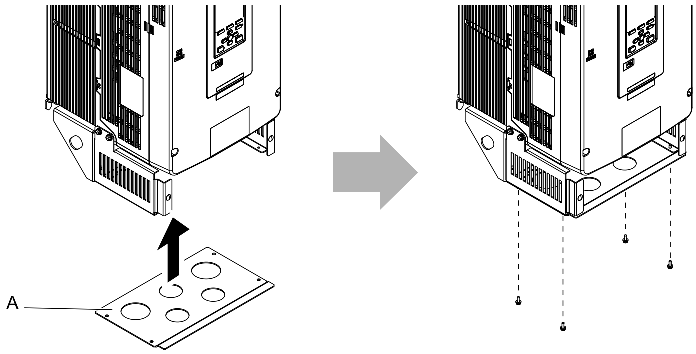


A - Front of drive
B - Screw holes on bottom

Figure 2.38 Locations of Screw Holes on Bottom

2. Align the screw holes on conduit bracket 2 with the screw holes on conduit bracket 1.

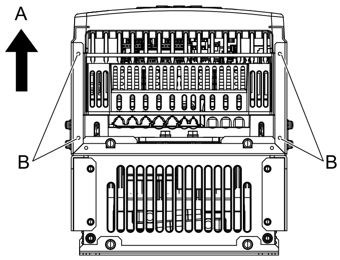
   Tighten the screws to a tightening torque of 0.98 N·m to 1.33 N·m (8.67 lb.·in. to 11.77 lb.·in.).



A - Conduit bracket 2

Figure 2.39 Attach Conduit Bracket 2

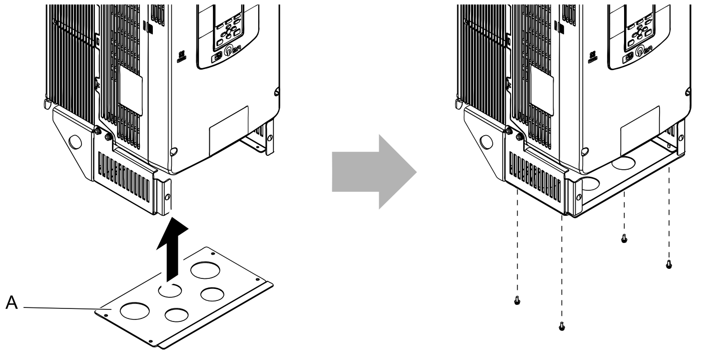
Figure 2.40 shows the locations of the screw holes on the bottom of conduit bracket 1.



A - Front of drive **B - Screw holes on bottom**

Figure 2.40 Locations of Screw Holes on Bottom of Conduit Bracket 1

3. Align the screw holes on conduit bracket 3 with the screw holes on conduit bracket 2.
   Tighten the screws to a tightening torque of 0.98 N·m to 1.33 N·m (8.67 lb.·in. to 11.77 lb.·in.) and lift bracket 3 a short distance.



A - Conduit bracket 3

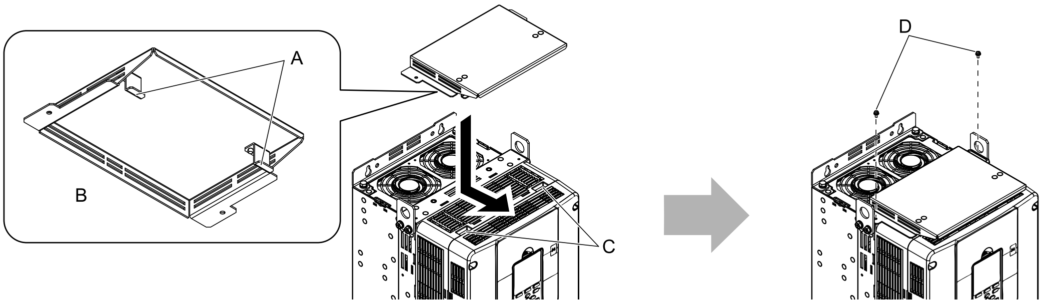
Figure 2.41 Attach Conduit Bracket 3

◆ Attach the Protective Cover of Drive Models 2138, 4089 - 4103

■ Attach the Top Protective Cover

Put the hooks on the back of the top protective cover into the hook holes on the top of the drive.

Move the cover forward a short distance and tighten the screws to a tightening torque of 0.98 N·m to 1.33 N·m (8.67 lb.·in. to 11.77 lb.·in.) to attach the cover.

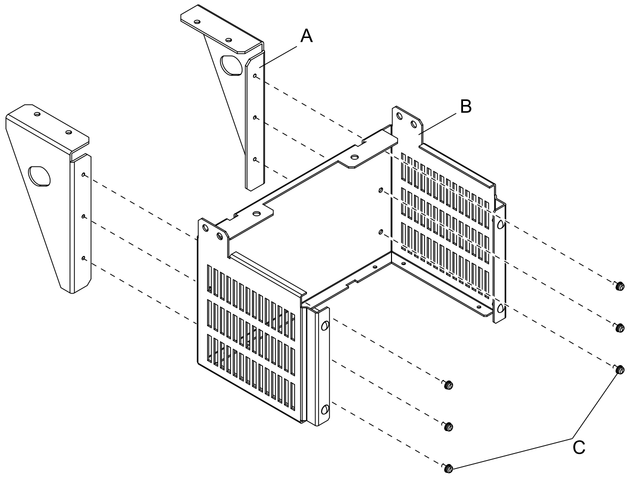


A - Hooks **C - Temporary placement holes**
B - Rear side of top protective cover

Figure 2.42 Attach the Top Protective Cover

■ Attach the Conduit Bracket

1. Align the screw holes on the stay bracket with the screw holes on the base. Tighten the included screws to a tightening torque of 0.98 N·m to 1.33 N·m·(8.67 lb.·in. to 11.77 lb.·in.) to attach the stay bracket to the base.

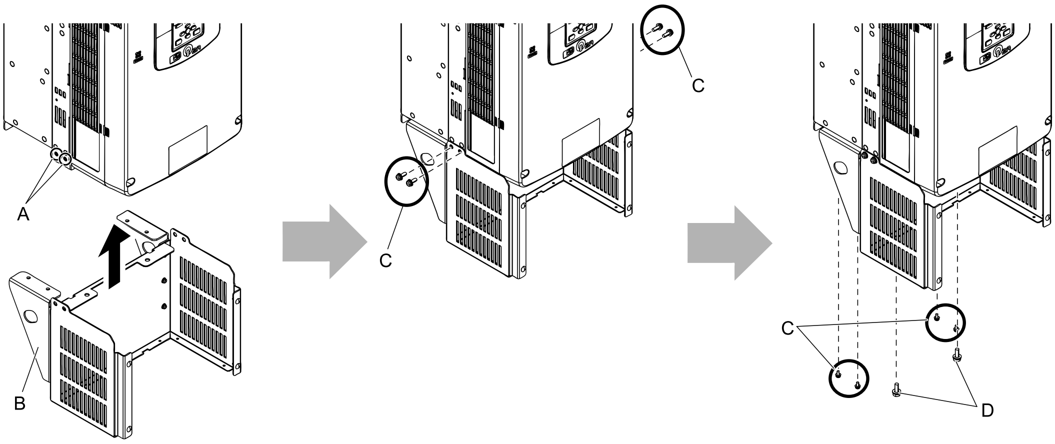


A - Stay bracket
B - Base
C - Screw

Figure 2.43 Assemble Conduit Bracket 1

2. Align the screw holes on conduit bracket 1 with the screw holes on the drive.

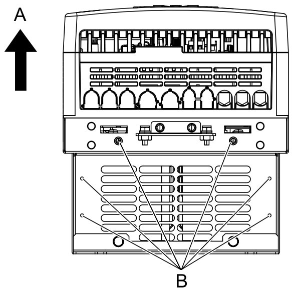
   Tighten the included screws to a tightening torque of 3.92 N·m to 4.90 N·m (34.70 lb.·in. to 43.37 lb.·in.) to attach the bracket to the drive.



A - Screw holes on sides
B - Conduit bracket 1
C - Screws A
D - Screws B

Figure 2.44 Attach Conduit Bracket 1

Figure 2.45 shows the locations of the screw holes on the bottom of the drive.

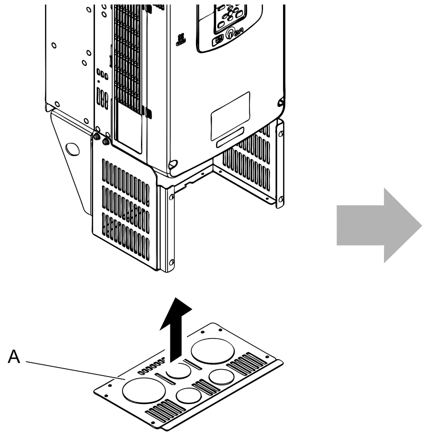


A - Front of drive
B - Screw holes on bottom

Figure 2.45 Locations of Screw Holes on Bottom

3. Align the screw holes on conduit bracket 2 with the screw holes on conduit bracket 1.

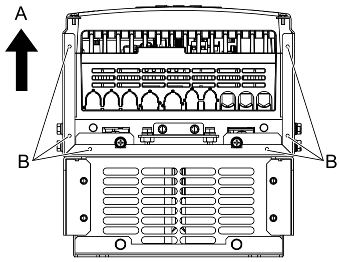
   Tighten the screws to a tightening torque of 0.98 N·m to 1.33 N·m (8.67 lb.·in. to 11.77 lb.·in.).



A - Conduit bracket 2

Figure 2.46 Attach Conduit Bracket 2

Figure 2.47 shows the locations of the screw holes on the bottom of conduit bracket 1.

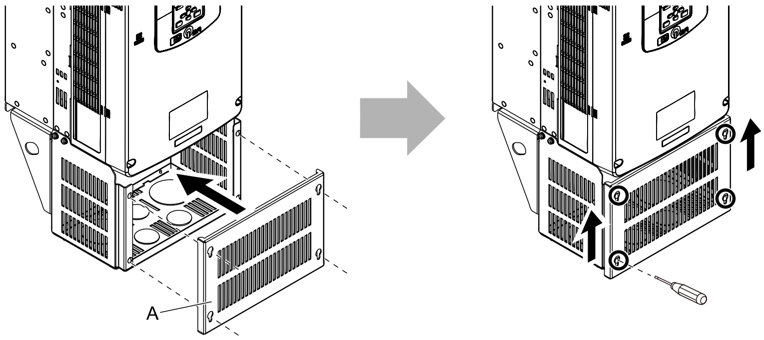


A - Front of drive **B - Screw holes on bottom**

Figure 2.47 Locations of Screw Holes on Bottom of Conduit Bracket 1

4. Align the screw holes on conduit bracket 3 with the screw holes on conduit bracket 2.

   Tighten the screws to a tightening torque of 0.98 N·m to 1.33 N·m (8.67 lb.·in. to 11.77 lb.·in.) and lift bracket 3 a short distance.



A - Conduit bracket 3

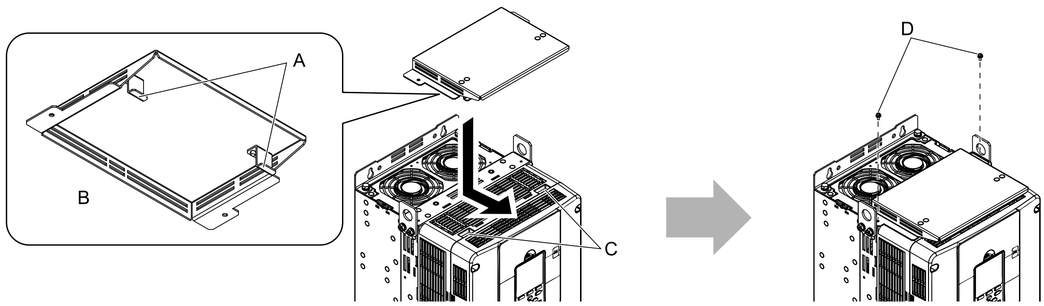
Figure 2.48 Attach Conduit Bracket 3

◆ Attach the Protective Cover of Drive Models 2169 - 2210, 4140 - 4168

■ Attach the Top Protective Cover

Put the hooks on the back of the top protective cover into the hook holes on the top of the drive.

Move the cover forward a short distance and tighten the screws to a tightening torque of 0.98 N·m to 1.33 N·m (8.67 lb.·in. to 11.77 lb.·in.) to attach the cover.

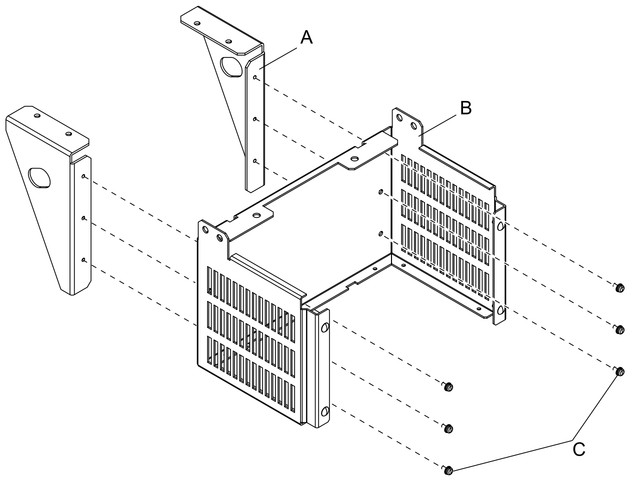


A - Hooks
B - Rear side of top protective cover
C - Temporary placement holes

Figure 2.49 Attach the Top Protective Cover

■ Attach the Conduit Bracket

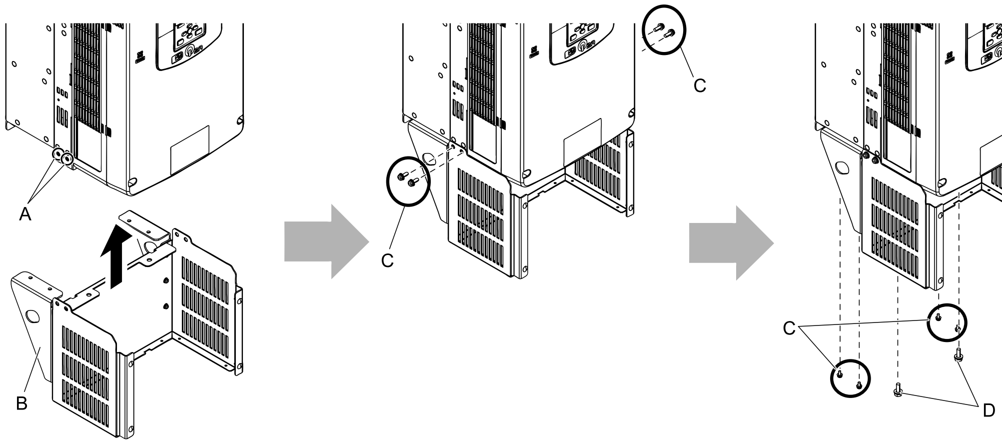
1. Align the screw holes on the stay bracket with the screw holes on the base. Tighten the included screws to a tightening torque of 0.98 N·m to 1.33 N·m (8.67 lb.·in. to 11.77 lb.·in.) to attach the stay bracket to the base.



A - Stay bracket
B - Base
C - Screw

Figure 2.50 Assemble Conduit Bracket 1

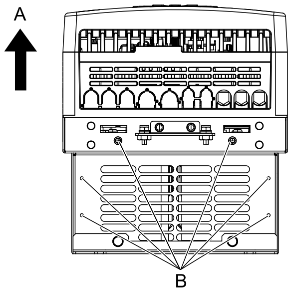
2. Align the screw holes on conduit bracket 1 with the screw holes on the drive and push the bracket into position. Use the screws to attach the bracket.
   Tighten the screws to a correct tightening torque.
   - Screw A: 3.92 N·m to 4.90 N·m (34.70 lb.·in. to 43.37 lb.·in.)
   - Screw B: 8.83 N·m to 10.79 N·m (78.15 lb.·in. to 95.49 lb.·in.)



A - Screw holes on sides | **C - Screws A**
B - Conduit bracket 1 | **D - Screws B**

Figure 2.51 Attach Conduit Bracket 1

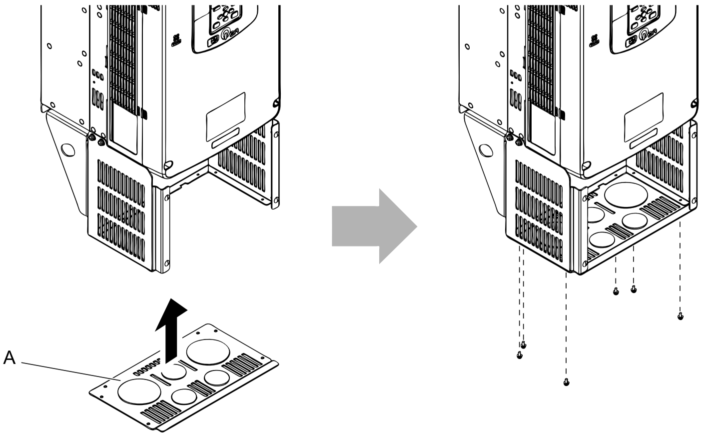
Figure 2.52 shows the locations of the screw holes on the bottom of the drive.



A - Front of drive | **B - Screw holes on bottom**

Figure 2.52 Locations of Screw Holes on Bottom

3. Align the screw holes on conduit bracket 2 with the screw holes on conduit bracket 1.
   Tighten the screws to a tightening torque of 0.98 N·m to 1.33 N·m (8.67 lb.·in. to 11.77 lb.·in.).



A - Conduit bracket 2

Figure 2.53 Attach Conduit Bracket 2

Figure 2.54 shows the locations of the screw holes on the bottom of conduit bracket 1.

Mechanical Installation

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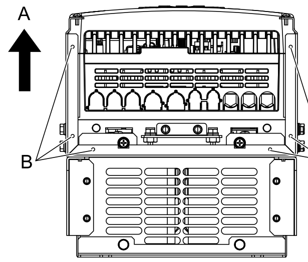
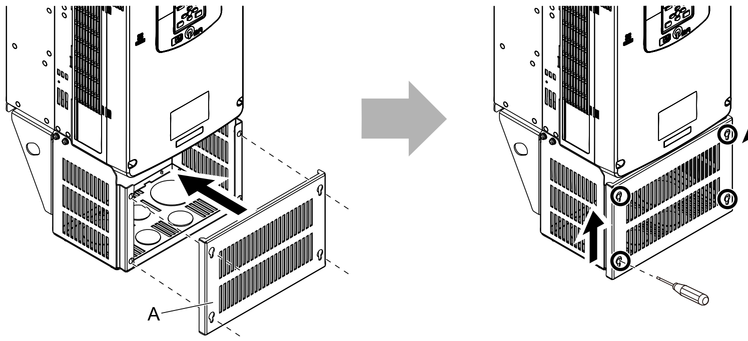


A - Front of drive **B - Screw holes on bottom**

Figure 2.54 Locations of Screw Holes on Bottom of Conduit Bracket 1

4. Align the screw holes on conduit bracket 3 with the screw holes on conduit bracket 2.

   Tighten the screws to a tightening torque of 0.98 N·m to 1.33 N·m (8.67 lb.·in. to 11.77 lb.·in.) and lift bracket 3 a short distance.



A - Conduit bracket 3

Figure 2.55 Attach Conduit Bracket 3

◆ Attach the Protective Cover of Drive Models 2257 - 2313, 4208 - 4296

■ Attach the Top Protective Cover

Align the screw holes of the top protective cover with the screw holes on the top of the drive.

Tighten the screws to a tightening torque of 0.98 N·m to 1.33 N·m (8.67 lb.·in. to 11.77 lb.·in.) to attach the cover.

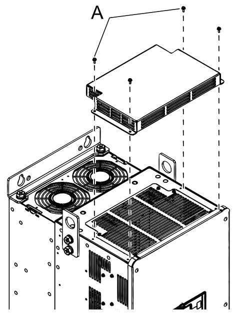
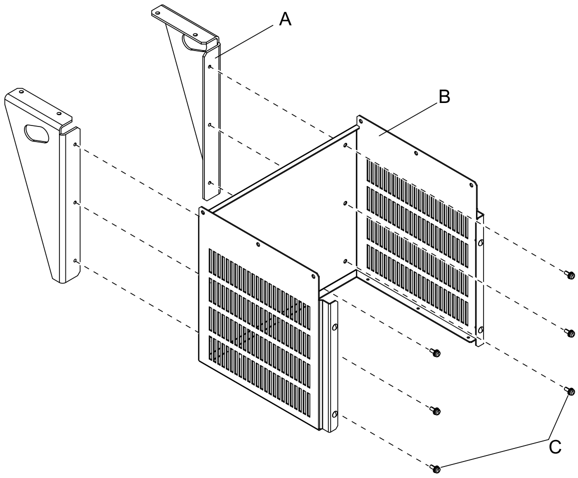


Figure 2.56 Attach the Top Protective Cover

■ Attach the Conduit Bracket

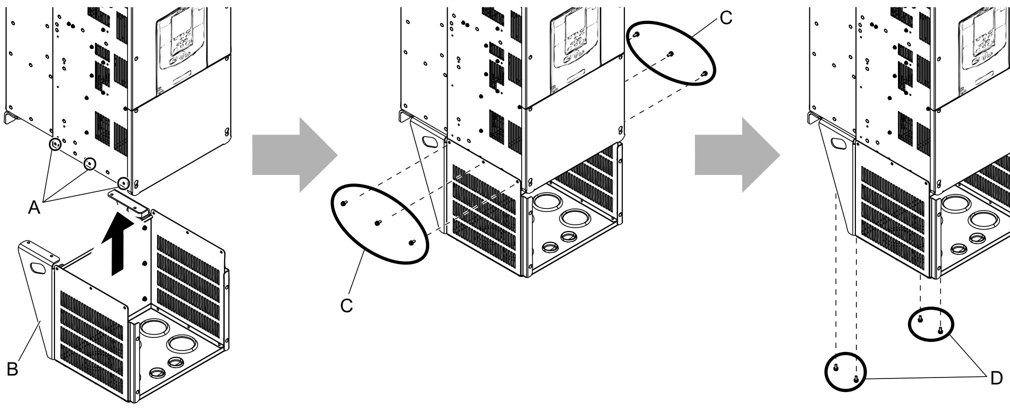
1. Align the screw holes on the stay bracket with the screw holes on the base. Tighten the included screws to a tightening torque of 0.98 N·m to 1.33 N·m (8.67 lb.·in. to 11.77 lb.·in.) to attach the stay bracket to the base.



A - Stay bracket
B - Base
C - Screw

Figure 2.57 Assemble Conduit Bracket 1

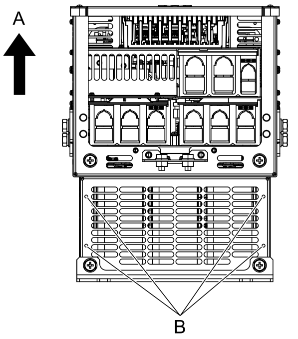
2. Align the screw holes on conduit bracket 1 with the screw holes on the drive and push the bracket into position.
   - Use the screws to attach the bracket.
   - Tighten the screws to a correct tightening torque:
     – Screw A: 0.98 N·m to 1.33 N·m (8.67 lb.·in. to 11.77 lb.·in.)
     – Screw B: 1.96 N·m to 2.53 N·m (17.35 lb.·in. to 22.39 lb.·in.)



A - Screw holes on sides
B - Conduit bracket 1
C - Screws A
D - Screws B

Figure 2.58 Attach Conduit Bracket 1

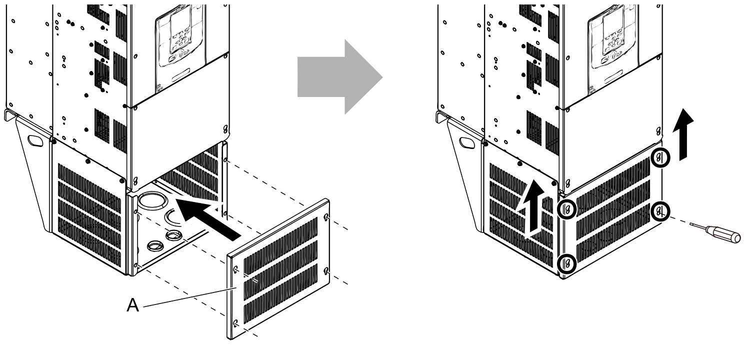
Figure 2.59 shows the locations of the screw holes on the bottom of the drive.



A - Front of drive **B - Screw holes on bottom**

Figure 2.59 Locations of Screw Holes on Bottom

3. Align the screw holes on conduit bracket 2 with the screw holes on conduit bracket 1.
   Tighten the screws to a tightening torque of 0.98 N·m to 1.33 N·m (8.67 lb.·in. to 11.77 lb.·in.).



A - Conduit bracket 2

Figure 2.60 Attach Conduit Bracket 2

◆ Attach the Protective Cover of Drive Models 2360, 4371

■ Attach the Top Protective Cover

Align the screw holes of the top protective cover with the screw holes on the top of the drive.
Tighten the screws to a tightening torque of 0.98 N·m to 1.33 N·m (8.67 lb.·in. to 11.77 lb.·in.) to attach the cover.

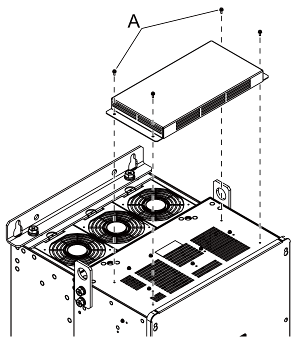
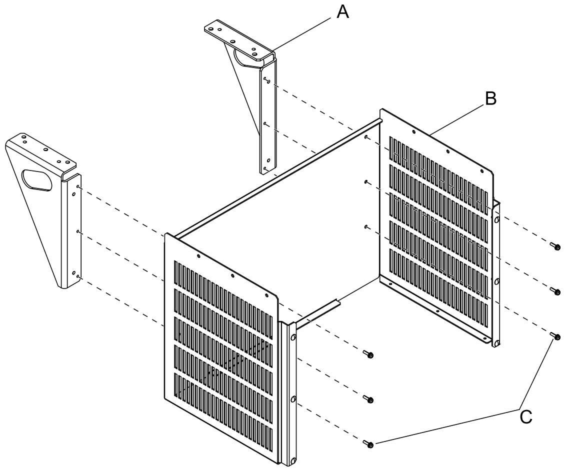


Figure 2.61 Attach the Top Protective Cover

■ Attach the Conduit Bracket

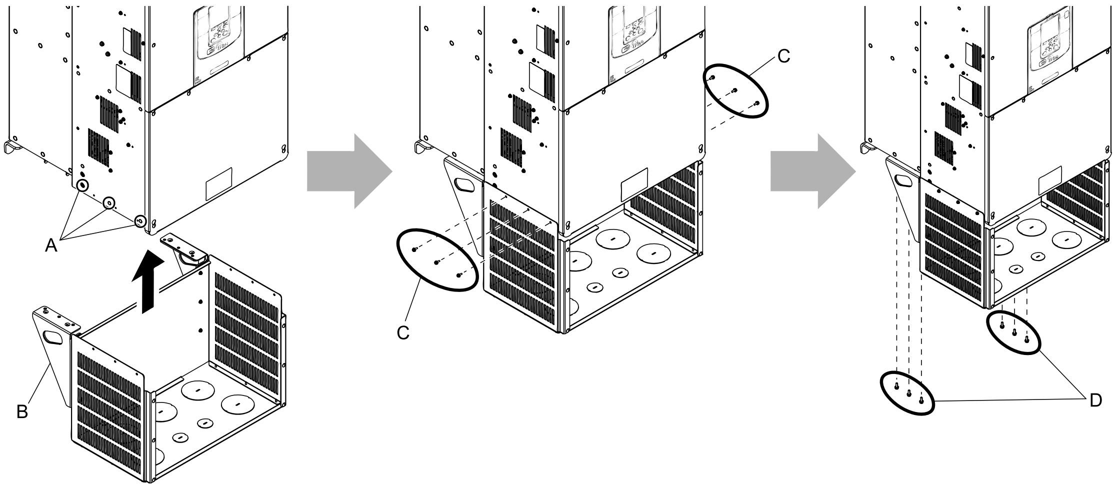
1. Align the screw holes on the stay bracket with the screw holes on the base. Tighten the included screws to a tightening torque of 0.98 N·m to 1.33 N·m (8.67 lb.·in. to 11.77 lb.·in.) to attach the stay bracket to the base.



A - Bracket
B - Base
C - Screws

Figure 2.62 Assemble Conduit Bracket 1

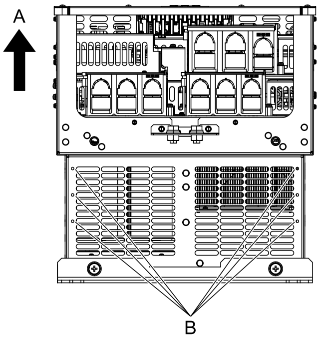
2. Align the screw holes on conduit bracket 1 with the screw holes on the drive and push the bracket into position.
   - Use the screws to attach the bracket.
   - Tighten the screws to a correct tightening torque.
     – Screw A: 0.98 N·m to 1.33 N·m (8.67 lb.·in. to 11.77 lb.·in.)
     – Screw B: 1.96 N·m to 2.53 N·m (17.35 lb.·in. to 22.39 lb.·in.)



A - Screw holes on sides
B - Conduit bracket 1
C - Screws A
D - Screws B

Figure 2.63 Attach Conduit Bracket 1

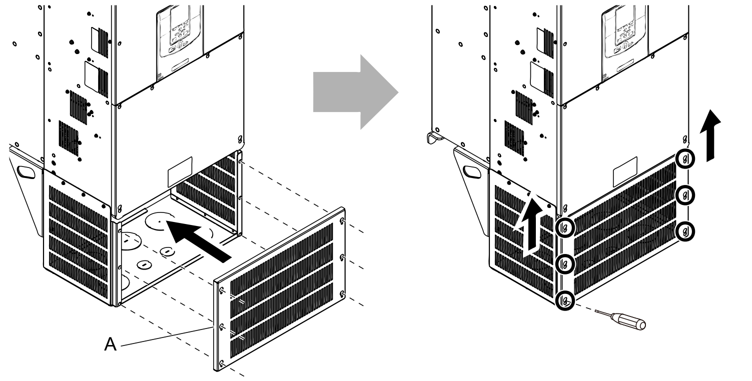
Figure 2.64 shows the locations of the screw holes on the bottom of the drive.



A - Front of drive **B - Screw holes on bottom**

Figure 2.64 Locations of Screw Holes on Bottom

3. Align the screw holes on conduit bracket 2 with the screw holes on conduit bracket 1.
   Tighten the screws to a tightening torque of 0.98 N·m to 1.33 N·m (8.67 lb.·in. to 11.77 lb.·in.).



A - Conduit bracket 2

Figure 2.65 Attach Conduit Bracket 2

2.9 Installation Methods

The drive installation methods include standard installation and external heatsink installation.

◆ Standard Installation

Refer to *Drive Exterior and Mounting Dimensions on page 388* for more information about external dimensions and installation procedure.

◆ External Heatsink

An attachment is necessary to install drive models smaller than 2082 (200 V class) and 4060 (400 V class) with the heatsink outside of the panel.

Note:

- The exterior mounting dimensions and installation dimensions for a standard installation are different than the dimensions for an external heatsink installation.
- The shaded parts of the panel cut-out dimensions are the gasket dimensions. Make sure that the gasket is not smaller than the specified dimension.

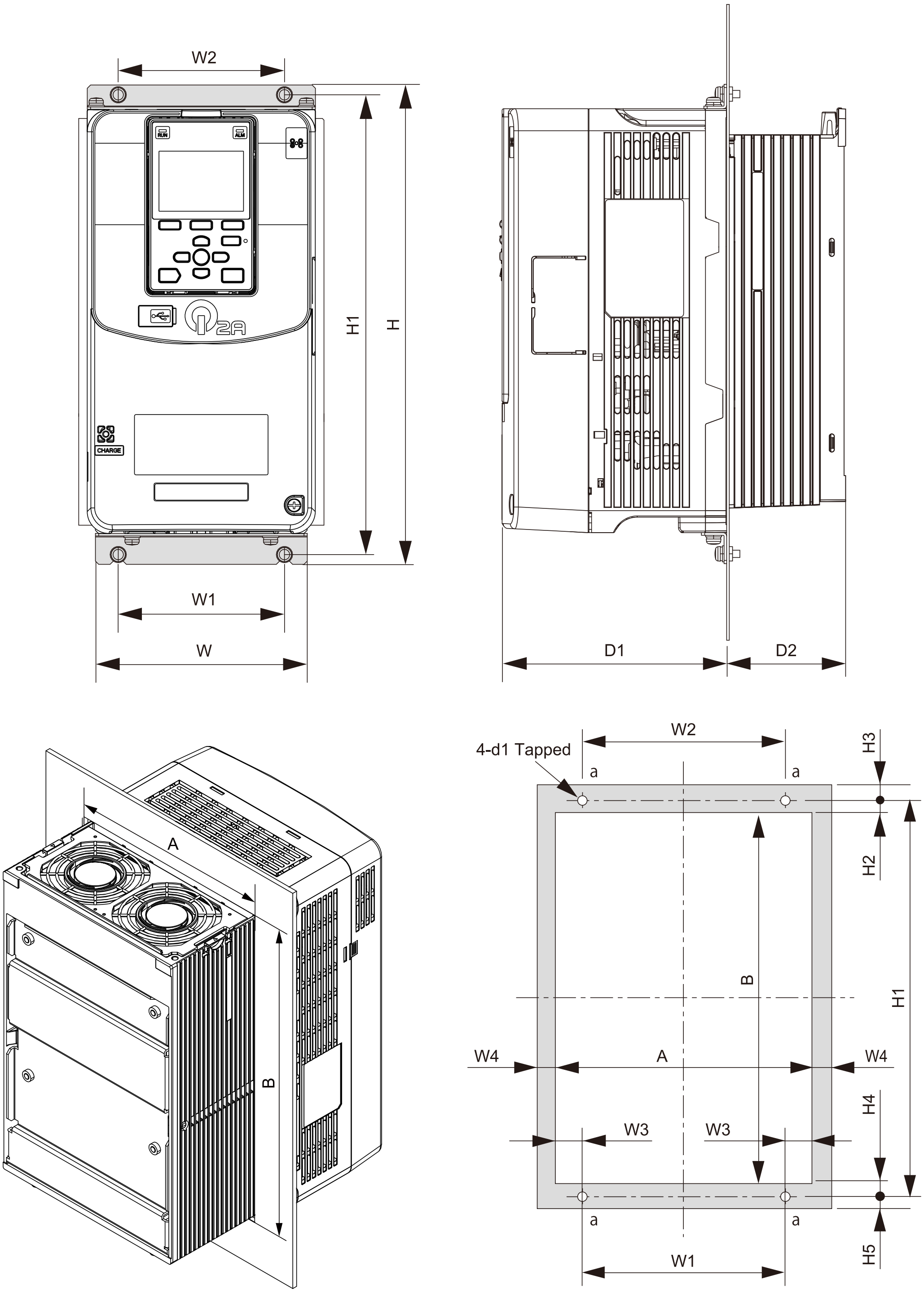


Figure 2.66 Panel Cut-Out Dimensions

Table 2.5 Panel Cut-Out Dimensions (200 V Class)

Model	Dimensions mm (in.)														
	W	H	D1	D2	W1	W2	W3	W4	H1	H2	H3	H4	H5	A	B	d1
2004 2006 2010 2012 2018 2021 2030 2042 *1	140 (5.51)	294 (11.57)	138 (5.43)	38 (1.50)	102 (4.02)	102 (4.02)	16 (0.63)	3 (0.12)	282 (11.10)	23 (0.91)	6 (0.24)	26 (1.02)	6 (0.24)	134 (5.28)	233 (9.17)	M5
2056 *1	180 (7.09)	329 (12.95)	134 (5.28)	68 (2.68)	140 (5.51)	140 (5.51)	17 (0.67)	3 (0.12)	318 (12.52)	23.5 (0.93)	5 (0.20)	24.5 (0.97)	6 (0.24)	174 (6.85)	270 (10.63)	M5

Model	Dimensions mm (in.)															
	W	H	D1	D2	W1	W2	W3	W4	H1	H2	H3	H4	H5	A	B	d1
2070 2082 *1	220 (8.66)	384 (15.12)	140 (5.51)	87 (3.43)	192 (7.56)	192 (7.56)	11 (0.43)	3 (0.12)	371 (14.61)	27 (1.06)	7 (0.28)	25 (0.98)	6 (0.24)	214 (8.43)	319 (12.56)	M6
2110	240 (9.45)	400 (15.75)	166 (6.54)	114 (4.49)	195 (7.68)	204 (8.03)	14.5 (0.57)	8 (0.32)	385 (15.16)	19.5 (0.77)	7.5 (0.30)	19.5 (0.77)	7.5 (0.30)	224 (8.82)	346 (13.62)	M6
2138	255 (10.04)	450 (17.72)	166 (6.54)	114 (4.49)	170 (6.69)	210 (8.27)	34.5 (1.36)	8 (0.32)	436 (17.17)	20 (0.79)	8 (0.32)	20 (0.79)	6 (0.24)	239 (9.41)	396 (15.59)	M6
2169 2211	264 (10.39)	543 (21.38)	186 (7.32)	149 (5.87)	190 (7.48)	220 (8.66)	29 (1.14)	8 (0.32)	527 (20.75)	19.5 (0.77)	8.5 (0.34)	20.5 (0.81)	7.5 (0.30)	248 (9.76)	487 (19.17)	M8
2257 2313	312 (12.28)	700 (27.56)	260 (10.24)	160 (6.30)	218 (8.58)	263 (10.35)	39 (1.54)	8 (0.32)	675 (26.56)	33 (1.30)	12 (0.47)	32 (1.26)	13 (0.51)	296 (11.65)	610 (24.02)	M10
2360 2415	440 (17.32)	800 (31.50)	254 (10.00)	218 (8.58)	370 (14.57)	310 (12.20)	23 (0.91)	12 (0.47)	773 (30.43)	31.5 (1.24)	14 (0.55)	31.5 (1.24)	13 (0.51)	416 (16.38)	710 (27.95)	M12

*1 The attachment for external heatsink installation is necessary.

Table 2.6 Panel Cut-Out Dimensions (400 V Class)

Model	Dimensions mm (in.)																	
	W	H	D1	D2	W1	W2	W3	W4	W5	W6	H1	H2	H3	H4	H5	A	B	d1
4002 4004 4005 4007 4009 4012 4018 *1	140 (5.51)	294 (11.57)	138 (5.43)	38 (1.50)	102 (4.02)	102 (4.02)	16 (0.63)	3 (0.12)	-	-	282 (11.10)	23 (0.91)	6 (0.24)	26 (1.02)	6 (0.24)	134 (5.28)	233 (9.17)	M5
4023 *1	140 (5.51)	294 (11.57)	138 (5.43)	73 (2.87)	102 (4.02)	102 (4.02)	16 (0.63)	3 (0.12)	-	-	282 (11.10)	23 (0.91)	6 (0.24)	26 (1.02)	6 (0.24)	134 (5.28)	233 (9.17)	M5
4031 4038 *1	180 (7.09)	329 (12.95)	134 (5.28)	68 (2.68)	140 (5.51)	140 (5.51)	17 (0.67)	3 (0.12)	-	-	318 (12.52)	23.5 (0.925)	5 (0.20)	24.5 (0.97)	6 (0.24)	174 (6.85)	270 (10.63)	M5
4044 *1	220 (8.66)	384 (15.12)	140 (5.51)	87 (3.43)	192 (7.56)	192 (7.56)	11 (0.43)	3 (0.12)	-	-	371 (14.61)	27 (1.06)	7 (0.28)	25 (0.98)	6 (0.24)	214 (8.43)	319 (12.56)	M6
4060 *1	220 (8.66)	384 (15.12)	140 (5.51)	106 (4.17)	192 (7.56)	192 (7.56)	11 (0.43)	3 (0.12)	-	-	371 (14.61)	27 (1.06)	7 (0.28)	25 (0.98)	6 (0.24)	214 (8.43)	319 (12.56)	M6
4075	240 (9.45)	400 (15.75)	166 (6.54)	114 (4.49)	195 (7.68)	204 (8.03)	14.5 (0.57)	8 (0.32)	-	-	385 (15.16)	19.5 (0.77)	7.5 (0.30)	19.5 (0.77)	7.5 (0.30)	224 (8.82)	346 (13.62)	M6
4089 4103	255 (10.04)	450 (17.72)	166 (6.54)	114 (4.49)	170 (6.69)	210 (8.27)	34.5 (1.36)	8 (0.32)	-	-	436 (17.17)	20 (0.79)	8 (0.32)	20 (0.79)	6 (0.24)	239 (9.41)	396 (15.59)	M6
4140 4168	264 (10.39)	543 (21.38)	186 (7.32)	149 (5.87)	190 (7.48)	220 (8.66)	29 (1.14)	8 (0.32)	-	-	527 (20.75)	19.5 (0.77)	8.5 (0.34)	20.5 (0.81)	7.5 (0.30)	248 (9.76)	487 (19.17)	M8
4208 4250 4296	312 (12.28)	700 (27.56)	260 (10.24)	160 (6.30)	218 (8.58)	263 (10.35)	39 (1.54)	8 (0.32)	-	-	675 (26.56)	33 (1.30)	12 (0.47)	32 (1.26)	13 (0.51)	296 (11.65)	610 (24.02)	M10
4371 4389	440 (17.32)	800 (31.50)	254 (10.00)	218 (8.58)	370 (14.57)	310 (12.20)	23 (0.91)	12 (0.47)	-	-	773 (30.43)	31.5 (1.24)	14 (0.55)	31.5 (1.24)	13 (0.51)	416 (16.38)	710 (27.95)	M12
4453 4568 4675	510 (20.08)	1140 (44.88)	260 (10.24)	220 (8.66)	450 (17.72)	404 (15.91)	18 (0.71)	12 (0.47)	179 (7.05)	225 (8.86)	1110 (43.70)	34 (1.34)	15 (0.59)	34 (1.34)	15 (0.59)	486 (19.13)	1042 (41.02)	M12

*1 The attachment for external heatsink installation is necessary.

3

Electrical Installation

This chapter explains how to wire the control circuit terminals, motor, and power supply.

3.1 Safety Precautions

⚠DANGER

Electrical Shock Hazard

Electrical Shock Hazard. Do not examine, connect, or disconnect wiring on an energized drive. Before servicing, disconnect all power to the equipment and wait for the time specified on the warning label at a minimum. The internal capacitor stays charged after the drive is de-energized. The charge indicator LED extinguishes when the DC bus voltage decreases below 50 Vdc. When all indicators are OFF, measure for dangerous voltages to make sure that the drive is safe.

If you do work on the drive when it is energized, it will cause serious injury or death from electrical shock.

Make sure that all electrical connections are correct and install all drive covers before energizing the drive. Use terminals for their intended function only.

Incorrect wiring or ground connections, and incorrect repair of protective covers can cause death or serious injury.

⚠WARNING

Electrical Shock Hazard

Correctly ground the drive before turning on the EMC filter switch.

Failure to obey can cause death or serious injury.

Use the terminals for the drive only for their intended purpose. Refer to the technical manual for more information about the I/O terminals.

Wiring and grounding incorrectly or modifying the cover may damage the equipment or cause injury.

Crush Hazard

Use a lifting mechanism made to move large drives when necessary.

Failure to obey can cause death or serious injury from falling equipment.

Do not try to flip over a hanging drive or leave a hanging drive unattended.

Failure to obey can cause death or serious injury from falling equipment.

Prevent more than 1.96 m/s^2 (0.2 G) vibration and impact to a hanging drive.

Failure to obey can cause death or serious injury from falling equipment.

Use screws to correctly attach the drive front cover, terminal blocks, and other drive components before hanging the drive vertically.

Failure to obey can cause serious injury or death from falling equipment.

Only approved personnel can operate a crane or hoist to move the drive.

Failure to obey can cause death or serious injury from falling equipment.

Fire Hazard

When installing the drive into a closed cabin or cabinet, use a cooling fan or cooler to decrease the temperature around the drive. Make sure that the intake air temperature to the drive is 50 °C (122 °F) or less for open chassis type drives, (IP20) and 40 °C (104 °F) or less for enclosed wall-mounted type (UL Type1) drives.

Failure to obey can cause the drive to overheat and cause fire, death or serious injury.

When installing dynamic braking options, wire the components as specified by the wiring diagrams.

Failure to obey can result in fire, death or serious injury. Incorrect wiring can cause damage to braking components.

Do not use the main circuit power supply (Overcurrent Category III) at incorrect voltages. Make sure that the drive rated voltage aligns with the power supply voltage before energizing the drive.

Failure to obey can cause death or serious injury.

⚠WARNING

Do not put flammable or combustible materials on top of the drive and do not install the drive near flammable or combustible materials. Attach the drive to metal or other noncombustible material.

Failure to obey can cause death or serious injury.

Tighten screws against the bit at an angle in the specified range shown in this manual.

If you tighten the screws at an angle not in the specified range, you can have loose connections that can cause damage to the terminal block or start a fire.

Tighten all terminal screws to the correct tightening torque.

Connections that are too loose or too tight can cause incorrect operation and damage to the drive. Incorrect connections can also cause death or serious injury from fire.

Electrical Shock Hazard

Do not make changes to the drive body or drive circuitry.

Failure to obey can cause death or serious injury and will void warranty. The manufacturer is not responsible for changes to the product made by the user.

Only let authorized persons install, wire, maintain, examine, replace parts, and repair the drive.

Failure to obey can cause death or serious injury.

Do not remove covers or touch circuit boards while the drive is energized.

Failure to obey can cause death or serious injury.

Do not work on the drive or around the drive while wearing loose clothing or jewelry. Tighten loose clothing and remove all metal objects such as watches or rings.

Failure to obey can cause death or serious injury.

Always use a type B Residual Current Monitor/Residual Current Device (RCM/RCD) where a residual current operated protective or monitoring device protects against direct or indirect contact as specified by IEC/EN 60755 The drive can cause a residual current with a DC component in the protective earthing conductor.

Failure to obey can cause death or serious injury.

The leakage current of the drive will be more than 3.5 mA. The IEC/EN 61800-5-1: 2007 standard specifies that users must wire the power supply to automatically turn off when the protective ground wire disconnects. Users can also connect a protective ground wire that has a minimum cross-sectional area of 10 mm^2 (copper wire) or 16 mm^2 (aluminum wire).

Failure to obey these standards can cause death or serious injury.

Ground the neutral point on the power supply to comply with the EMC Directive before turning on the EMC filter or if there is high resistance grounding.

If the EMC filter is switched ON without the neutral point being grounded or if there is high resistance grounding, it can cause death or serious injury.

Do not operate equipment when covers are missing. Some figures in this section include drives without covers or safety shields to more clearly show the inside of the drive. Replace covers and shields before operation. Use drives only as specified by the instructions.

Failure to obey can cause death or serious injury.

⚠CAUTION

Crush Hazard

Do not hold the drive by the front cover or terminal cover. Tighten the screws correctly before moving the drive.

Failure to obey can cause minor to moderate injury.

NOTICE

Do not let unwanted objects, for example metal shavings or wire clippings, fall into the drive during drive installation and project construction. Put a temporary cover over the top of the drive during installation. Remove the temporary cover before start-up or the drive will overheat.

Failure to obey can cause damage to the drive.

Observe correct electrostatic discharge (ESD) procedures when touching the drive.

Failure to obey can cause ESD damage to the drive circuitry.

To use a standard blower-cooled motor, reduce the motor torque in the low-speed range. If 100% torque is continuously necessary at low speed, use a special motor or vector control motor. Select a motor that is compatible with the necessary load torque and operating speed range.

Operating the motor in the low speed range decreases the cooling effects, increases motor temperature, and can cause overheating and motor damage.

The speed range for continuous operation will be different depending on the lubrication method and motor manufacturer. To operate the motor at a speed higher than the rated speed, contact the manufacturer.

If you continuously operate an oil-lubricated motor in the low-speed range, it can cause burning.

When the input voltage is 440 V or higher or the wiring distance is more than 100 meters, pay special attention to the motor insulation voltage or use a drive-rated motor with reinforced insulation.

Failure to obey can cause motor winding failure.

If you operated a machine at constant speed and then operated the same machine in variable-speed mode, motor vibration will increase.

Install vibration-proof rubber on the motor base or use the frequency jump function to avoid the frequency that is resonating the machine.

The motor may require more acceleration torque with drive operation than with a commercial power supply. Check the load torque characteristics of the machine to be used with the motor.

The rated input current of submersible motors is higher than the rated input current of standard motors. Use the rated output current to select an applicable drive. When the distance between the motor and drive is long, use a wire that can connect the motor to the drive without a reduction in motor torque.

To use an explosion-proof motor, you must do an explosion-proof test with the drive. As the drive is not explosion-proof, make sure that you install it in a safe area.

Failure to obey could cause damage to the drive.

Do not lift the drive with the cover removed.

Failure to obey can cause damage to the drive board and terminal block.

Do not use unshielded wire for control wiring. Use shielded, twisted-pair wires and ground the shield to the ground terminal of the drive.

Failure to obey can cause electrical interference and unsatisfactory system performance.

Do not allow unqualified personnel to use the product. Before you connect a dynamic braking option to the drive, make sure that you review Braking Unit and Braking Resistor Unit Installation Manual TOBPC72060001.

Failure to obey can cause damage to the drive and braking circuit.

Do not change the drive circuitry.

Failure to obey can cause damage to the drive and will void warranty. The manufacturer is not responsible for modifications of the product made by the user.

Make sure that all connections are correct after you install the drive and connecting peripheral devices.

Failure to obey can cause damage to the drive.

3.2 Standard Connection Diagram

Wire the drive as specified by Figure 3.1.

WARNING! *Sudden Movement Hazard. Set the MFDI terminal parameters before you close the control circuit wiring. Incorrect Run/Stop circuit sequence settings can cause death or serious injury from moving equipment.*

WARNING! *Sudden Movement Hazard. Correctly wire the start/stop and safety circuits before energizing the drive. Momentarily closing a digital input terminal can start a drive that is programmed for 3-Wire control. Failure to obey can cause death or serious injury from moving equipment.*

WARNING! *Sudden Movement Hazard.*
When using a 3-Wire sequence:
- *Set the drive for 3-Wire sequence.*
- *Set b1-17 = 1 [RUN@PowerUp Selection = Disregard RUN]*
- *Wire the drive for 3-Wire sequence.*

If these three conditions are correct, the motor can rotate in reverse when energizing the drive:
- *The drive is wired for 3-Wire sequence.*
- *The drive is set for a 2-Wire sequence (default).*
- *b1-17 = 2 [Accept RUN]*

Failure to obey can cause death or serious injury from moving equipment.

NOTICE: *Fire Hazard. Install sufficient branch circuit short circuit protection as specified by applicable codes and this manual. The drive is suited for circuits that supply not more than 100,000 RMS symmetrical amperes, 240 Vac maximum (200 V Class), 480 Vac maximum (400 V Class). Failure to obey can cause death or serious injury.*

NOTICE: *When the input voltage is 440 V or higher or if the wiring distance is longer than 100 m (328 ft.) be sure to use a drive duty motor or carefully monitor the motor insulation voltage. Failure to obey can cause damage to the motor insulation.*

NOTICE: *Do not connect the AC control circuit ground to the drive enclosure. Failure to obey can cause incorrect control circuit operation.*

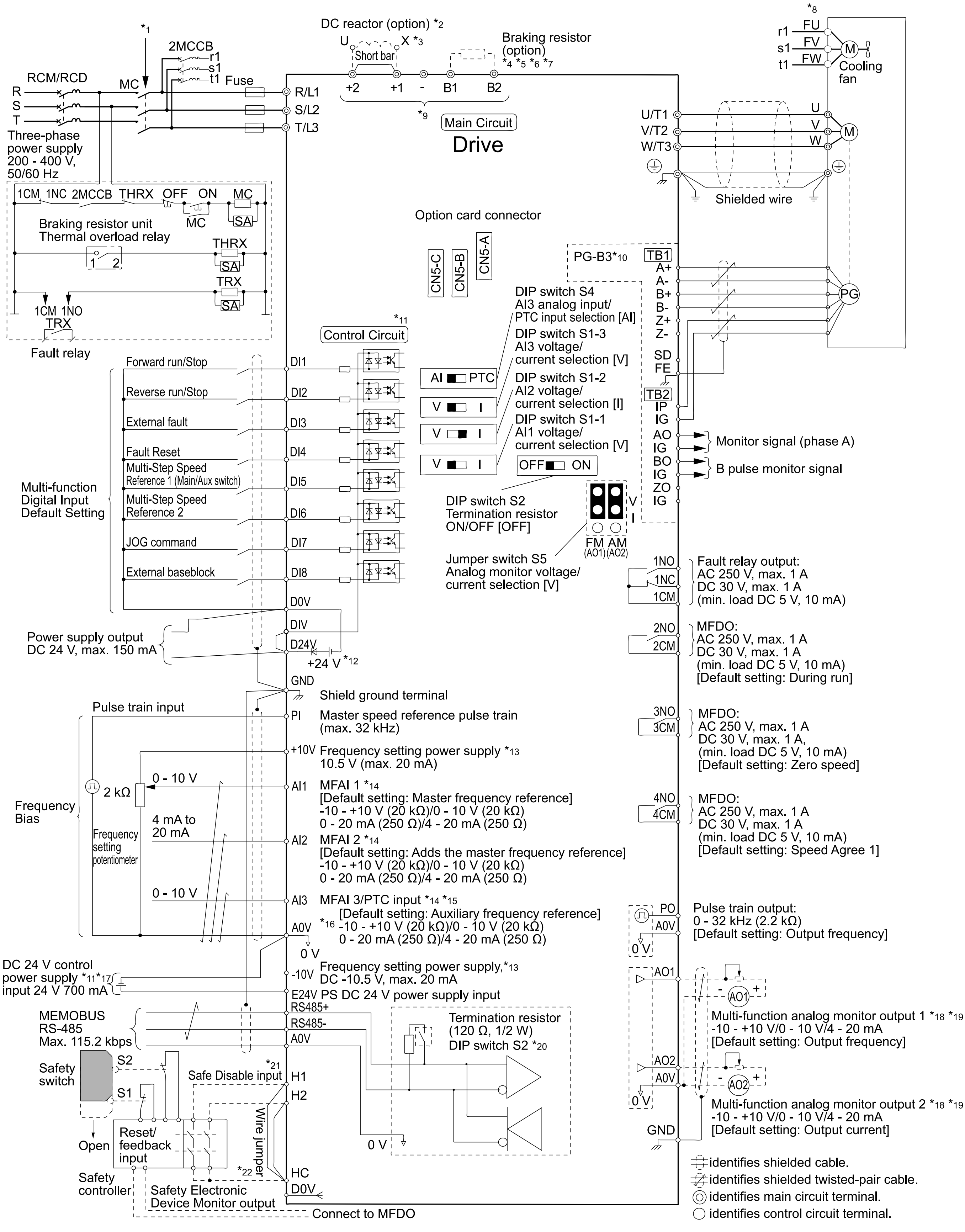


Figure 3.1 Standard Drive Connection Diagram

*1 Set the wiring sequence to de-energize the drive with the fault relay output. If the drive outputs a fault during fault restart when you use the fault restart function, set *L5-02 = 2 [Fault@Reset Select = Enable Fault Output]* to de-energize the drive. Be careful when you use a cut-off sequence. The default setting for *L5-02 = 1 [Fault@Reset Select = Disable Fault Output]*.

*2 When you install a DC reactor, you must remove the jumper between terminals +1 and +2.

*3 Models 2110 to 2415 and 4060 to 4675 have a DC reactor.

*4 When you use an optional regenerative converter, regenerative unit, or braking unit, set *L8-55 = 0 [DB IGBT Protection = Disable]* to disable the protection function of the drive braking transistor. If *L8-55 = 1 [DB IGBT Protection = Enabled]*, the drive will detect *rF [Braking Resistor Fault]*.

*5 When you use a regenerative converter, regenerative unit, braking unit, braking resistor, or braking resistor unit, set *L3-04 = 0 [StallP@Decel Enable = Disabled]*. If *L3-04 = 1 [StallP@Decel Enable = Enabled]*, the drive could possibly not stop in the specified deceleration time.

*6 When you use an ERF-type braking resistor, set *L8-01 = 1 [3%ERF DBR Protection = Enabled]* and set a wiring sequence to de-energize the drive with the fault relay output.

*7 When you connect a braking unit (CDBR series) or a braking resistor unit (LKEB series) to drive models 2110, 2138, and 4103, make sure that you use wires that are in the range of the applicable gauges for the drive. A junction terminal is necessary to connect wires that are less than the applicable gauge to the drive. Contact the manufacturer or your nearest sales representative for more information about selection and installation of the junction terminal.

*8 Cooling fan wiring is not necessary for self-cooling motors.

*9 Connect peripheral options to terminals -, +1, +2, B1, and B2.

WARNING! *Electrical Shock Hazard. Use terminals -, +1, +2, B1, and B2 to connect options to the drive. Do not connect an AC power supply lines to these terminals. Failure to obey can cause death or serious injury.*

*10 Encoder circuit wiring (wiring to PG-B3 option card) is not necessary for applications that do not use motor speed feedback.

*11 Connect 24 V power to terminal E24V-A0V to maintain power to the drive control circuit when the main circuit is OFF.

*12 Install a wire jumper between terminals D0V-DIC-D24V to select the type of the power supply for MFDI (sinking/sourcing mode or internal/external power supply).

NOTICE: *Do not close the circuit between terminals D24V and D0V. Failure to obey will cause damage to the drive.*

- Sinking Mode: Install a jumper between terminals DIC and D24V.

  NOTICE: *Do not close the circuit between terminals DIC and D0V in Sinking Mode. Failure to obey will cause damage to the drive.*

- Sourcing Mode: Install a jumper between terminals DIC and D0V.

  NOTICE: *Do not close the circuit between terminals DIC and D24V in Source Mode. Failure to obey will cause damage to the drive.*

- External power supply: Remove the wire jumper between terminals DIC-D24V and terminals DIC-D0V.

*13 The maximum output current capacity for terminals +10V and -10V on the control circuit is 20 mA.

NOTICE: *Do not install a jumper between terminals +10V, -10V, and A0V. Failure to obey can cause damage to the drive.*

*14 DIP switches S1-1 to S1-3 set terminals AI1 to AI3 for voltage or current input. The default setting for S1-1 and S1-3 is voltage input ("V" side). The default setting for S1-2 is current input ("I" side).

*15 DIP switch S4 sets terminal AI3 for analog or PTC input. Set DIP switch S1-3 to the "V" side, and set *H3-05 = 0 [AI3 Signal Level Select = 0 to 10V (Lower Limit at 0)]* to set terminal AI3 for PTC input with DIP switch S4.

*16 Do not ground the control circuit terminals A0V or connect them to the drive.

WARNING! *Do not connect the A0V control circuit terminals to ground. Failure to obey can cause drive malfunction or failure.*

*17 Connect the positive lead from an external 24 Vdc power supply to terminal E24V and the negative lead to terminal A0V.

NOTICE: *Do not connect terminals E24V and A0V inversely. Failure to obey will cause damage to the drive.*

*18 Use multi-function analog monitor outputs with analog frequency meters, ammeters, voltmeters, and wattmeters. Do not use monitor outputs with feedback-type signal devices.

*19 Jumper switch S5 sets terminal AO1 and AO2 for voltage or current output. The default setting for S5 is voltage output ("V" side).

*20 Set DIP switch S2 to "ON" to enable the termination resistor in the last drive in a Modbus network.

*21 Use only SOURCE Mode for Safe Disable input.

*22 Disconnect the wire jumper between H1 and HC, and H2 and HC to use the Safe Disable input.

3.3 Main Circuit Wiring

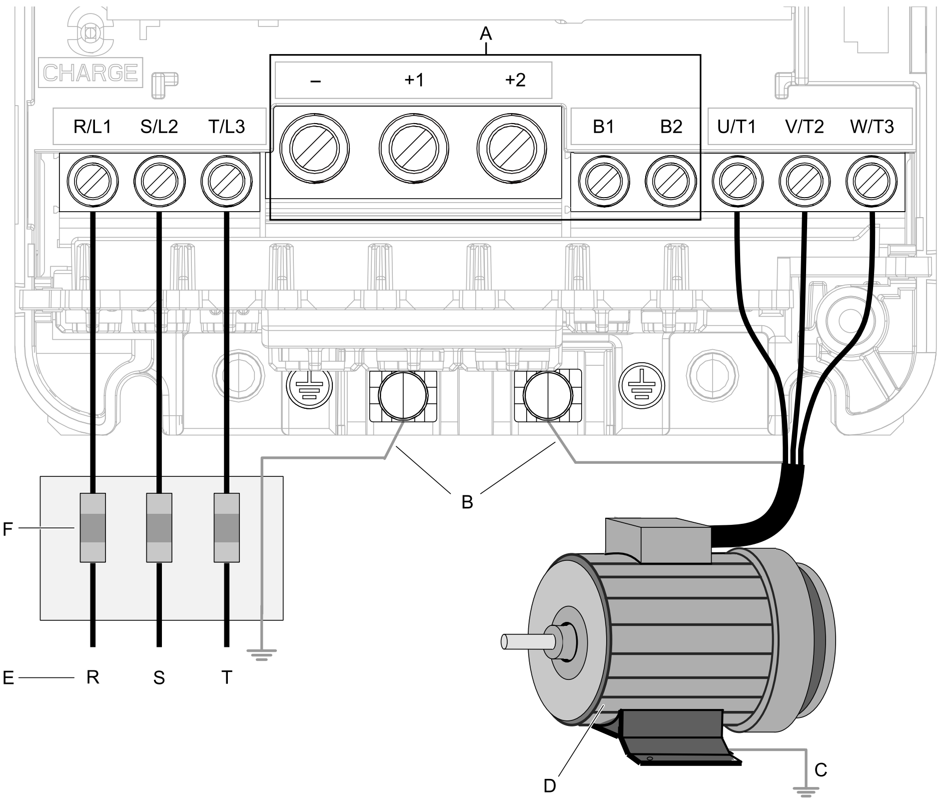
This section gives information about the functions, specifications, and procedures necessary to safely and correctly wire the main circuit in the drive.

NOTICE: *Do not solder the ends of wire connections to the drive. Soldered wiring connections can become loose. Incorrect wiring procedures can cause drive malfunction because of loose terminal connections.*

NOTICE: *Turn the drive ON (Run) and OFF (Stop) a maximum of one time each 30 minutes with the MC on the power source side to extend the service life of the relay contacts and electrolytic capacitors in the drive. Run and Stop the motor as much as possible with the drive. The drive can fail if users frequently turn the drive ON and OFF with the MC on the power source side to Run and Stop the drive. Incorrect operation can decrease the service life of the relay contacts and electrolytic capacitors.*

◆ Motor and Main Circuit Connections

WARNING! *Electrical Shock Hazard. Do not connect terminals R/L1, S/L2, T/L3, U/T1, V/T2, W/T3, -, +1, +2, +3, B1, or B2 to the ground terminal. Failure to obey can cause death, serious injury, or damage to equipment.*



A - DC bus terminal
B - Connect to the drive ground terminal.
C - Ground the motor case.
D - Three-Phase Motor
E - Use R, S, T for input power supply.
F - Input Protection (Fuses or Circuit Breakers)

Note:

The location of terminals are different for different drive models.

Figure 3.2 Wiring the Main Circuit and Motor

◆ Configuration of Main Circuit Terminal Block

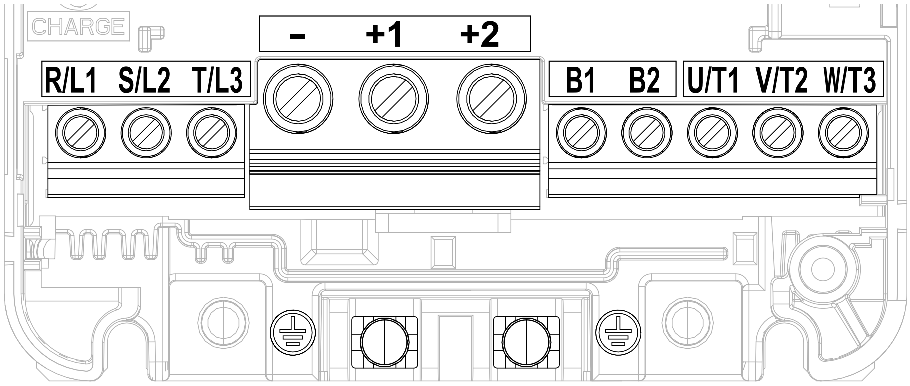


Figure 3.3 Configuration of Main Circuit Terminal Block for Drive Models 2004 - 2042, 4002 - 4023

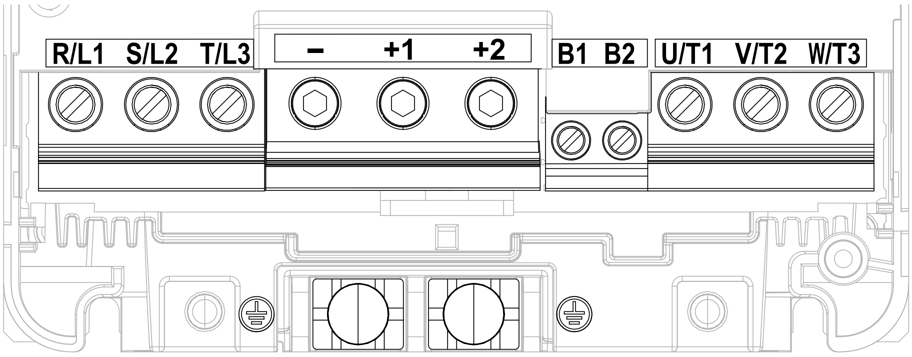


Figure 3.4 Configuration of Main Circuit Terminal Block for Drive Models 2056, 4031, 4038

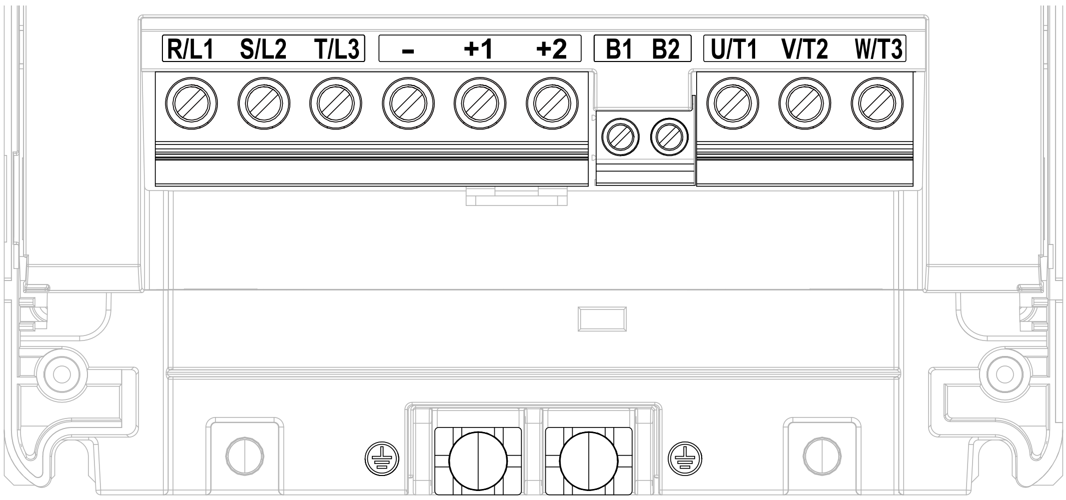


Figure 3.5 Configuration of Main Circuit Terminal Block for Drive Model 2070, 2082, 4044

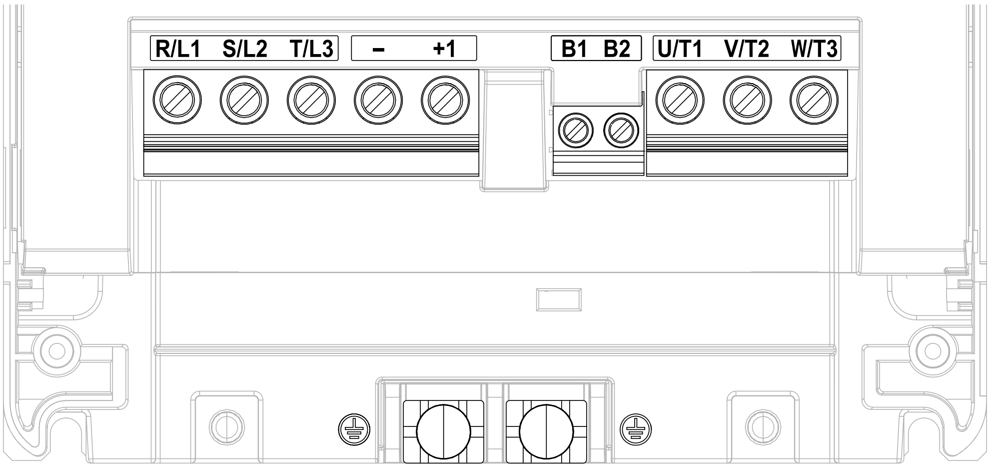


Figure 3.6 Configuration of Main Circuit Terminal Block for Drive Model 4060

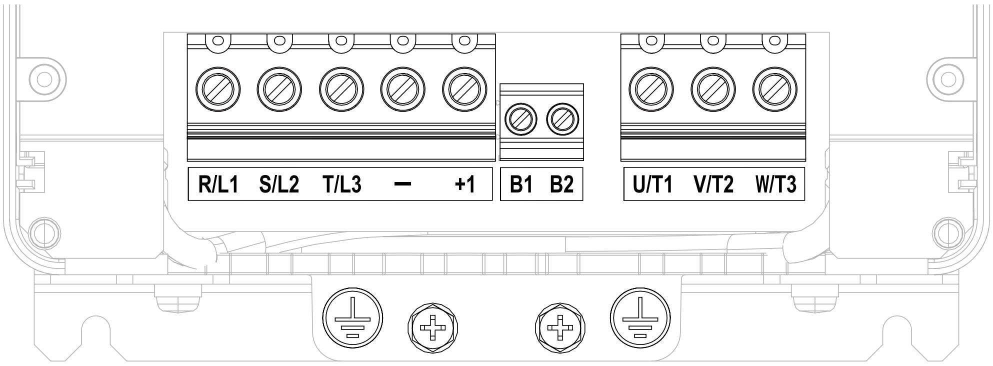


Figure 3.7 Configuration of Main Circuit Terminal Block for Drive Model 2110, 4075

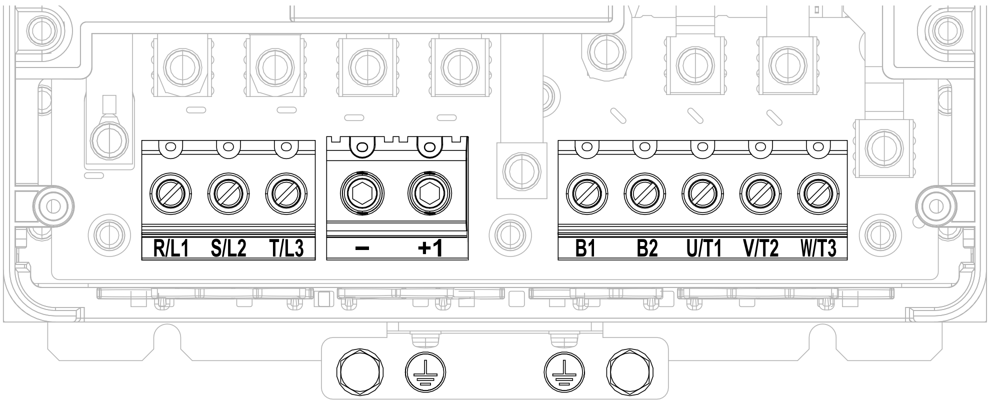


Figure 3.8 Configuration of Main Circuit Terminal Block for Drive Model 4089

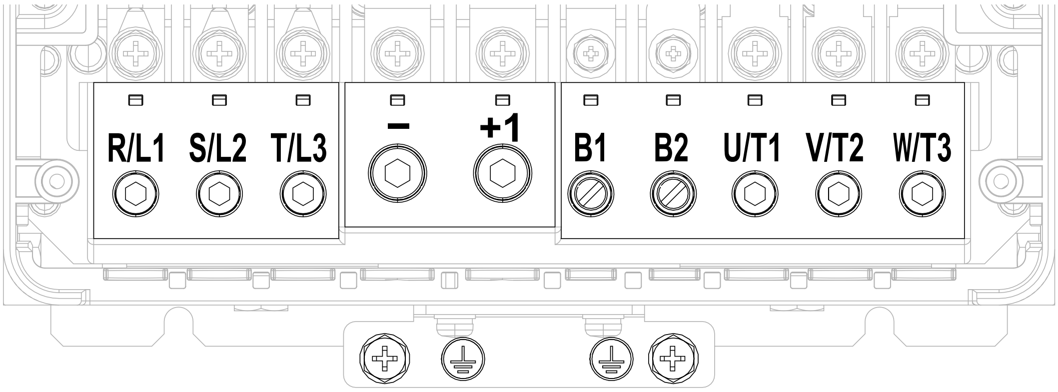


Figure 3.9 Configuration of Main Circuit Terminal Block for Drive Models 2138, 4103

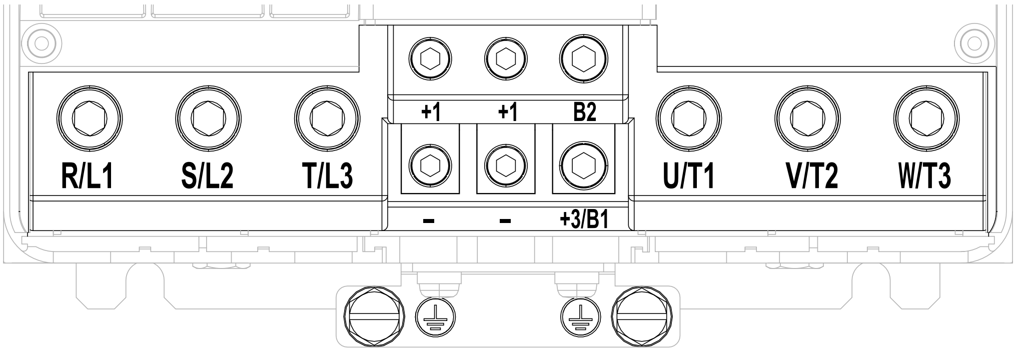


Figure 3.10 Configuration of Main Circuit Terminal Block for Drive Models 2169, 2211, 4140, 4168

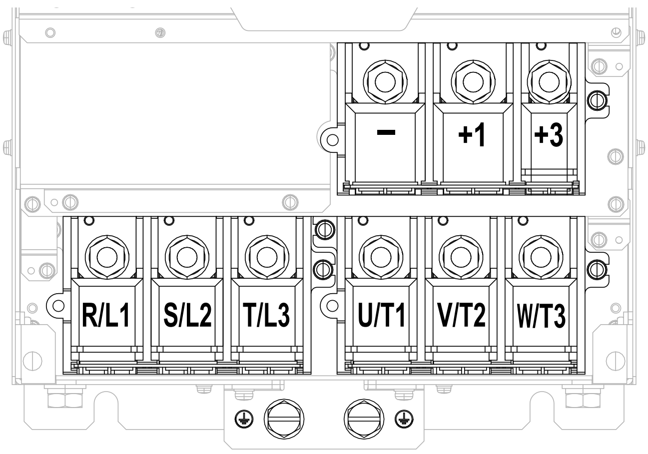


Figure 3.11 Configuration of Main Circuit Terminal Block for Drive Models 2257, 2313, 4208 - 4296

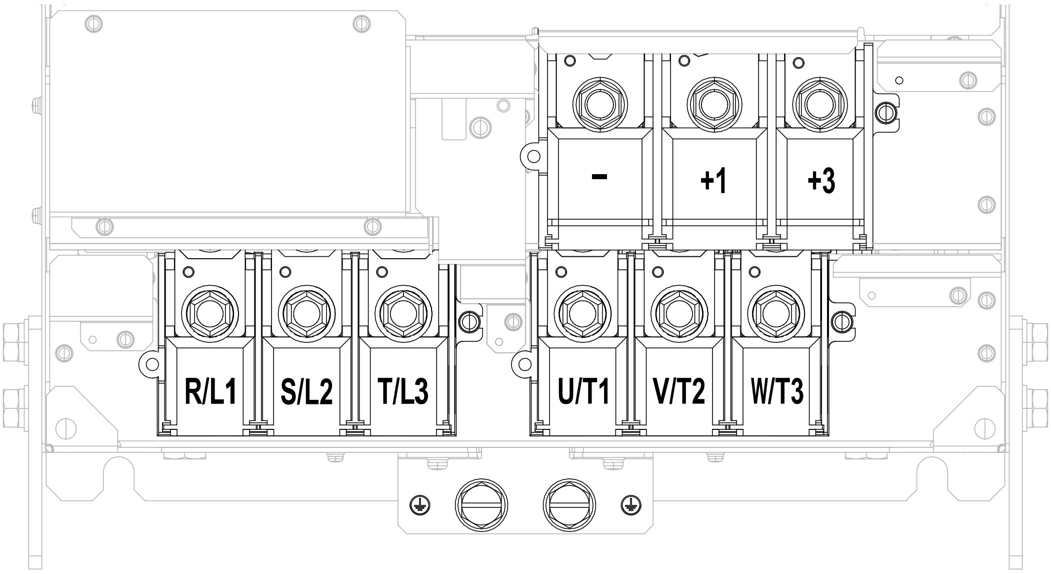


Figure 3.12 Configuration of Main Circuit Terminal Block for Drive Models 2360, 2415, 4371, 4389

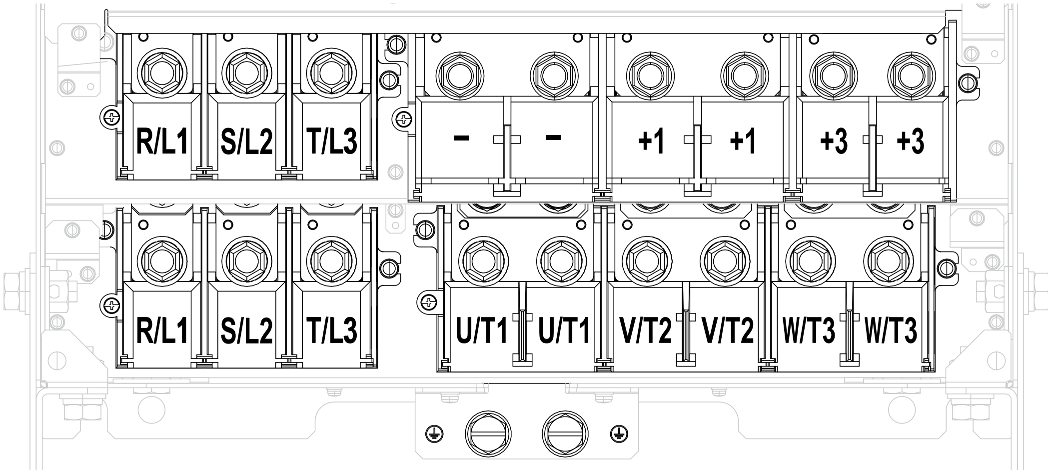


Figure 3.13 Configuration of Main Circuit Terminal Block for Drive Models 4453 - 4675

◆ Main Circuit Terminal Functions

Table 3.1 Main Circuit Terminal Functions

Terminals	Model			Function
	2004 - 2082 4002 - 4044	2110 - 2138 4060 - 4168	2169 - 2415 4208 - 4675	
R/L1	Main circuit power supply input			To connect a commercial power supply.
S/L2				
T/L3				
U/T1	Drive output			To connect a motor.
V/T2				
W/T3				
B1	Braking resistor connection		-	To connect a braking resistor or braking resistor unit.
B2				

<table>
<tr><th rowspan="2">Terminals</th><th colspan="3">Model</th><th rowspan="2">Function</th></tr>
<tr><th>2004 - 2082
4002 - 4044</th><th>2110 - 2138
4060 - 4168</th><th>2169 - 2415
4208 - 4675</th></tr>
<tr><td>+2</td><td rowspan="3">• DC power supply input (+1 and -)
• DC reactor connection (+1 and +2)</td><td colspan="2">-</td><td rowspan="4">To connect peripheral devices, for example:
• DC power input
• Braking Unit
• DC Reactor
Note:
Remove the jumper between terminals +1 and +2 to connect a DC reactor.</td></tr>
<tr><td>+1</td><td rowspan="2">DC power supply input (+1 and -)</td><td rowspan="3">• DC power supply input (+1 and -)
• Braking unit connection (+3 and -)</td></tr>
<tr><td>-</td></tr>
<tr><td>+3</td><td colspan="2">-</td></tr>
<tr><td>⏚</td><td colspan="3">• 200 V: D class grounding (ground to 100 Ω or less)
• 400 V: C class grounding (ground to 10 Ω or less)</td><td>To ground the drive.</td></tr>
</table>

Use terminals B1 and - to connect a CDBR-type control unit to drive models 2004 to 2138 and 4002 to 4168 that have built-in braking transistors.

◆ Wire Selection

■ Wire Selection Precautions

WARNING! *Electrical Shock Hazard. The leakage current of the drive will be more than 3.5 mA. The IEC/EN 61800-5-1: 2007 standard specifies that users must wire the power supply to automatically turn off when the protective ground wire disconnects. Users can also connect a protective ground wire that has a minimum cross-sectional area of 10 mm² (copper wire) or 16 mm² (aluminum wire). Failure to obey these standards can cause death or serious injury.*

Think about line voltage drop before selecting wire gauges. Select wire gauges that drop the voltage by 2% or less of the rated voltage. Increase the wire gauge and the cable length when the risk of voltage drops increases. Calculate line voltage drop with this formula:

Line voltage drop (V) = $\sqrt{3}$ × wire resistance (Ω/km) × wiring distance (m) × motor rated current (A) × 10^{-3}.

■ Precautions during Wiring

- Use terminals B1 and - to connect braking units to drives that have built-in braking transistors (models 2004 to 2138 and 4002 to 4168). Use terminals +3 and - to connect braking units to drives that do not have built-in braking transistors.
- Refer to “Braking Unit, Braking Resistor Unit Instruction Manual (TOBPC72060001)” for information about wire gauges and tightening torques to connect braking resistor units or braking units.
- Use terminals +1 and - to connect a regenerative converter or regenerative unit.

NOTICE: *Do not connect a braking resistor to terminals +1 or -. Failure to obey can cause damage to the drive circuitry.*

■ Wire Gauges and Tightening Torques

- The recommended wire gauges are based on continuous current ratings of 75 °C (167 °F) 600 V class 2 heat-resistant indoor PVC wire. Assume these conditions:
  – Ambient temperature: 40 °C (104 °F) or lower
  – Wiring distance: 100 m (3281 ft.) or shorter
  – Normal Duty Rated current value
- Use terminals +1, +2, +3, -, B1, and B2 to connect a peripheral option such as a DC reactor or a braking resistor. Do not connect other items to these terminals.
- Refer to the instruction manual for each device for recommended wire gauges to connect peripheral devices or options to terminals +1, +2, +3, -, B1, and B2. Contact the manufacturer or your nearest sales representative if the recommended wire gauges for the peripheral devices or options are out of the range of the applicable gauges for the drive.

Select the correct wires for main circuit wiring.

Refer to *Wire Gauges and Tightening Torques on page 177* for wire gauges and tightening torques as specified by European standards.

Refer to *Main Circuit Wire Gauges and Tightening Torques on page 201* for wire gauges and tightening torques as specified by UL standards.

◆ Main Circuit Terminal and Motor Wiring

This section outlines the various steps, precautions, and checkpoints for wiring the main circuit terminals and motor terminals.

WARNING! *Electrical Shock Hazard. Do not connect the AC power line to the output terminals of the drive. Failure to obey can cause death or serious injury by fire.*

NOTICE: *Make sure that you align the phase order for the drive and motor when you connect the motor to drive output terminals U/T1, V/T2, and W/T3. Failure to obey correct wiring procedures can cause the motor to run in reverse if the phase order is incorrect.*

NOTICE: *Do not connect phase-advancing capacitors or LC/RC noise filters to the output circuits. Failure to obey can cause damage to the drive, phase-advancing capacitors, LC/RC noise filters, and leakage breakers (ELCB, GFCI, or RCM/RCD).*

■ Cable Length Between Drive and Motor

When the wiring between the drive and the motor is too long, voltage drop along the motor cable can decrease motor torque, usually at low frequency output. If you connect motors in parallel with long motor cable, this is also a problem. Drive output current increases when the leakage current from the cable increases. An increase in leakage current can cause overcurrent and decrease the precision of the current detection.

Use the values in Table 3.2 to adjust the drive carrier frequency. When the system configuration makes the motor wiring distance more than 100 m (328 ft), do not use metal conduits or use isolated cables for each phase to decrease stray capacitance.

Table 3.2 Carrier Frequency against Cable Length Between Drive and Motor

Cable Length Between Drive and Motor	Up to 50 m (164 ft.)	Up to 100 m (328 ft.)	More than 100 m (328 ft.)
Carrier Frequency	15 kHz or less	5 kHz or less	2 kHz or less

Note:
- To set the carrier frequency in a drive that is operating more than one motor, calculate the cable length as the total distance of wiring to all connected motors.
- In *A1-02 = 5 or 6 [Control Method = PM OLVector or PM AOLVector]*, the maximum cable length is 100 m (328 ft.).
- When you connect to a PM motor, it can be necessary to adjust the overcurrent detection. Refer to *L8-27 OverCurr Det Gain on page 798* for more information.

■ Ground Wiring

Follow the precautions to wire the ground for one drive or a series of drives.

WARNING! *Electrical Shock Hazard. Make sure that the protective ground wire complies with technical standards and local safety regulations. The leakage current of the drive will be more than 3.5 mA. The IEC/EN 61800-5-1:2007 standard specifies that you must wire the power supply to automatically turn off when the protective ground wire disconnects. You can also connect a protective ground wire that has a minimum cross-sectional area of 10 mm² (copper wire) or 16 mm² (aluminum wire). Failure to obey these standards can cause death or serious injury.*

WARNING! *Electrical Shock Hazard. Ground the neutral point on the power supply to comply with the EMC Directive before turning on the EMC filter or if there is high resistance grounding. If the EMC filter is switched ON without the neutral point being grounded or if there is high resistance grounding, it can cause death or serious injury.*

WARNING! *Electrical Shock Hazard. Use a ground wire that complies with technical standards on electrical equipment and use the minimum length of ground wire. Incorrect equipment grounding can cause serious injury or death from dangerous electrical potentials on the equipment chassis.*

WARNING! *Electrical Shock Hazard.*
Correctly ground the ground terminals. Obey federal and local electrical wiring codes for correct grounding methods.
- *200 V class: ground to 100 Ω or less*
- *400 V class: ground to 10 Ω or less*

Failure to obey can cause death or serious injury from contacting ungrounded electrical equipment.

NOTICE: *Do not share the ground wire with other devices, for example welding machines or large-current electrical equipment. Incorrect equipment grounding can cause drive or equipment malfunction from electrical interference.*

NOTICE: *To use more than one drive, obey the instructions to ground all drives. Incorrect equipment grounding can cause incorrect operation of drives and equipment.*

Do not loop the grounding wire when connecting more than one drive.

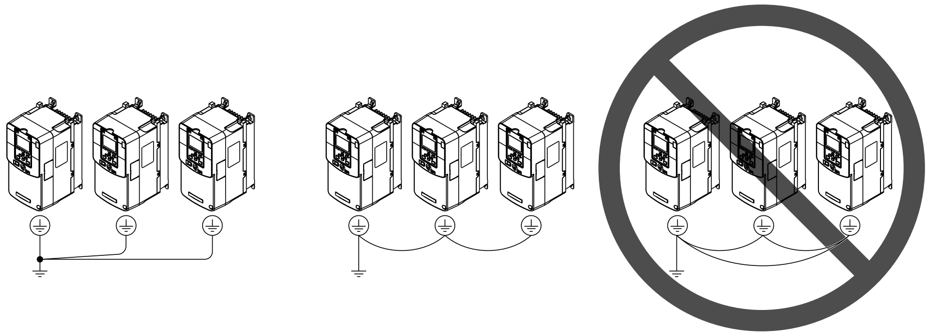


Figure 3.14 Wiring More than One Drive

Wiring the Main Circuit Terminal Block

WARNING! *Electrical Shock Hazard. De-energize the drive and correctly ground the terminal board before you wire the main circuit terminals. Failure to obey can cause death or serious injury.*

Protection of Main Circuit Terminals

When wiring the main circuit terminals, do not let cable ends go near terminals or the drive. If you use crimped terminals, make sure that you also use insulation caps.

Main Circuit Configuration

The figures in this section show the different schematics of the drive main circuit The connections change when the drive capacity changes. The DC power supply for the main circuit also supplies power to the control circuit.

WARNING! *Fire Hazard. The braking resistor connection terminals are B1 and B2. Do not connect braking resistors to other terminals. Incorrect wiring connections could cause the braking resistor to overheat. Failure to obey can cause death or serious injury by fire and damage to the drive and braking circuit.*

NOTICE: *Do not use the negative DC bus terminal "-" as a ground terminal. This terminal is at high DC voltage potential. Incorrect wiring connections could cause damage to the drive.*

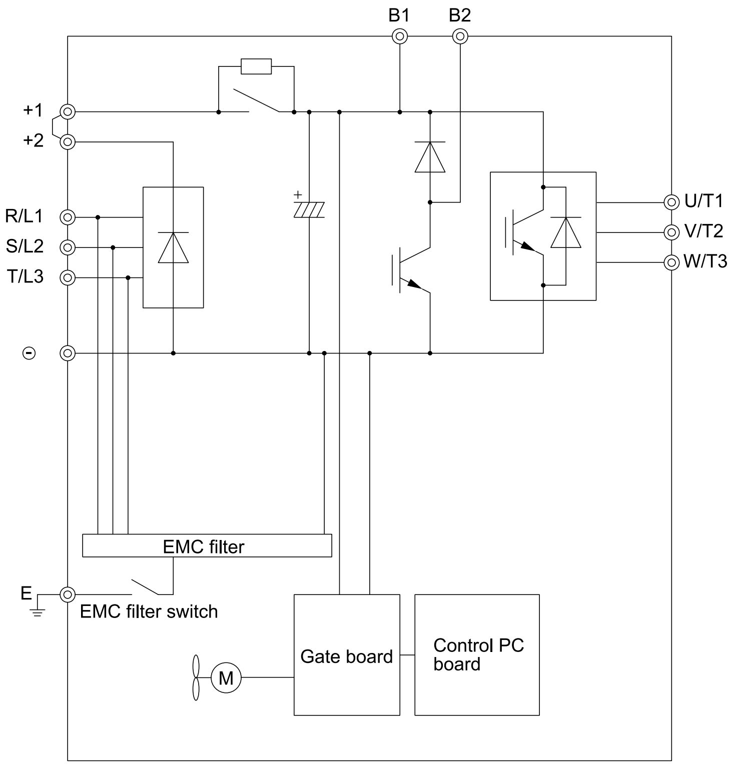


Figure 3.15 Drive Main Circuit Configuration for Drive Models 2004 to 2082, 4002 to 4044

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3

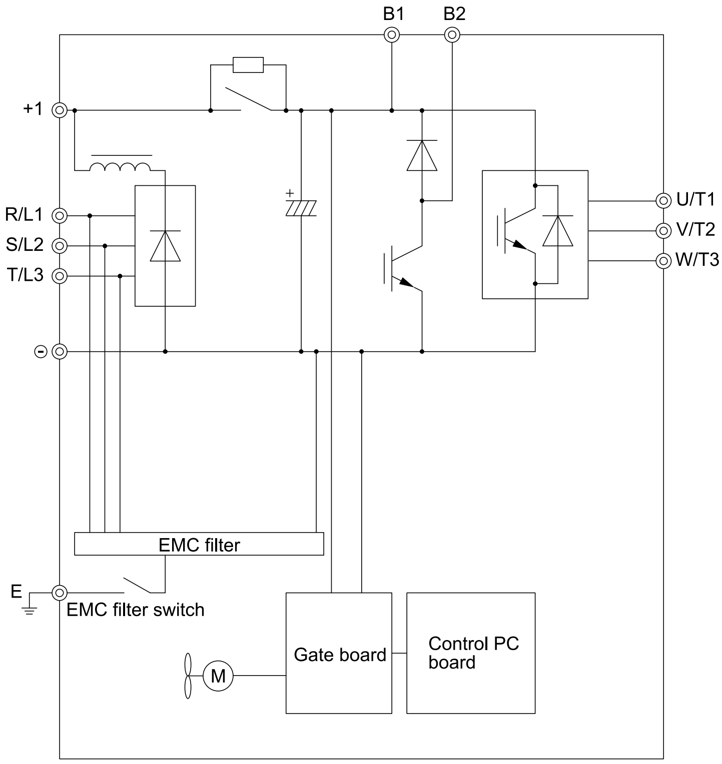


Figure 3.16 Drive Main Circuit Configuration for Drive Models 2110 to 2138, 4060 to 4168

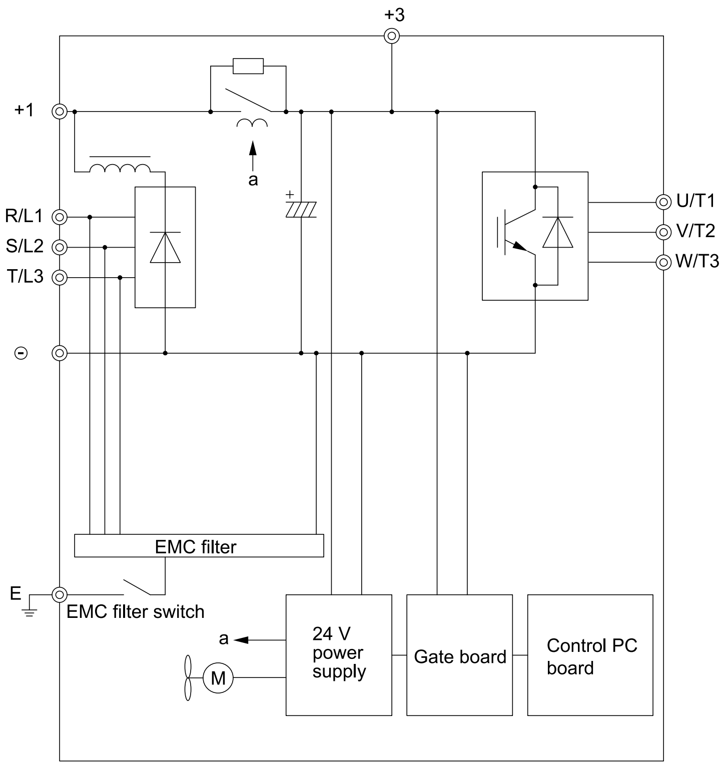


Figure 3.17 Drive Main Circuit Configuration for Drive Models 2169 to 2313, 4208 to 4250

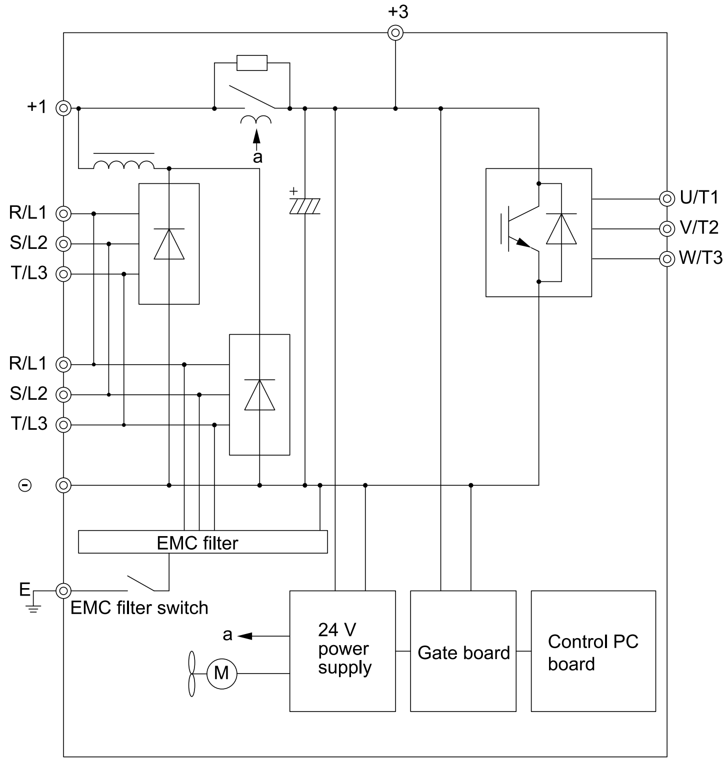


Figure 3.18 Drive Main Circuit Configuration for Drive Models 2360 to 2415, 4302 to 4675

3.4 Main Circuit Terminal Block Wiring

DANGER! *Electrical Shock Hazard. Electrical Shock Hazard. Do not examine, connect, or disconnect wiring on an energized drive. Before servicing, disconnect all power to the equipment and wait for the time specified on the warning label at a minimum. The internal capacitor stays charged after the drive is de-energized. The charge indicator LED extinguishes when the DC bus voltage decreases below 50 Vdc. When all indicators are OFF, measure for dangerous voltages to make sure that the drive is safe. If you do work on the drive when it is energized, it will cause serious injury or death from electrical shock.*

◆ Wiring the Main Circuit Terminal Block for Drive Models 2004 - 2211, and 4002 - 4168

Wire the main circuit terminal block correctly as specified by the instructions in the manual.

Read these instructions before wiring the terminal block.

■ Notes on Wiring the Main Circuit Terminal Block

Read these notes before you wire the main circuit terminal block.

- Use UL-Listed, vinyl-coated insulated copper wires for operation with a continuous maximum permitted temperature of 75 °C at 600 V
- Remove all unwanted objects that are near the terminal block connections.
- Remove the insulation from the connection wires to the wire stripping lengths shown in the manual.
- Do not use bent or crushed wires. Remove the damaged end of the wire before you use it. Incorrect connections can cause death or serious injury from fire.
- Do not solder stranded wire. Soldered wire connections can become loose over time and cause unsatisfactory drive performance.
- If you use stranded wire, make sure that all of the wire strands are in the connection. Also, do not twist the stranded wire too much. Incorrect connections can cause death or serious injury from fire.
- Put the wire all the way into the terminal block. Remove the insulation from the wire to the recommended wire stripping length to fit the wire with insulation in the plastic housing.
- Use a torque driver, torque ratchet, or torque wrench for the screws. A slotted driver or a hex tool will be necessary to wire the screw clamp terminal. Use applicable tools as specified by the recommended conditions in the product manual.
- If you use power tools to tighten the terminal screws, use a low speed setting (300 to 400 r/min). Failure to obey can cause damage to the terminal screws.
- Wire gauges on existing drive models to be replaced may not match wire gauge ranges on new drives.
- Do not tighten the terminal screws at an angle of 5 degrees or more. Failure to obey can cause damage to the terminal screws.

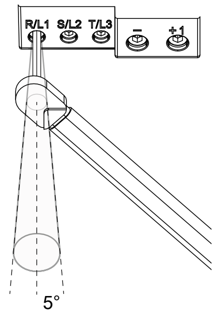


Figure 3.19 Permitted Angle

- Put the bit all the way into the hex socket to tighten the hex socket cap screw.
- When tightening slotted screws, hold the straight-edge screwdriver perpendicularly to the screw. Do not allow the tip of the screwdriver to shift or protrude from the groove of the screw.

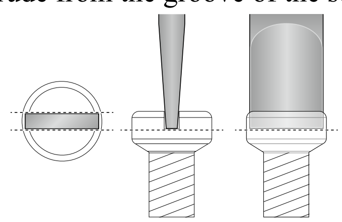
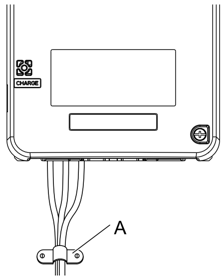


Figure 3.20 Tightening Slotted Screws

- After connecting the wires to the terminal block, lightly pull on the wires to make sure that they do not come out of the terminals.
- Remove the correct section of the wiring cover to make wiring easier.
- Do not let strain on the wiring cause damage. Use a strain relief near the wiring to release the tension.



A - Strain relief

Figure 3.21 Strain Relief Example

Table 3.3 Recommended Wiring Tools

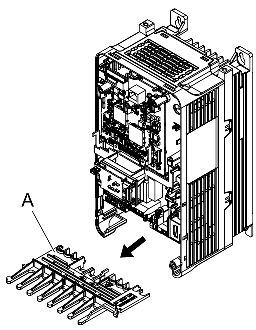
Screw	Adapter	Bit		Torque Driver Model (Tightening Torque)	Torque Wrench
		Model	Manufacturer		
M4	Bit	SF-BIT-SL 1,0X4,0-70	PHOENIX CONTACT	TSD-M 3NM (1.2 - 3 N·m)	-
M5 *1	Bit	SF-BIT-SL 1,2X6,5-70	PHOENIX CONTACT	Wire Gauge ≤ 25 mm² (AWG 10): TSD-M 3NM (1.2 - 3 N·m)	Wire Gauge ≤ 25 mm² (AWG 10): -
				Wire Gauge ≥ 30 mm² (AWG 8): -	Wire Gauge ≥ 30 mm² (AWG 8): 4.1 - 4.5 N·m *2 *3
5 M6	Bit	SF-BIT-HEX 5-50	PHOENIX CONTACT	-	5 - 9 N·m *2 *3
M6	Bit	SF-BIT-SL 1,2X6,5-70	PHOENIX CONTACT	-	3 - 3.5 N·m *2 *3
6 M8	Bit	SF-BIT-HEX 6-50	PHOENIX CONTACT	-	8 - 12 N·m *2 *3
8 M10	Bit	SF-BIT-HEX 8-50	PHOENIX CONTACT	-	12 - 14 N·m *2 *3

*1 When wiring drive models 2056 and 4089 and smaller, select the correct tools for the wire gauge.
*2 Use 6.35 mm (0.25 in) bit socket holder.
*3 Use a torque wrench that can apply this torque measurement range.

■ Main Circuit Terminal Block Wiring Procedure

The keypad and front cover must be removed before wiring the main circuit terminal block.

1. Pull the wiring cover forward to remove it from the drive.



A - Wiring cover

Figure 3.22 Remove the Wiring Cover

2. Put the end of a prepared wire into the terminal block.

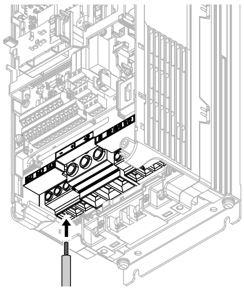


Figure 3.23 Install the Electrical Wire

Note:

If there is a jumper between terminals +1 and +2, loosen the terminal block screws and remove the jumper before wiring the terminals.

3. Tighten the screws to the specified torque.

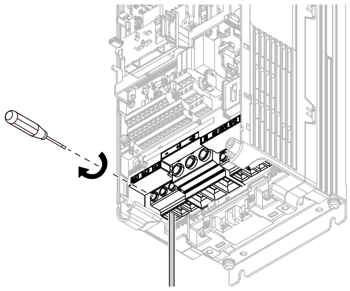
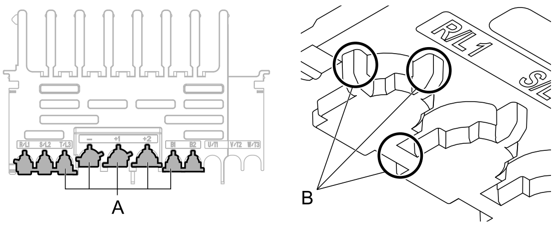


Figure 3.24 Tighten Terminal Block Screws

4. Check the signal from the wired terminal and use a diagonal-cutting pliers to remove areas of the wiring cover cutaway section.

   Cut the areas shown in Figure 3.25.



A - Cutaway section

B - Use a diagonal-cutting pliers to clip this area.

Figure 3.25 Clip the Cutaway Section of the Wiring Cover

Note:

- Different drive models have different wiring cover shapes.
- Remove only the areas from the wiring cover that apply to the wired terminal. The drive will not keep its IP20 protective level if areas that do not apply to the wired terminal are removed.
- Tightly hold the cutaway section when removing pieces of the cutaway section. Pieces of the cutaway section can fly out and cause injury.
- Remove sharp edges from the wiring cover cutaway section to prevent damage to the wires.
- The drive might not keep its IP20 protective level if wires other than those specified by the manufacturer are used, even if the wiring cover is used correctly. Contact the manufacturer or your nearest sales representative for more information.

5. Install the wiring cover to its initial position. Put the cables through the holes cut from the wiring cover.

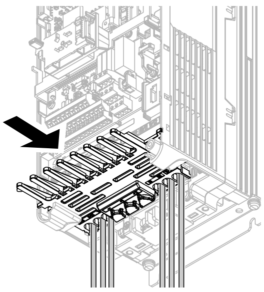


Figure 3.26 Reattach the Wiring Cover

6. Install the front cover and the keypad to their initial positions.

◆ Wiring the Main Circuit Terminal Block for Drive Models 2257 - 2415, and 4208 - 4675

Wire the main circuit terminal block correctly as specified by the instructions in the manual.

Read these instructions before wiring the terminal block.

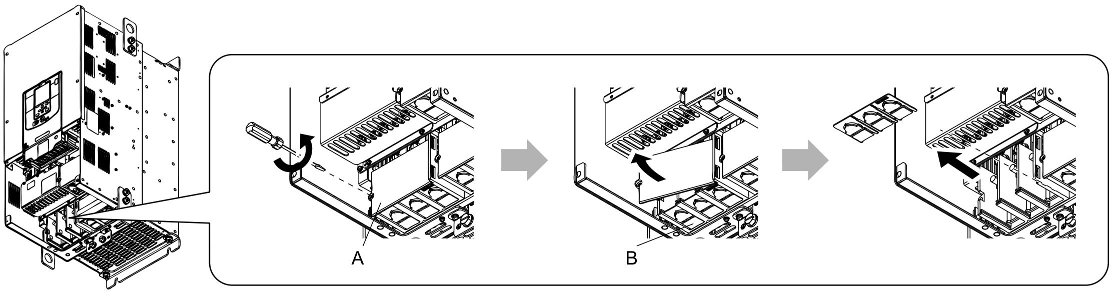
■ Notes on Wiring the Main Circuit Terminal Block

- Do not shake the electrical wire too much.
- Be sure to use only wires with the correct size, stripped wire length, and tightening torque as specified by the manufacturer.
- Use tools that fit the shape of the screw head to tighten and loosen the terminal block screws.
- Make sure that there are no loose stranded wires or frayed wires after wiring is complete.

■ Main Circuit Terminal Block Wiring Procedure

The keypad and front cover must be removed before wiring the main circuit terminal block.

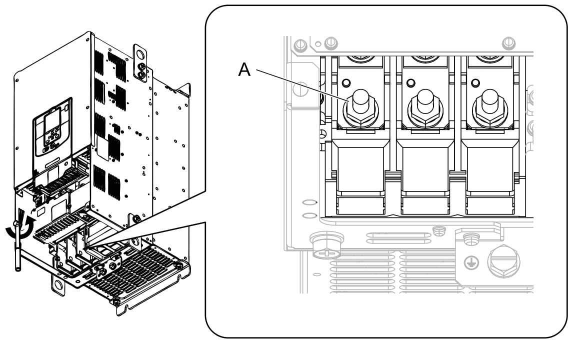
1. Remove the screws on the terminal block cover and pull the terminal block cover away from the drive. Pull the wiring cover away from the drive to remove the wiring cover after removing the terminal block cover.



A - Terminal block cover **B - Wiring cover**

Figure 3.27 Remove the Wiring Cover

2. Remove the terminal block nut.



A - Nut

Figure 3.28 Remove the Terminal Block Nut

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3. Wire the closed-loop crimp terminal to the main circuit terminal block.

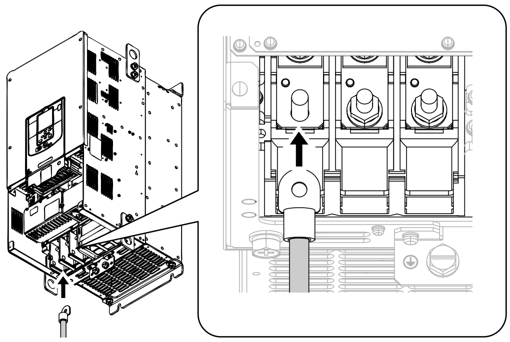


Figure 3.29 Install the Electrical Wire

4. Tighten the nut to the specified torque.

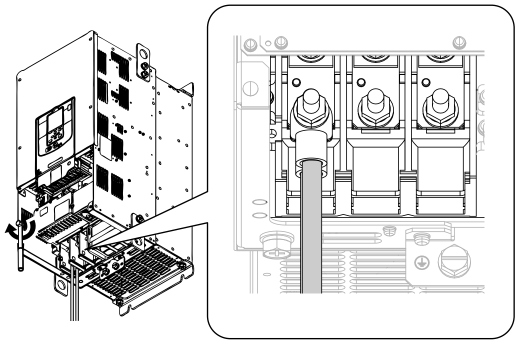
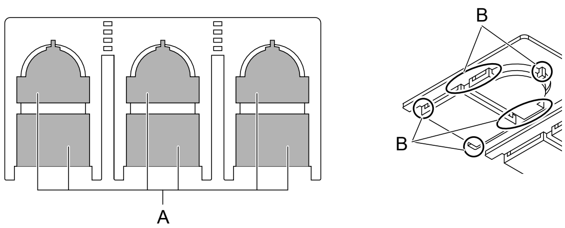


Figure 3.30 Tighten the Terminal Block Nut

5. Check the signal from the wired terminal and use a diagonal-cutting pliers to remove areas of the wiring cover cutaway section.
   Cut the areas shown in Figure 3.31.



A - Cutaway section

B - Use a diagonal-cutting pliers to clip this area.

Figure 3.31 Clip the Cutaway Section of the Wiring Cover

Note:
- Different drive models have different wiring cover shapes.
- Remove only the areas from the wiring cover that apply to the wired terminal. The drive will not keep its IP20 protective level if areas that do not apply to the wired terminal are removed.
- Tightly hold the cutaway section when removing pieces of the cutaway section. Pieces of the cutaway section can fly out and cause injury.
- Remove sharp edges from the wiring cover cutaway section to prevent damage to the wires.
- The drive might not keep its IP20 protective level if wires other than those specified by the manufacturer are used, even if the wiring cover is used correctly. Contact the manufacturer or your nearest sales representative for more information.
- If the recommended gauge for the electrical wires are used, the wiring cover of the main circuit power input terminal and the drive output terminal do not need to be attached. Attach the wiring cover when using the applicable gauge for electrical wires.

6. Attach the wiring cover and terminal block cover to their initial positions and tighten the screws on the terminal block cover.

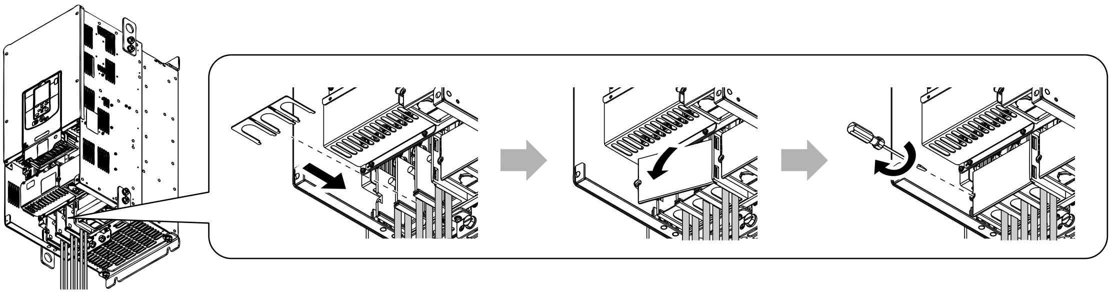


Figure 3.32 Reattach the Wiring Cover

7. Put the terminal cover back in its initial position.

3.5 Control Circuit Wiring

This section gives information about wiring the control circuit.

◆ Control Circuit Connection Diagram

Wire the drive control circuit as shown in Figure 3.33.

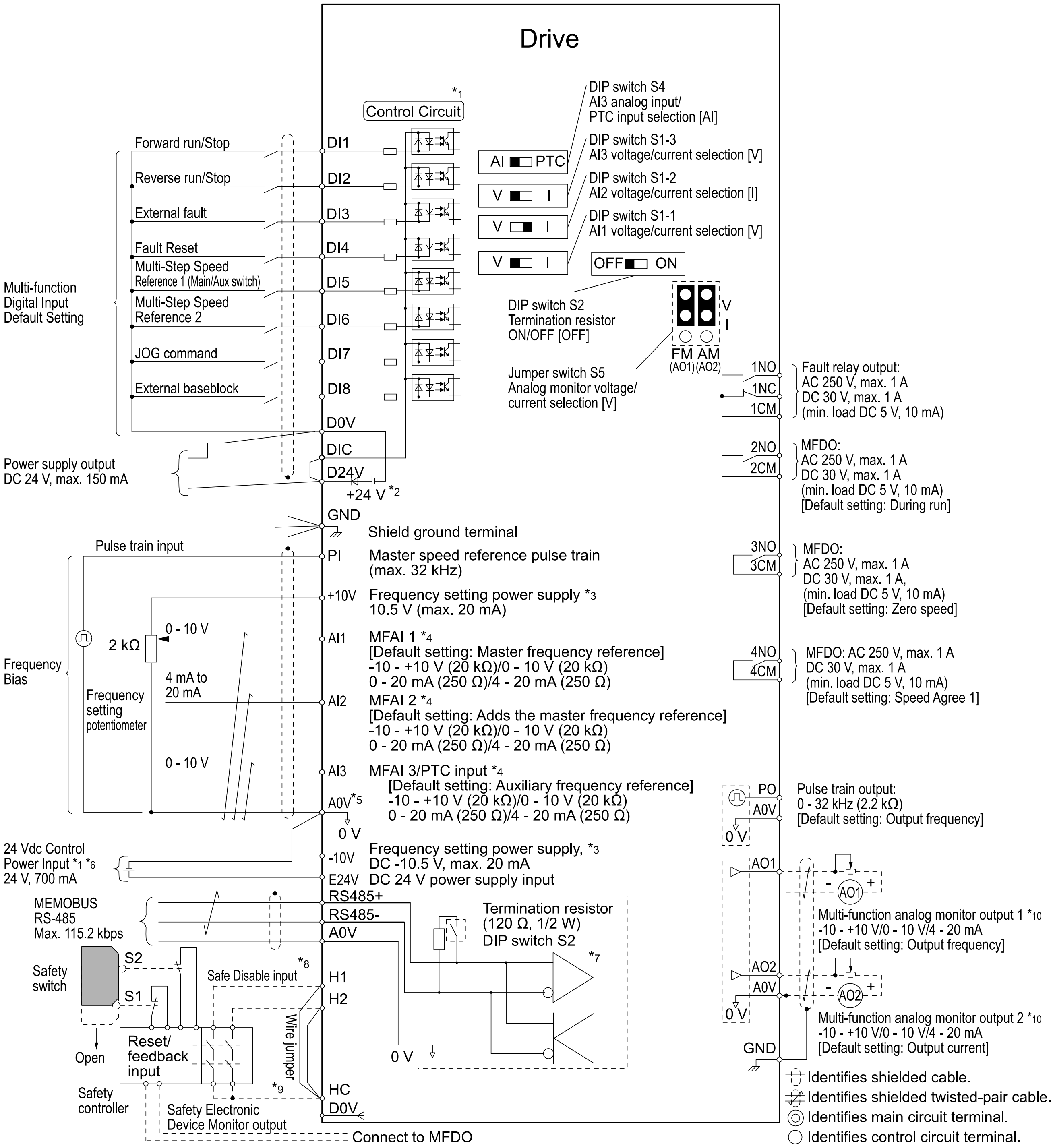


Figure 3.33 Control Circuit Connection Diagram

*1 To operate the control circuit while the main circuit power supply is OFF, connect a 24 V power supply unit (option).

*2 Install a wire jumper between terminals DIC-D24V-D0V to select the type of the power supply for MFDI (sinking/sourcing mode or internal/external power supply).

NOTICE: *Do not close the circuit between terminals D24V and D0V. Failure to obey will cause damage to the drive.*

- Sinking Mode: Install a jumper between terminals DIC and D24V.

  NOTICE: *Do not close the circuit between terminals DIC and D0V in Sinking Mode. Failure to obey will cause damage to the drive.*
- Sourcing Mode: Install a jumper between terminals DIC and D0V.

  NOTICE: *Do not close the circuit between terminals DIC and D24V in Source Mode. Failure to obey will cause damage to the drive.*
- External power supply: Remove the wire jumper between terminals DIC-D0V and terminals DIC-D24V.

*3 The output current capacity of the +10V and -10V terminals on the control circuit is 20 mA.

NOTICE: *Do not install a jumper between terminals +10V, -10V, and A0V. Failure to obey can cause damage to the drive.*

*4 Set DIP switches S1-1 to S1-3 to select between a voltage or current input signal to terminals AI1 to AI3. The default setting for S1-1 and S1-3 is voltage input (“V” side). The default setting for S1-2 is current input (“I” side).

*5 Do not ground the control circuit terminals A0V or connect them to the drive.

WARNING! *Do not ground the control circuit terminals A0V or connect them to the drive. Failure to comply may cause malfunction or failure.*

*6 Make sure that you connect terminals E24V and A0V correctly. Failure to obey will cause damage to the drive.

*7 Set DIP switch S2 to the ON position to enable the termination resistor in the last drive in a Modbus communications.

*8 To use the internal power supply with the Safe Disable input, use sourcing mode.

*9 Disconnect the wire jumper between H1 and HC, and H2 and HC to use the Safe Disable input.

*10 Use multi-function analog monitor outputs with analog frequency meters, ammeters, voltmeters, and wattmeters. Do not use monitor outputs with feedback-type signal devices.

◆ Control Circuit Terminal Block Functions

The parameters of group *H: TERMINALS* set functions for the multi-function input and output terminals.

WARNING! *Sudden Movement Hazard. Correctly wire the control circuits and make sure that control circuits operate correctly after connecting the wires. Drives with untested control circuits can cause death or serious injury.*

WARNING! *Sudden Movement Hazard. Make sure that the drive I/O signals and external sequence are correct before doing a test run. The I/O terminal function can automatically change from the factory setting when the setting for Macro Preset changes. Failure to obey can cause death or serious injury.*

NOTICE: *Turn the drive ON (Run) and OFF (Stop) a maximum of one time each 30 minutes with the MC on the power source side to extend the service life of the relay contacts and electrolytic capacitors in the drive. Run and Stop the motor as much as possible with the drive. The drive can fail if users frequently turn the drive ON and OFF with the MC on the power source side to Run and Stop the drive. Incorrect operation can decrease the service life of the relay contacts and electrolytic capacitors.*

■ Multi-function Input Terminals

This chapter contains a list of input terminals and functions.

Table 3.4 Digital Inputs

Terminal	Name (Default)	Function (Signal Level)
DI1	MFDI selection 1 (ON: Forward run OFF: Stop)	• Photocoupler • 24 V, 6 mA **Note:** Install the wire jumpers between terminals DIC-D24V and DIC-D0V to set the MFDI power supply (sinking/ sourcing mode or internal/external power supply). • Sinking Mode: Install a jumper between terminals DIC and D24V. **NOTICE:** *Do not close the circuit between terminals DIC and D0V in Sinking Mode. Failure to obey will cause damage to the drive.* • Sourcing Mode: Install a jumper between terminals DIC and D0V. **NOTICE:** *Do not close the circuit between terminals DIC and D24V in Source Mode. Failure to obey will cause damage to the drive.* • External power supply: No jumper necessary between terminals DIC-D0V and terminals DIC-D24V.
DI2	MFDI selection 2 (ON: Reverse run OFF: Stop)	
DI3	MFDI selection 3 (External fault (N.O.))	
DI4	MFDI selection 4 (Fault reset)	
DI5	MFDI selection 5 (Multi-step speed reference 1)	
DI6	MFDI selection 6 (Multi-step speed reference 2)	
DI7	MFDI selection 7 (Jog command)	
DI8	MFDI selection 8 (Baseblock command (N.O.))	
D0V	MFDI power supply 0 V	MFDI power supply, 24 V (maximum 150 mA) **NOTICE:** *Do not close the circuit between terminals D24V and D0V. Failure to obey will cause damage to the drive.*
DIC	MFDI selection common	
D24V	MFDI power supply +24 Vdc	

Table 3.5 Safe Disable Input

Terminal	Name (Default)	Function (Signal Level)
H1	Safe Disable input 1	Remove the jumper between terminals H1-HC and H2-HC to use the Safe Disable input. • 24 V, 6 mA • ON: Normal operation • OFF: Coasting motor • Internal impedance 4.7 kΩ • OFF Minimum OFF time of 2 ms.
H2	Safe Disable input 2	
HC	Safe Disable function common	Safe Disable function common **NOTICE:** *Do not close the circuit between terminals HC and D0V. Failure to obey will cause damage to the drive.*

Table 3.6 Master Frequency Reference

Terminal	Name (Default)	Function (Signal Level)
PI	Master frequency reference pulse train input (Master frequency reference)	• Response frequency: 0 Hz to 32 kHz • H level duty: 30% to 70% • H level voltage: 3.5 V to 13.2 V • L level voltage: 0.0 V to 0.8 V • Input impedance: 3 kΩ
+10V	Power supply for frequency setting	10.5 V (allowable current 20 mA maximum)
-10V	Power supply for frequency setting	-10.5 V (allowable current 20 mA maximum)
AI1	MFAI1 (Master frequency reference)	Voltage input or current input Select terminal AI1 with DIP switch S1-1 and *H3-01 [AI1 Signal Level Select]*. Select terminal AI2 with DIP switch S1-2 and *H3-09 [AI2 Signal Level Select]*. • -10 V to +10 V/-100% to +100% (input impedance: 20 kΩ) • 0 V to 10 V/100% (input impedance: 20 kΩ) • 4 mA to 20 mA/100%, 0 mA to 20 mA/100% (input impedance: 250 Ω)
AI2	MFAI2 (Combined to terminal A1)	
AI3	MFAI3/PTC input (Auxiliary frequency reference)	• Voltage input or current input Select with DIP switch S1-3 and *H3-05 [AI3 Signal Level Select]*. – -10 V to +10 V/-100% to +100% (input impedance: 20 kΩ) – 0 V to 10 V/100% (input impedance: 20 kΩ) – 4 mA to 20 mA/100%, 0 mA to 20 mA/100% (input impedance: 250 Ω) • PTC input (Motor Overheat Protection) Set DIP switch S4 to “PTC” and set DIP switch S1-3 to “V” to set terminal AI3 for PTC input.
A0V	Frequency reference common	0 V
GND	Connecting shielded cable	-

■ Output Terminals

This chapter contains a list of output terminals and functions.

Table 3.7 Fault Relay Output

Terminal	Name (Default)	Function (Signal Level)
1NO	N.O. output (Fault)	• Relay output • 30 Vdc, 10 mA to 1 A • 250 Vac, 10 mA to 1 A • Minimum load: 5 V, 10 mA (Reference value)
1NC	N.C. output (Fault)	
1CM	Digital output common	

Table 3.8 MFDO

Terminal	Name (Default)	Function (Signal Level)
2NO	MFDO (During run)	• Relay output • 30 Vdc, 10 mA to 1 A • 250 Vac, 10 mA to 1 A • Minimum load: 5 V, 10 mA (Reference value) **Note:** Do not set functions that frequently switch ON/OFF to MFDO (2NO to 4CM) because this will decrease the performance life of the relay contacts. The manufacturer estimates switching life at 200,000 times (assumes 1 A, resistive load).
2CM		
3NO	MFDO (Zero speed)	
3CM		
4NO	MFDO (Speed agree 1)	
4CM		

Table 3.9 Monitor Output

Terminal	Name (Default)	Function (Signal Level)
PO	Pulse train output (Output frequency)	32 kHz (maximum) Refer to "Pulse Train Output" on page 96 for more information.
AO1	Analog monitor output 1 (Output frequency)	Select voltage or current output. • 0 V to 10 V/0% to 100% • -10 V to +10 V/-100% to +100% • 4 mA to 20 mA (receiver recommended impedance: 250 Ω) **Note:** Select with jumper switch S5 and *H4-07 [AO1 Signal Level Select]* or *H4-08 [AO2 Signal Level Select]*.
AO2	Analog monitor output 2 (Output current)	
A0V	Monitor common	0 V

■ External Power Supply Input Terminals

This chapter contains a list of the functions of the external power supply input terminals.

Table 3.10 External Power Supply Input Terminals

Terminal	Name (Default)	Function
E24V	External 24 V power supply input	Supplies backup power to the drive control circuit, keypad, and option board. 21.6 VDC to 26.4 VDC, 700 mA
A0V	External 24 V power supply ground	0 V

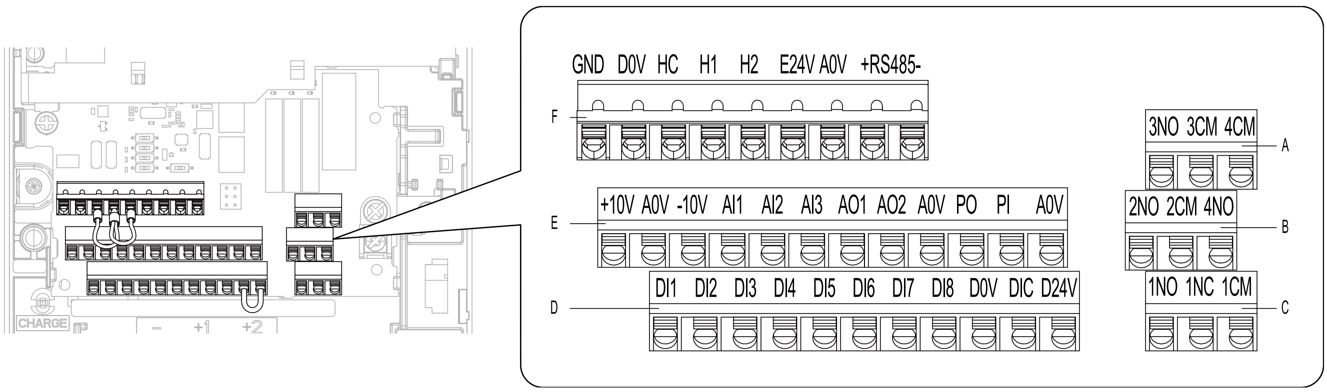
■ Serial Communication Terminals

This chapter contains a list of the functions of serial communication terminals and functions.

Table 3.11 Modbus Communication

Terminal	Terminal Name	Function (Signal Level)	
RS485+	Communication input/output (+)	Modbus communications Use an RS-485 cable to connect the drive. **Note:** Set DIP switch S2 to ON to enable the termination resistor in the last drive in a Modbus network.	• RS-485 • Modbus communication protocol • Maximum 115.2 kbps
RS485-	Communication output (-)		
A0V	Signal ground	0 V	

◆ Control Circuit Terminal Configuration



A - Terminal block (TB2-3)
B - Terminal block (TB2-2)
C - Terminal block (TB2-1)
D - Terminal block (TB1)
E - Terminal block (TB3)
F - Terminal block (TB4)

Figure 3.34 Control Circuit Terminal Arrangement

Use the tables in this section to select the correct wires. Use shielded wire for the control circuit terminal block. Use crimp ferrules on the wire ends to make wiring easier and more reliable.

Table 3.12 Control Circuit Wire Gauges and Tightening Torques

Terminal	Bare Wire		Crimp Ferrule	
	Recommended Gauge mm² (AWG)	Applicable Gauge mm² (AWG)	Recommended Gauge mm² (AWG)	Applicable Gauge mm² (AWG)
DI1 - DI8, D0V, DIC, D24V H1, H2, HC PI, +10V, -10V, AI1, AI2, AI3, A0V PO, AO1, AO2, A0V RS485+, RS485-, A0V 1NO, 1NC, 1CM, 2NO, 2CM, 3NO, 3CM, 4CO, 4CM E24V, GND	0.75 (18)	• Stranded wire 0.2 - 1.0 (24 - 18) • Solid wire 0.2 - 1.5 (24 - 16)	0.5 (20)	0.25 - 0.5 (24 - 20)

■ Crimp Ferrules

Attach an insulated sleeve when you use crimp ferrules.

Use the CRIMPFOX 6, a crimping tool made by PHOENIX CONTACT.

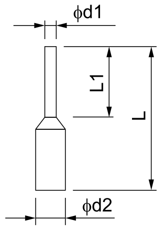


Figure 3.35 External Dimensions of Crimp Ferrules

Table 3.13 Crimp Ferrule Models and Sizes

Wire Gauge mm² (AWG)	Model	L (mm)	L1 (mm)	φd1 (mm)	φd2 (mm)
0.25 (24)	AI 0.25-8YE	12.5	8	0.8	2.0
0.34 (22)	AI 0.34-8TQ	12.5	8	0.8	2.0
0.5 (20)	AI 0.5-8WH, AI 0.5-8OG	14	8	1.1	2.5

◆ Wiring the Control Circuit Terminal

WARNING! *Electrical Shock Hazard. Do not remove covers or touch circuit boards while the drive is energized. Failure to obey can cause death or serious injury.*

NOTICE: *Isolate control circuit wiring from main circuit wiring (terminals R/L1, S/L2, T/L3, B1, B2, U/T1, V/T2, W/T3, -, +1, +2) and other high-power wiring. Incorrect wiring procedures could cause drive malfunction because of electrical interference.*

NOTICE: *Isolate contact output terminals 1NO, 1NC, 1CM, 2NO, 2CM, 3NO, 3CM, 4CO, 4CM from other control circuit wiring. The drive and connected equipment will malfunction or the drive can trip because of incorrect wiring.*

NOTICE: *Use a class 2 power supply when connecting to the control terminals. Refer to NEC Article 725 Class 1, Class 2, and Class 3 Remote-Control, Signaling, and Power Limited Circuits for requirements concerning class 2 power supplies. Improper application of peripheral devices could result in drive performance degradation due to improper power supply.*

NOTICE: *Insulate wire shields with tape or shrink tubing to prevent contact with other signal lines or equipment. Incorrect wiring procedures could cause the drive or connected equipment to malfunction because of short circuits.*

NOTICE: *Connect the shield of shielded cable to the applicable ground terminal. Incorrect equipment grounding could cause the drive or connected equipment to malfunction or to trip again and again.*

Correctly ground the drive terminals and complete main circuit wiring before you wire the control circuit.

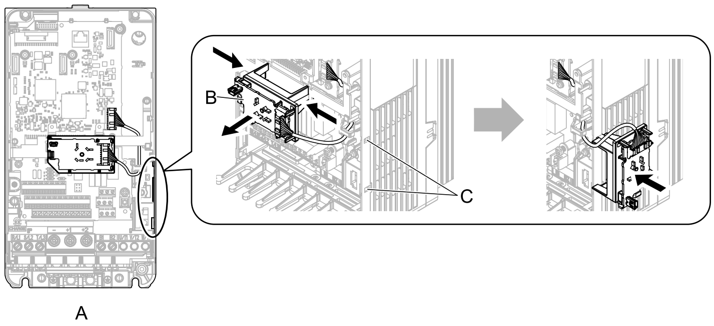
Remove the keypad and front cover.

1. Push in on the tabs on the both sides of the USB port board to release the board from the bracket. Pull the board forward to remove it.

   NOTICE: *Make sure that the USB port board is safe after you remove it from the bracket. Failure to obey will cause damage to the USB port board.*

Note:

You can temporarily store the USB port board with the temporary placement holes on the drive. The location of the temporary placement holes changes by drive model.

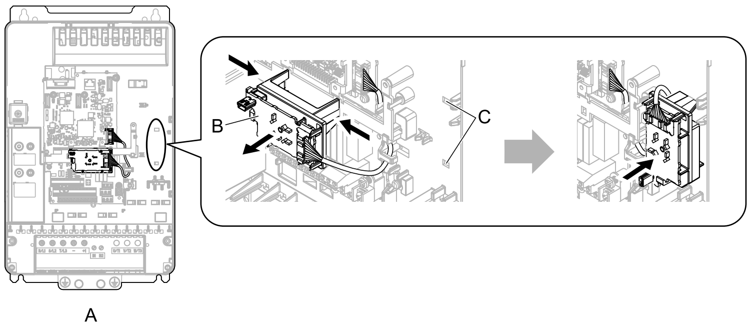


A - Drive front

B - USB port board

C - Temporary placement holes

Figure 3.36 Remove the USB Port Board

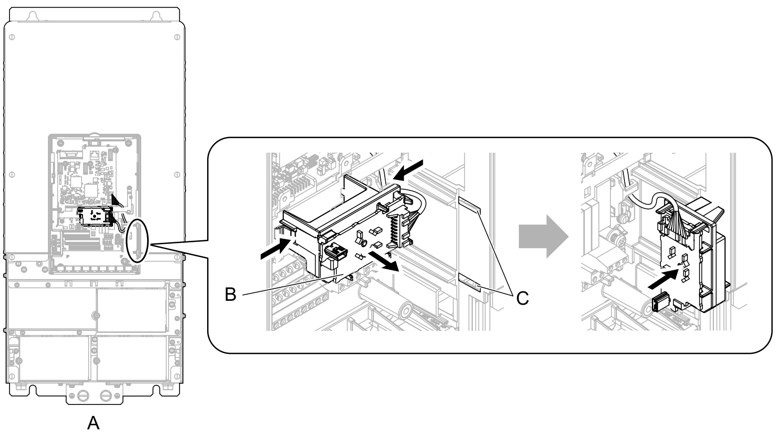


A - Drive front

B - USB port board

C - Temporary placement holes

Figure 3.37 Remove the USB Port Board



A - Drive front

B - USB port board

C - Temporary placement holes

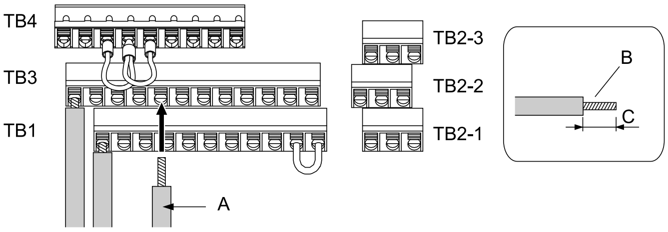
Figure 3.38 Remove the USB Port Board

2. Refer to the following figure and wire the control circuit.

WARNING! *Fire Hazard. Tighten all terminal screws to the correct tightening torque. Connections that are too loose or too tight can cause incorrect operation and damage to the drive. Incorrect connections can also cause death or serious injury from fire.*

NOTICE: *Use shielded, twisted-pair wires and ground the shield to the ground terminal of the drive. Failure to obey can cause electrical interference and unsatisfactory system performance.*

NOTICE: *Do not use control circuit wiring that is longer than 50 m (164 ft.) to supply the frequency reference with an analog signal from a remote source. Failure to obey could cause unsatisfactory system performance.*



A - Wire with a crimp ferrule attached, or unsoldered wire with the core wires lightly twisted

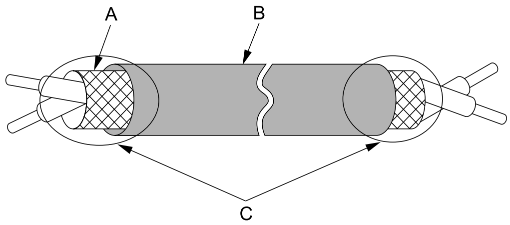
B - Pull back the shielding and lightly twist the end with your fingers to keep the ends from fraying.

C - Remove approximately 5.5 mm (0.21 in.) of the covering at the end of the wire if you do not use crimp ferrules.

Figure 3.39 Wiring Procedure for the Control Circuit

Note:

- Do not solder the core wire. Soldered wire connections can become loose over time and cause unsatisfactory drive performance.
- Prepare the wire ends of shielded twisted-pair wires as shown in Figure 3.40 to use an analog reference from an external frequency setting potentiometer to set the frequency. Connect the shield to terminal GND of the drive.



A - Connect the cable sheath to terminal GND of the drive.

B - Sheath

C - Insulate with electrical tape or shrink tubing.

Figure 3.40 Preparing Ends of Shielded Cable

3. Put the cable through the clearance in the wiring cover.

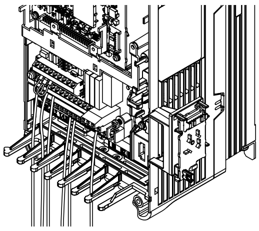


Figure 3.41 Control Circuit Wiring

4. Install the USB port board, front cover, and the keypad to their initial positions.

◆ Switches and Jumpers on the Terminal Board

The terminal board has switches to adapt the drive I/Os to the external control signals.

Set the switches to select the functions for each terminal.

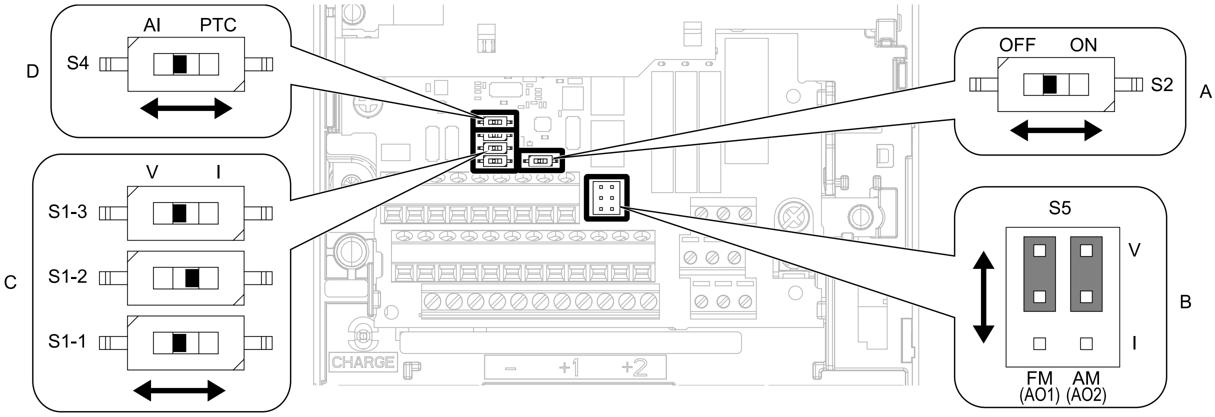


Figure 3.42 Locations of Switches

Table 3.14 I/O Terminals and Switches Functions

Posi tion	Switch	Terminal	Function	Default Setting
A	DIP switch S2	-	Enables and disables the Modbus communications termination resistor.	OFF
B	Jumper switch S5	AO1, AO2	Sets terminals AO1 and AO2 to voltage or current output.	AO1: V (voltage output) AO2: V (voltage output)
C	DIP switch S1-1	AI1	Selects the input signal type (voltage/current).	V (voltage input)
	DIP switch S1-2	AI2	Selects the input signal type (voltage/current).	I (current input)
	DIP switch S1-3	AI3	Selects the input signal type (voltage/current).	V (voltage input)
D	DIP switch S4	AI3	Selects MFAI or PTC input.	AI (analog input)

3.6 Control I/O Connections

This section gives information about the settings for the listed control circuit I/O signals.

- MFDI (terminals DI1 to DI8)
- MFDO (terminals 2NO, 2CM, 3NO, 3CM, 4NO, and 4CM)
- Pulse train output (terminal PO)
- MFAI (terminals AI1 to AI3)
- PTC input (terminal AI3)
- MFAO (terminals AO1, AO2)
- Modbus communications (terminals RS485+, RS485-, A0V)

◆ Pulse Train Output (Terminal PO)

You can use pulse train monitor output terminal PO for sourcing mode or for sinking mode.

NOTICE: *Connect peripheral devices correctly. Failure to obey can cause incorrect drive operation and damage to the drive or connected circuits.*

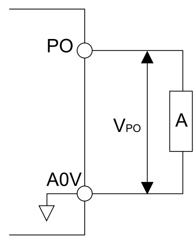
■ Use for sourcing mode

The load impedance changes the voltage level of the pulse train output signal.

Load Impedance R_L(kΩ)	Output Voltage V_{MP}(V)
1.5 kΩ or more	5 V or more
4.0 kΩ or more	8 V or more
10 kΩ or more	10 V or more

Note:

Use the formula in Figure 3.43 to calculate the necessary load resistance (kΩ) to increase output voltage $(V)_{MP}$.



$R_L = V_{PO} \times 2 / (12 - V_{PO})$

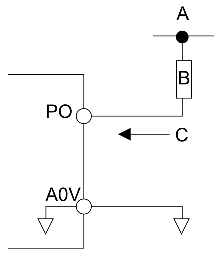
A - Load impedance

Figure 3.43 Wiring to Use Pulse Train Output in Sourcing Mode

■ Use in sinking mode

The external power supply changes the voltage level of the pulse train output signal. Keep the voltage from an external source between 10.8 Vdc to 16.5 Vdc. Adjust the load impedance to keep the current at 16 mA or lower.

External Power Supply (V)	Load Impedance (kΩ)	Sinking Current (mA)
10.8 Vdc to 16.5 Vdc	1.0 kΩ or more	16 mA maximum



A - External power supply
B - Load impedance
C - Sinking current

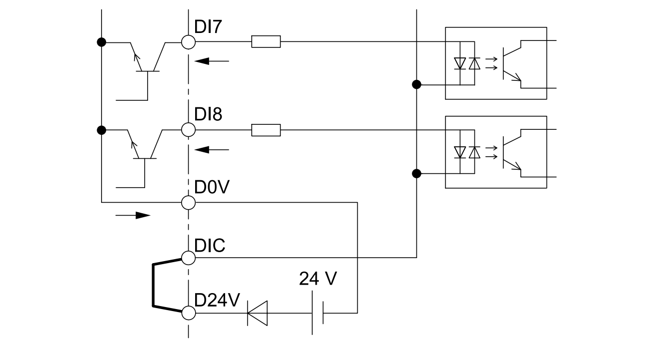
Figure 3.44 Wiring to Use Pulse Train Output in Sinking Mode

◆ Set Sinking Mode/Sourcing Mode

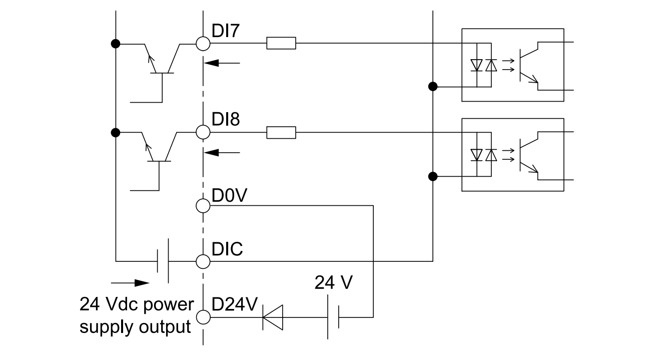
Close the circuit between terminals DIC-D24V and DIC-D0V to set the sinking mode/sourcing mode and the internal/external power supply for the MFDI terminals. The default setting for the drive is internal power supply sinking mode.

NOTICE: *Do not close the circuit between terminals D24V and D0V. Failure to obey will cause damage to the drive.*

Sinking Mode (NPN)

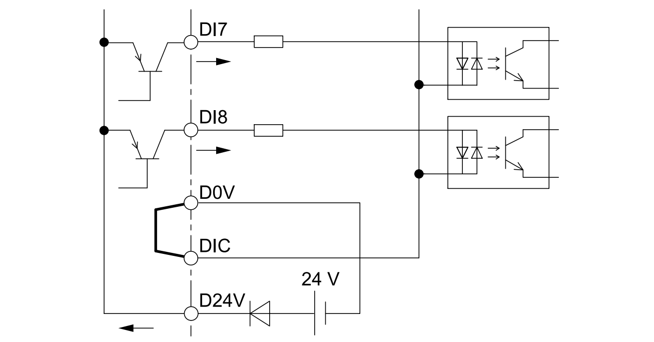


Internal Power Supply (Terminal D0V-D24V)

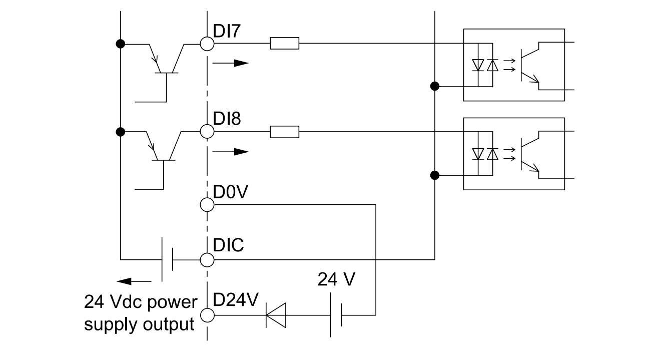


External Power 24 V

Sourcing Mode (PNP)



Internal Power Supply (Terminal D0V-D24V)



External Power 24 V

◆ Set Input Signals for MFAI Terminals AI1 to AI3

Use terminals AI1 to AI3 to input a voltage or a current signal.

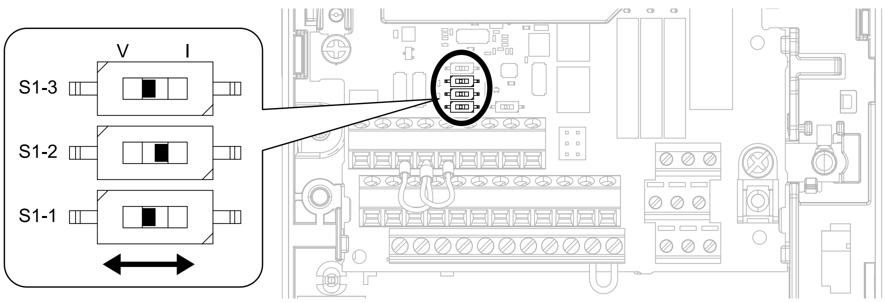


Figure 3.45 Location of DIP Switch S1

Electrical Installation

3

Table 3.15 MFAI Terminals AI1 to AI3 Signal Settings

Terminal	Input Signal	DIP Switch Settings	Parameter
AI1	Voltage input	S1-1 = V (Default)	*H3-01 [AI1 Signal Level Select]* = 0: 0 V to 10 V/0% to 100% (input impedance: 20 kΩ) *H3-01 [AI1 Signal Level Select]* = 1: -10 V to +10 V/-100% to 100% (input impedance: 20 kΩ)
	Current input	S1-1 = I	*H3-01 [AI1 Signal Level Select]* = 2: 4 mA to 20 mA/0% to 100% (input impedance: 250 Ω) *H3-01 [AI1 Signal Level Select]* = 3: 0 mA to 20 mA/0% to 100% (input impedance: 250 Ω)
AI2	Voltage input	S1-2 = V	*H3-09 [AI2 Signal Level Select]* = 0: 0 V to 10 V/0% to 100% (input impedance: 20 kΩ) *H3-09 [AI2 Signal Level Select]* = 1: -10 V to +10 V/-100% to 100% (input impedance: 20 kΩ)
	Current input	S1-2 = I (Default)	*H3-09 [AI2 Signal Level Select]* = 2: 4 mA to 20 mA/0% to 100% (input impedance: 250 Ω) *H3-09 [AI2 Signal Level Select]* = 3: 0 mA to 20 mA/0% to 100% (input impedance: 250 Ω)
AI3	Voltage input	S1-3 = V (Default)	*H3-05 [AI3 Signal Level Select]* = 0: 0 V to 10 V/0% to 100% (input impedance: 20 kΩ) *H3-05 [AI3 Signal Level Select]* = 1: -10 V to +10 V/-100% to 100% (input impedance: 20 kΩ)
	Current input	S1-3 = I	*H3-05 [AI3 Signal Level Select]* = 2: 4 mA to 20 mA/0% to 100% (input impedance: 250 Ω) *H3-05 [AI3 Signal Level Select]* = 3: 0 mA to 20 mA/0% to 100% (input impedance: 250 Ω)

Note:
- Set *H3-02, H3-10 = 3 [AI1 Function Selection, AI2 Function Selection = FrqBIAS Frq]* to set AI1 and AI2 to frequency reference. The drive will add the analog input values together to make the frequency reference.
- Use tweezers or a jig with a tip width of approximately 0.8 mm (0.03 in.) to set DIP switches.
- Set DIP switch S4 to "AI" to use terminal AI3 as an analog input (voltage/current) terminal. The default setting for DIP switch S4 is "AI".

◆ Set MFAI Terminal AI3 to PTC Input

Set terminal AI3 as an MFAI or as the PTC input for motor overload protection.

Use DIP switch S4 to set the input function.

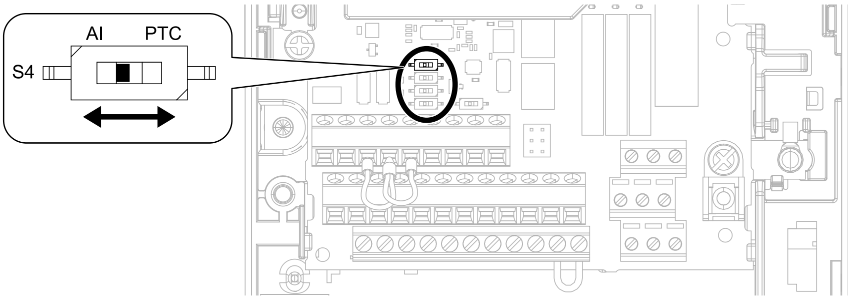


Figure 3.46 Location of DIP Switch S4

Terminal	DIP Switch Settings	Description
AI3	AI (Default)	Functions as an MFAI terminal. Set *H3-06 [AI3 Function Selection]* to select the input function.
	PTC	Functions as the PTC input terminal. Set *H3-06 = 16 [AI3 Function Selection = Mot PTC Input]*. Set S1-3 to "V" for voltage input.

◆ Set Output Signals for MFAO Terminals AO1, AO2

Set the signal type for terminals AO1 and AO2 to voltage or current output. Use jumper switch S5 and *H4-07 [AO1 Signal Level Select], H4-08 [AO2 Signal Level Select]* to set the signal type.

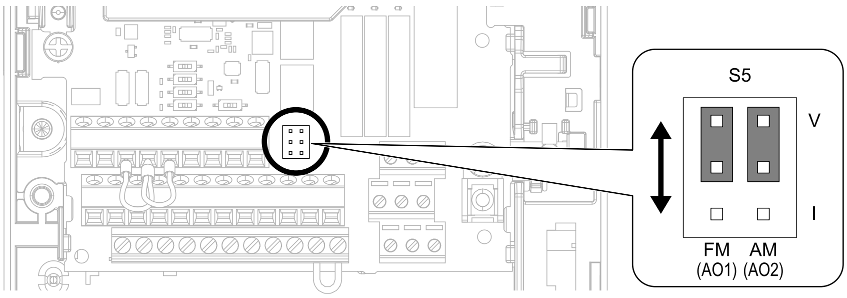
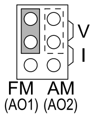
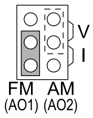
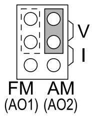
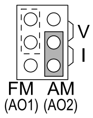


Figure 3.47 Location of Jumper Switch S5

Terminal	Types of Output Signals	Jumper Switch S5	Parameter Signal Level
AO1	Voltage output (Default)		H4-07 [AO1 Signal Level Select] = 0: 0 V to 10 V H4-07 [AO1 Signal Level Select] = 1: -10 V to +10 V
	Current output		H4-07 [AO1 Signal Level Select] = 2: 4 mA to 20 mA
AO2	Voltage output (Default)		H4-08 [AO2 Signal Level Select] = 0: 0 V to 10 V H4-08 [AO2 Signal Level Select] = 1: -10 V to +10 V
	Current output		H4-08 [AO2 Signal Level Select] = 2: 4 mA to 20 mA

◆ Switch ON Termination Resistor for Modbus Communications

When the drive is the last slave in a Modbus communications, set DIP switch S2 to the ON position. This drive has a built-in termination resistor for the RS-485 interface.

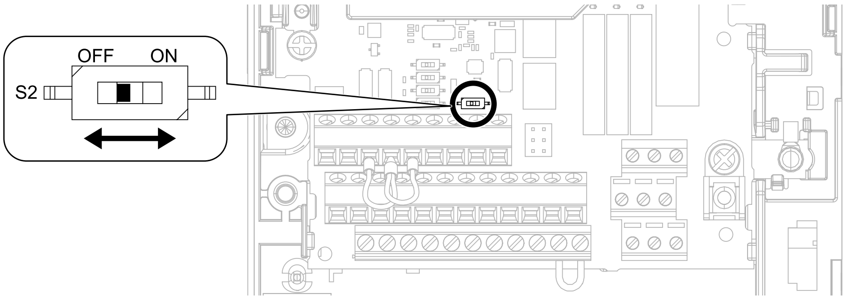


Figure 3.48 Location of DIP Switch S2

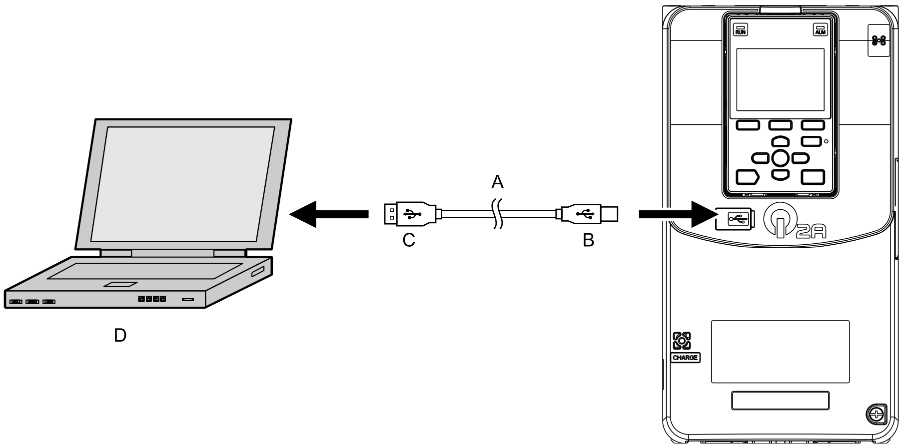
Table 3.16 Modbus Communications Termination Resistor Setting

DIP Switch S2	Description
ON	The built-in termination resistor is ON.
OFF (Default)	The built-in termination resistor is OFF.

3.7 Connect the Drive to a PC

The drive has a mini-B type USB port.

You can use a USB cable (USB 2.0, type: A - mini-B) to connect the drive to a type-A USB port on a PC. After you connect the drive to the PC, you can use Q2Edit software to monitor drive performance and manage parameter settings.



A - USB 2.0, type A - mini-B cable
B - Mini-B type connector
C - Type-A connector
D - PC

Figure 3.49 Connect to a PC (USB)

3.8 External Interlock

For applications that will have unwanted effects on the system if the drive stops, make an interlock between fault relay output (1NO, 1NC, 1CM) and the MFDO *Drive Ready* signal.

◆ Drive Ready

When the drive is operating or is prepared to accept a Run command, the MFDO terminal to which *Drive Ready [H2-xx = 1]* is set will enter the ON status.

In these conditions, Drive Ready is OFF and the drive ignores Run commands:

- The drive is de-energized
- During a fault
- There is problem with the control power supply
- There is a parameter setting error that will not let the drive run, although a Run command is entered
- An overvoltage or undervoltage fault occurs when the Run command is entered
- The drive is in Programming Mode.

Interlock Circuit Example

This is an example of how two drives that run one application use the Drive Ready and Fault output signals to interlock with the controller.

Terminal	Output Signal	Parameter Settings for Output Signal
1NO, 1NC, 1CM	Fault	-
2NO, 2CM	Drive Ready	H2-01 = 1 [Drive Ready]

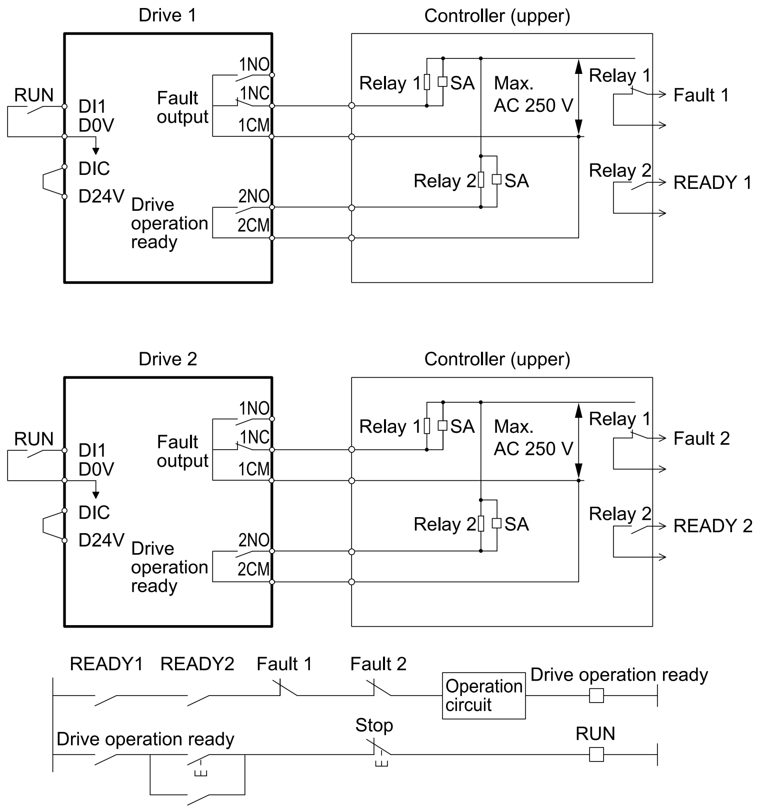


Figure 3.50 Interlock Circuit Example

3.9 Braking Resistor Installation

A braking resistor or braking resistor unit (dynamic braking option) helps stop the motor quickly and smoothly when there is high load inertia. If you try to decelerate a motor in less time than usual for a coast to stop, the motor will rotate faster than the synchronous speed that aligns with the set frequency. This will cause the motor to become an induction generator. The inertia energy of the motor and regenerate to the drive and charge the drive DC bus capacitor and increase the voltage. If the voltage is more than the overvoltage level, an *ov [Overvoltage]* will occur. To prevent these overvoltage faults, a dynamic braking option is necessary.

WARNING!
Set L3-04 = 0 [StallP@Decel Enable = Disabled] when operating the drive with:
- *a regenerative converter*
- *regenerative unit*
- *braking unit*
- *braking resistor*
- *braking resistor unit.*

Failure to obey could prevent the drive from stopping in the specified deceleration time and cause serious injury or death.

NOTICE: *Do not allow unqualified personnel to use the product. Before you connect a dynamic braking option to the drive, make sure that you review "Braking Unit, Braking Resistor Unit Instruction Manual (TOBPC72060001)". Failure to obey can cause damage to the drive and braking circuit.*

Note:
- Select the correct braking circuit size to dissipate the power that is necessary to decelerate the load in the correct time. Before you run the drive, make sure that the braking circuit can dissipate the energy for the set deceleration time.
- To install a dynamic braking option, set *L8-01 = 0 [3%ERF DBR Protection = Disabled]*.

WARNING! *Fire Hazard. The braking resistor connection terminals are B1 and B2. Do not connect braking resistors to other terminals. Incorrect wiring connections could cause the braking resistor to overheat. Failure to obey can cause death or serious injury by fire and damage to the drive and braking circuit.*

NOTICE: *Connect braking resistors to the drive as shown in the I/O wiring examples. Incorrectly wiring braking circuits can cause damage to the drive or equipment.*

To connect a Yaskawa ERF series braking resistor to the drive, set *L8-01 = 1 [3%ERF DBR Protection= Enabled]*.

To use a non-ERF type braking resistor, connect a thermal overload relay between the drive and the braking resistor, and set a circuit to de-energize the drive at the trip contacts of the thermal overload relay.

◆ Install a Braking Resistor: ERF-Type

Connect the braking resistor to drive models 2004 to 2021 and 4002 to 4012 as shown.

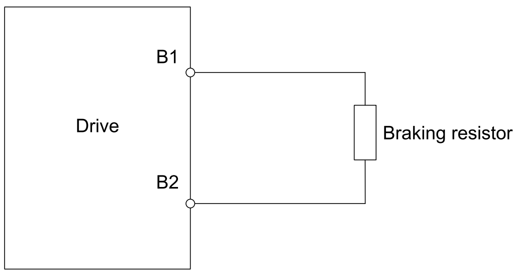


Figure 3.51 Install a Braking Resistor: ERF-Type

When you use a braking resistor, set *L8-01 = 1 [3%ERF DBR Protection = Enabled]* and set one of the MFDO parameters *H2-01 to H2-03 = 4C [Multi-Function Digital Output 1 to Multi-Function Digital Output 3 = BrkRes Fault]*. Use a sequence that uses MFDO to de-energize the drive.

◆ Install a Braking Resistor Unit: LKEB-Type

Connect the braking resistor unit as shown.

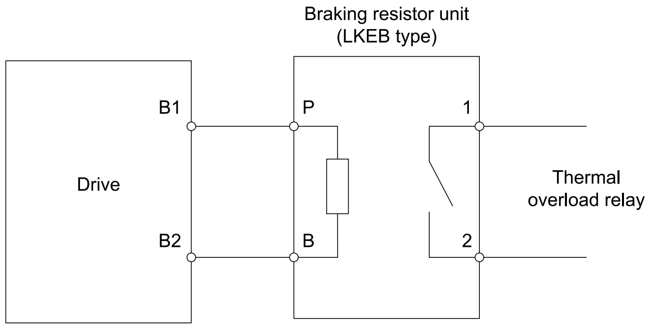


Figure 3.52 Install a Braking Resistor Unit: LKEB-Type

To install a braking resistor unit, set *L8-01 = 0 [3%ERF DBR Protection = Disabled]*.

Models 2004 to 2138 and 4002 to 4168 have a built-in braking transistor.

To prevent overheating the braking resistor unit, set a sequence to de-energize the drive at the trip contacts of the thermal overload relay.

◆ Install a Braking Unit Connection: CDBR-Type

To install a CDBR type braking unit, connect terminal +3 on the drive to terminal + on the braking unit. Then connect terminal - on the drive to terminal - on the braking unit. Terminal +2 on the drive is not necessary for CDBR-type braking unit connections.

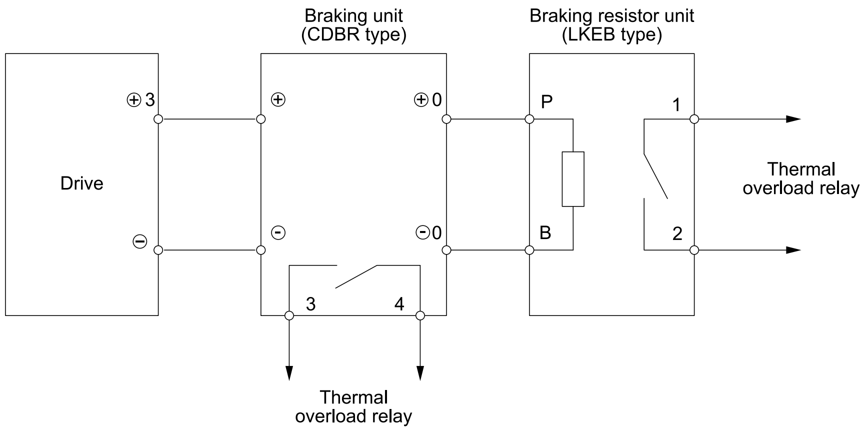


Figure 3.53 Install a Braking Unit: CDBR-Type/Braking Resistor Unit: LKEB-Type

Set *L8-55 = 0 [DB IGBT Protection = Disable]*.

Note:

To install a CDBR-type braking unit to the drive models 2004 to 2138 and 4002 to 4168 that have a built-in braking transistor, connect drive terminal B1 to terminal + on the braking unit.

◆ Connect Braking Units in Parallel

To connect two or more braking units in parallel, wire and select connections as shown.

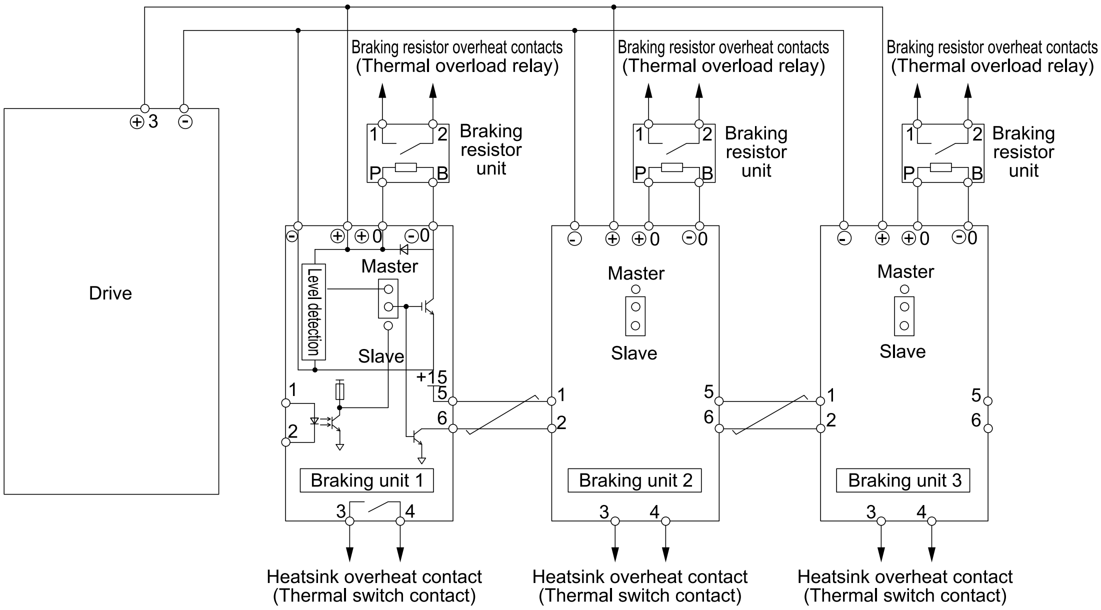


Figure 3.54 Connect Braking Units in Parallel

Braking units have connectors to select master or slave. On the first braking unit, select the master side. On the second unit and all subsequent units, select the slave side.

◆ Dynamic Braking Option Overload Protection

To prevent overheating the dynamic braking option, set a sequence to de-energize the drive at the trip contacts of the thermal overload relay.

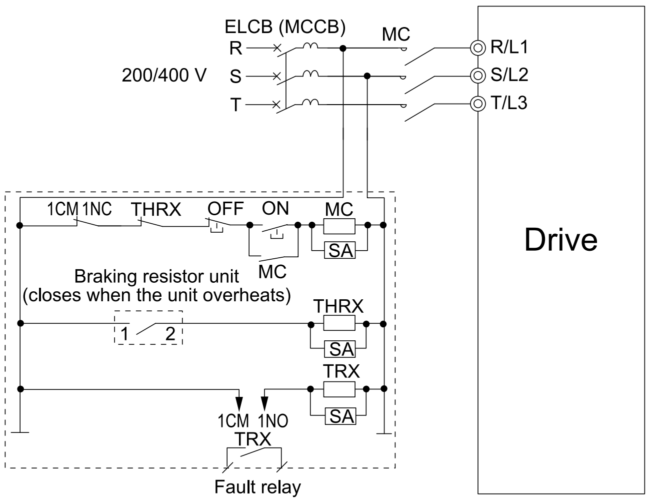


Figure 3.55 Power Supply Interrupt for Overheat Protection Example

WARNING! *Fire Hazard. When you use a braking unit, use a thermal relay on the braking resistors and set a fault contact output for the braking resistor unit to disconnect drive main power through an input contactor.* ***Incorrect braking circuit protection can overheat the resistors and cause death or serious injury by fire.***

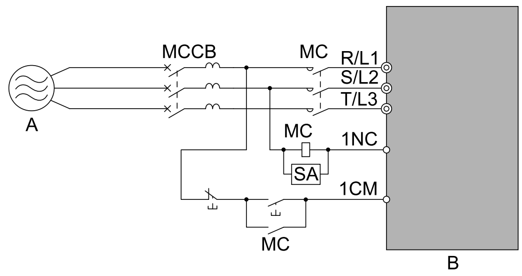
3.10 Drive Wiring Protection

◆ Install a Molded-Case Circuit Breaker (MCCB) or Residual Current Monitor/ Device (RCM/RCD)

Install a molded-case circuit breaker (MCCB) or a ground fault circuit interrupter (RCM/RCD) for line protection between the power supply and main circuit power supply input terminals R/L1, S/L2, and T/L3. The MCCB/ RCM/RCD give overload protection and also prevent damage to the main circuit and the devices that are wired to the main circuit.

Use the information in this section to select the correct MCCB or RCM/RCD and to safely connect the device.

- The capacity of the MCCB or RCM/RCD must be 1.5 to 2 times the rated output current of the drive. Use an MCCB or RCM/RCD as an alternative to overheat protection (150% for one minute at the rated output current) to prevent drive faults.
- When you connect more than one drive to one MCCB or RCM/RCD that is shared with other equipment, refer to Figure 3.56 and use a magnetic contactor (MC) and set a sequence that de-energizes the drive when it outputs errors.



A - Power Supply **B - Drive**

Figure 3.56 Connect an MCCB

WARNING! *Electrical Shock Hazard. Use an MCCB, RCM/RCD, or Magnetic Contactor (MC) to de-energize the drive before you wire the main circuit terminal. Failure to obey can cause death or serious injury.*

◆ Install a Residual Current Monitoring/Detection (RCM/RCD)

When the drive output does switches at high speeds, it causes high frequency leakage current. To prevent electrical shock and fires caused by ground fault protection that is not sufficient, install an RCM/RCD.

Use a high frequency RCM/RCD at the power input side of the drive and make sure that each drive has a minimum cumulative sensitivity amperage of 30 mA. The specialized breaker removes high-frequency leakage current, and only detects the leakage current from frequency bands that are dangerous to humans.

If a device does not have protection against high frequencies, high frequency leakage currents can cause the device to malfunction. If you have a malfunction on a device that is not protected, decrease the carrier frequency of the drive, switch to a better breaker, or use an RCM/RCD with a minimum cumulative sensitivity amperage of 200 mA for each drive.

These conditions can have an effect on leakage current:

- Drive capacity
- Carrier frequency
- Wiring distance and types of motor cables
- EMI/RFI filter

To prevent damage and injury to personnel and drives, use a high-frequency RCM/RCD that is rated for AC and DC power supplies.

Note:

The manufacturer recommends these RCM/RCDs, which are designed to operate with high frequencies.
- Mitsubishi Electric Corporation; NV series
- Schneider Electric; NS series

Electrical Installation

3

3.11 Dynamic Braking Option, Motor Protection

◆ Install an Electromagnetic Contactor (MC) at the Input Side of the Drive

You can use an MC as an alternative to a molded case circuit breaker (MCCB) when:

- The protective functions of the drive have been triggered
- An emergency stop occurred, and the sequence de-energizes the drive.

If an MC on the input side of the drive (primary side) stops the drive, regenerative braking will not operate, and the drive will coast to stop.

NOTICE: *Do not connect electromagnetic switches or MCs to the output motor circuits without correct sequencing. Incorrect sequencing of output motor circuits could cause damage to the drive.*

NOTICE: *Turn the drive ON (Run) and OFF (Stop) a maximum of one time each 30 minutes with the MC on the power source side to extend the service life of the relay contacts and electrolytic capacitors in the drive. Run and Stop the motor as much as possible with the drive. The drive can fail if users frequently turn the drive ON and OFF with the MC on the power source side to Run and Stop the drive. Incorrect operation can decrease the service life of the relay contacts and electrolytic capacitors.*

NOTICE: *Use an MC to make sure that you can fully remove power to the drive when necessary. Wire the MC to open when a fault output terminal is triggered.*

Note:
- When machinery must not restart after recovery from a momentary power loss that occurred during run, install an MC at the input side of the drive and set a sequence that does not automatically set the start signal to ON after recovery of power.
- When it is necessary to stop momentary power loss, for example to maintain a circuit that has momentary power loss, use a delayed-release MC.

◆ Protect the Braking Resistor/Braking Resistor Unit

Use an MC on the input side (primary side) to prevent damage to the braking resistor/braking resistor unit.

WARNING! *Fire Hazard. When you use a braking unit, use a thermal relay on the braking resistors and set a fault contact output for the braking resistor unit to disconnect drive main power through an input contactor.* ***Incorrect braking circuit protection can overheat the resistors and cause death or serious injury by fire.***

◆ Install a Thermal Overload Relay on the Drive Output

A thermal overload relay disconnects the power line to the motor during a motor overload condition to prevent damage to the motor.

Install a thermal overload relay between the drive and motor in these conditions:

- When operating more than one motor from one drive.
- When operating the motor directly from the power line with a power line bypass.

When operating one motor from one drive, it is not necessary to install a thermal overload relay. The drive has electronic motor overload protection in the drive software.

Note:
- When you install a thermal overload relay, set parameter *L1-01 = 0 [Motor Cool Type for OL1 Calc = Disabled]*.
- Set up a sequence that will trip an external fault (coast to stop) for the contacts of the thermal overload relay.

◆ General Precautions When Using Thermal Overload Relays

When you use a motor thermal overload relay on the drive output to prevent nuisance trips and overheating of the motor at low speeds, be sure to think about these application precautions:

- **Operation of a low speed motor**
  Usually, you use thermal overload relays on general-purpose motors (standard motors). When a drive drives a general-purpose motor, the motor current is approximately 5% to 10% more than with a commercial power supply. When a motor with a shaft-driven fan operates at low speeds, the cooling capacity decreases. This can cause the motor to overheat when the load current is in the motor rated value. Enable the electronic thermal protection in the drive when possible to prevent this problem.
  The electronic thermal overload function uses the relation between the speed and heat characteristics in the variable speed control range to simulate the cooling ability of general-purpose motors and forced-vented motors to prevent damage to the motor.
- **Operating more than one motor from one drive**
  To disable the overload protection function of the electronic thermal protector of the drive, set *L1-01 = 0 [Motor Cool Type for OL1 Calc = Disabled]*.

Note:

If you operate more than one motor from one drive, you cannot use the electronic thermal protection of the drive.

- **Length of the motor cables**
  If you use long motor cables with a high carrier frequency, the increased leakage current can cause nuisance tripping of the thermal relay. To prevent this, decrease the carrier frequency or increase the tripping level of the thermal overload relay.
- **Nuisance tripping because of high drive carrier frequency.**
  High carrier frequency PWM drives make current waveforms that can increase the temperature in overload relays. It may be necessary to increase the trip level setting when encountering nuisance triggering of the relay.

WARNING! *Fire Hazard. Make sure that a secondary problem is not the cause of the overload before you increase the detection level of the thermal relay. Verify local ordinances for electrical wiring, then adjust electrothermal settings. Incorrect wiring can cause death or serious injury from fire.*

3.12 Improve the Power Factor

◆ Connect an AC Reactor or a DC Reactor

AC reactors and DC reactors decrease surges in current and improve the power factor on the input side of the drive.

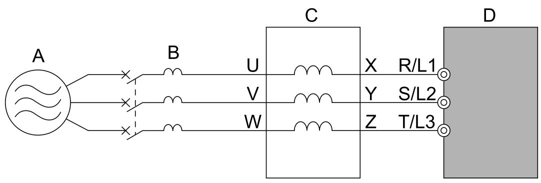
Connect an AC reactor or a DC reactor to the input side (primary side) in the these conditions:

- To decrease harmonic current or improve the power factor of the power supply
- When there is switching of phase advancing capacitor
- With a large capacity power supply transformer (600 kVA or more).

Note:
- You can use an AC reactor and DC reactor together.
- When you connect a thyristor converter (for example, a DC drive) to the same power supply system, you should use an AC reactor, regardless of the conditions of the power supply.
- The main circuit terminal block for the drive, and the terminal blocks for the AC and DC reactors come in different shapes. Use caution when you prepare the ends of the wires.

◆ Connect an AC Reactor

When you connect an AC reactor to the output side (secondary side) of the driver, set *C6-02 = 1 [Carrier Frequency Selection = 2.0 kHz]*.

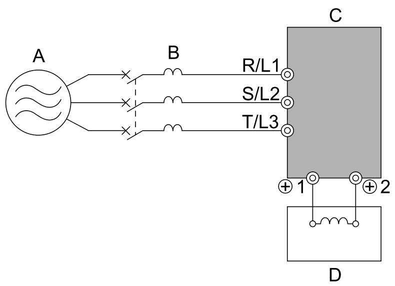


A - Power supply
B - MCCB
C - AC reactor
D - Drive

Figure 3.57 AC Reactor Connection Example

◆ Connect a DC Reactor

When you install a DC link choke, remove the jumper between terminals +1 and +2. If you will not use a DC link choke, do not remove the jumper.



A - Power supply
B - MCCB
C - Drive
D - DC reactor

Figure 3.58 DC Reactor Connection Example

3.13 Prevent Switching Surge

◆ Connect a Surge Protective Device

A surge protective device decreases the surge voltage that is generated from switching an inductive load near the drive. Inductive loads include:

- Magnetic contactors
- Electromagnetic relays
- Magnetic valves
- Solenoids
- Magnetic brakes.

Always use a surge protective device or diode with inductive loads.

Note:

Do not connect a surge protective device to the drive output side.

3.14 Decrease Noise

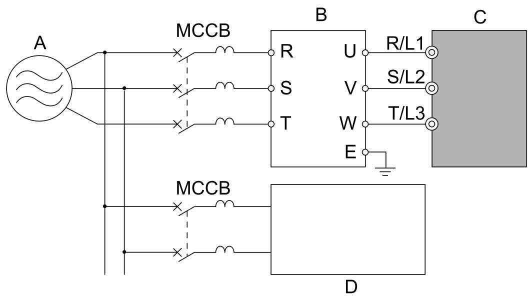
Note:

The main circuit terminal block for the drive and the terminal block for the noise filter come in different shapes. Use caution when you prepare the ends of the wires.

◆ Connect a Noise Filter to the Input Side (Primary Side)

High-speed switching makes noise in the drive output. This noise flows from the drive to the power supply, and can possibly have an effect on other equipment. Install a noise filter to the input side of the drive to decrease the quantity of noise that flows to the power supply. A noise filter also prevents noise from entering the drive from the power supply.

- Use a noise filter specially designed for drives.
- Install the noise filter as close as possible to the drive.



A - Power supply
B - Input side (primary side) noise filter
C - Drive
D - Other controller

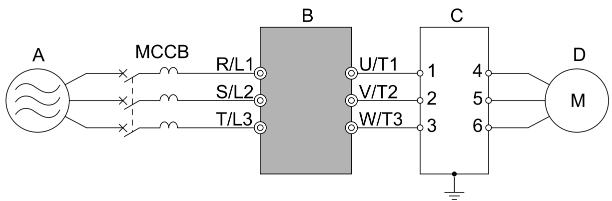
Note:

The input side (primary side) noise filter model is LNFD-xx.

Figure 3.59 Example of Connecting the Noise Filter on the Input Side (Primary Side)

◆ Connect a Noise Filter to the Output Side (Secondary Side)

A noise filter on the output side of the drive decreases inductive noise and radio frequency interference.



A - Power supply
B - Drive
C - Noise filter on output side (secondary side)
D - Motor

Figure 3.60 Example of Connecting the Noise Filter on the Output Side (Secondary Side)

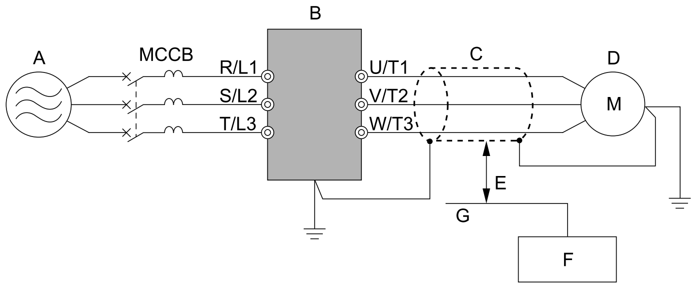
NOTICE: *Do not connect phase-advancing capacitors or LC/RC noise filters to the output circuits. Failure to obey can cause damage to the drive, phase-advancing capacitors, LC/RC noise filters, and leakage breakers (ELCB, GFCI, or RCM/RCD).*

Glossary

- Radio frequency interference:
  Electromagnetic waves radiated from the drive and cables make noise through the full radio bandwidth that can have an effect on nearby devices.
- Inductive noise:
  The noise from electromagnetic induction can have an effect on the signal line and can cause the controller to malfunction.

■ Prevent Inductive Noise

In addition to installing a noise filter, you can also run all wiring through a grounded metal conduit to decrease inductive noise occurring at the output side. Put the cables a minimum of 30 cm (11.8 in.) away from the signal line to prevent induced noise. Ground the cables to metal conduits.



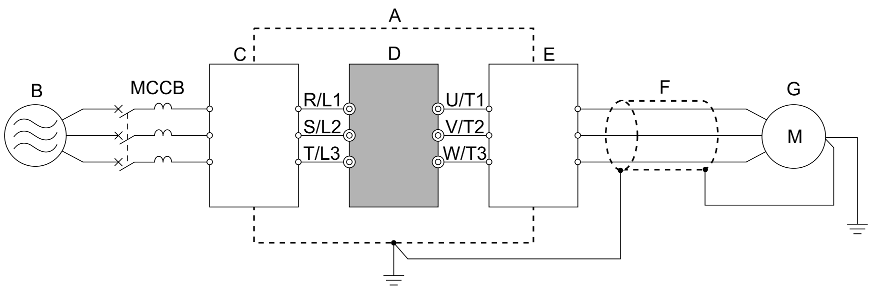
A - Power supply
B - Drive
C - Shielded motor cable
D - Motor
E - Minimum of 30 cm (11.8 in.) apart
F - Controller
G - Signal line

Figure 3.61 Prevent Inductive Noise

■ Decrease Radio Frequency Interference

The drive, input lines, and output lines generate radio frequency interference. Use noise filters on input and output sides and install the drive in a steel box to decrease radio frequency interference.

Keep the cable between the drive and motor as short as possible.



A - Steel box
B - Power supply
C - Noise filter
D - Drive
E - Noise filter
F - Shielded motor cable
G - Motor

Figure 3.62 Decrease Radio Frequency Interference

3.15 Protect the Drive during Failures

Use branch circuit protection to protect against short circuits and to maintain compliance with UL61800-5-1. The manufacturer recommends connecting semiconductor protection fuses on the input side for branch circuit protection.

WARNING! *Electrical Shock Hazard. Do not immediately energize the drive or operate peripheral devices after the drive blows a fuse or trips an RCM/RCD. Wait for the time specified on the warning label at a minimum and make sure that all indicators are OFF. Then check the wiring and peripheral device ratings to find the cause of the problem. Contact the manufacturer before energizing the drive or peripheral devices if the cause is not known. Failure to obey can cause death or serious injury and damage to the drive.*

◆ Branch Circuit Protection for 200 V Class (ND)

Use the fuses specified in this document to prepare the drive for use on a circuit that supplies not more than 100,000 RMS symmetrical amperes and 240 Vac when there is a short circuit in the power supply.

The built-in short circuit protection of the drive does not provide branch circuit protection. The user must provide branch circuit protection as specified by the National Electric Code (NEC), the Canadian Electric Code, Part I (CEC), and local codes.

Table 3.17 Factory-Recommended Branch Circuit Protection: 200 V Class (ND)

Drive Model	Maximum Applicable Motor Output kW (HP)	Input Current Rating A	Semiconductor Protection Fuse Rated Current Manufacturer: EATON/Bussmann
2004	0.75 (0.75)	4.8	FWH-45B
2006	1.1 (1.5)	6.7	FWH-45B
2010	2.2 (3)	12.7	FWH-45B
2012	3 (4)	17	FWH-50B
2018	3.7 (5)	20.7	FWH-80B
2021	5.5 (7.5)	30	FWH-80B
2030	7.5 (10)	40.3	FWH-125B
2042	11 (15)	52	FWH-150B
2056	15 (20)	78.4	FWH-200B
2070	18.5 (25)	96	FWH-225A
2082	22 (30)	114	FWH-225A FWH-250A *1
2110	30 (40)	111	FWH-225A FWH-250A *1
2138	37 (50)	136	FWH-275A FWH-300A *1
2169	45 (60)	164	FWH-275A FWH-350A *1
2211	55 (75)	200	FWH-325A FWH-450A *1
2257	75 (100)	271	FWH-600A
2313	90 (125)	324	FWH-800A
2360	110 (150)	394	FWH-1000A
2415	-	-	-

*1 A fuse with a large rated current for applications with repeated loads is recommended.

◆ Branch Circuit Protection for 200 V Class (HD)

Use the fuses specified in this document to prepare the drive for use on a circuit that supplies not more than 100,000 RMS symmetrical amperes and 240 Vac when there is a short circuit in the power supply.

The built-in short circuit protection of the drive does not provide branch circuit protection. The user must provide branch circuit protection as specified by the National Electric Code (NEC), the Canadian Electric Code, Part I (CEC), and local codes.

Table 3.18 Factory-Recommended Branch Circuit Protection: 200 V Class (HD)

Drive Model	Maximum Applicable Motor Output kW (HP)	Input Current Rating A	Semiconductor Protection Fuse Rated Current Manufacturer: EATON/Bussmann
2004	0.55 (0.5)	3.6	FWH-45B
2006	0.75 (1)	4.8	FWH-45B
2010	1.5 (2)	8.9	FWH-45B
2012	2.2 (3)	12.7	FWH-50B
2018	3 (4)	17	FWH-80B
2021	3.7 (5)	20.7	FWH-80B
2030	5.5 (7.5)	30	FWH-125B
2042	7.5 (10)	40.3	FWH-150B
2056	11 (15)	58.2	FWH-200B
2070	15 (20)	78.4	FWH-225A
2082	18.5 (25)	96	FWH-225A FWH-250A *1
2110	22 (30)	82	FWH-225A FWH-250A *1
2138	30 (40)	111	FWH-275A FWH-300A *1
2169	37 (50)	136	FWH-275A FWH-350A *1
2211	45 (60)	164	FWH-325A FWH-450A *1
2257	55 (75)	200	FWH-600A
2313	75 (100)	271	FWH-800A
2360	90 (125)	324	FWH-1000A
2415	110 (150)	394	FWH-1000A

*1 A fuse with a large rated current for applications with repeated loads is recommended.

◆ Branch Circuit Protection for 400 V Class (ND)

Use the fuses specified in this document to prepare the drive for use on a circuit that supplies not more than 100,000 RMS symmetrical amperes and 480 Vac when there is a short circuit in the power supply.

The built-in short circuit protection of the drive does not provide branch circuit protection. The user must provide branch circuit protection as specified by the National Electric Code (NEC), the Canadian Electric Code, Part I (CEC), and local codes.

Table 3.19 Factory-Recommended Branch Circuit Protection: 400 V Class (ND)

Drive Model	Maximum Applicable Motor Output kW (HP)		Input Current Rating A	Semiconductor Protection Fuse Rated Current Manufacturer: EATON/ Bussmann
	Input Voltage < 460 V	Input Voltage ≥ 460 V		
4002	0.75 (1)	0.75 (1)	2.5	FWH-50B
4004	1.5 (2)	1.5 (2)	4.7	FWH-50B
4005	2.2 (3)	2.2 (3)	6.7	FWH-50B
4007	3.0 (4)	3.0 (4)	8.9	FWH-60B
4009	4.0 (5)	3.7 (5)	11.7	FWH-60B
4012	5.5 (7.5)	5.5 (7.5)	15.8	FWH-60B
4018	7.5 (10)	7.5 (10)	21.2	FWH-80B
4023	11 (15)	11 (15)	30.6	FWH-90B
4031	15 (20)	15 (20)	41.3	FWH-150B
4038	18.5 (25)	18.5 (25)	50.5	FWH-200B
4044	22 (30)	22 (30)	59.7	FWH-200B

Drive Model	Maximum Applicable Motor Output kW (HP)		Input Current Rating A	Semiconductor Protection Fuse Rated Current Manufacturer: EATON/ Bussmann
	Input Voltage < 460 V	Input Voltage ≥ 460 V		
4060	30 (40)	30 (40)	58.3	FWH-225A
4075	37 (50)	37 (50)	71.5	FWH-250A
4089	45 (60)	45 (60)	86.5	FWH-275A
4103	55 (75)	55 (75)	105	FWH-275A
4140	75 (100)	75 (100)	142	FWH-300A
4168	90 (125)	90 (125)	170	FWH-325A FWH-400A *1
4208	110 (150)	110 (150)	207	FWH-500A
4250	132 (175)	150 (200)	248	FWH-600A
4296	160 (200)	185 (250)	300	FWH-700A
4371	200 (250)	220 (300)	373	FWH-800A
4389	220 (300)	260 (350)	410	FWH-1000A
4453	250 (335)	300 (400)	465	FWH-1200A
4568	315 (400)	335 (450)	584	FWH-1200A
4675	355 (450)	370 (500)	657	FWH-1400A FWH-1600A *1

*1 A fuse with a large rated current for applications with repeated loads is recommended.

◆ Branch Circuit Protection for 400 V Class (HD)

Use the fuses specified in this document to prepare the drive for use on a circuit that supplies not more than 100,000 RMS symmetrical amperes and 480 Vac when there is a short circuit in the power supply.

The built-in short circuit protection of the drive does not provide branch circuit protection. The user must provide branch circuit protection as specified by the National Electric Code (NEC), the Canadian Electric Code, Part I (CEC), and local codes.

Table 3.20 Factory-Recommended Branch Circuit Protection: 400 V Class (HD)

Drive Model	Maximum Applicable Motor Output kW (HP)		Input Current Rating A	Semiconductor Protection Fuse Rated Current Manufacturer: EATON/ Bussmann
	Input Voltage < 460 V	Input Voltage ≥ 460 V		
4002	0.55 (0.75)	0.55 (0.75)	1.9	FWH-50B
4004	1.1 (1.5)	0.75 (1)	3.5	FWH-50B
4005	1.5 (2)	1.5 (2)	4.7	FWH-50B
4007	2.2 (3)	2.2 (3)	6.7	FWH-60B
4009	3 (4)	3 (4)	8.9	FWH-60B
4012	4.0 (5)	3.7 (5)	11.7	FWH-60B
4018	5.5 (7.5)	5.5 (7.5)	15.8	FWH-80B
4023	7.5 (10)	7.5 (10)	21.2	FWH-90B
4031	11 (15)	11 (15)	30.6	FWH-150B
4038	15 (20)	15 (20)	41.3	FWH-200B
4044	18.5 (25)	18.5 (25)	50.5	FWH-200B
4060	22 (30)	22 (30)	43.1	FWH-225A
4075	30 (40)	30 (40)	58.3	FWH-250A
4089	37 (50)	37 (50)	71.5	FWH-275A
4103	45 (60)	45 (60)	86.5	FWH-275A
4140	55 (75)	55 (75)	105	FWH-300A
4168	75 (100)	75 (100)	142	FWH-325A FWH-400A *1
4208	90 (125)	90 (125)	170	FWH-500A

Drive Model	Maximum Applicable Motor Output kW (HP)		Input Current Rating A	Semiconductor Protection Fuse Rated Current Manufacturer: EATON/ Bussmann
	Input Voltage < 460 V	Input Voltage ≥ 460 V		
4250	110 (150)	110 (150)	207	FWH-600A
4296	132 (175)	150 (200)	248	FWH-700A
4371	160 (200)	185 (250)	300	FWH-800A
4389	200 (250)	220 (300)	373	FWH-1000A
4453	220 (300)	260 (350)	410	FWH-1200A
4568	250 (335)	300 (400)	465	FWH-1200A
4675	315 (400)	335 (450)	584	FWH-1400A FWH-1600A *1

*1 A fuse with a large rated current for applications with repeated loads is recommended.

Electrical Installation

3

3.16 Wiring Checklist

Wire the drive, check these items, then do a test run.

Table 3.21 Power Supply Voltage/Output Voltage

Checked	No.	Item to Check
	1	The power supply voltage must be within the input voltage specification range of the drive.

Table 3.22 Main Circuit Wiring

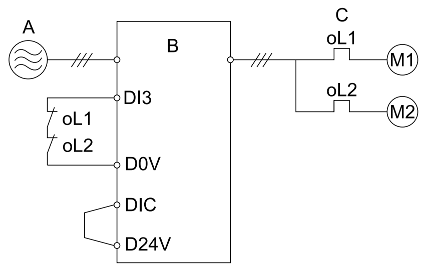
Checked	No.	Item to Check
	1	Put the power supply through a molded-case circuit breaker (MCCB) before it gets to the drive input. Connect an applicable MCCB.
	2	Correctly wire the power supply to drive terminals R/L1, S/L2, and T/L3.
	3	Correctly wire the drive and motor together. The motor lines and drive output terminals U/T1, V/T2, and W/T3 must align to make the correct phase order. **Note:** If the phase order is incorrect, the drive will rotate in the opposite direction.
	4	Use 600 V heat resistant indoor PVC wire for the power supply and motor lines. **Note:** Wire gauge recommendations assume use of 600 V class 2 heat-resistant indoor PVC wire.
	5	Use the correct wire gauges for the main circuit. **Note:** • When the wiring distance between the drive and the motor is long, use this formula for the voltage drop in the wire: Motor rated voltage (V) × 0.02 ≥ √3 × wire resistance (Ω/km) × wiring distance (m) × motor rated current (A) × 10^{-3} • When the cable between the drive and motor is longer than 50 m (164 ft.), use parameter *C6-02 [Carrier Frequency Selection]* to decrease the carrier frequency.
	6	Correctly ground the drive.
	7	Tighten main circuit and grounding terminal screws of the drive to their specified torques.
	8	When operating more than one motor from one drive, set up overload protection circuits.  **A - Power Supply** **B - Drive** **C - oL1 - oLn: thermal overload relay** **Note:** Set *H1-03 = 25 [DI3 Function Selection = External Fault (NC-Always-Coast)]*.
	9	When you use a braking resistor or a braking resistor unit, install an electromagnetic contactor (MC). Correctly install the resistor and make sure that overload protection uses the MC to shut off the power supply.
	10	Make sure that phase advancing capacitors, input noise filters, or ELCBs, GFCIs, RCM/RCDs are NOT installed on the output side of the drive.

Table 3.23 Control Circuit Wiring

Checked	No.	Item to Check
	1	Use twisted-pair cable for all drive control circuit wiring.
	2	Ground the shields of shielded wiring to the terminal GND.
	3	For 3-Wire sequence, set parameters for MFDI terminals, and wire control circuits.
	4	Correctly install any option cards.
	5	Examine the drive for other wiring errors. Only use a multimeter to check wiring.
	6	Tighten the control circuit terminal screws of the drive to their specified torques.
	7	Pick up all wire clippings.
	8	Make sure that none of the wires on the terminal block touch other terminals or connections.
	9	Isolate control circuit wiring from main circuit wiring.

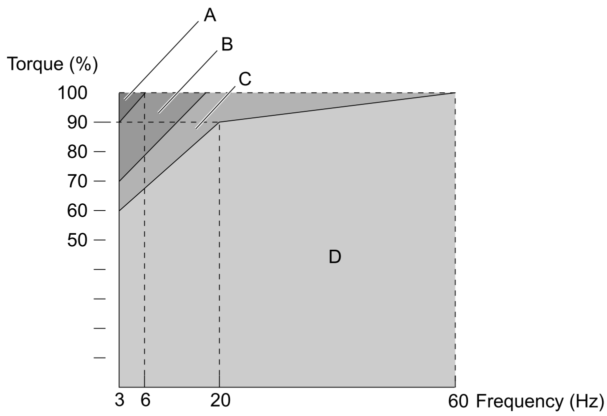
Checked	No.	Item to Check
	10	Make sure that control circuit wiring is not longer than 50 m (164 ft.).
	11	Make sure that Safe Disable input wiring is not longer than 30 m (98 ft.).

3.17 Motor Application Precautions

◆ Precautions for Existing Standard Motors

■ Low-Speed Range

When a drive operates a standard motor, it will lose more power compared to operating the motor with a commercial power supply. In the low speed range, the temperature of the motor increases quickly because the motor cannot decrease its temperature when the speed decreases. In these conditions, decrease the load torque of the motor in the low-speed range. The following graphic shows the permitted load characteristics for a Yaskawa standard motor. When 100% continuous torque is necessary at low speeds, use a motor designed to operate with a drive.



A - 25% ED (or 15 min.)
B - 40% ED (or 20 min.)
C - 60% ED (or 40 min.)
D - Continuous operation

Figure 3.63 Permitted Load Characteristics for a Yaskawa Standard Motors

■ Insulation Withstand Voltage

Consider motor voltage tolerance levels and motor insulation in applications with an input voltage of over 440 V or particularly long wiring distances. Use an insulated drive motor.

NOTICE: *Use a motor that provides insulation correct for PWM drives. Failure to obey can cause a short circuit or ground fault from insulation deterioration.*

■ High-Speed Operation

If you operate a motor more than its rated speed, you can have problems with the motor bearing durability and dynamic balance of the machine. Contact the motor or machine manufacturer.

■ Torque Characteristics

When you operate a motor with a drive, the torque characteristics are different than when you operate the motor directly from line power. Make sure that you know about the load torque characteristics for your application.

■ Vibration

Vibrations could occur in the these conditions:

- Resonance with the natural frequency of machinery
  Use caution if you add a variable-speed drive to applications that operate the motor from line power at a constant speed. If resonance occurs, install shock-absorbing rubber around the base of the motor and enable the Jump frequency control.
- The motor is not balanced
  Use caution if the motor speed is more than the rated motor speed.
- Subsynchronous resonance
  Subsynchronous resonance can occur with long motor shafts and in applications such as turbines, blowers, and fans with high inertia loads.
  Use Closed Loop Vector Control when these applications have subsynchronous resonance problems.

■ Audible Noise

The audible noise of the motor changes when the carrier frequency setting changes. When you use a high carrier frequency, audible noise from the motor is equivalent to the motor noise generated when you operate from line power. If you operate at speeds that are more than the rated rotation speed, the unwanted motor noise increases.

◆ Precautions for PM Motors

- Contact the manufacturer or your nearest sales representative to use a PM motor that is not from the drive manufacturer..
- You cannot operate a PM motor from a commercial power supply. If you must operate from a commercial power supply, use an induction motor.
- You cannot operate more than one PM motor from one drive. Use an induction motor and a variable-speed control drive.
- In Open Loop Vector Control for PM motor (PM OLVector), the motor can operate in the reverse direction for 1/2 turn (electrical angle) at start up.
- The quantity of generated starting torque changes when the control method and motor type change. Verify the starting torque, permitted load characteristics, impact load tolerance, and speed control range before you set up the motor with the drive. Contact the manufacturer or your nearest sales representative to use a motor that does not meet these specifications.
- In PM OLVector control, braking torque is always 125% or less when operating between 20% and 100% speed. A braking resistor unit will not change the value. Braking torque is 50% or less when operating at 20% speed or less.
- In PM OLVector control, the allowable load inertia moment is approximately 50 times higher than the motor inertia moment. Use Closed Loop Vector Control for PM motors for applications with a larger inertia moment.
- When you use a holding brake in PM OLVector control, release the brake before you start the motor. Failure to set the correct timing can cause a decrease in speed. Do not use these configurations in applications with heavy loads, for example conveyors or elevators.
- To restart a coasting motor that is rotating faster than 200 Hz in V/f Control, first use the Short Circuit Braking function to stop the motor. A special braking resistor unit is necessary for Short Circuit Braking. Contact the manufacturer or your nearest sales representative for more information.
  To restart a coasting motor that is rotating slower than 200 Hz, use the Speed Search function.
  If the motor cable is long, use Short Circuit Braking to stop the motor.

  Note:
  The Short Circuit Braking function uses the drive to forcefully cause a short across the motor wires to stop the motor before it has time to coast to a stop.
- You can also use EZ Open Loop Vector Control (EZOLV) to operate synchronous reluctance motors (SynRM). Contact the manufacturer or your nearest sales representative for more information.
- After you replace a failed PM motor encoder, make sure that the motor can rotate and do Z Pulse Offset Tuning or PM Rotational Auto-Tuning.
- If *oC [Overcurrent]*, *STPo [Motor Step-Out Detected]*, or *LSo [Low Speed Motor Step-Out]* occur during restart, retry Speed Search and use the Short Circuit Braking function when starting to adjust the motor.

◆ Precautions for Specialized Motors

■ Pole Change Motors

The rated current of pole change motors is different than standard motors. Check the maximum current of the motor before you select a drive. Always stop the motor before you switch between the number of motor poles. If you change the number of poles while the motor is rotating, the overvoltage from regeneration or the overcurrent protection circuitry will make the motor coast to stop.

■ Submersible Motors

The rated current of a submersible motor is more than the rated current of a standard motor. Use a sufficiently large motor cable that will not let voltage drop decrease the maximum torque level.

■ Explosion-Proof Motors

You must test the motor and the drive together for explosion-proof certification. You must also test existing installations of explosion-proof motors. The drive is not designed for explosion-proof areas. Install the drive in a safe location.

The encoder used with pressure-resistant explosion-proof motors is intrinsically safe. When wiring between the drive and encoder, always connect through a specialized pulse coupler.

■ Geared Motors

The continuous speed range is different for different lubricating methods and manufacturers. For oil lubrication, continuous operation in the low-speed range can cause burnout. Contact the manufacturer for more information about applications where operating at more than the rated frequency is necessary.

■ Single-Phase Motors

Variable speed drives are not designed to operate with single-phase motors. The drive is for use with three-phase motors only. If you use capacitors to start the motor, it can cause a high frequency current to flow to the capacitors and can damage the capacitors. A split-phase start or a repulsion start can burn out the starter coils because the internal centrifugal switch is not activated.

■ Motors with Brakes

If you use a drive to operate a motor that has a brake connected to the output side, low voltage levels can cause the brake to possibly not release at start. Use a motor with a brake that has a dedicated source of power for the brake. Connect the brake power supply to the power supply side of the drive. Motors with built-in brakes make noise when operating at low speeds.

◆ Notes on the Power Transmission Mechanism

For power transmission machinery that uses oil to lubricate gearboxes, transmissions, or reduction gears, make sure that you use precaution if you operate the machinery continuously at low speed. Oil does not lubricate the system as well at low speeds. If you operate at frequencies higher than the rated frequency, it can cause problems with the power transmission mechanism. These problems include audible noise, decreased service life, and decreased durability.

4

Startup Procedure and Test Run

4.1 Safety Precautions

DANGER

Electrical Shock Hazard

Electrical Shock Hazard. Do not examine, connect, or disconnect wiring on an energized drive. Before servicing, disconnect all power to the equipment and wait for the time specified on the warning label at a minimum. The internal capacitor stays charged after the drive is de-energized. The charge indicator LED extinguishes when the DC bus voltage decreases below 50 Vdc. When all indicators are OFF, measure for dangerous voltages to make sure that the drive is safe.

If you do work on the drive when it is energized, it will cause serious injury or death from electrical shock.

WARNING

Electrical Shock Hazard

Do not operate equipment when covers are missing. Some figures in this section include drives without covers or safety shields to more clearly show the inside of the drive. Replace covers and shields before operation. Use drives only as specified by the instructions.

Failure to obey can cause death or serious injury.

Do not remove covers or touch circuit boards while the drive is energized.

Failure to obey can cause death or serious injury.

Prepare an isolated holding brake. The holding brake wiring must activate an external sequence to de-energize the drive or trigger an emergency switch when the drive detects a fault.

Failure to obey could cause death or serious injury.

Crush Hazard

In hoist applications, use the applicable safety precautions to prevent the load from falling.

Failure to obey can cause death or serious injury from falling loads.

4.2 Component Names and Functions

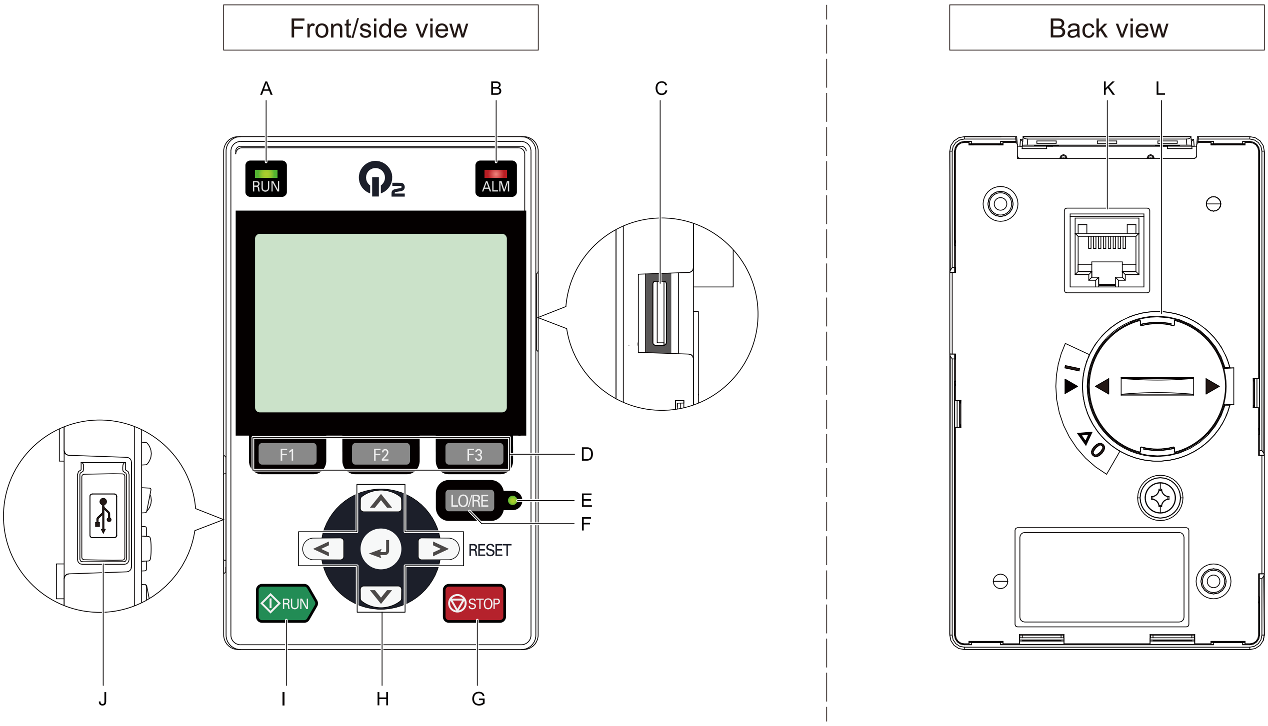


Figure 4.1 Keypad

Table 4.1 Keypad: Names and Functions

No.	Name	Function
A	RUN LED RUN	Illuminates to show that the drive is operating the motor. The LED turns OFF when the drive stops. Flashes to show that: • The drive is decelerating to stop. • The drive received a Run command but the frequency reference is 0 Hz. Flashes quickly to show that: • The drive received a Run command from the Multi-Function Digital Input (MFDI) terminals and is switching to REMOTE Mode. • The drive received a Run command from the MFDI terminals when the drive is not in Drive Mode. • The drive received a Fast Stop command. • The safety function shuts off the drive output. • The user pushed STOP on the keypad while the drive is operating in REMOTE Mode. • The drive is energized with an active Run command and *b1-17 = 1 [RUN@PowerUp Selection = Disregard RUN]*.
B	ALM LED ALM	Illuminates when the drive detects a fault. Flashes when the drive detects: • Alarm • An oPE parameter setting error • A fault or alarm during Auto-Tuning The light switches off when the drive is in normal operation. There is no fault or alarm.
C	microSD Card Insertion Slot	The insertion point for a microSD card.
D	Function Keys (F1, F2, F3) F1 F2 F3	The menu shown on the bottom line of the keypad sets the functions for function keys.
E	LO/RE LED LO/RE	Illuminated: The keypad controls the Run command (LOCAL Mode). OFF: The control circuit terminal or serial transmission device controls the Run command (REMOTE Mode). **Note:** • LOCAL: Operated using the keypad. Use the keypad to enter Run/Stop commands and the frequency reference command. • REMOTE: Operated from the control circuit terminal or serial transmission. Use the frequency reference source entered in *b1-01 [Freq. Ref. Sel. 1]* and the Run command source selected in *b1-02 [Run Comm. Sel 1]*.
F	LO/RE Selection Key LO/RE	Switches drive control for the Run command and frequency reference between the keypad (LOCAL) and an external source (REMOTE). **Note:** • Stop operation to enable the LO/RE Selection Key when in Drive Mode. Set *o2-01 = 0 [LO/RE Key Selection of Function = Disabled]* to disable switching from REMOTE to LOCAL by LO/RE. • The drive will not switch between LOCAL and REMOTE when it is receiving a Run command from an external source.

No.	Name	Function
G	STOP Key STOP	Stops drive operation. **Note:** The STOP key has highest priority. Push STOP to stop the motor even when a Run command (REMOTE Mode) is active at any external Run command source. Set *o2-02 = 0 [STOP Key Selection of Function = Disabled]* to disable the priority in STOP.
H	Left Arrow Key <	Moves the cursor to the left. In the Manual Setup menu, it is possible to navigate MANUAL1 to MANUAL3 menus using the Left and Right keys.
	Up Arrow Key/Down Arrow Key ∧ / ∨	• Scrolls up or down to display the next item or the previous item. • Selects parameter numbers, and increments or decrements setting values.
	Right Arrow Key (RESET) >	• Moves the cursor to the right. • Continues to the next screen. • Clears drive faults.
	ENTER Key	• Enters parameter values and settings. • Selects menu items to move the user between keypad displays. • Selects each mode, parameter, and set value.
I	RUN Key RUN	Starts the drive in LOCAL mode. Starts the motor tuning procedure in Auto-Tuning Mode. **Note:** Push LO/RE on the keypad to set the drive to LOCAL Mode before using the keypad to operate the motor.
J	USB Terminal	Insertion point for a mini USB cable. Uses a USB cable (USB standard 2.0, type A - mini-B) to connect the keypad to a PC.
K	RJ-45 Connector	Connects to the drive using an RJ-45 8-pin straight through UTP CAT5e extension cable or keypad connector.
L	Clock Battery Cover	Cover for the customer-supplied clock battery. **Note:** • Make sure to prepare the type CR2016 clock battery with a nominal voltage of 3 V. The clock battery is not supplied as accessories.

WARNING! *Sudden Movement Hazard. The drive may start unexpectedly if switching control sources when setting b1-07 = 2 [LO/RE Run Selection = Accept RUN]. Clear all personnel from rotating machinery and electrical connections prior to switching control sources. Failure to comply may cause death or serious injury.*

◆ LED Flashing Statuses

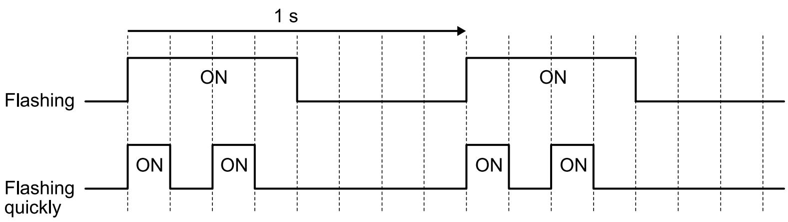


Figure 4.2 LED Flashing Statuses

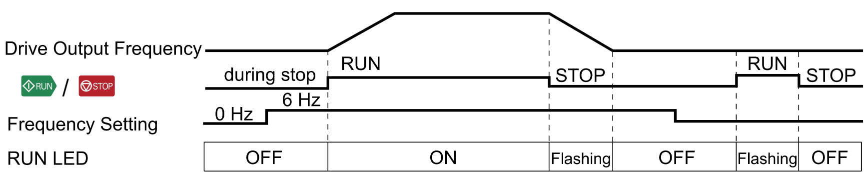


Figure 4.3 Relation between RUN LED and Drive Operation

◆ Operator Display

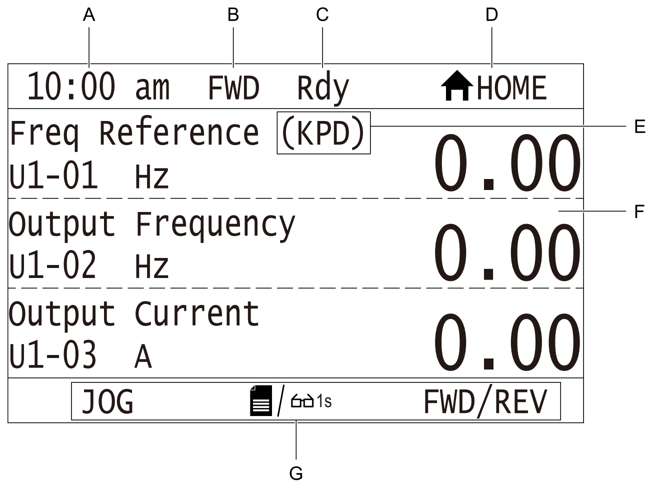


Figure 4.4 Operator Display Indications

Table 4.2 Operator Display Indications and Meanings

Symbol	Name	Description
A	Time display area	Shows the current time. Set the time on the default settings screen.
B	Forward run/Reverse run indication	Shows direction of motor rotation. • FWD: Shown when set to Forward run. • REV: Shown when set to Reverse run. **Note:** In Q2pack operation, FWD or REV flash.
C	Ready	The screen will show Rdy when the drive is ready for operation or when the drive is running.
D	Mode display area	Shows the name of the current mode or screen.
E	Frequency reference source indicator	Shows the current frequency reference source. • KPD: keypad • AI: analog input terminal (terminals AI1 to AI3) • COM: Modbus communications • OPT: option card • PI: pulse train input terminal (terminal PI)
F	Data display area	Shows parameter values, monitor values, and details of the results of operations.
G	Function keys 1 to 3 (F1 to F3)	The function names shown in this area will change when the selected screen changes. Push one of the function keys F1 to F3 on the keypad to do the function.

◆ Keypad Mode and Menu Displays

Table 4.3 Drive Mode, Menu Screens and Functions

Mode	Menu Screen	Function
Drive Mode	Monitor & Diagnostics	Shows drive monitors, Custom Monitors, Fault Log, Data Logger.
Programming Mode	Parameters	Changes parameter settings.
	Modified Parameters	Shows standard and Q2pack related modified parameters.
	Manual Setup	Holds a list of user-set parameters and monitors.
	Wizard & Autotuning	Calls Setup Wizards for easy commissioning or Auto-Tuning.
	Configuration	Sets language, date/time, backlight, parameter backup function.

Note:

- Push  to set *d1-01 [Reference 1]* when the Home screen shows *U1-01 [Frequency Reference]* in LOCAL Mode.
- The keypad will show [Rdy] when the drive is in Drive Mode. The drive is prepared to accept a Run command.
- The drive will not accept a Run command in Programming Mode in the default setting. Set *b1-08 [RUN@PRG Mode Selection]* to accept or reject a Run command from an external source while in Programming Mode.
  – Set *b1-08 = 1 [RUN@PRG Mode Selection = NoRUN@Program]* to reject the Run command from an external source while in Programming Mode (default).
  – Set *b1-08 = 2 [RUN@PRG Mode Selection = RUN@Program]* to accept the Run command from an external source while in Programming Mode.
  – Set *b1-08 = 3 [RUN@PRG Mode Selection = Program@Stop only]* to prevent changes from Drive Mode to Programming Mode while the drive is operating.
- On the Home screen, keep F2 pushed for 3 s to toggle between compact layout and detailed layout.

4.3 Start-up Procedures

This section gives the basic steps necessary to start up the drive.

Use the flowcharts in this section to find the most applicable start-up method for your application.

This section gives information about only the most basic settings.

◆ Flowchart A: Connect and Run the Motor with Minimum Setting Changes

Flowchart A shows a basic start-up sequence to connect and run a motor with a minimum of setting changes. Settings can change when the application changes.

Use the drive default parameter settings for basic applications where high precision is not necessary.

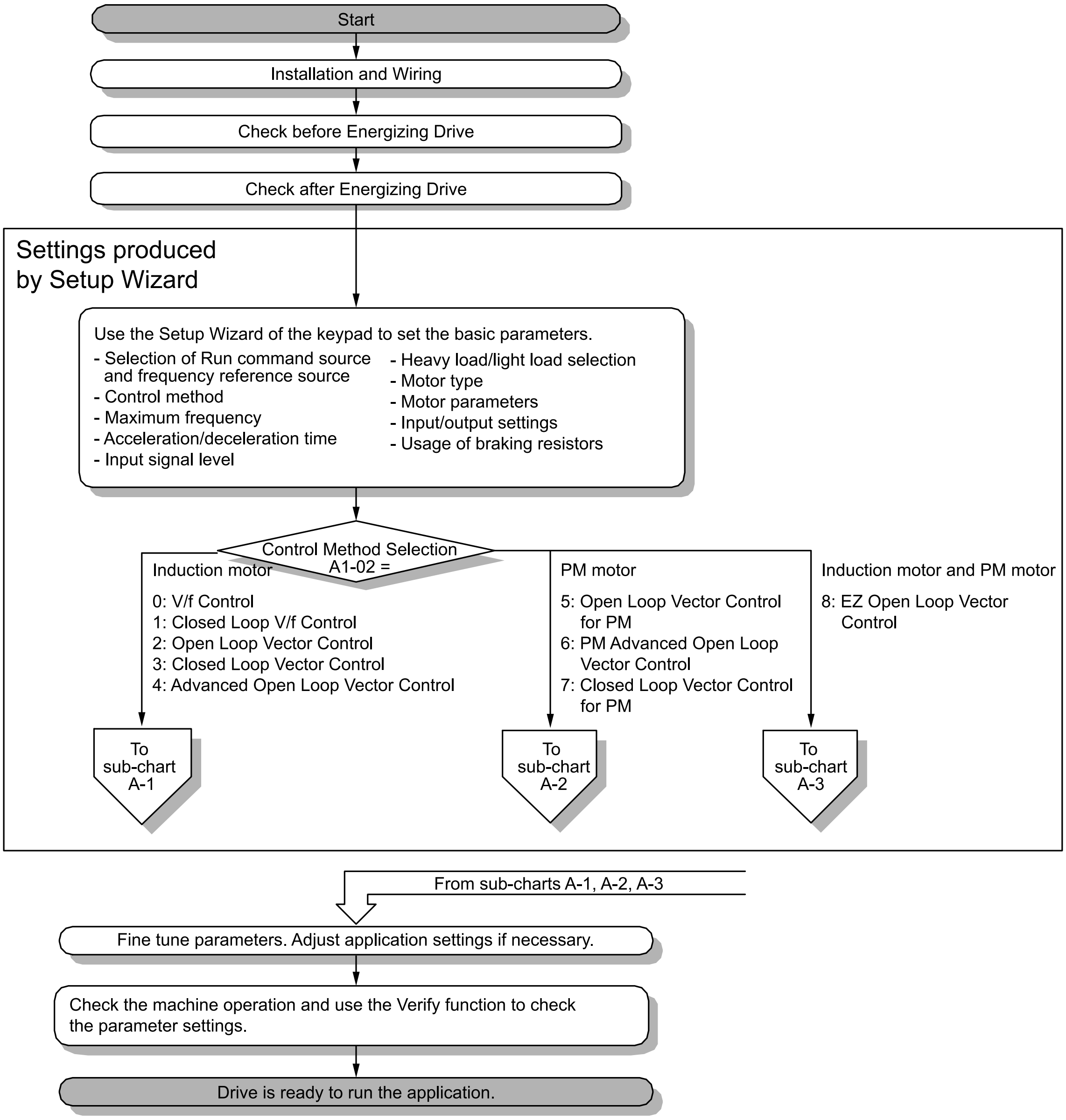


Figure 4.5 Basic Steps before Startup

Startup Procedure and Test Run

4

◆ Sub-Chart A-1: Induction Motor Auto-Tuning and Test Run Procedure

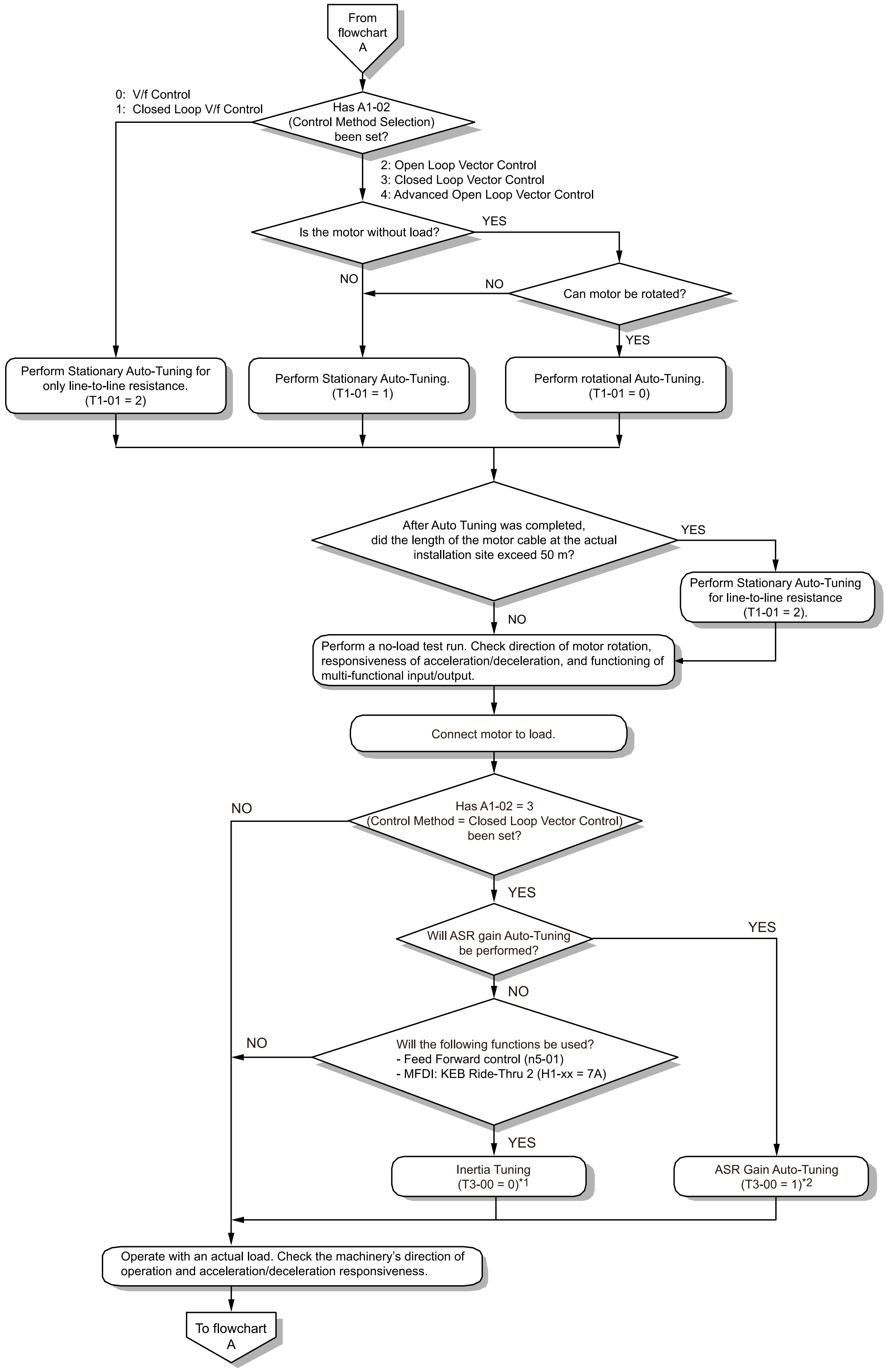


Figure 4.6 Induction Motor Auto-Tuning and Test Run Procedure

*1 Be sure to release the holding brake before doing Inertia Tuning.
*2 In ASR Tuning, the drive will automatically tune Feed Forward control and KEB Ride-Thru 2 parameters.

◆ Sub-Chart A-2: PM Motor Auto-Tuning and Test Run Procedure

Sub-Chart A-2 gives the basic steps to start up the drive for a PM motor.

Note:

1. Although Auto-Tuning will set parameters for speed control with an encoder, set *F1-05 [Enc1 Rotat Selection]* before starting Auto-Tuning.
2. If you replace the encoder, do Z Pulse Offset Tuning.

WARNING! *Crash Hazard. Test the system to make sure that the drive operates safely after you wire the drive and set parameters. Failure to obey can cause injury or damage to equipment.*

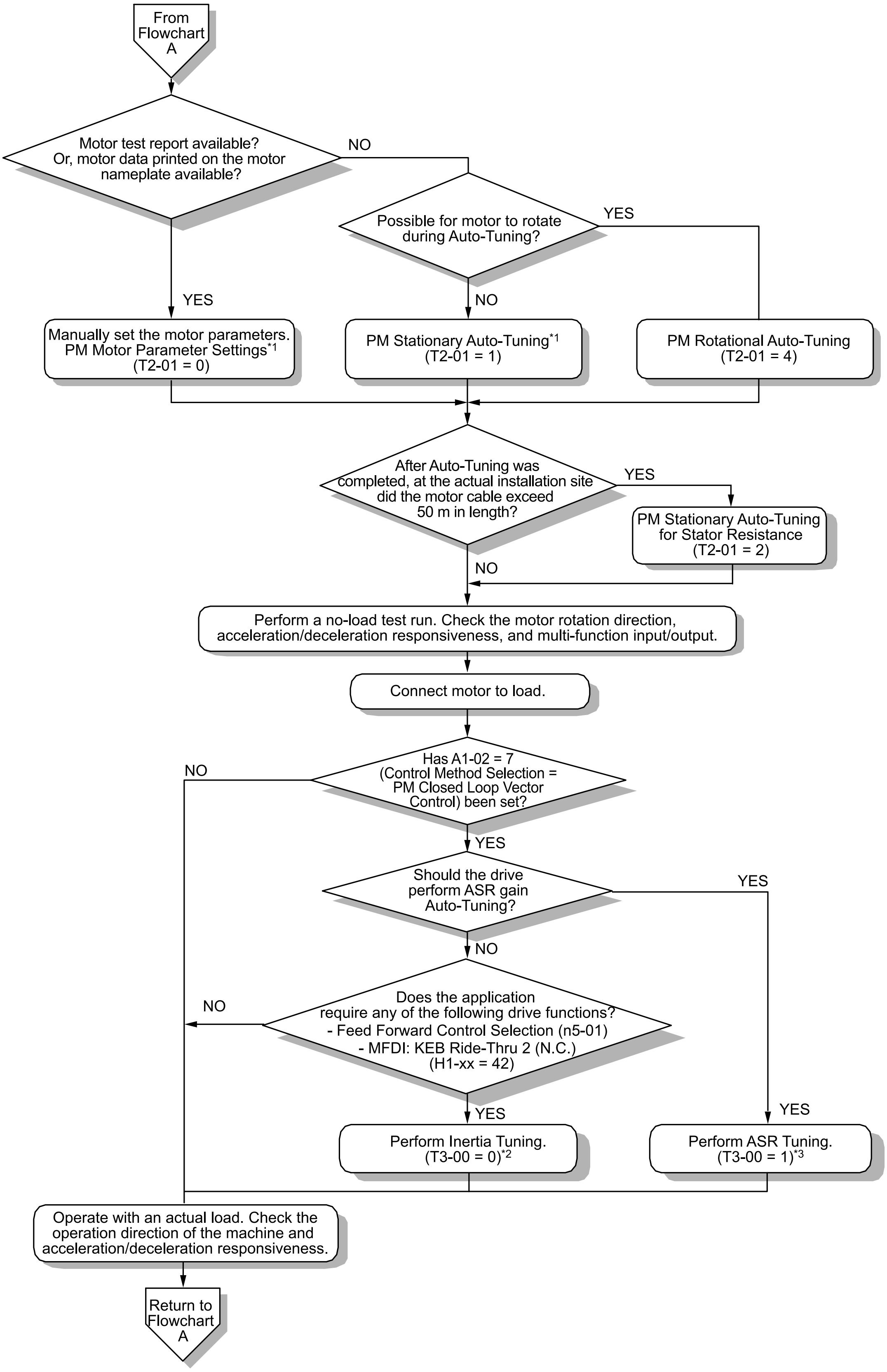


Figure 4.7 PM Motor Auto-Tuning and Test Run Procedure

Startup Procedure and Test Run

4

*1 For Yaskawa PM motors (SMRA-series, SSR1-series, or SST4-series), set E5-01 [PM Mot Code Selection]. For PM motors from a different manufacturer, set *E5-01 PM Mot Code Selection = FFFF*.
*2 Be sure to release the holding brake before doing Inertia Tuning.
*3 In ASR Tuning, the drive will automatically tune Feed Forward control and KEB Ride-Thru 2 parameters.

◆ Sub-Chart A-3: EZ Open Loop Vector Control Test Run Procedure

Subchart A-3 gives the setup procedure to run a PM motor in EZ Open Loop Vector Control.

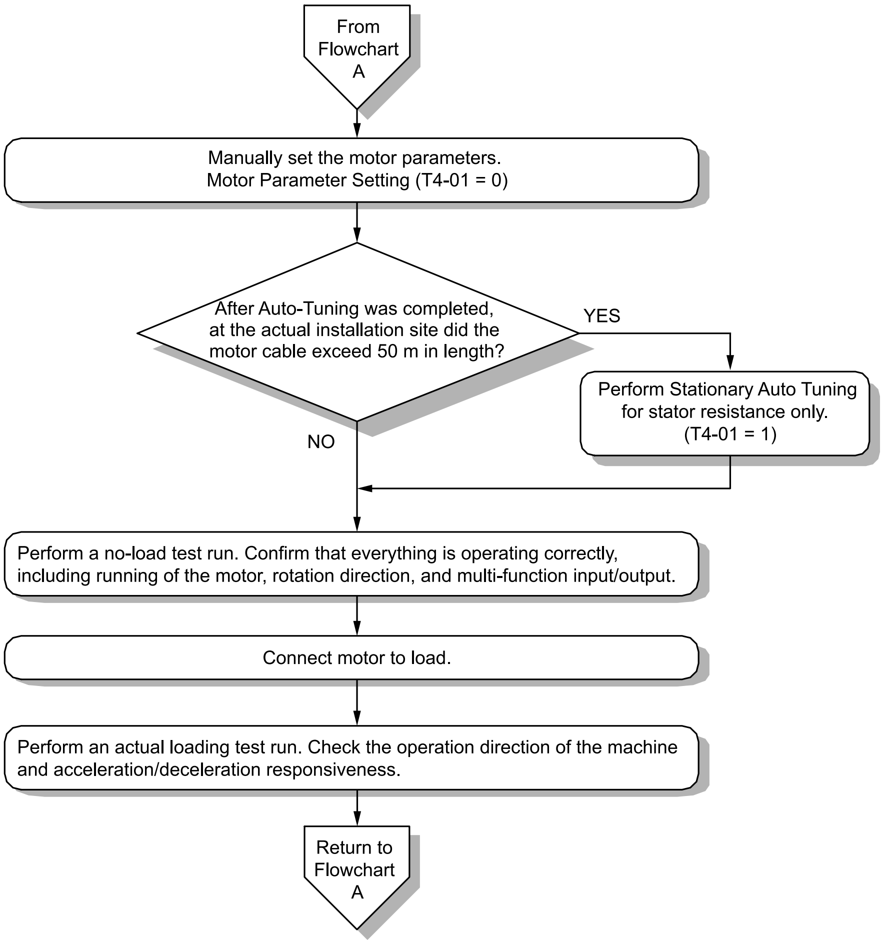


Figure 4.8 Procedure for Test Run of EZ Open Loop Vector Control Method

4.4 Items to Check before Starting Up the Drive

◆ Check before Energizing the Drive

Check these items before energizing the drive.

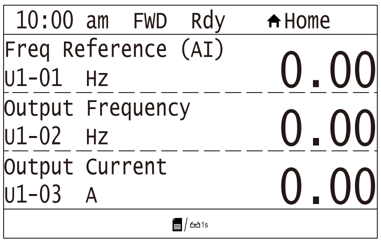
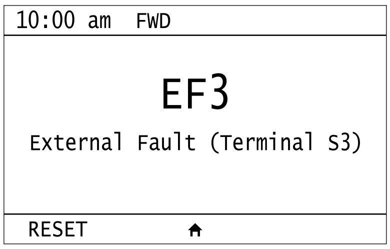
Table 4.4 Items to Check before Energizing the Drive

Items to Check	Description
Input Power Supply Voltage	The voltage of the input power supply must be: 200 V class: three-phase AC 200 V to 240 V 50/60 Hz, DC 270 V to 340 V 400 V class: three-phase AC 380 V to 480 V 50/60 Hz, DC 510 V to 680 V
	Correctly and safely wire power supply input terminals R/L1, S/L2, T/L3.
	Correctly ground the drive and motor.
Connection between Drive Output Terminals and Motor Terminals	Correctly wire drive output terminals (U/T1, V/T2, and W/T3) and motor terminals (U, V, and W), and tighten loose screws.
Control Circuit Terminal Wiring	Turn OFF the inputs from all devices and switches connected to the drive control circuit terminals.
Control Circuit Terminal Status	Turn OFF the inputs from all devices and switches connected to the drive control circuit terminals.
Connection between Machinery and Motor	Disengage all couplings and belts that connect the motor and machinery.

◆ Check after Energizing the Drive

Check these items after energizing the drive. The keypad will show these screens depending on the drive status.

Table 4.5 Display Status after Energizing the Drive

Status	Display	Description
During Usual Operation	 HOME Screen	The data display area will show the HOME screen
When the Drive Detects a Fault		The display changes depending on the fault. Refer to "Troubleshooting" to remove the cause of the fault. ALM will illuminate. **Note:** If the screen shows a different screen, do these steps to show the fault content again: 1. Push < from the HOME screen. 2. Push F2 (Home) from a different screen than the HOME screen.

Startup Procedure and Test Run

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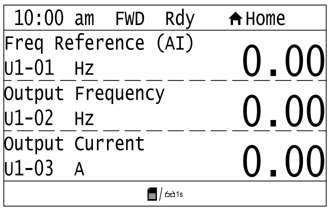
4.5 Keypad Operation

◆ Use the HOME Screen

The functions that can be controlled from the HOME screen and the content that is displayed are explained in the following.



■ View Monitors Shown in Home Screen

By default, the HOME screen shows monitor data in the data display area.

- To change what the screen shows, change the setting for *o1-40 [Home Screen Selection Mode]*.
- When *o1-40* is set to “Custom Monitors”, and there is more than one screen, use ∧ or ∨ to switch between screens.
- To toggle between 6-line mode and 3-line mode, press F2 for 2 seconds.

■ JOG Operation

Push LO/RE to illuminate LO/RE.
The LO/RE key is only active in Monitor menus.

Push F1 (JOG) to run the motor.

Release F1 to stop the motor.

■ Change Motor between Forward/Reverse Run

You can change the direction of motor rotation when operating the drive from the keypad.

Push LO/RE to illuminate LO/RE.
The LO/RE key is only active in Monitor menus.

Push F3 (FWD/REV) to toggle the direction of motor rotation between forward and reverse.

■ Show the Standard Monitor

Push F2 (⌂) to go back to the HOME screen.

Note:

When a fault, minor fault, or an error occurs, push F2 (⌂) until the content of the fault is displayed. Push F2 again to show the standard monitors (*Ux-xx*).

■ Change the Frequency Reference Value

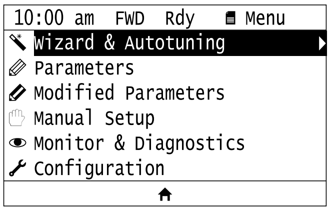
1. Push LO/RE to illuminate LO/RE.
   The LO/RE key is only active in Monitor menus.
2. Push ↵ to access the screen to change the frequency.
3. Push < or > to select the specified digit, then push ∧ or ∨ to change the value.
4. Push ↵ to confirm the change.

Note:

The HOME screen must show *U1-01 [Frequency Reference]*.
You can activate the LO/RE key only in the HOME screen.

■ Show the Main Menu

Push F2 to show the main menu.



Push F2 (⌂) to go back to the HOME screen.

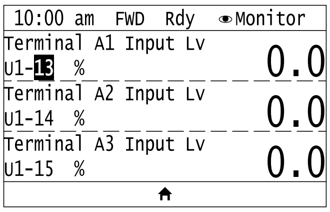
◆ Show the Standard Monitor

This section shows how to show the standard monitor (*Ux-xx [U: MONITORS]*).

1. Push F2 (⌂) to show the HOME screen.

Note:
- [⌂ Home] appears in the upper right hand corner of the screen when in HOME mode.
- If [⌂] is not shown on F2, push F1 (↺) to show [⌂] on F2.

2. Push F2 (Menu).
3. Push ∧ or ∨ to select [Monitor & Diagnostics], then push ↵.
4. Push ∧ or ∨ to select [Standard Monitors], then push ↵.
5. Push ∧ or ∨ to change the monitor items displayed.
   Push F2 for 2 s to toggle between 3-line view and 6-line view.



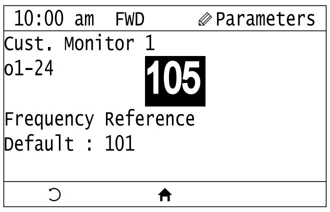
◆ Set Custom Monitors

You can select and register a maximum of 12 monitoring items to regularly show on the keypad.
This procedure shows how to set the motor speed to [Custom Monitor 1].

1. Push F2 (⌂) to show the HOME screen.

Note:
- [⌂ Home] appears in the upper right hand corner of the screen when in HOME mode.
- If [⌂] is not shown on F2, push F1 (↺) to show [⌂] on F2.

2. Push F2 (Menu).
3. Push ∧ or ∨ to select [Monitor & Diagnostics], then push ↵.
4. Push ∧ or ∨ to select [Custom Monitors], then push F3 (⚙).
5. Push ∧ or ∨ to select [Cust. Monitor 1], then push ↵.
6. Push ∧ or ∨ to select the monitor number to register.
   Enter the three digits in “x-xx” part of monitor *Ux-xx* to identify which monitor to output. For example, to show monitor *U1-05*, set it to “105” as shown in this figure.



Push ↵.

The configuration procedure is complete.

◆ Show Custom Monitors

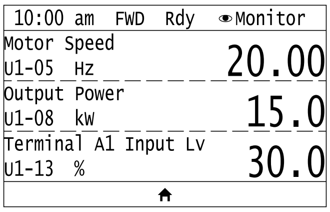
The procedure in this section shows how to show the registered custom monitors.

1. Push F2 (🏠) to show the HOME screen.

Note:
- [🏠 Home] appears in the upper right hand corner of the screen when in HOME mode.
- If [🏠] is not shown on F2, push F1 (↻) to show [🏠] on F2.

2. Push F2 (▤).
3. Push ▲ or ▼ to select [Monitor & Diagnostics], then push ↵.
4. Push ▲ or ▼ to select [Custom Monitors], then push ↵.

The keypad shows the selected monitor as shown in this figure.



- When there are a minimum of two screens, push ▲ or ▼ to switch between screens.
- If you registered only one custom monitor to [Custom Monitor 1], the screen will show only one monitor. If you registered custom monitors only to [Custom Monitor 1] and [Custom Monitor 2], the screen will show only two monitors.
- Push F2 for 2 s to toggle between 3-line view and 6-line view.
- To remove monitors from the Custom Monitor list, chose ‘0’ [Through Mode].

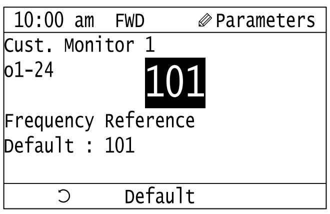
◆ Set the Monitors to Show as a Bar Graph

The procedure in this section shows how to show the frequency reference monitor as a bar graph.

1. Push F2 (🏠) to show the HOME screen.

Note:
- [🏠 Home] appears in the upper right hand corner of the screen when in HOME mode.
- If [🏠] is not shown on F2, push F1 (↻) to show [🏠] on F2.

2. Push F2 (▤).
3. Push ▲ or ▼ to select [Monitor & Diagnostics], then push ↵.
4. Push ▲ or ▼ to select [Bar Graph], then push F3 (⚙).
5. Push ▲ or ▼ to select the location to store the monitor, then push ↵.
6. Push ↵.
7. Push ▲ or ▼ to select the monitor number to register.
   Enter the three digits in “x-xx” part of monitor *Ux-xx* to identify which monitor to output. For example, to show monitor *U1-01 [Frequency Reference]*, set it to "101" as shown in this figure.



   Push ↵.

The configuration procedure is complete.

◆ Show Monitors as Bar Graphs

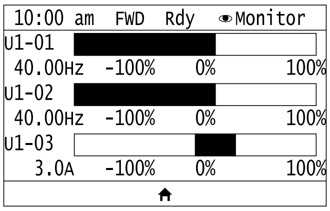
The procedure in this section shows how to show a specific monitor as a bar graph. You can show a maximum of three.

1. Push F2 () to display the HOME screen.

Note:
- [Home] appears in the upper right hand corner of the screen when in HOME mode.
- If [] is not shown on F2, push F1 () to show [] on F2.

2. Push F2 ().
3. Push or to select [Monitor & Diagnostics], then push .
4. Push or to select [Bar Graph], and push .

The screen will show the monitors as shown in this figure.



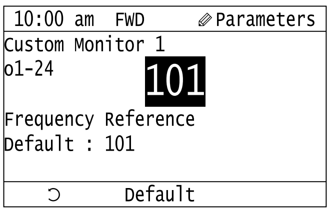
◆ Set the Monitors to Show as Analog Gauges

The procedure in this section shows how to show the frequency reference monitor as an analog gauge.

1. Push F2 () to show the HOME screen.

Note:
- [Home] appears in the upper right hand corner of the screen when in HOME mode.
- If [] is not shown on F2, push F1 () to show [] on F2.

2. Push F2 ().
3. Push or to select [Monitor & Diagnostics], then push .
4. Push or to select [Analog Gauge], then push F3 ().
5. Push .
6. Push or to select the monitor number to register.
   Enter the three digits in “x-xx” part of monitor *Ux-xx* to identify which monitor to output. For example, to show monitor *U1-01 [Frequency Reference]*, set it to "101" as shown in this figure.



   Push .

The configuration procedure is complete.

◆ Display Monitors as an Analog Gauge

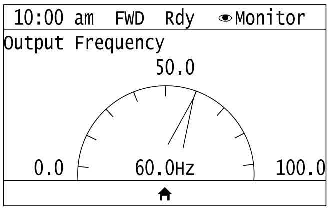
The following explains how to display the contents selected for a monitor as an analog gauge.

1. Push F2 (Home) to show the HOME screen.

Note:
- [Home] appears in the upper right hand corner of the screen when in HOME mode.
- If [Home] is not shown on F2, push F1 to show [Home] on F2.

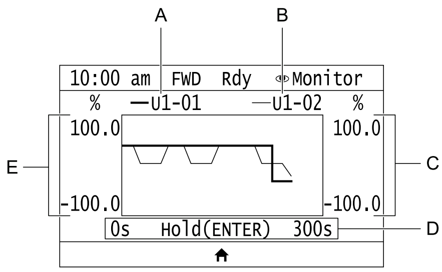
2. Push F2.
3. Push Up or Down to select [Monitor & Diagnostics], then push Enter.
4. Push Up or Down to select [Analog Gauge], then push Enter.

It will be displayed as follows.



◆ Set Monitoring Items to be Shown as a Trend Plot

You must set the items in this figure to display as a trend plot.



A - Monitor Parameter 1 (set with [Custom Monitor 1])
B - Monitor Parameter 2 (set with [Custom Monitor 2])
C - Trend Plot 2 Scale Max/Min Scale Value
D - Trend Plot Time Scale
E - Trend Plot 1 Scale Max/Min Scale Value

■ Select Monitor Items to Show as a Trend Plot

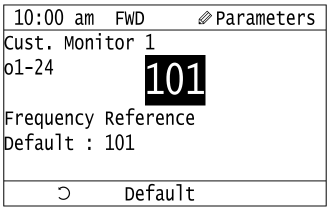
The procedure in this section shows how to show the frequency reference monitor as a trend plot.

1. Push F2 (Home) to show the HOME screen.

Note:
- [Home] appears in the upper right hand corner of the screen when in HOME mode.
- If [Home] is not shown on F2, push F1 to show [Home] on F2.

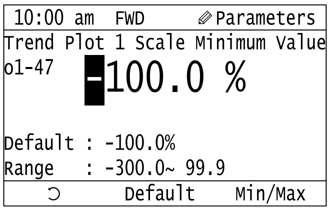
2. Push F2.
3. Push Up or Down to select [Monitor & Diagnostics], then push Enter.
4. Push Up or Down to select [Trend Plot], then push F3.
5. Push Up or Down to select [Custom Monitor 1], then push Enter.
6. Push Enter.
7. Push Up or Down to select the monitor number to register.

   When the *U parameters* are on the display as "Ux-xx", the three digits in "x-xx" identify which monitor to output. For example, to show monitor *U1-01 [Frequency Reference]*, set it to "101" as shown in this figure.



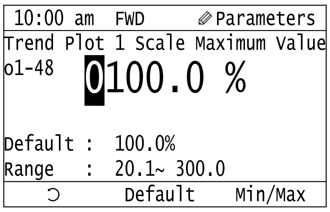
Push .

8. Push or to select [Trend Plot 1 Min Scale Value], then push .
9. Push or to select the specified digit, then push or to select the correct number.



- Push F2 (Default) to set the parameters to the factory default.
- Push F3 (Min/Max) to move between the minimum value and maximum value.

10. Push to keep the changes.
11. Push or to select [Trend Plot 1 Max Scale Value], then push .
12. Push or to select the specified digit, then push or to select the correct number.



- Push F2 (Default) to set the parameters to the factory default.
- Push F3 (Min/Max) to move between the minimum value and maximum value.

13. Push to keep the changes.
14. Push F1 ().
If necessary, use the same procedure to set [Custom Monitor 2].

■ Set the Time Scale for the Trend Plot Monitor

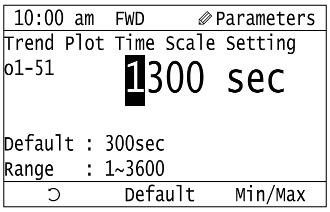
The procedure in this section shows how to set the time scale for the trend plot monitor.

1. Push F2 () to show the HOME screen.

Note:
- [Home] appears in the upper right hand corner of the screen when in HOME mode.
- If [] is not shown on F2, push F1 () to show [] on F2.

2. Push F2 ().
3. Push or to select [Monitor & Diagnostics], then push .
4. Push or to select [Trend Plot], then push F3 ().
5. Push or to select [Trend Plot Time Scale Setting], then push .
6. Push or to select the specified digit, then push or to select the correct number.

7. Push to keep the changes.



The configuration procedure is complete.

◆ Show Monitor Items as a Trend Plot

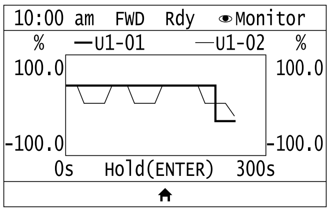
The procedure in this section shows how to show the selected monitor data as a trend plot.

1. Push F2 ( ) to show the HOME screen.

Note:
- [Home] appears in the upper right hand corner of the screen when in HOME mode.
- If [ ] is not shown on F2, push F1 ( ) to show [ ] on F2.

2. Push F2 ( ).
3. Push or to select [Monitor & Diagnostics], then push .
4. Push or to select [Trend Plot], then push .

The screen will show the monitors as shown in this figure.



Note:

Push (Hold) to switch between Pause and Restart for the monitor display. The “Hold (ENTER)” message flashes while monitoring is paused.

◆ Change Parameter Settings

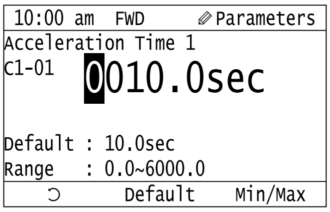
Do the steps in this procedure to set parameters for the application. This example shows how to change the setting value for *C1-01 [Accel Time 1]*.

1. Push F2 ( ) to show the HOME screen.

Note:
- [Home] appears in the upper right hand corner of the screen when in HOME mode.
- If [ ] is not shown on F2, push F1 ( ) to show [ ] on F2.

2. Push F2 ( ).
3. Push or to select [Parameters], then push .
4. Push or to select [C: TUNING], then push .
5. Push or to select [C1: ACCEL / DECEL], then push .
6. Push or to select *C1-01*, then push .

7. Push < or > to select the specified digit. then push ∧ or ∨ to select the correct number.



- Push F2 [Default] to set the parameters to factory defaults.
- Push F3 [Min/Max] to show the minimum value or the maximum value on the display.

8. Push ↵ to keep the changes.
9. Continue to change parameters, then push F1 [↻] to go back to the home screen after you change all the applicable parameters.

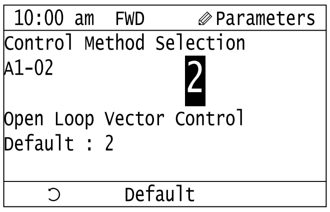
◆ Examine Manual Setup Parameters

The Manual Setup Parameters show the parameters set in *A2-01 to A2-32 [MAN1 Param1 to MAN3 Param12]*. This lets users to quickly access and change settings to these parameters.

1. Push F2 (⌂) to show the HOME screen.

Note:
- [⌂ Home] appears in the upper right hand corner of the screen when in HOME mode.
- If [⌂] is not shown on F2, push F1 (↻) to show [⌂] on F2.

2. Push F2 (▤).
3. Push ∧ or ∨ to select [Manual Setup], then push ↵.
4. To change the parameter settings, push ∧ or ∨ to select the parameter, then push ↵.
5. Push < or > to select the digit, then push ∧ or ∨ to change the value.



6. Change the value, push ↵.

The parameter setting procedure is complete.

◆ Save a Backup of Parameters

You can save a backup of the drive parameters to the keypad. The keypad can store parameter setting values for a maximum of four drives in different storage areas. Making backups of the parameter settings can save time when setting parameters after replacing a drive. If you set up more than one drive, you can copy the parameter settings from a drive that completed a test run to the other drives.

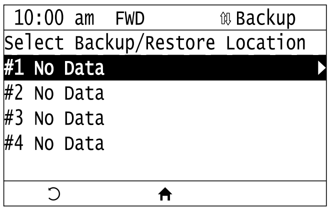
Note:
- Always stop the motor before making a backup of the parameters.
- When making a backup, the drive will not accept Run commands.

1. Push F2 (⌂) to show the HOME screen.

Note:
- [⌂ Home] appears in the upper right hand corner of the screen when in HOME mode.
- If [⌂] is not shown on F2, push F1 (↻) to show [⌂] on F2.

2. Push F2 (▤).
3. Push ∧ or ∨ to select [Configuration], then push ↵.

4. Push ∧ or ∨ to select [Parameter Backup/Restore], then push ↵.
5. Push ∧ or ∨ to select the items to back up, then push ↵.
6. Push ∧ or ∨ to select [Bck (Drive → OPE)], then push ↵.
7. Push ∧ or ∨ to select a memory location, then push ↵.



The keypad shows “End” when the backup procedure completes successfully.

◆ Write Backed-up Parameters to the Drive

You can back up parameters on the keypad and write them to different drives.

Note:
- Always stop the drive before you start to restore the parameter backups.
- The drive rejects Run commands while it is restoring parameters.

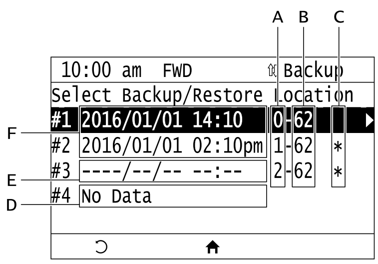
1. Push F2 (⌂) to show the HOME screen.

Note:
- [⌂ Home] appears in the upper right hand corner of the screen when in HOME mode.
- If [⌂] is not shown on F2, push F1 (↺) to show [⌂] on F2.

2. Push F2 (▤).
3. Push ∧ or ∨ to select [Configuration], then push ↵.
4. Push ∧ or ∨ to select [Parameter Backup/Restore], then push ↵.
5. Push ∧ or ∨ to select the item to restore, then push ↵.
6. Push ∧ or ∨ to select [Res (OPE → Drive)], then push ↵.
7. Push ∧ or ∨ to select the backed-up parameter data, then push ↵.

The keypad will show the "End" message when the write process is complete.

Note:
Different settings and conditions will change the keypad display.



A - ***A1-02 [Control Method]*** **settings**
B - ***o2-04 [Drive KVA Selection]*** **settings (2 or 3 digits)**
C - Presence of Q2pack parameter backup
D - Parameter backup data is not registered
E - Backup data does not contain the date information
F - Backup date

◆ Verify Keypad Parameters and Drive Parameters

This procedure verifies that the parameter setting values that were backed up in the keypad agree with the parameter setting values in the drive.

Note:
- Always stop the drive before you start to verify the parameters.
- The drive does not accept Run commands while restoring parameters.

1. Push F2 (Home) to show the HOME screen.

Note:
- [Home] appears in the upper right hand corner of the screen when in HOME mode.
- If [Home] is not shown on F2, push F1 (↻) to show [Home] on F2.

2. Push F2 (Menu).
3. Push ∧ or ∨ to select [Configuration], then push ↵.
4. Push ∧ or ∨ to select [Parameter Backup/Restore], then push ↵.
5. Push ∧ or ∨ to select the item to verify, then push ↵.
6. Push ∧ or ∨ to select [Verify (Check)], then push ↵.
7. Push ∧ or ∨ to select the data to verify, then push ↵.

The keypad shows "End" when the parameter settings backed up in the keypad agree with the parameter settings copied to the drive.

The keypad shows *vFyE [Parameters do not Match]* when the parameter settings backed up in the keypad do not agree with the parameter settings copied to the drive. Push one of the keys to return to Step 6.

◆ Delete Parameters Backed Up to the Keypad

This procedure deletes the parameters that were backed up to the keypad.

1. Push F2 (Home) to show the HOME screen.

Note:
- [Home] appears in the upper right hand corner of the screen when in HOME mode.
- If [Home] is not shown on F2, push F1 (↻) to show [Home] on F2.

2. Push F2 (Menu).
3. Push ∧ or ∨ to select [Configuration], then push ↵.
4. Push ∧ or ∨ to select [Parameter Backup/Restore], then push ↵.
5. Push ∧ or ∨ to select the item to delete, then push ↵.
6. Push ∧ or ∨ to select [Del (Clear OPE Memory)] , then push ↵.
7. Push ∧ or ∨ to select the data to delete, then push ↵.

The keypad will show the "End" message when the write process is complete.

◆ Check Modified Parameters

This procedure will show all parameters that were changed from their defaults as the result of Auto-Tuning or setting changes. This helps finding which settings have been changed, and is very useful when you replace a drive. This lets users quickly access and re-edit changed parameters. If no parameters have been changed, the keypad will show "0 Parameters".

1. Push F2 (Home) to show the HOME screen.

Note:
- [Home] appears in the upper right hand corner of the screen when in HOME mode.
- If [Home] is not shown on F2, push F1 (↻) to show [Home] on F2.

2. Push F2 (Menu).
3. Push ∧ or ∨ to select [Modified Parameters], then push ↵.

4. Push ∧ or ∨ to show the parameter to check.
5. To re-edit a parameter, push ∧ or ∨, select the parameter to edit, then push ↵.
6. Push < or > to select the digit, then push ∧ or ∨ to change the value.
7. When you are done changing the value, push ↵.

The parameter revision procedure is complete.

◆ Restore Modified Parameters to Defaults

This procedure will set all parameters with changed values to their default settings.

1. Push F2 (⌂) to show the HOME screen.

Note:
- [⌂ Home] appears in the upper right hand corner of the screen when in HOME mode.
- If [⌂] is not shown on F2, push F1 (↻) to show [⌂] on F2.

2. Push F2 (▤).
3. Push ∧ or ∨ to select [Modified Parameters], then push ↵.
4. Push ∧ or ∨ to select the parameters to return to their default settings, then push ↵.
5. Push F2 (Default).
6. Push ↵.

The modified parameter is now set to its default value.

◆ Show Fault History

You can examine a maximum of 10 fault codes, and dates and times when the faults occurred.

Note:
- Make sure that you first set the date and time on the keypad if you will monitor the date and time of the faults.
- If the keypad does not have a clock battery, you must set the date and time each time you energize the drive.

1. Push F2 (⌂) to show the HOME screen.

Note:
- [⌂ Home] appears in the upper right hand corner of the screen when in HOME mode.
- If [⌂] is not shown on F2, push F1 (↻) to show [⌂] on F2.

2. Push F2 (▤).
3. Push ∧ or ∨ to select [Monitor & Diagnostics], then push ↵.
4. Push ∧ or ∨ to select [Fault Log], then push ↵.
5. Push ∧ or ∨ to show the fault history you will examine.

◆ Auto-Tuning the Drive

Auto-Tuning uses motor characteristics to automatically set drive parameters.
Refer to the motor nameplate or the motor test report for the necessary information for Auto-Tuning.

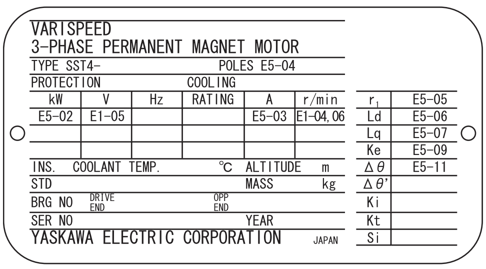


Figure 4.9 Motor Nameplate (Example)

WARNING! *Sudden Movement Hazard. Remove all persons and objects from the area around the drive, motor, and load before starting Auto-Tuning. The drive and motor can start suddenly during Auto-Tuning and cause death or serious injury.*

WARNING! *Electrical Shock Hazard. When doing Stationary Auto-Tuning, the motor will receive high voltage when the motor is stopped. Do not touch the motor until Auto-Tuning is completed. Failure to obey can cause injury or death from electrical shock.*

NOTICE: *Rotational Auto-Tuning will not function correctly if a holding brake is engaged on the load. Make sure that the motor can freely spin before starting Auto-Tuning. Failure to obey could cause incorrect operation of the drive.*

NOTICE: *Do not do Rotational Auto-Tuning with the load connected to the motor. Uncouple the load from the motor. Failure to obey can cause incorrect operation. The drive cannot accurately calculate motor parameters if the load is connected to the motor while doing Rotational Auto-Tuning, and the drive will not operate the motor correctly.*

This procedure shows how to do Rotational Auto-Tuning.

1. Push F2 () to show the HOME screen.

Note:

- [Home] appears in the upper right hand corner of the screen when in HOME mode.
- If [] is not shown on F2, push F1 () to show [] on F2.

2. Push F2 ().
3. Push or to select [Wizard & Autotuning], then push .
4. Push or to select [Auto-Tuning], then push .
5. Push or to select [Mtr Param Tuning], then push .
6. Push or to select [Rotary Auto-Tune], then push .
7. Follow the messages shown on the keypad to input the necessary Auto-Tuning data.

   Example: Push or to select the specified digit, then push or to change the number, then push to save the changes and continue to the next entry field.
8. Follow the messages shown on the keypad to do the next steps.
9. When the keypad shows the Auto-Tuning start screen, push RUN.

   Auto-Tuning starts.

   When doing Rotational Auto-Tuning, the motor will stay stopped for approximately one minute with power energized and then the motor will start to rotate.
10. When the keypad shows "End" after Auto-Tuning is complete, push or .

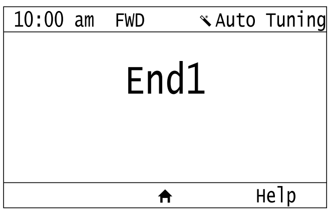
    The keypad will show a list of the changed parameters as the result of Auto-Tuning.
11. Push or in the parameter change confirmation screen to check the changed parameters, then select [Auto-Tuning Successful] at the bottom of the screen and push .

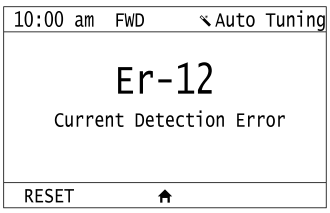
    To change a parameter, push or to select the parameter to change then push to show the Parameter setting screen.

Auto-Tuning is complete.

Note:

If the drive detects an error or you push STOP before Auto-Tuning is complete, Auto-Tuning will stop and the keypad will show an error code. *Endx* identifies that Auto-Tuning was successful with calculation errors. Find and repair the cause of the error and do Auto-Tuning again, or set the motor parameters manually. You can use the drive in the application if you cannot find the cause of the *Endx* error. *Er-xx* identifies that Auto-Tuning was not successful. Find and repair the cause of the error and do Auto-Tuning again.





◆ Set the Keypad Language Display

This procedure shows how to set the language shown on the keypad.

1. Push F2 (Home) to show the HOME screen.

Note:
- [Home] appears in the upper right hand corner of the screen when in HOME mode.
- If [Home] is not shown on F2, push F1 (⟳) to show [Home] on F2.

2. Push F2 (Menu).
3. Push ∧ or ∨ to select [Configuration], then push ↵.
4. Push ∧ or ∨ to select [Language Selection], then push ↵.
5. Push ∧ or ∨ to select the language, then push ↵.

The procedure to set the keypad language is complete.

◆ Set the Date and Time

This procedure shows how to set the date and time.

Note:
- If the keypad does not have a clock battery, you must set the date and time each time you energize the drive.
- To set the drive to detect an alarm when the battery is dead or when the clock is not set, install the battery then set *o4-24 = 1 [bAT Detection Selection = Enable (Alarm Detected)]*.
  Refer to *Replace the Keypad Battery on page 358* for information about the battery installation procedure.

1. Push F2 (Home) to show the HOME screen.

Note:
- [Home] appears in the upper right hand corner of the screen when in HOME mode.
- If [Home] is not shown on F2, push F1 (⟳) to show [Home] on F2.

2. Push F2 (Menu).
3. Push ∧ or ∨ to select [Configuration], then push ↵.
4. Push ∧ or ∨ to select [Set Date/Time], and push ↵.
5. Push ∧ or ∨ to select the format of date display, then push ↵.
6. Push ∧ or ∨ to select the format of time display, then push ↵.
7. Push < or > to select a number from Year/Month/Day, then push ∧ or ∨ to change the value.
8. When you are done changing the value, push ↵.
9. Push < or > to select the hour or minute, then push ∧ or ∨ to change the value.
10. When you are done setting the time, push ↵.

The procedure for setting the date and time is complete.

◆ Set Parameters Using the Q2 Wizard

The Q2 Wizard lets users follow simple messages on the keypad to set these basic parameters:

- Frequency reference source
- Input signal level
- Run command source
- Duty rating
- Motor type
- Control method
- Maximum frequency
- Input/output settings

Note:
The Q2 Wizard function will initialize all parameters before it sets the basic parameters.

1. Push F2 (⌂) to show the HOME screen.

Note:

- [⌂ Home] appears in the upper right hand corner of the screen when in HOME mode.
- If [⌂] is not shown on F2, push F1 (⟳) to show [⌂] on F2.

2. Push F2 (▤).
3. Push ∧ or ∨ to select [Wizard & Autotuning], then push ↵.
4. Push ∧ or ∨ to select [Q2 Wizard], then push ↵.
5. Push ∧ or ∨ to select [Yes], then push ↵.
   This operation will initialize all parameters.
6. Push ∧ or ∨ to select the item to set, then push ↵.
7. For the next steps, follow the instructions shown on the keypad until the “Parameter Change Confirmation Screen” is shown.
8. In the parameter change confirmation screen, push ∧ or ∨ to examine the changed parameter, then select [Apply each parameter] at the bottom of the screen and push ↵.

Note:

To change a parameter, push ∧ or ∨ to select the parameter to change, then push ↵ to show the parameter setting screen.

9. Push ∧ or ∨ to select [Yes], then push ↵ to apply the parameter settings.

The Q2 Wizard procedure is complete.

◆ Start Data Logging

The data log function keeps a record of a maximum of 10 drive monitors. This procedure shows how to start logging data.

1. Make sure that a microSD card is inserted in the keypad.
2. Push F2 (⌂) to show the HOME screen.

Note:

- [⌂ Home] appears in the upper right hand corner of the screen when in HOME mode.
- If [⌂] is not shown on F2, push F1 (⟳) to show [⌂] on F2.

3. Push F2 (▤).
4. Push ∧ or ∨ to select [Monitor & Diagnostics], then push ↵.
5. Push ∧ or ∨ to select [Data Logger], then push ↵.
6. Push ∧ or ∨ to select [Yes] or [No], then push ↵.
   - [Yes]: Data logging starts.
   - [No]: Data logging will not start.

   If the drive was logging data when you entered the command, the drive will ask to stop data logging.

◆ Set Data to Log

■ Set Monitor to Log

This procedure shows how to set the monitor for which to log data.

1. Push F2 (⌂) to show the HOME screen.

Note:

- [⌂ Home] appears in the upper right hand corner of the screen when in HOME mode.
- If [⌂] is not shown on F2, push F1 (⟳) to show [⌂] on F2.

2. Push F2 (▤).

3. Push ∧ or ∨ to select [Monitor & Diagnostics], then push ↵.
4. Push ∧ or ∨ to select [Data Logger], then push F3 (⚙).
5. Push ∧ or ∨ to select [Log Monitor], then push ↵.
6. Push ∧ or ∨ to select the save-destination monitor parameter, then push ↵.
7. Push ∧ or ∨ to select the monitor number to be logged, then push ↵.

The setting procedure is complete.

■ Set the Sampling Time

This procedure shows how to set the sampling time for data logging.

1. Push F2 (⌂) to show the HOME screen.

Note:
- [⌂ Home] appears in the upper right hand corner of the screen when in HOME mode.
- If [⌂] is not shown on F2, push F1 (↻) to show [⌂] on F2.

2. Push F2 (▤).
3. Push ∧ or ∨ to select [Monitor & Diagnostics], then push ↵.
4. Push ∧ or ∨ to select [Data Logger], then push F3 (Setup).
5. Push ∧ or ∨ to select [Log Sample Lapse], then push ↵.
6. Push < or > to select the digit, then push ∧ or ∨ to change the value.
7. When you are done changing the value, push ↵.

The procedure to set the sampling time is complete.

◆ Set Backlight to Automatically Turn OFF

You can set the backlight of the keypad screen to automatically turn OFF after a set length of time since the last key operation on the keypad. This procedure shows how to turn ON and turn OFF the backlight.

1. Push F2 (⌂) to show the HOME screen.

Note:
- [⌂ Home] appears in the upper right hand corner of the screen when in HOME mode.
- If [⌂] is not shown on F2, push F1 (↻) to show [⌂] on F2.

2. Push F2 (▤).
3. Push ∧ or ∨ to select [Configuration], then push ↵.
4. Push ∧ or ∨ to select [Backlight], then push ↵.
5. Push ∧ or ∨ to select [ON] or [OFF], then push ↵.
   - [ON]: Backlight is always ON
   - [OFF]: Backlight turns OFF after set length of time.
6. Push F3 (⚙).
7. Push ↵.
8. To adjust the time to turn off LCD backlight, push < or > to select the digit, then push ∧ or ∨ to change the value.
9. When you are done changing the value, push ↵.

The procedure to set the backlight to turn OFF automatically is complete.

◆ Show Information about the Drive

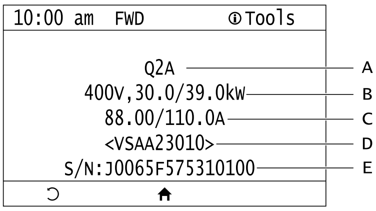
This procedure shows how to show the drive model, maximum applicable motor output (HD/ND), rated output current (HD/ND), software version, and the serial number on the keypad.

1. Push F2 (🏠) to show the HOME screen.

Note:
- [🏠 Home] appears in the upper right hand corner of the screen when in HOME mode.
- If [🏠] is not shown on F2, push F1 (↺) to show [🏠] on F2.

2. Push F2 (▤).
3. Push ∧ or ∨ to select [Configuration], then push ↵.
4. Push ∧ or ∨ to select [Drive Information], then push ↵.

The keypad will show the drive information.



A - Drive Series
B - Maximum Applicable Motor Output (HD/ND)
C - Rated Output Current (HD/ND)
D - Drive Software Version
E - Serial Number

◆ Write Automatically Backed-up Parameters to the Drive

You can automatically back up parameters to the keypad connected to the drive and write those parameters to a different drive as specified by the settings of *o3-06 [AutoBackup Selection]* and *o3-07 [AutoBackup Lapse]*.

Note:
- Set *o3-06 = 1 [AutoBackup Selection = Enabled]* in each drive to which you will write the parameters.
- This operation is not available when the parameters in the keypad and the parameters on the other drives are set to the same values.

1. Connect the keypad to the drive.
   The drive will ask to restore the parameters.
2. Push ∧ or ∨ to select [Yes] and then push ↵.
3. Push ∧ or ∨ to select [Yes] and then push ↵ to confirm the restore process.

The keypad will show the “End” message when the write process is complete.

4.6 Auto-Tuning

Auto-Tuning uses motor characteristics to automatically set drive parameters for vector control. Think about the type of motor, drive control method, and the motor installation environment and select the best Auto-Tuning method.

The keypad will show the messages with prompts to input the necessary parameter information. These prompts are specified by the selected Auto-Tuning method and the control method setting in *A1-02 [Control Method]*.

WARNING! *Crush Hazard. Rotational Auto-Tuning rotates the motor at a frequency that is 50% or more of the rated frequency of the motor. Make sure that there are no issues related to safety in the area around the drive and motor. Failure to obey can cause death or serious injury and damage to machinery.*

◆ Precautions before Auto-Tuning

Examine the topics in this section before you start Auto-Tuning.

■ Prepare for Basic Auto-Tuning

- You must input data from the motor nameplate or motor test report to do Auto-Tuning. Make sure that this data is available before Auto-Tuning the drive.
- For best performance, make sure that the drive input supply voltage is equal to or more than the motor rated voltage.

  Note:

  Better performance is possible when you use a motor with a base voltage that is less than the input supply voltage (20 V for 200 V class models and 40 V for 400 V class models). This is very important when operating the motor at more than 90% of base speed, where high torque precision is necessary. If the input power supply is equal to the motor rated voltage, the drive output voltage will not be sufficient, and performance will decrease.

- Push STOP on the keypad to cancel Auto-Tuning.
- If a Safe Disable input signal is input to the drive during Auto-Tuning, Auto-Tuning measurements will not complete successfully. If this occurs, cancel the Auto-Tuning, then do it again.
- The following table gives information about the terminal operations of digital inputs and outputs during Auto-Tuning.

Table 4.6 Status of Input/Output Terminals during Auto-Tuning

Auto-Tuning Type	Mode		Digital Input	Digital Output *1
Induction Motor Auto-Tuning	Rotational	Rotational Auto-Tuning	Disabled	Functions the same as during usual operation.
	Stationary	Stationary Auto-Tuning	Disabled	Keeps the status at the start of Auto-Tuning.
		Stationary Auto-Tuning for Line-to-Line Resistance	Disabled	Keeps the status at the start of Auto-Tuning.
PM Motor Auto-Tuning	Rotational	Z-Pulse Offset Tuning	Disabled	Keeps the status at the start of Auto-Tuning.
		PM Rotational Auto-Tuning	Disabled	Functions the same as during usual operation.
	Stationary	PM Motor Parameter Settings	Disabled	Disabled
		PM Stationary Auto-Tuning	Disabled	Keeps the status at the start of Auto-Tuning.
		PM Stationary Auto-Tuning for Stator Resistance	Disabled	Keeps the status at the start of Auto-Tuning.
EZ Tuning	Stationary	Motor Parameter Setting	Disabled	Disabled
		Stationary Auto-Tuning for Line-to-Line Resistance	Disabled	Keeps the status at the start of Auto-Tuning.
ASR and Inertia Tuning	Rotational	Inertia Tuning	Disabled	Functions the same as during usual operation.
		ASR Tuning	Disabled	Functions the same as during usual operation.
		Deceleration Rate Tuning	Disabled	Functions the same as during usual operation.
		KEB Tuning	Disabled	Functions the same as during usual operation.

*1 A terminal to which *H2-xx = 3 [H2-xx: MFDO Function Select = Fault]* is assigned functions the same as during usual operation.

WARNING! *Crush Hazard. Make sure that the holding brake does not open during Stationary Auto-Tuning for Line-to-Line Resistance with the machine connected to the motor. Wire the sequence to prevent a multi-function output terminal to open the holding brake during Auto-Tuning. Failure to obey can cause damage to the machine or personal injury.*

WARNING! *Sudden Movement Hazard. Disconnect the load from the motor for Rotational Auto-Tuning. Failure to obey could cause death or serious injury and cause damage to the machine.*

WARNING! *Crush Hazard. Rotational Auto-Tuning rotates the motor at a frequency that is 50% or more of the rated frequency of the motor. Make sure that there are no issues related to safety in the area around the drive and motor. Failure to obey can cause death or serious injury and damage to machinery.*

NOTICE: *Crush Hazard. When executing Auto-Tuning, voltage is applied to the motor before the motor rotates. Do not touch the motor until Auto-Tuning is completed. Failure to comply may result in injury or death from electrical shock. If PM Rotational Auto-Tuning is performed, the motor will remain stopped for approximately one minute with power applied and then the motor will rotate for one minute.*

■ Precautions before Rotational Auto-Tuning

WARNING! *Electrical Shock Hazard. In Rotational Auto-Tuning, the drive applies voltage to the motor before the motor rotates. Do not touch the motor until Auto-Tuning is complete. Failure to obey could cause serious injury.*

- Uncouple the drive from the motor before Rotational Auto-Tuning to prevent drive malfunction. If you do Rotational Auto-Tuning with the motor connected to a load that is more than 30% of the motor duty rating, the drive will not correctly calculate the motor parameters and the motor can operate incorrectly.
- When the load is 30% or less of the motor duty rating, you can do Auto-Tuning with the motor connected to a load.
- Make sure that the motor magnetic brake is released.
- Make sure that external force from the machine will not cause the motor to rotate.

■ Precautions before Stationary Auto-Tuning

- Make sure that the motor magnetic brake is not open.
- Make sure that external force from the machine will not cause the motor to rotate.

WARNING! *Electrical Shock Hazard. In Stationary Auto-Tuning, the drive applies voltage to the motor. Do not touch the motor until Auto-Tuning is complete. Failure to obey could cause serious injury.*

Automatically Set Mot Rated Slip and Mot No-Load Current

If *T1-12 = 1 [Test Mode Selection = Yes]* when selecting Stationary Auto-Tuning, the drive will automatically set motor parameters *E2-02 [Mot Rated Slip]* and *E2-03 [Mot No-Load Current]* after Auto-Tuning is complete when you use the motor for the first time in Drive Mode.

After Stationary Auto-Tuning is complete, use this procedures to do the operation in test mode:

1. Check the *E2-02* and *E2-03* values on the “Modified Parameters/Fault Log” screen or the “Parameters” screen.
2. Operate the motor in Drive Mode with these conditions:
   - Do not disconnect the wiring between the motor and drive.
   - Do not lock the motor shaft with a mechanical brake or other device.
   - The maximum motor load must be 30% of the rated load.
   - Keep a constant speed of 30% of *E1-06 [Base Frequency]* (default value = maximum frequency) or more for 1 second or longer.
3. After the motor stops, check the *E2-02* and *E2-03* values on the “Modified Parameters/Fault Log” screen or the “Parameters” screen again.
4. Make sure that the input data is correct.
   When the settings in *E2-02* and *E2-03* are different than in step 1, the drive set the values automatically.

Note:

- If you cannot operate the motor with the conditions in step 2 for the first test run and if the values set in *E2-02* and *E2-03* are much different than data in the official test report for the motor and the data listed in *Defaults by Drive Model and Duty Rating ND/HD on page 511*, these problems can occur:
  –Motor vibrations or hunting
  –Not sufficient torque
  –Overcurrent
  In elevator applications, there is a risk of the cage falling and causing personal injury.
  Do one of these precautions to decrease the risk:
  –After doing Stationary Auto-Tuning, operate the drive as specified by the conditions and procedure above.
  –Set *T1-12 = 0 [Test Mode Selection = No]*.
  –Do Rotational Auto-Tuning.
- If you initialize the drive after completing Step 1, do the procedure beginning from Step 1 again.
- For general-purpose motors, the target value for *E2-02* is 1 Hz to 3 Hz, and the target rated current for *E2-03* is 30% to 65%. Larger capacity motors have a lower rated slip, and a smaller ratio for the no-load current rated current. Refer to *Defaults by Drive Model and Duty Rating ND/HD on page 511* for details.

■ Precautions before Stationary Auto-Tuning for Line-to-Line Resistance and Stator Resistance Auto-Tuning

In V/f control, when the motor cable is 50 meters (164 feet), do Stationary Auto-Tuning for Line-to-Line Resistance.

WARNING! *Electrical Shock Hazard. In Stationary Auto-Tuning, the drive applies voltage to the motor. Do not touch the motor until Auto-Tuning is complete. Failure to obey could cause serious injury.*

■ Precautions before Inertia Tuning and ASR Tuning

Before Inertia Tuning or ASR Tuning, check these items:

WARNING! *Electrical Shock Hazard. In Rotational Auto-Tuning, the drive applies voltage to the motor before the motor rotates. Do not touch the motor until Auto-Tuning is complete. Failure to obey could cause serious injury.*

- Do rotational motor parameter tuning or look at the motor test report or nameplate to enter the values manually.
- Make sure that the motor magnetic brake is released.
- Connect the motor and load.
- Make sure that external force from the machine will not cause the motor to rotate.
- Make sure that the machine does not prevent reverse rotation. You cannot do Inertia Tuning or ASR Tuning with machines that prevent reverse rotation.
- When the motor can rotate during Auto-Tuning, check for safety issues near the drive, motor, and machine.

Note:

If there are gears between the machine and motor shaft, Inertia Tuning or ASR Tuning are possibly not applicable.

■ Precautions before Using Deceleration Rate Tuning and KEB Tuning

Before Deceleration Rate Tuning or KEB Tuning, check these items:

Note:

- Do not do Deceleration Rate Tuning if you use a braking resistor unit or a regenerative converter.
- Do Deceleration Rate Tuning and KEB Tuning with the load attached to the motor.
- Do not do Deceleration Rate Tuning or KEB Tuning for these applications:
  In Deceleration Rate Tuning and KEB Tuning, the drive will automatically rotate the motor forward and accelerate and decelerate the motor again and again.
  –On a machine that does not let the motor rotate forward
  –In applications with a small range of operation (trolleys and other such applications that can only move linearly)
  –In elevator applications
  –Applications where sudden acceleration and sudden deceleration are not applicable.
- To do KEB Tuning with the external main circuit capacitors connected to the drive, set *L3-26 [DC Bus Capacitors Extension]* then do KEB Tuning.
- Do not do KEB Tuning or Deceleration Rate Tuning if the drive is set to use *H1-xx = 61 [H1-xx: MFDI Function Select = Motor 2 Select]*. Failure to obey can cause an *ov [Overvoltage]* fault.

◆ Auto-Tuning for Induction Motors

This section gives information about Auto-Tuning for induction motors. Set these parameters for Auto-Tuning:

- Motor parameters *E1-xx [E1: V/F PARAMETER MOTOR 1], E2-xx [E2: MOTOR 1 PARAMETERS]* (*E3-xx [E3: V/F PARAMETER MOTOR 2], E4-xx [E4: MOTOR 2 PARAMETERS]* for motor 2)

- Speed feedback detection-use *F1-xx [F1: ENCODER]* parameters (only with CLV)

Note:

Do Stationary Auto-Tuning if you cannot do Rotational Auto-Tuning. There can be large differences between the measured results and the motor characteristics when Auto-Tuning is complete. Examine the parameters for the measured motor characteristics after you do Stationary Auto-Tuning.

Table 4.7 Types of Auto-Tuning for Induction Motors

Type	Parameter Settings	Application Conditions and Benefits	Applicable Control Method (Value of A1-02 [Control Method])				
			V/f Control (0)	PG V/f Control (1)	OLVector (2)	CLVector (3)	Adv OLVector (4)
Rotary Auto Tune	T1-01 = 0	• When you can decouple the motor and load the motor can rotate freely while Auto-Tuning. • When operating motors that have fixed output characteristics. • When it is necessary to use motors that have high-precision control. • When you cannot decouple the motor and load, but the motor load is less than 30%.	×	×	×	×	×
Static1 AutoTune	T1-01 = 1	• When you cannot decouple the motor and load, but the motor load is more than 30%. • When the information from the motor test report or motor nameplate is not available. **Note:** With Stationary Auto-Tuning, the energized drive stays stopped for approximately 1 minute. During this time, the drive automatically measures the necessary motor parameters. • When operating the motor with a light load after Auto-Tuning. The drive can automatically calculate the motor parameter settings necessary for torque control. Set *T1-12 = 1 [Test Mode Selection = Yes]* to do a test run after Auto-Tuning.	-	-	×	×	×
Static (R)	T1-01 = 2	• After Auto-Tuning, the wiring distance between the drive and motor changed by 50 m or more. • When the wiring distance is 50 m or more in the V/f Control mode. • When the motor output and drive capacity are different.	×	×	×	×	×

■ Input Data for Induction Motor Auto-Tuning

To do Auto-Tuning, input data for the items in the following table that have an "×". Before starting Auto-Tuning, record the information on the motor nameplate as a reference.

Table 4.8 Input Data for Induction Motor Auto-Tuning

Input Data	Unit	Auto-Tuning Mode (Value of T1-01 [Auto-tuning Mode Selection])		
		Rotary Auto Tune (0)	Static1 AutoTune (1)	Static (R) (2)
T1-02 [Motor Rated Power]	kW	×	×	×
T1-03 [Motor Rated Voltage]	V	×	×	-
T1-04 [Motor Rated Current]	A	×	×	×
T1-05 [Motor Base Frequency]	Hz	×	×	-
T1-06 [Motor Poles Number]	-	×	×	-
T1-07 [Motor Base Speed]	rpm	×	×	-
T1-08 [PG PulsePerRevolution]	-	× *1	× *1	-
T1-09 [Motor NoLoad Current]	A	-	×	-
T1-10 [Motor Rated Slip Frequency]	Hz	-	× *2	-
T1-11 [Motor Iron Loss]	W	× *3	-	-
T1-12 [Test Mode Selection] *4	-	-	× *5	-
T1-13 [No-load Voltage]	V	× *6	× *6	-

*1 Input this value when *A1-02 = 3 [Control Method = CLVector]*.
*2 0 Hz is displayed as the initial value. If you do not know the Motor Rated Slip Frequency, keep the setting at 0 Hz.
*3 Input this value when *A1-02 = 0 or 1 [Control Method = V/f Control or PG V/f Control]*.

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*4 If *T1-12 = 1 [Test Mode Selection = Yes]*, when you run the motor in Drive Mode for the first time after Auto-Tuning, the drive will automatically set *E2-02 [Mot Rated Slip]* and *E2-03 [Mot No-Load Current]*.
*5 Input this value when *T1-01 [Auto-tuning Mode Selection]* = 0 Hz.
*6 Set the same value to No-Load Voltage as *T1-03 [Motor Rated Voltage]* to get the same characteristics using Yaskawa 1000-Series drives or other legacy models.

◆ Auto-Tuning for PM Motors

This section gives information about Auto-Tuning for PM motors. Set these parameters for Auto-Tuning:

- Motor parameters *E1-xx [E1: V/F PARAMETER MOTOR 1], E5-xx [E5: PM MOTOR SETTINGS]*
- Speed feedback detection uses *F1-xx [F1: ENCODER]* (only with PM CLVector)

Table 4.9 Auto-Tuning for PM Motors

Method	Parameter Settings	Applicable When/Advantages	Applicable Control Method (Value of A1-02 [Control Method])		
			PM OLVector (5)	PM AOLVector (6)	PM CLVector (7)
PM Motor Parameter Settings	T2-01 = 0	• When the information from the motor test report or motor nameplate is not available. • Rotational/Stationary Auto-Tuning that energizes the motor is not done. Manually input the necessary motor parameters.	×	×	×
PM Static Full AutoTune	T2-01 = 1	• When the information from the motor test report or motor nameplate is not available. **Note:** With Stationary Auto-Tuning, the energized drive stays stopped for approximately 1 minute. During this time, the drive automatically measures the necessary motor parameters.	×	×	×
PM Static R Autotune	T2-01 = 2	• After Auto-Tuning, the wiring distance between the drive and motor changed by 50 m or more. • When the motor output and drive capacity are different.	×	×	×
Encoder Offset Autotune	T2-01 = 3	• When you do not know the encoder Z-pulse offset. • When the encoder was replaced • If you have compensated for the deviation from Z phase (Δθ). **Note:** The motor will rotate slowly while the drive measures the encoder base position.	-	-	×
PM Rotary Autotune	T2-01 = 4	• When the information from the motor test report or motor nameplate is available. • When you can decouple the motor and load the motor can rotate freely while Auto-Tuning. Values measured during Auto-Tuning are automatically set to the motor parameters.	×	×	×

■ Input Data for PM Motor Auto-Tuning

To do Auto-Tuning, input data for the items in the following tables that have an "×". Before starting Auto-Tuning, prepare the motor test report or record the information on the motor nameplate as a reference.

Table 4.10 Input Data for PM Motor Auto-Tuning

Input Data	Unit	Auto-Tuning Method (Value of T2-01 [PM AutoTune Mode Select])					
		PM Motor Parameter Settings (0)			PM Static Full AutoTune (1)		PM Static R Autotune (2)
A1-02 [Control Method]	**-**	**5, 6, 7**	**5**	**6, 7**	**5**	**6, 7**	**5, 6, 7**
T2-02 [PMMot Code Selection]	**-**	**Motor code of Yaskawa motor**	**FFFF** *1	**FFFF** *1	**-**	**-**	**-**
T2-03 [PMMot Motor Type]	-	-	-	-	×	×	-
T2-04 [PMMot Rated Power]	kW	-	×	×	×	×	-
T2-05 [PMMot Rated Voltage]	V	-	×	×	×	×	-
T2-06 [PMMot Rated Current]	A	-	×	×	×	×	x
T2-07 [PMMot Base Frequency]	Hz	-	×	-	×	-	-
T2-08 [PMMot Poles Number]	-	-	×	×	×	×	-
T2-09 [PMMot Base Speed]	rpm	-	-	×	-	×	-

Input Data	Unit	Auto-Tuning Method (Value of T2-01 [PM AutoTune Mode Select])					
		PM Motor Parameter Settings (0)			PM Static Full AutoTune (1)		PM Static R Autotune (2)
A1-02 [Control Method]	-	5, 6, 7	5	6, 7	5	6, 7	5, 6, 7
T2-02 [PMMot Code Selection]	-	Motor code of Yaskawa motor	FFFF *1	FFFF *1	-	-	-
T2-10 [PMMot Stator Resistance]	Ω	×	×	×	-	-	-
T2-11 [PMMot dAxis Inductance]	mH	×	×	×	-	-	-
T2-12 [PMMot qAxis Inductance]	mH	×	×	×	-	-	-
T2-13 [KE Unit Selection]	-	×	×	×	-	-	-
T2-14 [PMMot KE Voltage Constant]	*2	×	×	×	-	-	-
T2-15 [PullInCurrLv@PM Motor Tuning]	%	-	-	-	×	×	-
T2-16 [PMMot PG PulsePerRevolution]	-	*3	-	*3	-	*3	-
T2-17 [Enc Z-Pulse Offset]	Degrees	*3	-	*3	-	*3	-

*1 Set the motor code to FFFF for a PM motor.
*2 Changes when the value set in *T2-13 [KE Unit Selection]* changes.
*3 Input this value when *A1-02 = 7 [Control Method = PM CLVector]*.

Table 4.11 Input Data for PM Motor Auto-Tuning

Input Data	Unit	Auto-Tuning Method (Value of PM AutoTune Mode Select)			
		Encoder Offset Autotune (3)	PM Rotary Autotune (4)		
A1-02 [Control Method]	-	7	5	6	7
T2-02 [PMMot Code Selection]	-	-	-	-	-
T2-03 [PMMot Motor Type]	-	-	×	×	×
T2-04 [PMMot Rated Power]	kW	-	×	×	×
T2-05 [PMMot Rated Voltage]	V	-	×	×	×
T2-06 [PMMot Rated Current]	A	-	×	×	×
T2-07 [PMMot Base Frequency]	Hz	-	×	-	-
T2-08 [PMMot Poles Number]	-	-	×	×	×
T2-09 [PMMot Base Speed]	rpm	-	-	×	×
T2-10 [PMMot Stator Resistance]	Ω	-	-	-	-
T2-11 [PMMot dAxis Inductance]	mH	-	-	-	-
T2-12 [PMMot qAxis Inductance]	mH	-	-	-	-
T2-13 [KE Unit Selection]	-	-	-	-	-
T2-14 [PMMot KE Voltage Constant]	*1	-	-	-	-
T2-15 [PullInCurrLv@PM Motor Tuning]	%	-	×	×	×
T2-16 [PMMot PG PulsePerRevolution]	-	-	-	-	×
T2-17 [Enc Z-Pulse Offset]	Degrees	-	-	-	-

*1 Changes when the value set in *T2-13 [KE Unit Selection]* changes.

◆ EZ Tuning

This section gives information about the Auto-Tuning mode for EZ Open Loop Vector Control. Auto-Tuning will set the *E9-xx [E9: SIMPLE VECTOR SETTINGS]* parameters.

Table 4.12 EZ Tuning Mode Selection

Mode	Parameter Settings	Application Conditions and Benefits	Applicable Control Method (Value of A1-02 [Control Method])
Motor Constant	T4-01 = 0	• For efficient operation of induction motors and PM motors. • For derating torque applications, for example fans and pumps.	EZ Vector (8)
Static R Autotune	T4-01 = 1	• After Auto-Tuning, the wiring distance between the drive and motor changed by 50 m or more. • When the motor output and drive capacity are different.	EZ Vector (8)

■ Input Data for EZ Tuning

To do Auto-Tuning, input data for the items in the following table that have an "×". Before starting Auto-Tuning, prepare the motor test report or record the information on the motor nameplate as a reference.

Table 4.13 Input Data for EZ Tuning

Input Data	Unit	Auto-Tuning Mode (Value of T4-01 [EZ Tune Mode Selection])	
		Motor Constant (0)	Static R Autotune (1)
T4-02 [Motor Type Selection]	-	×	-
T4-03 [Motor Max Revolutions]	rpm	×	-
T4-04 [Motor Rated Revolutions]	rpm	×	-
T4-05 [Motor Rated Frequency]	Hz	×	-
T4-06 [Motor Rated Voltage]	V	×	-
T4-07 [Motor Rated Current]	A	×	×
T4-08 [Motor Rated Capacity]	kW	×	-
T4-09 [Motor Poles Number]	-	×	-

◆ Control Tuning

To increase drive responsiveness and prevent hunting, use Auto-Tuning to automatically adjust the control-related parameters.

These types of Auto-Tuning are available for the control system:

- Inertia Tuning
- ASR Tuning
- Deceleration Rate Tuning
- KEB Tuning

Note:

If you do Control Tuning, you cannot set any parameter of *H1-xx = 61 [H1-xx: MFDI Function Select = Motor 2 Select]*. Do not do Control Tuning for applications that switch between motor 1 and motor 2.

Table 4.14 Control Loop Tuning Selection

Mode	Value of Control Loop Tune Selection	Application Conditions and Benefits	Applicable Control Method (Value of A1-02 [Control Method])								
			V/f Control (0)	PG V/f Control (1)	OLVector (2)	CLVector (3)	Adv OLVector (4)	PM OLVector (5)	PM AOLVector (6)	PM CLVector (7)	EZ Vector (8)
Inertia Tuning	0	• For Feed Forward Control • When *L2-29 = 2 [KEB Method = Single KEB2 Ride-Thru]*. • When MFDI *H1-xx = 42 [H1-xx: MFDI Function Select = KEB Thru2 NC]*.	-	-	-	×	-	-	-	×	-
ASR Tuning	1	To let the set response frequency (including Inertia Tuning) automatically adjust the ASR gain.	-	-	-	×	-	-	-	×	-

Mode	Value of Control Loop Tune Selection	Application Conditions and Benefits	Applicable Control Method (Value of A1-02 [Control Method])								
			V/f Control (0)	PG V/f Control (1)	OLVector (2)	CLVector (3)	Adv OLVector (4)	PM OLVector (5)	PM AOLVector (6)	PM CLVector (7)	EZ Vector (8)
Deceleration Rate Tuning	2	To automatically adjust the deceleration rate to prevent an *ov [Overvoltage]* fault.	×	×	×	×	×	×	×	×	×
KEB Tuning	3	• To automatically adjust parameter settings to prevent an *ov [Overvoltage]* fault with the KEB Ride-Thru function. • When *L3-11 = 1 [Overvolt Supression Select = Enabled]*.	×	×	×	×	×	×	×	×	×

Table 4.15 Input Data for Control Tuning

Input Data	Unit	Auto-Tuning Mode (Value of T3-00 [Control Loop Tune Selection])			
		Inertia Tuning (0)	ASR (Speed Regulator) (1)	Dec Rate Tuning (2)	KEB Tuning (3)
T3-01 [Inertia Test Frequency]	Hz	×	×	-	-
T3-02 [Inertia Test Amplitude]	Rad	×	×	-	-
T3-03 [Motor Inertia]	$Kg \cdot m^2$	×	×	-	-
T3-04 [System ResponseFrequency]	Hz	-	×	-	-

■ Inertia Tuning

Inertia Tuning uses the motor speed and torque reference to estimate the system inertia and automatically sets the drive parameters related to the inertia ratio of the machinery and motor. Use Inertia Tuning for Feed Forward control or when *H1-xx = 42 [H1-xx: MFDI Function Select = KEB Thru2 NC]*.

Inertia tuning identifies the load inertia and optimizes the speed loop gain and feed forward gain to get a high level of control capability. You can set the speed response without thinking about the load, which increases the precision when synchronizing multiple drives. Since the motor can continue to operate during a power outage, Inertia Tuning keeps the best ramp to stop deceleration curve for KEB Ride-Thru.

■ ASR Tuning

ASR Tuning estimates the motor load inertia and automatically sets the parameters. ASR Tuning also uses the measured load inertia value to do an automatic adjustment after calculating the proportional gain of speed control (ASR).

■ Deceleration Rate Tuning

Deceleration Rate Tuning automatically sets the deceleration rate to prevent an *ov [Overvoltage]* fault during motor deceleration. Set *C1-11 [Ac/Dec Switch Frequency]* first to automatically set parameters *C1-02 [Decel Time 1]* (high speed range) and *C1-08 [Decel Time 4]* (low speed range).

■ KEB Tuning

KEB Tuning automatically sets parameters used for the KEB Ride-Thru function and for the overvoltage suppression function.

Control Tuning automatically sets the parameters in the following table to the best values.

Table 4.16 Parameters set in Control Tuning

Parameters Automatically Set	Inertia Tuning	ASR (Speed Regulator)	Dec Rate Tuning	KEB Tuning
C1-02 [Decel Time 1]	-	-	×	-
C1-08 [Decel Time 4]	-	-	× *1	-
C1-09 [Fast Stop Time]	-	-	-	× *2
C5-01 [ASR PGain 1]	-	×	-	-
C5-17 [Motor Inertia]	×	×	-	-
C5-37 [M2 Inertia]	×	×	-	-
C5-18 [Inertia Ratio of Load]	×	×	-	-

Parameters Automatically Set	Inertia Tuning	ASR (Speed Regulator)	Dec Rate Tuning	KEB Tuning
C5-38 [M2 Inertia Ratio of load]	×	×	-	-
L2-06 [KEB Decel Time]	-	-	-	× *3
L3-24 [Acc@Rated Torque]	×	×	-	-
L3-25 [Load Inertia Ratio]	×	×	-	×
n5-02 [Mot Inertia Acceleration Time]	×	×	-	-
n5-03 [FF Control Gain]	×	×	-	-

*1 The drive automatically sets *C1-08 [Decel Time 4]* only when *C1-11 [Ac/Dec Switch Frequency] ≠ 0*.

*2 When *L2-29 = 1 [KEB Method = Single KEB1 Ride-Thru]*, the drive will automatically adjust *C1-09 [Fast Stop Time]* and will not adjust *L2-06 [KEB Decel Time]*. If the Fast Stop time must not change, do not do KEB Tuning.

*3 When *L2-29 = 2, 3, or 4 [KEB Method = Single KEB2 Ride-Thru, System KEB1 Ride-Thru, or System KEB2 Ride-Thru]*, the drive will automatically adjust *L2-06 [KEB Decel Time]*.

4.7 Test Run

After you use the Setup Wizard to set the basic parameters and Auto-Tune the drive, the next step is to do a test run.

WARNING! *Crash Hazard. Test the system to make sure that the drive operates safely after you wire the drive and set parameters. Failure to obey can cause injury or damage to equipment.*

◆ No-Load Test Run

Before connecting the motor to the machine, make sure that you check the operation status of the motor.

■ Precautions before Operation

Before rotating the motor, check these items:

- Check for safety issues near the drive, motor, and machine.
- Make sure that all emergency stop circuits and machine safety mechanisms are operating correctly.

■ Items to Check before Operation

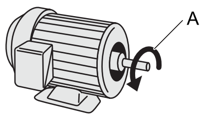
Check these items before operation:

- Is the motor rotating in the forward direction?
- Is the motor rotating smoothly (no unusual sounds or unusual vibrations)?
- Does the motor accelerate/decelerate smoothly?

◆ Do a No-Load Test Run

Do these steps for a no-load test run:

1. Energize the drive, or push F2 to show the HOME screen.
   If [Home] is not shown on F2, push F1 (Back) to show [Home] on F2.
2. Push LO/RE to illuminate the LOCAL/REMOTE indicator.
3. Push to show *d1-01 [Reference 1]*, and set it to 6.00 Hz.
4. Push RUN.
   The RUN indicator illuminates, and the motor runs at 6.00 Hz in the forward direction.
5. Make sure that the motor is rotating in the correct direction and that the drive does not show a fault.
   If the drive detects a fault, remove the cause.



A - Forward Rotation of Motor (Counter Clockwise Direction as Seen from Load Shaft)

6. Push to increase the frequency reference value.
   Change the setting value in increments of 10 Hz if necessary and examine the response.
7. Each time you increase the setting value, use *U1-03 [Output Current]* to check the drive output current.
   When the output current of the drive is not more than the motor rated current, the status is correct.
   Ex.: 6 Hz → 20 Hz → 30 Hz → 40 Hz → 50 Hz → 60 Hz
8. Make sure that the motor rotates correctly, then push STOP.
   The RUN indicator will flash. When the motor stops, the indicator will go out.

◆ Actual-Load Test Run

Test the operation without a load, then connect the motor and machine to do a test run.

■ Precautions before Operation

Before rotating the motor, check these items:

- Check for safety issues near the drive, motor, and machine.
- Make sure that all emergency stop circuits and machine safety mechanisms are operating correctly.
- Make sure that the motor is fully stopped.
- Connect the motor with the machine.
  Make sure that there are no loose installation screws and that the motor load shafts and machine junctions are correctly secured.
- Keep the keypad near you to push STOP immediately if there is unusual or incorrect operation.

Checklist before Operation

- Make sure that the direction of the machine operation is correct (The motor must rotate in the correct direction).
- Make sure that the motor accelerates and decelerates smoothly.

Do an Actual-Load Test Run

Connect the motor and machine, then do the test run with the same procedure you used for the no-load test run.

- Make sure that *U1-03 [Output Current]* is not too high.

1. Energize the drive, or push F2 (Home) to show the HOME screen.
   If [Home] is not shown on F2, push F1 (Back) to show [Home] on F2
2. Set *d1-01 [Reference 1]* to 6.00 Hz.
3. Push LO/RE to illuminate the LOCAL/REMOTE indicator.
4. Push RUN.
   The RUN indicator illuminates, and the motor runs at 6.00 Hz in the forward direction.
5. Make sure that the motor is rotating in the correct direction and that the drive does not show a fault.
   If the drive detects a fault, remove the cause.
6. Push ∧ to increase the frequency reference value.
   Change the setting value in increments of 10 Hz if necessary and examine the response.
7. Each time you increase the setting value, use *U1-03 [Output Current]* to check the drive output current.
   When the output current of the drive is not more than the motor rated current, the status is correct.
   Ex.: 6 Hz → 20 Hz → 30 Hz → 40 Hz → 50 Hz → 60 Hz
8. Make sure that the motor rotates correctly, then push STOP.
   The RUN indicator will flash. When the motor stops, the indicator will go out.
9. Change the frequency reference and direction of motor rotation, and make sure that there are no unusual sounds or vibrations.
10. If there are hunting or oscillation errors caused by control function, adjust the settings to stop the errors.

4.8 Fine Tuning during Test Runs (Adjust the Control Function)

This section gives information about the adjustment procedures to stop hunting or oscillation errors caused by control function during a test run. Adjust the applicable parameters as specified by your control method and drive status.

Note:

This section only lists frequently adjusted parameters. If you must adjust parameters that have a higher degree of precision, contact the manufacturer.

◆ V/f Control and Closed Loop V/f Control

Table 4.17 Parameters for Fine Tuning the Drive (V/f Control and Closed Loop V/f Control Methods)

Issue	Parameter Number	Solution	Default Setting	Recommended Setting
Hunting or oscillation at mid-range speeds (10 Hz to 40 Hz)	n1-02 [HuntPrev Gain Setting [	• If torque is not sufficient with heavy loads, decrease the setting value. • If hunting or oscillation occur with light loads, increase the setting value. • If hunting occurs with a low-inductance motor, for example a motor with a larger frame size or a high-frequency motor, lower the setting value.	1.00	0.10 - 2.00
• The volume of the motor excitation sound is too high. • Hunting or oscillation at low speeds (10 Hz or lower), or at mid-range speeds (10 Hz to 40 Hz)	C6-02 [Carrier Frequency Selection]	• If the volume of the motor excitation sound is too high, increase the carrier frequency. • If hunting or oscillation occur at low or mid-range speeds, decrease the carrier frequency.	1 (2 kHz) *1	1 to upper limit value
• Torque or speed response are slow. • Hunting or oscillation	C4-02 [Trq Comp Delay Time]	• If torque or speed response are slow, decrease the setting value. • If hunting or oscillation occur, increase the setting value.	200 ms *2	100 - 1000 ms
• Torque at low speeds (10 Hz or lower) is not sufficient. • Hunting or oscillation	C4-01 [Trq Comp Gain]	• If torque at low speeds (10 Hz or lower) is not sufficient, increase the setting value. • If hunting or oscillation occur with light loads, decrease the setting value.	1.00	0.50 - 1.50
• Torque at low speeds (10 Hz or lower) is not sufficient. • Large initial vibration at start up.	• E1-08 [Mid A Voltage] • E1-10 [Min Output Voltage]	• If torque at low speeds (10 Hz or lower) is not sufficient, increase the setting value. • If there is large initial vibration at start up, decrease the setting value	• E1-08: 15.0 V *3 • E1-10: 9.0 V *3	Default setting +/- 5 V *4
In V/f control method, speed precision is unsatisfactory.	C3-01 [Slip Comp Gain]	Set *Mot Rated Current (FLA)*, *Mot Rated Slip*, and *Mot No-Load Current*, then adjust *C3-01*.	0.0 (no slip compensation)	0.5 - 1.5
In Closed Loop V/f control method, speed precision is unsatisfactory.	• C5-01 [ASR PGain 1] • C5-02 [ASR ITime 1] *5	Adjust *C5-01, C5-02.*	• C5-01: 0.20 • C5-02: 0.200 s	• Proportional gain = 0.10 to 1.00 • Integral time = 0.100 to 2.000 s

*1 Default value changes when *o2-04 [Drive KVA Selection]* and *C6-01 [ND/HD Duty Selection]* values change.
*2 Default value changes when *A1-02 [Control Method]* and *o2-04 [Drive KVA Selection]* values change.
*3 Default value changes when *A1-02 [Control Method]* and *E1-03 [V/f Pattern Selection]* values change.
*4 Recommended settings are for 200 V class drives. Multiply the voltage by 2 for 400 V class drives.
*5 In Closed Loop V/f Control, ASR only controls the output frequency. You cannot make a high-gain as in Closed Loop Vector control.

◆ Open Loop Vector Control Method

In Open Loop Vector Control, keep *C4-01 [Trq Comp Gain]* at its default setting (1.00). Do not adjust it.

If you cannot get speed precision during regeneration in Open Loop Vector Control, set *C3-04 = 1 [Slip Comp@Regen = Enable>6 Hz]*.

Table 4.18 Parameters for Fine Tuning the Drive (Open Loop Vector Control Method)

Issue	Parameter Number	Solution	Default Setting	Recommended Setting
• Torque or speed response are slow. • Hunting or oscillation at mid-range speeds (10 Hz to 40 Hz)	n2-01 [AFR Gain]	• To increase the speed of torque or speed response, decrease the setting value in increments of 0.05. • If hunting or oscillation occur, decrease the setting value in increments of 0.05.	1.00	0.50 - 2.00
	n2-02 [AFR Time 1]	• To increase the speed of torque or speed response, decrease the setting value in increments of 10 ms and examine the response. • If hunting or oscillation occur or if the load inertia is too much, increase the setting value in increments of 50 ms and examine the response. **Note:** Make sure that this parameter setting is: *n2-02 ≤ n2-03 [AFR Time 2]* holds true. When you adjust *n2-02*, you must also increase the*C4-02 [Trq Comp Delay Time]* value by the same ratio.	50 ms	50 - 2000 ms
ov [overvoltage] occurs when the drive stops accelerating, starts to decelerate, or when there are large changes in the load.	n2-03 [AFR Time 2]	• If *ov* occurs, increase the setting value in increments of 50 ms and examine the response. • If the response is not sufficient, decrease the setting value in increments of 10 ms and examine the response. **Note:** Make sure that this parameter setting is: *n2-02 [AFR Time 1] ≤ n2-03*. When you adjust *n2-03* you must also increase the *C4-06 [M2 Trq Comp Delay Time]* value by the same ratio.	750 ms	750 - 2000 ms
	C4-06 [M2 Trq Comp Delay Time]	• If *ov* occurs, increase the setting value in increments of 10 ms and examine the response. • If the response is not sufficient, decrease the setting value in increments of 2 ms and examine the response. **Note:** Make sure that this parameter setting is: *C4-02 [Trq Comp Delay Time] ≤ C4-06*. When you adjust *C4-06*, you must also increase the *n2-03 [AFR Time 2]* value by the same ratio.	150 ms	150 - 750 ms
• Torque or speed response are slow. • Hunting or oscillation	C4-02 [Trq Comp Delay Time]	• If torque or speed response are slow, decrease the setting value in increments of 2 ms. • If hunting or oscillation occur, increase the setting value in increments of 10 ms. **Note:** Make sure that this parameter setting is: *C4-02 ≤ C4-06 M2 Trq Comp Delay Time*. When you adjust *C4-02*, you must also increase the *n2-02 AFR Time 1* value by the same ratio.	20 ms *1	20 - 100 ms *1
• Speed response is slow. • Speed is not stable.	C3-02 [Slip Comp Delay Time]	• If speed response is slow, decrease the setting value in increments of 10 ms. • If speed is not stable, increase the value in increments of 10 ms.	200 ms *1	100 - 500 ms
Speed precision is unsatisfactory.	C3-01 [Slip Comp Gain]	• If speed is too slow, increase the setting value in increments of 0.1. • If speed is too fast, decrease the setting value in increments of 0.1.	1.0 *2	0.5 - 1.5
• The volume of the motor excitation sound is too high. • Hunting or oscillation at low speeds (10 Hz or lower)	C6-02 [Carrier Frequency Selection]	• If the volume of the motor excitation sound is too high, increase the carrier frequency. • If hunting or oscillation occur at low speeds, decrease the carrier frequency.	1 (2 kHz) *3	0 to upper limit value
• Torque at low speeds (10 Hz or lower) is not sufficient. speed response is slow. • Speed response is slow. • Large initial vibration at start up.	• E1-08 [Mid A Voltage] • E1-10 [Min Output Voltage]	• If torque or speed response are slow, increase the setting value. • If there is large initial vibration at start up, decrease the setting value **Note:** If the setting value is set too high, a large torque reference may be output even with light loads.	• E1-08: 11.0 *2 • E1-10: 2.0 *2	Default setting +/- 2 V *4

*1 Default value changes when *A1-02 [Control Method]* and *o2-04 [Drive KVA Selection]* values change.
*2 Default value changes when *A1-02 [Control Method]* and *E1-03 [V/f Pattern Selection]* values change.
*3 Default value changes when *Drive KVA Selection* and *ND/HD Duty Selection* values change.
*4 Recommended settings are for 200 V class drives. Multiply the voltage by 2 for 400 V class drives.

◆ Closed Loop Vector Control Method

Table 4.19 Parameters for Fine Tuning the Drive (Closed Loop Vector Control Method)

Issue	Parameter Number	Solution	Default Setting	Recommended Setting
• Torque or speed response are slow. • Hunting or oscillation	• High speed C5-01 [ASR PGain 1] • Low speed C5-03 [ASR PGain 2] *1	• If torque or speed response are slow, increase the setting value in increments of 5.00. • If hunting or oscillation occur, decrease the setting value.	20.00	10.00 - 50.00
	• High speed C5-02 [ASR ITime 1] • Low speed C5-04 [ASR ITime 2] *1	• If torque or speed response are slow, decrease the setting value. • If hunting or oscillation occur, increase the setting value.	0.500 s	0.300 to 1.000 s
The drive cannot find ASR proportional gain or integral time for low speed or high speed.	C5-07 [ASR Gain Switch Frequency] *1	Change the ASR proportional gain and ASR integral time to conform to the output frequency.	0.0 Hz	0.0 Hz to maximum output frequency
Hunting or oscillation	C5-06 [ASR Delay Time] *1	• If torque or speed response are slow, decrease the setting value in increments of 10 ms. • If the rigidity of the machine is unsatisfactory and vibration is possible, increase the setting value.	4 ms	4 to 20 ms
• The volume of the motor excitation sound is too high. • Hunting or oscillation at low speeds (3 Hz or lower)	C6-02 [Carrier Frequency Selection]	• If the volume of the motor excitation sound is too high, increase the carrier frequency. • If hunting or oscillation occur at low speeds, decrease the carrier frequency.	1 (2.0 kHz) *2	2.0 kHz to upper limit value

*1 Refer to the section on C5: ASR - SPEED REGULATION parameters for more information about speed control (ASR).
*2 Default value changes when *o2-04 [Drive KVA Selection]* and *C6-01 [ND/HD Duty Selection]* values change.

◆ Advanced Open Loop Vector Control Method

Table 4.20 Parameters for Fine Tuning the Drive (Advanced Open Loop Vector Control Method)

Issue	Parameter Number	Solution	Default Setting	Recommended Setting
• *oS [Overspeed]* occurs. • Hunting or oscillation.	T1-01 [Auto-tuning Mode Selection]	• Make sure that the output of the drive and the motor are connected correctly. • Decouple the motor and machine and do Rotational Auto-Tuning.	-	0
The volume of the motor excitation sound is too high.	C6-02 [Carrier Frequency Selection]	If the volume of the motor excitation sound is too high, increase the carrier frequency.	1 (2 kHz) *1	1 to upper limit value
Speed precision is unsatisfactory	E2-02 [Mot Rated Slip]	• Decouple the motor and machine and do Rotational Auto-Tuning. • If the motor speed is slow, increase the value of *E2-02* in small increments (approximately 0.1% of the default setting value). • If the motor speed is fast, decrease the value of *E2-02* in small increments (approximately 0.1% of the default setting value).	*2	Set to a value that is ±5% of the current value.
• Torque or speed response are slow. • Hunting or oscillation	• High speed C5-01 [ASR PGain 1] • Low speed C5-03 [ASR PGain 2] *3	• If torque or speed response are slow, increase the setting value in increments of 5.00. • If hunting or oscillation occur, decrease the setting value.	20.00	10.00 - 50.00
	• High speed C5-02 [ASR ITime 1] • Low speed C5-04 [ASR ITime 2] *3	• If torque or speed response are slow, decrease the setting value. • If hunting or oscillation occur, increase the setting value.	0.500 s	0.300 to 1.000 s
The drive cannot find speed response for low speed or high speed.	• C5-07 [ASR Gain Switch Frequency] *4 • High speed C5-01 [ASR PGain 1] C5-02 [ASR ITime 1] • Low speed C5-03 [ASR PGain 2] *3 C5-04 [ASR ITime 2]	Change the ASR proportional gain and ASR integral time to conform to the output frequency.	0.0 Hz	0.0 to maximum output frequency
Hunting or oscillation	C5-06 [ASR Delay Time] *4	• If torque or speed response are slow, decrease the setting value in increments of 10 ms. • If the rigidity of the machine is unsatisfactory and vibration is possible, increase the setting value.	4 ms	4 to 20 ms

*1 Default value changes when *o2-04 [Drive KVA Selection]* and *C6-01 [ND/HD Duty Selection]* values change.
*2 Default value changes when *o2-04 [Drive KVA Selection]* value changes.
*3 Refer to the section on C5: ASR - SPEED REGULATION parameters for more information about speed control (ASR).
*4 The best values for a no-load operation are different than the best values for actual loading operation.

◆ Fine-Tuning Open Loop Vector Control for PM Motors

Table 4.21 Parameters for Fine-Tuning Performance in OLV/PM

Issue	Parameter Number	Solution	Default Setting	Recommended Setting
Unsatisfactory motor performance	E1: V/F PARAMETER MOTOR 1 parameters, E5: PM MOTOR SETTINGS parameters	• Check the settings for *E1-06 [Base Frequency], E1-04 [Max Output Frequency]*. • Check the *E5: PM MOTOR SETTINGS* parameters and make sure that all motor data has been set correctly. **Note:** Do not set *E5-05 [PM Mot Resistance (Ohms/Phase)]* to a line-to-line resistance value. • Do Auto-Tuning.	-	-
Unsatisfactory motor torque and speed response	n8-55 [Load Inertia]	Adjust to match the load inertia ratio of the motor and machine.	1	Near the actual load inertia ratio.
	n8-45 [SpdFbck Det.Gain]	Decrease the setting value in increments of 0.05.	0.80	-
	C4-01 [Trq Comp Gain]	Adjust the setting value. **Note:** Setting this value too high can cause overcompensation and motor oscillation.	0.00	1.00
• Oscillation at start. • Motor stalls.	n8-51 [Ac/Dec Pull-In Current]	Increase the setting value in increments of 5%.	50%	-
	• b2-02 [DCI Braking Current] • b2-03 [DCInj Time@Start]	Use DC Injection Braking at start. **Note:** This can cause the motor to rotate in reverse for approximately 1/8 of a turn at start.	• b2-02: 50% • b2-03: 0.0 s	• b2-02: Adjust as necessary. • b2-03: 0.5 s
	n8-55 [Load Inertia]	Increase the setting value. **Note:** When operating a single motor or with a minimum amount of inertia, setting this value too high can cause motor oscillation.	1	Near to the actual load inertia ratio.
There is too much current during deceleration.	n8-79 [Pull-In Curr@Deceleration]	Set *n8-79 < n8-51*.	0% **Note:** When *n8-79 = 0*, the drive will apply the *n8-51* setting to the pull-in current during deceleration.	Decrease in increments of 5%.
Stalling or oscillation occurs when load is applied during constant speed	n8-47 [Pull-In Comp.Time Constant]	Decrease the setting value in increments of 0.2 s.	5.0 s	-
	n8-48 [Pull-In Current (for PM Motors)]	Increase the setting value in increments of 5%.	30%	-
	n8-55 [Load Inertia]	Increase the setting value. **Note:** When operating a single motor or with a minimum amount of inertia, setting this value too high can cause motor oscillation.	1	Near to the actual load inertia ratio.
Hunting or oscillation	n8-45 [SpdFbck Det.Gain]	Increase the setting value in increments of 0.05.	0.80	-
The drive detects *STPo [Motor Step-Out Detected]* fault when the load is not too high.	• E5-09 [PM BackEMF Vpeak (mV/(rad/ s))] • E5-24 [PM BackEMF L-L Vrms (mV/rpm)]	• Adjust the setting value. • Examine the motor code on the motor nameplate or the data sheet, then set correct values for *E5-09* or *E5-24*.	*1	• Yaskawa motor Set the motor code from the motor nameplate. • Motor from another manufacturer Set the values from the test report.
The drive detected stalling or *STPo [Motor Step-Out Detected]* at high speed and maximum output voltage.	n8-62 [Output Volt Limit Level]	Set to a value lower than the actual input voltage.	• 400.0 V	-

*1 Default value changes when *E5-01 [PM Mot Code Selection]* and *o2-04 [Drive KVA Selection]* values change.

◆ Advanced Open Loop Vector Control Method for PM

Table 4.22 Parameters for Fine Tuning the Drive (Advanced Open Loop Vector Control Method for PM)

Issue	Parameter Number	Solution	Default Setting	Recommended Setting
• Torque or speed response are slow. • Hunting or oscillation	• High speed C5-01 [ASR PGain 1] • Low speed C5-03 [ASR PGain 2]	• If torque or speed response are slow, increase the setting value in increments of 5.00. • If hunting or oscillation occur, decrease the setting value.	10.00	5.00 - 30.00 *1
	• High speed C5-02 [ASR ITime 1] • Low speed C5-04 [ASR ITime 2]	• If torque or speed response are slow, decrease the setting value. • If hunting or oscillation occur, increase the setting value.	0.500 s	0.300 to 1.000 s *1
The drive cannot find ASR proportional gain or integral time for low speed or high speed.	C5-07 [ASR Gain Switch Frequency]	Change the ASR proportional gain and ASR integral time to conform to the output frequency.	0.0 %	0.0% to maximum rotation speed
Hunting or oscillation	C5-06 [ASR Delay Time]	If the rigidity of the machine is unsatisfactory and vibration is possible, increase the setting value in increments of 10 ms.	16 ms	16 to 35 ms *1
Step-out	E1: V/F PARAMETER MOTOR 1parameters, E5: PM MOTOR SETTINGS parameters	Refer to the motor nameplate or test report and set *E1: V/F PARAMETER MOTOR 1* or *E5: PM MOTOR SETTINGS* parameters correctly.	-	-

*1 The best values for a no-load operation are different than the best values for actual loading operation.

◆ Closed Loop Vector Control Method for PM

Table 4.23 Parameters for Fine Tuning the Drive (Closed Loop Vector Control Method for PM)

Issue	Parameter Number	Solution	Default Setting	Recommended Setting
• Torque or speed response are slow. • Hunting or oscillation	• High speed C5-01 [ASR PGain 1] • Low speed C5-03 [ASR PGain 2]	• If torque or speed response are slow, increase the setting value in increments of 5.00. • If hunting or oscillation occur, decrease the setting value.	20.00	10.00 - 50.00 *1
	• High speed C5-02 [ASR ITime 1] • Low speed C5-04 [ASR ITime 2]	• If torque or speed response are slow, decrease the setting value. • If hunting or oscillation occur, increase the setting value.	0.500 s	0.300 to 1.000 s *1
The drive cannot find speed response for low speed or high speed.	• C5-07 [ASR Gain Switch Frequency] • High speed C5-01 [ASR PGain 1] C5-02 [ASR ITime 1] • Low speed C5-03 [ASR PGain 2] C5-04 [ASR ITime 2]	Change the ASR proportional gain and ASR integral time to conform to the output frequency.	0.0 %	0.0% to maximum rotation speed
Hunting or oscillation	C5-06 [ASR Delay Time]	If the rigidity of the machine is unsatisfactory and vibration is possible, increase the setting value in increments of 10 ms.	4 ms	4 to 20 ms *1
Step-out	E1: V/F PARAMETER MOTOR 1parameters, E5: PM MOTOR SETTINGS parameters	Refer to the motor nameplate or test report and set *E1: V/F PARAMETER MOTOR 1* or *E5: PM MOTOR SETTINGS* parameters correctly.	-	-

*1 The best values for a no-load operation are different than the best values for actual loading operation.

◆ EZ Open Loop Vector Control Method

Table 4.24 Parameters for Fine Tuning the Drive (EZ Open Loop Vector Control Method)

Issue	Parameter Number	Solution	Default Setting	Recommended Setting
• Torque or speed response are slow. • Hunting or oscillation	• High speed C5-01 [ASR PGain 1] • Low speed C5-03 [ASR PGain 2]	• If torque or speed response are slow, increase the setting value in increments of 5.00. • If hunting or oscillation occur, decrease the setting value.	10.00	10.00 - 50.00 *1
	• High speed C5-02 [ASR ITime 1] • Low speed C5-04 [ASR ITime 2]	• If torque or speed response are slow, decrease the setting value. • If hunting or oscillation occur, increase the setting value.	0.500 s	0.300 to 1.000 s *1
The drive cannot find ASR proportional gain or integral time for low speed or high speed.	C5-07 [ASR Gain Switch Frequency]	Change the ASR proportional gain and ASR integral time to conform to the output frequency.	0.0%	0.0% to maximum rotation speed

Issue	Parameter Number	Solution	Default Setting	Recommended Setting
Hunting or oscillation	C5-06 [ASR Delay Time]	If the rigidity of the machine is unsatisfactory and vibration is possible, increase the setting value in increments of 10 ms.	4 ms	4 to 20 ms *1
Step-out	E9: SIMPLE VECTOR SETTINGS parameters	Refer to the motor nameplate or test report and set *E9: SIMPLE VECTOR SETTINGS* parameters correctly.	-	-
Oscillation when the motor starts.	n8-51 [Ac/Dec Pull-In Current]	Increase the setting value.	80%	Increase in increments of 5%.
Motor stalls.	L7-01 [FW Torque Limit] to L7-04 [RV Reg. TrqLimit]	Increase the setting value.	200%	Increase in increments of 10%.

*1 The best values for a no-load operation are different than the best values for actual loading operation.

4.9 Test Run Checklist

Examine the items in this checklist and check each item before a test run.

Check	No.	Description
	1	Correctly install and wire the drive as specified by this manual.
	2	Energize the drive.
	3	Set the voltage for the power supply in *E1-01 [Input AC Supply Voltage]*.

Check the applicable items as specified by your control method.

WARNING! *Sudden Movement Hazard. Correctly wire the start/stop and safety circuits before energizing the drive. Momentarily closing a digital input terminal can start a drive that is programmed for 3-Wire control. Failure to obey can cause death or serious injury from moving equipment.*

Table 4.25 V/f Control [A1-02 = 0] and Closed Loop V/f Control [A1-02 = 1]

Check	No.	Description
	4	Select the best V/f pattern for your application and motor characteristics. Example: For a motor with a rated frequency of 60 Hz, set *V/f Pattern Selection = 1 [Const Trq, 60Hz base, 60Hz max]* as a standard V/f pattern.

Table 4.26 Closed Loop V/f Control [A1-02 = 1]

Check	No.	Description
	5	Set *Enc1 Pulse Count (PPR)* correctly and make sure that encoder pulse counting direction is correct.
	6	Set *ASR PGain 1 and ASR ITime 1*.

Table 4.27 Open Loop Vector Control [A1-02 = 2] or Closed Loop Vector Control [A1-02 = 3]

Check	No.	Description
	7	Decouple motor shafts and machines.
	8	Refer to the information on the motor nameplate and set this data correctly: • Motor rated power (kW) to *T1-02* • Motor rated voltage (V) to *T1-03* • Motor rated current (A) to *T1-04* • Motor base frequency (Hz) to *T1-05* • Number of motor poles to *T1-06* • Motor base speed (min^{-1}) to *T1-07*
	9	Do Rotational Auto-Tuning.

Table 4.28 Closed Loop Vector Control [A1-02 = 3]

Check	No.	Description
	10	Set *Enc1 Pulse Count (PPR) and Enc1 Rotat Selection* .
	11	Set *ASR PGain 1 and ASR ITime 1*.

Table 4.29 PM Open Loop Vector Control [A1-02 = 5]

Check	No.	Description
	12	Set *E5-01 through E5-24 [PM Motor Settings]*.

Table 4.30 PM Advanced Open Loop Vector [A1-02 = 6]

Check	No.	Description
	13	Set *E5: PM MOTOR SETTINGS* parameters.
	14	Set *ASR PGain 1 and ASR ITime 1*.

Table 4.31 PM Closed Loop Vector Control [A1-02 = 7]

Check	No.	Description
	15	Set *E5: PM MOTOR SETTINGS* parameters.
	16	Set *ASR PGain 1 and ASR ITime 1*.
	17	Set *Enc1 Pulse Count (PPR) and Enc1 Rotat Selection*.
	18	Set *Enc ZPulse Offset*.

Check	No.	Description
	19	The keypad will show “Rdy” after starting to operate the motor.
	20	To give the Run command and frequency reference from the keypad, push LO/RE to set to LOCAL Mode (when in LOCAL Mode, the LO/RE LED illuminates).
	21	If the motor rotates in the opposite direction during test run, switch two of the motor cables (U/T1, V/T2, W/T3).
	22	Set Heavy Duty or Normal Duty Mode with *ND/HD Duty Selection* to conform to the load condition.
	23	Set *E2-01 [Mot Rated Current (FLA)] and L1-01 [Motor Cool Type for OL1 Calc]* correctly for motor thermal protection.
	24	Set the drive for REMOTE Mode when the control circuit terminals supply the Run command and frequency reference (in REMOTE Mode, the LO/RE LED turns OFF).
	25	When terminal AI1 is used for the frequency reference: • Voltage input – Set DIP Switch S1-1 on the drive to “V”. – Set *H3-01 = 0, 1 [AI1 Signal Level Select = 0 to 10V (Lower Limit at 0), -10 to +10V (Bipolar Reference)]*. – Set *H3-02 = 4 [AI1 Function Selection = Freq Ref/BIAS]*. • Current input – Set DIP Switch S1-1 on the drive to “I”. – Set *H3-01 = 2, 3 [AI1 Signal Level Select = 4 to 20 mA, 0 to 20 mA]*. – Set *H3-02 = 4 [AI1 Function Selection = Freq Ref/BIAS]*.
	26	When terminal AI2 is used for the frequency reference: • Voltage input – Set DIP Switch S1-2 on the drive to “V”. – Set *H3-09 = 0, 1 [AI2 Signal Level Select = 0 to 10V (Lower Limit at 0), -10 to +10V (Bipolar Reference)]*. – Set *H3-10 = 4 [AI2 Function Selection = Freq Ref/BIAS]*. • Current input – Set DIP Switch S1-2 on the drive to “I”. – Set *H3-09 = 2, 3 [AI2 Signal Level Select = 4 to 20 mA, 0 to 20 mA]*. – Set *H3-10 = 4 [AI2 Function Selection = Freq Ref/BIAS]*.
	27	When terminal AI3 is used for the frequency reference: • Voltage input – Set DIP Switch S4 on the drive to analog input side. – Set DIP Switch S1-3 on the drive to “V”. – Set *H3-05 = 0, 1 [AI3 Signal Level Select = 0 to 10V (Lower Limit at 0), -10 to +10V (Bipolar Reference)]*. – Set *H3-06 = 4 [AI3 Function Selection = Freq Ref/BIAS]*. • Current input – Set DIP Switch S4 on the drive to analog input side. – Set DIP Switch S1-3 on the drive to “I”. – Set *H3-05 = 2, 3 [AI3 Signal Level Select = 4 to 20 mA, 0 to 20 mA]*. – Set *H3-06 = 4 [AI3 Function Selection = Freq Ref/BIAS]*.
	28	Make sure that the frequency reference reaches the necessary minimum and maximum values. If drive operation is incorrect, make these adjustments: Gain adjustment: Set the maximum voltage and current values, then adjust the analog input gain until the frequency reference reaches the necessary value. (For terminal AI1 input: *H3-03*, for terminal AI2 input: *H3-11*, for terminal AI3 input: *H3-07*) Bias adjustment: Set the maximum voltage/current values, then adjust the analog input bias until the frequency reference reaches the necessary minimum value. (For terminal AI1 input: *H3-04*, for terminal AI2 input: *H3-12*, for terminal AI3 input: *H3-08*)

5

Standards Compliance

This chapter gives information about how to make the machines and devices that use this product comply with European standards and UL standards.

5.1 Safety Precautions

⚠DANGER

Electrical Shock Hazard

Electrical Shock Hazard. Do not examine, connect, or disconnect wiring on an energized drive. Before servicing, disconnect all power to the equipment and wait for the time specified on the warning label at a minimum. The internal capacitor stays charged after the drive is de-energized. The charge indicator LED extinguishes when the DC bus voltage decreases below 50 Vdc. When all indicators are OFF, measure for dangerous voltages to make sure that the drive is safe.

If you do work on the drive when it is energized, it will cause serious injury or death from electrical shock.

⚠WARNING

Electrical Shock Hazard

Do not operate equipment when covers are missing. Some figures in this section include drives without covers or safety shields to more clearly show the inside of the drive. Replace covers and shields before operation. Use drives only as specified by the instructions.

Failure to obey can cause death or serious injury.

Always ground the motor-side grounding terminal.

Contacting the motor case can cause death or serious injury from incorrect equipment grounding.

Do not remove covers or touch circuit boards while the drive is energized.

Failure to obey can cause death or serious injury.

Do not touch components while energized. Do not touch the output terminals directly with your hands. Also ensure that the output wiring do not come into contact with the drive case.

Failure to obey could cause death or serious injury.

Only let authorized persons install, wire, maintain, examine, replace parts, and repair the drive.

Failure to obey can cause death or serious injury.

Do not work on the drive or around the drive while wearing loose clothing or jewelry. Tighten loose clothing and remove all metal objects such as watches or rings.

Failure to obey can cause death or serious injury.

Do not make changes to the drive body or drive circuitry.

Failure to obey can cause death or serious injury and will void warranty. The manufacturer is not responsible for changes to the product made by the user.

Fire Hazard

Tighten all terminal screws to the correct tightening torque.

Connections that are too loose or too tight can cause incorrect operation and damage to the drive. Incorrect connections can also cause death or serious injury from fire.

Tighten screws against the bit at an angle in the specified range shown in this manual.

If you tighten the screws at an angle not in the specified range, you can have loose connections that can cause damage to the terminal block or start a fire.

Do not use the main circuit power supply (Overcurrent Category III) at incorrect voltages. Make sure that the drive rated voltage aligns with the power supply voltage before energizing the drive.

Failure to obey can cause death or serious injury.

Do not put flammable or combustible materials on top of the drive and do not install the drive near flammable or combustible materials. Attach the drive to metal or other noncombustible material.

Failure to obey can cause death or serious injury.

WARNING

Sudden Movement Hazard

Do not do work on the drive without eye protection. Wear eye protection before you start work on the drive.

Failure to obey could cause serious injury or death.

Electrical Shock Hazard

Do not immediately energize the drive or operate peripheral devices after the drive blows a fuse or trips an RCM/RCD. Wait for the time specified on the warning label at a minimum and make sure that all indicators are OFF. Then check the wiring and peripheral device ratings to find the cause of the problem. Contact the manufacturer before energizing the drive or peripheral devices if the cause is not known.

Failure to obey can cause death or serious injury and damage to the drive.

NOTICE

Observe correct electrostatic discharge (ESD) procedures when touching the drive and circuit boards.

Failure to obey can cause ESD damage to the drive circuitry.

Do not connect or disconnect the motor from the drive while the drive is supplying voltage.

Incorrect equipment sequencing can cause damage to the drive.

Do not use unshielded wire for control wiring. Use shielded twisted-pair wires and ground the shield to the ground terminal of the drive.

Failure to comply may cause electrical interference resulting in poor system performance.

Do not allow unqualified personnel to use the product. Before you connect a dynamic braking option to the drive, make sure that you review Braking Unit and Braking Resistor Unit Installation Manual TOBPC72060001.

Failure to obey can cause damage to the drive and braking circuit.

Do not change the drive circuitry.

Failure to obey can cause damage to the drive and will void warranty. The manufacturer is not responsible for modifications of the product made by the user.

Make sure that all connections are correct after you install the drive and connecting peripheral devices.

Failure to obey can cause damage to the drive.

5.2 European Standards

Figure 5.1 CE Mark

The CE Mark identifies that the product meets environmental and safety standards in the European Union. Products manufactured, sold, or imported in the European Union must display the CE Mark.

European Union standards include standards for electrical appliances (Low Voltage Directive), standards for electrical noise (EMC Directive), and standards for machinery (Machinery Directive).

This product displays the CE Mark in accordance with the Low Voltage Directive, the EMC Directive, and the Machinery Directive.

Table 5.1 Harmonized Standard

European Directive	Harmonized Standard
CE Low Voltage Directive Compliance 2014/35/EU	IEC/EN 61800-5-1:2007
EMC Directive 2014/30/EU	EN 61800-3 2004+A1:2012
Machinery Directive 2006/42/EC	• EN ISO 13849-1:2015 (Cat. 3, PL e) • IEC 62061/A1:2012 (SIL CL 3) • EN 62061/A1:2013 (SIL CL 3) • IEC/EN 61800-5-2:2007 (SIL3)

◆ EU Declaration of Conformity

EU Declaration of Conformity

YASKAWA

Translation – German | French | Italian | Spanish | Portuguese

EG-Konformitätserklärung | Déclaratione de conformiteé CE
Dichiarazione di conformità CE | Declaración de Conformidad de la CE
Declaração de Conformidade CE

YASKAWA Europe GmbH
Hauptstraße 185
65760 Eschborn

declares under sole responsibility conformity of the following products
erklärt in alleiniger Verantwortung die Konformität für folgende Produkte
déclare, sous sa seule responsabilité, que-les produits
dichiara sotto la propria esclusiva responsabilità la conformità dei seguenti prodotti
bajo su exclusiva responsabilidad la conformidad para los siguientes productos
declara, sob a sua exclusiva responsabilidade, a conformidade dos seguintes produtos

Model: CIPR-GA70 □ □ □□□ □ □ □ □ - □□□□□□
Q2A-□□□□□-□□□
(Where □ can be a letter from "A" to "Z" or a number from "0" to "9")

Directive of the European Parliament and Council
Richtlinie des Europäischen Parlamentes und Rates / Directive du Parlement européen et du Conseil
Direttiva del Parlamento europeo e del Consiglio / Directiva del Parlamento Europeo y del Consejo /
Diretiva do Parlamento Europeu e do Conselho

Low Voltage Directive (LVD) **: 2014/35/EU**
Niederspannungsrichtlinie / Directive Basse Tension
Direttiva sulla bassa tensione / Directiva de Baja Tensión / Diretiva "Baixa Tensão"

Electromagnetic Compatibility Directive (EMC) **: 2014/30/EU**
EMV-Richtlinie / Directive CEM
Direttiva EMC / Directiva sobre Compatibilidad Electromagnética / Diretiva CEM

Machine Directive (MD) **: 2006/42/EC**
Maschinenrichtlinie / Directive machines
Direttiva Macchine / Directiva de Máquinas / Directiva de máquinas

Restriction of the use of certain Hazardous Substances (RoHS) **: 2011/65/EU**
Beschränkung der Verwendung bestimmter gefährlicher Stoffe in Elektro- und Elektronikgeräten.
Relative à la limitation de l'utilisation de certaines substances dangereuses dans les équipements électriques et électroniques.
Sulla restrizione dell'uso di determinate sostanze pericolose nelle apparecchiature elettriche ed elettroniche.
Sobre restricciones a la utilización de determinadas sustancias peligrosas en aparatos eléctricos y electrónicos.
Relativa à restrição do uso de determinadas substâncias perigosas em equipamentos eléctricos e electrónicos.

Applied harmonized Standards:

EN 62061:2005/A2:2015 (SILCL3)	**EN 50581:2012**
EN ISO 13849-1:2015 (Cat.3, PL d)	**EN 61000-6-2:2005**
EN 61800-5-2:2007 (SIL3)	**EN 61000-6-4:2007/A1:2011**
EN 61800-5-1:2007	**EN 61800-3:2004/A1:2012**

Place / Date
Ort, Datum / Lieu et date / Luogo, data / Lugar, Fecha / Local, data

YASKAWA Europe GmbH
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65760 Eschborn

June 25th , 2018

i. V. [signature]

Senior Manager
European Technology Center
Drives Motion & Controls Division

Gunther Krei

Standards Compliance

5

EU Declaration of Conformity

Translation - Danish | Swedish | Finnish | Latvian | Estonian

YASKAWA

EF-overensstemmelseserklæring | EG-försäkran om överensstämmelse
EY-vaatimustenmukaisuusvakuutus | EK atbilstības deklarācija
EÜ vastavusdeklaratsioon

YASKAWA Europe GmbH
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declares under sole responsibility conformity of the following products
erklærer som eneste ansvarlig overensstemmelsen for følgende produkter
försäkrar på eget ansvar att följande produkter uppfyller kraven på överensstämmelse
vakuuttaa yksinomaisella vastuullaan seuraavien tuotteiden vaatimustenmukaisuuden
uz savu atbildību paziņo par tālāk minēto izstrādājumu atbilstību
deklareerib ainuvastutusel järgmiste toodete vastavust

Model: CIPR-GA70 □ □ □□□ □ □ □ □ - □□□□□□
Q2A-□□□□□-□□□
(Where □ can be a letter from "A" to "Z" or a number from "0" to "9")

Directive of the European Parliament and Council
Europa-Parlamentets og Rådets direktiv / EU-direktiv / Euroopan parlamentin ja neuvoston direktiivi
Eiropas Parlamenta un Padomes Direktīva / Euroopa Parlamendi ja nõukogu direktiiv

Low Voltage Directive (LVD) : 2014/35/EU
Lavspændingsdirektivet / Lågspänningsdirektivet / Pienjännitedirektiivi
Zemsprieguma direktīva / Madalpingedirektiiv

Electromagnetic Compatibility Directive (EMC) : 2014/30/EU
EMC-direktivet / EMC-direktivet / EMC-direktiivi
EMS direktīva / Elektromagnetilise ühilduvuse direktiiv

Machine Directive (MD) : 2006/42/EC
Maskindirektivet / Maskindirektivet / Konedirektiivi
Mašīnu direktīva / Masinadirektiiv

Restriction of the use of certain hazardous substances (RoHS) : 2011/65/EU
Om begrænsning af anvendelsen af visse farlige stoffer i elektrisk og elektronisk udstyr.
Om begränsning av användning av vissa farliga ämnen i elektrisk och elektronisk utrustning.
Tiettyjen vaarallisten aineiden käytön rajoittamisesta sähkö- ja elektroniikkalaitteissa.
Par dažu bīstamu vielu izmantošanas ierobežošanu elektriskās un elektroniskās iekārtās.
Dėl tam tikrų pavojingų medžiagų naudojimo elektros ir elektroninėje įrangoje apribojimo.

Applied harmonized Standards:

EN 62061:2005/A2:2015 (SILCL3)
EN ISO 13849-1:2015 (Cat.3, PL d)
EN 61800-5-2:2007 (SIL3)
EN 61800-5-1:2007
EN 50581:2012
EN 61000-6-2:2005
EN 61000-6-4:2007/A1:2011
EN 61800-3:2004/A1:2012

Place / Date
By, dato / Ort och datum / Paikka, pvm / Vieta, datums / Koht, kuupäev
YASKAWA Europe GmbH
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June 25th , 2018 i. V.

Senior Manager
European Technology Center
Drives Motion & Controls Division

Gunther Krei

EU Declaration of Conformity

Translation – Polish | Lithuanian | Czech | Slovak | Hungarian

YASKAWA

Deklaracja zgodności WE | EB atitikties deklaracija
ES Prohlášení o shodě | Vyhlásenie o zhode ES
EK megfelelőségi nyilatkozat

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declares under sole responsibility conformity of the following products
oświadcza z wyłączną odpowiedzialnością, że niżej wymienione wyroby są zgodne z odpowiednimi przepisami unijnymi
prisiimdama atsakomybę patvirtina toliau nurodytų gaminių atitiktį
Prohlašuje na svou výhradní odpovědnost shodu níže uvedených výrobků
potvrdzuje výlučnú zodpovednosť za zhodu pre nasledujúce výrobky
saját kizárólagos felelősségére kijelenti, hogy a következő termékek megfelelnek az alábbiakban megfogalmazott követelményeknek

Model: CIPR-GA70 □ □ □□□ □ □ □ □ - □□□□□□
Q2A-□□□□□-□□□
(Where □ can be a letter from "A" to "Z" or a number from "0" to "9")

Directive of the European Parliament and Council
Dyrektywa Parlamentu Europejskiego i Rady / Europos Parlamento ir Tarybos direktyva
Směrnice Evropského parlamentu a Rady / Smernice Európskeho parlamentu a Rady
Az Európai Parlament és az Európai Tanács irányelve

Low Voltage Directive (LVD) : 2014/35/EU
Dyrektywa dot. niskich napięć / Žemos įtampos direktyva
Směrnice o zařízeních nízkého napětí / Smernica o nízkom napätí
Kisfeszültségről szóló irányelv

Electromagnetic Compatibility Directive (EMC) : 2014/30/EU
Dyrektywa EMC / EMS direktyva / Směrnice o elektromagnetické kompatibilitě
Smernica EMC / Elektromágneses összeférhetőségről szóló irányelv

Machine Directive (MD) : 2006/42/EC
Dyrektywa w sprawie maszyn / Direktyva dėl mašinų
Směrnice o strojních zařízeních / Smernica o strojových zariadeniach / Gépekről szóló irányelv

Restriction of the use of certain hazardous substances (RoHS) : 2011/65/EU
W sprawie ograniczenia stosowania niektórych niebezpiecznych substancji w sprzęcie elektrycznym i elektronicznym.
Dėl tam tikrų pavojingų medžiagų naudojimo elektros ir elektroninėje įrangoje apribojimo.
O omezení používání některých nebezpečných látek v elektrických a elektronických zařízeních.
O obmedzení používania určitých nebezpečných látok v elektrických a elektronických zariadeniach.
Egyes veszélyes anyagok elektromos és elektronikus berendezésekben való alkalmazásának korlátozásáról.

Applied harmonized Standards:

EN 62061:2005/A2:2015 (SILCL3)	EN 50581:2012
EN ISO 13849-1:2015 (Cat.3, PL d)	EN 61000-6-2:2005
EN 61800-5-2:2007 (SIL3)	EN 61000-6-4:2007/A1:2011
EN 61800-5-1:2007	EN 61800-3:2004/A1:2012

Place / Date
Miejscowość, data / Vieta, data / Místo, datum / Miesto, dátum / Hely, dátum
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June 25th , 2018

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Drives Motion & Controls Division

Gunther Krei

EU Declaration of Conformity

YASKAWA

Translation – Dutch | Irish | Greek | Bulgarian | Romanian

EG-conformiteitsverklaring | Dearbhú Comhréireachta AE
Δήλωση Συμμόρφωσης ΕΚ | ЕО-Декларация за съответствие
Declaraţie de conformitate CE

YASKAWA Europe GmbH
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65760 Eschborn

declares under sole responsibility conformity of the following products
verklaart onder eigen verantwoordelijkheid de conformiteit van de volgende producten
a dhearbhaíonn faoi fhreagracht aonair comhréireacht na dtáirgí seo a leanas
επιβεβαιώνει, με αποκλειστική του ευθύνη, τη συμμόρφωση των ακόλουθων προϊόντων
декларира на собствена отговорност съответствието на следния продукт
declară pe răspunderea sa exclusivă conformitatea următoarelor produse

Model: CIPR-GA70 □ □ □□□ □ □ □ □ - □□□□□□
Q2A-□□□□□-□□□
(Where □ can be a letter from "A" to "Z" or a number from "0" to "9")

Directive of the European Parliament and Council
Richtlijn van het Europese Parlement en de Europese Raad
Treoir ó Pharlaimint na hEorpa agus ón gComhairle / Οδηγία του Ευρωπαϊκού Κοινοβουλίου και του Συμβουλίου
Директива на Европейския парламент и Съвета / Directiva Parlamentului European şi a Consiliului

Low Voltage Directive (LVD) : 2014/35/EU
Laagspanningsrichtlijn / Treoir maidir le hÍsealvoltas
Οδηγία για τη χαμηλή τάση / Директивата за ниско напрежение
Directive voltaj scăzut

Electromagnetic Compatibility Directive (EMC) : 2014/30/EU
EMC-richtlijn / Treoir maidir le Comhoiriúnacht Leictreamaighnéadach
Οδηγία ηλεκτρομαγνητικής συμβατότητας (EMC) / Директива за електромагнитна съвместимост
Directive CEM

Machine Directive (MD) : 2006/42/EC
Machinerichtlijn / Treoir maidir le hInnill (MD)
Οδηγία για τα μηχανήματα / Директива Машини (ДМ) / Directive maşinărie

A Restriction of the use of certain hazardous substances (RoHS) : 2011/65/EU
Betreffende beperking van het gebruik van bepaalde gevaarlijke stoffen in elektrische en elektronische apparatuur.
για τον περιορισμό της χρήσης ορισμένων επικίνδυνων ουσιών σε ηλεκτρικό και ηλεκτρονικό εξοπλισμό.
относно ограничението за употребата на определени опасни вещества в електрическото и електронното оборудване.
Privind restricţiile de utilizare a anumitor substanţe periculoase în echipamentele electrice şi electronice.

Applied harmonized Standards:

EN 62061:2005/A2:2015 (SILCL3)	EN 50581:2012
EN ISO 13849-1:2015 (Cat.3, PL d)	EN 61000-6-2:2005
EN 61800-5-2:2007 (SIL3)	EN 61000-6-4:2007/A1:2011
EN 61800-5-1:2007	EN 61800-3:2004/A1:2012

Place / Date
Plaats, Datum / Áit, Dáta / Τόπος, ημερομηνία / Място, Дата / Locul, data
YASKAWA Europe GmbH
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65760 Eschborn

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EU Declaration of Conformity

YASKAWA

Translation - Croatian | Slovene | Maltese

EZ Izjava o sukladnosti | Deklaracija o skladnosti ES
Dikjarazzjoni tal-KE dwar il-Konformità

YASKAWA Europe GmbH
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65760 Eschborn

declares under sole responsibility conformity of the following products
pod isključivom odgovornošću izjavljuje sukladnost sljedećih proizvoda
na lastno odgovornost potrjuje skladnost naslednjih izdelkov
tiddikjara taħt ir-responsabbiltà unika tagħha l-konformità tal-prodotti li ġejjin

Model: CIPR-GA70 □ □ □□□ □ □ □ □ - □□□□□□
Q2A-□□□□□-□□□
(Where □ can be a letter from "A" to "Z" or a number from "0" to "9")

Directive of the European Parliament and Council
Direktiva Europskog parlamenta i Vijeća / Direktiva Evropskega parlamenta in Sveta
Eiropas Parlamenta un Padomes Direktīva / Euroopa Parlamendi ja nõukogu direktiiv
Direttiva tal-Parlament Ewropew u tal-Kunsill

Low Voltage Directive (LVD) : 2014/35/EU
Direktiva o niskom naponu / Nizkonapetostna direktiva
Direttiva dwar il-Voltaġġ Baxx

Electromagnetic Compatibility Directive (EMC) : 2014/30/EU
Direktiva o elektromagnetskoj kompatibilnosti (EMC) / EMC direktiva
Direttiva dwar l-EMC

Machine Directive (MD) : 2006/42/EC
Direktiva o strojevima / Direktiva o strojih
Direttiva dwar il-Makkinarju (MD)

Restriction of the use of certain hazardous substances (RoHS) : 2011/65/EU
O ograničenju uporabe određenih opasnih tvari u električnoj i elektroničkoj opremi.
O omejevanju uporabe nekaterih nevarnih snovi v električni in elektronski opremi.
Dwar ir-restrizzjoni tal-użu ta' ċerti sustanzi perikolużi fit-tagħmir elettriku u elettroniku.

Applied harmonized Standards:

EN 62061:2005/A2:2015 (SILCL3)
EN ISO 13849-1:2015 (Cat.3, PL d)
EN 61800-5-2:2007 (SIL3)
EN 61800-5-1:2007
EN 50581:2012
EN 61000-6-2:2005
EN 61000-6-4:2007/A1:2011
EN 61800-3:2004/A1:2012

Place / Date
Mjesto, datum / Kraj, datum / Post, Data

YASKAWA Europe GmbH
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65760 Eschborn

June 25th , 2018

i.V.

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European Technology Center
Drives Motion & Controls Division

Gunther Krei

◆ CE Low Voltage Directive Compliance

This product is tested according to IEC/EN 61800-5-1:2007 and complies with the CE Low Voltage Directive. The following conditions must be satisfied for machines and devices incorporating this product to comply with the CE Low Voltage Directive.

■ Area of Use

Install this product in a location with overvoltage category III and pollution degree 2 or less. These standards are defined by IEC/EN 60664.

■ Guarding against Debris

When installing IP20 enclosure drives, use an enclosure that does not let unwanted material enter the drive from above or below.

■ Wiring Diagram

Example of a drive that is wired to comply with the CE Low Voltage Directive.

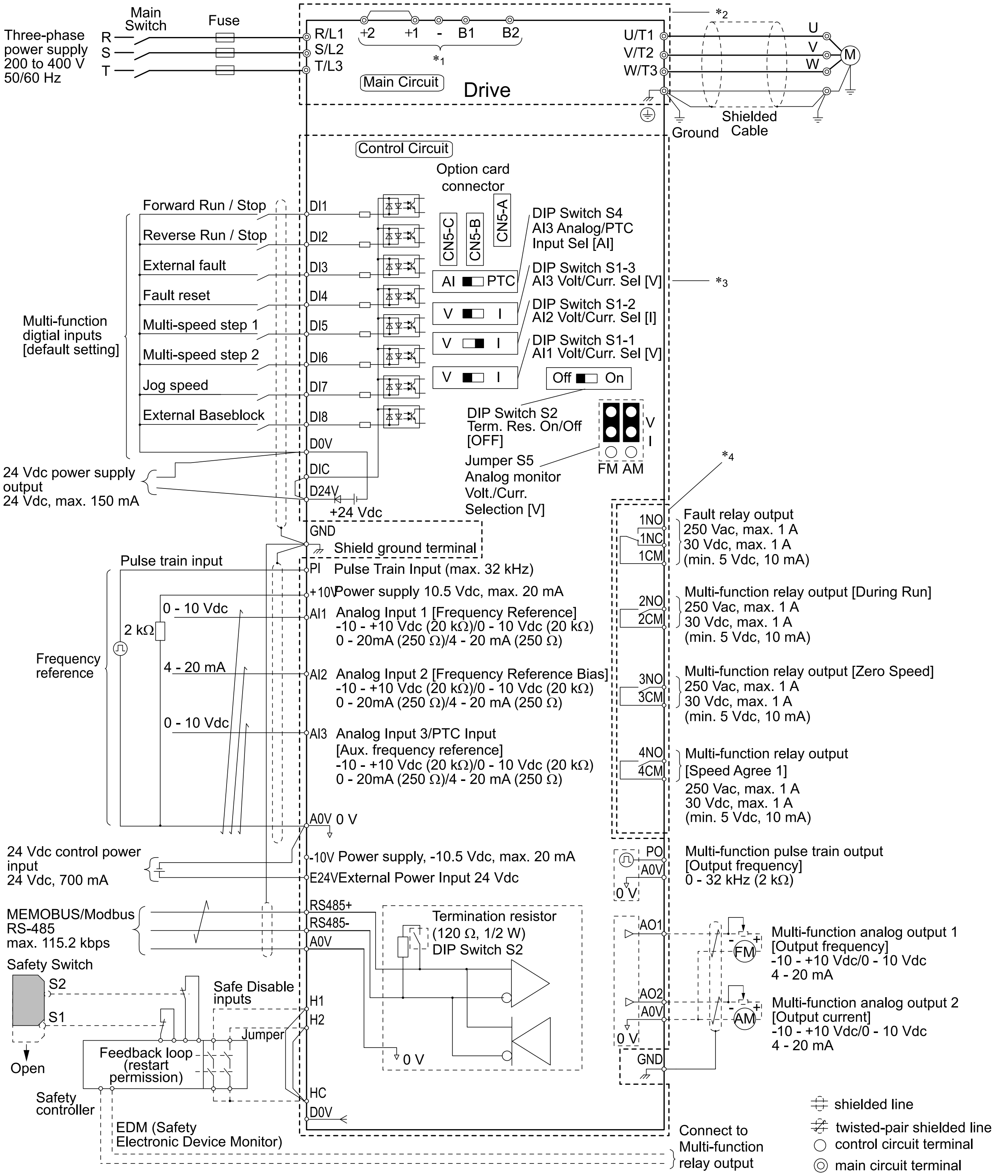


Figure 5.2 Wiring Diagram for CE Low Voltage Directive Compliance

*1 Connect peripheral options to terminals -, +1, +2, B1, and B2.

WARNING! *Electrical Shock Hazard. Use terminals -, +1, +2, B1, and B2 to connect options to the drive. Do not connect an AC power supply lines to these terminals. Failure to obey can cause death or serious injury.*

*2 For circuit protection, the main circuit is separated from the surface case that can touch the main circuit.

*3 The control circuit is a Safety Extra-Low Voltage circuit. Separate this circuit from other circuits with reinforced insulation. Make sure that the Safety Extra-Low Voltage circuit is connected as specified.

*4 Reinforced insulation separates the output terminals from other circuits. Users can also connect circuits that are not Safety Extra-Low Voltage circuits if the drive output is 250 Vac 1 A max. or 30 Vdc 1 A maximum.

■ Wire Gauges and Tightening Torques

WARNING! *Electrical Shock Hazard. Only connect peripheral options, for example a DC reactor or braking resistor, to terminals +1, +2, +3, -, B1, and B2. Failure to obey can cause death or serious injury.*

Refer to *Wire Gauges and Tightening Torques on page 77*for general conditions
Select the correct wires for main circuit wiring.

Three-Phase 200 V Class

Model	Terminal	Recommended Gauge mm²	Applicable Gauge (IP20 Applicable Gauge *1) mm²	Wire Stripping Length *2 mm	Terminal Screw		Tightening Torque N·m (in·lb)
					Size	Shape	
2004	R/L1, S/L2, T/L3	2.5	2.5 - 10 (2.5 - 10)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	U/T1, V/T2, W/T3	2.5	2.5 - 10 (2.5 - 10)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	-, +1, +2	2.5	2.5 - 16 (2.5 - 16)	18	M5	Slotted (-)	2.3 - 2.5 (19.8 - 22) *3
	B1, B2	2.5	2.5 - 4 (2.5 - 4)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	⏚	2.5 *4	2.5 - 10 (-)	-	M4	Phillips/slotted combo	1.2 - 1.5 (10.6 - 13.3)
2006	R/L1, S/L2, T/L3	2.5	2.5 - 10 (2.5 - 10)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	U/T1, V/T2, W/T3	2.5	2.5 - 10 (2.5 - 10)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	-, +1, +2	2.5	2.5 - 16 (2.5 - 16)	18	M5	Slotted (-)	2.3 - 2.5 (19.8 - 22) *3
	B1, B2	2.5	2.5 - 4 (2.5 - 4)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	⏚	2.5 *4	2.5 - 10 (-)	-	M4	Phillips/slotted combo	1.2 - 1.5 (10.6 - 13.3)
2010	R/L1, S/L2, T/L3	2.5	2.5 - 10 (2.5 - 10)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	U/T1, V/T2, W/T3	2.5	2.5 - 10 (2.5 - 10)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	-, +1, +2	2.5	2.5 - 16 (2.5 - 16)	18	M5	Slotted (-)	2.3 - 2.5 (19.8 - 22) *3
	B1, B2	2.5	2.5 - 4 (2.5 - 4)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	⏚	2.5 *4	2.5 - 10 (-)	-	M4	Phillips/slotted combo	1.2 - 1.5 (10.6 - 13.3)
2012	R/L1, S/L2, T/L3	2.5	2.5 - 10 (2.5 - 10)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	U/T1, V/T2, W/T3	2.5	2.5 - 10 (2.5 - 10)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	-, +1, +2	2.5	2.5 - 16 (2.5 - 16)	18	M5	Slotted (-)	2.3 - 2.5 (19.8 - 22) *3
	B1, B2	2.5	2.5 - 4 (2.5 - 4)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	⏚	2.5 *4	2.5 - 10 (-)	-	M4	Phillips/slotted combo	1.2 - 1.5 (10.6 - 13.3)
2018	R/L1, S/L2, T/L3	2.5	2.5 - 10 (2.5 - 10)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	U/T1, V/T2, W/T3	2.5	2.5 - 10 (2.5 - 10)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	-, +1, +2	4	2.5 - 16 (2.5 - 16)	18	M5	Slotted (-)	2.3 - 2.5 (19.8 - 22) *3
	B1, B2	2.5	2.5 - 4 (2.5 - 4)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	⏚	2.5 *4	2.5 - 10 (-)	-	M4	Phillips/slotted combo	1.2 - 1.5 (10.6 - 13.3)

Model	Terminal	Recommended Gauge mm²	Applicable Gauge (IP20 Applicable Gauge *1) mm²	Wire Stripping Length *2 mm	Terminal Screw		Tightening Torque N·m (in·lb)
					Size	Shape	
2021	R/L1, S/L2, T/L3	6	2.5 - 10 (2.5 - 10)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	U/T1, V/T2, W/T3	2.5	2.5 - 10 (2.5 - 10)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	-, +1, +2	6	2.5 - 16 (2.5 - 16)	18	M5	Slotted (-)	2.3 - 2.5 (19.8 - 22) *3
	B1, B2	2.5	2.5 - 4 (2.5 - 4)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	⏚	6 *4	4 - 10 (-)	-	M4	Phillips/slotted combo	1.2 - 1.5 (10.6 - 13.3)
2030	R/L1, S/L2, T/L3	10	2.5 - 10 (2.5 - 10)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	U/T1, V/T2, W/T3	6	2.5 - 10 (2.5 - 10)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	-, +1, +2	10	2.5 - 16 (2.5 - 16)	18	M5	Slotted (-)	2.3 - 2.5 (19.8 - 22) *3
	B1, B2	2.5	2.5 - 4 (2.5 - 4)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	⏚	10	6 - 10 (-)	-	M5	Phillips/slotted combo	2.0 - 2.5 (17.7 - 22.1)
2042	R/L1, S/L2, T/L3	10	2.5 - 10 (2.5 - 10)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	U/T1, V/T2, W/T3	10	2.5 - 10 (2.5 - 10)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	-, +1, +2	16	2.5 - 16 (2.5 - 16)	18	M5	Slotted (-)	2.3 - 2.5 (19.8 - 22) *3
	B1, B2	4	2.5 - 4 (2.5 - 4)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	⏚	10	6 - 10 (-)	-	M5	Phillips/slotted combo	2.0 - 2.5 (17.7 - 22.1)
2056	R/L1, S/L2, T/L3	25	2.5 - 25 (10 - 25)	18	M5	Slotted (-)	2.3 - 2.5 (19.8 - 22) *3
	U/T1, V/T2, W/T3	16	2.5 - 16 (6 - 16)	18	M5	Slotted (-)	2.3 - 2.5 (19.8 - 22) *3
	-, +1, +2	35	2.5 - 35 (10 - 35)	20	M6	Hex socket cap (WAF: 5 mm)	5 - 5.5 (45 - 49)
	B1, B2	10	2.5 - 10 (2.5 - 10)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	⏚	16	10 - 16 (-)	-	M6	Phillips/slotted combo	5.4 - 6.0 (47.8 - 53.1)
2070	R/L1, S/L2, T/L3	35	2.5 - 35 (25 - 35)	20	M6	Hex socket cap (WAF: 5 mm)	5 - 5.5 (45 - 49)
	U/T1, V/T2, W/T3	16	2.5 - 16 (16)	20	M6	Hex socket cap (WAF: 5 mm)	5 - 5.5 (45 - 49)
	-, +1, +2	50	2.5 - 50 (35 - 50)	20	M6	Hex socket cap (WAF: 5 mm)	5 - 5.5 (45 - 49)
	B1, B2	10	2.5 - 10 (2.5 - 10)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	⏚	16	16 - 25 (-)	-	M6	Phillips/slotted combo	5.4 - 6.0 (47.8 - 53.1)

Model	Terminal	Recommended Gauge mm²	Applicable Gauge (IP20 Applicable Gauge *1) mm²	Wire Stripping Length *2 mm	Terminal Screw		Tightening Torque N·m (in·lb)
					Size	Shape	
2082	R/L1, S/L2, T/L3	35	2.5 - 35 (25 - 35)	20	M6	Hex socket cap (WAF: 5 mm)	5 - 5.5 (45 - 49)
	U/T1, V/T2, W/T3	25	2.5 - 25 (16 - 25)	20	M6	Hex socket cap (WAF: 5 mm)	5 - 5.5 (45 - 49)
	-, +1, +2	50	2.5 - 50 (35 - 50)	20	M6	Hex socket cap (WAF: 5 mm)	5 - 5.5 (45 - 49)
	B1, B2	16	2.5 - 16 (2.5 - 16)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	⏚	16	16 - 25 (-)	-	M6	Phillips/slotted combo	5.4 - 6.0 (47.8 - 53.1)
2110	R/L1, S/L2, T/L3	35	16 - 35 (25 - 35)	27	M6	Hex socket cap (WAF: 5 mm)	8 - 9 (71 - 80)
	U/T1, V/T2, W/T3	35	16 - 35 (25 - 35)	27	M6	Hex socket cap (WAF: 5 mm)	8 - 9 (71 - 80)
	-, +1	50	25 - 50 (25 - 50)	27	M8	Hex socket cap (WAF: 6 mm)	10 - 12 (89 - 107)
	B1, B2	25	6 - 25 (6 - 25)	21	M6	Minus (-)	3 - 3.5 (27 - 31)
	⏚	16	16 - 25 (-)	-	M6	Hex bolt (+)	5.4 - 6.0 (47.8 - 53.1)
2138	R/L1, S/L2, T/L3	50	16 - 50 (50)	27	M6	Hex socket cap (WAF: 5 mm)	8 - 9 (71 - 80)
	U/T1, V/T2, W/T3	50	16 - 50 (50)	27	M6	Hex socket cap (WAF: 5 mm)	8 - 9 (71 - 80)
	-, +1	70	25 - 70 (50 - 70)	27	M8	Hex socket cap (WAF: 6 mm)	10 - 12 (89 - 107)
	B1, B2	35	6 - 35 (6 - 35)	21	M6	Minus (-)	3 - 3.5 (27 - 31)
	⏚	25	25 (-)	-	M6	Hex bolt (+)	5.4 - 6.0 (47.8 - 53.1)
2169	R/L1, S/L2, T/L3	70	50 - 95 (95)	37	M10	Hex socket cap (WAF: 8 mm)	12 - 14 (107 - 124)
	U/T1, V/T2, W/T3	70	50 - 95 (95)	37	M10	Hex socket cap (WAF: 8 mm)	12 - 14 (107 - 124)
	-, -, +1, +1 *5 *6	35	16 - 50 (50)	28	M6	Hex socket cap (WAF: 5 mm)	8 - 9 (71 - 80)
	+3 *6	50	25 - 70 (50 - 70)	28	M8	Hex socket cap (WAF: 6 mm)	8 - 9 (71 - 80)
	⏚	35	25 - 50 (-)	-	M8	Hex bolt (slotted)	9.0 - 11 (79.7 - 97.4)
2211	R/L1, S/L2, T/L3	95	50 - 95 (95)	37	M10	Hex socket cap (WAF: 8 mm)	12 - 14 (107 - 124)
	U/T1, V/T2, W/T3	95	50 - 95 (95)	37	M10	Hex socket cap (WAF: 8 mm)	12 - 14 (107 - 124)
	-, -, +1, +1 *5 *6	50	16 - 50 (50)	28	M6	Hex socket cap (WAF: 5 mm)	8 - 9 (71 - 80)
	+3 *6	70	25 - 70 (50 - 70)	28	M8	Hex socket cap (WAF: 6 mm)	8 - 9 (71 - 80)
	⏚	50	25 - 50 (-)	-	M8	Hex bolt (slotted)	9.0 - 11 (79.7 - 97.4)

Model	Terminal	Recommended Gauge mm²	Applicable Gauge (IP20 Applicable Gauge *1) mm²	Wire Stripping Length *2 mm	Terminal Screw		Tightening Torque N·m (in·lb)
					Size	Shape	
2257	R/L1, S/L2, T/L3	50 × 2P	25 - 95 × 2P (70 - 95 × 2P)	-	M10	Hex self-locking nut	20 (177)
	U/T1, V/T2, W/T3	50 × 2P	25 - 95 × 2P (70 - 95 × 2P)	-	M10	Hex self-locking nut	20 (177)
	-, +1	70 × 2P	35 - 120 × 2P (120 × 2P)	-	M10	Hex self-locking nut	20 (177)
	+3	35 × 2P	25 - 70 × 2P (70 × 2P)	-	M10	Hex self-locking nut	20 (177)
	⏚	95	95 - 240 (-)	-	M10	Hex bolt (slotted)	18 - 23 (159 - 204)
2313	R/L1, S/L2, T/L3	70 × 2P	25 - 95 × 2P (70 - 95 × 2P)	-	M10	Hex self-locking nut	20 (177)
	U/T1, V/T2, W/T3	70 × 2P	25 - 95 × 2P (70 - 95 × 2P)	-	M10	Hex self-locking nut	20 (177)
	-, +1	95 × 2P	35 - 120 × 2P (120 × 2P)	-	M10	Hex self-locking nut	20 (177)
	+3	50 × 2P	25 - 70 × 2P (70 × 2P)	-	M10	Hex self-locking nut	20 (177)
	⏚	95	95 - 240 (-)	-	M10	Hex bolt (slotted)	18 - 23 (159 - 204)
2360	R/L1, S/L2, T/L3	120 × 2P	70 - 150 × 2P (150 × 2P)	-	M12	Hex self-locking nut	35 (310)
	U/T1, V/T2, W/T3	120 × 2P	70 - 150 × 2P (150 × 2P)	-	M12	Hex self-locking nut	35 (310)
	-, +1	120 × 2P	95 - 185 × 2P (185 × 2P)	-	M12	Hex self-locking nut	35 (310)
	+3	70 × 2P	50 - 95 × 2P (-)	-	M12	Hex self-locking nut	35 (310)
	⏚	120	120 - 240 (-)	-	M12	Hex bolt (slotted)	32 - 40 (283 - 354)
2415	R/L1, S/L2, T/L3	120 × 2P	70 - 150 × 2P (150 × 2P)	-	M12	Hex self-locking nut	35 (310)
	U/T1, V/T2, W/T3	120 × 2P	70 - 150 × 2P (150 × 2P)	-	M12	Hex self-locking nut	35 (310)
	-, +1	120 × 2P	95 - 185 × 2P (185 × 2P)	-	M12	Hex self-locking nut	35 (310)
	+3	70 × 2P	50 - 95 × 2P (-)	-	M12	Hex self-locking nut	35 (310)
	⏚	120	120 - 240 (-)	-	M12	Hex bolt (slotted)	32 - 40 (283 - 354)

*1 For IP20 protection, use wires that are in the range of applicable gauges.
*2 Remove insulation from the ends of wires to expose the length of wire shown.
*3 For wire gauges more than 30 mm², tighten to a tightening torque of 4.1 N·m to 4.5 N·m (36 in·lb to 40 in·lb).
*4 Install an RCM/RCD with this wire gauge to maintain compliance with IEC/EN 61800-5-1:2007.
*5 Terminals - and +1 have two screws. The Recommended Gauge is the wire gauge for one terminal.
*6 A junction terminal is necessary to connect a braking unit (CDBR-series) to terminals - and +3.

Three-Phase 400 V Class

Model	Terminals	Recommended Gauge mm²	Applicable Gauge (IP20 Applicable Gauge *1) mm²	Wire Stripping Length *2 mm	Terminal Screw		Tightening Torque N·m (lb.·in.)
					Size	Shape	
4002	R/L1, S/L2, T/L3	2.5	2.5 - 10 (2.5 - 10)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	U/T1, V/T2, W/T3	2.5	2.5 - 10 (2.5 - 10)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	-, +1, +2	2.5	2.5 - 16 (2.5 - 16)	18	M5	Slotted (-)	2.3 - 2.5 (19.8 - 22) *3
	B1, B2	2.5	2.5 - 4 (2.5 - 4)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	⏚	2.5 *4	2.5 - 10 (-)	-	M4	Phillips/slotted combo	1.2 - 1.5 (10.6 - 13.3)
4004	R/L1, S/L2, T/L3	2.5	2.5 - 10 (2.5 - 10)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	U/T1, V/T2, W/T3	2.5	2.5 - 10 (2.5 - 10)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	-, +1, +2	2.5	2.5 - 16 (2.5 - 16)	18	M5	Slotted (-)	2.3 - 2.5 (19.8 - 22) *3
	B1, B2	2.5	2.5 - 4 (2.5 - 4)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	⏚	2.5 *4	2.5 - 10 (-)	-	M4	Phillips/slotted combo	1.2 - 1.5 (10.6 - 13.3)
4005	R/L1, S/L2, T/L3	2.5	2.5 - 10 (2.5 - 10)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	U/T1, V/T2, W/T3	2.5	2.5 - 10 (2.5 - 10)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	-, +1, +2	2.5	2.5 - 16 (2.5 - 16)	18	M5	Slotted (-)	2.3 - 2.5 (19.8 - 22) *3
	B1, B2	2.5	2.5 - 4 (2.5 - 4)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	⏚	2.5 *4	2.5 - 10 (-)	-	M4	Phillips/slotted combo	1.2 - 1.5 (10.6 - 13.3)
4007	R/L1, S/L2, T/L3	2.5	2.5 - 10 (2.5 - 10)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	U/T1, V/T2, W/T3	2.5	2.5 - 10 (2.5 - 10)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	-, +1, +2	2.5	2.5 - 16 (2.5 - 16)	18	M5	Slotted (-)	2.3 - 2.5 (19.8 - 22) *3
	B1, B2	2.5	2.5 - 4 (2.5 - 4)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	⏚	2.5 *4	2.5 - 10 (-)	-	M4	Phillips/slotted combo	1.2 - 1.5 (10.6 - 13.3)
4009	R/L1, S/L2, T/L3	2.5	2.5 - 10 (2.5 - 10)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	U/T1, V/T2, W/T3	2.5	2.5 - 10 (2.5 - 10)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	-, +1, +2	2.5	2.5 - 16 (2.5 - 16)	18	M5	Slotted (-)	2.3 - 2.5 (19.8 - 22) *3
	B1, B2	2.5	2.5 - 4 (2.5 - 4)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	⏚	2.5 *4	2.5 - 10 (-)	-	M4	Phillips/slotted combo	1.2 - 1.5 (10.6 - 13.3)

Model	Terminals	Recommended Gauge mm²	Applicable Gauge (IP20 Applicable Gauge *1) mm²	Wire Stripping Length *2 mm	Terminal Screw		Tightening Torque N·m (lb.·in.)
					Size	Shape	
4012	R/L1, S/L2, T/L3	2.5	2.5 - 10 (2.5 - 10)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	U/T1, V/T2, W/T3	2.5	2.5 - 10 (2.5 - 10)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	-, +1, +2	2.5	2.5 - 16 (2.5 - 16)	18	M5	Slotted (-)	2.3 - 2.5 (19.8 - 22) *3
	B1, B2	2.5	2.5 - 4 (2.5 - 4)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	⏚	2.5 *4	2.5 - 10 (-)	-	M4	Phillips/slotted combo	1.2 - 1.5 (10.6 - 13.3)
4018	R/L1, S/L2, T/L3	2.5	2.5 - 10 (2.5 - 10)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	U/T1, V/T2, W/T3	2.5	2.5 - 10 (2.5 - 10)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	-, +1, +2	4	2.5 - 16 (2.5 - 16)	18	M5	Slotted (-)	2.3 - 2.5 (19.8 - 22) *3
	B1, B2	2.5	2.5 - 4 (2.5 - 4)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	⏚	2.5 *4	2.5 - 10 (-)	-	M5	Phillips/slotted combo	2.0 - 2.5 (17.7 - 22.1)
4023	R/L1, S/L2, T/L3	6	2.5 - 10 (2.5 - 10)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	U/T1, V/T2, W/T3	4	2.5 - 10 (2.5 - 10)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	-, +1, +2	6	2.5 - 16 (2.5 - 16)	18	M5	Slotted (-)	2.3 - 2.5 (19.8 - 22) *3
	B1, B2	2.5	2.5 - 4 (2.5 - 4)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	⏚	6 *4	4 - 10 (-)	-	M5	Phillips/slotted combo	2.0 - 2.5 (17.7 - 22.1)
4031	R/L1, S/L2, T/L3	10	2.5 - 25 (10 - 25)	18	M5	Slotted (-)	2.3 - 2.5 (19.8 - 22) *3
	U/T1, V/T2, W/T3	6	2.5 - 16 (6 - 16)	18	M5	Slotted (-)	2.3 - 2.5 (19.8 - 22) *3
	-, +1, +2	10	2.5 - 35 (10 - 35)	20	M6	Hex socket cap (WAF: 5 mm)	5 - 5.5 (45 - 49)
	B1, B2	2.5	2.5 - 10 (2.5 - 10)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	⏚	10	6 - 16 (-)	-	M6	Phillips/slotted combo	5.4 - 6.0 (47.8 - 53.1)
4038	R/L1, S/L2, T/L3	10	2.5 - 25 (10 - 25)	18	M5	Slotted (-)	2.3 - 2.5 (19.8 - 22) *3
	U/T1, V/T2, W/T3	6	2.5 - 16 (6 - 16)	18	M5	Slotted (-)	2.3 - 2.5 (19.8 - 22) *3
	-, +1, +2	16	2.5 - 35 (10 - 35)	20	M6	Hex socket cap (WAF: 5 mm)	5 - 5.5 (45 - 49)
	B1, B2	4	2.5 - 10 (2.5 - 10)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	⏚	10	6 - 16 (-)	-	M6	Phillips/slotted combo	5.4 - 6.0 (47.8 - 53.1)

Model	Terminals	Recommended Gauge mm²	Applicable Gauge (IP20 Applicable Gauge *1) mm²	Wire Stripping Length *2 mm	Terminal Screw Size	Terminal Screw Shape	Tightening Torque N·m (lb.·in.)
4044	R/L1, S/L2, T/L3	16	2.5 - 16 (4 - 16)	18	M5	Slotted (-)	2.3 - 2.5 (19.8 - 22) *3
	U/T1, V/T2, W/T3	10	2.5 - 10 (6 - 10)	18	M5	Slotted (-)	2.3 - 2.5 (19.8 - 22) *3
	-, +1, +2	25	2.5 - 25 (6 - 25)	18	M5	Slotted (-)	2.3 - 2.5 (19.8 - 22) *3
	B1, B2	6	2.5 - 6 (2.5 - 6)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	⏚	16	10 - 25 (-)	-	M6	Phillips/slotted combo	5.4 - 6.0 (47.8 - 53.1)
4060	R/L1, S/L2, T/L3	16	2.5 - 16 (4 - 16)	18	M5	Slotted (-)	2.3 - 2.5 (19.8 - 22) *3
	U/T1, V/T2, W/T3	16	2.5 - 16 (6 - 16)	18	M5	Slotted (-)	2.3 - 2.5 (19.8 - 22) *3
	-, +1	25	2.5 - 25 (6 - 25)	18	M5	Slotted (-)	2.3 - 2.5 (19.8 - 22) *3
	B1, B2	10	2.5 - 10 (2.5 - 10)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	⏚	16	10 - 25 (-)	-	M6	Phillips/slotted combo	5.4 - 6.0 (47.8 - 53.1)
4075	R/L1, S/L2, T/L3	25	2.5 - 25 (2.5 - 25)	18	M5	Slotted (-)	2.3 - 2.5 (19.8 - 22) *3
	U/T1, V/T2, W/T3	25	2.5 - 25 (2.5 - 25)	18	M5	Slotted (-)	2.3 - 2.5 (19.8 - 22) *3
	-, +1	25	2.5 - 25 (4 - 25)	18	M5	Slotted (-)	2.3 - 2.5 (19.8 - 22) *3
	B1, B2	10	2.5 - 10 (2.5 - 10)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	⏚	16	16 - 25 (-)	-	M6	Hex bolt (+)	5.4 - 6.0 (47.8 - 53.1)
4089	R/L1, S/L2, T/L3	25	2.5 - 25 (10 - 25)	18	M5	Slotted (-)	2.3 - 2.5 (19.8 - 22) *3
	U/T1, V/T2, W/T3	25	2.5 - 25 (10 - 25)	18	M5	Slotted (-)	2.3 - 2.5 (19.8 - 22) *3
	-, +1	35	2.5 - 35 (16 - 35)	20	M6	Hex socket cap (WAF: 5 mm)	5 - 5.5 (45 - 49)
	B1, B2	16	2.5 - 16 (4 - 16)	18	M5	Slotted (-)	2.3 - 2.5 (19.8 - 22) *3
	⏚	16	16 - 25 (-)	-	M6	Hex bolt (+)	5.4 - 6.0 (47.8 - 53.1)
4103	R/L1, S/L2, T/L3	35	16 - 50 (50)	27	M6	Hex socket cap (WAF: 5 mm)	8 - 9 (71 - 80)
	U/T1, V/T2, W/T3	35	16 - 50 (50)	27	M6	Hex socket cap (WAF: 5 mm)	8 - 9 (71 - 80)
	-, +1	50	25 - 70 (50 - 70)	27	M8	Hex socket cap (WAF: 6 mm)	10 - 12 (89 - 107)
	B1, B2	25	6 - 35 (6 - 35)	21	M6	Minus (-)	3 - 3.5 (27 - 31)
	⏚	16	16 - 25 (-)	-	M6	Hex bolt (+)	5.4 - 6.0 (47.8 - 53.1)

Model	Terminals	Recommended Gauge mm²	Applicable Gauge (IP20 Applicable Gauge *1) mm²	Wire Stripping Length *2 mm	Terminal Screw		Tightening Torque N·m (lb.·in.)
					Size	Shape	
4140	R/L1, S/L2, T/L3	50	50 - 95 (95)	37	M10	Hex socket cap (WAF: 8 mm)	12 - 14 (107 - 124)
	U/T1, V/T2, W/T3	50	50 - 95 (95)	37	M10	Hex socket cap (WAF: 8 mm)	12 - 14 (107 - 124)
	-, -, +1, +1 *5	25	16 - 50 (50)	28	M6	Hex socket cap (WAF: 5 mm)	8 - 9 (71 - 80)
	B1, B2 *6	50	25 - 70 (50 - 70)	28	M8	Hex socket cap (WAF: 6 mm)	8 - 9 (71 - 80)
	⏚	25	25 - 50 (-)	-	M8	Hex bolt (slotted)	9.0 - 11 (79.7 - 97.4)
4168	R/L1, S/L2, T/L3	70	50 - 95 (95)	37	M10	Hex socket cap (WAF: 8 mm)	12 - 14 (107 - 124)
	U/T1, V/T2, W/T3	70	50 - 95 (95)	37	M10	Hex socket cap (WAF: 8 mm)	12 - 14 (107 - 124)
	-, -, +1, +1 *5	35	16 - 50 (50)	28	M6	Hex socket cap (WAF: 5 mm)	8 - 9 (71 - 80)
	B1, B2 *6	50	25 - 70 (50 - 70)	28	M8	Hex socket cap (WAF: 6 mm)	8 - 9 (71 - 80)
	⏚	35	25 - 50 (-)	-	M8	Hex bolt (slotted)	9.0 - 11 (79.7 - 97.4)
4208	R/L1, S/L2, T/L3	50 × 2P	25 - 95 × 2P (70 - 95 × 2P)	-	M10	Hex self-locking nut	20 (177)
	U/T1, V/T2, W/T3	50 × 2P	25 - 95 × 2P (70 - 95 × 2P)	-	M10	Hex self-locking nut	20 (177)
	-, +1	70 × 2P	35 - 120 × 2P (120 × 2P)	-	M10	Hex self-locking nut	20 (177)
	+3	35 × 2P	25 - 70 × 2P (70 × 2P)	-	M10	Hex self-locking nut	20 (177)
	⏚	50	50 - 240 (-)	-	M10	Hex bolt (slotted)	18 - 23 (159 - 204)
4250	R/L1, S/L2, T/L3	50 × 2P	25 - 95 × 2P (70 - 95 × 2P)	-	M10	Hex self-locking nut	20 (177)
	U/T1, V/T2, W/T3	50 × 2P	25 - 95 × 2P (70 - 95 × 2P)	-	M10	Hex self-locking nut	20 (177)
	-, +1	70 × 2P	35 - 120 × 2P (120 × 2P)	-	M10	Hex self-locking nut	20 (177)
	+3	50 × 2P	25 - 70 × 2P (70 × 2P)	-	M10	Hex self-locking nut	20 (177)
	⏚	70	70 - 240 (-)	-	M10	Hex bolt (slotted)	18 - 23 (159 - 204)
4296	R/L1, S/L2, T/L3	70 × 2P	25 - 95 × 2P (70 - 95 × 2P)	-	M10	Hex self-locking nut	20 (177)
	U/T1, V/T2, W/T3	70 × 2P	25 - 95 × 2P (70 - 95 × 2P)	-	M10	Hex self-locking nut	20 (177)
	-, +1	95 × 2P	35 - 120 × 2P (120 × 2P)	-	M10	Hex self-locking nut	20 (177)
	+3	70 × 2P	25 - 70 × 2P (70 × 2P)	-	M10	Hex self-locking nut	20 (177)
	⏚	95	95 - 240 (-)	-	M10	Hex bolt (slotted)	18 - 23 (159 - 204)

Model	Terminals	Recommended Gauge mm^2	Applicable Gauge (IP20 Applicable Gauge *1) mm^2	Wire Stripping Length *2 mm	Terminal Screw		Tightening Torque N·m (lb.·in.)
					Size	Shape	
4371	R/L1, S/L2, T/L3	120 × 2P	70 - 150 × 2P (150 × 2P)	-	M12	Hex self-locking nut	35 (310)
	U/T1, V/T2, W/T3	120 × 2P	70 - 150 × 2P (150 × 2P)	-	M12	Hex self-locking nut	35 (310)
	-, +1	120 × 2P	95 - 185 × 2P (185 × 2P)	-	M12	Hex self-locking nut	35 (310)
	+3	70 × 2P	50 - 95 × 2P (-)	-	M12	Hex self-locking nut	35 (310)
	⏚	120	120 - 240 (-)	-	M12	Hex bolt (slotted)	32 - 40 (283 - 354)
4389	R/L1, S/L2, T/L3	120 × 2P	70 - 150 × 2P (150 × 2P)	-	M12	Hex self-locking nut	35 (310)
	U/T1, V/T2, W/T3	120 × 2P	70 - 150 × 2P (150 × 2P)	-	M12	Hex self-locking nut	35 (310)
	-, +1	120 × 2P	95 - 185 × 2P (185 × 2P)	-	M12	Hex self-locking nut	35 (310)
	+3	95 × 2P	50 - 95 × 2P (-)	-	M12	Hex self-locking nut	35 (310)
	⏚	95	35 - 240 (-)	-	M12	Hex bolt (slotted)	32 - 40 (283 - 354)
4453	R/L1, S/L2, T/L3 R1/L11, S1/L21, T1/L31	120 × 4P	70 - 150 × 4P (150 × 4P)	-	M12	Hex self-locking nut	35 (310)
	U/T1, V/T2, W/T3	95 × 4P	70 - 150 × 4P (120 - 150 × 4P)	-	M12	Hex self-locking nut	35 (310)
	-, +1	95 × 4P	95 - 185 × 4P (185 × 4P)	-	M12	Hex self-locking nut	35 (310)
	+3	70 × 4P	35 - 95 × 4P (95 × 4P)	-	M12	Hex self-locking nut	35 (310)
	⏚	150	50 - 150 (-)	-	M12	Hex bolt (slotted)	32 - 40 (283 - 354)
4568	R/L1, S/L2, T/L3 R1/L11, S1/L21, T1/L31	120 × 4P	70 - 150 × 4P (150 × 4P)	-	M12	Hex self-locking nut	35 (310)
	U/T1, V/T2, W/T3	95 × 4P	70 - 150 × 4P (120 - 150 × 4P)	-	M12	Hex self-locking nut	35 (310)
	-, +1	95 × 4P	95 - 185 × 4P (185 × 4P)	-	M12	Hex self-locking nut	35 (310)
	+3	70 × 4P	35 - 95 × 4P (95 × 4P)	-	M12	Hex self-locking nut	35 (310)
	⏚	95 × 2P	60 - 150 (-)	-	M12	Hex bolt (slotted)	32 - 40 (283 - 354)
4675	R/L1, S/L2, T/L3 R1/L11, S1/L21, T1/L31	120 × 4P	70 - 150 × 4P (150 × 4P)	-	M12	Hex self-locking nut	35 (310)
	U/T1, V/T2, W/T3	95 × 4P	70 - 150 × 4P (120 - 150 × 4P)	-	M12	Hex self-locking nut	35 (310)
	-, +1	95 × 4P	95 - 185 × 4P (185 × 4P)	-	M12	Hex self-locking nut	35 (310)
	+3	70 × 4P	35 - 95 × 4P (95 × 4P)	-	M12	Hex self-locking nut	35 (310)
	⏚	95 × 2P	60 - 150 (-)	-	M12	Hex bolt (slotted)	32 - 40 (283 - 354)

*1 For IP20 protection, use wires that are in the range of applicable gauges.
*2 Remove insulation from the ends of wires to expose the length of wire shown.
*3 For wire gauges more than 30 mm^2, tighten to a tightening torque of 4.1 N·m to 4.5 N·m (36 lb.·in. to 40 lb.·in.).
*4 Install an RCM/RCD with this wire gauge to maintain compliance with IEC/EN 61800-5-1:2007.
*5 Terminals - and +1 have two screws. The Recommended Gauge is the wire gauge for one terminal.
*6 A junction terminal is necessary to connect a braking resistor unit (LKEB-series) to terminals B1 and B2.

■ Connect a Fuse to the Input Side (Primary Side)

The drive circuit protection must comply with IEC/EN 61800-5-1:2007 for protection against a short circuit in the internal circuitry. The manufacturer recommends connecting semiconductor protection fuses on the input side for branch circuit protection.

WARNING! *Electrical Shock Hazard. Do not immediately energize the drive or operate peripheral devices after the drive blows a fuse or trips an RCM/RCD. Wait for the time specified on the warning label at a minimum and make sure that all indicators are OFF. Then check the wiring and peripheral device ratings to find the cause of the problem. Contact the manufacturer before energizing the drive or peripheral devices if the cause is not known. Failure to obey can cause death or serious injury and damage to the drive.*

Table 5.2 Factory-Recommended Branch Circuit Protection (200 V Class)

Drive Model	Semiconductor Protection Fuse Rated Current Manufacturer: EATON/Bussmann
2004	FWH-45B
2006	FWH-45B
2010	FWH-45B
2012	FWH-50B
2018	FWH-80B
2021	FWH-80B
2030	FWH-125B
2042	FWH-150B
2056	FWH-200B
2070	FWH-225A
2082	FWH-225A FWH-250A *1
2110	FWH-225A FWH-250A *1
2138	FWH-275A FWH-300A *1
2169	FWH-275A FWH-350A *1
2211	FWH-325A FWH-450A *1
2257	FWH-600A
2313	FWH-800A
2360	FWH-1000A
2415	FWH-1000A

*1 The manufacturer recommends a fuse with a large rated current for applications with repeated loads.

Table 5.3 Factory-Recommended Branch Circuit Protection (400 V Class)

Drive Model	Semiconductor Protection Fuse Rated Current Manufacturer: EATON/Bussmann	Drive Model	Semiconductor Protection Fuse Rated Current Manufacturer: EATON/Bussmann
4002	FWH-50B	4075	FWH-250A
4004	FWH-50B	4089	FWH-275A
4005	FWH-50B	4103	FWH-275A
4007	FWH-60B	4140	FWH-300A
4009	FWH-60B	4168	FWH-325A FWH-400A *1
4012	FWH-60B	4208	FWH-500A
4018	FWH-80B	4250	FWH-600A
4023	FWH-90B	4296	FWH-700A
4031	FWH-150B	4371	FWH-800A
4038	FWH-200B	4389	FWH-1000A
4044	FWH-200B	4453	FWH-1200A
4060	FWH-225A		

Drive Model	Semiconductor Protection Fuse Rated Current Manufacturer: EATON/Bussmann
4568	FWH-1200A

Drive Model	Semiconductor Protection Fuse Rated Current Manufacturer: EATON/Bussmann
4675	FWH-1400A FWH-1600A *1

*1 A fuse with a large rated current for applications with repeated loads is recommended.

■ CE Standards Compliance for DC Power Supply Input

To comply with CE Standards, install a fuse for the DC power supply input.

Example for a DC power supply that has two drives connected in parallel.

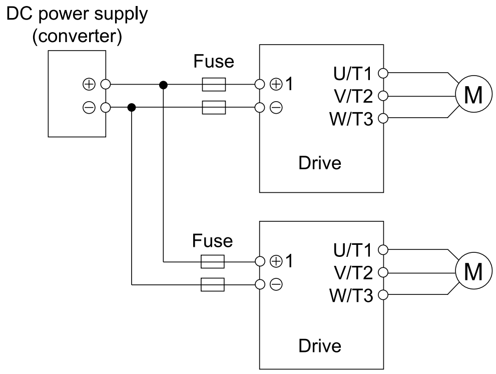


Figure 5.3 Wiring Example for DC Power Supply Input

WARNING! *Do not ground the main circuit bus. Failure to obey can cause death or serious injury.*

- Install a fuse for each drive when operating more than one drive. If one fuse blows, replace all fuses.
- Install the external filter (system) to comply with the EMC Directive.

Table 5.4 Recommended Fuse (Three-Phase 200 V Class)

Drive Model	Fuse Manufacturer: Bussmann	
	Model	Quantity
2004	FWH-45B	2
2006	FWH-45B	2
2010	FWH-45B	2
2012	FWH-50B	2
2018	FWH-80B	2
2021	FWH-80B	2
2030	FWH-125B	2
2042	FWH-150B	2
2056	FWH-200B	2
2070	FWH-250A	2
2082	FWH-250A FWH-300A *1	2
2110	FWH-250A FWH-275A *1	2
2138	FWH-300A FWH-350A *1	2
2169	FWH-350A FWH-450A *1	2
2211	FWH-450A FWH-600A *1	2
2257	FWH-600A FWH-700A *1	2
2313	FWH-800A FWH-1000A *1	2
2360	FWH-1000A	2
2415	FWH-1000A	2

*1 A fuse with a large rated current for applications with repeated loads is recommended.

Table 5.5 Recommended Fuse (Three-Phase 400 V Class)

Drive Model	Fuse Manufacturer: Bussmann	
	Model	Quantity
4002	FWH-50B	2
4004	FWH-50B	2
4005	FWH-50B	2
4007	FWH-60B	2
4009	FWH-60B	2
4012	FWH-60B	2
4018	FWH-80B	2
4023	FWH-90B	2
4031	FWH-150B	2
4038	FWH-200B	2
4044	FWH-200B	2
4060	FWH-225A	2
4075	FWH-250A	2
4089	FWH-275A	2
4103	FWH-275A	2
4140	FWH-300A FWH-325A *1	2
4168	FWH-400A FWH-450A *1	2
4208	FWH-500A FWH-600A *1	2
4250	FWH-600A FWH-700A *1	2
4296	FWH-700A FWH-800A *1	2
4371	FWH-800A FWH-1000A *1	2
4389	FWH-1000A FWH-1200A *1	2
4453	FWH-1200A FWH-1400A *1	2
4568	FWH-1200A FWH-1600A *1	2
4675	FWH-1600A	2

*1 A fuse with a large rated current for applications with repeated loads is recommended.

◆ EMC Directive

Drives with built-in EMC filters (models 2xxxB, 2xxxC, 4xxxB, 4xxxC) were tested in accordance with European standard IEC/EN 61800-3:2004/A1:2012, and comply with the EMC Directive.

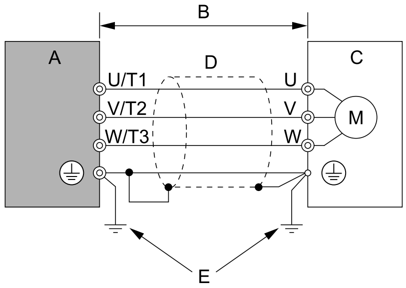
Use drives with built-in EMC filters or install external EMC filters to the drive input side to comply with the EMC Directive. Refer to *Installing the External EMC Noise Filter on page 195* for the installation of the EMC filter.

■ Install a Drive to Conform to the EMC Directive

Install drives with this procedure to comply with the EMC Directive when the drive is a single unit or installed in a larger device.

1. Install the drive on a grounded metal plate.

2. Wire the drive and motor.
3. Ground the wire shielding on the drive side and motor side.



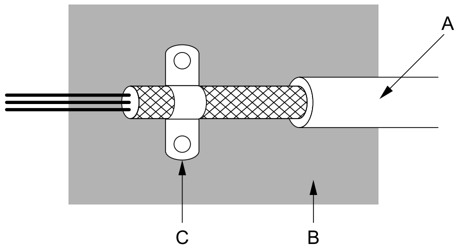
A - Drive
B - 10 m (32.8 ft.) maximum
C - Motor
D - Metal conduit
E - Grounding wire

Figure 5.4 Wiring the Drive and Motor

Note:
- Use a braided shield cable for the drive and motor wiring or put the wires through a metal conduit.
- The maximum wiring length between the drive and motor is 10 m (32.8 ft.). Keep the cable between the drive and motor as short as possible.
- Keep the grounding wire as short as possible.

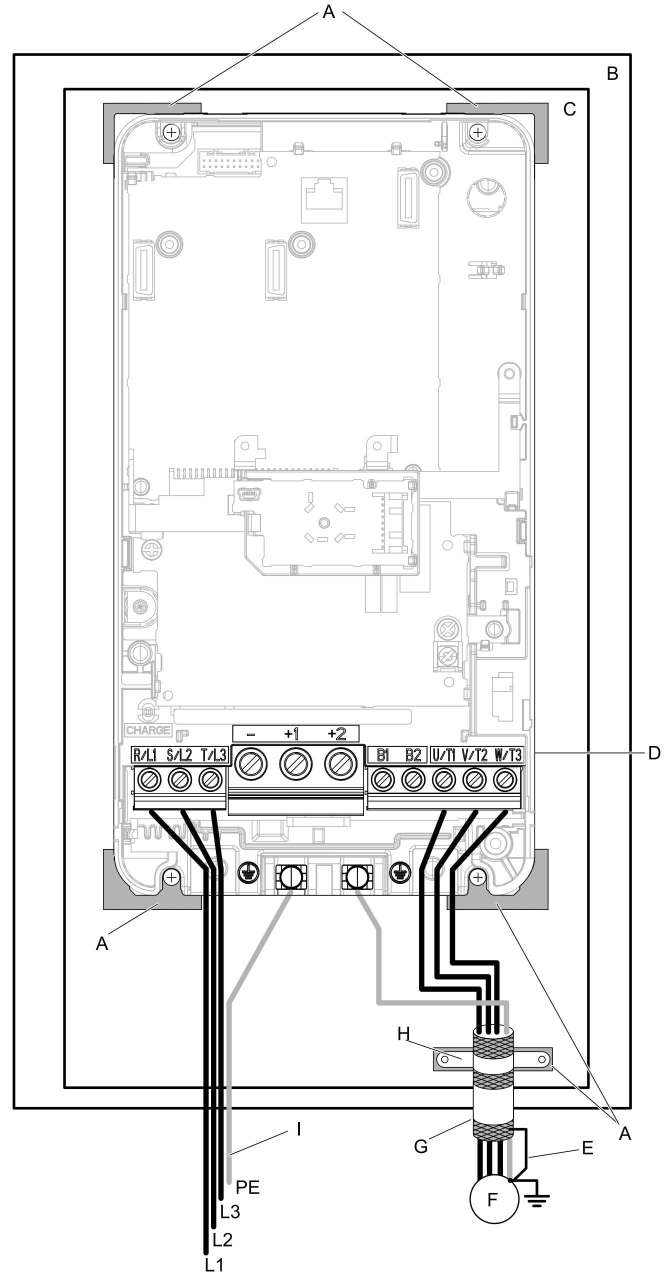
4. Use a cable clamp to ground the motor cable to the metal plate.

Note:
Make sure that the protective ground wire complies with technical specifications and local safety standards.



A - Braided shield cable
B - Metal plate
C - Cable clamp (conductive)

Figure 5.5 Ground the shield



A - Grounding surface (Remove any paint or sealant.)
B - Enclosure panel
C - Metal plate
D - Drive
E - Shielded wire
F - Motor
G - Motor cable
H - Cable clamp
I - Grounding wire

Figure 5.6 Install a Drive with a Built-in EMC Filter

5. Connect the DC reactor to decrease harmonic distortion. Refer to *DC Reactor on page 198* to select a DC reactor.

Note:
• To maintain compliance with IEC/EN 61000-3-2 on drive models 2004, 2006, 4002, and 4004, install a DC reactor.

Ground Wiring

WARNING! *Electrical Shock Hazard. Do not remove covers or touch circuit boards while the drive is energized. Failure to obey can cause death or serious injury.*

WARNING! *Electrical Shock Hazard. Ground the neutral point on the power supply to comply with the EMC Directive before turning on the EMC filter or if there is high resistance grounding. If the EMC filter is switched ON without the neutral point being grounded or if there is high resistance grounding, it can cause death or serious injury.*

Enable the Internal EMC Filter

Move the screw or screws to turn ON and OFF (enable and disable) the EMC filter.

WARNING! *Electrical Shock Hazard. Make sure that the power to the drive is OFF and the CHARGE LED light is OFF before you move the EMC filter screw or screws. Failure to obey could cause death or serious injury.*

WARNING! *Electrical Shock Hazard. Do not remove covers or touch circuit boards while the drive is energized. Failure to obey can cause death or serious injury.*

WARNING! *Electrical Shock Hazard. Ground the neutral point on the power supply to comply with the EMC Directive before turning on the EMC filter or if there is high resistance grounding. If the EMC filter is switched ON without the neutral point being grounded or if there is high resistance grounding, it can cause death or serious injury.*

WARNING! *Electrical Shock Hazard. Connect the ground cable correctly. Failure to obey can cause death or serious injury.*

NOTICE: *When disabling the internal EMC filter, move the screws from ON to OFF and then tighten to the specified torque. Completely removing the screws or tightening the screws to an incorrect torque may cause drive failure.*

NOTICE: *Move the EMC switch screw or screws to the OFF position for networks that are not symmetrically grounded. Failure to obey can cause damage to the drive.*

Make sure that the symmetric grounding network is applied, and install the screw or screws in the ON position to enable the built-in EMC filter in compliance with the EMC Directive. The EMC filter switch screw or screws are installed in the OFF position by default.

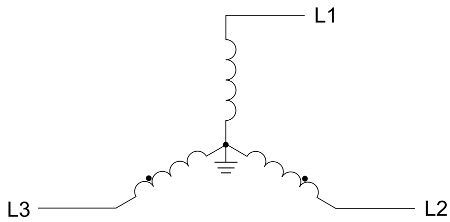
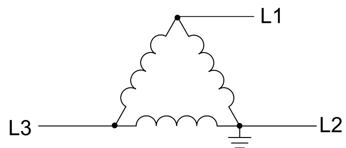
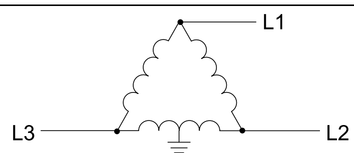
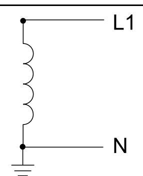
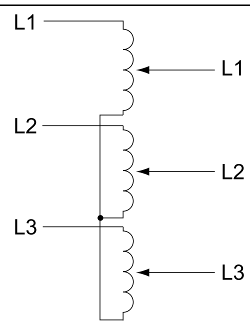
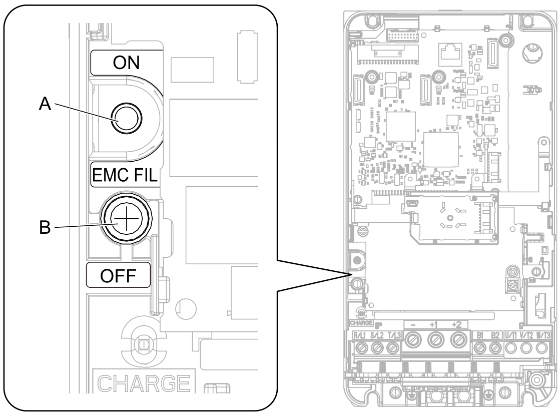


Figure 5.7 Symmetric Grounding

NOTICE: *When operating the drive with a non-grounding network, high resistance grounding, asymmetric grounding network, install the screw or screws in the OFF position to disable the built-in EMC filter. Failure to obey the instructions can damage the drive.*

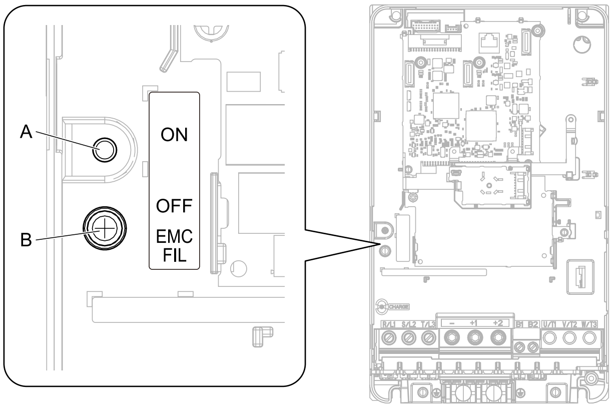
Table 5.6 Asymmetric Grounding

Type of Grounding	Diagram
Grounded at the corner of the delta connection	
Grounded at the middle of the side	
Single-phase, grounded at the end point	
Three-phase variable transformer without solidly grounded neutral	



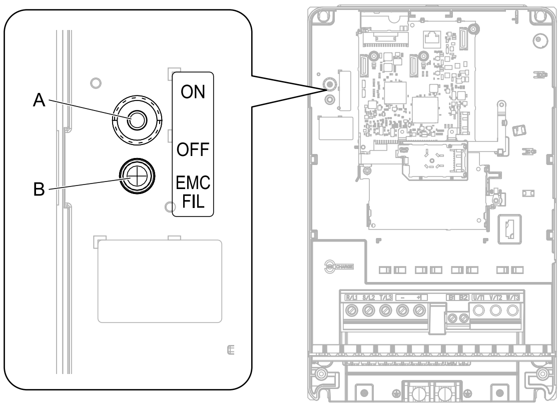
A - SW (ON) **B - Screw (OFF)**

Figure 5.8 EMC Filter Switch Location (2004 - 2042, 4002 - 4023)



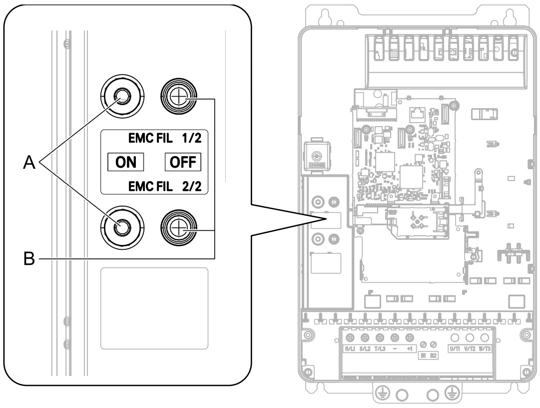
A - SW (ON) **B - Screw (OFF)**

Figure 5.9 EMC Filter Switch Location (2056, 4031, 4038)



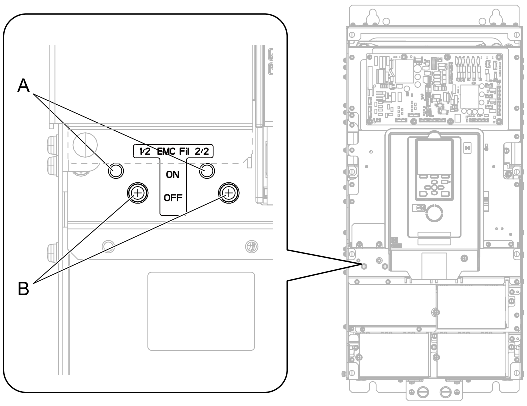
A - SW (ON) **B - Screw (OFF)**

Figure 5.10 EMC Filter Switch Location (2070, 2082, 4044, 4060)



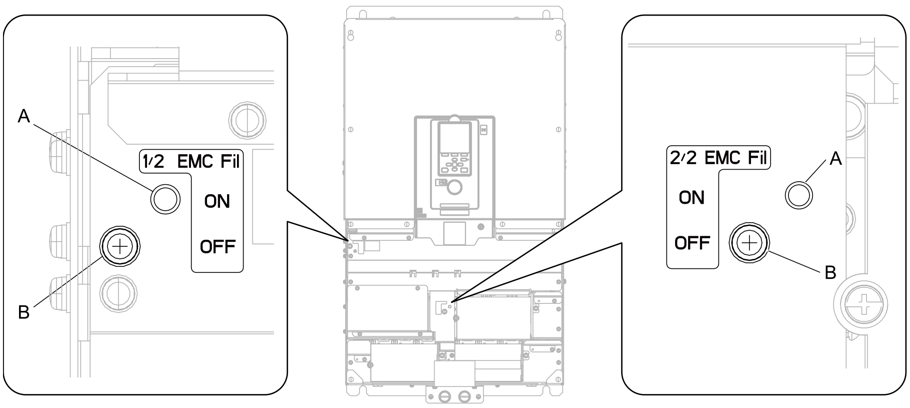
A - SW (ON) **B - Screw (OFF)**

Figure 5.11 EMC Filter Switch Location (2110 - 2211, 4075 - 4168)



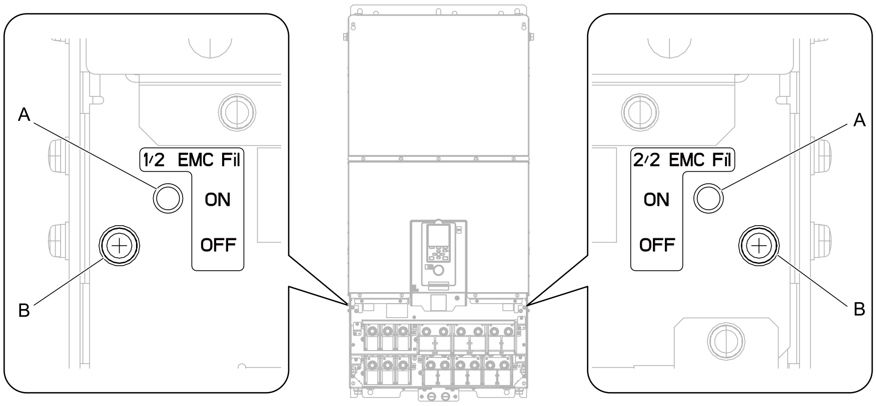
A - SW (ON) **B - Screw (OFF)**

Figure 5.12 EMC Filter Switch Location (2257 - 2313, 4208 - 4296)



A - SW (ON) **B - Screw (OFF)**

Figure 5.13 EMC Filter Switch Location (2360, 2415, 4371, 4389)



A - SW (ON)
B - Screw (OFF)

Figure 5.14 EMC Filter Switch Location (4453 - 4675)

If you lose an EMC filter switch screw, install the correct size screw with the correct tightening torque.

NOTICE: *Only use the screws specified in this manual. Failure to obey could damage the drive.*

Table 5.7 Screw Sizes and Tightening Torques

Model	Screw Size	Tightening Torque N·m
2004 - 2082, 4002 - 4060	M4 × 20	1.0 - 1.3
2110 - 2211, 4075 - 4168	M4 × 25	1.0 - 1.3
2257 - 2415, 4208 - 4675	M5 × 25	2.0 - 2.5

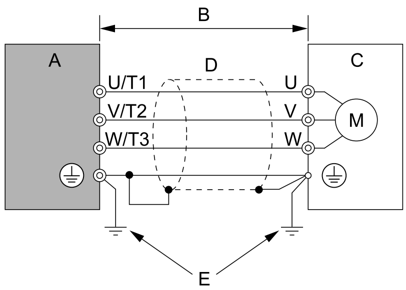
■ Installing the External EMC Noise Filter

Drive models 2xxxA and 4xxxA must meet conditions in this section to comply with EN 61800-3:2004+A1:2012.

Connect an EMC noise filter to the input side (primary side) that complies with European standards as specified by the manufacturer.

Use this procedure to install an EMC noise filter to make machinery and devices added to the drive comply with the EMC Directive.

1. Install the drive and EMC noise filter on the same grounded metal plate.
2. Wire the drive and motor.
3. Ground the wire shielding on the drive side and motor side.



A - Drive
B - 10 m (32.8 ft.) maximum
C - Motor
D - Metal conduit
E - Grounding wire

Figure 5.15 Wiring the Drive and Motor

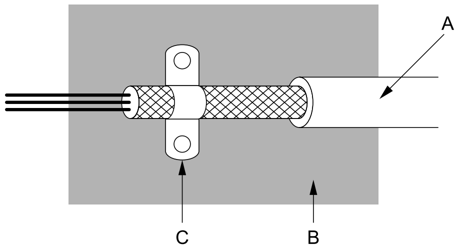
Note:
- Use a braided shield cable for the drive and motor wiring or put the wires through a metal conduit.
- The maximum wiring length between the drive and motor is 10 m (32.8 ft.). Keep the cable between the drive and motor as short as possible.
- Keep the grounding wire as short as possible.

4. Use a cable clamp to ground the motor cable to the metal plate.

Note:
Make sure that the protective ground wire complies with technical specifications and local safety standards.

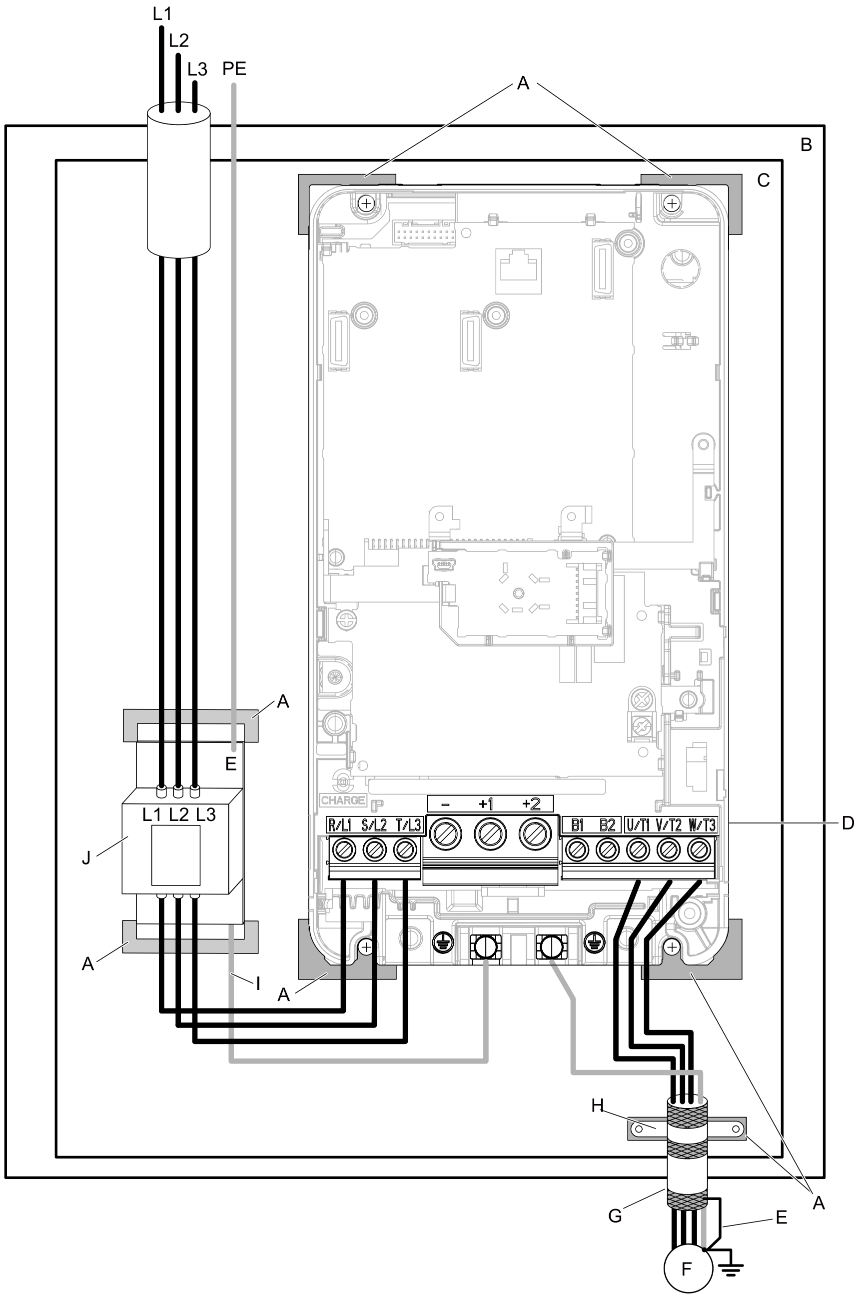
Standards Compliance

5



A - Braided shield cable
B - Metal plate
C - Cable clamp (conductive)

Figure 5.16 Ground the Shield



A - Grounding surface (Remove any paint or sealant.)
B - Enclosure panel
C - Metal plate
D - Drive
E - Ground the shield.
F - Motor
G - Motor cable (Braided shield cable: max. 10 m (32.8 ft.))
H - Cable clamp
I - Grounding wire
J - EMC noise filter

Figure 5.17 EMC Noise Filter and Drive Installation Procedure

5. Connect the DC reactor to decrease harmonic distortion. Refer to *DC Reactor on page 198* to select a DC reactor.

Note:

To maintain compliance with IEC/EN 61000-3-2 on drive models 2004, 2006, 4002, and 4004, install a DC reactor.

Ground Wiring

WARNING! *Electrical Shock Hazard. Do not remove covers or touch circuit boards while the drive is energized. Failure to obey can cause death or serious injury.*

WARNING! *Electrical Shock Hazard. Ground the neutral point on the power supply to comply with the EMC Directive before turning on the EMC filter or if there is high resistance grounding. If the EMC filter is switched ON without the neutral point being grounded or if there is high resistance grounding, it can cause death or serious injury.*

■ DC Reactor

To comply with IEC/EN 61000-3-2, install a DC reactor to drive models 2004, 2006, 4002, and 4004 when using an internal or external EMC filter.

Table 5.8 DC Reactors for Harmonic Suppression for 200 V Class(Manufacturer: Yaskawa Electric)

Drive Model	DC Reactor Model	DC Reactor Rating
2004	UZDA-B	5.4 A, 8 mH
2006	UZDA-B	5.4 A, 8 mH

Table 5.9 DC Reactors for Harmonic Suppression for 400 V Class (Manufacturer: Yaskawa Electric)

Drive Model	DC Reactor Model	DC Reactor Rating
4002	UZDA-B	3.2 A, 28 mH
4004	UZDA-B	3.2 A, 28 mH

5.3 UL Standards

Figure 5.18 UL/cUL Mark

The UL/cUL Mark indicates that this product satisfies stringent safety standards. This mark appears on products in the United States and Canada. It shows UL approval, indicating that it has been determined that the product complies with safety standards after undergoing strict inspection and assessment. UL-approved parts must be used for all major components that are built into electrical appliances that obtain UL approval.

This product has been tested in accordance with UL standard UL61800-5-1, and has been verified to be in compliance with UL standards.

Machines and devices integrated with this product must satisfy the following conditions for compliance with UL standards.

◆ Area of Use

Installation Environment	Overvoltage category III and pollution degree 2 or less (IEC/EN 60664)
Ambient Temperature	Enclosed wall-mounted type (UL Type 1): -10 °C to +40 °C (14 °F to 104 °F) Open chassis type (IP20): -10 °C to +50 °C (14 °F to 122 °F)

◆ Wire the Main Circuit Terminal Block

Wire the main circuit terminal block correctly as specified by the instructions in the manual.

To comply with UL standards on drive models from 2257 and from 4208, use UL-approved closed-loop crimp terminals. Use the tools recommend by the terminal manufacturer to crimp the closed-loop crimp terminal. Refer to *Closed-Loop Crimp Terminals on page 210* for more information about closed-loop crimp terminals (UL-compliant products).

To select the correct wire gauge, refer to *Main Circuit Wire Gauges and Tightening Torques on page 201*.

■ Notes on Wiring the Main Circuit Terminal Block

Read these notes before you wire the main circuit terminal block.

Note:
- Use UL-Listed, vinyl-coated insulated copper wires for operation with a continuous maximum permitted temperature of 75 °C at 600 V
- Remove all unwanted objects that are near the terminal block connections.
- Remove the insulation from the connection wires to the wire stripping lengths shown in the manual.
- Do not use bent or crushed wires. Remove the damaged end of the wire before you use it. Incorrect connections can cause death or serious injury from fire.
- Do not solder stranded wire. Soldered wire connections can become loose over time and cause unsatisfactory drive performance.
- If you use stranded wire, make sure that all of the wire strands are in the connection. Also, do not twist the stranded wire too much. Incorrect connections can cause death or serious injury from fire.
- Put the wire all the way into the terminal block. Remove the insulation from the wire to the recommended wire stripping length to fit the wire with insulation in the plastic housing.
- Use a torque driver, torque ratchet, or torque wrench for the screws. A slotted driver or a hex tool will be necessary to wire the screw clamp terminal. Use applicable tools as specified by the recommended conditions in the product manual.
- If you use power tools to tighten the terminal screws, use a low speed setting (300 to 400 r/min). Failure to obey can cause damage to the terminal screws.
- Wire gauges on existing drive models to be replaced may not match wire gauge ranges on new drives. Refer to the Technical Manual for wire gauges that you can and cannot use.
- Do not tighten the terminal screws at an angle of 5 degrees or more. Failure to obey can cause damage to the terminal screws.

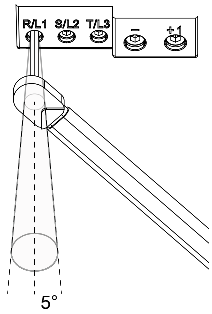


Figure 5.19 Permitted Angle

- Put the bit all the way into the hex socket to tighten the hex socket cap screw.
- When tightening slotted screws, hold the straight-edge screwdriver perpendicularly to the screw. Do not allow the tip of the screwdriver to shift or protrude from the groove of the screw.

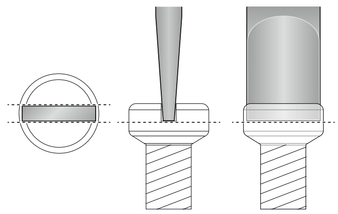
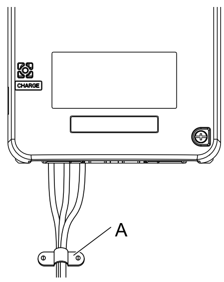


Figure 5.20 Tightening Slotted Screws

- After connecting the wires to the terminal block, lightly pull on the wires to make sure that they do not come out of the terminals.
- Remove the correct section of the wiring cover to make wiring easier.
- Do not let strain on the wiring cause damage. Use a strain relief near the wiring to release the tension.



A - Strain relief

Figure 5.21 Strain Relief Example

Table 5.10 Recommended Wiring Tools

Screw	Adapter	Bit		Torque Driver Model (Tightening Torque)	Torque Wrench
		Model	Manufacturer		
(-) M4	Bit	SF-BIT-SL 1,0X4,0-70	PHOENIX CONTACT	TSD-M 3NM (1.2 - 3 N·m)	-
(-) M5 *1	Bit	SF-BIT-SL 1,2X6,5-70	PHOENIX CONTACT	Wire Gauge ≤ 25 mm²(AWG 10): TSD-M 3NM (1.2 - 3 N·m)	Wire Gauge ≤ 25 mm² (AWG 10): -
				Wire Gauge ≥ 30 mm²(AWG 8): -	Wire Gauge ≥ 30 mm² (AWG 8): 4.1 - 4.5 N·m *2 *3
(5) M6	Bit	SF-BIT-HEX 5-50	PHOENIX CONTACT	-	5 - 9 N·m *2 *3
(-) M6	Bit	SF-BIT-SL 1,2X6,5-70	PHOENIX CONTACT	-	3 - 3.5 N·m *2 *3
(6) M8	Bit	SF-BIT-HEX 6-50	PHOENIX CONTACT	-	8 - 12 N·m *2 *3
(8) M10	Bit	SF-BIT-HEX 8-50	PHOENIX CONTACT	-	12 - 14 N·m *2 *3

*1 When wiring drive models 2056 and 4089 and smaller, select the correct tools for the wire gauge.
*2 Use 6.35 mm (0.25 in) bit socket holder.
*3 Use a torque wrench that can apply this torque measurement range.

■ Main Circuit Wire Gauges and Tightening Torques

Comply with local standards for correct wire gauges in the region where the drive is used.

WARNING! *Electrical Shock Hazard. Only connect peripheral options, for example a DC reactor or braking resistor, to terminals +1, +2, +3, -, B1, and B2. Failure to obey can cause death or serious injury.*

Refer to *Wire Gauges and Tightening Torques on page 77*for general conditions

Drives from model 2257 and from model 4208, use UL-approved closed-loop crimp terminals on the drive main circuit terminals. Use the tools recommend by the terminal manufacturer and make sure that the terminals are correctly connected.

Select the correct wires for main circuit wiring.

Three-Phase 200 V Class

Model	Terminal	Recommended Gauge AWG, kcmil	Applicable Gauge (IP20 Applicable Gauge *1) AWG, kcmil	Wire Stripping Length *2 mm	Terminal Screw		Tightening Torque N·m (in·lb)
					Size	Shape	
2004	R/L1, S/L2, T/L3	14	14 - 6 (14 - 6)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	U/T1, V/T2, W/T3	14	14 - 6 (14 - 6)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	-, +1, +2	14	14 - 3 (14 - 3)	18	M5	Slotted (-)	2.3 - 2.5 (19.8 - 22) *3
	B1, B2	14	14 - 10 (14 - 10)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	⏚	10	14 - 8 (-)	-	M4	Phillips/slotted combo	1.2 - 1.5 (10.6 - 13.3)
2006	R/L1, S/L2, T/L3	14	14 - 6 (14 - 6)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	U/T1, V/T2, W/T3	14	14 - 6 (14 - 6)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	-, +1, +2	14	14 - 3 (14 - 3)	18	M5	Slotted (-)	2.3 - 2.5 (19.8 - 22) *3
	B1, B2	14	14 - 10 (14 - 10)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	⏚	10	14 - 8 (-)	-	M4	Phillips/slotted combo	1.2 - 1.5 (10.6 - 13.3)

Model	Terminal	Recommended Gauge AWG, kcmil	Applicable Gauge (IP20 Applicable Gauge *1) AWG, kcmil	Wire Stripping Length *2 mm	Terminal Screw		Tightening Torque N·m (in·lb)
					Size	Shape	
2010	R/L1, S/L2, T/L3	12	14 - 6 (14 - 6)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	U/T1, V/T2, W/T3	14	14 - 6 (14 - 6)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	-, +1, +2	12	14 - 3 (14 - 3)	18	M5	Slotted (-)	2.3 - 2.5 (19.8 - 22) *3
	B1, B2	14	14 - 10 (14 - 10)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	⏚	10	14 - 8 (-)	-	M4	Phillips/slotted combo	1.2 - 1.5 (10.6 - 13.3)
2012	R/L1, S/L2, T/L3	10	14 - 6 (14 - 6)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	U/T1, V/T2, W/T3	12	14 - 6 (14 - 6)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	-, +1, +2	10	14 - 3 (14 - 3)	18	M5	Slotted (-)	2.3 - 2.5 (19.8 - 22) *3
	B1, B2	14	14 - 10 (14 - 10)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	⏚	10	14 - 8 (-)	-	M4	Phillips/slotted combo	1.2 - 1.5 (10.6 - 13.3)
2018	R/L1, S/L2, T/L3	10	14 - 6 (14 - 6)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	U/T1, V/T2, W/T3	10	14 - 6 (14 - 6)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	-, +1, +2	8	14 - 3 (14 - 3)	18	M5	Slotted (-)	2.3 - 2.5 (19.8 - 22) *3
	B1, B2	14	14 - 10 (14 - 10)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	⏚	10	14 - 8 (-)	-	M4	Phillips/slotted combo	1.2 - 1.5 (10.6 - 13.3)
2021	R/L1, S/L2, T/L3	8	14 - 6 (14 - 6)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	U/T1, V/T2, W/T3	10	14 - 6 (14 - 6)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	-, +1, +2	8	14 - 3 (14 - 3)	18	M5	Slotted (-)	2.3 - 2.5 (19.8 - 22) *3
	B1, B2	14	14 - 10 (14 - 10)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	⏚	10	12 - 8 (-)	-	M4	Phillips/slotted combo	1.2 - 1.5 (10.6 - 13.3)
2030	R/L1, S/L2, T/L3	6	14 - 6 (14 - 6)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	U/T1, V/T2, W/T3	8	14 - 6 (14 - 6)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	-, +1, +2	6	14 - 3 (14 - 3)	18	M5	Slotted (-)	2.3 - 2.5 (19.8 - 22) *3
	B1, B2	12	14 - 10 (14 - 10)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	⏚	8	10 - 8 (-)	-	M5	Phillips/slotted combo	2.0 - 2.5 (17.7 - 22.1)

Model	Terminal	Recommended Gauge AWG, kcmil	Applicable Gauge (IP20 Applicable Gauge *1) AWG, kcmil	Wire Stripping Length *2 mm	Terminal Screw		Tightening Torque N·m (in·lb)
					Size	Shape	
2042	R/L1, S/L2, T/L3	6	14 - 6 (14 - 6)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	U/T1, V/T2, W/T3	6	14 - 6 (14 - 6)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	-, +1, +2	3	14 - 3 (14 - 3)	18	M5	Slotted (-)	2.3 - 2.5 (19.8 - 22) *3
	B1, B2	10	14 - 10 (14 - 10)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	⏚	8	10 - 8 (-)	-	M5	Phillips/slotted combo	2.0 - 2.5 (17.7 - 22.1)
2056	R/L1, S/L2, T/L3	3	14 - 3 (8 - 3)	18	M5	Slotted (-)	2.3 - 2.5 (19.8 - 22) *3
	U/T1, V/T2, W/T3	4	14 - 4 (10 - 4)	18	M5	Slotted (-)	2.3 - 2.5 (19.8 - 22) *3
	-, +1, +2	1	14 - 1 (8 - 1)	20	M6	Hex socket cap (WAF: 5 mm)	5 - 5.5 (45 - 49)
	B1, B2	8	14 - 8 (14 - 8)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	⏚	6	8 - 6 (-)	-	M6	Phillips/slotted combo	5.4 - 6.0 (47.8 - 53.1)
2070	R/L1, S/L2, T/L3	1	14 - 1 (6 - 1)	20	M6	Hex socket cap (WAF: 5 mm)	5 - 5.5 (45 - 49)
	U/T1, V/T2, W/T3	3	14 - 3 (6 - 3)	20	M6	Hex socket cap (WAF: 5 mm)	5 - 5.5 (45 - 49)
	-, +1, +2	1/0	14 - 1/0 (4 - 1/0)	20	M6	Hex socket cap (WAF: 5 mm)	5 - 5.5 (45 - 49)
	B1, B2	8	14 - 8 (14 - 8)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	⏚	6	6 - 4 (-)	-	M6	Phillips/slotted combo	5.4 - 6.0 (47.8 - 53.1)
2082	R/L1, S/L2, T/L3	1/0	14 - 1/0 (6 - 1/0)	20	M6	Hex socket cap (WAF: 5 mm)	5 - 5.5 (45 - 49)
	U/T1, V/T2, W/T3	2	14 - 2 (6 - 2)	20	M6	Hex socket cap (WAF: 5 mm)	5 - 5.5 (45 - 49)
	-, +1, +2	2/0	14 - 2/0 (4 - 2/0)	20	M6	Hex socket cap (WAF: 5 mm)	5 - 5.5 (45 - 49)
	B1, B2	6	14 - 6 (14 - 6)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	⏚	6	6 - 4 (-)	-	M6	Phillips/slotted combo	5.4 - 6.0 (47.8 - 53.1)
2110	R/L1, S/L2, T/L3	1/0	6 - 1/0 (6 - 1/0)	27	M6	Hex socket cap (WAF: 5 mm)	8 - 9 (71 - 80)
	U/T1, V/T2, W/T3	1/0	6 - 1/0 (6 - 1/0)	27	M6	Hex socket cap (WAF: 5 mm)	8 - 9 (71 - 80)
	-, +1	2/0	2 - 2/0 (2 - 2/0)	27	M8	Hex socket cap (WAF: 6 mm)	10 - 12 (89 - 107)
	B1, B2	4	14 - 4 (10 - 4)	21	M6	Minus (-)	3 - 3.5 (27 - 31)
	⏚	6	6 - 4 (-)	-	M6	Hex bolt (+)	5.4 - 6.0 (47.8 - 53.1)

Model	Terminal	Recommended Gauge AWG, kcmil	Applicable Gauge (IP20 Applicable Gauge *1) AWG, kcmil	Wire Stripping Length *2 mm	Terminal Screw		Tightening Torque N·m (in·lb)
					Size	Shape	
2138	R/L1, S/L2, T/L3	2/0	6 - 2/0 (2 - 2/0)	27	M6	Hex socket cap (WAF: 5 mm)	8 - 9 (71 - 80)
	U/T1, V/T2, W/T3	2/0	6 - 2/0 (2 - 2/0)	27	M6	Hex socket cap (WAF: 5 mm)	8 - 9 (71 - 80)
	-, +1	4/0	2 - 4/0 (2 - 4/0)	27	M8	Hex socket cap (WAF: 6 mm)	10 - 12 (89 - 107)
	B1, B2	3	14 - 3 (10 - 3)	21	M6	Minus (-)	3 - 3.5 (27 - 31)
	⏚	4	4 (-)	-	M6	Hex bolt (+)	5.4 - 6.0 (47.8 - 53.1)
2169	R/L1, S/L2, T/L3	4/0	2 - 250 (2/0 - 250)	37	M10	Hex socket cap (WAF: 8 mm)	12 - 14 (107 - 124)
	U/T1, V/T2, W/T3	4/0	2 - 300 (3/0 - 300)	37	M10	Hex socket cap (WAF: 8 mm)	12 - 14 (107 - 124)
	-, -, +1, +1 *4 *5	1	6 - 2/0 (1/0 - 2/0)	28	M6	Hex socket cap (WAF: 5 mm)	8 - 9 (71 - 80)
	+3 *5	1/0	4 - 2/0 (1 - 2/0)	28	M8	Hex socket cap (WAF: 6 mm)	8 - 9 (71 - 80)
	⏚	4	4 - 1/0 (-)	-	M8	Hex bolt (slotted)	9.0 - 11 (79.7 - 97.4)
2211	R/L1, S/L2, T/L3	250	2 - 250 (2/0 - 250)	37	M10	Hex socket cap (WAF: 8 mm)	12 - 14 (107 - 124)
	U/T1, V/T2, W/T3	300	2 - 300 (3/0 - 300)	37	M10	Hex socket cap (WAF: 8 mm)	12 - 14 (107 - 124)
	-, -, +1, +1 *4 *5	2/0	6 - 2/0 (1/0 - 2/0)	28	M6	Hex socket cap (WAF: 5 mm)	8 - 9 (71 - 80)
	+3 *5	2/0	4 - 2/0 (1 - 2/0)	28	M8	Hex socket cap (WAF: 6 mm)	8 - 9 (71 - 80)
	⏚	4	4 - 1/0 (-)	-	M8	Hex bolt (slotted)	9.0 - 11 (79.7 - 97.4)
2257	R/L1, S/L2, T/L3	2/0 × 2P	3 - 4/0 × 2P (2/0 - 4/0 × 2P)	-	M10	Hex self-locking nut	20 (177)
	U/T1, V/T2, W/T3	2/0 × 2P	3 - 4/0 × 2P (2/0 - 4/0 × 2P)	-	M10	Hex self-locking nut	20 (177)
	-, +1	4/0 × 2P	2 - 250 × 2P (4/0 - 250 × 2P)	-	M10	Hex self-locking nut	20 (177)
	+3	1/0 × 2P	4 - 1/0 × 2P (1/0 × 2P)	-	M10	Hex self-locking nut	20 (177)
	⏚	3	3 - 350 (-)	-	M10	Hex bolt (slotted)	18 - 23 (159 - 204)
2313	R/L1, S/L2, T/L3	4/0 × 2P	3 - 4/0 × 2P (2/0 - 4/0 × 2P)	-	M10	Hex self-locking nut	20 (177)
	U/T1, V/T2, W/T3	3/0 × 2P	3 - 4/0 × 2P (2/0 - 4/0 × 2P)	-	M10	Hex self-locking nut	20 (177)
	-, +1	250 × 2P	2 - 250 × 2P (4/0 - 250 × 2P)	-	M10	Hex self-locking nut	20 (177)
	+3	1/0 × 2P	4 - 1/0 × 2P (1/0 × 2P)	-	M10	Hex self-locking nut	20 (177)
	⏚	2	2 - 350 (-)	-	M10	Hex bolt (slotted)	18 - 23 (159 - 204)

Model	Terminal	Recommended Gauge AWG, kcmil	Applicable Gauge (IP20 Applicable Gauge *1) AWG, kcmil	Wire Stripping Length *2 mm	Terminal Screw		Tightening Torque N·m (in·lb)
					Size	Shape	
2360	R/L1, S/L2, T/L3	250 × 2P	2/0 - 300 × 2P (250 - 300 × 2P)	-	M12	Hex self-locking nut	35 (310)
	U/T1, V/T2, W/T3	250 × 2P	2/0 - 300 × 2P (250 - 300 × 2P)	-	M12	Hex self-locking nut	35 (310)
	-, +1	350 × 2P	4/0 - 400 × 2P (300 - 400 × 2P)	-	M12	Hex self-locking nut	35 (310)
	+3	3/0 × 2P	1/0 - 4/0 × 2P (-)	-	M12	Hex self-locking nut	35 (310)
	⏚	1	1 - 350 (-)	-	M12	Hex bolt (slotted)	32 - 40 (283 - 354)
2415	R/L1, S/L2, T/L3	250 × 2P	2/0 - 300 × 2P (250 - 300 × 2P)	-	M12	Hex self-locking nut	35 (310)
	U/T1, V/T2, W/T3	300 × 2P	2/0 - 300 × 2P (250 - 300 × 2P)	-	M12	Hex self-locking nut	35 (310)
	-, +1	350 × 2P	4/0 - 400 × 2P (300 - 400 × 2P)	-	M12	Hex self-locking nut	35 (310)
	+3	3/0 × 2P	1/0 - 4/0 × 2P (-)	-	M12	Hex self-locking nut	35 (310)
	⏚	1	1 - 350 (-)	-	M12	Hex bolt (slotted)	32 - 40 (283 - 354)

*1 For IP20 protection, use wires that are in the range of applicable gauges.
*2 Remove insulation from the ends of wires to expose the length of wire shown.
*3 For wire gauges more than AWG 8, tighten to a tightening torque of 4.1 N·m to 4.5 N·m (36 in·lb to 40 in·lb).
*4 Terminals - and +1 have two screws. The Recommended Gauge is the wire gauge for one terminal.
*5 A junction terminal is necessary to connect a braking unit (CDBR-series) to terminals - and +3.

Three-Phase 400 V Class

Model	Terminals	Recommended Gauge AWG, kcmil	Applicable Gauge (IP20 Applicable Gauge *1) AWG, kcmil	Wire Stripping Length *2 mm	Terminal Screw		Tightening Torque N·m (lb·in.)
					Size	Shape	
4002	R/L1, S/L2, T/L3	14	14 - 6 (14 - 6)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	U/T1, V/T2, W/T3	14	14 - 6 (14 - 6)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	-, +1, +2	14	14 - 3 (14 - 3)	18	M5	Slotted (-)	2.3 - 2.5 (19.8 - 22) *3
	B1, B2	14	14 - 10 (14 - 10)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	⏚	12	14 - 8 (-)	-	M4	Phillips/slotted combo	1.2 - 1.5 (10.6 - 13.3)
4004	R/L1, S/L2, T/L3	14	14 - 6 (14 - 6)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	U/T1, V/T2, W/T3	14	14 - 6 (14 - 6)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	-, +1, +2	14	14 - 3 (14 - 3)	18	M5	Slotted (-)	2.3 - 2.5 (19.8 - 22) *3
	B1, B2	14	14 - 10 (14 - 10)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	⏚	12	14 - 8 (-)	-	M4	Phillips/slotted combo	1.2 - 1.5 (10.6 - 13.3)

Model	Terminals	Recommended Gauge AWG, kcmil	Applicable Gauge (IP20 Applicable Gauge *1) AWG, kcmil	Wire Stripping Length *2 mm	Terminal Screw		Tightening Torque N·m (lb·in.)
					Size	Shape	
4005	R/L1, S/L2, T/L3	14	14 - 6 (14 - 6)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	U/T1, V/T2, W/T3	14	14 - 6 (14 - 6)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	-, +1, +2	14	14 - 3 (14 - 3)	18	M5	Slotted (-)	2.3 - 2.5 (19.8 - 22) *3
	B1, B2	14	14 - 10 (14 - 10)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	⏚	10	14 - 8 (-)	-	M4	Phillips/slotted combo	1.2 - 1.5 (10.6 - 13.3)
4007	R/L1, S/L2, T/L3	14	14 - 6 (14 - 6)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	U/T1, V/T2, W/T3	14	14 - 6 (14 - 6)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	-, +1, +2	14	14 - 3 (14 - 3)	18	M5	Slotted (-)	2.3 - 2.5 (19.8 - 22) *3
	B1, B2	14	14 - 10 (14 - 10)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	⏚	10	14 - 8 (-)	-	M4	Phillips/slotted combo	1.2 - 1.5 (10.6 - 13.3)
4009	R/L1, S/L2, T/L3	14	14 - 6 (14 - 6)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	U/T1, V/T2, W/T3	14	14 - 6 (14 - 6)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	-, +1, +2	12	14 - 3 (14 - 3)	18	M5	Slotted (-)	2.3 - 2.5 (19.8 - 22) *3
	B1, B2	14	14 - 10 (14 - 10)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	⏚	10	14 - 8 (-)	-	M4	Phillips/slotted combo	1.2 - 1.5 (10.6 - 13.3)
4012	R/L1, S/L2, T/L3	12	14 - 6 (14 - 6)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	U/T1, V/T2, W/T3	14	14 - 6 (14 - 6)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	-, +1, +2	10	14 - 3 (14 - 3)	18	M5	Slotted (-)	2.3 - 2.5 (19.8 - 22) *3
	B1, B2	14	14 - 10 (14 - 10)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	⏚	10	14 - 8 (-)	-	M4	Phillips/slotted combo	1.2 - 1.5 (10.6 - 13.3)
4018	R/L1, S/L2, T/L3	10	14 - 6 (14 - 6)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	U/T1, V/T2, W/T3	10	14 - 6 (14 - 6)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	-, +1, +2	8	14 - 3 (14 - 3)	18	M5	Slotted (-)	2.3 - 2.5 (19.8 - 22) *3
	B1, B2	14	14 - 10 (14 - 10)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	⏚	10	14 - 8 (-)	-	M5	Phillips/slotted combo	2.0 - 2.5 (17.7 - 22.1)

Model	Terminals	Recommended Gauge AWG, kcmil	Applicable Gauge (IP20 Applicable Gauge *1) AWG, kcmil	Wire Stripping Length *2 mm	Terminal Screw		Tightening Torque N·m (lb·in.)
					Size	Shape	
4023	R/L1, S/L2, T/L3	8	14 - 6 (14 - 6)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	U/T1, V/T2, W/T3	10	14 - 6 (14 - 6)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	-, +1, +2	8	14 - 3 (14 - 3)	18	M5	Slotted (-)	2.3 - 2.5 (19.8 - 22) *3
	B1, B2	12	14 - 10 (14 - 10)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	⏚	10	12 - 8 (-)	-	M5	Phillips/slotted combo	2.0 - 2.5 (17.7 - 22.1)
4031	R/L1, S/L2, T/L3	6	14 - 3 (8 - 3)	18	M5	Slotted (-)	2.3 - 2.5 (19.8 - 22) *3
	U/T1, V/T2, W/T3	8	14 - 4 (10 - 4)	18	M5	Slotted (-)	2.3 - 2.5 (19.8 - 22) *3
	-, +1, +2	6	14 - 1 (8 - 1)	20	M6	Hex socket cap (WAF: 5 mm)	5 - 5.5 (45 - 49)
	B1, B2	10	14 - 8 (14 - 8)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	⏚	8	10 - 6 (-)	-	M6	Phillips/slotted combo	5.4 - 6.0 (47.8 - 53.1)
4038	R/L1, S/L2, T/L3	6	14 - 3 (8 - 3)	18	M5	Slotted (-)	2.3 - 2.5 (19.8 - 22) *3
	U/T1, V/T2, W/T3	8	14 - 4 (10 - 4)	18	M5	Slotted (-)	2.3 - 2.5 (19.8 - 22) *3
	-, +1, +2	4	14 - 1 (8 - 1)	20	M6	Hex socket cap (WAF: 5 mm)	5 - 5.5 (45 - 49)
	B1, B2	10	14 - 8 (14 - 8)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	⏚	6	10 - 6 (-)	-	M6	Phillips/slotted combo	5.4 - 6.0 (47.8 - 53.1)
4044	R/L1, S/L2, T/L3	4	14 - 4 (10 - 4)	18	M5	Slotted (-)	2.3 - 2.5 (19.8 - 22) *3
	U/T1, V/T2, W/T3	6	14 - 6 (10 - 6)	18	M5	Slotted (-)	2.3 - 2.5 (19.8 - 22) *3
	-, +1, +2	3	14 - 3 (10 - 3)	18	M5	Slotted (-)	2.3 - 2.5 (19.8 - 22) *3
	B1, B2	8	14 - 8 (14 - 8)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	⏚	6	8 - 4 (-)	-	M6	Phillips/slotted combo	5.4 - 6.0 (47.8 - 53.1)
4060	R/L1, S/L2, T/L3	4	14 - 4 (10 - 4)	18	M5	Slotted (-)	2.3 - 2.5 (19.8 - 22) *3
	U/T1, V/T2, W/T3	4	14 - 4 (10 - 4)	18	M5	Slotted (-)	2.3 - 2.5 (19.8 - 22) *3
	-, +1	3	14 - 3 (10 - 3)	18	M5	Slotted (-)	2.3 - 2.5 (19.8 - 22) *3
	B1, B2	8	14 - 8 (14 - 8)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	⏚	6	8 - 4 (-)	-	M6	Phillips/slotted combo	5.4 - 6.0 (47.8 - 53.1)

Model	Terminals	Recommended Gauge AWG, kcmil	Applicable Gauge (IP20 Applicable Gauge *1) AWG, kcmil	Wire Stripping Length *2 mm	Terminal Screw		Tightening Torque N·m (lb·in.)
					Size	Shape	
4075	R/L1, S/L2, T/L3	3	14 - 3 (12 - 3)	18	M5	Slotted (-)	2.3 - 2.5 (19.8 - 22) *3
	U/T1, V/T2, W/T3	3	14 - 3 (12 - 3)	18	M5	Slotted (-)	2.3 - 2.5 (19.8 - 22) *3
	-, +1	2	14 - 2 (10 - 2)	18	M5	Slotted (-)	2.3 - 2.5 (19.8 - 22) *3
	B1, B2	6	14 - 6 (14 - 6)	10	M4	Slotted (-)	1.5 - 1.7 (13.5 - 15)
	⏚	6	6 - 4 (-)	-	M6	Hex bolt (+)	5.4 - 6.0 (47.8 - 53.1)
4089	R/L1, S/L2, T/L3	2	14 - 2 (10 - 2)	18	M5	Slotted (-)	2.3 - 2.5 (19.8 - 22) *3
	U/T1, V/T2, W/T3	2	14 - 2 (10 - 2)	18	M5	Slotted (-)	2.3 - 2.5 (19.8 - 22) *3
	-, +1	1/0	14 - 1/0 (6 - 1/0)	20	M6	Hex socket cap (WAF: 5 mm)	5 - 5.5 (45 - 49)
	B1, B2	6	14 - 6 (14 - 6)	18	M5	Slotted (-)	2.3 - 2.5 (19.8 - 22) *3
	⏚	4	6 - 4 (-)	-	M6	Hex bolt (+)	5.4 - 6.0 (47.8 - 53.1)
4103	R/L1, S/L2, T/L3	1/0	6 - 2/0 (2 - 2/0)	27	M6	Hex socket cap (WAF: 5 mm)	8 - 9 (71 - 80)
	U/T1, V/T2, W/T3	1	6 - 2/0 (2 - 2/0)	27	M6	Hex socket cap (WAF: 5 mm)	8 - 9 (71 - 80)
	-, +1	2/0	2 - 4/0 (2 - 4/0)	27	M8	Hex socket cap (WAF: 6 mm)	10 - 12 (89 - 107)
	B1, B2	3	14 - 3 (10 - 3)	21	M6	Minus (-)	3 - 3.5 (27 - 31)
	⏚	4	6 - 4 (-)	-	M6	Hex bolt (+)	5.4 - 6.0 (47.8 - 53.1)
4140	R/L1, S/L2, T/L3	3/0	2 - 250 (2/0 - 250)	37	M10	Hex socket cap (WAF: 8 mm)	12 - 14 (107 - 124)
	U/T1, V/T2, W/T3	2/0	2 - 300 (3/0 - 300)	37	M10	Hex socket cap (WAF: 8 mm)	12 - 14 (107 - 124)
	-, -, +1, +1 *4	2	6 - 2/0 (1/0 - 2/0)	28	M6	Hex socket cap (WAF: 5 mm)	8 - 9 (71 - 80)
	B1, B2 *5	1	4 - 2/0 (1 - 2/0)	28	M8	Hex socket cap (WAF: 6 mm)	8 - 9 (71 - 80)
	⏚	4	4 - 1/0 (-)	-	M8	Hex bolt (slotted)	9.0 - 11 (79.7 - 97.4)
4168	R/L1, S/L2, T/L3	4/0	2 - 250 (2/0 - 250)	37	M10	Hex socket cap (WAF: 8 mm)	12 - 14 (107 - 124)
	U/T1, V/T2, W/T3	4/0	2 - 300 (3/0 - 300)	37	M10	Hex socket cap (WAF: 8 mm)	12 - 14 (107 - 124)
	-, -, +1, +1 *4	1/0	6 - 2/0 (1/0 - 2/0)	28	M6	Hex socket cap (WAF: 5 mm)	8 - 9 (71 - 80)
	B1, B2 *5	1/0	4 - 2/0 (1 - 2/0)	28	M8	Hex socket cap (WAF: 6 mm)	8 - 9 (71 - 80)
	⏚	4	4 - 1/0 (-)	-	M8	Hex bolt (slotted)	9.0 - 11 (79.7 - 97.4)

Model	Terminals	Recommended Gauge AWG, kcmil	Applicable Gauge (IP20 Applicable Gauge *1) AWG, kcmil	Wire Stripping Length *2 mm	Terminal Screw		Tightening Torque N·m (lb·in.)
					Size	Shape	
4208	R/L1, S/L2, T/L3	1/0 × 2P	3 - 4/0 × 2P (2/0 - 4/0 × 2P)	-	M10	Hex self-locking nut	20 (177)
	U/T1, V/T2, W/T3	1/0 × 2P	3 - 4/0 × 2P (2/0 - 4/0 × 2P)	-	M10	Hex self-locking nut	20 (177)
	-, +1	3/0 × 2P	2 - 250 × 2P (4/0 - 250 × 2P)	-	M10	Hex self-locking nut	20 (177)
	+3	1/0 × 2P	4 - 1/0 × 2P (1/0 × 2P)	-	M10	Hex self-locking nut	20 (177)
	⏚	4	4 - 350 (-)	-	M10	Hex bolt (slotted)	18 - 23 (159 - 204)
4250	R/L1, S/L2, T/L3	2/0 × 2P	3 - 4/0 × 2P (2/0 - 4/0 × 2P)	-	M10	Hex self-locking nut	20 (177)
	U/T1, V/T2, W/T3	2/0 × 2P	3 - 4/0 × 2P (2/0 - 4/0 × 2P)	-	M10	Hex self-locking nut	20 (177)
	-, +1	3/0 × 2P	2 - 250 × 2P (4/0 - 250 × 2P)	-	M10	Hex self-locking nut	20 (177)
	+3	1/0 × 2P	4 - 1/0 × 2P (1/0 × 2P)	-	M10	Hex self-locking nut	20 (177)
	⏚	2	2 - 350 (-)	-	M10	Hex bolt (slotted)	18 - 23 (159 - 204)
4296	R/L1, S/L2, T/L3	3/0 × 2P	3 - 4/0 × 2P (2/0 - 4/0 × 2P)	-	M10	Hex self-locking nut	20 (177)
	U/T1, V/T2, W/T3	3/0 × 2P	3 - 4/0 × 2P (2/0 - 4/0 × 2P)	-	M10	Hex self-locking nut	20 (177)
	-, +1	4/0 × 2P	2 - 250 × 2P (4/0 - 250 × 2P)	-	M10	Hex self-locking nut	20 (177)
	+3	1/0 × 2P	4 - 1/0 × 2P (1/0 × 2P)	-	M10	Hex self-locking nut	20 (177)
	⏚	2	2 - 350 (-)	-	M10	Hex bolt (slotted)	18 - 23 (159 - 204)
4371	R/L1, S/L2, T/L3	250 × 2P	2/0 - 300 × 2P (250 - 300 × 2P)	-	M12	Hex self-locking nut	35 (310)
	U/T1, V/T2, W/T3	250 × 2P	2/0 - 300 × 2P (250 - 300 × 2P)	-	M12	Hex self-locking nut	35 (310)
	-, +1	350 × 2P	4/0 - 400 × 2P (300 - 400 × 2P)	-	M12	Hex self-locking nut	35 (310)
	+3	3/0 × 2P	1 - 4/0 × 2P (-)	-	M12	Hex self-locking nut	35 (310)
	⏚	1	1 - 350 (-)	-	M12	Hex bolt (slotted)	32 - 40 (283 - 354)
4389	R/L1, S/L2, T/L3	300 × 2P	2/0 - 300 × 2P (250 - 300 × 2P)	-	M12	Hex self-locking nut	35 (310)
	U/T1, V/T2, W/T3	300 × 2P	2/0 - 300 × 2P (250 - 300 × 2P)	-	M12	Hex self-locking nut	35 (310)
	-, +1	400 × 2P	4/0 - 400 × 2P (300 - 400 × 2P)	-	M12	Hex self-locking nut	35 (310)
	+3	4/0 × 2P	1 - 4/0 × 2P (-)	-	M12	Hex self-locking nut	35 (310)
	⏚	1	1 - 350 (-)	-	M12	Hex bolt (slotted)	32 - 40 (283 - 354)

Model	Terminals	Recommended Gauge AWG, kcmil	Applicable Gauge (IP20 Applicable Gauge *1) AWG, kcmil	Wire Stripping Length *2 mm	Terminal Screw		Tightening Torque N·m (lb·in.)
					Size	Shape	
4453	R/L1, S/L2, T/L3, R1/L11, S1/L21, T1/L31	250 × 4P	2/0 - 300 × 4P (250 - 300 × 4P)	-	M12	Hex self-locking nut	35 (310)
	U/T1, V/T2, W/T3	4/0 × 4P	2/0 - 300 × 4P (250 - 300 × 4P)	-	M12	Hex self-locking nut	35 (310)
	-, +1	4/0 × 4P	3/0 - 400 × 4P (300 - 400 × 4P)	-	M12	Hex self-locking nut	35 (310)
	+3	3/0 × 4P	2 - 4/0 (4/0 × 4P)	-	M12	Hex self-locking nut	35 (310)
	⏚	1/0	1/0 - 300 (-)	-	M12	Hex bolt (slotted)	32 - 40 (283 - 354)
4568	R/L1, S/L2, T/L3, R1/L11, S1/L21, T1/L31	250 × 4P	2/0 - 300 × 4P (250 - 300 × 4P)	-	M12	Hex self-locking nut	35 (310)
	U/T1, V/T2, W/T3	4/0 × 4P	2/0 - 300 × 4P (250 - 300 × 4P)	-	M12	Hex self-locking nut	35 (310)
	-, +1	300 × 4P	3/0 - 400 × 4P (300 - 400 × 4P)	-	M12	Hex self-locking nut	35 (310)
	+3	3/0 × 4P	2 - 4/0 × 4P (4/0 × 4P)	-	M12	Hex self-locking nut	35 (310)
	⏚	2/0	2/0 - 300 (-)	-	M12	Hex bolt (slotted)	32 - 40 (283 - 354)
4675	R/L1, S/L2, T/L3, R1/L11, S1/L21, T1/L31	300 × 4P	2/0 - 300 × 4P (250 - 300 × 4P)	-	M12	Hex self-locking nut	35 (310)
	U/T1, V/T2, W/T3	300 × 4P	2/0 - 300 × 4P (250 - 300 × 4P)	-	M12	Hex self-locking nut	35 (310)
	-, +1	400 × 4P	3/0 - 400 × 4P (300 - 400 × 4P)	-	M12	Hex self-locking nut	35 (310)
	+3	4/0 × 4P	2 - 4/0 × 4P (4/0 × 4P)	-	M12	Hex self-locking nut	35 (310)
	⏚	2/0	2/0 - 300 (-)	-	M12	Hex bolt (slotted)	32 - 40 (283 - 354)

*1 For IP20 protection, use wires that are in the range of applicable gauges.
*2 Remove insulation from the ends of wires to expose the length of wire shown.
*3 For wire gauges more than AWG 8, tighten to a tightening torque of 4.1 N·m to 4.5 N·m (36 lb·in. to 40 lb·in.).
*4 Terminals - and +1 have two screws. The Recommended Gauge is the wire gauge for one terminal.
*5 A junction terminal is necessary to connect a braking resistor unit (LKEB-series) to terminals B1 and B2.

■ Closed-Loop Crimp Terminals

To comply with UL standards on drive models 2257 to 2415 and 4208 to 4675, use UL-approved closed-loop crimp terminals. Use the tools recommend by the terminal manufacturer to crimp the closed-loop crimp terminal. The manufacturer recommends closed-loop crimp terminals from JST Mfg. Co., Ltd. and insulation caps from Tokyo DIP Co., Ltd.

Comply with local standards for correct wire gauges in the region where the drive is used.

Contact the manufacturer or your nearest sales representative to order.

Refer to Table 5.11 and Table 5.12 to select crimp terminals as specified by drive model and wire gauge.

Note:

To comply with UL standards, use only insulated crimp terminals or crimp terminals with insulation tubing. Use UL-Listed, vinyl-coated insulated copper wires for operation with a continuous maximum permitted temperature of 75 °C at 600 V.

Table 5.11 Closed-Loop Crimp Terminals and Insulation Caps for 200 V Class

Model	Recommended Gauge (AWG, kcmil)					Terminal Screw Size	Crimp Terminal Model	Crimping Tool		Insulation Cap Model
	R/L1 S/L2 T/L3	U/T1 V/T2 W/T3	-, +1	+3				Tool Model	Die Jaw	
2004 - 2021	-	-	-	-	10	M4	R5.5-4	YA-4	AD-900	TP-005
2030, 2042	-	-	-	-	8	M5	R8-5	YA-4	AD-901	TP-008
2056	-	-	-	-	6	M6	R14-6	YA-4	AD-902	TP-014

Model	Recommended Gauge (AWG, kcmil)					Terminal Screw Size	Crimp Terminal Model	Crimping Tool		Insulation Cap Model
	R/L1 S/L2 T/L3	U/T1 V/T2 W/T3	-, +1	+3				Tool Model	Die Jaw	
2070 - 2110	-	-	-	-	6	M6	R14-6	YA-4	AD-902	TP-014
2138	-	-	-	-	4	M6	R22-6	YA-5	AD-953	TP-022
2169, 2211	-	-	-	-	4	M8	R22-8	YA-5	AD-953	TP-022
2257	-	-	-	-	3	M10	R38-10	YF-1 YET-150-1	TD-224, TD-212	TP-038
	-	-	-	1/0 × 2P	-		R60-10		TD-225, TD-213	TP-060
	2/0 × 2P	2/0 × 2P	-	-	-		80-10		TD-227, TD-214	TP-080
	-	-	4/0 × 2P	-	-		R100-10		TD-228, TD-214	TP-100
2313	-	-	-	-	2	M10	R38-10	YF-1 YET-150-1	TD-224, TD-212	TP-038
	-	-	-	1/0 × 2P	-		R60-10		TD-225, TD-213	TP-060
	-	3/0 × 2P	-	-	-		80-10		TD-227, TD-214	TP-080
	4/0 × 2P	-	-	-	-		R100-10		TD-228, TD-214	TP-100
	-	-	250 × 2P	-	-		R150-10		TD-229, TD-215	TP-150
2360	-	-	-	-	1	M12	R60-12	YF-1 YET-300-1	TD-321, TD-311	TP-060
	-	-	-	3/0 × 2P	-		80-12		TD-323, TD-312	TP-080
	250 × 2P	250 × 2P	-	-	-		R150-12		TD-325, TD-313	TP-150
	-	-	350 × 2P	-	-		R200-12		TD-327, TD-314	TP-200
2415	-	-	-	-	1	M12	R60-12	YF-1 YET-300-1	TD-321, TD-311	TP-060
	-	-	-	3/0 × 2P	-		80-12		TD-323, TD-312	TP-080
	250 × 2P	-	-	-	-		R150-12		TD-325, TD-313	TP-150
	-	300 × 2P								
	-	-	350 × 2P	-	-		R200-12		TD-327, TD-314	TP-200

Table 5.12 Closed-Loop Crimp Terminals and Insulation Caps for 400 V Class

Model	Recommended Gauge (AWG, kcmil)					Terminal Screw Size	Crimp Terminal Model	Crimping Tool		Insulation Cap Model
	R/L1 S/L2 T/L3	U/T1 V/T2 W/T3	-, +1	+3	⏚			Tool Model	Die Jaw	
4002, 4004	-	-	-	-	12	M4	R5.5-4	YA-4	AD-900	TP-005
4005 - 4012	-	-	-	-	10	M4	R5.5-4	YA-4	AD-900	TP-005
4018, 4023	-	-	-	-	10	M5	R5.5-5	YA-4	AD-900	TP-005
4031	-	-	-	-	8	M6	R8-6	YA-4	AD-901	TP-008
4038	-	-	-	-	6	M6	R14-6	YA-4	AD-902	TP-014
4044, 4060	-	-	-	-	6	M6	R14-6	YA-4	AD-902	TP-014
4075	-	-	-	-	6	M6	R14-6	YA-4	AD-902	TP-014
4089, 4103	-	-	-	-	4	M6	R22-6	YA-5	AD-953	TP-022
4140, 4168	-	-	-	-	4	M8	R22-8	YA-5	AD-953	TP-022

Model	Recommended Gauge (AWG, kcmil)					Terminal Screw Size	Crimp Terminal Model	Crimping Tool		Insulation Cap Model
	R/L1 S/L2 T/L3	U/T1 V/T2 W/T3	-, +1	+3	⏚			Tool Model	Die Jaw	
4208	-	-	-	-	4	M10	R22-10	YF-1 YET-150-1	TD-223, TD-212	TP-022
	1/0 × 2P	1/0 × 2P	-	1/0 × 2P	-		R60-10		TD-225, TD-213	TP-060
	-	-	3/0 × 2P	-	-		80-10		TD-227, TD-214	TP-080
4250	-	-	-	-	2	M10	R38-10	YF-1 YET-150-1	TD-224, TD-212	TP-038
	-	-	-	1/0 × 2P	-		R60-10		TD-225, TD-213	TP-060
	2/0 × 2P	2/0 × 2P	-	-	-		80-10		TD-227, TD-214	TP-080
	-	-	3/0 × 2P							
4296	-	-	-	-	2	M10	R38-10	YF-1 YET-150-1	TD-224, TD-212	TP-038
	-	-	-	1/0 × 2P	-		R60-10		TD-225, TD-213	TP-060
	3/0 × 2P	3/0 × 2P	-	-	-		80-10		TD-227, TD-214	TP-080
	-	-	4/0 × 2P	-	-		R100-10		TD-228, TD-214	TP-100
4371	-	-	-	-	1	M12	R60-12	YF-1 YET-300-1	TD-321, TD-311	TP-060
	-	-	-	3/0 × 2P	-		80-12		TD-323, TD-312	TP-080
	250 × 2P	250 × 2P	-	-	-		R150-12		TD-325, TD-313	TP-150
	-	-	350 × 2P	-	-		R200-12		TD-327, TD-314	TP-200
4389	-	-	-	-	1	M12	R60-12	YF-1 YET-300-1	TD-321, TD-311	TP-060
	-	-	-	4/0 × 2P	-		R100-12		TD-324, TD-312	TP-100
	300 × 2P	300 × 2P	-	-	-		R150-12		TD-325, TD-313	TP-150
	-	-	400 × 2P	-	-		R200-12		TD-327, TD-314	TP-200
4453	-	-	-	-	1/0	M12	R60-12	YF-1 YET-300-1	TD-321, TD-311	TP-060
	-	-	-	3/0 × 4P	-		80-12		TD-323, TD-312	TP-080
	-	4/0 × 4P	4/0 × 4P	-	-		R100-12		TD-324, TD-312	TP-100
	250 × 4P	-	-	-	-		R150-12		TD-325, TD-313	TP-150
4568	-	-	-	-	2/0	M12	80-12	YF-1 YET-300-1	TD-323, TD-312	TP-080
				3/0 × 4P	-					
	-	4/0 × 4P	-	-	-		R100-12		TD-324, TD-312	TP-100
	250 × 4P	-	-	-	-		R150-12		TD-325, TD-313	TP-150
	-		300 × 4P							
4675	-	-	-	-	2/0	M12	80-12	YF-1 YET-300-1	TD-323, TD-312	TP-080
	-	-	-	4/0 × 4P	-		R100-12		TD-324, TD-312	TP-100
	300 × 4P	300 × 4P	-	-	-		R150-12		TD-325, TD-313	TP-150
	-	-	400 × 4P	-	-		R200-12		TD-327, TD-314	TP-200

■ Factory-Recommended Branch Circuit Protection for UL Listing

WARNING! *Electrical Shock Hazard. Do not immediately energize the drive or operate peripheral devices after the drive blows a fuse or trips an RCM/RCD. Wait for the time specified on the warning label at a minimum and make sure that all indicators are OFF. Then check the wiring and peripheral device ratings to find the cause of the problem. Contact the manufacturer before energizing the drive or peripheral devices if the cause is not known. Failure to obey can cause death or serious injury and damage to the drive.*

- 200 V class
  Use the fuses specified in this document to prepare the drive for use on a circuit that supplies not more than 100,000 RMS symmetrical amperes and 240 Vac when there is a short circuit in the power supply.
- 400 V class
  Use the fuses specified in this document to prepare the drive for use on a circuit that supplies not more than 100,000 RMS symmetrical amperes and 480 Vac when there is a short circuit in the power supply.

The built-in short circuit protection of the drive does not provide branch circuit protection. The user must provide branch circuit protection as specified by the National Electric Code (NEC), the Canadian Electric Code, Part I (CEC), and local codes.

Table 5.13 Factory-Recommended Branch Circuit Protection: 200 V Class (ND)

Drive Model	Maximum Applicable Motor Output kW (HP)	Input Current Rating A	Semiconductor Protection Fuse Rated Current Manufacturer: EATON/Bussmann
2004	0.75 (0.75)	4.8	FWH-45B
2006	1.1 (1.5)	6.7	FWH-45B
2010	2.2 (3)	12.7	FWH-45B
2012	3 (4)	17	FWH-50B
2018	3.7 (5)	20.7	FWH-80B
2021	5.5 (7.5)	30	FWH-80B
2030	7.5 (10)	40.3	FWH-125B
2042	11 (15)	52	FWH-150B
2056	15 (20)	78.4	FWH-200B
2070	18.5 (25)	96	FWH-225A
2082	22 (30)	114	FWH-225A FWH-250A *1
2110	30 (40)	111	FWH-225A FWH-250A *1
2138	37 (50)	136	FWH-275A FWH-300A *1
2169	45 (60)	164	FWH-275A FWH-350A *1
2211	55 (75)	200	FWH-325A FWH-450A *1
2257	75 (100)	271	FWH-600A
2313	90 (125)	324	FWH-800A
2360	110 (150)	394	FWH-1000A
2415	-	-	-

*1 A fuse with a large rated current for applications with repeated loads is recommended.

Table 5.14 Factory-Recommended Branch Circuit Protection: 200 V Class (HD)

Drive Model	Maximum Applicable Motor Output kW (HP)	Input Current Rating A	Semiconductor Protection Fuse Rated Current Manufacturer: EATON/Bussmann
2004	0.55 (0.5)	3.6	FWH-45B
2006	0.75 (1)	4.8	FWH-45B
2010	1.5 (2)	8.9	FWH-45B
2012	2.2 (3)	12.7	FWH-50B
2018	3 (4)	17	FWH-80B
2021	3.7 (5)	20.7	FWH-80B

Drive Model	Maximum Applicable Motor Output kW (HP)	Input Current Rating A	Semiconductor Protection Fuse Rated Current Manufacturer: EATON/Bussmann
2030	5.5 (7.5)	30	FWH-125B
2042	7.5 (10)	40.3	FWH-150B
2056	11 (15)	58.2	FWH-200B
2070	15 (20)	78.4	FWH-225A
2082	18.5 (25)	96	FWH-225A FWH-250A *1
2110	22 (30)	82	FWH-225A FWH-250A *1
2138	30 (40)	111	FWH-275A FWH-300A *1
2169	37 (50)	136	FWH-275A FWH-350A *1
2211	45 (60)	164	FWH-325A FWH-450A *1
2257	55 (75)	200	FWH-600A
2313	75 (100)	271	FWH-800A
2360	90 (125)	324	FWH-1000A
2415	110 (150)	394	FWH-1000A

*1 A fuse with a large rated current for applications with repeated loads is recommended.

Table 5.15 Factory-Recommended Branch Circuit Protection: 400 V Class (ND)

Drive Model	Maximum Applicable Motor Output kW (HP) Input Voltage < 460 V	Maximum Applicable Motor Output kW (HP) Input Voltage ≥ 460 V	Input Current Rating A	Semiconductor Protection Fuse Rated Current Manufacturer: EATON/ Bussmann
4002	0.75 (1)	0.75 (1)	2.5	FWH-50B
4004	1.5 (2)	1.5 (2)	4.7	FWH-50B
4005	2.2 (3)	2.2 (3)	6.7	FWH-50B
4007	3.0 (4)	3.0 (4)	8.9	FWH-60B
4009	4.0 (5)	3.7 (5)	11.7	FWH-60B
4012	5.5 (7.5)	5.5 (7.5)	15.8	FWH-60B
4018	7.5 (10)	7.5 (10)	21.2	FWH-80B
4023	11 (15)	11 (15)	30.6	FWH-90B
4031	15 (20)	15 (20)	41.3	FWH-150B
4038	18.5 (25)	18.5 (25)	50.5	FWH-200B
4044	22 (30)	22 (30)	59.7	FWH-200B
4060	30 (40)	30 (40)	58.3	FWH-225A
4075	37 (50)	37 (50)	71.5	FWH-250A
4089	45 (60)	45 (60)	86.5	FWH-275A
4103	55 (75)	55 (75)	105	FWH-275A
4140	75 (100)	75 (100)	142	FWH-300A
4168	90 (125)	90 (125)	170	FWH-325A FWH-400A *1
4208	110 (150)	110 (150)	207	FWH-500A
4250	132 (175)	150 (200)	248	FWH-600A
4296	160 (200)	185 (250)	300	FWH-700A
4371	200 (250)	220 (300)	373	FWH-800A
4389	220 (300)	260 (350)	410	FWH-1000A
4453	250 (335)	300 (400)	465	FWH-1200A

Drive Model	Maximum Applicable Motor Output kW (HP) Input Voltage < 460 V	Maximum Applicable Motor Output kW (HP) Input Voltage ≥ 460 V	Input Current Rating A	Semiconductor Protection Fuse Rated Current Manufacturer: EATON/ Bussmann
4568	315 (400)	335 (450)	584	FWH-1200A
4675	355 (450)	370 (500)	657	FWH-1400A FWH-1600A *1

*1 A fuse with a large rated current for applications with repeated loads is recommended.

Table 5.16 Factory-Recommended Branch Circuit Protection: 400 V Class (HD)

Drive Model	Maximum Applicable Motor Output kW (HP) Input Voltage < 460 V	Maximum Applicable Motor Output kW (HP) Input Voltage ≥ 460 V	Input Current Rating A	Semiconductor Protection Fuse Rated Current Manufacturer: EATON/ Bussmann
4002	0.55 (0.75)	0.55 (0.75)	1.9	FWH-50B
4004	1.1 (1.5)	0.75 (1)	3.5	FWH-50B
4005	1.5 (2)	1.5 (2)	4.7	FWH-50B
4007	2.2 (3)	2.2 (3)	6.7	FWH-60B
4009	3 (4)	3 (4)	8.9	FWH-60B
4012	4.0 (5)	3.7 (5)	11.7	FWH-60B
4018	5.5 (7.5)	5.5 (7.5)	15.8	FWH-80B
4023	7.5 (10)	7.5 (10)	21.2	FWH-90B
4031	11 (15)	11 (15)	30.6	FWH-150B
4038	15 (20)	15 (20)	41.3	FWH-200B
4044	18.5 (25)	18.5 (25)	50.5	FWH-200B
4060	22 (30)	22 (30)	43.1	FWH-225A
4075	30 (40)	30 (40)	58.3	FWH-250A
4089	37 (50)	37 (50)	71.5	FWH-275A
4103	45 (60)	45 (60)	86.5	FWH-275A
4140	55 (75)	55 (75)	105	FWH-300A
4168	75 (100)	75 (100)	142	FWH-325A FWH-400A *1
4208	90 (125)	90 (125)	170	FWH-500A
4250	110 (150)	110 (150)	207	FWH-600A
4296	132 (175)	150 (200)	248	FWH-700A
4371	160 (200)	185 (250)	300	FWH-800A
4389	200 (250)	220 (300)	373	FWH-1000A
4453	220 (300)	260 (350)	410	FWH-1200A
4568	250 (335)	300 (400)	465	FWH-1200A
4675	315 (400)	335 (450)	584	FWH-1400A FWH-1600A *1

*1 A fuse with a large rated current for applications with repeated loads is recommended.

◆ Low Voltage Wiring for Control Circuit Terminals

You must provide low voltage wiring as specified by the National Electric Code (NEC), the Canadian Electric Code, Part I (CEC), and local codes. The NEC class 1 circuit conductor is recommended. Use the UL approved class 2 power supply for external power supply.

Table 5.17 Control Circuit Terminal Power Supplies

Input/Output	Terminals	Power Supply Specifications
Digital input	DI1 to DI8, D0V, DIC, D24V	Uses the LVLC power supply in the drive. Use the UL Listed class 2 power supply for external power supply.
Analog input	AI1 to AI3, A0V, +10V, -10V	Uses the LVLC power supply in the drive. Use the UL Listed class 2 power supply for external power supply.

Input/Output	Terminals	Power Supply Specifications
Analog output	AO1, AO2, A0V	Uses the LVLC power supply in the drive.
Pulse train output	PO, A0V	Uses the LVLC power supply in the drive. Use the UL Listed class 2 power supply for external power supply.
Pulse train input	PI, A0V	Uses the LVLC power supply in the drive. Use the UL Listed class 2 power supply for external power supply.
Safe disable input	H1, H2, HC	Uses the LVLC power supply in the drive. Use the UL Listed class 2 power supply for external power supply.
Serial communication input/output	A+, B-, A0V	Uses the LVLC power supply in the drive. Use the UL Listed class 2 power supply for external power supply.
24 V external power supply	E24V, A0V	Use the UL Listed class 2 power supply.

◆ Drive Motor Overload and Overheat Protection

The drive motor overload and overheat protection function complies with the National Electric Code (NEC) and the Canadian Electric Code, Part I (CEC).

Set the Motor Rated Current and *L1-01 [Motor Cool Type for OL1 Calc] through L1-04 [Motor oH FLT Reaction Select]* correctly to enable motor overload and overheat protection.

Refer to the control method and set the motor rated current with *E2-01 [Mot Rated Current (FLA)]*, *E5-03 [PM Mot Rated Current (FLA)]*, or *E9-06 [Motor Rated Current]*.

■ E2-01 Mot Rated Current (FLA)

No. (Hex.)	Name	Description	Default (Range)
E2-01 (030E)	Mot Rated Current (FLA)	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the motor rated current in amps.	Determined by o2-04 and C6-01 (10% to 200% of the drive rated current)

Note:
- If *E2-01 < E2-03 [Mot Rated Current (FLA) < Mot No-Load Current]* the drive will detect *oPE02 [Parameter Range Setting Error]*.
- The default settings and setting ranges are in these units:
  – 0.01 A: 4002 to 4023
  – 0.1 A: 4031 to 4675

The value set for *E2-01* becomes the reference value for motor protection, the torque limit, and torque control. Enter the motor rated current as written on the motor nameplate. The value of *E2-01* is automatically set to the value input for “Motor Rated Current” by the Auto-Tuning process.

■ E5-03 PM Mot Rated Current (FLA)

No. (Hex.)	Name	Description	Default (Range)
E5-03 (032B)	PM Mot Rated Current (FLA)	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the PM motor rated current (FLA).	Determined by E5-01 (10% to 200% of the drive rated current)

Note:

When the drive model changes, the display units for this parameter also change.
- 0.01 A: 4002 to 4023
- 0.1 A: 4031 to 4675

The drive automatically sets *E5-03* to the value input for “PM Motor Rated Current” after you do these types of Auto-Tuning:

- PM Motor Parameter Settings
- PM Stationary Auto-Tuning
- PM StaTun for Stator Resistance
- PM Rotational Auto-Tuning

■ E9-06 Motor Rated Current

No. (Hex.)	Name	Description	Default (Range)
E9-06 (11E9)	Motor Rated Current	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the motor rated current in amps.	Determined by E9-01 and o2-04 (10% to 200% of the drive rated current)

Note:

When the drive model changes, the display units for this parameter also change.
- 0.01 A: 4002 to 4023
- 0.1 A: 4031 to 4675

The setting value of *E9-06* is the reference value for motor protection. Enter the motor rated current shown on the motor nameplate. Auto-Tuning the drive will automatically set *E9-06* to the value input for “Motor Rated Current”.

■ L1-01 Motor Cool Type for OL1 Calc

No. (Hex.)	Name	Description	Default (Range)
L1-01 (0480)	Motor Cool Type for OL1 Calc	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the motor overload protection with electronic thermal protectors.	Determined by A1-02 (0 - 6)

This parameter enables and disables the motor overload protection with electronic thermal protectors.

The cooling capability of the motor changes when the speed control range of the motor changes. Use an electronic thermal protector that aligns with the permitted load characteristics of the motor to select motor protection.

The electronic thermal protector of the drive uses these items to calculate motor overload tolerance and supply overload protection for the motor:

- Output current
- Output frequency
- Motor thermal characteristics
- Time characteristics

If the drive detects motor overload, the drive will trigger an *oL1 [Motor Overload]* and stop the drive output.

Set *H2-01 = 4E [Multi-Function Digital Output 1 = Drive PreOH]* to set a motor overload alarm. If the motor overload level is more than 90% of the *oL1* detection level, the output terminal turns ON and triggers an overload alarm.

0 : Disabled

Disable motor protection when motor overload protection is not necessary or when the drive is operating more than one motor.

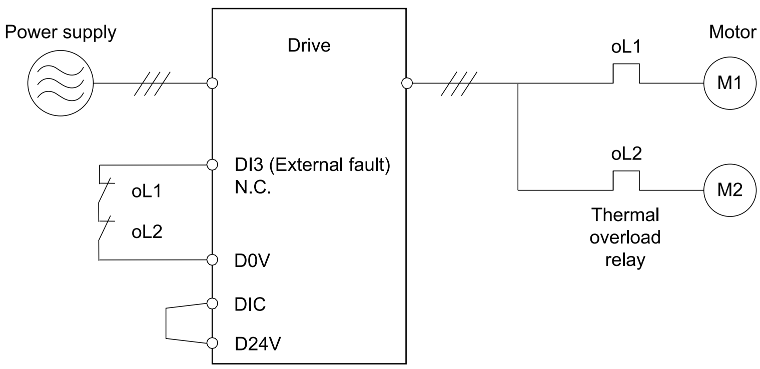


Figure 5.22 Example: Protection Circuit Configuration to Connect More than One Motor to One Drive

NOTICE: *When one drive is operating more than one motor at the same time or when the rated current of the motor is much larger than rated current of a standard motor, you cannot protect the motor with electronic thermal protection. To protect each motor, set L1-01 =1 [Motor Cool Type for OL1 Calc = VTorque], configure the circuits, then add thermal relays to each motor. The magnetic contactor installed for motor protection cannot be switched ON/OFF during run. Failure to obey can cause motor failure.*

1 : VTorque

Use this setting for general-purpose motors with a 60 Hz base frequency.

Standards Compliance

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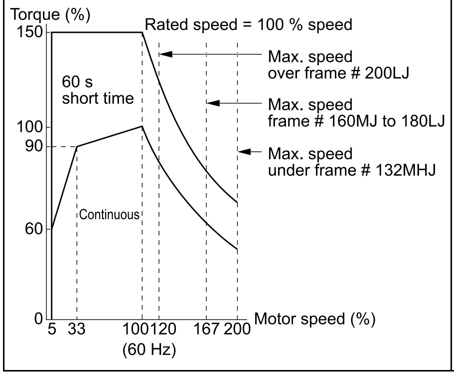
The overload tolerance decreases as motor speed decreases because the cooling fan speed decreases and the ability of the motor to cool decreases in the low speed range.

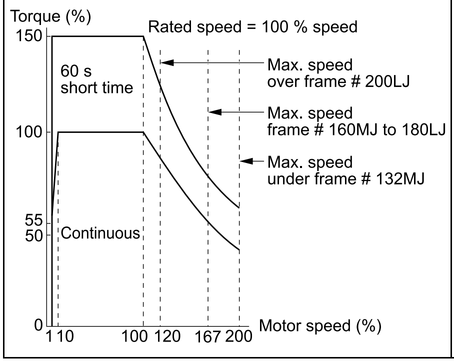
The overload tolerance characteristics of the motor change the trigger point for the electronic thermal protector. This provides motor overheat protection from low speed to high speed across the full speed range.

Load Tolerance	Cooling Capability	Overload Characteristics (at 100% motor load)
	This motor is designed to operate with commercial line power. Operate at a 60 Hz base frequency to maximize the motor cooling ability.	If the motor operates at frequencies less than 60 Hz, the drive will detect *oL1*. The drive triggers a fault relay output and the motor coasts to stop.

2 : CT 10:1 Speed Range

Use this setting for drive-dedicated motors with a speed range for constant torque of 1:10.

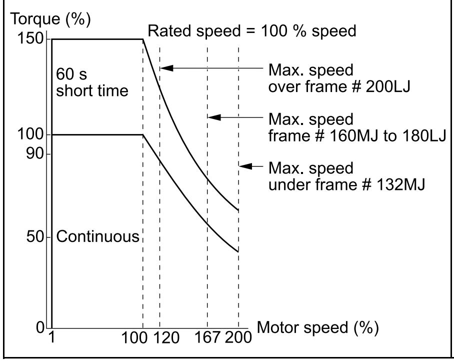
The speed control for this motor is 10% to 100% when at 100% load. Operating slower than 10% speed at 100% load will cause motor overload.

Load Tolerance	Cooling Capability	Overload Characteristics (at 100% motor load)
	This motor is designed to withstand increased temperatures during continuous operation in the low speed range (10% base frequency).	The motor operates continuously at 10% to 100% base frequency. Operating slower than 10% speed at 100% load will cause motor overload.

3 : CT 100:1 SpeedRange

Use this setting for vector motors with a speed range for constant torque of 1:100.

The speed control for this motor is 1% to 100% when at 100% load. Operating slower than 1% speed at 100% load will cause motor overload.

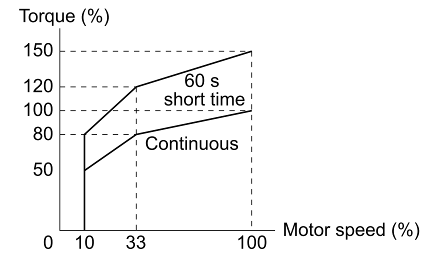
Load Tolerance	Cooling Capability	Overload Characteristics (at 100% motor load)
	This motor is designed to withstand increased temperatures during continuous operation in the low speed range (1% base frequency).	The motor operates continuously at 1% to 100% base frequency. Operating slower than 1% speed at 100% load will cause motor overload.

4 : PM VTorque

Use this setting for PM motors with derated torque characteristics.

The overload tolerance decreases as motor speed decreases because the cooling fan speed decreases and the ability of the motor to cool decreases in the low speed range.

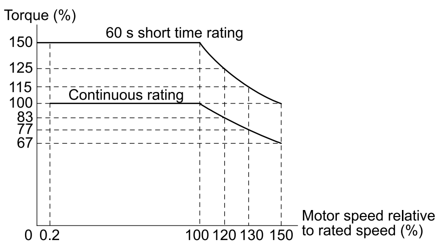
The overload tolerance characteristics of the motor change the trigger point for the electronic thermal protector. This provides motor overheat protection from low speed to high speed across the full speed range.

<table>
<tr><th>Load Tolerance</th><th>Cooling Capability</th><th>Overload Characteristics
(at 100% motor load)</th></tr>
<tr><td>
</td><td>This motor is designed to withstand increased temperatures during continuous operation at rated speed and rated torque.</td><td>If the motor operates continuously at lower speed than rated rotation speed at more than 100% torque, the drive will detect oL1. The drive triggers a fault relay output and the motor coasts to stop.</td></tr>
</table>

5 : PM CTorque

Use this setting with a PM motor for constant torque that has a speed range for constant torque of 1:500.

The speed control for this motor is 0.2% to 100% when at 100% load. Operating slower than 0.2% speed at 100% load will cause motor overload.

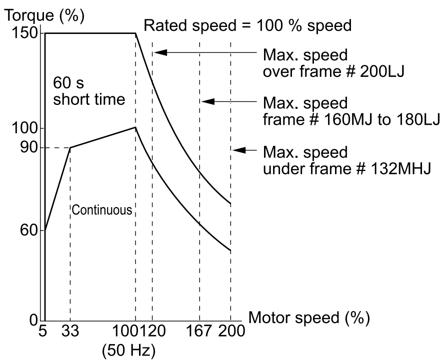
<table>
<tr><th>Load Tolerance</th><th>Cooling Capability</th><th>Overload Characteristics
(at 100% motor load)</th></tr>
<tr><td>
</td><td>This motor is designed to withstand increased temperatures during continuous operation in the low speed range (0.2% base frequency).</td><td>The motor operates continuously at 0.2% to 100% rated speed. Operating slower than 0.2% speed at 100% load will cause motor overload.</td></tr>
</table>

6 : VT (50Hz)

Use this setting for general-purpose motors with a 50 Hz base frequency.

The overload tolerance decreases as motor speed decreases because the cooling fan speed decreases and the ability of the motor to cool decreases in the low speed range.

The overload tolerance characteristics of the motor change the trigger point for the electronic thermal protector. This provides motor overheat protection from low speed to high speed across the full speed range.

<table>
<tr><th>Load Tolerance</th><th>Cooling Capability</th><th>Overload Characteristics
(at 100% motor load)</th></tr>
<tr><td>
</td><td>This motor is designed to operate with commercial line power. Operate at a 50 Hz base frequency to maximize the motor cooling ability.</td><td>If the motor operates at frequencies less than commercial line power, the drive will detect oL1. The drive triggers a fault relay output and the motor coasts to stop.</td></tr>
</table>

■ L1-02 OL1 Protect Time

No. (Hex.)	Name	Description	Default (Range)
L1-02 (0481)	OL1 Protect Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the operation time for the electronic thermal protector of the drive to prevent damage to the motor. Usually it is not necessary to change this setting.	1.0 min (0.1 - 5.0 min)

Set the overload tolerance time to the length of time that the motor can operate at 150% load from continuous operation at 100% load.

When the motor operates at 150% load continuously for 1 minute after continuous operation at 100% load (hot start), the default setting triggers the electronic thermal protector.

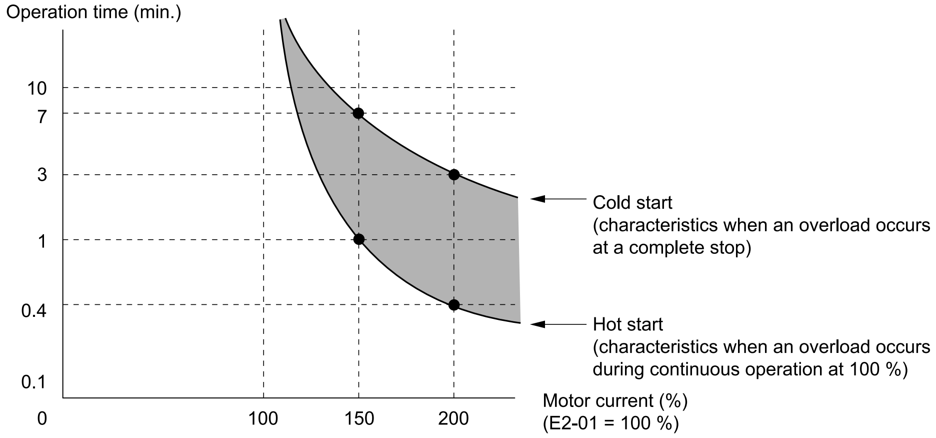


Figure 5.23 Example: Protection Operation Time for a General-purpose Motor at Rated Output Frequency

Motor overload protection operates in the range between a cold start and a hot start.

This example shows a general-purpose motor operating at the base frequency with *L1-02* set to 1.0 min.

- Cold start
  Shows the motor protection operation time characteristics when the overload occurs immediately after starting operation from a complete stop.
- Hot start
  Shows the motor protection operation time characteristics when overload occurs from continuous operation below the motor rated current.

■ L1-03 Motor oH AL Reaction Select

No. (Hex.)	Name	Description	Default (Range)
L1-03 (0482)	Motor oH AL Reaction Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets drive operation when the PTC input signal entered into the drive is at the *oH3 [Motor Overheat Alarm] detection level.*	3 (0 - 3)

0 : Ramp->Stop

The drive ramps the motor to stop in the deceleration time. Fault relay output terminal 1NO-1CM turns ON and 1NC-1CM turns OFF.

1 : Coast->Stop

The output turns OFF and the motor coasts to stop. Fault relay output terminal 1NO-1CM turns ON, and 1NC-1CM turns OFF.

2 : Fast Stop (C1-09)

The drive stops the motor in the deceleration time set in *C1-09 [Fast Stop Time]*. Fault relay output terminal 1NO-1CM turns ON, and 1NC-1CM turns OFF.

3 : Alarm Only

The keypad shows *oH3*, and operation continues. The output terminal set for *Alarm [H2-01 to H2-03 = 4]* turns ON.

■ Motor oH FLT Reaction Select

No. (Hex.)	Name	Description	Default (Range)
L1-04 (0483)	Motor oH FLT Reaction Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the drive operation when the PTC input signal to the drive is at the *oH4 [Motor Overheat Fault (PTC Input)]* detection level.	1 (0 - 2)

0 : Ramp->Stop

The drive ramps the motor to stop in the deceleration time. Fault relay output terminal 1NO-1CM turns ON and 1NC-1CM turns OFF.

1 : Coast->Stop

The output turns OFF and the motor coasts to stop. Fault relay output terminal 1NO-1CM turns ON, and 1NC-1CM turns OFF.

2 : Fast Stop (C1-09)

The drive stops the motor in the deceleration time set in *C1-09 [Fast Stop Time]*. Fault relay output terminal 1NO-1CM turns ON, and 1NC-1CM turns OFF.

5.4 China RoHS Compliance

Figure 5.24 China RoHS Mark

The China RoHS mark is displayed on products containing six specified hazardous substances that are in excess of regulatory limits, based on the "Administrative Measures for the Restriction of the Use of Hazardous Substances in Electrical and Electronic Products" and "Marking for the Restricted Use of Hazardous Substances in Electronic and Electrical Products" (SJ/T 11364-2014), which were promulgated on January 26, 2016. The number displayed in the center of the mark indicates the environment-friendly use period (number of years) in which electrical and electronic products that are being produced, sold, or imported to China can be used. The date of manufacture of the electrical and electronic product is the starting date of the environment-friendly use period for the product. The six specified hazardous substances contained in the product will not leak outside of the product during normal use within this period and will have no serious impact on the environment, the human body, or property.

The environment-friendly use period for this product is 15 years. This period is not the product warranty period.

Table 5.18 Contents of Hazardous Substances in This Product

Parts Name	Hazardous Substances					
	Lead (Pb)	Mercury (Hg)	Cadmium (Cd)	Hexavalent Chromium (Cr(VI))	Polybrominated Biphenyls (PBB)	Polybrominated Diphenyl Ethers (PBDE)
Circuit Board	×	○	○	○	○	○
Electronic Parts	×	○	○	○	○	○
Brass Screw	×	○	○	○	○	○
Aluminum Die Casting	×	○	○	○	○	○

This table has been prepared in accordance with the provisions outlined in SJ/T 11364.

○: Indicates that said hazardous substance contained in all of the homogeneous materials for this part is below or equal to the limit requirement of GB/T 26572.

×: Indicates that said hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement of GB/T 26572.

Note:

This product complies with EU RoHS directives. In this table, "×" indicates that hazardous substances that are exempt from EU RoHS directives are contained.

5.5 对应中国RoHS指令

图 5.25 中国RoHS标志

中国RoHS标志依据2016年1月26日公布的《电器电子产品有害物质限制使用管理办法》，以及《电子电气产品有害物质限制使用标识要求》（SJ/T 11364-2014）作成。电子电气产品中特定6种有害物质的含量超过规定值时，应标识此标志。中间的数字为在中国生产销售以及进口的电子电气产品的环保使用期限（年限）。电子电气产品的环保使用期限从生产日期算起。在期限内，正常使用产品的过程中，不会有特定的6种有害物质外泄进而对环境、人和财产造成深刻影响。

本产品的环保使用期限为15年。但需要注意的是环保使用期限并非产品的质量保证期限。

表 5.19 本产品中有害物质的名称及含量

部件名称	有害物质					
	铅(Pb)	汞(Hg)	镉(Cd)	六价铬(Cr(VI))	多溴联苯(PBB)	多溴二苯醚(PBDE)
实装基板	×	○	○	○	○	○
电子元件	×	○	○	○	○	○
黄铜螺钉	×	○	○	○	○	○
铝压铸	×	○	○	○	○	○

本表格依据SJ/T 11364的规定编制。
○：表示该有害物质在该部件所有均质材料中的含量均在GB/T 26572规定的限量要求以下。
×：表示该有害物质至少在该部件的某一均质材料中的含量超出GB/T 26572规定的限量要求。
（注） 本产品符合欧盟RoHS指令。上表中的“×”表示含有欧盟RoHS指令豁免的有害物质。

5.6 Safe Disable Input

Figure 5.26 TUV Mark

The TUV mark identifies that the product complies with the safety standards.

This section gives precautions to support the Safe Disable input. Contact the manufacturer for more information.

Table 5.20 Applied Safety Standards and Unified Standards

Safety Standards	Unified Standards
Functional Safety	IEC/EN 61508:2010 (SIL3)
	IEC/EN 62061/A2:2015 (SILCL3)
	IEC/EN 61800-5-2:2007 (SIL3)
Machine Safety	ISO/EN ISO 13849-1:2015 (Cat.3, PL e)
EMC	IEC/EN 61000-6-7:2015, IEC/EN61326-3-1:2008

SIL = Safety Integrity Level.

◆ Safe Disable Specifications

The Safe Disable input provides the stop function compliant to "Safe Torque Off" defined in IEC/EN 61800-5-2:2007. The Safe Disable input is designed to meet the requirements of EN ISO 13849-1 and IEC/EN 61508. It is also equipped with the safety status monitor to detect safety circuit errors.

When you install the drive as a component in a system, you must make sure that the system complies with the applicable safety standards.

Table 5.21 Specifications for the Safety Function

Item		Description
Input/output		• Input: 2 Safe Disable input (H1, H2) Signal ON level: 18 Vdc to 28 Vdc Signal OFF level: -4 Vdc to +4 Vdc • Output: 1 MFDO safety monitor output for external device monitor (EDM)
Response time from opening the input to stopping the drive output		3 ms or less
Response time from opening H1 and H2 terminal inputs to operating the EDM signal		20 ms or less
Failure probability	Less frequent operation request mode	PFD = $4.65E^{-6}$
	Frequent operation request mode or continuous mode	PFH = $1.11E^{-9}$
Performance level		The Safe Disable input complies with the performance level requirements of EN ISO 13849-1.
HFT (hardware fault tolerance)		N = 1
Type of subsystem		Type B

EDM = External Device Monitoring

PFD = Probability of Failure on Demand

PFH = Probability of Dangerous Failure per Hour

◆ Safety Precautions

DANGER! *Sudden Movement Hazard. Make sure that the full system or machinery in which the Safe Disable function is used complies with safety requirements. When implementing the Safe Disable function into the safety system of a machine, do a full risk assessment for the system to make sure that all parts of the system comply with applicable safety standards. Incorrect application of the Safe Disable function will cause serious injury or death.*

DANGER! *Sudden Movement Hazard. An external holding brake or dynamic brake are NOT drive safety components. Systems that use an external holding brake or dynamic brake with a drive output signal (including EDM) are not safe systems because the drive output signal is not a safety component. You must use a system that satisfies the safety requirements. Failure to obey will cause death or serious injury.*

DANGER! *Sudden Movement Hazard. Connect the Safe Disable inputs to the devices as specified by the safety requirements. Failure to obey will cause death or serious injury.*

WARNING! *Sudden Movement Hazard. With PM motors, the failure of two output transistors can cause current to flow through the motor winding and move the motor output axis 180 electrical degrees. This is possible when the Safe Disable function turns off the drive output. Make sure that output transistors failure will not effect the safety of the application when with the Safe Disable function. Failure to obey could cause death or serious injury.*

WARNING! *Electrical Shock Hazard. The Safe Disable function will turn off the drive output, but it will not stop the drive power supply and it cannot electrically isolate the drive output from the input. Always turn off the drive power supply during maintenance and installations on the drive input and output sides. Failure to obey could cause death or serious injury.*

WARNING! *Sudden Movement Hazard. An external gravitational force in the vertical axis will move the motor although the Safe Disable function is in operation. Failure to obey could cause serious injury or death.*

WARNING! *Sudden Movement Hazard. Remove the pre-installed wire links between terminals H1-HC and H2-HC to use the Safe Disable inputs. Failure to obey will prevent correct operation of the Safe Disable circuit and could cause death or serious injury.*

WARNING! *Sudden Movement Hazard. Regularly examine the Safe Disable input and all other safety features. A system that does not operate correctly can cause death or serious injury.*

WARNING! *Sudden Movement Hazard. Only let approved technicians with full knowledge of the drive, the instruction manual, and safety standards wire, examine, and maintain the Safe Disable input. Failure to obey could cause death or serious injury.*

NOTICE: *A maximum of 3 ms will elapse from when terminals H1 or H2 shut off until the drive switches to the "Safe Torque Off" status. Set the OFF status for terminals H1 and H2 to hold for at least 2 ms. The drive may not be able to switch to the "Safe Torque Off" status if terminals H1 and H2 are only open for less than 2 ms.*

NOTICE: *Only use the Safe Disable Monitor (multi-function output terminal set to the EDM function) to monitor the Safe Disable status or to find a malfunction in the Safe Disable inputs. The monitor output is not a safety output.*

NOTICE: *Drives that have a built-in safety function must be replaced 10 years after first use.*

◆ Using the Safe Disable Function

■ Safe Disable Circuit

The Safe Disable circuit has two isolated channels (terminals H1 and H2) that stop the output transistors. The input can use the internal power supply of the drive.

Set the EDM function to one of the MFDO terminals *[H2-xx = E or 10E]* to monitor the status of the Safe Disable function. This is the "Safe Disable monitor output function".

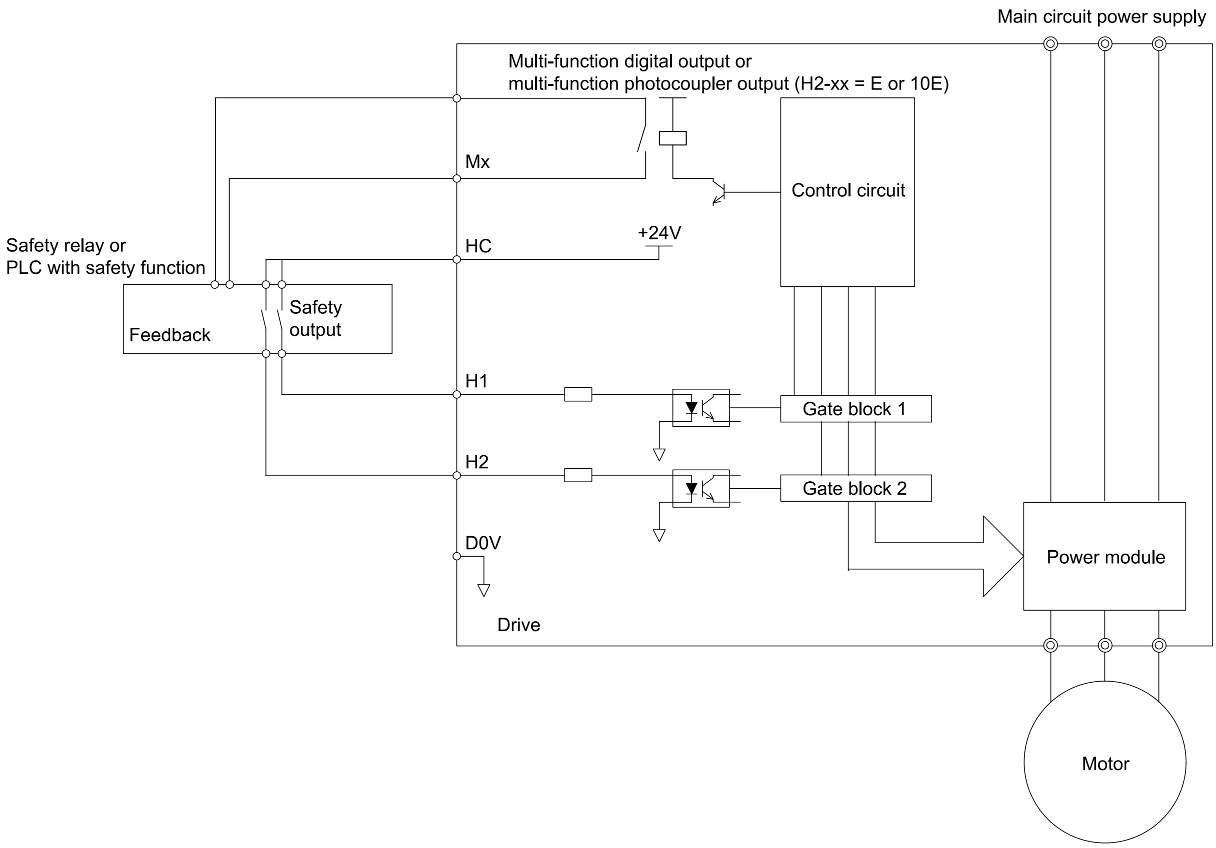


Figure 5.27 Safe Disable Function Wiring Example

■ Enabling and Disabling the Drive Output (“Safe Torque Off”)

Example of drive operation when as the drive changes from the "Safe Torque Off" status to usual operation.

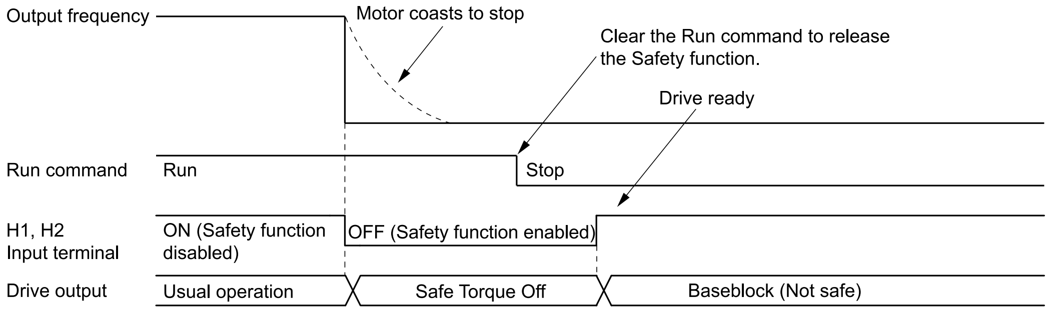


Figure 5.28 Safe Disable Operation

Switching from Usual Operation to “Safe Torque Off”

Turn OFF (open) safety input terminal H1 or H2 to enable the Safe Disable function. When the Safe Disable function is enabled while the motor is operating, the drive output and motor torque turn off and the motor always coasts to stop. The *b1-03 [Stopping Method Selection]* setting does not have an effect on the stopping method.

The “Safe Torque Off” status is only possible with the Safe Disable function. Clear the Run command to stop the drive. Turning off drive output (a baseblock condition) ≠ “Safe Torque Off”.

Note:

A maximum of 3 ms will elapse from when terminals H1 or H2 shut off until the drive switches to the "Safe Torque Off" status. Set the OFF status for terminals H1 and H2 to hold for at least 2 ms. The drive may not be able to switch to the “Safe Torque Off” status if terminals H1 and H2 are only open for less than 2 ms.

Turn OFF terminals H1 and H2 after the motor fully stops. This will prevent the motor from coasting to stop during usual operation.

Going from “Safe Torque Off” to Usual Operation

The safety input will only release when there is no Run command.

- During Stop:
  When the Safe Disable function is triggered during stop, close the circuit between terminals H1-HC and H2-HC to disable “Safe Torque Off”. Enter the Run command after the drive stops correctly.
- During Run:
  When the Safe Disable function is triggered during run, close the circuit between terminals H1-HC and H2-HC to disable “Safe Torque Off” after clearing the Run command. Enter the Stop command, then enter the Run command when terminals H1 and H2 are ON or OFF.

■ Safe Disable Monitor Output Function and Keypad Display

Information about the relation between the input channel status, Safety monitor output status, and drive output status.

Table 5.22 Safe Disable Input and External Device Monitor (EDM) Terminal Status

Input Channel Status		Safety Monitor Output Status		Drive Output Status	Keypad Display	LED Status Ring
Input 1 (H1-HC)	Input 2 (H2-HC)	MFDO Terminal (H2-xx = E)	MFDO Terminal (H2-xx = 10E)			
ON (Close the circuit)	ON (Close the circuit)	OFF	ON	Baseblock (Drive ready)	Normally displayed	Ready: Illuminated
OFF (Open)	ON (Close the circuit)	OFF	ON	Safety status (STo)	SToF (Flashing)	ALM/ERR: Flashing
ON (Close the circuit)	OFF (Open)	OFF	ON	Safety status (STo)	SToF (Flashing)	ALM/ERR: Flashing
OFF (Open)	OFF (Open)	ON	OFF	Safety status (STo)	STo (Flashing)	Ready: Flashing

Safety Function Status Monitor

The drive Safety monitor output sends a feedback signal about the status of the Safety function. The Safety monitor output is one of the possible settings available for the MFDO terminals. If there is damage to the Safe Disable circuit, a controller (PLC or safety relay) must read this signal as an input signal to hold the “Safe Torque Off” status. This will help verify the condition of the safety circuit. Refer to the manual for the safety device for more information about the Safety function.

It is possible to switch polarity of the Safety monitor output signal with the MFDO function settings.

Keypad Display

If the two input channels are OFF (Open), the keypad will flash *STo [Safe Torque OFF]*.

If there is damage to the Safe disable circuit or the drive, the keypad will flash *SToF [Safe Torque OFF Hardware]* when one input channel is OFF (Open), and the other is ON (Short circuit). When you use the Safe disable circuit correctly, the keypad will not show *SToF*.

If there is damage to the drive, the keypad will show *SCF [Safety Circuit Fault]* when the drive detects a fault in the Safe disable circuit. Refer to the chapter on Troubleshooting for more information.

■ Validating the Safe Disable Function

After you replace parts or do maintenance on the drive, first complete all necessary wiring to start the drive, then test the Safe Disable input with these steps. Keep a record of the test results.

- When the two input channels are OFF (Open), make sure that the keypad flashes *STo [Safe Torque OFF]*, and make sure that the motor is not running.
- Monitor the ON/OFF status of the input channels and make sure that MFDO set to the EDM function operates as shown in n.
  If one or more of the these items are true, the ON/OFF status of the MFDO may not display correctly on the keypad:
  – Incorrect parameter settings.
  – A problem with an external device.
  – The external wiring has a short circuit or is disconnected.
  – There is damage to the device.

  Find the cause and repair the problem to correctly display the status.
- Make sure that the EDM signal operates as expected during usual operation.

Standards Compliance

5

6

Network Communications

6.1 Field Bus Network Support

You can use the PLC to control and monitor the drive through the network. The drive has a standard RS-485 interface (Modbus communications). Install a separately sold communication option on the drive to support other network communications.

◆ Available Communication Options

The following field bus networks are compatible with the drive. Contact the manufacturer or your nearest sales representative to order a communication option.

Table 6.1 Available Field Bus Network

Type of Communications	Option model
EtherCAT	SI-ES3
PROFINET	SI-EP3
EtherNet/IP	SI-EN3

6.2 Modbus Communications

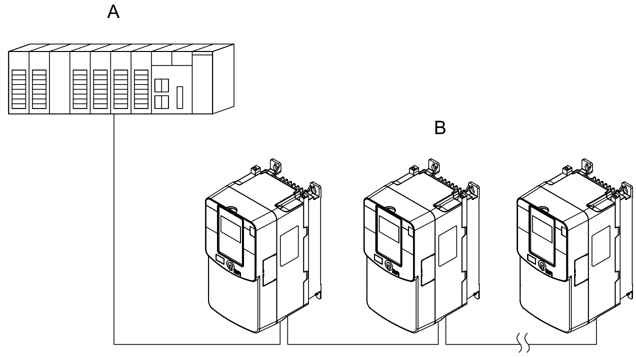
This section gives detailed information about the parameters, error codes and communication procedures for Modbus communications.

◆ Configure Master/Slave

You can use the Modbus protocol for serial communication with programmable controllers (PLC).

The Modbus communication uses one master (PLC) and a maximum of 31 slave drives. Serial communications usually starts with a signal from the master to the slave drives.

A slave drive that receives a command from the master does the specified function and then sends a response back to the master. You must set the address number for each slave drive before you start signal communications to make sure that the master uses the correct address numbers.



A - Master (PLC) **B - Slave (drive)**

Figure 6.1 PLC and Drive Connection Example

◆ Communication Specifications

Table 6.2 Modbus Specifications

Item	Specification
Interface	RS-485
Synchronization method	Asynchronous (start-stop synchronization)
Communication parameter	Communications speed: 1.2, 2.4, 4.8, 9.6, 19.2, 38.4, 57.6, 76.8, 115.2 kbps
	Data length: 8 bit (fixed)
	Parity: even, odd, none
	Stop bit 1 bit (fixed)
Communication protocol	Modbus standard (RTU mode only)
Number of possible units to connect	Maximum: 31 units

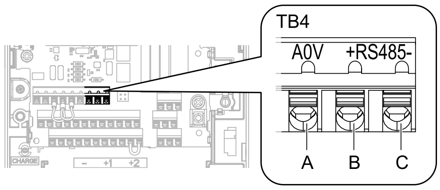
◆ Communication with the PLC

This section gives information about the settings for the termination resistor and how to connect to Modbus communications. Modbus communications uses an RS-485 interface (2-wire sequence).

■ Connect Communications Cable

Use this procedure to start communication between the PLC and drive.

1. De-energize the drive then connect the communications cable to the PLC and the drive. The drive uses terminal TB4 for Modbus communications.



A - Terminal AC: Signal ground
B - Terminal RS485+: Communication input/output (+)
C - Terminal RS485-: Communication input/output (-)

Figure 6.2 Communications Cable Connection Terminal (TB4)

Note:

Isolate the communications wiring from the main circuit wiring and other high-power wiring Use shielded wires for the communications wiring and connect cable sheaths to the ground terminal of the drive. Incorrect wiring procedures could cause drive malfunction because of electrical interference.

2. Install the termination resistor on the network termination slave drive. Set the DIP switch S2 to the ON position to enable the termination resistor on the drive.
3. Energize the drive.
4. Use the drive keypad to set the necessary communications parameters *H5-01 to H5-12*.
   - *H5-01 [Mbus Address]*
   - *H5-02 [Mbus BaudRate]*
   - *H5-03 [Mbus Parity]*
   - *H5-04 [Mbus Error Stop]*
   - *H5-05 [Mbus Fault Detection Selection]*
   - *H5-06 [Mbus Tx Wait Time]*
   - *H5-09 [Mbus CE Detect Time]*
   - *H5-10 [Mbus 0025H Unit Sel]*
   - *H5-11 [Mbus ENTER Command Mode]*
   - *H5-12 [Mbus Run Command Method Sel]*
5. De-energize the drive and wait for the keypad display to turn off.
6. Energize the drive.

The drive is prepared to start communication with the PLC.

■ Set the Termination Resistor

You must enable the termination resistor on the slave terminal of the drive to use Modbus communications. Use DIP switch S2 on the terminal block to enable and disable the built-in termination resistor. The following figure shows an example of how to set DIP switch S2.

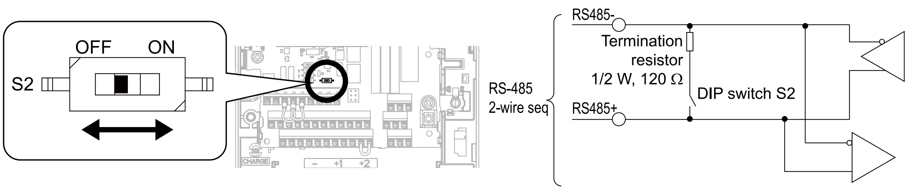


Figure 6.3 Modbus Communication Terminal and DIP Switch S2

Use the tip of a tweezers or a jig with a tip width of 0.8 mm (0.03 in.) to set the DIP switch. When you install the drive in the terminal of the communication line, set DIP switch S2 to ON. Set DIP switch S2 to OFF on all other drives.

■ Wiring Diagram for More than One Drive

The following figure shows how to wire more than one connected drive with using Modbus communications.

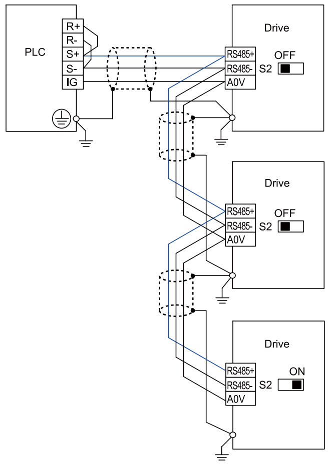


Figure 6.4 Wiring Diagram for More than One Drive

Set DIP switch S2 to the ON position on the last drive of the Modbus communication network to enable the termination resistor.

◆ Modbus Drive Operations

Drive parameters will apply to the settings when the drive is running during Modbus communications. This section gives information about the available functions and their related parameters.

■ Executable Functions

A PLC can do these operations with Modbus communications. Parameter settings (except H5-xx) do not have an effect on the availability of these operations.

- Monitor the drive status and operate the drive
- Set and view parameters
- Reset a fault
- Multi-function input setting (The input command from Modbus communications and MFDI terminals (DI1 to DI8) are linked by a logical OR operation.)

■ Drive Control

Select the external command that sets the frequency references and motor run/stop with Modbus communications. Use the following information to set the parameters as specified by the application.

Table 6.3 Required Parameter Settings for Drive Control from Modbus

LOCAL Control Selected	Parameter	Setting Value
External reference 1	b1-01 [Freq. Ref. Sel. 1]	*2 [Modbus]*
	b1-02 [Run Comm. Sel 1]	*2 [Modbus]*
External reference 2	b1-15 [Freq. Ref. Sel. 2]	*2 [Modbus]*
	b1-16 [Run Comm. Sel 2]	*2 [Modbus]*

For more information about operation mode selection, refer to *b1-01 [Freq. Ref. Sel. 1]* and *b1-02 [Run Comm. Sel 1]*. Refer to *H1-xx: MFDI Function Select = 9 [Ext. Ref. 1/2 Selection]* for more information about external command.

◆ Communications Timing

This section gives information about message timing.

To prevent overrun of the slave side, the master cannot send a message to the same drive for a selected length of time.

To prevent overrun of the master side, the slave cannot send a response message to the master for a selected length of time.

■ Command Message from Master to Slave

To prevent data loss and overrun, after the master receives a message from the slave, the master cannot send the same type of command message to the same slave for a selected length of time. The minimum wait time is different for each type of message.

Table 6.4 Minimum Wait Time to Send a Message

Command Type	Example	Minimum Wait Time
1	• Operation commands (Run command, stop command) • I/O settings • Reading the motor and parameter setting values	5 ms *1
2	Writing a parameter	50 ms *1
3	Writing of modified data with the Enter command	3 to 5 s *1

*1 When the drive receives a message in the minimum wait time, it does command type 1 and sends a response message. If the drive receives command type 2 or command type 3 messages in the minimum wait time, it will trigger a communications error or the drive will ignore the command.

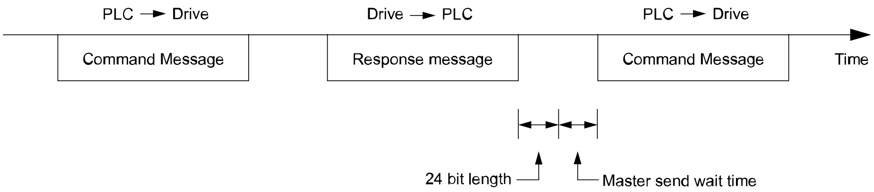


Figure 6.5 Minimum Wait Time to Send a Message

You must set the timer in the master to measure the length of time for the slave to respond to the master. If you set the timer, but the slave does not send a response message in a specified length of time, the master will send the message again.

■ Response Message from Slave

The slave receives the command message from the master then processes the data it received. The slave then waits for the time set in *H5-06 [Mbus Tx Wait Time]* then sends a response message to the master. If overrun occurs on the master, increase the wait time set in *H5-06*.

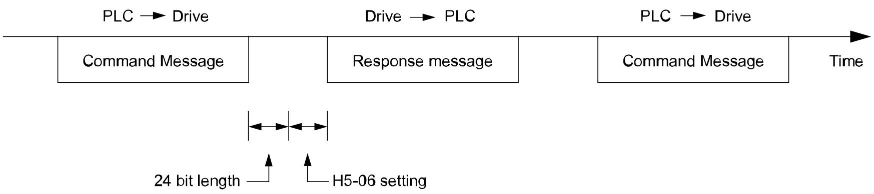


Figure 6.6 Response Wait Time

◆ Message Format

■ Communication Message Description

In Modbus communications, the master sends commands to the slave, then the slave responds. The master and slave send their messages in the configuration in the following figure. The length of the data changes when the description of the command (function) changes.

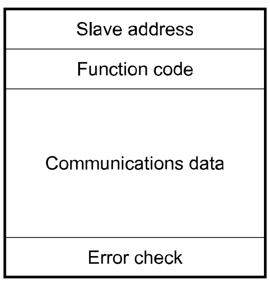


Figure 6.7 Message Format

■ Slave Address

Set the slave address of the drive to 00 to FF (Hex.). When the slave address is 00 (Hex), the master sends the command and all slaves receive the command.

The slave will not send a response message to the master.

■ Function Code

There are five function codes that set commands.

Table 6.5 Function Codes

Function Code (Hex.)	Subfunction Code (Hex.)	Function	Command Message		Response Message	
			Minimum Data Length (byte)	Maximum Data Length (byte)	Minimum Data Length (byte)	Maximum Data Length (byte)
03	-	Read the Description of Holding Register	8	8	7	37
08	-	Loopback Test	8	8	8	8
10	-	Writing to Multiple Holding Registers	11	41	8	8
5A	-	Writing to Multiple Holding Registers / Reading the Register Indicated	11	41	17	17
67	010D	Reading Contents of Non-Consecutive Holding Registers	10	248	10	248
	010E	Writing to Non-Consecutive Holding Registers	14	250	8	8

■ Communications Data

Communications data is a series of data that uses the combination of the communications register number and the data for these registers. The data length changes when the description of the command changes. For a loopback test, it switches to test code.

The communications register for the drive has a 2-byte length. Data that is written to the register for the drive is usually 2 bytes. Register data that is read from the drive is also 2 bytes.

■ Error Check

Error check uses the CRC-16 method to detect transmission errors. Use the procedure in this section to calculate CRC-16.

Command Data

When the drive receives data, it will make sure that there are no errors in the data. The drive uses the procedure below to calculate CRC-16, then compares that data with the CRC-16 value in the message. If the CRC-16 values do not agree, the drive will not execute a command message.

When you calculate CRC-16 in Modbus communications, make sure that you set the start value as FFFF (Hex.). All 16 bits must be 1.

Use this procedure to calculate CRC-16:

1. Make sure that the start value is FFFF (Hex.).
2. Calculate the FFFF (Hex.) start value and the XOR of the slave address (exclusive OR).
3. Move the step 2 results one column to the right. Do this shift until the carry bit is 1.
4. When the carry bit is 1, calculate XOR via the result from the above step 3 and A001 (Hex.).
5. Do steps 3 and 4 until the 8th shift to the right.
6. Use the result of step 5 to calculate the XOR and the data of the following messages (function code, register address, data). Do steps 3 to 5 until the last data, then calculate.
7. The result of the last right shift or the value of the last XOR calculation is the result for CRC-16.

The following figure lists examples of the CRC-16 calculation of slave address 02 (Hex.) and function code 03 (Hex.). The calculated results of CRC-16 for this section is D140 (Hex.).

Note:

The calculation example only gives information about some error checks with CRC-16. The drive will do the same error checks for the next data.

Description	Calculation	Overflow	Description	Calculation	Overflow
Initial value (FFFF(Hex.))	1111 1111 1111 1111		Function code 03 (Hex.)	0000 0011	
Address 02 (Hex.)	0000 0010		XOR w result	1000 0001 0011 1101	
XOR w initial value	1111 1111 1111 1101		Shift 1	0100 0000 1001 1110	1
Shift 1	0111 1111 1111 1110	1	XOR w A001 (Hex.)	1010 0000 0000 0001	
XOR w A001 (Hex.)	1010 0000 0000 0001		XOR result	1110 0000 1001 1111	
XOR result	1101 1111 1111 1111		Shift 2	0111 0000 0100 1111	1
Shift 2	0110 1111 1111 1111	1	XOR w A001 (Hex.)	1010 0000 0000 0001	
XOR w A001 (Hex.)	1010 0000 0000 0001		XOR result	1101 0000 0100 1110	
XOR result	1100 1111 1111 1110		Shift 3	0110 1000 0010 0111	0
Shift 3	0110 0111 1111 1111	0	Shift 4	0011 0100 0001 0011	1
Shift 4	0011 0011 1111 1111	1	XOR w A001 (Hex.)	1010 0000 0000 0001	
XOR w A001 (Hex.)	1010 0000 0000 0001		XOR result	1001 0100 0001 0010	
XOR result	1001 0011 1111 1110		Shift 5	0100 1010 0000 1001	0
Shift 5	0100 1001 1111 1111	0	Shift 6	0010 0101 0000 0100	1
Shift 6	0010 0100 1111 1111	1	XOR w A001 (Hex.)	1010 0000 0000 0001	
XOR w A001 (Hex.)	1010 0000 0000 0001		XOR result	1000 0101 0000 0101	
XOR result	1000 0100 1111 1110		Shift 7	0100 0010 1000 0010	1
Shift 7	0100 0010 0111 1111	0	XOR w A001 (Hex.)	1010 0000 0000 0001	
Shift 8	0010 0001 0011 1111	1	XOR result	1110 0010 1000 0011	
XOR w A001 (Hex.)	1010 0000 0000 0001		Shift 8	0111 0001 0100 0001	1
XOR result	1000 0001 0011 1110		XOR w A001 (Hex.)	1010 0000 0000 0001	
Perform operations with next data (function code)			XOR result	1101 0001 0100 0000	
			CRC-16	1101 0001 0100 0000 D 1 4 0 (Lower) (Upper)	
			Continue from here with next data.		

Figure 6.8 CRC-16 Calculation Example

Response Data

The drive does the CRC-16 calculation for the response message and makes sure that the data does not have errors. Make sure that the calculated value is the same value as the CRC-16 in the response message.

◆ Examples of Messages for Commands/Responses

The items in this section are examples of messages for commands/responses.

■ Read the Description of Holding Register

Uses function code 03 (Hex.) to read the contents of a maximum of 16 holding registers.

The following figure shows example messages when the drive reads status signal from the drive of slave 2, the error contents, fault contents, and frequency references.

Byte	Command Message		Setting Data (Hex.)	Response Message (normal)		Setting Data (Hex.)	Response Message (fault)		Setting Data (Hex.)
0	Slave address		02	Slave address		02	Slave address		02
1	Function code		03	Function code		03	Function code		83
2	Starting No.	Upper	00	Data Qty		08	Error code		03
3		Lower	20	First storage register	Upper	00	CRC-16	Upper	F1
4	Data Qty	Upper	00		Lower	65		Lower	31
5		Lower	04	Next storage register	Upper	00	-		
6	CRC-16	Upper	45		Lower	00	-		
7		Lower	F0	Next storage register	Upper	00	-		
8	-				Lower	00	-		
9	-			Next storage register	Upper	01	-		
10	-				Lower	F4	-		
11	-			CRC-16	Upper	AF	-		
12	-				Lower	82	-		

Figure 6.9 Message Example When Reading the Contents of Holding Register

■ Loopback Test

The loopback test uses function code 08 (Hex.) and returns the command message as a response message. This test checks communication between the master and slave. The test code and data can use desired values.

The following figure shows examples of messages given out when the loopback test is done with the drive of slave 1.

Byte	Command Message			Response Message (normal)		
			Setting Data (Hex.)			Setting Data (Hex.)
0	Slave address		01	Slave address		01
1	Function code		08	Function code		08
2	Test code	Upper	00	Test code	Upper	00
3		Lower	00		Lower	00
4	Data	Upper	A5	Data	Upper	A5
5		Lower	37		Lower	37
6	CRC-16	Upper	DA	CRC-16	Upper	DA
7		Lower	8D		Lower	8D

Figure 6.10 Message Example When Doing the Loopback Test

■ Writing to Multiple Holding Registers

You can write the data that you set to the number of holding registers set in function code 10 (hex). You must configure the number of the holding registers and each 8 higher bits and 8 lower bits in order in the command message for the write data. You can write to a maximum of 16 holding registers.

The following figure shows example messages when you use the PLC to set Forward run in the drive of slave 1 with a 60.00 Hz frequency reference.

Byte	Command message			Response message (when normal)			Response message (when there is a fault)		
			Setting data (Hex.)			Setting data (Hex.)			Setting data (Hex.)
0	Slave address		01	Slave address		01	Slave address		01
1	Function code		10	Function code		10	Function code		90
2	Starting No.	Upper	00	Starting No.	Upper	00	Error code		02
3		Lower	01		Lower	01	CRC-16	Upper	CD
4	Data Qty	Upper	00	Data Qty	Upper	00		Lower	C1
5		Lower	02		Lower	02	-		
6	Byte No.		04	CRC-16	Upper	10	-		
7	First data	Upper	00		Lower	08	-		
8		Lower	01	-			-		
9	Next data	Upper	17	-			-		
10		Lower	70	-			-		
11	CRC-16	Upper	6D	-			-		
12		Lower	B7	-			-		

Note:

The number of bytes set in the command message set the data quantity × 2 during the command message. The response message uses the same formula.

Figure 6.11 Message Example When Writing to Multiple Holding Registers

When you rewrite the parameter value with the write command through the *H5-11 [Mbus ENTER Command Mode]* setting, you must use the Enter command to save and enable the contents of the changes. Refer to *H5-11 Mbus ENTER Command Mode on page 749* and *Enter Command on page 240* for more information.

■ Reading from More than One Holding Register/Reading the Indicated Register

The drive uses function code 5A (Hex.) to write to more than one register, then it reads the contents of four holding registers at the same time.

The function for writing to more than one register is the same as the function for function code 10 (Hex.). You can write to a maximum of 16 holding registers.

The four holding registers to be read from are specified in *H5-25 [Mbus 5A Reg1 Selection] to H5-28 [Mbus 5A Reg4 Selection]*.

Table 6.6 shows example messages when you write to more than one holding register or when you read more than one command register. Table 6.6 uses this register data for the examples:

Network Communications

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- The drive for slave 1 is set for Forward run with a frequency reference of 60.00 Hz.
- The setting in *H5-25 to H5-28* and the data in the specified holding registers are as follows.
  - *H5-25* = 0044H: *U1-05 [Motor Speed]* = 60.00 Hz (6000 = 1770H)
  - *H5-26* = 0045H: *U1-06 [Output Voltage Ref]* = 200.0 V (2000 = 07D0H)
  - *H5-27* = 0042H: *U1-03 [Output Current]* = 50% of drive rated current (100% = 8192, 50% = 4096 = 1000H)
  - *H5-28* = 0049H: *U1-10 [In Terminal Status]* = 00H

When you rewrite the parameter value with the write command through the *H5-11 [Mbus ENTER Command Mode]* setting, you must use the Enter command to save and enable the contents of the changes. Refer to *H5-11 Mbus ENTER Command Mode on page 749* and *Enter Command on page 240* for more information.

Table 6.6 Message Example When Reading from More than One Holding Register/Reading the Indicated Register

Byte	Command Message		Setting Data (Hex.)	Response Message (when Normal)		Setting Data (Hex.)	Response Message (when There is a Fault)		Setting Data (Hex.)
0	Slave address		01	Slave address		01	Slave address		01
1	Function code		5A	Function code		5A	Function code		DA
2	Starting No.	Upper	00	Register status		0F	Register status		0F
3		Lower	01	Data in holding register 1 selected with H5-25	Upper	17	Data in holding register 1 selected with H5-25	Upper	17
4	Data Qty	Upper	00		Lower	70		Lower	70
5		Lower	02	Data in holding register 2 selected with H5-26	Upper	07	Data in holding register 2 selected with H5-26	Upper	07
6	Byte No.		04		Lower	D0		Lower	D0
7	First data	Upper	00	Data in holding register 3 selected with H5-27	Upper	10	Data in holding register 3 selected with H5-27	Upper	10
8		Lower	01		Lower	00		Lower	00
9	Next data	Upper	17	Data in holding register 4 selected with H5-28	Upper	00	Data in holding register 4 selected with H5-28	Upper	00
10		Lower	70		Lower	00		Lower	00
11	CRC-16	Upper	4F	Starting No.	Upper	00	Error code		02
12		Lower	43		Lower	01	CRC-16	Upper	E9
13	-			Data Qty	Upper	00		Lower	6C
14	-				Lower	02	-		
15	-			CRC-16	Upper	AC	-		
16	-				Lower	D0	-		

Note:
The number of bytes set in the command message set the data quantity × 2 during the command message. The response message uses the same formula.

Register status	
bit 0	Data in register 1 selected with H5-25 1: Successfully read the register, 0: Register read error
bit 1	Data in register 2 selected with H5-26 1: Successfully read the register, 0: Register read error
bit 2	Data in register 3 selected with H5-27 1: Successfully read the register, 0: Register read error
bit 3	Data in register 4 selected with H5-28 1: Successfully read the register, 0: Register read error
bit 4	Not used
bit 5	Not used
bit 6	Not used
bit 7	Not used

■ Reading the Contents of Non-Consecutive Holding Registers

The drive uses function code 67 (Hex.) and subfunction code 010D (Hex.) to read data with a maximum of 120 holding registers.

You must give the holding register number from which to read separately.

The following table shows example messages when you read the frequency reference and torque limit from the drive for slave 1. These specified holding registers data are used for the examples.

- 0024H:*U1-01 [Frequency Reference]* = 60.00 Hz (6000 = 1770H)
- 0028H:*U1-09 [Torque Reference]* = 100.0% (1000 = 03E8H)

Table 6.7 Message Example When Reading the Contents of Non-Consecutive Holding Registers

Byte	Command Message		Setting Data (Hex.)	Response Message (when Normal)		Setting Data (Hex.)	Response Message (when There is a Fault)		Setting Data (Hex.)
0	Slave address		01	Slave address		01	Slave address		01
1	Function code		67	Function code		67	Function code		E7
2	Subfunction code	Upper	01	Subfunction code	Upper	01	Error code		02
3		Lower	0D		Lower	0D	CRC-16	Upper	EA
4	Data Qty	Upper	00	Byte No.	Upper	00		Lower	31
5		Lower	02		Lower	04	-		
6	Holding register 1 No.	Upper	00	Holding register 1 data	Upper	17	-		
7		Lower	24		Lower	70	-		
8	Holding register 2 No.	Upper	00	Holding register 2 data	Upper	03	-		
9		Lower	28		Lower	E8	-		
10	CRC-16	Upper	8B	CRC-16	Upper	47	-		
11		Lower	29		Lower	ED	-		

Note:

The number of bytes set within the response message sets twice the number of data contained in the command message. The response message uses the same formula.

■ Writing to Non-Consecutive Holding Registers

You can separately write the specified data to a maximum of 60 holding registers that uses function code 67 (Hex.) and subfunction code 010E (Hex.) .

You must give the holding register number from which to write separately.

The following table shows example messages when you write the frequency reference and torque limit from the drive for slave 1. These specified holding registers data are used for the examples.

- 0002H: Frequency Reference = 60.00 Hz (6000 = 1770H)
- 0004H: Torque Limit = 150.0% (1500 = 05DCH)

When you rewrite the parameter value with the write command through the *H5-11 [Mbus ENTER Command Mode]* setting, you must use the Enter command to save and enable the contents of the changes. Refer to *H5-11 Mbus ENTER Command Mode on page 749* and *Enter Command on page 240* for more information.

Table 6.8 Message Example When Writing to Non-Consecutive Holding Registers

Byte	Command Message		Setting Data (Hex.)	Response Message (when Normal)		Setting Data (Hex.)	Response Message (when There is a Fault)		Setting Data (Hex.)
0	Slave address		01	Slave address		01	Slave address		01
1	Function code		67	Function code		67	Function code		E7
2	Subfunction code	Upper	01	Subfunction code	Upper	01	Error code		02
3		Lower	0E		Lower	0E	CRC-16	Upper	EA
4	Data Qty	Upper	00	Data Qty	Upper	00		Lower	31
5		Lower	02		Lower	02	-		
6	Byte No.	Upper	00	CRC-16	Upper	D5	-		
7		Lower	04		Lower	FC	-		
8	Holding register 1 No.	Upper	00	-			-		
9		Lower	02	-			-		

Byte	Command Message		Setting Data (Hex.)	Response Message (when Normal)	Setting Data (Hex.)	Response Message (when There is a Fault)	Setting Data (Hex.)
10	Holding register 1 data	Upper	17	-		-	
11		Lower	70	-		-	
12	Holding register 2 No.	Upper	00	-		-	
13		Lower	04	-		-	
14	Holding register 2 data	Upper	05	-		-	
15		Lower	DC	-		-	
16	CRC-16	Upper	55	-		-	
17		Lower	59	-		-	

Note:

The number of bytes set within the command message determines the data quantity × 2 during the command message. The response message uses the same formula.

◆ Enter Command

When you use Modbus communications to write parameters from the PLC to the drive, the *Mbus ENTER Command Mode* setting sets the function to enable these parameters from the Enter command. This section gives information about the Enter command.

■ Types of Enter Commands

The drive supports the two Enter commands shown in the following table.

Table 6.9 Types of Enter Commands

Register No. (Hex.)	Description
0900	When you write parameter data to the EEPROM, you will enable the data on the RAM at the same time. This process saves the parameter changes until you de-energize the drive.
0910	This updates the data on the RAM, but does not write data to the EEPROM. This process saves the parameter changes until you de-energize the drive.

Write 0 to register number 0900 or 0910 (Hex.) to enable the Enter command. You can only write to these registers. If you read to these registers, it will cause an error.

Note:

- You can write the EEPROM to the drive a maximum of 100,000 times. Do not frequently execute the Enter command (0900 (Hex.)) that is written to EEPROM. The Enter command register is write-only. If this register is read, it will cause a Register Number Error (02 (Hex.)).
- When the command data or broadcast message is transmitted to the drive, the Enter command is not necessary.

◆ Self-Diagnostics

The drive can use Self-Diagnostics to find the operation of the serial communications interface circuit. Self-Diagnostics connects the transmission terminal to the reception terminal on the control circuit. It then transmits the data sent by the drive and makes sure that the drive can communicate correctly.

Use this procedure to do Self-Diagnostics:

1. Energize the drive.
2. Set *H1-06 = 7F [DI6 Function Selection = Comms Test]*.
3. De-energize the drive.

4. Connect a jumper between control circuit terminals DI6 and D0V.

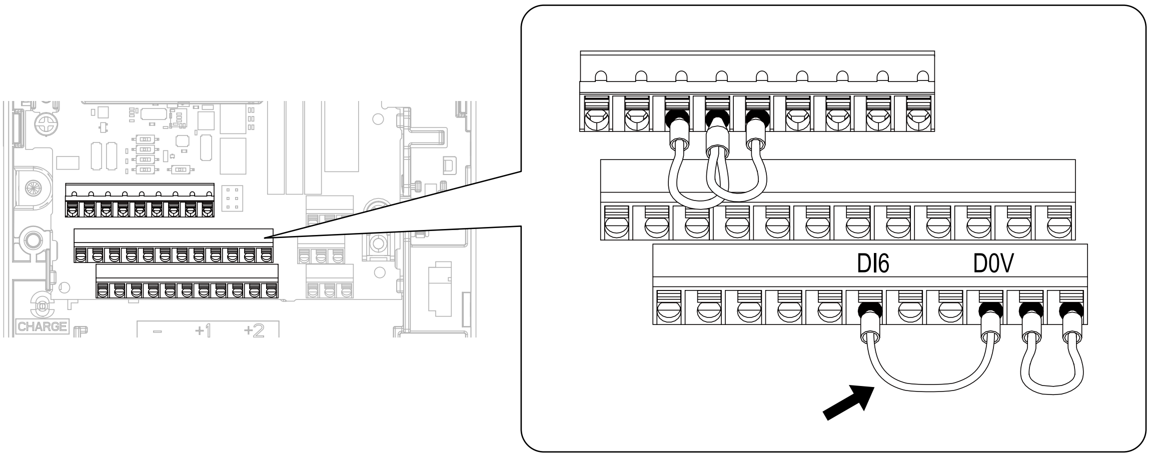


Figure 6.12 Self-Diagnostics Jumper Terminals

5. Energize the drive.
6. When normal, the keypad will show *PASS [Mbus communications test mode normal]*.
   When there is an error, the keypad will show *CE [Mbus communications error]*.
7. De-energize the drive.
8. Disconnect the wire jumper between terminals DI6 and D0V. Set terminal DI6 to its initial function.

Self-Diagnostics is complete and the drive returns to its usual function.

◆ Communications Data Table

This chapter shows the communications data. The data types are command data, monitor data, and broadcast message.

Refer to the Parameter List for parameter communications registers.

■ Command Data

You can read and write command data.

Note:

Set the reserved bit to 0. Do not write the data in the reserved register or the monitor register.

Table 6.10 Modbus Communications Command Data

Register No. (Hex.)	Description	
0000	Reserved	
0001	Run command, multi-function input command	
	bit 0	When *H5-12 = 0*, Forward run/stop 1: Forward run, 0: Stop When *H5-12 = 1*, run/stop 1: Run, 0: Stop
	bit 1	When *H5-12 = 0*, Reverse run/stop 1: Reverse run, 0: Stop When *H5-12 = 1*, Forward/Reverse run 1: Reverse, 0: Forward run
	bit 2	External Fault 1: EF0 [Option Card External Fault]
	bit 3	Fault Reset 1: Reset command
	bit 4	Multi-function input 1 When *H1-01 = 1 [Forward Run]*, the multi-function input command is “ComRef.” **Note:** When you switch the bit ON as ComRef, the frequency reference source changes to Modbus communications. When you connect a communication option to the drive, the frequency reference source gives priority to the communications option.
	bit 5	Multi-function input 2 When the multi-function input command is *H1-02 = 2 [Reverse Run]*, bit 5 is “ComCtrl.” **Note:** When you switch the bit ON as ComCtrl, the Run Command source changes to Modbus communications. When you connect a communication option to the drive, the Run Command source gives priority to the communications option.
	bit 6	Multi-function input 3
	bit 7	Multi-function input 4
	bit 8	Multi-function input 5
	bit 9	Multi-function input 6
	bit A	Multi-function input 7
	bit B	Multi-function input 8
	bit C - F	Reserved
0002	Frequency Reference	*o1-03 [FrqDisplay Unit Selection]* (unsigned) sets the units.
0003	Output voltage gain	Units: 0.1 % Setting range: 20 (2.0%) to 2000 (200.0%), the default value at energize: 1000 (100.0%)
0004	Torque reference/torque limit (0.1% signed)	
0005	Torque compensation (0.1% signed)	
0006	PID setpoint (0.01% signed)	
0007	Setting for the multi-function analog monitor output terminal 1 (10 V/4000 H)	
0008	Setting for the multi-function analog monitor output terminal 2 (10 V/4000 H)	
0009	MFDO setting	
	bit 0	MFDO (terminal 2NO-2CM) 1: ON, 0: OFF
	bit 1	MFDO (terminal 3NO-3CM) 1: ON, 0: OFF
	bit 2	MFDO (terminal 4NO-4CM) 1: ON, 0: OFF
	bit 3 - 5	Reserved
	bit 6	1: bit 7 function is enabled
	bit 7	Fault relay output (terminal 1NO/1NC-1CM) 1: ON, 0: OFF
	bit 8 - F	Reserved
000A	Pulse train output (Units: 1/1 Hz, setting range: 0 to 32000)	
000B - 000E	Reserved	

<table>
<tr><th>Register No. (Hex.)</th><th colspan="2">Description</th></tr>
<tr><td rowspan="13">000F</td><td colspan="2">Command selection setting</td></tr>
<tr><td>bit 0</td><td>Reserved</td></tr>
<tr><td>bit 1</td><td>Input for the PID setpoint
1: Enables target values from Modbus</td></tr>
<tr><td>bit 2</td><td>Torque reference/torque limit input
1: Enables setting values from Modbus</td></tr>
<tr><td>bit 3</td><td>Torque Compensation Input
1: Enables setting values from Modbus</td></tr>
<tr><td>bit 4</td><td>Reserved</td></tr>
<tr><td>bit 5</td><td>PID feedback from the Modbus
1: Enables PID feedback (15FF (Hex.)) from Modbus</td></tr>
<tr><td>bit 6 - B</td><td>Reserved</td></tr>
<tr><td>bit C</td><td>Terminal DI5 input of broadcast message
1: Enabled, 0: Disabled</td></tr>
<tr><td>bit D</td><td>Terminal DI6 input of broadcast message
1: Enabled, 0: Disabled</td></tr>
<tr><td>bit E</td><td>Terminal DI7 input of broadcast message
1: Enabled, 0: Disabled</td></tr>
<tr><td>bit F</td><td>Terminal DI8 input of broadcast message
1: Enabled, 0: Disabled</td></tr>
<tr><td>0010 - 001A</td><td colspan="2">Reserved</td></tr>
<tr><td>001B</td><td colspan="2">Analog monitor option AO-A3 analog output 1 value (10 V/4000 (Hex.))</td></tr>
<tr><td>001C</td><td colspan="2">Analog monitor option AO-A3 analog output 2 value (10 V/4000 (Hex.))</td></tr>
<tr><td>001D</td><td colspan="2">Digital output option DO-A3 output value (binary)</td></tr>
<tr><td>001E - 001F</td><td colspan="2">Reserved</td></tr>
<tr><td rowspan="4">15C0</td><td>bit 0</td><td>Extended multi-function input command 1</td></tr>
<tr><td>bit 1</td><td>Extended multi-function input command 2</td></tr>
<tr><td>bit 2</td><td>Extended multi-function input command 3</td></tr>
<tr><td>bit 3 - F</td><td>Reserved</td></tr>
<tr><td>3004</td><td colspan="2">Time Setting
Setting range: 0000 to 2359 (decimal), the default value at energize: 0000
Set the hour and the minute in HHMM format.
• HH: 00 to 23 (decimal)
• MM: 00 to 59 (decimal)</td></tr>
<tr><td>3005</td><td colspan="2">Year and Day Setting
Setting range: 1600 to 9906 (decimal), the default value at energize: 1600
Set the year and the day of the week in YYDW format.
• YY: the last two digits of the year from 16 to 99 (decimal)
• DW: the day of the week
– Sunday: 00
– Monday: 01
– Tuesday: 02
– Wednesday: 03
– Thursday: 04
– Friday: 05
– Saturday: 06</td></tr>
<tr><td>3006</td><td colspan="2">Date Setting
Setting range: 0101 to 1231 (decimal), the default value at energize: 0101
Set the month and the date in MMDD format.
• MM: 01 to 12 (decimal)
• DD: 01 to 31 (decimal)</td></tr>
<tr><td>3007</td><td colspan="2">Set the Date Information
Setting range: 0 to 8 (decimal), the default value at energize: 8
Set the values specified in 3004H to 3006H as the date and time.
• Command Data: 1
• Response Data: 0 (normal), 8 (fault)</td></tr>
</table>

■ Monitor Data

You can only read monitor data.

Table 6.11 Monitor Data for Modbus Communication

<table>
<tr><th>Register No. (Hex.)</th><th colspan="2">Description</th></tr>
<tr><td rowspan="15">0020</td><td colspan="2">Drive Status 1</td></tr>
<tr><td>bit 0</td><td>During Run
1: During run, 0: During stop</td></tr>
<tr><td>bit 1</td><td>During Reverse
1: During reverse, 0: Forward run</td></tr>
<tr><td>bit 2</td><td>Drive ready
1: Ready, 0: Not ready</td></tr>
<tr><td>bit 3</td><td>Faults
1: Fault</td></tr>
<tr><td>bit 4</td><td>Data Setting Error
1: oPExx error</td></tr>
<tr><td>bit 5</td><td>MFDO (terminal 2NO-2CM)
1: ON, 0: OFF</td></tr>
<tr><td>bit 6</td><td>MFDO (terminal 3NO-3CM)
1: ON, 0: OFF</td></tr>
<tr><td>bit 7</td><td>MFDO (terminal 4NO-4CM)
1: ON, 0: OFF</td></tr>
<tr><td>bit 8 - D</td><td>Reserved</td></tr>
<tr><td>bit E</td><td>ComRef status
1: Enabled</td></tr>
<tr><td>bit F</td><td>ComCtrl status
1: Enabled</td></tr>
<tr><td rowspan="17">0021</td><td colspan="2">Fault Description 1</td></tr>
<tr><td>bit 0</td><td>oC [Overcurrent], GF [Ground Fault]</td></tr>
<tr><td>bit 1</td><td>ov [DC Bus Overvoltage]</td></tr>
<tr><td>bit 2</td><td>oL2 [Drive Overloaded]</td></tr>
<tr><td>bit 3</td><td>oH1 [Heatsink Overheat], oH2 [External Overheat (H1-XX=7D)]</td></tr>
<tr><td>bit 4</td><td>rH [BrkTransOH], rr [Dynamic Braking Transistor Fault]</td></tr>
<tr><td>bit 5</td><td>Reserved</td></tr>
<tr><td>bit 6</td><td>FbL [PID Feedback Loss], FbH [Excessive PID Feedback]</td></tr>
<tr><td>bit 7</td><td>EF0 [Option Card External Fault], EF1 to EF8 [External Fault]</td></tr>
<tr><td>bit 8</td><td>CPFxx [Hardware Fault]
Note:
Includes oFx.</td></tr>
<tr><td>bit 9</td><td>oL1 [Motor Overload], oL3, L4 [Overtorque Detection 1/2], UL3, L4 [Undertorque Detection 1/2]</td></tr>
<tr><td>bit A</td><td>PGo [Encoder (PG) Feedback Loss], PGoH [Encoder (PG) Hardware Fault], oS [Overspeed], dEv [Speed Deviation]</td></tr>
<tr><td>bit B</td><td>During Uv [Undervoltage] detection</td></tr>
<tr><td>bit C</td><td>Uv1 [DC Bus Undervoltage], Uv2 [Control Power Undervoltage], Uv3 [Soft Charge Answerback Fault]</td></tr>
<tr><td>bit D</td><td>LF [Output Phase Loss], PF [Input Phase Loss]</td></tr>
<tr><td>bit E</td><td>CE [Modbus Communication Error], bUS [Option Communication Error]</td></tr>
<tr><td>bit F</td><td>oPr [Keypad Connection Fault]</td></tr>
</table>

Register No. (Hex.)	Description	
0022	Fault Contents	
	bit 0	1: During data writing, during motor switching
	bit 1	Reserved
	bit 2	
	bit 3	1: Upper/Lower Limit Fault
	bit 4	1: Data Integrity Fault
	bit 5	1: During EEPROM writing
	bit 6	0: EEPROM writing 1: Change data only on the RAM **Note:** Enabled when *H5-17 = 2 [ENTER@CPU Busy Response = Write RAM Only]*.
	bit 7 - F	Reserved
0023	U1-01 [Frequency Reference] **Note:** *o1-03 [FrqDisplay Unit Selection]* sets the units.	
0024	U1-02 [Output Frequency] **Note:** *o1-03 [FrqDisplay Unit Selection]* sets the units.	
0025	U1-06 [Output Voltage Ref] (units: 0.1 V) **Note:** Use *H5-10 [Mbus 0025H Unit Sel]* to change the setting unit.	
0026	U1-03 [Output Current] (units: 0.1 A)	
0027	U1-08 [Output Power]	
0028	U1-09 [Torque Reference]	
0029	Fault Description 2	
	bit 0	Reserved
	bit 1	GF [Ground Fault]
	bit 2	PF [Input Phase Loss]
	bit 3	LF [Output Phase Loss]
	bit 4	rH [Braking Resistor Overheat]
	bit 5	Reserved
	bit 6	oH4 [Motor Overheat Fault (PTC Input)]
	bit 7 - F	Reserved
002A	Minor Fault Description 1	
	bit 0 - 1	Reserved
	bit 2	EF [FWD/REV Run Command Input Error]
	bit 3	bb [Baseblock]
	bit 4	oL3 [Overtorque 1]
	bit 5	oH [Heatsink Overheat]
	bit 6	ov [DC Bus Overvoltage]
	bit 7	Uv [Undervoltage]
	bit 8	FAn [Internal Fan Fault]
	bit 9	CE [Modbus Communication Error]
	bit A	bUS [Option Communication Error]
	bit B	UL3/UL4 [Undertorque Detection 1/2]
	bit C	oH3 [Motor Overheat (PTC Input)]
	bit D	FbL [PID Feedback Loss], FbH [Excessive PID Feedback]
	bit E	Reserved
	bit F	CALL [Serial Comm Transmission Error]

Register No. (Hex.)	Description	
002B	U1-10 [In Terminal Status]	
	bit 0	1: Control circuit terminal DI1 ON
	bit 1	1: Control circuit terminal DI2 ON
	bit 2	1: Control circuit terminal DI3 ON
	bit 3	1: Control circuit terminal DI4 ON
	bit 4	1: Control circuit terminal DI5 ON
	bit 5	1: Control circuit terminal DI6 ON
	bit 6	1: Control circuit terminal DI7 ON
	bit 7	1: Control circuit terminal DI8 ON
	bit 8 - F	Reserved
002C	Drive Status 2	
	bit 0	During Run 1: During run
	bit 1	During zero speed 1: During zero speed
	bit 2	Speed agreement 1: During agreement
	bit 3	User-defined speed agreement 1: During agreement
	bit 4	Frequency Detection 1 1: Output frequency ≤ L4-01
	bit 5	Frequency Detection 2 1: Output frequency ≥ L4-01
	bit 6	Drive ready 1: Run ready
	bit 7	During low voltage detection 1: During detection
	bit 8	During baseblock 1: Drive output during baseblock
	bit 9	Frequency reference mode 1: No communication option, 0: Communication option
	bit A	Run command mode 1: No communication option, 0: Communication option
	bit B	During overtorque/undertorque 1, 2 detection
	bit C	Frequency reference loss 1: Loss
	bit D	Restart Enabled 1: Restart Enabled
	bit E	Faults 1: Fault generated
	bit F	Modbus communications timeout 1: At Timeout
002D	U1-11 [Out Terminal Status]	
	bit 0	MFDO (terminal 2NO-2CM) 1: ON, 0: OFF
	bit 1	MFDO (terminal 3NO-3CM) 1: ON, 0: OFF
	bit 2	MFDO (terminal 4NO-4CM) 1: ON, 0: OFF
	bit 3 - 6	Reserved
	bit 7	Fault relay output (terminal 1NO/1NC-1CM) 1: ON, 0: OFF
	bit 8 - F	Reserved
002E	Reserved	

Register No. (Hex.)	Description	
002F	Frequency reference bias (Up 2/Down 2 function) (Units: 0.1%)	
0030	Reserved	
0031	U1-07 [DC Bus Voltage] (unit: 1 V)	
0032	U1-09 [Torque Reference] (unit: 1%)	
0033	Reserved	
0034	Product code 1 [ASCII], product type 1 (Q2A =0A)	
0035	Product code 2 [ASCII], product type 2 (Q2A =72)	
0036 - 0037	Reserved	
0038	PID Feedback: Unsigned, input is equivalent to 100%/maximum output frequency (Units:0.1%)	
0039	PID Input: Signed, ±100%/±maximum output frequency (Units:0.1%)	
003A	PID Output: Signed, ±100%/±maximum output frequency (Units:0.1%)	
003B - 003C	Reserved	
003D	Communications error description **Note:** The drive saves the description of the communications error until you reset the fault.	
	bit 0	CRC Error
	bit 1	Data Length Error
	bit 2	Reserved
	bit 3	Parity Error
	bit 4	Overrun Error
	bit 5	Framing Error
	bit 6	Timeout
	bit 7 - F	Reserved
003E	Output frequency	Units: min^{-1} or r/min **Note:** Set Motor Pole Count *E2-04, E4-04, E5-04, E9-08*.
003F		0.01 % units
0040 - 004A	Used with *U1: STATUS*. Refer to the *U: MONITORS* for parameter details.	
004B	U1-12 [Drive Status]	
	bit 0	1: During run
	bit 1	1: During zero speed
	bit 2	1: During reverse
	bit 3	1: During reset signal input
	bit 4	1: During speed agreement
	bit 5	1: Drive operation ready
	bit 6	1: Minor Fault
	bit 7	1: Fault
	bit 8	1: oPExx [Operation Error] generation
	bit 9	1: Recovery from momentary power loss, 0: Power recovery
	bit A	1: Motor 2 Selection
	bit B	Reserved
	bit E	ComRef status/ NetRef status
	bit F	ComCtrl status/ NetCtrl status
004C - 007E	Use with *U1: STATUS, U4: MAINTENANCE, U5: PID, U6: ADVANCED*. Refer to *U2: FAULT* and *U3: FAULT HISTORY* for details.	
007F	Minor fault code (Refer to "Minor fault description" for more information on the minor fault codes.)	
0080 - 0097	Use with *U2: FAULT, U3: FAULT HISTORY*. Refer to *U: MONITORS* for details, and refer to "Fault Trace/Fault History Descriptions" for details on register values.	

Register No. (Hex.)	Description	
0098 - 0099	U4-01 [Cumulative OpeTime] (Ex.) When *U4-01* is 12345, 0098 (Hex.) = 1234 and 0099 (Hex.) = 5.	
009A - 009B	U4-03 [Fan Oper.Time] (Ex.) When *U4-03* is 12345, 009A (Hex.) = 1234 and 009B (Hex.) = 5.	
009C - 00AA	Reserved	
00AB	Drive rated current **Note:** The unit of display is different for different models. 2004 to 2042, 4002 to 4023: 0.01 A 2056 to 2415, 4031 to 4675: 0.1 A	
00AC	U1-05 [Motor Speed]	Units: min^{-1} or r/min **Note:** Set Motor Pole Count *E2-04, E4-04, E5-04, E9-08*.
00AD		Units: 0.01%
00AE, 00AF	Reserved	
00B0	Option codes connected to CN5-A	The drive stores option codes in the register. AI-A3 = 0003 (Hex.) AO-A3 = 0004 (Hex.) DI-A3 = 0001 (Hex.) DO-A3 = 0002 (Hex.) PG-B3 = 0011 (Hex.) PG-F3 = 0021 (Hex.) PG-RT3 = 0023 (Hex.) PG-X3 = 0012 (Hex.) SI-C3 = 5343 (Hex.) SI-EM3 = 1005 (Hex.) SI-EN3 = 1006 (Hex.) SI-ET3 = 1004 (Hex.) SI-N3 = 534E (Hex.) SI-P3 = 5350 (Hex.) SI-S3 = 5353 (Hex.) SI-T3 = 5354 (Hex.) SI-W3 = 1003 (Hex.)
00B1	Reserved	
00B2	Option codes connected to CN5-B	
00B3	Option codes connected to CN5-C	
00B4	Reserved	
00B5	U1-16 [SFS Output Frequency]	Units: min^{-1} or r/min **Note:** Set Motor Pole Count *E2-04, E4-04, E5-04, E9-08*.
00B6		Units: 0.01%
00B7	Frequency reference monitor	Units: min^{-1} or r/min **Note:** Set Motor Pole Count *E2-04, E4-04, E5-04, E9-08*.
00B8		Units: 0.01%
00B9 - 00BE	Reserved	
00BF	Operation error number *xx* of *oPExx* is displayed.	

Register No. (Hex.)	Description	
00C0	Fault Description 3	
	bit 0	Reserved
	bit 1	Uv1 [DC Bus Undervoltage]
	bit 2	Uv2 [Control Power Undervoltage]
	bit 3	Uv3 [Soft Charge Answerback Fault]
	bit 4	SC [Short Circuit/IGBT Failure]
	bit 5	GF [Ground Fault]
	bit 6	oC [Overcurrent]
	bit 7	ov [DC Bus Overvoltage]
	bit 8	oH [Heatsink Overheat]
	bit 9	oH1 [Heatsink Overheat]
	bit A	oL1 [Motor Overload]
	bit B	oL2 [Drive Overloaded]
	bit C	oL3 [Overtorque Detection 1]
	bit D	oL4 [Overtorque Detection 2]
	bit E	rr [Dynamic Braking Transistor]
	bit F	rH [Braking Resistor Overheat]
00C1	Fault Description 4	
	bit 0	EF3 [External Fault (Terminal DI3)]
	bit 1	EF4 [External Fault (Terminal DI4)]
	bit 2	EF5 [External Fault (Terminal DI5)]
	bit 3	EF6 [External Fault (Terminal DI6)]
	bit 4	EF7 [External Fault (Terminal DI7)]
	bit 5	EF8 [External Fault (Terminal DI8)]
	bit 6	FAn [Internal Fan Fault]
	bit 7	oS [Overspeed]
	bit 8	dEv [Speed Deviation]
	bit 9	PGo [Encoder (PG) Feedback Loss]
	bit A	PF [Input Phase Loss]
	bit B	LF [Output Phase Loss]
	bit C	oH3 [Motor Overheat (PTC Input)]
	bit D	oPr [Keypad Connection Fault]
	bit E	Err [EEPROM Write Error]
	bit F	oH4 [Motor Overheat Fault (PTC Input)]

Register No. (Hex.)	Description	
00C2	Fault Description 5	
	bit 0	CE [Modbus Communication Error]
	bit 1	bUS [Option Communication Error]
	bit 2 - 3	Reserved
	bit 4	CF [Control Fault]
	bit 5	SvE [Zero Servo Fault]
	bit 6	EF0 [Option Card External Fault]
	bit 7	FbL [PID Feedback Loss]
	bit 8	UL3 [Undertorque Detection 1]
	bit 9	UL4 [Undertorque Detection 2]
	bit A	oL7 [High Slip Braking Overload]
	bit B - E	Reserved
	bit F	Hardware Fault (includes *oFx* fault)
00C3	Fault Description 6	
	bit 0	Reserved
	bit 1	dv1 [Z Pulse Fault]
	bit 2	dv2 [Z Pulse Noise Fault Detection]
	bit 3	dv3 [Inversion Detection]
	bit 4	dv4 [Inversion Prevention Detection]
	bit 5	LF2 [Output Current Imbalance]
	bit 6	STPo [Motor Step-Out Detected]
	bit 7	PGoH [Encoder (PG) Hardware Fault]
	bit 8	E5 [MECHATROLINK Watchdog Timer Err]
	bit 9	Reserved
	bit A	SEr [Speed Search Retries Exceeded]
	bit B - F	Reserved
00C4	Fault Description 7	
	bit 0	FbH [Excessive PID Feedback]
	bit 1	EF1 [External Fault (Terminal DI1)]
	bit 2	EF2 [External Fault (Terminal DI2)]
	bit 3	oL5 [Mechanical Weakening Detection 1]
	bit 4	UL5 [Mechanical Weakening Detection 2]
	bit 5	CoF [Current Offset Fault]
	bit 6 - 7	Reserved
	bit 8	qFL [Q2pack Fault]
	bit 9	qFL1 [EEPROM Memory Q2pack Data Error]
	bit A	qFL2 [Q2pack Fault 2]
	bit B	qFL3 [Q2pack Fault 3]
	bit C	Reserved
	bit D	rF [Braking Resistor Fault]
	bit E	boL [BrakingTransistor Overload Fault]
	bit F	Reserved

Register No. (Hex.)	Description	
00C5	Fault Description 8	
	bit 0	LSo [LSo Fault]
	bit 1	nSE [Node Setup Error]
	bit 2 - 9	Reserved
	bit A	dv7 [Polarity Judge Timeout]
	bit B - D	Reserved
	bit E	LF3 [Output Phase Loss 3]
	bit F	UnbC [Current Imbalance]
00C6	Fault Description 9	
	bit 0	Uv4 [Gate Drive Board Power Supply Voltage Low]
	bit 1 - F	Reserved
00C7	Reserved	
00C8	Minor Fault Description 2	
	bit 0	Uv [Undervoltage]
	bit 1	ov [DC Bus Overvoltage]
	bit 2	oH [Heatsink Overheat]
	bit 3	Drive Overheat Alarm (oH2)
	bit 4	oL3 [Overtorque 1]
	bit 5	oL4 [Overtorque 2]
	bit 6	EF [FWD/REV Run Command Input Error]
	bit 7	bb [Baseblock]
	bit 8	EF3 [External Fault (Terminal DI3)]
	bit 9	EF4 [External Fault (Terminal DI4)]
	bit A	EF5 [External Fault (Terminal DI5)]
	bit B	EF6 [External Fault (Terminal DI6)]
	bit C	EF7 [External Fault (Terminal DI7)]
	bit D	EF8 [External Fault (Terminal DI8)]
	bit E	FAn [Internal Fan Fault]
	bit F	oS [Overspeed]
00C9	Minor Fault Description 3	
	bit 0	dEv [Speed Deviation]
	bit 1	PGo [Encoder (PG) Feedback Loss]
	bit 2	oPr [Keypad Connection Fault]
	bit 3	CE [Modbus Communication Error]
	bit 4	bUS [Option Communication Error]
	bit 5	CALL [Serial Comm Transmission Error]
	bit 6	oL1 [Motor Overload]
	bit 7	oL2 [Drive Overloaded]
	bit 8	Reserved
	bit 9	EF0 [Option Card External Fault]
	bit A	rUn [Motor Switch during Run]
	bit B	Reserved
	bit C	CALL [Serial Comm Transmission Error]
	bit D	UL3 [Undertorque Detection 1]
	bit E	UL4 [Undertorque Detection 2]
	bit F	SE [Modbus Test Mode Error]

Register No. (Hex.)	Description	
00CA	Minor Fault Description 4	
	bit 0	Reserved
	bit 1	oH3 [Motor Overheat (PTC Input)]
	bit 2 - 5	Reserved
	bit 6	FbL [PID Feedback Loss]
	bit 7	FbH [Excessive PID Feedback]
	bit 8	Reserved
	bit 9	dnE [Drive Disabled]
	bit A	PGoH [Encoder (PG) Hardware Fault]
	bit B - F	Reserved
00CB	Minor Fault Description 5	
	bit 0	E5 [MECHATROLINK Watchdog Timer Err]
	bit 1	AEr [Station Address Setting Error]
	bit 2	CyC [MECHATROLINK CommCycleSettingErr]
	bit 3	HCA [High Current Alarm]
	bit 4	LT-1 [Cooling Fan Maintenance Time]
	bit 5	LT-2 [Capacitor Maintenance Time]
	bit 6 - 7	Reserved
	bit 8	EF1 [External Fault (Terminal DI1)]
	bit 9	EF2 [External Fault (Terminal DI2)]
	bit A	SToF [Safe Torque OFF Hardware]
	bit B	STo [Safe Torque OFF]
	bit C	oL5 [Mechanical Weakening Detection 1]
	bit D	UL5 [Mechanical Weakening Detection 2]
	bit E - F	Reserved
00CC	Minor Fault Description 6	
	bit 0	Reserved
	bit 1	TrPC [IGBT Maintenance Time (90%)]
	bit 2	LT-3 [SoftChargeBypassRelay MainteTime]
	bit 3	LT-4 [IGBT Maintenance Time (50%)]
	bit 4	boL [Braking Transistor Overload]
	bit 5 - 7	Reserved
	bit 8	qAL1 [Q2pack Alarm]
	bit 9	qAL2 [Q2pack Alarm 2]
	bit A	qAL3 [Q2pack Alarm 3]
	bit B - F	Reserved
00CD - 00CF	Reserved	

Register No. (Hex.)	Description	
00D0	CPF Contents 1	
	bit 0 - 1	Reserved
	bit 2	CPF02 [A/D Conversion Error]
	bit 3	CPF03 [Control Board Connection Error]
	bit 4 - 5	Reserved
	bit 6	CPF06 [EEPROM Memory Data Error]
	bit 7	CPF07 [Terminal Board Connection Error]
	bit 8	CPF08 [Terminal Board Connection Error]
	bit 9	Reserved
	bit A	CPF10 [ASIC Verify Fault]
	bit B	CPF11 [RAM Fault]
	bit C	CPF12 [FLASH Memory Fault]
	bit D	CPF13 [Watchdog Circuit Exception]
	bit E	CPF14 [Control Circuit Fault]
	bit F	Reserved
00D1	CPF Contents 2	
	bit 0	CPF16 [Clock Fault]
	bit 1	CPF17 [Timing Fault]
	bit 2	CPF18 [Control Circuit Fault]
	bit 3	CPF19 [Control Circuit Fault]
	bit 4	CPF20 [Control Circuit Error]
	bit 5	CPF21 [Control Circuit Error]
	bit 6	CPF22 [Hybrid IC Error]
	bit 7	CPF23 [Control Board Connection Error]
	bit 8	CPF24 [Drive Unit Signal Fault]
	bit 9	CPF25 [Terminal Board not Connected]
	bit A	CPF26 [BB Circuit Error]
	bit B	CPF27 [PWM Set Reg Error]
	bit C	CPF28 [PWM Pattern Error]
	bit D	CPF29 [On-Delay Error]
	bit E	CPF30 [BB On Error]
	bit F	CPF31 [ASIC Code Error]

Register No. (Hex.)	Description	
00D2	CPF Contents 3	
	bit 0	CPF32 [ASIC Startup Error]
	bit 1	CPF33 [Watch-dog Eror]
	bit 2	CPF34 [Power/Clock Eror]
	bit 3	CPF35 [Ext A/D Conv Error]
	bit 4	CPU36 [CPU-ASIC Communication Error]
	bit 5	CPU37 [CPU-ASIC Communication Error]
	bit 6	CPU38 [EEPROM Data Error]
	bit 7	CPU39 [CPU-ASIC Communication Error]
	bit 8	CPF40 [Control Circuit Error]
	bit 9	CPF41 [EEPROM Memory Data Error]
	bit A	CPF42 [EEPROM Memory Data Error]
	bit B	CPF43 [EEPROM Memory Data Error]
	bit C	CPF44 [EEPROM Memory Data Error]
	bit D	CPF45 [EEPROM Memory Data Error]
	bit E - F	Reserved
00D3 - 00D7	Reserved	
00D8	oFA0x Description (CN5-A)	
	bit 0	oFA00 [Option Not Compatible with Port]
	bit 1	oFA01 [Option Fault/Connection Error]
	bit 2 - 4	Reserved
	bit 5	oFA05 [Option A/D Error]
	bit 6	oFA06 [Option Communication Error]
	bit 7 - F	Reserved
00D9	oFA1x Description (CN5-A)	
	bit 0	oFA10 [Option RAM Error]
	bit 1	oFA11 [Option Ope Mode Error]
	bit 2	oFA12 [Drive Receive CRC Error]
	bit 3	oFA13 [Drive Receive Frame Error]
	bit 4	oFA14 [Drive Receive Abort Error]
	bit 5	oFA15 [Option Receive CRC Error]
	bit 6	oFA16 [Option Receive Frame Error]
	bit 7	oFA17 [Option Receive Abort Error]
	bit 8 - F	Reserved
00DA	Reserved	

Register No. (Hex.)	Description	
00DB	oFA3x Description (CN5-A)	
	bit 0	oFA30 [COM ID Error]
	bit 1	oFA31 [Type Code Error]
	bit 2	oFA32 [SUM Check Error]
	bit 3	oFA33 [Option Receive Time Over]
	bit 4	oFA34 [Modbus Time Over]
	bit 5	oFA35 [Drive Receive Time Over 1]
	bit 6	oFA36 [CI Check Error]
	bit 7	oFA37 [Drive Receive Time Over 2]
	bit 8	oFA38 [Control Reference Error]
	bit 9	oFA39 [Drive Receive Time Over 3]
	bit A	oFA40 [CtrlResSel 1Err]
	bit B	oFA41 [Drive Receive Time Over 4]
	bit C	oFA42 [CtrlResSel 2Err]
	bit D	oFA43 [Drive Receive Time Over 5]
	bit E - F	Reserved
00DC	oFb0x Description (CN5-B)	
	bit 0	oFb00 [Option Not Compatible with Port]
	bit 1	oFb01 [Option Fault/Connection Error]
	bit 2	oFb02 [Duplicate Options]
	bit 3 - 4	Reserved
	bit 5	oFb05 [Option A/D Error]
	bit 6	oFb06 [Option Communication Error]
	bit 7 - F	Reserved
00DD	oFb1x Description (CN5-B)	
	bit 0	oFb10 [Option RAM Error]
	bit 1	oFb11 [Option Ope Mode Error]
	bit 2	oFb12 [Drive Receive CRC Error]
	bit 3	oFb13 [Drive Receive Frame Error]
	bit 4	oFb14 [Drive Receive Abort Error]
	bit 5	oFb15 [Option Receive CRC Error]
	bit 6	oFb16 [Option Receive Frame Error]
	bit 7	oFb17 [Option Receive Abort Error]
	bit 8 - F	Reserved
00DE - 00DF	Reserved	

Register No. (Hex.)	Description	
00E0	oFb3x Description (CN5-B)	
	bit 0	oFb30 [COM ID Error]
	bit 1	oFb31 [Type Code Error]
	bit 2	oFb32 [SUM Check Error]
	bit 3	oFb33 [Option Receive Time Over]
	bit 4	oFb34 [Modbus Time Over]
	bit 5	oFb35 [Drive Receive Time Over 1]
	bit 6	oFb36 [CI Check Error]
	bit 7	oFb37 [Drive Receive Time Over 2]
	bit 8	oFb38 [Control Reference Error]
	bit 9	oFb39 [Drive Receive Time Over 3]
	bit A	oFb40 [CtrlResSel 1Err]
	bit B	oFb41 [Drive Receive Time Over 4]
	bit C	oFb42 [CtrlResSel 2Err]
	bit D	oFb43 [Drive Receive Time Over 5]
	bit E - F	Reserved
00E1	oFC0x Description (CN5-C)	
	bit 0	oFC00 [Option Not Compatible with Port]
	bit 1	oFC01 [Option Fault/Connection Error]
	bit 2	oFC02 [Duplicate Options]
	bit 3 - 4	Reserved
	bit 5	oFC05 [Option A/D Error]
	bit 6	oFC06 [Option Communication Error]
	bit 7 - F	Reserved
00E2	oFC1x Description (CN5-C)	
	bit 0	oFC10 [Option RAM Error]
	bit 1	oFC11 [Option Ope Mode Error]
	bit 2	oFC12 [Drive Receive CRC Error]
	bit 3	oFC13 [Drive Receive Frame Error]
	bit 4	oFC14 [Drive Receive Abort Error]
	bit 5	oFC15 [Option Receive CRC Error]
	bit 6	oFC16 [Option Receive Frame Error]
	bit 7	oFC17 [Option Receive Abort Error]
	bit 8 - F	Reserved
00E3	Reserved	
00E4	oFC5x Description (CN5-C)	
	bit 0	oFC50 [Encoder Option A/D Conv Error]
	bit 1	oFC51 [EncOpAnlgCrctErr]
	bit 2	oFC52 [Encoder Option Comm Timeout]
	bit 3	oFC53 [Encoder Option Comm Data Fault]
	bit 4	oFC54 [Encoder Error]
	bit 5	oFC55 [Resolver Error]
	bit 6 - F	Reserved

Register No. (Hex.)	Description	
00E5	Minor Fault Description 9	
	bit 0	EP24v [External Power 24V Supply]
	bit 1 - 3	Reserved
	bit 4	bAT [Keypad Battery Low Voltage]
	bit 5	Reserved
	bit 6	CP1 [Comparator 1 Limit Error]
	bit 7	CP2 [Comparator 2 Limit Error]
	bit 8	TiM [Keypad Time Not Set]
	bit 9	bCE [Bluetooth Communication Error]
	bit A - F	Reserved
00E6 - 00E9	Reserved	
00EA	Fault Description 11	
	bit 0	TiM [Keypad Time Not Set]
	bit 1	bAT [Keypad Battery Low Voltage]
	bit 2- D	Reserved
	bit E	SCF [Safety Circuit Fault]
	bit F	Reserved
00EB - 00ED	Reserved	
00EE	Fault Description 12	
	bit 0 - 2	Reserved
	bit 3	CP1 [Comparator 1 Limit Error]
	bit 4	CP2 [Comparator 2 Limit Error]
	bit 5	bCE [Bluetooth Communication Error]
	bit 6 - F	Reserved
00EF - 00FA	Reserved	
00FB	Output current **Note:** The unit of display is different for different models. 2004 to 2042, 4002 to 4023: 0.01 A 2056 to 2415, 4031 to 4675: 0.1 A	

■ Broadcast Messages

Broadcast messages are available as read-only.

The undefined bit signal in the broadcast operation signal uses the local data signal.

Table 6.12 Broadcast Messages for Modbus Communication

Register No. (Hex.)	Description	
0001	Operation signal	
	bit 0	Run command 1: Run, 0: Stop
	bit 1	Reverse run command 1: Reverse, 0: Forward run
	bit 2 - 3	Reserved
	bit 4	External fault 1: EF0 [Option Card External Fault]
	bit 5	Fault Reset 1: Reset command
	bit 6 - B	Reserved
	bit C	MFDI terminal DI5 input
	bit D	MFDI terminal DI6 input
	bit E	MFDI terminal DI7 input
	bit F	MFDI terminal DI8 input
0002	Frequency reference	30000/100%

■ Fault Trace/Fault History Contents

The following table lists the fault codes that the commands from monitors *U2: FAULT, U3: FAULT HISTORY* read.

Table 6.13 Fault Trace/Fault History Contents

Fault Code (Hex.)	Name	Fault Code (Hex.)	Name
0002	Uv1 [DC Bus Undervoltage]	001B	PF [Input Phase Loss]
0003	Uv2 [Control Power Undervoltage]	001C	LF [Output Phase Loss]
0004	Uv3 [Soft Charge Answerback Fault]	001D	oH3 [Motor Overheat (PTC Input)]
0005	SC [Short Circuit/IGBT Failure]	001E	oPr [Keypad Connection Fault]
0006	GF [Ground Fault]	001F	Err [EEPROM Write Error]
0007	oC [Overcurrent]	0020	oH4 [Motor Overheat Fault (PTC Input)]
0008	ov [Overvoltage]	0021	CE [Modbus Communication Error]
0009	oH [Heatsink Overheat]	0022	bUS [Option Communication Error]
000A	oH1 [Heatsink Overheat]	0025	CF [Control Fault]
000B	oL1 [Motor Overload]	0026	SvE [Zero Servo Fault]
000C	oL2 [Drive Overload]	0027	EF0 [Option Card External Fault]
000D	oL3 [Overtorque Detection 1]	0028	FbL [PID Feedback Loss]
000E	oL4 [Overtorque Detection 2]	0029	UL3 [Undertorque Detection 1]
000F	rr [Dynamic Braking Transistor Fault]	002A	UL4 [Undertorque Detection 2]
0010	rH [Braking Resistor Overheat]	002B	oL7 [High Slip Braking Overload]
0011	EF3 [ExFault DI3]	002C	EF9 [ExFault DI9]
0012	EF4 [ExFault DI4]	002D	EF10 [ExFault DI10]
0013	EF5 [ExFault DI5]	002E	EF11 [ExFault DI11]
0014	EF6 [ExFault DI6]	002F	EF12 [ExFault DI12]
0015	EF7 [ExFault DI7]	0030	Includes oFx Fault [Hardware Fault]
0016	EF8 [ExFault DI8]	0032	dv1 [Z Pulse Fault]
0017	FAn [Internal Fan Fault]	0033	dv2 [Z Pulse Noise Fault Detection]
0018	oS [Overspeed]	0034	dv3 [Inversion Detection]
0019	dEv [Speed Deviation]	0035	dv4 [Inversion Prevention Detection]
001A	PGo [Encoder (PG) Feedback Loss]	0036	LF2 [Output Current Imbalance]

Fault Code (Hex.)	Name
0037	STPo [Motor Step-Out Detected]
0038	PGoH [Encoder (PG) Hardware Fault]
0039	E5 [MECHATROLINK Watchdog Timer Err]
003B	SEr [Speed Search Retries Exceeded]
0041	FbH [Excessive PID Feedback]
0042	EF1 [ExFault DI1]
0043	EF2 [ExFault DI2]
0044	oL5 [Mechanical Weakening Detection 1]
0045	UL5 [Mechanical Weakening Detection 2]
0046	CoF [Current Offset Fault]
0049	qFL [Q2pack Fault]
004A	qFL1 [EEPROM Memory Q2pack Data Error]
004B	qFL2 [Q2pack Fault 2]
004C	qFL3 [Q2pack Fault 3]
004E	rF [Braking Resistor Fault]
004F	boL [BrakingTransistor Overload Fault]
0051	LSo [Low Speed Motor Step-Out]
0052	nSE [Node Setup Error]
005B	dv7 [Polarity Judge Timeout]
005F	LF3 [Output Phase Loss 3]
0060	UnbC [Current Imbalance]
0061	Uv4 [Gate Drive Board Power Supply Voltage Low]
0083	CPF02 [A/D Conversion Error]
0084	CPF03 [Control Board Connection Error]
0087	CPF06 [EEPROM Memory Data Error]
0088	CPF07 [Terminal Board Connection Error]
0089	CPF08 [Terminal Board Connection Error]
008C	CPF11 [RAM Fault]
008D	CPF12 [FLASH Memory Fault]
008E	CPF13 [Watchdog Circuit Exception]
008F	CPF14 [Control Circuit Fault]
0091	CPF16 [Clock Fault]
0092	CPF17 [Timing Fault]
0093	CPF18 [Control Circuit Fault]
0094	CPF19 [Control Circuit Fault]
0095	CPF20 [Control Circuit Error]
0096	CPF21 [Control Circuit Error]
0097	CPF22 [Hybrid IC Error]
0098	CPF23 [Control Board Connection Error]
0099	CPF24 [Drive Unit Signal Fault]
009A	CPF25 [Terminal Board not Connected]
009B	CPF26 [BB Circuit Error]
009C	CPF27 [PWM Set Reg Error]
009D	CPF28 [PWM Pattern Error]
009E	CPF29 [On-Delay Error]
009F	CPF30 [BB On Error]

Fault Code (Hex.)	Name
00A0	CPF31 [ASIC Code Error]
00A1	CPF32 [ASIC Startup Error]
00A2	CPF33 [Watch-dog Eror]
00A3	CPF34 [Power/Clock Eror]
00A4	CPF35 [Ext A/D Conv Error]
00A5	CPF36 [ASIC COM Error]
00A6	CPF37 [ASIC COM Error]
00A7	CPF38 [EEPROM Data Error]
00A9	CPF40 [Control Circuit Error]
00AA	CPF41 [Control Circuit Error]
00AB	CPF42 [Control Circuit Error]
00AC	CPF43 [Control Circuit Error]
00AD	CPF44 [Control Circuit Error]
00AE	CPF45 [Control Circuit Error]
0101	oFA00 [Option Not Compatible with Port]
0102	oFA01 [Option Fault/Connection Error]
0106	oFA05 [Option A/D Error]
0107	oFA06 [Option Communication Error]
0111	oFA10 [Option RAM Error]
0112	oFA11 [Option Ope Mode Error]
0113	oFA12 [Drive Receive CRC Error]
0114	oFA13 [Drive Receive Frame Error]
0115	oFA14 [Drive Receive Abort Error]
0116	oFA15 [Option Receive CRC Error]
0117	oFA16 [Option Receive Frame Error]
0118	oFA17 [Option Receive Abort Error]
0131	oFA30 [COM ID Error]
0132	oFA31 [Type Code Error]
0133	oFA32 [SUM Check Error]
0134	oFA33 [Option Receive Time Over]
0135	oFA34 [Modbus Time Over]
0136	oFA35 [Drive Receive Time Over 1]
0137	oFA36 [CI Check Error]
0138	oFA37 [Drive Receive Time Over 2]
0139	oFA38 [Control Reference Error]
013A	oFA39 [Drive Receive Time Over 3]
013B	oFA40 [CtrlResSel 1Err]
013C	oFA41 [Drive Receive Time Over 4]
013D	oFA42 [CtrlResSel 2Err]
013E	oFA43 [Drive Receive Time Over 5]
0201	oFb00 [Option Not Compatible with Port]
0202	oFB01 [Option Fault/Connection Error]
0203	oFb02 [Duplicate Options]
0206	oFb05 [Option A/D Error]
0207	oFb06 [Option Communication Error]
0211	oFb10 [Option RAM Error]

Fault Code (Hex.)	Name
0212	oFb11 [Option Ope Mode Error]
0213	oFb12 [Drive Receive CRC Error]
0214	oFb13 [Drive Receive Frame Error]
0215	oFb14 [Drive Receive Abort Error]
0216	oFb15 [Option Receive CRC Error]
0217	oFb16 [Option Receive Frame Error]
0218	oFb17 [Option Receive Abort Error]
0231	oFb30 [Comm. ID Error]
0232	oFb31 [Model Code Error]
0233	oFb32 [Checksum Error]
0234	oFb33 [Comm. Option Timeout Waiting for Response]
0235	oFb34 [Modbus Ccommunications Timeout]
0236	oFb35 [Drive Timeout Waiting for Response]
0237	oFb36 [CI Check Error]
0238	oFb37 [Drive Timeout Waiting for Response]
0239	oFb38 [Control Command Selection Error]
023A	oFb39 [Drive timeout waiting for response]
023B	oFb40 [Control Response Selection 1 Error]
023C	oFb41 [Drive Timeout Waiting for Response]
023D	oFb42 [Control Response Selection 2 Error]
023E	oFb43 [Drive Timeout Waiting for Response]
0301	oFC00 [Option Not Compatible with Port]
0302	oFC01 [Option Fault/Connection Error]
0303	oFC02 [Duplicate Options]
0306	oFC05 [Option A/D Error]
0307	oFC06 [Option Communication Error]
0311	oFC10 [Option RAM Error]
0312	oFC11 [Option Ope Mode Error]
0313	oFC12 [Drive Receive CRC Error]
0314	oFC13 [Drive Receive Frame Error]
0315	oFC14 [Drive Receive Abort Error]
0316	oFC15 [Option Receive CRC Error]
0317	oFC16 [Option Receive Frame Error]
0318	oFC17 [Option Receive Abort Error]
0351	oFC50 [Encoder Option A/D Conv Error]
0352	oFC51 [EncOpAnlgCrctErr]
0353	oFC52 [Encoder Option Comm Timeout]
0354	oFC53 [Encoder Option Comm Data Fault]
0355	oFC54 [Encoder Error]
0356	oFC55 [Resolver Error]
0401	TiM [Keypad Time Not Set]
0402	bAT [Keypad Battery Low Voltage]
040F	SCF [Safety Circuit Fault]
0413	FAn1 [Drive Cooling Fan Fault]
0414	CP1 [Comparator 1 Limit Fault]
0415	CP2 [Comparator 2 Limit Fault]
0416	bCE [Bluetooth Communication Fault]

■ Minor Fault/Alarm Contents

The following table lists the minor fault/alarm codes that communications register (007 (Hex.)) reads.

Table 6.14 Minor Fault/Alarm Contents (007 (Hex.))

Minor Fault/ Alarm Code (Hex.)	Name
0001	Uv [Undervoltage]
0002	ov [DC Bus Overvoltage]
0003	oH [Heatsink Overheat]
0004	oH2 [External Overheat (H1-XX=B)]
0005	oL3 [Overtorque 1]
0006	oL4 [Overtorque 2]
0007	EF [FWD/REV Run Command Input Error]
0008	bb [Baseblock]
0009	EF3 [ExFault DI3]
000A	EF4 [ExFault DI4]
000B	EF5 [ExFault DI5]
000C	EF6 [ExFault DI6]
000D	EF7 [ExFault DI7]
000E	EF8 [ExFault DI8]
000F	FAn [Internal Fan Fault]
0010	oS [Overspeed]
0011	dEv [Speed Deviation]
0012	PGo [Encoder (PG) Feedback Loss]
0014	CE [Modbus Communication Error]
0015	bUS [Option Communication Error]
0016	CALL [Serial Comm Transmission Error]
0017	oL1 [Motor Overloaded]
0018	oL2 [Drive Overloaded]
001A	EF0 [Option Card External Fault]
001B	rUn [Motor Switch during Run]
001D	CALL [Serial Comm Transmission Error]
001E	UL3 [Undertorque Detection 1]
001F	UL4 [Undertorque Detection 2]
0020	SE [Modbus Test Mode Error]
0021	L24v [Loss of External Power 24 Supply]
0022	oH3 [Motor Overheat (PTC Input)]
0023	EF9 [ExFault DI9]

Minor Fault/ Alarm Code (Hex.)	Name
0024	EF10 [ExFault DI10]
0025	EF11 [ExFault DI11]
0026	EF12 [ExFault DI12]
0027	FbL [PID Feedback Loss]
0028	FbH [Excessive PID Feedback]
002A	dnE [Drive Disabled]
002B	PGoH [Encoder (PG) Hardware Fault]
0031	E5 [MECHATROLINK Watchdog Timer Err]
0032	AEr [Station Address Setting Error]
0033	CyC [MECHATROLINK CommCycleSettingErr]
0034	HCA [High Current Alarm]
0035	LT-1 [Cooling Fan Maintenance Time]
0036	LT-2 [Capacitor Maintenance Time]
0039	EF1 [ExFault DI1]
003A	EF2 [ExFault DI2]
003B	SToF [Safe Torque OFF Hardware]

Minor Fault/ Alarm Code (Hex.)	Name
003C	STo [Safe Torque OFF]
003D	oL5 [Mechanical Weakening Detection 1]
003E	UL5 [Mechanical Weakening Detection 2]
0042	TrPC [IGBT Maintenance Time (90%)]
0043	LT-3 [SoftChargeBypassRelay MainteTime]
0044	LT-4 [IGBT Maintenance Time (50%)]
0045	boL [Braking Transistor Overload]
0049	qAL1 [Q2pack Alarm]
004A	qAL2 [Q2pack Alarm 2]
004B	qAL3 [Q2pack Alarm 3]
0081	EP24v [External Power 24V Supply]
0085	bAT [Keypad Battery Low Voltage]
0087	CP1 [Comparator 1 Limit Error]
0088	CP2 [Comparator 2 Limit Error]
0089	TiM [Operator Time Not Set]
008A	bCE [Bluetooth Communication Error]

◆ Error Codes

■ Modbus Communications Error Code List

The following table lists the Modbus communications error codes.

When an error occurs, remove the cause of the error and restart communications.

Table 6.15 Modbus Communications Error Codes

Error Code (Hex.)	Name	Cause
01	Function Code Error	The PLC set a function code that was not 03, 08, or 10 (Hex.)
02	Register Number Error	• The register number that is trying to access is not registered. • A starting number that was not 0001 or 0002 (Hex.) was set when broadcasting.
03	Bit Count Error	• Read and write data quantities are more than the 1 to 16 range. (Command message data quantity is disabled.) • The data that was read from non-consecutive holding registers contained more than 120 bytes. • The data to be written to non-consecutive holding registers contained more than 60 bytes. • In the write mode, the number of bytes in the message is not the number of data × 2.
21	Data Setting Error	• Writing control data or parameters made the settings go out of the permitted setting range. • A parameter setting error occurred when writing a parameter.
22	Write Mode Error	• Tried to write a disabled parameter during run. • When there was a *CPF06 [EEPROM Memory Data Error]*, the master tried to write a parameter other than one of these: – *A1-00 [Language Selection]* – *A1-01 [Access Level]* – *A1-02 [Control Method]* – *A1-03 [Init Parameters]* – *A1-04 [Password Input]* – *A1-05 [Password Setting]* – *E1-03 [V/f Pattern Selection]* – *o2-04 [Drive KVA Selection]* • Writes the read-only data.
23	DC Bus Undervoltage Write Error	During *Uv [DC Bus Undervoltage]*, a *Uv* write disabled parameter was written.
24	Error Writing Data During Parameter Processing	Tried to write a parameter from the master during parameter processing on the drive side.
25	Writing into EEPROM Disabled	Writing into EEPROM write is disabled, but EEPROM write was executed from Modbus communications. When this error occurs, the keypad shows a message and the drive continues operation.

■ No Response from Slave

The slave ignores the command message from the master and will not send a response message in these conditions:

- When a communications error (overrun, framing, parity, CRC-16) is detected in the command message.
- When the slave address in the command message and the slave address for the drive side do not agree (Use *H5-01 [Mbus Address]* to set the slave address of the drive)
- When the time interval between the data of which the message is composed is longer than 24 bits
- When the data length for the command message is not accurate

Note:

- If the keypad shows *CALL [Serial Comm Transmission Error]*, refer to “Troubleshooting” to remove the cause of the error, and try to do communications again. If the keypad does not show *CALL*, check *U1-19 [Modbus Err.Code]* for the error and error type.
- If you execute the write function code when the slave address in the command message is 00 (Hex.), all of the slaves will execute the write command, but they will not send response messages to the master.

7

Troubleshooting

7.1 Safety Precautions

⚠DANGER

Electrical Shock Hazard

Electrical Shock Hazard. Do not examine, connect, or disconnect wiring on an energized drive. Before servicing, disconnect all power to the equipment and wait for the time specified on the warning label at a minimum. The internal capacitor stays charged after the drive is de-energized. The charge indicator LED extinguishes when the DC bus voltage decreases below 50 Vdc. When all indicators are OFF, measure for dangerous voltages to make sure that the drive is safe.

If you do work on the drive when it is energized, it will cause serious injury or death from electrical shock.

⚠WARNING

Electrical Shock Hazard

Do not operate equipment when covers are missing. Some figures in this section include drives without covers or safety shields to more clearly show the inside of the drive. Replace covers and shields before operation. Use drives only as specified by the instructions.

Failure to obey can cause death or serious injury.

Always ground the motor-side grounding terminal.

Contacting the motor case can cause death or serious injury from incorrect equipment grounding.

Do not immediately energize the drive or operate peripheral devices after the drive blows a fuse or trips a GFCI. Wait for the time specified on the warning label at a minimum and make sure that all indicators are OFF. Then check the wiring and peripheral device ratings to find the cause of the problem. Contact the manufacturer before energizing the drive or peripheral devices if the cause is not known.

Failure to obey can cause death or serious injury and damage to the drive.

Only let authorized persons install, wire, maintain, examine, replace parts, and repair the drive.

Failure to obey can cause death or serious injury.

Do not work on the drive or around the drive while wearing loose clothing or jewelry. Tighten loose clothing and remove all metal objects such as watches or rings.

Failure to obey can cause death or serious injury.

Do not remove covers or touch circuit boards while the drive is energized.

Failure to obey can cause death or serious injury.

Do not make changes to the drive body or drive circuitry.

Failure to obey can cause death or serious injury and will void warranty. Yaskawa is not responsible for changes to the product made by the user.

Fire Hazard

Tighten all terminal screws to the correct tightening torque.

Connections that are too loose or too tight can cause incorrect operation and damage to the drive. Incorrect connections can also cause death or serious injury from fire.

Tighten screws against the bit at an angle in the specified range shown in this manual.

If you tighten the screws at an angle not in the specified range, you can have loose connections that can cause damage to the terminal block or start a fire.

Do not use the main circuit power supply (Overcurrent Category III) at incorrect voltages. Make sure that the drive rated voltage aligns with the power supply voltage before energizing the drive.

Failure to obey can cause death or serious injury.

Do not put flammable or combustible materials on top of the drive and do not install the drive near flammable or combustible materials. Attach the drive to metal or other noncombustible material.

Failure to obey can cause death or serious injury.

⚠WARNING

Sudden Movement Hazard

Do not do work on the drive without eye protection. Wear eye protection before you start work on the drive.

Failure to obey could cause serious injury or death.

Crush Hazard

Use a lifting mechanism made to move large drives when necessary.

Failure to obey can cause death or serious injury from falling equipment.

NOTICE

Observe correct electrostatic discharge (ESD) procedures when touching the drive and circuit boards.

Failure to obey can cause ESD damage to the drive circuitry.

Do not connect or disconnect the motor from the drive while the drive is supplying voltage.

Incorrect equipment sequencing can cause damage to the drive.

Do not use unshielded wire for control wiring. Use shielded, twisted-pair wires and ground the shield to the ground terminal of the drive.

Failure to obey can cause electrical interference and unsatisfactory system performance.

Make sure that all connections are correct after you install the drive and connecting peripheral devices.

Failure to obey can cause damage to the drive.

7.2 Types of Faults, Minor Faults, Alarms, and Errors

If the drive or motor do not operate correctly, check the drive keypad for a code or message.

If problems occur that are not identified in this manual, contact the manufacturer with this information:

- Drive model
- Drive software version
- Date of purchase
- Description of the problem (such as failure conditions)

Contact the manufacturer if there is damage to the drive.

The following table contains descriptions of the different types of faults, minor faults, alarms, and errors that can occur during drive operation.

Table 7.1 Types of Faults, Minor Faults, Alarms, and Errors

Type	Drive Response
Faults	When the drive detects a fault, it will cause these conditions: • The keypad shows the fault code and ALM illuminate continuously. • The drive shuts off output, and the motor coasts to a stop. Some faults let the user select a motor stopping method. • Fault relay output 1NO-1CM will turn ON, and 1NC-1CM will turn OFF. The drive will not operate until you clear the fault with a Fault Reset and the drive goes back to usual status.
Minor Faults/Alarms	When the drive detects a minor fault or an alarm, it will cause these conditions: • The keypad shows the alarm code and ALM flash. • The drive will continue to operate the motor. Some alarms let the user select a motor stopping method. • If the drive detects a minor fault, the terminal set to *H2-01 to H2-03 = 4 [Multi-Function Digital Output 1 to Multi-Function Digital Output 3 = Alarm]* will switch ON. If you do not set parameters *H2-01 to H2-03* , the drive will not trigger MFDO terminals when it detects a minor fault. • The drive will not output a minor fault signal when it detects an alarm. It is not necessary to do Fault Reset.
Operation Errors	An error occurs when parameter settings do not agree or a parameter combination is incorrect. The drive will not operate until you set the parameters correctly. When the drive detects an operation error, these conditions will result: • The keypad shows the error code. • Multi-function outputs do not output an alarm signal. Find the parameters that caused the error and correct the settings.
Auto-Tuning Errors	An error occurs during Auto-Tuning. When the drive detects a tuning error, it will cause these conditions: • The keypad shows the error code. • Multi-function outputs do not output an alarm signal. • The motor coasts to stop. Remove the cause of the error and do Auto-Tuning again.
Copy Function Errors	An error occurs when you use the keypad for a backup, restore, or verify operation. When the drive detects a copy function error, it will cause these conditions: • The keypad shows the error code. • Multi-function outputs do not output an alarm signal. Push a key on the keypad to clear the error. Remove the cause of the error and try the backup, restore, or verify operation again.

7.3 List of Fault, Minor Fault, Alarm, and Error Codes

The following table shows the possible fault, minor fault, alarm, and error codes.

The display codes are in alphabetical order. Search the table for the code shown on the keypad, and identify its causes and possible solutions.

Note:

The number in parentheses adjacent to the code in the table identifies the fault code or minor fault code (hex. number) that was read during Modbus communications.

Example: AEr (0032)

Table 7.2 List of Fault, Minor Fault, Alarm, and Error Codes

Display (Hex.)	ALM LED	Type	Ref.
AEr (0032)	Flashing	Alarm	289
bAT (0085)	Flashing	Alarm	289
bAT (0402)	Illuminated	Fault	270
bb (0008)	Flashing	Alarm	289
bCE (008A)	Flashing	Alarm	289
bCE (0416)	Illuminated	Fault	270
boL (0045)	Flashing	Alarm	289
boL (004F)	Illuminated	Fault	270
bUS (0015)	Flashing	Alarm	289
bUS (0022)	Illuminated	Fault	270
CALL (001D)	Flashing	Alarm	290
CE (0014)	Flashing	Alarm	290
CE (0021)	Illuminated	Fault	270
CF (0025)	Illuminated	Fault	271
CoF (0046)	Illuminated	Fault	271
CP1 (0087)	Flashing	Alarm	290
CP1 (0414)	Illuminated	Fault	271
CP2 (0088)	Flashing	Alarm	291
CP2 (0415)	Illuminated	Fault	272
CPEr	-	Copy Function Error	309
CPF00, CPF01 CPF02, CPF03 (0083, 0084) CPF07, CPF08 (0088, 0089) CPF11 to CPF14 (008C to 008F) CPF16 to CPF24 (0091 to 0099) CPF26 to CPF38 (009B to 00A7) CPF40 to CPF45 (00A9 to 00AE)	Illuminated	Fault	272
CPF06 (0087)	Illuminated	Fault	272
CPF25 (009A)	Illuminated	Fault	272
CPyE	-	Copy Function Error	309
CrST	Flashing	Not an alarm.	291
CSEr	-	Copy Function Error	309
CyC (0033)	Flashing	Alarm	291
dEv (0011)	Flashing	Alarm	291
dEv (0019)	Illuminated	Fault	272
dFPS	-	Copy Function Error	309
dnE (002A)	Flashing	Alarm	291
dv1 (0032)	Illuminated	Fault	272
dv2 (0033)	Illuminated	Fault	272
dv3 (0034)	Illuminated	Fault	273
dv4 (0035)	Illuminated	Fault	273
dv7 (005B)	Illuminated	Fault	273
qAL2 (004A)	Flashing	Alarm	291
qAL3 (004B)	Flashing	Alarm	291
qAL1 (0049)	Flashing	Alarm	291
qFL1 (004A)	Illuminated	Fault	285
qFL2 (004B)	Illuminated	Fault	285
qFL3 (004C)	Illuminated	Fault	285
qFL (0049)	Illuminated	Fault	285
E5 (0031)	Flashing	Alarm	292
E5 (0039)	Illuminated	Fault	273
EF (0007)	Flashing	Alarm	292
EF0 (001A)	Flashing	Alarm	292
EF0 (0027)	Illuminated	Fault	274
EF1 (0042)	Illuminated	Fault	274
EF1 (0039)	Flashing	Alarm	292
EF2 (003A)	Flashing	Alarm	292
EF2 (0043)	Illuminated	Fault	274
EF3 (0009)	Flashing	Alarm	292
EF3 (0011)	Illuminated	Fault	274
EF4 (000A)	Flashing	Alarm	292
EF4 (0012)	Illuminated	Fault	274
EF5 (000B)	Flashing	Alarm	293
EF5 (0013)	Illuminated	Fault	274
EF6 (000C)	Flashing	Alarm	293
EF6 (0014)	Illuminated	Fault	274
EF7 (000D)	Flashing	Alarm	293
EF7 (0015)	Illuminated	Fault	275
EF8 (000E)	Flashing	Alarm	293
EF8 (0016)	Illuminated	Fault	275
End1	Flashing	Auto-Tuning Errors	305
End2	Flashing	Auto-Tuning Errors	305

Display (Hex.)	ALM LED	Type	Ref.
End3	Flashing	Auto-Tuning Errors	305
End4	Flashing	Auto-Tuning Errors	305
End5	Flashing	Auto-Tuning Errors	305
End6	Flashing	Auto-Tuning Errors	305
End7	Flashing	Auto-Tuning Errors	305
EP24v (0081)	Flashing	Alarm	293
Er-01	Flashing	Auto-Tuning Errors	305
Er-02	Flashing	Auto-Tuning Errors	306
Er-03	Flashing	Auto-Tuning Errors	306
Er-04	Flashing	Auto-Tuning Errors	306
Er-05	Flashing	Auto-Tuning Errors	306
Er-08	Flashing	Auto-Tuning Errors	306
Er-09	Flashing	Auto-Tuning Errors	307
Er-10	Flashing	Auto-Tuning Errors	307
Er-11	Flashing	Auto-Tuning Errors	307
Er-12	Flashing	Auto-Tuning Errors	307
Er-13	Flashing	Auto-Tuning Errors	307
Er-14	Flashing	Auto-Tuning Errors	307
Er-15	Flashing	Auto-Tuning Errors	307
Er-16	Flashing	Auto-Tuning Errors	307
Er-17	Flashing	Auto-Tuning Errors	308
Er-18	Flashing	Auto-Tuning Errors	308
Er-19	Flashing	Auto-Tuning Errors	308
Er-20	Flashing	Auto-Tuning Errors	308
Er-21	Flashing	Auto-Tuning Errors	308
Er-25	Flashing	Auto-Tuning Errors	308
Err (001F)	Illuminated	Fault	275
FAn (000F)	Flashing	Alarm	293
FAn (0017)	Illuminated	Fault	275
FAn1 (0413)	Illuminated	Fault	275
FbH (0028)	Flashing	Alarm	294
FbH (0041)	Illuminated	Fault	275
FbL (0027)	Flashing	Alarm	294
FbL (0028)	Illuminated	Fault	275
GF (0006)	Illuminated	Fault	276
HCA (0034)	Flashing	Alarm	294
iFEr	-	Copy Function Error	309
L24v (0021)	Flashing	Alarm	294
LF (001C)	Illuminated	Fault	276
LF2 (0036)	Illuminated	Fault	276
LoG	Flashing	Alarm	294
LSo (0051)	Illuminated	Fault	276
LT-1 (0035)	Flashing	Alarm	295
LT-2 (0036)	Flashing	Alarm	295
LT-3 (0043)	Flashing	Alarm	295
LT-4 (0044)	Flashing	Alarm	295

Display (Hex.)	ALM LED	Type	Ref.
ndAT	-	Copy Function Error	309
nSE (0052)	Illuminated	Fault	277
oC (0007)	Illuminated	Fault	277
oFA00 (0101)	Illuminated	Fault	278
oFA01 (0102)	Illuminated	Fault	278
oFA02 (0103)	Illuminated	Fault	278
oFA03 to oFA06 (0104 to 0107)	Illuminated	Fault	278
oFA10, oFA11 (0111, 0112)	Illuminated	Fault	278
oFA12 to oFA17 (0113 to 0118)	Illuminated	Fault	278
oFA30 to oFA43 (0131 to 013E)	Illuminated	Fault	278
oFb00 (0201)	Illuminated	Fault	279
oFb01 (0202)	Illuminated	Fault	279
oFb02 (0203)	Illuminated	Fault	279
oFb03 to oFb11 (0204 to 0212)	Illuminated	Fault	279
oFb12 to oFb17 (0213 to 0218)	Illuminated	Fault	279
oFC00 (0301)	Illuminated	Fault	279
oFC01 (0302)	Illuminated	Fault	279
oFC02 (0303)	Illuminated	Fault	279
oFC03 to oFC11 (0304 to 0312)	Illuminated	Fault	279
oFC12 to oFC17 (0313 to 0318)	Illuminated	Fault	279
oFC50 to oFC55 (0351 to 0356)	Illuminated	Fault	280
oH (0003)	Flashing	Alarm	295
oH (0009)	Illuminated	Fault	280
oH1 (000A)	Illuminated	Fault	280
oH2 (0004)	Flashing	Alarm	295
oH3 (001D)	Illuminated	Fault	280
oH3 (0022)	Flashing	Alarm	295
oH4 (0020)	Illuminated	Fault	281
oL1 (000B)	Illuminated	Fault	281
oL2 (000C)	Illuminated	Fault	282
oL3 (0005)	Flashing	Alarm	296
oL3 (000D)	Illuminated	Fault	282
oL4 (0006)	Flashing	Alarm	296
oL4 (000E)	Illuminated	Fault	282
oL5 (003D)	Flashing	Alarm	296
oL5 (0044)	Illuminated	Fault	282
oL7 (002B)	Illuminated	Fault	283
oPE01	Flashing	Parameter Setting Errors	300
oPE02	Flashing	Parameter Setting Errors	300
oPE03	Flashing	Parameter Setting Errors	300
oPE05	Flashing	Parameter Setting Errors	301

Display (Hex.)	ALM LED	Type	Ref.
oPE06	Flashing	Parameter Setting Errors	302
oPE07	Flashing	Parameter Setting Errors	302
oPE08	Flashing	Parameter Setting Errors	302
oPE09	Flashing	Parameter Setting Errors	303
oPE10	Flashing	Parameter Setting Errors	303
oPE11	Flashing	Parameter Setting Errors	303
oPE13	Flashing	Parameter Setting Errors	303
oPE15	Flashing	Parameter Setting Errors	303
oPE16	Flashing	Parameter Setting Errors	304
oPE18	Flashing	Parameter Setting Errors	304
oPE20	Flashing	Parameter Setting Errors	304
oPE33	Flashing	Parameter Setting Errors	304
oPr (001E)	Illuminated	Fault	283
oS (0010)	Flashing	Alarm	296
oS (0018)	Illuminated	Fault	283
ov (0002)	Flashing	Alarm	297
ov (0008)	Illuminated	Fault	283
PASS	Flashing	Not an alarm.	297
PF (0047)	Flashing	Alarm	297
PF (001B)	Illuminated	Fault	284
PGo (0012)	Flashing	Alarm	297
PGo (001A)	Illuminated	Fault	284
PGoH (002B)	Flashing	Alarm	297
PGoH (0038)	Illuminated	Fault	284
PWEr	-	Backup Function Error	309

Display (Hex.)	ALM LED	Type	Ref.
rdEr	-	Copy Function Error	309
rF (004E)	Illuminated	Fault	285
rH (0010)	Illuminated	Fault	285
rr (000F)	Illuminated	Fault	285
rUn (001B)	Flashing	Alarm	298
SC (0005)	Illuminated	Fault	285
SCF (040F)	Illuminated	Fault	286
SE (0020)	Flashing	Alarm	298
SEr (003B)	Illuminated	Fault	286
STo (003C)	Flashing	Alarm	298
SToF (003B)	Flashing	Alarm	298
STPo (0037)	Illuminated	Fault	286
SvE (0026)	Illuminated	Fault	286
TiM (0089)	Flashing	Alarm	298
TiM (0401)	Illuminated	Fault	286
TrPC (0042)	Flashing	Alarm	298
UL3 (001E)	Flashing	Alarm	298
UL3 (0029)	Illuminated	Fault	287
UL4 (001F)	Flashing	Alarm	298
UL4 (002A)	Illuminated	Fault	287
UL5 (003E)	Flashing	Alarm	299
UL5 (0045)	Illuminated	Fault	287
Uv (0001)	Flashing	Alarm	299
Uv1 (0002)	Illuminated	Fault	287
Uv2 (0003)	Illuminated	Fault	287
Uv3 (0004)	Illuminated	Fault	288
vAEr	-	Copy Function Error	309
vFyE	-	Copy Function Error	310

7.4 Faults

This section gives information about the causes and possible solutions of faults. You must use the Fault Reset operation to remove the fault before you can operate the drive. Use the information in this table to remove the cause of the fault.

Code	Name	Causes	Possible Solutions
bAT	Keypad Battery Low Voltage	The keypad battery voltage is low.	Replace the keypad battery.
Note: Use *o4-24 [bAT Detection Selection]* to enable/disable *bAT* detection.			

Code	Name	Causes	Possible Solutions
bCE	Bluetooth Communication Fault	The smart device with the Mobile Application installed is too far from the keypad.	Use the smart device 10 m (32.8 ft.) or nearer to the keypad. **Note:** *bCE* can occur when the smart device is 10 m or nearer to the keypad depending on the specifications of the smart device.
		Radio waves from a different device are causing interference with communications between the smart device and keypad.	Make sure that no device around the keypad uses the same radio bandwidth (2400 MHz to 2480 MHz), and prevent radio interference.
Note: • The drive detects this error when operating the drive with a smart device using the Bluetooth LCD keypad. • Do a Fault Reset to clear the fault. • Set the stopping method for this fault in *o2-27 [BLE Disconn.Selection@BLE Ctrl]*.			

Code	Name	Causes	Possible Solutions
boL	BrakingTransistor Overload Fault	The duty cycle of the braking transistor is high (the regeneration power or repetition frequency is high).	• Install a braking unit (CDBR-series). • Install a regenerative converter. • Increase the deceleration time.
		You enabled the protective function for the braking transistor when you have a regenerative converter.	Set *L8-55 = 0 [DB IGBT Protection = Disable]*.
		The braking transistor in the drive is broken.	Replace the entire drive.
Note: Do a Fault Reset to clear the fault.			

Code	Name	Causes	Possible Solutions
bUS	Option Communication Error	The drive did not receive a signal from the controller.	Correct wiring errors.
		The communications cable wiring is incorrect.	
		There is a short circuit or the communications cable is not connected.	• Repair short circuits and connect cables. • Replace the defective communications cable.
		Electrical interference caused a communication data error.	• Examine the control circuit lines, main circuit lines, and ground wiring, and decrease the effects of electrical interference. • Make sure that a magnetic contactor is not the source of the electrical interference, then use a Surge Protective Device if necessary. • Use only the recommended cables or other shielded line. Ground the shield on the controller side or the drive input power side. • Isolate the communication wiring from drive power lines, and install a noise filter to the input side of the power supply for communication. • Decrease the effects of electrical interference from the controller.
		The option card is incorrectly installed to the drive.	Correctly install the option card to the drive.
		The option card is damaged.	If the fault continues and the wiring is correct, replace the option card.
Note: • The drive detects this error if the Run command or frequency reference is assigned to the option card. • Do a Fault Reset to clear the fault. • If the drive detects this error, the drive will operate the motor as specified by the stopping method set in *F6-01 [Comm.Error Selection]*.			

Code	Name	Causes	Possible Solutions
CE	Modbus Communication Error	The communications cable wiring is incorrect.	Correct wiring errors.
		There is a short circuit or the communications cable is not connected.	• Repair short circuits and connect cables. • Replace the defective communications cable.

Code	Name	Causes	Possible Solutions
		Electrical interference caused a communication data error.	• Examine the control circuit lines, main circuit lines, and ground wiring, and decrease the effects of electrical interference. • Make sure that a magnetic contactor is not the source of the electrical interference, then use a Surge Protective Device if necessary. • Use only the recommended cables or other shielded line. Ground the shield on the controller side or the drive input power side. • Isolate the communication wiring from drive power lines, and install a noise filter to the input side of the power supply for communication. • Decrease the effects of electrical interference from the controller.

Note:
• The drive detects this error if it does not correctly receive control data for the *CE* detection time set to *H5-09 [Mbus CE Detect Time]*.
• Do a Fault Reset to clear the fault.
• If the drive detects this error, the drive will operate the motor as specified by the stopping method set in *H5-04 [Mbus Error Stop]*.

Code	Name	Causes	Possible Solutions
CF	Control Fault	Motor parameters are set incorrectly.	Correctly set the motor parameters and do Auto-Tuning again.
		Drive takes long to ramp to stop when *Control Method = 4 [Adv OLVector]* because of these settings: • The torque limit is too low. • *L3-11 = 1 [Overvolt Supression Select = Enabled]* • *d5-01 = 1 [Torque Ctrl Selection = Torque Control]*	When you have changes in Rotational Auto-Tuning and the installation environment, make sure that you do Line-to-Line Resistance Tuning and then set *L8-20 = 1 [CF / STPo Selection = Disabled]*. **Note:** Do test runs and examine the drive to start and stop correctly when *L8-20 = 1*.
		The torque limit is too low.	Adjust *L7-01 [FW Torque Limit], L7-02 [RV Torque Limit], L7-03 [FW Reg. TrqLimit], and L7-04 [RV Reg. TrqLimit]*.
		The load inertia is too big.	• Adjust *C1-02 [Decel Time 1], C1-04 [Decel Time 2], C1-06 [Decel Time 3], and C1-08 [Decel Time 4*. • Set the frequency reference to the minimum output frequency, and stop the Run command when the drive stops deceleration.
		The drive is trying to ramp to stop a machine that cannot do ramp to stop or on a machine for which deceleration is not necessary.	Correctly set *b1-03 [Stopping Method Selection]*.
		The motor and drive are connected incorrectly.	Correct wiring errors.
		Line-to-line Resistance Tuning is not done.	Do Stationary Auto-Tuning for Line-to-Line Resistance.
		The drive received a Run command while the motor was coasting.	• Examine the sequence and input the Run command after the motor fully stops. • Set *b3-01 = 1 [SpSrch@Start Selection = Enabled]*.

Note:
• The drive detects this error if the torque reference is more than the torque limit for 3 seconds or longer while the drive ramps to stop.
• Do a Fault Reset to clear the fault.

Code	Name	Causes	Possible Solutions
CoF	Current Offset Fault	The drive starts operation while the induced voltage stays in the motor (during coasting to a stop or after fast deceleration).	• Make a sequence that does not restart operation when induced voltage stays in the motor. • Set *b3-01 = 1 [SpSrch@Start Selection = Enabled]*. • Use *Speed Search from Fmax or Fref [H1-xx = 67, 68]* to do a speed search through one of the external terminals. **Note:** When controlling the PM motor, External Speed Search commands 1 and 2 operate the same.
		A drive hardware problem occurred.	Replace the drive.

Note:
• The drive detects this error if the current offset value is more than the permitted setting range while the drive automatically adjusts the current offset.
• Do a Fault Reset to clear the fault.

Code	Name	Causes	Possible Solutions
CP1	Comparator 1 Limit Fault	The monitor value set in *H2-20 [Compare1 Mon. Selection]* was within the range of *H2-21 [Compare1 Low Limit]* and *H2-22 [Compare1 Up Limit]*.	Examine the monitor value and remove the cause of the fault.

Note:
• The drive detects this error when the terminal is assigned to *H2-01, H2-02, and H2-03 = 3C [Multi-Function Digital Output 1, Multi-Function Digital Output 2, Multi-Function Digital Output 3 = Comparator1]*.
• Do a Fault Reset to clear the fault.
• Set the stopping method for this fault in *H2-33 [Compare1 Protection Selection]*.

Code	Name	Causes	Possible Solutions
CP2	Comparator 2 Limit Fault	The monitor value set in *H2-26 [Compare2 Mon. Selection]* was outside the range of *H2-27 [Compare2 Low Limit]* and *H2-28 [Compare2 Up Limit]*.	Examine the monitor value and remove the cause of the fault.

Note:
- The drive detects this error when the terminal is assigned to *H2-01, H2-02 , and H2-03 = 3D [Multi-Function Digital Output 1, Multi-Function Digital Output 2, and Multi-Function Digital Output 3 = Comparator2]*.
- Do a Fault Reset to clear the fault.
- Set the stopping method for this fault in *H2-35 [Compare2 Protection Selection]*.

Code	Name	Causes	Possible Solutions
CPF00 to CPF03, CPF07 to CPF08, CPF11 to CPF14, CPF16 to CPF24, and CPF26 to CPF39	Control Circuit Error	A drive hardware problem occurred.	• Re-energize the drive. • If the fault stays, replace the control board or the drive. For information about replacing the control board, contact the manufacturer or your nearest sales representative.

Note:
- Do a Fault Reset to clear the fault.
- Fault trace is not available for these faults.

Code	Name	Causes	Possible Solutions
CPF06	EEPROM Memory Data Error	The drive power supply was de-energized while a communication option card entered a parameter Write command.	Set *A1-03 = 2220, 3330 [Init Parameters = 2-Wire Initialization, 3-Wire Initialization]* and initialize the drive.
		An EEPROM peripheral circuit error occurred.	• Re-energize the drive. • If the fault stays, replace the control board or the drive. For information about replacing the control board, contact the manufacturer or your nearest sales representative.

Note:
- The drive detects this error if there is an error in the data written to the EEPROM of the drive.
- Do a Fault Reset to clear the fault.
- Fault trace is not available for this fault.

Code	Name	Causes	Possible Solutions
CPF25	Terminal Board not Connected	The terminal board is not correctly connected to the drive.	1. De-energize the drive. 2. Correctly connect the terminal board to the drive. 3. Re-energize the drive.

Note:
Do a Fault Reset to clear the fault.

Code	Name	Causes	Possible Solutions
dEv	Speed Deviation	The load is too heavy.	Decrease the load.
		Acceleration and deceleration times are set too short.	Increase the values set in *C1-01 [Accel Time 1] to C1-08 [Decel Time 4]*.
		The *dEv* detection level settings are incorrect.	Adjust *F1-10 [Speed Dev Level]* and *F1-11 [Speed Dev Delay Time]*.
		The load is locked up.	Examine the machine.
		The holding brake is stopping the motor.	Release the holding brake.

Note:
- The drive detects this error if the difference between the detected speed and the speed reference is more than the setting of *F1-10* for longer than *F1-11*.
- Do a Fault Reset to clear the fault.
- If the drive detects this error, the drive will operate the motor as specified by the stopping method set in *F1-04 [Speed Dev Detection Select]*.

Code	Name	Causes	Possible Solutions
dv1	Z Pulse Fault	The encoder option card or the encoder on the motor side is damaged.	1. Repair wiring errors and connect disconnected wires. Correctly ground the shielded wire of the encoder cable. 2. Re-energize the drive 3. If the fault stays, replace the control board or the drive. For information about replacing the control board, contact the manufacturer or your nearest sales representative.
		The encoder cable is disconnected or wired incorrectly.	

Note:
- The drive detects this error if it does not detect a Z pulse during one motor rotation.
- Do a Fault Reset to clear the fault.

Code	Name	Causes	Possible Solutions
dv2	Z Pulse Noise Fault Detection	Noise interference along the encoder cable.	Isolate the encoder cable from the drive output line or a different source of electrical interference.
		The encoder cable is disconnected or wired incorrectly.	Repair wiring errors and connect disconnected wires. Correctly ground the shielded wire of the encoder cable.

Code	Name	Causes	Possible Solutions
		The PG option card or the encoder on the motor side is damaged.	Repair the wiring and re-energize the drive, then replace the PG option card or the encoder if the problem continues.

Note:
- The drive detects this error if it does not detect a Z pulse during one motor rotation.
- Do a Fault Reset to clear the fault.

Code	Name	Causes	Possible Solutions
dv3	Inversion Detection	*E5-11 [Enc ZPulse Offset]* is set incorrectly.	Correctly set the value for Δθ to *E5-11* as specified by the values on the motor nameplate.
		There is a new encoder or the motor rotation direction changed.	Do Z Pulse Offset Tuning.
		An external force on the load side rotated the motor.	• Make sure that the motor is rotating in the correct direction. • Find and repair problems on the load side that cause the motor to rotate from the load side.
		Noise interference along the encoder cable.	Correctly ground the shielded wire of the encoder cable.
		The encoder cable is disconnected or incorrectly wired.	Examine for wiring errors or disconnected wires in the encoder cable, and repair problems.
		The setting for *F1-05 [Enc1 Rotat Selection]* is the opposite of the direction of motor rotation.	Correctly connect the motor wiring for each phase (U, V, W).
		The PG option card or the encoder on the motor side is damaged.	Repair the wiring and re-energize the drive, then replace the PG option card or the encoder if the problem continues.

Note:
- The drive detects this error if:
  - the torque reference and acceleration are in opposite directions.
  - the speed reference and actual motor speed are more than 30% different for the number of times set to *F1-18 [Dev3 Mode Selection]*.
- Do a Fault Reset to clear the fault.

Code	Name	Causes	Possible Solutions
dv4	Inversion Prevention Detection	An external force on the load side moved the motor.	• Make sure that the motor is rotating in the correct direction. • Find and repair problems on the load side that cause the motor to rotate from the load side. • Disable detection of this fault for applications that rotate the motor from the load side in the opposite direction of the speed reference. The drive will not detect this fault if *F1-19 = 0 [Dev4 Mode Selection = Disabled]*.
		E5-11 [Enc ZPulse Offset] is set incorrectly.	Correctly set the value for Δθ to *E5-11* as specified by the values on the motor nameplate.
		There is a new encoder or the motor rotation direction changed.	Do Z Pulse Offset Tuning.
		Noise interference along the encoder cable	Correctly ground the shielded wire of the encoder cable.
		The encoder cable is disconnected or incorrectly wired.	Examine for wiring errors or disconnected wires in the encoder cable, and repair problems.
		The PG option card or the encoder on the motor side is damaged.	Repair the wiring and re-energize the drive, then replace the PG option card or the encoder if the problem continues.

Note:
- The drive detects this error if the pulses in the opposite direction of the speed reference are more than the value set in *F1-19*.
- Do a Fault Reset to clear the fault.

Code	Name	Causes	Possible Solutions
dv7	Polarity Judge Timeout	There is a disconnection in the motor coil winding.	Measure the motor line-to-line resistance and replace the motor if a coil is disconnected.
		The screws on the drive output terminals are loose.	Tighten the terminal screws to the correct tightening torque.

Note:
- The drive detects this error if it cannot detect polarity in a pre-set length of time.
- Do a Fault Reset to clear the fault.

Code	Name	Causes	Possible Solutions
E5	MECHATROLINK Watchdog Timer Err	The drive detected a watchdog circuit exception while it received data from the controller.	Examine the MECHATROLINK cable connection. If this error occurs frequently, examine the wiring and decrease the effects of electrical interference as specified by these manuals: • MECHATROLINK-II Installation Guide (MECHATROLINK Members Association, manual number MMATDEP011) • MECHATROLINK-III Installation Guide (MECHATROLINK Members Association, manual number MMATDEP018)

Note:
- Do a Fault Reset to clear the fault.
- If the drive detects this fault, it will operate the motor as specified by the stop method set in *F6-25 [MLII Watchdog Error Sel]*.

Code	Name	Causes	Possible Solutions
EF0	Option Card External Fault	The communication option card received an external fault from the controller.	1. Find the device that caused the external fault and remove the cause. 2. Clear the external fault input from the controller.
		A programming error occurred on the controller side.	Examine the operation of the controller program.

Note:
• The drive detects this fault if the alarm function on the external device side is operating.
• Do a Fault Reset to clear the fault.
• If the drive detects this fault, it will operate the motor as specified by the stop method set in *F6-03 [Comm Ext Flt Select (EF0)]*.

Code	Name	Causes	Possible Solutions
EF1	External Fault (Terminal DI1)	MFDI terminal DI1 caused an external fault through an external device.	1. Find the device that caused the external fault and remove the cause. 2. Clear the external fault input in the MFDI.
		The wiring is incorrect.	Correctly connect the signal line to MFDI terminal DI1.
		External Fault [H1-01 = 20 to 2B] is set to MFDI terminal DI1, but the terminal is not in use.	Correctly set the MFDI.

Note:
Do a Fault Reset to clear the fault.

Code	Name	Causes	Possible Solutions
EF2	External Fault (Terminal DI2)	MFDI terminal DI2 caused an external fault through an external device.	1. Find the device that caused the external fault and remove the cause. 2. Clear the external fault input in the MFDI.
		The wiring is incorrect.	Correctly connect the signal line to MFDI terminal DI2.
		External Fault [H1-02 = 20 to 2B] is set to MFDI terminal DI2, but the terminal is not in use.	Correctly set the MFDI.

Note:
Do a Fault Reset to clear the fault.

Code	Name	Causes	Possible Solutions
EF3	External Fault (Terminal DI3)	MFDI terminal DI3 caused an external fault through an external device.	1. Find the device that caused the external fault and remove the cause. 2. Clear the external fault input in the MFDI.
		The wiring is incorrect.	Correctly connect the signal line to MFDI terminal DI3.
		External Fault [H1-03 = 20 to 2B] is set to MFDI terminal DI3, but the terminal is not in use.	Correctly set the MFDI.

Note:
Do a Fault Reset to clear the fault.

Code	Name	Causes	Possible Solutions
EF4	External Fault (Terminal DI4)	MFDI terminal DI4 caused an external fault through an external device.	1. Find the device that caused the external fault and remove the cause. 2. Clear the external fault input in the MFDI.
		The wiring is incorrect.	Correctly connect the signal line to MFDI terminal DI4.
		External Fault [H1-04 = 20 to 2B] is set to MFDI terminal DI4, but the terminal is not in use.	Correctly set the MFDI.

Note:
Do a Fault Reset to clear the fault.

Code	Name	Causes	Possible Solutions
EF5	External Fault (Terminal DI5)	MFDI terminal DI5 caused an external fault through an external device.	1. Find the device that caused the external fault and remove the cause. 2. Clear the external fault input in the MFDI.
		The wiring is incorrect.	Correctly connect the signal line to MFDI terminal DI5.
		External Fault [H1-05 = 20 to 2B] is set to MFDI terminal DI5, but the terminal is not in use.	Correctly set the MFDI.

Note:
Do a Fault Reset to clear the fault.

Code	Name	Causes	Possible Solutions
EF6	External Fault (Terminal DI6)	MFDI terminal DI6 caused an external fault through an external device.	1. Find the device that caused the external fault and remove the cause. 2. Clear the external fault input in the MFDI.
		The wiring is incorrect.	Correctly connect the signal line to MFDI terminal DI6.
		External Fault [H1-06 = 20 to 2B] is set to MFDI terminal DI6, but the terminal is not in use.	Correctly set the MFDI.

Note:
Do a Fault Reset to clear the fault.

Code	Name	Causes	Possible Solutions
EF7	External Fault (Terminal DI7)	MFDI terminal DI7 caused an external fault through an external device.	1. Find the device that caused the external fault and remove the cause. 2. Clear the external fault input in the MFDI.
		The wiring is incorrect.	Correctly connect the signal line to MFDI terminal DI7.
		External Fault [H1-07 = 20 to 2B] is set to MFDI terminal DI7, but the terminal is not in use.	Correctly set the MFDI.

Note:
Do a Fault Reset to clear the fault.

Code	Name	Causes	Possible Solutions
EF8	External Fault (Terminal DI8)	MFDI terminal DI8 caused an external fault through an external device.	1. Find the device that caused the external fault and remove the cause. 2. Clear the external fault input in the MFDI.
		The wiring is incorrect.	Correctly connect the signal line to MFDI terminal DI8.
		External Fault [H1-08 = 20 to 2B] is set to MFDI terminal DI8, but the terminal is not in use.	Correctly set the MFDI.

Note:
Do a Fault Reset to clear the fault.

Code	Name	Causes	Possible Solutions
Err	EEPROM Write Error	There was a problem with the EEPROM hardware.	• Re-energize the drive. • If the fault stays, replace the control board or the drive. For information about replacing the control board, contact the manufacturer or your nearest sales representative.
		Electrical interference corrupted the data while it was writing to the EEPROM of the drive.	• Push . • Set the parameters again.

Note:
Do a Fault Reset to clear the fault.

Code	Name	Causes	Possible Solutions
FAn	Internal Fan Fault	The circulation fan stopped operating correctly.	• Examine circulation fan operation. • Re-energize the drive. • Check *U4-03 [Fan Oper.Time]* and *U4-04 [Cool Fan Maintenance]*. If the performance life of the circulation fan is expired or if there is damage to the fan, replace the fan.
		There is a problem with the power supply of the electromagnetic contactor and the circulation fan.	1. Re-energize the drive. 2. If the fault stays, replace the control board or the drive. For information about replacing the control board, contact the manufacturer or your nearest sales representative.

Note:
Do a Fault Reset to clear the fault.

Code	Name	Causes	Possible Solutions
FAn1	Drive Cooling Fan Fault	The cooling fan stopped operating correctly.	• Examine cooling fan operation. • Re-energize the drive. • Check *U4-03 [Fan Oper.Time]* and *U4-04 [Cool Fan Maintenance]*. If the performance life of the cooling fan is expired or if there is damage to the fan, replace the fan.

Note:
Do a Fault Reset to clear the fault.

Code	Name	Causes	Possible Solutions
FbH	Excessive PID Feedback	The *FbH* detection level is set incorrectly.	Adjust *b5-36 [PID HiHi Limit Level]* and *b5-37 [PID HiHi Time]*.
		There is a problem with the PID feedback wiring.	Correct errors with the PID control wiring.
		The feedback sensor is not operating correctly.	Examine the sensors on the control device side.
		A fault occurred in the feedback input circuit of the drive.	Replace the control board or the drive. For information about replacing the control board, contact the manufacturer or your nearest sales representative.

Note:
• The drive detects this fault if the PID feedback input is more than the level set in *b5-36* for longer than *b5-37*.
• Do a Fault Reset to clear the fault.
• If the drive detects this fault, it will operate the motor as specified by the stop method set in *b5-12 [Fdback Loss Select Mode]*.

Code	Name	Causes	Possible Solutions
FbL	PID Feedback Loss	The *FbL* detection level is set incorrectly.	Adjust *b5-13 [Fdback Loss Lvl]* and *b5-14 [Fdback Loss Time]*.
		There is a problem with the PID feedback wiring.	Correct errors with the PID control wiring.
		The feedback sensor is not operating correctly.	Examine the sensors on the control device side.

Code	Name	Causes	Possible Solutions
		A fault occurred in the feedback input circuit of the drive.	Replace the control board or the drive. For information about replacing the control board, contact the manufacturer or your nearest sales representative.
Note: • The drive detects this fault if the PID feedback input is more than the level set in *b5-13* for longer than *b5-14*. • Do a Fault Reset to clear the fault. • If the drive detects this fault, it will operate the motor as specified by the stop method set in *b5-12 [Fdback Loss Select Mode]*.			
Code	**Name**	**Causes**	**Possible Solutions**
GF	Ground Fault	Overheating caused damage to the motor or the motor insulation is not satisfactory.	Measure the motor insulation resistance, and replace the motor if there is electrical conduction or unserviceable insulation.
		The motor main circuit cable is contacting ground to make a short circuit.	• Examine the motor main circuit cable for damage, and repair short circuits. • Measure the resistance between the motor main circuit cable and the ground terminal. If there is electrical conduction, replace the cable.
		An increase in the stray capacitance of the cable and the ground terminal caused an increase in the leakage current.	• If the wiring length of the cable is more than 100 m, decrease the carrier frequency. • Decrease the stray capacitance.
		There was a problem with the drive hardware.	Replace the control board or the drive. For information about replacing the control board, contact the manufacturer or your nearest sales representative.
Note: • The drive detects this fault if a current short to ground was more than 50% of rated current on the output side of the drive. • Do a Fault Reset to clear the fault. • *L5-08 [U/OV,OH,GF A-Reset Select]* disables the Auto Restart function.			
Code	**Name**	**Causes**	**Possible Solutions**
LF	Output Phase Loss	The motor main circuit cable is disconnected.	Connect motor main circuit cable wiring. Correct wiring errors in the main circuit drive input power.
		There is a disconnection in the motor coil winding.	If a coil is disconnected, measure the motor Line-to-Line Resistance and replace the motor.
		The screws on the drive output terminals are loose.	Tighten the terminal screws to the correct tightening torque.
		The rated output current of the motor is less than 5% of the drive rated current.	Examine the drive capacity or the motor output to be applied.
		You are trying to use a single-phase motor.	The drive cannot operate a single-phase motor.
		The output transistor in the drive is damaged.	• Re-energize the drive. • If the fault stays, replace the control board or the drive. For information about replacing the control board, contact the manufacturer or your nearest sales representative.
Note: • The drive detects this fault if phase loss occurs on the output side of the drive. • Do a Fault Reset to clear the fault. • Set *L8-07 [Out PhaseLoss Selection]* to enable and disable *LF* detection.			
Code	**Name**	**Causes**	**Possible Solutions**
LF2	Output Current Imbalance	Phase loss occurred in the wiring on the output side of the drive.	Examine for wiring errors or disconnected wires on the output side of the drive, and repair problems.
		The output terminal screws of the drive are loose.	Tighten the terminal screws to the correct tightening torque.
		There is not balance between the three phases of the PM motor impedance.	• Measure the Line-to-Line Resistance for each motor phase and make sure that resistance is equal in the three phases, and that all wires are connected correctly. • Replace the motor.
		The drive output circuit is broken.	• Re-energize the drive. • If the fault stays, replace the control board or the drive. For information about replacing the control board, contact the manufacturer or your nearest sales representative.
Note: • The drive detects this fault if there is not balance between the three phases of the output current from the PM motor. • Do a Fault Reset to clear the fault.			
Code	**Name**	**Causes**	**Possible Solutions**
LSo	Low Speed Motor Step-Out	The motor code set incorrectly.	• Set *E5-01 [PM Mot Code Selection]* correctly as specified by the motor. • For specialized motors, refer to the motor test report and set *E5-xx* correctly.
		The load is too heavy.	• Decrease the load. • Replace the drive and motor with larger capacity models.
		An external force on the load side caused the motor to move at start.	Find and repair problems on the load side that cause the motor to rotate from the load side.
		The drive incorrectly detected the motor magnetic pole position.	• Set *b3-01 = 1 [SpSrch@Start Selection = Enabled]*. • If the value for *U6-57 [PoleDis IdDifVal]* is lower than 819, increase the value set in *n8-84 [Polarity Det Current]*.

Code	Name	Causes	Possible Solutions
		Incorrect values set in *L8-93 [Lso Detect Time]*, *L8-94 [Lso Detect Level]*, and *L8-95 [Lso Amount]*.	Increase the values set in *L8-93 to L8-95*.

Note:
- The drive detects this fault if it detects step-out while running at low speed.
- Do a Fault Reset to clear the fault.
- *LSo* is a protective function that stops the motor and stops the reverse run if a motor without a motor code incorrectly detects the initial polarity. Decrease the values set in *L8-93 to L8-95* to a range in which the drive does not malfunction to quickly detect motor reversal.

Code	Name	Causes	Possible Solutions
nSE	Node Setup Error	The *H1-xx = 7E [Node Setup]* terminal was activated during run.	Stop the drive when the Node Setup function is in use.
		The drive received a Run command while the Node Setup function was active.	

Note:
Do a Fault Reset to clear the fault.

Code	Name	Causes	Possible Solutions
oC	Overcurrent	The load is too heavy.	• Measure the current flowing into the motor. • Replace the drive with a larger capacity model if the current value is more than the drive rated current. • Decrease the load or replace with a larger drive to prevent sudden changes in the current level.
		Overheating caused damage to the motor or the motor insulation is not satisfactory.	Measure the motor insulation resistance, and replace the motor if there is electrical conduction or unserviceable insulation.
		The motor main circuit cable is contacting ground to make a short circuit.	• Examine the motor main circuit cable for damage, and repair short circuits. • Measure the resistance between the motor main circuit cable and the ground terminal. If there is electrical conduction, replace the cable.
		A short circuit or ground fault on the drive output side caused damage to the output transistor of the drive.	• Make sure that there is not a short circuit in terminal B1 and terminals U/T1, V/T2, and W/T3. Make sure that there is not a short circuit in terminals - and terminals U/T1, V/T2, and W/T3. • If there is a short circuit, contact the manufacturer or your nearest sales representative.
		The acceleration time is too short.	• Calculate the torque necessary during acceleration related to the load inertia and the specified acceleration time. • Increase the values set in *C1-01 [Accel Time 1], C1-03 [Accel Time 2], C1-05 [Accel Time 3], or C1-07 [Accel Time 4]* until you get the necessary torque. • Increase the values set in *C2-01 [Jerk@Start of Accel], C2-02 [Jerk@End of Accel], C2-03 [Jerk@Start of Decel], and C2-04 [Jerk@End of Decel]* until you get the necessary torque. • Replace the drive with a larger capacity model.
		The drive is trying to operate a specialized motor or a motor that is larger than the maximum applicable motor output of the drive.	• Examine the motor nameplate, the motor, and the drive to make sure that the drive rated current is larger than the motor rated current. • Replace the drive with a larger capacity model.
		A magnetic contactor was switched at the output.	Set the operation sequence to not turn ON or OFF the magnetic contactor while the drive is outputting voltage.
		The V/f pattern settings are incorrect.	• Examine the ratios between the V/f pattern frequency and voltage. Decrease the voltage if it is too high compared to the frequency. • Adjust V/f Pattern Parameters *E1-04 to E1-10*. For motor 2, adjust *E3-04 to E3-10*.
		The torque compensation gain is too large.	Decrease the value set in *C4-01 [Trq Comp Gain]* to make sure that the motor does not stall.
		Electrical interference caused a problem.	Examine the control circuit lines, main circuit lines, and ground wiring, and decrease the effects of electrical interference.
		The gain during overexcitation operation is too large.	• Find the time when the fault occurs. • If the fault occurs at the same time as overexcitation operation, decrease the value set in *n3-13 [OverExcBr Gain]* and consider the motor flux saturation.
		The drive received a Run command while the motor was coasting.	• Examine the sequence and input the Run command after the motor fully stops. • Set *b3-01 = 1 [SpSrch@Start Selection = Enabled]* or set *H1-xx = 67, 68 [Speed Srch 1 or 2]* to input speed search commands from the MFDI terminals.
		The motor code is set incorrectly for PM Control Methods.	• Enter the correct motor code to *E5-01 [PM Mot Code Selection]* as specified by the PM motor. • For specialized motors, refer to the motor test report and set *E5: PM MOTOR SETTINGS* correctly.

Code	Name	Causes	Possible Solutions
		If the drive detects the fault at start or in the low speed range (10% or less) and *n8-57 = 1 [High-Freq Injection = Enabled]* for PM Control methods, the high frequency injection gain is too high.	• Set *E5: PM MOTOR SETTINGS* correctly or do Rotational Auto-Tuning. • Decrease the value of *n8-41 [HFI PoleDet Pgain]* in 0.5 unit increments. **Note:** Set *n8-41 > 0.0* for IPM motors.
		The current flowing in the motor is more than the value set in *L8-27 [OverCurr Det Gain]* for PM Control.	Correct the value set in *L8-27*.
		The control method is set incorrectly for the motor.	Set *A1-02 [Control Method]* correctly.
		The motor main circuit cable is too long.	Replace the drive with a larger capacity model.
		Speed search does not complete at start when you use an induction motor in EZOLV control.	When *E9-01 = 0 [Motor Type Selection = IM]*, set *b3-24 = 2 [SpSrch Method Selection = Current Det2]*.

Note:
• This fault occurs if the drive sensors detect a drive output current more than the specified overcurrent detection level.
• Do a Fault Reset to clear the fault.

Code	Name	Causes	Possible Solutions
oFA00	Option Not Compatible with Port	The option card connected to connector CN5-A is not compatible.	Connect the option card to the correct connector. **Note:** Encoder option cards are not compatible with connector CN5-A.

Note:
• Do a Fault Reset to clear the fault.
• Fault trace is not available for this fault.

Code	Name	Causes	Possible Solutions
oFA01	Option Fault/Connection Error	The option card connected to connector CN5-A is not compatible.	1. De-energize the drive. 2. Refer to the option card manual and correctly connect the option card to the connector on the drive.

Note:
Do a Fault Reset to clear the fault.

Code	Name	Causes	Possible Solutions
oFA02	Duplicate Options	The same option cards or the same type of option cards are connected to connectors CN5-A, B, and C.	Connect the option card to the correct connector. **Note:** Use connectors CN5-C and CN5-B to connect two encoder option cards.

Note:
Do a Fault Reset to clear the fault.

Code	Name	Causes	Possible Solutions
oFA03 to oFA06	Option Card Error Occurred at Option Port CN5-A	A fault occurred in the option card.	1. De-energize the drive. 2. Make sure that the option card is correctly connected to the connector. 3. If the problem continues, replace the option card.

Note:
Do a Fault Reset to clear the fault.

Code	Name	Causes	Possible Solutions
oFA10, oFA11	Option Card Error Occurred at Option Port CN5-A	A fault occurred in the option card.	1. De-energize the drive. 2. Make sure that the option card is correctly connected to the connector. 3. If the problem continues, replace the option card.

Note:
Do a Fault Reset to clear the fault.

Code	Name	Causes	Possible Solutions
oFA12 to oFA17	Option Card Connection Error (CN5-A)	A fault occurred in the option card.	1. De-energize the drive. 2. Make sure that the option card is correctly connected to the connector. 3. If the problem continues, replace the option card.

Note:
Do a Fault Reset to clear the fault.

Code	Name	Causes	Possible Solutions
oFA30 to oFA43	Communication Option Card Connection Error (CN5-A)	A fault occurred in the option card.	1. De-energize the drive. 2. Make sure that the option card is correctly connected to the connector. 3. If the problem continues, replace the option card.

Note:
Do a Fault Reset to clear the fault.

Code	Name	Causes	Possible Solutions
oFb00	Option Not Compatible with Port	The option card connected to connector CN5-B is not compatible.	Connect the option card to the correct connector. **Note:** DO-A3, AO-A3, PG-B3, and PG-X3 options can connect to connector CN5-B. Use connector CN5-C when connecting only one encoder option card.

Note:
- Do a Fault Reset to clear the fault.
- Fault trace is not available for this fault.

Code	Name	Causes	Possible Solutions
oFb01	Option Fault/Connection Error	The option card connected to connector CN5-B was changed during operation.	1. De-energize the drive. 2. Refer to the option card manual and correctly connect the option card to the connector on the drive.

Note:
Do a Fault Reset to clear the fault.

Code	Name	Causes	Possible Solutions
oFb02	Duplicate Options	The same option cards or the same type of option cards are connected to connectors CN5-A, B, and C.	Connect the option card to the correct connector.

Note:
Do a Fault Reset to clear the fault.

Code	Name	Causes	Possible Solutions
oFb03 to oFb11	Option Card Error Occurred at Option Port CN5-B	A fault occurred in the option card.	1. De-energize the drive. 2. Make sure that the option card is correctly connected to the connector. 3. If the problem continues, replace the option card.

Note:
Do a Fault Reset to clear the fault.

Code	Name	Causes	Possible Solutions
oFb12 to oFb17	Option Card Error Occurred at Option Port CN5-B	A fault occurred in the option card.	1. De-energize the drive. 2. Make sure that the option card is correctly connected to the connector. 3. If the problem continues, replace the option card.

Note:
Do a Fault Reset to clear the fault.

Code	Name	Causes	Possible Solutions
oFC00	Option Not Compatible with Port	The option card connected to connector CN5-C is not compatible.	Connect the option card to the correct connector. **Note:** AI-A3, DI-A3, and communication option cards cannot be connected to the CN5-C connector.

Note:
- Do a Fault Reset to clear the fault.
- Fault trace is not available for this fault.

Code	Name	Causes	Possible Solutions
oFC01	Option Fault/Connection Error	The option card connected to connector CN5-C was changed during operation.	1. De-energize the drive. 2. Refer to the option card manual and correctly connect the option card to the connector on the drive.

Note:
Do a Fault Reset to clear the fault.

Code	Name	Causes	Possible Solutions
oFC02	Duplicate Options	The same option cards or the same type of option cards are connected to connectors CN5-A, B, and C.	Connect the option card to the correct connector.

Note:
Do a Fault Reset to clear the fault.

Code	Name	Causes	Possible Solutions
oFC03 to oFC11	Option Card Error Occurred at Option Port CN5-C	A fault occurred in the option card.	1. De-energize the drive. 2. Make sure that the option card is correctly connected to the connector. 3. If the problem continues, replace the option card.

Note:
Do a Fault Reset to clear the fault.

Code	Name	Causes	Possible Solutions
oFC12 to oFC17	Option Card Error Occurred at Option Port CN5-C	A fault occurred in the option card.	1. De-energize the drive. 2. Make sure that the option card is correctly connected to the connector. 3. If the problem continues, replace the option card.

Note:
Do a Fault Reset to clear the fault.

Code	Name	Causes	Possible Solutions
oFC50 to oFC55	Option Card Error Occurred at Option Port CN5-C	A fault occurred in the option card.	Refer to the manual for the PG-RT3 or PG-F3 option card.

Note:

Do a Fault Reset to clear the fault.

Code	Name	Causes	Possible Solutions
oH	Heatsink Overheat	The ambient temperature is high and the heatsink temperature of the drive is more than the value set in *L8-02 [Overheat Alm Level]*.	• Measure the ambient temperature. • Increase the airflow in the control panel. • Install a cooling device (cooling fan or air conditioner) to lower the ambient temperature. • Remove objects near the drive that are producing too much heat.
		The load is too heavy.	• Measure the output current. • Decrease the load. • Decrease the value set in *C6-02 [Carrier Frequency Selection]*.
		The internal cooling fan of the drive stopped.	1. Use the procedure in this manual to replace cooling fan. 2. Set *o4-03 = 0 [Fan.Oper Setting = 0 h]*.

Note:
- The drive detects this fault if the heatsink temperature of the drive is more than the value set in *L8-02*.
- Do a Fault Reset to clear the fault.
- If the drive detects this fault, it will operate the motor as specified by the Stopping Method set in *L8-03 [Overheat Pre-Alarm Selection]*.

Code	Name	Causes	Possible Solutions
oH1	Heatsink Overheat	The ambient temperature is high and the heatsink temperature of the drive is more than the value set in *L8-02 [Overheat Alm Level]*.	• Measure the ambient temperature. • Increase the airflow in the control panel. • Install a cooling device (cooling fan or air conditioner) to lower the ambient temperature. • Remove objects near the drive that are producing too much heat.
		The load is too heavy.	• Measure the output current. • Decrease the load. • Decrease the value set in *C6-02 [Carrier Frequency Selection]*.

Note:
- The drive detects this fault if the heatsink temperature of the drive is more than the *oH1* detection level. *o2-04 [Drive KVA Selection]* determines the *oH1* detection level.
- Do a Fault Reset to clear the fault.
- *U/OV,OH,GF A-Reset Select* disables the Auto Restart function.

Code	Name	Causes	Possible Solutions
oH3	Motor Overheat (PTC Input)	The thermistor wiring that detects motor temperature is defective.	Correct wiring errors.
		A fault occurred on the machine. Example: The machine is locked.	Examine the machine and remove the cause of the fault
		The motor has overheated.	• Check the load level, acceleration/deceleration time, and motor start/stop frequency (cycle time). • Decrease the load. • Increase the values set in Acceleration/Deceleration Times *C1-01 to C1-08*. • Set *E2-01 [Mot Rated Current (FLA)]* correctly to the value specified by the motor nameplate. • Make sure that the motor cooling system is operating correctly, and repair or replace it if it is damaged. • Adjust V/f Pattern Parameters*E1-04 to E1-10*. For motor 2, adjust *E3-04 to E3-10*. Decrease the values set in *E1-08 [Mid A Voltage]* and *E1-10 [Min Output Voltage]*. **Note:** If the values set in *E1-08* and *E1-10* are too low, the load tolerance will decrease when operating the drive in the low speed range.

Note:
- The drive detects this fault if the motor overheat signal that was entered to an analog input terminal A3 is more than the alarm detection level when *H3-06 = 16 [AI3 Function Selection = Mot PTC Input]*.
- Do a Fault Reset to clear the fault.
- If the drive detects this fault, it will operate the motor as specified by the Stopping Method set in *L1-03 [Motor oH AL Reaction Select]*.

Code	Name	Causes	Possible Solutions
oH4	Motor Overheat Fault (PTC Input)	The motor has overheated.	• Check the load level, acceleration/deceleration time, and motor start/stop frequency (cycle time). • Decrease the load. • Increase the values set in Acceleration/Deceleration Times *C1-01 to C1-08*. • Set *E2-01 [Mot Rated Current (FLA)]* correctly to the value specified by the motor nameplate. • Make sure that the motor cooling system is operating correctly, and repair or replace it if it is damaged. • Adjust V/f Pattern Parameters *E1-04 to E1-10*. For motor 2, adjust *E3-04 to E3-10*. Decrease the values set in *E1-08 [Mid A Voltage]* and *E1-10 [Min Output Voltage]*. **Note:** If *E1-08* and *E1-10* are set too low, the overload tolerance will decrease at low speeds.

Note:
- The drive detects this fault if the motor overheat signal that was entered to an analog input terminals A1, A2, or A3 is more than the alarm detection level. (If *H3-02 [AI1 Function Selection], H3-10 [AI2 Function Selection], or H3-06 [AI3 Function Selection] = 16 [Mot PTC Input]* was set.)
- Do a Fault Reset to clear the fault.

Code	Name	Causes	Possible Solutions
oL1	Motor Overload	The load is too heavy.	Decrease the load. **Note:** Reset *oL1* when *U4-16 [MotorOLEstimate (oL1)]* < 100.
		The acceleration/deceleration times or cycle times are too short.	• Examine the acceleration/deceleration times and the motor start/stop frequencies (cycle times). • Increase the value set in Acceleration/Deceleration Times *C1-01 to C1-08*.
		Overload occurred while running at low speed.	• Lower the load when running at low speed. • Increase the motor speed. • If the motor is run frequently at low speeds, replace the motor with a larger motor or use a drive-dedicated motor. **Note:** For general-purpose motors, overload can occur while running at low speed when operating at below the rated current.
		L1-01 [Motor Cool Type for OL1 Calc] is set incorrectly.	Set *L1-01* in as specified by the motor qualities for a drive-dedicated motor.
		The V/f pattern does not fit the motor qualities.	• Examine the ratios between the V/f pattern frequency and voltage. Decrease the voltage if it is too high compared to the frequency. • Adjust V/f Pattern Parameters *E1-04 to E1-10*. For motor 2, adjust *E3-04 to E3-10*. Decrease the values set in *E1-08 [Mid A Voltage]* and *E1-10 [Min Output Voltage]*. **Note:** If *E1-08* and *E1-10* are set too low, the overload tolerance will decrease at low speeds.
		E1-06 [Base Frequency] is set incorrectly.	Set *E1-06* to the rated frequency shown on the motor nameplate.
		One drive is operating more than one motor.	Set *L1-01 = 0 [Motor Cool Type for OL1 Calc = Disabled]*, connect thermal overload relay to each motor to prevent damage to the motor.
		The electronic thermal protector qualities and the motor overload properties do not match.	• Examine the motor qualities and set *L1-01 [Motor Cool Type for OL1 Calc]* correctly. • Connect a thermal overload relay to the motor.
		The electronic thermal protector is operating at an incorrect level.	Set *E2-01 [Mot Rated Current (FLA)]* to the value shown on the motor nameplate.
		There is increased motor loss from overexcitation operation.	• Lower the value set in *n3-13 [OverExcBr Gain]*. • Set *L3-50 ≠ 3 or 4 [StallP@Decel Mode ≠ HiFlux Overexcitation or HiFlux2 Overexcitation]*. • Set *L3-04 = 0 [StallP@Decel Enable = Disabled]*.
		The speed search-related parameters are set incorrectly.	• Examine the settings for all speed search related parameters. • Adjust *b3-03 [SpSrch Deceleration Time]*. • Set *b3-24 = 1 [SpSrch Method Selection = Speed Estimation]* after Auto-Tuning.
		Phase loss in the input power supply is causing the output current to change.	Make sure that there is no phase loss, and repair problems.

Note:
- The drive detects this fault if the electronic thermal protector of the drive started the motor overload protection.
- Do a Fault Reset to clear the fault.
- *L5-07 [OL1-4 Auto-Reset Select]* disables the Auto Restart function.

Code	Name	Causes	Possible Solutions
oL2	Drive Overload	The load is too heavy.	Decrease the load.
		The acceleration/deceleration times or cycle times are too short.	• Examine the acceleration/deceleration times and the motor start/stop frequencies (cycle times). • Increase the value set in Acceleration/Deceleration Times *C1-01 to C1-08*.
		The V/f pattern does not fit the motor qualities.	• Examine the ratios between the V/f pattern frequency and voltage. Lower the voltage if it is too high compared to the frequency. • Adjust V/f Pattern Parameters *E1-04 to E1-10*. Lower the values set in *E1-08 [Mid A Voltage]* and *E1-10 [Min Output Voltage]* For motor 2, adjust *E3-04 to E3-10*. **Note:** If *E1-08* and *E1-10* are set too low, the overload tolerance is will decrease at low speeds.
		The drive capacity is too small.	Replace the drive with a larger capacity model.
		Overload occurred while running at low speed.	• Decrease the load when running at low speed. • Replace the drive with a larger capacity model. • Decrease the value set in *C6-02 [Carrier Frequency Selection]*.
		The torque compensation gain is too large.	Decrease the value set in *C4-01 [Trq Comp Gain]* to make sure that the motor does not stall.
		The speed search-related parameters are set incorrectly.	• Examine the settings for all speed search related parameters. • Adjust *b3-03 [SpSrch Deceleration Time]*. • Set *b3-24 = 1 [SpSrch Method Selection = Speed Estimation]* after Auto-Tuning.
		Phase loss in the input power supply is causing the output current to change.	• Correct any wiring errors in the main circuit drive input power. • Make sure that there is no phase loss, and repair problems.

Note:
• The drive detects this fault if the electronic thermal protector of the drive started the motor overload protection.
• Do a Fault Reset to clear the fault.
• *L5-07 [OL1-4 Auto-Reset Select]* disables the Auto Restart function.

Code	Name	Causes	Possible Solutions
oL3	Overtorque Detection 1	A fault occurred on the machine. Example: The machine is locked.	Examine the machine and remove the cause of the fault.
		The parameters are incorrect for the load.	Adjust *L6-02 [Trq Det1 Level]* and *L6-03 [Trq Det1 Time]* settings.

Note:
• The drive detects this fault if the drive output current is more than the level set in *L6-02* for longer than *L6-03*.
• Do a Fault Reset to clear the fault.
• If the drive detects this fault, it will operate the motor as specified by the Stopping Method set in *L6-01 [Trq Det1 Select]*.
• *L5-07 [OL1-4 Auto-Reset Select]* disables the Auto Restart function.

Code	Name	Causes	Possible Solutions
oL4	Overtorque Detection 2	A fault occurred on the machine. Example: The machine is locked.	Examine the machine and remove the cause of the fault.
		The parameters are incorrect for the load.	Adjust *L6-05 [Trq Det2 Level]* and *L6-06 [Trq Det2 Time]* settings.

Note:
• The drive detects this fault if the drive output current is more than the level set in *L6-05* for longer than *L6-06*.
• Do a Fault Reset to clear the fault.
• If the drive detects this fault, it will operate the motor as specified by the Stopping Method set in *L6-04 [Trq Det2 Select]*.
• *L5-07 [OL1-4 Auto-Reset Select]* disables the Auto Restart function.

Code	Name	Causes	Possible Solutions
oL5	Mechanical Weakening Detection 1	The drive detected overtorque as specified by the conditions for mechanical weakening detection set in *L6-08 [MechF Enable]*, and in *L6-56, L6-57, L6-58 [MechF Action, MechF AbsSpeed, MechF Method]*.	Do a deterioration diagnostic test on the machine side.

Note:
• Do a Fault Reset to clear the fault.
• If the drive detects this fault, it will operate the motor as specified by the Stopping Method set in *L6-08*, and in *L6-56, L6-57, L6-58 [MechF Action, MechF AbsSpeed, MechF Method]*.

Code	Name	Causes	Possible Solutions
oL7	High Slip Braking Overload	The load inertia is too large.	• Decrease deceleration times in *C1-02 [Decel Time 1], C1-04 [Decel Time 2], C1-06 [Decel Time 3], and C1-08 [Decel Time 4]* for applications that do not use High Slip Braking. • Use a braking resistor to decrease the deceleration time.
		An external force on the load side rotated the motor.	
		Something is preventing deceleration on the load side.	
		The value set in *n3-04 [HSB Overload Time]* is too small.	• Increase the value set in *n3-04*. • Connect a thermal overload relay to the motor, and set *n3-04 = 1200 s (maximum value)*.

Note:
• The drive detects this fault if the output frequency is constant for longer than *n3-04*.
• Do a Fault Reset to clear the fault.

Code	Name	Causes	Possible Solutions
oPr	Keypad Connection Fault	The keypad is not securely connected to the connector on the drive.	Examine the connection between the keypad and the drive.
		The connection cable between the drive and the keypad is disconnected.	• Remove the keypad and connect it again. • If the cable is damaged, replace it.

Note:
• The drive detects this fault if these conditions are correct:
 – *o2-06 = 1 [Keypad Disconnect Detection = Enabled]*.
 – *b1-02 = 0 [Run Comm. Sel 1 = Keypad]*, or the drive is operating in LOCAL Mode with the keypad.
• Do a Fault Reset to clear the fault.

Code	Name	Causes	Possible Solutions
oS	Overspeed	There is overshoot.	• Decrease *C5-01 [ASR PGain 1]* and increase *C5-02 [ASR ITime 1]*. • Adjust the pulse train gain with Pulse Train Input Setting Parameters *H6-02 to H6-05* .
		There is an incorrect number of PG pulses set in the drive.	Set *H6-02 [PI Frequency Scale]* to the pulse train frequency during 100% reference (maximum motor rotation speed).
		The *oS* detection level is set incorrectly.	Adjust *F1-08 [Overspeed Level]* and *F1-09 [Overspeed Delay Time]*.

Note:
• The drive detects this fault if the motor speed is more than the value set in *F1-08* for longer than *F1-09*.
• Do a Fault Reset to clear the fault.
• If the drive detects this fault, it will operate the motor as specified by the Stopping Method set in *F1-03 [Overspeed Detection Selection]*.

Code	Name	Causes	Possible Solutions
ov	Overvoltage	Deceleration time is too short and regenerative energy is flowing from the motor into the drive.	• Set *L3-04 = 1 [StallP@Decel Enable = Enabled]* and *L3-50 = 0 [StallP@Decel Mode = General Purpose]*. • Increase the values set in *C1-02 [Decel Time 1], C1-04 [Decel Time 2], C1-06 [Decel Time 3], or C1-08 [Decel Time 4]*. • Connect a dynamic braking option to the drive. • Perform Deceleration Rate Auto-Tuning.
		The acceleration time is too short.	• Make sure that sudden drive acceleration does not cause the fault. • Increase the values set in *C1-01 [Accel Time 1], C1-03 [Accel Time 2], C1-05 [Accel Time 3], or C1-07 [Accel Time 4]*. • Increase the value set in *C2-02 [Jerk@End of Accel]*. • Set *L3-11 = 1 [Overvolt Supression Select = Enabled]*.
		The braking load is too large.	Connect a dynamic braking option to the drive.
		There are surge voltages in the input power supply.	Connect a DC reactor to the drive. **Note:** If you turn the phase advancing capacitors ON and OFF and use thyristor converters in the same power supply system, there can be surge voltages that irregularly increase the input voltage.
		The drive output cable or motor is shorted to ground (the current short to ground is charging the main circuit capacitor of the drive through the power supply).	1. Examine the motor main circuit cable, terminals, and motor terminal box, and then remove ground faults. 2. Re-energize the drive.
		If the drive detects ov in these conditions, the speed search-related parameters are incorrect: • During speed search • During momentary power loss recovery • When the drive starts again automatically	• Examine the settings for all speed search related parameters. • Set *b3-19 ≠ 0 [Speed Retry Times ≠ 0 times]*. • Adjust *b3-03 [SpSrch Deceleration Time]* settings. • Do Stationary Auto-Tuning for Line-to-Line Resistance and then set *b3-24 = 1 [SpSrch Method Selection = Speed Estimation]*.
		The power supply voltage is too high.	Decrease the power supply voltage to match the drive rated voltage.
		The braking resistor or braking resistor unit wiring is incorrect.	Correct wiring errors in the connection to the braking resistor or braking resistor unit.
		The encoder cable is disconnected or wired incorrectly.	Examine for wiring errors or disconnected wires in the encoder cable, and repair problems.

Code	Name	Causes	Possible Solutions
		Noise interference along the encoder cable.	Isolate the encoder cable from the drive output line or a different source of electrical interference.
		Electrical interference caused a drive malfunction.	• Examine the control circuit lines, main circuit lines, and ground wiring, and decrease the effects of electrical interference. • Make sure that a magnetic contactor is not the source of the electrical interference, then use a Surge Protective Device if necessary.
		The load inertia is set incorrectly.	• Examine the load inertia settings with KEB, overvoltage suppression, or stall prevention during deceleration. • Adjust *L3-25 [Load Inertia Ratio]* to match the qualities of the machine.
		The Short Circuit Braking function used in OLV/PM control method.	Connect a braking resistor to the drive.
		There is motor hunting.	• Adjust *n1-02 [HuntPrev Gain Setting]* settings. • Adjust *n2-02 [AFR Time 1]* and *n2-03 [AFR Time 2]* settings. • Adjust *n8-45 [SpdFbck Det.Gain]* and *n8-47 [Pull-In Comp. Time Constant]* settings.
		Speed search does not complete at start when you use an induction motor in EZOLV control.	When *E9-01 = 0 [Motor Type Selection = IM]*, set *b3-24 = 2 [SpSrch Method Selection = Current Det2]*.

Note:
- The drive detects this error if the DC bus voltage is more than the *ov* detection level while the drive is running.
- The *ov* detection level is approximately 410 V with 200 V class drives. The detection level is approximately 820 V with 400 V class drives.
- Do a Fault Reset to clear the fault.
- Parameter *L5-08 [U/OV,OH,GFA-Reset Select]* disables the Auto Restart function.

Code	Name	Causes	Possible Solutions
PF	Input Phase Loss	There is a phase loss in the drive input power.	Correct errors with the wiring for main circuit drive input power.
		There is loose wiring in the drive input power terminals.	Tighten the terminal screws to the correct tightening torque.
		The drive input power voltage is changing too much.	• Examine the input power for problems. • Make the drive input power stable. • If the input power supply is good, examine the magnetic contactor on the main circuit side for problems.
		There is unsatisfactory balance between voltage phases.	• Examine the input power for problems. • Make the drive input power stable. • Set *L8-05 = 0 [In PhaseLoss Selection = Disabled]*.
		The main circuit capacitors have become unserviceable.	• Examine the capacitor maintenance time in monitor *U4-05 [Capacitor Maintenance]*. If *U4-05* is more than 90%, replace the control board or the drive. For information about replacing the control board, contact the manufacturer or your nearest sales representative. • If drive input power is correct and the fault stays, replace the control board or the drive. For information about replacing the control board, contact the manufacturer or your nearest sales representative.

Note:
- The drive detects this error if the DC bus voltage changes irregularly without regeneration.
- Do a Fault Reset to clear the fault.
- Use *L8-05* to enable and disable *PF* detection.

Code	Name	Causes	Possible Solutions
PGo	Encoder (PG) Feedback Loss	The encoder cable is disconnected or wired incorrectly.	Examine for wiring errors or disconnected wires in the encoder cable, and repair problems.
		The encoder is not receiving power.	Examine the encoder power supply.
		The holding brake is stopping the motor.	Release the holding brake.

Note:
- The drive detects this error if it does not receive the speed detection pulse signal from the encoder in the detection time set in *F1-14 [Enc PGOpen Time for Detection]*.
- Do a Fault Reset to clear the fault.
- If the drive detects this error, it will operate the motor as specified by the Stopping Method set in *F1-02 [PGOpen Detection Select]*.

Code	Name	Causes	Possible Solutions
PGoH	Encoder (PG) Hardware Fault	The encoder cable is disconnected.	Connect all encoder cable wires.

Note:
- Do a Fault Reset to clear the fault.
- If the drive detects this error, it will operate the motor as specified by the Stopping Method set in *F1-02 [PGOpen Detection Select]*.

Code	Name	Causes	Possible Solutions
qFL1	EEPROM Memory Q2pack Data Error	There is an error in the EEPROM peripheral circuit.	• Re-energize the drive. • If the fault stays, replace the control board or the drive. For information about replacing the control board, contact the manufacturer or your nearest sales representative.
		There is a problem with the EEPROM data.	Set *A1-03 = 2220, 3330 [Init Parameters = 2-Wire Initialization, 3-Wire Initialization]* to initialize the drive, then upload the Q2dev project to the drive again.

Note:
• The drive detects this error if there is an error in the Q2pack program that was saved to EEPROM.
• Do a Fault Reset to clear the fault.

Code	Name	Causes	Possible Solutions
qFL2	Q2pack Fault 2	There was a fault in the Q2pack program.	Examine the Q2pack program and remove the cause of the fault. This is not a drive fault.

Note:
Do a Fault Reset to clear the fault.

Code	Name	Causes	Possible Solutions
qFL3	Q2pack Fault 3	There was a fault in the Q2pack program.	Examine the Q2pack program and remove the cause of the fault. This is not a drive fault.

Note:
Do a Fault Reset to clear the fault.

Code	Name	Causes	Possible Solutions
qFL	Q2pack Fault	There was a fault in the Q2pack program.	Examine the Q2pack program and remove the cause of the fault. This is not a drive fault.

Note:
Do a Fault Reset to clear the fault.

Code	Name	Causes	Possible Solutions
rF	Braking Resistor Fault	The resistance of the dynamic braking option that is connected to the drive is too low.	Use a dynamic braking option that fits the model and duty rating of the drive.
		A regenerative converter, regenerative unit, or braking unit is connected to the drive.	Set *L8-55 = 0 [DB IGBT Protection = Disable]*.

Note:
Do a Fault Reset to clear the fault.

Code	Name	Causes	Possible Solutions
rH	Braking Resistor Overheat	The deceleration time is too short and excessive regenerative energy is flowing back into the drive.	• Check the load level, deceleration time, and speed. • Decrease the load. • Increase the value set in *C1-02 [Decel Time 1], C1-04 [Decel Time 2], C1-06 [Decel Time 3], or C1-08 [Decel Time 4]*. • Use a dynamic braking option that lets you use more power.
		The duty cycle is too high.	Examine the duty cycle. **Note:** When *L8-01 = 1 [3%ERF DBR Protection = Enabled]*, the maximum braking duty cycle is 3%.
		The braking load is too large.	• Calculate the braking load and braking power again, and decrease the braking load. • Use a braking resistor that improves braking power.
		The braking resistor is not sufficient.	Use the braking resistor specifications to select a sufficient braking resistor.

Note:
• The drive detects this error if the braking resistor overheat protective function is active.
• The magnitude of the braking load causes the braking resistor overheat alarm, NOT the surface temperature. If the duty cycle is higher than the braking resistor rating, the drive will show the alarm.
• Do a Fault Reset to clear the fault.
• *L8-01* enables fault detection.

Code	Name	Causes	Possible Solutions
rr	Dynamic Braking Transistor Fault	The drive control circuit is damaged.	• Re-energize the drive. • If the fault stays, replace the control board or the drive. For information about replacing the control board, contact the manufacturer or your nearest sales representative.
		There is a malfunction in the internal braking transistor of the drive.	

Note:
Do a Fault Reset to clear the fault.

Code	Name	Causes	Possible Solutions
SC	Short Circuit/IGBT Failure	Overheating caused damage to the motor or the motor insulation is not satisfactory.	Measure the motor insulation resistance, and replace the motor if there is electrical conduction or unserviceable insulation.
		The motor main circuit cable is contacting ground to make a short circuit.	• Examine the motor main circuit cable for damage, and repair short circuits. • Measure the resistance between the motor main circuit cable and the ground terminal. If there is electrical conduction, replace the cable.

Code	Name	Causes	Possible Solutions
		A short circuit or ground fault on the drive output side caused damage to the output transistor of the drive.	• Make sure that there is not a short circuit in terminal B1 and terminals U/T1, V/T2, and W/T3. Make sure that there is not a short circuit in terminals - and terminals U/T1, V/T2, and W/T3. • If there is a short circuit, contact the manufacturer or your nearest sales representative.

Note:
- The drive detects this error if there is a short circuit or ground fault on the drive output side, or an IGBT failure.
- Do a Fault Reset to clear the fault.

Code	Name	Causes	Possible Solutions
SCF	Safety Circuit Fault	The safety circuit is broken.	Replace the control board or the drive. For information about replacing the control board, contact the manufacturer or your nearest sales representative.

Note:
Do a Fault Reset to clear the fault.

Code	Name	Causes	Possible Solutions
SEr	Speed Search Retries Exceeded	The speed search-related parameters are set incorrectly.	• Decrease the value set in *b3-10 [Speed Det Gain for Estimation]*. • Increase the value set in *b3-17 [Speed Retry Current Level]*. • Increase the value set in *b3-18 [Speed Retry Delay]*. • Do Auto-Tuning again.
		The motor is coasting in the opposite direction of the Run command.	Set *b3-14 = 1 [Speed Bi-Directional Search = Enabled]*.

Note:
- The drive detects this error if the number of speed search restarts is more than the value set in *b3-19 [Speed Retry Times]*.
- Do a Fault Reset to clear the fault.

Code	Name	Causes	Possible Solutions
STPo	Motor Step-Out Detected	The motor code is set incorrectly for PM Control Methods.	• Enter the correct motor code to *E5-01 [PM Mot Code Selection]* as specified by the PM motor. • For specialized motors, refer to the motor test report and set *E5-xx* correctly.
		The load is too heavy.	• Increase the value set in *n8-55 [Load Inertia]*. • Increase the value set in *n8-51 [Ac/Dec Pull-In Current]*. If the drive detects *STPo* during deceleration when increasing the value set in *n8-51*, set the value of *n8-79 [Pull-In Curr@Deceleration]* lower than *n8-51*. • Decrease the load. • Replace the drive and motor with larger capacity models.
		The load inertia is too heavy.	Increase the value set in *n8-55*.
		The acceleration/deceleration times are too short.	• Increase the acceleration/deceleration times set in *C1-01 to C1-08 [Accel Time 1 to Decel Time 4]*. • Increase the value set in *C2-01 [Jerk@Start of Accel]*.
		Speed response is too slow.	• Increase the value set in *n8-55*. • If *STPo* occurs in Normal Duty mode when *A1-02 = 6 [Control Method = PM AOLVector]*, increase the value set in *n8-11 [Observ.Calc Gain2]* in increments of 10. If *STPo* occurs when starting a motor, decrease the value set in *n8-11* in increments of 10.

Note:
Do a Fault Reset to clear the fault.

Code	Name	Causes	Possible Solutions
SvE	Zero Servo Fault	The value set in the torque limit is too small.	Adjust torque limit-related parameters *L7-01 to L7-04*.
		The load torque is too large.	Decrease the load torque.
		Noise interference along the encoder cable	Isolate the encoder cable from the drive output line or a different source of electrical interference.

Note:
- The drive detects this error if motor rotation position moves during Zero Servo.
- Do a Fault Reset to clear the fault.

Code	Name	Causes	Possible Solutions
TiM	Keypad Time Not Set	There is a battery in the keypad, but the date and time are not set.	Set the date and time with the keypad.

Note:
- Do a Fault Reset to clear the fault.
- *o4-24 [bAT Detection Selection]* enables and disables *TiM* detection.

Code	Name	Causes	Possible Solutions
UL3	Undertorque Detection 1	A fault occurred on the machine. Example: There is a broken pulley belt.	Examine the machine and remove the cause of the fault.
		The parameters are incorrect for the load.	Adjust *L6-02 [Trq Det1 Level]* and *L6-03 [Trq Det1 Time]* settings.

Note:
- The drive detects this error if the drive output current is less than the level set in *L6-02* for longer than *L6-03*.
- Do a Fault Reset to clear the fault.
- If the drive detects this error, it will operate the motor as specified by the Stopping Method set in *L6-01 [Trq Det1 Select]*.

Code	Name	Causes	Possible Solutions
UL4	Undertorque Detection 2	A fault occurred on the machine. Example: There is a broken pulley belt.	Examine the machine and remove the cause of the fault.
		The parameters are incorrect for the load.	Adjust *L6-05 [Trq Det2 Level]* and *L6-06 [Trq Det2 Time]* settings.

Note:
- The drive detects this error if the drive output current is less than the level set in *L6-05* for longer than *L6-06*.
- Do a Fault Reset to clear the fault.
- If the drive detects this error, it will operate the motor as specified by the Stopping Method set in *L6-04 [Trq Det2 Select]*.

Code	Name	Causes	Possible Solutions
UL5	Mechanical Weakening Detection 2	The drive detected undertorque as specified by the conditions for mechanical weakening detection set in *L6-08 [MechF Enable]*.	Examine the machine for deterioration.

Note:
- Do a Fault Reset to clear the fault.
- If the drive detects this error, it will operate the motor as specified by the Stopping Method set in *L6-08*.

Code	Name	Causes	Possible Solutions
Uv1	DC Bus Undervoltage	There is a phase loss in the drive input power.	Correct errors with the wiring for main circuit drive input power.
		There is loose wiring in the drive input power terminals.	Tighten the terminal screws to the correct tightening torque.
		The drive input power voltage is changing too much.	• Examine the input power for problems. • Make the drive input power stable. • If the input power supply is good, examine the magnetic contactor on the main circuit side for problems.
		There was a loss of power.	Use a better power supply.
		The main circuit capacitors have become unserviceable.	Examine the capacitor maintenance time in monitor *U4-05 [Capacitor Maintenance]*. If *U4-05* is more than 90%, replace the control board or the drive. For information about replacing the control board, contact the manufacturer or your nearest sales representative.
		The relay or contactor on the soft-charge bypass relay is damaged.	*U4-06 [SoftChgRelay Maint]* shows the performance life of the soft-charge bypass relay. If *U4-06* is more than 90%, replace the board or the drive. For information about replacing the control board, contact the manufacturer or your nearest sales representative.

Note:
- The drive detects this error if the DC bus voltage decreases below the level set in *L2-05 [UV Detection Lvl (Uv1)]* while the drive is running.
- The *Uv1* detection level is approximately 190 V for a 200 V class drives. The detection level is approximately 380 V for 400 V class drives. The detection level is approximately 350 V when *E1-01 [Input AC Supply Voltage]* < 400.
- Do a Fault Reset to clear the fault.
- Fault trace is not available for this fault.
- *L5-08 [U/OV,OH,GF A-Reset Select]* disables the Auto Restart function.

Code	Name	Causes	Possible Solutions
Uv2	Control Power Undervoltage	The value set in *L2-02 [RideThrough Time@Power Loss]* increased and the momentary power loss recovery unit is not connected to the drive.	Connect the momentary power loss recovery unit to the drive.
		There was a problem with the drive hardware.	• Re-energize the drive. • If the fault stays, replace the control board or the drive. For information about replacing the control board, contact the manufacturer or your nearest sales representative.

Note:
- The drive detects this error if the control power supply voltage decreases.
- Do a Fault Reset to clear the fault.
- Fault trace is not available for this fault.

Code	Name	Causes	Possible Solutions
Uv3	Soft Charge Answerback Fault	The relay or contactor on the soft-charge bypass relay is damaged.	• Re-energize the drive. • If the fault stays, replace the control board or the drive. • Check monitor *U4-06 [SoftChgRelay Maint]* shows the performance life of the soft-charge bypass relay. If *U4-06* is more than 90%, replace the board or the drive. For information about replacing the board, contact the manufacturer or your nearest sales representative.
Note: • Do a Fault Reset to clear the fault. • Fault trace is not available for this fault.			

7.5 Minor Faults/Alarms

This section gives information about the causes and possible solutions when a minor fault or alarm occurs. Use the information in this table to remove the cause of the minor fault or alarm.

Code	Name	Causes	Possible Solutions
AEr	Station Address Setting Error	The node address for the option card is not in the permitted setting range.	• For CC-Link communication, set *F6-10 [CCLink Node Address]* correctly. • For MECHATROLINK communication, set *F6-20 [MLII Address]* correctly. • For CANopen communication, set *F6-35 [CANopen Address]* correctly.

Note:

If the drive detects this error, the terminal assigned to *H2-01, H2-02, and H2-03 = 4 [Multi-Function Digital Output 1, Multi-Function Digital Output 2, and Multi-Function Digital Output 3 = Alarm]* will be ON.

Code	Name	Causes	Possible Solutions
bAT	Keypad Battery Low Voltage	The keypad battery voltage is low.	Replace the keypad battery.

Note:
- If detected, the terminal assigned to *H2-01, H2-02, and H2-03 = 4 [Multi-Function Digital Output 1, Multi-Function Digital Output 2, and Multi-Function Digital Output 3 = Alarm]* will switch ON.
- Set *o4-24 [bAT Detection Selection]* to enable/disable *bAT* detection.

Code	Name	Causes	Possible Solutions
bb	Baseblock	An external baseblock command was entered through MFDI terminal DI1 to DI8, and the drive output stopped as shown by an external baseblock command.	Examine the external sequence and timing of the baseblock command input.

Note:

The drive will not output an alarm signal for this alarm.

Code	Name	Causes	Possible Solutions
bCE	Bluetooth Communication Error	The smart device with the Mobile Application is too far from the keypad.	Use the smart device within 10 m (32.8 ft.) from the keypad. **Note:** *bCE* can occur when the smart device is 10 m or nearer to the keypad depending on the specifications of the smart device.
		Radio waves from a different device are causing interference with communications between the smart device and keypad.	Make sure that no device around the keypad uses the same radio bandwidth (2400 MHz to 2480 MHz), and prevent radio interference.

Note:
- The drive detects this error when using the Bluetooth LCD keypad to operate the drive with a smart device.
- If the drive detects this error, the terminal assigned to *H2-01, H2-02, and H2-03 = 4 [Multi-Function Digital Output 1, Multi-Function Digital Output 2, and Multi-Function Digital Output 3 = Alarm]* will be ON.
- Use *o2-27 [BLE Disconn.Selection@BLE Ctrl]* to enable and disable *bCE* detection.

Code	Name	Causes	Possible Solutions
boL	Braking Transistor Overload	The duty cycle of the braking transistor is high (the regeneration power or repetition frequency is high).	• Install a braking unit (CDBR series). • Install a regenerative converter. • Increase the deceleration time.
		You enabled the protective function for the braking transistor when you have a regenerative converter.	Set *L8-55 = 0 [DB IGBT Protection = Disable]*.
		The braking transistor in the drive is broken.	Replace the drive.

Note:

If the drive detects this error, the terminal assigned to *H2-01, H2-02, and H2-03 = 4 [Multi-Function Digital Output 1, Multi-Function Digital Output 2, and Multi-Function Digital Output 3 = Alarm]* will be ON.

Code	Name	Causes	Possible Solutions
bUS	Option Communication Error	The communications cable wiring is incorrect.	Correct wiring errors.
		There is a short circuit or the communications cable is not connected.	• Repair short circuits and connect cables. • Replace the defective communications cable.
		Electrical interference caused a communication data error.	• Examine the control circuit lines, main circuit lines, and ground wiring, and decrease the effects of electrical interference. • Make sure that a magnetic contactor is not the source of the electrical interference, then use a Surge Protective Device if necessary. • Use only recommended cables or other shielded line. Ground the shield on the controller side or the drive input power side. • Separate the communication wiring from drive power lines, and install a noise filter to the input side of the power supply for communication. • Decrease the effects of electrical interference from the controller.
		The option card is incorrectly installed to the drive.	Correctly install the option card to the drive.

Code	Name	Causes	Possible Solutions
		The option card is damaged.	If the fault continues and the wiring is correct, replace the option card.

Note:
- The drive detects this error if the Run command or frequency reference is assigned to the option card.
- If the drive detects this error, the terminal assigned to *H2-01, H2-02, and H2-03 = 4 [Multi-Function Digital Output 1, Multi-Function Digital Output 2, and Multi-Function Digital Output 3 = Alarm]* will be ON.
- If the drive detects this error, the drive will operate the motor as specified by the stopping method set in *Comm.Error Selection*.

Code	Name	Causes	Possible Solutions
CALL	Serial Comm Transmission Error	The communications cable wiring is incorrect.	Correct any wiring errors.
		There is a short circuit or the communications cable is not connected.	• Repair short circuits and connect cables. • Replace the defective communications cable.
		There was a programming error on the controller side.	Examine communications at start-up and correct programming errors.
		The communications circuitry is damaged.	• Do a self-diagnostics check. • If the problem continues, replace the control board or the drive. For information about replacing the control board, contact the manufacturer or your nearest sales representative.
		The termination resistor setting for Modbus communications is incorrect.	On the last drive in a Modbus network, set DIP switch S2 to the ON position to enable the termination resistor.

Note:
- The drive detects this error if it does not correctly receive control data from the controller when energizing the drive.
- If the drive detects this error, the terminal assigned to *H2-01, H2-02, and H2-03 = 4 [Multi-Function Digital Output 1, Multi-Function Digital Output 2, and Multi-Function Digital Output 3 = Alarm]* will be ON.

Code	Name	Causes	Possible Solutions
CE	Modbus Communication Error	The communications cable wiring is incorrect.	Correct wiring errors.
		There is a short circuit or the communications cable is not connected.	• Repair short circuits and connect cables. • Replace the defective communications cable.
		Electrical interference caused a communication data error.	• Examine the control circuit lines, main circuit lines, and ground wiring, and decrease the effects of electrical interference. • Make sure that a magnetic contactor is not the source of the electrical interference, then use a Surge Protective Device if necessary. • Use only recommended cables or other shielded line. Ground the shield on the controller side or the drive input power side. • Separate the communication wiring from drive power lines, and install a noise filter to the input side of the power supply for communication. • Decrease the effects of electrical interference from the controller.
		The communication protocol is not compatible.	• Examine the values set in *H5-xx*. • Examine the settings on the controller side and correct the difference in communication conditions.
		The value set in *H5-09 [Mbus CE Detect Time]* is too small for the communications cycle.	• Change the controller software settings. • Increase the value set in *H5-09*.
		The controller software or hardware is causing a communication problem.	Examine the controller and remove the cause of the problem.

Note:
- The drive detects this error if it does not correctly receive control data for the *CE* detection time set to *H5-09*.
- If detected, the terminal assigned to *H2-01, H2-02, and H2-03 = 4 [Multi-Function Digital Output 1, Multi-Function Digital Output 2, and Multi-Function Digital Output 3 = Alarm]* will switch ON.
- If the drive detects this error, the drive will operate the motor as specified by the stopping method set in *H5-04 [Mbus Error Stop]*.

Code	Name	Causes	Possible Solutions
CP1	Comparator 1 Limit Error	The monitor value set in *H2-20 [Compare1 Mon. Selection]* was in the range of *H2-21 [Compare1 Low Limit]* and *H2-22 [Compare1 Up Limit]*.	Examine the monitor value and remove the cause of the error.

Note:
- The drive detects this error when the terminal is assigned to *H2-01, H2-02, and H2-03 = 3C [Multi-Function Digital Output 1, Multi-Function Digital Output 2, and Multi-Function Digital Output 3Comparator1]*.
- If the drive detects this error, the terminal assigned to *H2-01, H2-02, and H2-03 = 4 [Multi-Function Digital Output 1, Multi-Function Digital Output 2, and Multi-Function Digital Output 3 = Alarm]* will be ON.
- *H2-33 [Compare1 Protection Selection[* enables and disables *CP1* detection.

Code	Name	Causes	Possible Solutions
CP2	Comparator 2 Limit Error	The monitor value set in *H2-26 [Compare2 Mon. Selection]* was outside the range of *H2-27 [Compare2 Low Limit]* and *H2-28 [Compare2 Up Limit]*.	Examine the monitor value and remove the cause of the error.

Note:
- The drive detects this error when the terminal is assigned to *H2-01, H2-02, and H2-03 = 3D [Multi-Function Digital Output 1, Multi-Function Digital Output 2, and Multi-Function Digital Output 3 = Comparator2]*.
- If the drive detects this error, the terminal assigned to *H2-01, H2-02, and H2-03 = 4 [Multi-Function Digital Output 1, Multi-Function Digital Output 2, and Multi-Function Digital Output 3 = Alarm]* will be ON.
- *H2-35 [Compare2 Protection Selection]* enables and disables *CP2* detection.

Code	Name	Causes	Possible Solutions
CrST	Cannot Reset	The drive received a fault reset command when a Run command was active.	Turn off the Run command then de-energize and re-energize the drive.

Code	Name	Causes	Possible Solutions
CyC	MECHATROLINK CommCycleSettingErr	The communications cycle of the controller is not set in the permitted range of the MECHATROLINK interface option card.	Set the communications cycle of the controller in the permitted range of the MECHATROLINK interface option card.

Note:
If the drive detects this error, the terminal assigned to *H2-01, H2-02, and H2-03 = 4 [Multi-Function Digital Output 1, Multi-Function Digital Output 2, and Multi-Function Digital Output 3 = Alarm]* will be ON.

Code	Name	Causes	Possible Solutions
dEv	Speed Deviation	The load is too heavy	Decrease the load.
		Acceleration and deceleration times are set too short.	Increase the values set in Acceleration/Deceleration Time *C1-01 to C1-08 [Accel Time 1 to Decel Time 4]*.
		The *dEv* detection level settings are incorrect.	Adjust *F1-10 [Speed Dev Level]* and *F1-11 [Speed Dev Delay Time]*.
		The load is locked up.	Examine the machine.
		The holding brake is stopping the motor.	Release the holding brake.

Note:
- The drive detects this error if the difference between the detected speed and the speed reference is more than the setting of *F1-10* for longer than *F1-11*.
- If the drive detects this error, the terminal assigned to *H2-01, H2-02, and H2-03 = 4 [Multi-Function Digital Output 1, Multi-Function Digital Output 2, and Multi-Function Digital Output 3 = Alarm]* will be ON.
- If the drive detects this error, the drive will operate the motor as specified by the stopping method set in *F1-04 [Speed Dev Detection Select]*.

Code	Name	Causes	Possible Solutions
dnE	Drive Disabled	A terminal set for *H1-xx: MFDI Function Select = 1A [Drive Enable]* turned OFF.	Examine the operation sequence.

Note:
If the drive detects this error, the terminal assigned to *H2-01, H2-02, and H2-03 = 4 [Multi-Function Digital Output 1, Multi-Function Digital Output 2, and Multi-Function Digital Output 3 = Alarm]* will be ON.

Code	Name	Causes	Possible Solutions
qAL2	Q2pack Alarm 2	There was an error in the Q2pack program.	Examine the Q2pack program and remove the cause of the error. This is not a drive fault.

Note:
If the drive detects this error, the terminal assigned to *H2-01, H2-02, and H2-03 = 4 [Multi-Function Digital Output 1, Multi-Function Digital Output 2, and Multi-Function Digital Output 3 = Alarm]* will be ON.

Code	Name	Causes	Possible Solutions
qAL3	Q2pack Alarm 3	There was an error in the Q2pack program.	Examine the Q2pack program and remove the cause of the error. This is not a drive fault.

Note:
If the drive detects this error, the terminal assigned to *H2-01, H2-02, and H2-03 = 4 [Multi-Function Digital Output 1, Multi-Function Digital Output 2, and Multi-Function Digital Output 3 = Alarm]* will be ON.

Code	Name	Causes	Possible Solutions
qAL1	Q2pack Alarm	There was an error in the Q2pack program.	Examine the Q2pack program and remove the cause of the error. This is not a drive fault.

Note:
If the drive detects this error, the terminal assigned to *H2-01, H2-02, and H2-03 = 4 [Multi-Function Digital Output 1, Multi-Function Digital Output 2, and Multi-Function Digital Output 3 = Alarm]* will be ON.

Code	Name	Causes	Possible Solutions
E5	MECHATROLINK Watchdog Timer Err	The drive detected a watchdog circuit exception while it received data from the controller.	Examine the MECHATROLINK cable connection. If this error occurs frequently, examine the wiring and decrease the effects of electrical interference as specified by these manuals: • MECHATROLINK-II Installation Guide (MECHATROLINK Members Association, manual number MMATDEP011) • MECHATROLINK-III Installation Manual (MECHATROLINK Members Association, publication number MMATDEP018)

Note:
- If the drive detects this error, the terminal assigned to *H2-01, H2-02, and H2-03 = 4 [Multi-Function Digital Output 1, Multi-Function Digital Output 2, and Multi-Function Digital Output 3 = Alarm]* will be ON.
- If the drive detects this error, it will operate the motor as specified by the stop method set in *F6-25 [MLII Watchdog Error Sel]*.

Code	Name	Causes	Possible Solutions
EF	FWD/REV Run Command Input Error	A forward command and a reverse command were input at the same time for longer than 0.5 s.	Examine the forward and reverse command sequence and correct the problem.

Note:
- If the drive detects *EF*, the motor will ramp to stop.
- If the drive detects this error, the terminal assigned to *H2-01, H2-02, and H2-03 = 4 [Multi-Function Digital Output 1, Multi-Function Digital Output 2, and Multi-Function Digital Output 3 = Alarm]* will be ON.

Code	Name	Causes	Possible Solutions
EF0	Option Card External Fault	The communication option card received an external fault from the controller.	1. Find the device that caused the external fault and remove the cause. 2. Clear the external fault input from the controller.
		Programming error occurred on the controller side.	Examine the operation of the controller program.

Note:
- The drive detects this error if the alarm function on the external device side is operating.
- If the drive detects this error, the terminal assigned to *H2-01, H2-02, and H2-03 = 4 [Multi-Function Digital Output 1, Multi-Function Digital Output 2, and Multi-Function Digital Output 3 = Alarm]* will be ON.
- Set the stopping method for this fault in *F6-03 [Comm Ext Flt Select (EF0)]*.

Code	Name	Causes	Possible Solutions
EF1	External Fault (Terminal DI1)	MFDI terminal DI1 caused an external fault through an external device.	1. Find the device that caused the external fault and remove the cause. 2. Clear the external fault input in the MFDI.
		The wiring is incorrect.	Correctly connect the signal line to MFDI terminal DI1.
		External Fault [H1-01 = 2C to 2F] is set to MFDI terminal DI1, but the terminal is not in use.	Correctly set the MFDI.

Note:

If the drive detects this error, the terminal assigned to *H2-01, H2-02, and H2-03 = 4 [Multi-Function Digital Output 1, Multi-Function Digital Output 2, and Multi-Function Digital Output 3 = Alarm]* will be ON.

Code	Name	Causes	Possible Solutions
EF2	External Fault (Terminal DI2)	MFDI terminal DI2 caused an external fault through an external device.	1. Find the device that caused the external fault and remove the cause. 2. Clear the external fault input in the MFDI.
		The wiring is incorrect.	Correctly connect the signal line to MFDI terminal DI2.
		External Fault [H1-02 = 2C to 2F] is set to MFDI terminal DI2, but the terminal is not in use.	Correctly set the MFDI.

Note:

If the drive detects this error, the terminal assigned to *H2-01, H2-02, and H2-03 = 4 [Multi-Function Digital Output 1, Multi-Function Digital Output 2, and Multi-Function Digital Output 3 = Alarm]* will be ON.

Code	Name	Causes	Possible Solutions
EF3	External Fault (Terminal DI3)	MFDI terminal DI3 caused an external fault through an external device.	1. Find the device that caused the external fault and remove the cause. 2. Clear the external fault input in the MFDI.
		The wiring is incorrect.	Correctly connect the signal line to MFDI terminal DI3.
		External Fault [H1-03 = 2C to 2F] is set to MFDI terminal DI3, but the terminal is not in use.	Correctly set the MFDI.

Note:

If the drive detects this error, the terminal assigned to *H2-01, H2-02, and H2-03 = 4 [Multi-Function Digital Output 1, Multi-Function Digital Output 2, and Multi-Function Digital Output 3 = Alarm]* will be ON.

Code	Name	Causes	Possible Solutions
EF4	External Fault (Terminal DI4)	MFDI terminal DI4 caused an external fault through an external device.	1. Find the device that caused the external fault and remove the cause. 2. Clear the external fault input in the MFDI.
		The wiring is incorrect.	Correctly connect the signal line to MFDI terminal DI4.

Code	Name	Causes	Possible Solutions
		External Fault [H1-04 = 2C to 2F] is set to MFDI terminal DI4, but the terminal is not in use.	Correctly set the MFDI.

Note:
If the drive detects this error, the terminal assigned to *H2-01, H2-02, and H2-03 = 4 [Multi-Function Digital Output 1, Multi-Function Digital Output 2, and Multi-Function Digital Output 3 = Alarm]* will be ON.

Code	Name	Causes	Possible Solutions
EF5	External Fault (Terminal DI5)	MFDI terminal DI5 caused an external fault through an external device.	1. Find the device that caused the external fault and remove the cause. 2. Clear the external fault input in the MFDI.
		The wiring is incorrect.	Correctly connect the signal line to MFDI terminal DI5.
		External Fault [H1-05 = 2C to 2F] is set to MFDI terminal DI5, but the terminal is not in use.	Correctly set the MFDI.

Note:
If the drive detects this error, the terminal assigned to *H2-01, H2-02, and H2-03 = 4 [Multi-Function Digital Output 1, Multi-Function Digital Output 2, and Multi-Function Digital Output 3 = Alarm]* will be ON.

Code	Name	Causes	Possible Solutions
EF6	External Fault (Terminal DI6)	MFDI terminal DI6 caused an external fault through an external device.	1. Find the device that caused the external fault and remove the cause. 2. Clear the external fault input in the MFDI.
		The wiring is incorrect.	Correctly connect the signal line to MFDI terminal DI6.
		External Fault [H1-06 = 2C to 2F] is set to MFDI terminal DI6, but the terminal is not in use.	Correctly set the MFDI.

Note:
If the drive detects this error, the terminal assigned to *H2-01, H2-02, and H2-03 = 4 [Multi-Function Digital Output 1, Multi-Function Digital Output 2, and Multi-Function Digital Output 3 = Alarm]* will be ON.

Code	Name	Causes	Possible Solutions
EF7	External Fault (Terminal DI7)	MFDI terminal DI7 caused an external fault through an external device.	1. Find the device that caused the external fault and remove the cause. 2. Clear the external fault input in the MFDI.
		The wiring is incorrect.	Correctly connect the signal line to MFDI terminal DI7.
		External Fault [H1-07 = 2C to 2F] is set to MFDI terminal DI7, but the terminal is not in use.	Correctly set the MFDI.

Note:
If the drive detects this error, the terminal assigned to *H2-01, H2-02, and H2-03 = 4 [Multi-Function Digital Output 1, Multi-Function Digital Output 2, and Multi-Function Digital Output 3 = Alarm]* will be ON.

Code	Name	Causes	Possible Solutions
EF8	External Fault (Terminal DI8)	MFDI terminal DI8 caused an external fault through an external device.	1. Find the device that caused the external fault and remove the cause. 2. Clear the external fault input in the MFDI.
		The wiring is incorrect.	Correctly connect the signal line to MFDI terminal DI8.
		External Fault [H1-08 = 2C to 2F] is set to MFDI terminal DI8, but the terminal is not in use.	Correctly set the MFDI.

Note:
If the drive detects this error, the terminal assigned to *H2-01, H2-02, and H2-03 = 4 [Multi-Function Digital Output 1, Multi-Function Digital Output 2, and Multi-Function Digital Output 3 = Alarm]* will be ON.

Code	Name	Causes	Possible Solutions
EP24v	External Power 24V Supply	The voltage of the main circuit power supply decreased, and the 24 V power supply is supplying power to the drive.	• Examine the main circuit power supply. • Turn ON the main circuit power supply to run the drive.

Note:
• Set *o2-26 [Ext24V Mode Warning Display]* to enable or disable *EP24v* detection.
• The drive will not output an alarm signal for this alarm.

Code	Name	Causes	Possible Solutions
FAn	Internal Fan Fault	The circulation fan stopped operating correctly.	• Examine circulation fan operation. • Re-energize the drive. • Check *U4-03 [Fan Oper.Time]* and *U4-04 [Cool Fan Maintenance]*. If the performance life of the circulation fan is expired or if there is damage to the fan, replace the fan.
		There is a problem with the power supply of the electromagnetic contactor and the circulation fan.	1. Re-energize the drive. 2. If the fault stays, replace the control board or the drive. For information about replacing the control board, contact the manufacturer or your nearest sales representative.

Note:
If the drive detects this error, the terminal assigned to *H2-01, H2-02, and H2-03 = 4 [Multi-Function Digital Output 1, Multi-Function Digital Output 2, and Multi-Function Digital Output 3 = Alarm]* will be ON.

Code	Name	Causes	Possible Solutions
FbH	Excessive PID Feedback	The *FbH* detection level is set incorrectly.	Adjust *b5-36 [PID HiHi Limit Level]* and *b5-37 [PID HiHi Time]*.
		There is a problem with the PID feedback wiring.	Correct errors with the PID control wiring.
		The feedback sensor is not operating correctly.	Examine the sensors on the control device side.
		A fault occurred in the feedback input circuit of the drive.	Replace the control board or the drive. For information about replacing the control board, contact the manufacturer or your nearest sales representative.

Note:
- The drive detects this fault if the PID feedback input is more than the level set in *b5-36* for longer than *b5-37*.
- If the drive detects this error, the terminal assigned to *H2-01, H2-02, and H2-03 = 4 [Multi-Function Digital Output 1, Multi-Function Digital Output 2, and Multi-Function Digital Output 3 = Alarm]* will be ON.
- If the drive detects this fault, it will operate the motor as specified by the stop method set in *b5-12 [Fdback Loss Select Mode]*.

Code	Name	Causes	Possible Solutions
FbL	PID Feedback Loss	The *FbL* detection level is set incorrectly.	Adjust *b5-13 [Fdback Loss Lvl]* and *b5-14 [Fdback Loss Time]*.
		There is a problem with the PID feedback wiring.	Correct errors with the PID control wiring.
		The feedback sensor is not operating correctly.	Examine the sensors on the control device side.
		A fault occurred in the feedback input circuit of the drive.	Replace the control board or the drive. For information about replacing the control board, contact the manufacturer or your nearest sales representative.

Note:
- The drive detects this error if the PID feedback input is lower than the level set in *b5-13* for longer than *b5-14*.
- If the drive detects this error, the terminal assigned to *H2-01, H2-02, and H2-03 = 4 [Multi-Function Digital Output 1, Multi-Function Digital Output 2, and Multi-Function Digital Output 3 = Alarm]* will be ON.
- If the drive detects this error, it will operate the motor as specified by the stop method set in *b5-12 [Fdback Loss Select Mode]*.

Code	Name	Causes	Possible Solutions
HCA	High Current Alarm	The load is too heavy.	• Decrease the load for applications with repetitive starts and stops. • Replace the drive with a larger capacity model.
		The acceleration time is too short.	• Calculate the torque necessary during acceleration related to the load inertia and the specified acceleration time. • Increase the values set in Acceleration Times *C1-01, C1-03, C1-05, or C1-07 [Accel Time 1 to Accel Time 4]* until you get the necessary torque. • Increase the values set in Jerk Control *C2-01 to C2-04 [Jerk@Start of Accel to Jerk@End of Decel]* until you get the necessary torque. • Replace the drive with a larger capacity model.
		The drive is trying to operate a specialized motor or a motor that is larger than the maximum applicable motor output of the drive.	• Examine the motor nameplate, the motor, and the drive to make sure that the drive rated current is larger than the motor rated current. • Replace the drive with a larger capacity model.
		The current level temporarily increased because of speed search after a momentary power loss or while trying to Auto Restart.	If speed search or Auto Restart cause an increase in current, the drive can temporarily show this alarm. The time that the drive shows the alarm is short. No more steps are necessary to clear the alarm.

Note:
- The drive detects this error if the drive output current is more than the overcurrent alarm level (150% of the rated current).
- If the drive detects this error, the terminal assigned to *H2-01, H2-02, and H2-03 = 4 [Multi-Function Digital Output 1, Multi-Function Digital Output 2, and Multi-Function Digital Output 3 = Alarm]* will be ON.

Code	Name	Causes	Possible Solutions
L24v	Loss of External Power 24 Supply	The voltage of the backup 24 V power supply has decreased. The main circuit power supply is operating correctly.	• Examine the external 24 V power supply for disconnected wires and wiring errors and repair the problems. • Examine the external 24 V power supply for problems.

Note:
- Set *o2-23 [Ext24V Off Warning Display]* to enable or disable *L24v* detection.
- The drive will not output an alarm signal for this alarm.

Code	Name	Causes	Possible Solutions
LoG	Com Error / Abnormal SD card	There is not a micro SD in the keypad.	Put a micro SD card in the keypad.
		• The drive is connected to USB. • The number of log communication files is more than 1000. • The micro SD card does not have available memory space. • The line number data in a log communication file was changed. • A communication error between the keypad and drive occurred during a log communication.	Set *o5-01 = 0 [Log Start Selection = OFF]*.

Note:

If the drive detects this error, the terminal assigned to *H2-01, H2-02, and H2-03 = 6A [Multi-Function Digital Output 1, Multi-Function Digital Output 2, and Multi-Function Digital Output 3 = DataLog Error]* will be ON.

Code	Name	Causes	Possible Solutions
LT-1	Cooling Fan Maintenance Time	The cooling fan is at 90% of its expected performance life.	1. Use the procedures in this manual to replace the cooling fan. 2. Set *o4-03 = 0 [Fan.Oper Setting = 0 h]* to reset the cooling fan operation time.

Note:

When the estimated performance life is expired, the terminal assigned to *H2-01, H2-02, and H2-03 =63 [Multi-Function Digital Output 1, Multi-Function Digital Output 2, and Multi-Function Digital Output 3 = Maintenance]* will be ON.

Code	Name	Causes	Possible Solutions
LT-2	Capacitor Maintenance Time	The capacitors for the main circuit and control circuit are at 90% of expected performance life.	Replace the control board or the drive. For information about replacing the control board, contact the manufacturer or your nearest sales representative.

Note:

When the estimated performance life is expired, the terminal assigned to *H2-01, H2-02, and H2-03 = 63 [Multi-Function Digital Output 1, Multi-Function Digital Output 2, and Multi-Function Digital Output 3 = Maintenance]* will be ON.

Code	Name	Causes	Possible Solutions
LT-3	SoftChargeBypassRelay MainteTime	The soft charge bypass relay is at 90% of its expected performance life.	Replace the control board or the drive. For information about replacing the control board, contact the manufacturer or your nearest sales representative.

Note:

When the estimated performance life is expired, the terminal assigned to *H2-01, H2-02, and H2-03 = 63 [Multi-Function Digital Output 1, Multi-Function Digital Output 2, and Multi-Function Digital Output 3 = Maintenance]* will be ON.

Code	Name	Causes	Possible Solutions
LT-4	IGBT Maintenance Time (50%)	The IGBT is at 50% of its expected performance life.	Check the load, carrier frequency, and output frequency.

Note:

When the estimated performance life is expired, the terminal assigned to *H2-01, H2-02, and H2-03 = 63 [Multi-Function Digital Output 1, Multi-Function Digital Output 2, and Multi-Function Digital Output 3 = Maintenance]* will be ON.

Code	Name	Causes	Possible Solutions
oH	Heatsink Overheat	The ambient temperature is high and the heatsink temperature is more than the *L8-02 [Overheat Alm Level]*.	• Measure the ambient temperature. • Increase the airflow around the drive. • Install a cooling device (cooling fan or air conditioner) to lower the ambient temperature. • Remove objects near the drive that are producing too much heat.
		There is not sufficient airflow around the drive.	• Give the drive the correct installation space as shown in the manual. • Make sure that there is sufficient circulation around the control panel. • Examine the drive for dust or other unwanted materials that could clog the cooling fan. • Remove unwanted materials that prevent air circulation.
		The internal cooling fan or fans have stopped.	1. Use the procedures in this manual to replace the cooling fan. 2. Set *o4-03 = 0 [Fan.Oper Setting = 0 h]* to reset the cooling fan operation time.

Note:
- The drive detects this error if the heatsink temperature of the drive is more than *L8-02*.
- If the drive detects this error, the terminal assigned to *H2-01, H2-02, and H2-03 = 4 [Multi-Function Digital Output 1, Multi-Function Digital Output 2, and Multi-Function Digital Output 3 = Alarm]* will be ON.
- Set the stopping method for this fault in *L8-03 [Overheat Pre-Alarm Selection]*.

Code	Name	Causes	Possible Solutions
oH2	External Overheat (H1-XX=7D)	An external device sent an *oH2*.	1. Find the external device that output the overheat alarm. 2. Remove the cause of the problem. 3. Clear the *Overheat Alarm (oH2) [H1-xx = 7D]* that was set to MFDI terminals DI1 to DI8.

Note:

If the drive detects this error, the terminal assigned to *H2-01, H2-02, and H2-03 = 4 [Multi-Function Digital Output 1, Multi-Function Digital Output 2, and Multi-Function Digital Output 3 = Alarm]* will be ON.

Code	Name	Causes	Possible Solutions
oH3	Motor Overheat (PTC Input)	The thermistor wiring that detects motor temperature is defective.	Correct wiring errors.
		A fault occurred on the machine. Example: The machine is locked.	Examine the machine and remove the cause of the fault

Code	Name	Causes	Possible Solutions
		The motor has overheated.	• Check the load level, acceleration/deceleration time, and motor start/stop frequency (cycle time). • Decrease the load. • Increase the values set in Acceleration/Deceleration Times *C1-01 to C1-08*. • Set *E2-01 [Mot Rated Current (FLA)]* correctly to the value specified by the motor nameplate. • Make sure that the motor cooling system is operating correctly, and repair or replace it if it is damaged. • Adjust V/f Pattern Parameters *E1-04 to E1-10*. For motor 2, adjust *E3-04 to E3-10*. Decrease the values set in *E1-08 [Mid A Voltage]* and *E1-10 [Min Output Voltage]*. **Note:** If the values set in *E1-08* and *E1-10* are too low, the load tolerance will decrease when operating the drive in the low speed range.

Note:
- The drive detects this fault if the motor overheat signal that was entered to an analog input terminal A3 is more than the alarm detection level when *H3-06 = 16 [AI3 Function Selection = Motor Temperature (PTC Input)]*.
- If the drive detects this error, the terminal assigned to *H2-01, H2-02, and H2-03 = 4 [Multi-Function Digital Output 1, Multi-Function Digital Output 2, and Multi-Function Digital Output 3 = Alarm]* will be ON.
- If the drive detects this error, it will operate the motor as specified by the stopping method set in *L1-03 [Motor oH AL Reaction Select]*.

Code	Name	Causes	Possible Solutions
oL3	Overtorque 1	A fault occurred on the machine. Example: The machine is locked.	Examine the machine and remove the cause of the fault.
		The parameters are incorrect for the load.	Adjust *L6-02 [Trq Det1 Level]* and *L6-03 [Trq Det1 Time]* settings.

Note:
- The drive detects this fault if the drive output current is more than the level set in *L6-02* for longer than *L6-03*.
- If the drive detects this error, the terminal assigned to *H2-01, H2-02, and H2-03 = 4 [Multi-Function Digital Output 1, Multi-Function Digital Output 2, and Multi-Function Digital Output 3 = Alarm]* will be ON.
- Set the conditions that trigger the minor fault using *L6-01 [Trq Det1 Select]*.

Code	Name	Causes	Possible Solutions
oL4	Overtorque 2	A fault occurred on the machine. Example: The machine is locked.	Examine the machine and remove the cause of the fault.
		The parameters are incorrect for the load.	Adjust *L6-05 [Trq Det2 Level]* and *L6-06 [Trq Det2 Time]* settings.

Note:
- The drive detects this error if the drive output current is more than the level set in *L6-05* for longer than *L6-06*.
- If the drive detects this error, the terminal assigned to *H2-01, H2-02, and H2-03 = 4 [Multi-Function Digital Output 1, Multi-Function Digital Output 2, and Multi-Function Digital Output 3 = Alarm]* will be ON.
- Set the conditions that trigger the minor fault using *L6-04 [Trq Det2 Select]*.

Code	Name	Causes	Possible Solutions
oL5	Mechanical Weakening Detection 1	The drive detected overtorque as specified by the conditions for mechanical weakening detection set in *L6-08 [MechF Enable]*.	Do a deterioration diagnostic test on the machine side.

Note:
- If the drive detects this error, the terminal assigned to *H2-01, H2-02, and H2-03 = 4 [Multi-Function Digital Output 1, Multi-Function Digital Output 2, and Multi-Function Digital Output 3 = Alarm]* will be ON.
- If the drive detects this minor fault, it will operate the motor as specified by the Stopping Method set in *L6-08*.

Code	Name	Causes	Possible Solutions
oS	Overspeed	There is overshoot.	• Decrease *C5-01 [ASR PGain 1]* and increase *C5-02 [ASR ITime 1]*. • Adjust the pulse train gain with Pulse Train Input Setting Parameters *H6-02 to H6-05 [PI Frequency Scale to PI Filter Time]*.
		There are an incorrect number of PG pulses set in the drive.	Set *H6-02 [PI Frequency Scale]* to the pulse train frequency during 100% reference (maximum motor rotation speed).
		The *oS* detection level is set incorrectly.	Adjust *F1-08 [Overspeed Level]* and *F1-09 [Overspeed Delay Time]*.

Note:
- The drive detects this error if the motor speed is more than the value set in *F1-08* for longer than *F1-09*.
- If the drive detects this error, the terminal assigned to *H2-01, H2-02, and H2-03 = 4 [Multi-Function Digital Output 1, Multi-Function Digital Output 2, and Multi-Function Digital Output 3 = Alarm]* will be ON.
- If the drive detects this error, it will operate the motor as specified by the Stopping Method set in *F1-03 [Overspeed Detection Selection]*.

Code	Name	Causes	Possible Solutions
ov	DC Bus Overvoltage	There are surge voltages in the input power supply.	Connect a DC reactor to the drive. **Note:** If you turn the phase advancing capacitors ON and OFF and use thyristor converters in the same power supply system, there can be surge voltages that irregularly increase the input voltage.
		The drive output cable or motor is shorted to ground (the current short to ground is charging the main circuit capacitor of the drive through the power supply).	1. Examine the motor main circuit cable, terminals, and motor terminal box, and then remove ground faults. 2. Re-energize the drive.
		The power supply voltage is too high.	Decrease the power supply voltage to match the drive rated voltage.
		Electrical interference caused a drive malfunction.	• Examine the control circuit lines, main circuit lines, and ground wiring, and decrease the effects of electrical interference. • Check whether a magnetic contactor is the noise source, and use Surge Protective Device if necessary. • Set *L5-01 ≠ 0 [Auto-Reset Attempts ≠ 0 times]*.

Note:
- The drive detects this error if the DC bus voltage is more than the *ov* detection level when the Run command has not been input (while the drive is stopped).
- The *ov* detection level is approximately 410 V with 200 V class drives. The detection level is approximately 820 V with 400 V class drives.
- If the drive detects this error, the terminal assigned to *H2-01, H2-02, and H2-03 = 4 [Multi-Function Digital Output 1, Multi-Function Digital Output 2, and Multi-Function Digital Output 3 = Alarm]* will be ON.

Code	Name	Causes	Possible Solutions
PASS	Modbus Communication Test	The Modbus communications test is complete.	The *PASS* display will turn off after communications test mode is cleared.

Code	Name	Causes	Possible Solutions
PF	Input Phase Loss	There is a phase loss in the drive input power.	Correct errors with the wiring for main circuit drive input power.
		Loose wiring in the input power terminals.	Tighten the terminal screws to the correct tightening torque.
		The drive input power voltage is changing too much.	• Examine the input power for problems. • Make the drive input power stable.
		Unsatisfactory balance between voltage phases.	• Examine the input power for problems. • Make the drive input power stable. • If the input power supply is good, examine the magnetic contactor on the main circuit side for problems.
		The main circuit capacitors have become unserviceable.	• Examine the capacitor maintenance time in monitor *U4-05 [Capacitor Maintenance]*. • If *U4-05* is more than 90%, replace the capacitor. Contact the manufacturer or your nearest sales representative for more information.
			• Examine the input power for problems. • Re-energize the drive. • If the alarm stays, replace the circuit board or the drive. Contact the manufacturer or your nearest sales representative for more information.

Note:
- The drive detects this error if the DC bus voltage changes irregularly without regeneration.
- If the drive detects this error, the terminal assigned to *H2-01, H2-02, and H2-03 = 4 [Multi-Function Digital Output 1, Multi-Function Digital Output 2, and Multi-Function Digital Output 3 = Alarm]* will be ON.
- Use *L8-05 [In PhaseLoss Selection]* to enable and disable PF detection.

Code	Name	Causes	Possible Solutions
PGo	Encoder (PG) Feedback Loss	The encoder cable is disconnected or wired incorrectly.	Examine for wiring errors or disconnected wires in the encoder cable, and repair problems.
		The encoder is not receiving power.	Examine the encoder power supply.
		The holding brake is stopping the motor.	Release the holding brake.

Note:
- The drive detects this error if it does not receive the speed detection pulse signal from the encoder in the detection time set in *F1-14 [Enc PGOpen Time for Detection]*.
- If the drive detects this error, the terminal assigned to *H2-01, H2-02, and H2-03 = 4 [Multi-Function Digital Output 1, Multi-Function Digital Output 2, and Multi-Function Digital Output 3 = Alarm]* will be ON.
- If the drive detects this error, it will operate the motor as specified by the Stopping Method set in *F1-02 [PGOpen Detection Select]*.

Code	Name	Causes	Possible Solutions
PGoH	Encoder (PG) Hardware Fault	The encoder cable is disconnected.	Correct any disconnected wires in the encoder cable.

Note:
- If the drive detects this error, the terminal assigned to *H2-01, H2-02, and H2-03 = 4 [Multi-Function Digital Output 1, Multi-Function Digital Output 2, and Multi-Function Digital Output 3 = Alarm]* will be ON.
- If the drive detects this error, it will operate the motor as specified by the Stopping Method set in *F1-02 [PGOpen Detection Select]*.

Code	Name	Causes	Possible Solutions
rUn	Motor Switch during Run	The drive received a *Motor 2 Selection [H1-xx = 61]* during run.	Make sure that the drive receives the Motor 2 Selection while the drive is stopped.

Note:

If the drive detects this error, the terminal assigned to *H2-01, H2-02, and H2-03 = 4 [Multi-Function Digital Output 1, Multi-Function Digital Output 2, and Multi-Function Digital Output 3 = Alarm]* will be ON.

Code	Name	Causes	Possible Solutions
SE	Modbus Test Mode Error	Modbus communications self-diagnostics *[H1-xx = 7F]* was done while the drive was running.	Stop the drive and do Modbus communications self-diagnostics.

Note:

If the drive detects this error, the terminal assigned to *H2-01, H2-02, and H2-03 = 4 [Multi-Function Digital Output 1, Multi-Function Digital Output 2, and Multi-Function Digital Output 3 = Alarm]* will be ON.

Code	Name	Causes	Possible Solutions
STo	Safe Torque OFF	Safe Disable inputs H1-HC and H2-HC are open.	• Make sure that the Safe Disable signal is input from an external source to terminal H1-HC and H2-HC. • When the Safe Disable function is not in use, connect terminals H1-HC and H2-HC.
		There is internal damage to the two Safe Disable channels.	Replace the board or the drive. For information about replacing the control board, contact the manufacturer or your nearest sales representative.

Note:
- The drive will not output an alarm signal for this alarm.
- If the drive detects this error, the terminal assigned to *H2-01, H2-02, H2-03 = E [Multi-Function Digital Output 1, Multi-Function Digital Output 2, and Multi-Function Digital Output 3 = Safe Torque OFF]* will be ON.

Code	Name	Causes	Possible Solutions
SToF	Safe Torque OFF Hardware	One of the two terminals H1-HC or H2-HC received the Safe Disable input signal.	• Make sure that the Safe Disable signal is input from an external source to terminal H1-HC and H2-HC. • When the Safe Disable function is not in use, connect terminals H1-HC and H2-HC.
		The Safe Disable input signal is wired incorrectly.	
		There is internal damage to one Safe Disable channel.	Replace the control board or the drive. For information about replacing the control board, contact the manufacturer or your nearest sales representative.

Note:

If the drive detects this error, the terminal assigned to *H2-01, H2-02, and H2-03 = 4 [Multi-Function Digital Output 1, Multi-Function Digital Output 2, and Multi-Function Digital Output 3 = Alarm]* will be ON.

Code	Name	Causes	Possible Solutions
TiM	Keypad Time Not Set	There is a battery in the keypad, but the date and time are not set.	Set the date and time with the keypad.

Note:
- *o4-24 [bAT Detection Selection]* enables and disables *TiM* detection.
- If the drive detects this error, the terminal assigned to *H2-01, H2-02, and H2-03 = 4 [Multi-Function Digital Output 1, Multi-Function Digital Output 2, and Multi-Function Digital Output 3 = Alarm]* will be ON.

Code	Name	Causes	Possible Solutions
TrPC	IGBT Maintenance Time (90%)	The IGBT is at 90% of its expected performance life.	Replace the IGBT or the drive. For information about replacing the control board, contact the manufacturer or your nearest sales representative.

Note:

If the drive detects this error, the terminal assigned to *H2-01, H2-02, and H2-03 = 4 [Multi-Function Digital Output 1, Multi-Function Digital Output 2, and Multi-Function Digital Output 3 = Alarm]* will be ON.

Code	Name	Causes	Possible Solutions
UL3	Undertorque Detection 1	A fault occurred on the machine. Example: There is a broken pulley belt.	Examine the machine and remove the cause of the fault.
		The parameters are incorrect for the load.	Adjust *L6-02 [Trq Det1 Level]* and *L6-03 [Trq Det1 Time]* settings.

Note:
- The drive detects this error if the drive output current is less than the level set in *L6-02* for longer than *L6-03*.
- If the drive detects this error, the terminal assigned to *H2-01, H2-02, and H2-03 = 4 [Multi-Function Digital Output 1, Multi-Function Digital Output 2, and Multi-Function Digital Output 3 = Alarm]* will be ON.
- If the drive detects this error, it will operate the motor as specified by the Stopping Method set in *L6-51 [Trq Det1 Action]* when *L6-01 = 1 [Trq Det1 Select = Enabled]*.

Code	Name	Causes	Possible Solutions
UL4	Undertorque Detection 2	A fault occurred on the machine. Example: There is a broken pulley belt.	Examine the machine and remove the cause of the fault.
		The parameters are incorrect for the load.	Adjust *L6-05 [Trq Det2 Level]* and *L6-06 [Trq Det2 Time]* settings.

Note:
- The drive detects this error if the drive output current is less than the level set in *L6-05* for longer than *L6-06*.
- If the drive detects this error, the terminal assigned to *H2-01, H2-02, and H2-03 = 4 [Multi-Function Digital Output 1, Multi-Function Digital Output 2, and Multi-Function Digital Output 3 = Alarm]* will be ON.
- If the drive detects this error, it will operate the motor as specified by the Stopping Method set in *L6-04 [Trq Det2 Select]*.

Code	Name	Causes	Possible Solutions
UL5	Mechanical Weakening Detection 2	The drive detected undertorque as specified by the conditions for mechanical weakening detection set in *L6-08 [MechF Enable]*.	Examine the machine for deterioration.

Note:
- If the drive detects this error, the terminal assigned to *H2-01, H2-02, and H2-03 = 4 [Multi-Function Digital Output 1, Multi-Function Digital Output 2, and Multi-Function Digital Output 3 = Alarm]* will be ON.
- If the drive detects this error, it will operate the motor as specified by the Stopping Method set in *L6-08*.

Code	Name	Causes	Possible Solutions
Uv	Undervoltage	The drive input power voltage is changing too much.	• Examine the input power for problems. • Make the drive input power stable. • If the input power supply is good, examine the magnetic contactor on the main circuit side for problems.
		There is a phase loss in the drive input power.	Correct errors with the wiring for main circuit drive input power.
		There is loose wiring in the drive input power terminals.	Tighten the terminal screws to the correct tightening torque.
		There was a loss of power.	Use a better power supply.
		The main circuit capacitors have become unserviceable.	Examine the capacitor maintenance time in monitor *U4-05 [Capacitor Maintenance]*. If *U4-05* is more than 90%, replace the control board or the drive. For information about replacing the control board, contact the manufacturer or your nearest sales representative.
		The drive input power transformer is too small and voltage drops when the power is switched on.	• Check for an alarm when a molded-case circuit breaker, Leakage Breaker (ELCB, GFCI, or RCM/RCD) (with overcurrent protective function), or magnetic contactor is ON. • Check the capacity of the drive power supply transformer.
		Air inside the drive is too hot.	Check the ambient temperature of the drive.
		The Charge LED is broken.	Replace the control board or the entire drive. For information about replacing the control board, contact the manufacturer or your nearest sales representative.

Note:
- The drive detects this error if one of these conditions is correct when the Run command has not been input (while the drive is stopped).
  – The DC bus voltage < *L2-05 [UV Detection Lvl (Uv1)]*.
  – The Contactor that prevents inrush current in the drive was opened.
  – There is low voltage in the control drive input power.
- If the drive detects this error, the terminal assigned to *H2-01, H2-02, and H2-03 = 4 [Multi-Function Digital Output 1, Multi-Function Digital Output 2, and Multi-Function Digital Output 3 = Alarm]* will be ON.

7.6 Parameter Setting Errors

Parameter setting errors occur when multiple parameter settings do not agree, or when parameter setting values are not correct. Refer to the table in this section, examine the parameter setting that caused the error, and remove the cause of the error. You must first correct the parameter setting errors before you can operate the drive. The drive will not send notification signals for the faults and alarms when these parameter setting errors occur.

Code	Name	Causes	Possible Solutions
oPE01	Drive Capacity Setting Error	The value set in *o2-04 [Drive KVA Selection]* does not agree with the drive model.	Set *o2-04* to the correct value.
Code	**Name**	**Causes**	**Possible Solutions**
oPE02	Parameter Range Setting Error	Parameters settings are not in the applicable setting range.	1. Push ↵ to show *U1-18 [oPE Fault Parameter]*, and find parameters that are not in the applicable setting range. 2. Correct the parameter settings. **Note:** If more than one error occurs at the same time, other *oPExx* errors have priority over *oPE02*.
		Set *E2-01 ≤ E2-03 [Mot Rated Current (FLA) ≤ Mot No-Load Current]*.	Make sure that *E2-01 > E2-03*. **Note:** If it is necessary to set *E2-01 < E2-03*, first lower the value set in *E2-03*, and then set *E2-01*.
Code	**Name**	**Causes**	**Possible Solutions**
oPE03	Multi-Function Input Setting Err	The settings for these parameters do not agree: • Terminal DI1 to DI8 Function Selection *H1-01 to H1-08* • Terminal D1 to DF Function Selection *F3-10 to F3-25* • Virtual Multi-Function Inputs 1 to 4 *H7-01 to H7-04*	Set the parameters correctly.
		The settings for the standby mode function do not agree: • *b8-50 = 0 [Standby Mode Selection = Disabled]* and *H2-xx: MFDO Function Select = C [@Standby]* • *b8-50 = 1 [Enabled]* and *H2-xx ≠ C*	Set the parameters correctly.
		The settings for MFDIs overlap. **Note:** This does not include *H1-xx: MFDI Function Select = 20 to 2F [External Fault]* and *[Reserved]*.	Set the parameters correctly to prevent MFDI function overlap.
		These pairs of MFDI functions are not set to Digital Inputs (*H1-xx*, *F3-10 to F3-25*, and *H7-01 to H7-04*) at the same time: • Setting values *62 [Up Command]* and *63 [Down Command]* • Setting values *65 [Up2 Command]* and *66 [Dw2 Command]* • Setting values *3 [Run Command]* and *4 [FWD/REV Cmd]*	Set the MFDI pairs.
		A minimum of two of these MFDI combinations are set to Digital Inputs (*H1-xx*, *F3-10 to F3-25*, and *H7-01 to H7-04*) at the same time: • Setting values *62 [Up Command]* and *63 [Down Command]* • Setting values *65 [Up2 Command]* and *66 [Dw2 Command]* • Setting values *17 [Ac/Dec Hold]* • Setting values *16 [Ref Sample]* • Setting values *E to 10 [Add Offset Frequency 1 to 3 (d7-01 to d7-03)]*	Remove the function settings that are not in use.
		These PID settings are enabled at the same time. • *b5-01 [PID Enable]* • *H1-xx = 62 [Up Command]* • *H1-xx = 63 [Down Command]*	• Set *b5-01 = 0 [Disabled]*. • Remove the function Up/Down command settings.

Code	Name	Causes	Possible Solutions
		These commands are set in Digital Inputs (*H1-xx*, *F3-10 to F3-25*, and *H7-01 to H7-04*) at the same time: • Setting values *67 [SpdSrch Fmax]* and *68 [SpdSrch Fref]* • Setting values *40, 41, 42, 43 [KEB Thru1 NC, KEB Thru1 NO, KEB Thru2 NC, KEB Thru2 NO]* and *32 [HiSlipBraking]* • Setting values *61 [Motor 2 Select]* and *19 [Ac/Dec Time2]* • Setting values *40, 41 [KEB Thru1 NC, KEB Thru1 NO]* and *42, 43 [KEB Thru2 NC, KEB Thru2 NO]* • Setting values *1, 2 [Forward Run, Reverse Run]* and *3, 4 [Run Command, FWD/REV Cmd]* • Setting values *30 [DCInj Cmd]* and *1A [Drive Enable]* • Setting values *61 [Motor 2 Select]* and *65, 66 [Up2 Command, Dw2 Command]*	Remove the function settings that are not in use.
		Settings for N.C. and N.O. input *[H1-xx]* for these functions were selected at the same time: • Setting value *34 [Fast Stop NO]* • Setting value *35 [Fast Stop NC]*	Remove one of the function settings.
		These settings were entered while *H1-xx = 9 [Ext Ref 1/2]*: • *b1-15 = 4 [Freq. Ref. Sel. 2 = Pulse Train Input]* • *H6-01 ≠ 0 [PI Pulse Train Function ≠ Freq Ref]*	Set *H6-01 = 0*
		These settings were entered while *H1-xx = 9 [Ext Ref 1/2]*: • *b1-15 = 3 [Option PCB]* or *b1-16 = 3 [Run Comm. Sel 2 = Option PCB]* • No option card is connected to the drive.	Connect an input option card to the drive.
		These settings were entered while *H1-xx = 9 [Ext Ref 1/2]*: • *b1-15 = 1 [Analog Input]* • *H3-02 ≠ 0 [AI1 Function Selection ≠ Frequency Reference]* or *H3-10 ≠ 0 [AI2 Function Selection ≠]*	Set *H3-02 = 0* or *H3-10 = 0*.
		These parameters are set at the same time: • *H1-xx ≠ 1A [Drive Enable]* • *H2-xx = 2 [Drive Enable]*	Set the parameters correctly.
		These parameters are set at the same time: • *H6-01 ≠ 3 [PG Feedback]* • *H1-xx = 15 [FWD/REV Det]*	Set the parameters correctly.
		The following parameters are set at the same time: • *H1-xx = 65/66 [Up2 Command/Dw2 Command]* • *H3-01, H3-05, H3-09 = 1 [AI1 Signal Level Select, AI3 Signal Level Select, AI2 Signal Level Select = -10 to +10V (Bipolar Reference)]*	Remove one of the function settings.
		These settings do not agree: • A PG-RT3 option is connected to the drive. • *H1-xx = 61 [Motor 2 Select]* is set.	Set the parameter correctly. **Note:** The Motor Switch function is not available with the PG-RT3 option.

Code	Name	Causes	Possible Solutions
oPE05	Run Cmd/Freq Ref Source Sel Err	The setting to assign the Run command or frequency reference to an option card or the pulse train input is incorrect.	Correct the parameter settings.
		b1-01 = 3 [Freq. Ref. Sel. 1 = Option PCB] is set, but there is no option card connected to the drive.	Connect an option card to the drive.
		b1-02 = 3 [Run Comm. Sel 1 = Option PCB] is set, but there is no option card connected to the drive.	
		The following parameters are set at the same time: • *b1-01 = 4 [Pulse Train Input]* • *H6-01 ≠ 0 [PI Pulse Train Function ≠ Freq Ref]*	Set *H6-01 = 0*.

Code	Name	Causes	Possible Solutions
		The following parameters are set at the same time: • *F3-01 = 6 [D.In Funct Selection = BCD (5-digit), 0.01 Hz]* • *F3-03 = 0, 1 [D.In Data Length Select = 8-bit, 12-bit]*	Set *F3-03 = 2 [16-bit]*.
		These parameters are set and there is an AI-A3 option card connected to the drive: • *H1-xx = 9 [Ext Ref 1/2]* • *b1-15 = 3 [Freq. Ref. Sel. 2 = Option PCB]* • *F2-01 = 0 [An.In Funct.Selection = 3 Independent Channels]*	Correct the parameter settings.

Code	Name	Causes	Possible Solutions
oPE06	Control Method Selection Error	*A1-02 = 1, 3, or 7 [Control Method = CL-V/f, CLV, CLV/PM]* is set, but there is no encoder option card connected to the drive.	• Connect an encoder option card to the drive. • Set *A1-02* correctly.

Code	Name	Causes	Possible Solutions
oPE07	Analog Input Selection Error	The settings for *H3-02, H3-06, H3-10, and H7-30 [AI1 Function Selection, AI3 Function Selection, and AI2 Function Selection* and *Virtual AIn Select Function]* overlap.	Set *H3-02, H3-06, H3-10, and H7-30* correctly to prevent overlap. **Note:** It is possible to set these functions to multiple analog input terminals at the same time: • Setting value *4 [FrqBIAS Frq]* • Setting values *0 [Through Mode]*
		The following parameters are set at the same time: • *H3-02, H3-06, H3-10, H7-30 = F [PID Fbk]* • *H6-01 = 1 [PI Pulse Train Function = PIDFbk Value]*	Remove the function settings that are not in use.
		The following parameters are set at the same time: • *H3-02, H3-06, H3-10, H7-30 = 10 [PID SetPoint]* • *H6-01 = 2 [PID SP Value]*	
		The following parameters are set at the same time: • *H3-02, H3-06, H3-10, H7-30 = 10 [PID SetPoint]* • *b5-18 = 1 [b5-19 PID SP Selection = Enabled]*	
		The following parameters are set at the same time: • *H6-01 = 2 [PI Pulse Train Function = PID SP Value]* • *b5-18 = 1 [b5-19 PID SP Selection = Enabled]*	

Code	Name	Causes	Possible Solutions
oPE08	Parameter Selection Error	A function was set that is not compatible with the control method selected in *A1-02 [Control Method]*.	1. Push ↵ to show *U1-18 [oPE Fault Parameter]*, and find parameters that are not in the applicable setting range. 2. Correct the parameter settings. **Note:** If more than one error occurs at the same time, other *oPExx* errors have priority over *oPE02*.
		These parameters were set in OLV Control: • *n2-02 > n2-03 [AFR Time 1 > AFR Time 2]* • *C4-02 > C4-06 [Trq Comp Delay Time > M2 Trq Comp Delay Time]*	• Set *n2-02 < n2-03*. • Set *C4-02 < C4-06*.
		In OLV/PM control, PM Motor Parameters *E5-02 to E5-07 = 0*.	• Set *E5-01 [PM Mot Code Selection]* correctly as specified by the motor. • For specialized motors, refer to the motor test report and set *E5-xx* correctly.
		In PM motor control methods: • *E5-09 = 0.0 [PM BackEMF Vpeak (mV/(rad/ s)) = 0.0 mV/(rad/s)]* • *E5-24 = 0.0 [PM BackEMF L-L Vrms (mV/rpm) = 0.0 mV/min*$^{-1}$*]*	Set *E5-09* or *E5-24* to the correct value.
		In PM motor control methods, *E5-09 ≠ 0* and *E5-24 ≠ 0*.	Set *E5-09 = 0* or *E5-24 = 0*.
		In AOLV/PM control: • *n8-57 = 0 [High-Freq Injection = Disabled]*. • *E1-09 [Min Output Frequency]* is set lower than the lower limit value.	Correct the parameter settings.

Code	Name	Causes	Possible Solutions
oPE09	PID Control Selection Fault	The following parameters are set at the same time: • *b5-15 ≠ 0.0 [Sleep Start Level ≠ 0.0 Hz]* • *b1-03 = 2, 3 [Stopping Method Selection = DC Inj->Stop, Timed Coast->Stop]*	• Set *b5-15 ≠ 0.0*. • Set *b1-03 = 0, 1 [Ramp->Stop, Coast->Stop]*.
		The following parameters are set at the same time: • *b5-01 = 1 and b5-72 = 0, 1 [PID D-FF Mode = D=Fdback, D=FdFwd]* • *d2-02 ≠ 0.0 [FRef Lower Limit ≠ 0.0%]*	Correct the parameter settings.
		The following parameters are set at the same time: • *b5-01 = 1 and b5-72 = 0, 1 [PID D-FF Mode = D=Fdback, D=FdFwd]* • *b5-11 = 1 [PID Output Reverse Selection = Negative lower limit]*	Correct the parameter settings.
		The following parameters are set at the same time: • *b5-01 = 1 and b5-70 = 1, and B5-72 = 0, 1 [PID MainRefMode = Fref + PID, and = D=Fdback, D=FdFwd]* • *d2-02 ≠ 0.0*	Correct the parameter settings.

Note:
The drive detects this error if the PID control function selection is incorrect.
(When *b5-01 = 1 [PID Enable = Enabled]*)

Code	Name	Causes	Possible Solutions
oPE10	V/f Data Setting Error	The parameters that set the V/f pattern do not satisfy these conditions: • For motor 1: *E1-09 ≤ E1-07 < E1-06 ≤ E1-11 ≤ E1-04Min Output Frequency ≤ Mid A Frequency < Base Frequency ≤ Mid B Frequency ≤ Max Output Frequency* • For motor 2: *E3-09 ≤ E3-07 < E3-06 ≤ E3-11 ≤ E3-04M2 Min Out Frequency ≤ M2 Mid A Frequency < M2 Base Frequency ≤ M2 Mid B Frequency ≤ M2 Max Out Frequency*	Set the parameters correctly to satisfy the conditions.

Code	Name	Causes	Possible Solutions
oPE11	Carrier Frequency Setting Error	The following parameters are set at the same time: • *C6-05 [Carrier Freq Proportional Gain] > 6* • *C6-04 > C6-03 [Carrier Lower Frequency Limit > Carrier Upper Frequency Limit]* **Note:** When *C6-05 < 7*, *C6-04* becomes disabled. *C6-03* stays active.	Set *C6-02 to C6-05* correctly.
		C6-02 to C6-05 settings are not in the applicable setting range.	

Code	Name	Causes	Possible Solutions
oPE13	Pulse Monitor Selection Error	*H6-06 = 101, 102, 105, or 116 [PO Mon.Selection = Frequency Reference, Output Frequency, Motor Speed, Output Frequency after Soft Starter]* has not been set when *H6-07 = 0 [PO Freq.Scaling = 0 Hz]*.	Set *H6-06* correctly.

Code	Name	Causes	Possible Solutions
oPE15	Torque Control Setting Error	More than one parameter is selecting torque control at the same time. • *d5-01 = 1 [Torque Ctrl Selection = Torque Control]* • *H1-xx: MFDI Function Select = 13 [Spd/Trq Switch]*	Correct the parameter settings.
		Droop control and Feed Forward control are enabled at the same time that torque control is selected. • *d5-01 = 1* or *H1-xx = 13* • *b7-01 ≠ 0.0 [Droop Ctrl Gain ≠ 0.0%]* or *n5-01 = 1 [FF Control Selection = Enabled]*	Correct the parameter settings.
		KEB Ride-Thru 2 (N.O., N.C.) is enabled at the same time that torque control is selected. • *d5-01 = 1* or *H1-xx = 13* • *H1-xx = 42 [KEB Thru2 NC]* or *H1-xx = 43 [KEB Thru2 NO]*	Correct the parameter settings.
		Optimal deceleration or overexcitation deceleration 2 is enabled at the same time that torque control is selected. • *d5-01 = 1* or *H1-xx = 13* • *L3-04 = 1, and L3-50 = 1, 4 [StallP@Decel Enable = Enabled, and StallP@Decel Mode = Automatic Decel Reduction, HiFlux2 Overexcitation]*	Correct the parameter settings.

Code	Name	Causes	Possible Solutions
oPE16	Energy Saving Constants Error	The Energy Saving parameters are not set in the applicable setting range.	Make sure that *E5-xx* is set correctly as specified by the motor nameplate data.
Code	**Name**	**Causes**	**Possible Solutions**
oPE18	Online Tuning Param Setting Err	The parameters that control online tuning are set incorrectly. In OLV control, one of these parameters was set when *n6-01 = 2 [Online Tune Selection = VoltageAdjustment]*: • *E2-02 [Mot Rated Slip]* is set to 30% of the default setting or lower. • *E2-06 [Motor Leak Inductance]* is set to 50% of the default setting or lower. • *E2-03 = 0 [Mot No-Load Current = 0 A]* has been set.	Set *E2-02, E2-03, and E2-06* correctly.
Code	**Name**	**Causes**	**Possible Solutions**
oPE20	PG-F3 Setting Error	The value set in *F1-01 [Enc1 Pulse Count (PPR)]* does not agree with the number of encoder pulses.	• Examine the *F1-01* value and the number of encoder pulses. • Set *F1-01* correctly.
		The calculation encoder signal frequency at maximum speed is more than 20 kHz.	Decrease the value set for *E1-04 [Max Output Frequency]* and make sure that the output frequency of the encoder is not more than 20 kHz.
Code	**Name**	**Causes**	**Possible Solutions**
oPE33	Digital Output Selection Error	These two parameters are set at the same time: • *H2-60 ≠ 0 [2NO-2CM 2nd Function ≠ Through Mode]* • *H2-01 = 1xx [Multi-Function Digital Output 1 = Inverse output of xx]*	Clear the *H2-01 to H2-03 = 1xx [Inverse output of xx]* settings. **Note:** It is not possible to set *H2-01 to H2-03 = 1xx [Inverse output of xx]* when using output functions for logic operations (*H2-60, H2-63, H2-66 ≠ 0*).
		These two parameters are set at the same time: • *H2-63 ≠ 0 [3NO-3CM 2nd Function ≠ Through Mode]* • *H2-02 = 1xx [Multi-Function Digital Output 2 = Inverse output of xx]*	
		These two parameters are set at the same time: • *H2-66 ≠ 0 [4NO-4CM 2nd Function ≠ Through Mode]* • *H2-03 = 1xx [Multi-Function Digital Output 3 = Inverse output of xx]*	
		These parameter pairs are set incorrectly: • *H2-21 > H2-22 [Compare1 Low Limit > Compare1 Up Limit]* • *H2-27 > H2-28 [Compare2 Low Limit > Compare2 Up Limit]*	• Set parameters *H2-21 ≤ H2-22*. • Set parameters *H2-27 ≤ H2-28*.

7.7 Auto-Tuning Errors

This table gives information about errors detected during Auto-Tuning. If the drive detects an Auto-Tuning error, the keypad will show the error and the motor will coast to stop. The drive will not send notification signals for faults and alarms when Auto-Tuning errors occur.

Two types of Auto-Tuning errors are: *Endx* and *Erx*. *Endx* identifies that Auto-Tuning has successfully completed with calculation errors. Find and repair the cause of the error and do Auto-Tuning again, or set the motor parameters manually. You can use the drive in the application if you cannot find the cause of the *Endx* error.

Erx identifies that Auto-Tuning was not successful. Find and repair the cause of the error and do Auto-Tuning again.

Code	Name	Causes	Possible Solutions
End1	Excessive Rated Voltage Setting	The torque reference was more than 20% during Auto-Tuning or the no-load current that was measured after Auto-Tuning is more than 80%.	• Make sure that the input motor nameplate data is correct. • Do Auto-Tuning again and correctly set the motor nameplate data. • If you can uncouple the motor and load, remove the motor from the machine and do Rotational Auto-Tuning again. • If you cannot uncouple the motor and load, use the results from Auto-Tuning.
Code	**Name**	**Causes**	**Possible Solutions**
End2	Iron Core Saturation Coefficient	The motor nameplate data entered during Auto-Tuning is incorrect.	• Make sure that the input motor nameplate data is correct. • Do Auto-Tuning again and correctly set the motor nameplate data.
		Auto-Tuning results were not in the applicable parameter setting range, and *E2-07* or *E2-08 [Mot Sat Coeff 2]* have temporary values.	• Examine and repair damaged motor wiring. • If you can uncouple the motor and load, remove the motor from the machine and do Rotational Auto-Tuning again.
Code	**Name**	**Causes**	**Possible Solutions**
End3	Rated Current Setting Alarm	The rated current value is incorrect.	Do Auto-Tuning again and set the correct rated current shown on the motor nameplate.
Code	**Name**	**Causes**	**Possible Solutions**
End4	Adjusted Slip Calculation Error	The Auto-Tuning results were not in the applicable parameter setting range.	• Make sure the input motor nameplate data is correct. • Do Rotational Auto-Tuning again and correctly set the motor nameplate data. • If you cannot uncouple the motor and load, do Stationary Auto-Tuning 2.
		The motor rated slip that was measured after Stationary Auto-Tuning was 0.2 Hz or lower.	
		The motor rated slip that was measured after compensation with *E2-08 [Mot Sat Coeff 2]* is not in the applicable range.	
		The secondary resistor measurement results were not in the applicable range.	
Code	**Name**	**Causes**	**Possible Solutions**
End5	Resistance Tuning Error	The Auto-Tuning results of the Line-to-Line Resistance were not in the applicable range.	• Make sure that the input motor nameplate data is correct. • Examine and repair damaged motor wiring.
Code	**Name**	**Causes**	**Possible Solutions**
End6	Leakage Inductance Alarm	The Auto-Tuning results were not in the applicable parameter setting range.	Make sure that the input motor nameplate data is correct, and do Auto-Tuning again.
		A1-02 [Control Method] setting is not applicable.	• Examine the value set in *A1-02*. • Make sure that the input motor nameplate data is correct, and do Auto-Tuning again.
Code	**Name**	**Causes**	**Possible Solutions**
End7	No-Load Current Alarm	The Auto-Tuning results of the motor no-load current value were not in the applicable range.	Examine and repair damaged motor wiring.
		Auto-Tuning results were less than 5% of the motor rated current.	Make sure that the input motor nameplate data is correct, and do Auto-Tuning again.
Code	**Name**	**Causes**	**Possible Solutions**
Er-01	Motor Data Error	The motor nameplate data entered during Auto-Tuning is incorrect.	• Make sure that the input motor nameplate data is correct. • Do Auto-Tuning again and correctly set the motor nameplate data.
		The combination of the motor rated power and motor rated current do not match.	• Examine the combination of drive capacity and motor output. • Do Auto-Tuning again, and correctly set the motor rated power and motor rated current.

Code	Name	Causes	Possible Solutions
		The combination of the motor rated current that was entered during Auto-Tuning and *E2-03 [Mot No-Load Current]* do not match.	1. Examine the motor rated current and the no-load current. 2. Set *E2-03* correctly. 3. Do Auto-Tuning again, and correctly set the motor rated current.
		The combination of the setting values of Motor Base Frequency and Motor Base Speed do not match.	Do Auto-Tuning again, and correctly set the Motor Base Frequency and Motor Base Speed.
Code	**Name**	**Causes**	**Possible Solutions**
Er-02	Drive in an Alarm State	The motor nameplate data entered during Auto-Tuning is incorrect.	• Make sure that the input motor nameplate data is correct. • Do Auto-Tuning again and correctly set the motor nameplate data.
		There is a defective motor cable or cable connection.	Examine and repair motor wiring.
		The load is too heavy.	• Decrease the load. • Examine the machine area to see if, for example, the motor shaft is locked.
		The drive detected a minor fault during Auto-Tuning.	1. Stop Auto-Tuning. 2. Examine the minor fault code and remove the cause of the problem. 3. Do Auto-Tuning again.
Code	**Name**	**Causes**	**Possible Solutions**
Er-03	STOP Button was Pressed	During Auto-Tuning, STOP was pushed and Auto-Tuning was interrupted.	Auto-Tuning did not complete correctly. Do Auto-Tuning again.
Code	**Name**	**Causes**	**Possible Solutions**
Er-04	Line-to-Line Resistance Error	The Auto-Tuning results were not in the applicable parameter setting range.	• Examine and repair motor wiring. • Disconnect the machine from the motor and do Rotational Auto-Tuning again.
		Auto-Tuning did not complete in a pre-set length of time.	
		There is a defective motor cable or cable connection.	
		The motor nameplate data entered during Auto-Tuning is incorrect.	• Make sure that the input motor nameplate data is correct. • Do Auto-Tuning again and correctly set the motor nameplate data.
Code	**Name**	**Causes**	**Possible Solutions**
Er-05	No-Load Current Error	The Auto-Tuning results were not in the applicable parameter setting range.	• Examine and repair motor wiring. • Disconnect the machine from the motor and do Rotational Auto-Tuning again.
		Auto-Tuning did not complete in a pre-set length of time.	
		The motor nameplate data entered during Auto-Tuning is incorrect.	• Make sure that the input motor nameplate data is correct. • Do Auto-Tuning again and correctly set the motor nameplate data.
		Rotational Auto-Tuning was done with a load that was more than 30% of the rating connected to the motor.	• Disconnect the machine from the motor and do Rotational Auto-Tuning again. • If you cannot uncouple the motor and load, make sure that the load is less than 30% of the motor rating. If a mechanical brake is installed in the motor, release the brake during Rotational Auto-Tuning.
Code	**Name**	**Causes**	**Possible Solutions**
Er-08	Rated Slip Error	The motor nameplate data entered during Auto-Tuning is incorrect.	• Make sure that the input motor nameplate data is correct. • Do Auto-Tuning again and correctly set the motor nameplate data.
		Auto-Tuning did not complete in a pre-set length of time.	• Examine and repair the motor wiring. • If the motor and machine are connected during Rotational Auto-Tuning, decouple the motor from the machinery.
		The Auto-Tuning results were not in the applicable parameter setting range.	
		Rotational Auto-Tuning was done with a load that was more than 30% of the rating connected to the motor.	• Disconnect the machine from the motor and do Rotational Auto-Tuning again. • If you cannot uncouple the motor and load, make sure that the load is less than 30% of the motor rating. If a mechanical brake is installed in the motor, release the brake during Rotational Auto-Tuning.

Code	Name	Causes	Possible Solutions
Er-09	Acceleration Error	The motor did not accelerate for the specified acceleration time.	1. Increase the value set in *C1-01 [Accel Time 1]*. 2. Disconnect the machine from the motor and do Rotational Auto-Tuning again.
		The value of *L7-01 [FW Torque Limit] or L7-02 [RV Torque Limit]* is small.	Increase the value set in *L7-01 or L7-02*.
		Rotational Auto-Tuning was done with a load that was more than 30% of the rating connected to the motor.	• Disconnect the machine from the motor and do Rotational Auto-Tuning again. • If you cannot uncouple the motor and load, make sure that the load is less than 30% of the motor rating. If a mechanical brake is installed in the motor, release the brake during Rotational Auto-Tuning.

Code	Name	Causes	Possible Solutions
Er-10	Motor Direction Error	There is defective drive and motor wiring.	Examine and repair motor wiring.
		There is defective drive and encoder wiring.	Examine and repair the wiring to the encoder.
		The direction of the motor and the setting of *F1-05 [Enc1 Rotat Selection]* are opposite.	Set *F1-05* correctly.
		The machine pulled the motor to rotate in the opposite direction.	Disconnect the machine from the motor and do Rotational Auto-Tuning again.
		When the torque reference is 100% or higher, the sign of the speed reference was opposite of the detected speed.	

Code	Name	Causes	Possible Solutions
Er-11	Motor Speed Error	The torque reference during acceleration is too high (100%).	• Increase the value set in *C1-01 [Accel Time 1]*. • Disconnect the machine from the motor and do Rotational Auto-Tuning again.

Code	Name	Causes	Possible Solutions
Er-12	Current Detection Error	There is a phase loss in the drive input power. (U/T1, V/T2, W/T3)	Examine and repair motor wiring.
		The current exceeded the current rating of the drive.	• Check the motor wiring for any short circuits between the wires. • Check and turn ON any magnetic contactors used between motors. • Replace the control board or the drive. For information about replacing the control board, contact the manufacturer or your nearest sales representative.
		The output current is too low.	
		You tried Auto-Tuning without a motor connected to the drive.	Connect the motor and do Auto-Tuning.
		There was a current detection signal error.	Replace the control board or the drive. For information about replacing the control board, contact the manufacturer or your nearest sales representative.

Code	Name	Causes	Possible Solutions
Er-13	Leakage Inductance Error	The motor rated current value is incorrect.	Correctly set the rated current indicated on the motor nameplate and perform Auto-Tuning again.
		The drive could not complete tuning for leakage inductance in fewer than 300 seconds.	Examine and repair motor wiring.

Code	Name	Causes	Possible Solutions
Er-14	Motor Speed Error 2	The motor speed was more than two times the amplitude of speed reference during Inertia Tuning.	Decrease the value set in *C5-01 [ASR PGain 1]*.

Code	Name	Causes	Possible Solutions
Er-15	Torque Saturation Error	During Inertia Tuning, the output torque was more than the value set in Torque Limit *L7-01 to L7-04*.	• Increase the value set in *L7-01 [FW Torque Limit], L7-02 [RV Torque Limit], L7-03 [FW Reg. TrqLimit], and L7-04 [RV Reg. TrqLimit]* as much as possible. • Decrease the values set for the frequency and amplitude of the test signals used when doing inertia tuning. First, decrease the test signal amplitude, and then do Inertia Tuning. If the error continues, decrease the test signal frequency and do Inertia Tuning again.

Code	Name	Causes	Possible Solutions
Er-16	Inertia ID Error	The inertia found by the drive was too small or too large during Inertia Tuning (10% or less, or 50000% or more).	• Decrease the values set for the frequency and amplitude of the test signals used when doing inertia tuning. First, decrease the test signal amplitude, and then do Inertia Tuning. If the error continues, decrease the test signal frequency and do Inertia Tuning again • Correctly set the motor inertia as specified by the motor, and do Inertia Tuning again.

Code	Name	Causes	Possible Solutions
Er-17	Reverse Prohibited Error	*b1-04 = 1 [Reverse Operation Selection = Reverse disabled]* has been set. **Note:** You cannot do Inertia Tuning if the drive cannot rotate the motor in reverse.	1. Enable reverse in the target machine. 2. Set *b1-04 = 0 [Reverse enabled]*. 3. Do Inertia Tuning again.
Er-18	Back EMF Error	The result of the induced voltage tuning was not in the applicable range.	1. Make sure that the input motor nameplate data is correct. 2. Do Auto-Tuning again and correctly set the motor nameplate data.
Er-19	PM Inductance Error	The Auto-Tuning results of the PM motor inductance were not in the applicable range.	1. Make sure that the input motor nameplate data is correct. 2. Do Auto-Tuning again and correctly set the motor nameplate data.
Er-20	Stator Resistance Error	The Auto-Tuning results of the PM Motor Stator Resistance were not in the applicable range.	1. Make sure that the input motor nameplate data is correct. 2. Do Auto-Tuning again and correctly set the motor nameplate data.
Er-21	Z Pulse Correction Error	The motor is wired incorrectly.	1. Repair motor and encoder wiring errors. 2. Do Z Pulse Offset Tuning again.
		The encoder is wired incorrectly.	
		Auto-Tuning was performed when the motor was coasting.	1. Make sure that the motor has stopped completely. 2. Do Z Pulse Offset Tuning again.
		The setting for the direction of the encoder motor rotation is incorrect.	1. Set the direction of motor rotation of the encoder in *F1-05 [Enc1 Rotat Selection]* correctly. 2. Do Z Pulse Offset Tuning again.
		The number of encoder pulses is incorrect.	1. Set the number of encoder pulses in *F1-01 [Enc1 Pulse Count (PPR)]* correctly. 2. Do Z Pulse Offset Tuning again.
		The encoder is damaged.	• Examine the signal output from the encoder. • Replace the encoder.
Er-25	HighFreq Inject Param Tuning Err	The motor data is incorrect.	Do Stationary Auto-Tuning again. **Note:** If the drive detects *Er-25* after doing Stationary Auto-Tuning, the motor may not be able to use high frequency injection control. For details, contact the manufacturer or your nearest sales representative.

7.8 Backup Function Operating Mode Display and Errors

◆ Operating Mode Display

When doing the backup function tasks, the keypad will show the current task. These indicators do not show that an error has occurred.

Keypad Display	Name	Display	State
Drive and Keypad mismatch. Should the parameters be restored?	Detection of inconsistency between the drive and keypad	Normally displayed	The drive detected the connection of a keypad from a different drive. Select [Yes] to copy parameters backed up in the keypad to the connected drive.
Restore Restore from keypad	Restoring parameters	Flashing	The parameters stored in the keypad have been restored to the drive.
End	Backup/restore/verify operation ended normally	Normally displayed	The parameter backup, restore, or verify operation ended normally.
Backup Backup from Drive	Backing up parameters	Flashing	The parameters stored in the drive are being backed up to the keypad.
Verify Keypad & Drive	Verifying parameters	Flashing	The parameter settings stored in the keypad and the parameter settings in the drive match or are being compared.

◆ Backup Function Runtime Errors

When an error occurs, the keypad shows a code to identify the error. The table in this section show the error codes. Refer to these tables to remove the cause of the errors.

Push any key on the keypad to clear an error.

Code	Name	Causes	Possible Solutions
CPEr	Control Mode Mismatch	The keypad setting and drive setting for *A1-02 [Control Method]* do not match.	1. Set *A1-02* on the drive to the same value that is on the keypad. 2. Restore the parameters.
CPyE	Error Writing Data	Parameter restore did not end correctly.	Restore the parameters.
CSEr	Control Mode Mismatch	The keypad is broken.	Replace the keypad.
dFPS	Drive Model Mismatch	An attempt was made to restore parameters that were backed up on a different drive model.	1. Examine the drive model that was used to back up the parameters on the keypad. 2. Restore the parameters.
iFEr	Keypad Communication Error	There was a communications error between the keypad and the drive.	Examine the connector or cable connection.
ndAT	Error Received Data	The parameter settings for model and specifications (power supply voltage and capacity) are different between the keypad and the drive.	1. Make sure that drive model and the value set in *o2-04 [Drive KVA Selection]* are the same. 2. Restore the parameters.
		The parameters are not stored in the keypad.	1. Connect a keypad that has the correct parameters. 2. Restore the parameters.
PWEr	Q2pack Password Mismatch	The password set in the backup operation with *[q: Q2PACK PARAMETERS]* and *[r: Q2PACK JOINTS]* is incorrect.	Set the Q2pack PC software password supplied for the Q2pack program user ID downloaded to the drive.
Note: *U8-11 and U8-12 [Q2pack Ver 1 and Q2pack Ver 2]* show the user ID of the Q2pack program.			
rdEr	Error Reading Data	Backup was executed with *o3-02 = 0 [COPY Allow Selection = Disabled]* set.	Set *o3-02 = 1 [Enabled]* and backup again.
vAEr	Voltage Class, Capacity Mismatch	The power supply specifications or drive capacity parameter settings are different between the keypad and the drive.	1. Make sure that drive model and the value set in *o2-04 [Drive KVA Selection]* are the same. 2. Restore the parameters.

Code	Name	Causes	Possible Solutions
vFyE	Parameters do not Match	The parameters that are backed up in the keypad and the parameters in the drive are not the same.	1. Restore or backup the parameter again. 2. Verify the parameters.

7.9 Diagnosing and Resetting Faults

When a fault occurs and the drive stops, do the procedures in this section to remove the cause of the fault, then re-energize the drive.

◆ Fault and Power Loss Occur at the Same Time

WARNING! *Sudden Movement Hazard. Do not do work on the drive without eye protection. Wear eye protection before you start work on the drive. Failure to obey could cause serious injury or death.*

WARNING! *Electrical Shock Hazard. Do not immediately energize the drive or operate peripheral devices after the drive blows a fuse or trips an RCM/RCD. Wait for the time specified on the warning label at a minimum and make sure that all indicators are OFF. Then check the wiring and peripheral device ratings to find the cause of the problem. Contact the manufacturer before energizing the drive or peripheral devices if the cause is not known. Failure to obey can cause death or serious injury and damage to the drive.*

1. Supply power to the control circuit from the external 24 V input.
2. Use monitor parameters *U2: FAULT* to show the fault code and data about the operating status of the drive immediately before the fault occurred.
3. Use the information in the Troubleshooting tables to remove the fault.

Note:

1. To find the faults that were triggered, check the fault history in *U2-02 [Previous Fault]*. To find information about drive status (such as frequency, current, and voltage) when the faults were triggered, check *U2-03 to U2-20*.
2. If the fault display stays after you re-energize the drive, remove the cause of the fault and reset.

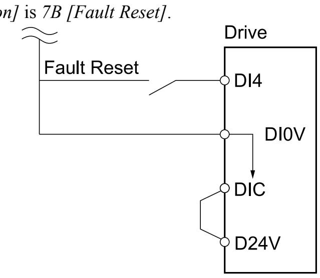
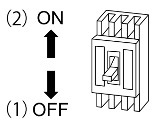
◆ Fault Occurs Without Power Loss

1. Examine the fault code shown on the keypad.
2. Use the information in the Troubleshooting tables to remove the fault. Refer to *Troubleshooting on page 263*.
3. Do a fault reset.

◆ Fault Reset

If a fault occurs, you must remove the cause of the fault and re-energize the drive. The following table lists the different methods to reset the drive after a fault.

Table 7.3 Fault Reset Methods

Methods	Description
1	While the keypad is showing the fault or alarm code, push F1 (Reset) or > on the keypad.
2	Switch ON the MFDI terminal set to *H1-xx = 7B [MFDI Function Select = Fault Reset]*. **Note:** The default setting for *H1-04 [DI4 Function Selection]* is *7B [Fault Reset]*. 
3	1. De-energize the drive main circuit power supply. 2. Energize the drive again after the keypad display goes out. 

If the drive receives a Run command from a communication option or control circuit terminal, the drive will not reset the fault. Remove the Run command then try to clear the fault. If you do a fault reset when the drive has a Run command, the keypad will show minor fault *CrST [Remove RUN Command to Reset]*.

7.10 Troubleshooting Without Fault Display

If the drive or motor operate incorrectly, but the keypad does not show a fault or error code, refer to the items in this section.

- Motor hunting and oscillation
- Unsatisfactory motor torque
- Unsatisfactory speed precision
- Unsatisfactory motor torque and speed response
- Motor noise

◆ The Parameter Settings Will Not Change

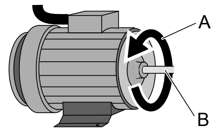
Causes	Possible Solutions
The drive is operating the motor (the drive is in Drive Mode).	Stop the drive and change to Programming Mode.
Parameter *A1-01 = 0 [Access Level = Monitor only]*.	Set *A1-01 = 2 [Standard Parameters]* or *A1-01 = 3 [Expert Parameters]*.
Parameter *H1-xx: MFDI Function Select = 7C [Prg Lock]*.	Turn ON the terminals to which *H1-xx = 7C* is set, and then change the parameters.
An incorrect password was entered in *A1-04 [Password Input]*.	• Enter the correct password to *A1-04* again. • If you forgot the password, set the password again with *A1-04* and *A1-05 [Password Setting]*. **Note:** If the password is set, it will not be possible to change these parameters until the password matches: • *A1-01 [Access Level]* • *A1-02 [Control Method]* • *A1-03 [Init Parameters]* • *A1-06 [Macro Preset]* • *A1-07 [Q2pack Enable]* • *A2-01 to A2-32 [MAN1 Param1 to MAN3 Param12]*
The drive detected *Uv [Undervoltage]*.	• View *U1-07 [DC Bus Voltage]* to see the power supply voltage. • Examine the main circuit wiring.

◆ The Motor Does Not Rotate After Entering Run Command

Causes	Possible Solutions
The drive is not in Drive Mode.	1. Make sure that the keypad shows [Rdy]. 2. If the keypad does not show [Rdy], go back to the Home screen.
The drive stopped, LO/RE was pushed, and changed the Run command source to the keypad.	Do one of these two: • Push LO/RE. • Re-energize the drive. **Note:** Set *o2-01 = 0 [LO/RE Key Selection of Function = Disabled]* to prevent changing the Run command source with LO/RE.
Auto-Tuning completed.	Go back to the Home screen on the keypad. **Note:** When Auto-Tuning completes, the drive changes to Programming Mode. The drive will not accept a Run command unless the drive is in Drive Mode.
The drive received a fast stop command.	Turn off the fast stop input signal.
The settings for the source that supplies the Run command are incorrect.	Set *b1-02 [Run Comm. Sel 1]* correctly.
The frequency reference source is set incorrectly.	Set *b1-01 [Freq. Ref. Sel. 1]* correctly.
There is defective wiring in the control circuit terminals.	• Correctly wire the drive control circuit terminals. • View *U1-10 [In Terminal Status]* for input terminal status.
The settings for voltage input and current input of the master frequency reference are incorrect.	Examine these analog input terminal signal level settings: • Terminal AI1: DIP switch S1-1 and *H3-01 [AI1 Signal Level Select]* • Terminal AI2: DIP switch S1-2 and *H3-09 [AI2 Signal Level Select]* • Terminal AI3: DIP switch S4, S1-3 and *H3-05 [AI3 Signal Level Select]*
The selection for the sinking/sourcing mode and the internal/external power supply is incorrect.	• For sinking mode, close the circuit between terminals DIC-D24V with a wire jumper. • For sourcing mode, close the circuit between terminals DIC-DI0V with a wire jumper. • For external power supply, remove the wire jumper.
The frequency reference is too low.	• View *U1-01 [Frequency Reference]*. • Increase the frequency reference to a value higher than *E1-09 [Min Output Frequency]*.

Causes	Possible Solutions
The MFAI setting is incorrect.	• Make sure that the functions set to the MFAI are correct. The frequency reference is 0 when *H3-02, H3-10, H3-06 = 5 [AI1 Function Selection, AI2 Function Selection, AI3 Function Selection = Freq Gain]* and voltage (current) is not input. • View *U1-13 [Terminal AI1 Input Lv], U1-14 [Terminal AI2 Input Lv], U1-15 [Terminal AI3 Input Lv]* to see if the analog input values set to terminals AI1, AI2, and AI3 are applicable.
STOP was pushed.	Turn the Run command OFF then ON from an external input. **Note:** When you push STOP during operation, the drive will ramp to stop. Set *o2-02 = 0 [STOP Key Selection of Function = Disabled]* to disable the STOP function.
The 2-wire sequence and 3-wire sequence are set incorrectly.	• Set one of the parameters *H1-03 to H1-08 [DI3 Function Selection to DI8 Function Selection[* to *5 [3-Wire Seq.]* to enable the 3-wire sequence. • If a 2-wire sequence is necessary, make sure that *H1-03 to H1-08 ≠ 5*.

◆ The Motor Rotates in the Opposite Direction from the Run Command

Causes	Possible Solutions
The phase wiring between the drive and motor is incorrect.	• Examine the wiring between the drive and motor. • Connect drive output terminals U/T1, V/T2, and W/T3 in the correct sequence to agree with motor terminals U, V, and W. • Switch two motor cables U, V, and W to reverse motor direction.
The forward direction for the motor is set incorrectly.	• Connect drive output terminals U/T1, V/T2, and W/T3 in the correct sequence to agree with motor terminals U, V, and W. • Switch two motor cables U, V, and W to reverse motor direction.  A - Forward Rotation Direction B - Load Shaft **Figure 7.1 Forward Rotating Motor** **Note:** Refer to the motor specifications, and make sure that the forward rotation direction is correct for the application. The forward rotation direction of motors can be different for different motor manufacturers and types.
The signal connections for forward run and reverse run on the drive control circuit terminals and control panel side are incorrect.	Correctly wire the control circuit.
The motor is running at almost 0 Hz and the Speed Search estimated the speed to be in the opposite direction.	Set *b3-14 = 0 [Speed Bi-Directional Search = Disabled]*, then the drive will only do speed search in the specified direction.

◆ The Motor Rotates in Only One Direction

Causes	Possible Solutions
The drive will not let the motor rotate in reverse.	Set *b1-04 = 0 [Reverse Operation Selection = Enabled]*.
The drive did not receive a Reverse run signal and 3-Wire sequence is selected.	Turn ON the terminals to which *H1-xx = 5 [3-Wire Seq.]* is set, and then enable reverse operation.

◆ The Motor Is Too Hot

Causes	Possible Solutions
The load is too heavy.	• Decrease the load. • Increase the acceleration and deceleration times. • Examine the values set in *L1-01 [Motor Cool Type for OL1 Calc], L1-02 [OL1 Protect Time]*, and *E2-01 [Mot Rated Current (FLA)]*. • Use a larger motor. **Note:** The motor also has a short-term overload rating. Examine this rating carefully before setting drive parameters.
The motor is running continuously at a very low speed.	• Change the run speed. • Use a drive-dedicated motor.

Causes	Possible Solutions
The drive is operating in a vector control mode, but Auto-Tuning has not been done.	• Do Auto-Tuning. • Calculate motor parameter and set motor parameters. • Set *A1-02 = 0 [Control Method = V/f Control]*.
The voltage insulation between motor phases is not sufficient.	• Use a motor with a voltage tolerance that is higher than the maximum voltage surge. • Use a drive-dedicated motor that is rated for use with AC drives for applications that use a motor on drives rated higher than 400 V class. • Install an AC reactor on the output side of the drive and set *C6-02 = 1 [Carrier Frequency Selection = 2.0 kHz]*. **Note:** When the motor is connected to the drive output terminals U/T1, V/T2, and W/T3, surges occur between the drive switching and the motor coils. These surges can be three times the drive input power supply voltage (600 V for a 200 V class drive, 1200 V for a 400 V class drive).
The air around the motor is too hot.	• Measure the ambient temperature. • Decrease the temperature in the area until it is in the specified temperature range.
The motor fan stopped or is clogged.	• Clean the motor fan. • Make the drive environment better.

◆ The Correct Auto-Tuning Mode Is Not Available

Causes	Possible Solutions
The desired Auto-Tuning mode is not available for the selected control mode.	Change the motor control method with parameter *A1-02 [Control Method]*.

◆ The Motor Stalls during Acceleration or Accel/Decel Time Is Too Long

Causes	Possible Solutions
The drive and motor system reached the torque limit or current suppression will not let the drive accelerate.	• Decrease the load. • Use a larger motor. **Note:** Although the drive has a Stall Prevention function and a Torque Compensation Limit function, accelerating too fast or trying to drive a load that is too large can exceed the limits of the motor.
Torque limit is set incorrectly.	Set the torque limit correctly.
The acceleration time setting is too short.	Check the values set in *C1-01, C1-03, C1-05, or C1-07 [Accel Time 1, Accel Time 2, Accel Time 3, or Accel Time 4[* and set them to applicable values.
The load is too heavy.	• Increase the acceleration time. • Examine the mechanical brake and make sure that it is fully releasing. • Decrease the load to make sure that the output current stays less than the motor rated current. • Use a larger motor. **Note:** • In extruder and mixer applications, the load can increase as the temperature decreases. • Although the drive has a Stall Prevention function and a Torque Compensation Limit function, accelerating too fast or trying to drive a load that is too large can exceed the limits of the motor.
The frequency reference is low.	• Examine *E1-04 [Max Output Frequency]* and increase the setting if it is set too low. • Examine *U1-01 [Frequency Reference]* for the correct frequency reference. • Examine the multi-function input terminals to see if a frequency reference signal switch has been set. • Examine the low gain level set in *H3-03 [AI1 Gain Setting], H3-11 [AI2 Gain Setting], H3-07 [AI3 Gain Setting]* if you use MFAI.
The frequency reference is set incorrectly.	When *H3-02, H3-10, H3-06 = 5 [AI1 Function Selection, AI2 Function Selection, AI3 Function Selection = Freq Gain]* are set, see if voltage (current) has been set. • Check the values set in *H3-02, H3-10, and H3-06*. • Use *U1-13 [Terminal AI1 Input Lv], U1-14 [Terminal AI2 Input Lv], and U1-15 [Terminal AI3 Input Lv]* to make sure that the analog input values set to terminals AI1, AI2, and AI3 are applicable.
The motor characteristics and drive parameter settings are not compatible.	• Set the correct V/f pattern to agree with the characteristics of the motor. • Examine the V/f pattern set in *E1-03 [V/f Pattern Selection]*. • Perform Rotational Auto-Tuning.
The drive is operating in vector control mode, but Auto-Tuning is not completed.	• Do Auto-Tuning. • Calculate motor data and reset motor parameters. • Set *A1-02 = 0 [Control Method = V/f Control]*.
Parameter *A1-02 = 4 [Control Method = Adv OLVector]* and the speed estimation response is too slow.	Increase the value set in *n4-65 [HF FlxEstim Response]* in 0.1-unit increments.
The Stall Prevention level during acceleration setting is too low.	Increase the value set in *L3-02 [StallP Level@Accel]*. **Note:** If the *L3-02* value is too low, the acceleration time can be unsatisfactorily long.

Causes	Possible Solutions
The Stall Prevention level during run setting is too low.	Increase the value set in *L3-06 [StallP Level@Run]*. **Note:** If the *L3-06* value is too low, speed will decrease while the drive outputs torque.
Drive reached the limitations of the V/f motor control method.	• When the motor cable is longer than 50 m (164 ft.), do Auto-Tuning for line-to-line resistance. • Set the V/f pattern to “High Starting Torque”. • Use a Vector Control method. **Note:** V/f control method does not provide high torque at low speeds.

◆ The Drive Frequency Reference Is Different than the Controller Frequency Reference Command

Causes	Possible Solutions
The analog input gain and bias for the frequency reference input are set incorrectly.	Examine the gain and bias settings for the analog inputs that set the frequency reference. • Terminal AI1: *H3-03 [AI1 Gain Setting]*, *H3-04 [AI1 Bias Setting]* • Terminal AI2: *H3-11 [AI2 Gain Setting]*, *H3-12 [AI2 Bias Setting]* • Terminal AI3: *H3-07 [AI3 Gain Setting]*, *H3-08 [AI3 Bias Setting]*
The drive is receiving frequency bias signals from analog input terminals AI1 to AI3 and the sum of all signals makes the frequency reference.	• Examine parameters *H3-02 [AI1 Function Selection], H3-10 [AI2 Function Selection], H3-06 [AI3 Function Selection]*. If two or more of these parameters are set to *4 [FrqBIAS Frq]*, change the settings. • Use *U1-13 [Terminal AI1 Input Lv], U1-14 [Terminal AI2 Input Lv], and U1-15 [Terminal AI3 Input Lv]* to make sure that the analog input values set to terminals AI1, AI2, and AI3 are applicable.
Examine the gain and bias settings for the analog inputs that set the frequency reference.	Reduce the value set in *n4-70 [Speed Comp@LowFrequency]*.
PID control is enabled.	If PID control is not necessary, set *b5-01 = 0 [PID Enable = Disabled]*. **Note:** When PID control is enabled, the drive adjusts the output frequency as specified by the target value. The drive will only accelerate to the maximum output frequency set in *E1-04 [Max Output Frequency]* while PID control is active.

◆ The Motor Speed Is Not Stable When Using a PM Motor

Causes	Possible Solutions
E5-01 [PM Mot Code Selection] is set incorrectly.	Refer to “Motor Performance Fine-Tuning” in the Technical Manual.
The drive is operating the motor at more than the specified speed control range.	Examine the speed control range and adjust the speed.
The motor is operating at a speed reference of 5% or lower.	Use a different drive to operate a motor at a speed reference of 5% or lower. Contact the manufacturer.
The motor is hunting.	Adjust these parameters to have the largest effect: • *n8-55 [Load Inertia]* • *n8-45 [SpdFbck Det.Gain]* • *C4-02 [Trq Comp Delay Time]*
Hunting occurs at start.	Increase the value set in *C2-01 [Jerk@Start of Accel]*.
Too much current is flowing through the drive.	Set *E5-01 [PM Mot Code Selection]* correctly as specified by the motor. For special-purpose motors, enter the correct value to *E5-xx* as specified by the motor test report.
Speed response is too slow.	Increases the setting value of *n8-11 [Observ.Calc Gain2]* in 10-unit increments.

◆ There Is Too Much Motor Oscillation and the Rotation Is Irregular

Causes	Possible Solutions
Unsatisfactory balance of motor phases.	• Make sure that the drive input power voltage supplies stable power. • Set *L8-05 = 0 [In PhaseLoss Selection = Disabled]*.
The hunting prevention function is disabled.	• Set *n1-01 = 2 [HuntPrev Selection = Enabled (High Carrier)]*. • Increase the value of *n2-01 [AFR Gain]* or *n2-02 [AFR Time 1]*.

◆ Deceleration Takes Longer Than Expected When Dynamic Braking Is Enabled

Causes	Possible Solutions
The stall prevention during deceleration setting is incorrect.	• Examine the setting for *L3-04 [StallP@Decel Enable]*. • When the drive has a dynamic braking option installed, set *L3-04 = 0 [Disabled]*. • If the drive detects *ov [Overvoltage]*, set *L3-04 = 1 [Enabled]* and *L3-50 = 2 [Gen Purpose w/ DB Resistor]*.
The deceleration time setting is too long.	Set *C1-02, C1-04, C1-06, or C1-08 [Decel Time 1, Decel Time 2, Decel Time 3, or Decel Time 4]* to applicable values.
The motor torque is not sufficient.	Use a larger motor. **Note:** If these items are correct, the demand on the motor is more than the motor capacity: • Parameter settings are correct. • The drive does not detect *ov [Overvoltage]*.

The drive and motor system reached the torque limit.	• Examine the values set in *L7-01 to L7-04 [FW Torque Limit to RV Reg. TrqLimit]* and increase them if necessary.
	Note:
	If the torque limit is enabled, deceleration time can increase because the drive cannot output more torque than the limit.
	• If *H3-02, H3-10, H3-06 = 9, B, C, D [AI1 Function Selection, AI2 Function Selection, AI3 Function Selection = Torque Limit]* has been set, examine the settings for the MFAIs.
	  • Examine the values set in *H3-02, H3-10, and H3-06*.
	  • Use *U1-13, U1-14, and U1-15 [Terminal AI1 Input Lv, Terminal AI2 Input Lv, and Terminal AI3 Input Lv]* to make sure that the analog input values set to terminals AI1, AI2, and AI3 are applicable.

The load is more than the internal torque limit as specified by the drive rated current.	Replace the drive with a larger capacity model.

◆ The Load Falls When a Brake Is Applied

Causes	Possible Solutions
The open/close timing of the brake is incorrect.	Refer to "Notes on Controlling the Brake when Using the Hoist Application Preset" in the Technical Manual and take appropriate measures.
The DC injection braking is not sufficient.	Increase the value set in *b2-02 [DCI Braking Current]*.

◆ There Is Audible Noise from the Drive or Motor Cables When the Drive Is Energized

Causes	Possible Solutions
The relay switching in the drive is making too much noise.	• Use *C6-02 [Carrier Frequency Selection]* to decrease the carrier frequency. • Connect a noise filter to the input side of the drive power supply. • Connect a noise filter to the output side of the drive. • Isolate the control circuit wiring from the main circuit wiring. • Use a metal cable gland to wire the drive. • Shield the periphery of the drive with metal. • Make sure that the drive and motor are grounded correctly. • Make sure that ground faults have not occurred in the wiring or motor.

◆ Residual Current Monitoring/Detection (RCM/RCD) Trips During Run

Causes	Possible Solutions
There is too much leakage current from the drive.	• Increase the RCM/RCD sensitivity or use RCM/RCD with a higher threshold. • Use *C6-02 [Carrier Frequency Selection]* to decrease the carrier frequency. • Decrease the length of the cable used between the drive and the motor. • Install a noise filter or AC reactor on the output side of the drive. Set *C6-02 = 1 [2.0 kHz]* when connecting an AC reactor. • Disable the internal EMC filter.

◆ Motor Rotation Causes Unexpected Audible Noise from Connected Machinery

Causes	Possible Solutions
The carrier frequency and the resonant frequency of the connected machinery are the same.	• Adjust *C6-02, C6-03, C6-04, and C6-05 [Carrier Frequency Selection, Carrier Upper Frequency Limit, Carrier Lower Frequency Limit, and Carrier Freq Proportional Gain]*. • Set *C6-02 = 1 to 6 [Carrier Frequency Selection = Frequency other than Swing PWM]*. **Note:** If *C6-02 = 7 to A [Carrier Frequency Selection = Swing PWM]*, the user will not know if the noise comes from the drive or the machine.
The drive output frequency and the resonant frequency of the connected machinery are the same.	• Adjust *d3-01, d3-02, d3-03, and d3-04 [Jump Frequency 1, Jump Frequency 2, Jump Frequency 3, and Jump Frequency Width]*. • Put the motor on a rubber pad to decrease vibration.

◆ Motor Rotation Causes Oscillation or Hunting

Causes	Possible Solutions
The frequency reference is assigned to an external source, and there is electrical interference in the signal.	Make sure that electrical interference does not have an effect on the signal lines. • Isolate control circuit wiring from main circuit wiring. • Use twisted-pair cables or shielded wiring for the control circuit. • Increase the value of *H3-13 [An.In FilterTime Constant]*.
The cable between the drive and motor is too long.	• Do Auto-Tuning. • Make the wiring as short as possible.
The PID parameters are not sufficiently adjusted.	Adjust *b5: PID CONTROL* parameters.

◆ PID Output Fault

Causes	Possible Solutions
There is no PID feedback input.	• Examine the MFAI terminal settings. • See if *H3-02, H3-10, H3-06 = F [AI1 Function Selection, AI2 Function Selection, AI3 Function Selection = PID Fbk]* is set. • Make sure that the MFAI terminal settings agree with the signal inputs. • Examine the connection of the feedback signal. • Make sure that *b5: PID CONTROL* is set correctly. **Note:** If there is no PID feedback input to the terminal, the detected value is 0, which causes a PID fault and also causes the drive to operate at maximum frequency.
The detection level and the target value do not agree.	Use *H3-03, H3-11, and H3-07 [AI1 Gain Setting, AI2 Gain Setting, and AI3 Gain Setting]* to adjust PID target and feedback signal scaling. **Note:** PID control keeps the difference between the target value and detection value at 0. Set the input level for the values relative to each other.
Reverse drive output frequency and speed detection. When output frequency increases, the sensor detects a speed decrease.	Set *b5-09 = 1 [PID Output Level Selection = Reverse output]*.

◆ The Starting Torque Is Not Sufficient

Causes	Possible Solutions
Auto-Tuning has not been done in vector control method.	Do Auto-Tuning.
The control method was changed after doing Auto-Tuning.	Do Auto-Tuning again.
Stationary Auto-Tuning for Line-to-Line Resistance was done.	Do Rotational Auto-Tuning.

◆ The Motor Rotates after the Drive Output Is Shut Off

Causes	Possible Solutions
DC Injection Braking is too low and the drive cannot decelerate correctly.	• Increase the value set in *b2-02 [DCI Braking Current]*. • Increase the value set in *b2-04 [DCInj Time@Stop]*.
The stopping method makes the drive coast to stop.	Set *b1-03 = 0 or 2 [Stopping Method Selection = Ramp->Stop, DC Inj->Stop]*.

◆ The Output Frequency Is Lower Than the Frequency Reference

Causes	Possible Solutions
The frequency reference is in the Jump frequency range.	Adjust *d3-01, d3-02, d3-03, and d3-04 [Jump Frequency 1, Jump Frequency 2, Jump Frequency 3, and Jump Frequency Width]* . **Note:** Enabling the Jump frequency prevents the drive from outputting the frequencies specified in the Jump range.
The upper limit for the frequency reference has been exceeded.	Set *E1-04 [Max Output Frequency]* and *d2-01 [FRef Upper Limit]* to the best values for the application. **Note:** This calculation supplies the upper value for the output frequency: *E1-04* × *d2-01* / 100
A large load triggered Stall Prevention function during acceleration.	• Decrease the load. • Adjust *L3-02 [StallP Level@Accel]*.
L3-01 = 4 [StallP Mode@Accel = ILim Mode] has been set.	1. Check whether the V/f pattern and motor parameter settings are appropriate, and set them correctly. 2. If this does not solve the problem, and it is not necessary to limit the current level of stall during acceleration, adjust *L3-02*. 3. If this does not solve the problem, set *L3-01 = 2 [General Purpose]*.
The motor is rotating at this speed: *b2-01 [ZSpd/DCI Threshold]* ≤ Motor Speed < *E1-09 [Min Output Frequency]*	• Set *b1-21 = 2 [CLV Start Selection = Accept RUN]*. • Set *E1-09* < *b2-01*.

◆ The Motor Is Making an Audible Noise

Causes	Possible Solutions
100% of the rated output current of the drive was exceeded while operating at low speeds.	• If the sound is coming from the motor, set *L8-38= 1[Carrier Reduction Mode = Enable<6 Hz]*. • If *oL2 [Drive Overloaded]* occurs frequently after setting *L8-38 = 1*, replace the drive with a high-capacity drive.

◆ The Motor Will Not Restart after a Loss of Power

Causes	Possible Solutions
The drive did not receive a Run command after applying power.	• Examine the sequence and wiring that enters the Run command. • Set up a relay to make sure that the Run command stays enabled during a loss of power.
For applications that use 3-wire sequence, the momentary power loss continued for a long time, and the relay that keeps the Run command has been switched off.	Examine the wiring and circuitry for the relay that keeps the Run command enabled during the momentary power loss ride-thru time.

8

Periodic Inspection and Maintenance

This chapter gives information about how to examine and maintain drives in use, how to replace cooling fans and other parts, and how to store drives.

8.1 Safety Precautions

⚠DANGER

Electrical Shock Hazard

Electrical Shock Hazard. Do not examine, connect, or disconnect wiring on an energized drive. Before servicing, disconnect all power to the equipment and wait for the time specified on the warning label at a minimum. The internal capacitor stays charged after the drive is de-energized. The charge indicator LED extinguishes when the DC bus voltage decreases below 50 Vdc. When all indicators are OFF, measure for dangerous voltages to make sure that the drive is safe.

If you do work on the drive when it is energized, it will cause serious injury or death from electrical shock.

While the drive is ON, never attempt to change any wiring, disconnect any option cards or connectors, or replace the cooling fan. Before performing any repairs, shut OFF the power supply to the drive and verify that there is no residual voltage in the unit.

Failure to do so may result in serious electric shock.

A motor will continue to run even when the power supply to the drive has been turned OFF. PM motors generate induced voltage to the terminal of the motor even when the power supply to the drive has been switched OFF.

Failure to comply could result in death or serious injury.

⚠WARNING

Electrical Shock Hazard

Do not operate equipment when covers are missing. Some figures in this section include drives without covers or safety shields to more clearly show the inside of the drive. Replace covers and shields before operation. Use drives only as specified by the instructions.

Failure to obey can cause death or serious injury.

Always ground the motor-side grounding terminal.

Contacting the motor case can cause death or serious injury from incorrect equipment grounding.

Only let authorized persons install, wire, maintain, examine, replace parts, and repair the drive.

Failure to obey can cause death or serious injury.

Do not work on the drive or around the drive while wearing loose clothing or jewelry. Tighten loose clothing and remove all metal objects such as watches or rings.

Failure to obey can cause death or serious injury.

Fire Hazard

Tighten all terminal screws to the correct tightening torque.

Connections that are too loose or too tight can cause incorrect operation and damage to the drive. Incorrect connections can also cause death or serious injury from fire.

Do not use the main circuit power supply (Overcurrent Category III) at incorrect voltages. Make sure that the drive rated voltage aligns with the power supply voltage before energizing the drive.

Failure to obey can cause death or serious injury.

Do not put flammable or combustible materials on top of the drive and do not install the drive near flammable or combustible materials. Attach the drive to metal or other noncombustible material.

Failure to obey can cause death or serious injury.

⚠CAUTION

Burn Hazard

Do not touch a hot drive heatsink. De-energize the drive, wait 15 minutes minimum, and make sure that the heatsink is cool to replace the cooling fans.

Failure to obey can cause minor to moderate injury.

NOTICE

Observe correct electrostatic discharge (ESD) procedures when touching the drive.
Failure to obey can cause ESD damage to the drive circuitry.

Follow cooling fan replacement instructions. Replace all fans when performing maintenance to help ensure maximum useful product life.
Improper fan replacement could cause damage the drive.

Do not use unshielded wire for control wiring. Use shielded twisted-pair wires and ground the shield to the ground terminal of the drive.
Failure to comply may cause electrical interference resulting in poor system performance.

Do not change the drive circuitry.
Failure to obey can cause damage to the drive and will void warranty. The manufacturer cannot be made responsible for modifications of the product made by the user.

Make sure that all connections are correct after you install the drive and connecting peripheral devices.
Failure to obey can cause damage to the drive.

Comply with proper wiring practices. Connect motor input terminals U, V and W to drive output terminals U/T1, V/T2, and W/T3. The phase order for the drive and motor should match.
The motor may run in reverse if the phase order is backward.

Turn the drive ON (Run) and OFF (Stop) a maximum of one time each 30 minutes with the MC on the power source side to extend the service life of the relay contacts and electrolytic capacitors in the drive. Run and Stop the motor as much as possible with the drive.
The drive can fail if users frequently turn the drive ON and OFF with the MC on the power source side to Run and Stop the drive. Incorrect operation can decrease the service life of the relay contacts and electrolytic capacitors.

Do not connect or operate damaged equipment or equipment with missing parts.
Failure to obey can cause damage to the drive and connected equipment.

8.2 Inspection

Power electronics have limited life and can show changes in performance and deterioration of performance after years of use in usual conditions. To help prevent these problems, it is important to do preventive maintenance and regular inspection, and replace parts on the drive.

Drives contain different types of power electronics, for example power transistors, semiconductors, capacitors, resistors, fans, and relays. The electronics in the drive are necessary for correct motor control.

Follow the inspection lists in this chapter as a part of a regular maintenance program.

- Examine the drive one time each year at a minimum.
- The operating conditions, environmental conditions, and use conditions will have an effect on the examination frequency for connected equipment.
- Examine the drive more frequently if you use the drive in bad conditions or in these conditions:
  - High ambient temperatures
  - Frequent starting and stopping
  - Changes in the AC power supply or load
  - Too much vibration or shock loading
  - Dust, metal dust, salt, sulfuric acid, or chlorine atmospheres
  - Unsatisfactory storage conditions.

DANGER! *Electrical Shock Hazard. Electrical Shock Hazard. Do not examine, connect, or disconnect wiring on an energized drive. Before servicing, disconnect all power to the equipment and wait for the time specified on the warning label at a minimum. The internal capacitor stays charged after the drive is de-energized. The charge indicator LED extinguishes when the DC bus voltage decreases below 50 Vdc. When all indicators are OFF, measure for dangerous voltages to make sure that the drive is safe. If you do work on the drive when it is energized, it will cause serious injury or death from electrical shock.*

◆ Recommended Daily Inspection

Examine the items in the following table each day to make sure that the components do not wear out or fail. Make a copy of this checklist and put a check mark in the “Checked” column after each inspection.

Table 8.1 Daily Inspection Checklist

Inspection Area	Inspection Points	Corrective Action	Checked
Motor	Examine for unusual oscillation or noise coming from the motor.	• Check the load coupling. • Measure motor vibration. • Tighten all loose components.	
Cooling System	Examine for unusual heat from the drive or motor and visible discoloration.	• Check for a load that is too heavy. • Tighten loose screws. • Check for a dirty heatsink or motor. • Check the ambient temperature.	
	Examine the cooling fans, circulation fans, and circuit board cooling fans.	• Check for a clogged or dirty fan. • Use the performance life monitor to check for correct fan operation.	
Surrounding Environment	Make sure that the installation environment is applicable.	Remove the source of contamination or correct unsatisfactory environment.	
Load	Make sure that the drive output current is not more than the motor or drive rating for an extended period of time.	• Check for a load that is too heavy. • Check the correct motor parameter settings.	
Power Supply Voltage	Examine main power supply and control voltages.	• Correct the voltage or power supply to agree with nameplate specifications. • Verify all main circuit phases.	

◆ Recommended Periodic Inspection

Examine the items in the following tables one time each year at a minimum. The operating conditions, environmental conditions, and use conditions will have an effect on the examination frequency for connected equipment. You must use your experience with the application to select the correct inspection frequency for each drive installation. Periodic inspections will help to prevent performance deterioration and product failure. Make a copy of this checklist and put a check mark in the “Checked” column after each inspection.

Table 8.2 Main Circuit Periodic Inspection Checklist

Inspection Area	Inspection Points	Corrective Action	Checked
General	• Examine equipment for discoloration from too much heat or deterioration. • Examine for damaged parts.	• Replace damaged components as necessary. • The drive does not have many serviceable parts and it could be necessary to replace the drive.	
	Examine for dirt, unwanted particles, or dust on components.	• Examine enclosure door seal. • Use a vacuum cleaner to remove unwanted particles and dust without touching the components. • If you cannot remove unwanted particles and dust with a vacuum cleaner, replace the components.	
Conductors and Wiring	• Examine wiring and connections for discoloration or damage. Examine wiring and connections for discoloration from too much heat. • Examine wire insulation and shielding for discoloration and wear.	Repair or replace damaged wiring.	
Terminal Block	Examine terminals for stripped, damaged, or loose connections.	• Tighten loose screws. • Replace damaged screws or terminals. **Note:** On drive models 2056, 2070, 4031, and 4038, you cannot replace the hex screws.	
Electromagnetic Contactors and Relays	• Examine contactors and relays for too much noise during operation. • Examine coils for signs of too much heat, such as melted or broken insulation.	• Check coil voltage for overvoltage or undervoltage conditions. • Replace broken relays, contactors, or circuit boards that you can remove.	
Dynamic Braking Option	Examine the insulation for discoloration from too much heat.	If there is discoloration in the option, check to make sure that the wiring is not damaged. A small quantity of discoloration is not a problem.	
Electrolytic Capacitor	• Examine for leaks, discoloration, or cracks. • Check if the cap has come off, if there is swelling, or if there are leaks from broken sides.	The drive does not have many serviceable parts and it could be necessary to replace the drive.	
Diodes, IGBT (Power Transistor)	Examine for dust or other unwanted material collected on the surface.	• Use a vacuum cleaner to remove unwanted particles and dust without touching the components. • If you cannot remove unwanted particles and dust with a vacuum cleaner, replace the components.	

Table 8.3 Motor Periodic Inspection Checklist

Inspection Area	Inspection Points	Corrective Action	Checked
Operation Check	Check for increased vibration or unusual noise.	Stop the motor and contact approved maintenance personnel as necessary.	

Table 8.4 Control Circuit Periodic Inspection Checklist

Inspection Area	Inspection Points	Corrective Action	Checked
General	• Examine terminals for stripped, damaged, or loose connections. • Make sure that all terminals have been correctly tightened.	• Tighten loose screws. • Replace damaged screws or terminals. • If terminals are integral to a circuit board, it could be necessary to replace the control board or the drive.	
Circuit Boards	• Check for odor, discoloration, or rust. • Make sure that all connections are correctly fastened. • Make sure that the surface of the circuit board does not have dust or oil mist.	• Tighten loose connections. • Use a vacuum cleaner to remove unwanted particles and dust without touching the components. • If you cannot remove unwanted particles and dust with a vacuum cleaner, replace the components. • Do not use solvents to clean the board. • The drive does not have many serviceable parts and it could be necessary to replace the drive.	

Table 8.5 Cooling System Periodic Inspection Checklist

Inspection Area	Inspection Points	Corrective Action	Checked
Cooling Fans	• Check for unusual oscillation or unusual noise. • Check for damaged or missing fan blades.	Clean or replace the fans as necessary.	
Heatsink	• Examine for dust or other unwanted material collected on the surface. • Examine for dirt.	Use a vacuum cleaner to remove unwanted particles and dust without touching the components.	
Air Duct	Examine air intake, exhaust openings and make sure that there are no unwanted materials on the surface.	Clear blockages and clean air duct as necessary.	

Table 8.6 Keypad Periodic Inspection Checklist

Inspection Area	Inspection Points	Corrective Action	Checked
General	• Make sure that the keypad shows the data correctly. • Examine for dust or other unwanted material that collected on components in the area.	• If you have problems with the display or the keys, contact the manufacturer or your nearest sales representative. • Clean the keypad.	

8.3 Maintenance

The drive Maintenance Monitors keep track of component wear and tell the user when the end of the estimated performance life is approaching. The Maintenance Monitors prevent the need to shut down the full system for unexpected problems. Users can set alarm notifications for the maintenance periods for these drive components:

- Cooling fan
- Electrolytic capacitor
- Soft charge bypass relay
- IGBT

Contact the manufacturer or your nearest sales representative for more information about part replacement.

◆ Replaceable Parts

You can replace these parts of the drive:

- Control circuit terminal board
- Cooling fan, circulation fan
- Keypad

If there is a failure in the main circuit, replace the drive.

If the drive is in the warranty period, contact the manufacturer or your nearest sales representative before you replace parts. The manufacturer reserves the right to replace or repair the drive as specified by the warranty policy.

WARNING! *Electrical Shock Hazard. Electrical Shock Hazard. Do not examine, connect, or disconnect wiring on an energized drive. Before servicing, disconnect all power to the equipment and wait for the time specified on the warning label at a minimum. The internal capacitor stays charged after the drive is de-energized. The charge indicator LED extinguishes when the DC bus voltage decreases below 50 Vdc. When all indicators are OFF, measure for dangerous voltages to make sure that the drive is safe. If you do work on the drive when it is energized, it will cause serious injury or death from electrical shock.*

◆ Part Replacement Guidelines

The following table shows the standard replacement period for replacement parts. When you replace these parts, make sure that you use manufacturer approved replacement parts for the applicable model and design revision number of your drive.

Table 8.7 Standard Replacement Period

Part	Standard Replacement Period
Cooling fan	10 years
Electrolytic Capacitor *1	10 years

*1 If there is damage to parts that you cannot repair or replace, replace the drive.

NOTICE: *Estimated performance life based on specific usage conditions. These conditions are provided for the purpose of replacing parts to maintain performance. Some parts may require more frequent replacement due to poor environments or rigorous use. Usage conditions for estimated performance life: Ambient temperature: Yearly average of 40 °C (IP00/Open Type enclosure); Load factor: 80% maximum; Operation time: 24 hours a day*

◆ Monitors that Display the Lifespan of Drive Components

The drive keypad shows percentage values for the replacement parts to help you know when you must replace those components. Use the monitors in the table below to check replacement periods. When the monitor value is 100%, the component is at the end of its useful life and there is an increased risk of drive malfunction. The manufacturer recommends that you check the maintenance period regularly to make sure that you get the maximum performance life.

Table 8.8 Performance Life Monitors

Monitor No.	Component	Description
U4-03	Cooling fan	Shows the total operation time of fans as 0 to 99999 hours. After this value is 99999, the drive automatically resets it to 0.
U4-04		Shows the total fan operation time as a percentage of the specified maintenance period.
U4-05	Electrolytic capacitor	Shows the total capacitor usage time as a percentage of the specified maintenance period.
U4-06	Soft charge bypass relay	Shows the number of times the drive is energized as a percentage of the performance life of the inrush circuit.
U4-07	IGBT	Shows the percentage of the maintenance period reached by the IGBTs.

◆ Alarm Outputs for Maintenance Monitors

You can use *H2-xx: MFDO Function Select* to send a message that tells you when a specified component is near the end of its performance life estimate. Set the applicable value to *H2-xx* as shown in the table below for your component.

When the specified component is near the end of its performance life estimate, the MFDO terminals set for *H2-xx = 63 [Maintenance]* will turn ON, and the keypad will show an alarm that identifies the component to replace.

Table 8.9 Maintenance Period Alarms

Display	Alarm Name	Cause	Solution	MFDO (Setting Value in H2-xx)
LT-1	Cooling Fan Maintenance Time	The cooling fan is at 90% of its performance life estimate.	Replace the cooling fan, then set *o4-03 = 0 [Fan.Oper Setting = 0 h]* to reset the cooling fan operation time.	63
LT-2	Capacitor Maintenance Time	The main circuit and control circuit capacitors are at 90% of their performance life estimate.	Replace the board or the drive. Contact the manufacturer or your nearest sales representative to replace the board.	
LT-3	SoftChargeBypassRelay MainteTime	The soft charge bypass relay is at 90% of its performance life estimate.	Replace the board or the drive. Contact the manufacturer or your nearest sales representative to replace the board.	
LT-4	IGBT Maintenance Time (50%)	The IGBTs are at 50% of their performance life estimate.	Check the load, carrier frequency, and output frequency.	
TrPC	IGBT Maintenance Time (90%)	The IGBTs are at 90% of their performance life estimate.	Replace the IGBTs or the drive.	4

◆ Related Parameters

Replace the component, then set Maintenance Setting *o4-03, o4-05, o4-07, and o4-09 = 0* to reset the Maintenance Monitor. If these parameters are not reset after the corresponding parts have been replaced, the Maintenance Monitor function will continue to count down the performance life from the value that was reached with the old part. If the Maintenance Monitor is not reset, the drive will not have the correct value of the performance life for the new component.

Note:

The drive installation environment has an effect on the maintenance period.

Table 8.10 Maintenance Setting Parameters

Parameter	Function
o4-03 [Fan.Oper Setting]	Sets the value from which to start the cumulative drive cooling fan operation time in 10-hour units. **Note:** When *o4-03 = 30* has been set, the drive will count the operation time for the cooling fan from 300 hours and *U4-03 [Fan Oper.Time]* will show *300 h*.
o4-05 [Cap.Maint.Setting]	Sets the value from which to start the count for the main circuit capacitor maintenance period as a percentage.
o4-07 [PreChgRly Preset Maintenance Cnt]	Sets as a percentage the value from which to start the count for the soft charge bypass relay maintenance time.
o4-09 [IGBT Preset Maintenance Cnt]	Sets the value from which to start the count for the IGBT maintenance period as a percentage.

8.4 Replace a Cooling Fan and Circulation Fan

To replace a cooling fan or circulation fan, contact the manufacturer or your nearest sales representative. Pay attention to the safety instructions.

◆ Replace a Fan (Models 2018, 2021, 4007 to 4012)

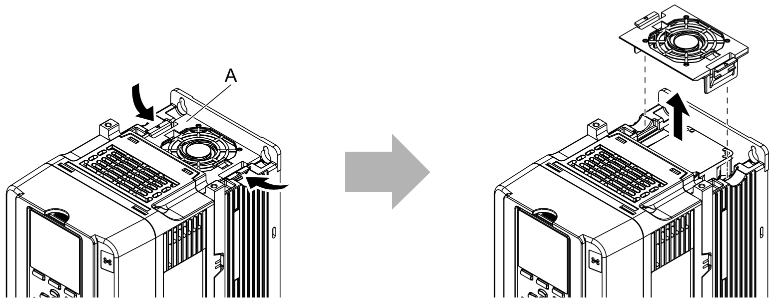
WARNING! *Electrical Shock Hazard. Electrical Shock Hazard. Do not examine, connect, or disconnect wiring on an energized drive. Before servicing, disconnect all power to the equipment and wait for the time specified on the warning label at a minimum. The internal capacitor stays charged after the drive is de-energized. The charge indicator LED extinguishes when the DC bus voltage decreases below 50 Vdc. When all indicators are OFF, measure for dangerous voltages to make sure that the drive is safe. If you do work on the drive when it is energized, it will cause serious injury or death from electrical shock.*

CAUTION! *Burn Hazard. Do not touch a hot drive heatsink. De-energize the drive, wait 15 minutes minimum, and make sure that the heatsink is cool to replace the cooling fans. Failure to obey can cause minor to moderate injury.*

NOTICE: *Follow cooling fan replacement instructions. Replace all fans when performing maintenance to help ensure maximum useful product life. Improper fan replacement could cause damage the drive.*

■ Remove a Fan

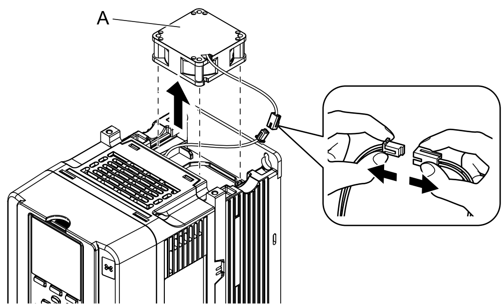
1. To remove the fan finger guard from the drive, push the hooks on the left and right sides of it and pull up.



A - Fan finger guard

Figure 8.1 Remove the Fan Finger Guard

2. Pull the cooling fan straight up from the drive. Disconnect the power supply connector and remove the fan from the drive.



A - Cooling fan

Figure 8.2 Remove the Cooling Fan

■ Install a Fan

Reverse the removal procedure to install a cooling fan.

1. Connect the drive and the fan connector.

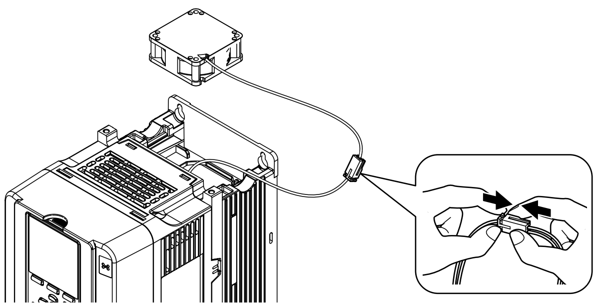
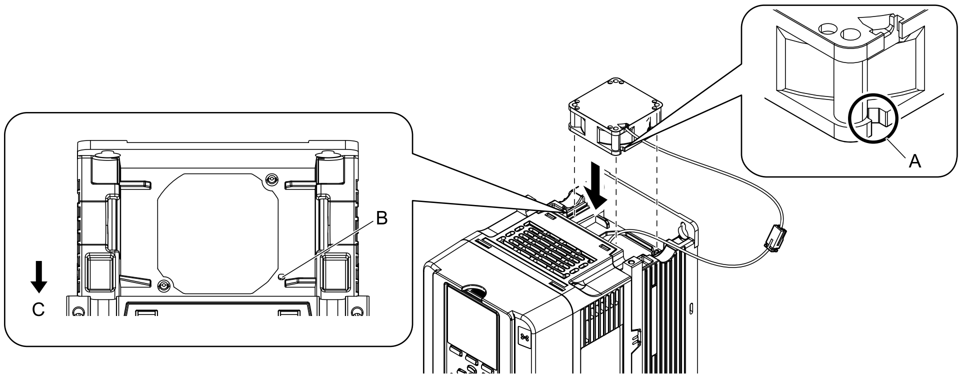


Figure 8.3 Connect Connector

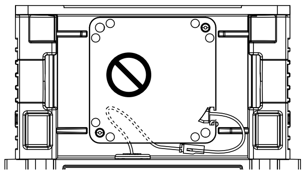
2. Align the notches on the fan with the pins on the drive and install the cooling fan in the drive.



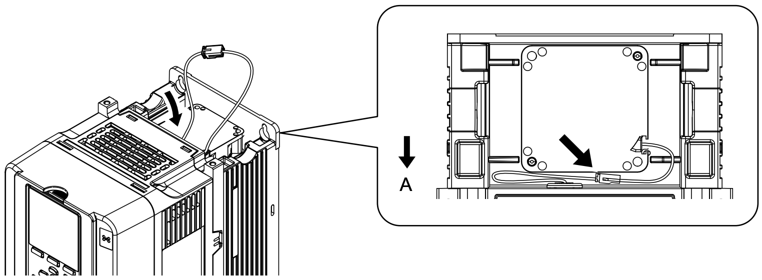
A - Notch on fan
B - Alignment pins on drive
C - Front of drive

Figure 8.4 Install the Cooling Fan

Note:
When you install the cooling fan, make sure that you do not pinch cables between the cooling fan and the drive.



3. Put the cable in the recess of the drive.



A - Front of drive

Figure 8.5 Put the Cable in the Drive Recess

4. Push the hooks on the left and right sides of the fan finger guard and click it into place on the drive.

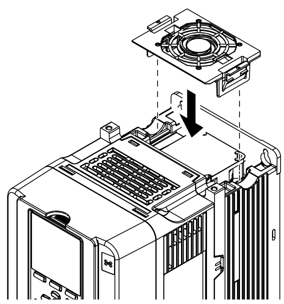


Figure 8.6 Reattach the Fan Finger Guard

5. Energize the drive and set *o4-03 = 0 [Fan.Oper Setting = 0 h]* to reset the cooling fan operation time.

◆ Replace a Fan (Models 2030, 2042, 4018, 4023)

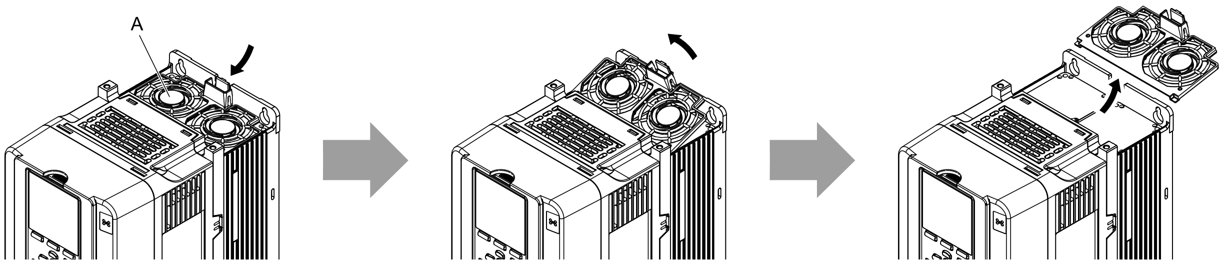
WARNING! *Electrical Shock Hazard. Electrical Shock Hazard. Do not examine, connect, or disconnect wiring on an energized drive. Before servicing, disconnect all power to the equipment and wait for the time specified on the warning label at a minimum. The internal capacitor stays charged after the drive is de-energized. The charge indicator LED extinguishes when the DC bus voltage decreases below 50 Vdc. When all indicators are OFF, measure for dangerous voltages to make sure that the drive is safe. If you do work on the drive when it is energized, it will cause serious injury or death from electrical shock.*

CAUTION! *Burn Hazard. Do not touch a hot drive heatsink. De-energize the drive, wait 15 minutes minimum, and make sure that the heatsink is cool to replace the cooling fans. Failure to obey can cause minor to moderate injury.*

NOTICE: *Follow cooling fan replacement instructions. Replace all fans when performing maintenance to help ensure maximum useful product life. Improper fan replacement could cause damage the drive.*

■ Remove a Fan

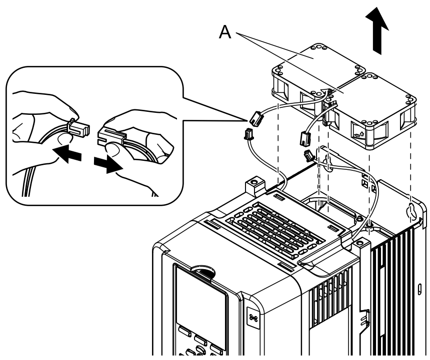
1. To remove the fan finger guard from the drive, push the hook on the back side of the fan finger guard and pull up.



A - Fan finger guard

Figure 8.7 Remove the Fan Finger Guard

2. Pull the cooling fan straight up from the drive. Disconnect the power supply connector and remove the fan from the drive.



A - Cooling Fan

Figure 8.8 Remove the Cooling Fan

■ Install a Fan

Reverse the removal procedure to install a cooling fan.

1. Connect the drive and the fan connector.

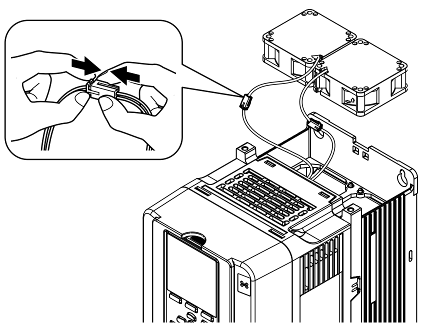
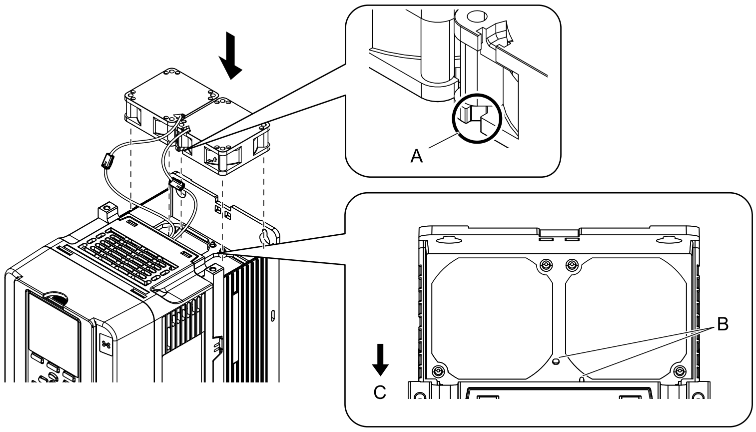


Figure 8.9 Connect the Power Supply Connector

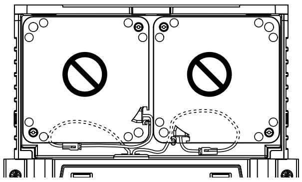
2. Align the notches on the fan with the pins on the drive and install the cooling fan in the drive.



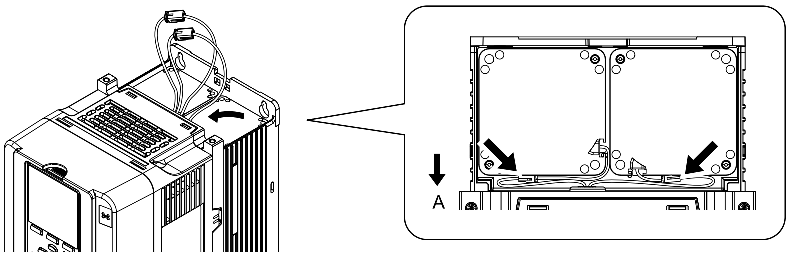
A - Notch on fan
B - Alignment pins on drive
C - Front of drive

Figure 8.10 Install the Cooling Fan

Note:
When you install the cooling fan, make sure that you do not pinch cables between the cooling fan and the drive.



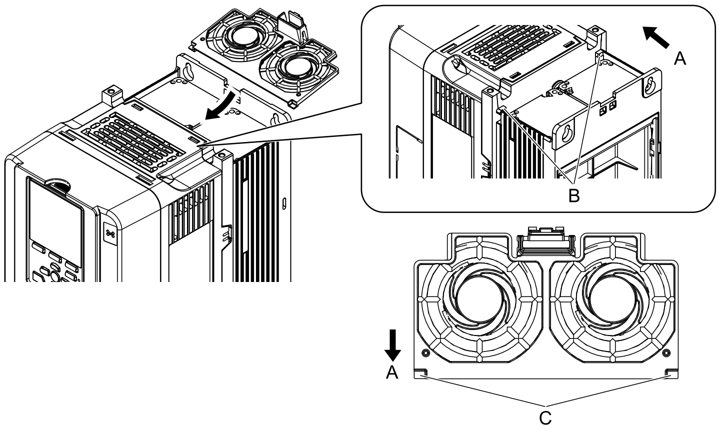
3. Put the cable in the recess of the drive.



A - Front of drive

Figure 8.11 Put the Cable in the Drive Recess

4. Hold the fan finger guard at an angle and put the connector tabs on the fan finger guard into the holes on the drive.



A - Front of drive
B - Drive holes
C - Connector tabs

Figure 8.12 Reattach the Fan Finger Guard

5. Push the hook on the back side of the fan finger guard and click it into place on the drive.

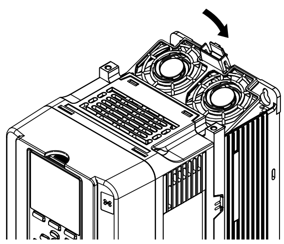


Figure 8.13 Reattach the Fan Finger Guard

6. Energize the drive and set *o4-03 = 0 [Fan.Oper Setting = 0 h]* to reset the cooling fan operation time.

◆ Replace a Fan (Models 2056, 4031, 4038)

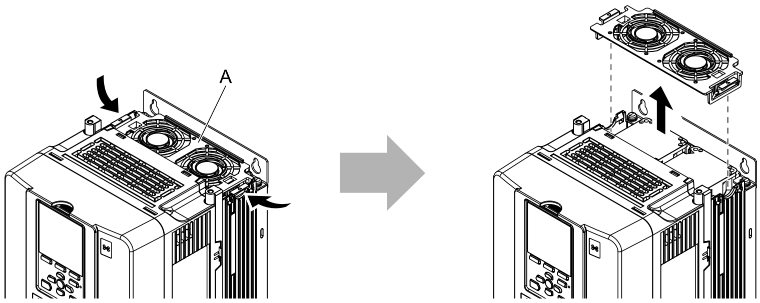
WARNING! *Electrical Shock Hazard. Electrical Shock Hazard. Do not examine, connect, or disconnect wiring on an energized drive. Before servicing, disconnect all power to the equipment and wait for the time specified on the warning label at a minimum. The internal capacitor stays charged after the drive is de-energized. The charge indicator LED extinguishes when the DC bus voltage decreases below 50 Vdc. When all indicators are OFF, measure for dangerous voltages to make sure that the drive is safe. If you do work on the drive when it is energized, it will cause serious injury or death from electrical shock.*

CAUTION! *Burn Hazard. Do not touch a hot drive heatsink. De-energize the drive, wait 15 minutes minimum, and make sure that the heatsink is cool to replace the cooling fans. Failure to obey can cause minor to moderate injury.*

NOTICE: *Follow cooling fan replacement instructions. Replace all fans when performing maintenance to help ensure maximum useful product life. Improper fan replacement could cause damage the drive.*

■ Remove a Fan

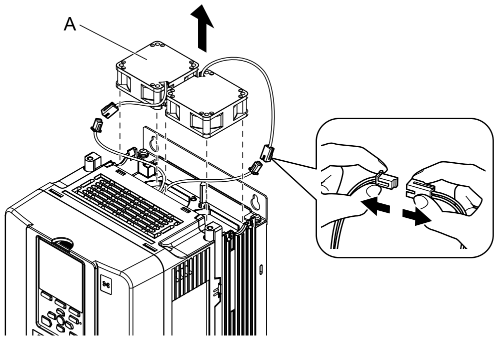
1. To remove the fan finger guard from the drive, push the hooks on the left and right sides of it and pull up.



A - Fan finger guard

Figure 8.14 Remove the Fan Finger Guard

2. Pull the cooling fan straight up from the drive. Disconnect the power supply connector and remove the fan from the drive.



A - Cooling fan

Figure 8.15 Remove the Cooling Fans

■ Install a Fan

Reverse the removal procedure to install a cooling fan.

1. Connect the drive and the fan connector.

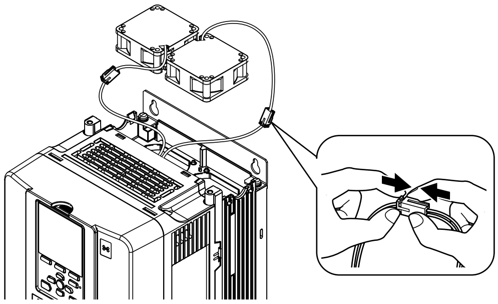
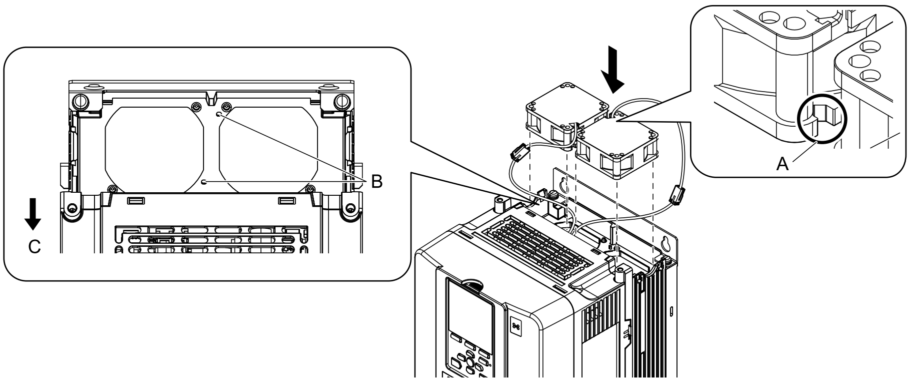


Figure 8.16 Connect the Power Supply Connector

2. Align the notches on the fan with the pin on the drive and install the cooling fan in the drive.

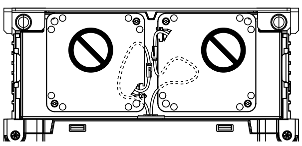


A - Notch on fan
B - Alignment pins on drive
C - Front of drive

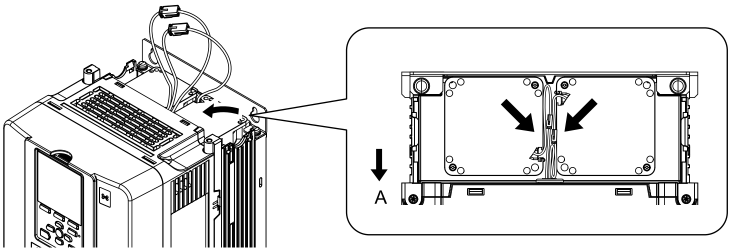
Figure 8.17 Install the Cooling Fan

Note:

When you install the cooling fan, make sure that you do not pinch cables between the cooling fan and the drive.



3. Put the cable in the recess of the drive.



A - Front of drive

Figure 8.18 Put the Cable in the Drive Recess

4. Push the hooks on the left and right sides of the fan finger guard and click it into place on the drive.

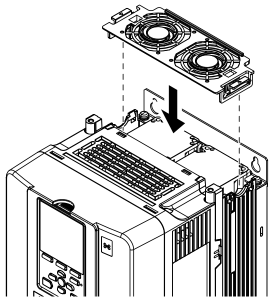


Figure 8.19 Reattach the Fan Finger Guard

5. Energize the drive and set *o4-03 = 0 [Fan.Oper Setting = 0 h]* to reset the cooling fan operation time.

◆ Replace a Fan (Models 2070 to 2110, 4044 to 4075)

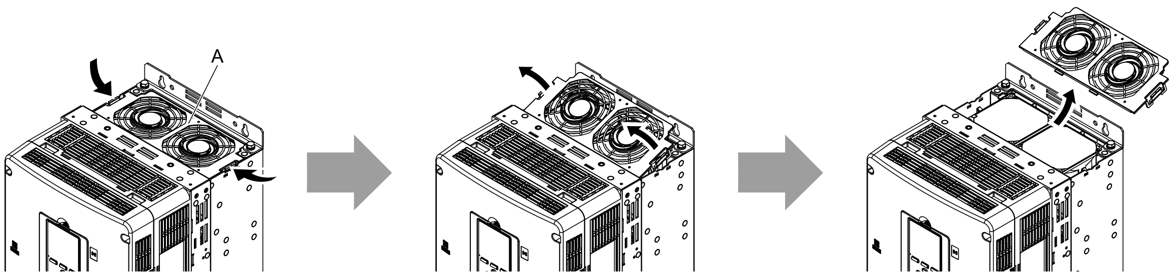
WARNING! *Electrical Shock Hazard. Electrical Shock Hazard. Do not examine, connect, or disconnect wiring on an energized drive. Before servicing, disconnect all power to the equipment and wait for the time specified on the warning label at a minimum. The internal capacitor stays charged after the drive is de-energized. The charge indicator LED extinguishes when the DC bus voltage decreases below 50 Vdc. When all indicators are OFF, measure for dangerous voltages to make sure that the drive is safe. If you do work on the drive when it is energized, it will cause serious injury or death from electrical shock.*

CAUTION! *Burn Hazard. Do not touch a hot drive heatsink. De-energize the drive, wait 15 minutes minimum, and make sure that the heatsink is cool to replace the cooling fans. Failure to obey can cause minor to moderate injury.*

NOTICE: *Follow cooling fan replacement instructions. Replace all fans when performing maintenance to help ensure maximum useful product life. Improper fan replacement could cause damage the drive.*

■ Remove a Fan

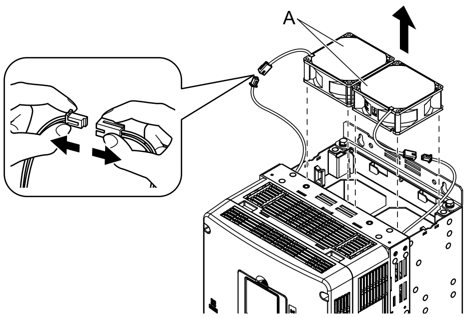
1. To remove the fan finger guard from the drive, push the tabs on the left and right sides of it and pull up the back side of the guard.



A - Fan finger guard

Figure 8.20 Remove the Fan Finger Guard

2. Pull the cooling fan straight up from the drive. Disconnect the power supply connector and remove the fan from the drive.



A - Cooling Fan

Figure 8.21 Remove the Cooling Fan

■ Install a Fan

Reverse the removal procedure to install a cooling fan.

1. Connect the drive and the fan connector.

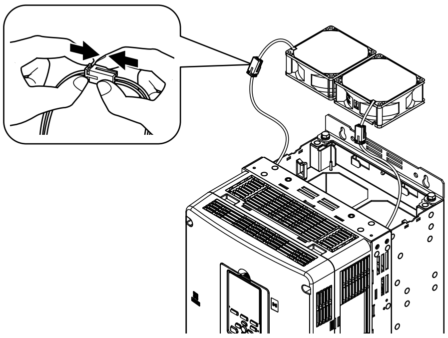
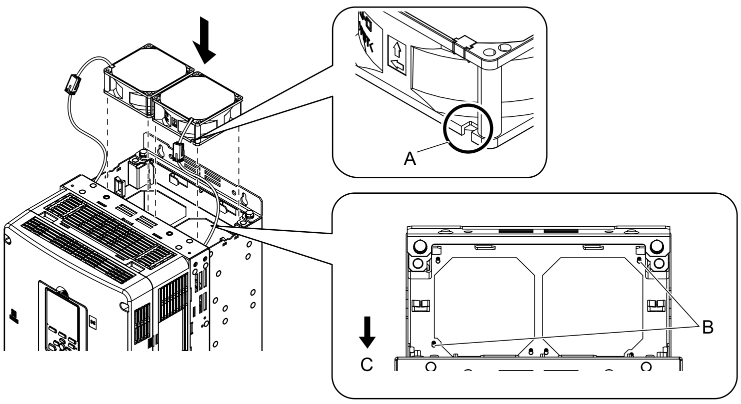


Figure 8.22 Connect Connector

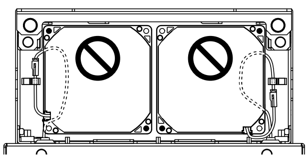
2. Align the notches on the fan with the pins on the drive and install the cooling fan in the drive.



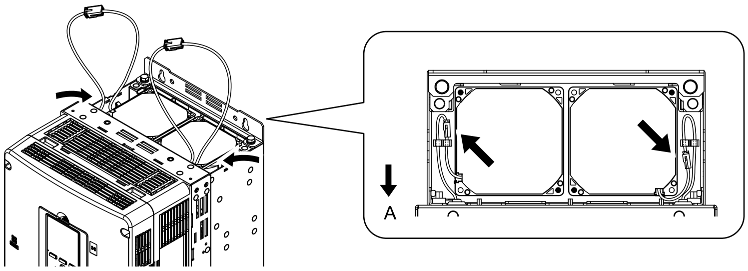
A - Notch on fan **C - Front of drive**
B - Alignment pins on drive

Figure 8.23 Install the Cooling Fan

Note:
When you install the cooling fan, make sure that you do not pinch cables between the cooling fan and the drive.



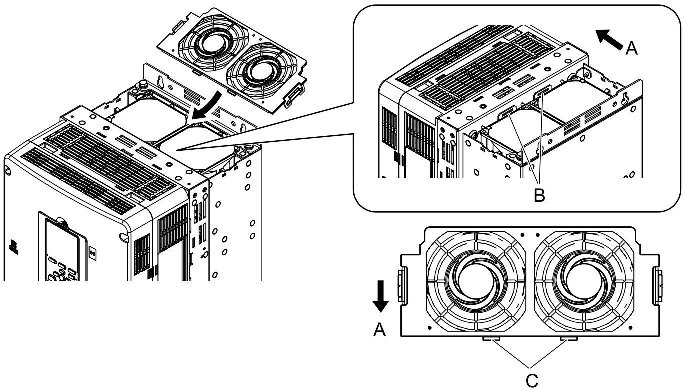
3. Put the cable in the recess of the drive.



A - Front of drive

Figure 8.24 Put the Cable in the Drive Recess

4. Hold the fan finger guard at an angle and put the connector tabs on the fan finger guard into the holes on the drive.



A - Front of drive
B - Drive holes
C - Connector tabs

Figure 8.25 Reattach the Fan Finger Guard

5. Push the hooks on the left and right sides of the fan finger guard and click it into place on the drive.

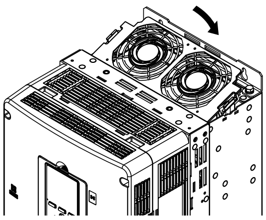


Figure 8.26 Reattach the Fan Finger Guard

6. Energize the drive and set *o4-03 = 0 [Fan.Oper Setting = 0 h]* to reset the cooling fan operation time.

◆ Replace a Fan (Models 2138 to 2313, 4089 to 4296)

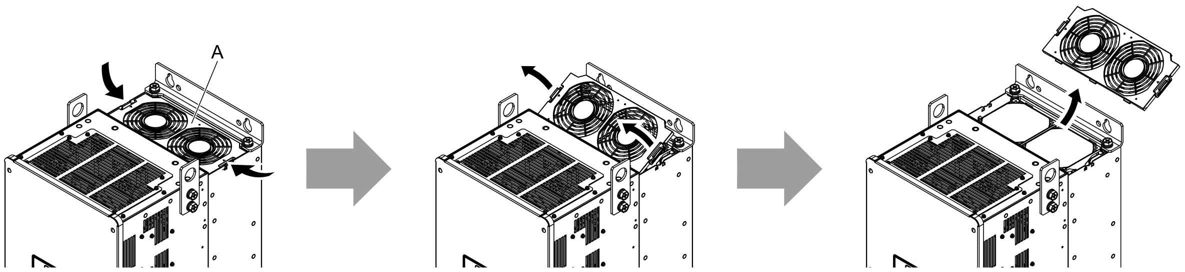
WARNING! *Electrical Shock Hazard. Electrical Shock Hazard. Do not examine, connect, or disconnect wiring on an energized drive. Before servicing, disconnect all power to the equipment and wait for the time specified on the warning label at a minimum. The internal capacitor stays charged after the drive is de-energized. The charge indicator LED extinguishes when the DC bus voltage decreases below 50 Vdc. When all indicators are OFF, measure for dangerous voltages to make sure that the drive is safe. If you do work on the drive when it is energized, it will cause serious injury or death from electrical shock.*

CAUTION! *Burn Hazard. Do not touch a hot drive heatsink. De-energize the drive, wait 15 minutes minimum, and make sure that the heatsink is cool to replace the cooling fans. Failure to obey can cause minor to moderate injury.*

NOTICE: *Follow cooling fan replacement instructions. Replace all fans when performing maintenance to help ensure maximum useful product life. Improper fan replacement could cause damage the drive.*

■ Remove a Fan

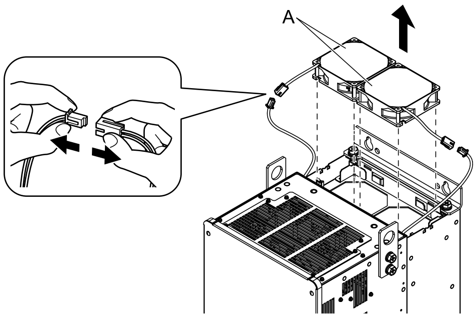
1. To remove the fan finger guard from the drive, push the tabs on the left and right sides of it and pull up the back side of the guard.



A - Fan finger guard

Figure 8.27 Remove the Fan Finger Guard

2. Pull the cooling fan straight up from the drive. Disconnect the power supply connector and remove the fan from the drive.



A - Cooling Fan

Figure 8.28 Remove the Cooling Fan

■ Install a Fan

Reverse the removal procedure to install a cooling fan.

1. Connect the drive and the fan connector.

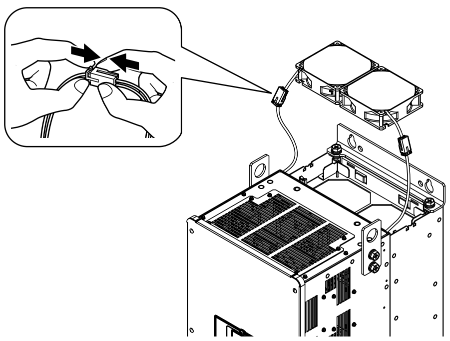
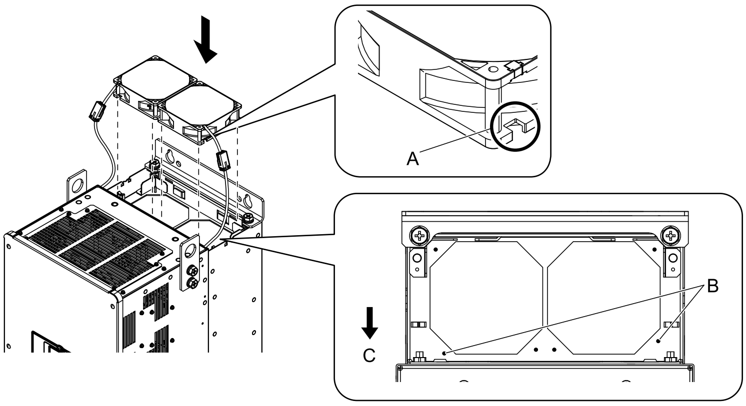


Figure 8.29 Connect Connector

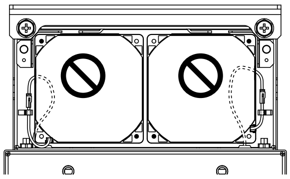
2. Align the notches on the fan with the pins on the drive and install the cooling fan in the drive.



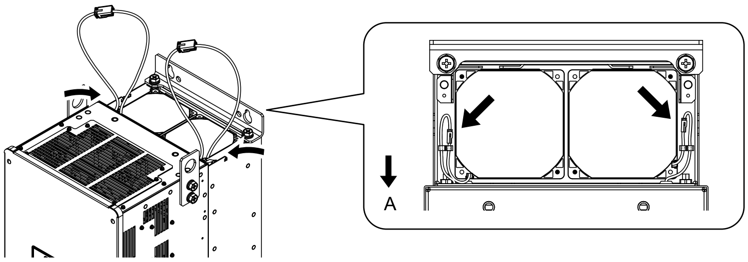
A - Notch on fan
B - Alignment pins on drive
C - Front of drive

Figure 8.30 Install the Cooling Fan

Note:
When you install the cooling fan, make sure that you do not pinch cables between the cooling fan and the drive.



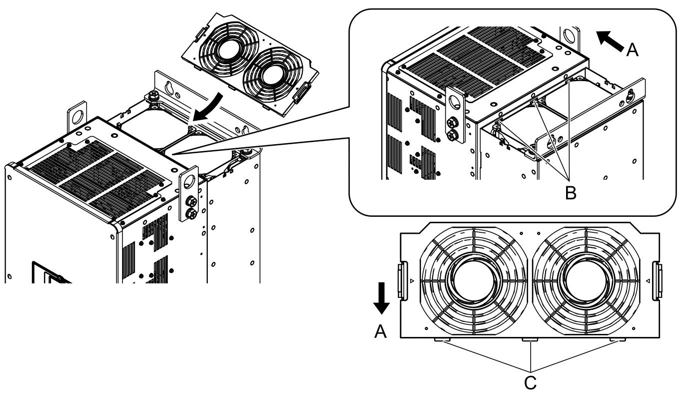
3. Put the cable in the recess of the drive.



A - Front of drive

Figure 8.31 Put the Cable in the Drive Recess

4. Hold the fan finger guard at an angle and put the connector tabs on the fan finger guard into the holes on the drive.



A - Front of drive
B - Drive holes
C - Connector tabs

Figure 8.32 Reattach the Fan Finger Guard

5. Push the hooks on the left and right sides of the fan finger guard and click it into place on the drive.

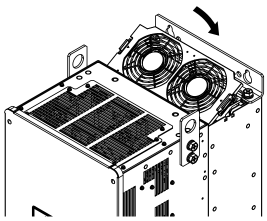


Figure 8.33 Reattach the Fan Finger Guard

6. Energize the drive and set *o4-03 = 0 [Fan.Oper Setting = 0 h]* to reset the cooling fan operation time.

◆ Replace Fans (Models 2360, 2415, 4371, 4389)

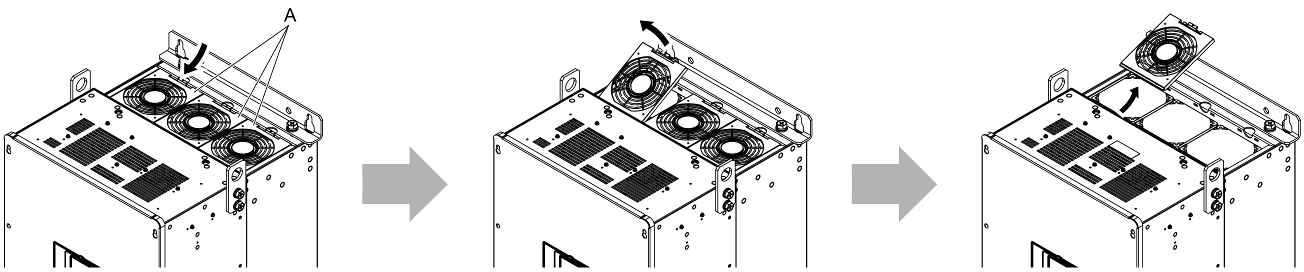
WARNING! *Electrical Shock Hazard. Electrical Shock Hazard. Do not examine, connect, or disconnect wiring on an energized drive. Before servicing, disconnect all power to the equipment and wait for the time specified on the warning label at a minimum. The internal capacitor stays charged after the drive is de-energized. The charge indicator LED extinguishes when the DC bus voltage decreases below 50 Vdc. When all indicators are OFF, measure for dangerous voltages to make sure that the drive is safe. If you do work on the drive when it is energized, it will cause serious injury or death from electrical shock.*

CAUTION! *Burn Hazard. Do not touch a hot drive heatsink. De-energize the drive, wait 15 minutes minimum, and make sure that the heatsink is cool to replace the cooling fans. Failure to obey can cause minor to moderate injury.*

NOTICE: *Follow cooling fan replacement instructions. Replace all fans when performing maintenance to help ensure maximum useful product life. Improper fan replacement could cause damage the drive.*

■ Remove a Fan

1. To remove the fan finger guards from the drive, push the hook on the back side of each guard and pull up.



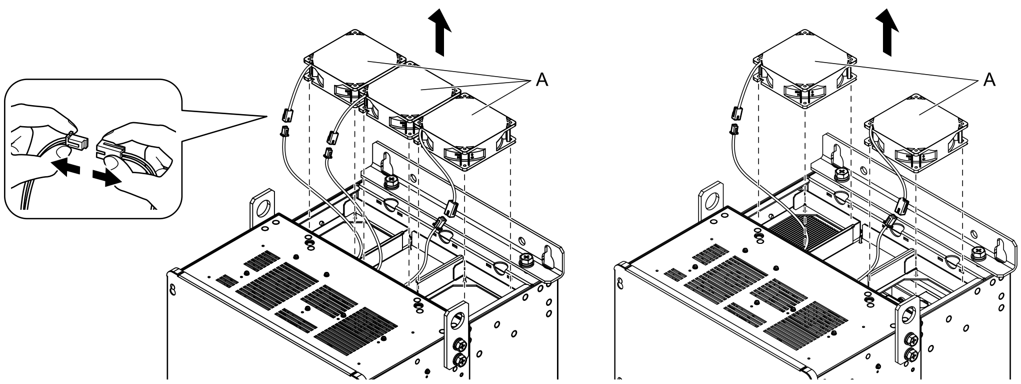
A - Fan finger guard

Figure 8.34 Remove the Fan Finger Guard

2. Pull the cooling fan straight up from the drive. Disconnect the power supply connector and remove the fan from the drive.

Note:

The number of fans is different for different drive models.



A - Cooling Fan

Figure 8.35 Remove the Cooling Fan

■ Install a Fan

Reverse the removal procedure to install a fan unit.

1. Connect the drive and the fan connector.

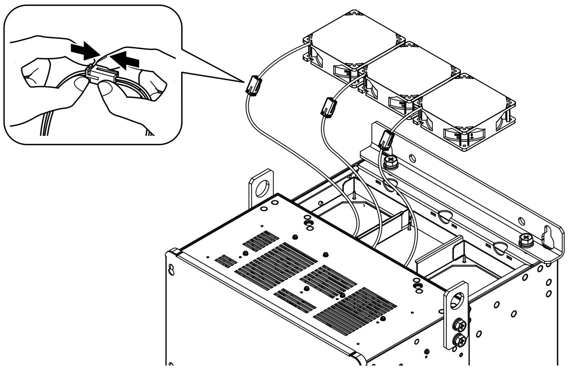
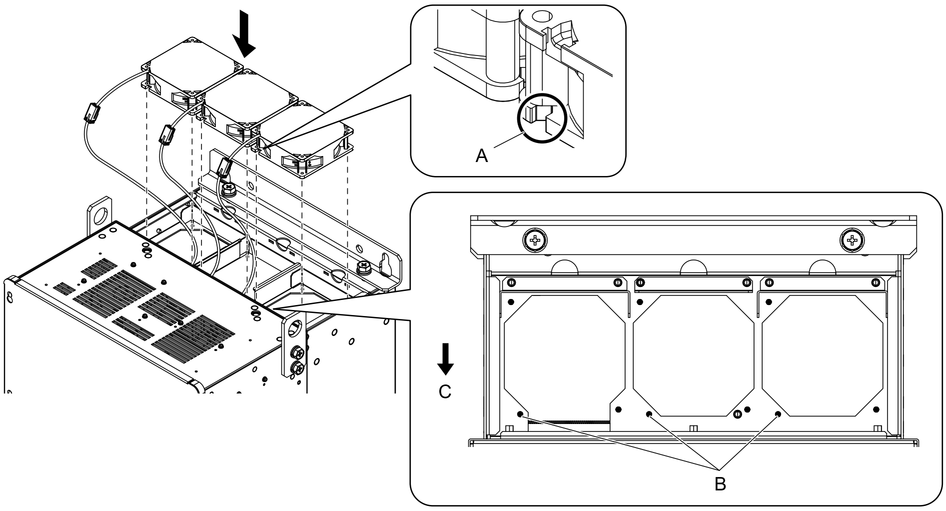


Figure 8.36 Connect Connector

2. Align the notches on the fan with the pins on the drive and install the cooling fan in the drive.

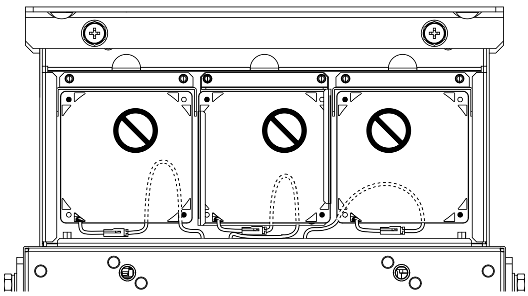


A - Notch on fan
B - Alignment pins on drive
C - Front of drive

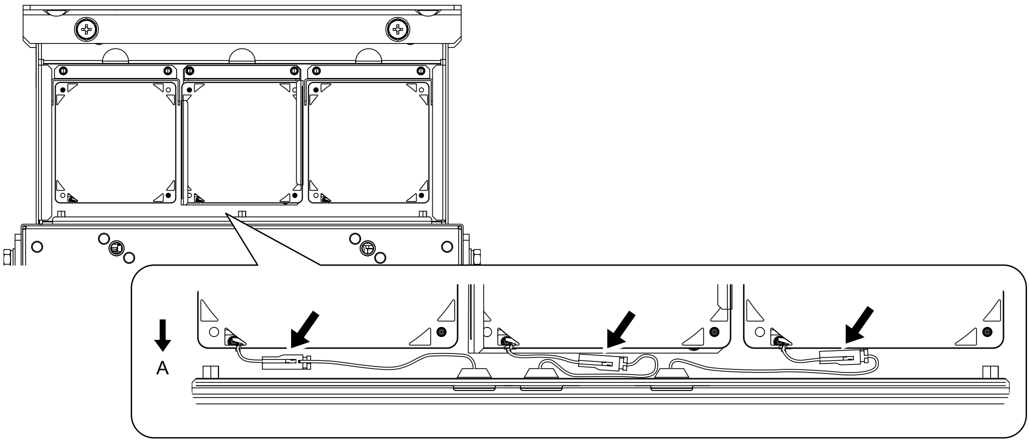
Figure 8.37 Install the Cooling Fan

Note:

When you install the cooling fan, make sure that you do not pinch cables between the cooling fan and the drive.



3. Put the cable in the recess of the drive.



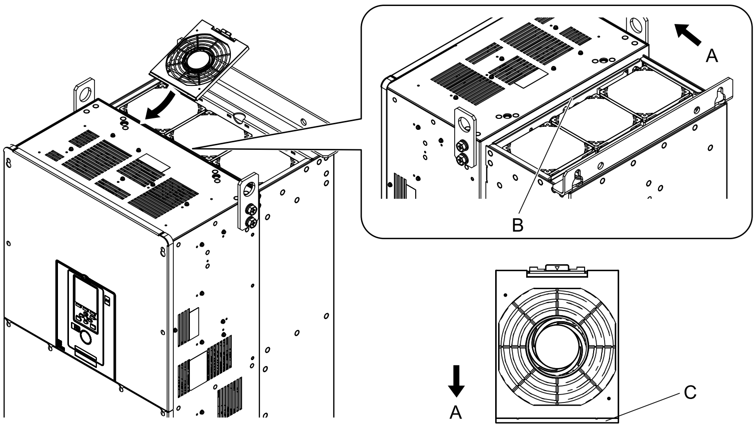
A - Front of drive

Figure 8.38 Put the Cable in the Drive Recess

4. Hold the fan finger guard at an angle and put the connector tabs on the fan finger guard into the holes on the drive.

Note:

When you install the cooling fan, make sure that you do not pinch cables between the fan finger guard and the drive.



A - Front of drive
B - Insertion area
C - Connector tabs

Figure 8.39 Reattach the Fan Finger Guard

5. Push the hook on the back side of the fan finger guard and click it into place on the drive.

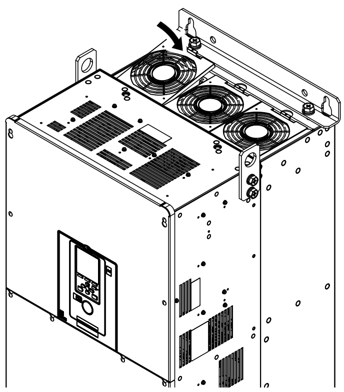


Figure 8.40 Reattach the Fan Finger Guard

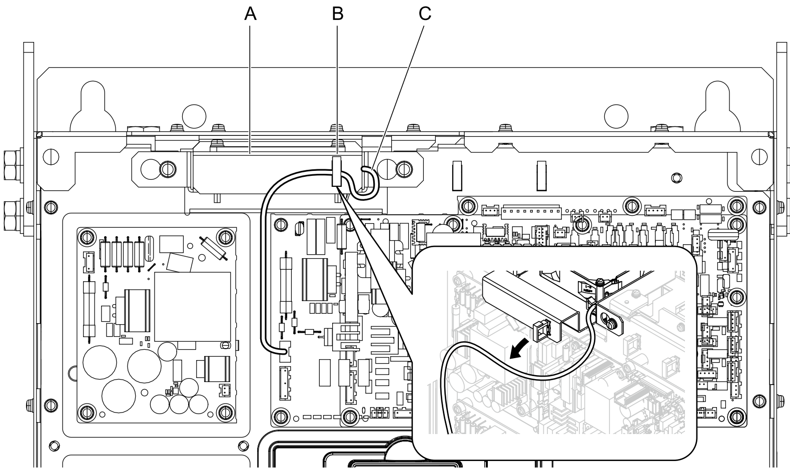
6. Energize the drive and set *o4-03 = 0 [Fan.Oper Setting = 0 h]* to reset the cooling fan operation time.

■ Remove Circulation Fans

Remove the drive cover.

CAUTION! *Crush Hazard. Only loosen the cover screws. Do not fully remove the cover screws. Make sure that the covers do not fall. Missing cover screws can cause the cover to fall and cause injury.*

1. Unplug the fan cable from the hook.

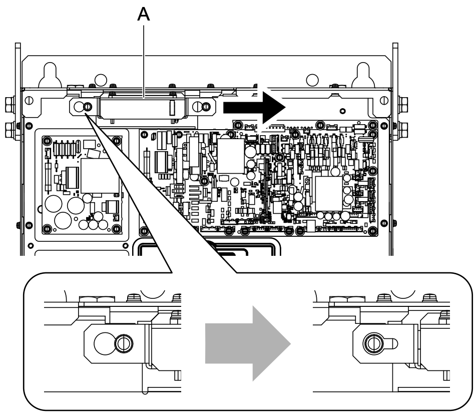


A - Fan unit
B - Hook
C - Fan cable

Figure 8.41 Circulation Fan Components

2. Loosen the fan unit screws and slide the fan unit to the right.

Note:
To remove the fan unit, it is only necessary to loosen the screws.



A - Fan unit

Figure 8.42 Slide the Fan Unit

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3. Disconnect the relay connector then remove the fan unit.

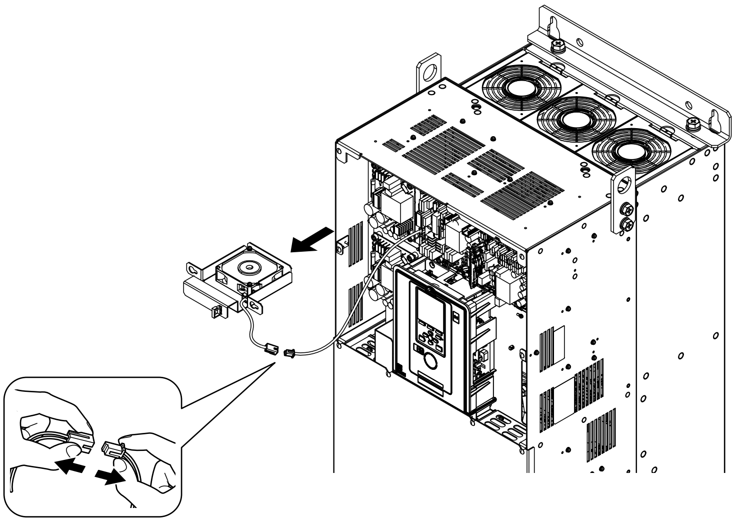
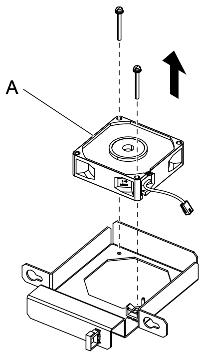


Figure 8.43 Remove the Fan Unit

4. Remove the screws that safety the cooling fan and remove the fan.



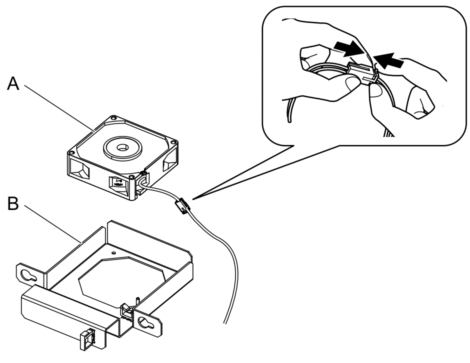
A - Cooling Fan

Figure 8.44 Remove the Cooling Fan

■ Install Circulation Fans

Reverse the removal procedure to install a circulation fan.

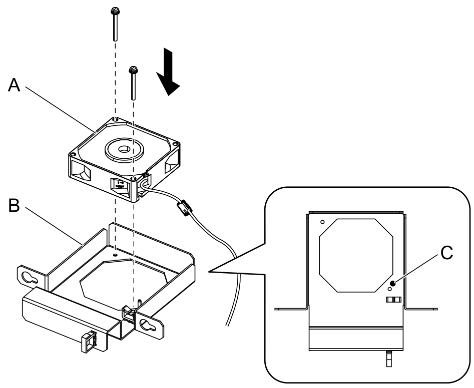
1. Connect the drive and the fan connector.



A - Cooling Fan **B - Fan unit base**

Figure 8.45 Connect Connector

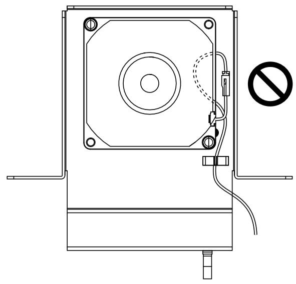
2. Align the pins on the fan unit base with the notches on the fan, and use the screws to safety.
   Tighten the M4 screws to a tightening torque of 0.98 N·m to 1.33 N·m (8.67 lb.·in. to 11.77 lb.·in.).



A - Cooling Fan
B - Fan unit base
C - Alignment pin on fan unit base

Figure 8.46 Install the Cooling Fan

Note:
When you install the cooling fan, make sure that you do not pinch cables between the cooling fan and the fan unit base.



3. Put the fan unit into the specified location and use screws to safety it to the drive.
   Tighten the screws to a tightening torque of 0.98 N·m to 1.33 N·m (8.67 lb.·in. to 11.77 lb.·in.).

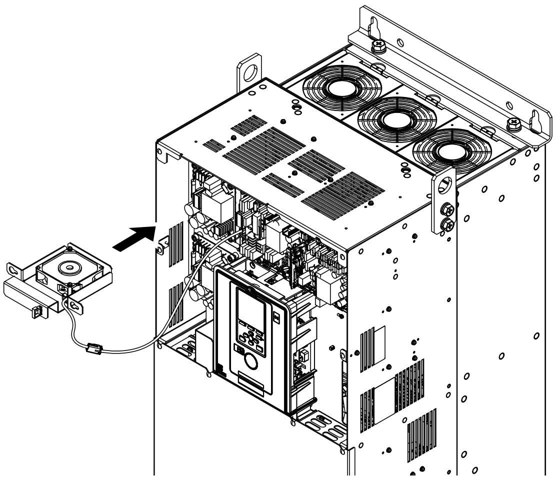


Figure 8.47 Install the Fan Unit

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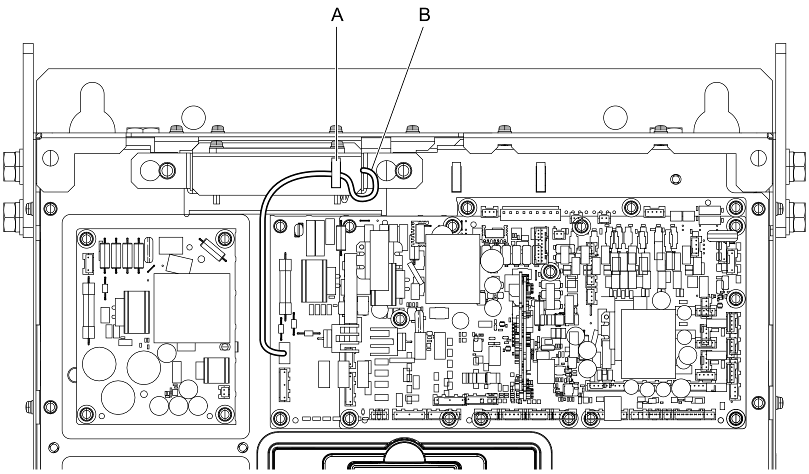
4. Safety the fan cable to the hook.



A - Hook **B - Fan cable**

5. Reattach the drive cover.
6. Energize the drive and set *o4-03 = 0 [Fan.Oper Setting = 0 h]* to reset the cooling fan operation time.

◆ Replace Fans (Models 4453 to 4675)

WARNING! *Electrical Shock Hazard. Electrical Shock Hazard. Do not examine, connect, or disconnect wiring on an energized drive. Before servicing, disconnect all power to the equipment and wait for the time specified on the warning label at a minimum. The internal capacitor stays charged after the drive is de-energized. The charge indicator LED extinguishes when the DC bus voltage decreases below 50 Vdc. When all indicators are OFF, measure for dangerous voltages to make sure that the drive is safe. If you do work on the drive when it is energized, it will cause serious injury or death from electrical shock.*

CAUTION! *Burn Hazard. Do not touch a hot drive heatsink. De-energize the drive, wait 15 minutes minimum, and make sure that the heatsink is cool to replace the cooling fans. Failure to obey can cause minor to moderate injury.*

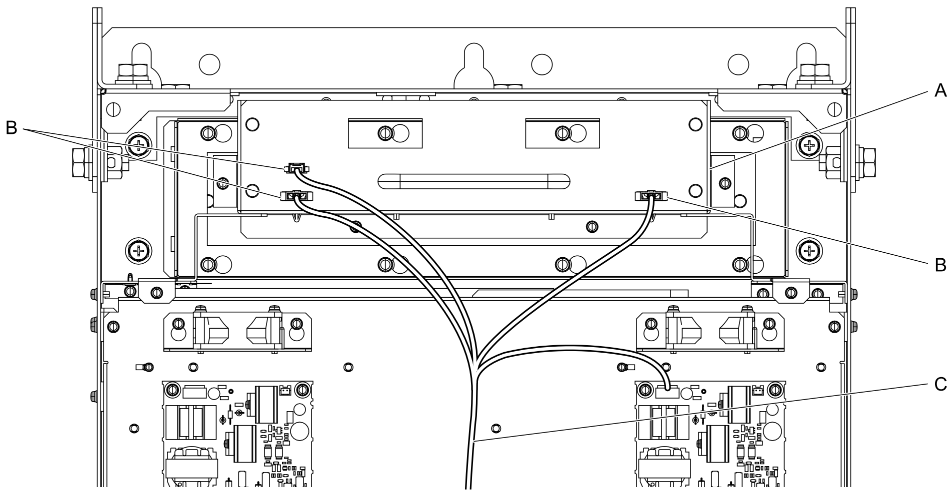
NOTICE: *Follow cooling fan replacement instructions. Replace all fans when performing maintenance to help ensure maximum useful product life. Improper fan replacement could cause damage the drive.*

■ Remove a Fan

1. Remove the drive cover.

   CAUTION! *Crush Hazard. Only loosen the cover screws. Do not fully remove the cover screws. Make sure that the covers do not fall. Missing cover screws can cause the cover to fall and cause injury.*

2. Unplug the fan cables from the fan connectors.

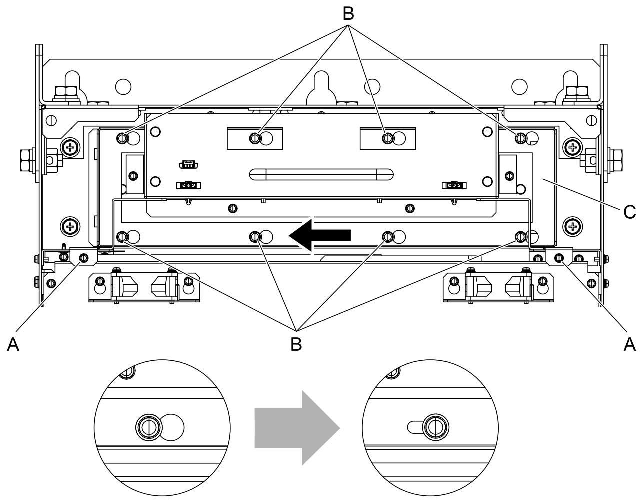


A - Fan unit **C - Fan cable**
B - Fan connector

Figure 8.48 Circulation Fan Components

3. Loosen the fan unit screws and slide the slide panel to the left.

Note:
To remove the fan unit, it is only necessary to loosen the Screws B.



A - Screws A
B - Screws B
C - Slide panel

Figure 8.49 Slide the Slide Panel

4. Remove the fan unit and the slide panel at the same time.

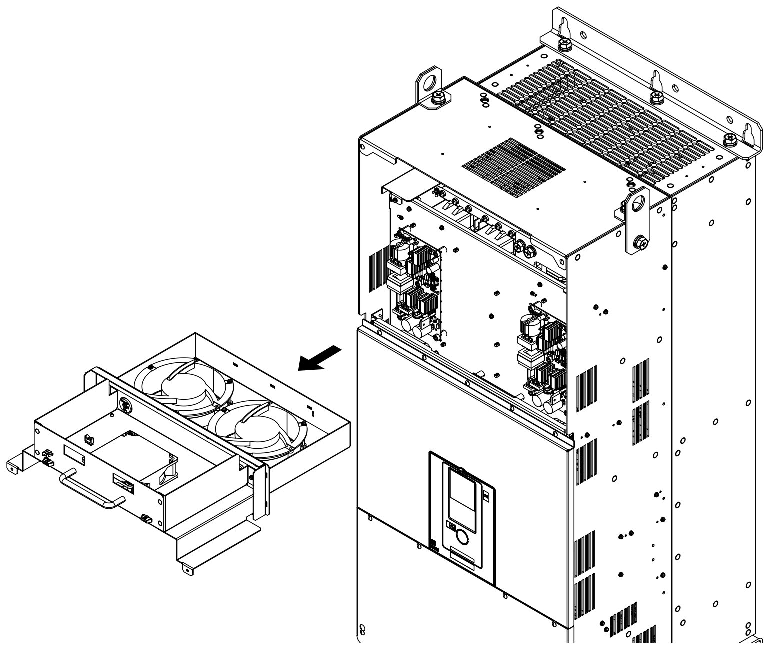
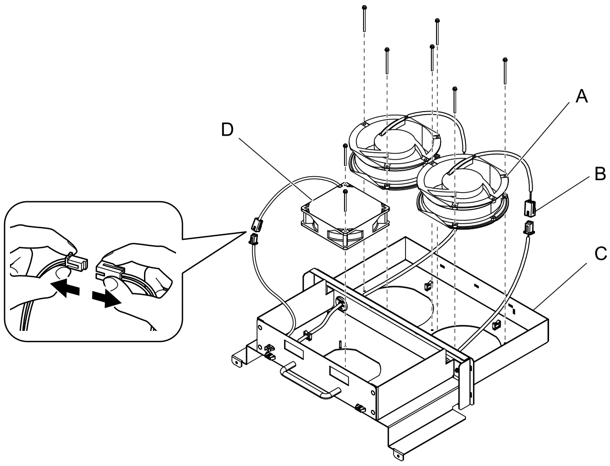


Figure 8.50 Remove the Fan Unit

5. Unplug the power supply connector, remove the screws that safety the cooling fan and circulation fan, and then remove the fans.



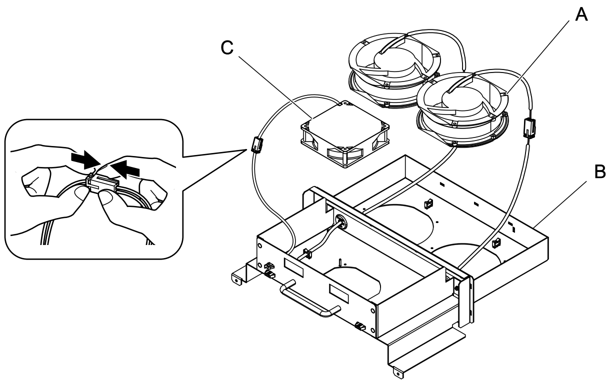
A - Cooling Fan
B - Relay connector
C - Fan unit base
D - Circulation Fans

Figure 8.51 Remove the Cooling Fan

Install a Fan

Reverse the removal procedure to install a cooling fan.

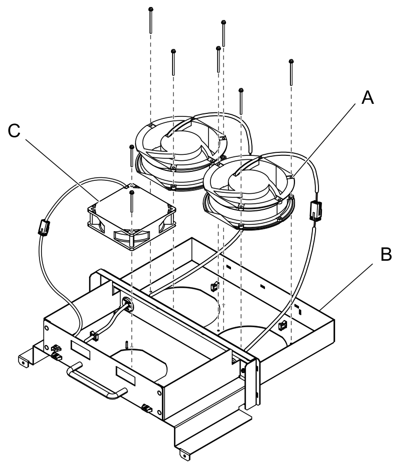
1. Connect the drive and the fan connector.



A - Cooling Fan
B - Fan unit base
C - Circulation Fans

Figure 8.52 Connect Connector

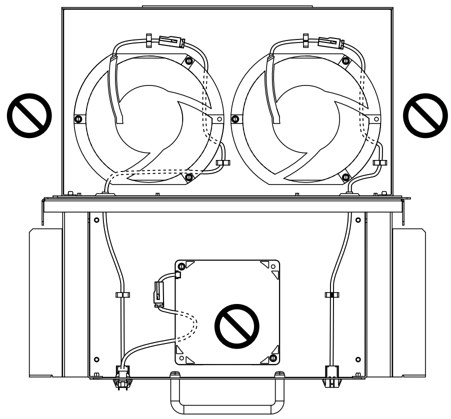
2. Align the pins on the fan unit base with the notches on the fan, and use the screws to safety.
   Tighten the M4 screws to a tightening torque of 0.98 N·m to 1.33 N·m (8.67 lb.·in. to 11.77 lb.·in.).



A - Cooling Fan **C - Circulation Fans**
B - Fan unit base

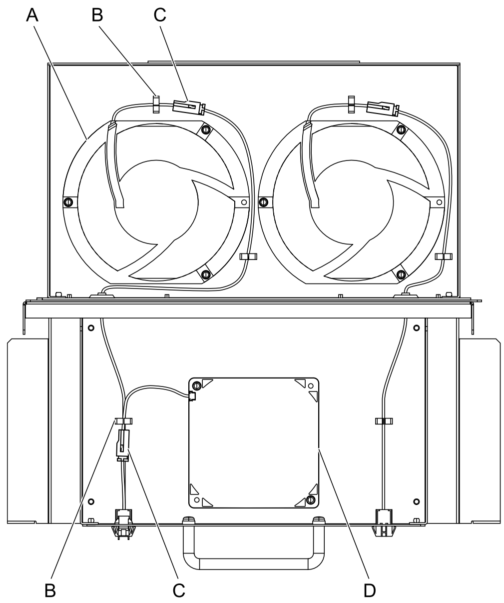
Figure 8.53 Install the Cooling Fan

Note:
When you install the cooling fan, make sure that you do not pinch cables between the cooling fan and the fan unit base.



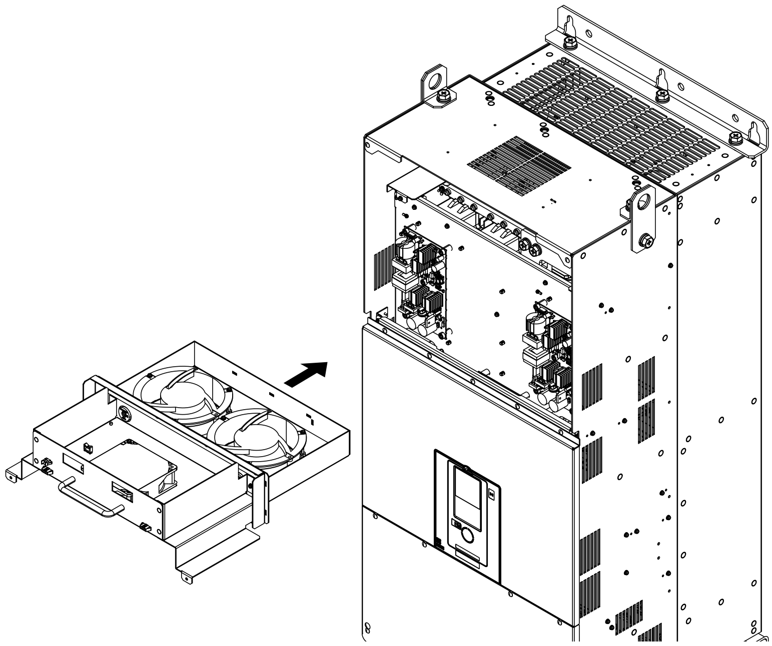
3. Put the cables in their initial locations.

Note:
Safety the relay cable to the hook.

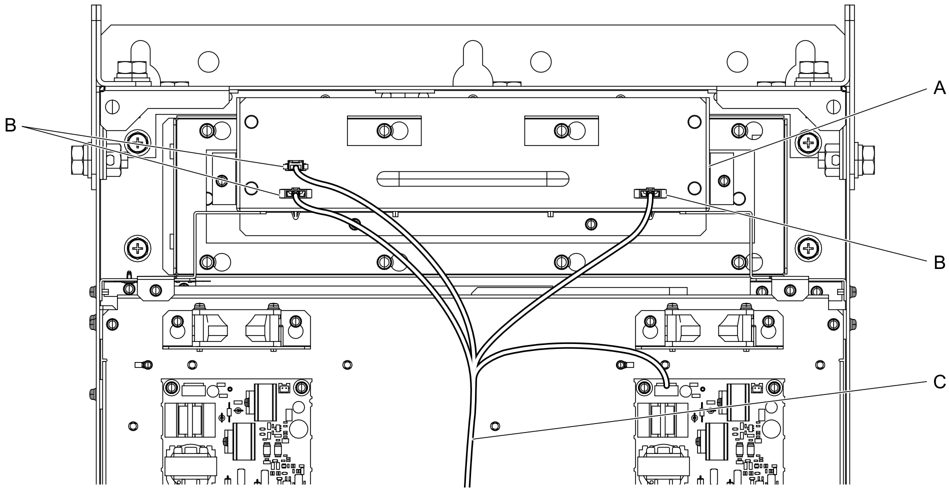


A - Cooling Fan **C - Relay connector**
B - Cable hook **D - Circulation Fans**

4. Put the fan unit into the specified location and use screws to safety it to the drive.
   Tighten the screws to a tightening torque of 1.96 N·m to 2.53 N·m (17.35 lb.·in. to 22.39 lb.·in.).



5. Connect the fan cable to the fan connector.



A - Fan unit
B - Fan connector
C - Fan cable

Figure 8.54 Connect Cooling Fan Connectors

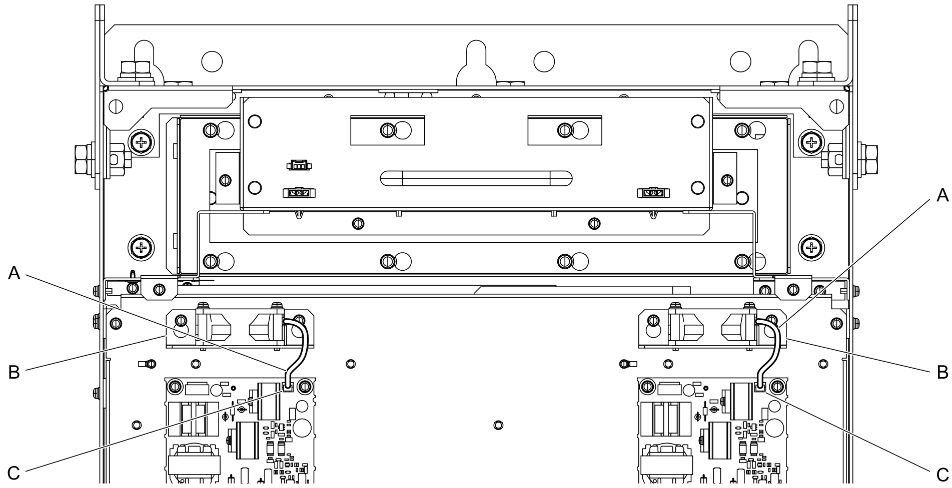
6. Reattach the drive cover.
7. Energize the drive and set *o4-03 = 0 [Fan.Oper Setting = 0 h]* to reset the cooling fan operation time.

■ Remove the Circuit Board Cooling Fan

Remove the drive cover.

CAUTION! *Crush Hazard. Only loosen the cover screws. Do not fully remove the cover screws. Make sure that the covers do not fall. Missing cover screws can cause the cover to fall and cause injury.*

1. Unplug the fan cables from the fan connectors.

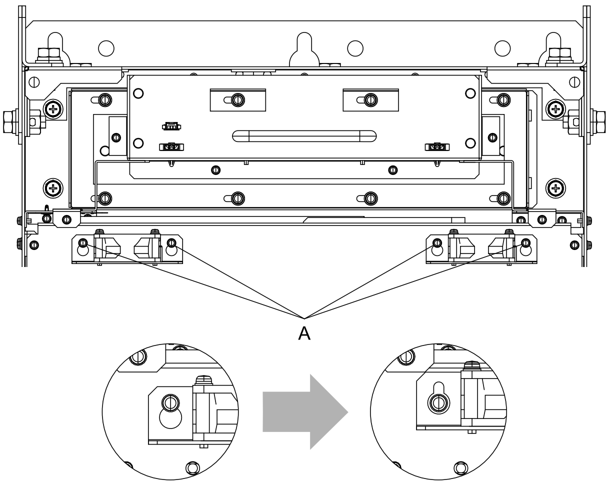


A - Fan cable
B - Circuit board cooling fan unit
C - Fan connector

Figure 8.55 Circulation Fan Components

2. Loosen the circuit board cooling fan unit screws and slide the circuit board cooling fan unit up.

Note:
To remove the fan unit, it is only necessary to loosen the screws.



A - Screws

Figure 8.56 Slide the Circuit Board Cooling Fan Unit

3. Remove the circuit board cooling fan unit.

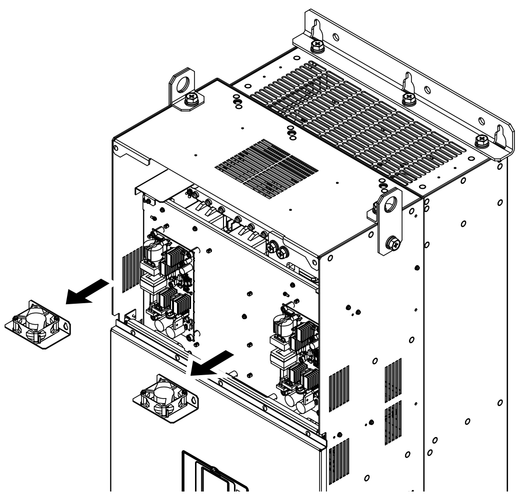


Figure 8.57 Remove the Circuit Board Cooling Fan Unit

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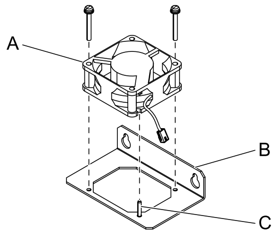
4. Remove the screws that safety the circuit board cooling fan and remove the fan.



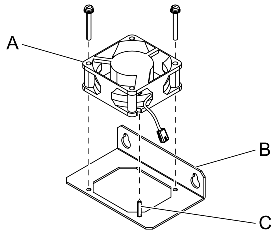
A - Circuit Board Cooling Fans
B - Fan unit base
C - Alignment pin on fan unit base

Figure 8.58 Remove the Circuit Board Cooling Fan

■ Attach the Circuit Board Cooling Fan

Reverse the removal procedure to install a cooling fan.

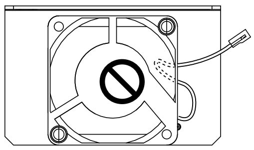
1. Align the pins on the fan unit base with the notches on the fan and put the circuit board cooling fan in the fan unit, then use the screws to safety the circuit board cooling fan to the fan unit base.
   Tighten the M4 screws to a tightening torque of 0.98 N·m to 1.33 N·m (8.67 lb.·in. to 11.77 lb.·in.).



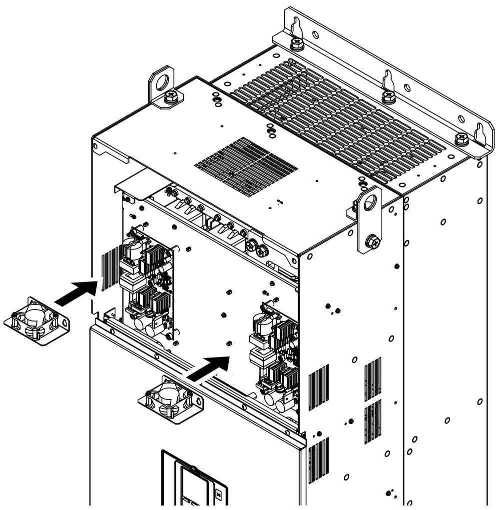
A - Circuit Board Cooling Fans
B - Fan unit base
C - Alignment pin on fan unit base

Figure 8.59 Attach the Circuit Board Cooling Fan

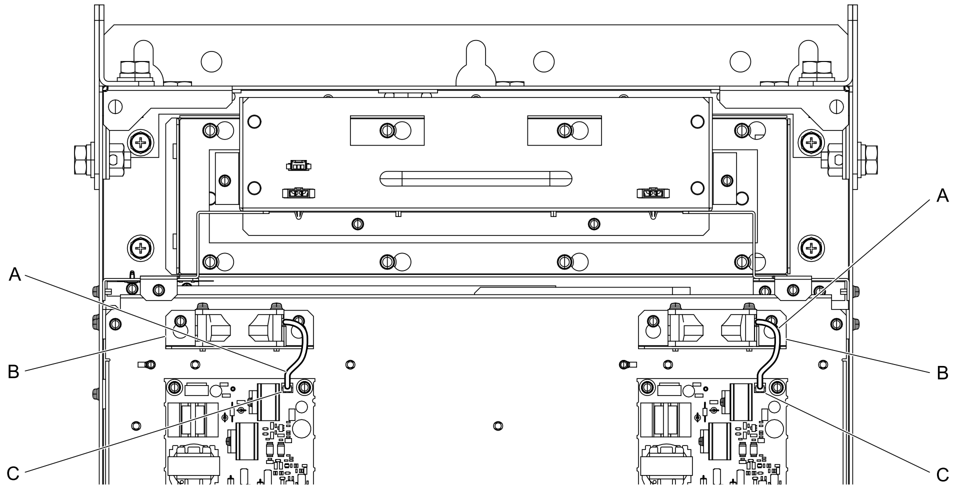
Note:
When you install the circuit board cooling fan, make sure that you do not pinch cables between the circuit board cooling fan and the fan unit base.



2. Put the fan unit into the specified location and use screws to safety it to the drive.
   Tighten the screws to a tightening torque of 0.98 N·m to 1.33 N·m (8.67 lb.·in. to 11.77 lb.·in.).



3. Connect the fan cable to the fan connector.



A - Fan cable
B - Circuit board cooling fan unit
C - Fan connector

Figure 8.60 Connect Cooling Fan Connectors

4. Reattach the drive cover.
5. Energize the drive and set *o4-03 = 0 [Fan.Oper Setting = 0 h]* to reset the cooling fan operation time.

8.5 Replace the Drive

WARNING! *Electrical Shock Hazard. While the drive is ON, never attempt to change any wiring, disconnect any option cards or connectors, or replace the cooling fan. Before performing any repairs, shut OFF the power supply to the drive and verify that there is no residual voltage in the unit. Failure to do so may result in serious electric shock.*

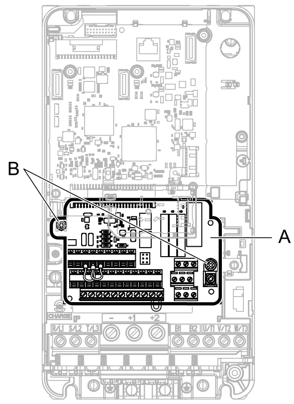
WARNING! *Electrical Shock Hazard. Only let authorized persons install, wire, maintain, examine, replace parts, and repair the drive. Failure to obey can cause death or serious injury.*

WARNING! *Electrical Shock Hazard. Electrical Shock Hazard. Do not examine, connect, or disconnect wiring on an energized drive. Before servicing, disconnect all power to the equipment and wait for the time specified on the warning label at a minimum. The internal capacitor stays charged after the drive is de-energized. The charge indicator LED extinguishes when the DC bus voltage decreases below 50 Vdc. When all indicators are OFF, measure for dangerous voltages to make sure that the drive is safe. If you do work on the drive when it is energized, it will cause serious injury or death from electrical shock.*

NOTICE: *Observe correct electrostatic discharge (ESD) procedures when touching the drive and circuit boards. Failure to obey can cause ESD damage to the drive circuitry.*

◆ About the Control Circuit Terminal Block

You can remove the control circuit terminal block of the drive and install a new terminal block. If there is a failure in the drive, you can use this feature to easily replace the control circuit terminal block.



A - Control circuit terminal block **B - Control circuit terminal block fastening screw**

Figure 8.61 Control Circuit Terminal Block

◆ Notes on Wiring the Main Circuit Terminal Block

Read these notes before you wire the main circuit terminal block.

Note:
- Use UL-Listed, vinyl-coated insulated copper wires for operation with a continuous maximum permitted temperature of 75 °C at 600 V
- Remove all unwanted objects that are near the terminal block connections.
- Remove the insulation from the connection wires to the wire stripping lengths shown in the manual.
- Do not use bent or crushed wires. Remove the damaged end of the wire before you use it. Incorrect connections can cause death or serious injury from fire.
- Do not solder stranded wire. Soldered wire connections can become loose over time and cause unsatisfactory drive performance.
- If you use stranded wire, make sure that all of the wire strands are in the connection. Also, do not twist the stranded wire too much. Incorrect connections can cause death or serious injury from fire.
- Put the wire all the way into the terminal block. Remove the insulation from the wire to the recommended wire stripping length to fit the wire with insulation in the plastic housing.
- Use a torque driver, torque ratchet, or torque wrench for the screws. A slotted driver or a hex tool will be necessary to wire the screw clamp terminal. Use applicable tools as specified by the recommended conditions in the product manual.
- If you use power tools to tighten the terminal screws, use a low speed setting (300 to 400 r/min). Failure to obey can cause damage to the terminal screws.
- Wire gauges on existing drive models to be replaced may not match wire gauge ranges on this drive.
- Do not tighten the terminal screws at an angle of 5 degrees or more. Failure to obey can cause damage to the terminal screws.

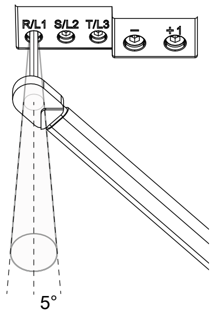


Figure 8.62 Permitted Angle

- Put the bit all the way into the hex socket to tighten the hex socket cap screw.
- When tightening slotted screws, hold the straight-edge screwdriver perpendicularly to the screw. Do not allow the tip of the screwdriver to shift or protrude from the groove of the screw.

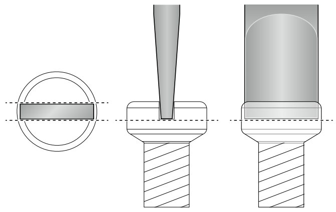
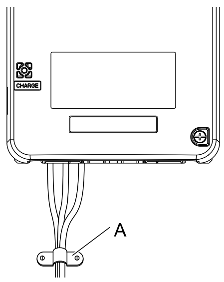


Figure 8.63 Tightening Slotted Screws

- After connecting the wires to the terminal block, lightly pull on the wires to make sure that they do not come out of the terminals.
- Remove the correct section of the wiring cover to make wiring easier.
- Do not let strain on the wiring cause damage. Use a strain relief near the wiring to release the tension.



A - Strain relief

Figure 8.64 Strain Relief Example

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Table 8.11 Recommended Wiring Tools

Screw Size	Screw Shape	Adapter	Bit		Torque Driver Model (Tightening Torque)	Torque Wrench
			Model	Manufacturer		
M4	Slotted (-)	Bit	SF-BIT-SL 1,0X4,0-70	PHOENIX CONTACT	TSD-M 3NM (1.2 - 3 N·m)	-
M5 *1	Slotted (-)	Bit	SF-BIT-SL 1,2X6,5-70	PHOENIX CONTACT	Wire Gauge ≤ 25 mm 2 (AWG 10): TSD-M 3NM (1.2 - 3 N·m)	Wire Gauge ≤ 25 mm 2 (AWG 10): -
					Wire Gauge ≥ 30 mm 2 (AWG 8): -	Wire Gauge ≥ 30 mm 2 (AWG 8): 4.1 - 4.5 N·m *2 *3
M6	Hex socket cap (WAF: 5 mm)	Bit	SF-BIT-HEX 5-50	PHOENIX CONTACT	-	5 - 9 N·m *2 *3
	Slotted (-)	Bit	SF-BIT-SL 1,2X6,5-70	PHOENIX CONTACT	-	3 - 3.5 N·m *2 *3
M8	Hex socket cap (WAF: 6 mm)	Bit	SF-BIT-HEX 6-50	PHOENIX CONTACT	-	8 - 12 N·m *2 *3
M10	Hex socket cap (WAF: 8 mm)	Bit	SF-BIT-HEX 8-50	PHOENIX CONTACT	-	12 - 14 N·m *2 *3

*1 When wiring drive models 2056 and 4089 and smaller, select the correct tools for the wire gauge.
*2 Use 6.35 mm (0.25 in) bit socket holder.
*3 Use a torque wrench that can apply this torque measurement range.

◆ Remove the Control Circuit Terminal Block

Remove the keypad and the drive front cover before doing these steps.

1. Loosen the screws on the control circuit terminal block.

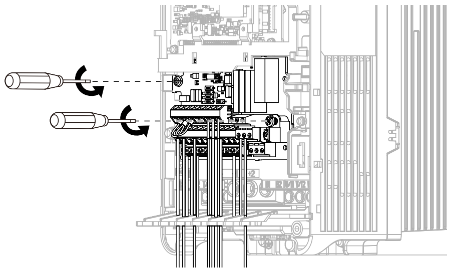


Figure 8.65 Loosen the Screws

2. Slide the wired control circuit terminal block down and remove it.

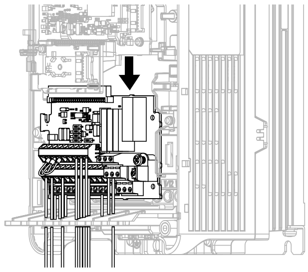
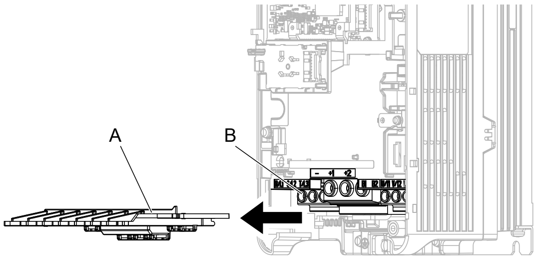


Figure 8.66 Remove the Control Circuit Terminal Block

◆ Wire a New Drive

Remove the keypad, front cover, and control circuit terminal block of the new drive. Wire the drive to the main circuit terminal block before you install a wired control circuit terminal block.

1. Pull the wiring cover away from the drive to remove it.



A - Wiring cover B - Main circuit terminal block

Figure 8.67 Remove the Wiring Cover

2. Loosen the main circuit terminal block screws to fully open the terminal block opening.

Note:
The terminal block openings ship from the factory as fully open.

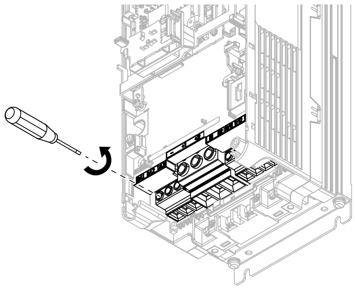


Figure 8.68 Loosen Terminal Block Screws

3. Put a wire with prepared ends into the main circuit terminal block.

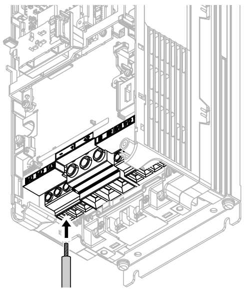


Figure 8.69 Install the Electrical Wire

Note:
If there is a jumper between terminals +1 and +2, loosen the terminal block screws to remove the jumper before you wire to terminals +1 and +2.

4. Tighten the screws to the specified torque.

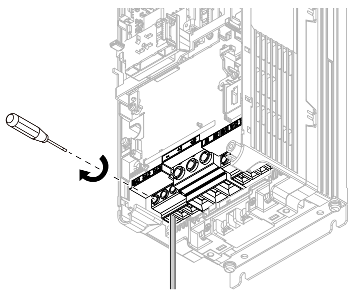
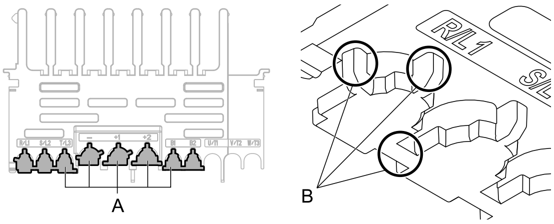


Figure 8.70 Tighten Terminal Block Screws

5. Check the terminal sign that you wired and use a nipper to clip the specified cutaway section of the wiring cover.



A - Cutaway sections **B - Clip here with nippers**

Figure 8.71 Clip the Cutaway Section of the Wiring Cover

Note:
- Different drive models have different wiring cover shapes.
- Only clip the section of the wiring cover that applies to the wired terminal. If you clip areas that do not apply to wired terminals, the protective enclosure will not keep its IP20 protective level.
- Be careful when clipping the cutaway section of the wiring cover, as the section may fly out in unpredictable directions.
- Make sure that the clipped section does not cause damage to the wires.
- If you use wires that are not specified by the manufacturer, the protective enclosure could lose its IP20 protective level, although the wiring cover is correct. Contact the manufacturer or your nearest sales representative for more information.

6. Put the wiring cover in its initial position. Put the cables through the holes that you cut out of the wiring cover.

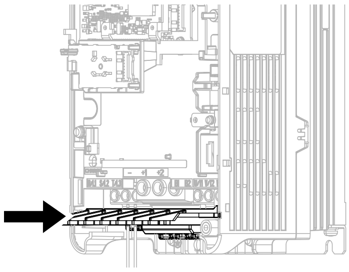
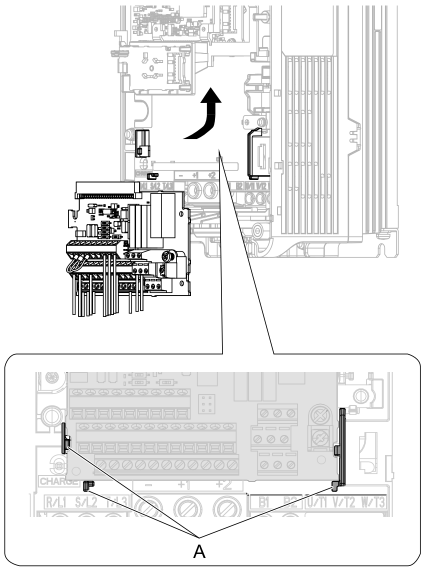


Figure 8.72 Reattach the Wiring Cover

◆ Connect the Control Circuit Terminal Block

1. To put a wired control circuit terminal block in the drive, align it with the guides and move it straight up.



A - Guides

Figure 8.73 Put the Terminal Block into the Connector

2. Tighten the M3 screws to a tightening torque of 0.5 N·m to 0.6 N·m (4.4 lb.·in. to 5.3 lb.·in.).

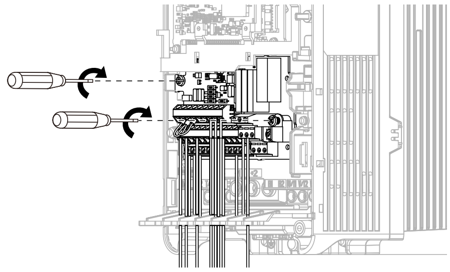


Figure 8.74 Safety the Terminal Block

3. Install the front cover and the keypad to their initial positions.
4. Check *o2-04 [Drive KVA Selection]*.

Note:
- When you save parameter information in a keypad that you installed before you replaced the terminal block, make sure that you use that keypad to restore the parameter data.
- To reset the performance life monitors for the components, set Maintenance Period *o4-01 to o4-13*.

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8.6 Replace the Keypad Battery

When the keypad battery is expired, the date and time go back to the default settings. Use this procedure to replace the battery.

WARNING! *Preventing Fire. Handle keypad batteries properly. Do not attempt to charge the battery or disassemble the keypad. Improper handling may result in batteries bursting and igniting, which could cause fire and injury.*

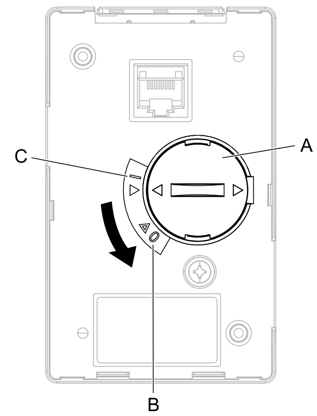
To replace the battery, use a type CR2016 battery with these properties:

- Nominal voltage: 3 V
- Operating temperature range: -20 °C to +85 °C (-4 °F to +185 °F)

WARNING! *Preventing Fire. Do not disassemble batteries. Do not expose batteries to heat or fire. Improper handling may result in batteries bursting and igniting, which could cause fire and injury.*

NOTICE: *The battery remains in use even when power to the drive has been shut off. Be sure to also remove the battery in the keypad when the drive will be shut off for long periods of time. Replace the battery with a new one immediately after the expected lifespan has passed. A dead battery left inside the keypad may leak and damage the keypad and drive.*

1. De-energize the drive and remove the keypad.
2. Use a slotted screwdriver to turn the battery cover counterclockwise and remove the cover.

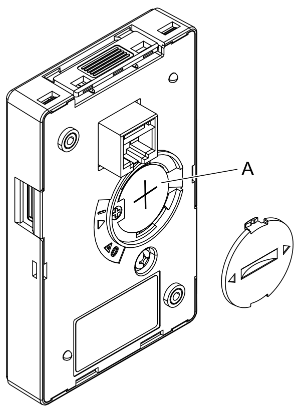


A - Battery cover **C - Closed**
B - Opened

Figure 8.75 Remove the Battery Cover

3. Remove the used battery from the keypad.
4. Insert the new battery.

Note:
- The battery cover side is the positive pole. Make sure that the polarity is correct when you put the battery in the keypad.
- Discard the used battery as specified by local regulations.



A - Battery

Figure 8.76 Insert the New Battery

5. Put the battery cover on the keypad and use a slotted screwdriver to turn the battery cover clockwise to close it.
6. Install the keypad on the drive.

8.7 Storage Guidelines

The chemicals in the electrolytic capacitors and other electronic parts of the drive change over time. When you store the drive for long periods of time, use the information in this section to help keep the performance life estimates.

◆ Storage Location

- Temperature and Humidity
  Put the drive in a location where the temperature is between -10 °C to +40 °C (14 °F to 104 °F) and the relative humidity is 95% or less. Do not put the drive in direct sunlight or where there will be condensation or ice. When you are storing the drive for a maximum of one month, you can put the drive in a location where the temperature is -20 °C to +70 °C (4 °F to 158 °F).

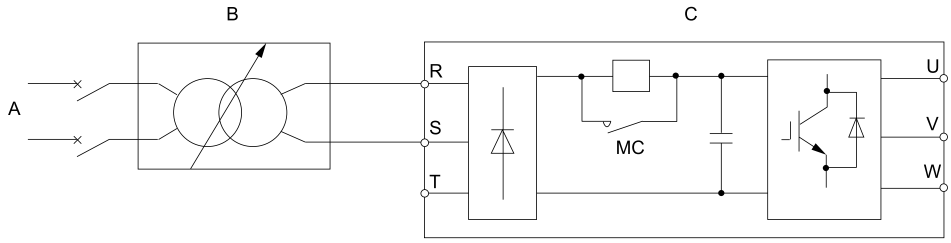
  Note:
  Correctly package and store the drive during shipping to prevent vibration and shock damage.
- Dust and Oil Mist
  Do not keep the drive locations with dust or oil mist. For example, cement factories and cotton mills.
- Corrosive Gas
  Do not keep the drive in locations with corrosive gas. For example, chemical plants, refineries, and sewage plants.
- Salt Damage
  Do not keep the drive in salty locations. For example, locations near the ocean, and salt damage-designated locations.

Do not keep the drive in unsatisfactory locations. Keep all drives in storage rooms that are safe from unsatisfactory elements.

◆ Regluar Application of Power

To prevent deterioration of the capacitors, the manufacturer recommends that you apply power to the drive a minimum of one time each year for a minimum of 30 minutes.

If you store the drive for longer than two years and do not apply power, the manufacturer recommends that you use a variable power source and gradually increase the power from 0 V to the rated drive voltage over a period of 2 to 3 minutes. Apply power for a minimum of 1 hour with no load to reform the main circuit electrolytic capacitor. When you operate the drive after you apply power, wire the drive correctly and check for drive faults, overcurrents, motor vibration, motor speed differences, and other defects during operation.



A - AC power supply
B - Variable power source
C - Drive

Figure 8.77 Power Distribution Method

Periodic Inspection and Maintenance

8

9

Disposal

9.1 Safety Precautions

DANGER

Electrical Shock Hazard

Make sure that all electrical connections are correct and install all drive covers before energizing the drive. Use terminals for their intended function only.

Incorrect wiring or ground connections, and incorrect repair of protective covers can cause death or serious injury.

WARNING

Electrical Shock Hazard

Only let authorized persons install, wire, maintain, examine, replace parts, and repair the drive.

Failure to obey can cause death or serious injury.

Do not work on the drive or around the drive while wearing loose clothing or jewelry. Tighten loose clothing and remove all metal objects such as watches or rings.

Failure to obey can cause death or serious injury.

Preventing Fire

Handle keypad batteries properly. Do not attempt to charge the battery or disassemble the keypad.

Improper handling may result in batteries bursting and igniting, which could cause fire and injury.

Do not disassemble batteries. Do not expose batteries to heat or fire.

Improper handling may result in batteries bursting and igniting, which could cause fire and injury.

Sudden Movement Hazard

Do not do work on the drive without eye protection. Wear eye protection before you start work on the drive.

Failure to obey could cause serious injury or death.

Crush Hazard

Only approved personnel can operate a crane or hoist to move the drive.

Failure to obey can cause death or serious injury from falling equipment.

Use a lifting mechanism made to move large drives when necessary.

Failure to obey can cause death or serious injury from falling equipment.

CAUTION

Crush Hazard

Do not hold the drive by the front cover or terminal cover. Tighten the screws correctly before moving the drive.

Failure to obey can cause minor to moderate injury.

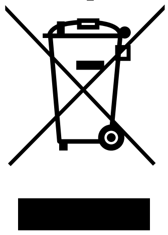
NOTICE

The battery remains in use even when power to the drive has been shut off. Be sure to also remove the battery in the keypad when the drive will be shut off for long periods of time. Replace the battery with a new one immediately after the expected lifespan has passed.

A dead battery left inside the keypad may leak and damage the keypad and drive.

9.2 Disposal Instructions

Correctly discard the drive, packing material, battery, and microSD card as specified by regional, local, and municipal laws and regulations for this product.



Note:
- Remove the battery and microSD card from the keypad before you discard the drive.
- We recommend that customers physically destroy the microSD card in a shredder or use data wipe software to fully erase the card.

10

Specifications

10.1 Drive Duty Modes

The drive has two duty modes from which to select for the application: Heavy Duty (HD) and Normal Duty (ND). When *E1-01 [Input AC Supply Voltage]* ≥ 460 V, the specifications listed here change.

- The input power kVA
- The maximum applicable motor output
- The rated input current
- The rated output capacity
- The rated output current

Table 10.1 Drive Duty Modes

Duty Rating	C6-01 Setting	Application	Default Carrier Frequency	Overload Tolerance (oL2 [Drive Overload])
Heavy Duty Rating (HD)	0	• Extruder • Conveyor • Constant torque or high overload capacity	2 kHz	150% rated output current for 60 seconds
Normal Duty Rating (ND)	1	• Fan • Pump • Blower • Variable speed control	2 kHz Swing-PWM	110% rated output current for 60 seconds

10.2 Model Specifications (200 V Class)

Table 10.2 Rating (200 V Class)

Model			2004	2006	2010	2012	2018	2021	2030	2042
Maximum Applicable Motor Output (kW)		HD1 *1	0.55	0.75	1.5	2.2	3	4	5.5	7.5
		ND1 *2	0.75	1.1	2.2	3	4	5.5	7.5	11
Maximum Applicable Motor Output (HP)		HD1 *1	1/2	1	2	3	4	5	7 1/2	10
		ND1 *2	3/4	1 1/2	3	4	5	7 1/2	10	15
Input	Rated Input Current (A)	HD1 (AC)	3.6	4.8	8.9	12.7	17	20.7	30	40.3
		HD1 (DC)	4.5	5.9	11	16	21	25	37	49
		ND1 (AC)	4.8	6.7	12.7	17	20.7	30	40.3	52
		ND1 (DC)	5.9	8.2	16	21	25	37	49	71
Output	Rated Output Capacity (kVA)	HD1 *3	1.2	1.9	3.0	4.2	5.3	6.7	9.5	12.6
		ND1 *4	1.3	2.3	3.7	4.6	6.7	8.0	11.4	16.0
	Rated Output Current (A)	HD1	3.2	5	8	11	14	17.5	25	33
		ND1	3.5	6	9.6	12.2	17.5	21	30	42
	Overload Tolerance		• HD: 150% of the rated output current for 60 seconds The permitted frequency of overload is once every 10 minutes. • ND: 110% of the rated output current for 60 seconds The permitted frequency of overload is once every 10 minutes. **Note:** Derating may be necessary for applications that start and stop frequently.							
	Carrier Frequency		HD1: 8 kHz without derating the drive capacity. ND1: 2 kHz without derating the drive capacity. Derate the drive capacity to use values to 15 kHz maximum.							
	Maximum Output Voltage		Three-phase 200 V to 240 V **Note:** The maximum output voltage is proportional to the input voltage.							
	Maximum Output Frequency		• Advanced Open Loop Vector Control (AOLV) and EZ Open Loop Vector Control (EZOLV): 120 Hz • Closed Loop V/f Control (CL-V/f), Closed Loop Vector Control (CLV), Advanced Open Loop Vector Control for PM (AOLV/PM), and Closed Loop Vector Control for PM (CLV/PM): 400 Hz • V/f Control (V/f), Open Loop Vector Control (OLV), and Open Loop Vector Control for PM (OLV/PM): 590 Hz							
Measures for Harmonics	DC reactor		External options							
Braking Device	Braking Transistor		Standard internal characteristics							
EMC Filter	EMC Filter IEC61800-3, C2/C3		Factory option • Models 2xxxB: There is a category C3 EMC filter in the drive. • Models 2xxxC: There is a category C2 EMC filter in the drive.							
Power Supply	Rated Voltage/Rated Frequency		• Three-phase AC power supply 200 V to 240 V at 50/60 Hz • DC power supply 270 V to 340 V							
	Permitted Voltage Fluctuation		-15% to +10%							
	Permitted Frequency Fluctuation		±5%							
	Input Power (kVA)	HD1	1.5	2.0	3.7	5.3	7.1	8.6	12.5	16.8
		ND1	2.0	2.8	5.3	7.1	8.6	12.5	16.8	21.6

*1 The maximum applicable motor output complies with 208 V motor ratings as specified in NEC Table 430.250. The rated output current of the drive output amps must be equal to or more than the motor rated current.
*2 The maximum applicable motor output is based on 4-pole, general-purpose 220 V motor ratings. The rated output current of the drive output amps must be equal to or more than the motor rated current.
*3 The rated output capacity is calculated with a rated output voltage of 208 V.
*4 The rated output capacity is calculated with a rated output voltage of 220 V.

Table 10.3 Rating (200 V Class)

Model		2056	2070	2082	2110	2138
Maximum Applicable Motor Output (kW)	HD1 *1	11	15	18.5	22	30
	ND1 *2	15	18.5	22	30	37
Maximum Applicable Motor Output (HP)	HD1 *1	15	20	25	30	40
	ND1 *2	20	25	30	40	50

Model			2056	2070	2082	2110	2138
Input	Rated Input Current (A)	HD1 (AC)	58.2	78.4	96	82	111
		HD1 (DC)	71	96	118	101	136
		ND1 (AC)	78.4	96	114	111	136
		ND1 (DC)	96	118	139	136	167
Output	Rated Output Capacity (kVA)	HD1 *3	17.9	22.9	28.6	33.5	43.8
		ND1 *4	21.3	26.7	31.2	41.9	52.6
	Rated Output Current (A)	HD1	47	60	75	88	115
		ND1	56	70	82	110	138
	Overload Tolerance		• HD: 150% of the rated output current for 60 seconds The permitted frequency of overload is once every 10 minutes. • ND: 110% of the rated output current for 60 seconds The permitted frequency of overload is once every 10 minutes. **Note:** Derating may be necessary for applications that start and stop frequently.				
	Carrier Frequency		HD1: 8 kHz without derating the drive capacity. ND1: 2 kHz without derating the drive capacity. Derate the drive capacity to use values to 15 kHz maximum.				
	Maximum Output Voltage		Three-phase 200 V to 240 V **Note:** The maximum output voltage is proportional to the input voltage.				
	Maximum Output Frequency		• Advanced Open Loop Vector Control (AOLV) and EZ Open Loop Vector Control (EZOLV): 120 Hz • Closed Loop V/f Control (CL-V/f), Closed Loop Vector Control (CLV), Advanced Open Loop Vector Control for PM (AOLV/PM), and Closed Loop Vector Control for PM (CLV/PM): 400 Hz • V/f Control (V/f), Open Loop Vector Control (OLV), and Open Loop Vector Control for PM (OLV/PM): 590 Hz				
Measures for Harmonics	DC reactor		External options			Standard internal characteristics	
Braking Device	Braking Transistor		Standard internal characteristics				
EMC Filter	EMC Filter IEC61800-3, C2/C3		Factory option • Models 2xxxB: There is a category C3 EMC filter in the drive. • Models 2xxxC: There is a category C2 EMC filter in the drive.				
Power Supply	Rated Voltage/Rated Frequency		• Three-phase AC power supply 200 V to 240 V at 50/60 Hz • DC power supply 270 V to 340 V				
	Permitted Voltage Fluctuation		-15% to +10%				
	Permitted Frequency Fluctuation		±5%				
	Input Power (kVA)	HD1	24.2	32.6	39.9	34.1	46.1
		ND1	32.6	39.9	47.4	46.1	56.5

*1 The maximum applicable motor output complies with 208 V motor ratings as specified in NEC Table 430.250. The rated output current of the drive output amps must be equal to or more than the motor rated current.
*2 The maximum applicable motor output is based on 4-pole, general-purpose 220 V motor ratings. The rated output current of the drive output amps must be equal to or more than the motor rated current.
*3 The rated output capacity is calculated with a rated output voltage of 208 V.
*4 The rated output capacity is calculated with a rated output voltage of 220 V.

Table 10.4 Rating (200 V Class)

Model			2169	2211	2257	2313	2360	2415
Maximum Applicable Motor Output (kW)		HD1 *1	37	45	55	75	90	110
		ND1 *2	45	55	75	90	110	-
Maximum Applicable Motor Output (HP)		HD1 *1	50	60	75	100	125	150
		ND1 *2	60	75	100	125	150	-
Input	Rated Input Current (A)	HD1 (AC)	136	164	200	271	324	394
		HD1 (DC)	167	202	245	332	397	483
		ND1 (AC)	164	200	271	324	394	-
		ND1 (DC)	202	245	332	397	483	-

Model			2169	2211	2257	2313	2360	2415
Output	Rated Output Capacity (kVA)	HD1 *3	55.3	68.6	81.9	108	132	158
		ND1 *4	64.4	80.4	97.9	119	137	-
	Rated Output Current (A)	HD1	145	180	215	283	346	415
		ND1	169	211	257	313	360	-
	Overload Tolerance		• HD: 150% of the rated output current for 60 seconds The permitted frequency of overload is once every 10 minutes. • ND: 110% of the rated output current for 60 seconds The permitted frequency of overload is once every 10 minutes. **Note:** Derating may be necessary for applications that start and stop frequently.					
	Carrier Frequency		HD1: 5 kHz without derating the drive capacity. ND: 2 kHz without derating the drive capacity. Derate the drive capacity to use values to 10 kHz maximum.					
	Maximum Output Voltage		Three-phase 200 V to 240 V **Note:** The maximum output voltage is proportional to the input voltage.					
	Maximum Output Frequency		• Advanced Open Loop Vector Control (AOLV) and EZ Open Loop Vector Control (EZOLV): 120 Hz • Closed Loop V/f Control (CL-V/f), Closed Loop Vector Control (CLV), Advanced Open Loop Vector Control for PM (AOLV/PM), and Closed Loop Vector Control for PM (CLV/PM): 400 Hz • V/f Control (V/f), Open Loop Vector Control (OLV), and Open Loop Vector Control for PM (OLV/PM): 590 Hz					
Measures for Harmonics	DC reactor		Standard internal characteristics					
Braking Device	Braking Transistor		External options					
EMC Filter	EMC Filter IEC61800-3, C2/C3		Factory option • Models 2xxxB: There is a category C3 EMC filter in the drive. • Models 2xxxC: There is a category C2 EMC filter in the drive.					
Power Supply	Rated Voltage/Rated Frequency		• Three-phase AC power supply 200 V to 240 V at 50/60 Hz • DC power supply 270 V to 340 V					
	Permitted Voltage Fluctuation		-15% to +10%					
	Permitted Frequency Fluctuation		±5%					
	Input Power (kVA)	HD1	56.5	68.2	83.1	113	135	164
		ND1	68.2	83.1	113	135	164	-

*1 The maximum applicable motor output complies with 208 V motor ratings as specified in NEC Table 430.250. The rated output current of the drive output amps must be equal to or more than the motor rated current.
*2 The maximum applicable motor output is based on 4-pole, general-purpose 220 V motor ratings. The rated output current of the drive output amps must be equal to or more than the motor rated current.
*3 The rated output capacity is calculated with a rated output voltage of 208 V.
*4 The rated output capacity is calculated with a rated output voltage of 220 V.

10.3 Model Specifications (400 V Class)

Table 10.5 Rating (400 V Class)

Model		Input Voltage	Duty Rating	4002	4004	4005	4007	4009	4012	4018	4023
Maximum Applicable Motor Output (kW)		< 460 V *1	HD	0.55	0.75	1.5	2.2	3	3.7	5.5	7.5
			ND	0.75	1.5	2.2	3	3.7	5.5	7.5	11
		≧ 460 V *2	HD	0.55	0.75	1.5	2.2	3	3.7	5.5	7.5
			ND	0.75	1.5	2.2	3	3.7	5.5	7.5	11
Maximum Applicable Motor Output (HP)		< 460 V *1	HD	3/4	1	2	3	4	5	7 1/2	10
			ND	1	2	3	4	5	7 1/2	10	15
		≧ 460 V *2	HD	3/4	1	2	3	4	5	7 1/2	10
			ND	1	2	3	4	5	7 1/2	10	15
Input	Rated Input Current (A) *3	< 460 V	HD (AC)	1.9	3.5	4.7	6.7	8.9	11.7	15.8	21.2
			HD (DC)	2.3	4.3	5.8	8.2	11	15	20	26
			ND (AC)	2.5	4.7	6.7	8.9	11.7	15.8	21.2	30.6
			ND (DC)	3.1	5.8	8.2	11	15	20	26	38
		≥ 460 V	HD (AC)	1.6	2.1	3.9	5.5	7.4	9.0	13.1	17.5
			HD (DC)	1.9	2.5	4.8	6.8	9.0	11	16	22
			ND (AC)	2.1	3.9	5.5	7.4	9.0	13.1	17.5	25.3
			ND (DC)	2.5	4.8	6.8	9.0	11	16	22	31
Outputs	Rated Output Capacity (kVA)	< 460 V *4	HD	1.2	2.2	3.2	3.6	4.7	6.1	10	12
			ND	1.4	2.7	3.6	4.7	5.9	7.8	12	15
		≧ 460 V *5	HD	1.3	1.7	2.7	3.8	5.5	6.1	8.8	11
			ND	1.7	2.4	3.8	5.5	6.1	8.8	11	17
	Rated Output Current (A)	< 460 V	HD	1.8	3.4	4.8	5.5	7.2	9.2	14.8	18
			ND	2.1	4.1	5.4	7.1	8.9	11.9	17.5	23.4
		≥ 460 V	HD	1.6	2.1	3.4	4.8	6.9	7.6	11	14
			ND	2.1	3	4.8	6.9	7.6	11	14	21
	Overload Tolerance			• HD: 150% of the rated output current for 60 seconds • ND: 110% of the rated output current for 60 seconds **Note:** Derating may be necessary for applications that start and stop frequently.							
	Carrier Frequency			HD: 8 kHz without derating the drive capacity. ND: 2 kHz without derating the drive capacity. Derate the drive capacity to use values to 15 kHz maximum.							
	Maximum Output Voltage			Three-phase 380 V to 480 V **Note:** The maximum output voltage is proportional to the input voltage.							
	Maximum Output Frequency			• Advanced Open Loop Vector Control (AOLV) and EZ Open Loop Vector Control (EZOLV): 120 Hz • Closed Loop V/f Control (CL-V/f), Closed Loop Vector Control (CLV), Advanced Open Loop Vector Control for PM (AOLV/PM), and Closed Loop Vector Control for PM (CLV/PM): 400 Hz • V/f Control (V/f), Open Loop Vector Control (OLV), and Open Loop Vector Control for PM (OLV/PM): 590 Hz							
Measures for Harmonics	DC Reactor			External options							
Braking Device	Braking Transistor			Standard internal characteristics							
EMC Filter	EMC Filter IEC61800-3, C3			There is a category C3 EMC filter in the drive.							

Model		Input Voltage	Duty Rating	4002	4004	4005	4007	4009	4012	4018	4023
Power Supply	Rated Voltage/Rated Frequency			• Three-phase AC power supply 380 V to 480 V at 50/60 Hz • DC power supply 513 V to 679 V							
	Permitted Voltage Fluctuation			-15% to +10%							
	Permitted Frequency Fluctuation			±5%							
	Input Power (kVA)	< 460 V	HD	1.5	2.8	3.7	5.3	7.1	9.3	13	17
			ND	2.0	3.7	5.3	7.1	9.3	13	17	24
		≥ 460 V	HD	1.3	1.7	3.2	4.6	6.1	7.5	11	15
			ND	2.1	4.0	5.6	7.5	9.1	13	18	26

*1 The maximum applicable motor output complies with 380 V motor ratings as specified in Annex G of IEC 60947-4-1. The rated output current of the drive output amps must be equal to or more than the motor rated current.
*2 The maximum applicable motor output complies with 460 V motor ratings as specified in NEC Table 430.250. The rated output current of the drive output amps must be equal to or more than the motor rated current.
*3 Assumes the value at the rated output current. The input current rating changes when the power supply transformer, input reactor, wiring connections, or power supply impedance change.
*4 The rated output capacity is calculated with a rated output voltage of 380 V.
*5 The rated output capacity is calculated with a rated output voltage of 460 V.

Table 10.6 Rating (400 V Class)

Model		Input Voltage	Duty Rating	4031	4038	4044	4060	4075	4089	4103
Maximum Applicable Motor Output (kW)		< 460 V *1	HD	11	15	18.5	22	30	37	45
			ND	15	18.5	22	30	37	45	55
		≧ 460 V *2	HD	11	15	18.5	22	30	37	45
			ND	15	18.5	22	30	37	45	55
Maximum Applicable Motor Output (HP)		< 460 V *1	HD	15	20	25	30	40	50	60
			ND	20	25	30	40	50	60	75
		≧ 460 V *2	HD	15	20	25	30	40	50	60
			ND	20	25	30	40	50	60	75
Input	Rated Input Current (A) *3	< 460 V	HD (AC)	30.6	41.3	50.5	43.1	58.3	71.5	86.5
			HD (DC)	38	51	62	53	72	88	106
			ND (AC)	41.3	50.5	59.7	58.3	71.5	86.5	105
			ND (DC)	51	62	74	72	88	106	129
		≥ 460 V	HD (AC)	25.3	34.1	41.7	35.6	48.1	59.0	71.4
			HD (DC)	31	42	52	44	59	73	88
			ND (AC)	34.1	41.7	49.4	48.1	59.0	71.4	86.9
			ND (DC)	42	52	61	59	73	88	107

Specifications

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Model		Input Voltage	Duty Rating	4031	4038	4044	4060	4075	4089	4103
Outputs	Rated Output Capacity (kVA)	< 460 V *4	HD	16	20	26	30	39	49	60
			ND	20	25	29	39	49	59	68
		≧ 460 V *5	HD	17	22	27	32	41	52	61
			ND	22	27	32	41	52	61	76
	Rated Output Current (A)	< 460 V	HD	24	31	39	45	60	75	91
			ND	31	38	44	59.6	74.9	89.2	103
		≥ 460 V	HD	21	27	34	40	52	65	77
			ND	27	34	40	52	65	77	96
	Overload Tolerance			• HD: 150% of the rated output current for 60 seconds • ND: 110% of the rated output current for 60 seconds **Note:** Derating may be necessary for applications that start and stop frequently.						
	Carrier Frequency			HD: 8 kHz without derating the drive capacity. ND: 2 kHz without derating the drive capacity. Derate the drive capacity to use values to 15 kHz maximum.						
	Maximum Output Voltage			Three-phase 380 V to 480 V **Note:** The maximum output voltage is proportional to the input voltage.						
	Maximum Output Frequency			• Advanced Open Loop Vector Control (AOLV) and EZ Open Loop Vector Control (EZOLV): 120 Hz • Closed Loop V/f Control (CL-V/f), Closed Loop Vector Control (CLV), Advanced Open Loop Vector Control for PM (AOLV/PM), and Closed Loop Vector Control for PM (CLV/PM): 400 Hz • V/f Control (V/f), Open Loop Vector Control (OLV), and Open Loop Vector Control for PM (OLV/PM): 590 Hz						
Measures for Harmonics	DC Reactor			External options			Standard internal characteristics			
Braking Device	Braking Transistor			Standard internal characteristics						
EMC Filter	EMC Filter IEC61800-3, C3			There is a category C3 EMC filter in the drive.						
Power Supply	Rated Voltage/Rated Frequency			• Three-phase AC power supply 380 V to 480 V at 50/60 Hz • DC power supply 513 V to 679 V						
	Permitted Voltage Fluctuation			-15% to +10%						
	Permitted Frequency Fluctuation			±5%						
	Input Power (kVA)	< 460 V	HD	24	33	40	34	46	57	69
			ND	33	40	48	46	57	69	84
		≥ 460 V	HD	21	28	35	30	40	49	59
			ND	35	42	50	49	60	73	88

*1 The maximum applicable motor output complies with 380 V motor ratings as specified in Annex G of IEC 60947-4-1. The rated output current of the drive output amps must be equal to or more than the motor rated current.
*2 The maximum applicable motor output complies with 460 V motor ratings as specified in NEC Table 430.250. The rated output current of the drive output amps must be equal to or more than the motor rated current.
*3 Assumes the value at the rated output current. The input current rating changes when the power supply transformer, input reactor, wiring connections, or power supply impedance change.
*4 The rated output capacity is calculated with a rated output voltage of 380 V.
*5 The rated output capacity is calculated with a rated output voltage of 460 V.

Table 10.7 Rating (400 V Class)

Model		Input Voltage	Duty Rating	4140	4168	4208	4250	4296	4371	4389
Maximum Applicable Motor Output (kW)		< 460 V *1	HD	55	75	90	110	132	160	200
			ND	75	90	110	132	160	200	220
		≧ 460 V *2	HD	55	75	90	110	150	185	220
			ND	75	90	110	150	185	220	260
Maximum Applicable Motor Output (HP)		< 460 V *1	HD	75	100	125	150	175	200	250
			ND	100	125	150	175	200	250	300
		≧ 460 V *2	HD	75	100	125	150	200	250	300
			ND	100	125	150	200	250	300	350
Input	Rated Input Current *3(A)	< 460 V	HD (AC)	105	142	170	207	248	300	373
			HD (DC)	129	174	209	254	304	367	457
			ND (AC)	142	170	207	248	300	373	410
			ND (DC)	174	209	254	304	367	457	502
		≥ 460 V	HD (AC)	86.9	118	141	171	232	289	346
			HD (DC)	107	144	172	210	284	354	424
			ND (AC)	118	141	171	232	289	346	403
			ND (DC)	144	172	210	284	354	424	494
Outputs	Rated Output Capacity (kVA)	< 460 V *4	HD	74	99	118	142	171	200	244
			ND	92	111	137	165	195	244	256
		≧ 460 V *5	HD	76	99	124	143	191	241	288
			ND	99	124	143	191	241	288	330
	Rated Output Current (A)	< 460 V	HD	112	150	180	216	260	304	371
			ND	140	168	208	250	296	371	389
		≥ 460 V	HD	96	124	156	180	240	302	361
			ND	124	156	180	240	302	361	414
	Overload Tolerance			• HD: 150% of the rated output current for 60 seconds • ND: 110% of the rated output current for 60 seconds **Note:** Derating may be necessary for applications that start and stop frequently.						
	Carrier Frequency			HD: 5 kHz without derating the drive capacity. ND: 2 kHz without derating the drive capacity. Derate the drive capacity to use values to 10 kHz maximum.						
	Maximum Output Voltage			Three-phase 380 V to 480 V **Note:** The maximum output voltage is proportional to the input voltage.						
	Maximum Output Frequency			• Advanced Open Loop Vector Control (AOLV) and EZ Open Loop Vector Control (EZOLV): 120 Hz • Closed Loop V/f Control (CL-V/f), Closed Loop Vector Control (CLV), Advanced Open Loop Vector Control for PM (AOLV/PM), and Closed Loop Vector Control for PM (CLV/PM): 400 Hz • V/f Control (V/f), Open Loop Vector Control (OLV), and Open Loop Vector Control for PM (OLV/PM): 590 Hz						
Measures for Harmonics	DC Reactor			Standard internal characteristics						
Braking Device	Braking Transistor			Standard internal characteristics		External options				
EMC Filter	EMC Filter IEC61800-3, C3			There is a category C3 EMC filter in the drive.						

Specifications

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Model		Input Voltage	Duty Rating	4140	4168	4208	4250	4296	4371	4389
Power Supply	Rated Voltage/Rated Frequency			• Three-phase AC power supply 380 V to 480 V at 50/60 Hz • DC power supply 513 V to 679 V						
	Permitted Voltage Fluctuation			-15% to +10%						
	Permitted Frequency Fluctuation			±5%						
	Input Power (kVA)	< 460 V	HD	84	113	136	165	198	239	297
			ND	113	136	165	198	239	297	327
		≥ 460 V	HD	72	98	117	142	193	240	288
			ND	120	143	174	236	295	352	410

*1 The maximum applicable motor output complies with 380 V motor ratings as specified in Annex G of IEC 60947-4-1. The rated output current of the drive output amps must be equal to or more than the motor rated current.
*2 The maximum applicable motor output complies with 460 V motor ratings as specified in NEC Table 430.250. The rated output current of the drive output amps must be equal to or more than the motor rated current.
*3 Assumes the value at the rated output current. The input current rating changes when the power supply transformer, input reactor, wiring connections, or power supply impedance change.
*4 The rated output capacity is calculated with a rated output voltage of 380 V.
*5 The rated output capacity is calculated with a rated output voltage of 460 V.

Table 10.8 Rating (400 V Class)

Model		Input Voltage	Duty Rating	4453	4568	4675
Maximum Applicable Motor Output (kW)		< 460 V *1	HD	220	250	315
			ND	250	315	355
		≧ 460 V *2	HD	260	300	335
			ND	300	335	370
Maximum Applicable Motor Output (HP)		< 460 V *1	HD	300	335	400
			ND	335	400	450
		≧ 460 V *2	HD	350	400	450
			ND	400	450	500
Input	Rated Input Current *3 (A)	< 460 V	HD (AC)	410	465	584
			HD (DC)	502	569	715
			ND (AC)	465	584	657
			ND (DC)	569	715	805
		≥ 460 V	HD (AC)	403	460	516
			HD (DC)	494	563	632
			ND (AC)	460	516	573
			ND (DC)	563	632	702

Model		Input Voltage	Duty Rating	4453	4568	4675
Outputs	Rated Output Capacity (kVA)	< 460 V *4	HD	272	298	398
			ND	298	374	444
		≧ 460 V *5	HD	330	380	410
			ND	380	410	482
	Rated Output Current (A)	< 460 V	HD	414	453	605
			ND	453	568	675
		≥ 460 V	HD	414	477	515
			ND	477	515	605
	Overload Tolerance			• HD: 150% of the rated output current for 60 seconds • ND: 110% of the rated output current for 60 seconds **Note:** Derating may be necessary for applications that start and stop frequently.		
	Carrier Frequency			HD: 2 kHz without derating the drive capacity. ND: 2 kHz without derating the drive capacity. Derate the drive capacity to use values to 5 kHz maximum.		
	Maximum Output Voltage			Three-phase 380 V to 480 V **Note:** The maximum output voltage is proportional to the input voltage.		
	Maximum Output Frequency			• Advanced Open Loop Vector Control (AOLV) and EZ Open Loop Vector Control (EZOLV): 120 Hz • Closed Loop V/f Control (CL-V/f), Closed Loop Vector Control (CLV), Advanced Open Loop Vector Control for PM (AOLV/PM), and Closed Loop Vector Control for PM (CLV/PM): 400 Hz • V/f Control (V/f), Open Loop Vector Control (OLV), and Open Loop Vector Control for PM (OLV/PM): 590 Hz		
Measures for Harmonics	DC Reactor			Standard internal characteristics		
Braking Device	Braking Transistor			External options		
EMC Filter	EMC Filter IEC61800-3, C3			There is a category C3 EMC filter in the drive.		
Power Supply	Rated Voltage/Rated Frequency			• Three-phase AC power supply 380 V to 480 V at 50/60 Hz • DC power supply 513 V to 679 V		
	Permitted Voltage Fluctuation			-15% to +10%		
	Permitted Frequency Fluctuation			±5%		
	Input Power (kVA)	< 460 V	HD	327	370	465
			ND	370	465	523
		≥ 460 V	HD	335	382	429
			ND	468	526	584

*1 The maximum applicable motor output complies with 380 V motor ratings as specified in Annex G of IEC 60947-4-1. The rated output current of the drive output amps must be equal to or more than the motor rated current.
*2 The maximum applicable motor output complies with 460 V motor ratings as specified in NEC Table 430.250. The rated output current of the drive output amps must be equal to or more than the motor rated current.
*3 Assumes the value at the rated output current. The input current rating changes when the power supply transformer, input reactor, wiring connections, or power supply impedance change.
*4 The rated output capacity is calculated with a rated output voltage of 380 V.
*5 The rated output capacity is calculated with a rated output voltage of 460 V.

10.4 Drive Specifications

- To get the OLV, CLV, and AOLV specifications, do Rotational Auto-Tuning.
- To get the longest product life, install the drive in an environment that meets the necessary specifications.

Table 10.9 Control Characteristics

Item	Specification
Control Methods	• V/f Control (V/f Control) • Closed Loop V/f Control (PG V/f Control) • Open Loop Vector Control (OLVector) • Closed Loop Vector Control (CLVector) • Advanced Open Loop Vector Control (Adv OLVector) • Open Loop Vector Control for PM (PM OLVector) • Advanced Open Loop Vector Control for PM (PM AOLVector) • Closed Loop Vector Control for PM (PM CLVector) • EZ Vector Control (EZ Vector)
Frequency Control Range	• Adv OLVector and EZ Vector: 0.01 Hz to 120 Hz • PG V/f Control, CLVector, PM AOLVector, and PM CLVector: 0.01 Hz to 400 Hz • V/f Control, OLVector, and PM OLVector: 0.01 Hz to 590 Hz
Frequency Accuracy (Temperature Fluctuation)	Digital inputs: Within ±0.01% of the maximum output frequency (-10 °C to +40 °C (14 °F to 104 °F)) Analog inputs: Within ±0.1% of the maximum output frequency (25 °C ±10 °C (77 °F ±18 °F))
Frequency Setting Resolution	Digital inputs: 0.01 Hz Analog inputs: 1/2048 of the maximum output frequency (11-bit signed)
Output Frequency Resolution	0.001 Hz
Frequency Setting Signal	Main speed frequency reference: -10 Vdc to +10 Vdc (20 kΩ), 0 Vdc to 10 Vdc (20 kΩ), 4 mA to 20 mA (250 Ω), 0 mA to 20 mA (250 Ω) Main speed reference: Pulse train input (maximum 32 kHz)
Starting Torque	• V/f Control: 150%/3 Hz • PG V/f Control: 150%/3 Hz • OLVector: 200%/0.3 Hz • CLVector: 200%/0 min^{-1} (r/min) • Adv OLVector: 200%/0.3 Hz • PM OLVector: 100%/5% speed • PM AOLVector: 200%/0 min^{-1} (r/min) • PM CLVector: 200%/0 min^{-1} (r/min) • EZ Vector: 100%/1% speed **Note:** Correctly select drive capacity for this starting torque in these control methods: • OLVector • CLVector • Adv OLVector • PM AOLVector • PM CLVector
Speed Control Range	• V/f Control: 1:40 • PG V/f Control: 1:40 • OLVector: 1:200 • CLVector: 1:1500 • Adv OLVector: 1:200 • PM OLVector: 1:20 • PM AOLVector: 1:100 (when high frequency injection is enabled) • PM CLVector: 1:1500 • EZ Vector: 1:100
Zero Speed Control	Possible in these control methods: • CLVector • PM AOLVector • PM CLVector
Torque Limits	Parameter settings allow different limits in four quadrants in these control methods: • OLVector • CLVector • Adv OLVector • PM AOLVector • PM CLVector • EZ Vector
Accel/Decel Time	0.0 s to 6000.0 s The drive can set four pairs of different acceleration and deceleration times.

Item	Specification
Braking Torque	Approximately 20% Approximately 125% with a dynamic braking option • Short-time average deceleration torque Motor output 0.4/0.75 kW: over 100% Motor output 1.5 kW: over 50% Motor output 2.2 kW and larger: over 20%, Overexcitation Braking/High Slip Braking allow for approximately 40% • Continuous regenerative torque: Approximately 20%. Dynamic braking option allows for approximately 125%, 10% ED, 10 s **Note:** • Models 2004 to 2138, 4002 to 4168 have a braking transistor. • Short-time average deceleration torque refers to the torque needed to decelerate the motor (uncoupled from the load) from the rated speed to zero. Motor characteristics can change the actual specifications. • Motor characteristics change the continuous regenerative torque and short-time average deceleration torque for motors 2.2 kW and larger.
V/f Characteristics	Select from 15 pre-defined V/f patterns, or a user-set V/f pattern.
Main Control Functions	Torque Control, Droop Control, Speed/Torque Control Switching, Feed Forward Control, Zero Servo Function, Restart After Momentary Power Loss, Speed Search, Overtorque/Undertorque Detection, Torque Limit, 17 Step Speed (max.), Accel/Decel Switch, Jerk Control, 3-wire Sequence, Auto-Tuning (Rotational and Stationary), Dwell Function, Cooling Fan ON/OFF Switch, Slip Compensation, Torque Compensation, Frequency Jump, Upper/Lower Limits for Frequency Reference, DC Injection Braking at Start and Stop, Overexcitation Braking, High Slip Braking, PID Control (with Sleep Function), Energy Saving Control, Modbus Communication (RS-485 max, 115.2 kbps), Auto Restart, Application Presets, Q2pack (customized functions), Removable Terminal Block with Parameter Backup Function, Online Tuning, KEB, Overexcitation Deceleration, Inertia (ASR) Tuning, Overvoltage Suppression, High Frequency Injection

Table 10.10 Protection Function

Item	Specification
Motor Protection	Electronic thermal overload protection
Momentary Overcurrent Protection	Drive stops when the output current is more than 200% of the HD output current.
Overload Protection	Drive stops when the output current exceeds these overload tolerance. • HD: 150% of the drive rated output current for 60 s • ND: 110% of the drive rated output current for 60 s **Note:** • The drive can trigger the overload protection function within the overload tolerance if the output frequency is less than 6 Hz. • Do not allow the overload more than once every ten minutes.
Overvoltage Protection	200 V class: Stops when the DC bus voltage is more than approximately 410 V 400 V class: Stops when the DC bus voltage is more than approximately 820 V
Undervoltage Protection	200 V class: Stops when the DC bus voltage decreases to less than approximately 190 V 400 V class: Stops when the DC bus voltage decreases to less than approximately 380 V
Momentary Power Loss Ride-thru	Stops when power loss is longer than 15 ms. Continues operation if power loss is shorter than 2 s (depending on parameter settings). **Note:** • Stop time may be shortened depending on the load and motor speed. • Drive capacity will change the continuous operation time. A Momentary Power Loss Recovery Unit is necessary to continue operation through a 2 s power loss on models 2004 to 2056 and 4002 to 4031.
Heatsink Overheat Protection	Thermistor
Braking Resistor Overheat Protection	Overheat detection for braking resistor (optional ERF-type, 3% ED)
Stall Prevention	Stall prevention is available during acceleration, deceleration, and during run.
Ground Fault Protection	Electronic circuit protection **Note:** This protection detects ground faults during run. The drive will not provide protection when: • There is a low-resistance ground fault for the motor cable or terminal block • Energizing the drive when there is a ground fault.
DC Bus Charge LED	Charge LED illuminates when DC bus voltage is more than 50 V.

Table 10.11 Environment

Environment	Conditions
Area of Use	Indoors, 3C2 (IEC 60721-3-3)
Power Supply	Overvoltage Category III (IEC 61800-5-1)
Ambient Temperature Setting	IP20 enclosure: -10 °C to +60 °C (14 °F to 140 °F). Derate the output current and output voltage if the drive is installed in areas with ambient temperatures from +50 °C to +60 °C (122 °F to 140 °F). UL Type 1 enclosure: -10 °C to +50 °C (14 °F to 122 °F). Derate the output current and output voltage if the drive is installed in areas with ambient temperatures from +40 °C to +50 °C (104 °F to 122 °F). • Drive reliability is better in environments that do not have wide temperature fluctuations. • When installing the drive in an enclosure, use a cooling fan or air conditioner to keep the internal air temperature in the permitted range. • Do not let the drive freeze. • To install the drive in areas with ambient temperatures 40 °C to 60 °C (104 °F to 140 °F), derate the output current.
Humidity	95% RH or less, non-condensing

Environment	Conditions
Storage Temperature	-20 °C to +70 °C (-4 °F to +158 °F) (short-term temperature during transportation)
Surrounding Area	Pollution degree 2 (IEC 62477-1) or less Install the drive in an area without: • Oil mist, corrosive or flammable gas, or dust • Metal powder, oil, water, or other unwanted materials • Radioactive materials or flammable materials, including wood • Harmful gas or fluids • Salt • Direct sunlight Keep wood and other flammable materials away from the drive.
Altitude	1000 m (3281 ft.) maximum **Note:** Derate the output current by 1% for each 100 m (328 ft.) to install the drive in altitudes between 1000 m to 4000 m (3281 ft. to 13123 ft.). It is not necessary to derate the rated voltage in these conditions: • Installing the drive at 2000 m (6562 ft.) or lower • Installing the drive between 2000 m to 4000 m (6562 ft. to 13123 ft.) and grounding the neutral point on the power supply. Contact the manufacturer or your nearest sales representative when not grounding the neutral point.
Vibration	• 10 Hz to 20 Hz: 1 G (9.8 m/s^2, 32.15 ft/s^2) • 20 Hz to 55 Hz: 2004 to 2211, 4002 to 4168: 0.6 G (5.9 m/s^2, 19.36 ft/s^2) 2257 to 2415, 4208 to 4675: 0.2 G (2.0 m/s^2, 6.56 ft/s^2)
Installation Orientation	Install the drive vertically for sufficient cooling airflow.

Table 10.12 Standard

Item	Specification
Harmonized Standard	• UL61800-5-1 • EN61800-3 • IEC/EN61800-5-1 • Two Safe Disable inputs and one EDM output according to ISO/EN13849-1:2015 (Cat. 3, PLe), IEC/EN61508:2010 (SIL3)
Protection Design	Open-chassis type (IP20) Enclosed wall-mounted type (UL Type 1) **Note:** Install a UL Type 1 kit on an open-chassis type (IP20) drive to convert the drive to a wall-mount enclosure (UL Type 1).

10.5 Drive Derating

You must derate the drive capacity to operate the drive above the rated temperature, altitude, and default carrier frequency.

◆ Carrier Frequency Settings and Rated Current Values

The following tables show how the drive rated output current changes when *C6-02 [Carrier Frequency Selection]* value changes. The output current value changes linearly as the carrier frequency changes. You can use the values from the tables to calculate a frequency that is not shown.

■ 200 V Class

Table 10.13 Carrier Frequency and Rated Current Derating

Model	Rated Current (A)											
	Heavy Duty Rating (HD1)						Normal Duty Rating (ND1)					
	2 kHz	5 kHz	8 kHz	10 kHz	12.5 kHz	15 kHz	2 kHz	5 kHz	8 kHz	10 kHz	12.5 kHz	15 kHz
2004	3.2	3.2	3.2	3.1	2.9	2.78	3.5	3.3	2.9	2.7	2.4	2.10
2006	5.0	5.0	5.0	4.8	4.6	4.3	6	5.6	5	4.6	4.1	3.6
2010	8.0	8.0	8.0	7.4	6.6	5.8	9.6	9.0	8	7.4	6.6	5.8
2012	11.0	11.0	11.0	10.4	9.6	8.8	12	11.7	11	10.5	9.9	9.3
2018	14.0	14.0	14.0	12.6	10.8	9.1	17.5	16.1	14	12.6	10.8	9.1
2021	17.5	17.5	17.5	16.1	14.3	12.6	21	19.6	17	16.1	14.3	12.5
2030	25.0	25.0	25.0	23.0	20.5	18.0	30	28.0	25	23.0	20.5	18.0
2042	33.0	33.0	33.0	29.3	24.8	20.2	42	38.4	33	29.4	24.9	20.4
2056	47.0	47.0	47.0	43.4	38.9	34.4	56	52.4	47	43.4	38.9	34.4
2070	60.0	60.0	60.0	56.0	51.0	46	70	66.0	60	56.0	51.0	46.0
2082	75.0	75.0	75.0	68.6	60.5	53	82	82.0	75	68.8	61.0	53.1
2110	88.0	88.0	88.0	80.5	71.0	62	110	102.7	92	84.3	75.2	66.0
2138	115.0	115.0	115.0	105.1	92.8	81	138	128.8	115	105.8	94.3	82.8
2169	145.0	145.0	125.2	112.0	-	-	169	152.7	128.3	112.0	-	-
2211	180.0	180.0	155.2	138.6	-	-	211	190.2	158.9	138.1	-	-
2257	215.0	215.0	184.8	164.7	-	-	257	230.4	190.5	163.9	-	-
2313	283.0	283.0	249.0	226.4	-	-	313	288.5	251.7	227.1	-	-
2360	346.0	346.0	294.3	259.8	-	-	360	330.8	287.6	258.8	-	-
2415	415.0	415.0	365.2	332.0	-	-	-	-	-	-	-	-

■ 400 V Class

Table 10.14 Carrier Frequency and Rated Current Derating (< 460 V)

Model	Rated Current (A)											
	Heavy Duty Rating (HD1)						Normal Duty Rating (ND1)					
	2 kHz	5 kHz	8 kHz	10 kHz	12.5 kHz	15 kHz	2 kHz	5 kHz	8 kHz	10 kHz	12.5 kHz	15 kHz
4002	1.8	1.8	1.8	1.6	1.3	1.0	2.1	2.0	1.8	1.7	1.5	1.4
4004	3.4	3.4	3.4	2.9	2.3	1.7	4.1	3.8	3.4	3.1	2.8	2.4
4005	4.8	4.8	4.8	4.3	3.7	3.0	5.4	5.2	4.8	4.6	4.3	3.9
4007	5.5	5.5	5.5	4.9	4.1	3.2	7.1	6.5	5.5	4.8	4.0	3.2
4009	7.2	7.2	7.2	6.5	5.6	4.8	8.9	8.2	7.2	6.5	5.6	4.8
4012	9.2	9.2	9.2	8.1	6.8	5.4	11.9	10.8	9.2	8.1	6.7	5.4
4018	14.8	14.8	14.8	13.1	11.0	8.9	17.5	17.3	14.8	13.1	11.0	8.9
4023	18.0	18.0	18.0	15.9	13.4	10.8	23	21.5	18.3	16.2	13.6	11.0
4031	24.0	24.0	24.0	21.2	17.7	14.1	31	28.2	24.0	21.1	17.6	14.1

Model	Rated Current (A)											
	Heavy Duty Rating (HD1)						Normal Duty Rating (ND1)					
	2 kHz	5 kHz	8 kHz	10 kHz	12.5 kHz	15 kHz	2 kHz	5 kHz	8 kHz	10 kHz	12.5 kHz	15 kHz
4038	31.0	31.0	31.0	27.5	23.0	18.6	38	36.3	31.0	27.5	23.0	18.6
4044	39.0	39.0	39.0	34.5	29.0	23.4	44	43.6	37.5	33.5	28.4	23.4
4060	45.0	45.0	45.0	39.1	31.8	24.4	60	53.7	44.9	39.1	31.7	24
4075	60.0	60.0	60.0	53.1	44.6	36.0	75	73.8	62.9	55.6	46.5	37
4089	75.0	75.0	75.0	66.4	55.7	45.0	89	88.8	75.8	67.2	56.4	46
4103	91.0	91.0	91.0	80.6	67.6	54.6	103	103.0	90.3	80.1	67.3	55
4140	112.0	112.0	91.8	78.4	-	-	140	122.8	96.7	79	-	-
4168	150.0	150.0	123.0	105.0	-	-	168	150.5	124.4	107	-	-
4208	180.0	180.0	147.6	126.0	-	-	208	179.7	137.2	109	-	-
4250	216.0	216.0	177.1	151.2	-	-	250	221.8	179.4	151	-	-
4296	260.0	260.0	213.2	182.0	-	-	296	263.4	214.6	182	-	-
4371	304.0	304.0	249.3	212.8	-	-	371	327.2	261.6	218	-	-
4389	371.0	371.0	304.2	259.7	-	-	389	348	286.3	245	-	-
4453	389.0	324.8	-	-	-	-	453	349	-	-	-	-
4568	453.0	378.3	-	-	-	-	568	437	-	-	-	-
4675	605.0	505.2	-	-	-	-	675	529	-	-	-	-

Table 10.15 Carrier Frequency and Rated Current Derating (≥ 460 V)

Model	Rated Current (A)											
	Heavy Duty Rating (HD2)						Normal Duty Rating (ND2)					
	2 kHz	5 kHz	8 kHz	10 kHz	12.5 kHz	15 kHz	2 kHz	5 kHz	8 kHz	10 kHz	12.5 kHz	15 kHz
4002	2.1	1.9	1.6	1.4	1.1	0.9	2.1	2.0	1.8	1.7	1.5	1.4
4004	2.8	2.5	2.1	1.8	1.4	1.1	3.0	2.8	2.5	2.3	2.0	1.8
4005	4.3	3.9	3.4	3.0	2.6	2.2	4.8	4.6	4.3	4.0	3.8	3.5
4007	6.2	5.6	4.8	4.2	3.5	2.8	6.9	6.3	5.3	4.7	3.9	3.2
4009	8.6	7.9	6.9	6.2	5.4	4.6	7.6	7.0	6.1	5.5	4.8	4.1
4012	9.8	8.9	7.6	6.7	5.6	4.5	11.0	10.0	8.5	7.5	6.2	5.0
4018	14.1	12.9	11.0	9.7	8.2	6.6	15.2	13.9	11.8	10.5	8.8	7.1
4023	18.0	16.4	14.0	12.4	10.4	8.4	21	19.3	16.4	14.6	12.2	9.9
4031	27.2	24.7	21.0	18.5	15.4	12.4	27	24.5	20.9	18.4	15.4	12.3
4038	34.7	31.6	27.0	23.9	20.1	16.2	34	32.5	27.7	24.6	20.6	16.6
4044	34.0	34.0	34.0	30.1	25.3	20.4	40	39.6	34.1	30.5	25.9	21.3
4060	40.0	40.0	40.0	34.8	28.3	21.7	52	46.9	39.2	34.1	27.7	21
4075	52.0	52.0	52.0	46.1	38.6	31.2	65	64.1	54.6	48.3	40.4	33
4089	65.0	65.0	65.0	57.6	48.3	39.0	77	76.6	65.5	58.0	48.7	39
4103	77.0	77.0	77.0	68.2	57.2	46.2	96	96.0	84.1	74.6	62.8	51
4140	96.0	96.0	78.7	67.2	-	-	124	108.7	85.7	70	-	-
4168	124.0	124.0	101.7	86.8	-	-	156	139.8	115.5	99	-	-
4208	156.0	156.0	127.9	109.2	-	-	180	155.5	118.7	94	-	-
4250	180.0	180.0	147.6	126.0	-	-	240	212.9	172.3	145	-	-
4296	240.0	240.0	196.8	168.0	-	-	302	268.8	218.9	186	-	-
4371	302.0	302.0	247.6	211.4	-	-	361	318.5	254.7	212	-	-
4389	361.0	361.0	296.0	252.7	-	-	414	370	303.3	259	-	-
4453	414.0	345.0	-	-	-	-	477	367	-	-	-	-

Model	Rated Current (A)											
	Heavy Duty Rating (HD2)						Normal Duty Rating (ND2)					
	2 kHz	5 kHz	8 kHz	10 kHz	12.5 kHz	15 kHz	2 kHz	5 kHz	8 kHz	10 kHz	12.5 kHz	15 kHz
4568	477.0	397.5	-	-	-	-	515	397	-	-	-	-
4675	-	-	-	-	-	-	-	-	-	-	-	-

◆ Carrier Frequency Settings and Rated Current Values when Using PM Advanced Open Loop Vector Control Method

The following tables show how the drive rated output current changes when *C6-02 [Carrier Frequency Selection]* value changes, and when *A1-02 = 6 [Control Method = PM AOLVector]*. The output current value changes linearly as the carrier frequency changes. You can use the values from the tables to calculate a frequency that is not shown.

■ 200 V Class

Table 10.16 AOLV/PM Carrier Frequency and Rated Current Derating

Model	Rated Current (A)											
	Heavy Duty Rating (HD1)						Normal Duty Rating (ND1)					
	2 kHz	4 kHz	6 kHz	8 kHz	10 kHz	12 kHz	2 kHz	4 kHz	6 kHz	8 kHz	10 kHz	12 kHz
2004	3.2	3.2	3.1	3.0	2.8	2.6	3.5	3.1	2.8	2.4	2.1	1.7
2006	5.0	5.0	4.9	4.6	4.3	4.1	6.0	5.4	4.8	4.2	3.6	3.0
2010	8.0	8.0	7.7	6.7	5.8	4.8	9.6	8.6	7.7	6.7	5.8	4.8
2012	11.0	11.0	10.7	9.8	8.8	7.9	12.2	11.5	10.7	10.0	9.3	8.6
2018	14.0	14.0	13.3	11.2	9.1	6.9	17.5	15.4	13.3	11.2	9.1	6.9
2021	17.5	17.5	16.8	14.7	12.6	10.4	21.0	18.9	16.8	14.6	12.5	10.4
2030	25.0	25.0	24.0	21.0	18.0	15.0	30.0	27.0	24.0	21.0	18.0	15.0
2042	33.0	33.0	31.2	25.7	20.2	14.7	42.0	36.6	31.2	25.8	20.4	15.0
2056	47.0	47.0	45.2	39.8	34.4	29.0	56.0	50.6	45.2	39.8	34.4	29.0
2070	60.0	60.0	58.0	52.0	46.0	40.0	70.0	64.0	58.0	52.0	46.0	40.0
2082	75.0	75.0	71.8	62.1	52.5	42.9	82.0	81.4	72.0	62.6	53.1	43.7
2110	88.0	88.0	84.2	72.9	61.6	50.3	110.0	99.0	88.0	77.0	66.0	55.0
2138	115.0	115.0	110.1	95.3	80.5	65.7	138.0	124.2	110.4	96.6	82.8	69.0
2169	145.0	138.4	118.6	98.8	78.9	-	169.0	144.6	120.1	95.7	71.2	-
2211	180.0	171.7	146.9	122.0	97.2	-	211.0	179.7	148.5	117.2	86.0	-
2257	215.0	204.9	174.7	144.5	114.3	-	257.0	217.1	177.2	137.3	97.4	-
2313	283.0	271.7	237.7	203.8	169.8	-	313.0	276.2	239.4	202.6	165.8	-
2360	346.0	328.8	277.0	225.3	173.6	-	359.6	316.4	273.2	230.0	186.8	-
2415	415.0	398.4	348.6	298.8	249.0	-	-	-	-	-	-	-

■ 400 V Class

Table 10.17 AOLV/PM Carrier Frequency and Rated Current Derating (< 460 V)

Model	Rated Current (A)											
	Heavy Duty Rating (HD1)						Normal Duty Rating (ND1)					
	2 kHz	4 kHz	6 kHz	8 kHz	10 kHz	12 kHz	2 kHz	4 kHz	6 kHz	8 kHz	10 kHz	12 kHz
4002	1.8	1.8	1.7	1.3	1.0	0.6	2.1	1.9	1.7	1.6	1.4	1.2
4004	3.4	3.4	3.2	2.4	1.7	1.0	4.1	3.7	3.3	2.8	2.4	2.0
4005	4.8	4.8	4.5	3.8	3.0	2.3	5.4	5.0	4.7	4.3	3.9	3.6
4007	5.5	5.5	5.2	4.2	3.2	2.3	7.1	6.1	5.2	4.2	3.2	2.3
4009	7.2	7.2	6.9	5.8	4.8	3.8	8.9	7.9	6.8	5.8	4.8	3.7

Model	Rated Current (A)											
	Heavy Duty Rating (HD1)						Normal Duty Rating (ND1)					
	2 kHz	4 kHz	6 kHz	8 kHz	10 kHz	12 kHz	2 kHz	4 kHz	6 kHz	8 kHz	10 kHz	12 kHz
4012	9.2	9.2	8.7	7.0	5.4	3.8	11.9	10.3	8.6	7.0	5.4	3.8
4018	14.8	14.8	14.0	11.4	8.9	6.3	17.5	16.5	14.0	11.4	8.9	6.3
4023	18.0	18.0	17.0	13.9	10.8	7.7	23.4	20.4	17.3	14.1	11.0	7.8
4031	24.0	24.0	22.6	18.4	14.1	9.9	31.0	26.8	22.6	18.3	14.1	9.9
4038	31.0	31.0	29.2	23.9	18.6	13.3	38.0	34.5	29.2	23.9	18.6	13.3
4044	39.0	39.0	36.8	30.1	23.4	16.7	44.0	41.6	35.5	29.5	23.4	17.3
4060	45.0	45.0	42.1	33.3	24.4	15.6	59.6	50.8	42.0	33.2	24.4	15.6
4075	60.0	60.0	56.6	46.3	36.0	25.7	74.9	70.2	59.3	48.4	37.5	26.5
4089	75.0	75.0	70.7	57.9	45.0	32.1	89.2	84.5	71.5	58.6	45.6	32.7
4103	91.0	91.0	85.8	70.2	54.6	39.0	103.0	100.5	85.2	69.9	54.6	39.3
4140	112.0	105.3	85.1	65.0	44.8	-	140.0	114.1	88.1	62.0	36.0	-
4168	150.0	141.0	114.0	87.0	60.0	-	168.0	141.8	115.6	89.5	63.3	-
4208	180.0	169.2	136.8	104.4	72.0	-	208.0	165.5	123.1	80.6	38.1	-
4250	216.0	203.0	164.2	125.3	86.4	-	250.0	207.7	165.3	123.0	80.6	-
4296	260.0	244.4	197.6	150.8	104.0	-	296.0	247.1	198.3	149.4	100.6	-
4371	304.0	285.8	231.0	176.3	121.6	-	371.0	305.3	239.7	174.0	108.3	-
4389	371.0	348.7	282.0	215.2	148.4	-	389.0	327.5	265.7	203.8	142.0	-
4453	389.0	292.5	-	-	-	-	453.0	296.7	-	-	-	-
4568	453.0	340.7	-	-	-	-	568.0	372.0	-	-	-	-
4675	605.0	455.0	-	-	-	-	675.0	455.0	-	-	-	-

Table 10.18 AOLV/PM Carrier Frequency and Rated Current Derating (≥ 460 V)

Model	Rated Current (A)											
	Heavy Duty Rating (HD2)						Normal Duty Rating (ND2)					
	2 kHz	4 kHz	6 kHz	8 kHz	10 kHz	12 kHz	2 kHz	4 kHz	6 kHz	8 kHz	10 kHz	12 kHz
4002	2.1	1.8	1.5	1.2	0.9	0.6	2.1	1.9	1.7	1.6	1.4	1.2
4004	2.8	2.4	2.0	1.5	1.1	0.6	3.0	2.7	2.4	2.1	1.8	1.5
4005	4.3	3.8	3.2	2.7	2.2	1.6	4.8	4.5	4.2	3.8	3.5	3.2
4007	6.2	5.4	4.5	3.7	2.8	2.0	6.9	6.0	5.0	4.1	3.2	2.2
4009	8.6	7.6	6.6	5.6	4.6	3.6	7.6	6.7	5.8	5.0	4.1	3.2
4012	9.8	8.5	7.2	5.8	4.5	3.1	11.0	9.5	8.0	6.5	5.0	3.5
4018	14.1	12.3	10.4	8.5	6.6	4.7	15.2	13.2	11.2	9.1	7.1	5.1
4023	18.0	15.6	13.2	10.8	8.4	6.0	21.0	18.3	15.5	12.7	9.9	7.0
4031	27.2	23.5	19.8	16.1	12.4	8.7	27.0	23.3	19.6	16.0	12.3	8.6
4038	34.7	30.1	25.5	20.8	16.2	11.6	34.0	30.9	26.2	21.4	16.6	11.9
4044	34.0	34.0	32.1	26.2	20.4	14.6	40.0	37.8	32.3	26.8	21.3	15.8
4060	40.0	40.0	37.4	29.6	21.7	13.9	52.0	44.3	36.7	29.0	21.3	13.6
4075	52.0	52.0	49.0	40.1	31.2	22.3	65.0	60.9	51.4	42.0	32.5	23.0
4089	65.0	65.0	61.3	50.1	39.0	27.9	77.0	72.9	61.7	50.6	39.4	28.2
4103	77.0	77.0	72.6	59.4	46.2	33.0	96.0	93.6	79.4	65.1	50.9	36.6
4140	96.0	90.2	73.0	55.7	38.4	-	124.0	101.1	78.0	54.9	31.9	-
4168	124.0	116.6	94.2	71.9	49.6	-	156.0	131.7	107.4	83.1	58.8	-
4208	156.0	146.6	118.6	90.5	62.4	-	180.0	143.2	106.5	69.7	33.0	-
4250	180.0	169.2	136.8	104.4	72.0	-	240.0	199.4	158.7	118.1	77.4	-
4296	240.0	225.6	182.4	139.2	96.0	-	302.0	252.2	202.3	152.5	102.6	-

Model	Rated Current (A)											
	Heavy Duty Rating (HD2)						Normal Duty Rating (ND2)					
	2 kHz	4 kHz	6 kHz	8 kHz	10 kHz	12 kHz	2 kHz	4 kHz	6 kHz	8 kHz	10 kHz	12 kHz
4371	302.0	283.9	229.5	175.2	120.8	-	361.0	297.2	233.5	169.7	105.9	-
4389	361.0	339.3	274.4	209.4	144.4	-	414.0	347.6	281.1	214.7	148.3	-
4453	414.0	310.5	-	-	-	-	477.0	312.6	-	-	-	-
4568	477.0	357.8	-	-	-	-	515.0	337.5	-	-	-	-
4675	-	-	-	-	-	-	-	-	-	-	-	-

◆ Altitude Derating

Install the drive in a location that with an altitude of 1000 m (3281 ft.) or lower.

Derate the output current by 1% for each 100 m (328 ft.) to install the drive in altitudes between 1000 m to 4000 m (3281 ft. to 13123 ft.).

It is not necessary to derate the rated voltage in these conditions:

- Installing the drive at 2000 m (6562 ft.) or lower
- Installing the drive between 2000 m to 4000 m (6562 ft. to 13123 ft.) and grounding the neutral point on the power supply.
  Contact the manufacturer or your nearest sales representative when the drive is not grounded with the neutral network.

10.6 Drive Watt Loss

◆ 200 V Class

Table 10.19 Drive Watt Loss (Heavy Duty)

Model	Rated Output Current A	Carrier Frequency kHz	Interior Unit Loss W	Cooling Fin Loss W	Total Loss W
2004	3.2	8	35	18	53
2006	5	8	37	26	63
2010	8	8	44	43	87
2012	11	8	50	61	111
2018	14	8	47	82	129
2021	17.5	8	56	105	161
2030	25	8	74	174	248
2042	33	8	88	183	271
2056	47	8	112	267	379
2070	60	8	145	373	518
2082	75	8	179	478	657
2110	88	8	155	563	718
2138	115	8	212	680	892
2169	145	5	275	820	1095
2211	180	5	314	991	1305
2257	215	5	398	1252	1650
2313	283	5	502	1643	2145
2360	346	5	582	1978	2560
2415	415	5	644	2359	3003

Table 10.20 Drive Watt Loss (Normal Duty)

Model	Rated Output Current A	Carrier Frequency kHz	Interior Unit Loss W	Cooling Fin Loss W	Total Loss W
2004	3.5	2	35	16	51
2006	6	2	38	25	63
2010	9.6	2	49	46	95
2012	12.2	2	56	62	118
2018	17.5	2	53	88	141
2021	21	2	75	125	200
2030	30	2	95	206	301
2042	42	2	129	227	356
2056	56	2	149	302	451
2070	70	2	177	403	580
2082	82	2	202	467	669
2110	110	2	192	631	823
2138	138	2	269	814	1083
2169	169	2	338	941	1279
2211	211	2	384	1131	1515
2257	257	2	519	1534	2053
2313	313	2	579	1794	2373
2360	360	2	655	2071	2726
2415	-	-	-	-	-

◆ 400 V Class

Table 10.21 Drive Watt Loss (Heavy Duty: < 460 V)

Model	Rated Output Current A	Carrier Frequency kHz	Interior Unit Loss W	Cooling Fin Loss W	Total Loss W
4002	1.8	8	38	15	53
4004	3.4	8	42	28	70
4005	4.8	8	46	37	83
4007	5.5	8	48	45	93
4009	7.2	8	37	61	98
4012	9.2	8	46	82	128
4018	14.8	8	65	140	205
4023	18	8	73	150	223
4031	24	8	101	211	312
4038	31	8	119	272	391
4044	39	8	148	354	502
4060	45	8	126	389	515
4075	60	8	165	527	692
4089	75	8	184	617	801
4103	91	8	237	779	1016
4140	112	5	300	956	1256
4168	150	5	486	1274	1760
4208	180	5	446	1432	1878
4250	216	5	558	1464	2022
4296	260	5	692	2061	2753
4371	304	5	824	2346	3170
4389	371	5	777	2212	2989
4453	414	2	963	2696	3659
4568	453	2	1086	3035	4121
4675	605	2	1328	3995	5323

Table 10.22 Drive Watt Loss (Heavy Duty: ≥ 460 V)

Model	Rated Output Current A	Carrier Frequency kHz	Interior Unit Loss W	Cooling Fin Loss W	Total Loss W
4002	1.6	8	38	15	53
4004	2.1	8	39	19	58
4005	3.4	8	43	30	73
4007	4.8	8	46	43	89
4009	6.9	8	35	63	98
4012	7.6	8	39	71	110
4018	11	8	53	110	163
4023	14	8	59	120	179
4031	21	8	85	192	277
4038	27	8	99	245	344
4044	34	8	124	320	444
4060	40	8	115	361	476
4075	52	8	147	477	624
4089	65	8	165	566	731
4103	77	8	206	700	906

Model	Rated Output Current A	Carrier Frequency kHz	Interior Unit Loss W	Cooling Fin Loss W	Total Loss W
4140	96	5	265	849	1114
4168	124	5	400	1073	1473
4208	156	5	405	1300	1705
4250	180	5	454	1174	1628
4296	240	5	664	2021	2685
4371	302	5	843	2499	3342
4389	361	5	745	2161	2906
4453	414	2	1024	2835	3859
4568	477	2	1183	3329	4512
4675	-	-	-	-	-

Table 10.23 Drive Watt Loss (Normal Duty: < 460 V)

Model	Rated Output Current A	Carrier Frequency kHz	Interior Unit Loss W	Cooling Fin Loss W	Total Loss W
4002	2.1	2	39	16	55
4004	4.1	2	44	33	77
4005	5.4	2	48	31	79
4007	7.1	2	52	44	96
4009	8.9	2	42	58	100
4012	11.9	2	57	84	141
4018	17.5	2	82	144	226
4023	23.4	2	108	185	293
4031	31	2	138	222	360
4038	38	2	145	270	415
4044	44	2	168	335	503
4060	59.6	2	157	444	601
4075	74.9	2	185	527	712
4089	89.2	2	212	665	877
4103	103	2	264	766	1030
4140	140	2	393	1126	1519
4168	168	2	574	1348	1922
4208	208	2	493	1465	1958
4250	250	2	686	1738	2424
4296	296	2	805	2155	2960
4371	371	2	1022	2553	3575
4389	389	2	867	2393	3260
4453	453	2	1086	3035	4121
4568	568	2	1429	3989	5418
4675	675	2	1526	4572	6098

Table 10.24 Drive Watt Loss (Normal Duty: ≥ 460 V)

Model	Rated Output Current A	Carrier Frequency kHz	Interior Unit Loss W	Cooling Fin Loss W	Total Loss W
4002	2.1	2	39	16	55
4004	3	2	42	25	67
4005	4.8	2	45	28	73
4007	6.9	2	50	42	92
4009	7.6	2	35	49	84

Model	Rated Output Current A	Carrier Frequency kHz	Interior Unit Loss W	Cooling Fin Loss W	Total Loss W
4012	11	2	49	76	125
4018	14	2	64	112	176
4023	21	2	87	158	245
4031	27	2	109	188	297
4038	34	2	116	234	350
4044	40	2	137	296	433
4060	52	2	133	379	512
4075	65	2	156	450	606
4089	77	2	180	569	749
4103	96	2	229	698	927
4140	124	2	334	982	1316
4168	156	2	481	1199	1680
4208	180	2	429	1275	1704
4250	240	2	648	1643	2291
4296	302	2	817	2257	3074
4371	361	2	975	2561	3536
4389	414	2	873	2422	3295
4453	477	2	1183	3329	4512
4568	515	2	1320	3697	5017
4675	-	-	-	-	-

10.7 Drive Exterior and Mounting Dimensions

◆ Drive Dimensions for Open Chassis Type (IP20)

■ 2004 to 2042, 4002 to 4023

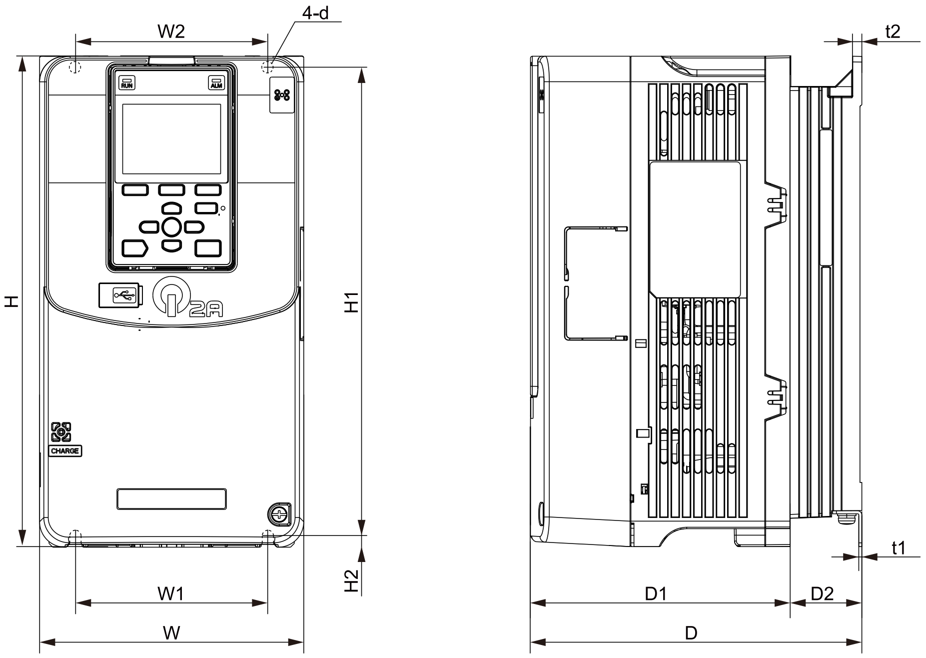

Figure 10.1 Exterior and Mounting Dimensions Diagram for 2004 to 2042, 4002 to 4023

Table 10.25 200 V class (IP20)

Model	Dimensions mm (in.)												Weight kg (lb.)
	W	H	D	D1	D2	W1	W2	H1	H2	t1	t2	d	
2004	140 (5.51)	260 (10.24)	176 (6.93)	138 (5.43)	38 (1.50)	102 (4.02)	102 (4.02)	248 (9.76)	6 (0.236)	1.6 (0.063)	5 (0.197)	M5	3.5 (7.72)
2006	140 (5.51)	260 (10.24)	176 (6.93)	138 (5.43)	38 (1.50)	102 (4.02)	102 (4.02)	248 (9.76)	6 (0.236)	1.6 (0.063)	5 (0.197)	M5	3.5 (7.72)
2010	140 (5.51)	260 (10.24)	176 (6.93)	138 (5.43)	38 (1.50)	102 (4.02)	102 (4.02)	248 (9.76)	6 (0.236)	1.6 (0.063)	5 (0.197)	M5	3.5 (7.72)
2012	140 (5.51)	260 (10.24)	176 (6.93)	138 (5.43)	38 (1.50)	102 (4.02)	102 (4.02)	248 (9.76)	6 (0.236)	1.6 (0.063)	5 (0.197)	M5	3.5 (7.72)
2018	140 (5.51)	260 (10.24)	211 (8.31)	138 (5.43)	73 (2.87)	102 (4.02)	102 (4.02)	248 (9.76)	6 (0.236)	1.6 (0.063)	5 (0.197)	M5	3.9 (8.60)
2021	140 (5.51)	260 (10.24)	211 (8.31)	138 (5.43)	73 (2.87)	102 (4.02)	102 (4.02)	248 (9.76)	6 (0.236)	1.6 (0.063)	5 (0.197)	M5	3.9 (8.60)
2030	140 (5.51)	260 (10.24)	211 (8.31)	138 (5.43)	73 (2.87)	102 (4.02)	102 (4.02)	248 (9.76)	6 (0.236)	1.6 (0.063)	5 (0.197)	M5	4.2 (9.26)
2042	140 (5.51)	260 (10.24)	211 (8.31)	138 (5.43)	73 (2.87)	102 (4.02)	102 (4.02)	248 (9.76)	6 (0.236)	1.6 (0.063)	5 (0.197)	M5	4.2 (9.26)

Table 10.26 400 V class (IP20)

Model	Dimensions mm (in.)												Weight kg (lb.)
	W	H	D	D1	D2	W1	W2	H1	H2	t1	t2	d	
4002	140 (5.51)	260 (10.24)	176 (6.93)	138 (5.43)	38 (1.50)	102 (4.02)	102 (4.02)	248 (9.76)	6 (0.236)	1.6 (0.063)	5 (0.197)	M5	3.5 (7.72)
4004	140 (5.51)	260 (10.24)	176 (6.93)	138 (5.43)	38 (1.50)	102 (4.02)	102 (4.02)	248 (9.76)	6 (0.236)	1.6 (0.063)	5 (0.197)	M5	3.5 (7.72)
4005	140 (5.51)	260 (10.24)	176 (6.93)	138 (5.43)	38 (1.50)	102 (4.02)	102 (4.02)	248 (9.76)	6 (0.236)	1.6 (0.063)	5 (0.197)	M5	3.5 (7.72)

Model	Dimensions mm (in.)												Weight kg (lb.)
	W	H	D	D1	D2	W1	W2	H1	H2	t1	t2	d	
4007	140 (5.51)	260 (10.24)	211 (8.31)	138 (5.43)	73 (2.87)	102 (4.02)	102 (4.02)	248 (9.76)	6 (0.236)	1.6 (0.063)	5 (0.197)	M5	3.9 (8.60)
4009	140 (5.51)	260 (10.24)	211 (8.31)	138 (5.43)	73 (2.87)	102 (4.02)	102 (4.02)	248 (9.76)	6 (0.236)	1.6 (0.063)	5 (0.197)	M5	3.9 (8.60)
4012	140 (5.51)	260 (10.24)	211 (8.31)	138 (5.43)	73 (2.87)	102 (4.02)	102 (4.02)	248 (9.76)	6 (0.236)	1.6 (0.063)	5 (0.197)	M5	3.9 (8.60)
4018	140 (5.51)	260 (10.24)	211 (8.31)	138 (5.43)	73 (2.87)	102 (4.02)	102 (4.02)	248 (9.76)	6 (0.236)	1.6 (0.063)	5 (0.197)	M5	4.2 (9.26)
4023	140 (5.51)	260 (10.24)	211 (8.31)	138 (5.43)	73 (2.87)	102 (4.02)	102 (4.02)	248 (9.76)	6 (0.236)	1.6 (0.063)	5 (0.197)	M5	4.2 (9.26)

■ 2056, 4031, 4038

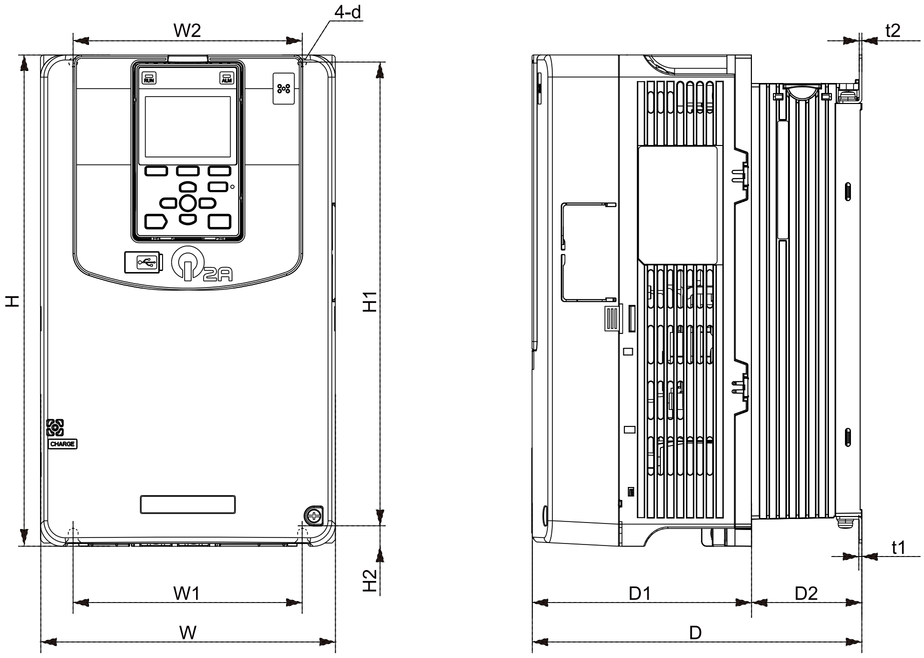

Figure 10.2 Exterior and Mounting Dimensions Diagram for 2056, 4031, 4038

Table 10.27 200 V class (IP20)

Model	Dimensions mm (in.)												Weight kg (lb.)
	W	H	D	D1	D2	W1	W2	H1	H2	t1	t2	d	
2056	180 (7.09)	300 (11.81)	202 (7.95)	134 (5.28)	68 (2.68)	140 (5.51)	140 (5.51)	284 (11.18)	8 (0.315)	1.6 (0.063)	1.6 (0.063)	M5	6 (13.23)

Table 10.28 400 V class (IP20)

Model	Dimensions mm (in.)												Weight kg (lb.)
	W	H	D	D1	D2	W1	W2	H1	H2	t1	t2	d	
4031	180 (7.09)	300 (11.81)	202 (7.95)	134 (5.28)	68 (2.68)	140 (5.51)	140 (5.51)	284 (11.18)	8 (0.315)	1.6 (0.063)	1.6 (0.063)	M5	6 (13.23)
4038	180 (7.09)	300 (11.81)	202 (7.95)	134 (5.28)	68 (2.68)	140 (5.51)	140 (5.51)	284 (11.18)	8 (0.315)	1.6 (0.063)	1.6 (0.063)	M5	6 (13.23)

■ 2070, 2082, 4044, 4060

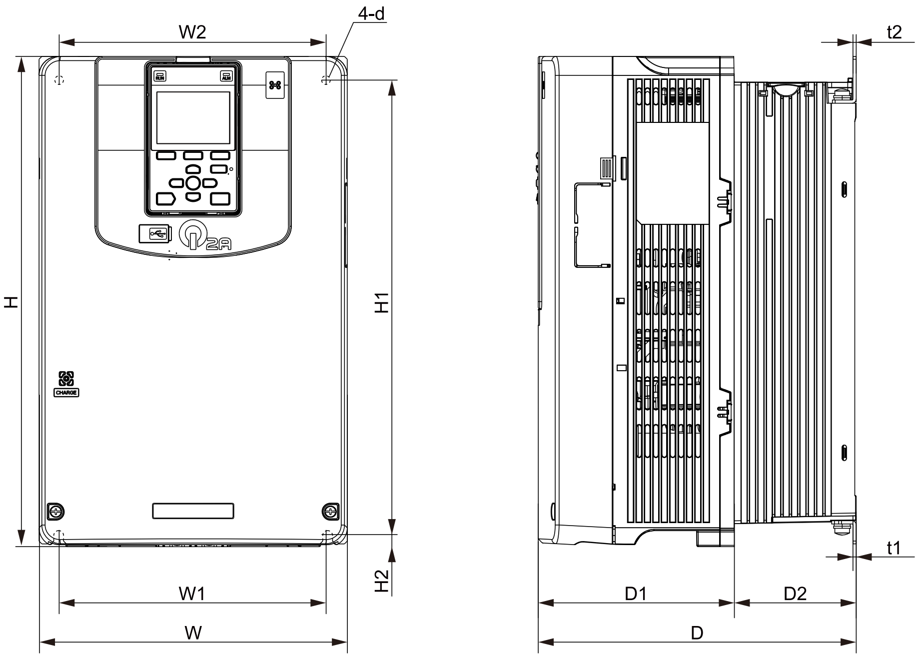

Figure 10.3 Exterior and Mounting Dimensions Diagram for 2070, 2082, 4044, 4060

Table 10.29 200 V class (IP20)

Model	Dimensions mm (in.)												Weight kg (lb.)
	W	H	D	D1	D2	W1	W2	H1	H2	t1	t2	d	
2070	220 (8.66)	350 (13.78)	227 (8.94)	140 (5.51)	87 (3.43)	192 (7.56)	192 (7.56)	335 (13.19)	8 (0.315)	2.3 (0.091)	2.3 (0.091)	M6	8.5 (18.74)
2082	220 (8.66)	350 (13.78)	227 (8.94)	140 (5.51)	87 (3.43)	192 (7.56)	192 (7.56)	335 (13.19)	8 (0.315)	2.3 (0.091)	2.3 (0.091)	M6	9.0 (19.84)

Table 10.30 400 V class (IP20)

Model	Dimensions mm (in.)												Weight kg (lb.)
	W	H	D	D1	D2	W1	W2	H1	H2	t1	t2	d	
4044	220 (8.66)	350 (13.78)	227 (8.94)	140 (5.51)	87 (3.43)	192 (7.56)	192 (7.56)	335 (13.19)	8 (0.315)	2.3 (0.091)	2.3 (0.091)	M6	7.5 (16.53)
4060	220 (8.66)	350 (13.78)	246 (9.69)	140 (5.51)	106 (4.17)	192 (7.56)	192 (7.56)	335 (13.19)	8 (0.315)	2.3 (0.091)	2.3 (0.091)	M6	12 (26.46)

Specifications

10

■ 2110, 4075

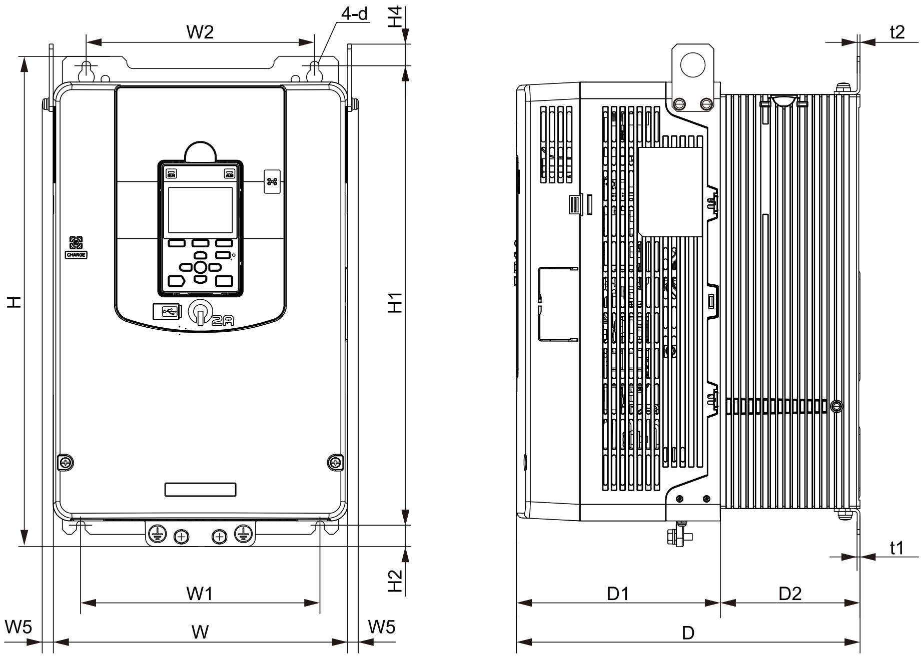

Figure 10.4 Exterior and Mounting Dimensions Diagram for 2110, 4075

Table 10.31 200 V class (IP20)

Model	Dimensions mm (in.)														Weight kg (lb.)
	W	H	D	D1	D2	W1	W2	W5 (max.)	H1	H2	H4	t1	t2	d	
2110	240 (9.45)	400 (15.75)	280 (11.02)	166 (6.54)	114 (4.49)	195 (7.68)	186 (7.32)	12 (0.472)	375 (14.76)	17.5 (0.689)	17.5 (0.689)	2.3 (0.091)	2.3 (0.091)	M6	22 (48.50)

Table 10.32 400 V class (IP20)

Model	Dimensions mm (in.)														Weight kg (lb.)
	W	H	D	D1	D2	W1	W2	W5 (max.)	H1	H2	H4	t1	t2	d	
4075	240 (9.45)	400 (15.75)	280 (11.02)	166 (6.54)	114 (4.49)	195 (7.68)	186 (7.32)	12 (0.472)	375 (14.76)	17.5 (0.689)	17.5 (0.689)	2.3 (0.091)	2.3 (0.091)	M6	17 (37.48)

■ 2138, 4089, 4103

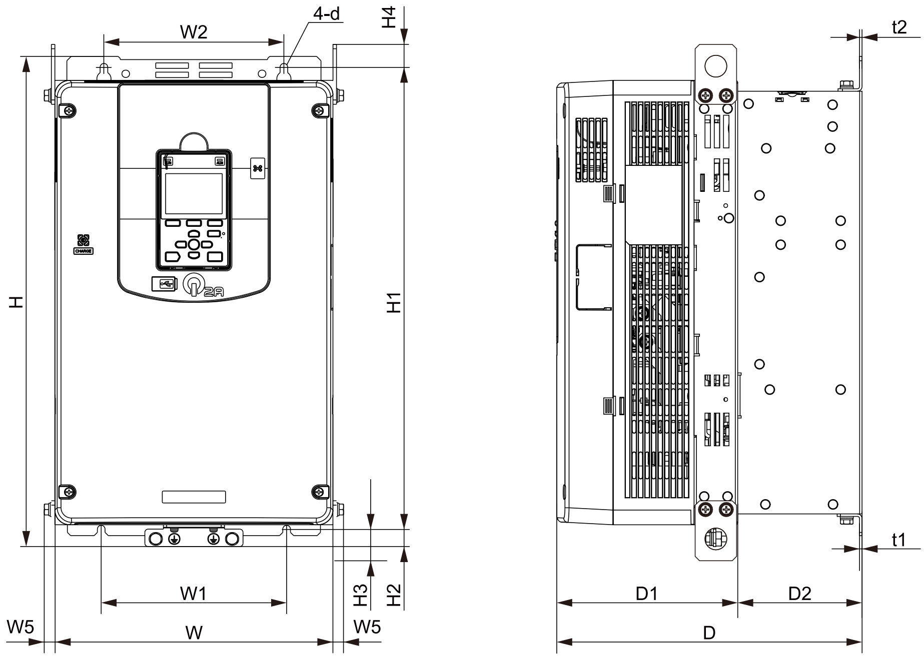

Figure 10.5 Exterior and Mounting Dimensions Diagram for 2138, 4089, 4103

Table 10.33 200 V class (IP20)

Model	Dimensions mm (in.)														Weight kg (lb.)
	W	H	D	D1	D2	W1	W2	W5 (max.)	H1	H2	H3	H4	t1	t2	d	
2138	255 (10.04)	450 (17.72)	280 (11.02)	166 (6.54)	114 (4.49)	170 (6.69)	165 (6.50)	12 (0.472)	424 (16.69)	16 (0.630)	29 (1.14)	21 (0.827)	2.3 (0.091)	2.3 (0.091)	M6	24 (52.91)

Table 10.34 400 V class (IP20)

Model	Dimensions mm (in.)															Weight kg (lb.)
	W	H	D	D1	D2	W1	W2	W5 (max.)	H1	H2	H3	H4	t1	t2	d	
4089	255 (10.04)	450 (17.72)	280 (11.02)	166 (6.54)	114 (4.49)	170 (6.69)	165 (6.50)	12 (0.472)	424 (16.69)	16 (0.630)	29 (1.14)	21 (0.827)	2.3 (0.091)	2.3 (0.091)	M6	22 (48.50)
4103	255 (10.04)	450 (17.72)	280 (11.02)	166 (6.54)	114 (4.49)	170 (6.69)	165 (6.50)	12 (0.472)	424 (16.69)	16 (0.630)	29 (1.14)	21 (0.827)	2.3 (0.091)	2.3 (0.091)	M6	25 (55.11)

■ 2169, 2211, 4140, 4168

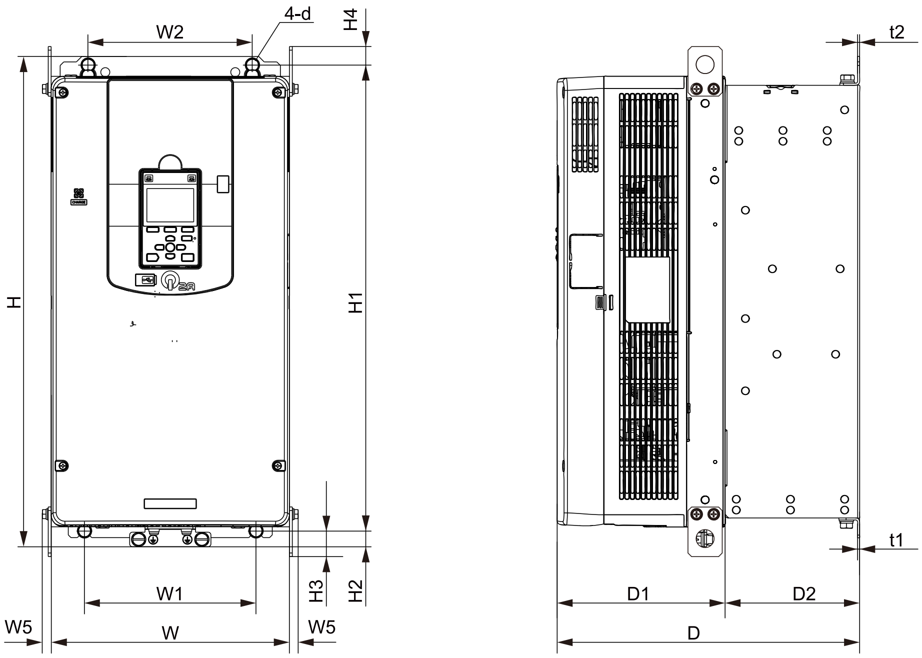

Figure 10.6 Exterior and Mounting Dimensions Diagram for 2169, 2211, 4140, 4168

Table 10.35 200 V class (IP20)

Model	Dimensions mm (in.)														Weight kg (lb.)
	W	H	D	D1	D2	W1	W2	W5 (max.)	H1	H2	H3	H4	t1	t2	d	
2169	264 (10.39)	543 (21.38)	335 (13.19)	186 (7.32)	149 (5.87)	190 (7.48)	182 (7.17)	12 (0.472)	516 (20.31)	17.5 (0.689)	28.5 (1.12)	20.5 (0.807)	2.3 (0.091)	2.3 (0.091)	M8	39 (85.98)
2211	264 (10.39)	543 (21.38)	335 (13.19)	186 (7.32)	149 (5.87)	190 (7.48)	182 (7.17)	12 (0.472)	516 (20.31)	17.5 (0.689)	28.5 (1.12)	20.5 (0.807)	2.3 (0.091)	2.3 (0.091)	M8	40 (88.18)

Table 10.36 400 V class (IP20)

Model	Dimensions mm (in.)															Weight kg (lb.)
	W	H	D	D1	D2	W1	W2	W5 (max.)	H1	H2	H3	H4	t1	t2	d	
4140	264 (10.39)	543 (21.38)	335 (13.19)	186 (7.32)	149 (5.87)	190 (7.48)	182 (7.17)	12 (0.472)	516 (20.31)	17.5 (0.689)	28.5 (1.12)	20.5 (0.807)	2.3 (0.091)	2.3 (0.091)	M8	38 (83.77)
4168	264 (10.39)	543 (21.38)	335 (13.19)	186 (7.32)	149 (5.87)	190 (7.48)	182 (7.17)	12 (0.472)	516 (20.31)	17.5 (0.689)	28.5 (1.12)	20.5 (0.807)	2.3 (0.091)	2.3 (0.091)	M8	39 (85.98)

■ 2257, 2313, 4208 to 4296

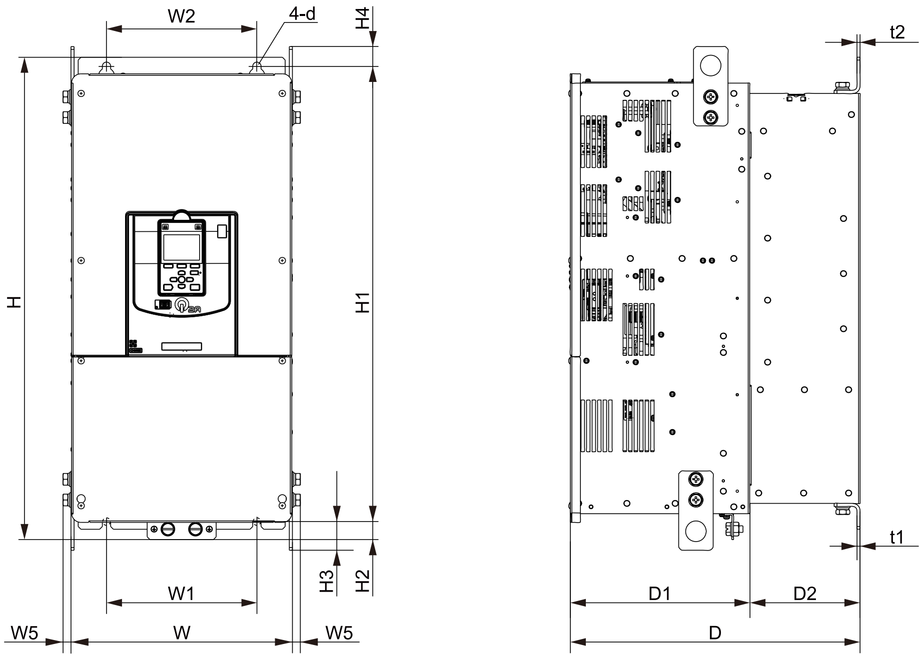

Figure 10.7 Exterior and Mounting Dimensions Diagram for 2257, 2313, 4208 to 4296

Table 10.37 200 V class (IP20)

Model	Dimensions mm (in.)														Weight kg (lb.)
	W	H	D	D1	D2	W1	W2	W5 (max.)	H1	H2	H3	H4	t1	t2	d	
2257	312 (12.28)	700 (27.56)	420 (16.54)	260 (10.24)	160 (6.30)	218 (8.58)	218 (8.58)	18 (0.709)	659 (25.94)	28 (1.10)	43.5 (1.71)	28.5 (1.12)	4.5 (0.177)	4.5 (0.177)	M10	67 (147.7)
2313	312 (12.28)	700 (27.56)	420 (16.54)	260 (10.24)	160 (6.30)	218 (8.58)	218 (8.58)	18 (0.709)	659 (25.94)	28 (1.10)	43.5 (1.71)	28.5 (1.12)	4.5 (0.177)	4.5 (0.177)	M10	67 (147.7)

Table 10.38 400 V class (IP20)

Model	Dimensions mm (in.)														Weight kg (lb.)
	W	H	D	D1	D2	W1	W2	W5 (max.)	H1	H2	H3	H4	t1	t2	d	
4208	312 (12.28)	700 (27.56)	420 (16.54)	260 (10.24)	160 (6.30)	218 (8.58)	218 (8.58)	18 (0.709)	659 (25.94)	28 (1.10)	43.5 (1.71)	28.5 (1.12)	4.5 (0.177)	4.5 (0.177)	M10	71 (156.5)
4250	312 (12.28)	700 (27.56)	420 (16.54)	260 (10.24)	160 (6.30)	218 (8.58)	218 (8.58)	18 (0.709)	659 (25.94)	28 (1.10)	43.5 (1.71)	28.5 (1.12)	4.5 (0.177)	4.5 (0.177)	M10	71 (156.5)
4296	312 (12.28)	700 (27.56)	420 (16.54)	260 (10.24)	160 (6.30)	218 (8.58)	218 (8.58)	18 (0.709)	659 (25.94)	28 (1.10)	43.5 (1.71)	28.5 (1.12)	4.5 (0.177)	4.5 (0.177)	M10	71 (156.5)

■ 2360, 2415, 4371, 4389

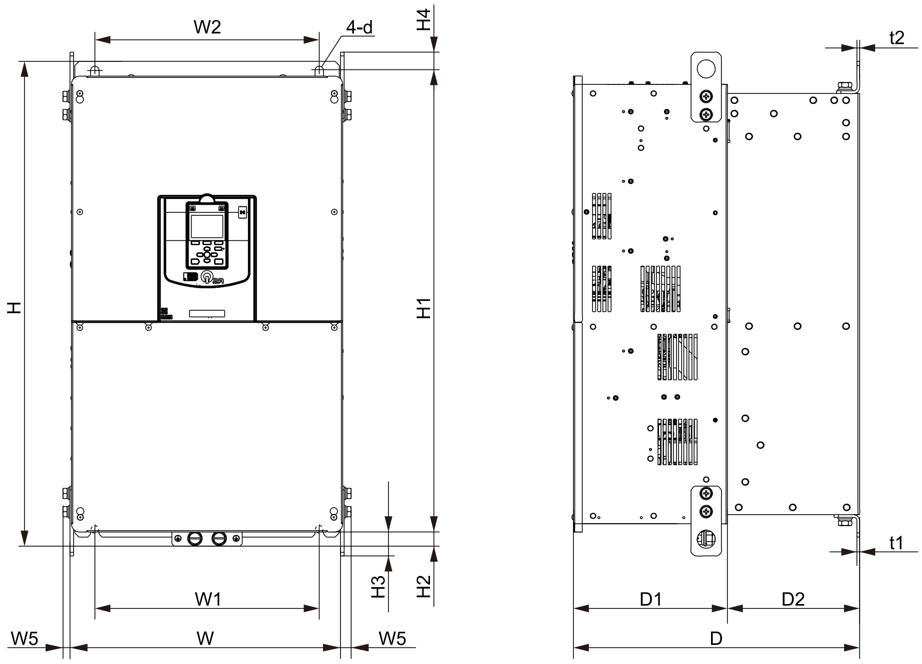

Figure 10.8 Exterior and Mounting Dimensions Diagram for 2360, 2415, 4371, 4389

Table 10.39 200 V class (IP20)

Model	Dimensions mm (in.)														Weight kg (lb.)
	W	H	D	D1	D2	W1	W2	W5 (max.)	H1	H2	H3	H4	t1	t2	d	
2360	440 (17.32)	800 (31.50)	472 (18.58)	254 (10.00)	218 (8.58)	370 (14.57)	370 (14.57)	20 (0.787)	757 (29.80)	28 (1.10)	44 (1.73)	30 (1.18)	4.5 (0.177)	4.5 (0.177)	M12	104 (229.3)
2415	440 (17.32)	800 (31.50)	472 (18.58)	254 (10.00)	218 (8.58)	370 (14.57)	370 (14.57)	20 (0.787)	757 (29.80)	28 (1.10)	44 (1.73)	30 (1.18)	4.5 (0.177)	4.5 (0.177)	M12	119 (262.3)

Table 10.40 400 V class (IP20)

Model	Dimensions mm (in.)														Weight kg (lb.)
	W	H	D	D1	D2	W1	W2	W5 (max.)	H1	H2	H3	H4	t1	t2	d	
4371	440 (17.32)	800 (31.50)	472 (18.58)	254 (10.00)	218 (8.58)	370 (14.57)	370 (14.57)	20 (0.787)	757 (29.80)	28 (1.10)	44 (1.73)	30 (1.18)	4.5 (0.177)	4.5 (0.177)	M12	122 (269.0)
4389	440 (17.32)	800 (31.50)	472 (18.58)	254 (10.00)	218 (8.58)	370 (14.57)	370 (14.57)	20 (0.787)	757 (29.80)	28 (1.10)	44 (1.73)	30 (1.18)	4.5 (0.177)	4.5 (0.177)	M12	126 (277.8)

■ 4453 to 4675

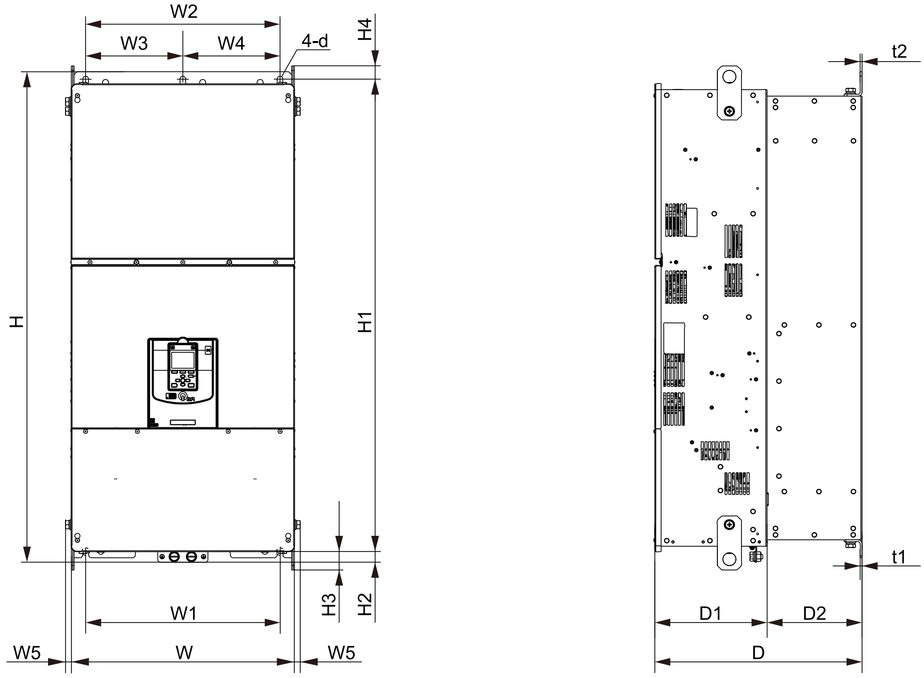

Figure 10.9 Exterior and Mounting Dimensions Diagram for 4453 to 4675

Table 10.41 400 V class (IP20)

Model	Dimensions mm (in.)																Weight
	W	H	D	D1	D2	W1	W2	W3	W4	W5 (max.)	H1	H2	H3	H4	t1	t2	d	kg (lb.)
4453	510 (20.08)	1140 (44.88)	480 (18.90)	260 (10.24)	220 (8.66)	450 (17.72)	450 (17.72)	225 (8.86)	225 (8.86)	20 (0.787)	1093 (43.03)	25.5 (1.00)	43.5 (1.71)	30.5 (1.20)	4.5 (0.177)	4.5 (0.177)	M12	198 (436.5)
4568	510 (20.08)	1140 (44.88)	480 (18.90)	260 (10.24)	220 (8.66)	450 (17.72)	450 (17.72)	225 (8.86)	225 (8.86)	20 (0.787)	1093 (43.03)	25.5 (1.00)	43.5 (1.71)	30.5 (1.20)	4.5 (0.177)	4.5 (0.177)	M12	198 (436.5)
4675	510 (20.08)	1140 (44.88)	480 (18.90)	260 (10.24)	220 (8.66)	450 (17.72)	450 (17.72)	225 (8.86)	225 (8.86)	20 (0.787)	1093 (43.03)	25.5 (1.00)	43.5 (1.71)	30.5 (1.20)	4.5 (0.177)	4.5 (0.177)	M12	207 (456.3)

◆ Drive Dimensions for Enclosed Wall-mounted Type (UL Type 1)

■ 4002 to 4023

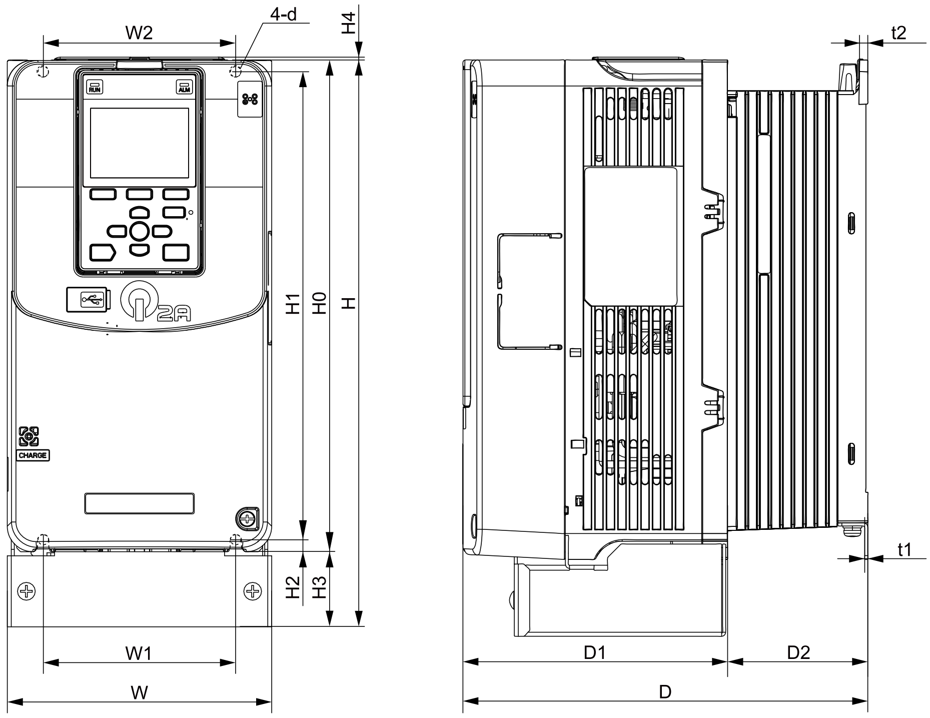

Figure 10.10 Exterior and Mounting Dimensions Diagram 1

Table 10.42 400 V Class (UL Type 1)

Model	Dimensions mm (in.)															Weight kg (lb.)
	W	H	D	D1	D2	W1	W2	H0	H1	H2	H3	H4	t1	t2	d	
4002	140 (5.51)	300 (11.81)	176 (6.93)	138 (5.43)	38 (1.50)	102 (4.02)	102 (4.02)	260 (10.24)	248 (9.76)	6 (0.236)	40 (1.57)	1.5 (0.059)	1.6 (0.063)	5 (0.197)	M5	4.1 (9.04)
4004	140 (5.51)	300 (11.81)	176 (6.93)	138 (5.43)	38 (1.50)	102 (4.02)	102 (4.02)	260 (10.24)	248 (9.76)	6 (0.236)	40 (1.57)	1.5 (0.059)	1.6 (0.063)	5 (0.197)	M5	4.1 (9.04)
4005	140 (5.51)	300 (11.81)	176 (6.93)	138 (5.43)	38 (1.50)	102 (4.02)	102 (4.02)	260 (10.24)	248 (9.76)	6 (0.236)	40 (1.57)	1.5 (0.059)	1.6 (0.063)	5 (0.197)	M5	4.1 (9.04)
4007	140 (5.51)	300 (11.81)	211 (8.31)	138 (5.43)	73 (2.87)	102 (4.02)	102 (4.02)	260 (10.24)	248 (9.76)	6 (0.236)	40 (1.57)	1.5 (0.059)	1.6 (0.063)	5 (0.197)	M5	4.5 (9.92)
4009	140 (5.51)	300 (11.81)	211 (8.31)	138 (5.43)	73 (2.87)	102 (4.02)	102 (4.02)	260 (10.24)	248 (9.76)	6 (0.236)	40 (1.57)	1.5 (0.059)	1.6 (0.063)	5 (0.197)	M5	4.5 (9.92)
4012	140 (5.51)	300 (11.81)	211 (8.31)	138 (5.43)	73 (2.87)	102 (4.02)	102 (4.02)	260 (10.24)	248 (9.76)	6 (0.236)	40 (1.57)	1.5 (0.059)	1.6 (0.063)	5 (0.197)	M5	4.5 (9.92)
4018	140 (5.51)	300 (11.81)	211 (8.31)	138 (5.43)	73 (2.87)	102 (4.02)	102 (4.02)	260 (10.24)	248 (9.76)	6 (0.236)	40 (1.57)	1.5 (0.059)	1.6 (0.063)	5 (0.197)	M5	4.8 (10.58)
4023	140 (5.51)	300 (11.81)	211 (8.31)	138 (5.43)	73 (2.87)	102 (4.02)	102 (4.02)	260 (10.24)	248 (9.76)	6 (0.236)	40 (1.57)	1.5 (0.059)	1.6 (0.063)	5 (0.197)	M5	4.8 (10.58)

■ 4031, 4038

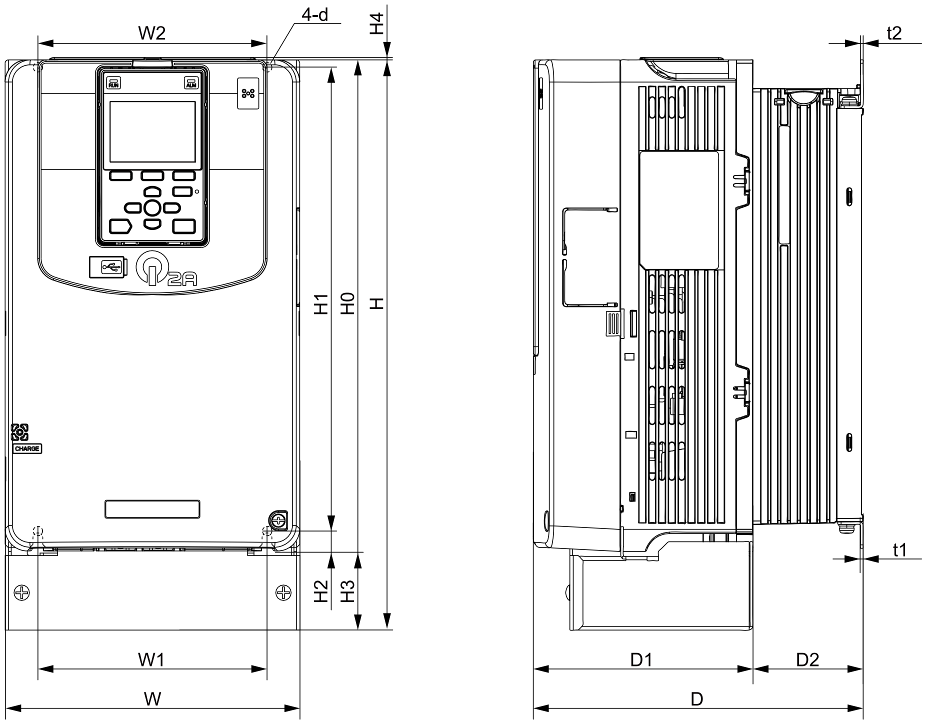

Figure 10.11 Exterior and Mounting Dimensions Diagram 2

Table 10.43 400 V Class (UL Type 1)

Model	Dimensions mm (in.)															Weight kg (lb.)
	W	H	D	D1	D2	W1	W2	H0	H1	H2	H3	H4	t1	t2	d	
4031	180 (7.09)	340 (13.39)	202 (7.95)	134 (5.28)	68 (2.68)	140 (5.51)	140 (5.51)	300 (11.81)	284 (11.18)	8 (0.315)	40 (1.57)	1.5 (0.059)	1.6 (0.063)	1.6 (0.063)	M5	7 (15.43)
4038	180 (7.09)	340 (13.39)	202 (7.95)	134 (5.28)	68 (2.68)	140 (5.51)	140 (5.51)	300 (11.81)	284 (11.18)	8 (0.315)	40 (1.57)	1.5 (0.059)	1.6 (0.063)	1.6 (0.063)	M5	7 (15.43)

■ 4044, 4060

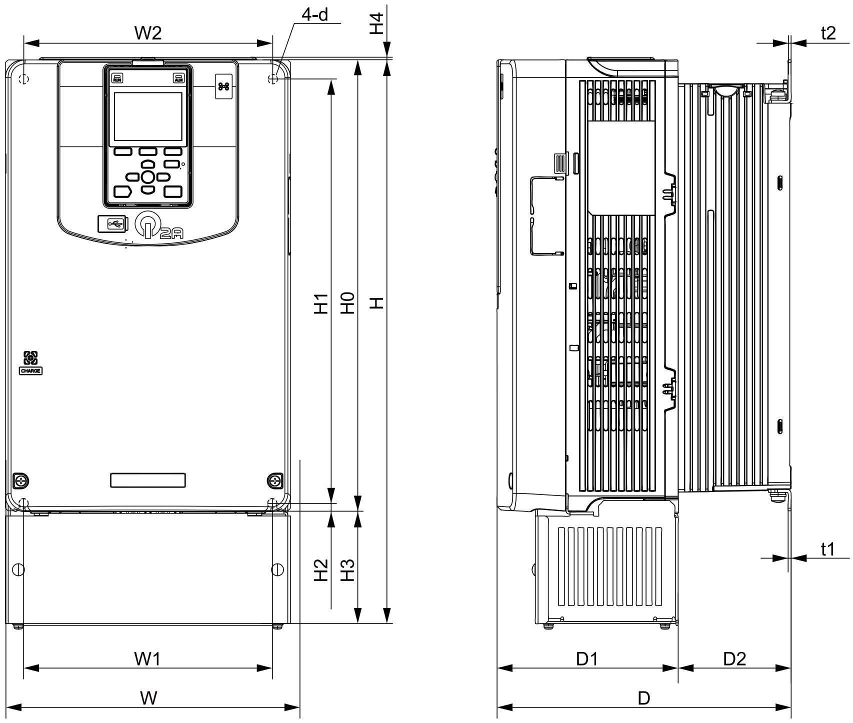

Figure 10.12 Exterior and Mounting Dimensions Diagram 3

Table 10.44 400 V Class (UL Type 1)

Model	Dimensions mm (in.)															Weight kg (lb.)
	W	H	D	D1	D2	W1	W2	H0	H1	H2	H3	H4	t1	t2	d	
4044	220 (8.66)	400 (15.75)	227 (8.94)	140 (5.51)	87 (3.43)	192 (7.56)	192 (7.56)	350 (13.78)	335 (13.19)	8 (0.315)	50 (1.97)	1.5 (0.059)	2.3 (0.091)	2.3 (0.091)	M6	8.5 (18.74)
4060	220 (8.66)	400 (15.75)	246 (9.69)	140 (5.51)	106 (4.17)	192 (7.56)	192 (7.56)	350 (13.78)	335 (13.19)	8 (0.315)	50 (1.97)	1.5 (0.059)	2.3 (0.091)	2.3 (0.091)	M6	13 (28.66)

■ 4075

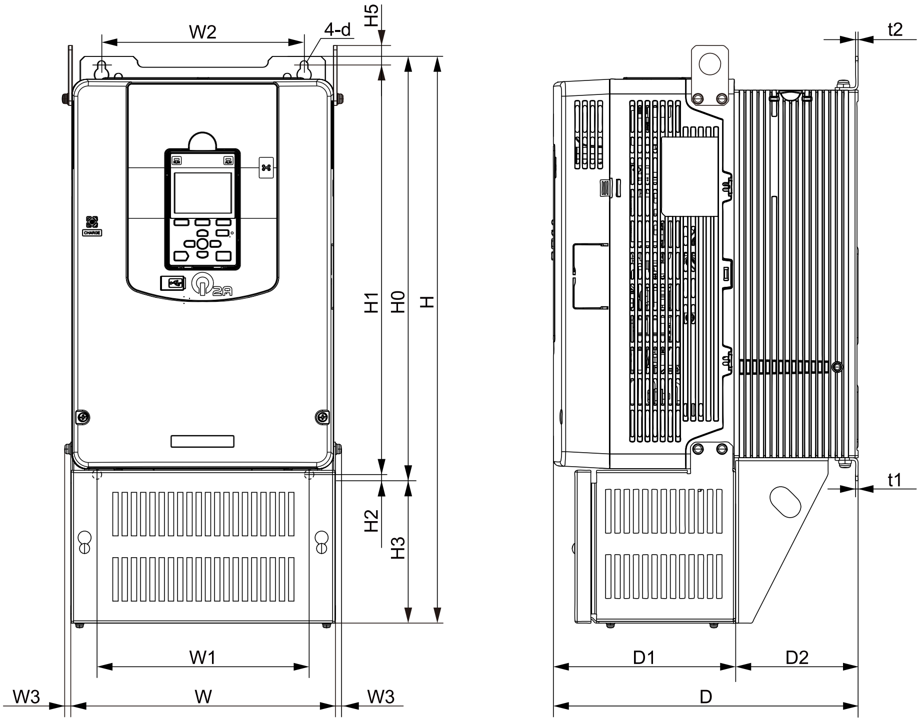

Figure 10.13 Exterior and Mounting Dimensions Diagram 4

Table 10.45 400 V Class (UL Type 1)

Model	Dimensions mm (in.)															Weight kg (lb.)
	W	H	D	D1	D2	W1	W2	W3 (max.)	H0	H1	H2	H3	H5	t1	t2	d	
4075	244 (9.61)	500 (19.69)	280 (11.02)	166 (6.54)	114 (4.49)	195 (7.68)	186 (7.32)	10 (0.394)	400 (15.75)	375 (14.76)	17.5 (0.689)	100 (3.94)	17.5 (0.689)	2.3 (0.091)	2.3 (0.091)	M6	20 (44.09)

Specifications

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■ 4089, 4103

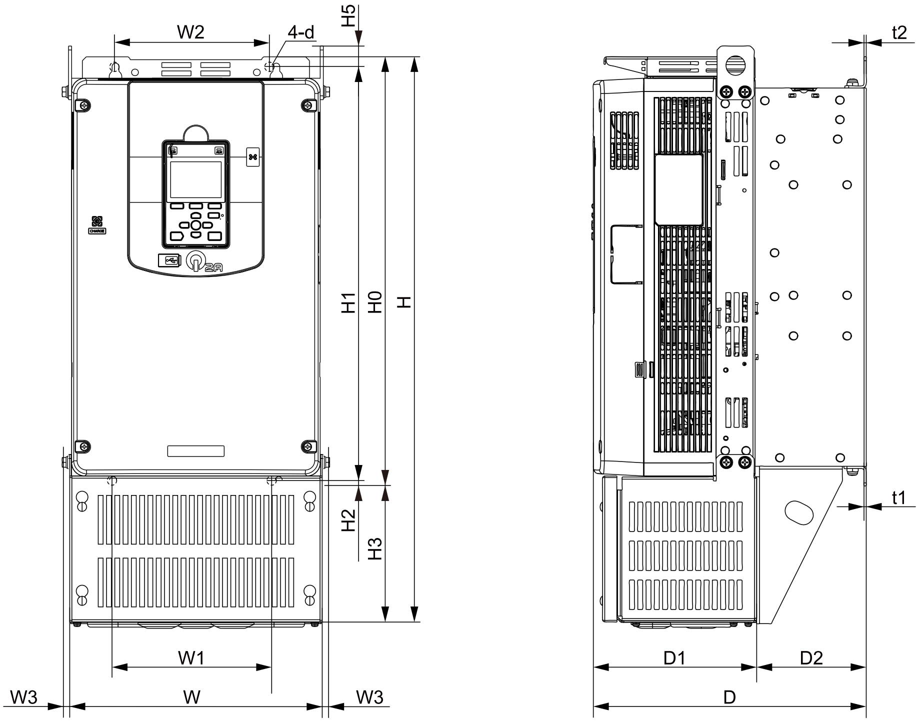

Figure 10.14 Exterior and Mounting Dimensions Diagram 5

Table 10.46 400 V Class (UL Type 1)

Model	Dimensions mm (in.)															Weight kg (lb.)
	W	H	D	D1	D2	W1	W2	W3 (max.)	H0	H1	H2	H3	H5	t1	t2	d	
4089	259 (10.20)	580 (22.83)	280 (11.02)	166 (6.54)	114 (4.49)	170 (6.69)	165 (6.50)	10 (0.394)	450 (17.72)	424 (16.69)	16 (0.630)	130 (5.12)	21 (0.827)	2.3 (0.091)	2.3 (0.091)	M6	25 (55.11)
4103	259 (10.20)	580 (22.83)	280 (11.02)	166 (6.54)	114 (4.49)	170 (6.69)	165 (6.50)	10 (0.394)	450 (17.72)	424 (16.69)	16 (0.630)	130 (5.12)	21 (0.827)	2.3 (0.091)	2.3 (0.091)	M6	29 (63.93)

■ 4140, 4168

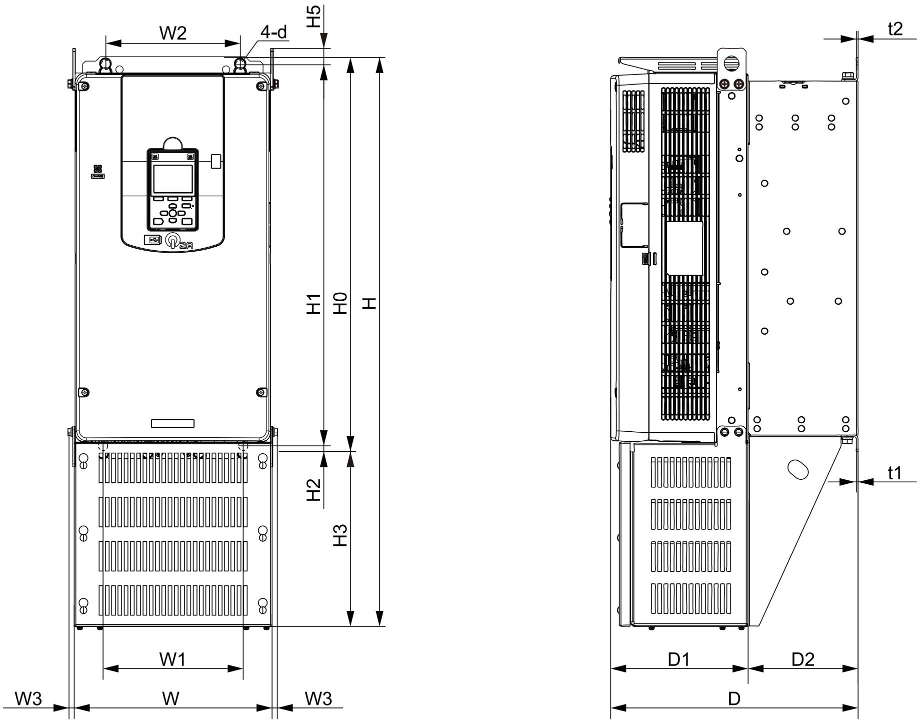

Figure 10.15 Exterior and Mounting Dimensions Diagram 6

Table 10.47 400 V Class (UL Type 1)

Model	Dimensions mm (in.)																Weight kg (lb.)
	W	H	D	D1	D2	W1	W2	W3 (max.)	H0	H1	H2	H3	H5	t1	t2	d	
4140	268 (10.55)	700 (27.56)	335 (13.19)	186 (7.32)	149 (5.87)	190 (7.48)	182 (7.17)	10 (0.394)	543 (21.38)	516 (20.31)	17.5 (0.689)	157 (6.18)	20.5 (0.807)	2.3 (0.091)	2.3 (0.091)	M8	43 (94.80)
4168	268 (10.55)	700 (27.56)	335 (13.19)	186 (7.32)	149 (5.87)	190 (7.48)	182 (7.17)	10 (0.394)	543 (21.38)	516 (20.31)	17.5 (0.689)	157 (6.18)	20.5 (0.807)	2.3 (0.091)	2.3 (0.091)	M8	44 (97.00)

■ 4208 to 4296

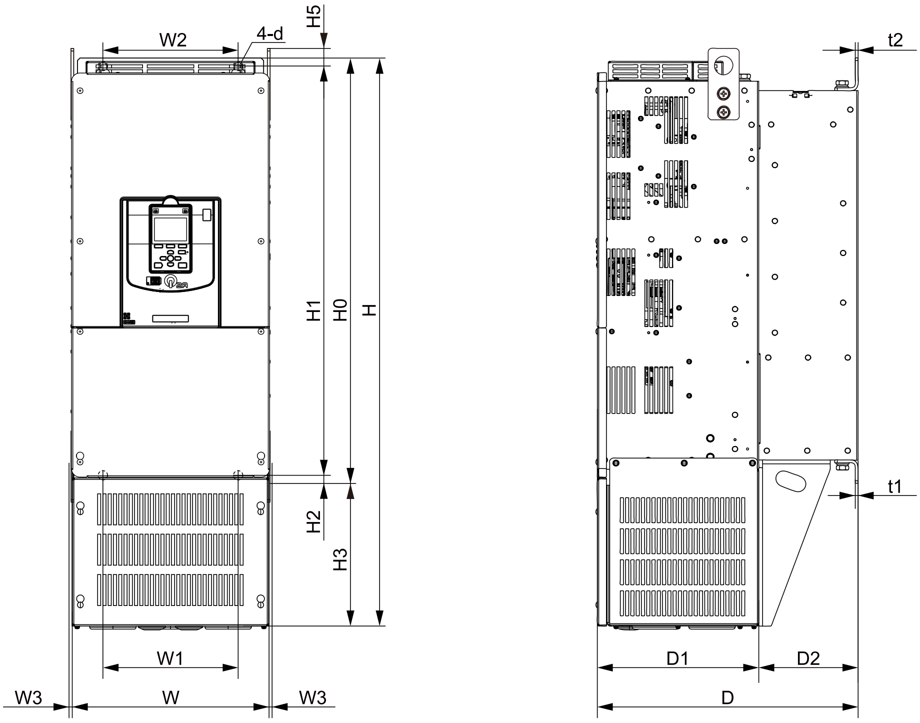

Figure 10.16 Exterior and Mounting Dimensions Diagram 7

Table 10.48 400 V Class (UL Type 1)

Model	Dimensions mm (in.)																Weight kg (lb.)
	W	H	D	D1	D2	W1	W2	W3 (max.)	H0	H1	H2	H3	H5	t1	t2	d	
4208	316 (12.44)	915 (36.02)	420 (16.54)	260 (10.24)	160 (6.30)	218 (8.58)	218 (8.58)	16 (0.630)	700 (27.56)	659 (25.94)	28 (1.102)	215 (8.46)	28.5 (1.122)	4.5 (0.177)	4.5 (0.177)	M10	79 (174.16)
4250	316 (12.44)	915 (36.02)	420 (16.54)	260 (10.24)	160 (6.30)	218 (8.58)	218 (8.58)	16 (0.630)	700 (27.56)	659 (25.94)	28 (1.102)	215 (8.46)	28.5 (1.122)	4.5 (0.177)	4.5 (0.177)	M10	79 (174.16)
4296	316 (12.44)	915 (36.02)	420 (16.54)	260 (10.24)	160 (6.30)	218 (8.58)	218 (8.58)	16 (0.630)	700 (27.56)	659 (25.94)	28 (1.102)	215 (8.46)	28.5 (1.122)	4.5 (0.177)	4.5 (0.177)	M10	79 (174.16)

■ 4371

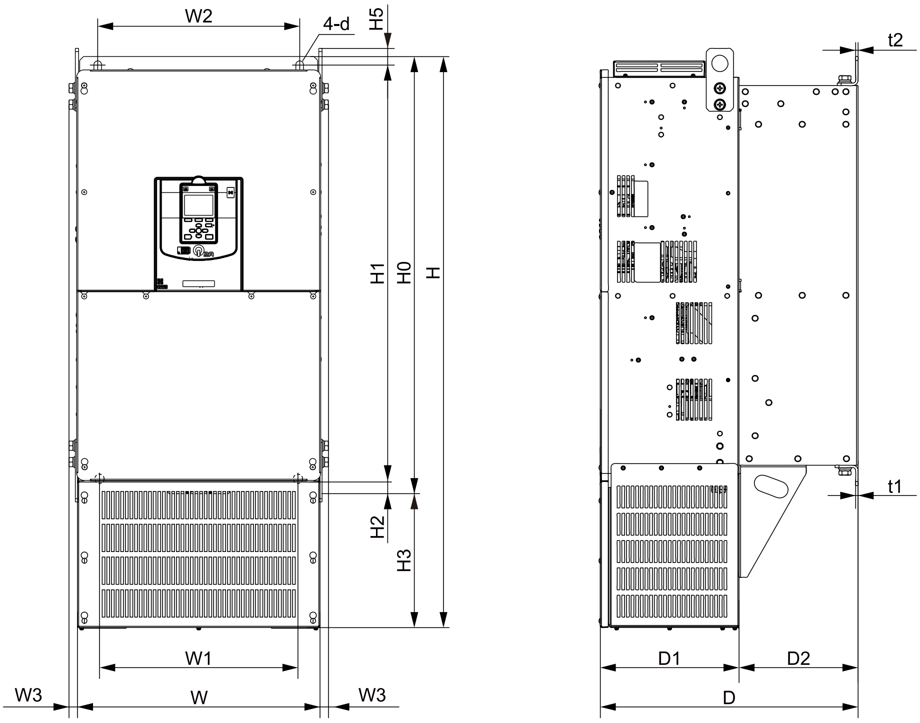

Figure 10.17 Exterior and Mounting Dimensions Diagram 8

Table 10.49 400 V Class (UL Type 1)

Model	Dimensions mm (in.)															Weight kg (lb.)
	W	H	D	D1	D2	W1	W2	W3 (max.)	H0	H1	H2	H3	H5	t1	t2	d	
4371	444 (17.48)	1045 (41.14)	472 (18.58)	254 (10.00)	218 (8.58)	370 (14.57)	370 (14.57)	18 (0.709)	800 (31.50)	757 (29.80)	28 (1.102)	245 (9.65)	30 (1.181)	4.5 (0.177)	4.5 (0.177)	M12	130 (286.60)

Specifications

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10.8 Knock-Out Hole Dimensions (UL Type 1)

◆ 4002 to 4023

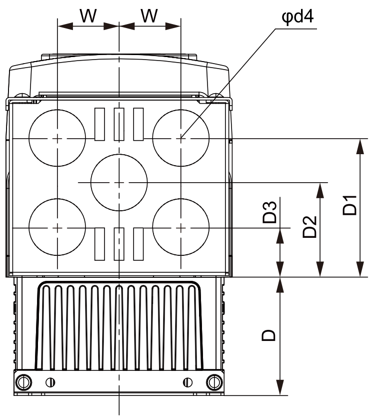

Figure 10.18 Knock-Out Dimensions Diagram 1 (Models: 4002 to 4023)

Model	Dimensions mm (in.)					
	D	D1	D2	D3	W	φd4
4002 to 4005	39 (1.54)	85 (3.35)	57.5 (2.26)	30 (1.18)	38.2 (1.50)	35 (1.38)
4007 to 4023	74 (2.91)	85 (3.35)	57.5 (2.26)	30 (1.18)	38.2 (1.50)	35 (1.38)

◆ 4031, 4038

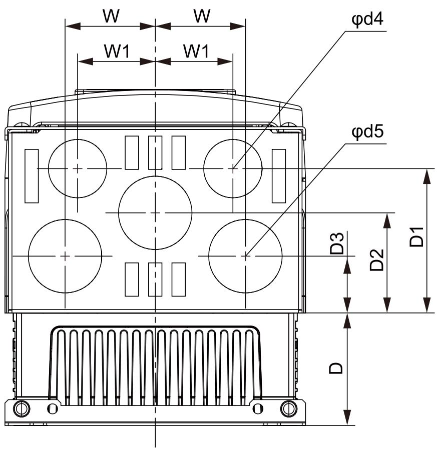

Figure 10.19 Knock-Out Dimensions Diagram 2 (Models: 4031, and 4038)

Model	Dimensions mm (in.)							
	D	D1	D2	D3	W	W1	φd4	φd5
4031, 4038	67.5 (2.66)	86.5 (3.41)	60 (2.36)	34 (1.34)	54 (2.13)	46.5 (1.83)	35 (1.38)	44 (1.73)

◆ 4044, 4060

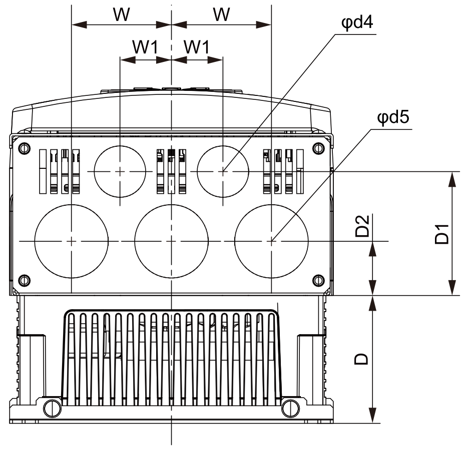

Figure 10.20 Knock-Out Dimensions Diagram 3 (Models: 4044, and 4060)

Model	Dimensions mm (in.)						
	D	D1	D2	W	W1	φd4	φd5
4044	87.2 (3.43)	84.3 (3.32)	36.8 (1.45)	68 (2.68)	35 (1.38)	35 (1.38)	50 (1.97)
4060	106.2 (4.18)	84.3 (3.32)	36.8 (1.45)	68 (2.68)	35 (1.38)	35 (1.38)	50 (1.97)

◆ 4075

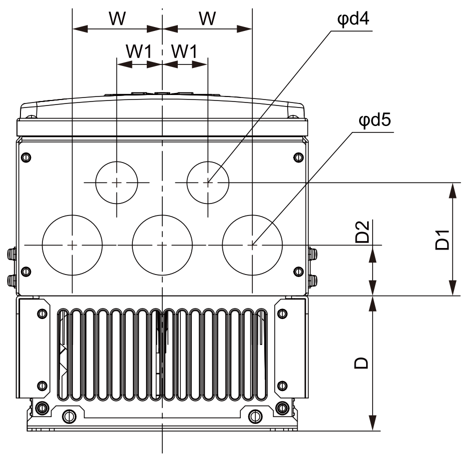

Figure 10.21 Knock-Out Dimensions Diagram 4 (Models: 4075)

Model	Dimensions mm (in.)						
	D	D1	D2	W	W1	φd4	φd5
4075	112.5 (4.43)	96 (3.78)	48.5 (1.91)	73 (2.87)	38 (1.50)	35 (1.38)	50 (1.97)

Specifications

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◆ 4089, 4103

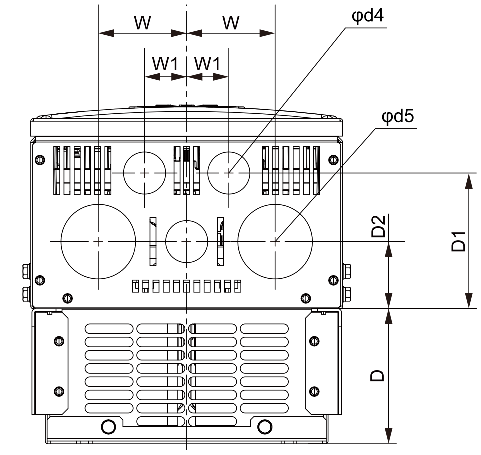

Figure 10.22 Knock-Out Dimensions Diagram 5 (Models: 4089, and 4103)

Model	Dimensions mm (in.)						
	D	D1	D2	W	W1	φd4	φd5
4089, 4103	112.4 (4.43)	112.8 (4.44)	55.8 (2.20)	73.5 (2.89)	35 (1.38)	35 (1.38)	62 (2.44)

◆ 4140, 4168

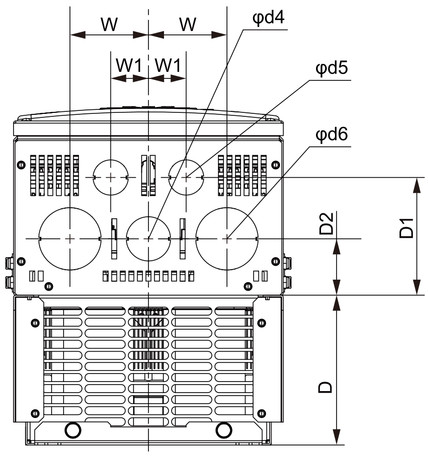

Figure 10.23 Knock-Out Dimensions Diagram 6 (Models: 4140, and 4168)

Model	Dimensions mm (in.)							
	D	D1	D2	W	W1	φd4	φd5	φd6
4140, 4168	149 (5.87)	117 (4.61)	56 (2.20)	78 (3.07)	37.5 (1.48)	44 (1.73)	35 (1.38)	62 (2.44)

◆ 4208 to 4296

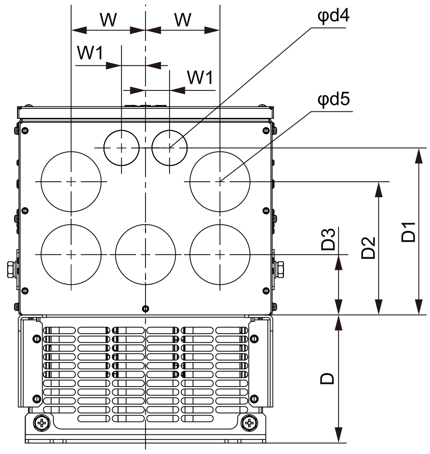

Figure 10.24 Knock-Out Dimensions Diagram 8 (Models: 4208, 4250, and 4296)

Model	Dimensions mm (in.)							
	D	D1	D2	D3	W	W1	φd4	φd5
4208, 4250, 4296	160 (6.30)	208.4 (8.20)	166.3 (6.55)	75.3 (2.96)	92.8 (3.65)	27.5 (1.08)	35 (1.38)	62 (2.44)

◆ 4371

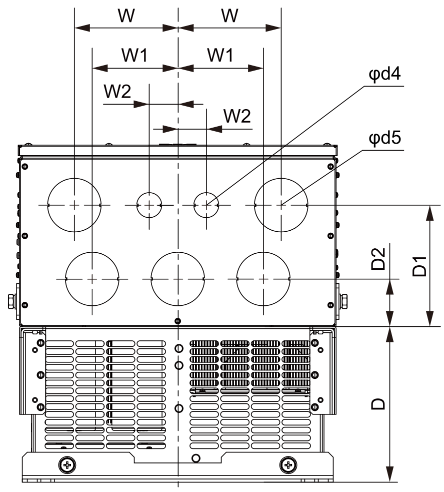

Figure 10.25 Knock-Out Dimensions Diagram 9 (Models: 4371)

Model	Dimensions mm (in.)							
	D	D1	D2	W	W1	W2	φd4	φd5
4371	218 (8.58)	170 (6.69)	66.6 (2.62)	145 (5.71)	40 (1.57)	120 (4.72)	35 (1.38)	75 (2.95)

Specifications

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10.9 Peripheral Devices and Options

This chapter shows the available peripheral devices and options for the drive.

- Selection: Refer to the drive catalog for information about available products.
- Installation and wiring: Refer to the instruction manual for each option.

◆ Main Circuit Options

Name	Model	Purpose
DC Reactor	UZDA series	To improve the drive input power factor. • To prevent damage to the drive when the power supply capacity is large. You must only use this option when the power supply capacity is more than 600 kVA. • To decrease harmonic current. • To improve the power supply total power factor.
AC Reactor	UZBA series	To improve the drive input power factor. • To prevent damage to the drive when the power supply capacity is large. You must only use this option when the power supply capacity is more than 600 kVA. • To decrease harmonic current. • To improve the power supply total power factor.
Braking Resistor	ERF-150WJ Series	To decrease the regenerative energy of the motor and decrease the deceleration time (duty cycle of 3% ED). You must also use the installation attachment.
Braking Resistor with Fuse	CF120-B579 Series	To decrease the regenerative energy of the motor and decrease the deceleration time (duty cycle of 3% ED). You must also use the installation attachment.
Braking Resistor Unit	LKEB series	To decrease the regenerative energy of the motor and decrease the deceleration time (duty cycle of 10% ED). The unit contains a thermal overload relay.
Braking Unit	CDBR series	Use with a braking resistor unit to decrease motor deceleration times.
Molded-Case Circuit Breaker (MCCB)	NF series	To prevent short circuit damage to the power supply system and provide overload protection for wiring.
Residual Current Monitor/ Detector (RCM/RCD)	NV and NS series	To prevent short circuit damage to the power supply system, provide overload protection for wiring, prevent electrical shock, and provide ground fault protection against earth leakage fires. **Note:** • You can use a molded-case circuit breaker as a replacement for an RCM/RCD that is upstream in the power supply system. • When you use a high frequency RCM/RCD at the power input side of the drive, make sure that each drive has a minimum cumulative sensitivity amperage of 30 mA.
Input Side Magnetic Contactor (MC)	SC series	To prevent burn damage when connecting a braking resistor. This option fully opens the circuit between the power supply and drive.
Surge Protective Device	400 V class: RFN3AL-504KD	To absorb open/close surges from the magnetic contactor and control relay. You must connect this option to magnetic contactors, control relays, magnetic valves, or magnetic brake coils.
Zero-Phase Reactor	F6045GB F11080GB F200160PB	To decrease wiring noise. You can use this option on the input side and the output side of the drive. **Note:** Install this option around the drive input power system and as near to the drive as possible.
Fuse Fuse Holder	400 V class: CR6L series, CS5F series, or FWH series	To prevent part failure, we recommend that you connect a fuse to the input side of the drive.
Input Side Noise Filter	LNFB, LNFD, and FN series	To decrease wiring noise. **Note:** Install this option around the drive input power system and as near to the drive as possible.
Output Side Noise Filter	LF series	To decrease wiring noise. **Note:** Install this option around the drive input power system and as near to the drive as possible.
Capacitor-Type Noise Filter	3XYG 1003	To decrease wiring noise. You must only use this option around the drive input power system. Do not connect this option to the output side.
Momentary Power Loss Recovery Unit	400 V class: P0020	To make sure that the drive has power during the momentary power loss ride-thru time (2 seconds).
Low-Voltage Manual Load Switch	“AICUT” LB series	PM motors act as generators when coasting to provide voltage to terminals. Install this option to prevent electric shock.

◆ Keypad Options

Name	Model	Purpose
LCD Operator Extension Cable	WV001 (1 m [3.3 ft] length) WV003 (3 m [9.8 ft] length)	To connect the keypad and drive. This option is an RJ-45, 8-pin straight-through UTP CAT5e cable.
Installation Support Set A	900-192-933-001	To attach the keypad to the control panel. This option uses screws.
Installation Support Set B	900-192-933-002	To attach the keypad to the control panel. This option uses nut clamps. Use this option when weld studs are located in the control panel.

◆ Attachments

Name	Model	Purpose
External Heatsink Mount Kit	900-193-209-001 900-193-209-002 900-193-209-003	Use this option to install the heatsink outside of the control panel. **Note:** When you use external heatsink mounting, it may be necessary to decrease the current.
UL Type 1 Kit	900-192-121-001 900-192-121-002 900-192-121-003 900-192-121-004 900-192-121-005	To change an open chassis type (IP20) drive to an enclosed wall-mounted type (UL Type 1) drive.
Braking Resistor Installation Attachment	EZZ020805A	To install a braking resistor to a drive.
External Mounting Attachment for Braking Unit Fin	EZZ021711A	To install the heatsink for the braking unit outside of the control panel.

◆ Engineering Tools

Name	Model	Purpose
Q2edit	-	To use a PC to configure drives and manage parameters.
Q2dev	-	To use a PC to do advanced drive programming.

◆ Option Cards

Name	Model	Purpose	Document No.
Complementary Type PG	PG-B3	This option is for use with PG V/f Control and OLVector control methods. The drive detects motor rotation speed from the pulse generator as feedback. The drive can then enable control of the output frequency keep a constant motor speed. • Complementary output PG support • A, B, and Z pulse (Three-phase pulse) input • Maximum input frequency: 50 kHz • Pulse monitor output: Open-collector (24 V, maximum of 30 mA) • Encoder power supply: 12 V, maximum 200 mA current.	TOBPC73060075
Motor PG Feedback Line Driver Interface	PG-X3	This option is for use with CLVector, PG V/f Control, and PM CLVector control methods. The drive detects motor rotation speed from the pulse generator as feedback. The drive can then enable control of the output frequency keep a constant motor speed. • RS-422 output encoder support • A, B, and Z pulse (differential pulse) input • Maximum input frequency: 300 kHz • Pulse monitor: Equivalent to RS-422 level • Encoder voltage output: 5 V or 12V, maximum 200 mA current	TOBPC73060076

Name	Model	Purpose	Document No.
Encoder Type (EnDat)	PG-F3	This option is for use with CLV/PM control method. The drive detects motor rotation speed from the pulse generator as feedback. The drive can then enable control of the output frequency keep a constant motor speed. • Supports EnDat 2.1/01, EnDat 2.2/01, EnDat 2.2/22 models from HEIDENHAIN • Supports HIPERFACE models from SICK STEGMANN • Maximum input frequency: 20 kHz (use for low-speed applications, for example gearless motors) **Note:** EnDat 2.2/22 has no limits on input frequencies. • Cable length: Maximum of 20 m (65.6 ft) for encoders and maximum of 30 m (98.4 ft) for pulse monitors • Pulse monitor: Equivalent to RS-422 level **Note:** You cannot use pulse monitor when using EnDat 2.2/22. • Encoder voltage output: 5 V at a maximum current of 330 mA, or 8 V at a maximum current of 150 mA **Note:** Use these types of encoder cables: • EnDat 2.1/01 and EnDat 2.2/01: HEIDENHAIN 17-pin cables • EnDat 2.2/22: HEIDENHAIN 8-pin cables • HIPERFACE: SICK STEGMANN 8-pin cables	TOBPC73060077
Resolver Interface	PG-RT3	To connect resolvers that are electrically compatible with resolver model TS2640N321E64 from Tamagawa Seiki Co., Ltd. These are the typical electrical characteristics of model TS2640N321E64: • Resolver motor excitation voltage: 10 Vac rms at 10 kHz • Transformation ratio [K]: 0.5 ±5% • Resolver input current: 100 mA rms • Cable length: 10 m (32.8 ft) maximum. 100 m (328 ft) maximum with SS5 or SS7 series motors from Yaskawa Motor Co., Ltd. and encoder cables from Yaskawa Controls Co., Ltd.) This option is for use with CLVector and PM CLVector control methods.	TOBPC73060087
Analog Input	AI-A3	To configure very accurate analog references at high resolution. • Input signal level: -10 Vdc to +10 Vdc (20 kΩ) at 4 mA to 20 mA (250 Ω) • Input channel: 3 channels Use a DIP switch to select voltage input or current input. • Input resolution – Voltage input: 13 bits (1/8192) + encoding – Current input: 1/4096	TOBPC73060078
Analog Monitor	AO-A3	To use analog signals to monitor the drive output frequency and output current. • Output resolution: 11 bits (1/2048) + encoding • Output voltage: -10 Vdc to +10 Vdc (non-insulated) • Output channels: 2 channels	TOBPC73060079
Digital Inputs	DI-A3	To use digital speed references and MFDI with a maximum 16 bits of resolution. • Input signals: Binary, 16 bits: BCD4 digits + SIGN signal + SET signal Use parameters to select 6 bits, 8 bits, or 12 bits. • Input voltage: 24 V (insulated) • Input current: 8 mA	TOBPC73060080
Digital Output	DO-A3	To output insulated digital signals and monitor the operation status of the drive (alarm signals and detecting zero speed). Type of output: • Photocoupler relays: 6 channels (48 V, 50 mA maximum) • Relay contact output: 2 channels (250 Vac at 1 A or less, 30 Vdc at 1 A or less)	TOBPC73060081
EtherNet/IP	SI-EN3	This option uses the host controller over EtherNet/IP communication to: • Operate and stop the drive • Set and view parameters • Monitor output frequency, output current, and other statuses	*1
PROFINET	SI-EP3	This option uses the host controller over PROFINET communication to: • Operate and stop the drive • Set and view parameters • Monitor output frequency, output current, and other statuses	*1
EtherCat	SI-ES3	This option uses the host controller over EtherCat communication to: • Operate and stop the drive • Set and view parameters • Monitor output frequency, output current, and other statuses	SIEPC71061699
Powerlink	SI-EL3	This option uses the host controller over Powerlink communication to: • Operate and stop the drive • Set and view parameters • Monitor output frequency, output current, and other statuses	*1

*1 Contact the manufacturer or your nearest sales representative for more information.

◆ Types of Option Cards and Connectors

Option PCB	Available Connector Ports	Number of Options Permitted
PG-B3, PG-X3	CN5-C (CN5-B)	2 *1
PG-F3 *2 and PG-RT3 *2	CN5-C	1
AO-A3, DO-A3	CN5-A, B, and C	1
AI-A3 *3, DI-A3 *3, SI-EL3, SI-EN3, SI-EP3, SI-ES3	CN5-A	1

*1 To connect only one PG option card, use the CN5-C connector. To connect two PG option cards, use the CN5-C and CN5-B connectors.

*2 If you use the motor switching function, you cannot use this option.

*3 To use AI-A3 and DI-A3 input statuses as monitors, connect the option cards to one of CN5-A, CN5-B, or CN5-C. Use U1-21, U1-22, and U1-23 to confirm the AI-A3 input status. Use U1-17 to confirm the DI-A3 input status.

11

Parameter List

11.1 How to Read the Parameter List

Icon	Description
V/f	The parameter is available when operating the drive with V/f Control.
CL-V/f	The parameters is available when operating the drive with Closed Loop V/f Control.
OLV	The parameter is available when operating the drive with Open Loop Vector Control.
CLV	The parameter is available when operating the drive with Closed Loop Vector Control.
AOLV	The parameter is available when operating the drive with Advanced Open Loop Vector Control.
OLV/PM	The parameter is available when operating the drive with Open Loop Vector Control for PM.
AOLV/PM	The parameter is available when operating the drive with Advanced Open Loop Vector Control for PM.
CLV/PM	The parameter is available when operating the drive with Closed Loop Vector Control for PM.
EZOLV	The parameter is available when operating the drive with EZ Open Loop Vector Control.
Hex.	Hexadecimal numbers that represent Modbus addresses to change parameters over network communication.
RUN	The parameter can be changed during run.
Expert	The parameter is available in Expert Mode only. *1

*1 Set *A1-01 = 3 [Access Level = Expert Parameters]* to display and set Expert Mode parameters on the keypad.

Gray icons identify parameters that are not available in the specified control method.

11.2 A: INITIALIZATION

◆ A1: INITIALIZATION

No. (Hex.)	Name	Description	Default (Range)	Ref.
A1-00 (0100) RUN	Language Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the language for the LCD keypad. **Note:** When you initialize the drive with parameter *A1-03 [Init Parameters]*, the drive will not reset this parameter. 0 : English 1 : Japanese 2 : German 3 : French 4 : Italian 5 : Spanish 6 : Portuguese 7 : Chinese 8 : Czech 9 : Russian 10 : Turkish 11 : Polish 12 : Greek	0 (0 - 12)	530
A1-01 (0101) RUN	Access Level	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets user access to parameters. The access level controls which parameters the keypad will display, and which parameters the user can set. 0 : Monitor only 1 : Manual Setup 2 : Standard Parameters 3 : Expert Parameters	2 (0 - 3)	530
A1-02 (0102)	Control Method	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the control method for the drive application and the motor. 0 : V/f Control 1 : PG V/f Control 2 : OLVector 3 : CLVector 4 : Adv OLVector 5 : PM OLVector 6 : PM AOLVector 7 : PM CLVector 8 : EZ Vector	0 (0 - 8)	531
A1-03 (0103)	Init Parameters	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets parameters to default values. 0 : No Initialization 1110 : User / Solution Initialization 2220 : 2-Wire Initialization 3330 : 3-Wire Initialization 4440 : Q2pack Init	0 (0 - 9990)	532
A1-04 (0104)	Password Input	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Entry point for the password set in *A1-05 [Password Setting]*. The user can view the settings of parameters that are locked without entering the password. Enter the correct password in this parameter to change parameter settings.	0000 (0000 - 9999)	533
A1-05 (0105)	Password Setting	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Set the password to lock parameters and prevent changes to parameter settings. Enter the correct password in *A1-04 [Password Input]* to unlock parameters and accept changes.	0000 (0000 - 9999)	534
A1-07 (0128)	Q2pack Enable	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the drive to operate with Q2pack. 0 : Disable Q2pack 1 : Enable Q2pack 2 : With DI	0 (0 - 2)	534
A1-12 (1564)	Bluetooth ID	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the password necessary to use Bluetooth to control the drive with a mobile device.	- (0000 - 9999)	535

◆ A2: MANUAL SELECTION

No. (Hex.)	Name	Description	Default (Range)	Ref.
A2-01 to A2-32 (0106 - 0125)	MAN1 Param1 to MAN3 Param12	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV You can select a maximum of 32 parameters or monitors for the drive and set them to parameters *A2-01 to A2-32*. The [Manual Setup] section of the keypad shows the set parameters. You can immediately access these set parameters.	Parameters in General-Purpose Setup Mode (Determined by A1-07)	535
A2-33 (0126)	Manual Autoset Parameters	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the automatic save feature for changes to parameters *MAN2 Param7 to MAN3 Param12*. 0 : Manual Entry 1 : Auto Save	0 (0, 1)	535

11.3 b: APPLICATION

◆ b1: OPERATION MODE SELECT

No. (Hex.)	Name	Description	Default (Range)	Ref.
b1-01 (0180)	Freq. Ref. Sel. 1	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the input method for the frequency reference. 0 : Keypad 1 : Analog Input 2 : Modbus 3 : Option PCB 4 : Pulse Train Input	1 (0 - 4)	537
b1-02 (0181)	Run Comm. Sel 1	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the input method for the Run command. 0 : Keypad 1 : Analog Input 2 : Modbus 3 : Option PCB	1 (0 - 3)	539
b1-03 (0182)	Stopping Method Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the method to stop the motor after removing a Run command or entering a Stop command. **Note:** The setting range is 0, 1, and 3 when *A1-02 = 3, 4, 5, 6, 7, or 8 [Control Method = CLVector, Adv OLVector, PM OLVector, PM AOLVector, PM CLVector, or EZ Vector]*. 0 : Ramp->Stop 1 : Coast->Stop 2 : DC Inj->Stop 3 : Timed Coast->Stop 9 : Distance Stop	0 (0 - 3, 9)	539
b1-04 (0183)	Reverse Operation Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the reverse operation function. Disable reverse operation in fan or pump applications where reverse rotation is dangerous. 0 : Enabled 1 : Disabled	0 (0, 1)	543
b1-05 (0184)	Below Min. Freq. Operation	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the drive operation when the frequency reference decreases to less than the value set in *E1-09 [Min Output Frequency]*. 1 : Operate@FRef 2 : Baseblock coast 3 : Min. Frequency 4 : Zero Speed	1 (1 - 4)	543
b1-06 (0185)	Double Scan DI Inputs Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the number of times that the drive reads the sequence input command to prevent problems from electrical interference. 1 : Single Scan 2 : Double Scan	2 (1, 2)	544
b1-07 (0186)	LO/RE Run Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets drive response to an existing Run command when the drive receives a second Run command from a different location. 1 : Cycle RUN 2 : Accept RUN	1 (1, 2)	544
b1-08 (0187)	RUN@PRG Mode Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the conditions for the drive to accept a Run command entered from an external source when using the keypad to set parameters. 1 : NoRUN@Program 2 : RUN@Program 3 : Program@Stop only	2 (1 - 3)	545
b1-14 (01C3)	Phase Order Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the phase order for output terminals U/T1, V/T2, and W/T3. This parameter can align the Forward Run command from the drive and the forward direction of the motor without changing wiring. 0 : Standard 1 : Phase Order Switch	0 (0, 1)	545

No. (Hex.)	Name	Description	Default (Range)	Ref.
b1-15 (01C4)	Freq. Ref. Sel. 2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the input method for frequency reference 2. 0 : Keypad 1 : Analog Input 2 : Modbus 3 : Option PCB 4 : Pulse Train Input	0 (0 - 4)	545
b1-16 (01C5)	Run Comm. Sel 2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the input method for Run Command 2 when the user switches the control circuit terminals ON/OFF to change the Run command source. 0 : Keypad 1 : Analog Input 2 : Modbus 3 : Option PCB	0 (0 - 3)	547
b1-17 (01C6)	RUN@PowerUp Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets drive response when energizing a drive that has an external Run command. Set this parameter in applications where energizing or de-energizing the drive enables the Run command. 1 : Disregard RUN 2 : Accept RUN	1 (1, 2)	548
b1-21 (0748) Expert	CLV Start Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets drive response to a Run command when *A1-02 = 3 or 7 [Control Method = CLVector or PM CLVector]*. Usually it is not necessary to change this setting. 1 : Reject RUN 2 : Accept RUN	1 (1, 2)	548
b1-35 (1117) Expert	DI Deadband Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the deadband time for MFDIs.	0.0 ms (0.0 to 100.0 ms)	549

◆ b2: DC INJ / SHORT CKT BRAKE

No. (Hex.)	Name	Description	Default (Range)	Ref.
b2-01 (0189)	ZSpd/DCI Threshold	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the frequency to start DC Injection Braking, Short Circuit Braking, and Zero Servo. **Note:** This parameter is available when *b1-03 = 0 [Stopping Method Selection = Ramp->Stop]*.	Determined by A1-02 (0.0 - 10.0 Hz)	549
b2-02 (018A)	DCI Braking Current	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the DC Injection Braking current as a percentage of the drive rated current.	50% (0 - 100%)	550
b2-03 (018B)	DCInj Time@Start	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the DC Injection Braking Time at stop. Sets the zero speed control at stop in CLV, AOLV, or CLV/PM.	A1-02 = 4: 0.03 s Other than A1-02 = 4: 0.00 s (0.00 - 10.00 s)	550
b2-04 (018C)	DCInj Time@Stop	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the DC Injection Braking Time at stop. Sets the zero speed control at stop in CLV, AOLV, or CLV/PM.	Determined by A1-02 (0.00 - 10.00 s)	550
b2-08 (0190)	MagFlux Comp Value	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets how much current the drive injects when DC Injection Braking at Start starts (Initial Excitation) as a percentage of *E2-03 [Mot No-Load Current]*.	0% (0 - 1000%)	551
b2-12 (01BA)	SCB Time@Start	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Short Circuit Braking time at start.	0.00 s (0.00 - 25.50 s)	551
b2-13 (01BB)	SCB Time@Stop	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Short Circuit Braking time at stop.	A1-02 = 8: 0.00 s Other than A1-02 = 8: 0.50 s (0.00 - 25.50 s)	551
b2-18 (0177)	SCB Current	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Short Circuit Braking Current as a percentage of the motor rated current.	100.0% (0.0 - 200.0%)	552

◆ b3: SPEED SEARCH

No. (Hex.)	Name	Description	Default (Range)	Ref.
b3-01 (0191)	SpSrch@Start Selection	**V/f** **CL-V/f** **OLV** CLV **AOLV** **OLV/PM** **AOLV/PM** CLV/PM **EZOLV** Sets the Speed Search at Start function where the drive will perform Speed Search with each Run command. 0 : Disabled 1 : Enabled	Determined by A1-02 (0, 1)	555
b3-02 (0192)	SpSrch Deactivation Current	**V/f** CL-V/f **OLV** CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the current level that stops Speed Search as a percentage of the drive rated output current. Usually it is not necessary to change this setting.	Determined by A1-02 (0 - 200%)	555
b3-03 (0193)	SpSrch Deceleration Time	**V/f** CL-V/f **OLV** CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the deceleration time during Speed Search operation. Set the length of time to decelerate from the maximum output frequency to the minimum output frequency.	2.0 s (0.1 - 10.0 s)	555
b3-04 (0194)	SpSrch V/F Gain	**V/f** CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the ratio used to reduce the V/f during searches to reduce the output current during speed searches.	Determined by o2-04 (10 - 100)	556
b3-05 (0195)	SpSrch Delay Time	**V/f** **CL-V/f** **OLV** **CLV** **AOLV** **OLV/PM** **AOLV/PM** **CLV/PM** **EZOLV** Sets the Speed Search delay time to activate a magnetic contactor installed between the drive and motor.	0.2 s (0.0 - 100.0 s)	556
b3-06 (0196) Expert	Speed Curr Lev1 for Estimation	**V/f** **CL-V/f** **OLV** CLV **AOLV** OLV/PM AOLV/PM CLV/PM **EZOLV** Sets the level of current that flows to the motor during Speed Estimation Speed Search as a coefficient of the motor rated current. Usually it is not necessary to change this setting.	Determined by o2-04 (0.0 - 2.0)	556
b3-07 (0197) Expert	Speed Curr Lev2 for Estimation	**V/f** **CL-V/f** **OLV** CLV **AOLV** OLV/PM AOLV/PM CLV/PM EZOLV Sets the level of current that flows to the motor during Speed Estimation Speed Search as a coefficient of *E2-03 [Mot No-Load Current]* or *E4-03 [M2 No-Load Current]*. Usually it is not necessary to change this setting.	1.0 (0.0 - 3.0)	556
b3-08 (0198) Expert	Speed ACR PGain for Estimation	**V/f** **CL-V/f** **OLV** **CLV** **AOLV** **OLV/PM** **AOLV/PM** CLV/PM **EZOLV** Sets the proportional gain for the automatic current regulator during Speed Estimation Speed Search. Also adjusts speed search responsiveness. Usually it is not necessary to change this setting.	A1-02 = 0 through 4: Determined by o2-04 , A1-02 = 5, 6, or 8: Determined by A1-02 (0.00 - 6.00)	556
b3-09 (0199) Expert	Speed ACR ITime for Estimation	**V/f** **CL-V/f** **OLV** **CLV** **AOLV** **OLV/PM** **AOLV/PM** CLV/PM **EZOLV** Sets the integral time for the automatic current regulator during Speed Estimation Speed Search. Also adjusts speed search responsiveness. Usually it is not necessary to change this setting.	Determined by A1-02 (0.0 - 1000.0 ms)	556
b3-10 (019A) Expert	Speed Det Gain for Estimation	**V/f** CL-V/f **OLV** CLV **AOLV** OLV/PM AOLV/PM CLV/PM EZOLV Sets the gain to correct estimated frequencies from Speed Estimation Speed Search.	1.05 (1.00 - 1.20)	557
b3-14 (019E)	Speed Bi-Directional Search	**V/f** **CL-V/f** **OLV** CLV **AOLV** OLV/PM AOLV/PM CLV/PM **EZOLV** Sets the direction of Speed Search to the direction of the frequency reference or in the motor rotation direction as detected by the drive. 0 : Disabled 1 : Enabled	Determined by A1-02 (0, 1)	557
b3-17 (01F0) Expert	Speed Retry Current Level	**V/f** CL-V/f **OLV** CLV **AOLV** OLV/PM AOLV/PM CLV/PM EZOLV Sets the current level for the search retry function in Speed Estimation Speed Search as a percentage where drive rated current is a setting value of 100%.	150% (0 - 200%)	557
b3-18 (01F1) Expert	Speed Retry Delay	**V/f** CL-V/f **OLV** CLV **AOLV** OLV/PM AOLV/PM CLV/PM EZOLV Sets the length of time that the drive will wait to retry Speed Estimation Speed Search when too much current flow stopped the Speed Search.	0.10 s (0.00 - 1.00 s)	557
b3-19 (01F2)	Speed Retry Times	**V/f** CL-V/f **OLV** CLV **AOLV** **OLV/PM** **AOLV/PM** CLV/PM **EZOLV** Sets the number of times to restart Speed Search if Speed Search does not complete.	3 times (0 - 10 times)	557
b3-24 (01C0)	SpSrch Method Selection	**V/f** **CL-V/f** **OLV** CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Speed Search method when starting the motor or when restoring power after a momentary power loss. 1 : Speed Estimation 2 : Current Det2	2 (1, 2)	557
b3-25 (01C8) Expert	SpSrch Wait Time	**V/f** CL-V/f **OLV** CLV **AOLV** **OLV/PM** **AOLV/PM** CLV/PM **EZOLV** Sets the length of time the drive will wait to start the Speed Search Retry function.	0.5 s (0.0 - 30.0 s)	558
b3-26 (01C7) Expert	Dir. Determ. Level	**V/f** **CL-V/f** **OLV** CLV **AOLV** OLV/PM AOLV/PM CLV/PM EZOLV Sets the level to find the motor rotation direction. Increase the value if the drive cannot find the direction.	1000 (40 - 60000)	558
b3-27 (01C9) Expert	SS@RUNbeforeBB	**V/f** **CL-V/f** **OLV** CLV **AOLV** **OLV/PM** **AOLV/PM** CLV/PM **EZOLV** Sets the conditions necessary to start Speed Search. 0 : SS@RUNbeforeBB 1 : SS Always	0 (0, 1)	558

Parameter List

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No. (Hex.)	Name	Description	Default (Range)	Ref.
b3-29 (077C) Expert	SpSrch BackEMF Threshold	V/f CL-V/f OLV CLV AOLV **OLV/PM** **AOLV/PM** CLV/PM EZOLV Sets the induced voltage for motors that use Speed Search. The drive will start Speed Search when the motor induced voltage level is the same as the setting value. Usually it is not necessary to change this setting.	10% (0 - 10%)	558
b3-31 (0BC0) Expert	SpSrch I Ref Level	**V/f** **CL-V/f** **OLV** CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the current level that decreases the output current during Current Detection Speed Search.	1.50 (1.50 - 3.50)	558
b3-32 (0BC1) Expert	SpSrch I End Level	**V/f** **CL-V/f** **OLV** CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the current level that completes Speed Search.	1.20 (0.00 - 1.49)	559
b3-33 (0B3F) Expert	SpSrch@Uv Selection	**V/f** **CL-V/f** **OLV** **CLV** **AOLV** **OLV/PM** **AOLV/PM** **CLV/PM** **EZOLV** Sets the function that starts Speed Search at start-up if the drive detects a *Uv [Undervoltage]* when it receives a Run command. 0 : Disabled 1 : Enabled	1 (0, 1)	559
b3-35 (0BC3) Expert	BckEMF Low Detection Level	**V/f** **CL-V/f** **OLV** **CLV** **AOLV** **OLV/PM** **AOLV/PM** CLV/PM **EZOLV** Sets the level of induced voltage that the drive must detect to start Speed Search.	10% (5 - 50%)	559
b3-36 (0BC4) Expert	HiBackEMF DetLev	**V/f** **CL-V/f** **OLV** **CLV** **AOLV** **OLV/PM** **AOLV/PM** CLV/PM **EZOLV** Sets one of the factors in the formula to prevent drive restarts and cause the drive to enter standby. The drive will enter standby and will not restart when the detected induced voltage of the motor ≥ power supply voltage × *b3-36*. Usually it is not necessary to change this setting.	97.0% (50.0% - 100.0%)	559
b3-54 (3123)	Search Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM **EZOLV** Sets the length of time that the drive will run Speed Search.	400 ms (10 - 2000 ms)	559
b3-55 (3124) Expert	Speed Curr Rise Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM **EZOLV** Sets the length of time that the drive will increase the current from zero current to the setting value of *b3-06 [Speed Curr Levl for Estimation]*.	10 ms (10 - 2000 ms)	560

◆ b4: TIMER

No. (Hex.)	Name	Description	Default (Range)	Ref.
b4-01 (01A3)	Timer ON Time Delay	**V/f** **CL-V/f** **OLV** **CLV** **AOLV** **OLV/PM** **AOLV/PM** **CLV/PM** **EZOLV** Sets the ON-delay time for the timer input.	0.0 s (0.0 - 3000.0 s)	560
b4-02 (01A4)	Timer OFF Time Delay	**V/f** **CL-V/f** **OLV** **CLV** **AOLV** **OLV/PM** **AOLV/PM** **CLV/PM** **EZOLV** Sets the OFF-delay time for the timer input.	0.0 s (0.0 - 3000.0 s)	561
b4-03 (0B30) Expert	2NO-2CM ON Time Delay	**V/f** **CL-V/f** **OLV** **CLV** **AOLV** **OLV/PM** **AOLV/PM** **CLV/PM** **EZOLV** Sets the delay time to activate the contact after the function set in *H2-01* activates.	0 ms (0 - 65000 ms)	561
b4-04 (0B31) Expert	2NO-2CM OFF Time Delay	**V/f** **CL-V/f** **OLV** **CLV** **AOLV** **OLV/PM** **AOLV/PM** **CLV/PM** **EZOLV** Sets the delay time to deactivate the contact after the function set in *H2-01* deactivates.	0 ms (0 - 65000 ms)	561
b4-05 (0B32) Expert	3NO-3CM ON Time Delay	**V/f** **CL-V/f** **OLV** **CLV** **AOLV** **OLV/PM** **AOLV/PM** **CLV/PM** **EZOLV** Sets the delay time to activate the contact after the function set in *H2-02* activates.	0 ms (0 - 65000 ms)	561
b4-06 (0B33) Expert	3NO-3CM OFF Time Delay	**V/f** **CL-V/f** **OLV** **CLV** **AOLV** **OLV/PM** **AOLV/PM** **CLV/PM** **EZOLV** Sets the delay time to deactivate the contact after the function set in *H2-02* deactivates.	0 ms (0 - 65000 ms)	561
b4-07 (0B34) Expert	4NO-4CM ON Time Delay	**V/f** **CL-V/f** **OLV** **CLV** **AOLV** **OLV/PM** **AOLV/PM** **CLV/PM** **EZOLV** Sets the delay time to activate the contact after the function set in *H2-03* activates.	0 ms (0 - 65000 ms)	561
b4-08 (0B35) Expert	4NO-4CM OFF Time Delay	**V/f** **CL-V/f** **OLV** **CLV** **AOLV** **OLV/PM** **AOLV/PM** **CLV/PM** **EZOLV** Sets the delay time to deactivate the contact after the function set in *H2-03* deactivates.	0 ms (0 - 65000 ms)	561

◆ b5: PID CONTROL

No. (Hex.)	Name	Description	Default (Range)	Ref.
b5-01 (01A5)	PID Enable	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Enables PID control. 0 : Disabled 1 : Enabled	0 (0,1)	567
b5-70 (01E5)	PID MainRefMode	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the PID main reference mode. 0 : PID only 1 : Fref + PID	0 (0, 1)	567
b5-71 (01E6)	PID Fdbk 1/2 Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Selects the feedback configuration for PID control. 0 : Feedback 1 1 : Feedback 2	0 (0, 1)	567
b5-72 (01E7)	PID D-FF Mode	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Determines whether the D part is in the feedback path or used for feed forward control. 0 : D=Fdback 1 : D=FdFwd	0 (0, 1)	568
b5-02 (01A6) RUN	Proportional Gain (P)	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the proportional gain (P) that is applied to PID input.	1.00 (0.00 - 25.00)	568
b5-03 (01A7) RUN	Integral Time (I)	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the integral time (I) that is applied to PID input.	1.0 s (0.0 - 360.0 s)	568
b5-04 (01A8) RUN	Integral Limit	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the upper limit for I control as a percentage of *E1-04 [Max Output Frequency]*.	100.0% (0.0 - 100.0%)	568
b5-05 (01A9) RUN	Derivative Time (D)	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the derivative time (D) for PID control. This parameter adjusts system responsiveness.	0.00 s (0.00 - 10.00 s)	569
b5-06 (01AA) RUN	PID Output Limit	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the maximum possible output from the PID controller as a percentage of *E1-04 [Max Output Frequency]*.	100.0% (0.0 - 100.0%)	569
b5-07 (01AB) RUN	PID Offset Adjustment	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the offset for the PID control output as a percentage of *E1-04 [Max Output Frequency]*.	0.0% (-100.0 - +100.0%)	569
b5-08 (01AC) Expert	PID Primary Delay Time Constant	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the primary delay time constant for the PID control output. Usually it is not necessary to change this setting.	0.00 s (0.00 - 10.00 s)	569
b5-09 (01AD)	PID Output Level Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the polarity of the PID output. 0 : Normal output 1 : Reverse output	0 (0, 1)	569
b5-10 (01AE) RUN	PID Output Gain Setting	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the amount of gain to apply to the PID output.	1.00 (0.00 - 25.00)	569
b5-11 (01AF)	PID Output Reverse Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function that enables and disables reverse motor rotation for negative PID control output. 0 : 0 lower limit 1 : Negative lower limit	0 (0, 1)	570
b5-12 (01B0)	Fdback Loss Select Mode	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the drive response to PID feedback loss. Sets drive operation after the drive detects PID feedback loss. 0 : DO Only Always 1 : AL+DO Always 2 : FLT+DO Always 3 : DO Only@PID Enable 4 : AL+DO@PID Enable 5 : FLT+DO@PID Enable	0 (0 - 5)	570
b5-13 (01B1)	Fdback Loss Lvl	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the level that triggers *PID Feedback Loss [FbL]* as a percentage of *E1-04 [Max Output Frequency]*.	0% (0 - 100%)	571

No. (Hex.)	Name	Description	Default (Range)	Ref.
b5-14 (01B2)	Fdback Loss Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the length of time that PID Feedback must be less than *b5-13 [Fdback Loss Lvl]* to detect *PID Feedback Loss [FbL]*.	1.0 s (0.0 - 25.5 s)	571
b5-15 (01B3)	Sleep Start Level	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the output level that triggers the PID Sleep function.	Determined by A1-02 (0.0 - 590.0)	571
b5-16 (01B4)	Sleep Delay Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets a delay time to start or stop the PID Sleep function.	0.0 s (0.0 - 25.5 s)	571
b5-17 (01B5)	PID Accel/Decel Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Raises or lowers the PID setpoint using the acceleration and deceleration times set to the drive. This is a soft-starter for the PID setpoint.	0.5 s (0.0 - 6000.0 s)	571
b5-18 (01DC)	b5-19 PID SP Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function that enables and disables *b5-19 [PID Setpoint Value]*. 0 : Disabled 1 : Enabled	0 (0, 1)	571
b5-19 (01DD) RUN	PID Setpoint Value	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the PID setpoint when *b5-18 = 1 [b5-19 PID SP Selection = Enabled]*.	0.00% (0.00 - 100.00%)	572
b5-20 (01E2)	PID Unit Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the units to set and show *b5-19 [PID Setpoint Value]*. 0 : 1 : 0.01Hz units 1 : 0.01% units 2 : rpm 3 : User Units	1 (0 - 3)	572
b5-34 (019F) RUN	PID Out Low Limit Level	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the output lower limit for the PID control as a percentage of *E1-04 [Max Output Frequency]*.	0.0% (-100.0 - +100.0%)	572
b5-35 (01A0) RUN	PID In Hi Limit Level	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the input upper limit for the PID control as a percentage of *E1-04 [Max Output Frequency]*.	1000.0% (0.0 - 1000.0%)	572
b5-36 (01A1)	PID HiHi Limit Level	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the level that triggers *Excessive PID Feedback [FbH]* as a percentage of *E1-04 [Max Output Frequency]*.	100% (0 - 100%)	572
b5-37 (01A2)	PID HiHi Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the length of time that the feedback signal must be more than the level set in *b5-36 [PID HiHi Limit Level]* to cause *Excessive PID Feedback [FbH]*.	1.0 s (0.0 - 25.5 s)	572
b5-38 (01FE)	PID SP User Scale for Display	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the display for *U5-01, U5-04* when the drive operates at the maximum output frequency.	Determined by b5-20 (1 - 60000)	573
b5-39 (01FF)	PID SP User digits for Display	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the number of digits to set and show the PID setpoint. 0 : No Decimal Places 1 : 1 Decimal Place 2 : 2 decimal places 3 : 3 Decimal Places	2 (0 - 3)	573
b5-40 (017F)	Fref Mon@PID	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the contents for monitor *U1-01 [Frequency Reference]* in PID control. 0 : U1-01 with PID Output 1 : U1-01 without PID Output	0 (0, 1)	573
b5-47 (017D)	PID Out Rev Operation Mode	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets reverse motor rotation when the PID control output is negative. 0 : Lower Limit is Zero 1 : Negative Output Accepted	1 (0, 1)	573
b5-53 (0B8F) RUN	PID I Ramp Limit	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the responsiveness of PID control when the PID feedback changes quickly.	0.0 Hz (0.0 - 10.0 Hz)	573
b5-55 (0BE1)	PID Fback Mon Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the monitor for PID Feedback (*Ux-xx*).	000 (000 - 999)	574
b5-56 (0BE2)	PID FdbkMon Gain	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the gain for the monitor specified in *b5-55 [PID Fback Mon Selection]*.	1.00 (0.00 - 10.00)	574
b5-57 (11DD)	PID FdbkMon Bias	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the bias for the monitor specified in *b5-55 [PID Fback Mon Selection]*.	0.00 (-10.00 - +10.00)	574

No. (Hex.)	Name	Description	Default (Range)	Ref.
b5-58 to b5-60 (1182 - 1184) RUN	PID Setpoint 2 to PID Setpoint 4	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the PID setpoint when *H1-xx = 77 or 78 [MFDI Function Select = PID SP Selection 1/2]*. This value is a percentage where *E1-04 [Max Output Frequency]* setting = a setting value of 100%.	0.00% (0.00 - 100.00%)	574
b5-61 (119A)	PID LoLim Select for Trim Mode	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function that adjusts the PID output in relation to the frequency reference. 0 : Disabled 1 : Enabled	0 (0, 1)	574
b5-62 (119B)	PID LoLim Value for Trim Mode	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the lower limit of the PID frequency reference trim as a percentage where *E1-04 [Max Output Frequency]* setting = a setting value of 100%.	0.00% (0.00 - 100.00%)	575
b5-63 (119C)	PID DifFB Mon Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the monitor for PID Differential Feedback (*Ux-xx*).	000 (000 - 999)	575
b5-64 (119D)	PID DifFB Mon Gain	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the gain for the monitor specified in *b5-63 [PID DifFB Mon Selection]*.	1.00 (0.00 - 10.00)	575
b5-65 (119F)	PID DifFB Mon Bias	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the bias for the monitor specified in *b5-63 [PID DifFB Mon Selection]*.	0.00 (-10.00 - +10.00)	575
b5-66 (11DE)	PID Fback Mon Level	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the signal level for the monitor specified in *b5-55 [PID Fback Mon Selection]*. 0 : Absolute 1 : Bi-directional (+/-)	0 (0, 1)	575
b5-67 (11DF)	PID DifFB Mon Level	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the signal level for the monitor specified in *b5-63 [PID DifFB Mon Selection]*. 0 : Absolute 1 : Bi-directional (+/-)	0 (0, 1)	575
b5-89 (0B89) RUN	Sleep Method Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets sleep and wake up operation when using PID. 0 : Standard 1 : EZ Sleep/Wake-up	0 (0, 1)	576
b5-90 (0B90)	EZsleep Unit	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the measurement units for *b5-91 [EZsleep Min Spd]* and *b5-92 [EZsleep Level]*. 0 : rpm 1 : 0.1Hz units	1 (0, 1)	576
b5-91 (0B91) RUN	EZsleep Min Spd	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the minimum speed for the EZ Sleep/Wakeup function. This parameter uses the largest value from *b5-91*, *b5-34 [PID Out Low Limit Level]*, and *d2-02 [FRef Lower Limit]*.	0.0 Hz or 0 rpm (r/min) (0.0 to 590.0 Hz or 0 to 35400 rpm (r/min))	576
b5-92 (0B92) RUN	EZsleep Level	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the value that the output frequency or motor speed must be less than for longer than *b5-93 [EZsleep Time]* to enter Sleep Mode.	0.0 Hz or 0 rpm (r/min) (0.0 to 590.0 Hz or 0 to 35400 rpm (r/min))	576
b5-93 (0B93) RUN	EZsleep Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the length of time that the output frequency or motor speed must be less than *b5-92 [EZsleep Level]* to enter Sleep Mode.	5.0 s (0.0 - 1000.0 s)	576
b5-94 (0B94) RUN	EZsleep Wake Level	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the level at which the drive resumes operation when exiting Sleep Mode.	0.00% (0.00 - 600.00%)	576
b5-95 (0B95)	EZsleep Wake Mode	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the wake-up mode to use when exiting Sleep Mode. 0 : Setpoint Delta 1 : Absolute	1 (0, 1)	577
b5-96 (0B96)	EZsleep Wake Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the EZ Wake-up time.	1.0 s (0.0 - 1000.0 s)	577

◆ b6: DWELL FUNCTION

No. (Hex.)	Name	Description	Default (Range)	Ref.
b6-01 (01B6)	Dwell Ref.@Start	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the output frequency that the drive will hold momentarily when the motor starts.	0.0 (Determined by A1-02)	577
b6-02 (01B7)	Dwell Time@Start	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the length of time that the drive will hold the output frequency when the motor starts.	0.0 s (0.0 - 10.0 s)	578

No. (Hex.)	Name	Description	Default (Range)	Ref.
b6-03 (01B8)	Dwell Ref@Stop	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the output frequency that the drive will hold momentarily when ramping to stop the motor.	0.0 (Determined by A1-02)	578
b6-04 (01B9)	Dwell Time@Stop	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the length of time for the drive to hold the output frequency when ramping to stop the motor.	0.0 s (0.0 - 10.0 s)	578

◆ b7: DROOP CONTROL

No. (Hex.)	Name	Description	Default (Range)	Ref.
b7-01 (01CA) RUN	Droop Ctrl Gain	CLV AOLV CLV/PM Sets the amount of deceleration when the torque reference is at 100% of Maximum Output Frequency.	0.0% (0.0 - 100.0%)	578
b7-02 (01CB) RUN	Droop Ctrl Delay Time	CLV AOLV CLV/PM Sets the responsiveness of Droop control. Decrease this setting when drive response is slow. Increase this setting when hunting or oscillation occur.	0.05 s (0.03 - 2.00 s)	579
b7-03 (017E)	Droop Ctrl Limit Selection	CLV AOLV CLV/PM Sets the Droop control limit function. 0 : Disabled 1 : Enabled	1 (0, 1)	579

◆ b8: ENERGY SAVING

No. (Hex.)	Name	Description	Default (Range)	Ref.
b8-01 (01CC)	eSave Ctrl Selection	V/f CL-V/f OLV CLV AOLV AOLV/PM CLV/PM EZOLV Sets the Energy-saving control function. 0 : Disabled 1 : Enabled 2 : Search Enabled	0 (Determined by A1-02)	579
b8-02 (01CD) RUN Expert	eSave Ctrl Gain	OLV CLV AOLV Sets the gain for Energy-saving control.	Determined by A1-02 (0.0 - 10.0)	579
b8-03 (01CE) RUN Expert	eSave Filter Time	OLV CLV AOLV Sets the responsiveness for Energy-saving control.	Determined by A1-02, C6-01, and o2-04 (0.00 - 10.00 s)	580
b8-04 (01CF) Expert	eSave Coef. Value	V/f CL-V/f Sets the Energy-saving control coefficient to maintain maximum motor efficiency. The default setting is for Yaskawa motors.	Determined by C6-01, E2-11, o2-04 (0.00 - 655.00)	580
b8-05 (01D0) Expert	Power Det.Filter Time	V/f CL-V/f Sets the time constant to measure output power.	20 ms (0 - 2000 ms)	580
b8-06 (01D1) Expert	Srch Op.Volt Limit	V/f CL-V/f Sets the voltage limit for Search Operation as a percentage where motor rated voltage is a setting value of 100%.	0% (0 - 100%)	580
b8-16 (01F8) Expert	PM eSave Coef.Ki	AOLV/PM CLV/PM Sets torque linearity. This parameter uses the Ki value from the motor nameplate. Usually it is not necessary to change this setting.	1.00 (0.00 - 3.00)	580
b8-17 (01F9) Expert	PM eSave Coef.Kt	AOLV/PM CLV/PM Sets torque linearity. This parameter uses the Kt value from the motor nameplate. Usually it is not necessary to change this setting.	1.00 (0.00 - 3.00)	581
b8-18 (01FA) Expert	eSave d-Axis Filter Time	AOLV/PM CLV/PM Sets the d-axis current reference filter time constant.	100 ms (0 - 5,000 ms)	581
b8-19 (0B40) Expert	eSave Search Frequency	AOLV/PM CLV/PM EZOLV Sets the frequency of Energy-saving control search operations. Usually it is not necessary to change this setting.	Determined by A1-02 (20 - 300 Hz)	581

No. (Hex.)	Name	Description	Default (Range)	Ref.
b8-20 (0B41) Expert	PM eSave Width for Test	V/f CL-V/f OLV CLV AOLV OLV/PM **AOLV/PM** **CLV/PM** **EZOLV** Sets the amplitude of Energy-saving control search operations.	1.0 degrees (0.1 - 5.0 degrees)	581
b8-21 (0B42) Expert	PM eSave Gain for Test	V/f CL-V/f OLV CLV AOLV OLV/PM **AOLV/PM** **CLV/PM** EZOLV Sets the gain of Energy-saving control search operations.	0.3Hz (0.1 - 20.0 Hz)	581
b8-22 (0B43) Expert	PM eSave LPF Cutoff Frq	V/f CL-V/f OLV CLV AOLV OLV/PM **AOLV/PM** **CLV/PM** EZOLV Sets the frequency of the filter used to extract the high-efficiency phase from search operations. Usually it is not necessary to change this setting.	10.0 Hz (1.0 - 30.0 Hz)	582
b8-23 (0B44) Expert	PM eSave Srch Limit	V/f CL-V/f OLV CLV AOLV OLV/PM **AOLV/PM** **CLV/PM** EZOLV Sets the search operations output limit. Usually it is not necessary to change this setting.	15.0 degrees (0.0 - 30.0 degrees)	582
b8-24 (0B45) Expert	PM eSave HiF Gain for ACR	V/f CL-V/f OLV CLV AOLV OLV/PM **AOLV/PM** **CLV/PM** EZOLV Sets the gain for high-frequency current control.	200.0 Hz (100.0 - 1000.0 Hz)	582
b8-25 (0B46) Expert	PM eSave Srch Start Level	V/f CL-V/f OLV CLV AOLV OLV/PM **AOLV/PM** **CLV/PM** EZOLV Sets the start level for search operations.	10.0% (0.0 - 100.0%)	582
b8-26 (0B47) Expert	PM eSave Pwr SP Setpoint	V/f CL-V/f OLV CLV AOLV OLV/PM **AOLV/PM** **CLV/PM** EZOLV Sets a value to increase torque accuracy.	0.0% (-10.0 - +10.0%)	582
b8-28 (0B8B) Expert	OverExc Action Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM **EZOLV** Sets the function for excitation operation. 0 : Disabled 1 : Enabled	0 (0, 1)	582
b8-29 (0B8C)	eSave Priority Mode	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM **EZOLV** Sets the priority of drive response between changes to the load or Energy-saving control. 0 : Priority: Drive Response 1 : Priority: Energy Savings	0 (0, 1)	582
b8-50 (0B0D)	Standby Mode Selection	**V/f** **CL-V/f** **OLV** **CLV** **AOLV** **OLV/PM** **AOLV/PM** **CLV/PM** **EZOLV** Sets the Standby Mode function. 0 : Disabled 1 : Enabled	0 (0, 1)	583
b8-51 (0B01)	Standby Mode Wait Time	**V/f** **CL-V/f** **OLV** **CLV** **AOLV** **OLV/PM** **AOLV/PM** **CLV/PM** **EZOLV** Sets the delay time before turning off the electromagnetic contactor after the drive stops.	600 s (0 - 6000 s)	583

◆ b9: ZERO SERVO

No. (Hex.)	Name	Description	Default (Range)	Ref.
b9-01 (01DA)	Zero Servo Gain	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM **CLV/PM** EZOLV Sets the responsiveness for the Zero Servo function.	5 (0 - 100)	584
b9-02 (01DB)	Zero Servo Width for Completion	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM **CLV/PM** EZOLV Sets the range to trigger an output terminal set for “Zero Servo Complete” during Zero Servo operation. Be sure to set the deviation from the Zero Servo start position.	10 (0 - 16383)	584

11.4 C: TUNING

◆ C1: ACCEL / DECEL

No. (Hex.)	Name	Description	Default (Range)	Ref.
C1-01 (0200) RUN	Accel Time 1	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the length of time to accelerate from zero to maximum output frequency.	10.0 s (0.0 - 6000.0 s)	587
C1-02 (0201) RUN	Decel Time 1	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the length of time to decelerate from maximum output frequency to zero.	10.0 s (0.0 - 6000.0 s)	587
C1-03 (0202) RUN	Accel Time 2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the length of time to accelerate from zero to maximum output frequency.	10.0 s (0.0 - 6000.0 s)	587
C1-04 (0203) RUN	Decel Time 2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the length of time to decelerate from maximum output frequency to zero.	10.0 s (0.0 - 6000.0 s)	587
C1-05 (0204) RUN	Accel Time 3	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the length of time to accelerate from zero to maximum output frequency.	10.0 s (0.0 - 6000.0 s)	587
C1-06 (0205) RUN	Decel Time 3	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the length of time to decelerate from maximum output frequency to zero.	10.0 s (0.0 - 6000.0 s)	587
C1-07 (0206) RUN	Accel Time 4	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the length of time to accelerate from zero to maximum output frequency.	10.0 s (0.0 - 6000.0 s)	588
C1-08 (0207) RUN	Decel Time 4	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the length of time to decelerate from maximum output frequency to zero.	10.0 s (0.0 - 6000.0 s)	588
C1-09 (0208)	Fast Stop Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the length of time that the drive will decelerate to zero for a Fast Stop. **Note:** • Decelerating too quickly can cause an *ov [Overvoltage]* fault that shuts off the drive while the motor to coasts to a stop. Set a Fast Stop time in *C1-09* that prevents motor coasting and makes sure that the motor stops quickly and safely. • When *L2-29 = 1 [KEB Method = Single KEB1 Ride-Thru]* and you do KEB Auto-Tuning, the drive will automatically set *C1-09*. If you must not change the Fast Stop time, do not do KEB Auto-Tuning.	10.0 s (0.0 - 6000.0 s)	588
C1-10 (0209)	Ac/Dec Units	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the setting units for *C1-01 to C1-08 [Accel/Decel Times 1 to 4]*, *C1-09 [Fast Stop Time]*, *L2-06 [KEB Decel Time]*, and *L2-07 [KEB Accel Time]*. 0 : 0.01s 1 : 0.1s	1 (0, 1)	588
C1-11 (020A)	Ac/Dec Switch Frequency	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the frequency at which the drive will automatically change acceleration and deceleration times.	Determined by A1-02 (0.0 - 590.0 Hz)	589
C1-14 (0264)	Ac/Dec Base Frequency	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the base frequency used to calculate acceleration and deceleration rates.	0.0 Hz (0.0 - 590.0 Hz)	589

◆ C2: JERK CONTROL

No. (Hex.)	Name	Description	Default (Range)	Ref.
C2-01 (020B)	Jerk@Start of Accel	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the jerk acceleration time at start.	Determined by A1-02 (0.00 - 10.00 s)	591
C2-02 (020C)	Jerk@End of Accel	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the jerk acceleration time at completion.	0.20 s (0.00 - 10.00 s)	591
C2-03 (020D)	Jerk@Start of Decel	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the jerk deceleration time at start.	0.20 s (0.00 - 10.00 s)	591
C2-04 (020E)	Jerk@End of Decel	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the jerk deceleration time at completion.	0.00 s (0.00 - 10.00 s)	591

◆ C3: SLIP COMPENSATION

No. (Hex.)	Name	Description	Default (Range)	Ref.
C3-01 (020F) RUN	Slip Comp Gain	**V/f** CL-V/f **OLV** **CLV** **AOLV** OLV/PM AOLV/PM CLV/PM **EZOLV** Sets the gain for the slip compensation function. Usually it is not necessary to change this setting. **Note:** Correctly set these parameters before changing the slip compensation gain: • *E2-01 [Mot Rated Current (FLA)]* • *E2-02 [Mot Rated Slip]* (Set during Auto-Tuning when *A1-02 = 2 [Control Method = OLVector]*) • *E2-03 [Mot No-Load Current]*	Determined by A1-02 (0.0 - 2.5)	591
C3-02 (0210) RUN	Slip Comp Delay Time	**V/f** CL-V/f **OLV** CLV AOLV OLV/PM AOLV/PM CLV/PM **EZOLV** Sets the slip compensation delay time when speed is unstable or when the slip compensation response is too slow. Usually it is not necessary to change this setting.	Determined by A1-02 (0 - 10000 ms)	592
C3-03 (0211)	Slip Comp Limit	**V/f** CL-V/f **OLV** CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the upper limit for the slip compensation function as a percentage of the motor rated slip.	200% (0 - 250%)	592
C3-04 (0212)	Slip Comp@Regen	**V/f** CL-V/f **OLV** CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the slip compensation function during regenerative operation. 0 : Disabled 1 : Enable>6 Hz 2 : Enable>C3-15	0 (0 - 2)	592
C3-05 (0213)	Vout Limit Selection	V/f CL-V/f **OLV** **CLV** **AOLV** OLV/PM AOLV/PM CLV/PM EZOLV Sets the automatic reduction of motor magnetic flux when the output voltage is saturated. 0 : Disabled 1 : Enabled	0 (0, 1)	593
C3-16 (0261) Expert	Vout Limit Start Level	V/f CL-V/f **OLV** **CLV** **AOLV** OLV/PM AOLV/PM CLV/PM EZOLV Sets the modulation factor that starts the output voltage limit operation when *C3-05 = 1 [Vout Limit Selection = Enabled]*.	90.0% (70.0 - 90.0%)	593
C3-17 (0262) Expert	Vout Limit Max Level	V/f CL-V/f **OLV** **CLV** **AOLV** OLV/PM AOLV/PM CLV/PM EZOLV Sets the modulation factor used with *C3-18 [Vout Limit Level]* for the output voltage limit operation when *C3-05 = 1 [Vout Limit Selection = Enabled]*.	100.0% (85.0 - 100.0%)	593
C3-18 (0263) Expert	Vout Limit Level	V/f CL-V/f **OLV** **CLV** **AOLV** OLV/PM AOLV/PM CLV/PM EZOLV Sets the maximum drop width of the voltage reference when *C3-05 = 1 [Vout Limit Selection = Enabled]*.	90.0% (50.0 - 100.0%)	593
C3-21 (033E) RUN	M2 Slip Comp Gain	**V/f** CL-V/f **OLV** **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the gain for the motor 2 slip compensation function. Usually it is not necessary to change this setting. **Note:** Correctly set these parameters before changing the slip compensation gain: • *E4-01 [M2 Rated Current (FLA)]* • *E4-02 [M2 Rated Slip]* (Set during Auto-Tuning when *E3-01 = 2 [M2 Control Method Selection = OLVector]*) • *E4-03 [M2 No-Load Current]*	Determined by E3-01 (0.0 - 2.5)	593
C3-22 (0241) RUN	M2 Slip Comp DelayTime	**V/f** CL-V/f **OLV** CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the slip compensation delay time for motor 2 when speed is unstable or when the slip compensation response is too slow. Usually it is not necessary to change this setting.	Determined by E3-01 (0 - 10000 ms)	594
C3-23 (0242)	M2 Slip Comp Limit	**V/f** CL-V/f **OLV** CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the upper limit for the slip compensation function as a percentage of the motor 2 rated slip.	200% (0 - 250%)	594
C3-24 (0243)	M2 Slip Comp Regen Condition	**V/f** CL-V/f **OLV** CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the slip compensation during regenerative operation function for motor 2. 0 : Disabled 1 : Enable>6 Hz 2 : Enable>C3-15	0 (0 - 2)	594
C3-28 (1B5B) Expert	Adaptative Slip Control Mode	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the slip compensation function mode. 0 : Normal 1 : Advanced	0 (0, 1)	595

◆ C4: TORQUE COMPENSATION

No. (Hex.)	Name	Description	Default (Range)	Ref.
C4-01 (0215) RUN	Trq Comp Gain	**V/f** **CL-V/f** **OLV** CLV AOLV **OLV/PM** AOLV/PM CLV/PM **EZOLV** Sets the gain for the torque compensation function. Use this parameter value for motor 1 when operating multiple motors.	Determined by A1-02 (0.00 - 2.50)	595
C4-02 (0216) RUN	Trq Comp Delay Time	**V/f** **CL-V/f** **OLV** CLV AOLV **OLV/PM** AOLV/PM CLV/PM **EZOLV** Sets the torque compensation delay time. Usually it is not necessary to change this setting.	Determined by A1-02 (0 - 60000 ms)	595
C4-03 (0217)	Trq Comp@FWD Start	V/f CL-V/f **OLV** CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the amount of torque reference for forward start as a percentage of the motor rated torque.	0.0% (0.0 - 200.0%)	595
C4-04 (0218)	Trq Comp@REV Start	V/f CL-V/f **OLV** CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the amount of torque reference for reverse start as a percentage of the motor rated torque.	0.0% (-200.0 - 0.0%)	596
C4-05 (0219)	Trq Comp Time	V/f CL-V/f **OLV** CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the starting torque constant to use with *C4-03 and C4-04 [Trq Comp@FWD Start and Trq Comp@REV Start]*.	10 ms (0 - 200 ms)	596
C4-06 (021A)	M2 Trq Comp Delay Time	V/f CL-V/f **OLV** CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the value if *ov [Overvoltage]* occurs with sudden changes in the load, at the end of acceleration, or at the start of deceleration.	150 ms (0 - 10000 ms)	596
C4-07 (0341) RUN	M2 Trq Comp Gain	**V/f** **CL-V/f** **OLV** CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the gain for motor 2 torque compensation function when using the Motor Switch function.	1.00 (0.00 - 2.50)	596
C4-19 (0B8D) Expert	Torque Ripple Suppress Min Freq	**V/f** **CL-V/f** **OLV** **CLV** **AOLV** **OLV/PM** **AOLV/PM** CLV/PM **EZOLV** Sets a frequency to limit current and torque ripple. Increase this parameter in 1.0 Hz increments when current ripples and torque ripples occur during low-speed operation. Set this parameter to 0.0 to disable the function if increasing the value does not fix the problem. Usually it is not necessary to change this setting.	0.1 Hz (0.0 - 10.0 Hz)	596
C4-20 (0BCB) Expert	Vcomp Adjust 1	**V/f** **CL-V/f** **OLV** **CLV** **AOLV** **OLV/PM** **AOLV/PM** CLV/PM **EZOLV** Sets voltage precision compensation. Usually it is not necessary to change this setting.	120 (0 - 200)	597
C4-21 (0BCC) Expert	Vcomp Adjust 2	**V/f** **CL-V/f** **OLV** **CLV** **AOLV** **OLV/PM** **AOLV/PM** CLV/PM **EZOLV** Sets voltage precision compensation. Usually it is not necessary to change this setting.	5 (0 - 10)	597

◆ C5: ASR - SPEED REGULATION

No. (Hex.)	Name	Description	Default (Range)	Ref.
C5-01 (021B) RUN	ASR PGain 1	V/f **CL-V/f** OLV **CLV** **AOLV** OLV/PM **AOLV/PM** **CLV/PM** **EZOLV** Sets the gain to adjust ASR response.	Determined by A1-02 (0.00 - 300.00)	600
C5-02 (021C) RUN	ASR ITime 1	V/f **CL-V/f** OLV **CLV** **AOLV** OLV/PM **AOLV/PM** **CLV/PM** **EZOLV** Sets the ASR integral time.	Determined by A1-02 (0.000 - 60.000 s)	600
C5-03 (021D) RUN	ASR PGain 2	V/f **CL-V/f** OLV **CLV** **AOLV** OLV/PM **AOLV/PM** **CLV/PM** **EZOLV** Sets the gain to adjust ASR response.	Determined by A1-02 (0.00 - 300.00)	601
C5-04 (021E) RUN	ASR ITime 2	V/f **CL-V/f** OLV **CLV** **AOLV** OLV/PM **AOLV/PM** **CLV/PM** **EZOLV** Sets the ASR integral time.	Determined by A1-02 (0.000 - 60.000 s)	601
C5-05 (021F)	ASR Limit	V/f **CL-V/f** OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the ASR output limit as a percentage of *E1-04 [Max Output Frequency]*.	5.0% (0.0 - 20.0%)	601
C5-06 (0220)	ASR Delay Time	V/f CL-V/f OLV **CLV** **AOLV** OLV/PM **AOLV/PM** **CLV/PM** **EZOLV** Sets the filter time constant for the time from the speed loop to the torque command output. Usually it is not necessary to change this setting.	Determined by A1-02 (0.000 - 0.500 s)	601
C5-07 (0221)	ASR Gain Switch Frequency	V/f CL-V/f OLV **CLV** **AOLV** OLV/PM **AOLV/PM** **CLV/PM** **EZOLV** Sets the frequency where the drive will switch between these parameters: *C5-01 and C5-03 [ASR PGain 1 and ASR PGain 2]* *C5-02 and C5-04 [ASR ITime 1 and ASR ITime 2]*	Determined by A1-02 (Determined by A1-02)	601
C5-08 (0222)	ASR Integral Limit	V/f CL-V/f OLV **CLV** **AOLV** OLV/PM **AOLV/PM** **CLV/PM** **EZOLV** Sets the upper limit for ASR as a percentage of the rated load.	400% (0 - 400%)	601

No. (Hex.)	Name	Description	Default (Range)	Ref.
C5-12 (0386)	Integral@Ac/Dec Operation	V/f **CL-V/f** OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets integral operation during acceleration and deceleration. 0 : Disabled 1 : Enabled	0 (0, 1)	602
C5-17 (0276) Expert	Motor Inertia	V/f CL-V/f OLV **CLV** **AOLV** OLV/PM AOLV/PM **CLV/PM** EZOLV Sets the motor inertia.	Determined by o2-04, C6-01, and E5-01 (0.0001 - 6.0000 kgm²)	602
C5-18 (0277) Expert	Inertia Ratio of Load	V/f CL-V/f OLV **CLV** **AOLV** OLV/PM AOLV/PM **CLV/PM** EZOLV Sets the load inertia ratio for the motor inertia.	1.0 (0.0 - 6000.0)	602
C5-21 (0356) RUN	M2 ASR PGain 1	V/f **CL-V/f** OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the gain to adjust ASR response for motor 2.	Determined by E3-01 (0.00 - 300.00)	602
C5-22 (0357) RUN	M2 ASR ITime 1	V/f **CL-V/f** OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the ASR integral time for motor 2.	Determined by E3-01 (0.000 - 60.000 s)	602
C5-23 (0358) RUN	M2 ASR PGain 2	V/f **CL-V/f** OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the gain to adjust ASR response for motor 2.	Determined by E3-01 (0.00 - 300.00)	603
C5-24 (0359) RUN	M2 ASR ITime 2	V/f **CL-V/f** OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the ASR integral time for motor 2.	Determined by E3-01 (0.000 - 60.000 s)	603
C5-25 (035A)	M2 ASR Limit	V/f **CL-V/f** OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the ASR output limit for motor 2 as a percentage of *E1-04 [Max Output Frequency]*.	5.0% (0.0 - 20.0%)	603
C5-26 (035B)	M2 ASR Delay Time	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the filter time constant for the time from the speed loop to the torque command output for motor 2. Usually it is not necessary to change this setting.	Determined by E3-01 (0.000 - 0.500 s)	603
C5-27 (035C)	M2 ASR Gain Switchover Freq	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the frequency where the drive will switch between these parameters: *C5-21 and C5-23 [M2 ASR PGain 1 and M2 ASR PGain 2]* *C5-22 and C5-24 [M2 ASR ITime 1 and M2 ASR ITime 2]*	0.0 (0.0 - 400.0)	603
C5-28 (035D)	M2 ASR Intgl Limit	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the upper limit for ASR for motor 2 as a percentage of the rated load.	400% (0 - 400%)	604
C5-29 (0B18) Expert	Speed Ctrl Response Mode	**V/f** **CL-V/f** **OLV** **CLV** **AOLV** **OLV/PM** **AOLV/PM** **CLV/PM** **EZOLV** Sets the level of speed control responsiveness. Usually it is not necessary to change this setting. 0 : Standard 1 : High Perf 1	0 (0, 1)	604
C5-32 (0361)	M2 I Oper@Ac/Dec	V/f **CL-V/f** OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets integral operation during acceleration and deceleration for motor 2. 0 : Disabled 1 : Enabled	0 (0, 1)	604
C5-37 (0278) Expert	M2 Inertia	V/f CL-V/f OLV **CLV** **AOLV** OLV/PM AOLV/PM CLV/PM EZOLV Sets the motor inertia for motor 2.	Determined by o2-04 and C6-01 (0.0001 - 6.0000 kgm²)	604
C5-38 (0279) Expert	M2 Inertia Ratio of load	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the load inertia ratio for the motor 2 inertia.	1.0 (0.0 - 6000.0)	604
C5-39 (030D)	ASR Delay Time 2	V/f CL-V/f OLV CLV AOLV OLV/PM **AOLV/PM** **CLV/PM** EZOLV Sets the filter time constant for the time from the speed loop to the torque command output for motor 2. Usually it is not necessary to change this setting.	0 ms (0 - 500 ms)	604
C5-50 (0B14) Expert	Notch Filter Frequency	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM **CLV/PM** EZOLV Sets the machine resonance frequency. **Note:** Set this parameter to 0 Hz to disable the notch filter.	0 Hz (0, or 2 to 100 Hz)	605
C5-51 (0B15) Expert	Notch Filter Bandwidth	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM **CLV/PM** EZOLV Sets the notch width of the notch filter. Set this parameter to 0.0 to disable the function.	1.0 (0.5 - 5.0)	605

◆ C6: DUTY AND CARRIER

No. (Hex.)	Name	Description	Default (Range)	Ref.
C6-01 (0223)	ND/HD Duty Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the drive duty rating. 0 : HD Rating 1 : ND Rating	0 (0, 1)	605
C6-02 (0224)	Carrier Frequency Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the carrier frequency for the transistors in the drive. 1 : 2.0 kHz 2 : 5.0 kHz (4.0 kHz for AOLV/PM) 3 : 8.0 kHz (6.0 kHz for AOLV/PM) 4 : 10.0 kHz (8.0 kHz for AOLV/PM) 5 : 12.5 kHz (10.0 kHz for AOLV/PM) 6 : 15.0 kHz (12.0 kHz AOLV/PM) 7 : Swing PWM 1 (Audible Sound 1) 8 : Swing PWM 2 (Audible Sound 2) 9 : Swing PWM 3 (Audible Sound 3) A : Swing PWM 4 (Audible Sound 4) F : User (C6-03 to C6-05) **Note:** The carrier frequency for Swing PWM 1 to 4 is equivalent to 2.0 kHz.	Determined by A1-02, C6-01, and o2-04 (Determined by A1-02)	606
C6-03 (0225)	Carrier Upper Frequency Limit	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the upper limit of the carrier frequency. Set *C6-02 = F [Carrier Frequency Selection = User (C6-03 to C6-05)]* to set this parameter.	Determined by C6-02 (1.0 - 15.0 kHz)	607
C6-04 (0226)	Carrier Lower Frequency Limit	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the lower limit of the carrier frequency. Set *C6-02 = F [Carrier Frequency Selection = User Defined (C6-03 to C6-05)]* to set this parameter.	Determined by C6-02 (1.0 - 15.0 kHz)	607
C6-05 (0227)	Carrier Freq Proportional Gain	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the proportional gain for the carrier frequency. Set *C6-02 = F [Carrier Frequency Selection = User Defined (C6-03 to C6-05)]* to set this parameter.	Determined by C6-02 (0 - 99)	608
C6-09 (022B)	Carrier@Autotune Rotational	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Auto-Tuning carrier frequency. Usually it is not necessary to change this setting. 0 : 5 kHz 1 : use C6-03	0 (0, 1)	608

11.5 d: REFERENCE

◆ d1: FREQUENCY REFERENCE

No. (Hex.)	Name	Description	Default (Range)	Ref.
d1-01 (0280) RUN	Reference 1	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the frequency reference in the units from *o1-03 [FrqDisplay Unit Selection]*. **Note:** *o1-03 = 1 [0.01% (100%=E1-04)]* when *A1-02 = 6, 7 [Control Method = PM AOLVector, PM CLVector]*.	0.00 Hz (0.00 - 590.00 Hz)	611
d1-02 (0281) RUN	Reference 2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the frequency reference in the units from *o1-03 [FrqDisplay Unit Selection]*. **Note:** *o1-03 = 1 [0.01% (100% = E1-04)]* when *A1-02 = 6, 7 [Control Method = PM AOLVector, PM CLVector]*.	0.00 Hz (0.00 - 590.00 Hz)	611
d1-03 (0282) RUN	Reference 3	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the frequency reference in the units from *o1-03 [FrqDisplay Unit Selection]*. **Note:** The default setting is *o1-03 = 1 [0.01% (100%=E1-04)]* when *A1-02 = 6, 7 [Control Method = PM AOLVector, PM CLVector]*.	0.00 Hz (0.00 - 590.00 Hz)	612
d1-04 (0283) RUN	Reference 3	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the frequency reference in the units from *o1-03 [FrqDisplay Unit Selection]*. **Note:** The default setting is *o1-03 = 1 [0.01% (100%=E1-04)]* when *A1-02 = 6, 7 [Control Method = PM AOLVector, PM CLVector]*.	0.00 Hz (0.00 - 590.00 Hz)	612
d1-05 (0284) RUN	Reference 5	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the frequency reference in the units from *o1-03 [FrqDisplay Unit Selection]*. **Note:** The default setting is *o1-03 = 1 [0.01% (100%=E1-04)]* when *A1-02 = 6, 7 [Control Method = PM AOLVector, PM CLVector]*.	0.00 Hz (0.00 - 590.00 Hz)	612
d1-06 (0285) RUN	Reference 6	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the frequency reference in the units from *o1-03 [FrqDisplay Unit Selection]*. **Note:** The default setting is *o1-03 = 1 [0.01% (100%=E1-04)]* when *A1-02 = 6, 7 [Control Method = PM AOLVector, PM CLVector]*.	0.00 Hz (0.00 - 590.00 Hz)	612
d1-07 (0286) RUN	Reference 7	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the frequency reference in the units from *o1-03 [FrqDisplay Unit Selection]*. **Note:** The default setting is *o1-03 = 1 [0.01% (100%=E1-04)]* when *A1-02 = 6, 7 [Control Method = PM AOLVector, PM CLVector]*.	0.00 Hz (0.00 - 590.00 Hz)	612
d1-08 (0287) RUN	Reference 8	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the frequency reference in the units from *o1-03 [FrqDisplay Unit Selection]*. **Note:** The default setting is *o1-03 = 1 [0.01% (100%=E1-04)]* when *A1-02 = 6, 7 [Control Method = PM AOLVector, PM CLVector]*.	0.00 Hz (0.00 - 590.00 Hz)	613
d1-09 (0288) RUN	Reference 9	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the frequency reference in the units from *o1-03 [FrqDisplay Unit Selection]*. **Note:** The default setting is *o1-03 = 1 [0.01% (100%=E1-04)]* when *A1-02 = 6, 7 [Control Method = PM AOLVector, PM CLVector]*.	0.00 Hz (0.00 - 590.00 Hz)	613
d1-10 (028B) RUN	Reference 10	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the frequency reference in the units from *o1-03 [FrqDisplay Unit Selection]*. **Note:** The default setting is *o1-03 = 1 [0.01% (100%=E1-04)]* when *A1-02 = 6, 7 [Control Method = PM AOLVector, PM CLVector]*.	0.00 Hz (0.00 - 590.00 Hz)	613
d1-11 (028C) RUN	Reference 11	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the frequency reference in the units from *o1-03 [FrqDisplay Unit Selection]*. **Note:** The default setting is *o1-03 = 1 [0.01% (100%=E1-04)]* when *A1-02 = 6, 7 [Control Method = PM AOLVector, PM CLVector]*.	0.00 Hz (0.00 - 590.00 Hz)	613
d1-12 (028D) RUN	Reference 12	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the frequency reference in the units from *o1-03 [FrqDisplay Unit Selection]*. **Note:** The default setting is *o1-03 = 1 [0.01% (100%=E1-04)]* when *A1-02 = 6, 7 [Control Method = PM AOLVector, PM CLVector]*.	0.00 Hz (0.00 - 590.00 Hz)	613

No. (Hex.)	Name	Description	Default (Range)	Ref.
d1-13 (028E) RUN	Reference 13	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the frequency reference in the units from *o1-03 [FrqDisplay Unit Selection]*. **Note:** The default setting is *o1-03 = 1 [0.01% (100%=E1-04)]* when *A1-02 = 6, 7 [Control Method = PM AOLVector, PM CLVector]*.	0.00 Hz (0.00 - 590.00 Hz)	614
d1-14 (028F) RUN	Reference 14	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the frequency reference in the units from *o1-03 [FrqDisplay Unit Selection]*. **Note:** The default setting is *o1-03 = 1 [0.01% (100%=E1-04)]* when *A1-02 = 6, 7 [Control Method = PM AOLVector, PM CLVector]*.	0.00 Hz (0.00 - 590.00 Hz)	614
d1-15 (0290) RUN	Reference 15	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the frequency reference in the units from *o1-03 [FrqDisplay Unit Selection]*. **Note:** The default setting is *o1-03 = 1 [0.01% (100%=E1-04)]* when *A1-02 = 6, 7 [Control Method = PM AOLVector, PM CLVector]*.	0.00 Hz (0.00 - 590.00 Hz)	614
d1-16 (0291) RUN	Reference 16	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the frequency reference in the units from *o1-03 [FrqDisplay Unit Selection]*. **Note:** The default setting is *o1-03 = 1 [0.01% (100%=E1-04)]* when *A1-02 = 6, 7 [Control Method = PM AOLVector, PM CLVector]*.	0.00 Hz (0.00 - 590.00 Hz)	614
d1-17 (0292) RUN	Jog Reference	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the JOG frequency reference in the units from *o1-03 [FrqDisplay Unit Selection]*. Set *H1-xx: MFDI Function Select = 6 [Jog Reference]* to use the Jog frequency reference. **Note:** *o1-03 = 1 [0.01% (100%=E1-04)]* when *A1-02 = 6, 7 [Control Method = PM AOLVector, PM CLVector]*.	6.00 Hz (0.00 - 590.00 Hz)	614

◆ d2: REFERENCE LIMITS

No. (Hex.)	Name	Description	Default (Range)	Ref.
d2-01 (0289)	FRef Upper Limit	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets maximum limit for all frequency references. This value is a percentage of *E1-04 [Max Output Frequency]*.	100.0% (0.0 - 110.0%)	615
d2-02 (028A)	FRef Lower Limit	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets minimum limit for all frequency references. This value is a percentage of *E1-04 [Max Output Frequency]*.	0.0% (0.0 - 110.0%)	615
d2-03 (0293)	Analog FRef Lower Limit	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the lower limit of the master frequency reference (Multi-Step Speed 1) as a percentage of *E1-04 [Max Output Frequency]*.	0.0% (0.0 - 110.0%)	615

◆ d3: JUMP FREQUENCY

No. (Hex.)	Name	Description	Default (Range)	Ref.
d3-01 (0294)	Jump Frequency 1	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the median value of the frequency band that the drive will avoid.	0.0 Hz (Determined by A1-02)	616
d3-02 (0295)	Jump Frequency 2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the median value of the frequency band that the drive will avoid.	0.0 Hz (Determined by A1-02)	616
d3-03 (0296)	Jump Frequency 3	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the median value of the frequency band that the drive will avoid.	0.0 Hz (Determined by A1-02)	616
d3-04 (0297)	Jump Frequency Width	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the width of the frequency band that the drive will avoid.	1.0 Hz (Determined by A1-02)	616

◆ d4: FREQUENCY UP/DOWN

No. (Hex.)	Name	Description	Default (Range)	Ref.
d4-01 (0298)	FRef Hold Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function that saves the frequency reference or the frequency bias (Up/Down 2) after a Stop command or when de-energizing the drive. Set *H1-xx: MFDI Function Select* to one of the these values to operate this parameter: • *17 [Ac/Dec Hold]* • *62/63 [Up Command/Down Command]* • *65/66 [Up2 Command/Dw2 Command]* 0 : Disabled 1 : Enabled	0 (0, 1)	617
d4-03 (02AA) RUN	Up/Dw2 Bias Step Frequency	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the bias that the Up/Down 2 function adds to or subtracts from the frequency reference.	0.00 Hz (0.00 - 99.99 Hz)	619
d4-04 (02AB) RUN	Up/Dw2 Ramp Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the acceleration and deceleration times for the Up/Down 2 function to apply the bias to the frequency reference. 0 : Current Ac/Dec Time 1 : Ac/Dec 4	0 (0, 1)	619
d4-05 (02AC) RUN	Up/Dw2 Bias Mode Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function that saves the bias value to the drive when you open or close the two *H1-xx = 65, 66 [Up2 Command, Dw2 Command]*. Set *d4-03 [Up/Dw2 Bias Step Frequency] = 0.00* before you set this parameter. 0 : Hold@Up=Dw=0 1 : Reset@Up=Dw	0 (0, 1)	620
d4-06 (02AD)	FRef Bias(Up/Dw2)	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Saves the bias value from the Up/Down 2 Command when the value set in *E1-04* is 100%.	0.0% (-99.9 - +100.0%)	620
d4-07 (02AE) RUN	Analog FRef Fluctuate Limit	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV If the frequency reference changes for more than the level set to this parameter, then the bias value will be held. Parameter *E1-04 [Max Output Frequency]* is 100%.	1.0% (0.1 - 100.0%)	620
d4-08 (02AF) RUN	Up/Dw2 Bias Upper Limit	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the upper limit of the Up/Down 2 bias as a percentage of *E1-04 [Max Output Frequency]*.	100.0% (0.0 - 100.0%)	621
d4-09 (02B0) RUN	Up/Dw2 Bias Lower Limit	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the lower limit of the Up/Down 2 bias as a percentage of *E1-04 [Max Output Frequency]*.	0.0% (-99.9 - 0.0%)	621
d4-10 (02B6)	Up/Dw Frq Low Limit Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the lower frequency limit for the Up/Down function. 0 : d2-02/Analog (larger level) 1 : d2-02	0 (0, 1)	621
d4-11 (02B7)	Bi-Dir Out Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function that changes the frequency reference to a Bi-Directional internal frequency reference. 0 : Disabled 1 : Enabled	0 (0, 1)	621
d4-12 (02B8)	Stop Position Gain	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the gain to adjust the stopping accuracy. Set this parameter when *b1-03 = 9 [Stopping Method Selection = Distance Stop]*.	1.00 (0.50 - 2.55)	622

◆ d5: TORQUE CONTROL

No. (Hex.)	Name	Description	Default (Range)	Ref.
d5-01 (029A)	Torque Ctrl Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the drive for torque control or speed control. 0 : Speed Control 1 : Torque Control	0 (0, 1)	626
d5-02 (029B)	Torque Ref Delay Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the primary delay time constant for the torque reference filter.	Determined by A1-02 (0 - 1000 ms)	626
d5-03 (029C)	Speed Limit Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the torque control speed limit method. 1 : Active Freq Reference 2 : d5-04 Setting	1 (1, 2)	626

No. (Hex.)	Name	Description	Default (Range)	Ref.
d5-04 (029D)	Speed Limit	V/f CL-V/f OLV **CLV** **AOLV** OLV/PM **AOLV/PM** **CLV/PM** EZOLV Sets the speed limit during Torque Control as a percentage of *E1-04 [Max Output Frequency]*. Set *d5-03 = 2 [Speed Limit Selection = d5-04 Setting]* before you set this parameter.	0% (-120 - +120%)	627
d5-05 (029E)	Speed Limit Bias	V/f CL-V/f OLV **CLV** **AOLV** OLV/PM **AOLV/PM** **CLV/PM** EZOLV Sets a bias to the speed limit as a percentage of *E1-04 [Max Output Frequency]*.	10% (0 - 120%)	627
d5-06 (029F)	Spd/Trq Chg Time	V/f CL-V/f OLV **CLV** **AOLV** OLV/PM **AOLV/PM** **CLV/PM** EZOLV Sets the delay time to switch between Speed Control and Torque Control. Set *H1-xx = 13 [H1-xx: MFDI Function Select = Spd/Trq Switch]* before you set this parameter.	0 ms (0 - 1000 ms)	627
d5-08 (02B5)	UniDir Speed Bias	V/f CL-V/f OLV **CLV** **AOLV** OLV/PM **AOLV/PM** **CLV/PM** EZOLV Sets the direction of the speed limit reference to which Speed Limit Bias *[d5-05]* applies. 0 : Disabled 1 : Enabled	1 (0, 1)	627

◆ d6: FIELD WEAKENING / FORCING

No. (Hex.)	Name	Description	Default (Range)	Ref.
d6-01 (02A0)	Field Weak Level	**V/f** **CL-V/f** OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the drive output voltage as a percentage of *E1-05 [Max Output Voltage]* when *H1-xx = 44 [Field Weakening]* is activated.	80% (0 - 100%)	628
d6-02 (02A1)	Field Weak FqLimit	**V/f** **CL-V/f** OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the minimum output frequency to start field weakening.	0.0 Hz (0.0 - 590.0 Hz)	628
d6-03 (02A2)	Field Force Selection	V/f CL-V/f **OLV** **CLV** **AOLV** OLV/PM AOLV/PM CLV/PM EZOLV Sets the field forcing function. 0 : Disabled 1 : Enabled	0 (0, 1)	628
d6-06 (02A5)	Field Force Limit	V/f CL-V/f **OLV** **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the maximum level that Field Forcing can increase the excitation current reference as a percentage of *E2-03 [Mot No-Load Current]*. Usually it is not necessary to change this setting.	400% (100 - 400%)	628

◆ d7: OFFSET FREQUENCY

No. (Hex.)	Name	Description	Default (Range)	Ref.
d7-01 (02B2) RUN	Offset Frq 1	**V/f** **CL-V/f** **OLV** **CLV** **AOLV** **OLV/PM** **AOLV/PM** **CLV/PM** **EZOLV** Sets the value to add to or subtract from the frequency reference when *H1-xx = 0E [H1-xx: MFDI Function Select = Offset Frq 1]* as a percentage of *E1-04 [Max Output Frequency]*.	0.0% (-100.0 - +100.0%)	629
d7-02 (02B3) RUN	Offset Frq 2	**V/f** **CL-V/f** **OLV** **CLV** **AOLV** **OLV/PM** **AOLV/PM** **CLV/PM** **EZOLV** Sets the value to add to or subtract from the frequency reference when *H1-xx = 0F [H1-xx: MFDI Function Select = Offset Frq 2]* as a percentage of *E1-04 [Max Output Frequency]*.	0.0% (-100.0 - +100.0%)	629
d7-03 (02B4) RUN	Offset Frq 3	**V/f** **CL-V/f** **OLV** **CLV** **AOLV** **OLV/PM** **AOLV/PM** **CLV/PM** **EZOLV** Sets the value to add to or subtract from the frequency reference when *H1-xx = 10 [H1-xx: MFDI Function Select = Offset Frq 3]* as a percentage of *E1-04 [Max Output Frequency]*.	0.0% (-100.0 - +100.0%)	629

11.6 E: MOTOR

◆ E1: V/F PARAMETER MOTOR 1

No. (Hex.)	Name	Description	Default (Range)	Ref.
E1-01 (0300)	Input AC Supply Voltage	**V/f** **CL-V/f** **OLV** **CLV** **AOLV** **OLV/PM** **AOLV/PM** **CLV/PM** **EZOLV** Sets the drive input voltage. **NOTICE:** *Set this parameter to align with the drive input voltage (not motor voltage). The protective features of the drive will not function if this parameter is incorrect. Failure to obey will cause incorrect drive operation.*	400 V: 400 V (400 V Class: 310 to 510 V)	631
E1-03 (0302)	V/f Pattern Selection	**V/f** **CL-V/f** **OLV** CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the V/f pattern for the drive and motor. You can use one of the preset patterns or you can make a custom pattern. 0 : CT_50-50Hzmax 1 : CT_60-60Hzmax 2 : CT_50-60Hzmax 3 : CT_60-72Hzmax 4 : VT_50-35HzmidV 5 : VT_50-50HzmidV 6 : VT_60-35HzmidV 7 : VT_60-50HzmidV 8 : HT_50Hz_125 V 9 : HTrq50Hz-165 V A : HTrq60Hz-125V B : HT_60Hz-165V C : HF_60-90Hzmax D : HF_60-120Hzmax E : HF_60-180Hzmax F : (F) : Custom **Note:** • When *A1-02 = 2 [Control Method = OLVector]*, settings *0* through *E* are not available. • Set the correct V/f pattern for the application and operation area. An incorrect V/f pattern can decrease motor torque and increase current from overexcitation.	F (Determined by A1-02)	631
E1-04 (0303)	Max Output Frequency	**V/f** **CL-V/f** **OLV** **CLV** **AOLV** **OLV/PM** **AOLV/PM** **CLV/PM** EZOLV Sets the maximum output frequency for the V/f pattern.	Determined by A1-02 and E5-01 (Determined by A1-02 and E5-01)	636
E1-05 (0304)	Max Output Voltage	**V/f** **CL-V/f** **OLV** **CLV** **AOLV** **OLV/PM** **AOLV/PM** **CLV/PM** EZOLV Sets the maximum output voltage for the V/f pattern.	Determined by A1-02 (400 V Class: 0.0 - 510.0 V)	636
E1-06 (0305)	Base Frequency	**V/f** **CL-V/f** **OLV** **CLV** **AOLV** **OLV/PM** **AOLV/PM** **CLV/PM** EZOLV Sets the base frequency for the V/f pattern.	Determined by A1-02 and E5-01 (0.0 - E1-04)	636
E1-07 (0306)	Mid A Frequency	**V/f** **CL-V/f** **OLV** CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets a middle output frequency for the V/f pattern.	Determined by A1-02 (0.0 - E1-04)	636
E1-08 (0307)	Mid A Voltage	**V/f** **CL-V/f** **OLV** CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets a middle output voltage for the V/f pattern.	Determined by A1-02 , C6-01 and o2-04 (400 V Class: 0.0 to 510.0 V)	637
E1-09 (0308)	Min Output Frequency	**V/f** **CL-V/f** **OLV** **CLV** **AOLV** **OLV/PM** **AOLV/PM** **CLV/PM** EZOLV Sets the minimum output frequency for the V/f pattern.	Determined by A1-02 and E5-01 (Determined by A1-02, E1-04, and E5-01)	637
E1-10 (0309)	Min Output Voltage	**V/f** **CL-V/f** **OLV** CLV **AOLV** OLV/PM AOLV/PM CLV/PM EZOLV Sets the minimum output voltage for the V/f pattern.	Determined by A1-02	637
E1-11 (030A) Expert	Mid B Frequency	**V/f** **CL-V/f** **OLV** **CLV** **AOLV** OLV/PM AOLV/PM CLV/PM EZOLV Sets a middle output frequency for the V/f pattern.	0.0 Hz (0.0 - E1-04)	637
E1-12 (030B) Expert	Min Output Voltage	**V/f** **CL-V/f** **OLV** **CLV** **AOLV** OLV/PM AOLV/PM CLV/PM EZOLV Sets minimum output voltage for the V/f pattern.	0.0 V	637
E1-13 (030C) Expert	Base Voltage	**V/f** **CL-V/f** **OLV** **CLV** **AOLV** OLV/PM AOLV/PM CLV/PM EZOLV Sets the base voltage for the V/f pattern.	0.0 V	637

Parameter List

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◆ E2: MOTOR 1 PARAMETERS

No. (Hex.)	Name	Description	Default (Range)	Ref.
E2-01 (030E)	Mot Rated Current (FLA)	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the motor rated current in amps.	Determined by o2-04 and C6-01 (10% to 200% of the drive rated current)	638
E2-02 (030F)	Mot Rated Slip	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets motor rated slip.	Determined by o2-04, C6-01 (0.000 - 20.000 Hz)	638
E2-03 (0310)	Mot No-Load Current	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the no-load current for the motor in amps when operating at the rated frequency and the no-load voltage.	Determined by o2-04 and C6-01 (0 to E2-01)	638
E2-04 (0311)	Motor Pole Count	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the number of motor poles. **Note:** • When *A1-02 = 0, 1, 3 [Control Method = V/f Control, PG V/f Control, CLVector]*, the maximum value is 120. • When *A1-02 = 2, 4 [OLVector, Adv OLVector]*, the maximum value is 48.	4 (2 - 120)	638
E2-05 (0312)	Motor L-L Resistance	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the line-to-line resistance for the motor stator windings.	Determined by o2-04 and C6-01 (0.000 - 65.000 Ω)	639
E2-06 (0313)	Motor Leak Inductance	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the voltage drop from motor leakage inductance when the motor is operating at the rated frequency and rated current. This value is a percentage of Motor Rated Voltage.	Determined by o2-04 and C6-01 (0.0 - 60.0%)	639
E2-07 (0314)	Mot Sat Coeff 1	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Set the motor iron-core saturation coefficient when the magnetic flux is 50%.	0.50 (0.00 - 0.50)	639
E2-08 (0315)	Mot Sat Coeff 2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the motor iron-core saturation coefficient at 75% of the magnetic flux.	0.75 (E2-07 - 0.75)	639
E2-09 (0316) Expert	Motor Mech Loss	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the mechanical loss of the motor. Motor rated power (kw) = 100.0%. Usually it is not necessary to change this setting.	0.0% (0.0 - 10.0%)	639
E2-10 (0317)	Motor Iron Loss	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the motor iron loss.	Determined by o2-04 and C6-01 (0 - 65535 W)	640
E2-11 (0318)	Motor Rated Power (kW)	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the motor rated output in 0.01 kW increments.	Determined by o2-04, C6-01 (0.00 - 650.00)	640

◆ E3: V/F PARAMETER MOTOR 2

No. (Hex.)	Name	Description	Default (Range)	Ref.
E3-01 (0319)	M2 Control Method Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the control method for motor 2. **Note:** When you change this setting, the drive will set all parameters that are dependent on this parameter to their default settings. 0 : V/f Control 1 : PG V/f Control 2 : OLVector 3 : CLVector	0 (0 - 3)	640
E3-04 (031A)	M2 Max Out Frequency	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Set the maximum output frequency for the motor 2 V/f pattern.	Determined by E3-01 (40.0 - 590.0 Hz)	641
E3-05 (031B)	M2 Max Out Voltage	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the maximum output voltage for the motor 2 V/f pattern.	Determined by E3-01 (400 V Class: 0.0 - 510.0 V)	641
E3-06 (031C)	M2 Base Frequency	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the base frequency for the motor 2 V/f pattern.	Determined by E3-01 (0.0 - E3-04)	641
E3-07 (031D)	M2 Mid A Frequency	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets a middle output frequency for the motor 2 V/f pattern.	Determined by E3-01 (0.0 - E3-04)	641
E3-08 (031E)	M2 Mid A Voltage	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets a middle output voltage for the motor 2 V/f pattern.	Determined by E3-01 (400 V Class: 0.0 - 510.0 V)	641
E3-09 (031F)	M2 Min Out Frequency	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the minimum output frequency for the motor 2 V/f pattern.	Determined by E3-01 (0.0 - E3-04)	641

No. (Hex.)	Name	Description	Default (Range)	Ref.
E3-10 (0320)	M2 Min Out Voltage	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the minimum output voltage for the motor 2 V/f pattern.	Determined by E3-01 (400 V Class: 0.0 - 510.0 V)	641
E3-11 (0345) Expert	M2 Mid B Frequency	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets a middle output frequency for the motor 2 V/f pattern. Set this parameter to adjust the V/f pattern for the constant output range. Usually it is not necessary to change this setting.	0.0 Hz (0.0 - E3-04)	641
E3-12 (0346) Expert	M2 Min Out Voltage	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets a middle output voltage for the motor 2 V/f pattern. Set this parameter to adjust the V/f pattern for the constant output range. Usually it is not necessary to change this setting.	0.0 V (400 V Class: 0.0 - 510.0 V)	642
E3-13 (0347) Expert	M2 Base Voltage	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the base voltage for the motor 2 V/f pattern. Set this parameter to adjust the V/f pattern for the constant output range. Usually it is not necessary to change this setting.	0.0 V (400 V Class: 0.0 - 510.0 V)	642

◆ E4: MOTOR 2 PARAMETERS

No. (Hex.)	Name	Description	Default (Range)	Ref.
E4-01 (0321)	M2 Rated Current (FLA)	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the motor rated current for motor 2 in amps.	Determined by o2-04 and C6-01 (10% to 200% of the drive rated current)	642
E4-02 (0322)	M2 Rated Slip	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the motor rated slip for motor 2.	Determined by o2-04 and C6-01 (0.000 - 20.000 Hz)	642
E4-03 (0323)	M2 No-Load Current	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the no-load current for motor 2 in amps when operating at the rated frequency and the no-load voltage.	Determined by o2-04 and C6-01 (0 to E4-01)	643
E4-04 (0324)	M2 Pole Count	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the number of poles for motor 2.	4 (2 - 120)	643
E4-05 (0325)	M2 L-L Resistance	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the line-to-line resistance for the motor 2 stator windings.	Determined by o2-04 and C6-01 (0.000 - 65.000 Ω)	643
E4-06 (0326)	M2 Leak Inductance	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the voltage drop from motor 2 leakage inductance as a percentage of Motor Rated Voltage when motor 2 operates at the rated frequency and rated current.	Determined by o2-04, C6-01 (0.0 - 60.0%)	643
E4-07 (0343)	M2 Satur Coeff 1	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the motor 2 iron-core saturation coefficient at 50% of the magnetic flux.	0.50 (0.00 - 0.50)	644
E4-08 (0344)	M2 Satur Coeff 2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the motor 2 iron-core saturation coefficient at 75% of the magnetic flux.	0.75 (E4-07 - 0.75)	644
E4-09 (033F) Expert	M2 Mech Loss	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the mechanical loss of motor 2. Motor rated power (kW) is 100%. Usually it is not necessary to change this setting.	0.0% (0.0 - 10.0%)	644
E4-10 (0340)	M2 Iron Loss	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the motor iron loss for motor 2.	Determined by o2-04 and C6-01 (0 - 65535 W)	644
E4-11 (0327)	M2 Rated Power (kW)	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the motor 2 rated power in 0.01 kW increments (1 HP = 0.746 kW).	Determined by o2-04 and C6-01 (0.00 - 650.00 kW)	644

◆ E5: PM MOTOR SETTINGS

No. (Hex.)	Name	Description	Default (Range)	Ref.
E5-01 (0329)	PM Mot Code Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the motor code for Yaskawa PM motors. The drive uses the motor code to set some parameters to their correct settings automatically.	Determined by A1-02, o2-04, and C6-01 (0000 - FFFF)	645
E5-02 (032A)	PM Mot Rated Power (kW)	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the PM motor rated power.	Determined by E5-01 (0.10 - 650.00 kW)	645
E5-03 (032B)	PM Mot Rated Current (FLA)	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the PM motor rated current (FLA).	Determined by E5-01 (10% to 200% of the drive rated current)	216

No. (Hex.)	Name	Description	Default (Range)	Ref.
E5-04 (032C)	PM Mot Pole Count	V/f CL-V/f OLV CLV AOLV **OLV/PM** **AOLV/PM** **CLV/PM** EZOLV Sets the number of PM motor poles. **Note:** • When *A1-02 = 7 [Control Method = PM CLVector]*, the maximum value is 120. • When *A1-02 = 5, 6 or 8 [PM OLVector, PM AOLVector or EZ Vector]*, the maximum value is 48.	Determined by E5-01 (2 - 120)	645
E5-05 (032D)	PM Mot Resistance (Ohms/Phase)	V/f CL-V/f OLV CLV AOLV **OLV/PM** **AOLV/PM** **CLV/PM** EZOLV Sets the resistance per phase of the PM motors. Set 50% of the line-to-line resistance.	Determined by E5-01 (0.000 - 65.000 Ω)	646
E5-06 (032E)	PM d-Axis Inductance (mH/Phase)	V/f CL-V/f OLV CLV AOLV **OLV/PM** **AOLV/PM** **CLV/PM** EZOLV Sets the PM motor d-axis inductance.	Determined by E5-01 (0.00 - 300.00 mH)	646
E5-07 (032F)	PM q-Axis Inductance (mH/Phase)	V/f CL-V/f OLV CLV AOLV **OLV/PM** **AOLV/PM** **CLV/PM** EZOLV Sets the PM motor q-axis inductance.	Determined by E5-01 (0.00 - 600.00 mH)	646
E5-09 (0331)	PM BackEMF Vpeak (mV/(rad/ s))	V/f CL-V/f OLV CLV AOLV **OLV/PM** **AOLV/PM** **CLV/PM** EZOLV Sets the peak value of PM motor induced voltage.	Determined by E5-01 (0.0 - 2000.0 mV/(rad/s))	646
E5-11 (0333)	Enc ZPulse Offset	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM **CLV/PM** EZOLV Sets the encoder Z-pulse offset.	0.0 degrees (-180.0 - +180.0 degrees)	646
E5-24 (0353)	PM BackEMF L-L Vrms (mV/rpm)	V/f CL-V/f OLV CLV AOLV **OLV/PM** **AOLV/PM** **CLV/PM** EZOLV Sets the RMS value for PM motor line voltage.	Determined by E5-01 (0.0 - 6500.0 mV/min^{-1})	647
E5-25 (035E) Expert	Polar Est Timeout	V/f CL-V/f OLV CLV AOLV **OLV/PM** **AOLV/PM** **CLV/PM** EZOLV Sets the function that switches polarity for initial polarity estimation. Usually it is not necessary to change this setting. 0 : Disabled 1 : Enabled	0 (0, 1)	647

◆ E9: SIMPLE VECTOR SETTINGS

No. (Hex.)	Name	Description	Default (Range)	Ref.
E9-01 (11E4)	Motor Type Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM **EZOLV** Sets the type of motor. 0 : IM (Induction) 1 : PM (Permanent Magnet) 2 : SynRM (Synchronous Reluctance)	0 (0 - 2)	647
E9-02 (11E5)	Maximum Speed	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM **EZOLV** Sets the maximum speed of the motor.	Determined by E9-01 (40.0 - 120.0 Hz)	647
E9-03 (11E6)	Rated Speed	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM **EZOLV** Sets the rated rotation speed of the motor.	Determined by E9-01 (100 - 7200 min^{-1})	648
E9-04 (11E7)	Base Frequency	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM **EZOLV** Sets the rated frequency of the motor.	Determined by E9-01 (40.0 - 120.0 Hz)	648
E9-05 (11E8)	Base Voltage	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM **EZOLV** Sets the rated voltage of the motor.	Determined by E9-01 (400 V Class: 0.0 to 510.0 V)	648
E9-06 (11E9)	Motor Rated Current	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM **EZOLV** Sets the motor rated current in amps.	Determined by E9-01 and o2-04 (10% to 200% of the drive rated current)	217
E9-07 (11EA)	Motor Rated Power (kW)	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM **EZOLV** Sets the motor rated power in 0.01 kW increments (1 HP = 0.746 kW).	Determined by E9-02 and o2-04 (0.00 - 650.00 kW)	648
E9-08 (11EB)	Motor Pole Count	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM **EZOLV** Sets the number of motor poles.	4 (2 - 120)	648
E9-09 (11EC)	Motor Rated Slip	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM **EZOLV** Sets the motor rated slip.	0.0 Hz (0.0 - 20.0 Hz)	649
E9-10 (11ED)	Motor L-L Resistance	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM **EZOLV** Sets the line-to-line resistance for the motor stator windings.	Determined by o2-04 (0.000 - 65.000 Ω)	649

11.7 F: OPTIONS

◆ F1: ENCODER

No. (Hex.)	Name	Description	Default (Range)	Ref.
F1-01 (0380)	Enc1 Pulse Count (PPR)	V/f **CL-V/f** OLV **CLV** **AOLV** OLV/PM AOLV/PM **CLV/PM** EZOLV Sets the number of output pulses for each motor revolution.	1024 ppr (1 - 60000 ppr)	651
F1-02 (0381)	PGOpen Detection Select	V/f **CL-V/f** OLV **CLV** **AOLV** OLV/PM AOLV/PM **CLV/PM** EZOLV Sets the method to stop the motor or let the motor continue operating when the drive detects a *PGo [Encoder (PG) Feedback Loss]*. 0 : Ramp->Stop 1 : Coast->Stop 2 : Fast Stop (C1-09) 3 : Alarm Only 4 : No Alarm Display	1 (0 - 4)	651
F1-03 (0382)	Overspeed Detection Selection	V/f **CL-V/f** OLV **CLV** **AOLV** OLV/PM AOLV/PM **CLV/PM** **EZOLV** Sets the method to stop the motor or let the motor continue operating when the drive detects a *oS [Overspeed]*. 0 : Ramp->Stop 1 : Coast->Stop 2 : Fast Stop (C1-09) 3 : Alarm Only	1 (0 - 3)	651
F1-04 (0383)	Speed Dev Detection Select	V/f **CL-V/f** OLV **CLV** **AOLV** OLV/PM **AOLV/PM** **CLV/PM** **EZOLV** Sets the method to stop the motor or let the motor continue operating when the drive detects a *dEv [Speed Deviation]*. 0 : Ramp->Stop 1 : Coast->Stop 2 : Fast Stop (C1-09) 3 : Alarm Only	3 (0 - 3)	652
F1-05 (0384)	Enc1 Rotat Selection	V/f **CL-V/f** OLV **CLV** **AOLV** OLV/PM AOLV/PM **CLV/PM** EZOLV Sets the output sequence for the A and B pulses from the encoder, assuming that the motor is operating in the forward direction. 0 : A Leads in FWD Direction 1 : B Leads in FWD Direction	Determined by A1-02 (0, 1)	652
F1-06 (0385)	Enc1 Pulse Scaling for Monitor	V/f **CL-V/f** OLV **CLV** **AOLV** OLV/PM AOLV/PM **CLV/PM** EZOLV Sets the ratio between the pulse input and the pulse output of the encoder as a 3-digit number. The first digit is the numerator and the second and third digits set the denominator. The dividing ratio = (1 + x)/yz when the setting value is a 3-digit value (xyz).	001 (001 - 032, 102 - 132 (1 - 1/32))	652
F1-08 (0387)	Overspeed Level	V/f **CL-V/f** OLV **CLV** **AOLV** OLV/PM **AOLV/PM** **CLV/PM** **EZOLV** Sets the detection level of *oS [Overspeed]* as a percentage when the maximum output frequency is 100%.	115% (0 - 120%)	652
F1-09 (0388)	Overspeed Delay Time	V/f **CL-V/f** OLV **CLV** **AOLV** OLV/PM **AOLV/PM** **CLV/PM** **EZOLV** Sets the length of time that the speed feedback must be more than the *F1-08* level to cause an *oS [Overspeed]*.	Determined by A1-02 (0.0 - 2.0 s)	653
F1-10 (0389)	Speed Dev Level	V/f **CL-V/f** OLV **CLV** **AOLV** OLV/PM **AOLV/PM** **CLV/PM** **EZOLV** Sets the detection level of *dEv [Speed Deviation]* as a percentage when the maximum output frequency is 100%.	10% (0 - 50%)	653
F1-11 (038A)	Speed Dev Delay Time	V/f **CL-V/f** OLV **CLV** **AOLV** OLV/PM **AOLV/PM** **CLV/PM** **EZOLV** Sets the length of time that the difference between the frequency reference and speed feedback must be more than the level in *F1-10* to cause a *dEv [Speed Deviation]*.	0.5 s (0.0 - 10.0 s)	653
F1-12 (038B)	Enc1 Gear Teeth1	V/f **CL-V/f** OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the number of gear teeth on the motor side. This parameter and *F1-13 [Enc1 Gear Teeth2]* set the gear ratio between the motor and encoder.	0 (0 - 1000)	653
F1-13 (038C)	Enc1 Gear Teeth2	V/f **CL-V/f** OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the number of gear teeth on the load side. This parameter and *F1-12 [Enc1 Gear Teeth1]* set the gear ratio between the motor and encoder.	0 (0 - 1000)	653
F1-14 (038D)	Enc PGOpen Time for Detection	V/f **CL-V/f** OLV **CLV** **AOLV** OLV/PM AOLV/PM **CLV/PM** EZOLV Sets the length of time that the drive must not receive a pulse signal to cause a *PGo [Encoder (PG) Feedback Loss]*. **Note:** Motor speed and load conditions can cause *ov [Overvoltage]* and *oC [Overcurrent]* faults.	2.0 s (0.0 - 10.0 s)	653
F1-18 (03AD)	Dev3 Mode Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM **CLV/PM** EZOLV Sets the number of rotations necessary to detect conditions that invert the torque reference and rate of acceleration and cause *dv3 [Inversion Detection]*.	10 (0 - 10)	654
F1-19 (03AE)	Dev4 Mode Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM **CLV/PM** EZOLV Sets the number of pulses necessary to cause *dv4 [Inversion Prevention Detection]*.	128 (0 - 5000)	654

No. (Hex.)	Name	Description	Default (Range)	Ref.
F1-20 (03B4)	Enc1 PCB Disconnect Detect	V/f **CL-V/f** OLV **CLV** **AOLV** OLV/PM AOLV/PM **CLV/PM** EZOLV Sets the function that enables and disables detection of a disconnected encoder connection cable to cause *PGoH [Encoder (PG) Hardware Fault]*. 0 : Disabled 1 : Enabled	1 (0, 1)	654
F1-21 (03BC)	Enc1 Signal Selection	V/f **CL-V/f** OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the number of channels for the signal to the encoder option card. 0 : A Pulse Detection 1 : AB Pulse Detection	0 (0, 1)	654
F1-30 (03AA)	M2 Enc PCB Port Select	V/f **CL-V/f** OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the drive port to install the motor 2 encoder option card. 0 : CN5-C 1 : CN5-B	1 (0, 1)	654
F1-31 (03B0)	Enc2 Pulse Count (PPR)	V/f **CL-V/f** OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the number of output pulses for each motor revolution for motor 2.	1024 ppr (1 - 60000 ppr)	655
F1-32 (03B1)	Enc2 Rotat Selection	V/f **CL-V/f** OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the output sequence for the A and B pulses from the encoder for motor 2. This parameter assumes that the motor is operating in the forward direction. 0 : A leads in FWD Direction 1 : B leads in FWD Direction	0 (0, 1)	655
F1-33 (03B2)	Enc2 Gear Teeth1	V/f **CL-V/f** OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the number of gear teeth on the motor side for motor 2. This parameter and *F1-34 [Enc2 Gear Teeth2]* set the gear ratio between the motor and encoder.	0 (0 - 1000)	655
F1-34 (03B3)	Enc2 Gear Teeth2	V/f **CL-V/f** OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the number of gear teeth on the load side for motor 2. This parameter and *F1-33 [Enc2 Gear Teeth1]* set the gear ratio between the motor and encoder.	0 (0 - 1000)	655
F1-35 (03BE)	Enc2 Pulse Scaling for Monitor	V/f **CL-V/f** OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the ratio between the pulse input and the pulse output of the encoder as a 3-digit number for motor 2. The first digit is the numerator and the second and third digits set the denominator. The dividing ratio = (1 + x)/yz when the setting value is a 3-digit value (xyz).	001 (001 - 032, 102 - 132 (1 - 1/32))	655
F1-36 (03B5)	Enc2 PCB Disconnect Detect	V/f **CL-V/f** OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function that enables and disables detection of a disconnected encoder connection cable to cause *PGoH [Encoder (PG) Hardware Fault]* for motor 2. 0 : Disabled 1 : Enabled	1 (0, 1)	656
F1-37 (03BD)	Enc2 Signal Selection	V/f **CL-V/f** OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the number of channels for the signal to the encoder option card for motor 2. 0 : A Pulse Detection 1 : AB Pulse Detection	0 (0, 1)	656
F1-50 (03D2)	Enc Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM **CLV/PM** EZOLV Sets the type of encoder connected to the PG-F3 option. 0 : EnDat Sin/Cos 1 : EnDat Serial Only 2 : Hiperface	0 (0 - 2)	656
F1-51 (03D3)	PGoH Detect Level	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM **CLV/PM** EZOLV The drive will detect *PGoH [Encoder (PG) Hardware Fault]* when the value of this parameter is less than the value of $\sqrt{\sin^2\theta + \cos^2\theta}$. **Note:** Set *F1-20 = 1 [Enc1 PCB Disconnect Detect = Enabled]* to enable this function.	80% (1 - 100%)	656
F1-52 (03D4)	Serial Enc bps for Communication	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM **CLV/PM** EZOLV Sets the communication speed between the PG-F3 option and the serial encoder. 0 : 1M/9600bps 1 : 500k/19200bps 2 : 1M/38400bps	0 (0 - 2)	656

◆ F2: ANALOG INPUT

No. (Hex.)	Name	Description	Default (Range)	Ref.
F2-01 (038F)	An.In Funct.Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the input method for the analog reference used with AI-A3. 0 : 3 Independent Channels 1 : 3 Channels Added Together	0 (0, 1)	657
F2-02 (0368) RUN	An.In Option Gain	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the analog reference gain as a percentage when the maximum output frequency is 100%. **Note:** Set *F2-01 = 1 [An.In Funct.Selection = 3 Channels Added Together]* to enable this function.	100.0% (-999.9 - +999.9%)	658
F2-03 (0369) RUN	An.In Option Bias	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the analog reference bias as a percentage when the maximum output frequency is 100%. **Note:** Set *F2-01 = 1 [An.In Funct.Selection = 3 Channels Added Together]* to enable this function.	0.0% (-999.9 - +999.9%)	658

◆ F3: DIGITAL INPUT

No. (Hex.)	Name	Description	Default (Range)	Ref.
F3-01 (0390)	D.In Funct Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the data format of digital input signals. Set *o1-03 = 0 or 1 [FrqDisplay Unit Selection = 0.01 Hz or 0.01% (100%=E1-04)]* to enable this function. **Note:** The input signal type is BCD when *o1-03 = 2 or 3 [rpmor User-selected units]*. The *o1-03* value sets the setting units. 0 : BCD, 1% units 1 : BCD, 0.1% units 2 : BCD, 0.01% units 3 : BCD, 1 Hz units 4 : BCD, 0.1 Hz units 5 : BCD, 0.01 Hz units 6 : BCD (5-digit), 0.01 Hz 7 : Binary Input 8 : MF Digital Input	0 (0 - 8)	659
F3-03 (03B9)	D.In Data Length Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the number of bits to set the frequency reference with *DI-A3*. 0 : 8-bit 1 : 12-bit 2 : 16-bit	2 (0 - 2)	659
F3-10 (0BE3) Expert	D0 Function Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function for terminal D0 of the DI-A3 when *F3-01 = 8 [D.In Funct Selection = MF Digital Input]*.	0 (0 - 4, 6 - 19F)	660
F3-11 (0BE4) Expert	D1 Function Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function for terminal D1 of the DI-A3 when *F3-01 = 8 [D.In Funct Selection = MF Digital Input]*.	0 (0 - 4, 6 - 19F)	660
F3-12 (0BE5) Expert	D2 Function Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function for terminal D2 of the DI-A3 when *F3-01 = 8 [D.In Funct Selection = MF Digital Input]*.	0 (0 - 4, 6 - 19F)	661
F3-13 (0BE6) Expert	D3 Function Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function for terminal D3 of the DI-A3 when *F3-01 = 8 [D.In Funct Selection = MF Digital Input]*.	0 (0 - 4, 6 - 19F)	661
F3-14 (0BE7) Expert	D4 Function Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function for terminal D4 of the DI-A3 when *F3-01 = 8 [D.In Funct Selection = MF Digital Input]*.	0 (0 - 4, 6 - 19F)	661
F3-15 (0BE8) Expert	D5 Function Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function for terminal D5 of the DI-A3 when *F3-01 = 8 [D.In Funct Selection = MF Digital Input]*.	0 (0 - 4, 6 - 19F)	661
F3-16 (0BE9) Expert	D6 Function Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function for terminal D6 of the DI-A3 when *F3-01 = 8 [D.In Funct Selection = MF Digital Input]*.	0 (0 - 4, 6 - 19F)	661

No. (Hex.)	Name	Description	Default (Range)	Ref.
F3-17 (0BEA) Expert	D7 Function Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function for terminal D7 of the DI-A3 when *F3-01 = 8 [D.In Funct Selection = MF Digital Input]*.	0 (0 - 4, 6 - 19F)	661
F3-18 (0BEB) Expert	D8 Function Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function for terminal D8 of the DI-A3 when *F3-01 = 8 [D.In Funct Selection = MF Digital Input]*.	0 (0 - 4, 6 - 19F)	661
F3-19 (0BEC) Expert	D9 Function Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function for terminal D9 of the DI-A3 when *F3-01 = 8 [D.In Funct Selection = MF Digital Input]*.	0 (0 - 4, 6 - 19F)	661
F3-20 (0BED) Expert	DA Function Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function for terminal DA of the DI-A3 when *F3-01 = 8 [D.In Funct Selection = MF Digital Input]*	0 (0 - 4, 6 - 19F)	662
F3-21 (0BEE) Expert	DB Function Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function for terminal DB of the DI-A3 when *F3-01 = 8 [D.In Funct Selection = MF Digital Input]*.	0 (0 - 4, 6 - 19F)	662
F3-22 (0BEF) Expert	DC Function Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function for terminal DC of the DI-A3 when *F3-01 = 8 [D.In Funct Selection = MF Digital Input]*.	0 (0 - 4, 6 - 19F)	662
F3-23 (0BF0) Expert	DD Function Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function for terminal DD of the DI-A3 when *F3-01 = 8 [D.In Funct Selection = MF Digital Input]*.	0 (0 - 4, 6 - 19F)	662
F3-24 (0BF1) Expert	DE Function Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function for terminal DE of the DI-A3 when *F3-01 = 8 [D.In Funct Selection = MF Digital Input]*.	0 (0 - 4, 6 - 19F)	662
F3-25 (0BF2) Expert	DF Function Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function for terminal DF of the DI-A3 when *F3-01 = 8 [D.In Funct Selection = MF Digital Input]*.	0 (0 - 4, 6 - 19F)	662

◆ F4: ANALOG OUTPUT

No. (Hex.)	Name	Description	Default (Range)	Ref.
F4-01 (0391)	Term.V1 Funct Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the monitor signal output from terminal V1.	102 (000 - 999)	663
F4-02 (0392) RUN	Term.V1 Gain	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the gain of the monitor signal that is sent from terminal V1. Sets the analog signal output level from the terminal V1 at 10 V or 20 mA as 100% when an output for monitoring items is 100%.	100.0% (-999.9 - +999.9%)	663
F4-03 (0393)	Term.V2 Function Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the number for monitor item of output from terminal V2.	103 (000 - 999)	663
F4-04 (0394) RUN	Term.V2 Gain	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the gain of the monitor signal that is sent from terminal V2. When an output for monitoring items is 0%, this parameter sets the analog signal output level from the V2 terminal at 10 V or 20 mA as 100%.	50.0% (-999.9 - +999.9%)	664
F4-05 (0395) RUN	Term.V1 Bias	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the bias of the monitor signal that is sent from terminal V1. Set the level of the analog signal sent from the V1 terminal at 10 V or 20 mA as 100% when an output for monitoring items is 0%.	0.0% (-999.9 - +999.9%)	664
F4-06 (0396) RUN	Term.V2 Bias	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the bias of the monitor signal that is sent from terminal V2. Set the level of the analog signal sent from the V2 terminal at 10 V or 20 mA as 100% when an output for monitoring items is 0%.	0.0% (-999.9 - +999.9%)	664
F4-07 (0397)	Term.V1 Level of Signal	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the output signal level for terminal V1. 0 : 0 to 10V 1 : -10 to 10V	0 (0, 1)	664
F4-08 (0398)	Term.V2 Level of Signal	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the output signal level for terminal V2. 0 : 0 to 10V 1 : -10 to 10V	0 (0, 1)	664

◆ F5: DIGITAL OUTPUT

No. (Hex.)	Name	Description	Default (Range)	Ref.
F5-01 (0399)	Term.P1-PC Function Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function of terminal P1-PC on the DO-A3 option. Set *F5-09 = 2 [DO-A3 Output Mode Selection = 8 CH Sel (F5-01 to F5-08)]* to enable this function.	5 (0 - 1A7)	666
F5-02 (039A)	Term.P2-PC Function Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function of terminal P2-PC on the DO-A3 option. Set *F5-09 = 2 [DO-A3 Output Mode Selection = 8 CH Sel (F5-01 to F5-08)]* to enable this function.	7 (0 - 1A7)	666
F5-03 (039B)	Term.P3-PC Function Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function of terminal P3-PC on the DO-A3 option. Set *F5-09 = 2 [DO-A3 Output Mode Selection = 8 CH Sel (F5-01 to F5-08)]* to enable this function.	F (0 - 1A7)	666
F5-04 (039C)	Term.P4-PC Function Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function of terminal P4-PC on the DO-A3 option. Set *F5-09 = 2 [DO-A3 Output Mode Selection = 8 CH Sel (F5-01 to F5-08)]* to enable this function.	13 (0 - 1A7)	666
F5-05 (039D)	Term.P5-PC Function Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function of terminal P5-PC on the DO-A3 option. Set *F5-09 = 2 [DO-A3 Output Mode Selection = 8 CH Sel (F5-01 to F5-08)]* to enable this function.	1 (0 - 1A7)	666
F5-06 (039E)	Term.P6-PC Function Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function of terminal P6-PC on the DO-A3 option. Set *F5-09 = 2 [DO-A3 Output Mode Selection = 8 CH Sel (F5-01 to F5-08)]* to enable this function.	B (0 - 1A7)	666
F5-07 (039F)	Term.M1-M2 Function Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function of terminal 2NO-2CM on the DO-A3 option. Set *F5-09 = 2 [DO-A3 Output Mode Selection = 8 CH Sel (F5-01 to F5-08)]* to enable this function.	0 (0 - 1A7)	667
F5-08 (03A0)	Term.M3-M4 Function Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function of terminal 3NO-3CM on the DO-A3 option. Set *F5-09 = 2 [DO-A3 Output Mode Selection = 8 CH Sel (F5-01 to F5-08)]* to enable this function.	0 (0 - 1A7)	667
F5-09 (03A1)	DO-A3 Output Mode Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the output mode of signals from the DO-A3 option. 0 : 8 CH Individual 1 : Bin Code Output 2 : 8 CH Sel (F5-01 to F5-08)	0 (0 - 2)	667

◆ F6: COMMUNICATIONS

No. (Hex.)	Name	Description	Default (Range)	Ref.
F6-01 (03A2)	Comm.Error Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the method to stop the motor or let the motor continue operating when the drive detects a *bUS [Option Communication Error]*. 0 : Ramp->Stop 1 : Coast->Stop 2 : Fast Stop (C1-09) 3 : Alarm Only 4 : AL-Run at d1-04 5 : AL-Ramp Stop	1 (0 - 5)	668
F6-02 (03A3)	Comm Ext Flt Detect (EF0)	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets when the drive will detect *EF0 [Option Card External Fault]* is detected. 0 : Always Detected 1 : Detect@RUN Only	0 (0, 1)	669
F6-03 (03A4)	Comm Ext Flt Select (EF0)	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the method to stop the motor or let the motor continue operating when the drive detects an *EF0 [Option Card External Fault]*. 0 : Ramp->Stop 1 : Coast->Stop 2 : Fast Stop (C1-09) 3 : Alarm Only	1 (0 - 3)	669
F6-04 (03A5)	bUS Err Det.Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the delay time for the drive to detect *bUS [Option Communication Error]*. **Note:** When you install an option card in the drive, the parameter value changes to 0.0 s.	2.0 s (0.0 - 5.0 s)	669
F6-06 (03A7)	Trq Ref/Lim Comms	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function that enables and disables the torque reference and torque limit received from the communication option. 0 : Disabled 1 : Enabled	0 (0, 1)	669

No. (Hex.)	Name	Description	Default (Range)	Ref.
F6-07 (03A8)	Multi-Ref@NetRef/ ComRef	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function that enables and disables the multi-step speed reference when the frequency reference source is NetRef or ComRef (communication option card or Modbus communications). 0 : Disable MultiStep References 1 : Enable MultiStep References	0 (0, 1)	669
F6-08 (036A)	Comm Par RST@Initialize	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function to initialize *F6-xx and F7-xx parameters* when the drive is initialized with *A1-03 [Init Parameters]*. 0 : Retain Pars - No Reset 1 : Factory Default - Reset	0 (0, 1)	670
F6-10 (03B6)	CCLink Node Address	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the node address for CC-Link communication. Restart the drive after changing this setting. **Note:** Be sure to set a node address that is different than all other node addresses. Do not set this parameter to *0*. Incorrect parameter settings will cause *AEr [Station Address Setting Error]* errors and the L.ERR LED on the option will come on.	0 (0 - 64)	670
F6-11 (03B7)	CCLink Comm Speed	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the communication speed for CC-Link communication. Restart the drive after you change this setting. 0 : 156 kbps 1 : 625 kbps 2 : 2.5 Mbps 3 : 5 Mbps 4 : 10 Mbps	0 (0 - 4)	670
F6-14 (03BB)	BUS Err. AutoReset	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the automatic reset function for *bUS [Option Communication Errors]*. 0 : Disabled 1 : Enabled	0 (0, 1)	670
F6-16 (0B8A)	Gateway Mode	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the gateway mode operation and the number of connected slave drives. 0 : Disabled 1 : 1 Slave Drive 2 : 2 Slave Drives 3 : 3 Slave Drives 4 : 4 Slave Drives	0 (0 - 4)	671
F6-20 (036B)	MLII Address	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the station address for MECHATROLINK communication. Restart the drive after changing this setting. **Note:** • The setting range changes if using MECHATROLINK-II or MECHATROLINK-III: –MECHATROLINK-II (SI-T3) range: 20 - 3F –MECHATROLINK-III (SI-ET3) range: 03 - EF • Be sure to set a node address that is different than all other node addresses. Incorrect parameter settings will cause *AEr [Station Address Setting Error]* errors and the L.ERR LED on the option will come on. • The drive detects *AEr* errors when the station address is 20 or 3F.	0021h (MECHATROLINK-II : 0020h - 003Fh , MECHATROLINK-III : 0003h - 00EFh)	673
F6-21 (036C)	MLII Frame Size	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the frame size for MECHATROLINK communication. Restart the drive after you change this setting. 0 : 32-byte 1 : 17-byte	0 (0, 1)	674
F6-22 (036D)	MLII Link Speed	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the communications speed for MECHATROLINK-II. Restart the drive after you change this setting. **Note:** This parameter is only available with the MECHATROLINK-II option. 0 : 10 Mbps 1 : 4 Mbps	0 (0, 1)	674
F6-23 (036E)	MLII Mon Sel (E)	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Modbus register used for the monitor functions of INV_CTL (drive operation control command) and INV_I/O (drive I/O control command). Restart the drive after you change this setting.	0000h (0000h - FFFFh)	674
F6-24 (036F)	MLII Mon Sel (F)	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Modbus register used for the monitor functions of INV_CTL (drive operation control command) and INV_I/O (drive I/O control command). Restart the drive after you change this setting.	0000h (0000h - FFFFh)	674

No. (Hex.)	Name	Description	Default (Range)	Ref.
F6-25 (03C9)	MLII Watchdog Error Sel	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the method to stop the motor or let the motor continue operating when the drive detects an *E5 [MECHATROLINK Watchdog Timer Err]*. 0 : Ramp->Stop 1 : Coast->Stop 2 : Fast Stop (C1-09) 3 : Alarm Only	1 (0 - 3)	674
F6-26 (03CA)	MLII bUS Err Detected	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the number of times that the option must detect a *bUS* alarm to cause a *bUS [Option Communication Error]*.	2 times (2 - 10 times)	675
F6-30 (03CB)	PROFI-DP Address	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the node address for PROFIBUS-DP communication. Restart the drive after changing this setting. **Note:** Be sure to set a node address that is different than all other node addresses.	0 (0 - 125)	675
F6-31 (03CC)	PROFI-DP Clear Command Mode	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets what the drive will do after it receives the Clear Mode command. 0 : Reset 1 : Hold Previous State	0 (0, 1)	675
F6-32 (03CD)	PROFI-DP Data Format Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the data format of PROFIBUS-DP communication. Restart the drive after changing this setting. 0 : PPO Type 1 : Conventional 2 : PPO (bit0) 3 : PPO (Enter) 4 : Conv (Enter) 5 : PPO (bit0,Enter)	0 (0 - 5)	675
F6-35 (03D0)	CANopen Address	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the node address for CANopen communication. Restart the drive after changing this setting. **Note:** Be sure to set an address that is different than all other node addresses. Do not set this parameter to *0*. Incorrect parameter settings will cause *AEr [Station Address Setting Error]* errors and the L.ERR LED on the option will come on.	0 (0 - 126)	676
F6-36 (03D1)	CANopen BaudRate	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the CANopen communications speed. Restart the drive after you change this setting. 0 : Auto-Detection 1 : 10 kbps 2 : 20 kbps 3 : 50 kbps 4 : 125 kbps 5 : 250 kbps 6 : 500 kbps 7 : 800 kbps 8 : 1 Mbps	0 (0 - 8)	676
F6-45 (02FB)	BACnet Address	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the node address for BACnet communication. **Note:** Set a node address that is unique. Do not set this parameter to a value of 0.	1 (0 - 127)	676
F6-46 (02FC)	BACnet BaudRate	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the BACnet communications speed. 1 : 1200 bps 2 : 2400 bps 3 : 4800 bps 4 : 9600 bps 5 : 19.2 kbps 6 : 38.4 kbps 7 : 57.6 kbps 8 : 76.8 kbps 9 : 115.2 kbps	3 (0 - 8)	676
F6-47 (02FD)	BACNet Rx-Tx Wait Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the wait time for the drive to receive and send BACnet communication.	5 ms (5 - 65 ms)	677
F6-48 (02FE)	BACnet DevOb Id0	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the last word of BACnet communication addresses.	0 (0 - FFFF)	677
F6-49 (02FF)	BACnet DevOb Id1	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the last word of BACnet communication addresses.	0 (0 - 3F)	677

No. (Hex.)	Name	Description	Default (Range)	Ref.
F6-50 (03C1)	DNet MAC Address	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the MAC address for DeviceNet communication. Restart the drive after you change this setting. **Note:** Be sure to set a MAC address that is different than all other node addresses. Do not set this parameter to 0. Incorrect parameter settings will cause *AEr [Station Address Setting Error]* errors and the MS LED on the option will flash.	0 (0 - 64)	677
F6-51 (03C2)	DNet Baud Rate	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the DeviceNet communications speed. Restart the drive after you change this setting. 0 : 125 kbps 1 : 250 kbps 2 : 500 kbps 3 : Adjustable from Network 4 : Detect Automatically	0 (0 - 4)	677
F6-52 (03C3)	DNet PCA Setting	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the format of data that the DeviceNet communication master sends to the drive.	21 (0 - 255)	677
F6-53 (03C4)	DNet PPA Setting	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the format of data that the drive sends to the DeviceNet communication master.	71 (0 - 255)	677
F6-54 (03C5)	DNet Idle Fault Detection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function to detect *EF0 [Option Card External Fault]* when the drive does not receive data from the DeviceNet master. 0 : Enabled 1 : Disabled, No Fault Detection 2 : Vendor Specific 3 : RUN Forward 4 : RUN Reverse	0 (0 - 4)	678
F6-55 (03C6)	DNet Baud Monitor	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function to see the actual DeviceNet communications speed using the keypad. This parameter functions as a monitor only. 0 : 125 kbps 1 : 250 kbps 2 : 500 kbps	0 (0 - 2)	678
F6-56 (03D7)	DNet Speed Scale Factor	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the speed scale for DeviceNet communication.	0 (-15 - +15)	678
F6-57 (03D8)	DNet Current Scale Factor	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the current scale of the DeviceNet communication master.	0 (-15 - +15)	678
F6-58 (03D9)	DNet Torque Scale Factor	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the torque scale of the DeviceNet communication master.	0 (-15 - +15)	678
F6-59 (03DA)	DNet Power Scaling	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the power scale of the DeviceNet communication master.	0 (-15 - +15)	678
F6-60 (03DB)	DNet Voltage Scale	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the voltage scale of the DeviceNet communication master.	0 (-15 - +15)	678
F6-61 (03DC)	DNet Time Scale	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the time scale of the DeviceNet communication master.	0 (-15 - +15)	679
F6-62 (03DD)	DNet Heartbeat Interval	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the heartbeat for DeviceNet communication. Set this parameter to 0 to disable the heartbeat function.	0 (0 - 10)	679
F6-63 (03DE)	DNet Network MAC ID	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function to see the actual DeviceNet MAC address using the keypad. This parameter functions as a monitor only.	0 (0 - 63)	679
F6-64 to F6-67 (03DF - 03E2)	DynOut.Ass109 P1 to P4	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets Configurable Outputs 1 to 4 written to the Modbus register.	0000h (0000h - FFFFh)	679
F6-68 to F6-71 (03E3, 03E4, 03C7, and 03C8)	DynIn.Ass159 P1 to 4	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets Configurable Inputs 1 to 4 written to the Modbus register.	0000h (0000h - FFFFh)	679
F6-72 (081B)	PowerLink Address	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the node ID for PowerLink communication. **Note:** Set a node address that is unique. Do not set this parameter to a value of 0.	0 (0 - 255)	679

◆ F7: ETHERNET

No. (Hex.)	Name	Description	Default (Range)	Ref.
F7-01 (03E5)	IP Address 1	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the first octet of the IP Address for the device that is connecting to the network. Restart the drive after you change this parameter. **Note:** When *F7-13 = 0 [Addr Mode@Startup = Static]*: • Use parameters *F7-01 to F7-04 [IP Address 1 to IP Address 4]* to set the IP Address. Be sure to set a different IP address for each drive on the network. • Also set parameters *F7-01 to F7-12*.	192 (0 - 255)	679
F7-02 (03E6)	IP Address 2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the second octet of the IP Address for the device that is connecting to the network. Restart the drive after you change this parameter. **Note:** When *F7-13 = 0 [Addr Mode@Startup = Static]*: • Use parameters *F7-01 to F7-04 [IP Address 1 to IP Address 4]* to set the IP Address. Be sure to set a different IP address for each drive on the network. • Also set parameters *F7-01 to F7-12*.	168 (0 - 255)	679
F7-03 (03E7)	IP Address 3	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the third octet of the IP Address for the device that is connecting to the network. Restart the drive after you change this parameter. **Note:** When *F7-13 = 0 [Addr Mode@Startup = Static]*: • Use parameters *F7-01 to F7-04 [IP Address 1 to IP Address 4]* to set the IP Address. Be sure to set a different IP address for each drive on the network. • Also set parameters *F7-01 to F7-12*.	1 (0 - 255)	680
F7-04 (03E8)	IP Address 4	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the fourth octet of the IP Address for the device that is connecting to the network. Restart the drive after you change this parameter. **Note:** When *F7-13 = 0 [Addr Mode@Startup = Static]*: • Use parameters *F7-01 to F7-04 [IP Address 1 to IP Address 4]* to set the IP Address. Be sure to set a different IP address for each drive on the network. • Also set parameters *F7-01 to F7-12*.	20 (0 - 255)	680
F7-05 (03E9)	Subnet Mask 1	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the first octet of the subnet mask of the connected network. **Note:** Set this parameter when *F7-13 = 0 [Addr Mode@Startup = Static]*.	255 (0 - 255)	680
F7-06 (03EA)	Subnet Mask 2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the second octet of the subnet mask of the connected network. **Note:** Set this parameter when *F7-13 = 0 [Addr Mode@Startup = Static]*.	255 (0 - 255)	680
F7-07 (03EB)	Subnet Mask 3	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the third octet of the subnet mask of the connected network. **Note:** Set this parameter when *F7-13 = 0 [Addr Mode@Startup = Static]*.	255 (0 - 255)	680
F7-08 (03EC)	Subnet Mask 4	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the fourth octet of the subnet mask of the connected network. **Note:** Set this parameter when *F7-13 = 0 [Addr Mode@Startup = Static]*.	0 (0 - 255)	680
F7-09 (03ED)	Gateway Addr 1	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the first octet of the gateway address of the connected network. **Note:** Set this parameter when *F7-13 = 0 [Addr Mode@Startup = Static]*.	192 (0 - 255)	681
F7-10 (03EE)	Gateway Addr 2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the second octet of the gateway address of the connected network. **Note:** Set this parameter when *F7-13 = 0 [Addr Mode@Startup = Static]*.	168 (0 - 255)	681
F7-11 (03EF)	Gateway Addr 3	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the third octet of the gateway address of the connected network. **Note:** Set this parameter when *F7-13 = 0 [Addr Mode@Startup = Static]*.	1 (0 - 255)	681
F7-12 (03F0)	Gateway Addr 4	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the fourth octet of the gateway address of the connected network. **Note:** Set this parameter when *F7-13 = 0 [Addr Mode@Startup = Static]*.	1 (0 - 255)	681

No. (Hex.)	Name	Description	Default (Range)	Ref.
F7-13 (03F1)	Addr Mode@Startup	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the method to set option card IP addresses. 0 : Static 1 : BOOTP 2 : DHCP **Note:** • The following setting values are available when using the PROFINET communication option card (SI-EP3). –0: Static –2: DCP • When *F7-13 = 0*, set parameters *F7-01 to F7-12 [Subnet Mask 3 to Gateway Addr 4]* to set the IP Address. Be sure to set a different IP address for each drive on the network.	2 (0 - 2)	681
F7-14 (03F2)	Duplex Mode Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the duplex mode setting method. 0 : Half/Half 1 : Auto/Auto 2 : Full/Full 3 : Half/Auto 4 : Half/Full 5 : Auto/Half 6 : Auto/Full 7 : Full/Half 8 : Full/Auto	1 (0 - 8)	681
F7-15 (03F3)	Comm. BaudRate	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the communications speed. 10 : 10/10 Mbps 102 : 100/10 Mbps	10 (10, 102)	682
F7-16 (03F4)	Timeout Value	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the detection time for a communications timeout. **Note:** Set this parameter to 0.0 to disable the connection timeout function.	0.0 s (0.0 - 30.0 s)	682
F7-17 (03F5)	E/IP Speed Scale Factor	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the scaling factor for the speed monitor in the EtherNet/IP Class ID 2AH Object.	0 (-15 - +15)	682
F7-18 (03F6)	E/IP Current Scale Factor	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the scaling factor for the output current monitor in the EtherNet/IP Class ID 2AH Object.	0 (-15 - +15)	682
F7-19 (03F7)	E/IP Torque Scale Factor	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the scaling factor for the torque monitor in the EtherNet/IP Class ID 2AH Object.	0 (-15 - +15)	682
F7-20 (03F8)	E/IP Power Scale Factor	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the scaling factor for the power monitor in the EtherNet/IP Class ID 2AH Object.	0 (-15 - +15)	683
F7-21 (03F9)	E/IP Voltage Scale Factor	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the scaling factor for the voltage monitor in the EtherNet/IP Class ID 2AH Object.	0 (-15 - +15)	683
F7-22 (03FA)	E/IP Time Scale Factor	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the scaling factor for the time monitor in the EtherNet/IP Class ID 2AH Object.	0 (-15 - +15)	683
F7-23 to F7-27 (03FB - 03FF) F7-28 to F7-32 (0370 - 0374)	DynOut.Ass116 P1 to 5 for CommCard DynOut.Ass116 P6 to 10 for CommCard	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets Output Assembly 116. The drive writes the values from Output Assembly 116 to the Modbus address register that is stored for each parameter. The drive will not write the values from Output Assembly 116 to the registers when the Modbus address is 0.	0	683
F7-33 to F7-42 (0375 - 037E)	DynIn.Ass166 P1 to 10 for CommCard	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets Input Assembly 166. The drive sends the values from the Modbus address registers stored for each parameter to Input Assembly 166. The drive returns the default register value for the option card when the Modbus address is 0 and the value sent to Input Assembly 166 is not defined.	0	683
F7-60 (0780)	PZD1 WR(CtrlWrd)	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Modbus address for PZD1 (PPO output). PZD1 (PPO output) functions as the STW when *F7-60 = 0, 1, or 2*.	0	683
F7-61 (0781)	PZD2 WR(FRef)	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Modbus address for PZD2 (PPO output). PZD2 (PPO output) functions as the HSW when *F7-61 = 0, 1, or 2*.	0	683
F7-62 (0782)	PZD3 Write	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Modbus address for PZD3 (PPO output). A value of 0, 1, or 2 will disable the PZD3 (PPO output) write operation to the Modbus register.	0	683
F7-63 (0783)	PZD4 Write	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Modbus address for PZD4 (PPO output). A value of 0, 1, or 2 will disable the PZD4 (PPO output) write operation to the Modbus register.	0	684

No. (Hex.)	Name	Description	Default (Range)	Ref.
F7-64 (0784)	PZD5 Write	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Modbus address for PZD5 (PPO output). A value of 0, 1, or 2 will disable the PZD5 (PPO output) write operation to the Modbus register.	0	684
F7-65 (0785)	PZD6 Write	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Modbus address for PZD6 (PPO output). A value of 0, 1, or 2 will disable the PZD6 (PPO output) write operation to the Modbus register.	0	684
F7-66 (0786)	PZD7 Write	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Modbus address for PZD7 (PPO output). A value of 0, 1, or 2 will disable the PZD7 (PPO output) write operation to the Modbus register.	0	684
F7-67 (0787)	PZD8 Write	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Modbus address for PZD8 (PPO output). A value of 0, 1, or 2 will disable the PZD8 (PPO output) write operation to the Modbus register.	0	684
F7-68 (0788)	PZD9 Write	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Modbus address for PZD9 (PPO output). A value of 0, 1, or 2 will disable the PZD9 (PPO output) write operation to the Modbus register.	0	684
F7-69 (0789)	PZD10 Write	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Modbus address for PZD10 (PPO output). A value of 0, 1, or 2 will disable the PZD10 (PPO output) write operation to the Modbus register.	0	684
F7-70 (078A)	PZD1 RD (StatWord)	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Modbus address for PZD1 (PPO Read). PZD1 (PPO input) functions as the ZSW when *F7-70 = 0*.	0	684
F7-71 (078B)	PZD2 RD (OutFreq)	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Modbus address for PZD2 (PPO Read). PZD2 (PPO input) functions as the HIW when *F7-71 = 0*.	0	685
F7-72 (078C)	PZD3 Read	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Modbus address for PZD3 (PPO Read). A value of 0 will disable the PZD3 (PPO input) load operation from the Modbus register.	0	685
F7-73 (078D)	PZD4 Read	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Modbus address for PZD4 (PPO Read). A value of 0 will disable the PZD4 (PPO input) load operation from the Modbus register.	0	685
F7-74 (078E)	PZD5 Read	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Modbus address for PZD5 (PPO Read). A value of 0 will disable the PZD5 (PPO input) load operation from the Modbus register.	0	685
F7-75 (078F)	PZD6 Read	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Modbus address for PZD6 (PPO Read). A value of 0 will disable the PZD6 (PPO input) load operation from the Modbus register.	0	685
F7-76 (0790)	PZD7 Read	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Modbus address for PZD7 (PPO Read). A value of 0 will disable the PZD7 (PPO input) load operation from the Modbus register.	0	685
F7-77 (0791)	PZD8 Read	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Modbus address for PZD8 (PPO Read). A value of 0 will disable the PZD8 (PPO input) load operation from the Modbus register.	0	685
F7-78 (0792)	PZD9 Read	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Modbus address for PZD9 (PPO Read). A value of 0 will disable the PZD9 (PPO input) load operation from the Modbus register.	0	685
F7-79 (0793)	PZD10 Read	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Modbus address for PZD10 (PPO Read). A value of 0 will disable the PZD10 (PPO input) load operation from the Modbus register.	0	686

11.8 H: TERMINALS

H1: DIGITAL INPUTS

No. (Hex.)	Name	Description	Default (Range)	Ref.
H1-01 (0438)	DI1 Function Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function for MFDI terminal DI1. **Note:** The default setting is *0* when the drive is initialized for *3-Wire Initialization [A1-03 = 3330]*.	1 (1 - 4, 6 - 19F)	687
H1-02 (0439)	DI2 Function Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function for MFDI terminal DI2. **Note:** The default setting is *0* when the drive is initialized for *3-Wire Initialization [A1-03 = 3330]*.	2 (1 - 4, 6 - 19F)	688
H1-03 (0400)	DI3 Function Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function for MFDI terminal DI3.	24 (0 - 19F)	688
H1-04 (0401)	DI4 Function Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function for MFDI terminal DI4.	7B (0 - 19F)	688
H1-05 (0402)	DI5 Function Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function for MFDI terminal DI5. **Note:** The default setting is *0* when the drive is initialized for *3-Wire Initialization [A1-03 = 3330]*.	A (0 - 19F)	688
H1-06 (0403)	DI6 Function Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function for MFDI terminal DI6. **Note:** The default setting is *A* when the drive is initialized for *3-Wire Initialization [A1-03 = 3330]*.	B (0 - 19F)	688
H1-07 (0404)	DI7 Function Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function for MFDI terminal DI7. **Note:** The default setting is *B* when the drive is initialized for *3-Wire Initialization [A1-03 = 3330]*.	6 (0 - 19F)	688
H1-08 (0405)	DI8 Function Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function for MFDI terminal DI8. **Note:** The default setting is *6* when the drive is initialized for *3-Wire Initialization [A1-03 = 3330]*.	1B (0 - 19F)	688
H1-21 (0B70)	DI1 Funct.Sel 2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the second function for MFDI terminal DI1.	0 (1 - 4, 6 - 19F)	689
H1-22 (0B71)	DI2 Funct.Sel 2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the second function for MFDI terminal DI2.	0 (1 - 4, 6 - 19F)	689
H1-23 (0B72)	DI3 Funct.Sel 2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the second function for MFDI terminal DI3.	0 (1 - 4, 6 - 19F)	689
H1-24 (0B73)	DI4 Funct.Sel 2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the second function for MFDI terminal DI4.	0 (1 - 4, 6 - 19F)	689
H1-25 (0B74)	DI5 Funct.Sel 2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the second function for MFDI terminal DI5.	0 (1 - 4, 6 - 19F)	689
H1-26 (0B75)	DI6 Funct.Sel 2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the second function for MFDI terminal DI6.	0 (1 - 4, 6 - 19F)	689
H1-27 (0B76)	DI7 Funct.Sel 2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the second function for MFDI terminal DI7.	0 (1 - 4, 6 - 19F)	690
H1-28 (0B77)	DI8 Funct.Sel 2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the second function for MFDI terminal DI8.	0 (1 - 4, 6 - 19F)	690
H1-40 (0B54)	Mbus 15C0h b0 Input Function	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the MFDI function for *bit 0* of Modbus register *15C0 (Hex.)*.	0 (1 - 4, 6 - 19F)	690
H1-41 (0B55)	Mbus 15C0h b1 Input Function	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the MFDI function for *bit 1* of Modbus register *15C0 (Hex.)*.	0 (1 - 4, 6 - 19F)	690
H1-42 (0B56)	Mbus 15C0h b2 Input Function	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the MFDI function for *bit 2* of Modbus register *15C0 (Hex.)*.	0 (1 - 4, 6 - 19F)	690

■ H1-xx: Multi-Function Digital Input Setting Values

Setting	Function	Description	Ref.
0	Through Mode	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Setting for terminals that are not being used or terminals being used in through mode.	690
1	Forward Run	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Forward Run command for 2-wire sequence 1. Set this function and *H1-xx = 2 [Reverse Run]* together. ON : Forward Run OFF : Run Stop **Note:** • Turning ON the Forward Run command terminal and the Reverse Run command terminal will cause alarm *EF [FWD/REV Run Command Input Error]* and the motor will ramp to stop. • Initialize the drive with a 2-wire sequence to set the Forward Run command to terminal DI1. • This function will not operate at the same time as *H1-xx = 3, 4 [Run Command, FWD/REV Cmd]*.	691
2	Reverse Run	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Reverse Run command for 2-wire sequence 1. Set this function and *H1-xx = 1 [Forward Run]* together. ON : Reverse Run OFF : Run Stop **Note:** • Turning ON the Forward Run command terminal and the Reverse Run command terminal will cause alarm EF [FWD/REV Run Command Input Error] and the motor will ramp to stop. • Initialize the drive with a 2-wire sequence to set the Reverse Run command to terminal DI2. • This function will not operate at the same time as *H1-xx = 3, 4 [Run Command, FWD/REV Cmd]*.	691
3	Run Command	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Run command for 2-wire sequence 2. Set this function and *H1-xx = 4 [FWD/REV Cmd]* together. ON : Run OFF : Stop **Note:** This function will not operate at the same time as *H1-xx = 1, 2 [Forward Run, Reverse Run]*.	691
4	FWD/REV Cmd	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the direction of motor rotation for 2-wire sequence 2. Set this function and *H1-xx = 3 [Run Command]* together. ON : Reverse OFF : Forward **Note:** This function will not operate at the same time as *H1-xx = 1, 2 [Forward Run, Reverse Run]*.	691
5	3-Wire Seq.	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the direction of motor rotation for 3-wire sequence.	692
6	Jog Reference	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the drive to use the JOG Frequency Reference (JOG command) set in *d1-17*. The JOG Frequency Reference (JOG command) overrides Frequency References 1 to 16 (d1-01 to d1-16).	692
7	Jog Forward	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the command to operate the motor in the forward direction at the Jog Frequency set in *d1-17 [Jog Reference]*.	693
8	Jog Reverse	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the command to operate the motor in the reverse direction at the Jog Frequency set in *d1-17 [Jog Reference]*.	693
9	Ext Ref 1/2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the drive to use Run command source 1/2 or Reference command source 1/2 when in REMOTE Mode. ON : *b1-15 [Freq. Ref. Sel. 2], b1-16 [Run Comm. Sel 2]* OFF : *b1-01 [Freq. Ref. Sel. 1], b1-02 [Run Comm. Sel 1]*	693
A	MultSpd Ref1	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Uses speed references *d1-01 to d1-08 [Reference 1 to Reference 8]* to set a multi-step speed reference.	693
B	MultSpd Ref2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Uses speed references *d1-01 to d1-08 [Reference 1 to Reference 8]* to set a multi-step speed reference.	693
C	MultSpd Ref3	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Uses speed references *d1-01 to d1-08 [Reference 1 to Reference 8]* to set a multi-step speed reference.	694
D	MultSpd Ref4	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the command to switch *d1-09 to d1-16 [Reference 9 to Reference 16]* with multi-step speed references 1, 2 and 3.	694
E	Offset Frq 1	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function to add the offset frequency set in *d7-01 [Offset Frq 1]* to the frequency reference when the terminal activates.	694
F	Offset Frq 2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function to add the offset frequency set in *d7-02 [Offset Frq 2]* to the frequency reference when the terminal activates.	694
10	Offset Frq 3	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function to add the offset frequency set in *d7-03 [Offset Frq 3]* to the frequency reference when the terminal activates.	694

Setting	Function	Description	Ref.
11	LOC/REM Sel.	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets drive control for the keypad (LOCAL) or an external source (REMOTE). ON : LOCAL OFF : REMOTE	694
12	AI Input Sel	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the command that enables or disables the terminals selected in *H3-14 [An.In Term.Enable Sel]*. ON : Input to the terminal selected with *H3-14* is enabled OFF : Input to the terminal selected with *H3-14* is disabled	695
13	Spd/Trq Switch	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function to switch between torque control and speed control. ON : Torque control OFF : Speed control	695
14	AI Trq Polarity	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the rotation direction of the external torque reference. ON : External torque reference reverse direction OFF : External torque reference forward direction	695
15	FWD/REV Det	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the rotation direction of the motor when in Simple Closed Loop V/f Control method and *F1-21, F1-37 = 0 [Encoder Option Function Selection = A Pulse Detection]*, or when in Closed Loop V/f Control method. ON : Reverse OFF : Forward	695
16	Ref Sample	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the command to sample the frequency reference at terminals AI1, AI2, or AI3 and hold the frequency reference at that frequency.	695
17	Ac/Dec Hold	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Momentarily pauses motor acceleration and deceleration when the terminal is turned ON, retains the output frequency that was stored in the drive at the time of the pause, and restarts motor operation.	696
18	Ac/Dec Time1	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the drive to use *C1-01, C1-02 [Accel Time 1, Decel Time 1]* or *C1-03, C1-04 [Accel Time 2, Decel Time 2]*.	696
19	Ac/Dec Time2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Set this function and *H1-xx = 18 [Ac/Dec Time1]* together. Sets the drive to use *C1-05, C1-06 [Accel Time 3, Decel Time 3]* or *C1-07, C1-08 [Accel Time 4, Decel Time 4]*.	696
1A	Drive Enable	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function to show *dnE [Drive Enabled]* on the keypad and ignore Run commands when the terminal is OFF.	696
1B	Baseblock NO	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the command that stops drive output and coasts the motor to stop when the input is ON. ON : Baseblock (drive output stop) OFF : Normal operation	697
1E	Baseblock NC	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the command that stops drive output and coasts the motor to stop when the input terminal is OFF. ON : Normal operation OFF : Baseblock (drive output stop)	697
20 to 2F	External Fault	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets a command to stop the drive when a failure or fault occurs on an external device. 20 : ExF NO-AlRmp 21 : ExF NC-AlRmp 22 : ExF NO-RnRmp 23 : ExF NC-RnRmp 24 : ExF NO-AlCoast 25 : ExF NC-AlCoast 26 : ExF NO-RnCoast 27 : ExF NC-RnCoast 28 : ExF NO-AlFStop 29 : ExF NC-AlFStop 2A : ExF NO-RnFStop 2B : ExF NC-RnFStop 2C : ExF NO-AlAlarm 2D : ExF NC-AlAlarm 2E : ExF NO-RnAlarm 2F : ExF NC-RnAlarm	697
30	DCInj Cmd	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the command to use DC Injection Braking to stop the motor. **Note:** When *A1-02 = 8 [Control Method = EZ Vector]*, this function is available if you use a PM motor.	698
31	Zero Servo	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function to hold a stopped motor.	698

Setting	Function	Description	Ref.
32	HiSlipBraking	**V/f** **CL-V/f** OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the command to use high-slip braking to stop the motor.	699
34	Fast Stop NO	**V/f** **CL-V/f** **OLV** **CLV** **AOLV** **OLV/PM** **AOLV/PM** **CLV/PM** **EZOLV** Sets the command to ramp to stop in the deceleration time set in *C1-09 [Fast Stop Time]* when the input terminal is ON while the drive is operating.	699
35	Fast Stop NC	**V/f** **CL-V/f** **OLV** **CLV** **AOLV** **OLV/PM** **AOLV/PM** **CLV/PM** **EZOLV** Sets the command to ramp to stop in the deceleration time set in *C1-09 [Fast Stop Time]* when the input terminal is ON while the drive is operating.	699
3E	SCBraking NO	V/f CL-V/f OLV CLV AOLV **OLV/PM** **AOLV/PM** CLV/PM **EZOLV** Sets operation of Short Circuit Braking (N.O.). ON : Short Circuit Braking is enabled. OFF : Normal operation **Note:** When *A1-02 = 8 [Control Method = EZ Vector]*, this function is available if you use a PM motor.	700
3F	SCBraking NC	V/f CL-V/f OLV CLV AOLV **OLV/PM** **AOLV/PM** CLV/PM **EZOLV** Sets operation of Short Circuit Braking (N.C.). ON : Normal operation OFF : Short Circuit Braking is enabled. **Note:** When *A1-02 = 8 [Control Method = EZ Vector]*, this function is available if you use a PM motor.	700
40	KEB Thru1 NC	**V/f** **CL-V/f** **OLV** **CLV** **AOLV** **OLV/PM** **AOLV/PM** **CLV/PM** **EZOLV** Sets operation of the KEB1 function through the KEB Ride-Thru 1 (N.C.). ON : Normal operation OFF : Deceleration during momentary power loss	700
41	KEB Thru1 NO	**V/f** **CL-V/f** **OLV** **CLV** **AOLV** **OLV/PM** **AOLV/PM** **CLV/PM** **EZOLV** Sets operation of the KEB1 function through the KEB Ride-Thru 1 (N.O.). ON : Deceleration during momentary power loss OFF : Normal operation	700
42	KEB Thru2 NC	**V/f** **CL-V/f** **OLV** **CLV** **AOLV** **OLV/PM** **AOLV/PM** **CLV/PM** **EZOLV** Sets operation of the KEB2 function through the KEB Ride-Thru 2 (N.C.). ON : Normal operation OFF : Deceleration during momentary power loss	701
43	KEB Thru2 NO	**V/f** **CL-V/f** **OLV** **CLV** **AOLV** **OLV/PM** **AOLV/PM** **CLV/PM** **EZOLV** Sets operation of the KEB2 function through the KEB Ride-Thru 2 (N.O.). ON : Deceleration during momentary power loss OFF : Normal operation	701
44	Field weakening	**V/f** **CL-V/f** OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function to send the Field Weakening Level and Field Weakening Frequency Limit commands set in *d6-01 [Field Weak Level] and d6-02 [Field Weak FqLimit]* when the input terminal is activated.	701
45	ASR Gain Switch	V/f CL-V/f OLV **CLV** **AOLV** OLV/PM **AOLV/PM** **CLV/PM** **EZOLV** Sets the function to switch the ASR proportional gain set in *C5-01 [ASR PGain 1] and C5-03 [ASR PGain 2]*. ON : C5-03 OFF : C5-01	701
46	ASR I Reset	V/f **CL-V/f** OLV **CLV** **AOLV** OLV/PM **AOLV/PM** **CLV/PM** **EZOLV** Sets the command to reset the integral value and use PI control or P control for the speed control loop. ON : P control OFF : PI control	702
47	PG Enc Disable	V/f **CL-V/f** OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the command to disable speed feedback control and run the drive in V/f control or use speed feedback from the encoder. ON : Speed feedback control disable (V/f Control) OFF : Speed feedback control enable (Closed Loop V/f Control)	702
60	Timer Fn Input	**V/f** **CL-V/f** **OLV** **CLV** **AOLV** **OLV/PM** **AOLV/PM** **CLV/PM** **EZOLV** Sets the command to start the timer function. Use this setting with *Timer Output [H2-xx = 39]*.	702
61	Motor 2 Select	**V/f** **CL-V/f** **OLV** **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the command for the drive to operate motor 1 or motor 2. Stop the motors before switching. ON : Operate motor 2 OFF : Operate motor 1	702
62	Up Command	**V/f** **CL-V/f** **OLV** **CLV** **AOLV** **OLV/PM** **AOLV/PM** **CLV/PM** **EZOLV** Sets the command to use a button to increase the drive frequency reference. You must also set Setting 63 *[Down Command]*. ON : Increases the frequency reference. OFF : Holds the current frequency reference.	703

Setting	Function	Description	Ref.
63	Down Command	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the command to decrease the drive frequency reference using a button. Users must also set *Setting 62 [Up Command]*. ON : Decreases the frequency reference. OFF : Holds the current frequency reference.	704
65	Up2 Command	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function to increase the frequency reference bias value to accelerate the motor when the terminal is activated. Set this function and *H1-xx = 66 [Dw2 Command]* together. **Note:** When using this function, set the optimal bias limit value with *d4-08 and d4-09 [Up/Dw2 Bias Upper Limit and Up/Dw2 Bias Lower Limit]*.	705
66	Dw2 Command	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function to increase the frequency reference bias value to accelerate the motor when the terminal is activated. Set this function and *H1-xx = 65 [Up2 Command]* together. **Note:** When using this function, set the optimal bias limit value with *d4-08 and d4-09 [Up/Dw2 Bias Upper Limit and Up/Dw2 Bias Lower Limit]*.	706
67	SpdSrch Fmax	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function to start speed search using an external reference although *b3-01 = 0 [SpSrch@Start Selection = Disabled]*. **Note:** The drive will detect *oPE03 [Multi-Function Input Setting Err]* when *H1-xx = 67 and 68* are set at the same time.	706
68	SpdSrch Fref	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function to start speed search using an external reference although *b3-01 = 0 [SpSrch@Start Selection = Disabled]*. **Note:** The drive will detect *oPE03 [Multi-Function Input Setting Err]* when *H1-xx = 67 and 68* are set at the same time.	706
6A	PID Disable	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the command to disable PID control when *b5-01 = 1 [PID Enable = Enabled]*. ON : PID control disabled OFF : PID control enabled	706
71	PID I Reset	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the command to reset and hold the PID control integral to 0 when the terminal is ON.	707
72	PID I Hold	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the command to hold the integral value of the PID control while the terminal is activated.	707
75	PID SS Cancel	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the PID soft starter function. ON : Disabled OFF : Enabled	707
76	PID InLv Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the command to turn the terminal ON and OFF to switch the PID input level (polarity).	707
77	PID SP 1	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Set this function and *H1-xx = 78 [PID SP 2]* together. Sets the function to switch the PID setpoint to *b5-58 to b5-60 [PID Setpoint 2 to PID Setpoint 4]*.	707
78	PID SP 2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Set this function and *H1-xx = 77 [PID SP 1]* together. Sets the function to switch the PID setpoint to *b5-58 to b5-60 [PID Setpoint 2 to PID Setpoint 4]*.	707
7A	PID BiDir	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets operation of the PID Bi-Directional function. ON : Enabled OFF : Disabled	707
7B	Fault Reset	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the command to reset the current fault when the Run command is inactive. **Note:** The drive ignores the fault reset command when the Run command is active. Remove the Run command before trying to reset a fault.	708
7C	Prg Lock	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the command to prevent parameter changes when the terminal is OFF. ON : Program Lockout OFF : Parameter Write Prohibit	708
7D	Drive OH2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the drive to display an *oH2 [Drive Overheat Warning]* alarm when the input terminal is ON. The alarm does not have an effect on drive operation.	708
7E	Node Setup	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function in CANopen communications to start the Node Setup function to set the drive node address from the host controller.	708

Setting	Function	Description	Ref.
7F	Comms Test	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Set the function for the drive to self-test RS-485 serial communications operation.	708
90 to 97	Q2pack DI1 to 8	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets digital inputs used with Q2pack. Refer to the Q2pack Online Manual for more information.	708
9F	Q2pack Disable	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets operation of the Q2pack program saved in the drive. ON : Disabled OFF : Enabled **Note:** Set *A1-07 = 2 [Q2pack Enable = With DI]* to use this function.	708
101 to 19F	Inverse Input of 1 to 9F	Sets the function of the selected MFDI to operate inversely. To select the function, enter "1xx", where the "xx" is the function setting value. **Note:** You cannot use inverse input for all functions. Refer to Table 12.39 for more information.	709

◆ H2: DIGITAL OUTPUTS

No. (Hex.)	Name	Description	Default (Range)	Ref.
H2-01 (040B)	Multi-Function Digital Output 1	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function for MFDO terminal 2NO-2CM. **Note:** Set this parameter to *0* when the terminal is not being used or to use the terminal in through mode.	0 (0 - 1FF)	711
H2-02 (040C)	Multi-Function Digital Output 2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function for MFDO terminal 3NO-3CM. **Note:** Set this parameter to *0* when the terminal is not being used or to use the terminal in through mode.	1 (0 - 1FF)	711
H2-03 (040D)	Multi-Function Digital Output 3	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function for MFDO terminal 4NO-4CM. **Note:** Set this parameter to *0* when the terminal is not being used or to use the terminal in through mode.	2 (0 - 1FF)	711
H2-06 (0437)	kWH Out Unit Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the unit for the output signal when *H2-01 to H2-03 = 65 [xNO-xCM Func Selection = WattH Pulse]*. 1 : 0.1 kWh units 2 : 1 kWh units 3 : 10 kWh units 4 : 100 kWh units 5 : 1000 kWh units	1 (1 - 5)	711
H2-07 (0B3A)	Mbus Reg1 Address Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the address of the Modbus register output to the MFDO terminal.	0001 (0001 - 1FFF)	712
H2-08 (0B3B)	Mbus Reg1 Bit Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the bit of the Modbus register output to the MFDO terminal.	0000 (0000 - FFFF)	712
H2-09 (0B3C)	Mbus Reg2 Address Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the address of the Modbus register output to the MFDO terminal.	0001 (0001 - 1FFF)	712
H2-10 (0B3D)	Mbus Reg2 Bit Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the bit of the Modbus register output to the MFDO terminal.	0000 (0000 - FFFF)	712
H2-20 (1540)	Compare1 Mon. Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the monitor number for comparator 1. Set the *x-xx* part of the *Ux-xx [MONITOR]*. For example, set *x-xx* to 102 to monitor *U1-02 [Output Frequency]*.	102 (000 - 999)	713
H2-21 (1541)	Compare1 Low Limit	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the lower limit detection level for comparator 1 when the full scale analog output for the monitor selected in *H2-20 [Compare1 Mon.Selection]* is the 100% value.	0.0% (0.0 - 300.0%)	713
H2-22 (1542)	Compare1 Up Limit	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the upper limit detection level for comparator 1 when the full scale analog output for the monitor selected in *H2-20 [Compare1 Mon.Selection]* is the 100% value.	0.0% (0.0 - 300.0%)	713
H2-23 (1543)	Compare1 Hysteresis	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the hysteresis level for comparator 1 when the full scale analog output for the monitor selected in *H2-20 [Compare1 Mon.Selection]* is the 100% value.	0.0% (0.0 - 10.0%)	713
H2-24 (1544)	Compare1 On-Delay Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the on-delay time for comparator 1.	0.0 s (0.0 - 600.0 s)	713

No. (Hex.)	Name	Description	Default (Range)	Ref.
H2-25 (1545)	Compare1 Off-Delay Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the off-delay time for comparator 1.	0.0 s (0.0 - 600.0 s)	713
H2-26 (1546)	Compare2 Mon. Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the monitor number for comparator 2. Set the *x-xx* part of the *Ux-xx [MONITOR]*. For example, set *x-xx* to 102 to monitor *U1-02 [CF Error Code]*.	103 (000 - 999)	714
H2-27 (1547)	Compare2 Low Limit	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the lower limit detection level for comparator 1 when the full scale analog output for the monitor selected in *H2-26 [Compare2 Mon.Selection]* is the 100% value.	0.0% (0.0 - 300.0%)	714
H2-28 (1548)	Compare2 Up Limit	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the upper limit detection level for comparator 1 when the full scale analog output for the monitor selected in *H2-26 [Compare2 Mon.Selection]* is the 100% value.	0.0% (0.0 - 300.0%)	714
H2-29 (1549)	Compare2 Hysteresis	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the hysteresis level for comparator 2 when the full scale analog output for the monitor selected in *H2-26 [Compare2 Mon.Selection]* is the 100% value.	0.0% (0.0 - 10.0%)	714
H2-30 (154A)	Compare2 On-Delay Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the on-delay time for comparator 2.	0.0 s (0.0 - 600.0 s)	714
H2-31 (154B)	Compare2 Off-Delay Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the off-delay time for comparator 2.	0.0 s (0.0 - 600.0 s)	715
H2-32 (159A)	Compare1 Filter Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the time constant that is applied to the primary delay filter used for the analog output of the monitor selected with *H2-20 [Compare1 Mon.Selection]*.	0.0s (0.0 - 10.0 s)	715
H2-33 (159B)	Compare1 Protection Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets drive operation when it detects *CP1 [Comparator1 Limit Fault]*. 0 : Ramp->Stop 1 : Coast->Stop 2 : Fast Stop (C1-09) 3 : Alarm Only 4 : Low Speed (L8-19)	4 (0 - 4)	715
H2-34 (159C)	Compare2 Filter Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the time constant that is applied to the primary delay filter used for the analog output of the monitor selected with *H2-26 [Compare2 Mon.Selection]*.	0.0s (0.0 - 10.0 s)	715
H2-35 (159D)	Compare2 Protection Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets drive operation when it detects *CP2 [Comparator2 Limit Fault]*. 0 : Ramp->Stop 1 : Coast->Stop 2 : Fast Stop (C1-09) 3 : Alarm Only 4 : Low Speed (L8-19)	4 (0 - 4)	715
H2-36 (159E)	Compare1 HoldTime	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the length of time that *CP1 [Comparator1 Limit Fault]* is disabled.	0.0 s (0.0 - 10.0 s)	716
H2-37 (159F)	Compare2 HoldTime	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the length of time that *CP2 [Comparator2 Limit Fault]* is disabled.	0.0 s (0.0 - 10.0 s)	716
H2-40 (0B58)	Mbus 15E0h b0 Output Function	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the MFDO for bit 0 of Modbus register 15E0 (Hex.).	0 (0 - 1A7)	716
H2-41 (0B59)	Mbus 15E0h b1 Output Function	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the MFDO for bit 1 of Modbus register 15E0 (Hex.).	0 (0 - 1A7)	716
H2-42 (0B5A)	Mbus 15E0h b2 Output Function	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the MFDO for bit 2 of Modbus register 15E0 (Hex.).	0 (0 - 1A7)	716
H2-60 (1B46) Expert	2NO-2CM 2nd Function	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Selects the second function for terminal 2NO-2CM. The logical calculation results of the terminals assigned to functions by *H2-01 [Multi-Function Digital Output 1]* is output.	0 (0 - A7)	716
H2-61 (1B47) Expert	2NO-2CM Logic Operation	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the logical operation for the functions set in *H2-01 [Multi-Function Digital Output 1]* and *H2-60 [2NO-2CM 2nd Function]*.	1 (1 - 9)	717
H2-62 (1B48) Expert	2NO-2CM Dly Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the minimum on time used to output the logical calculation results from terminal 2NO-2CM.	0.1 s (0.0 - 25.0 s)	717
H2-63 (1B49) Expert	3NO-3CM 2nd Function	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Selects the second function for terminal 3NO-3CM. The logical calculation results of the terminals assigned to functions by *H2-02 [Multi-Function Digital Output 2]* is output.	0 (0 - A7)	717
H2-64 (1B4A) Expert	3NO-3CM Logic Operation	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the logical operation for the functions set in *H2-02 [Multi-Function Digital Output 2]* and *H2-63 [3NO-3CM 2nd Function]*.	1 (1 - 9)	717

No. (Hex.)	Name	Description	Default (Range)	Ref.
H2-65 (1B4B) Expert	3NO-3CM Dly Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the minimum on time used to output the logical calculation results from terminal 3NO-3CM.	0.1 s (0.0 - 25.0 s)	717
H2-66 (1B4C) Expert	4NO-4CM 2nd Function	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Selects the second function for terminal 4NO-4CM. The logical calculation results of the terminals assigned to functions by *H2-03 [Multi-Function Digital Output 3]* is output.	0 (0 - A7)	717
H2-67 (1B4D) Expert	4NO-4CM Logic Operation	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the logical operation for the functions set in *H2-03 [Multi-Function Digital Output 3]* and *H2-66 [4NO-4CM 2nd Function]*.	1 (1 - 9)	717
H2-68 (1B4E) Expert	4NO-4CM Dly Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the minimum on time used to output the logical calculation results from terminal 4NO-4CM.	0.1 s (0.0 - 25.0 s)	718

■ H2-xx: MFDO Function Selections

<table>
<tr><th>Setting</th><th>Function</th><th>Description</th><th>Ref.</th></tr>
<tr><td>0</td><td>Through Mode</td><td>V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV
Use this setting for unused terminals or to use terminals in through mode. Also use this setting as the PLC contact output via Modbus or the communication option. This signal does not function if signals from the PLC are not configured.</td><td>718</td></tr>
<tr><td>1</td><td>Drive Ready</td><td>V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV
The terminal activates when the drive is ready and running.</td><td>718</td></tr>
<tr><td>2</td><td>Drive Enable</td><td>V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV
This terminal activates when the H1-xx = 1A [Drive Enable] terminal activates.</td><td>718</td></tr>
<tr><td>3</td><td>Fault</td><td>V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV
The terminal activates when the drive detects a fault.
Note:
The terminal will not turn on for CPF00 and CPF01 [Control Circuit Error] faults.</td><td>718</td></tr>
<tr><td>4</td><td>Alarm</td><td>V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV
The terminal turns on when the drive detects a minor fault.</td><td>718</td></tr>
<tr><td>5</td><td>@Run</td><td>V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV
The terminal activates when the Run command is input and when the drive is making voltage.
ON : Drive is running
OFF : Drive is stopping</td><td>718</td></tr>
<tr><td>6</td><td>@Reverse</td><td>V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV
The terminal activates when the motor operates in the reverse direction.
ON : The motor is operating in the reverse direction.
OFF : The motor is operating in the forward direction or the motor stopped.</td><td>719</td></tr>
<tr><td>7</td><td>Zero Speed</td><td>V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV
The terminal activates when the output frequency is less than the value of E1-09 [Min Output Frequency] or b2-01 [ZSpd/DCI Threshold].
Note:
A1-02 [Control Method] selects which parameter is the reference.
<table>
<tr><th>A1-02 Setting</th><th>Control Method</th><th>Parameter Used as the Reference</th></tr>
<tr><td>0</td><td>V/f Control</td><td>E1-09</td></tr>
<tr><td>1</td><td>PG V/f Control</td><td>E1-09</td></tr>
<tr><td>2</td><td>OLVector</td><td>b2-01</td></tr>
<tr><td>3</td><td>CLVector</td><td>E1-09</td></tr>
<tr><td>4</td><td>Adv OLVector</td><td>E1-09</td></tr>
<tr><td>5</td><td>PM OLVector</td><td>E1-09</td></tr>
<tr><td>6</td><td>PM AOLVector</td><td>E1-09</td></tr>
<tr><td>7</td><td>PM CLVector</td><td>b2-01</td></tr>
<tr><td>8</td><td>EZ Vector</td><td>E1-09</td></tr>
</table>
ON : Output frequency < value of E1-09 or b2-01.
OFF : Output frequency ≥ value of E1-09 or b2-01.</td><td>719</td></tr>
<tr><td>8</td><td>ZeroServo ok</td><td>V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV
The terminal activates when positioning in the range set with b9-02 [Zero Servo Width for Completion] completes after sending the Zero-Servo command.</td><td>720</td></tr>
</table>

Setting	Function	Description	Ref.
9	@Regeneration	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal activates on when the motor is regenerating. ON : Motor is regenerating. OFF : Motor is operating or stopped.	720
A	@SpeedLimit	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal activates when the speed limit is active.	720
B	@FreqOutput	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal activates when the drive outputs frequency. ON : The drive outputs frequency. OFF : The drive does not output frequency.	720
C	@Standby	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal deactivates after the drive stops operating and after the time set with *b8-51 [Standby Mode Wait Time]*. ON : The Run command turns on and the magnetic contactor on the input side turns on. OFF : The Run command turns off and the drive stops operating. Then, the magnetic contactor on the input side turns off after the time set with *b8-51 [Standby Mode Wait Time]* elapses.	721
D	LO/RE Status	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal activates when the Run command source or frequency reference source is LOCAL. ON : LOCAL OFF : REMOTE	721
E	EDM Safety	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal turns on (safety stop state) when the safety circuit and safety diagnosis circuit are operating correctly and when terminals H1-HC and H2-HC are off (released). ON : Safety stop state OFF : Safety circuit fault or RUN/READY	721
F	SpeedAgree1	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal turns on when the output frequency is in the range of the frequency reference ± *L4-02 [SpAgree Det. Width]*. **Note:** The drive uses the motor speed as the reference in CLV. ON : The output frequency is in the range of "frequency reference ± *L4-02*." OFF : The output frequency does not align with the frequency reference although the drive is running.	722
10	USpeedAgree1	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal activates when the output frequency is in the range of *L4-01 [SpAgree Det.Level]* ± *L4-02 [SpAgree Det.Width]* and in the range of the frequency reference ± *L4-02*. **Note:** • The detection function operates in the two motor rotation directions. • In CLV, the forward/reverse detection level is the value of "Motor Speed ± *L4-02*." ON : The output frequency is in the range of "*L4-01* ± *L4-02*" and the range of frequency reference ± *L4-02*. OFF : The output frequency is not in the range of "*L4-01* ± *L4-02*" or the in the range of frequency reference ± *L4-02*.	722
11	SpeedAgree2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal activates when the output frequency is in the range of the frequency reference ± *L4-04 [SpAgree Det. Width(+/-)]*. **Note:** The drive uses the motor speed as the reference in CLV and CLV/PM. ON : The output frequency is in the range of "frequency reference ± *L4-04*". OFF : The output frequency is not in the range of "frequency reference ± *L4-04*".	723
12	USpeedAgree2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal activates when the output frequency is in the range of *L4-03 [SpAgree Det.Level(+/-)]* ± *L4-04 [SpAgree Det.Width(+/-)]* and in the range of the frequency reference ± *L4-04*. ON : The output frequency is in the range of "*L4-03* ± *L4-04*" and the range of frequency reference ± *L4-04*. OFF : The output frequency is not in the range of "*L4-03* ± *L4-04*" or the in the range of frequency reference ± *L4-04*.	723
13	FreqDetect 1	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal turns off when the output frequency is higher than the value of *L4-01 [SpAgree Det.Level]* + *L4-02 [SpAgree Det.Width]*. After the terminal turns off, the terminal continues to remain off until the output frequency reaches the level set with *L4-01*. **Note:** • The detection function operates in the two motor rotation directions. The value of *L4-01* is used as the forward/reverse detection level. • In CLV, the motor speed is the reference. ON : The output frequency is less than the value of *L4-01* or does not exceed the value of *L4-01* + *L4-02*. OFF : The output frequency exceeds the value of *L4-01* + *L4-02*.	724
14	FreqDetect 2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal activates when the output frequency is higher than the setting value of *L4-01 [SpAgree Det.Level]*. After the terminal activates, the terminal stays on until the output frequency is at the value of *L4-01 - L4-02*. ON : The output frequency is higher than the value of *L4-01*. OFF : The output frequency is less than the value of "*L4-01 - L4-02*", or is less than the value of *L4-01*.	724

Setting	Function	Description	Ref.
15	FreqDetect 3	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal deactivates when the output frequency is higher than the setting value of "*L4-03 [SpAgree Det.Level (+/-)]* + *L4-04 [SpAgree Det.Width(+/-)]*". After the terminal deactivates, the terminal stays off until the output frequency is at the value of *L4-03*. **Note:** • The detection level set with *L4-03* is a signed value. The drive will only detect in one direction. • The drive uses the motor speed as the reference in CLV and CLV/PM. ON : The output frequency is less than the value of *L4-03* or is not higher than the value of *L4-03* + *L4-04*. OFF : The output frequency is higher than the value of *L4-03* + *L4-04*.	724
16	FreqDetect 4	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal activates when the output frequency is higher than the value of *L4-03 [SpAgree Det.Level(+/-)]*. After the terminal activates, the terminal stays on until the output frequency is at the value of *L4-03 - L4-04*. ON : The output frequency is higher than the value of *L4-03*. OFF : The output frequency is less than the value of "*L4-03 - L4-04*", or it is not higher than the value of *L4-03*.	725
17	@Fast Stop	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal activates when the fast stop is in operation.	725
18	@KEBridethru	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The activates during KEB Ride-Thru.	725
19	@ShortCBraking	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal activates during Short Circuit Braking. **Note:** When *A1-02 = 8 [Control Method = EZ Vector]*, this function is available if you use a PM motor.	726
1A	@BaseblockNO	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal turns on during baseblock. When the drive is in baseblock, the drive output transistor stops switching and the drive will not make DC bus voltage. ON : During baseblock OFF : The drive is not in baseblock.	726
1B	@BaseblockNC	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal deactivates during baseblock. When the drive is in baseblock, the drive output transistor stops switching and does not make DC bus voltage. ON : The drive is not in baseblock. OFF : During baseblock	726
1C	FreqRefSource	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Shows the selected frequency reference source. ON : The keypad is the frequency reference source. OFF : *b1-01 or b1-15 [Freq. Ref. Sel. 1 or Freq. Ref. Sel. 2]* is the frequency reference source.	726
1D	RunCmdSource	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Shows the selected Run command source. ON : The keypad is the Run command source. OFF : *b1-02* or *b1-16* [Run Comm. Sel 1 or Run Comm. Sel 2] is the Run command source.	726
1E	Motor2 Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal activates when motor 2 is selected. ON : Motor 2 Selection OFF : Motor 1 Selection	726
1F	Restart Enable	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal activates when the Auto Restart function is trying to restart after a fault.	726
20	FltReset Active	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal turns on when the drive receives the Reset command from the control circuit terminal, serial communications, or the communication option.	727
21	PolePos Detection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal activates when drive receives a Run command and the drive detects the motor magnetic pole position of the PM motor.	727
22	Ext 24V Supply	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal activates when there is an external 24V power supply between terminals E24V-A0V. ON : An external 24V power supply supplies power. OFF : An external 24V power supply does not supply power.	727
2F	@SpeedSearch	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal activates when the drive is doing speed search.	727
30	@TorqueLimit	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal activates when the torque reference is the torque limit set with *L7 parameters*, *H3-02 [AI1 Function Selection]*, *H3-06 [AI3 Function Selection]*, or *H3-10 [AI2 Function Selection]*.	727
31	@SpdLim@Trq	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The motor accelerates in the forward direction or the reverse direction after enabling torque control and the externally input torque reference is disproportionate to the load. The output terminal activates when this speed is not higher than a constant speed and the motor speed is at the speed limit. This does not include operation when the drive is stopped.	727

Parameter List

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Setting	Function	Description	Ref.
32	TrqDetect1NO	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal activates when the drive detects overtorque or undertorque. ON : The output current/torque is more than the torque value set with *L6-02 [Trq Det1 Level]*, or the level is less than the torque value set with *L6-02* for longer than the time set with *L6-03 [Trq Det1 Time]*.	727
33	TrqDetect1NC	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal deactivates when the drive detects overtorque or undertorque. OFF : The output current/torque is more than the torque value set with *L6-02 [Trq Det1 Level]*, or the level is less than the torque value set with *L6-02* for longer than the time set with *L6-03 [Trq Det1 Time]*.	728
37	TrqDetect2NO	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal activates when the drive detects overtorque or undertorque. ON : The output current/torque is more than the torque value set with *L6-05 [Trq Det2 Level]*, or the level is less than the torque value set with *L6-05* for longer than the time set with *L6-06 [Trq Det2 Time]*.	728
38	TrqDetect2NC	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal deactivates when the drive detects overtorque or undertorque. OFF : The output current/torque is more than the torque value set with *L6-05 [Trq Det2 Level]*, or the level is less than the torque value set with *L6-05* for longer than the time set with *L6-06 [Trq Det2 Time]*.	728
39	Timer Output	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Use this setting when the drive uses the timer function as an output terminal.	728
3C	Comparator 1	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The monitor value set with *H2-20 [Compare1 Mon.Selection]* is on while in range of the time set with *H2-24 [Compare1 On-Delay Time]* and the values of *H2-21 [Compare1 Low Limit] and H2-22 [Compare1 Up Limit]* are in range.	728
3D	Comparator 2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The monitor value set with *H2-26 [Compare2 Mon.Selection]* is on while in range of the time set with *H2-30 [Compare2 On-Delay Time]* and the values of *H2-27 [Compare2 Low Limit] and H2-28 [Compare2 Up Limit]* are in range.	729
3E	PID Fbk Low	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The activates when the drive detects *FbL [PID Feedback Loss]*.	729
3F	PID Fbk High	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal activates when the drive detects *FbH [Excessive PID Feedback]*.	729
4A	DC Bus Undervolt	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal activates when the DC bus voltage or control circuit power supply is less than the voltage set with *L2-05 [UV Detection Lvl (Uv1)]*. The terminal also turns on when there is a fault with the DC bus voltage. ON : The DC bus voltage is less than the setting value of *L2-05*. OFF : The DC bus voltage is more than the setting value of *L2-05*.	730
4B	FreqRef Loss	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal activates when the drive detects a loss of frequency reference.	730
4C	BrkRes Fault	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal activates when the mounting-type braking resistor is overheating or when there is a braking transistor fault.	730
4D	Motor OL1	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal activates when the electronic thermal protection value of the motor overload protective function is a minimum of 90% of the detection level.	730
4E	Drive PreOH	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal activates when the drive heatsink temperature is at the level set with *L8-02 [Overheat Alm Level]*.	730
4F	PreOHTimeLim	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal activates when *L8-03 = 4 [Overheat Pre-Alarm Selection = Run@L8-19 Rate]* and *oH [Heatsink Overheat]* does not clear after the drive decreases the frequency for 10 cycles.	730
60	BrkTransFault	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal activates when the internal braking transistor overheats and the drive detects an *rr [Dynamic Braking Transistor Fault]* fault.	730
61	BrkTransOH	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal activates when the braking resistor overheats and the drive detects an *rH [Braking Resistor Overheat]* fault.	731
62	Fan Alarm	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal activates when the drive detects a cooling fan failure in the drive.	731
63	Maintenance	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal activates when drive components are at their estimated maintenance period. Tells the user about the maintenance period for these items: • IGBT • Cooling fan • Capacitor • Soft charge bypass relay	731
65	WattH Pulse	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Outputs the pulse that shows the watt hours.	731
66	MechWeakDetect	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal activates when the drive detects mechanical weakening.	731

Setting	Function	Description	Ref.
67	ModbusReg 1	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal activates when the bit specified by *H2-08 [Mbus Reg1 Bit Select]* for the Modbus register address set with *H2-07 [Mbus Reg1 Address Select]* activates.	731
69	ModbusReg 2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal activates when the bit specified by *H2-10 [Mbus Reg2 Bit Select]* for the Modbus register address set with *H2-09 [Mbus Reg2 Address Select]* activates.	731
6A	DataLog Error	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal activates when the drive detects a *LoG [Com Error / Abnormal SD card]*.	732
90 to 93	Q2pack DO1 to 4	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Q2pack digital output. Refer to the Q2pack online manual for more information.	732
A0 to A7	Q2pack ExDO1 to 8	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the digital output for the Q2pack DO-A3 option card. Refer to the Q2pack online manual for more information.	732
100 to 1A7	Inverse Output of 0 to A7	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Causes inverse output of the function for the selected MFDO. Uses the last two digits of 1xx to select which function to inversely output.	732

◆ H3: ANALOG INPUTS

No. (Hex.)	Name	Description	Default (Range)	Ref.
H3-01 (0410)	AI1 Signal Level Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the input signal level for MFAI terminal AI1. 0 : 0 to 10V (Lower Limit at 0) (Q2V: 0 to 10 V with zero limit) 1 : -10 to +10V (Bipolar Reference) (Q2V: 0 to 10 V without zero limit) 2 : 4 to 20 mA (Q2A Only) 3 : 0 to 20 mA (Q2A Only)	0 (0 - 3)	734
H3-02 (0434)	AI1 Function Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets a function for MFAI terminal AI1.	4 (0 - 32)	734
H3-03 (0411) RUN	AI1 Gain Setting	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the gain of the analog signal input to MFAI terminal AI1.	100.0% (-999.9 - +999.9%)	734
H3-04 (0412) RUN	AI1 Bias Setting	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the bias of the analog signal input to MFAI terminal AI1.	0.0% (-999.9 - +999.9%)	735
H3-05 (0413)	AI3 Signal Level Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the input signal level for MFAI terminal AI3. 0 : 0 to 10V (Lower Limit at 0) 1 : -10 to +10V (Bipolar Reference) 2 : 4 to 20 mA 3 : 0 to 20 mA	0 (0 - 3)	735
H3-06 (0414)	AI3 Function Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets a function for MFAI terminal AI3.	1 (0 - 32)	735
H3-07 (0415) RUN	AI3 Gain Setting	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the gain of the analog signal input to MFAI terminal AI3.	100.0% (-999.9 - +999.9%)	735
H3-08 (0416) RUN	AI3 Bias Setting	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the bias of the analog signal input to MFAI terminal AI3.	0.0% (-999.9 - +999.9%)	736
H3-09 (0417)	AI2 Signal Level Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the input signal level for MFAI terminal AI2. 0 : 0 to 10V (Lower Limit at 0) (Q2V: 0 to 10 V with zero limit) 1 : -10 to +10V (Bipolar Reference) (Q2V: 0 to 10 V without zero limit) 2 : 4 to 20 mA (Q2A Only) 3 : 0 to 20 mA (Q2A Only)	2 (0 - 3)	736
H3-10 (0418)	AI2 Function Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets a function for MFAI terminal AI2.	4 (0 - 32)	736
H3-11 (0419) RUN	AI2 Gain Setting	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the gain of the analog signal input to MFAI terminal AI2.	100.0% (-999.9 - +999.9%)	736
H3-12 (041A) RUN	AI2 Bias Setting	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the bias of the analog signal input to MFAI terminal AI2.	0.0% (-999.9 - +999.9%)	737

No. (Hex.)	Name	Description	Default (Range)	Ref.
H3-13 (041B)	An.In FilterTime Constant	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the time constant to apply a primary delay filter to the MFAI terminal.	0.03 s (0.00 - 2.00 s)	737
H3-14 (041C)	An.In Term.Enable Sel	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the enabled terminal or terminals when *H1-xx: MFDI Function Select = 12 [AI Input Sel]* is ON. 1 : AI1 only 2 : AI2 only 3 : AI1 and AI2 4 : AI3 only 5 : AI1 and AI3 6 : AI2 and AI3 7 : AI1, AI2, and AI3	7 (1 - 7)	737
H3-16 (02F0)	AI1 Offset	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the offset level for analog signals input to terminal AI1. Usually it is not necessary to change this setting.	0 (-500 - +500)	737
H3-17 (02F1)	AI2 Offset	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the offset level for analog signals input to terminal AI2. Usually it is not necessary to change this setting.	0 (-500 - +500)	737
H3-18 (02F2)	AI3 Offset	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the offset level for analog signals input to terminal AI3. Usually it is not necessary to change this setting.	0 (-500 - +500)	738
H3-40 (0B5C)	15C1h Input Function	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Modbus AI1 function.	0 (0, 3, 6 - 2F)	738
H3-41 (0B5F)	15C2h Input Function	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Modbus AI2 function.	0 (0, 3, 6 - 2F)	738
H3-42 (0B62)	15C3h Input Function	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Modbus AI3 function.	0 (0, 3, 6 - 2F)	738
H3-43 (117F)	Mbus In FilterTime Const	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the time constant to apply a primary delay filter to the Modbus analog input terminal.	0.00 s (0.00 - 2.00 s)	738

■ H3-xx: MFAI Function Selections

Setting	Function	Description	Ref.
0	Through Mode	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Value for terminals that are not being used or terminals being used in through mode.	738
1	AuxFreqRef1	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets Reference 2 through multi-step speed reference to enable the command reference (Auxiliary Frequency Reference 1) from the analog input terminal set here. This value is a percentage where *E1-04 [Max Output Frequency]* setting is a setting value of 100%.	739
2	AuxFreqRef2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets Reference 3 through multi-step speed reference to enable the command reference (Auxiliary Frequency Reference 2) from the analog input terminal set here. This value is a percentage where *E1-04 [Max Output Frequency]* setting is a setting value of 100%.	739
3	FrqBIAS Frq	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Enters the bias value added to the frequency reference if *E1-04 [Max Output Frequency]* is 100%.	739
4	Freq Ref/BIAS	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The input value from the MFAI terminal set with this function becomes the master frequency reference.	739
5	Freq Gain	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The drive multiplies the analog frequency reference with the input value from the MFAI set with this function.	739
6	OutVolt Bias	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Set this parameter to input a bias signal and amplify the output voltage.	739
7	TorqCompensation	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Enters the torque compensation value if the motor rated torque is 100%.	740
8	TorqRef/Lim	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Enters the torque reference if the motor rated torque is 100%. This setting is the torque limit for speed control.	740
9	FW Trq Lim	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Enters the forward torque limit if the motor rated torque is 100%.	740
B	Rev Trq Lim	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Enters the load torque limit if the motor rated torque is 100%.	741
C	RegenTrqLim	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Enters the regenerative torque limit if the motor rated torque is 100%.	741

Setting	Function	Description	Ref.
D	GenerTrqLim	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Enters the torque limit that is the same for all quadrants for forward, reverse, and regenerative operation if the motor rated torque is 100%.	741
E	OvUntrq Level	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Enters a signal to adjust the overtorque/undertorque detection level. **Note:** Use this function with *L6-01 [Trq Det1 Select]*. This parameter functions as an alternative to *L6-02 [Trq Det1 Level]*.	741
F	PID Fbk	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Enters the PID feedback value.	742
10	PID SetPoint	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Enters the PID setpoint.	742
11	Diff PIDFbk	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Enters the PID differential feedback value if the full scale analog signal (10 V or 20 mA) is 100%.	742
12	AcDcTimeGain	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Enters a signal to adjust the gain used for *C1-01 to C1-08 [Accel Time 1 to Decel Time 4]* if the full scale analog signal (10 V or 20 mA) is 100%.	742
13	DCInjBrakCurr	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Enters a signal to adjust the current level used for DC Injection Braking if the drive rated output current is 100%.	742
14	StallPLev@Rn	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Enters a signal to adjust the stall prevention level during run if the drive rated current is 100%.	743
15	OutFLowLimSel	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Enters a signal to adjust the output frequency lower limit level if *E1-04 [Max Output Frequency]* = 100%.	743
16	Mot PTC Input	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Uses the motor Positive Temperature Coefficient (PTC) thermistor to prevent heat damage to the motor if the current value when the 10 V (or 20 mA) analog signal is input is 100%.	743
30	Q2pack AI1	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Use with Q2pack. Refer to the Q2pack online manual for more information.	743
31	Q2pack AI1	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Use with Q2pack. Refer to the Q2pack online manual for more information.	743
32	Q2pack AI3	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Use with Q2pack. Refer to the Q2pack online manual for more information.	744

◆ H4: ANALOG OUTPUTS

No. (Hex.)	Name	Description	Default (Range)	Ref.
H4-01 (041D)	AO1 An.Out Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the monitor number to send from MFAO terminal AO1. Set the *x-xx* part of the *U: MONITORS*. For example, set *H4-01 = 102* to monitor *U1-02 [Output Frequency]*.	102 (000 - 999)	745
H4-02 (041E) RUN	AO1 An.Out Gain	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the gain of the monitor signal that is sent from MFAO terminal AO1. Sets the analog signal output level from the terminal AO1 at 10 V or 20 mA as 100% when an output for monitoring items is 100%.	100.0% (-999.9 - +999.9%)	745
H4-03 (041F) RUN	AO1 An.Out Bias	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the bias of the monitor signal that is sent from MFAO terminal AO1. Set the level of the analog signal sent from terminal AO1 at 10 V or 20 mA as 100% when an output for monitoring items is 0%.	0.0% (-999.9 - +999.9%)	746
H4-04 (0420)	AO2 An.Out Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the monitoring number to be output from the MFAO terminal AO2. Set the *x-xx* part of the *U: MONITORS*. For example, set *H4-04* to *102* to monitor *U1-02 [Output Frequency]*.	103 (000 - 999)	746
H4-05 (0421) RUN	AO2 An.Out Gain	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the gain of the monitor signal that is sent from MFAO terminal AO2. When an output for monitoring items is 0%, this parameter sets the analog signal output level from the AO2 terminal at 10 V or 20 mA as 100%.	50.0% (-999.9 - +999.9%)	746
H4-06 (0422) RUN	AO2 An.Out Bias	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the bias of the monitor signal that is sent from MFAO terminal AO2. Set the level of the analog signal sent from the AO2 terminal at 10 V or 20 mA as 100% when an output for monitoring items is 0%.	0.0% (-999.9 - +999.9%)	746

No. (Hex.)	Name	Description	Default (Range)	Ref.
H4-07 (0423)	AO1 Signal Level Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the MFAO terminal AO1 output signal level. **Note:** Set jumper S5 on the terminal board to the correct position after changing this parameter. 1 : 0 to 10 Vdc 2 : -10 to +10 Vdc 3 : 4 to 20 mA	1 (1 - 3)	746
H4-08 (0424)	AO2 Signal Level Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the MFAO terminal AO2 output signal level. **Note:** Set jumper S5 on the terminal board to the correct position after changing this parameter. 1 : 0 to 10 Vdc 2 : -10 to +10 Vdc 3 : 4 to 20 mA	1 (1 - 3)	747
H4-20 (0B53)	An.Pwr Mon 100% Level	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the level at 10 V when *U1-08 [Output Power]* is set for analog output.	0.00 kW (0.00 - 650.00 kW)	747

◆ H5: MODBUS PORTS

No. (Hex.)	Name	Description	Default (Range)	Ref.
H5-01 (0425)	Mbus Address	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the communication slave address for drives. **Note:** • Restart the drive after changing the parameter setting. • Setting 0 will not let the drive respond to Modbus communications.	1FH (0 - FFH)	747
H5-02 (0426)	Mbus BaudRate	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the communications speed for Modbus communications. **Note:** Restart the drive after you change the parameter setting. 1 : 1200 bps 2 : 2400 bps 3 : 4800 bps 4 : 9600 bps 5 : 19.2 kbps 6 : 38.4 kbps 7 : 57.6 kbps 8 : 76.8 kbps 9 : 115.2 kbps	4 (1 - 9)	747
H5-03 (0427)	Mbus Parity	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the communications parity used for Modbus communications. **Note:** Restart the drive after you change the parameter setting. 1 : Even parity 2 : Odd parity 3 : No parity	3 (1 - 3)	748
H5-04 (0428)	Mbus Error Stop	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the motor Stopping Method when the drive detects *CE [Modbus Communication Error]* issues. 0 : Ramp->Stop 1 : Coast->Stop 2 : Fast Stop (C1-09) 3 : Alarm Only	3 (0 - 3)	748
H5-05 (0429)	Mbus Fault Detection Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function that detects *CE [Modbus Communication Error]* issues during Modbus communications. 0 : Disabled 1 : Enabled	1 (0, 1)	748
H5-06 (042A)	Mbus Tx Wait Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the time to wait to send a response message after the drive receives a command message from the master. **Note:** Restart the drive after you change the parameter setting.	5 ms (0 - 65 ms)	748
H5-09 (0435)	Mbus CE Detect Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the detection time for *CE [Modbus Communication Error]* issues when communication stops.	2.0 s (0.0 - 10.0 s)	749

No. (Hex.)	Name	Description	Default (Range)	Ref.
H5-10 (0436)	Mbus 0025H Unit Sel	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the unit of measure used for the Modbus communications monitor register 0025H (output voltage reference monitor). 0 : 0.1 V units 1 : 1 V units	0 (0, 1)	749
H5-11 (043C)	Mbus ENTER Command Mode	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function to make the Enter command necessary to change parameters through Modbus communications. 0 : Enter Required 1 : No Enter Required	0 (0, 1)	749
H5-12 (043D)	Mbus Run Command Method Sel	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the input method for the Run command when *b1-02 = 2 [Run Comm. Sel 1 = Modbus]* or *b1-16 = 2 [Run Comm. Sel 2 = Modbus]*. 0 : F/ST R/ST 1 : RUN/ST F/R	0 (0, 1)	749
H5-17 (11A1) Expert	ENTER@CPU Busy Response	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets operation when the EEPROM write command is sent without EEPROM write available. Usually it is not necessary to change this setting. 1 : Ignore (No Write) 2 : Write RAM Only	1 (1, 2)	750
H5-18 (11A2)	Mbus Speed Filter over Comms	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the filter time constant used when monitoring motor speed during Modbus communications or with a communication option.	0 ms (0 - 100 ms)	750
H5-20 (0B57)	Mbus Par Reload Mode	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function to immediately enable updated Modbus communications parameters. 1 : Reload@Power Cycle 2 : Reload Now	1 (1, 2)	750
H5-25 (1589) RUN	Mbus 5A Reg1 Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Returns the contents of the specified Modbus communications register when responding to the master device.	0044H (U1-05) (0000H - FFFFH)	750
H5-26 (158A) RUN	Mbus 5A Reg2 Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Returns the contents of the specified Modbus communications register when responding to the master device.	0045H (U1-06) (0000H - FFFFH)	750
H5-27 (158B) RUN	Mbus 5A Reg3 Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Returns the contents of the specified Modbus communications register when responding to the master device.	0042H (U1-03) (0000H - FFFFH)	751
H5-28 (158C) RUN	Mbus 5A Reg4 Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Returns the contents of the specified Modbus communications register when responding to the master device.	0049H (U1-10) (0000H - FFFFH)	751

◆ H6: PULSE INPUT OUTPUT

No. (Hex.)	Name	Description	Default (Range)	Ref.
H6-01 (042C)	PI Pulse Train Function	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function for pulse train input terminal RP. 0 : Freq Ref 1 : PIDFbk Value 2 : PID SP Value 3 : PG Feedback	0 (0 - 3)	751
H6-02 (042D) RUN	PI Frequency Scale	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the frequency of the pulse train input signal used when the function set with *H6-01 [PI Pulse Train Function]* is 100%.	1440 Hz (100 - 32000 Hz)	752
H6-03 (042E) RUN	PI Function Gain	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the gain used when the function in *H6-01 [PI Pulse Train Function]* is input to terminal PI.	100.0% (0.0 - 1000.0%)	752
H6-04 (042F) RUN	PI Function Bias	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the bias used when the function in *H6-01 [PI Pulse Train Function]* is input to terminal PI. Sets a value when the pulse train is 0 Hz.	0.0% (-100.0 - 100.0%)	752
H6-05 (0430) RUN	PI Filter Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the time constant for the primary delay filters of the pulse train input.	0.10 s (0.00 - 2.00 s)	753

No. (Hex.)	Name	Description	Default (Range)	Ref.
H6-06 (0431) RUN	PO Mon.Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets a function for pulse train monitor output terminal PO. Sets the “x-xx” part of the *Ux-xx* monitor.	102 (000, 031, 101, 102, 105, 116, 501, 502, 801 - 809, 821 - 825, 831 - 839, 851 - 855)	753
H6-07 (0432) RUN	PO Freq.Scaling	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the frequency of the pulse train output signal used when the monitor set with *H6-06 [PO Mon.Selection]* is 100%.	1440 Hz (0 - 32000 Hz)	753
H6-08 (043F)	PI Minimum Frequency	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the minimum frequency of the pulse train signal that terminal PI can detect.	0.5 Hz (0.1 - 1000.0 Hz)	754
H6-09 (156E)	PO Volt.PhaseSync Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Set whether to output the pulse synchronized with drive output voltage phase from the pulse train monitor output terminal PO. This parameter is only enabled when *H6-06 = 102 [PO Mon.Selection = Output Frequency]* and *H6-07 = 0 [PO Freq.Scaling = 0 Hz]*. 0 : Disabled 1 : Enabled	0 (0, 1)	754

◆ H7: VIRTUAL INPUT OUTPUT

No. (Hex.)	Name	Description	Default (Range)	Ref.
H7-00 (116F) Expert	Virtual MFIO Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function to enable and disable the virtual I/O function. Set this parameter to 1 to operate the virtual I/O function. 0 : Disabled 1 : Enabled	0 (0, 1)	755
H7-01 (1185) Expert	Virtual In1 Select Function	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function that enters the virtual input set in *H7-10 [Virtual Out1 Select Function]*.	0 (0 - 4, 6 - 19F)	755
H7-02 (1186) Expert	Virtual In2 Select Function	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function that enters the virtual input set in *H7-12 [Virtual Out2 Select Function]*.	0 (0 - 4, 6 - 19F)	755
H7-03 (1187) Expert	Virtual In3 Select Function	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function that enters the virtual input set in *H7-14 [Virtual Out3 Select Function]*.	0 (0 - 4, 6 - 19F)	755
H7-04 (1188) Expert	Virtual In4 Select Function	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function that enters the virtual input set in *H7-16 [Virtual Out4 Select Function]*.	0 (0 - 4, 6 - 19F)	755
H7-10 (11A4) Expert	Virtual Out1 Select Function	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function for virtual digital output 1.	0 (0 - 1A7)	755
H7-11 (11A5) Expert	Virtual Out1 Delay Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the minimum ON time for virtual digital output 1.	0.1 s (0.0 - 25.0 s)	755
H7-12 (11A6) Expert	Virtual Out2 Select Function	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function for virtual digital output 2.	0 (0 - 1A7)	755
H7-13 (11A7) Expert	Virtual Out2 Delay Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the minimum ON time for virtual digital output 2.	0.1 s (0.0 - 25.0 s)	756
H7-14 (11A8) Expert	Virtual Out3 Select Function	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function for virtual digital output 3.	0 (0 - 1A7)	756
H7-15 (11A9) Expert	Virtual Out3 Delay Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the minimum ON time for virtual digital output 3.	0.1 s (0.0 - 25.0 s)	756
H7-16 (11AA) Expert	Virtual Out4 Select Function	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function for virtual digital output 4.	0 (0 - 1A7)	756
H7-17 (11AB) Expert	Virtual Out4 Delay Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the minimum ON time for virtual digital output 4.	0.1 s (0.0 - 25.0 s)	756

No. (Hex.)	Name	Description	Default (Range)	Ref.
H7-30 (1177)	Virtual AIn Select Function	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the virtual analog input function.	0 (0 - 32)	756
H7-31 (1178) RUN Expert	Virtual AIn Gain	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the virtual analog input gain.	100.0% (-999.9 - 999.9%)	756
H7-32 (1179) RUN Expert	Virtual AIn Bias	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the virtual analog input bias.	0.0% (-999.9 - 999.9%)	756
H7-40 (1163)	Virtual AOut Enable	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the signal level of the virtual analog output. 1 : 0-100 (Absolute Value) 2 : -10 +10 VDC 3 : 0-10 VDC	1 (1 - 3)	757
H7-41 (1164)	Virtual AOut Select Function	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the monitor to be output from the virtual analog output. Set the *x-xx* part of the *Ux-xx [MONITOR]*. For example, set *x-xx* to *102* to monitor *U1-02 [Output Frequency]*.	102 (0 - 999)	757
H7-42 (1165)	Virtual AOut Filter Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the time constant for a primary filter of the virtual analog output.	0.00 s (0.00 - 2.00 s)	757

11.9 L: PROTECTION

◆ L1: MOTOR PROTECTION

No. (Hex.)	Name	Description	Default (Range)	Ref.
L1-01 (0480)	Motor Cool Type for OL1 Calc	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the motor overload protection with electronic thermal protectors. 0 : Disabled 1 : VTorque 2 : CT 10:1 Speed Range 3 : CT 100:1 SpeedRange 4 : PM VTorque 5 : PM CTorque 6 : VT (50Hz) **Note:** When only one motor is connected to a drive, set *L1-01 = 1 to 6 [Enabled]*. External thermal relays are not necessary in these conditions.	Determined by A1-02 (0 - 6)	217
L1-02 (0481)	OL1 Protect Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the operation time for the electronic thermal protector of the drive to prevent damage to the motor. Usually it is not necessary to change this setting.	1.0 min (0.1 - 5.0 min)	219
L1-03 (0482)	Motor oH AL Reaction Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets drive operation when the PTC input signal entered into the drive is at the *oH3 [Motor Overheat Alarm] detection level*. 0 : Ramp->Stop 1 : Coast->Stop 2 : Fast Stop (C1-09) 3 : Alarm Only	3 (0 - 3)	220
L1-04 (0483)	Motor oH FLT Reaction Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the drive operation when the PTC input signal to the drive is at the *oH4 [Motor Overheat Fault (PTC Input)]* detection level. 0 : Ramp->Stop 1 : Coast->Stop 2 : Fast Stop (C1-09)	1 (0 - 2)	220
L1-05 (0484)	Motor Therm.Filter Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the primary delay time constant for the PTC input signal entered to the drive. This parameter prevents accidental motor overheat faults.	0.20 s (0.00 - 10.00 s)	763
L1-08 (1103)	oL1 Current Level	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the reference current for the motor 1 thermal overload detection. **Note:** When the current level > 0.0 A, you cannot set this value < 10% of drive rated current.	0.0 A (0.0 A or 10% to 150% of the drive rated current)	763
L1-09 (1104)	M2 oL1 Curr.Level	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the reference current for the motor 2 thermal overload detection. **Note:** When the current level > 0.0 A, you cannot set this value < 10% of drive rated current.	0.0 A (0.0 A or 10 to 150% of the drive rated current)	763
L1-13 (046D)	Motor oL1 Memory Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function that keeps the current electronic thermal protector value when the drive stops receiving power. 0 : Disabled 1 : Enabled	1 (0, 1)	764

◆ L2: POWER LOSS RIDE THROUGH

No. (Hex.)	Name	Description	Default (Range)	Ref.
L2-01 (0485)	RideThru@PwrLoss	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the drive operation after a momentary power loss. 0 : Disabled 1 : Enabled	0 (0, 1)	769
L2-50 (0453)	RidThruMode@PwrLoss	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the drive operation after a momentary power loss.. 0 : Timer Controlled 1 : While CPU Active 2 : KEB Mode 3 : KEB Stop Mode 4 : KEB Decel to Stop	0 (0 - 4)	773

No. (Hex.)	Name	Description	Default (Range)	Ref.
L2-02 (0486)	RideThrough Time@Power Loss	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the maximum time that the drive will wait until trying to restart after power loss.	Determined by o2-04 and C6-01 (0.0 - 25.5 s)	769
L2-03 (0487)	Min Baseblck Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the minimum baseblock time when the drive restores power after a momentary power loss.	Determined by o2-04 and C6-01 (0.1 - 5.0 s)	770
L2-04 (0488)	Powloss Ramp Time@recovery	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the time for the drive output voltage to go back to correct voltage after completing speed searches.	Determined by o2-04 and C6-01 (0.0 - 5.0 s)	770
L2-05 (0489)	UV Detection Lvl (Uv1)	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the voltage at which a *Uv1 [DC Bus Undervoltage]* fault is triggered or at which the KEB function is activated. Usually it is not necessary to change this setting. **NOTICE:** *Damage to Equipment. Install an AC reactor option on the input side of the power supply when setting this parameter lower than the default value. Failure to obey will cause damage to drive circuitry.*	Determined by E1-01 (Determined by E1-01)	770
L2-06 (048A) Expert	KEB Decel Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the deceleration time during KEB operation used to decrease the maximum output frequency to 0. **Note:** When *L2-29 = 2, 3 , 4 [KEB Method = Single KEB2 Ride-Thru, System KEB1 Ride-Thru, System KEB2 Ride-Thru]* and you do KEB Auto-Tuning, the drive will automatically set this value.	0.0 s (0.0 to 6000.0 s)	770
L2-07 (048B) Expert	KEB Accel Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the acceleration time to return the frequency to the frequency reference before a power loss after canceling KEB operation.	0.0 s (0.0 to 6000.0 s)	771
L2-08 (048C) Expert	Frq.Gain@KEB Start	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the quantity of output frequency reduction used when KEB operation starts as a percentage of the motor rated slip before starting KEB operation.	100% (0 - 300%)	771
L2-09 (048D) Expert	KEB Min.Frq Level	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the quantity of output frequency reduction used when KEB operation starts as a percentage of the motor rated slip.	20% (0 - 100%)	771
L2-10 (048E) Expert	Minimum KEB Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the minimum length of time to operate the KEB after the drive detects a momentary power loss.	50 ms (0 - 25500 ms)	771
L2-11 (0461) Expert	KEB DC Volt Setpoint	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the target value that controls the DC bus voltage to a constant level in Single Drive KEB Ride-Thru 2. Sets the DC bus voltage level that completes the KEB operation for all other KEB methods.	Determined by E1-01 (Determined by E1-01)	772
L2-29 (0475) Expert	KEB Method	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the KEB function operation mode. 1 : Single KEB1 Ride-Thru 2 : Single KEB2 Ride-Thru 3 : System KEB1 Ride-Thru 4 : System KEB2 Ride-Thru	1 (1 - 4)	772
L2-30 (045E) Expert	KEB ZeroSpeed Operation	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the operation when the output frequency decreases below the zero level (DC braking injection starting frequency) during *KEB deceleration when L2-01 = 1 [RideThru@PwrLoss = Enabled* and *L2-50 = 2 to 4 [RidThruMode@PwrLoss= KEB Mode, KEB Stop Mode, or KEB Decel to Stop]*. 1 : Baseblock 2 : DC/SC Braking	1 (1, 2)	773
L2-31 (045D) Expert	KEB StartV Offset Level	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the KEB start voltage offset.	Determined by A1-02 (400 V Class: 0 - 200 V)	773

◆ L3: STALL PREVENTION

No. (Hex.)	Name	Description	Default (Range)	Ref.
L3-01 (048F)	StallP Mode@Accel	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the method of the Stall Prevention During Acceleration. 1 : Disabled 2 : General Purpose 3 : Intelligent Accel 4 : ILim Mode	2 (1 - 4)	775
L3-02 (0490)	StallP Level@Accel	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the output current level to start Stall Prevention during acceleration as a percentage of the drive rated output current.	Determined by C6-01 and L8-38 (0 - 150%)	776
L3-03 (0491)	StallP Limit@Accel	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the lower limit for the stall prevention level during acceleration used for constant output ranges as a percentage of the drive rated output current.	50% (0 - 100%)	776
L3-04 (0492)	StallP@Decel Enable	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Enables Stall Prevention during deceleration. 0 : Disabled 1 : Enabled	1 (0-1)	777
L3-50 (0458)	StallP@Decel Mode	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the method that the drive will use to prevent overvoltage faults when decelerating. **Note:** 1. To connect a dynamic braking option (braking resistor or braking resistor unit) to the drive, set this parameter to *0 or 3*. Parameter values *1, 2, 4, and 5* will enable Stall Prevention function during deceleration, and the dynamic braking option will not function. 2. The setting range changes when the *A1-02 [Control Method]* value changes: • When *A1-02 = 5 [PM OLVector]*, setting range is *0 to 2* • When *A1-02 = 6, 7, or 8 [PM AOLVector, PM CLVector, or EZ Vector]*, setting range is *0, 1*. 0 : General Purpose 1 : Automatic Decel Reduction 2 : Gen Purpose w/ DB Resistor 3 : HiFlux Overexcitation 4 : HiFlux2 Overexcitation	0 (Determined by A1-02)	782
L3-51 (0459)	StallP@RUNDecTime	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function to enable and disable Stall Prevention During Run. **Note:** An output frequency less than 6 Hz will disable Stall Prevention during Run regardless of *L3-05* and *L3-06 [StallP Level@Run]* settings. 0 : Dec Time 1 (C1-02) 1 : Dec Time 2 (C1-04)	0 (Determined by A1-02)	783
L3-05 (0493)	StallP@RUN Enable	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Enables Stall Prevention during Run. 0 : Disabled 1 : Enabled	Determined by A1-02 (0 - Determined by A1-02)	777
L3-06 (0494)	StallP Level@Run	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the current level that starts Stall Prevention during run. A setting of 100% is equal to the drive rated current. **Note:** This parameter is applicable if *L3-05 = 1 [StallP@RUN Enable = Enabled]* and *L3-51 = 0, 1 [StallP@RUNDecTime= Dec Time 1 (C1-02), Dec Time 2 (C1-04)]*.	Determined by C6-01 and L8-38 (30 - 150%)	777
L3-11 (04C7)	Overvolt Supression Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the overvoltage suppression function. 0 : Disabled 1 : Enabled	0 (0, 1)	778
L3-17 (0462)	DCBus Regul.Level	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the target value for the DC bus voltage when the overvoltage suppression function and the Decel Stall Prevention function (Intelligent Stall Prevention) are active.	400 V Class: 750 V (400 V Class: 300 - 800 V)	778
L3-20 (0465) Expert	DCBus VoltAdj Gain	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the proportional gain used to control the DC bus voltage.	Determined by A1-02 (0.00 - 5.00)	778
L3-21 (0466) Expert	OVSup Acc/Dec Gain	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the proportional gain to calculate acceleration and deceleration rates.	Determined by A1-02 (0.10 - 10.00)	779
L3-22 (04F9)	StallP@Acc Deceleration Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the momentary deceleration time that the drive will use when it tries to accelerate a PM motor and detected motor stalls. This function is applicable when *L3-01 = 2 [StallP Mode@Accel = General Purpose]*.	0.0 s (0.0 - 6000.0 s)	779

No. (Hex.)	Name	Description	Default (Range)	Ref.
L3-23 (04FD)	CHP Stall P Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function to automatically decrease the Stall Prevention Level during Run for constant output ranges. 1 : Level@L3-06 2 : Automatic Reduction	1 (1, 2)	779
L3-24 (046E) Expert	Acc@Rated Torque	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the motor acceleration time to reach the maximum frequency at the motor rated torque for stopped single-drive motors.	Determined by o2-04, C6-01, E2-11, and E5-01 (0.001 - 10.000 s)	779
L3-25 (046F) Expert	Load Inertia Ratio	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the ratio between motor inertia and machine inertia.	1.0 (1.0 - 1000.0)	780
L3-26 (0455) Expert	DC Bus Capacitors Extension	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the capacity for external main circuit capacitors. Sets this parameter when you use the KEB Ride-Thru function. Usually it is not necessary to change this setting.	0 μF (0 to 65000 μF)	780
L3-27 (0456)	StallP Detect Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets a delay time between reaching the Stall Prevention level and starting the Stall Prevention function.	50 ms (0 - 5000 ms)	781
L3-34 (016F) Expert	Torque Lim.Delay Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the filter time constant that returns the torque limit to its initial value when KEB operation operates in Single Drive KEB Ride-Thru mode.	Determined by A1-02 (0.000 - 1.000 s)	781
L3-35 (0747) Expert	SpAgree Width@StallP	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the width for speed agreement when *L3-04 = 1 [StallP@Decel Enable = Enabled]* and *L3-50 = 1 [StallP@Decel Mode = Automatic Decel Reduction]*. Usually it is not necessary to change this setting.	0.00 Hz (0.00 - 1.00 Hz)	781
L3-36 (11D0)	VibSup Gain@Accel	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the gain to suppress current and motor speed hunting during operation when *L3-01 = 4 [StallP Mode@Accel = ILim Mode]*. Usually it is not necessary to change this setting.	Determined by A1-02 (0.0 - 100.0)	781
L3-37 (11D1) Expert	CurLim ITime@Accel	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Usually it is not necessary to change this setting.	5 ms (0 - 100 ms)	781
L3-38 (11D2) Expert	CurLim PGain@Accel	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Suppresses current hunting and overshooting that occurs when the drive stalls during acceleration. Usually it is not necessary to change this setting.	10.0 (0.0 - 100.0)	781
L3-39 (11D3)	CurLim Filt@Accel	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the time constant to adjust the acceleration rate when *L3-01 = 4 [StallP Mode@Accel = ILim Mode]*. Usually it is not necessary to change this setting.	100.0 ms (1.0 - 1000.0 ms)	782
L3-40 (11D4)	CurLim SCurve@Acc/Dec	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function to enable and disable the best Jerk Control Settings used for current-limited acceleration. 0 : Disabled 1 : Enabled	0 (0, 1)	782

◆ L4: SPEED DETECTION

No. (Hex.)	Name	Description	Default (Range)	Ref.
L4-01 (0499)	SpAgree Det.Level	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the level to detect speed agree or motor speed. Sets the level to detect speed agree or motor speed when *H2-01 to H2-03 = F, 10, 13, 14 [DO Function Select = SpeedAgree1, USpeedAgree1, FreqDetect 1, FreqDetect 2]*.	Determined by A1-02 (Determined by A1-02)	784
L4-02 (049A)	SpAgree Det.Width	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the width to detect speed agree or motor speed. Sets the width to detect speed agree or motor speed when *H2-01 to H2-03 = F, 10, 13, 14 [DO Function Select = SpeedAgree1, USpeedAgree1, FreqDetect 1, FreqDetect 2]*.	Determined by A1-02 (Determined by A1-02)	784
L4-03 (049B)	SpAgree Det.Level(+/-)	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the level to detect speed agree or motor speed. Sets the level to detect speed agree or motor speed when *H2-01 to H2-03 = 11, 12, 15, 16 [DO Function Select = SpeedAgree2, USpeedAgree2, FreqDetect 3, FreqDetect 4]*.	Determined by A1-02 (Determined by A1-02)	784
L4-04 (049C)	SpAgree Det.Width(+/-)	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the width to detect speed agree or motor speed. Sets the width to detect speed agree or motor speed when *H2-01 to H2-03 = 11, 12, 15, 16 [DO Function Select = SpeedAgree2, USpeedAgree2, FreqDetect 3, FreqDetect 4]*.	Determined by A1-02 (Determined by A1-02)	784

No. (Hex.)	Name	Description	Default (Range)	Ref.
L4-05 (049D)	FrefLoss Det.Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the operation when the drive detects a loss of frequency reference. 1 : Stop 2 : Run@L4-06PrevRef	1 (1, 2)	784
L4-06 (04C2)	Freq.Ref@RefLoss	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the frequency reference as a percentage to continue drive operation after it detects a frequency reference loss. The value is a percentage of the frequency reference before the drive detected the loss.	80.0% (0.0 - 100.0%)	785
L4-07 (0470)	SpAgree Det.Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the condition that activates speed detection. 1 : No Detect@BB 2 : Always Detect	1 (1, 2)	785

◆ L5: FAULT RESTART

No. (Hex.)	Name	Description	Default (Range)	Ref.
L5-01 (049E)	Auto-Reset Attempts	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the number of times that the drive will try to restart.	0 (0 - 10 times)	785
L5-02 (049F)	Fault@Reset Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function that sends signals to the MFDO terminal set for *Fault [H2-xx = 3]* while the drive is automatically restarting. 1 : Disable Fault Output 2 : Enable Fault Output	1 (1, 2)	786
L5-04 (046C)	Interval Reset Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the time interval between each Auto Restart attempt. Set *L5-05 = 1 [Reset Method = Continuous]* to enable this function.	10.0 s (0.5 - 600.0 s)	786
L5-05 (0467)	Reset Method	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the count method for the Auto Restart operation. 1 : Continuous 2 : Use L5-04 Time	1 (1, 2)	786
L5-07 (0B2A)	OL1-4 Auto-Reset Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Use these 4 digits to set the Auto Restart function for *oL1* to *oL4*. From left to right, the digits set *oL1*, *oL2*, *oL3*, and *oL4*, in order. 0 : Disabled 1 : Enabled(—/—/—/oL4)	1111 (0000 - 1111)	786
L5-08 (0B2B)	U/OV,OH,GF A-Reset Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Use these 4 digits to set the Auto Restart function for *Uv1*, *ov*, *oH1*, and *GF*. From left to right, the digits set *Uv1*, *ov*, *oH1*, and *GF*, in order. 0 : Disabled 1 : Enabled(—/-/—/GF)	1111 (0000 - 1111)	786

◆ L6: TORQUE DETECTION

No. (Hex.)	Name	Description	Default (Range)	Ref.
L6-01 (04A1)	Trq Det1 Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Enables overtorque and undertorque detection and the operation of drives (operation status) after detection. 0 : Disabled 1 : Enabled	0 (0, 1)	789
L6-50 (04CC)	Trq Det1 Type	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the speed range that detects overtorque and undertorque. 0 : At Overload 1 : At Underload	0 (0, 1)	791
L6-51 (04CD)	Trq Det1 Action	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets operation of drives (operation status) after detection. 0 : Alarm 1 : Fault	0 (0, 1)	791
L6-52 (04CE)	Trq Det1 Condition	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets operation of drives (operation status) after detection. 0 : At Speed Agree 1 : During Run	0 (0, 1)	791

No. (Hex.)	Name	Description	Default (Range)	Ref.
L6-02 (04A2)	Trq Det1 Level	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the detection level for Overtorque/Undertorque Detection 1. In V/f control, drive rated output current = 100% value. In vector control, motor rated torque = 100% value.	150% (0 - 300%)	789
L6-03 (04A3)	Trq Det1 Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the detection time for Overtorque/Undertorque Detection 1.	0.1 s (0.0 - 10.0 s)	789
L6-04 (04A4)	Trq Det2 Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the speed range that detects overtorque and undertorque and the operation of drives (operation status) after detection. 0 : Disabled 1 : Enabled	0 (0, 1)	789
L6-53 (04CF)	Trq Det2 Type	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the speed range that detects overtorque and undertorque. 0 : At Overload 1 : At Underload	0 (0, 1)	791
L6-54 (04D0)	Trq Det2 Action	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets operation of drives (operation status) after detection. 0 : Alarm 1 : Fault	0 (0, 1)	791
L6-55 (04D1)	Trq Det2 Condition	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets operation of drives (operation status) after detection. 0 : At Speed Agree 1 : During Run	0 (0, 1)	791
L6-05 (04A5)	Trq Det2 Level	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the detection level for Overtorque/Undertorque Detection 2. In V/f control, drive rated output current = 100% value. In vector control, motor rated torque = 100% value.	150% (0 - 300%)	789
L6-06 (04A6)	Trq Det2 Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the detection time for Overtorque/Undertorque Detection 2.	0.1 s (0.0 - 10.0 s)	790
L6-07 (04E5)	Trq Detect Filter Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the time constant for a primary filter to the torque reference or to the output current used to detect overtorque/undertorque.	0 ms (0 - 1000 ms)	790
L6-08 (0468)	MechF Enable	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the speed where the drive detects mechanical deterioration and how the drive operates (operation status) after detection. 0 : Disabled 1 : Enabled	0 (0, 1)	790
L6-56 (04D2)	MechF Action	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the speed where the drive detects mechanical deterioration and how the drive operates (operation status) after detection. Only available when *L6-08 = 1 [MechF Enable = Enabled]*. 0 : Alarm 1 : Fault	0 (0, 1)	791
L6-57 (04D3)	MechF AbsSpeed	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the speed where the drive detects mechanical deterioration and how the drive operates (operation status) after detection. Only available when *L6-08 = 1 [MechF Enable = Enabled]*. 0 : Spd Absolute 1 : Spd Signed	0 (0, 1)	791
L6-58 (04D4)	MechF Method	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the speed where the drive detects mechanical deterioration and how the drive operates (operation status) after detection. Only available when *L6-08 = 1 [MechF Enable = Enabled]*. Use parameter L6-57 [MechF AbsSpeed] to either use absolute speed or signed speed value. 0 : Spd>L6-09 1 : Spd<L6-09	0 (0, 1)	792
L6-09 (0469)	MechFatigue Speed Detect Level	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the speed level as a percentage where the drive will operate the mechanical deterioration detection function, with *E1-04 [Max Output Frequency]* is the 100% value.	110.0% (-110.0 - +110.0%)	790
L6-10 (046A)	MechFatigue Delay Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the time for mechanical deterioration detection.	0.1 s (0.0 - 10.0 s)	790
L6-11 (046B)	MechFatigue Hold Off Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the time that the drive will start mechanical deterioration detection triggered by the cumulative operation time of the drive.	0 h (0 - 65535 h)	790

◆ L7: TORQUE LIMIT

No. (Hex.)	Name	Description	Default (Range)	Ref.
L7-01 (04A7) RUN	FW Torque Limit	V/f CL-V/f **OLV** **CLV** **AOLV** OLV/PM **AOLV/PM** **CLV/PM** **EZOLV** Sets the torque limit value for forward motoring as a percentage, where motor rated torque is the 100% value.	200% (0 - 300%)	792
L7-02 (04A8) RUN	RV Torque Limit	V/f CL-V/f **OLV** **CLV** **AOLV** OLV/PM **AOLV/PM** **CLV/PM** **EZOLV** Sets the torque limit value for reversed motoring as a percentage, where motor rated torque is the 100% value.	200% (0 - 300%)	793
L7-03 (04A9) RUN	FW Reg. TrqLimit	V/f CL-V/f **OLV** **CLV** **AOLV** OLV/PM **AOLV/PM** **CLV/PM** **EZOLV** Sets the torque limit value for forward regenerative conditions as a percentage of the motor rated torque.	200% (0 - 300%)	793
L7-04 (04AA) RUN	RV Reg. TrqLimit	V/f CL-V/f **OLV** **CLV** **AOLV** OLV/PM **AOLV/PM** **CLV/PM** **EZOLV** Sets the torque limit value for reversed regenerative conditions as a percentage of the motor rated torque.	200% (0 - 300%)	793
L7-06 (04AC)	TrqLimit Integral Time	V/f CL-V/f **OLV** CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the integral time constant for the torque limit function.	200 ms (5 - 10000 ms)	793
L7-07 (04C9)	TrqLimit@Acc/Decel	V/f CL-V/f **OLV** CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the torque limit function during acceleration and deceleration. 1 : P-ctrl@Ac/Dec 2 : I-ctrl@Ac/Dec	1 (1, 2)	794
L7-16 (044D)	TrqLimit@Start	V/f CL-V/f **OLV** **CLV** **AOLV** OLV/PM **AOLV/PM** **CLV/PM** **EZOLV** Assigns a time filter to allow the torque limit to build at start. 0 : Disabled 1 : Enabled	1 (0, 1)	794
L7-35 (1B57) Expert	LowF Reg.TrqLimit Lvl	V/f CL-V/f OLV CLV **AOLV** OLV/PM AOLV/PM CLV/PM EZOLV Sets the torque limit used during low-speed regeneration. Usually it is not necessary to change this setting.	50.00% (0.00 - 200.00%)	794
L7-36 (1B58) Expert	Reg.TrqLimit Derate Freq	V/f CL-V/f OLV CLV **AOLV** OLV/PM AOLV/PM CLV/PM EZOLV Sets the frequency width at which *L7-35 [LowF Reg.TrqLimit Lvl]* operates.	6.00 Hz (0.00 - 30.00 Hz)	794

◆ L8: DRIVE PROTECTION

No. (Hex.)	Name	Description	Default (Range)	Ref.
L8-01 (04AD)	3%ERF DBR Protection	**V/f** **CL-V/f** **OLV** **CLV** **AOLV** **OLV/PM** **AOLV/PM** **CLV/PM** **EZOLV** Sets the function to enable braking resistor protection with a Yaskawa ERF series braking resistor (3% ED) installed on the heatsink. 0 : Disabled 1 : Enabled	0 (0, 1)	795
L8-02 (04AE)	Overheat Alm Level	**V/f** **CL-V/f** **OLV** **CLV** **AOLV** **OLV/PM** **AOLV/PM** **CLV/PM** **EZOLV** Sets the *oH* detection level.	Determined by o2-04 and C6-01 (50 - 150 °C)	795
L8-03 (04AF)	Overheat Pre-Alarm Selection	**V/f** **CL-V/f** **OLV** **CLV** **AOLV** **OLV/PM** **AOLV/PM** **CLV/PM** **EZOLV** Sets operation after the drive detects an *oH* alarm. 0 : Ramp->Stop 1 : Coast->Stop 2 : Fast Stop (C1-09) 3 : Alarm Only 4 : Run@L8-19 Rate	3 (0 - 4)	795
L8-05 (04B1)	In PhaseLoss Selection	**V/f** **CL-V/f** **OLV** **CLV** **AOLV** **OLV/PM** **AOLV/PM** **CLV/PM** **EZOLV** Sets the function to enable and disable input phase loss detection. 0 : Disabled 1 : Enabled	1 (0, 1)	796
L8-07 (04B3)	Out PhaseLoss Selection	**V/f** **CL-V/f** **OLV** **CLV** **AOLV** **OLV/PM** **AOLV/PM** **CLV/PM** **EZOLV** Sets the function to enable and disable output phase loss detection. The drive starts output phase loss detection when the output current decreases to less than 5% of the drive rated current. **Note:** The drive can incorrectly start output phase loss detection in these conditions: • The motor rated current is very small compared to the drive rating. • The drive is operating a PM motor with a small load. 0 : Disabled 1 : 1PH Loss Det 2 : 2/3PH Loss Det	0 (0 - 2)	796

No. (Hex.)	Name	Description	Default (Range)	Ref.
L8-09 (04B5)	Ground Fault Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function to enable and disable ground fault protection. 0 : Disabled 1 : Enabled	Determined by o2-04 (0, 1)	797
L8-10 (04B6)	Fan Operate Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets operation of the heatsink cooling fan. 1 : Dur Run (OffDly) 2 : Always On 3 : Fan ON @Heating of Drive	1 (1 - 3)	797
L8-11 (04B7)	Fan Off-Delay Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the length of time that the drive will wait before stopping the cooling fan after cancelling the Run command when *L8-10 = 1 [Fan Operate Selection = Dur Run (OffDly)]*.	60 s (0 - 300 s)	797
L8-12 (04B8)	Ambient Temperature Setting	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the ambient temperature of the drive installation area.	40 °C (-10 - +50 °C)	797
L8-15 (04BB)	oL2@LoSpeed Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function to decrease drive overload at low speeds to prevent damage to the main circuit transistor during low speed operation (at 6 Hz or slower) to prevent *oL2 [Drive Overloaded]*. **Note:** Contact the manufacturer before disabling this function at low speeds. If you frequently operate drives with high output current in low speed ranges, it can cause heat stress and decrease the life span of drive IGBTs. 0 : Disabled 1 : Enabled	1 (0, 1)	797
L8-18 (04BE)	Soft CurrLim Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Set the software current limit selection function to prevent damage to the main circuit transistor caused by too much current. 0 : Disabled 1 : Enabled	0 (0, 1)	798
L8-19 (04BF)	Frq Reduct@oHPre-Alarm	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the ratio at which the drive derates the frequency reference when during an *oH* alarm.	0.8 (0.1 to 0.9)	798
L8-20 (04C0) Expert	CF / STPo Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets operation after the drive detects a *CF* fault when *A1-02 = 4 [Control Method = Adv OLVector]*. 1 : Disabled 2 : CF/STPo Detection Enabled 3 : CF ALM/Stop	Determined by A1-02 (1 - 3)	798
L8-27 (04DD)	OverCurr Det Gain	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the PM motor overcurrent detection level as a percentage of the motor rated current value.	300.0% (0.0 - 400.0%)	798
L8-29 (04DF)	LF2 Unbalance Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function to detect *LF2*. 0 : Disabled 1 : Enabled	1 (0, 1)	799
L8-31 (04E1)	LF2 Detect Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the LF2 [Output Current Imbalance] detection time.	3 (1 to 100)	799
L8-32 (04E2)	Fan Failure Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets operation when the drive detects *FAn [Internal Agitating Fan Fault]*. 0 : Ramp->Stop 1 : Coast->Stop 2 : Fast Stop (C1-09) 3 : Alarm Only 4 : Run@L8-19 Rate	1 (0 - 4)	799
L8-35 (04EC)	Installation Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the type of drive installation. 0 : IP00/IP20/Open-Chassis 1 : Side-by-Side Mounting 2 : IP21/NEMA Type 1/IP55 3 : Finless/Ext.Heatsink	Determined by the drive model (0 - 3)	800
L8-38 (04EF)	Carrier Reduction Mode	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the carrier frequency reduction function. The drive reduces the carrier frequency when the output current is more than a specified level. 0 : Disabled 1 : Enable<6 Hz 2 : Enab@AllSpeed	Determined by A1-02, C6-01, and o2-04 (0 - 2)	800

Parameter List

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No. (Hex.)	Name	Description	Default (Range)	Ref.
L8-40 (04F1)	Carrier Red Off-Delay Time	**V/f** **CL-V/f** **OLV** **CLV** AOLV **OLV/PM** AOLV/PM **CLV/PM** **EZOLV** Sets the length of time until the automatically reduced carrier frequency returns to the condition before the reduction.	Determined by A1-02 (0.00 - 2.00 s)	801
L8-41 (04F2)	HCA alarm Selection	**V/f** **CL-V/f** **OLV** **CLV** **AOLV** **OLV/PM** **AOLV/PM** **CLV/PM** **EZOLV** Sets the function to cause an *HCA [Current Alarm]* when the output current is more than 150% of the drive rated current. 0 : Disabled 1 : Enabled	0 (0, 1)	801
L8-51 (0471) Expert	STPo Current Level	V/f CL-V/f OLV CLV AOLV **OLV/PM** AOLV/PM CLV/PM **EZOLV** Sets the *STPo [Desynchronization Error]* detection level as a percentage of the output current.	0.0% (0.0 - 300.0%)	801
L8-52 (0472) Expert	STPo Integral Level	V/f CL-V/f OLV CLV AOLV **OLV/PM** AOLV/PM CLV/PM EZOLV Sets the detection level for *STPo [Desynchronization Error]* related to the ACR integral value.	1.0 (0.1 - 2.0)	801
L8-53 (0473) Expert	STPo Integral Time	V/f CL-V/f OLV CLV AOLV **OLV/PM** AOLV/PM CLV/PM EZOLV Sets the length of time until the drive detects *STPo* after exceeding the value of *L8-51 [STPo Current Level]*.	1.0 s (1.0 - 10.0 s)	801
L8-54 (0474) Expert	STPo Id Diff Detection	V/f CL-V/f OLV CLV AOLV **OLV/PM** AOLV/PM CLV/PM **EZOLV** Sets the Id deviation detection function for *STPo [Desynchronization Error]*. 0 : Disable 1 : Enabled	1 (0, 1)	801
L8-55 (045F)	DB IGBT Protection	**V/f** **CL-V/f** **OLV** **CLV** **AOLV** **OLV/PM** **AOLV/PM** **CLV/PM** **EZOLV** Sets the protection function for the internal braking transistor. 0 : Disable 1 : Enabled	1 (0, 1)	802
L8-56 (047D) Expert	StallP@Acc Activation Time	V/f CL-V/f OLV CLV AOLV **OLV/PM** AOLV/PM CLV/PM EZOLV Sets the length time that the acceleration stall prevention function can continue to operate before the drive detects an *STPo [Desynchronization Error]*.	5000 ms (100 - 5000 ms)	802
L8-57 (047E) Expert	StallP Retry Counts	V/f CL-V/f OLV CLV AOLV **OLV/PM** AOLV/PM CLV/PM EZOLV Sets the number of times the acceleration stall prevention function can operate until speeds match before the drive detects an *STPo [Desynchronization Error]*.	10 times (1 - 10 times)	802
L8-90 (0175) Expert	STPo Detect Level	V/f CL-V/f OLV CLV AOLV **OLV/PM** **AOLV/PM** CLV/PM **EZOLV** Sets the detection level that the control fault must be equal to or more than to cause an *STPo [Desynchronization Error]*.	Determined by A1-02 (0 - 5000 times)	802
L8-93 (073C) Expert	Lso Detect Time	V/f CL-V/f OLV CLV AOLV OLV/PM **AOLV/PM** CLV/PM EZOLV Sets the length of time the drive will wait to start baseblock after detecting *LSo [LSo Fault]*.	1.0 s (0.0 - 10.0 s)	802
L8-94 (073D) Expert	Lso Detect Level	V/f CL-V/f OLV CLV AOLV OLV/PM **AOLV/PM** CLV/PM EZOLV Sets the detection level for *LSo [Low Speed Motor Step-Out]* as a percentage of *E1-04 [Max Output Frequency]*.	3% (0 - 10%)	803
L8-95 (077F) Expert	Lso Amount	V/f CL-V/f OLV CLV AOLV OLV/PM **AOLV/PM** CLV/PM EZOLV Sets the average count of *LSo [Low Speed Motor Step-Out]* detections.	10 times (1 - 50 times)	803

◆ L9: DRIVE PROTECTION 2

No. (Hex.)	Name	Description	Default (Range)	Ref.
L9-16 (11DC) Expert	FAn1 Detect Time	**V/f** **CL-V/f** **OLV** **CLV** **AOLV** **OLV/PM** **AOLV/PM** **CLV/PM** **EZOLV** Sets the detection time for *FAn1 [Drive Cooling Fan Failure]*. The manufacturer recommends that you do not change this parameter value.	4.0 s (0.0 - 30.0 s)	803

11.10 n: SPECIAL

◆ n1: HUNTING PREVENTION

No. (Hex.)	Name	Description	Default (Range)	Ref.
n1-01 (0580)	HuntPrev Selection	**V/f** **CL-V/f** OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function to prevent hunting. 0 : Disabled 1 : Enabled 2 : Enabled (High Carrier)	Determined by o2-04 (0 - 2)	804
n1-02 (0581) Expert	HuntPrev Gain Setting	**V/f** **CL-V/f** OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Adjusts the behavior of the hunting prevention function. Usually it is not necessary to change this setting.	1.00 (0.00 - 2.50)	804
n1-03 (0582) Expert	HuntPrev Time Constant	**V/f** **CL-V/f** OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the primary delay time constant of the hunting prevention function. Usually it is not necessary to change this setting.	Determined by o2-04 (0 - 500 ms)	804
n1-05 (0530) Expert	HuntPrev Gain Reverse Mode	**V/f** **CL-V/f** OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the performance of the hunting prevention function. This parameter adjusts Reverse run. Usually it is not necessary to change this setting.	0.00 (0.00 - 2.50)	804
n1-08 (1105) Expert	CurrDetect Method	**V/f** **CL-V/f** **OLV** **CLV** **AOLV** **OLV/PM** **AOLV/PM** **CLV/PM** **EZOLV** Sets how the drive decreases the motor vibration that is caused by leakage current. Usually it is not necessary to change this setting. 1 : 2-Phases 2 : 3-Phases	1 (1, 2)	805
n1-13 (1B59) Expert	DCBus Stab.Control	**V/f** **CL-V/f** OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the oscillation suppression function for the DC bus voltage. 0 : Disabled 1 : Enabled	0 (0, 1)	805
n1-14 (1B5A) Expert	DCBus Stab Time	**V/f** **CL-V/f** OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets a length of time for the drive to suppress oscillation in relation to the DC bus voltage. Set *n1-13 = 1 [DCBus Stab.Control = Enabled]* to enable this parameter.	100.0 ms (50.0 - 500.0 ms)	805
n1-15 (0BF8) Expert	PWM VOffset Calibration	**V/f** **CL-V/f** **OLV** **CLV** **AOLV** **OLV/PM** **AOLV/PM** **CLV/PM** **EZOLV** Sets the calibration method that the drive uses to decrease torque/current ripple. 1 : No Calibration 2 : Calib@Next Start 3 : Calib@Every Start	Determined by A1-02 (1 - 3)	805
n1-16 (0BFB)	HuntPrev HiFc Gain	**V/f** **CL-V/f** OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the gain for the hunting prevention function. This parameter functions best with a high carrier frequency. Usually it is not necessary to change this setting.	Determined by o2-04 (0.00 - 2.50)	805
n1-17 (0BFC) Expert	HuntPrev HiFc Filter	**V/f** **CL-V/f** OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the responsiveness of the hunting prevention function. Usually it is not necessary to change this setting.	500 ms (0 - 1000 ms)	806

◆ n2: AFR - AUTO FREQ REGULATION

No. (Hex.)	Name	Description	Default (Range)	Ref.
n2-01 (0584)	AFR Gain	V/f CL-V/f **OLV** CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the gain of the AFR function as a magnification value. Usually it is not necessary to change this setting.	1.00 (0.00 - 10.00)	806
n2-02 (0585)	AFR Time 1	V/f CL-V/f **OLV** CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the time constant that sets the rate of change for the AFR function. Usually it is not necessary to change this setting.	50 ms (0 - 2000 ms)	806
n2-03 (0586)	AFR Time 2	V/f CL-V/f **OLV** CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the time constant that sets the speed difference of the AFR function. Use this parameter for speed searches or regeneration. Usually it is not necessary to change this setting.	750 ms (0 - 2000 ms)	806

◆ n3: HIGHSLIP/OVEREXCITATION BRAKE

No. (Hex.)	Name	Description	Default (Range)	Ref.
n3-01 (0588) Expert	HSB Dec Freq Width	**V/f** **CL-V/f** OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets how much the drive lowers the output frequency during high-slip braking as a percentage where *E1-04 [Max Output Frequency]* = 100%.	5% (1 - 20%)	808
n3-02 (0589) Expert	HSB CurrLim Level	**V/f** **CL-V/f** OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the maximum current output during high-slip braking as a percentage where *E2-01 [Mot Rated Current (FLA)]* = 100%. Also set the current suppression to prevent exceeding drive overload tolerance.	Determined by C6-01, L8-38 (0 - 200%)	808
n3-03 (058A) Expert	HSB DwellTime@Stop	**V/f** **CL-V/f** OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the dwell time, a length of time when high-slip braking is ending and during which the motor speed decreases and runs at a stable speed. For a set length of time, the drive will hold the actual output frequency at the minimum output frequency set in *E1-09*.	1.0 s (0.0 - 10.0 s)	809
n3-04 (058B) Expert	HSB Overload Time	**V/f** **CL-V/f** OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the time used to detect *oL7 [High Slip Braking Overload]*, which occurs when the output frequency does not change during high-slip braking. Usually it is not necessary to change this setting.	40 s (30 - 1200 s)	809
n3-13 (0531)	OverExcBr Gain	**V/f** **CL-V/f** **OLV** **CLV** **AOLV** OLV/PM AOLV/PM CLV/PM EZOLV Sets the gain value that the drive multiplies by the V/f pattern output value during overexcitation deceleration to calculate the overexcitation level.	1.10 (1.00 - 1.40)	809
n3-14 (0532) Expert	OverExcBr Harmonics Selection	**V/f** **CL-V/f** **OLV** CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function that injects harmonic signals during overexcitation deceleration. 0 : Disabled 1 : Enabled	0 (0, 1)	809
n3-21 (0579)	OverExcBr Current Level	**V/f** **CL-V/f** **OLV** **CLV** **AOLV** OLV/PM AOLV/PM CLV/PM EZOLV Sets the upper limit of the current that is suppressed at the time of overexcitation deceleration, where the drive rated current = 100% value.	100% (0 - 150%)	810
n3-23 (057B)	OverExcBr Operation	**V/f** **CL-V/f** **OLV** **CLV** **AOLV** OLV/PM AOLV/PM CLV/PM EZOLV Sets the direction of motor rotation where the drive will enable overexcitation. 1 : Enabled@Both directions 2 : Enabled@FW direction 3 : Enabled@REV direction	1 (1 - 3)	810

◆ n4: ADV. OPEN LOOP VECTOR TUNING

No. (Hex.)	Name	Description	Default (Range)	Ref.
n4-60 (1B80)	LoSpeed Comp Gain	V/f CL-V/f OLV CLV **AOLV** OLV/PM AOLV/PM CLV/PM EZOLV Sets a compensation gain to improve the control qualities for motoring loads in the low speed range.	1.000 (0.500 - 2.000)	810
n4-61 (1B81)	LoSpeed Comp Frequency Level	V/f CL-V/f OLV CLV **AOLV** OLV/PM AOLV/PM CLV/PM EZOLV Sets a frequency at which the settings for *n4-60 [LoSpeed Comp Gain]*, *n4-62 [Reg LoSpd Cmp Gain]* are enabled. When the output frequency < *n4-61*, the drive adjusts the torque to agree with the settings for *n4-60* and *n4-62*. Usually it is not necessary to change this setting.	6.00 Hz (0.50 - 12.00 Hz)	810
n4-62 (1B82)	Reg LoSpd Cmp Gain	V/f CL-V/f OLV CLV **AOLV** OLV/PM AOLV/PM CLV/PM EZOLV Sets a compensation gain to improve the control qualities for regenerative loads in the low speed range.	1.000% (0.500 - 2.000%)	811
n4-63 (1B83)	HF SpdEstim Response	V/f CL-V/f OLV CLV **AOLV** OLV/PM AOLV/PM CLV/PM EZOLV Sets the responsiveness of the speed estimation in high speed ranges, where the output frequency is ≥ *n4-67 [SpEstim Gain SwFrequency]*.	1.000 (0.001 - 5.000)	811
n4-64 (1B84)	LF SpdEstim Response	V/f CL-V/f OLV CLV **AOLV** OLV/PM AOLV/PM CLV/PM EZOLV Sets the responsiveness of the speed estimation in low speed ranges, where 0 ≤ the output frequency, which is < *n4-67 [SpEstim Gain SwFrequency]*.	1.000 (0.001 - 5.000)	811
n4-65 (1B85)	HF FlxEstim Response	V/f CL-V/f OLV **CLV** **AOLV** OLV/PM AOLV/PM CLV/PM EZOLV Sets the responsiveness of the magnetic flux estimation in high speed ranges, where the output frequency is ≥ *n4-67 [SpEstim Gain SwFrequency]*. Usually it is not necessary to change this setting.	0.90 (0.50 - 1.50)	811
n4-66 (1B86)	LF FlxEstim Response	V/f CL-V/f OLV **CLV** **AOLV** OLV/PM AOLV/PM CLV/PM EZOLV Sets the responsiveness of the magnetic flux estimation in low speed ranges, where 0 ≤ the output frequency, which is < *n4-67 [SpEstim Gain SwFrequency]*. Usually it is not necessary to change this setting.	0.90 (0.50 - 1.50)	811
n4-67 (1B87)	SpEstim Gain SwFrequency	V/f CL-V/f OLV **CLV** **AOLV** OLV/PM AOLV/PM CLV/PM EZOLV Sets the switching frequency for estimation gain for these parameters: *n4-63 [HF SpdEstim Response]* *n4-64 [LF SpdEstim Response]* *n4-65 [HF FlxEstim Response]* *n4-66 [LF FlxEstim Response]* Usually it is not necessary to change this setting.	6.00 Hz (0.00 - E1-04)	812

No. (Hex.)	Name	Description	Default (Range)	Ref.
n4-68 (1B88)	SpEstim Filter Time Constant	V/f CL-V/f OLV CLV **AOLV** OLV/PM AOLV/PM CLV/PM EZOLV Sets the primary delay time constant for the speed estimation value. Usually it is not necessary to change this setting.	1 ms (1 - 10 ms)	812
n4-69 (1B89)	Flux Control Response	V/f CL-V/f OLV CLV **AOLV** OLV/PM AOLV/PM CLV/PM EZOLV Unifies control of magnetic flux to make motor vibrations more stable.	1.00 (0.00 - 60.00)	812
n4-70 (1B8A)	Speed Comp@LowFrequency	V/f CL-V/f OLV CLV **AOLV** OLV/PM AOLV/PM CLV/PM EZOLV Sets the function to make the drive more stable when operating at low speeds. Usually it is not necessary to change this setting.	0.60 Hz (0.00 - 1.50 Hz)	812
n4-71 (1B8B)	Flux Detect Method	V/f **CL-V/f** OLV CLV **AOLV** OLV/PM AOLV/PM CLV/PM EZOLV Chooses the method of estimating the magnetic flux. 1 : Method 1 2 : Method 2	1 (1, 2)	812
n4-72 (1B8C)	Spd Fbk Mode	V/f CL-V/f OLV CLV **AOLV** OLV/PM AOLV/PM CLV/PM EZOLV Sets the requirement for an encoder option when *A1-02 = 4 [Control Method = Adv OLVector]*. 1 : Without PG 2 : With PG	1 (1, 2)	812
n4-73 (1B8D)	PGO Recover Selection	V/f CL-V/f OLV CLV **AOLV** OLV/PM AOLV/PM CLV/PM EZOLV Sets the restart mode to Without Encoder Mode or the With Encoder Mode when an encoder is disconnected. 1 : Without PG 2 : With PG	1 (1, 2)	813
n4-74 (1B8E)	Flux Control Limit	V/f CL-V/f OLV CLV **AOLV** OLV/PM AOLV/PM CLV/PM EZOLV Sets the control level for flux loop control output.	160% (100 - 500%)	813

◆ n5: FEED FORWARD CONTROL

No. (Hex.)	Name	Description	Default (Range)	Ref.
n5-01 (05B0)	FF Control Selection	V/f CL-V/f OLV **CLV** **AOLV** OLV/PM **AOLV/PM** **CLV/PM** EZOLV Sets the feed forward function. 0 : Disabled 1 : Enabled	0 (0, 1)	814
n5-02 (05B1)	Mot Inertia Acceleration Time	V/f CL-V/f OLV **CLV** **AOLV** OLV/PM **AOLV/PM** **CLV/PM** EZOLV Sets the length of time for the motor to accelerate from the stopped to the maximum frequency with a single motor at the rated torque. Inertia Tuning automatically sets the motor acceleration time.	Determined by C6-01, E5-01, and o2-04 (0.001 - 10.000 s)	814
n5-03 (05B2)	FF Control Gain	V/f CL-V/f OLV **CLV** **AOLV** OLV/PM **AOLV/PM** **CLV/PM** EZOLV Sets the ratio between load inertia and motor inertia. Inertia Tuning automatically sets the Feedforward Control Gain value.	1.00 (0.00 - 100.00)	815
n5-04 (05B3) RUN Expert	Speed Response Frequency	V/f CL-V/f OLV **CLV** **AOLV** OLV/PM **AOLV/PM** **CLV/PM** EZOLV Sets the response frequency for the speed reference. Usually it is not necessary to change this setting.	Determined by A1-02 (0.00 - 500.00 Hz)	816

◆ n6: ONLINE TUNING

No. (Hex.)	Name	Description	Default (Range)	Ref.
n6-01 (0570)	Online Tune Selection	V/f CL-V/f **OLV** CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the type of motor data that Online Tuning uses for OLV control. 0 : Disabled 1 : Line-to-Line Resistance Tuning 2 : VoltageAdjustment	0 (0 - 2)	816
n6-05 (05C7) Expert	Online Tune Gain	V/f CL-V/f **OLV** CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the compensation gain when *n6-01 = 2 [Online Tune Selection = VoltageAdjustment]*. Usually it is not necessary to change this setting.	1.0 (0.1 - 50.0)	816
n6-11 (1B56) Expert	Online Resist Tuning	V/f CL-V/f OLV **CLV** **AOLV** OLV/PM AOLV/PM CLV/PM EZOLV Sets the responsiveness for online resistor tuning. Set this parameter to approximately *1.000* to enable the function. The function is disabled when the value is *0.000*.	0.000 (0.000 - 1.000)	816

◆ n7: SIMPLE VECTOR TUNING

No. (Hex.)	Name	Description	Default (Range)	Ref.
n7-01 (3111) Expert	LoFreq Damping Gain	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM **EZOLV** Sets the oscillation suppression gain for the low speed range.	1.0 (0.1 - 10.0)	817
n7-05 (3115) Expert	TrqCtrl Response Gain	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM **EZOLV** Sets the response gain related to changes in the load.	1.00 (0.10 - 10.00)	817
n7-07 (3117) Expert	Speed Calc.Gain1	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM **EZOLV** Sets the speed calculation gain during usual operation. Usually it is not necessary to change this setting.	15.0 Hz (1.0 - 50.0 Hz)	817
n7-08 (3118) Expert	Speed Calc.Gain2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM **EZOLV** Sets the speed calculation gain during a speed search.	25.0 Hz (1.0 - 50.0 Hz)	817
n7-10 (311A) Expert	Pull-in SwitchSpeed	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM **EZOLV** Sets a speed range proportional to the rated frequency that enables pull-in current commands.	10.0% (0.0 - 100.0%)	817
n7-17 (3122)	Resist.Temp. Compensation	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM **EZOLV** Sets the function to adjust for changes in the motor resistance value caused by changes in the temperature. 1 : Invalid 2 : Valid (1 Time) 3 : Valid (Every Time)	2 (1 - 3)	817

◆ n8: PM MOTOR CONTROL TUNING

No. (Hex.)	Name	Description	Default (Range)	Ref.
n8-01 (0540) Expert	PolPos Detection Current	V/f CL-V/f OLV CLV AOLV **OLV/PM** **AOLV/PM** **CLV/PM** EZOLV Sets the Initial Rotor Position Estimated Current as a percentage where *E5-03 [PM Mot Rated Current (FLA)]* = 100%. Usually it is not necessary to change this setting.	50% (0 - 100%)	818
n8-02 (0541) Expert	Pole Align Current Level	V/f CL-V/f OLV CLV AOLV OLV/PM **AOLV/PM** **CLV/PM** EZOLV Sets the current at the time of polar attraction as a percentage where motor rated current = 100%. Usually it is not necessary to change this setting.	80% (0 - 150%)	818
n8-03 (0542)	Current Start Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM **CLV/PM** EZOLV Sets the length of the Current Starting Time, which is used for Z Pulse Offset Tuning. Usually it is not necessary to change this parameter.	1.5 s (1.5 - 5.0 s)	818
n8-04 (0543) Expert	Pole Align Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM **CLV/PM** EZOLV Sets the length of the Polar Attraction Time, which is used for Z Pulse Offset Tuning. Usually it is not necessary to change this setting.	1.5 s (1.5 - 5.0 s)	818
n8-11 (054A)	Observ.Calc Gain2	V/f CL-V/f OLV CLV AOLV OLV/PM **AOLV/PM** **CLV/PM** EZOLV Sets the gain for speed estimation. Usually it is not necessary to change this setting.	Determined by n8-72 (0.0 - 1000.0)	819
n8-14 (054D) Expert	Polar Comp Gain3	V/f CL-V/f OLV CLV AOLV OLV/PM **AOLV/PM** CLV/PM EZOLV Sets the gain for speed estimation. Usually it is not necessary to change this setting.	2.000 (0.000 - 20.000)	819
n8-15 (054E) Expert	Polar Comp Gain4	V/f CL-V/f OLV CLV AOLV OLV/PM **AOLV/PM** CLV/PM EZOLV Sets the gain for speed estimation. Usually it is not necessary to change this setting.	2.000 (0.000 - 20.000)	819
n8-21 (0554) Expert	Mot Back-EMF (Ke) Gain	V/f CL-V/f OLV CLV AOLV OLV/PM **AOLV/PM** CLV/PM EZOLV Sets the gain for speed estimation. Usually it is not necessary to change this setting.	0.90 (0.80 - 1.00)	819
n8-35 (0562)	InitRotorPos Selection	V/f CL-V/f OLV CLV AOLV **OLV/PM** **AOLV/PM** **CLV/PM** EZOLV Sets how the drive detects the position of the rotor at start. **Note:** When you use an SPM motor, set this parameter to 1. 1 : Pull-In 2 : HiFreq Injection 3 : Pulse Injection	Determined by A1-02 (1 - 3)	819
n8-36 (0563)	HFI Signal Frequency	V/f CL-V/f OLV CLV AOLV **OLV/PM** **AOLV/PM** **CLV/PM** EZOLV Sets the injection frequency for high frequency injection.	500 Hz (200 - 5000 Hz)	819
n8-37 (0564) Expert	HFI Voltage Amplitude Level	V/f CL-V/f OLV CLV AOLV OLV/PM **AOLV/PM** **CLV/PM** EZOLV Sets the high frequency injection amplitude as a percentage where 400 V = 100% for a 400 V class drives. Usually it is not necessary to change this setting.	20.0% (0.0 - 50.0%)	820

No. (Hex.)	Name	Description	Default (Range)	Ref.
n8-41 (0568) Expert	HFI PoleDet Pgain	V/f CL-V/f OLV CLV AOLV **OLV/PM** **AOLV/PM** **CLV/PM** EZOLV Sets the speed estimation response for high frequency injection. Usually it is not necessary to change this setting.	3.0 (1.0 - 100.0)	820
n8-42 (0569) Expert	HFI PoleDet iTime	V/f CL-V/f OLV CLV AOLV **OLV/PM** **AOLV/PM** **CLV/PM** EZOLV Sets the oscillation suppression gain of the speed estimation for high frequency injection. Usually it is not necessary to change this setting.	1.0 (0.1 - 5.0)	820
n8-45 (0538)	SpdFbck Det.Gain	V/f CL-V/f OLV CLV AOLV **OLV/PM** AOLV/PM CLV/PM EZOLV Sets the internal speed feedback detection reduction unit gain as a magnification value. Usually it is not necessary to change this parameter.	0.80 (0.00 - 10.00)	820
n8-47 (053A)	Pull-In Comp.Time Constant	V/f CL-V/f OLV CLV AOLV **OLV/PM** AOLV/PM CLV/PM EZOLV Sets the time constant the drive uses to align the pull-in current reference value with the actual current value. Usually it is not necessary to change this parameter.	5.0 s (0.0 - 100.0 s)	820
n8-48 (053B)	Pull-In Current (for PM Motors)	V/f CL-V/f OLV CLV AOLV **OLV/PM** AOLV/PM CLV/PM EZOLV Sets the d-axis current that flows to the motor during run at constant speed as a percentage where *E5-03 [PM Mot Rated Current (FLA)]* = 100%.	30% (20 - 200%)	821
n8-49 (053C) Expert	Heavy Load Id Current	V/f CL-V/f OLV CLV AOLV **OLV/PM** AOLV/PM CLV/PM EZOLV Sets the d-axis current to that the drive will supply to the motor to run it at a constant speed with a heavy load. This parameter is a percentage where *E5-03 [PM Mot Rated Current (FLA)] = 100%*. Usually it is not necessary to change this setting.	Determined by E5-01 (-200.0 - 0.0%)	821
n8-51 (053E)	Ac/Dec Pull-In Current	V/f CL-V/f OLV CLV AOLV **OLV/PM** AOLV/PM CLV/PM **EZOLV** Sets the pull-in current that can flow during acceleration/deceleration as a percentage where *E5-03 [PM Mot Rated Current (FLA)]* = 100%.	Determined by A1-02 (0 - 200%)	821
n8-54 (056D) Expert	Volt-Err Compensation Time	V/f CL-V/f OLV CLV AOLV **OLV/PM** AOLV/PM CLV/PM EZOLV Sets the time constant that the drive uses when adjusting for voltage errors.	1.00 s (0.00 - 10.00 s)	821
n8-55 (056E)	Load Inertia	V/f CL-V/f OLV CLV AOLV **OLV/PM** AOLV/PM CLV/PM EZOLV Sets the ratio between motor inertia and machine inertia. 1 : <1:10 2 : 1:10-1:30 3 : 1:30-1:50 4 : >1:50	1 (1 - 4)	821
n8-57 (0574)	High-Freq Injection	V/f CL-V/f OLV CLV AOLV OLV/PM **AOLV/PM** CLV/PM EZOLV Sets the function that detects motor speed with high frequency injection. 0 : Disabled 1 : Enabled	0 (0, 1)	822
n8-62 (057D) Expert	Output Volt Limit Level	V/f CL-V/f OLV CLV AOLV **OLV/PM** **AOLV/PM** **CLV/PM** **EZOLV** Sets the output voltage limit to prevent saturation of the output voltage. Usually it is not necessary to change this setting.	400 V Class: 400.0 V (400 V Class: 0.0 - 460.0 V)	822
n8-65 (065C) Expert	SpdFbk Gain@OV Suppression	V/f CL-V/f OLV CLV AOLV **OLV/PM** AOLV/PM CLV/PM EZOLV Sets the gain of internal speed feedback detection suppression while the overvoltage suppression function is operating as a magnification value. Usually it is not necessary to change this parameter.	1.50 (0.00 - 10.00)	822
n8-69 (065D) Expert	Spd Obs. P Gain Control	V/f CL-V/f OLV CLV AOLV OLV/PM **AOLV/PM** CLV/PM EZOLV Sets the gain that the drive uses for speed estimation. Usually it is not necessary to change this setting.	1.00 (0.00 - 20.00)	823
n8-72 (0655) Expert	Spd Obs. Method Selection	V/f CL-V/f OLV CLV AOLV OLV/PM **AOLV/PM** CLV/PM EZOLV Selects the speed estimation method. Usually it is not necessary to change this setting. 1 : Method 1 2 : Method 2	2 (1, 2)	823
n8-74 (05C3) Expert	Light Load Iq Level	V/f CL-V/f OLV CLV AOLV **OLV/PM** AOLV/PM CLV/PM EZOLV Set *n8-48 [Pull-In Current (for PM Motors)]* to the level of the load current (q-axis current) to be applied.	30% (0 - 255%)	823
n8-75 (05C4) Expert	Mid Load Iq Level (Low)	V/f CL-V/f OLV CLV AOLV **OLV/PM** AOLV/PM CLV/PM EZOLV Set *n8-78 [Mid Load Id Current]* to the level of the load current (q-axis current) to be applied.	50% (0 - 255%)	823
n8-77 (05CE) Expert	Hvy Load Iq Level	V/f CL-V/f OLV CLV AOLV **OLV/PM** AOLV/PM CLV/PM EZOLV Set *n8-49 [Heavy Load Id Current]* to the level of the load current (q-axis current) to be applied.	90% (0 - 255%)	823
n8-78 (05F4) Expert	Mid Load Id Current	V/f CL-V/f OLV CLV AOLV **OLV/PM** AOLV/PM CLV/PM EZOLV Sets the level of the pull-in current for mid-range loads.	0% (0 - 255%)	823

No. (Hex.)	Name	Description	Default (Range)	Ref.
n8-79 (05FE)	Pull-In Curr@Deceleration	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets, the pull-in current allowed to flow during deceleration as a percentage of the motor rated current. **Note:** When *n8-79 = 0*, the drive will use the value set in *n8-51 [Ac/Dec Pull-In Current]*.	0% (0 - 200%)	824
n8-84 (02D3) Expert	Polarity Det Current	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the current that the drive uses to estimate the initial motor magnetic pole as a percentage where *E5-03 [PM Mot Rated Current (FLA)]* = 100%.	100% (0 - 150%)	824
n8-94 (012D) Expert	FluxPos Est.Method	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the criteria that the drive uses to find changes in speed or load. Usually it is not necessary to change this setting. 1 : Softstarter 2 : Speed Feedback	Determined by d5-01 (1, 2)	824
n8-95 (012E) Expert	FluxPos Est.Filter Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the time constant of the filter used for the recognition criteria value for speed and load changes. Usually it is not necessary to change this setting.	30 ms (0 - 100 ms)	824

11.11 o: KEYPAD

◆ o1: KEYPAD DISPLAY

No. (Hex.)	Name	Description	Default (Range)	Ref.
o1-02 (0501) RUN	Mon.Sel@Power-Up	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the monitor item that the keypad screen shows after energizing the drive. Refer to “U: Monitors” for information about the monitor items that the keypad screen can show. This parameter is only available when using an LED keypad. 1 : FreqReference (U1-01) 2 : Direction 3 : OutFrequency (U1-02) 4 : OutCurrent (U1-03) 5 : User Monitor (o1-01)	1 (1 - 5)	826
o1-03 (0502)	FrqDisplay Unit Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the display units for the frequency reference and output frequency. 0 : 0.01 Hz 1 : 0.01% (100%=E1-04) 2 : rpm 3 : User-selected units	Determined by A1-02 (0 - 3)	826
o1-04 (0503)	V/f Pattern Unit for Display	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the setting unit for parameters that set the V/f pattern frequency. 0 : Hz 1 : rpm	Determined by A1-02 (0, 1)	827
o1-05 (0504) RUN	LCD Contrast Adjustment	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the contrast of the LCD display on the keypad.	5 (0 - 10)	827
o1-10 (0520)	FrqDisplay Max Value	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the value that the drive shows as the maximum output frequency.	Determined by o1-03 (1 - 60000)	827
o1-11 (0521)	FrqDisplay Decimal Places	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the number of decimal places for frequency reference and monitor values. 0 : (XXXXX) No Decimal Places 1 : (XXXX.X) 1 Decimal Place 2 : (XXX.XX) 2 Decimal Places 3 : (XX.XXX) 3 Decimal Places	Determined by o1-03 (0 - 3)	828
o1-24 to o1-35 (11AD - 11B8) RUN	Cust.Monitor 1 to 12	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets a maximum of 12 monitors as user monitors. This parameter is only available with an LED keypad.	o1-24: 101 o1-25: 102 o1-26: 103 o1-27 to o1-35: 0 (0, 101 - 999)	828
o1-36 (11B9) RUN	LCD Backlight Brightness	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the intensity of the LCD keypad backlight.	3 (1 - 5)	828
o1-37 (11BA) RUN	LCD Blight ON/OFF Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the automatic shut off function for the LCD backlight. 0 : OFF 1 : ON	1 (0, 1)	828
o1-38 (11BB) RUN	LCD Blight Off-Delay	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the time until the LCD backlight automatically turns off.	60 s (10 - 300 s)	829
o1-40 (11BD) RUN	Home Screen Selection Mode	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the monitor display mode for the Home screen. This parameter is only available when using an LCD keypad. 0 : Custom Monitors 8 : Bar Graph 9 : Analog Gauge 10 : Trend Plot	0 (0, 8 - 10)	829
o1-41 (11C1) RUN	1stMon Area Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the horizontal axis used to show the monitor that was set in *o1-24 [Cust.Monitor 1]* as a bar graph. This parameter is only available with an LCD keypad. 0 : +/- Area (- o1-42 - o1-42) 1 : + Area (0 - o1-42)	0 (0 - 1)	829
o1-42 (11C2) RUN	1stMon Area Setting	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the horizontal axis value used to display the monitor that was set in *o1-24 [Cust. Monitor 1]* as a bar graph. This parameter is only available with an LCD keypad.	100.0% (0.0 - 100.0%)	829

No. (Hex.)	Name	Description	Default (Range)	Ref.
o1-43 (11C3) RUN	2ndMon Area Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the horizontal axis used to show the monitor that was set in *o1-25* as a bar graph. This parameter is only available with an LCD keypad. 0 : + - Area (- o1-44 - o1-44) 1 : + Area (0 - o1-44)	0 (0 - 1)	829
o1-44 (11C4) RUN	2ndMon Area Setting	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the horizontal axis value used to display the monitor that was set in *o1-25 [Cust. Monitor 2]* as a bar graph. This parameter is only available with an LCD keypad.	100.0% (0.0 - 100.0%)	830
o1-45 (11C5) RUN	3rdMon Area Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the horizontal axis used to show the monitor that was set in *o1-26* as a bar graph. This parameter is only available with an LCD keypad. 0 : + - Area (- o1-46 - o1-46) 1 : + Area (0 - o1-46)	0 (0 - 1)	830
o1-46 (11C6) RUN	3rdMon Area Setting	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the horizontal axis value used to display the monitor that was set in *o1-26 [Cust. Monitor 3]* as a bar graph. This parameter is only available with an LCD keypad.	100.0% (0.0 - 100.0%)	830
o1-47 (11C7) RUN	Trend Plot 1 Min Scale Value	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the minimum value for the vertical axis used to display the monitor that was set in *o1-24 [Cust.Monitor 1]* as a trend plot. This parameter is only available with an LCD keypad.	100% (-300 - +300%)	830
o1-48 (11C8) RUN	Trend Plot 1 Max Scale Value	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the maximum value for the vertical axis used to display the monitor that was set in *o1-24 [Cust.Monitor 1]* as a trend plot. This parameter is only available with an LCD keypad.	100.0% (-99.9 - +300.0%)	830
o1-49 (11C9) RUN	Trend Plot 2 Min Scale Value	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the minimum value for the vertical axis used to display the monitor that was set in *o1-25[Cust.Monitor 2]* as a trend plot. This parameter is only available with an LCD keypad.	100% (-300 - +300%)	830
o1-50 (11CA) RUN	Trend Plot 2 Max Scale Value	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the maximum value for the vertical axis used to display the monitor that was set in *o1-25 [Cust.Monitor 2]* as a trend plot. This parameter is only available with an LCD keypad.	100.0% (-99.9 - +300.0%)	830
o1-51 (11CB) RUN	Trend Plot Time Scale Setting	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the time scale (horizontal axis) to display the trend plot. When you change this setting, the drive automatically adjusts the data sampling time. This parameter is only available with an LCD keypad.	5 s (1 - 3600 s)	831
o1-55 (11EE) RUN	AnGauge Area Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the range used to display the monitor set in *o1-24 [Cust.Monitor 1]* as an analog gauge. This parameter is only available with an LCD keypad. 0 : + - Area (- o1-56 - o1-56) 1 : + Area (0 - o1-56)	1 (0, 1)	831
o1-56 (11EF) RUN	AnGauge Area Setting	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the value used to display the monitor set in *o1-24 [Cust.Monitor 1]* as an analog meter. This parameter is only available with an LCD keypad.	100.0% (0.0 - 100.0%)	831

◆ o2: KEYPAD OPERATION

No. (Hex.)	Name	Description	Default (Range)	Ref.
o2-01 (0505)	LO/RE Key Selection of Function	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function that lets the drive switch between LOCAL and REMOTE Modes using the LO/RE button. 0 : Disabled 1 : Enabled	1 (0, 1)	831
o2-02 (0506)	STOP Key Selection of Function	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function to stop the drive with the STOP button on the keypad when the Run command source for the drive is REMOTE (external) and not assigned to the keypad. 0 : Disabled 1 : Enabled	1 (0, 1)	832
o2-03 (0507)	UserPar Set Default Values	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function to keep the settings of changed parameters as user parameter defaults to use during initialization. 0 : No change 1 : Set defaults 2 : Clear all	0 (0 - 2)	832
o2-04 (0508)	Drive KVA Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Drive Model code. Set this parameter after replacing the control board.	Determined by the drive (-)	832

No. (Hex.)	Name	Description	Default (Range)	Ref.
o2-05 (0509)	LCD FreqRef Mode@Home Screen	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function that makes it necessary to push the ↵ button to change the frequency reference value with the keypad when in Drive Mode. 0 : Disabled 1 : Enabled	0 (0, 1)	833
o2-06 (050A)	Keypad Disconnect Detection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function that stops the drive if you disconnect the keypad connection cable from the drive or if you damage the cable while the keypad is the Run command source. 0 : Disabled 1 : Enabled	Determined by o2-09 (0, 1)	833
o2-07 (0527)	Keypad Dir@Power-Up	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the direction of motor rotation when the drive is energized and the keypad is the Run command source. 0 : Forward 1 : Reverse	0 (0, 1)	834
o2-09 (050D)	Region Code for Initialization	-	-	-
o2-23 (11F8)	Ext24V Off Warning Display	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function to give a warning when the backup external 24 V power supply turns off when the main circuit power supply is in operation. 0 : Disabled 1 : Enabled	0 (0, 1)	834
o2-26 (1563)	Ext24V Mode Warning Display	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV When you connect a backup external 24 V power supply, this parameter sets the function to trigger an alarm when the main circuit power supply voltage decreases. **Note:** The drive will not run when it is operating from one 24-V external power supply. 0 : Disabled 1 : Enabled	0 (0, 1)	834
o2-27 (1565)	BLE Disconn. Selection@BLE Ctrl	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets drive operation if the Bluetooth device is disconnected when you operate the drive in Bluetooth Mode. 0 : Ramp->Stop 1 : Coast->Stop 2 : Fast Stop (C1-09) 3 : Alarm Only 4 : No Alarm Display	3 (0 - 4)	834

◆ o3: COPY FUNCTION

No. (Hex.)	Name	Description	Default (Range)	Ref.
o3-01 (0515)	COPY Keypad Selection of Mode	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function that saves and copies drive parameters to a different drive with the keypad. 0 : Copy Select 1 : Bck (Drive->OPE) 2 : Res (OPE->Drive) 3 : Verify (Check) 4 : Del (Clear OPE Memory)	0 (0 - 4)	835
o3-02 (0516)	COPY Allow Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the copy function when *o3-01 = 1 [COPY Keypad Selection of Mode = Bck (Drive->OPE)]*. 0 : Disabled 1 : Enabled	0 (0, 1)	835
o3-04 (0B3E)	COPY Memory Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the storage location for drive parameters when you back up and restore parameters. This parameter is only available with an LCD keypad. 0 : Memory 1 1 : Memory 2 2 : Memory 3 3 : Memory 4	0 (0 - 3)	835
o3-05 (0BDA)	COPY Items Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets which parameters are backed up, restored, and referenced. This parameter is only available with an LED keypad. 0 : Std 1 : Std+Solution	0 (0, 1)	835

No. (Hex.)	Name	Description	Default (Range)	Ref.
o3-06 (0BDE)	AutoBackup Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function that automatically backs up parameters. This parameter is only available when using an LCD keypad. 0 : Disabled 1 : Enabled	1 (0, 1)	836
o3-07 (0BDF)	AutoBackup Lapse	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the interval at which the automatic parameter backup function saves parameters from the drive to the keypad. **Note:** This parameter is only available with an LED keypad. 1 : 10 minutes 2 : 30 minutes 3 : 60 minutes 4 : 12 hours	2 (1 - 4)	836

◆ o4: MAINTENANCE MONITORS

No. (Hex.)	Name	Description	Default (Range)	Ref.
o4-01 (050B)	Cum.Oper TimeSetting	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the initial value of the cumulative drive operation time in 10-hour units.	0 h (0 - 9999 h)	836
o4-02 (050C)	Cum.Oper TimeSelect	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the condition that counts the cumulative operation time. 1 : Log Power-On Time 2 : Log Run Time	1 (1, 2)	836
o4-03 (050E)	Fan.Oper Setting	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the value from which to start the cumulative drive cooling fan operation time in 10-hour units.	0 h (0 - 9999 h)	837
o4-05 (051D)	Cap.Maint.Setting	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the *U4-05 [Capacitor Maintenance]* monitor value.	0% (0 - 150%)	837
o4-07 (0523)	PreChgRly Preset Maintenance Cnt	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the *U4-06 [SoftChgRelay Maint]* monitor value.	0% (0 - 150%)	837
o4-09 (0525)	IGBT Preset Maintenance Cnt	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the *U4-07 [IGBT Maintenance]* monitor value.	0% (0 - 150%)	837
o4-11 (0510)	Flt.History Initialization	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Resets the records of Monitors *[U2: FAULT]* and *[U3: FAULT HISTORY]*. 0 : No Reset 1 : Reset	0 (0, 1)	838
o4-12 (0512)	kWh Monitor Initialization	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Resets the monitor values for *U4-10 [kWh Lower 4Digits]* and *U4-11 [kWh Upper 5Digits]*. 0 : No Reset 1 : Reset	0 (0, 1)	838
o4-13 (0528)	NumOfRunCom Init Counter	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Resets the monitor values for *U4-02 [Num of Run Commands]*, *U4-24 [No of Travels (L)]*, and *U4-25 [No of Travels(H)]*. 0 : No Reset 1 : Reset	0 (0, 1)	838
o4-22 (154F) RUN	Time Format	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the time display format. This parameter is only available when using an LCD keypad. 0 : 24 Hour Clock 1 : 12 Hour Clock 2 : 12 Hour JP Clock	0 (0 - 2)	838
o4-23 (1550) RUN	Date Format	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the date display format. This parameter is only available when using an LED keypad. 0 : YYYY/MM/DD 1 : DD/MM/YYYY 2 : MM/DD/YYYY	0 (0 - 2)	838
o4-24 (310F) RUN	bAT Detection Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets operation when the drive detects *bAT [Keypad Battery Low Voltage]* and *TiM [Keypad Time Not Set]*. 0 : Disabled 1 : Enable (Alarm Detected) 2 : Enable (Fault Detected)	0 (0 - 2)	839

◆ o5: DATA LOGGER

No. (Hex.)	Name	Description	Default (Range)	Ref.
o5-01 (1551) RUN	Log Start Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the data log function. This parameter is only available on an LCD keypad. 0 : OFF 1 : ON (Data Logging)	0 (0 - 1)	841
o5-02 (1552) RUN	Log Sample Lapse	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the data log sampling cycle. This parameter is only available on an LCD keypad.	1000 ms (100 - 6000 ms)	842
o5-03 (1553) RUN	Log Mon Data 1	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the data log monitor. This parameter is only available on an LCD keypad.	101 (000,101 - 855)	842
o5-04 (1554) RUN	Log Mon Data 2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the data log monitor. This parameter is only available on an LCD keypad.	102 (000,101 - 855)	842
o5-05 (1555) RUN	Log Mon Data 3	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the data log monitor. This parameter is only available on an LCD keypad.	103 (000,101 - 855)	842
o5-06 (1556) RUN	Log Mon Data 4	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the data log monitor. This parameter is only available on an LCD keypad.	107 (000,101 - 855)	842
o5-07 (1557) RUN	Log Mon Data 5	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the data log monitor. This parameter is only available on an LCD keypad.	108 (000,101 - 855)	843
o5-08 (1558) RUN	Log Mon Data 6	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the data log monitor. This parameter is only available on an LCD keypad.	000 (000,101 - 855)	843
o5-09 (1559) RUN	Log Mon Data 7	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the data log monitor. This parameter is only available on an LCD keypad.	000 (000,101 - 855)	843
o5-10 (155A) RUN	Log Mon Data 8	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the data log monitor. This parameter is only available on an LCD keypad.	000 (000,101 - 855)	843
o5-11 (155B) RUN	Log Mon Data 9	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the data log monitor. This parameter is only available on an LCD keypad.	000 (000,101 - 855)	843
o5-12 (155C) RUN	Log Mon Data 10	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the data log monitor. This parameter is only available on an LCD keypad.	000 (000,101 - 855)	844

11.12 q: Q2PACK PARAMETERS

◆ q1-01 to q8-40: Q2pack Parameters

No. (Hex.)	Name	Description	Default (Range)
q1-01 to q8-40: (1600 to 17E7)	Reserved for Q2pack	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV These parameters are reserved for use with Q2pack.	Refer to “Q2pack Operation Manual”.

11.13 r: Q2PACK JOINTS

◆ r1: Q2PACK JOINTS

No. (Hex.)	Name	Description	Default (Range)
r1-01 to r1-40: (1840 to 1867)	Q2pack Joints	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Q2pack joints 1 to 20 (Upper / Lower)	0 (0 - FFFFH)

Parameter List

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11.14 T: AUTOTUNING

◆ T0: TUNE MODE

No. (Hex.)	Name	Description	Default (Range)	Ref.
T0-00 (1197)	Tune Mode Selection	**V/f** **CL-V/f** **OLV** **CLV** **AOLV** **OLV/PM** **AOLV/PM** **CLV/PM** **EZOLV** Sets the type of Auto-Tuning. 0 : Motor Parameter Tuning 1 : Control Tuning	0 (0, 1)	845

◆ T1: INDUCTION MOTOR

No. (Hex.)	Name	Description	Default (Range)	Ref.
T1-00 (0700)	Mot1/Mot2 Selection	**V/f** **CL-V/f** **OLV** **CLV** **AOLV** OLV/PM AOLV/PM CLV/PM EZOLV Sets which motor to tune when motor 1/2 switching is enabled. You can only use the keypad to set this parameter. You cannot use external input terminals to set it. **Note:** Set *H1-xx = 61 [Motor 2 Selection]* ON to set this parameter. The keypad will not show this parameter when *H1-xx = 61* is OFF. 1 : Motor 1 (sets E1-xx, E2-xx) 2 : Motor 2 (sets E3-xx, E4-xx)	1 (1, 2)	845
T1-01 (0701)	Auto-tuning Mode Selection	**V/f** **CL-V/f** **OLV** **CLV** **AOLV** OLV/PM AOLV/PM CLV/PM EZOLV Sets the type of Auto-Tuning. 0 : Rotary Auto Tune 1 : Static1 AutoTune 2 : Static (R)	Determined by A1-02 (Determined by A1-02)	846
T1-02 (0702)	Motor Rated Power	**V/f** **CL-V/f** **OLV** **CLV** **AOLV** OLV/PM AOLV/PM CLV/PM EZOLV Sets the rated output power (kW) of the motor.	Determined by o2-04 and C6-01 (0.00 - 650.00 kW)	846
T1-03 (0703)	Motor Rated Voltage	**V/f** **CL-V/f** **OLV** **CLV** **AOLV** OLV/PM AOLV/PM CLV/PM EZOLV Sets the rated voltage (V) of the motor. Enter the base speed voltage for constant output motors.	Determined by o2-04 and C6-01 (400 V Class: 0.0 - 511.0 V)	846
T1-04 (0704)	Motor Rated Current	**V/f** **CL-V/f** **OLV** **CLV** **AOLV** OLV/PM AOLV/PM CLV/PM EZOLV Sets the rated current (A) of the motor.	Determined by o2-04 (10% to 200% of the drive rated current)	846
T1-05 (0705)	Motor Base Frequency	**V/f** **CL-V/f** **OLV** **CLV** **AOLV** OLV/PM AOLV/PM CLV/PM EZOLV Sets the base frequency (Hz) of the motor.	50.0 Hz (0.0 - 590.0 Hz)	846
T1-06 (0706)	Motor Poles Number	**V/f** **CL-V/f** **OLV** **CLV** **AOLV** OLV/PM AOLV/PM CLV/PM EZOLV Sets the number of motor poles.	4 (2 - 48)	846
T1-07 (0707)	Motor Base Speed	**V/f** **CL-V/f** **OLV** **CLV** **AOLV** OLV/PM AOLV/PM CLV/PM EZOLV Sets the motor base speed for Auto-Tuning (min^{-1} (r/min)).	1450 min^{-1} (r/min) (0 - 35400 min^{-1} (r/min))	847
T1-08 (0708)	PG PulsePerRevolution	V/f CL-V/f OLV **CLV** **AOLV** OLV/PM AOLV/PM CLV/PM EZOLV Sets the number of PG (pulse generator, encoder) pulses.	1024 ppr (0 - 60,000 ppr)	847
T1-09 (0709)	Motor NoLoad Current	V/f CL-V/f **OLV** **CLV** **AOLV** OLV/PM AOLV/PM CLV/PM EZOLV Sets the no-load current of the motor.	- (0A - T1-04; max. of 2999.9)	847
T1-10 (070A)	Motor Rated Slip Frequency	V/f CL-V/f **OLV** **CLV** **AOLV** OLV/PM AOLV/PM CLV/PM EZOLV Sets the motor rated slip.	- (0.000 - 20.000 Hz)	847
T1-11 (070B)	Motor Iron Loss	**V/f** **CL-V/f** OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the iron loss for calculating the energy-saving coefficient.	Determined by E2-11 or E4-11 (0 - 65535 W)	847
T1-12 (0BDB)	Test Mode Selection	V/f CL-V/f **OLV** **CLV** **AOLV** OLV/PM AOLV/PM CLV/PM EZOLV Sets the function to enable Test Mode after Stationary Auto-Tuning. When you can operate the motor with a light load attached after Stationary Auto-Tuning is complete, enable this parameter. **Note:** You must first set *T1-10 [Motor Rated Slip Frequency]* = 0 Hz to enable this parameter. 0 : No 1 : Yes	0 (0, 1)	847
T1-13 (0BDC)	No-load Voltage	V/f CL-V/f **OLV** **CLV** **AOLV** OLV/PM AOLV/PM CLV/PM EZOLV Sets the no-load voltage of the motor. If no-load voltage is necessary at rated speed for the motor test report, set the voltage in this parameter. If the motor test report is not available, do not change this parameter.	90% of T1-03 (400 V Class: 0.0 - 510.0 V)	848

◆ T2: PM MOTOR

No. (Hex.)	Name	Description	Default (Range)	Ref.
T2-01 (0750)	PM AutoTune Mode Select	V/f CL-V/f OLV CLV AOLV **OLV/PM** **AOLV/PM** **CLV/PM** EZOLV Sets the type of Auto-Tuning for PM motors. 0 : PM Motor Parameter Settings 1 : PM Static Full AutoTune 2 : PM Static R Autotune 3 : Encoder Offset Autotune 4 : PM Rotary Autotune	0 (Determined by A1-02)	848
T2-02 (0751)	PMMot Code Selection	V/f CL-V/f OLV CLV AOLV **OLV/PM** **AOLV/PM** **CLV/PM** EZOLV Sets the PM motor code for drives operating SMRA, SSR1, or SST4-series Yaskawa PM motors.	Determined by A1-02 and o2-04 (0000 - FFFF)	848
T2-03 (0752)	PMMot Motor Type	V/f CL-V/f OLV CLV AOLV **OLV/PM** **AOLV/PM** **CLV/PM** EZOLV Sets the type of PM motor the drive will operate. 0 : IPM Motor 1 : SPM Motor	1 (0, 1)	848
T2-04 (0730)	PMMot Rated Power	V/f CL-V/f OLV CLV AOLV **OLV/PM** **AOLV/PM** **CLV/PM** EZOLV Sets the rated output power (kW) of a PM motor.	Determined by o2-04 and C6-01 (0.00 - 650.00 kW)	849
T2-05 (0732)	PMMot Rated Voltage	V/f CL-V/f OLV CLV AOLV **OLV/PM** **AOLV/PM** **CLV/PM** EZOLV Sets the rated voltage (V) of the motor.	400 V Class: 400.0 V (400 V Class: 0.0 - 510.0 V)	849
T2-06 (0733)	PMMot Rated Current	V/f CL-V/f OLV CLV AOLV **OLV/PM** **AOLV/PM** **CLV/PM** EZOLV Sets the rated current (A) of the motor.	Determined by o2-04 (10% to 200% of the drive rated current)	849
T2-07 (0753)	PMMot Base Frequency	V/f CL-V/f OLV CLV AOLV **OLV/PM** AOLV/PM CLV/PM EZOLV Sets the base frequency (Hz) of the motor.	87.5 Hz (0.0 - 590.0 Hz)	849
T2-08 (0734)	PMMot Poles Number	V/f CL-V/f OLV CLV AOLV **OLV/PM** **AOLV/PM** **CLV/PM** EZOLV Sets the number of motor poles.	6 (2 - 48)	849
T2-09 (0731)	PMMot Base Speed	V/f CL-V/f OLV CLV AOLV OLV/PM **AOLV/PM** **CLV/PM** EZOLV Sets the motor base speed (min^{-1} (r/min)).	1750 min^{-1} (r/min) (0 - 34500 min^{-1} (r/min))	849
T2-10 (0754)	PMMot Stator Resistance	V/f CL-V/f OLV CLV AOLV **OLV/PM** **AOLV/PM** **CLV/PM** EZOLV Sets the stator resistance for each motor phase. **Note:** This parameter does not set line-to-line resistance.	Determined by T2-02 (0.000 - 65.000 Ω)	849
T2-11 (0735)	PMMot dAxis Inductance	V/f CL-V/f OLV CLV AOLV **OLV/PM** **AOLV/PM** **CLV/PM** EZOLV Sets the d-axis inductance of the motor on a per phase basis.	Determined by T2-02 (0.00 - 600.00 mH)	849
T2-12 (0736)	PMMot qAxis Inductance	V/f CL-V/f OLV CLV AOLV **OLV/PM** **AOLV/PM** **CLV/PM** EZOLV Sets the q-Axis inductance of the motor on a per phase basis.	Determined by T2-02 (0.00 - 600.00 mH)	850
T2-13 (0755)	KE Unit Selection	V/f CL-V/f OLV CLV AOLV **OLV/PM** **AOLV/PM** **CLV/PM** EZOLV Sets the units that the drive uses to set the induced voltage constant. 0 : mV/rpm 1 : mV/(rad/sec)	1 (0, 1)	850
T2-14 (0737)	PMMot KE Voltage Constant	V/f CL-V/f OLV CLV AOLV **OLV/PM** **AOLV/PM** **CLV/PM** EZOLV Sets the motor induced voltage constant (Ke).	Determined by T2-13 (0.0 - 2000.0)	850
T2-15 (0756)	PullInCurrLv@PM Motor Tuning	V/f CL-V/f OLV CLV AOLV **OLV/PM** **AOLV/PM** **CLV/PM** EZOLV Sets the level of the pull-in current as a percentage, where 100% = motor rated current. Usually it is not necessary to change this setting.	30% (0 - 120%)	850
T2-16 (0738)	PMMot PG PulsePerRevolution	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM **CLV/PM** EZOLV Sets the number of PG (pulse generator, encoder) pulses.	1024 ppr (1 - 15000 ppr)	850
T2-17 (0757)	Enc Z-Pulse Offset	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM **CLV/PM** EZOLV Sets the encoder Z-pulse offset (Δθ) (pulse generator, encoder) that is listed on the motor nameplate.	0.0° (-180.0 - +180.0°)	850

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◆ T3: ASR

No. (Hex.)	Name	Description	Default (Range)	Ref.
T3-00 (1198)	Control Loop Tune Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the type of Control Auto-Tuning. 0 : Inertia Tuning 1 : ASR (Speed Regulator) 2 : Dec Rate Tuning 3 : KEB Tuning **Note:** Settings *0 and 1* are available only when *A1-02 = 3, 7 [Control Method = CLVector , PM CLVector]*.	0 (0 - 3)	850
T3-01 (0760)	Inertia Test Frequency	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the frequency of the test signal applied to the motor during Inertia Tuning. Usually it is not necessary to change this setting.	3.0 Hz (0.1 - 20.0 Hz)	851
T3-02 (0761)	Inertia Test Amplitude	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the amplitude of the test signal applied to the motor during Inertia Tuning. Usually it is not necessary to change this setting.	0.5 rad (0.1 - 10.0 rad)	851
T3-03 (0762)	Motor Inertia	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the inertia of the motor. This value uses the test signal response to calculate the load inertia.	Determined by o2-04, C6-01, and E5-01 (0.0001 - 6.0000 kgm^2)	851
T3-04 (0763)	System ResponseFrequency	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV This parameter uses the load inertia value from the Inertia Tuning process to automatically calculate and set *C5-01 [ASR PGain 1]*.	10.0 Hz (0.1 - 50.0 Hz)	851

◆ T4: SIMPLE VECTOR

No. (Hex.)	Name	Description	Default (Range)	Ref.
T4-01 (3130)	EZ Tune Mode Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the type of Auto-Tuning for EZOLV control. 0 : Motor Constant 1 : Static R Autotune	0 (0, 1)	852
T4-02 (3131)	Motor Type Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the type of motor. 0 : IM (Induction) 1 : PM (Permanent Magnet) 2 : SynRM (Synchronous Reluctance)	0 (0, 1, 2)	852
T4-03 (3132)	Motor Max Revolutions	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the maximum motor revolutions (rpm).	- ((40 to 120 Hz) × 60 × 2 / E9-08)	852
T4-04 (3133)	Motor Rated Revolutions	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets rated rotation speed (rpm) of the motor.	- ((40 to 120 Hz) × 60 × 2 / E9-08)	852
T4-05 (3134)	Motor Rated Frequency	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the rated frequency (Hz) of the motor.	Determined by E9-01 and o2-04 (40.0 - 120.0 Hz)	852
T4-06 (3135)	Motor Rated Voltage	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the rated voltage (V) of the motor.	400 V Class: 400.0 V (400 V Class: 0.0 - 510.0 V)	853
T4-07 (3136)	Motor Rated Current	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the rated current (A) of the motor.	Determined by o2-04 and C6-01 (10% to 200% of the drive rated current)	853
T4-08 (3137)	Motor Rated Capacity	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the motor rated capacity in 0.01 kW units.	Determined by E9-10 (0.10 - 650.00 kW)	853
T4-09 (3138)	Motor Poles Number	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the number of motor poles.	Determined by E9-01 (2 - 48)	853

11.15 U: MONITORS

◆ U1: STATUS

No. (Hex.)	Name	Description	MFAO Signal Level	Ref.
U1-01 (0040)	Frequency Reference	Shows the actual frequency reference value. Parameter *o1-03 [FrqDisplay Unit Selection]* selects the units. Unit: 0.01 Hz	10 V = Max. frequency (-10 V to +10 V)	-
U1-02 (0041)	Output Frequency	Shows the actual output frequency. Parameter *o1-03 [FrqDisplay Unit Selection]* selects the units. Unit: 0.01 Hz	10 V = Max. frequency (-10 V to +10 V)	-
U1-03 (0042)	Output Current	Shows the actual output current. The keypad shows the value of *U1-03* in amperes (A). When looking at the monitor through Modbus communications, the current is “8192 = drive rated current (A).” Calculate the current from the monitor value that is in at Modbus communications using “Numerals being displayed / 8192 × drive rated current (A).” Unit: Determined by the drive model. • 0.01 A:4002 to 4023 • 0.1 A: 4031 to 4675	10 V = Drive rated current	-
U1-04 (0043)	Control Method	Shows the drive control method. 0 : V/f Control 1 : PG V/f Control 2 : OLVector 3 : CLVector 4 : Adv OLVector 5 : PM OLVector 6 : PM AOLVector 7 : PM CLVector 8 : EZ Vector	No signal output available	-
U1-05 (0044)	Motor Speed	Shows the actual detected motor speed. Parameter *o1-03 [FrqDisplay Unit Selection]* selects the units. Unit: 0.01 Hz	10 V = Max. frequency (-10 V to +10 V)	-
U1-06 (0045)	Output Voltage Ref	Shows the output voltage reference. Unit: 0.1 V	400 V class: 10 V = 400 Vrms	-
U1-07 (0046)	DC Bus Voltage	Shows the DC bus voltage. Unit: 1 V	400 V class: 10 V = 400 V	-
U1-08 (0047)	Output Power	Shows the internally-calculated output power. Changing the setting of *A1-02 [Control Method]* also changes the signal level of the analog output. • *A1-02 = 0, 1 [V/f Control]*: Drive capacity (kW) • *A1-02 = 2 to 8 [Vector Control]*: *Motor Rated Power (kW) [E2-11]* Unit: Drive capacity and *C6-01 [ND/HD Duty Selection]* calculate the maximum applicable motor output. • Less than 11 kW (15 HP): 0.01 kW • Less than 11 kW (15 HP): 0.1 kW	10 V: Drive capacity (motor rated power) kW (-10 V to +10 V)	-
U1-09 (0048)	Torque Reference	Shows the internal torque reference value. Unit: 0.1%	10 V = Motor rated torque (-10 V to +10 V)	-
U1-10 (0049)	In Terminal Status	Shows the status of the MFDI terminal where 1 = (ON) and 0 = (OFF). For example, *U1-10* shows “00000011” when terminals DI1 and DI2 are ON. bit 0 : Terminal DI1 (MFDI 1) bit 1 : Terminal DI2 (MFDI 2) bit 2 : Terminal DI3 (MFDI 3) bit 3 : Terminal DI4 (MFDI 4) bit 4 : Terminal DI5 (MFDI 5) bit 5 : Terminal DI6 (MFDI 6) bit 6 : Terminal DI7 (MFDI 7) bit 7 : Terminal DI8 (MFDI 8)	No signal output available	-
U1-11 (004A)	Out Terminal Status	Shows the status of the MFDO terminal where 1 = (ON) and 0 = (OFF). For example, *U1-11* shows “00000011” when terminals 2NO-2CM and 3NO-3CM are ON. bit 0 : Terminals 2NO-2CM bit 1 : Terminals 3NO-3CM bit 2 : Terminals 4NO-4CM bit 3 : Not used (normal value of 0). bit 4 : Not used (normal value of 0). bit 5 : Not used (normal value of 0). bit 6 : Not used (normal value of 0). bit 7 : Fault relay 1NO/1NC-1CM	No signal output available	-

No. (Hex.)	Name	Description	MFAO Signal Level	Ref.
U1-12 (004B)	Drive Status	Shows drive status where 1 = (ON) and 0 = (OFF). For example, U1-12 shows “00000101” during run with the Reverse Run command. bit 0 : During run bit 1 : During zero-speed bit 2 : During reverse bit 3 : During fault reset signal input bit 4 : During speed agreement bit 5 : Drive ready bit 6 : During minor fault detection bit 7 : During fault detection	No signal output available	-
U1-13 (004E)	Terminal AI1 Input Lv	Shows the signal level of terminal AI1. Unit: 0.1%	10 V = 100% (-10 V to +10 V)	-
U1-14 (004F)	Terminal AI2 Input Lv	Shows the signal level of terminal AI2. Unit: 0.1%	10 V = 100% (-10 V to +10 V)	-
U1-15 (0050)	Terminal AI3 Input Lv	Shows the signal level of terminal AI3. Unit: 0.1%	0 V = 100% (-10 V to +10 V)	-
U1-16 (0053)	SFS Output Frequency	Shows the output frequency after soft start. Shows the frequency with acceleration and deceleration times and Jerk Control. Parameter *o1-03 [FrqDisplay Unit Selection]* selects the units. Unit: 0.01 Hz	10 V = Max. frequency (-10 V to +10 V)	-
U1-17 (0058)	DI-A3 Input Status	Shows the reference value input from DI-A3 option. Shows the input signal for DI-A3 in hexadecimal as set in *F3-01 [D.In Funct Selection]*. 3FFFF: Set (1 bit) + Sign (1 bit) + 16 bit	No signal output available	-
U1-18 (0061)	oPE Fault Parameter	Shows the parameter number that caused the *oPE02 [Parameter Range Setting Error]* or *oPE08 [Parameter Selection Error]*.	No signal output available	-
U1-19 (0066)	Modbus Err.Code	Shows the contents of the Modbus communication error where 1 = (error) and 0 = (no error). For example, *U1-19* shows “00000001” when a CRC error occurs. bit 0 : CRC Error bit 1 : Data Length Error bit 2 : Not used (normal value of 0). bit 3 : Parity Error bit 4 : Overrun Error bit 5 : Framing Error bit 6 : Timed Out bit 7 : Not used (normal value of 0).	No signal output available	-
U1-21 (0077)	AI-A3 Term V1 Level	Shows the analog reference of terminal V1 on analog input option card AI-A3. Unit: 0.1%	10 V = 100% (-10 V to +10 V)	-
U1-22 (072A)	AI-A3 Term V2 Level	Shows the analog reference of terminal V2 on analog input option card AI-A3. Unit: 0.1%	10 V = 100% (-10 V to +10 V)	-
U1-23 (072B)	AI-A3 Term V3 Level	Shows the analog reference of terminal V3 on analog input option card AI-A3. Unit: 0.1%	10 V = 100% (-10 V to +10 V)	-
U1-24 (007D)	Input Pulse Monitor	Shows the frequency to pulse train input terminal PI. Unit: 1 Hz	Determined by H6-02	-
U1-25 (004D)	SoftNumber Flash	Shows the FLASH ID.	No signal output available	-
U1-26 (005B)	SoftNumber ROM	Shows the ROM ID.	No signal output available	-
U1-50 (1199) Expert	Virt. Analog Input	Shows the virtual analog input value.	Determined by H7-40	-
U1-91 (154E) Expert	Output Voltage	Shows the drive internal output voltage reference. Unit: 0.1 V	400 V class: 10 V = 400 Vrms	-

◆ U2: FAULT

No. (Hex.)	Name	Description	MFAO Signal Level	Ref.
U2-01 (0080)	Current Fault	Shows the fault that the drive has when viewing the monitor.	No signal output available	-
U2-02 (0081)	Previous Fault	Shows the fault that occurred most recently.	No signal output available	-
U2-03 (0082)	FreqRef@PrevFault	Shows the frequency reference at the fault that occurred most recently. Use *U1-01 [Frequency Reference]* to monitor the actual frequency reference value. Unit: 0.01 Hz	No signal output available	-
U2-04 (0083)	OutFreq@PrevFault	Shows the output frequency at the fault that occurred most recently. Use *U1-02 [Output Frequency]* to monitor the actual output frequency. Unit: 0.01 Hz	No signal output available	-
U2-05 (0084)	OutCurr@PrevFault	Shows the output current at the fault that occurred most recently. Use *U1-03 [Output Current]* to monitor the actual output current. The keypad shows the value of *U1-03* in amperes (A). When looking at the monitor through Modbus communications, the current is “8192 = drive rated current (A)”. Calculate the current from the monitor value that is in at Modbus communications using “Numerals being displayed / 8192 × drive rated current (A)”. Unit: Determined by the drive model. • 0.01 A: 4002 to 4023 • 0.1 A: 4031 to 4675	No signal output available	-
U2-06 (0085)	MotorSpd@PrevFault	Shows the motor speed at the fault that occurred most recently. Use *U1-05 [Motor Speed]* to monitor the actual motor speed. Unit: 0.01 Hz	No signal output available	-
U2-07 (0086)	OutVolt@PrevFault	Shows the output voltage reference at the fault that occurred most recently. Use *U1-06 [Output Voltage Ref]* to monitor the actual output voltage reference. Unit: 0.1 V	No signal output available	-
U2-08 (0087)	DCBusVolt@PrevFault	Shows the DC bus voltage at the fault that occurred most recently. Use *U1-07 [DC Bus Voltage]* to monitor the actual DC bus voltage. Unit: 1 V	No signal output available	-
U2-09 (0088)	OutPow@PrevFault	Shows the output power at the fault that occurred most recently. Use *U1-08 [Output Power]* to monitor the actual output power. Unit: 0.1 kW	No signal output available	-
U2-10 (0089)	TrqRef@PrevFault	Shows the torque reference at the fault that occurred most recently as a percentage of the motor rated torque. Use *U1-09 [Torque Reference]* to monitor the actual torque reference. Unit: 0.1%	No signal output available	-
U2-11 (008A)	InStat@PrevFault	Shows the status of the MFDI terminals at the most recent fault where 1 = (ON) and 0 = (OFF). For example, *U2-11* shows “00000011” when terminals DI1 and DI2 are ON. Use *U1-10 [In Terminal Status]* to monitor the actual MFDI terminal status. bit 0 : Terminal DI1 bit 1 : Terminal DI2 bit 2 : Terminal DI3 bit 3 : Terminal DI4 bit 4 : Terminal DI5 bit 5 : Terminal DI6 bit 6 : Terminal DI7 bit 7 : Terminal DI8	No signal output available	-
U2-12 (008B)	OutStat@PrevFault	Shows the status of the MFDO terminals at the most recent fault where 1 = (ON) and 0 = (OFF). For example, *U2-12* shows “00000011” when terminals 2NO-2CM and 3NO-3CM are ON. Use *U1-11 [Out Terminal Status]* to monitor the actual MFDO terminal status. bit 0 : Terminals 2NO-2CM bit 1 : Terminals 3NO-3CM bit 2 : Terminals 4NO-4CM bit 3 : Not used (normal value of 0). bit 4 : Not used (normal value of 0). bit 5 : Not used (normal value of 0). bit 6 : Not used (normal value of 0). bit 7 : Fault relay 1NO/1NC-1CM	No signal output available	-

No. (Hex.)	Name	Description	MFAO Signal Level	Ref.
U2-13 (008C)	DrvStat@PrevFault	Shows the operation status of the drive at the most recent fault where 1 = (ON) and 0 = (OFF). For example, *U2-13* shows "00000001" during run. Use *U1-12 [Drive Status]* to monitor the actual drive status. bit 0 : During run bit 1 : During zero-speed bit 2 : During reverse bit 3 : During fault reset signal input bit 4 : During speed agreement bit 5 : Drive ready bit 6 : During minor fault detection bit 7 : During fault detection	No signal output available	-
U2-14 (008D)	OpeTime@PreFault	Shows the cumulative operation time of the drive at the fault that occurred most recently. Use *U4-01 [Cumulative OpeTime]* to monitor the actual cumulative operation time. Unit: 1 h	No signal output available	-
U2-15 (07E0)	SFSFreq@PrevFault	Shows the output frequency after soft start at the fault that occurred most recently. Use *U1-16 [SFS Output Frequency]* to monitor the actual output frequency after soft start. Unit: 0.01 Hz	No signal output available	-
U2-16 (07E1)	qCurrent@PrevFault	Shows the q-axis current of the motor at the fault that occurred most recently. Use *U6-01 [Iq Sec Current]* to monitor the actual q-Axis current of the motor. Unit: 0.1 %	No signal output available	-
U2-17 (07E2)	dCurrent@PreFault	Shows the d-axis current of the motor at the fault that occurred most recently. Use *U6-02 [Id ExcCurrent]* to monitor the actual d-Axis current of the motor. Unit: 0.1 %	No signal output available	-
U2-19 (07EC)	RotorDev@PrevFault	Shows the amount of control axis deviation (Δθ) at the fault that occurred most recently. Use *U6-10 [ContAxisDeviation]* to monitor the actual amount of control axis deviation (Δθ). Unit: 0.1 °	No signal output available	-
U2-20 (008E)	DrvTemp@PreFault	Shows the heatsink temperature at the fault that occurred most recently. Use *U4-08 [Heatsink Temperature]* to monitor the actual temperature of the heatsink. Unit: 1 °C	No signal output available	-
U2-21 (1166) Expert	STPoSt@PrevFault	Monitors conditions to detect *STPo [Motor Step-Out Detected]* faults. The bit for each condition is displayed as ON or OFF. bit 0 : Excessive current bit 1 : Induced voltage deviation bit 2 : d-axis current deviation bit 3 : Motor lock at startup bit 4 : Acceleration stall continue bit 5 : Acceleration stall repeat bit 6 : Not used (normal value of 0). bit 7 : Not used (normal value of 0).	No signal output available	-

◆ U3: FAULT HISTORY

No. (Hex.)	Name	Description	MFAO Signal Level	Ref.
U3-01 to U3-10 (0090 - 0093) (0804 - 0809)	1st to 10th Newest Fault	Shows the fault history of the first to tenth most recent faults. **Note:** The drive saves the *U3-01 to U3-04 [1st to 4th Newest Fault]* fault histories to two types of registers at the same time for the Modbus communications.	No signal output available	-
U3-11 to U3-20 (0094 - 0097, 080E - 0813)	1st to 10th NewstFlt Timing	Shows the cumulative operation time when the first to tenth most recent faults occurred. Unit: 1 h **Note:** The drive saves the *U3-11 to U3-14 [1st to 4th NewstFlt Timing]* the cumulative operation time to two types of registers at the same time for the Modbus communications.	No signal output available	-

◆ U4: MAINTENANCE

No. (Hex.)	Name	Description	MFAO Signal Level	Ref.
U4-01 (004C)	Cumulative OpeTime	Shows the cumulative operation time of the drive. Use parameter *o4-01 [Cum.Oper TimeSetting]* to reset this monitor. Use parameter *o4-02 [Cum.Oper TimeSelect]* to select the cumulative operation times from: • The time from when the drive is energized until it is de-energized. • The time at which the Run command is turned ON. The maximum value that the monitor will show is *99999*. The value then resets and starts counting again from *0*. Unit: 1 h **Note:** The Modbus communication data is shown in 10 h units. Use register 0099H for data in 1 h units.	No signal output available	-
U4-02 (0075)	Num of Run Commands	Shows how many times that the drive has received a Run command. Use parameter *o4-13 [NumOfRunCom Init Counter]* to reset this monitor. The maximum value that the monitor will show is *65535*. The value then resets and starts counting again from *0*. Unit: 1	No signal output available	-
U4-03 (0067)	Fan Oper.Time	Shows the cumulative operation time of the cooling fans. Use parameter *o4-03 [Fan.Oper Setting]* to reset this monitor. The maximum value that the monitor will show is *99999*. The value then resets and starts counting again from 0. Unit: 1 h **Note:** The Modbus communication data is shown in 10 h units. Use register 009BH for data in 1 h units.	No signal output available	-
U4-04 (007E)	Cool Fan Maintenance	Shows the cumulative operation time of the cooling fans as a percentage of the replacement life of the cooling fans. Use parameter *o4-03 [Fan.Oper Setting]* to reset this monitor. Unit: 1% **Note:** Replace the cooling fans when this monitor is 90%.	No signal output available	-
U4-05 (007C)	Capacitor Maintenance	Shows the operation time of the electrolytic capacitors for the main circuit and control circuit as a percentage of the replacement life of the electrolytic capacitors. Use parameter *o4-05 [Cap.Maint.Setting]* to reset this monitor. Unit: 1% **Note:** Replace the electrolytic capacitor when this monitor is 90%.	No signal output available	-
U4-06 (07D6)	SoftChgRelay Maint	Shows the operation time of the soft charge bypass relay as a percentage of the replacement life of the soft charge bypass relay. Use parameter *o4-07 [PreChgRly Preset Maintenance Cnt]* to reset this monitor. Unit: 1% **Note:** Replace the drive when this monitor is 90%.	No signal output available	-
U4-07 (07D7)	IGBT Maintenance	Shows the operation time of the IGBTs as a percentage of the replacement life of the IGBTs. Set parameter *o4-09 [IGBT Preset Maintenance Cnt]* to reset this monitor. Unit: 1% **Note:** Replace the drive when this monitor is 90%.	No signal output available	-
U4-08 (0068)	Heatsink Temperature	Shows the heatsink temperature of the drive. Unit: 1 °C	10 V: 100 °C	-
U4-09 (005E)	LED Check	Turns on all of the keypad LEDs to make sure that the LEDs operate correctly. Push with *U4-09* shown on the keypad. All LEDs on the keypad will turn on. **Note:** When Safety input 2 CH is open (STo), READY will flash.	No signal output available	-
U4-10 (005C)	kWh Lower 4Digits	Displays the lower 4 digits of the watt hour value for the drive. Unit: 1 kWh **Note:** The watt hour is displayed in 9 digits. Parameter *U4-11 [kWh Upper 5Digits]* displays the upper 5 digits and *U4-10* displays the lower 4 digits. Example for 12345678.9 kWh: *U4-10*: 678.9 kWh *U4-11*: 12345 MWh	No signal output available	-

No. (Hex.)	Name	Description	MFAO Signal Level	Ref.
U4-11 (005D)	kWh Upper 5Digits	Shows the upper 5 digits of the watt hour value for the drive. Unit: 1 MWh **Note:** Monitor *U4-11* shows the upper 5 digits and *U4-10 [kWh Lower 4Digits]* shows the lower 4 digits. Example for 12345678.9 kWh: *U4-10*: 678.9 kWh *U4-11*: 12345 MWh	No signal output available	-
U4-13 (07CF)	Peak Hold Current	Shows the hold value of the peak value (rms) for the drive output current. Use *U4-14 [PeakHold OutFreq]* to show the drive output frequency at the time that the drive holds the output current. The drive will hold the peak hold current at the next start up and restart of the power supply. The drive keeps the held value during baseblock (during stop). The keypad shows the value of *U4-13* in amperes (A). When looking at the monitor through Modbus communications, the current is “8192 = drive rated current (A).” Calculate the current from the monitor value that is in at Modbus communications using “Numerals being displayed / 8192 × drive rated current (A). Unit: Determined by the drive model. • 0.01 A: 4002 to 4023 • 0.1 A: 4031 to 4675	No signal output available	-
U4-14 (07D0)	PeakHold OutFreq	Displays the output frequency at which the peak value (rms) of the drive output current is held. The peak hold current can be monitored by *U4-13 [Peak Hold Current]*. The peak hold output frequency will be cleared at the next startup and restart of the power supply. The drive keeps the value that was under hold during baseblock (during stop). Unit: 0.01 Hz	No signal output available	-
U4-16 (07D8)	MotorOLEstimate (oL1)	Shows the integrated value of *oL1 [Motor Overload]* as a percentage of *oL1* detection level. Unit: 0.1%	10 V: 100%	-
U4-18 (07DA)	FRef Source Selected	Shows the selected frequency reference source. The keypad shows the frequency reference source as “XY-nn” as specified by these rules: X: *Ext Ref 1/2 [H1-xx = 9]* selection status • 1: *b1-01 [Freq. Ref. Sel. 1]* • 2: *b1-15 [Freq. Ref. Sel. 2]* Y-nn: Frequency reference source • 0-01: Keypad (*d1-01 [Reference 1]*) • 1-00: Analog input (unassigned) • 1-01: MFAI terminal AI1 • 1-02: MFAI terminal AI2 • 1-03: MFAI terminal AI3 • 2-02 to 2-17: Multi-step speed reference (*d1-02 to d1-17 [Reference 2 to Reference 16, and Jog Reference]*) • 3-01: Modbus communications • 4-01: Communication option card • 5-01: Pulse train input • 7-01: Q2pack • 9-01: Up/Down command	No signal output available	-
U4-19 (07DB)	Mbus FreqReference Value	Shows the frequency reference sent to the drive from the Modbus communications as a decimal. Unit: 0.01%	No signal output available	-
U4-20 (07DC)	Option FreqReference Value	Shows the frequency reference sent to the drive from the communication option as a decimal.	No signal output available	-

No. (Hex.)	Name	Description	MFAO Signal Level	Ref.
U4-21 (07DD)	Run Source Selected	Shows the selected Run command source. The keypad shows the Run command source as “XY-nn” as specified by these rules: X: *Ext Ref 1/2 [H1-xx = 9]* selection status • 1: *b1-02 [Run Comm. Sel 1]* • 2: *b1-16 [Run Comm. Sel 2]* Y: Run command source • 0: Keypad • 1: Control circuit terminal • 3: Modbus communications • 4: Communication option card • 7: Q2pack nn: Run command limit status data • 00: No limit status. • 01: The Run command was left ON when the drive stopped in the Programming Mode. • 02: The Run command was left ON when switching from LOCAL Mode to REMOTE Mode. • 03: The Run command is in standby after the drive was energized until the soft charge bypass contactor turns ON. **Note:** The drive will detect *Uv1 [DC Bus Undervoltage]* or *Uv [Undervoltage]* if the soft charge bypass contactor does not turn ON after 10 s. • 04: Restart after run stop is prohibited. • 05: Fast stop has been executed using the MFDI terminal. Or, the motor has ramped to stop by pressing the STOP key on the keypad. • 06: *b1-17 = 1 [RUN@PowerUp Selection = Disregard RUN]* is set. • 07: During baseblock while coast to stop with timer. • 08: Frequency reference is below *E1-09 [Min Output Frequency]* during baseblock. • 09: Waiting for the Enter command from PLC.	No signal output The keypad shows the Run command source as "XY-nn" as specified by these rules: available	-
U4-22 (07DE)	Mbus CmdWord Value	Shows the operation signal (register 0001H) sent to the drive from Modbus communications as a 4-digit hexadecimal number (zero suppress). The keypad shows the operation signal as specified by these rules: bit 0 : Forward run/Stop bit 1 : Reverse run/Stop bit 2 : External fault bit 3 : Fault Reset bit 4 : Multi-function input 1 bit 5 : Multi-function input 2 bit 6 : Multi-function input 3 bit 7 : Multi-function input 4 bit 8 : Multi-function input 5 bit 9 : Multi-function input 6 bit A : Multi-function input 7 bit B : Multi-function input 8 bit C : Not used (normal value of 0). bit D : Not used (normal value of 0). bit E : Not used (normal value of 0). bit F : Not used (normal value of 0).	No signal output available	-
U4-23 (07DF)	Option CmdWord Value	Shows the operation signal (register 0001H) sent to the drive from Modbus communications as a 4-digit hexadecimal number. The keypad shows the operation signal as specified by these rules: bit 0 : Forward run/Stop bit 1 : Reverse run/Stop bit 2 : External fault bit 3 : Fault Reset bit 4 : Multi-function input 1 bit 5 : Multi-function input 2 bit 6 : Multi-function input 3 bit 7 : Multi-function input 4 bit 8 : Multi-function input 5 bit 9 : Multi-function input 6 bit A : Multi-function input 7 bit B : Multi-function input 8 bit C : Not used (normal value of 0). bit D : Not used (normal value of 0). bit E : Not used (normal value of 0). bit F : Not used (normal value of 0).	No signal output available	-
U4-24 (07E6)	No of Travels(L)	Shows the lower 4 digits of the drive run count. **Note:** The drive run count appears as an 8-digit number. The upper 4 digits of *U4-25 [No of Travels(H)]* and the lower 4 digits of *U4-24* appears.	No signal output available	-

No. (Hex.)	Name	Description	MFAO Signal Level	Ref.
U4-25 (07E7)	No of Travels(H)	Shows the lower 4 digits of the drive run count. **Note:** The keypad shows the drive run count in 8 digits. Monitor *U4-25* shows the upper 4 digits and *U4-24 [No of Travels(L)]* shows the lower 4 digits.	No signal output available	-
U4-52 (1592)	Torque Ref from Comm	Displays the torque reference given to the drive via a serial communication option card or via Modbus communications as a decimal number. Unit: 0.1%	No signal output available	-

◆ U5: PID

No. (Hex.)	Name	Description	MFAO Signal Level	Ref.
U5-01 (0057)	PID Feedback	Shows the PID control feedback value. Parameter *b5-20 [PID Unit Selection]* sets the display units. Unit: 0.01%	10 V: Maximum frequency (-10 V to +10 V)	-
U5-02 (0063)	PID Input	Shows the change between the PID setpoint and PID feedback (the quantity of PID input) as a percentage of the maximum output frequency. Unit: 0.01%	10 V: Maximum frequency (-10 V to +10 V)	-
U5-03 (0064)	PID Output	Shows the PID control output as a percentage of the maximum output frequency. Unit: 0.01%	10 V: Maximum frequency (-10 V to +10 V)	-
U5-04 (0065)	PID Setpoint	Shows the PID setpoint. Parameter *b5-20 [PID Unit Selection]* sets the display units. Unit: 0.01%	10 V: Maximum frequency (-10 V to +10 V)	-
U5-05 (07D2)	PID Diff.Feedbk	Shows the PID differential feedback value as a percentage of the maximum output frequency. This monitor is available after setting *H3-02, H3-10, or H3-06 = 11 [MFAI Function Select = Diff PIDFbk]*. Unit: 0.01%	10 V: Maximum frequency (-10 V to +10 V)	-
U5-06 (07D3)	PID AdjustFeedback	Shows the difference from calculating *U5-05 - U5-01 [PID Diff.Feedbk] - [PID Feedback]*. Unit: 0.01% **Note:** *U5-01 = U5-06* when *H3-02, H3-10, or H3-06 ≠ 11 [MFAI Function Select = Diff PIDFbk]*.	10 V: Maximum frequency (-10 V to +10 V)	-
U5-21 (0872) Expert	Energy Save Ki Coeff	Shows the energy-saving coefficient Ki value for PM. Unit: 0.01	No signal output available	-
U5-22 (0873) Expert	Energy Save Kt Coeff	Shows the energy-saving coefficient Kt value for PM. Unit: 0.01	No signal output available	-
U5-99 (1599)	PID Setpoint Command	Shows the PID setpoint command. Parameter *b5-20 [PID Unit Selection]* sets display units. Unit: 0.01%	10 V: Maximum frequency (-10 V to +10 V)	-

◆ U6: ADVANCED

No. (Hex.)	Name	Description	MFAO Signal Level	Ref.
U6-01 (0051)	Iq Sec Current	Shows the value calculated for the motor secondary current as a percentage of the motor rated secondary current. (q axis) Unit: 0.1%	10 V: Motor secondary rated current (-10 V to +10 V)	-
U6-02 (0052)	Id ExcCurrent	Shows the value calculated for the motor excitation current as a percentage of the motor rated secondary current. (d axis) Unit: 0.1%	10 V: Motor secondary rated current (-10 V to +10 V)	-
U6-03 (0054)	ASR Input	Shows the ASR input value as a percentage of the maximum frequency. Unit: 0.01%	10 V: Maximum frequency (-10 V to +10 V)	-
U6-04 (0055)	ASR Output	Shows the ASR output value as a percentage of the motor rated secondary current. Unit: 0.01%	10 V: Motor secondary rated current (-10 V to +10 V)	-
U6-05 (0059)	Vq OutputVoltRef	Shows the drive internal voltage reference for motor secondary current control. (q axis) Unit: 0.1 V	400 V class: 10 V = 400 Vrms (-10 V to +10 V)	-
U6-06 (005A)	Vd OutputVoltRef	Shows the drive internal voltage reference for motor excitation current control. (d axis) Unit: 0.1 V	400 V class: 10 V = 400 Vrms (-10 V to +10 V)	-

No. (Hex.)	Name	Description	MFAO Signal Level	Ref.
U6-07 (005F) Expert	q-Axis ACR Output	Shows the output value for current control related to motor secondary current. (q axis) Unit: 0.1%	400 V class: 10 V = 400 Vrms (-10 V to +10 V)	-
U6-08 (0060) Expert	d-Axis ACR Output	Shows the output value for current control related to motor excitation current. (d axis) Unit: 0.1%	400 V class: 10 V = 400 Vrms (-10 V to +10 V)	-
U6-09 (07C0) Expert	AdvPhase Compen	Displays the data on forward phase compensation for the calculation results of the amount of control axis deviation. Unit: 1 °	10 V: 180° (-10 V to +10 V)	-
U6-10 (07C1) Expert	ContAxisDeviation	Shows the deviation between the γδ-Axis used for motor control and the dq-Axis. Unit: 0.1 °	10 V: 180° (-10 V to +10 V)	-
U6-13 (07CA) Expert	MagPolePos (Enc)	Shows the value of the flux position detection. Unit: 0.1 °	10 V: 180° (-10 V to +10 V)	-
U6-14 (07CB) Expert	MagPolePos (Obs)	Shows the value of the flux position estimation. Unit: 0.1 °	10 V: 180 ° (-10 V to +10 V)	-
U6-17 (07D1) Expert	Energy Save Coeff	Shows the total time of direction of motor rotation detections for Speed Estimation Speed Searches. This value adjusts *b3-26 [Dir. Determ. Level]*. **Note:** Upper limit is +32767 and lower limit is -32767.	No signal output available	-
U6-18 (07CD)	SpdDetectPG1 Counter	Shows the number of pulses for speed detection (PG1). Unit: 1 pulse	10 V: 65536	-
U6-19 (07E5)	SpdDetectPG2 Counter	Shows the number of pulses for speed detection (PG2). Unit: 1 pulse	10 V: 65536	-
U6-20 (07D4)	FRef Bias (UpDw2)	Shows the bias value used to adjust the frequency reference. Unit: 0.1%	10 V: Maximum Frequency	-
U6-21 (07D5)	Offset Frequency	Shows the total value of *d7-01 to d7-03 [Offset Frq 1 to Offset Frq 3]* selected with *Add Offset Frequency 1 to 3 [H1-xx = E to 10]*. Unit: 0.1%	10 V: Maximum Frequency	-
U6-22 (0062)	Pulse Move@Zero Servo	Shows the distance that the rotor moved from its last position when Zero Servo is available. The value shown in this monitor = 4 X [No. of PG pulses]. Unit: 1 pulse	10 V: Number of pulses per revolution (-10 V to +10 V)	-
U6-25 (006B) Expert	ASR Output Level	Shows the primary delay filter input value of the ASR (speed control loop). Unit: 0.01%	10 V: Motor secondary rated current (-10 V to +10 V)	-
U6-26 (006C) Expert	Feed Fwd Cont Output	Shows the Feed Forward control output. Unit: 0.01%	10 V: Motor secondary rated current (-10 V to +10 V)	-
U6-27 (006D) Expert	FF Estimate SPD	Shows the feed forward estimated speed. Unit: 0.01%	10 V = Maximum frequency (-10 V to +10 V)	-
U6-31 (007B)	Trq Detect Monitor	Monitors the torque reference or the output current after applying the filter set to *L6-07 [Trq Detect Filter Time]*. Unit: 0.1%	10 V:100%	-
U6-36 (0720) Expert	Comm Err n-Host	Shows the number of inter-CPU communication errors. De-energizing the drive sets this number to 0.	No signal output available	-
U6-37 (0721) Expert	Comm Err n-Sensor	Shows the number of inter-CPU communication errors. De-energizing the drive sets this number to 0.	No signal output available	-
U6-48 (072E) Expert	ASIC Comm Errors	Counts the number of inter-ASIC communication errors detected by the ASIC. This count is reset to 0 when the power to the drive is turned off.	No signal output available	-
U6-57 (07C4)	PoleDis IdDifVal	Shows the change from the integrated current when finding the polarity. Unit: 1 **Note:** If the change from the integrated current is less than 819, increase *n8-84 [Polarity Det Current]*. *U6-57 = 8192* is equivalent to the motor rated current.	No signal output available	-

No. (Hex.)	Name	Description	MFAO Signal Level	Ref.
U6-80 to U6-83 (07B0 to 07B3)	OPT IP ADR1 to 4	Shows the currently available local IP Address. • *U6-80*: 1st octet • *U6-81*: 2nd octet • *U6-82*: 3rd octet • *U6-83*: 4th octet	No signal output available	-
U6-84 to U6-87 (07B4 to 07B7)	Online Subnet 1 to 4	Shows the currently available subnet mask. • *U6-84*: 1st octet • *U6-85*: 2nd octet • *U6-86*: 3rd octet • *U6-87*: 4th octet	No signal output available	-
U6-88 to U6-91 (07B8, 07B9, 07F0, 07F1)	Online Gateway 1 to 4	Shows the currently available gateway address. • *U6-88*: 1st octet • *U6-89*: 2nd octet • *U6-90*: 3rd octet • *U6-91*: 4th octet	No signal output available	-
U6-92 (07F2)	Online Speed	Shows the currently available communications speed. 10: 10 Mbps 100: 100 Mbps	No signal output available	-
U6-93 (07F3)	Online Duplex	Shows the currently available Duplex setting.	No signal output available	-
U6-98 (07F8)	First Fault	Shows the contents of the most recent communication options fault (DeviceNet, Modbus TCP/IP, EtherNet/IP).	No signal output available	-
U6-99 (07F9)	Current Fault	Shows the contents of current fault from communication options (DeviceNet, Modbus TCP/IP, EtherNet/IP).	No signal output available	-

◆ U8: Q2PACK MONITORS

No. (Hex.)	Name	Description	MFAO Signal Level	Ref.
U8-01 to U8-10 (1950 - 1959)	Q2pack Mon 1 to 10	Shows Q2pack Monitors 1 to 10. Unit: 0.01%	10 V = 100%	-
U8-11 to U8-13 (195A - 195C)	Q2pack Ver 1 to 3	Shows Q2pack Versions 1 to 3.	No signal output available	-
U8-18 (1961)	Q2pack Base Platform	Shows the Q2pack platform version.	No signal output available	-
U8-21 to U8-25 (1964 - 1968)	Q2pack Mon 21 to 25	Shows Q2pack User Monitors 21 to 25. 0.01%	10 V = 100%	-
U8-31 to U8-40 (196E - 1977)	Q2pack Mon 31 to 40	Shows Q2pack User Monitors 31 to 40. 0.01%	10 V = 100%	-
U8-51 to U8-55 (1982 - 1986)	Q2pack Mon 51 to 55	Shows Q2pack User Monitors 51 to 55. 0.01%	10 V = 100%	-

11.16 A1-02 [Control Method] Dependent Parameters

The values for the parameters in these tables depend on the values for parameter *A1-02 [Control Method]*. Changing the setting for *A1-02 [Control Method]* will change the default settings.

◆ Induction Motor Control Methods

Parameter	Setting Range	Unit	Control Method				
			V/f Control (0)	PG V/f Control (1)	OLVector (2)	CLVector (3)	Adv OLVector (4)
b2-01 ZSpd/DCI Threshold	0.0 - 10.0	0.1 Hz	0.5	0.5	0.5	0.5	0.5
b2-04 DCInj Time@Stop	0.00 - 10.00	0.01 s	0.50	0.50	0.50	0.50	0.50
b3-01 SpSrch@Start Selection	0 - 1	1	0	1	0	1	0
b3-14 Speed Bi-Directional Search	0 - 1	1	1	0	1	1	1
b5-15 Sleep Start Level	0.0 - 400.0	0.1 Hz	0.0	0.0	0.0	0.0	0.0
b6-01 Dwell Ref.@Start	0.0 - 400.0	0.1 Hz	0.0	0.0	0.0	0.0	0.0
b6-03 Dwell Ref@Stop	0.0 - 400.0	0.1 Hz	0.0	0.0	0.0	0.0	0.0
b8-02 eSave Ctrl Gain	0.0 - 10.0	0.1	-	-	0.7	1.0	1.0
b8-03 eSave Filter Time	0.00 - 10.00	0.01 s	-	-	0.50 *1	0.01 *1	0.01 *1
C1-11 Ac/Dec Switch Frequency	0.0 - 400.0	0.1 Hz	0.0	0.0	0.0	0.0	0.0
C2-01 Jerk@Start of Accel	0.00 - 10.00	0.01 s	0.20	0.20	0.20	0.20	0.20
C3-01 Slip Comp Gain	0.0 - 2.5	0.1	0.0	-	1.0	1.0	0.1
C3-02 Slip Comp Delay Time	0 - 10000	1 ms	2000	-	200	-	-
C4-01 Trq Comp Gain	0.00 - 2.50	0.01	1.00	1.00	1.00	-	-
C4-02 Trq Comp Delay Time	0 - 10000	1 ms	200 *2	200 *2	20	-	-
C5-01 ASR PGain 1	0.00 - 300.00	0.01	-	0.20	-	20.00	10.00
C5-02 ASR ITime 1	0.000 - 60.000	0.001 s	-	0.200	-	0.500	0.500
C5-03 ASR PGain 2	0.00 - 300.00	0.01	-	0.02	-	20.00	10.00
C5-04 ASR ITime 2	0.000 - 10.000	0.001 s	-	0.050	-	0.500	0.500
C5-06 ASR Delay Time	0.000 - 0.500	0.001 s	-	-	-	0.004	0.004
C5-07 ASR Gain Switch Frequency	0.0 - 400.0	0.1 Hz	0.0	0.0	0.0	0.0	0.0
C6-02 Carrier Frequency Selection	1 - F	1	1 *3	1 *3	1 *3	1	1
d3-01 Jump Frequency 1	0.0 - 400.0	0.1 Hz	0.0	0.0	0.0	0.0	0.0
d3-02 Jump Frequency 2	0.0 - 400.0	0.1 Hz	0.0	0.0	0.0	0.0	0.0
d3-03 Jump Frequency 3	0.0 - 400.0	0.1 Hz	0.0	0.0	0.0	0.0	0.0
d3-04 Jump Frequency Width	0.0 - 20.0	0.1 Hz	1.0	1.0	1.0	1.0	1.0
d5-02 Torque Ref Delay Time	0 - 1000	1 ms	-	-	-	0	0
E1-04 Max Output Frequency	40.0 - 400.0 *3 *4	0.1 Hz	60.0 *5	60.0 *5	60.0	60.0	60.0
E1-05 Max Output Voltage	0.0 - 255.0 *6	0.1 V	200.0 *5	200.0 *5	200.0	200.0	200.0
E1-06 Base Frequency	0.0 - 400.0 *4	0.1 Hz	60.0 *5	60.0 *5	60.0	60.0	60.0
E1-07 Mid A Frequency	0.0 - 400.0 *4	0.1 Hz	3.0 *5	3.0 *5	3.0	0.0	3.0
E1-08 Mid A Voltage	0.0 - 255.0 *6	0.1 V	15.0 *5	15.0 *5	11.0	0.0	10.0
E1-09 Min Output Frequency	0.0 - 400.0 *4	0.1 Hz	1.5 *5	1.5 *5	0.5	0.0	0.6
E1-10 Min Output Voltage	0.0 - 255.0 *6	0.1 V	9.0 *5	9.0 *5	2.0	0.0	2.0
F1-01 Enc1 Pulse Count (PPR)	0 - 60000	1 ppr	600	600	600	600	600
F1-05 Enc1 Rotat Selection	0 - 1	1	0	0	0	0	0
F1-09 Overspeed Delay Time	0.0 - 2.0	0.1 s	-	1.0	-	0.0	0.1
H4-20 An.Pwr Mon 100% Level	0.00 - 650.00	0.01	Default value of E2-11	Default value of E2-11	Determined by E2-11	Determined by E2-11	Determined by E2-11

Parameter List

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Parameter	Setting Range	Unit	Control Method				
			V/f Control (0)	PG V/f Control (1)	OLVector (2)	CLVector (3)	Adv OLVector (4)
L1-01 Motor Cool Type for OL1 Calc	0 - 4	1	1	1	1	1	1
L3-05 StallP@RUN Enable	0 - 3	1	1	1	-	-	-
L3-20 DCBus VoltAdj Gain	0.00 - 5.00	0.01	1.00	1.00	0.30	0.30	0.30
L3-21 OVSup Acc/Dec Gain	0.10 - 10.00	0.01	1.00	1.00	1.00	1.00	1.00
L3-36 VibSup Gain@Accel	0.0 - 100.0	0.1	10.0	10.0	20.0	-	-
L4-01 SpAgree Det.Level	0.0 - 400.0 *7	0.1	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz
L4-02 SpAgree Det.Width	0.0 - 20.0	0.1	2.0 Hz	2.0 Hz	2.0 Hz	2.0 Hz	2.0 Hz
L4-03 SpAgree Det.Level(+/-)	-400.0 - +400.0 *8	0.1	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz
L4-04 SpAgree Det.Width(+/-)	0.0 - 20.0	0.1	2.0 Hz	2.0 Hz	2.0 Hz	2.0 Hz	2.0 Hz
L8-38 Carrier Reduction Mode	0 - 2	1	*3	*3	*3	*3	*3
L8-40 Carrier Red Off-Delay Time	0.00 - 2.00	0.01 s	0.50	0.50	0.50	0.50	0.50
n1-15 PWM VOffset Calibration	0 - 2	1	1	1	1	1	2
o1-03 FrqDisplay Unit Selection	0 - 3	1	0	0	0	0	0
o1-04 V/f Pattern Unit for Display	0 - 1	1	-	-	-	0	0

*1 Drive models and 4103 to 4675 use these default settings when *C6-01 = 1 [ND/HD Duty Selection = ND Rating]*. Drive models 4140 to 4675 use these default settings when *C6-01 = 0 [ND/HD Duty Selection = HD Rating]*.

- *A1-02 = 2 [Control Method = OLVector]* : 2.00
- *A1-02 = 3, 4 [Control Method = CLVector, Adv OLVector]* : 0.05

*2 The default setting is 1000 ms for drive models 4103 to 4675.
*3 The default setting varies depending on the setting of *C6-01 [ND/HD Duty Selection]*.
*4 The setting range varies depending on the setting of *E5-03 [PM Mot Rated Current (FLA)]* when *A1-02 = 5 [Control Method = PM OLVector]*.
*5 The default setting varies depending on drive model and *E1-03 [V/f Pattern Selection]* settings.
*6 This is the value for 200 V class drives. Double the value for 400 V class drives.
*7 The maximum value within the setting range is 100.0 when *A1-02 = 5 or 7 [Control Method = PM OLVector or PM CLVector]*.
*8 The setting range is -100.0 to 100.0 when *A1-02 = 5 or 7 [Control Method = PM OLVector or PM CLVector]*.

◆ Control Method for PM Motors and Simple Vector Control

No.	Setting Range	Unit	Control Method			
			PM OLVector (5)	PM AOLVector (6)	PM CLVector (7)	EZ Vector (8)
b2-01 ZSpd/DCI Threshold	0.0 - 10.0	0.1	0.5 Hz	1.0%	0.5%	1.0%
b2-04 DCInj Time@Stop	0.00 - 10.00	0.01 s	0.00	0.00	0.00	0.00
b3-01 SpSrch@Start Selection	0 - 1	1	0	0	1	0
b3-14 Speed Bi-Directional Search	0 - 1	1	1	1	1	1
b5-15 Sleep Start Level	0.0 - 400.0 *1	0.1	0.0 Hz	0.0 %	0.0 %	0.0 %
b6-01 Dwell Ref.@Start	0.0 - 400.0 *1	0.1	0.0 Hz	0.0 %	0.0 %	0.0 %
b6-03 Dwell Ref@Stop	0.0 - 400.0 *1	0.1	0.0 Hz	0.0 %	0.0 %	0.0 %
b8-02 eSave Ctrl Gain	0.0 - 10.0	0.1	-	-	-	-
b8-03 eSave Filter Time	0.00 - 10.00	0.01 s	-	-	-	-
C1-11 Ac/Dec Switch Frequency	0.0 - 400.0 *1	0.1	0.0 Hz	0.0 %	0.0 %	0.0 %
C2-01 Jerk@Start of Accel	0.00 - 10.00	0.01 s	1.00	0.20	0.20	1.00
C3-01 Slip Comp Gain	0.0 - 2.5	0.1	-	-	-	Determined by E9-01
C3-02 Slip Comp Delay Time	0 - 10000	1 ms	-	-	-	200
C4-01 Trq Comp Gain	0.00 - 2.50	0.01	0.00	-	-	0.00
C4-02 Trq Comp Delay Time	0 - 10000	1 ms	100	-	-	100
C5-01 ASR PGain 1	0.00 - 300.00	0.01	10.00	10.00	20.00	10.00

No.	Setting Range	Unit	Control Method			
			PM OLVector (5)	PM AOLVector (6)	PM CLVector (7)	EZ Vector (8)
C5-02 ASR ITime 1	0.000 - 60.000	0.001 s	0.500	0.500	0.500	0.500
C5-03 ASR PGain 2	0.00 - 300.00	0.01	-	10.00	20.00	10.00
C5-04 ASR ITime 2	0.000 - 10.000	0.001 s	-	0.500	0.500	0.500
C5-06 ASR Delay Time	0.000 - 0.500	0.001 s	-	0.016	0.004	0.004
C5-07 ASR Gain Switch Frequency	0.0 - 400.0 *1	0.1	0.0 Hz	0.0 %	0.0 %	0.0 %
C6-02 Carrier Frequency Selection	1 - F	1	2	2	2	2
d3-01 Jump Frequency 1	0.0 - 400.0 *1	0.1	0.0 Hz	0.0 %	0.0 %	0.0 %
d3-02 Jump Frequency 2	0.0 - 400.0 *1	0.1	0.0 Hz	0.0 %	0.0 %	0.0 %
d3-03 Jump Frequency 3	0.0 - 400.0 *1	0.1	0.0 Hz	0.0 %	0.0 %	0.0 %
d3-04 Jump Frequency Width	0.0 - 20.0 *2	0.1	1.0 Hz	1.0 %	1.0 %	1.0 %
d5-02 Torque Ref Delay Time	0 - 1000	1 ms	-	-	0	-
E1-04 Max Output Frequency	40.0 - 400.0 *3	0.1 Hz	Determined by E5-01	Determined by E5-01	Determined by E5-01	-
E1-05 Max Output Voltage	0.0 - 255.0 *4	0.1 V	Determined by E5-01	Determined by E5-01	Determined by E5-01	-
E1-06 Base Frequency	0.0 - 400.0	0.1 Hz	Determined by E5-01	Determined by E5-01	Determined by E5-01	-
E1-07 Mid A Frequency	0.0 - 400.0	0.1 Hz	-	-	-	-
E1-08 Mid A Voltage	0.0 - 255.0 *4	0.1 V	-	-	-	-
E1-09 Min Output Frequency	0.0 - 400.0	0.1 Hz	Determined by E5-01	Determined by E5-01	0.0	-
E1-10 Min Output Voltage	0.0 - 255.0 *4	0.1 V	-	-	-	-
F1-01 Enc1 Pulse Count (PPR)	0 - 60000	1 ppr	1024	1024	1024	600
F1-05 Enc1 Rotat Selection	0 - 1	1	1	1	1	0
F1-09 Overspeed Delay Time	0.0 - 2.0	0.1 s	-	-	0.0	-
H4-20 An.Pwr Mon 100% Level	0.00 - 650.00	0.01	Determined by E5-01	Determined by E5-01	Determined by E5-01	Determined by E9-07
L1-01 Motor Cool Type for OL1 Calc	0 - 4	1	4	4	5	Determined by E9-01
L3-05 StallP@RUN Enable	0 - 3	1	1	-	-	3
L3-20 DCBus VoltAdj Gain	0.00 - 5.00	0.01	0.65	0.65	0.65	0.65
L3-21 OVSup Acc/Dec Gain	0.10 - 10.00	0.01	1.00	1.00	1.00	1.00
L3-36 VibSup Gain@Accel	0.0 - 100.0	0.1	-	-	-	-
L4-01 SpAgree Det.Level	0.0 - 400.0 *1	0.1	0.0 Hz	0.0 %	0.0 %	0.0 %
L4-02 SpAgree Det.Width	0.0 - 20.0 *2	0.1	2.0 Hz	4.0%	4.0%	4.0%
L4-03 SpAgree Det.Level(+/-)	-400.0 - +400.0 *5	0.1	0.0 Hz	0.0 %	0.0 %	0.0 %
L4-04 SpAgree Det.Width(+/-)	0.0 - 20.0 *2	0.1	2.0 Hz	4.0%	4.0%	4.0%
L8-38 Carrier Reduction Mode	0 - 2	1	0	0	0	0
L8-40 Carrier Red Off-Delay Time	0.00 - 2.00	0.01 s	0.00	0.00	0.00	0.00
n1-15 PWM VOffset Calibration	0 - 2	1	1	1	1	1
o1-03 FrqDisplay Unit Selection	0 - 3	1	0	1	1	1
o1-04 V/f Pattern Unit for Display	0 - 1	1	-	1	1	-

*1 The setting range is 0.0 to 100.0 when *A1-02 = 6 or 7 [Control Method = PM AOLVector or PM CLVector]*.
*2 The setting range is 0.0 to 40.0 when *A1-02 = 6 or 7 [Control Method = PM AOLVector or PM CLVector]*.
*3 The default setting varies depending on the setting of *ND/HD Duty Selection*.
*4 This is the value for 200 V class drives. Double the value for 400 V class drives.
*5 The setting range is -100.0 to +100.0 when *A1-02 = 6 or 7 [Control Method = PM AOLVector or PM CLVector]*.

11.17 E1-03 [V/f Pattern Selection] Dependent Parameters

The values for the parameters in these tables depend on the values for parameter *A1-02 [Control Method]* and *E1-03 [V/f Pattern Selection]*. Changing the settings for *A1-02 [Control Method]* and *E1-03 [V/f Pattern Selection]* will change the default settings.

Table 11.1 Parameters Changed by E1-03 (4002 to 4012)

No.	Unit	Setting of E1-03 [V/f Pattern Selection]																Setting of A1-02 [Control Method]				
		0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F *1	OLVector (2)	CLVector (3)	PM OLVector (5)	PM AOL Vector (6)	PM CLVector (7)
E1-04	Hz	50.0	60.0	60.0	72.0	50.0	50.0	60.0	60.0	50.0	50.0	60.0	60.0	90.0	120.0	180.0	50.0	50.0	50.0	*2	*2	*2
E1-05 *3	V	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	*2	*2	*2
E1-06	Hz	50.0	60.0	50.0	60.0	50.0	50.0	60.0	60.0	50.0	50.0	60.0	60.0	60.0	60.0	60.0	50.0	50.0	50.0	*2	*2	*2
E1-07	Hz	2.5	3.0	3.0	3.0	25.0	25.0	30.0	30.0	2.5	2.5	3.0	3.0	3.0	3.0	3.0	2.5	3.0	0.0	-	-	-
E1-08 *3	V	15.0	15.0	15.0	15.0	35.0	50.0	35.0	50.0	19.0	24.0	19.0	24.0	15.0	15.0	15.0	15.0	14.4	0.0	-	-	-
E1-09	Hz	1.3	1.5	1.5	1.5	1.3	1.3	1.5	1.5	1.3	1.3	1.5	1.5	1.5	1.5	1.5	1.3	0.5	0.0	*2	*2	0.0
E1-10 *3	V	9.0	9.0	9.0	9.0	8.0	9.0	8.0	9.0	11.0	13.0	11.0	15.0	9.0	9.0	9.0	9.0	3.0	0.0	-	-	-

*1 These values are the default settings for *E1-04 [Max Output Frequency] through E1-10 [Min Output Voltage]* and *E3-04 [M2 Max Out Frequency] through E3-10 [M2 Min Out Voltage]*. These settings are the same as those for the V/f pattern when *E1-03 = 1 [V/f Pattern Selection = CT_60-60Hzmax]*.
*2 The default setting varies depending on the setting of *E5-01 [PM Mot Code Selection]*.
*3 This is the value for 200 V class drives. Double the value for 400 V class drives.

Table 11.2 Parameters Changed by E1-03 (4018 to 4103)

No.	Unit	Setting of E1-03 [V/f Pattern Selection]																Setting of A1-02 [Control Method]				
		0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F *1	OLVector (2)	CLVector (3)	PM OLVector (5)	PM AOL Vector (6)	PM CLVector (7)
E1-04	Hz	50.0	60.0	60.0	72.0	50.0	50.0	60.0	60.0	50.0	50.0	60.0	60.0	90.0	120.0	180.0	50.0	50.0	50.0	*2	*2	*2
E1-05 *3	V	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	*2	*2	*2
E1-06	Hz	50.0	60.0	50.0	60.0	50.0	50.0	60.0	60.0	50.0	50.0	60.0	60.0	60.0	60.0	60.0	50.0	50.0	50.0	*2	*2	*2
E1-07	Hz	2.5	3.0	3.0	3.0	25.0	25.0	30.0	30.0	2.5	2.5	3.0	3.0	3.0	3.0	3.0	2.5	3.0	0.0	-	-	-
E1-08 *3	V	14.0	14.0	14.0	14.0	35.0	50.0	35.0	50.0	18.0	23.0	18.0	23.0	14.0	14.0	14.0	14.0	13.2	0.0	-	-	-
E1-09	Hz	1.3	1.5	1.5	1.5	1.3	1.3	1.5	1.5	1.3	1.3	1.5	1.5	1.5	1.5	1.5	1.3	0.5	0.0	*2	*2	0.0
E1-10 *3	V	7.0	7.0	7.0	7.0	6.0	7.0	6.0	7.0	9.0	11.0	9.0	13.0	7.0	7.0	7.0	7.0	2.4	0.0	-	-	-

*1 These values are the default settings for *E1-04 [Max Output Frequency] through E1-10 [Min Output Voltage]* and *E3-04 [M2 Max Out Frequency] through E3-10 [M2 Min Out Voltage]*. These settings are the same as those for the V/f pattern when *E1-03 = 1 [V/f Pattern Selection = CT_60-60Hzmax]*.
*2 The default setting varies depending on the setting of *E5-01 [PM Mot Code Selection]*.
*3 This is the value for 200 V class drives. Double the value for 400 V class drives.

Table 11.3 Parameters Changed by E1-03 (4140 to 4675)

No.	Unit	Setting of E1-03 [V/f Pattern Selection]																Setting of A1-02 [Control Method]				
		0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F *1	OLVector (2)	CLVector (3)	PM OLVector (5)	PM AOLVector (6)	PM CLVector (7)
E1-04	Hz	50.0	60.0	60.0	72.0	50.0	50.0	60.0	60.0	50.0	50.0	60.0	60.0	90.0	120.0	180.0	50.0	50.0	50.0	*2	*2	*2
E1-05 *3	V	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	*2	*2	*2
E1-06	Hz	50.0	60.0	50.0	60.0	50.0	50.0	60.0	60.0	50.0	50.0	60.0	60.0	60.0	60.0	60.0	50.0	50.0	50.0	*2	*2	*2
E1-07	Hz	2.5	3.0	3.0	3.0	25.0	25.0	30.0	30.0	2.5	2.5	3.0	3.0	3.0	3.0	3.0	2.5	3.0	0.0	-	-	-
E1-08 *3	V	12.0	12.0	12.0	12.0	35.0	50.0	35.0	50.0	15.0	20.0	15.0	20.0	12.0	12.0	12.0	12.0	13.2	0.0	-	-	-
E1-09	Hz	1.3	1.5	1.5	1.5	1.3	1.3	1.5	1.5	1.3	1.3	1.5	1.5	1.5	1.5	1.5	1.3	0.5	0.0	*2	*2	0.0
E1-10 *3	V	6.0	6.0	6.0	6.0	5.0	6.0	5.0	6.0	7.0	9.0	7.0	11.0	6.0	6.0	6.0	6.0	2.4	0.0	-	-	-

*1 These values are the default settings for *E1-04 [Max Output Frequency] through E1-10 [Min Output Voltage]* and *E3-04 [M2 Max Out Frequency] through E3-10 [M2 Min Out Voltage]*. These settings are the same as those for the V/f pattern when *E1-03 = 1 [V/f Pattern Selection = CT_60-60Hzmax]*.

*2 The default setting varies depending on the setting of *E5-01 [PM Mot Code Selection]*.

*3 This is the value for 200 V class drives. Double the value for 400 V class drives.

11.18 E3-01 [M2 Control Method Selection] Dependent Parameters

The values for the parameters in these tables depend on the values for parameter *E3-01 [M2 Control Method Selection]*. Changing the setting for *E3-01 [M2 Control Method Selection]* will change the default settings.

Parameter	Setting Range	Unit	Motor 2 Control Method (setting value of E3-01)			
			V/f Control (0)	PG V/f Control (1)	OLVector (2)	CLVector (3)
C3-21 M2 Slip Comp Gain	0.0 to 2.50	0.1	0.0	-	1.0	1.0
C3-22 M2 Slip Comp DelayTime	0 to 10000	1 ms	2000	-	200	-
C5-22 M2 ASR PGain 1	0.00 to 300.00	0.01	-	0.20	-	20.00
C5-22 M2 ASR ITime 1	0.000 to 10.000	0.001 s	-	0.200	-	0.500
C5-23 M2 ASR PGain 2	0.00 to 300.00	0.01	-	0.02	-	20.00
C5-24 M2 ASR ITime 2	0.000 to 10.000	0.001 s	-	0.050	-	0.500
C5-26 M2 ASR Delay Time	0.000 to 0.500	0.001 s	-	-	-	0.004
E3-04 M2 Max Out Frequency	40.0 to 590.0	0.1 Hz	60.0	60.0	60.0	60.0
E3-05 M2 Max Out Voltage	0.0 to 255.0 *1	0.1 V	200.0	200.0	200.0	200.0
E3-06 M2 Base Frequency	0.0 to 590.0	0.1 Hz	60.0	60.0	60.0	60.0
E3-07 M2 Mid A Frequency	0.0 to 590.0	0.1 Hz	3.0	3.0	3.0	0.0
E3-08 M2 Mid A Voltage	0.0 to 255.0 *1	0.1 V	15.0	15.0	11.0	0.0
E3-09 M2 Min Out Frequency	0.0 to 590.0	0.1 Hz	1.5	1.5	0.5	0.0
E3-10 M2 Min Out Voltage	0.0 to 255.0 *1	0.1 V	9.0	9.0	2.0	0.0
E3-11 M2 Mid B Frequency	0.0 to 590.0	Determined by o1-04	0.0	0.0	0.0	0.0
E3-12 M2 Min Out Voltage	0.0 to 255.0 *1	0.1 V	0.0	0.0	0.0	0.0
E3-13 M2 Base Voltage	0.0 to 255.0 *1	0.1 V	0.0	0.0	0.0	0.0

*1 This is the value for 200 V class drives. Double the value for 400 V class drives.

11.19 Defaults by Drive Model and Duty Rating ND/HD

The values for the parameters in these tables depend on the values for parameters *o2-04 [Drive KVA Selection]* and *C6-01 [ND/HD Duty Selection]*. Changing the settings for *o2-04* and *C6-01* will change the default settings.

◆ 400 V Class

Parameters within parentheses are for motor 2.

Parameter	Unit	Drive Model							
		4002		4004		4005		4007	
C6-01 ND/HD Duty Selection	-	HD	ND	HD	ND	HD	ND	HD	ND
		0	1	0	1	0	1	0	1
E2-11 Motor Rated Power (kW) (E4-11 M2 Rated Power (kW))	**kW**	**0.4**	**0.75**	**1.1**	**1.5**	**1.5**	**2.2**	**2.2**	**3.0**
b3-04 SpSrch V/F Gain	%	100	100	100	100	100	100	100	100
b3-06 Speed Curr Lev1 for Estimation	-	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
b3-08 Speed ACR PGain for Estimation	-	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
b3-26 Dir. Determ. Level	-	1000	1000	1000	1000	1000	1000	1000	1000
b8-03 eSave Filter Time	s	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
b8-04 eSave Coef. Value	-	576.4	447.4	447.4	338.8	338.8	313.6	313.6	265.7
C5-17 Motor Inertia (C5-37 M2 Inertia)	kgm^2	0.0015	0.0028	0.0028	0.0068	0.0068	0.0088	0.0088	0.0158
C6-02 Carrier Frequency Selection	-	1	7	1	7	1	7	1	7
E2-01 Mot Rated Current (FLA) (E4-01 M2 Rated Current (FLA))	A	1	1.6	1.6	3.1	3.1	4.2	4.2	5.7
E2-02 Mot Rated Slip (E4-02 M2 Rated Slip)	Hz	2.9	2.6	2.6	2.5	2.5	3	3	2.7
E2-03 Mot No-Load Current (E4-03 M2 No-Load Current)	A	0.6	0.8	0.8	1.4	1.4	1.5	1.5	1.9
E2-05 Motor L-L Resistance (E4-05 M2 L-L Resistance)	Ω	38.198	22.459	22.459	10.1	10.1	6.495	6.495	4.360
E2-06 Motor Leak Inductance (E4-06 M2 Leak Inductance)	%	18.2	14.3	14.3	18.3	18.3	18.7	18.7	19
E2-10 Motor Iron Loss (E4-10 M2 Iron Loss)	W	14	26	26	53	53	77	77	105
E5-01 PM Mot Code Selection	-	1232	1232	1233	1233	1235	1235	1236	1236
L2-02 RideThrough Time@Power Loss	s	0.1	0.1	0.2	0.2	0.3	0.3	0.5	0.5
L2-03 Min Baseblck Time	s	0.2	0.3	0.3	0.4	0.4	0.5	0.5	0.5
L2-04 Powloss Ramp Time@recovery	s	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
L2-05 UV Detection Lvl (Uv1)	-	380	380	380	380	380	380	380	380
L3-24 Acc@Rated Torque	s	0.178	0.142	0.142	0.166	0.166	0.145	0.145	0.145
L8-02 Overheat Alm Level	°C	100	100	105	105	112	112	110	110
L8-09 Ground Fault Selection	-	1	1	1	1	1	1	1	1
L8-38 Carrier Reduction Mode	-	2	2	2	2	2	2	2	2
n1-01 HuntPrev Selection	-	1	1	1	1	1	1	1	1
n1-03 HuntPrev Time Constant	ms	10	10	10	10	10	10	10	10
n1-16 HuntPrev HiFc Gain	-	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
n5-02 Mot Inertia Acceleration Time	s	0.178	0.142	0.142	0.166	0.166	0.145	0.145	0.145
n8-11 Observ.Calc Gain2	-	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0

Parameter	Unit	Drive Model							
		4009		4012		4018		4023	
C6-01 ND/HD Duty Selection	**-**	**HD**	**ND**	**HD**	**ND**	**HD**	**ND**	**HD**	**ND**
		0	**1**	**0**	**1**	**0**	**1**	**0**	**1**
E2-11 Motor Rated Power (kW) (E4-11 M2 Rated Power (kW))	**kW**	**3.0**	**4.0**	**4.0**	**5.5**	**5.5**	**7.5**	**7.5**	**11**
b3-04 SpSrch V/F Gain	%	100	100	100	100	100	100	100	100
b3-06 Speed Curr Lev1 for Estimation	-	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
b3-08 Speed ACR PGain for Estimation	-	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
b3-26 Dir. Determ. Level	-	1000	1000	1000	1000	1000	1000	1000	1000
b8-03 eSave Filter Time	s	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
b8-04 eSave Coef. Value	-	265.7	245.8	245.8	189.5	189.5	145.38	145.38	140.88
C5-17 Motor Inertia (C5-37 M2 Inertia)	kgm^2	0.0158	0.0158	0.0158	0.0255	0.026	0.037	0.037	0.053
C6-02 Carrier Frequency Selection	-	1	7	1	7	1	7	1	7
E2-01 Mot Rated Current (FLA) (E4-01 M2 Rated Current (FLA))	A	5.7	7	7	9.8	9.8	13.3	13.3	19.9
E2-02 Mot Rated Slip (E4-02 M2 Rated Slip)	Hz	2.7	2.7	2.7	1.5	1.5	1.3	1.3	1.7
E2-03 Mot No-Load Current (E4-03 M2 No-Load Current)	A	1.9	2.3	2.3	2.6	2.6	4	4	5.6
E2-05 Motor L-L Resistance (E4-05 M2 L-L Resistance)	Ω	4.360	3.333	3.333	1.595	1.595	1.152	1.152	0.922
E2-06 Motor Leak Inductance (E4-06 M2 Leak Inductance)	%	19	19.3	19.3	18.2	18.2	15.5	15.5	19.6
E2-10 Motor Iron Loss (E4-10 M2 Iron Loss)	W	105	130	130	193	193	263	263	385
E5-01 PM Mot Code Selection	-	FFFF	FFFF	1238	1238	123A	123A	123B	123B
L2-02 RideThrough Time@Power Loss	s	0.5	0.5	0.5	0.5	0.8	0.8	1	1
L2-03 Min Baseblck Time	s	0.5	0.6	0.6	0.7	0.7	0.8	0.8	0.9
L2-04 Powloss Ramp Time@recovery	s	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
L2-05 UV Detection Lvl (Uv1)	-	380	380	380	380	380	380	380	380
L3-24 Acc@Rated Torque	s	0.145	0.154	0.154	0.168	0.168	0.175	0.175	0.265
L8-02 Overheat Alm Level	°C	100	100	100	100	105	105	105	105
L8-09 Ground Fault Selection	-	1	1	1	1	1	1	1	1
L8-38 Carrier Reduction Mode	-	2	2	2	2	2	2	2	2
n1-01 HuntPrev Selection	-	1	1	1	1	1	1	1	1
n1-03 HuntPrev Time Constant	ms	10	10	10	10	10	10	10	10
n1-16 HuntPrev HiFc Gain	-	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
n5-02 Mot Inertia Acceleration Time	s	0.145	0.154	0.154	0.168	0.168	0.175	0.175	0.265
n8-11 Observ.Calc Gain2	-	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0

Parameter	Unit	Drive Model							
		4031		4038		4044		4060	
C6-01 ND/HD Duty Selection	**-**	**HD**	**ND**	**HD**	**ND**	**HD**	**ND**	**HD**	**ND**
		0	**1**	**0**	**1**	**0**	**1**	**0**	**1**
E2-11 Motor Rated Power (kW) (E4-11 M2 Rated Power (kW))	**kW**	**11**	**15**	**15**	**18.5**	**18.5**	**22**	**22**	**30**
b3-04 SpSrch V/F Gain	%	100	100	100	100	100	100	100	100
b3-06 Speed Curr Lev1 for Estimation	-	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
b3-08 Speed ACR PGain for Estimation	-	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
b3-26 Dir. Determ. Level	-	1000	1000	1000	1000	1000	1000	1000	1000

Parameter	Unit	Drive Model							
		4031		4038		4044		4060	
C6-01 ND/HD Duty Selection	-	HD	ND	HD	ND	HD	ND	HD	ND
		0	1	0	1	0	1	0	1
E2-11 Motor Rated Power (kW) (E4-11 M2 Rated Power (kW))	**kW**	**11**	**15**	**15**	**18.5**	**18.5**	**22**	**22**	**30**
b8-03 eSave Filter Time	s	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
b8-04 eSave Coef. Value	-	140.88	126.26	126.26	115.74	115.74	103.58	103.58	92.54
C5-17 Motor Inertia (C5-37 M2 Inertia)	kgm^2	0.053	0.076	0.076	0.138	0.138	0.165	0.165	0.220
C6-02 Carrier Frequency Selection	-	1	7	1	7	1	7	1	7
E2-01 Mot Rated Current (FLA) (E4-01 M2 Rated Current (FLA))	A	19.9	26.5	26.5	32.9	32.9	38.6	38.6	52.3
E2-02 Mot Rated Slip (E4-02 M2 Rated Slip)	Hz	1.7	1.6	1.6	1.67	1.67	1.7	1.7	1.8
E2-03 Mot No-Load Current (E4-03 M2 No-Load Current)	A	5.6	7.6	7.6	7.8	7.8	9.2	9.2	10.9
E2-05 Motor L-L Resistance (E4-05 M2 L-L Resistance)	Ω	0.922	0.55	0.55	0.403	0.403	0.316	0.316	0.269
E2-06 Motor Leak Inductance (E4-06 M2 Leak Inductance)	%	19.6	17.2	17.2	20.1	20.1	23.5	23.5	20.7
E2-10 Motor Iron Loss (E4-10 M2 Iron Loss)	W	385	440	440	508	508	586	586	750
E5-01 PM Mot Code Selection	-	123D	123D	123E	123E	123F	123F	1240	1240
L2-02 RideThrough Time@Power Loss	s	2	2	2	2	2	2	2	2
L2-03 Min Baseblck Time	s	0.9	1	1	1	1	1	1	1.1
L2-04 Powloss Ramp Time@recovery	s	0.3	0.6	0.6	0.6	0.6	0.6	0.6	0.6
L2-05 UV Detection Lvl (Uv1)	-	380	380	380	380	380	380	380	380
L3-24 Acc@Rated Torque	s	0.265	0.244	0.244	0.317	0.317	0.355	0.355	0.323
L8-02 Overheat Alm Level	°C	100	100	120	120	120	120	130	137
L8-09 Ground Fault Selection	-	1	1	1	1	1	1	1	1
L8-38 Carrier Reduction Mode	-	2	2	2	2	2	2	2	2
n1-01 HuntPrev Selection	-	2	2	2	2	2	2	2	2
n1-03 HuntPrev Time Constant	ms	10	10	10	10	10	10	10	10
n1-16 HuntPrev HiFc Gain	-	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
n5-02 Mot Inertia Acceleration Time	s	0.265	0.244	0.244	0.317	0.317	0.355	0.355	0.323
n8-11 Observ.Calc Gain2	-	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0

Parameter	Unit	Drive Model							
		4075		4089		4103		4140	
C6-01 ND/HD Duty Selection	-	HD	ND	HD	ND	HD	ND	HD	ND
		0	1	0	1	0	1	0	1
E2-11 Motor Rated Power (kW) (E4-11 M2 Rated Power (kW))	**kW**	**30**	**37**	**37**	**45**	**45**	**55**	**55**	**75**
b3-04 SpSrch V/F Gain	%	100	100	100	100	100	80	80	80
b3-06 Speed Curr Lev1 for Estimation	-	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.7
b3-08 Speed ACR PGain for Estimation	-	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.8
b3-26 Dir. Determ. Level	-	1000	1000	1000	1000	1000	1000	1000	1000
b8-03 eSave Filter Time	s	0.50	0.50	0.50	0.50	0.50	2.00	2.00	2.00
b8-04 eSave Coef. Value	-	92.54	76.32	76.32	71.56	71.56	67.2	67.2	46.2
C5-17 Motor Inertia (C5-37 M2 Inertia)	kgm^2	0.220	0.273	0.273	0.333	0.333	0.490	0.49	0.90

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Parameter	Unit	Drive Model							
		4075		4089		4103		4140	
C6-01 ND/HD Duty Selection	-	HD	ND	HD	ND	HD	ND	HD	ND
		0	1	0	1	0	1	0	1
E2-11 Motor Rated Power (kW) (E4-11 M2 Rated Power (kW))	**kW**	**30**	**37**	**37**	**45**	**45**	**55**	**55**	**75**
C6-02 Carrier Frequency Selection	-	1	7	1	7	1	7	1	7
E2-01 Mot Rated Current (FLA) (E4-01 M2 Rated Current (FLA))	A	52.3	65.6	65.6	79.7	79.7	95	95	130
E2-02 Mot Rated Slip (E4-02 M2 Rated Slip)	Hz	1.8	1.33	1.33	1.6	1.6	1.46	1.46	1.39
E2-03 Mot No-Load Current (E4-03 M2 No-Load Current)	A	10.9	19.1	19.1	22	22	24	24	36
E2-05 Motor L-L Resistance (E4-05 M2 L-L Resistance)	Ω	0.269	0.155	0.155	0.122	0.122	0.088	0.088	0.092
E2-06 Motor Leak Inductance (E4-06 M2 Leak Inductance)	%	20.7	18.8	18.8	19.9	19.9	20	20	20
E2-10 Motor Iron Loss (E4-10 M2 Iron Loss)	W	750	925	925	1125	1125	1260	1260	1600
E5-01 PM Mot Code Selection	-	1242	1242	1243	1243	1244	1244	1245	1245
L2-02 RideThrough Time@Power Loss	s	2	2	2	2	2	2	2	2
L2-03 Min Baseblck Time	s	1.1	1.1	1.1	1.2	1.2	1.2	1.2	1.3
L2-04 Powloss Ramp Time@recovery	s	0.6	0.6	0.6	0.6	0.6	1	1	1
L2-05 UV Detection Lvl (Uv1)	-	380	380	380	380	380	380	380	380
L3-24 Acc@Rated Torque	s	0.323	0.32	0.32	0.387	0.387	0.317	0.317	0.533
L8-02 Overheat Alm Level	°C	120	120	115	115	126	131	120	120
L8-09 Ground Fault Selection	-	1	1	1	1	1	1	1	1
L8-38 Carrier Reduction Mode	-	2	2	2	2	2	2	2	2
n1-01 HuntPrev Selection	-	2	2	2	2	2	2	2	2
n1-03 HuntPrev Time Constant	ms	10	10	10	10	10	10	30	30
n1-16 HuntPrev HiFc Gain	-	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
n5-02 Mot Inertia Acceleration Time	s	0.323	0.32	0.32	0.387	0.387	0.317	0.317	0.533
n8-11 Observ.Calc Gain2	-	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0

Parameter	Unit	Drive Model							
		4168		4208		4250		4296	
C6-01 ND/HD Duty Selection	-	HD	ND	HD	ND	HD	ND	HD	ND
		0	1	0	1	0	1	0	1
E2-11 Motor Rated Power (kW) (E4-11 M2 Rated Power (kW))	**kW**	**75**	**90**	**90**	**110**	**110**	**132**	**132**	**160**
b3-04 SpSrch V/F Gain	%	60	60	60	60	60	60	60	60
b3-06 Speed Curr Lev1 for Estimation	-	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
b3-08 Speed ACR PGain for Estimation	-	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
b3-26 Dir. Determ. Level	-	1000	1000	1000	1000	1000	1000	1000	1000
b8-03 eSave Filter Time	s	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
b8-04 eSave Coef. Value	-	46.2	38.91	38.91	36.23	36.23	32.79	32.79	30.13
C5-17 Motor Inertia (C5-37 M2 Inertia)	kgm^2	0.90	1.10	1.10	1.90	1.90	2.10	2.10	3.30
C6-02 Carrier Frequency Selection	-	1	7	1	7	1	7	1	7
E2-01 Mot Rated Current (FLA) (E4-01 M2 Rated Current (FLA))	A	130	156	156	190	190	223	223	270

Parameter	Unit	Drive Model							
		4168		4208		4250		4296	
C6-01 ND/HD Duty Selection	-	**HD**	**ND**	**HD**	**ND**	**HD**	**ND**	**HD**	**ND**
		0	**1**	**0**	**1**	**0**	**1**	**0**	**1**
E2-11 Motor Rated Power (kW) (E4-11 M2 Rated Power (kW))	**kW**	**75**	**90**	**90**	**110**	**110**	**132**	**132**	**160**
E2-02 Mot Rated Slip (E4-02 M2 Rated Slip)	Hz	1.39	1.4	1.4	1.4	1.4	1.38	1.38	1.35
E2-03 Mot No-Load Current (E4-03 M2 No-Load Current)	A	36	40	40	49	49	58	58	70
E2-05 Motor L-L Resistance (E4-05 M2 L-L Resistance)	Ω	0.092	0.056	0.056	0.046	0.046	0.035	0.035	0.029
E2-06 Motor Leak Inductance (E4-06 M2 Leak Inductance)	%	20	20	20	20	20	20	20	20
E2-10 Motor Iron Loss (E4-10 M2 Iron Loss)	W	1600	1760	1760	2150	2150	2350	2350	2850
E5-01 PM Mot Code Selection	-	1246	1246	1247	1247	1248	1248	1249	1249
L2-02 RideThrough Time@Power Loss	s	2	2	2	2	2	2	2	2
L2-03 Min Baseblck Time	s	1.3	1.5	1.5	1.7	1.7	1.7	1.7	1.8
L2-04 Powloss Ramp Time@recovery	s	1	1	1	1	1	1	1	1
L2-05 UV Detection Lvl (Uv1)	-	380	380	380	380	380	380	380	380
L3-24 Acc@Rated Torque	s	0.533	0.592	0.592	0.646	0.646	0.673	0.673	0.777
L8-02 Overheat Alm Level	°C	110	110	105	105	120	120	120	120
L8-09 Ground Fault Selection	-	1	1	1	1	1	1	1	1
L8-38 Carrier Reduction Mode	-	2	2	2	2	2	2	2	2
n1-01 HuntPrev Selection	-	2	2	2	2	2	2	2	2
n1-03 HuntPrev Time Constant	ms	30	30	30	30	30	30	30	30
n1-16 HuntPrev HiFc Gain	-	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
n5-02 Mot Inertia Acceleration Time	s	0.533	0.592	0.592	0.646	0.646	0.673	0.673	0.777
n8-11 Observ.Calc Gain2	-	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0

Parameter	Unit	Drive Model							
		4371		4389		4453		4568	
C6-01 ND/HD Duty Selection	-	**HD**	**ND**	**HD**	**ND**	**HD**	**ND**	**HD**	**ND**
		0	**1**	**0**	**1**	**0**	**1**	**0**	**1**
E2-11 Motor Rated Power (kW) (E4-11 M2 Rated Power (kW))	**kW**	**160**	**200**	**200**	**220**	**220**	**250**	**250**	**315**
b3-04 SpSrch V/F Gain	%	60	60	60	60	60	60	60	60
b3-06 Speed Curr Lev1 for Estimation	-	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
b3-08 Speed ACR PGain for Estimation	-	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
b3-26 Dir. Determ. Level	-	1000	1000	1000	1000	1000	1000	1000	1000
b8-03 eSave Filter Time	s	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
b8-04 eSave Coef. Value	-	30.13	30.57	30.57	27.13	27.13	21.76	21.76	21.76
C5-17 Motor Inertia (C5-37 M2 Inertia)	kgm^2	3.30	3.60	3.60	4.10	4.10	6.50	6.50	11.00
C6-02 Carrier Frequency Selection	-	1	7	1	7	1	7	1	7
E2-01 Mot Rated Current (FLA) (E4-01 M2 Rated Current (FLA))	A	270	310	310	370	370	500	500	500
E2-02 Mot Rated Slip (E4-02 M2 Rated Slip)	Hz	1.35	1.3	1.3	1.3	1.3	1.25	1.25	1.25
E2-03 Mot No-Load Current (E4-03 M2 No-Load Current)	A	70	81	81	96	96	130	130	130

Parameter	Unit	Drive Model							
		4371		4389		4453		4568	
C6-01 ND/HD Duty Selection	-	HD	ND	HD	ND	HD	ND	HD	ND
		0	1	0	1	0	1	0	1
E2-11 Motor Rated Power (kW) (E4-11 M2 Rated Power (kW))	kW	160	200	200	220	220	250	250	315
E2-05 Motor L-L Resistance (E4-05 M2 L-L Resistance)	Ω	0.029	0.025	0.025	0.02	0.02	0.014	0.014	0.014
E2-06 Motor Leak Inductance (E4-06 M2 Leak Inductance)	%	20	20	20	20	20	20	20	20
E2-10 Motor Iron Loss (E4-10 M2 Iron Loss)	W	2850	3200	3200	3700	3700	4700	4700	4700
E5-01 PM Mot Code Selection	-	124A	124A	124A	124A	124A	124A	124A	124A
L2-02 RideThrough Time@Power Loss	s	2	2	2	2	2	2	2	2
L2-03 Min Baseblck Time	s	1.8	1.9	1.9	2	2	2.1	2.1	2.1
L2-04 Powloss Ramp Time@recovery	s	1	1	1.8	1.8	1.8	2	2	2
L2-05 UV Detection Lvl (Uv1)	-	380	380	380	380	380	380	380	380
L3-24 Acc@Rated Torque	s	0.777	0.864	0.864	0.91	0.91	1.392	1.392	1.392
L8-02 Overheat Alm Level	°C	130	130	140	140	140	140	140	140
L8-09 Ground Fault Selection	-	1	1	1	1	1	1	1	1
L8-38 Carrier Reduction Mode	-	2	2	2	2	2	2	2	2
n1-01 HuntPrev Selection	-	2	2	2	2	2	2	2	2
n1-03 HuntPrev Time Constant	ms	30	30	100	100	100	100	100	100
n1-16 HuntPrev HiFc Gain	-	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
n5-02 Mot Inertia Acceleration Time	s	0.777	0.864	0.864	0.91	0.91	1.392	1.392	1.392
n8-11 Observ.Calc Gain2	-	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0

Parameter	Unit	Drive Model	
		4675	
C6-01 ND/HD Duty Selection	-	HD	ND
		0	1
E2-11 Motor Rated Power (kW) (E4-11 M2 Rated Power (kW))	kW	315	355
b3-04 SpSrch V/F Gain	%	60	60
b3-06 Speed Curr Lev1 for Estimation	-	0.7	0.7
b3-08 Speed ACR PGain for Estimation	-	0.8	0.8
b3-26 Dir. Determ. Level	-	1000	1000
b8-03 eSave Filter Time	s	2.00	2.00
b8-04 eSave Coef. Value	-	21.76	23.84
C5-17 Motor Inertia (C5-37 M2 Inertia)	kgm^2	11.00	12.00
C6-02 Carrier Frequency Selection	-	1	7
E2-01 Mot Rated Current (FLA) (E4-01 M2 Rated Current (FLA))	A	500	650
E2-02 Mot Rated Slip (E4-02 M2 Rated Slip)	Hz	1.25	1
E2-03 Mot No-Load Current (E4-03 M2 No-Load Current)	A	130	130
E2-05 Motor L-L Resistance (E4-05 M2 L-L Resistance)	Ω	0.014	0.012
E2-06 Motor Leak Inductance (E4-06 M2 Leak Inductance)	%	20	20

Parameter	Unit	Drive Model	
		4675	
C6-01 ND/HD Duty Selection	**-**	**HD**	**ND**
		0	**1**
E2-11 Motor Rated Power (kW) (E4-11 M2 Rated Power (kW))	**kW**	**315**	**355**
E2-10 Motor Iron Loss (E4-10 M2 Iron Loss)	W	4700	5560
E5-01 PM Mot Code Selection	-	FFFF	FFFF
L2-02 RideThrough Time@Power Loss	s	2	2
L2-03 Min Baseblck Time	s	2.1	2.3
L2-04 Powloss Ramp Time@recovery	s	2	2.2
L2-05 UV Detection Lvl (Uv1)	-	380	380
L3-24 Acc@Rated Torque	s	1.392	1.667
L8-02 Overheat Alm Level	°C	140	140
L8-09 Ground Fault Selection	-	1	1
L8-38 Carrier Reduction Mode	-	2	2
n1-01 HuntPrev Selection	-	2	2
n1-03 HuntPrev Time Constant	ms	100	100
n1-16 HuntPrev HiFc Gain	-	0.50	0.50
n5-02 Mot Inertia Acceleration Time	s	1.392	1.667
n8-11 Observ.Calc Gain2	-	50.0	50.0

11.20 Parameters Changed by PM Motor Code Selection

Note:

The motor codes listed in these tables are the only correct setting values.

◆ Yaskawa SSR1 Series IPM Motors (Derated Torque)

Table 11.4 SSR1 Series Motor Code Setting for Specification of 400 V at 1750 min^{-1} (r/min)

Parameter	Unit	Motor Code (setting value of E5-01)							
E5-01 PM Mot Code Selection	-	1232	1233	1235	1236	1238	123A	123B	123D
Voltage Class	V	400	400	400	400	400	400	400	400
Capacity	kW	0.4	0.75	1.5	2.2	3.7	5.5	7.5	11
Motor Rotation Speed	min^{-1}	1750	1750	1750	1750	1750	1750	1750	1750
E5-02 PM Mot Rated Power (kW)	kW	0.4	0.75	1.5	2.2	3.7	5.5	7.5	11.0
E5-03 PM Mot Rated Current (FLA)	A	0.89	1.56	2.81	4.27	7.08	10.31	13.65	20.7
E5-04 PM Mot Pole Count	-	6	6	6	6	6	6	6	6
E5-05 PM Mot Resistance (Ohms/ Phase)	Ω	25.370	9.136	6.010	3.297	1.798	0.982	0.786	0.349
E5-06 PM d-Axis Inductance (mH/ Phase)	mH	169.00	92.08	67.71	34.40	32.93	22.7	16.49	13.17
E5-07 PM q-Axis Inductance (mH/ Phase)	mH	197.50	119.56	81.71	54.00	37.70	26.80	23.46	15.60
E5-09 PM BackEMF Vpeak (mV/ (rad/ s))	mVs/rad	392.6	440.6	478.3	466.3	478.8	478.1	520.0	481.5
E5-24 PM BackEMF L-L Vrms (mV/rpm)	mV/(r/ min)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E1-04 Max Output Frequency	Hz	87.5	87.5	87.5	87.5	87.5	87.5	87.5	87.5
E1-05 Max Output Voltage	V	380.0	380.0	380.0	380.0	380.0	380.0	380.0	380.0
E1-06 Base Frequency	Hz	87.5	87.5	87.5	87.5	87.5	87.5	87.5	87.5
E1-09 Min Output Frequency	Hz	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4
C5-17 Motor Inertia	kgm^2	0.0011	0.0017	0.0023	0.0043	0.0083	0.014	0.017	0.027
L3-24 Acc@Rated Torque *1	s	0.092	0.076	0.051	0.066	0.075	0.083	0.077	0.084
n5-02 Mot Inertia Acceleration Time	s	0.092	0.076	0.051	0.066	0.075	0.083	0.077	0.084
n8-49 Heavy Load Id Current	%	-8.6	-11.5	-10.3	-19.8	-8.5	-11.0	-18.6	-12.5

*1 Default settings vary depending on the setting of *o2-04 [Drive KVA Selection]*.

Table 11.5 SSR1 Series Motor Code Setting for Specification of 400 V at 1750 min^{-1} (r/min)

Parameter	Unit	Motor Code (setting value of E5-01)							
E5-01 PM Mot Code Selection	-	123E	123F	1240	1242	1243	1244	1245	1246
Voltage Class	V	400	400	400	400	400	400	400	400
Capacity	kW	15	18	22	30	37	45	55	75
Motor Rotation Speed	min^{-1}	1750	1750	1750	1750	1750	1750	1750	1750
E5-02 PM Mot Rated Power (kW)	kW	15	18.50	22.00	30.00	37.00	45.00	55.00	75.00
E5-03 PM Mot Rated Current (FLA)	A	27.5	33.4	39.8	52.0	65.8	77.5	92.7	126.6
E5-04 PM Mot Pole Count	-	6	6	6	6	6	6	6	6
E5-05 PM Mot Resistance (Ohms/ Phase)	Ω	0.272	0.207	0.148	0.235	0.079	0.054	0.049	0.029
E5-06 PM d-Axis Inductance (mH/ Phase)	mH	10.30	8.72	6.81	5.4	4.08	3.36	3.16	2.12
E5-07 PM q-Axis Inductance (mH/ Phase)	mH	12.77	11.22	8.47	7.26	5.12	3.94	3.88	2.61
E5-09 PM BackEMF Vpeak (mV/ (rad/ s))	mVs/rad	498.8	509.5	503.9	561.7	528.5	558.1	623.8	594.5

Parameter	Unit	Motor Code (setting value of E5-01)							
E5-24 PM BackEMF L-L Vrms (mV/rpm)	mV/(r/min)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E1-04 Max Output Frequency	Hz	87.5	87.5	87.5	87.5	87.5	87.5	87.5	87.5
E1-05 Max Output Voltage	V	380.0	380.0	380.0	380.0	380.0	380.0	380.0	380.0
E1-06 Base Frequency	Hz	87.5	87.5	87.5	87.5	87.5	87.5	87.5	87.5
E1-09 Min Output Frequency	Hz	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4
C5-17 Motor Inertia	kgm^2	0.046	0.055	0.064	0.116	0.140	0.259	0.31	0.42
L3-24 Acc@Rated Torque *1	s	0.102	0.101	0.098	0.130	0.127	0.193	0.191	0.187
n5-02 Mot Inertia Acceleration Time	s	0.102	0.101	0.098	0.130	0.127	0.193	0.191	0.187
n8-49 Heavy Load Id Current	%	-15.5	-17.9	-15.1	-16.8	-14.1	-8.8	-9.6	-10.3

*1 Default settings vary depending on the setting of *o2-04 [Drive KVA Selection]*.

Table 11.6 SSR1 Series Motor Code Setting for Specification of 400 V at 1750 min^{-1} (r/min)

Parameter	Unit	Motor Code (setting value of E5-01)			
E5-01 PM Mot Code Selection	-	1247	1248	1249	124A
Voltage Class	V	400	400	400	400
Capacity	kW	90	110	132	160
Motor Rotation Speed	min^{-1}	1750	1750	1750	1750
E5-02 PM Mot Rated Power (kW)	kW	90.00	110.00	132.00	160.00
E5-03 PM Mot Rated Current (FLA)	A	160.4	183.3	222.9	267.7
E5-04 PM Mot Pole Count	-	6	6	6	6
E5-05 PM Mot Resistance (Ohms/Phase)	Ω	0.019	0.017	0.012	0.008
E5-06 PM d-Axis Inductance (mH/Phase)	mH	1.54	1.44	1.21	0.97
E5-07 PM q-Axis Inductance (mH/Phase)	mH	2.06	2.21	1.46	1.28
E5-09 PM BackEMF Vpeak (mV/(rad/ s))	mVs/rad	524.1	583.7	563.6	601.2
E5-24 PM BackEMF L-L Vrms (mV/rpm)	mV/(r/min)	0.0	0.0	0.0	0.0
E1-04 Max Output Frequency	Hz	87.5	87.5	87.5	87.5
E1-05 Max Output Voltage	V	380.0	380.0	380.0	380.0
E1-06 Base Frequency	Hz	87.5	87.5	87.5	87.5
E1-09 Min Output Frequency	Hz	4.4	4.4	4.4	4.4
C5-17 Motor Inertia	kgm^2	0.56	0.83	0.96	1.61
L3-24 Acc@Rated Torque *1	s	0.208	0.254	0.243	0.338
n5-02 Mot Inertia Acceleration Time	s	0.208	0.254	0.243	0.338
n8-49 Heavy Load Id Current	%	-17.0	-21.7	-10.9	-13.2

*1 Default settings vary depending on the setting of *o2-04 [Drive KVA Selection]*.

Table 11.7 SSR1 Series Motor Code Setting for Specification of 400 V at 1450 min^{-1} (r/min)

Parameter	Unit	Motor Code (setting value of E5-01)							
PM Mot Code Selection	-	1332	1333	1335	1336	1338	133A	133B	133D
Voltage Class	V	400	400	400	400	400	400	400	400
Capacity	kW	0.4	0.75	1.5	2.2	3.7	5.5	7.5	11
Motor Rotation Speed	min^{-1}	1450	1450	1450	1450	1450	1450	1450	1450
PM Mot Rated Power (kW)	kW	0.4	0.75	1.5	2.2	3.7	5.5	7.5	11.0
PM Mot Rated Current (FLA)	A	0.94	1.56	2.81	4.27	6.98	10.21	13.85	19.5
PM Mot Pole Count	-	6	6	6	6	6	6	6	6
PM Mot Resistance (Ohms/Phase)	Ω	12.760	7.421	4.825	2.656	1.353	0.999	0.713	0.393
PM d-Axis Inductance (mH/Phase)	mH	128.60	85.11	58.87	46.42	31.73	26.20	27.06	15.51

Parameter	Unit	Motor Code (setting value of E5-01)							
PM q-Axis Inductance (mH/Phase)	mH	166.96	113.19	80.59	60.32	40.45	30.94	33.45	19.63
PM BackEMF Vpeak (mV/(rad/ s))	mVs/rad	528.6	544.2	568.5	572.8	562.9	587.6	670.1	612.7
PM BackEMF L-L Vrms (mV/rpm)	mV/(r/min)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Max Output Frequency	Hz	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5
Max Output Voltage	V	380.0	380.0	380.0	380.0	380.0	380.0	380.0	380.0
Base Frequency	Hz	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5
Min Output Frequency	Hz	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
Motor Inertia	kgm^2	0.0017	0.0023	0.0043	0.0083	0.0136	0.017	0.027	0.046
Acc@Rated Torque *1	s	0.098	0.071	0.066	0.087	0.085	0.072	0.084	0.096
Mot Inertia Acceleration Time	s	0.098	0.071	0.066	0.087	0.085	0.072	0.084	0.096
Heavy Load Id Current	%	-6.6	-9.2	-13.5	-12.1	-13.7	-10.1	-12.2	-15.5

*1 Default settings vary depending on the setting of *Drive KVA Selection*.

Table 11.8 SSR1 Series Motor Code Setting for Specification of 400 V at 1450 min^{-1} (r/min)

Parameter	Unit	Motor Code (setting value of E5-01)						
PM Mot Code Selection	-	133E	133F	1340	1342	1343	1344	1345
Voltage Class	V	400	400	400	400	400	400	400
Capacity	kW	15	18	22	30	37	45	55
Motor Rotation Speed	min^{-1}	1450	1450	1450	1450	1450	1450	1450
PM Mot Rated Power (kW)	kW	15	18.50	22.00	30.00	37.00	45.00	55.00
PM Mot Rated Current (FLA)	A	27.4	32.9	37.6	52.5	63.2	76.4	96.1
PM Mot Pole Count	-	6	6	6	6	6	6	6
PM Mot Resistance (Ohms/Phase)	Ω	0.295	0.223	0.164	0.137	0.093	0.059	0.048
PM d-Axis Inductance (mH/Phase)	mH	12.65	9.87	7.90	7.01	5.93	4.17	3.11
PM q-Axis Inductance (mH/Phase)	mH	15.87	12.40	10.38	8.68	6.79	5.22	4.55
PM BackEMF Vpeak (mV/(rad/ s))	mVs/rad	624.6	610.4	655.4	708.4	739.2	703.0	747.1
PM BackEMF L-L Vrms (mV/rpm)	mV/(r/min)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Max Output Frequency	Hz	72.5	72.5	72.5	72.5	72.5	72.5	72.5
Max Output Voltage	V	380.0	380.0	380.0	380.0	380.0	380.0	380.0
Base Frequency	Hz	72.5	72.5	72.5	72.5	72.5	72.5	72.5
Min Output Frequency	Hz	3.6	3.6	3.6	3.6	3.6	3.6	3.6
Motor Inertia	kgm^2	0.055	0.064	0.116	0.140	0.259	0.312	0.42
Acc@Rated Torque *1	s	0.085	0.080	0.122	0.108	0.161	0.160	0.175
Mot Inertia Acceleration Time	s	0.085	0.080	0.122	0.108	0.161	0.160	0.175
Heavy Load Id Current	%	-15.1	-16.0	-15.7	-11.5	-6.8	-11.5	-14.8

*1 Default settings vary depending on the setting of *Drive KVA Selection*.

Table 11.9 SSR1 Series Motor Code Setting for Specification of 400 V at 1450 min^{-1} (r/min)

Parameter	Unit	Motor Code (setting value of E5-01)			
PM Mot Code Selection	-	1346	1347	1348	1349
Voltage Class	V	400	400	400	400
Capacity	kW	75	90	110	132
Motor Rotation Speed	min^{-1}	1450	1450	1450	1450
PM Mot Rated Power (kW)	kW	75.00	90.00	110.00	132.00
PM Mot Rated Current (FLA)	A	124.0	153.1	186.5	226.0
PM Mot Pole Count	-	6	6	6	6

Parameter	Unit	Motor Code (setting value of E5-01)			
PM Mot Resistance (Ohms/Phase)	Ω	0.028	0.024	0.015	0.011
PM d-Axis Inductance (mH/Phase)	mH	2.32	2.20	1.45	1.23
PM q-Axis Inductance (mH/Phase)	mH	2.97	3.23	1.88	1.67
PM BackEMF Vpeak (mV/(rad/ s))	mVs/rad	639.3	708.0	640.7	677.0
PM BackEMF L-L Vrms (mV/rpm)	mV/(r/min)	0.0	0.0	0.0	0.0
Max Output Frequency	Hz	72.5	72.5	72.5	72.5
Max Output Voltage	V	380.0	380.0	380.0	380.0
Base Frequency	Hz	72.5	72.5	72.5	72.5
Min Output Frequency	Hz	3.6	3.6	3.6	3.6
Motor Inertia	kgm^2	0.56	0.83	0.96	1.61
Acc@Rated Torque *1	s	0.171	0.213	0.201	0.281
Mot Inertia Acceleration Time	s	0.171	0.213	0.201	0.281
Heavy Load Id Current	%	-15.8	-19.6	-14.9	-15.1

*1 Default settings vary depending on the setting of *Drive KVA Selection*.

Table 11.10 SSR1 Series Motor Code Setting for Specification of 400 V at 1150 min^{-1} (r/min)

Parameter	Unit	Motor Code (setting value of E5-01)							
E5-01 PM Mot Code Selection	-	1432	1433	1435	1436	1438	143A	143B	143D
Voltage Class	V	400	400	400	400	400	400	400	400
Capacity	kW	0.4	0.75	1.5	2.2	3.7	5.5	7.5	11
Motor Rotation Speed	min^{-1}	1150	1150	1150	1150	1150	1150	1150	1150
E5-02 PM Mot Rated Power (kW)	kW	0.4	0.75	1.5	2.2	3.7	5.5	7.5	11.0
E5-03 PM Mot Rated Current (FLA)	A	0.94	1.51	3.00	4.43	7.08	10.10	13.33	19.9
E5-04 PM Mot Pole Count	-	6	6	6	6	6	6	6	6
E5-05 PM Mot Resistance (Ohms/ Phase)	Ω	19.320	10.800	4.456	2.044	1.483	1.215	0.660	0.443
E5-06 PM d-Axis Inductance (mH/ Phase)	mH	194.70	129.20	76.88	48.60	37.58	44.54	26.36	19.10
E5-07 PM q-Axis Inductance (mH/ Phase)	mH	252.84	160.90	97.52	61.40	47.65	56.26	34.20	24.67
E5-09 PM BackEMF Vpeak (mV/ (rad/ s))	mVs/rad	640.9	654.1	728.8	688.9	702.0	861.5	783.0	762.2
E5-24 PM BackEMF L-L Vrms (mV/rpm)	mV/(r/ min)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E1-04 Max Output Frequency	Hz	57.5	57.5	57.5	57.5	57.5	57.5	57.5	57.5
E1-05 Max Output Voltage	V	380.0	380.0	380.0	380.0	380.0	380.0	380.0	380.0
E1-06 Base Frequency	Hz	57.5	57.5	57.5	57.5	57.5	57.5	57.5	57.5
E1-09 Min Output Frequency	Hz	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9
C5-17 Motor Inertia	kgm^2	0.0017	0.0023	0.0083	0.0136	0.0171	0.027	0.046	0.055
L3-24 Acc@Rated Torque *1	s	0.062	0.044	0.080	0.090	0.067	0.072	0.088	0.073
n5-02 Mot Inertia Acceleration Time	s	0.062	0.044	0.080	0.090	0.067	0.072	0.088	0.073
n8-49 Heavy Load Id Current	%	-8.8	-9.9	-9.3	-10.0	-12.8	-12.3	-15.3	-16.7

*1 Default settings vary depending on the setting of *o2-04 [Drive KVA Selection]*.

Table 11.11 SSR1 Series Motor Code Setting for Specification of 400 V at 1150 min^{-1} (r/min)

Parameter	Unit	Motor Code (setting value of E5-01)					
E5-01 PM Mot Code Selection	-	143E	143F	1440	1442	1443	1444
Voltage Class	V	400	400	400	400	400	400
Capacity	kW	15	18	22	30	37	45

Parameter	Unit	Motor Code (setting value of E5-01)					
Motor Rotation Speed	min-1	1150	1150	1150	1150	1150	1150
E5-02 PM Mot Rated Power (kW)	kW	15	18.50	22.00	30.00	37.00	45.00
E5-03 PM Mot Rated Current (FLA)	A	27.8	31.8	37.2	52.1	64.8	76.6
E5-04 PM Mot Pole Count	-	6	6	6	6	6	6
E5-05 PM Mot Resistance (Ohms/Phase)	Ω	0.331	0.264	0.192	0.140	0.093	0.063
E5-06 PM d-Axis Inductance (mH/Phase)	mH	15.09	13.32	9.52	8.16	6.13	4.63
E5-07 PM q-Axis Inductance (mH/Phase)	mH	18.56	18.00	12.60	11.40	9.10	6.15
E5-09 PM BackEMF Vpeak (mV/(rad/ s))	mVs/rad	749.6	842.7	821.8	872.3	857.7	866.6
E5-24 PM BackEMF L-L Vrms (mV/rpm)	mV/(r/min)	0.0	0.0	0.0	0.0	0.0	0.0
E1-04 Max Output Frequency	Hz	57.5	57.5	57.5	57.5	57.5	57.5
E1-05 Max Output Voltage	V	380.0	380.0	380.0	380.0	380.0	380.0
E1-06 Base Frequency	Hz	57.5	57.5	57.5	57.5	57.5	57.5
E1-09 Min Output Frequency	Hz	2.9	2.9	2.9	2.9	2.9	2.9
C5-17 Motor Inertia	kgm2	0.064	0.116	0.140	0.259	0.312	0.418
L3-24 Acc@Rated Torque *1	s	0.062	0.091	0.092	0.125	0.122	0.135
n5-02 Mot Inertia Acceleration Time	s	0.062	0.091	0.092	0.125	0.122	0.135
n8-49 Heavy Load Id Current	%	-14.9	-17.9	-15.9	-17.7	-20.1	-13.8

*1 Default settings vary depending on the setting of *o2-04 [Drive KVA Selection]*.

Table 11.12 SSR1 Series Motor Code Setting for Specification of 400 V at 1150 min-1 (r/min)

No.	Unit	Motor Code (setting value of E5-01)			
E5-01 PM Mot Code Selection	-	1445	1446	1447	1448
Voltage Class	V	400	400	400	400
Capacity	kW	55	75	90	110
Motor Rotation Speed	min-1	1150	1150	1150	1150
E5-02 PM Mot Rated Power (kW)	kW	55.00	75.00	90.00	110.00
E5-03 PM Mot Rated Current (FLA)	A	92.0	127.1	150.5	185.4
E5-04 PM Mot Pole Count	-	6	6	6	6
E5-05 PM Mot Resistance (Ohms/Phase)	Ω	0.051	0.033	0.027	0.015
E5-06 PM d-Axis Inductance (mH/Phase)	mH	3.96	3.03	2.60	1.89
E5-07 PM q-Axis Inductance (mH/Phase)	mH	5.00	5.14	3.28	2.33
E5-09 PM BackEMF Vpeak (mV/(rad/ s))	mVs/rad	854.0	823.1	853.4	829.2
E5-24 PM BackEMF L-L Vrms (mV/rpm)	mV/(r/min)	0.0	0.0	0.0	0.0
E1-04 Max Output Frequency	Hz	57.5	57.5	57.5	57.5
E1-05 Max Output Voltage	V	380.0	380.0	380.0	380.0
E1-06 Base Frequency	Hz	57.5	57.5	57.5	57.5
E1-09 Min Output Frequency	Hz	2.9	2.9	2.9	2.9
C5-17 Motor Inertia	kgm2	0.56	0.83	0.96	1.61
L3-24 Acc@Rated Torque *1	s	0.147	0.161	0.154	0.212
n5-02 Mot Inertia Acceleration Time	s	0.147	0.161	0.154	0.212
n8-49 Heavy Load Id Current	%	-12.5	-28.8	-13.3	-11.6

*1 Default settings vary depending on the setting of *o2-04 [Drive KVA Selection]*.

◆ Yaskawa SST4 Series IPM Motors (Constant Torque)

Table 11.13 SST4 Series Motor Code Setting for Specification of 400 V at 1750 min^{-1} (r/min)

No.	Name	Unit	Motor Code (setting value of E5-01)							
E5-01	PM Mot Code Selection	-	2232	2233	2235	2236	2238	223A	223B	223D
	Voltage Class	V	400	400	400	400	400	400	400	400
	Capacity	kW	0.4	0.75	1.5	2.2	3.7	5.5	7.5	11
	Motor Rotation Speed	min^{-1}	1750	1750	1750	1750	1750	1750	1750	1750
E5-02	PM Mot Rated Power (kW)	kW	0.4	0.75	1.5	2.2	3.7	5.5	7.5	11.0
E5-03	PM Mot Rated Current (FLA)	A	0.92	1.77	3.33	4.48	7.50	10.42	14.27	20.5
E5-04	PM Mot Pole Count	-	6	6	6	6	6	6	6	6
E5-05	PM Mot Resistance (Ohms/Phase)	Ω	8.935	4.570	3.096	1.906	0.972	1.103	0.630	0.429
E5-06	PM d-Axis Inductance (mH/Phase)	mH	80.14	48.04	35.60	30.31	20.03	23.41	14.86	14.34
E5-07	PM q-Axis Inductance (mH/Phase)	mH	110.76	64.88	47.84	38.36	24.97	28.70	17.25	17.25
E5-09	PM BackEMF Vpeak (mV/(rad/ s))	mVs/rad	416.5	399.4	438.5	475.5	463.7	485.8	470.4	513.4
E5-24	PM BackEMF L-L Vrms (mV/rpm)	mV/(r/ min)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E1-04	Max Output Frequency	Hz	87.5	87.5	87.5	87.5	87.5	87.5	87.5	87.5
E1-05	Max Output Voltage	V	380.0	380.0	380.0	380.0	380.0	380.0	380.0	380.0
E1-06	Base Frequency	Hz	87.5	87.5	87.5	87.5	87.5	87.5	87.5	87.5
E1-09	Min Output Frequency	Hz	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4
C5-17	Motor Inertia	kgm^2	0.0016	0.0022	0.0042	0.0081	0.0133	0.013	0.017	0.027
L3-24 *1	Acc@Rated Torque	s	0.134	0.099	0.094	0.124	0.121	0.081	0.075	0.082
n5-02	Mot Inertia Acceleration Time	s	0.134	0.099	0.094	0.124	0.121	0.081	0.075	0.082
n8-49	Heavy Load Id Current	%	-7.5	-8.5	-9.8	-8.2	-9.1	-13.1	-9.2	-12.4

*1 Default settings vary depending on the setting of *o2-04 [Drive KVA Selection]*.

Table 11.14 SST4 Series Motor Code Setting for Specification of 400 V at 1750 min^{-1} (r/min)

No.	Name	Unit	Motor Code (setting value of E5-01)							
E5-01	PM Mot Code Selection	-	223E	223F	2240	2242	2243	2244	2245	2246
	Voltage Class	V	400	400	400	400	400	400	400	400
	Capacity	kW	15	18	22	30	37	45	55	75
	Motor Rotation Speed	min^{-1}	1750	1750	1750	1750	1750	1750	1750	1750
E5-02	PM Mot Rated Power (kW)	kW	15	18.50	22.00	30.00	37.00	45.00	55.00	75.00
E5-03	PM Mot Rated Current (FLA)	A	26.4	34.2	38.8	52.2	65.4	77.6	99.3	130.2
E5-04	PM Mot Pole Count	-	6	6	6	6	6	6	6	6
E5-05	PM Mot Resistance (Ohms/Phase)	Ω	0.275	0.196	0.160	0.120	0.077	0.052	0.036	0.023
E5-06	PM d-Axis Inductance (mH/Phase)	mH	9.99	7.92	6.82	5.24	3.57	2.98	1.59	1.59
E5-07	PM q-Axis Inductance (mH/Phase)	mH	12.37	9.64	8.51	6.44	4.65	3.75	2.78	1.97
E5-09	PM BackEMF Vpeak (mV/(rad/ s))	mVs/rad	505.3	489.2	509.5	566.2	531.6	530.6	515.2	515.2
E5-24	PM BackEMF L-L Vrms (mV/rpm)	mV/(r/ min)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E1-04	Max Output Frequency	Hz	87.5	87.5	87.5	87.5	87.5	87.5	87.5	87.5
E1-05	Max Output Voltage	V	380.0	380.0	380.0	380.0	380.0	380.0	380.0	380.0

No.	Name	Unit	Motor Code (setting value of E5-01)							
E1-06	Base Frequency	Hz	87.5	87.5	87.5	87.5	87.5	87.5	87.5	87.5
E1-09	Min Output Frequency	Hz	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4
C5-17	Motor Inertia	kgm²	0.044	0.054	0.063	0.113	0.137	0.252	0.30	0.41
L3-24 *1	Acc@Rated Torque	s	0.099	0.098	0.096	0.126	0.124	0.188	0.186	0.184
n5-02	Mot Inertia Acceleration Time	s	0.099	0.098	0.096	0.126	0.124	0.188	0.186	0.184
n8-49	Heavy Load Id Current	%	-15.1	-14.3	-15.3	-11.3	-14.5	-13.2	-22.6	-11.9

*1 Default settings vary depending on the setting of *o2-04 [Drive KVA Selection]*.

Table 11.15 SST4 Series Motor Code Setting for Specification of 400 V at 1750 min⁻¹ (r/min)

No.	Name	Unit	Motor Code (setting value of E5-01)						
E5-01	PM Mot Code Selection	-	2247	2248	2249	224A	224C	224D	224E
	Voltage Class	V	400	400	400	400	400	400	400
	Capacity	kW	90	110	132	160	200	220	300
	Motor Rotation Speed	min⁻¹	1750	1750	1750	1750	1750	1750	1750
E5-02	PM Mot Rated Power (kW)	kW	90.00	110.00	132.00	160.00	200.00	250.00	300.00
E5-03	PM Mot Rated Current (FLA)	A	153.1	184.4	229.2	269.8	346.9	421.9	520.8
E5-04	PM Mot Pole Count	-	6	6	6	6	6	6	6
E5-05	PM Mot Resistance (Ohms/Phase)	Ω	0.019	0.017	0.012	0.008	0.005	0.004	0.002
E5-06	PM d-Axis Inductance (mH/Phase)	mH	1.51	1.43	1.13	0.96	0.65	0.67	0.40
E5-07	PM q-Axis Inductance (mH/Phase)	mH	1.76	1.92	1.54	1.26	0.88	0.74	0.52
E5-09	PM BackEMF Vpeak (mV/(rad/ s))	mVs/rad	538.3	590.9	548.2	603.9	556.8	593.1	495.4
E5-24	PM BackEMF L-L Vrms (mV/rpm)	mV/(r/min)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E1-04	Max Output Frequency	Hz	87.5	87.5	87.5	87.5	87.5	87.5	87.5
E1-05	Max Output Voltage	V	380.0	380.0	380.0	380.0	380.0	380.0	380.0
E1-06	Base Frequency	Hz	87.5	87.5	87.5	87.5	87.5	87.5	87.5
E1-09	Min Output Frequency	Hz	4.4	4.4	4.4	4.4	4.4	4.4	4.4
C5-17	Motor Inertia	kgm²	0.55	0.82	0.96	1.60	1.95	2.82	3.70
L3-24 *1	Acc@Rated Torque	s	0.205	0.250	0.244	0.336	0.327	0.379	0.414
n5-02	Mot Inertia Acceleration Time	s	0.205	0.250	0.244	0.336	0.327	0.379	0.414
n8-49	Heavy Load Id Current	%	-8.6	-14.8	-17.5	-12.5	-14.7	-5.1	-16.3

*1 Default settings vary depending on the setting of *o2-04 [Drive KVA Selection]*.

Table 11.16 SST4 Series Motor Code Setting for Specification of 400 V at 1450 min⁻¹ (r/min)

No.	Name	Unit	Motor Code (setting value of E5-01)							
E5-01	PM Mot Code Selection	-	2332	2333	2335	2336	2338	233A	233B	233D
	Voltage Class	V	400	400	400	400	400	400	400	400
	Capacity	kW	0.4	0.75	1.5	2.2	3.7	5.5	7.5	11
	Motor Rotation Speed	min⁻¹	1450	1450	1450	1450	1450	1450	1450	1450
E5-02	PM Mot Rated Power (kW)	kW	0.4	0.75	1.5	2.2	3.7	5.5	7.5	11.0
E5-03	PM Mot Rated Current (FLA)	A	0.91	1.67	3.02	4.74	7.08	10.21	13.96	20.5
E5-04	PM Mot Pole Count	-	6	6	6	6	6	6	6	6
E5-05	PM Mot Resistance (Ohms/Phase)	Ω	12.616	7.340	2.724	1.232	1.509	1.112	0.720	0.393

No.	Name	Unit	Motor Code (setting value of E5-01)							
E5-06	PM d-Axis Inductance (mH/Phase)	mH	113.84	77.84	40.00	27.52	31.73	23.09	25.28	13.36
E5-07	PM q-Axis Inductance (mH/Phase)	mH	157.16	103.56	60.80	37.00	40.88	34.39	35.20	18.44
E5-09	PM BackEMF Vpeak (mV/(rad/ s))	mVs/rad	490.8	513.8	543.7	520.3	580.8	602.7	601.5	584.6
E5-24	PM BackEMF L-L Vrms (mV/rpm)	mV/(r/ min)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E1-04	Max Output Frequency	Hz	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5
E1-05	Max Output Voltage	V	380.0	380.0	380.0	380.0	380.0	380.0	380.0	380.0
E1-06	Base Frequency	Hz	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5
E1-09	Min Output Frequency	Hz	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
C5-17	Motor Inertia	kgm^2	0.0016	0.0022	0.0081	0.0133	0.0133	0.017	0.027	0.044
L3-24 *1	Acc@Rated Torque	s	0.092	0.068	0.125	0.139	0.083	0.070	0.082	0.092
n5-02	Mot Inertia Acceleration Time	s	0.092	0.068	0.125	0.139	0.083	0.070	0.082	0.092
n8-49	Heavy Load Id Current	%	-9.5	-9.4	-13.7	-10.0	-12.9	-19.9	-22.8	-19.8

*1 Default settings vary depending on the setting of *o2-04 [Drive KVA Selection]*.

Table 11.17 SST4 Series Motor Code Setting for Specification of 400 V at 1450 min^{-1} (r/min)

No.	Name	Unit	Motor Code (setting value of E5-01)							
E5-01	PM Mot Code Selection	-	233E	233F	2340	2342	2343	2344	2345	2346
	Voltage Class	V	400	400	400	400	400	400	400	400
	Capacity	kW	15	18	22	30	37	45	55	75
	Motor Rotation Speed	min^{-1}	1450	1450	1450	1450	1450	1450	1450	1450
E5-02	PM Mot Rated Power (kW)	kW	15	18.50	22.00	30.00	37.00	45.00	55.00	75.00
E5-03	PM Mot Rated Current (FLA)	A	27.1	34.2	37.6	50.9	65.4	80.2	96.1	129.2
E5-04	PM Mot Pole Count	-	6	6	6	6	6	6	6	6
E5-05	PM Mot Resistance (Ohms/Phase)	Ω	0.291	0.220	0.192	0.136	0.091	0.064	0.048	0.028
E5-06	PM d-Axis Inductance (mH/Phase)	mH	11.77	8.94	8.32	6.68	5.30	3.76	3.09	2.24
E5-07	PM q-Axis Inductance (mH/Phase)	mH	14.60	11.40	10.64	8.16	6.80	4.88	4.75	3.03
E5-09	PM BackEMF Vpeak (mV/(rad/ s))	mVs/rad	610.3	595.2	711.6	710.8	652.7	604.8	669.1	646.8
E5-24	PM BackEMF L-L Vrms (mV/rpm)	mV/(r/ min)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E1-04	Max Output Frequency	Hz	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5
E1-05	Max Output Voltage	V	380.0	380.0	380.0	380.0	380.0	380.0	380.0	380.0
E1-06	Base Frequency	Hz	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5
E1-09	Min Output Frequency	Hz	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
C5-17	Motor Inertia	kgm^2	0.054	0.063	0.113	0.137	0.252	0.304	0.41	0.55
L3-24 *1	Acc@Rated Torque	s	0.083	0.079	0.118	0.105	0.157	0.156	0.172	0.169
n5-02	Mot Inertia Acceleration Time	s	0.083	0.079	0.118	0.105	0.157	0.156	0.172	0.169
n8-49	Heavy Load Id Current	%	-14.5	-16.1	-11.8	-10.5	-15.6	-17.4	-21.7	-17.3

*1 Default settings vary depending on the setting of *o2-04 [Drive KVA Selection]*.

Table 11.18 SST4 Series Motor Code Setting for Specification of 400 V at 1450 min-1 (r/min)

No.	Name	Unit	Motor Code (setting value of E5-01)					
E5-01	PM Mot Code Selection	-	2347	2348	2349	234A	234C	234D
	Voltage Class	V	400	400	400	400	400	400
	Capacity	kW	90	110	132	160	200	250
	Motor Rotation Speed	min^{-1}	1450	1450	1450	1450	1450	1450
E5-02	PM Mot Rated Power (kW)	kW	90.00	110.00	132.00	160.00	200.00	250.00
E5-03	PM Mot Rated Current (FLA)	A	153.1	191.7	226.0	268.8	331.3	422.9
E5-04	PM Mot Pole Count	-	6	6	6	6	6	6
E5-05	PM Mot Resistance (Ohms/Phase)	Ω	0.024	0.015	0.011	0.007	0.006	0.003
E5-06	PM d-Axis Inductance (mH/Phase)	mH	2.20	1.34	1.23	0.92	0.84	0.61
E5-07	PM q-Axis Inductance (mH/Phase)	mH	3.23	2.16	1.67	1.30	1.25	0.89
E5-09	PM BackEMF Vpeak (mV/(rad/ s))	mVs/rad	708.0	637.8	677.0	661.7	687.1	655.9
E5-24	PM BackEMF L-L Vrms (mV/rpm)	mV/(r/ min)	0.0	0.0	0.0	0.0	0	0.0
E1-04	Max Output Frequency	Hz	72.5	72.5	72.5	72.5	72.5	72.5
E1-05	Max Output Voltage	V	380.0	380.0	380.0	380.0	380.0	380.0
E1-06	Base Frequency	Hz	72.5	72.5	72.5	72.5	72.5	72.5
E1-09	Min Output Frequency	Hz	3.6	3.6	3.6	3.6	3.6	3.6
C5-17	Motor Inertia	kgm^2	0.82	0.96	1.60	1.95	2.82	3.70
L3-24 *1	Acc@Rated Torque	s	0.210	0.201	0.279	0.281	0.325	0.341
n5-02	Mot Inertia Acceleration Time	s	0.210	0.201	0.279	0.281	0.325	0.341
n8-49	Heavy Load Id Current	%	-19.6	-24.1	-15.1	-17.0	-19.8	-19.3

*1 Default settings vary depending on the setting of *o2-04 [Drive KVA Selection]*.

Table 11.19 SST4 Series Motor Code Setting for Specification of 400 V at 1150 min-1 (r/min)

No.	Name	Unit	Motor Code (setting value of E5-01)						
E5-01	PM Mot Code Selection	-	2432	2433	2435	2436	2438	243A	243B
	Voltage Class	V	400	400	400	400	400	400	400
	Capacity	kW	0.4	0.75	1.5	2.2	3.7	5.5	7.5
	Motor Rotation Speed	min^{-1}	1150	1150	1150	1150	1150	1150	1150
E5-02	PM Mot Rated Power (kW)	kW	0.4	0.75	1.5	2.2	3.7	5.5	7.5
E5-03	PM Mot Rated Current (FLA)	A	0.89	1.72	3.02	4.58	7.40	10.21	13.75
E5-04	PM Mot Pole Count	-	6	6	6	6	6	6	6
E5-05	PM Mot Resistance (Ohms/Phase)	Ω	10.720	6.080	4.336	2.143	1.428	1.199	0.648
E5-06	PM d-Axis Inductance (mH/Phase)	mH	122.20	61.16	70.24	46.20	33.87	41.67	21.24
E5-07	PM q-Axis Inductance (mH/Phase)	mH	170.80	97.12	90.04	60.28	42.98	69.15	33.04
E5-09	PM BackEMF Vpeak (mV/(rad/ s))	mVs/rad	626.1	626.1	703.1	727.6	699.0	861.5	759.7
E5-24	PM BackEMF L-L Vrms (mV/rpm)	mV/(r/ min)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E1-04	Max Output Frequency	Hz	57.5	57.5	57.5	57.5	57.5	57.5	57.5
E1-05	Max Output Voltage	V	380.0	380.0	380.0	380.0	380.0	380.0	380.0
E1-06	Base Frequency	Hz	57.5	57.5	57.5	57.5	57.5	57.5	57.5
E1-09	Min Output Frequency	Hz	2.9	2.9	2.9	2.9	2.9	2.9	2.9

No.	Name	Unit	Motor Code (setting value of E5-01)						
C5-17	Motor Inertia	kgm²	0.0022	0.0042	0.0081	0.0133	0.0168	0.027	0.044
L3-24 *1	Acc@Rated Torque	s	0.080	0.081	0.078	0.088	0.066	0.070	0.085
n5-02	Mot Inertia Acceleration Time	s	0.080	0.081	0.078	0.088	0.066	0.070	0.085
n8-49	Heavy Load Id Current	%	-8.4	-11.0	-9.9	-9.0	-11.4	-23.2	-22.1

*1 Default settings vary depending on the setting of *o2-04 [Drive KVA Selection]*.

Table 11.20 SST4 Series Motor Code Setting for Specification of 400 V at 1150 min⁻¹ (r/min)

No.	Name	Unit	Motor Code (setting value of E5-01)						
E5-01	PM Mot Code Selection	-	243D	243E	243F	2440	2442	2443	2444
	Voltage Class	V	400	400	400	400	400	400	400
	Capacity	kW	11	15	18	22	30	37	45
	Motor Rotation Speed	min⁻¹	1150	1150	1150	1150	1150	1150	1150
E5-02	PM Mot Rated Power (kW)	kW	11.0	15	18.50	22.00	30.00	37.00	45.00
E5-03	PM Mot Rated Current (FLA)	A	19.5	27.7	32.7	39.2	51.8	63.0	76.6
E5-04	PM Mot Pole Count	-	6	6	6	6	6	6	6
E5-05	PM Mot Resistance (Ohms/Phase)	Ω	0.460	0.325	0.260	0.209	0.140	0.106	0.076
E5-06	PM d-Axis Inductance (mH/Phase)	mH	17.76	12.83	11.68	10.09	8.12	6.43	4.96
E5-07	PM q-Axis Inductance (mH/Phase)	mH	22.72	17.19	15.16	16.25	9.84	7.71	6.56
E5-09	PM BackEMF Vpeak (mV/(rad/ s))	mVs/rad	740.4	716.6	809.1	786.2	888.8	857.7	941.6
E5-24	PM BackEMF L-L Vrms (mV/rpm)	mV/(r/min)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E1-04	Max Output Frequency	Hz	57.5	57.5	57.5	57.5	57.5	57.5	57.5
E1-05	Max Output Voltage	V	380.0	380.0	380.0	380.0	380.0	380.0	380.0
E1-06	Base Frequency	Hz	57.5	57.5	57.5	57.5	57.5	57.5	57.5
E1-09	Min Output Frequency	Hz	2.9	2.9	2.9	2.9	2.9	2.9	2.9
C5-17	Motor Inertia	kgm²	0.054	0.063	0.113	0.137	0.252	0.304	0.410
L3-24 *1	Acc@Rated Torque	s	0.071	0.061	0.089	0.090	0.122	0.119	0.132
n5-02	Mot Inertia Acceleration Time	s	0.071	0.061	0.089	0.090	0.122	0.119	0.132
n8-49	Heavy Load Id Current	%	-16.7	-20.2	-15.2	-27.7	-9.8	-10.2	-11.5

*1 Default settings vary depending on the setting of *o2-04 [Drive KVA Selection]*.

Table 11.21 SST4 Series Motor Code Setting for Specification of 400 V at 1150 min⁻¹ (r/min)

No.	Name	Unit	Motor Code (setting value of E5-01)						
E5-01	PM Mot Code Selection	-	2445	2446	2447	2448	2449	244A	244C
	Voltage Class	V	400	400	400	400	400	400	400
	Capacity	kW	55	75	90	110	132	160	200
	Motor Rotation Speed	min⁻¹	1150	1150	1150	1150	1150	1150	1150
E5-02	PM Mot Rated Power (kW)	kW	55.00	75.00	90.00	110.00	132.00	160.00	200.00
E5-03	PM Mot Rated Current (FLA)	A	93.1	128.1	153.1	186.5	221.9	269.8	336.5
E5-04	PM Mot Pole Count	-	6	6	6	6	6	6	6
E5-05	PM Mot Resistance (Ohms/Phase)	Ω	0.051	0.032	0.026	0.015	0.012	0.009	0.007
E5-06	PM d-Axis Inductance (mH/Phase)	mH	3.99	2.97	2.44	1.87	1.49	1.41	1.22

No.	Name	Unit	Motor Code (setting value of E5-01)						
E5-07	PM q-Axis Inductance (mH/Phase)	mH	5.39	3.90	3.23	2.46	2.08	1.88	1.51
E5-09	PM BackEMF Vpeak (mV/(rad/ s))	mVs/rad	853.8	829.6	835.6	833.4	848.6	889.1	915.0
E5-24	PM BackEMF L-L Vrms (mV/rpm)	mV/(r/ min)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E1-04	Max Output Frequency	Hz	57.5	57.5	57.5	57.5	57.5	57.5	57.5
E1-05	Max Output Voltage	V	380.0	380.0	380.0	380.0	380.0	380.0	380.0
E1-06	Base Frequency	Hz	57.5	57.5	57.5	57.5	57.5	57.5	57.5
E1-09	Min Output Frequency	Hz	2.9	2.9	2.9	2.9	2.9	2.9	2.9
C5-17	Motor Inertia	kgm^2	0.55	0.82	0.96	1.60	1.95	2.82	3.70
L3-24 *1	Acc@Rated Torque	s	0.145	0.159	0.155	0.211	0.214	0.256	0.268
n5-02	Mot Inertia Acceleration Time	s	0.145	0.159	0.155	0.211	0.214	0.256	0.268
n8-49	Heavy Load Id Current	%	-15.9	-15.7	-15.7	-14.7	-16.5	-14.1	-10.3

*1 Default settings vary depending on the setting of *o2-04 [Drive KVA Selection]*.

12

Parameter Details

12.1 A: INITIALIZATION

The parameter group *A: INITIALIZATION* sets the operating environment and operating conditions for the drive.

◆ A1: INITIALIZATION

A1 parameters set the operating environment and operating conditions for the drive. For example, these parameters set the keypad language, the control method, and the parameter access level for the drive.

■ A1-00 Language Selection

No. (Hex.)	Name	Description	Default (Range)
A1-00 (0100) RUN	Language Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the language for the LCD keypad.	0 (0 - 12)

Note:

When you initialize the drive with parameter *A1-03 [Init Parameters]*, the drive will not reset this parameter.

0 : English

1 : Japanese

2 : German

3 : French

4 : Italian

5 : Spanish

6 : Portuguese

7 : Chinese

8 : Czech

9 : Russian

10 : Turkish

11 : Polish

12 : Greek

■ A1-01 Access Level

No. (Hex.)	Name	Description	Default (Range)
A1-01 (0101) RUN	Access Level	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets user access to parameters. The access level controls which parameters the keypad will display, and which parameters the user can set.	2 (0 - 3)

0 : Monitor only

Access to *A1-00, A1-01, A1-04 [Password Input]*, and the *U: MONITORS*.

1 : Manual Setup

Access to *A1-00, A1-01, A1-04*, *A2-01 to A2-32 [MAN1 Param1 to MAN3 Param12]*, and the *U: MONITORS*.

2 : Standard Parameters

Access to all parameters, but not Expert Mode parameters.

3 : Expert Parameters

Access to all parameters including Expert Mode parameters.

Table 12.1 shows which keypad screens are available for each *A1-01* settings.

Table 12.1 Access Level and Available Keypad Screens

Mode	Keypad Screen	*A1-01 [Access Level]* Setting			
		0	1	2	3
Drive Mode	Monitors	Yes	Yes	Yes	Yes
Programming Mode	Parameters	Yes	Yes	Yes	Yes
	Manual Setup	Yes	Yes	Yes	Yes
	Parameter Backup/Restore	No	No	Yes	Yes
	Modified Parameters/Fault Log	No	No	Yes	Yes
	Auto-Tuning	No	No	Yes	Yes
	Initial Setup Screen	No	No	Yes	Yes
	Diagnostic Tools	No	No	Yes	Yes

Note:
- When you use *A1-04* and *A1-05 [Password Setting]* to set a password, you cannot change the values set in *A1-01 to A1-03, A1-07*,or *A2-01 to A2-32*.
- When *H1-xx: MFDI Function Select = 7C [Prg Lock]*, you must activate the terminal to change parameter settings.
- When you use Modbus communications, you must send the Enter command from the controller to the drive and complete the serial communication write process before you can use the keypad to change parameter settings.

■ A1-02 Control Method

No. (Hex.)	Name	Description	Default (Range)
A1-02 (0102)	Control Method	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the control method for the drive application and the motor.	0 (0 - 8)

Note:
- When you change the *A1-02* setting, the parameter values specified by *A1-02* are changed to their default values.
- To use the 2 motor switchover function, first turn OFF the terminal to which *H1-xx: MFDI Function Select = 61 [Motor 2 Select]* is set, then change the *A1-02* setting. An incorrect procedure will trigger *oPE08 [Parameter Selection Error]*.

Selects the control method for the drive application and the motor.

0 : V/f Control

Use this control method in these applications and conditions:

- For general variable-speed control applications in which a high level of responsiveness or high-precision speed control is not necessary.
- To connect more than one motor to one drive
- When there is not sufficient data to set the motor parameters
- When it is not possible to do Auto-Tuning. The speed control range is 1:40.

1 : PG V/f Control

Use this control method in these applications and conditions:

- For general applications in which a high level of responsiveness is not necessary, but high-precision speed control is necessary.
- When there is not sufficient data to set the motor parameters
- When it is not possible to do Auto-Tuning. The speed control range is 1:40.

2 : OLVector

Use this control method for general variable-speed control applications in which high-precision speed control is necessary. In this control method, a feedback signal from the motor is not necessary to have high torque response and high torque when operating at low speeds. The speed control range is 1:120.

3 : CLVector

Use this control method for general variable-speed control applications in which these qualities are necessary:

- A high level of responsiveness
- High-precision speed control up to zero speed
- High-precision torque control. A speed feedback signal from the motor is necessary for this control method. The speed control range is 1:1500.

4 : Adv OLVector

This is a control method for induction motors. Use this control method for applications in which high-precision speed control is necessary.

This control method has high speed and torque response and high torque when operating at low speeds. The speed control range is 1:200.

5 : PM OLVector

The drive controls an IPM motor or SPM motor in this control method. Use this control method for general variable-speed control applications in which a high level of responsiveness or high-precision speed control are not necessary. The speed control range is 1:20.

6 : PM AOLVector

The drive can control an IPM motor in this control method. Use this control method for general variable-speed control applications in which high-precision speed control and torque limit are necessary. The speed control range is 1:20. The speed control range is 1:100 when *n8-57 = 1 [High-Freq Injection = Enabled]*.

7 : PM CLVector

The drive controls a PM motor in this control method. Use this control method for constant torque applications in which high-precision control with a PM motor is necessary. Also use this control method for general variable-speed control applications in which high torque response and high-precision torque control are necessary. A speed feedback signal from the motor is necessary for this control method. The speed control range is 1:1500.

8 : EZ Vector

The drive controls induction motors and PM motors in this control method. This control method uses an easier procedure to operate motors with more efficiency. Use this control method for derating torque applications. For example, fans and pumps.

■ A1-03 Init Parameters

No. (Hex.)	Name	Description	Default (Range)
A1-03 (0103)	Init Parameters	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets parameters to default values.	0 (0 - 9990)

Note:
- After you initialize the drive, the drive automatically sets *A1-03 = 0*.
- User Parameters can save the parameter values for your application and use these values as default values for drive initialization.
- To use the 2 motor switchover function, first turn OFF the terminal to which *H1-xx: MFDI Function Select = 61 [Motor 2 Select]* is set, then change the *A1-02* setting. An incorrect procedure will trigger *oPE08 [Parameter Selection Error]*.

0 : No Initialization

1110 : User / Solution Initialization

Sets parameters to the values set by the user as user settings. Set *o2-03 = 1 [UserPar Set Default Values = Set defaults]* to save the user settings.

You can save the parameter settings that were adjusted for the test run as user-set default values to the drive. Set *A1-03 = 1110* to reset to the saved parameter settings.

Follow this procedure to save User Parameter setting values, and to do a User Initialization.

1. Set parameters correctly for the application.
2. Set *o2-03 = 1 [UserPar Set Default Values = Set defaults]*.
   This saves parameter settings for a User Initialization.
   The drive will then automatically set *o2-03 = 0*.
3. When you make changes to the parameter values after you save the settings as User Parameter Settings, the drive will set the parameters to the User Parameter Setting value when you initialize with *A1-03 = 1110*.
   When you initialize the drive, the drive sets the parameter values to the User Parameter setting values.

2220 : 2-Wire Initialization

Sets MFDI terminal DI1 to Forward Run and terminal DI2 to Reverse Run, and resets all parameters to default settings.

3330 : 3-Wire Initialization

Sets MFDI terminal DI1 to Run, terminal DI2 to Stop, and terminal DI5 to FWD/REV, and resets all parameters to default settings.

4440 : Q2pack Init

The drive will not initialize the parameters in Table 12.2 when *A1-03 = 2220, 3330*.

Table 12.2 Parameters that are not Initialized Using a 2-Wire Sequence or a 3-Wire Sequence

No.	Name
A1-00	Language Selection
A1-02	Control Method
A1-07	Q2pack Enable
E1-03	V/f Pattern Selection
E5-01	PM Mot Code Selection
E5-02	PM Mot Rated Power (kW)
E5-03	PM Mot Rated Current (FLA)
E5-04	PM Mot Pole Count
E5-05	PM Mot Resistance (Ohms/Phase)
E5-06	PM d-Axis Inductance (mH/Phase)
E5-07	PM q-Axis Inductance (mH/Phase)
E5-09	PM BackEMF Vpeak (mV/(rad/ s))
E5-11	Enc ZPulse Offset
E5-24	PM BackEMF L-L Vrms (mV/rpm)
E5-25	Polar Est Timeout
F6-08	Comm Par RST@Initialize
F6-xx/F7-xx	Communication Option Parameters Set *F6-08 = 1 [Comm Par RST@Initialize = Factory Default - Reset]* to initialize communication option card parameters.
L8-35	Installation Selection
o2-04	Drive KVA Selection
q1-xx - q8-xx	q1-01 to q8-40: Q2pack Parameters
r1-xx	Connection 1a

Note:
- When *A1-03 = 2220, 3330*, the drive automatically set *A1-05 [Password Setting] = 0000*. Make sure that you set the password again for applications where a password is necessary.

■ A1-04 Password Input

No. (Hex.)	Name	Description	Default (Range)
A1-04 (0104)	Password Input	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Entry point for the password set in *A1-05 [Password Setting]*. The user can view the settings of parameters that are locked without entering the password. Enter the correct password in this parameter to change parameter settings.	0000 (0000 - 9999)

If the password entered in *A1-04* does not agree with the password setting in *A1-05*, you cannot change these parameters:

- *A1-01 [Access Level]*
- *A1-02 [Control Method]*
- *A1-03 [Init Parameters]*
- *A1-07 [Q2pack Enable]*
- *A2-01 to A2-32 [MAN1 Param1 to MAN3 Param12]*

To lock parameter settings after making changes without changing the password, enter the incorrect password in *A1-04* and push ↵.

Enter the Password to Unlock Parameters

Use this procedure to unlock parameter settings.

Set the password in *A1-05 [Password Setting]*, and show the Parameter Setting Mode screen on the keypad.

This procedure verifies the password, and makes sure that the parameter settings are unlocked.

1. Push ∧ or ∨ to select "A: INITIALIZATION", then push ↵.

2. Push or to select *[A1-04]*, then push .
   You can now change parameter settings.
3. Push or to move the digit and enter the password.
4. Push to confirm the password.
   The drive unlocks the parameters and automatically shows the Parameters Screen.
5. Push or to show *[A1-02]*, then push .
   The keypad shows the setting value for *[A1-02]*.
6. Push or to make sure that you can change the setting value.

Push F1 (Back) until the keypad shows the Parameter Setup Mode screen.

A1-05 Password Setting

No. (Hex.)	Name	Description	Default (Range)
A1-05 (0105)	Password Setting	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Set the password to lock parameters and prevent changes to parameter settings. Enter the correct password in *A1-04 [Password Input]* to unlock parameters and accept changes.	0000 (0000 - 9999)

This parameter can lock these parameter settings:

- *A1-01 [Access Level]*
- *A1-02 [Control Method]*
- *A1-03 [Init Parameters]*
- *A1-07 [Q2pack Enable]*
- *A2-01 to A2-32 [MAN1 Param1 to MAN3 Param12]*

Note:

- Usually, the keypad will not show *A1-05*. To show and set *A1-05*, show *A1-04 [Password Input]* and then push STOP and on the keypad at the same time.
- After you set *A1-05*, the keypad will not show it again until you enter the correct password in *A1-04*. Make sure that you remember the *A1-05* setting value. If you do not know the *A1-05* setting value, contact the manufacturer or your nearest sales representative.
- When *A1-03 = 2220, 3330 [2-Wire Initialization, 3-Wire Initialization]*, the drive is initialized to *A1-05 = 0000*. Be sure to set the password again when a password is necessary for the application.
- Change the setting value in *A1-05* to change the password. The new setting value becomes the new password.
- When you use the password to unlock and change a parameter, enter a value other than the password in *A1-04* to lock the parameter again with the same password.
- If *A1-04 ≠ A1-05*, Modbus Communication cannot read or write *A1-05*.

A1-07 Q2pack Enable

No. (Hex.)	Name	Description	Default (Range)
A1-07 (0128)	Q2pack Enable	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the drive to operate with Q2pack.	0 (0 - 2)

Q2pack is a simple visual programming tool that lets you connect function blocks to customize the drive and add PLC functions.

Note:

- DriveWorksEZ will overwrite drive settings when it uses MFDI/MFDO and MFAI/MFAO. When you use DriveWorksEZ to make changes to the drive, the changes will stay after you disable Q2pack.
- For more information about Q2pack, contact the manufacturer or your nearest sales representative.

0 : Disable Q2pack

1 : Enable Q2pack

2 : With DI

Set *H1-xx: MFDI Function Select = 9F [Q2pack Disable]*. Deactivate the digital input to enable programs made with Q2pack and activate the terminal to disable the programs.

A1-11 Firmware Update Lock

No. (Hex.)	Name	Description	Default (Range)
A1-11 (111D) Expert	Firmware Update Lock	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV This function locks the drive firmware. When enabled, users cannot flash new drive firmware.	0 (0, 1)

0 : Disabled

Lock is disabled.

1 : Enabled

Lock is enabled.

A1-12 Bluetooth ID

No. (Hex.)	Name	Description	Default (Range)
A1-12 (1564)	Bluetooth ID	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the password necessary to use Bluetooth to control the drive with a mobile device.	- (0000 - 9999)

A2: MANUAL SELECTION

You can register frequently used parameters and recently changed parameters here to access them quickly. You can show the registered parameters in [Manual Parameters] in the main menu.

A2-01 to A2-32 MAN1 Param1 to MAN3 Param12

No. (Hex.)	Name	Description	Default (Range)
A2-01 to A2-32 (0106 - 0125)	MAN1 Param1 to MAN3 Param12	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV You can select a maximum of 32 parameters or monitors for the drive and set them to parameters *A2-01 to A2-32*. The [Manual Setup] section of the keypad shows the set parameters. You can immediately access these set parameters.	Parameters in General-Purpose Setup Mode (Determined by A1-07)

Note:
- You must set *A1-01 = 1 [Access Level = Manual Setup]* to access parameters *A2-01 to A2-32*.
- When *A1-07 = 1 or 2 [Q2pack Enable = Enable Q2pack or With DI]*, the drive saves *q: Q2PACK PARAMETERS* to *A2-01 to A2-32*.

The drive saves these parameters to *A2-01 to A2-32*.

- The drive saves a maximum of 32 parameters.

  Note:
  Set *A1-01 = 2 [Standard Parameters]* or *A1-01 = 3 [Expert Parameters]* to register the necessary parameters.

- The drive automatically saves changed parameters to *A2-17 to A2-32*.

  Note:
  Set *Manual Autoset Parameters = 1 [Auto Save]*.

A2-33 Manual Autoset Parameters

No. (Hex.)	Name	Description	Default (Range)
A2-33 (0126)	Manual Autoset Parameters	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the automatic save feature for changes to parameters *MAN2 Param7 to MAN3 Param12*.	0 (0, 1)

0 : Manual Entry

Set User Parameters manually.

1 : Auto Save

The drive automatically registers changed parameters to *A2-17 to A2-32*. The drive automatically saves the most recently changed parameter to *A2-17*, and saves a maximum of 16 parameters. After the drive registers 16 parameters, when you save a new parameter, the drive will remove a parameter from the User Parameter list to make space for the new parameter. The drive removes parameters with First In, First Out.

You can show the registered parameters in [Manual Parameters] in the main menu.

Note:

In General-Purpose Setup Mode, the drive registers parameters starting from *A2-27* because parameters *A2-26* and lower are already registered by default.

12.2 b: APPLICATION

The parameter group *b: APPLICATION* sets the following functions.

- Frequency reference source/Run command source
- Stopping method settings
- DC Injection Braking
- Speed Search
- Timer Function
- PID control
- Dwell function
- Droop control
- Energy Savings Control
- Zero Servo Control

◆ b1: OPERATION MODE SELECT

b1 parameters set the operation mode for the drive.

■ b1-01 Freq. Ref. Sel. 1

No. (Hex.)	Name	Description	Default (Range)
b1-01 (0180)	Freq. Ref. Sel. 1	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the input method for the frequency reference.	1 (0 - 4)

Note:

- Push LO/RE on the keypad to set the input mode to LOCAL and enter the frequency reference from the keypad.
- When the drive receives a Run command when the frequency reference is 0 Hz or less than the *E1-09 [Min Output Frequency]* value, RUN on the keypad will flash. Check the setting for the frequency reference input and enter a value more than or equal to the *E1-09* value.

0 : Keypad

Use the keypad to enter the frequency reference.

Use ∧ and ∨ on the keypad to change the frequency reference.

1 : Analog Input

Use MFAI terminals AI1, AI2, and AI3 to input an analog frequency reference with a voltage or current input signal.

- Voltage Input
  Refer to Table 12.3 to use a voltage signal input to one of the MFAI terminals.

Table 12.3 Frequency Reference Voltage Input

Terminal	Terminal Signal Level	Parameter Settings				Note
		Signal Level Selection	Function Selection	Gain	Bias	
AI1	0 - 10 V	H3-01 = 0	H3-02 = 0 [Frequency Reference]	H3-03	H3-04	Set DIP switch S1-1 to “V” for voltage input.
	-10 - 10 V	H3-01 = 1				
AI2	0 - 10 V	H3-09 = 0	H3-10 = 0 [Frequency Reference]	H3-11	H3-12	Set DIP switch S1-2 to “V” for voltage input.
	-10 - 10 V	H3-09 = 1				
AI3	0 - 10 V	H3-05 = 0	H3-06 = 0 [Frequency Reference]	H3-07	H3-08	Set DIP switch S1-3 to “V” for voltage input. Set DIP switch S4 to “AI” for analog input.
	-10 - 10 V	H3-05 = 1				

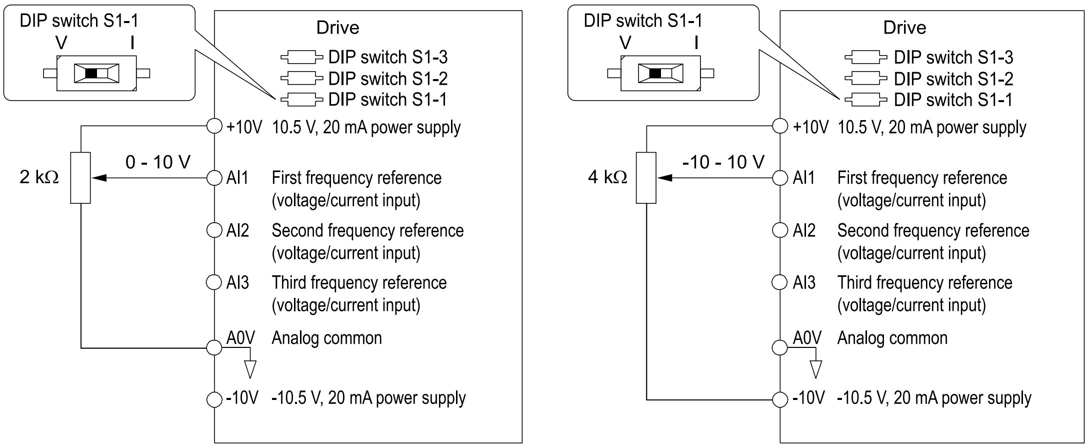


Figure 12.1 Example of Setting the Frequency Reference with a Voltage Signal to Terminal AI1

Note:

You can also use this diagram to wire terminals AI2 and AI3.

- Current Input
  Refer to Table 12.4 to use a current signal input to one of the MFAI terminals.

Table 12.4 Frequency Reference Current Input

Terminal	Signal Level	Parameter Settings				Note
		Signal Level Selection	Function Selection	Gain	Bias	
AI1	4 mA to 20 mA	H3-01 = 2	H3-02 = 0 [Frequency Reference]	H3-03	H3-04	Set DIP switch S1-1 to "I" for current input.
	0 - 20 mA	H3-01 = 3				
AI2	4 mA to 20 mA	H3-09 = 2	H3-10 = 0 [Frequency Reference]	H3-11	H3-12	Set DIP switch S1-2 to "I" for current input.
	0 - 20 mA	H3-09 = 3				
AI3	4 mA to 20 mA	H3-05 = 2	H3-06 = 0 [Frequency Reference]	H3-07	H3-08	Set DIP switch S1-3 to "I" for current input. Set DIP switch S4 to "AI" for analog input.
	0 - 20 mA	H3-05 = 3				

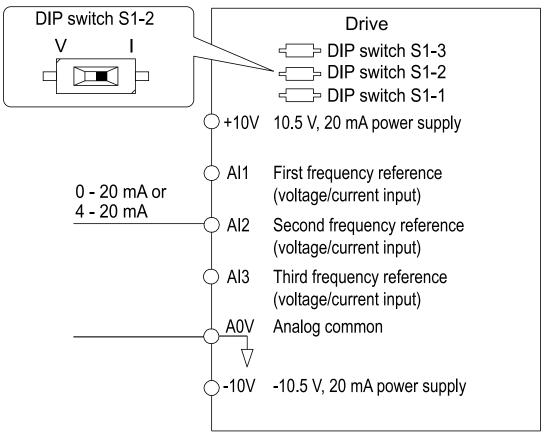


Figure 12.2 Example of Setting the Frequency Reference with a Current Signal to Terminal AI2

Note:

You can also use this diagram to wire terminals AI1 and AI3.

Changing between master and auxiliary frequency references

Use the multi-step speed reference function to change the frequency reference input between terminals AI1, AI2, and AI3.

2 : Modbus

Use Modbus communications to enter the frequency reference.

3 : Option PCB

Use a communications option card or input option card connected to the drive to enter the frequency reference.

Refer to the instruction manual included with the option card to install and set the option card.

Note:

If *b1-01 = 3* but no connected option card, then *oPE05 [Run Cmd/Freq Ref Source Sel Err]* will flash on the keypad.

4 : Pulse Train Input

Use a pulse train signal from the pulse train input terminal PI to enter the frequency reference.

Do this procedure to make sure that the pulse train signal is operating correctly.

1. Set *b1-01 = 4*, *H6-01 = 1 [PI Pulse Train Function = PIDFbk Value]*.
2. Set *H6-02 [PI Frequency Scale]* to the number of pulses that determine 100% of the frequency reference.
3. Enter a pulse train signal on the terminal PI and make sure that the keypad shows a correct frequency reference.

■ b1-02 Run Comm. Sel 1

No. (Hex.)	Name	Description	Default (Range)
b1-02 (0181)	Run Comm. Sel 1	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the input method for the Run command.	1 (0 - 3)

0 : Keypad

Use the keypad to enter the Run command.

You can use the JOG operation or the FWD/REV commands from the keypad.

Note:

LO/RE will illuminate when the keypad is the Run command source.

1 : Analog Input

Use the control circuit terminals to enter the Run command. Select the input method for the Run command with an *H1-xx* parameter.

Set *H1-xx = 1 to 5 [3-Wire Sequence, Run Command (2-Wire Sequence)]*. The default setting is 2-wire sequence 1.

- 2-wire Sequence 1
  This sequence has two input types: FWD/Stop and REV/Stop. Set *A1-03 = 2220 [Init Parameters = 2-Wire Initialization]* to initialize the drive and set terminals DI1 and DI2 for a 2-wire sequence.
- 2-wire Sequence 2
  This sequence has two input types: Run/Stop and FWD/REV.
- 3-Wire Sequence
  This sequence has three input types: Run, Stop, and FWD/REV. Set *A1-03 = 3330 [Init Parameters = 3-Wire Initialization]* to initialize the drive and set terminals DI1, DI2, and DI5 for a 3-wire sequence.

2 : Modbus

Use Modbus communications to enter the Run command.

3 : Option PCB

Use a communications option card or input option card connected to the drive to enter the Run command.

Refer to the instruction manual included with the option card to install and set the option card.

Note:

If *b1-02 = 3* but no connected option card, then *oPE05 [Run Cmd/Freq Ref Source Sel Err]* will flash on the keypad.

■ b1-03 Stopping Method Selection

No. (Hex.)	Name	Description	Default (Range)
b1-03 (0182)	Stopping Method Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the method to stop the motor after removing a Run command or entering a Stop command.	0 (0 - 3, 9)

Note:

The setting range is 0, 1, and 3 when *A1-02 = 3, 4, 5, 6, 7, or 8 [Control Method = CLVector, Adv OLVector, PPM OLVector, PM AOLVector, PM CLVector, or EZ Vector]*.

Select the applicable stopping method for the application from these four options:

0 : Ramp->Stop

Enter the Stop command or turn OFF the Run command to decelerate the motor to stop.

The drive ramps the motor to stop as specified by the deceleration time. The default setting for the deceleration time is *C1-02 [Decel Time 1]*. The actual deceleration time changes as the load conditions change (for example, mechanical loss and inertia).

If the output frequency is less than or equal to the value set in *b2-01 [ZSpd/DCI Threshold]* during deceleration, the drive will do DC Injection Braking, Zero Speed Control, or Short Circuit Braking, as specified by the control method.

- **Ramp to Stop with V/f, AOLV, CL-V/f, and OLV Control Methods**
  Parameter *b2-01* sets the frequency to start DC Injection Braking at stop. If the output frequency is less than or equal to the value set in *b2-01* during deceleration, then the drive will perform DC Injection Braking for the time set in *b2-04 [DCInj Time@Stop]*.

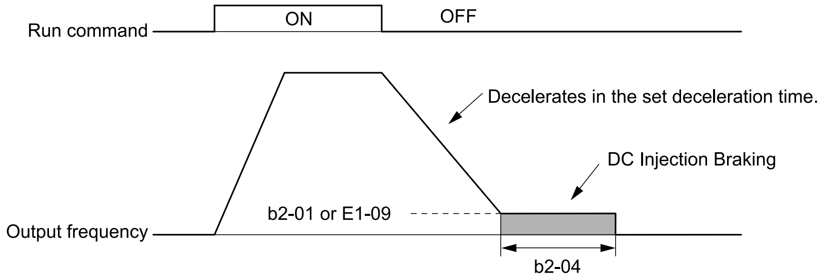


Figure 12.3 Ramp to Stop with V/f, AOLV, CL-V/f, and OLV Control Methods

Note:

When *b2-01 ≤ E1-09 [Min Output Frequency]*, the drive will start DC Injection Braking from the frequency set in *E1-09*.

- **Ramp to Stop with CLV/PM, AOLV/PM, and EZOLV Control Methods**
  Parameter *b2-01* sets the frequency to start Short Circuit Braking. When the output frequency is less than or equal to the value set in *b2-01* during deceleration, then the drive will do Short Circuit Braking for the time set in *b2-13 [SCB Time@Stop]*. When *b2-04 ≠ 0*, the drive will do DC Injection Braking for the time set in *b2-04* when Short Circuit Braking is complete.

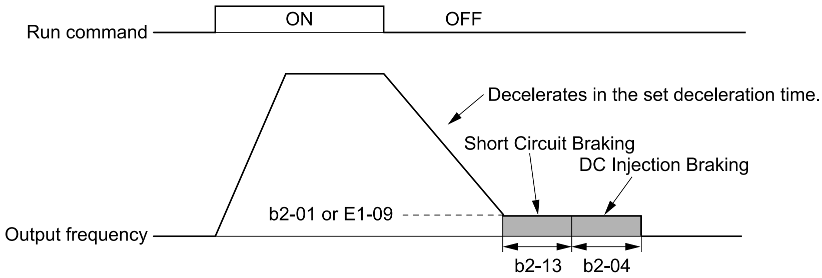


Figure 12.4 Ramp to Stop with CLV/PM, AOLV/PM, and EZOLV Control Methods

Note:

When *b2-01 ≤ E1-09*, the drive will start Short Circuit Braking from the frequency set in *E1-09*.

If *b2-01 = 0 Hz* and *E1-09 = 0 Hz*, the drive will not do Short Circuit Braking.

- **Ramp to Stop in CLV and CLV/PM Control Methods**
  Parameter *b2-01* sets the frequency to start Zero Speed Control at stop. When the output frequency is less than or equal to the value set in *b2-01* during deceleration, the drive will do Zero Speed Control for the time set in *b2-04*.

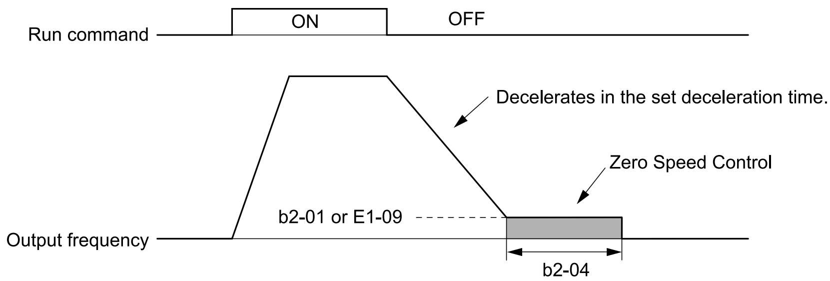


Figure 12.5 Ramp to Stop in CLV and CLV/PM Control Methods

Note:

When if *b2-01 ≤ E1-09*, the drive will start Zero Speed Control from the frequency set in *E1-09*.

1 : Coast->Stop

Enter the Stop command or turn OFF the Run command and turn OFF drive output and coast the motor to stop.

Load conditions will have an effect on the deceleration rate as the motor coasts to stop (for example, mechanical loss and inertia).

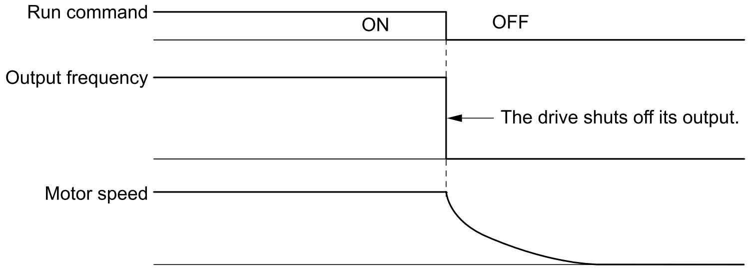


Figure 12.6 Coast to Stop

Note:

The drive ignores the Run command for the time set in *L2-03 [Min Baseblck Time]* when the Stop command is entered or when the Run command is switched OFF. Do not enter the Run command until the motor comes to a complete stop. Use DC Injection or Speed Search to restart the motor before it stops.

2 : DC Inj->Stop

Enter the Stop command or turn OFF the Run command and turn OFF drive output for the time set in *L2-03*. The drive waits for the minimum baseblock time and then injects the amount of DC current into the motor set in *b2-02 [DCI Braking Current]* to stop the motor with DC current.

DC Injection Braking stops the motor more quickly than coast to stop.

Note:

If *A1-02 = 3, 4, 5, 6, or 7*, DC Injection Braking to Stop is not available.

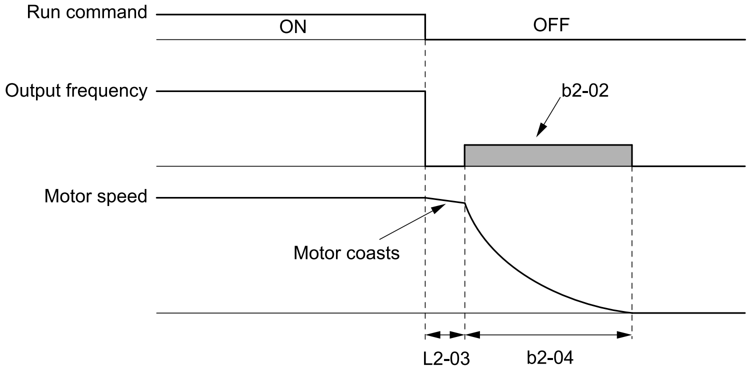


Figure 12.7 DC Injection Braking to Stop

The value set in *b2-04* and the output frequency when the drive receives the Stop command determine the DC Injection Braking time. The drive calculates the DC Injection Braking time as in Figure 12.8.

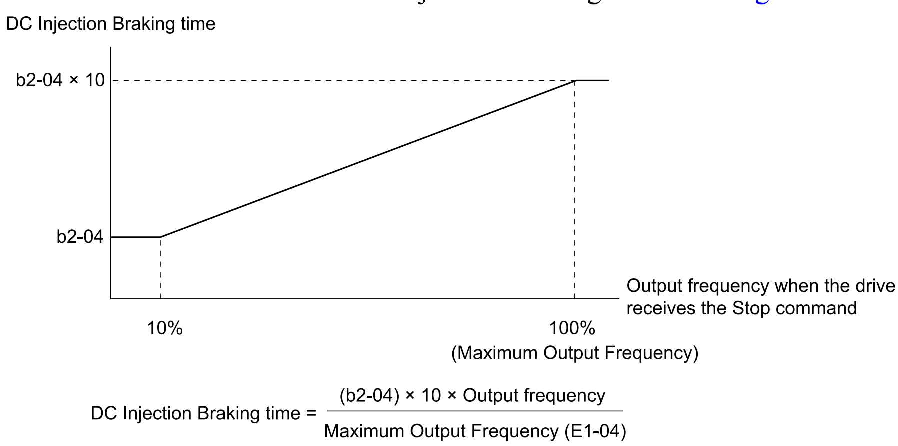


Figure 12.8 DC Injection Braking Time and Output Frequency

Note:

Set *L2-03* to a high value that will not trigger *oC [Overcurrent]* when the drive uses DC Injection Braking to stop the motor.

3 : Timed Coast->Stop

Enter the Stop command or turn OFF the Run command and turn OFF drive output and coast the motor to stop. The drive ignores the Run command until the “Run wait time” *t* is expired.

To start the drive again, enter the Run command after the “Run wait time” *t* is expired.

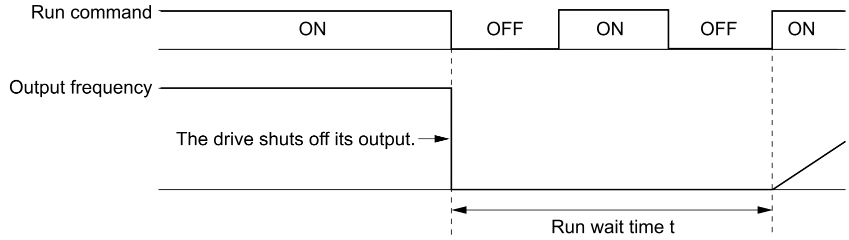


Figure 12.9 Coast to Stop with Timer

The active deceleration time and the output frequency when drive receives the Stop command determine the length of “Run wait time” *t*.

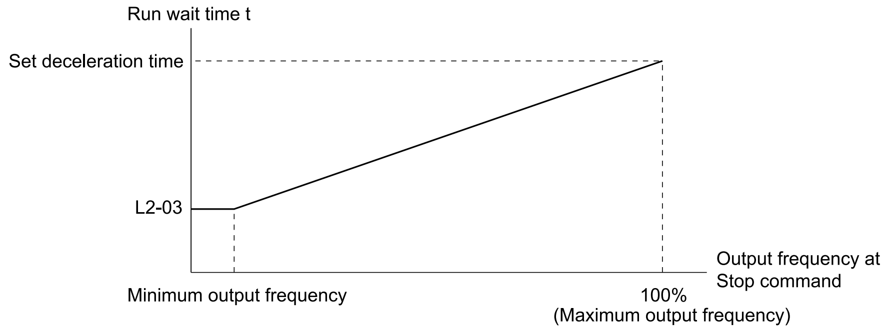


Figure 12.10 Run Wait Time and Output Frequency

9 : Distance Stop

Enter the Stop command or turn OFF the Run command for the drive to always decelerate for the same distance. The drive uses the active deceleration time and the value set in *E1-04 [Max Output Frequency]* to calculate stopping distance S1. The drive holds its current speed when stopping from a frequency less than the maximum speed. When the distance covered is equal to S1 minus S2, the drive ramps to stop in the current deceleration time. Adjust the stopping precision with *d4-12 [Stop Position Gain]*.

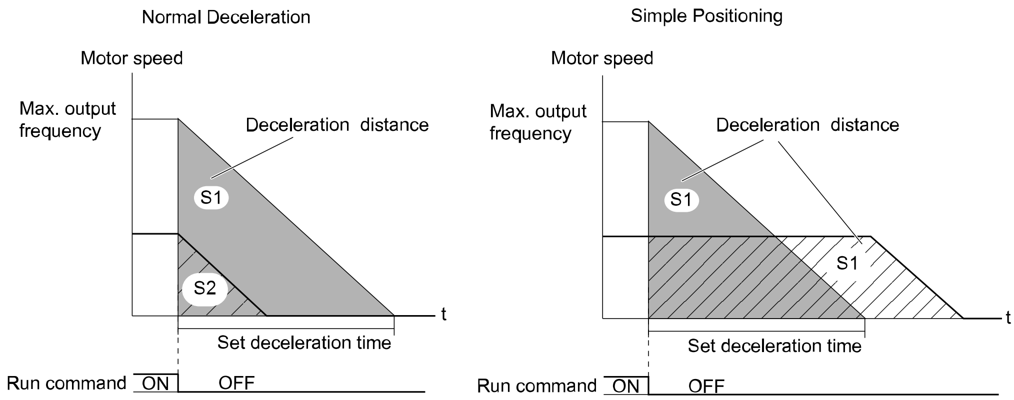


Figure 12.11 Deceleration When Set for Stop in Position

Note:

Note these points when setting Stop in Position.

- The drive uses the deceleration time that was active when the drive received the Stop command or when the Run command was turned OFF to calculate the stop time. If you change the deceleration time during deceleration, the positioning will not be accurate.
- Set *b6-03 = 0.0 [Dwell Ref@Stop = 0.0]*, *b6-04 = 0.0 [Dwell Time@Stop = 0.0 s]*.
- The KEB Ride-Thru function is not available. Set *H1-xx: MFDI Function Select ≠ 40, 41, 42, 43 [KEB Thru1 NC, KEB Thru1 NO, KEB Thru2 NC, KEB Thru2 NO]*.
- Set *L3-04 = 0 [StallP@Decel Enable = Disabled]*. A dynamic braking option can be necessary for regenerative loads.
- Set *L3-11 = 0 [Overvolt Supression Select = Disabled]*.
- The High Slip Braking function is not available. Set *H1-xx: MFDI Function Select ≠ 32 [HiSlipBraking]*.
- Set *C2-03, C2-04 = 0.00 [Jerk@Start of Decel, Jerk@End of Decel = 0.00 s]*.

■ b1-04 Reverse Operation Selection

No. (Hex.)	Name	Description	Default (Range)
b1-04 (0183)	Reverse Operation Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the reverse operation function. Disable reverse operation in fan or pump applications where reverse rotation is dangerous.	0 (0, 1)

When reverse operation is prohibited, the drive will not accept a Reverse operation command.

0 : Enabled

The drive will accept a Reverse operation command.

1 : Disabled

The drive will not accept a Reverse operation command.

■ b1-05 Below Min. Freq. Operation

No. (Hex.)	Name	Description	Default (Range)
b1-05 (0184)	Below Min. Freq. Operation	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the drive operation when the frequency reference decreases to less than the value set in *E1-09 [Min Output Frequency]*.	1 (1 - 4)

1 : Operate@FRef

When the frequency reference is less than the value set in *E1-09*, the drive will continue to operate the motor as specified by the frequency reference.

If the motor speed is less than or equal to the value set in *b2-01 [ZSpd/DCI Threshold]* when you enter the Stop command (or deactivate the Run command), the drive will do Zero Speed Control for the time set in *b2-04 [DCInj Time@Stop]* and then turn OFF its output.

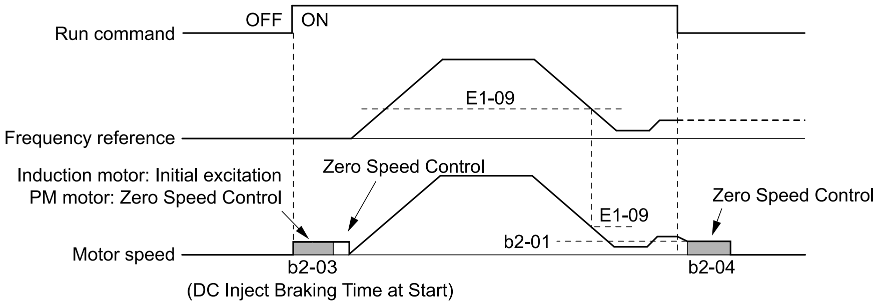


Figure 12.12 Operate at the Frequency Reference

2 : Baseblock coast

If the frequency reference is less than the value set in *E1-09*, the drive stops motor voltage output and the motor coasts to stop. If the motor speed is less than or equal to the value set in *b2-01*, then the drive will do Zero Speed Control for the time set in *b2-04*.

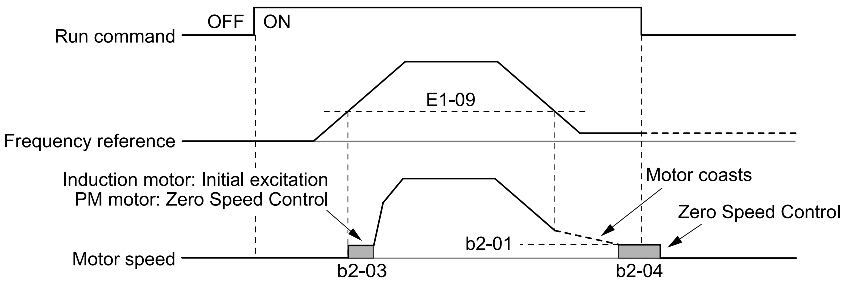


Figure 12.13 Baseblock (Motor Coasts)

3 : Min. Frequency

The drive operates the motor at the minimum frequency reference set in *E1-09* and the Run command is still enabled.

The drive decelerates the motor when the Stop command is entered (or when the Run command is switched OFF). If the motor speed falls below or is equal to the value set in *b2-01*, then the drive will perform Zero Speed Control for the time set in *b2-04*.

Parameter Details

12

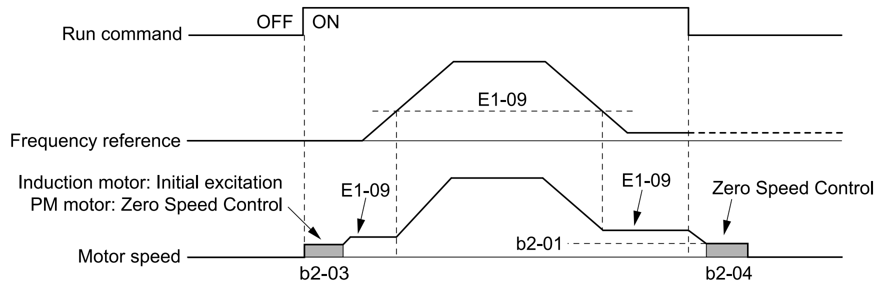


Figure 12.14 Operate at Minimum Frequency

4 : Zero Speed

The drive performs Zero Speed Control when the frequency reference falls below the value set in *E1-09*.

The drive performs Zero Speed Control again for the time set in *b2-04* when the Stop command is entered (or when the Run command is switched OFF).

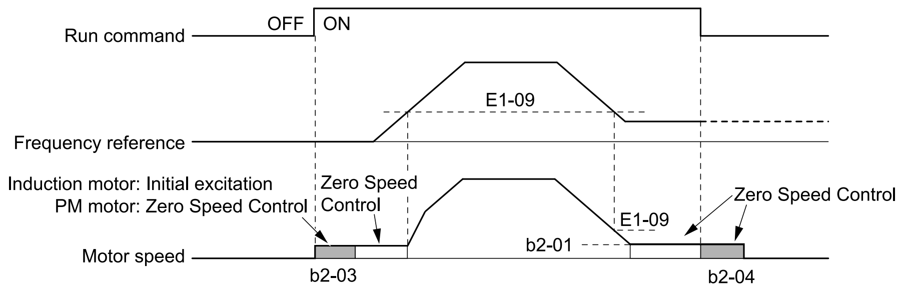


Figure 12.15 Operate at Zero Speed

■ b1-06 Double Scan DI Inputs Select

No. (Hex.)	Name	Description	Default (Range)
b1-06 (0185)	Double Scan DI Inputs Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the number of times that the drive reads the sequence input command to prevent problems from electrical interference.	2 (1, 2)

1 : Single Scan

The drive reads the terminal status one time. The drive immediately reads all changes to the terminal status.

This setting lets the drive quickly respond to changes in the sequence, but electrical interference can cause problems.

2 : Double Scan

The drive reads the terminal status two times. The drive reads all changes to the terminal status two times to make sure that the reading is the same.

The drive responds more slowly than when it reads the sequence one time, but this setting prevents electrical interference problems.

■ b1-07 LO/RE Run Selection

No. (Hex.)	Name	Description	Default (Range)
b1-07 (0186)	LO/RE Run Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets drive response to an existing Run command when the drive receives a second Run command from a different location.	1 (1, 2)

This parameter interlocks the drive to help prevent accidents that can occur if the motor starts to rotate because the Run command source changed.

To switch the RUN command source, push LO/RE on the keypad or set *H1-xx = 11, 9 [MFDI Function Select = LOC/REM Sel., Ext Ref 1/2]* and turn the terminal ON/OFF.

1 : Cycle RUN

If a Run command is enabled when you switch between Run command sources, the drive will not operate the motor.

When the drive is operating the motor, turn OFF the Run command to stop the motor. Enter the Run command again to start operation.

2 : Accept RUN

If a Run command is enabled when you switch between Run command sources, the drive will start to operate the motor or continue to operate the motor.

WARNING! *Sudden Movement Hazard.*
When using a 3-Wire sequence:
- *Set the drive for 3-Wire sequence.*
- *Set b1-17 = 1 [RUN@PowerUp Selection = Disregard RUN]*
- *Wire the drive for 3-Wire sequence.*

If these three conditions are correct, the motor can rotate in reverse when energizing the drive:
- *The drive is wired for 3-Wire sequence.*
- *The drive is set for a 2-Wire sequence (default).*
- *b1-17 = 2 [RUN@PowerUp Selection = Accept RUN]*

Failure to obey can cause death or serious injury from moving equipment.

■ b1-08 RUN@PRG Mode Selection

No. (Hex.)	Name	Description	Default (Range)
b1-08 (0187)	RUN@PRG Mode Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the conditions for the drive to accept a Run command entered from an external source when using the keypad to set parameters.	2 (1 - 3)

As a safety precaution, when the drive is in Programming Mode, it will not respond to a Run command.

This parameter helps prevent accidents that can occur if the motor starts to rotate because the drive received a Run command from an external source while the user is programming the drive. You can also set the drive to not show the Programming Mode when a Run command is active.

1 : NoRUN@Program

The drive rejects the Run command while in Programming Mode.

2 : RUN@Program

The drive accepts a Run command entered from an external source while in Programming Mode.

3 : Program@Stop only

The drive does not let the user enter Programming Mode when the drive is operating. The drive does not show the Programming Mode when a Run command is active.

■ b1-14 Phase Order Selection

No. (Hex.)	Name	Description	Default (Range)
b1-14 (01C3)	Phase Order Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the phase order for output terminals U/T1, V/T2, and W/T3. This parameter can align the Forward Run command from the drive and the forward direction of the motor without changing wiring.	0 (0, 1)

0 : Standard

1 : Phase Order Switch

■ b1-15 Freq. Ref. Sel. 2

No. (Hex.)	Name	Description	Default (Range)
b1-15 (01C4)	Freq. Ref. Sel. 2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the input method for frequency reference 2.	0 (0 - 4)

This parameter is enabled when *H1-xx = 9 [MFDI Function Select = Ext Ref 1/2]* is activated.

Note:
- Push LO/RE on the keypad to set the input mode to LOCAL and enter the frequency reference from the keypad.
- When the drive receives a Run command when the frequency reference is 0 Hz or less than the *E1-09 [Min Output Frequency]* value, the RUN on the keypad will flash. Check the setting for the frequency reference input and enter a value more than or equal to the *E1-09* value.

0 : Keypad

Use the keypad to enter the frequency reference.

Use and on the keypad to change the frequency reference.

1 : Analog Input

Use MFAI terminals AI1, AI2, and AI3 to input an analog frequency reference with a voltage or current input signal.

- Voltage Input
  Refer to Table 12.5 to use a voltage signal input to one of the MFAI terminals.

Table 12.5 Frequency Reference Voltage Input

Terminal	Terminal Signal Level	Parameter Settings				Note
		Signal Level Selection	Function Selection	Gain	Bias	
AI1	0 - 10 V	H3-01 = 0	H3-02 = 0 [Frequency Bias]	H3-03	H3-04	Set DIP switch S1-1 to “V” for voltage input.
	-10 - +10 V	H3-01 = 1				
AI2	0 - 10 V	H3-09 = 0	H3-10 = 0 [Frequency Bias]	H3-11	H3-12	Set DIP switch S1-2 to “V” for voltage input.
	-10 - +10 V	H3-09 = 1				
AI3	0 - 10 V	H3-05 = 0	H3-06 = 0 [Frequency Bias]	H3-07	H3-08	Set DIP switch S1-3 to “V” for voltage input. Set DIP switch S4 to “AI” for analog input.
	-10 - +10 V	H3-05 = 1				

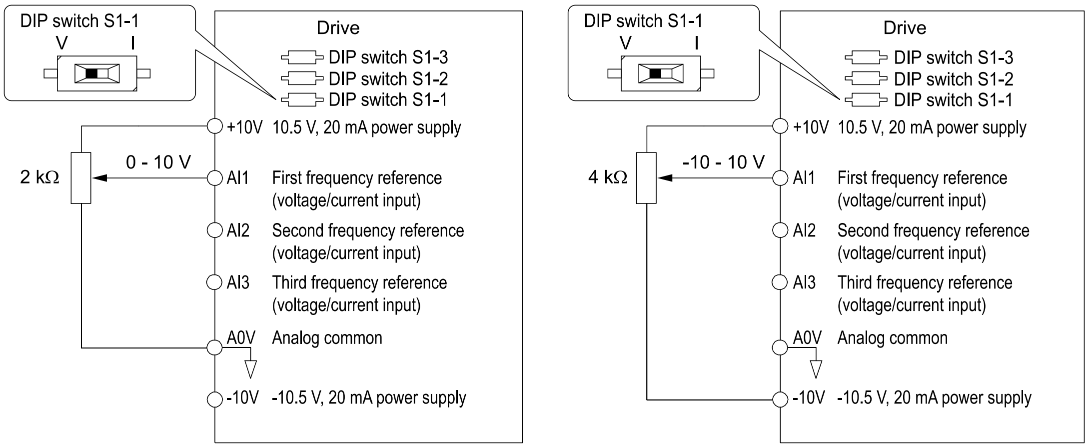


Figure 12.16 Example of Setting the Frequency Reference with a Voltage Signal to Terminal AI1

Note:
You can also use this diagram to wire terminals AI2 and AI3.

- Current Input
  Refer to Table 12.6 to use a current signal input to one of the MFAI terminals.

Table 12.6 Frequency Reference Current Input

Terminal	Signal Level	Parameter Settings				Note
		Signal Level Selection	Function Selection	Gain	Bias	
AI1	4 - 20 mA	H3-01 = 2	H3-02 = 0 [Frequency Bias]	H3-03	H3-04	Set DIP switch S1-1 to “I” for current input.
	0 - 20 mA	H3-01 = 3				
AI2	4 - 20 mA	H3-09 = 2	H3-10 = 0 [Frequency Bias]	H3-11	H3-12	Set DIP switch S1-2 to “I” for current input.
	0 - 20 mA	H3-09 = 3				
AI3	4 - 20 mA	H3-05 = 2	H3-06 = 0 [Frequency Bias]	H3-07	H3-08	Set DIP switch S1-3 to “I” for current input. Set DIP switch S4 to “AI” for analog input.
	0 - 20 mA	H3-05 = 3				

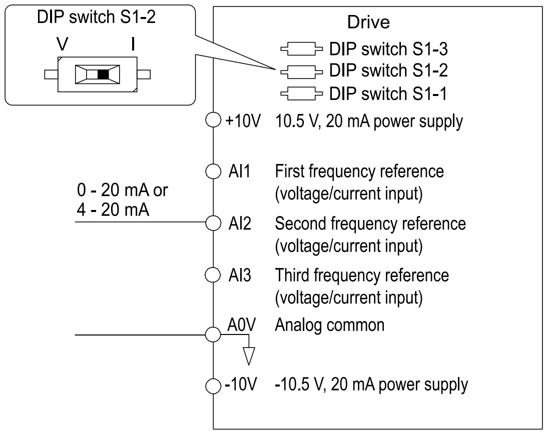


Figure 12.17 Example of Setting the Frequency Reference with a Current Signal to Terminal A2

Note:

You can also use this diagram to wire terminals AI1 and AI3.

Changing between Master and Auxiliary Frequency References

Use the multi-step speed reference function to change the frequency reference input between terminals AI1, AI2, and AI3.

2 : Modbus

Use Modbus communications to enter the frequency reference.

3 : Option PCB

Use a communications option card or input option card connected to the drive to enter the frequency reference.

Refer to the instruction manual included with the option card to install and set the option card.

Note:

If *b1-01 = 3* but no connected option card, then *oPE05 [Run Cmd/Freq Ref Source Sel Err]* will flash on the keypad.

4 : Pulse Train Input

Use a pulse train signal from the pulse train input terminal PI to enter the frequency reference.

Do this procedure to make sure that the pulse train signal is operating correctly.

1. Set *b1-01 = 4*, *H6-01 = 1 [PI Pulse Train Function = PIDFbk Value]*.
2. Set *H6-02 [PI Frequency Scale]* to the number of pulses that determine 100% of the frequency reference.
3. Enter a pulse train signal on the terminal PI and make sure that the keypad shows a correct frequency reference.

■ b1-16 Run Comm. Sel 2

No. (Hex.)	Name	Description	Default (Range)
b1-16 (01C5)	Run Comm. Sel 2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the input method for Run Command 2 when the user switches the control circuit terminals ON/OFF to change the Run command source.	0 (0 - 3)

This parameter is enabled when *H1-xx = 9 [MFDI Function Select = Ext Ref 1/2]* is activated.

0 : Keypad

Use the keypad to enter the Run command.

You can use the JOG operation or the FWD/REV commands from the keypad.

Note:

LO/RE will illuminate when the keypad is the Run command source.

1 : Analog Input

Use the control circuit terminals to enter the Run command. Select the input method for the Run command with an *H1-xx* parameter

Set *H1-xx = 1 to 5 [3-Wire Sequence, Run Command (2-Wire Sequence)]*. The default setting is 2-wire sequence 1.

- 2-wire Sequence 1

This sequence has two input types: FWD/Stop and REV/Stop. Set *A1-03 = 2220 [Init Parameters = 2-Wire Initialization]* to initialize the drive and set terminals DI1 and DI2 for a 2-wire sequence.

- 2-wire Sequence 2
  This sequence has two input types: Run/Stop and FWD/REV.
- 3-Wire Sequence
  This sequence has three input types: Run, Stop, and FWD/REV. Set *A1-03 = 3330 [Init Parameters = 3-Wire Initialization]* to initialize the drive and set terminals DI1, DI2, and DI5 for a 3-wire sequence.

2 : Modbus

Use Modbus communications to enter the Run command.

3 : Option PCB

Use a communications option card or input option card connected to the drive to enter the Run command.

Refer to the instruction manual included with the option card to install and set the option card.

Note:

If *b1-02 = 3* but no connected option card, then *oPE05 [Run Cmd/Freq Ref Source Sel Err]* will flash on the keypad.

■ b1-17 RUN@PowerUp Selection

No. (Hex.)	Name	Description	Default (Range)
b1-17 (01C6)	RUN@PowerUp Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets drive response when energizing a drive that has an external Run command. Set this parameter in applications where energizing or de-energizing the drive enables the Run command.	1 (1, 2)

1 : Disregard RUN

The drive does not start to operate the application when the power is switched ON, even when there is an existing Run command.

Enter the Run command again to operate the application.

Note:

When you energize the drive, the RUN light on the keypad will flash quickly if the Run command is already enabled from an external source.

2 : Disregard RUN

When there is an existing Run command, the drive starts to operate the application when the power is switched ON.

WARNING! *Sudden Movement Hazard.*
When using a 3-Wire sequence:
- *Set the drive for 3-Wire sequence.*
- *Set b1-17 = 1 [RUN@PowerUp Selection = Disregard RUN]*
- *Wire the drive for 3-Wire sequence.*

If these three conditions are correct, the motor can rotate in reverse when energizing the drive:
- *The drive is wired for 3-Wire sequence.*
- *The drive is set for a 2-Wire sequence (default).*
- *b1-17 = 2 [RUN@PowerUp Selection = Accept RUN]*

Failure to obey can cause death or serious injury from moving equipment.

■ b1-21 CLV Start Selection

No. (Hex.)	Name	Description	Default (Range)
b1-21 (0748) Expert	CLV Start Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets drive response to a Run command when *A1-02 = 3 or 7 [Control Method = CLVector or PM CLVector]*. Usually it is not necessary to change this setting.	1 (1, 2)

1 : Reject RUN

When motor speed ≥ *b2-01* or motor speed < *E1-09*, the drive will not accept a Run command.

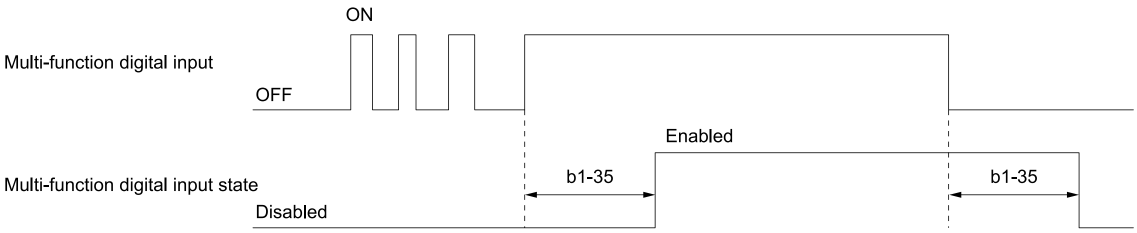
2 : Accept RUN

When motor speed ≥ *b2-01* or motor speed < *E1-09*, the drive will accept a Run command.

■ b1-35 DI Deadband Time

No. (Hex.)	Name	Description	Default (Range)
b1-35 (1117) Expert	DI Deadband Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the deadband time for MFDIs.	0.0 ms (0.0 to 100.0 ms)

When the on/off time for MFDIs is longer than the time set in *b1-35*, the drive activates the MFDI. Set this parameter to prevent malfunctions caused by relay chattering for applications in which relays send input to MFDI terminals.



◆ b2: DC INJ / SHORT CKT BRAKE

b2 parameters set the DC Injection Braking and Short Circuit Braking functions.

- DC Injection Braking: A braking method that injects DC current into the motor windings. This function should not be used too frequently, because it generates a fair amount of heat in the motor.
- Short Circuit Braking: A braking method for PM motors.

■ b2-01 ZSpd/DCI Threshold

No. (Hex.)	Name	Description	Default (Range)
b2-01 (0189)	ZSpd/DCI Threshold	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the frequency to start DC Injection Braking, Short Circuit Braking, and Zero Servo.	Determined by A1-02 (0.0 - 10.0 Hz)

Note:

This parameter is available when *b1-03 = 0 [Stopping Method Selection = Ramp->Stop]*.

When the control method selected in *A1-02 [Control Method]* changes, the *b2-01* function changes.

- *A1-02 = 0, 1, 2, or 4 [V/f Control, PG V/f Control, OLVector, or Adv OLVector]* and *n4-72 = 1[Spd Fbk Mode = Without PG]*
  In these control methods, *b2-01* sets the starting frequency for DC Injection Braking at Stop. When the output frequency is less than or equal to the value set in *b2-01*, the drive will inject the quantity of DC current set in *b2-02 [DCI Braking Current]* into the motor for the time set in *b2-04 [DCInj Time@Stop]*.

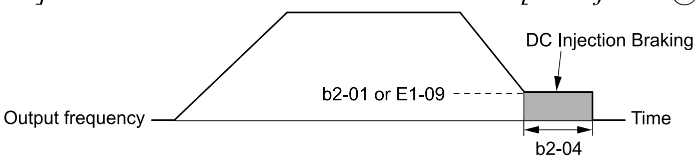


Figure 12.18 DC Injection Braking at Stop

Note:

When *b2-01 ≤ E1-09 [Min Output Frequency]*, the drive will start DC Injection Braking from the frequency set in *E1-09*.

- *A1-02 = 5, 6, or 8 [PM OLVector, PM AOLVector, or EZ Vector]*
  In these control methods, *b2-01* sets the starting frequency for Short Circuit Braking at Stop. When the output frequency is less than or equal to the value set in *b2-01*, the drive will do Short Circuit Braking for the time set in *b2-13 [SCB Time@Stop]*. When *b2-04 > 0.00 s*, the drive will complete Short Circuit Braking, then do DC Injection Braking for the time set in *b2-04*.

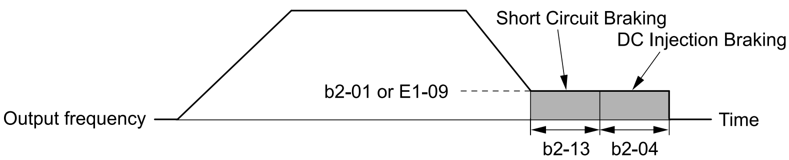


Figure 12.19 Short Circuit Braking at Stop

Note:

When *b2-01 ≤ E1-09 [Min Output Frequency]*, the drive will start Short Circuit Braking from the frequency set in *E1-09*. If *b2-01 and E1-09 = 0 Hz*, the drive will not do Short Circuit Braking.

- *A1-02 = 3 or 7 [CLVector or PM CLVector]* or *A1-02 = 4 [Adv OLVector]* and *n4-72 = 2 [With PG]*
  In these control methods, *b2-01* sets the starting frequency for Zero Speed Control at Stop. When the output frequency is less than or equal to the value set in *b2-01*, the drive will do Zero Speed Control for the time set in *b2-04*.

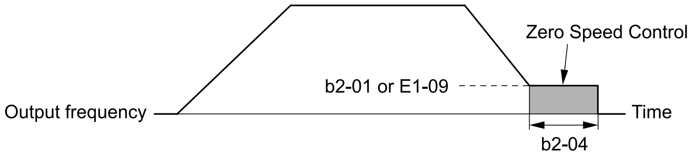


Figure 12.20 Zero Speed Control at Stop

Note:

When *b2-01 ≤ E1-09 [Min Output Frequency]*, the drive will start Short Circuit Braking from the frequency set in *E1-09*.

■ b2-02 DCI Braking Current

No. (Hex.)	Name	Description	Default (Range)
b2-02 (018A)	DCI Braking Current	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the DC Injection Braking current as a percentage of the drive rated current.	50% (0 - 100%)

When the DC Injection Braking current is more than 50%, the drive decreases the carrier frequency to 1 kHz. The motor rated current determines how much DC Injection Braking current that the drive can use.

The DC Injection Braking current level has an effect on the strength of the magnetic field that locks the motor shaft. As the current level increases, the motor windings will supply more heat. Do not set this parameter higher than the level that is necessary to hold the motor shaft.

Note:

When *A1-02 = 4 [Control Method = Adv OLVector]* and *n4-72 = 2 [Spd Fbk Mode = With PG]*, the drive ignores the *b2-02* setting and does initial excitation.

■ b2-03 DCInj Time@Start

No. (Hex.)	Name	Description	Default (Range)
b2-03 (018B)	DCInj Time@Start	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the DC Injection Braking Time at stop. Sets the zero speed control at stop in CLV, AOLV, or CLV/PM.	A1-02 = 4: 0.03 s Other than A1-02 = 4: 0.00 s (0.00 - 10.00 s)

This function stops then restarts a coasting motor and increases motor flux to make high starting torque (a process called initial excitation). Set this parameter to 0.00 to disable the function.

Note:

To restart a coasting motor, use DC Injection Braking to stop and then restart the motor, or enable Speed Search. DC Injection Braking can trigger *ov [Overvoltage]* or *oC [Overcurrent]*.

■ b2-04 DCInj Time@Stop

No. (Hex.)	Name	Description	Default (Range)
b2-04 (018C)	DCInj Time@Stop	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the DC Injection Braking Time at stop. Sets the zero speed control at stop in CLV, AOLV, or CLV/PM.	Determined by A1-02 (0.00 - 10.00 s)

This function fully stops a motor with a large inertia during deceleration and will not let the inertia continue to rotate the motor.

Set this parameter to 0.00 to disable the function.

When a longer time is required to stop the motor, increase the value.

■ b2-08 MagFlux Comp Value

No. (Hex.)	Name	Description	Default (Range)
b2-08 (0190)	MagFlux Comp Value	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets how much current the drive injects when DC Injection Braking at Start starts (Initial Excitation) as a percentage of *E2-03 [Mot No-Load Current]*.	0% (0 - 1000%)

This parameter starts a high-capacity motor (motors with a large secondary circuit time constant). This function can quickly increase motor flux to make high starting torque (a process called initial excitation).

The DC Injection Braking at start current level changes linearly from the value set in *b2-08* to the value set in *E2-03*, as shown in Figure 12.21.

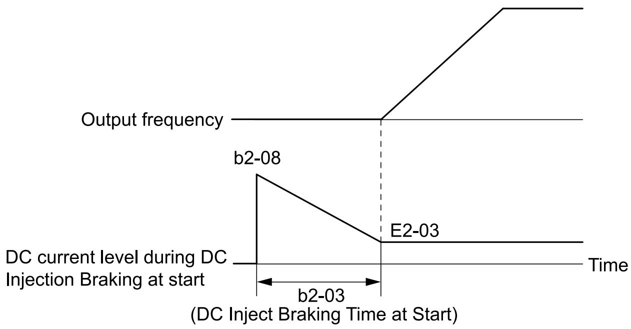


Figure 12.21 DC Current Level during DC Injection Braking at Start

Note:
- If *b2-08 < 100%*, flux will develop very slowly.
- When *b2-08 = 0%* the DC current level will be the DC Injection current set in *b2-02 [DCI Braking Current]*.
- If *b2-08* is set too high, DC Injection Braking at start will make a loud audible noise. Adjust *b2-08* to decrease the volume to the permitted level.

■ b2-12 SCB Time@Start

No. (Hex.)	Name	Description	Default (Range)
b2-12 (01BA)	SCB Time@Start	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Short Circuit Braking time at start.	0.00 s (0.00 - 25.50 s)

This function restarts a stopped PM motor. The drive short circuits all three motor phases to make braking torque in the motor.

Set this parameter to 0.00 to disable the function.

Note:
- Short circuit Braking will let external forces rotate the PM motor. Use DC Injection Braking to prevent motor rotation from external forces.
- Motor speed and load conditions can make it necessary to install a dynamic braking option on the drive.

■ b2-13 SCB Time@Stop

No. (Hex.)	Name	Description	Default (Range)
b2-13 (01BB)	SCB Time@Stop	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Short Circuit Braking time at stop.	A1-02 = 8: 0.00 s Other than A1-02 = 8: 0.50 s (0.00 - 25.50 s)

This function fully stops a PM motor with a large inertia during deceleration and will not let the inertia continue to rotate the motor.

Short Circuit Braking operates for the time set in *b2-13* when output frequency is less than the value set in *b2-01 [ZSpd/DCI Threshold] or E1-09 [Min Output Frequency]*.

Set this parameter to 0.00 to disable the function.

Note:

Motor speed and load conditions can make it necessary to install a dynamic braking option on the drive.

■ b2-18 SCB Current

No. (Hex.)	Name	Description	Default (Range)
b2-18 (0177)	SCB Current	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Short Circuit Braking Current as a percentage of the motor rated current.	100.0% (0.0 - 200.0%)

The Short Circuit Braking current cannot be higher than the drive rated current, although a higher current level can be set using *b2-18*. The maximum rated current is 120% when the drive is set for Normal Duty (*C6-01 = 1 [ND Rating]*). The maximum rated current is 150% when the drive is set for Heavy Duty (*C6-01 = 0 [HD Rating]*).

◆ b3: SPEED SEARCH

The Speed Search function detects the actual speed of a coasting motor, then restarts the motor before the motor stops. Use Speed Search in these conditions:

- To continue operation after momentary power loss
- To switch from commercial power supply to drive power
- To restart a coasting fan

For example, the drive output turns off and the motor coasts when there is a momentary loss of power. After you return power, the drive does Speed Search on the coasting motor, and restarts the motor from the detected speed.

When you use a PM motor, enable *b3-01 [SpSrch@Start Selection]*.

There are two types of Speed Search for induction motors: Current Detection and Speed Estimation. Use parameter *b3-24 [SpSrch Method Selection]* to select the type of Speed Search.

Parameter settings are different for different types of Speed Search. Refer to the following table for more information.

Table 12.7 Speed Search and Related Parameters

Parameter	Current Detection 2	Speed Estimation
b3-01 [SpSrch@Start Selection]	x	x
b3-03 [SpSrch Deceleration Time]	x	-
b3-05 [SpSrch Delay Time]	x	x
b3-06 [Speed Curr Lev1 for Estimation]	-	x
b3-07 [Speed Curr Lev2 for Estimation]	-	x
b3-08 [Speed ACR PGain for Estimation]	-	x
b3-09 [Speed ACR ITime for Estimation]	-	x
b3-10 [Speed Det Gain for Estimation]	-	x
b3-14 [Speed Bi-Directional Search]	-	x
b3-17 [Speed Retry Current Level]	x	x
b3-18 [Speed Retry Delay]	x	x
b3-19 [Speed Retry Times]	x	x
b3-24 [SpSrch Method Selection]	x (2)	x (1)
b3-25 [SpSrch Wait Time]	x	x
b3-26 [Dir. Determ. Level]	-	x
b3-27 [SS@RUNbeforeBB]	x	x
b3-29 [SpSrch BackEMF Threshold]	-	-
b3-31 [SpSrch I Ref Level]	x	-
b3-32 [SpSrch I End Level]	x	-
b3-33 [SpSrch@Uv Selection]	x	x
b3-35 [BckEMF Low Detection Level]	x	x
b3-36 [HiBackEMF DetLev]	x	x
b3-54 [Search Time]	-	-
b3-55 [Speed Curr Rise Time]	-	-

Note:
- To use Speed Estimation Speed Search with V/f Control, do Rotational Auto-Tuning before you set the Speed Search function. If the wire length between the drive and motor changed since the last time you did Auto-Tuning, do Stationary Auto-Tuning for Line-to-Line Resistance process again.
- If *A1-02 = 5, 6 [PM OLVector, PM AOLVector]* and the wiring distance between the motor and drive is long or if the motor is coasting at more than or equal to 200 Hz, do not use Speed Search to restart the motor. Use Short Circuit Braking.

■ Current Detection 2

Use this Speed Search function with induction motors. Set *b3-24 = 2 [SpSrch Method Selection = Current Det2]*. Current Detection Speed Search injects current into the motor to detect the speed of an induction motor. Speed Search increases the output voltage for the time set in *L2-04 [Powloss Ramp Time@recovery]*, starting from the maximum output frequency or the frequency reference.

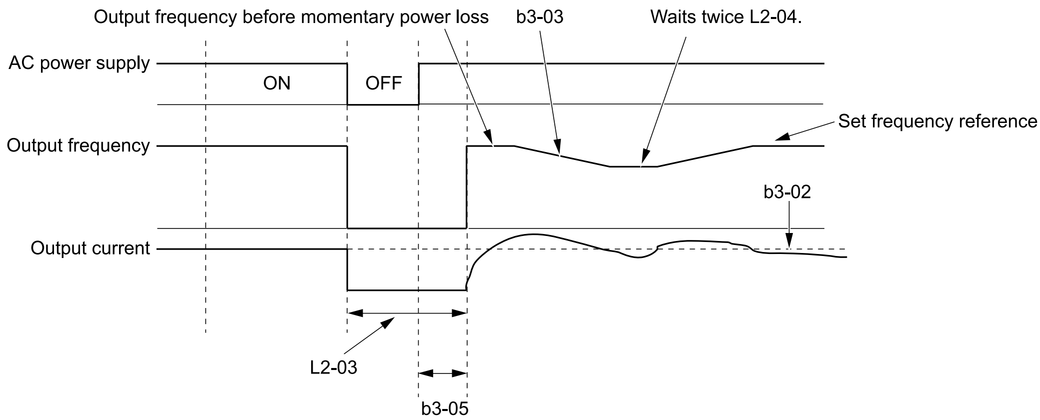


Figure 12.22 Current Detection Speed Search after Momentary Power Loss

Note:

After you return power, the drive will not do Speed Search until the time set in *b3-05 [SpSrch Delay Time]* is expired. Thus, the drive will not always start Speed Search although the time set in *L2-03 [Min Baseblck Time]* is expired.

If you enter the Run command at the same time as Speed Search, the drive will not do Speed Search until the time set in *L2-03* is expired. If the value set in *L2-03* < *b3-05*, the drive will use the wait time set in *b3-05*.

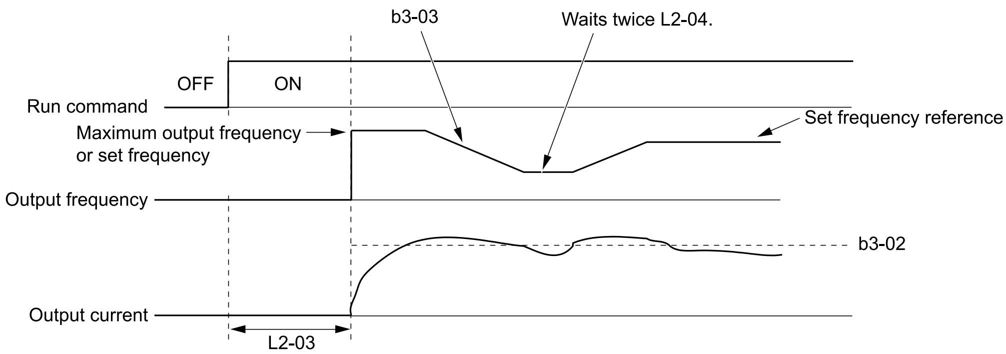


Figure 12.23 Speed Search Selection at Start (Current Detection Type)

WARNING! *Sudden Movement Hazard. If you do Current Detection Speed Search with light loads or a stopped motor, the motor can suddenly accelerate and cause serious injury or death.*

Note:
- You cannot use Current Detection Speed Search with PM motors.
- If the motor is rotating in reverse, you cannot do Speed Search.
- If the drive detects *oL1 [Motor Overload]* during Current Detection Speed Search, decrease the value set in *b3-03*.
- If the drive detects *oC [Overcurrent]* or *ov [Overvoltage]* during Current Detection Speed Search after the drive recovers from a momentary power loss, increase the value set in *L2-03*.

■ Speed Estimation

Use this Speed Search function with induction motors. Set *b3-24 = 1 [SpSrch Method Selection = Speed Estimation]*. This function uses less current and has a shorter search time than other functions. This function lets you do Speed Search when the motor is rotating in reverse. When you return power after a power loss, the motor will not suddenly accelerate.

Note:

You cannot do Speed Estimation Speed Search in these conditions:
- When you operate more than one motor with one drive
- When you use a high-speed motor (200 Hz or higher)
- When you use a 1.5 kW or smaller motor.
- When the motor output is more than 1 frame size smaller than the drive capacity
- When there is a long wiring distance between the drive and motor

For these conditions, use Current Detection Speed Search.

Speed Estimation Speed Search uses these two steps to estimate the motor speed:

1. Residual Voltage Search
   When there is a short baseblock time, the drive searches for residual voltage. The drive uses the residual voltage in the motor to estimate the motor speed and direction of rotation. The drive outputs the estimated motor speed as frequency, then uses the deceleration rate set in *L2-04* to increase the voltage. When the output voltage aligns with the V/f pattern, the drive accelerates or decelerates the motor to the frequency reference. If the drive cannot estimate the motor speed because of low residual voltage, it will automatically do Current Injection.

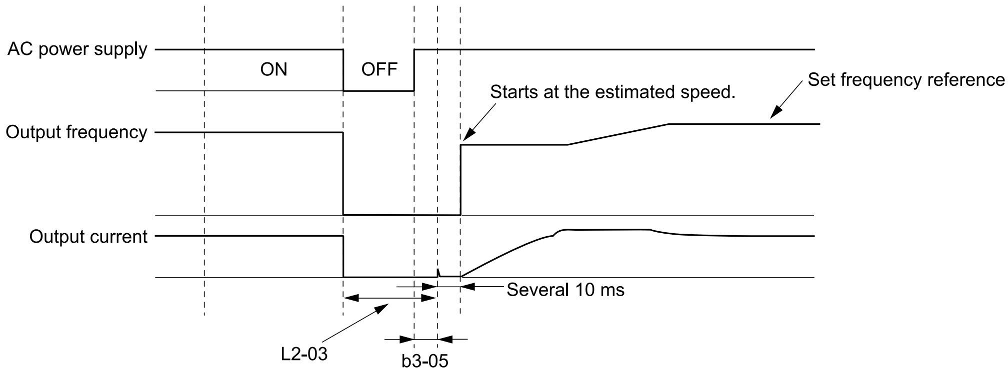


Figure 12.24 Speed Search after Baseblock

Note:

After you return power, the drive waits for the time set in *b3-05*. If power loss is longer than the time set in *L2-03*, the drive will start Speed Search when the time set in *b3-05* is expired after the power recovery.

2. Current Injection
   If there is not sufficient residual voltage in the motor, the drive does Current Injection. The drive injects the quantity of DC current set in *b3-06 [Speed Curr Lev1 for Estimation]* into the motor windings to estimate the motor speed and direction of rotation. The drive outputs the estimated motor speed as frequency, then uses the deceleration rate set in *L2-04* to increase the voltage. When the output voltage aligns with the V/f pattern, the drive accelerates or decelerates the motor to the frequency reference.

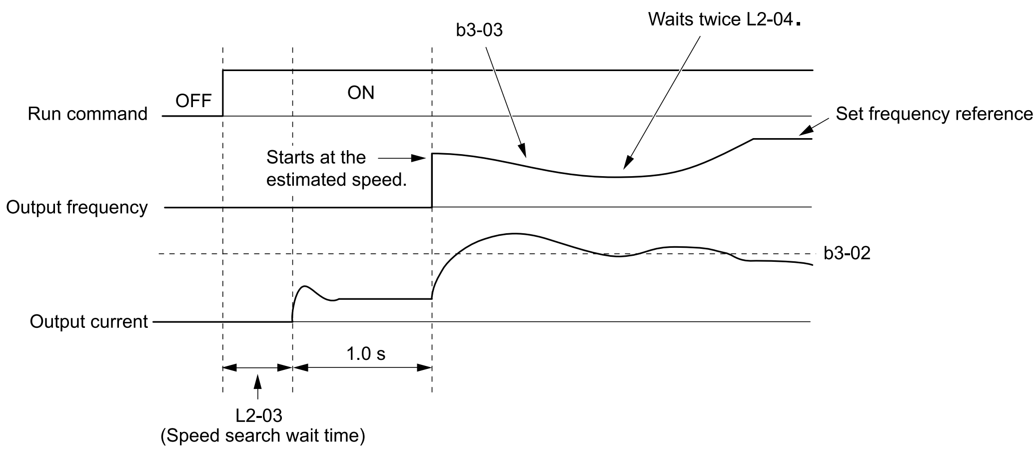


Figure 12.25 Speed Search Selection at Start

Note:

Set the lower limit of the delay time to *b3-05* for when Speed Search starts.

■ Speed Search and Operation Conditions

These conditions apply to Speed Search operation. When *A1-02 = 0, 1, 2 [Control Method = V/f Control, PG V/f Control, OLVector]*, set *b3-24 [SpSrch Method Selection]* before you do Speed Search.

- Do Speed Search with each Run Command
  The drive ignores a Speed Search command from the external terminals.
- Use an MFDI to do an External Speed Search Command
  To use an MFDI to do Speed Search, input the Run command at the same time that terminal DIx set for Speed Search activates, or after Speed Search activates.
  Set Speed Search to *H1-xx* to do the function externally. You cannot set external Speed Search 1 and 2 at the same time.

Table 12.8 Execute Speed Search via the Digital Input Terminals

H1-xx Setting	Name	Current Detection 2	Speed Estimation
67	SpdSrch Fmax	ON: Speed Search starts from *E1-04 [Max Output Frequency]*.	External Speed Search commands 1 and 2 work the same. The drive estimates the motor speed, then starts Speed Search from the estimated speed.
68	SpdSrch Fref	ON: Speed Search starts from the frequency reference immediately before you input the Speed Search command.	

- Do Speed Search with Each Auto Restart
  Set *L5-01 [Auto-Reset Attempts] = 1* or more. After there is an Auto Restart fault, the drive automatically does Speed Search.
- Do Speed Search after Momentary Power Loss
  Set *L2-01 =1 [RideThru@PwrLoss = Enabled]*, and set *L2-50 = 0, 1 [RidThruMode@PwrLoss = Timer Controlled, While CPU Active]*.
- Do Speed Search after You Clear the External Baseblock Command
  After you clear the external baseblock command, enable the Run command, and when the output frequency is higher than the minimum frequency, the drive does Speed Search.

■ b3-01 SpSrch@Start Selection

No. (Hex.)	Name	Description	Default (Range)
b3-01 (0191)	SpSrch@Start Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Speed Search at Start function where the drive will perform Speed Search with each Run command.	Determined by A1-02 (0, 1)

0 : Disabled

Enter a Run command to start to operate the drive at the minimum output frequency.

When the Run command is enabled and the *Speed Search from Fmax or Fref [H1-xx = 67, 68]* is input from a multi-function input terminal, the drive will do Speed Search and start to operate the motor.

1 : Enabled

Enter the Run command to do Speed Search. The drive completes Speed Search then starts to operate the motor.

■ b3-02 SpSrch Deactivation Current

No. (Hex.)	Name	Description	Default (Range)
b3-02 (0192)	SpSrch Deactivation Current	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the current level that stops Speed Search as a percentage of the drive rated output current. Usually it is not necessary to change this setting.	Determined by A1-02 (0 - 200%)

If the drive cannot restart the motor, decrease this setting.

■ b3-03 SpSrch Deceleration Time

No. (Hex.)	Name	Description	Default (Range)
b3-03 (0193)	SpSrch Deceleration Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the deceleration time during Speed Search operation. Set the length of time to decelerate from the maximum output frequency to the minimum output frequency.	2.0 s (0.1 - 10.0 s)

This is the output frequency deceleration time used by Current Detection Speed Search and by the Current Injection Method of Speed Estimation Speed Search.

Note:
If the drive detects *oL1 [Motor Overload]* during Current Detection Speed Search, decrease the value set in *b3-03*.

b3-04 SpSrch V/F Gain

No. (Hex.)	Name	Description	Default (Range)
b3-04 (0194)	SpSrch V/F Gain	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the ratio used to reduce the V/f during searches to reduce the output current during speed searches.	Determined by o2-04 (10 - 100)

Use the this formula to calculate the output voltage during Speed Search:

Output voltage during Speed Search = Configured V/f × b3-04

When the current detection search operates correctly, this configuration is not necessary.

b3-05 SpSrch Delay Time

No. (Hex.)	Name	Description	Default (Range)
b3-05 (0195)	SpSrch Delay Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Speed Search delay time to activate a magnetic contactor installed between the drive and motor.	0.2 s (0.0 - 100.0 s)

When you use a magnetic contactor between the drive and motor, you must close the contactor before the drive will do Speed Search. This parameter sets a delay time to activate the magnetic contactor.

b3-06 Speed Curr Lev1 for Estimation

No. (Hex.)	Name	Description	Default (Range)
b3-06 (0196) Expert	Speed Curr Lev1 for Estimation	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the level of current that flows to the motor during Speed Estimation Speed Search as a coefficient of the motor rated current. Usually it is not necessary to change this setting.	Determined by o2-04 (0.0 - 2.0)

When the speed estimation value is the minimum output frequency, increase this setting. You can do this when the motor coasts at a high speed while the drive estimates the speed during Speed Estimation Speed Search. The limit of the output current during speed search is automatically the drive rated current.

When the drive cannot accurately estimate the speed after you adjust this parameter, use Current Detection Speed Search.

b3-07 Speed Curr Lev2 for Estimation

No. (Hex.)	Name	Description	Default (Range)
b3-07 (0197) Expert	Speed Curr Lev2 for Estimation	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the level of current that flows to the motor during Speed Estimation Speed Search as a coefficient of *E2-03 [Mot No-Load Current]* or *E4-03 [M2 No-Load Current]*. Usually it is not necessary to change this setting.	1.0 (0.0 - 3.0)

During Speed Estimation Speed Searches, when the speed estimation value aligns with the minimum output frequency, increase the setting value in 0.1-unit increments. The limit of the output current during speed search is automatically the drive rated current.

b3-08 Speed ACR PGain for Estimation

No. (Hex.)	Name	Description	Default (Range)
b3-08 (0198) Expert	Speed ACR PGain for Estimation	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the proportional gain for the automatic current regulator during Speed Estimation Speed Search. Also adjusts speed search responsiveness. Usually it is not necessary to change this setting.	A1-02 = 0 through 4: Determined by o2-04 , A1-02 = 5, 6, or 8: Determined by A1-02 (0.00 - 6.00)

b3-09 Speed ACR ITime for Estimation

No. (Hex.)	Name	Description	Default (Range)
b3-09 (0199) Expert	Speed ACR ITime for Estimation	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the integral time for the automatic current regulator during Speed Estimation Speed Search. Also adjusts speed search responsiveness. Usually it is not necessary to change this setting.	Determined by A1-02 (0.0 - 1000.0 ms)

■ b3-10 Speed Det Gain for Estimation

No. (Hex.)	Name	Description	Default (Range)
b3-10 (019A) Expert	Speed Det Gain for Estimation	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the gain to correct estimated frequencies from Speed Estimation Speed Search.	1.05 (1.00 - 1.20)

If the drive detects *ov [DC Bus Overvoltage]* when you restart the motor, increase the setting value.

■ b3-14 Speed Bi-Directional Search

No. (Hex.)	Name	Description	Default (Range)
b3-14 (019E)	Speed Bi-Directional Search	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the direction of Speed Search to the direction of the frequency reference or in the motor rotation direction as detected by the drive.	Determined by A1-02 (0, 1)

0 : Disabled

The drive uses the frequency reference to detect the direction of motor rotation.

1 : Enabled

The drive detects the direction of motor rotation during Speed Search.

■ b3-17 Speed Retry Current Level

No. (Hex.)	Name	Description	Default (Range)
b3-17 (01F0) Expert	Speed Retry Current Level	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the current level for the search retry function in Speed Estimation Speed Search as a percentage where drive rated current is a setting value of 100%.	150% (0 - 200%)

When a large quantity of current flows during Speed Estimation Speed Search, the drive temporarily stops operation to prevent overvoltage and overcurrent. When the current is at the level set in *b3-17*, the drive tries speed search again.

■ b3-18 Speed Retry Delay

No. (Hex.)	Name	Description	Default (Range)
b3-18 (01F1) Expert	Speed Retry Delay	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the length of time that the drive will wait to retry Speed Estimation Speed Search when too much current flow stopped the Speed Search.	0.10 s (0.00 - 1.00 s)

When the current is more than the level set in *b3-17 [Speed Retry Current Level]* during the time set in *b3-18*, the drive tries speed search again.

■ b3-19 Speed Retry Times

No. (Hex.)	Name	Description	Default (Range)
b3-19 (01F2)	Speed Retry Times	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the number of times to restart Speed Search if Speed Search does not complete.	3 times (0 - 10 times)

If the drive does the number of Speed Search restarts set in this parameter, it will trigger an *SEr [Speed Search Retries Exceeded]* error.

■ b3-24 SpSrch Method Selection

No. (Hex.)	Name	Description	Default (Range)
b3-24 (01C0)	SpSrch Method Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Speed Search method when starting the motor or when restoring power after a momentary power loss.	2 (1, 2)

Set *b3-01 = 1 [SpSrch@Start Selection = Enabled]* to do Speed Search at start. Set *L2-01 = 1 [RideThru@PwrLoss = Enabled]*] to do Speed Search after you restore power after a momentary power loss.

1 : Speed Estimation

The drive uses the residual voltage from a short baseblock time to estimate the motor speed.

If there is not sufficient residual voltage, then the drive will inject DC current into the motor to estimate the motor speed.

2 : Current Det2

The drive will inject DC current into the motor to estimate motor speed.

■ b3-25 SpSrch Wait Time

No. (Hex.)	Name	Description	Default (Range)
b3-25 (01C8) Expert	SpSrch Wait Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the length of time the drive will wait to start the Speed Search Retry function.	0.5 s (0.0 - 30.0 s)

If the drive detects these faults during speed search, increase the setting value:

- *oC [Overcurrent]*
- *ov [Overvoltage]*
- *SEr [Speed Search Retries Exceeded]*

■ b3-26 Dir. Determ. Level

No. (Hex.)	Name	Description	Default (Range)
b3-26 (01C7) Expert	Dir. Determ. Level	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the level to find the motor rotation direction. Increase the value if the drive cannot find the direction.	1000 (40 - 60000)

■ b3-27 SS@RUNbeforeBB

No. (Hex.)	Name	Description	Default (Range)
b3-27 (01C9) Expert	SS@RUNbeforeBB	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the conditions necessary to start Speed Search.	0 (0, 1)

Executes *Speed Search from Fmax or Fref [H1-xx = 67/68]* for initial speed searches or from the MFDI terminal.

0 : SS@RUNbeforeBB

1 : SS Always

■ b3-29 SpSrch BackEMF Threshold

No. (Hex.)	Name	Description	Default (Range)
b3-29 (077C) Expert	SpSrch BackEMF Threshold	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the induced voltage for motors that use Speed Search. The drive will start Speed Search when the motor induced voltage level is the same as the setting value. Usually it is not necessary to change this setting.	10% (0 - 10%)

To make adjustments, gradually decrease the setting value. If you decrease the setting value too much, speed search will not operate correctly.

■ b3-31 SpSrch I Ref Level

No. (Hex.)	Name	Description	Default (Range)
b3-31 (0BC0) Expert	SpSrch I Ref Level	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the current level that decreases the output current during Current Detection Speed Search.	1.50 (1.50 - 3.50)

Set this parameter as a ratio of *E2-03 [Mot No-Load Current]*. Sets a current level given that *E2-03* is 30% of the motor rated current when *E2-03* ≤ Motor Rated Current × 0.3.

b3-32 SpSrch I End Level

No. (Hex.)	Name	Description	Default (Range)
b3-32 (0BC1) Expert	SpSrch I End Level	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the current level that completes Speed Search.	1.20 (0.00 - 1.49)

The Current Detection Speed Search gradually decreases the output frequency to search for the motor speed when the output current is equal to or less than Speed Search Current Complete Level.

Set this parameter as a ratio of *E2-03 [Mot No-Load Current]*. Sets a current level given that *E2-03* is 30% of the motor rated current when *E2-03* ≤ Motor Rated Current × 0.3.

b3-33 SpSrch@Uv Selection

No. (Hex.)	Name	Description	Default (Range)
b3-33 (0B3F) Expert	SpSrch@Uv Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function that starts Speed Search at start-up if the drive detects a *Uv [Undervoltage]* when it receives a Run command.	1 (0, 1)

Set these parameters as shown to enable *b3-33*:

- *L2-01 = 1 [RideThru@PwrLoss = Enabled]*
- *L2-50 = 0, 1 [RidThruMode@PwrLoss = Timer Controlled, While CPU Active]*
- *b3-01 = 1 [SpSrch@Start Selection = Enabled]*
- *b1-03 = 1 [Stopping Method Selection = Coast->Stop]*

0 : Disabled

1 : Enabled

b3-35 BckEMF Low Detection Level

No. (Hex.)	Name	Description	Default (Range)
b3-35 (0BC3) Expert	BckEMF Low Detection Level	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the level of induced voltage that the drive must detect to start Speed Search.	10% (5 - 50%)

For example, when the induced voltage at 10% of the setting is a minimum of 20 V for 200 V class drives, the drive will do restarts.

b3-36 HiBackEMF DetLev

No. (Hex.)	Name	Description	Default (Range)
b3-36 (0BC4) Expert	HiBackEMF DetLev	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets one of the factors in the formula to prevent drive restarts and cause the drive to enter standby. The drive will enter standby and will not restart when the detected induced voltage of the motor ≥ power supply voltage × *b3-36*. Usually it is not necessary to change this setting.	97.0% (50.0% - 100.0%)

For example, if the setting value is 83.0% and the voltage does not decrease to the induced voltage at approximately 183 V when the power supply voltage is 220 V, the drive will not do restarts.

b3-54 Search Time

No. (Hex.)	Name	Description	Default (Range)
b3-54 (3123)	Search Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the length of time that the drive will run Speed Search.	400 ms (10 - 2000 ms)

If you set this parameter too low, Speed Search will not operate correctly.

If the drive detects *oC [Overcurrent]* immediately after Speed Search Starts:

- Increase the value of *L2-03 [Min Baseblck Time]* and decrease the motor speed you use to start Speed Search.
- Increases the setting value of *b3-08 [Speed ACR PGain for Estimation]*.
- Increase the value of *b3-54*.

If the drive detects *oC* or *ov [DC Bus Overvoltage]* during Speed Search, increase the value of *b3-08*.

b3-55 Speed Curr Rise Time

No. (Hex.)	Name	Description	Default (Range)
b3-55 (3124) Expert	Speed Curr Rise Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the length of time that the drive will increase the current from zero current to the setting value of *b3-06 [Speed Curr Lev1 for Estimation]*.	10 ms (10 - 2000 ms)

Gradually increase the setting value when a large quantity of current flows after speed search starts. If you set this value too high, speed search will not operate correctly.

b4: TIMER

The drive uses timers to delay activating and deactivating MFDO terminals.

Timers prevent sensors and switches from making chattering noise.

There are two types of timers:

- Timers that set a delay for timer inputs and timer outputs.
  These timers delay activating and deactivating of the MFDIs and MFDOs.
  To enable this function, set *H1-xx: MFDI Function Select = 60 [Timer Fn Input], and set H2-01, H2-02, and H2-03 = 39 [Multi-Function Digital Output 1, Multi-Function Digital Output 2, and Multi-Function Digital Output 3 = Timer Output]*.
- Timers that set a delay to activate and deactivate MFDO terminals.
  These timers delay activating and deactivating MFDO terminals.
  To enable this function, set delay times in parameters *b4-03 to b4-08*.

Timer Function Operation

- Timers that set a delay for timer inputs and timer outputs
  Triggers timer output if the timer input is active for longer than the time set in *b4-01 [Timer ON Time Delay]*. Triggers timer output late for the time set in *b4-02 [Timer OFF Time Delay]*. Figure 12.26 shows an example of how the timer function works.

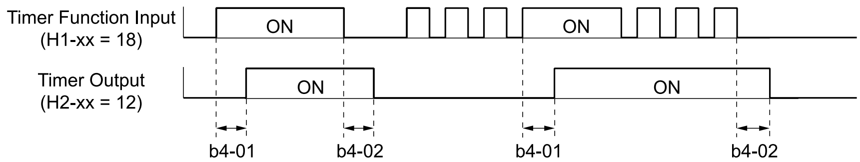


Figure 12.26 Example of Timer Function Operation

- Setting on/off-delay time for MFDO
  Figure 12.27 uses H2-01 terminals to show an example of how the timer function works. Use *b4-03 [2NO-2CM ON Time Delay]* and *b4-04 [2NO-2CM OFF Time Delay]* to set this function.

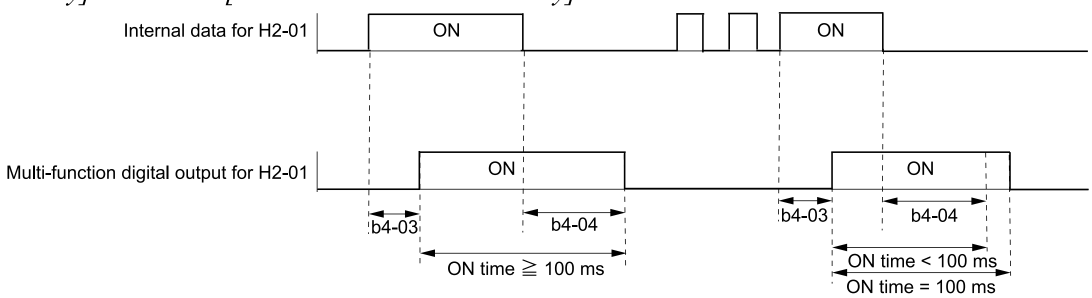


Figure 12.27 Example of How the Timer Function Works with H2-01 Terminals

Note:
When the terminal is triggered, it continues for a minimum of 100 ms. The on/off-delay time of MFDO terminal does not have an effect.

b4-01 Timer ON Time Delay

No. (Hex.)	Name	Description	Default (Range)
b4-01 (01A3)	Timer ON Time Delay	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the ON-delay time for the timer input.	0.0 s (0.0 - 3000.0 s)

■ b4-02 Timer OFF Time Delay

No. (Hex.)	Name	Description	Default (Range)
b4-02 (01A4)	Timer OFF Time Delay	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the OFF-delay time for the timer input.	0.0 s (0.0 - 3000.0 s)

■ b4-03 2NO-2CM ON Time Delay

No. (Hex.)	Name	Description	Default (Range)
b4-03 (0B30) Expert	2NO-2CM ON Time Delay	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the delay time to activate the contact after the function set in *H2-01* activates.	0 ms (0 - 65000 ms)

■ b4-04 2NO-2CM OFF Time Delay

No. (Hex.)	Name	Description	Default (Range)
b4-04 (0B31) Expert	2NO-2CM OFF Time Delay	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the delay time to deactivate the contact after the function set in *H2-01* deactivates.	0 ms (0 - 65000 ms)

■ b4-05 3NO-3CM ON Time Delay

No. (Hex.)	Name	Description	Default (Range)
b4-05 (0B32) Expert	3NO-3CM ON Time Delay	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the delay time to activate the contact after the function set in *H2-02* activates.	0 ms (0 - 65000 ms)

■ b4-06 3NO-3CM OFF Time Delay

No. (Hex.)	Name	Description	Default (Range)
b4-06 (0B33) Expert	3NO-3CM OFF Time Delay	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the delay time to deactivate the contact after the function set in *H2-02* deactivates.	0 ms (0 - 65000 ms)

■ b4-07 4NO-4CM ON Time Delay

No. (Hex.)	Name	Description	Default (Range)
b4-07 (0B34) Expert	4NO-4CM ON Time Delay	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the delay time to activate the contact after the function set in *H2-03* activates.	0 ms (0 - 65000 ms)

■ b4-08 4NO-4CM OFF Time Delay

No. (Hex.)	Name	Description	Default (Range)
b4-08 (0B35) Expert	4NO-4CM OFF Time Delay	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the delay time to deactivate the contact after the function set in *H2-03* deactivates.	0 ms (0 - 65000 ms)

◆ b5: PID CONTROL

The drive has a PID control function. You can control drive output to adjust the proportional gain, integral time, and derivative time that has an effect on the bias between the target value and the feedback value to match the target value to the detected value. Use this function to adjust the drive output to accurately match the flow, pressure, and temperature in the application match the target value.

Use a combination of these controls to increase the performance:

- P control
  P control has a proportional effect on the deviation. It outputs the product (the controlled output) proportional to the deviation. You cannot use only the offset from P control to get to zero deviation.

- I control
  I control is the integral of the deviation. It uses an integral value of the deviation to output the product (the controlled output). I control helps align the feedback value and the target value.
- D control
  D control is the derivative of the deviation. D control has an effect on drive output when there are sudden, large changes in the output. It quickly returns drive output to the value before the sudden change. It multiplies a time constant by a derivative value of the deviation (slope of the deviation), and adds that result to PID input to calculate the deviation of the signal, then it corrects the deviation.

Note:

D control has causes less stable operation because the noise changes the deviation signal. Use D control only when necessary.

■ PID Control Operation

The modified output (output frequency) changes when the drive uses PID control to keep the deviation (the difference between the target value and the feedback value) constant.

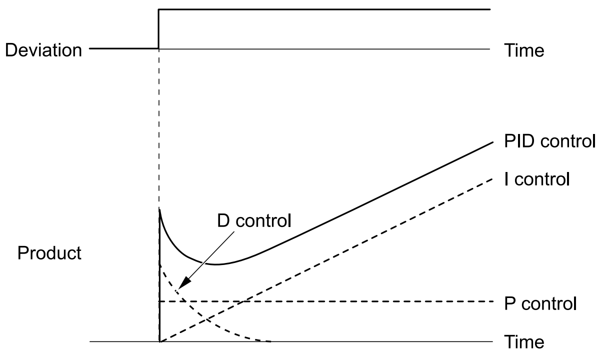


Figure 12.28 PID Control Operation

■ PID Control Applications

Table 12.9 PID Control Applications

Application	Description	Sensors Used
Speed control	• The drive uses a feedback signal for the machine speed, and adjusts that speed to align with the target value. • The drive uses speed data from other machinery as the target value to do synchronous control. The drive then adds that target value to the feedback from the machine it is operating to align its speed with the other machinery.	Tacho generator
Pressure control	The drive uses feedback from the actual pressure to hold constant pressure.	Pressure sensor
Flow control	The drive uses feedback from the actual flow to hold constant flow.	Flow rate sensor
Temperature control	The drive uses feedback from the actual temperature to control a fan and hold constant temperature.	Thermocoupler, thermistor

■ Input Methods for the PID Setpoint

Use *b5-01 = 1 [PID Enable = Enabled]* and *b5-70 to b5-72* to select how the PID setpoint is input to the drive.

When *b5-70 = 0 [PID MainRefMode = PID only]* or *b5-70 = 1 [Fref + PID] and b5-72 = 0 [PID D-FF Mode = D=Fdback]*, the frequency reference set in *b1-01 [Freq. Ref. Sel. 1]* or *b1-15 [Freq. Ref. Sel. 2]* will be the PID setpoint, or the one of the values shown in Table 12.10 will be the PID setpoint.

When *b5-70 = 1 [PID MainRefMode = Fref + PID]* or *b5-70 = 1 [Fref + PID] and b5-72 = 0 [PID D-FF Mode = D=Fdback]*, one of the inputs in Table 12.10 will be the PID setpoint.

Table 12.10 Input Methods for the PID Setpoint

Input Methods for the PID Setpoint	Setting
Multi-function analog input terminal AI1	Set *H3-02 = 10 [AI1 Function Selection = PID SetPoint]*.
Multi-function analog input terminal AI2	Set *H3-10 [AI2 Function Selection] = 10* .
Multi-function analog input terminal AI3	Set *H3-06 [AI3 Function Selection] = 10*.
Modbus register 0006H	Sets Modbus register 000FH (Control Selection Setting) bit 1 to 1 (PID setpoint input). Enters the PID setpoint to Modbus register 0006H (PID Target, 0.01% units, signed).

Input Methods for the PID Setpoint	Setting
Pulse train input terminal DI	Set *H6-01 = 3 [PI Pulse Train Function = PG Feedback]*.
b5-19 [PID Setpoint Value]	Set *b5-18 = 1 [b5-19 PID SP Selection = Enabled]*. Enters the PID setpoint to *b5-19*.

Note:

If you set two inputs for the PID setpoint, it will trigger operation error *oPE07 [Analog Input Selection Error]*.

■ Entering the PID Feedback Value

You can use two methods to input the PID feedback value to the drive. One method uses a single feedback signal for usual PID control. The other method uses two signals. The difference between those signals sets the deviation.

- **Use one feedback signal.**
  Use Table 12.11 to select how the feedback signal is input to the drive for PID control.

Table 12.11 PID Feedback Input Method

PID Feedback Input Method	Setting
Multi-function analog input terminal AI1	Set *H3-02 = F [PID Fbk]*.
Multi-function analog input terminal AI2	Set *H3-10 = F*.
Multi-function analog input terminal AI3	Set *H3-06 = F*.
Pulse train input terminal DI	Set *H6-01 = 2 [PID SP Value]*.

- **The drive uses two feedback signals, and the difference between those signals becomes the deviation.**
  Use Table 12.12 to select how the second feedback signal is input to the drive. The drive calculates the deviation of the second feedback value. Set *H3-02, H3-06, or H3-10 = 11 [AI1 Function Selection, AI3 Function Selection, or AI2 Function Selection = Diff PIDFbk]* to enable the second feedback signal used to calculated the deviation.

Table 12.12 PID Differential Feedback Input Method

PID Differential Feedback Input Method	Setting
Multi-function analog input terminal AI1	Set *H3-02 = 11 [Diff PIDFbk]*.
Multi-function analog input terminal AI2	Set *H3-10 = 11*.
Multi-function analog input terminal AI3	Set *H3-06 = 11*.

Note:

If you set more than one of *H3-02, H3-06, and H3-10* to *11*, it will trigger *oPE07 [Analog Input Selection Error]*.

Parameter Details

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■ PID Control Block Diagram

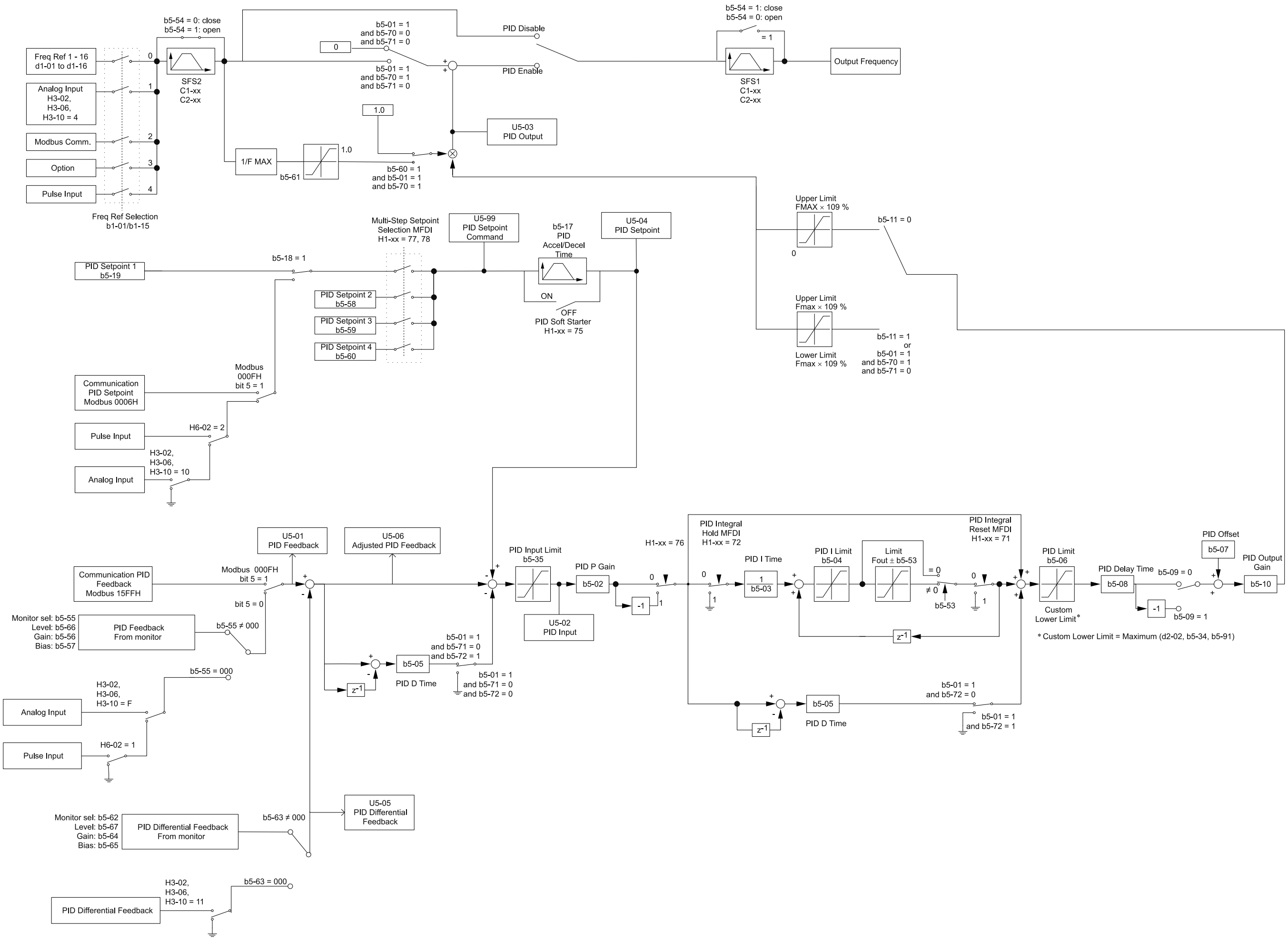

Figure 12.29 PID Control Block Diagram

■ PID Feedback Loss Detection

The PID feedback loss detection function detects broken sensors and defective wiring between the drive and sensors.

Use the PID feedback loss detection function when you use PID control. If the feedback signal is too low, the motor can suddenly accelerate to the maximum output frequency. This function prevents such risks to the load.

The drive uses two methods to detect feedback loss:

- *PID Feedback Loss [FbL]*
  Set these parameters for the PID feedback loss detection function.
  The drive detects feedback loss when the feedback value is less than the value in *b5-13* for longer than the time in *b5-14*.
  – *b5-12 [Fdback Loss Select Mode]*
  – *b5-13 [Fdback Loss Lvl]*
  – *b5-14 [Fdback Loss Time]*
- *Excessive PID Feedback [FbH]*
  Set these parameters to set how the drive detects a feedback level that is too high.
  The drive detects too much PID feedback when the feedback value is more than the value in *b5-36* for longer than the time in *b5-37*.
  – *b5-12 [Fdback Loss Select Mode]*
  – *b5-36 [PID HiHi Limit Level]*
  – *b5-37 [PID HiHi Time]*

Figure 12.30 shows the operation principle when the feedback value is too low, and the drive detects feedback loss. The operation is the same when the drive detects too much feedback.

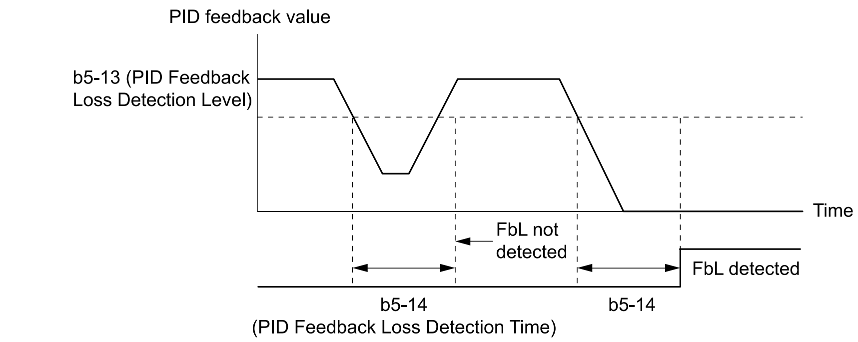

Figure 12.30 Time Chart for PID Feedback Loss Detection Time

■ PID Sleep

PID sleep stops drive operation when the PID output or the frequency reference is less than *b5-15 [Sleep Start Level]*. This function shuts off drive output after the motor decelerates to the set frequency.

The drive will automatically restart the motor when the PID output or the frequency reference is more than the *b5-15* value for the time set in *b5-16 [Sleep Delay Time]*.

Figure 12.31 shows the PID Sleep function.

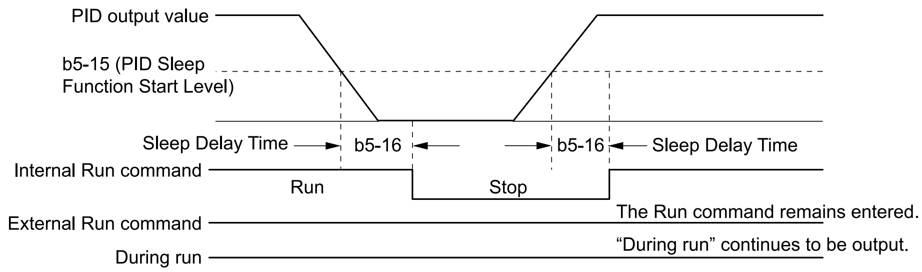

Figure 12.31 PID Sleep Time Chart

Note:
- The PID Sleep function is enabled when PID control is disabled.
- When the PID Sleep function is triggered, the drive will stop the motor as specified by *b1-03 [Stopping Method Selection]*.

■ Fine-Tuning PID

Fine-tune the following parameter settings to have PID control eliminate problems with overshoot and oscillation.

- *b5-02 [Proportional Gain (P)]*
- *b5-03 [Integral Time (I)]*
- *b5-05 [Derivative Time (D)]*
- *b5-08 [PID Primary Delay Time Constant]*

Parameter Details

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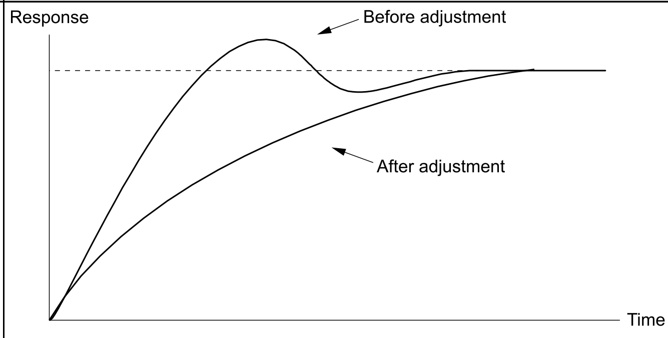
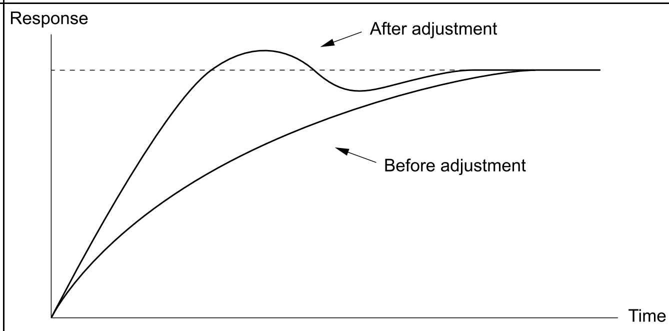
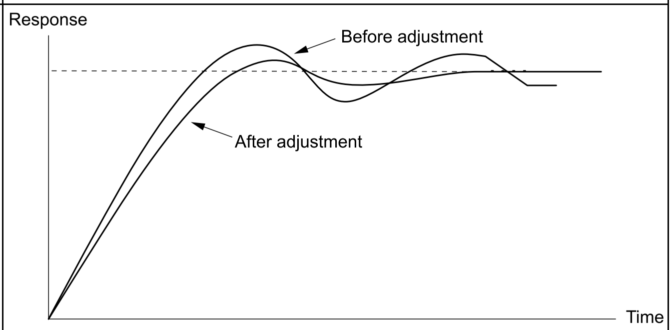
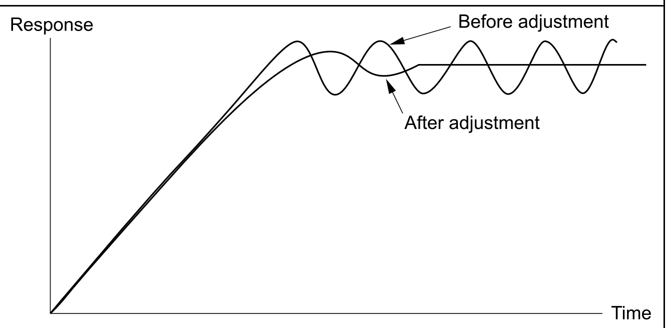
Purpose	Procedure	Results
Prevent overshoot.	• Set *b5-05 [Derivative Time (D)]* to a smaller value. • Set *b5-03 [Integral Time (I)]* to a larger value.	
Quickly stabilize control.	• Set *b5-05 [Derivative Time (D)]* to a larger value. • Set *b5-03 [Integral Time (I)]* to a smaller value.	
Prevent long-cycle oscillations.	Set *b5-03 [Integral Time (I)]* to a larger value.	
Prevent short-cycle oscillations.	• Set *b5-05 [Derivative Time (D)]* to a smaller value. • If you set *b5-05 = 0.00 [Derivative Time (D) = disabling D control]* and it does not stop oscillation, then set *b5-02 [Proportional Gain (P)]* to a smaller value or set *b5-08 [PID Primary Delay Time Constant]* to a larger value.	

■ EZ Sleep/Wake-up Functionality

Set *b5-89 = 1 [Sleep Method Selection = EZ Sleep/Wake-up]* to enable the EZ Sleep/Wake-up function.

Note:

- When *b5-89 = 0 [Sleep Method Selection = Standard]*, the EZ Sleep function and related parameters are disabled. Parameter *b5-91 [EZsleep Min Spd]* is not included in this rule.
- Set *b5-89 = 1* to disable *b5-15 [Sleep Start Level]*.

Configuration Parameter	Description
b5-90 [EZsleep Unit]	Sets the unit of measure for *b5-92 [EZsleep Level]*. When *b5-90 = 1[0.1Hz units]*, the setting range of *b5-91 [EZsleep Min Spd]* is 0.0 to 590.0 Hz. When *b5-90 = 0 [rpm]*, the setting range is 0 to 35400 min^{-1} (r/min). **Note:** When you change *b5-90*, the value of *b5-92* is not automatically updated.
b5-91 [EZsleep Min Spd]	This parameter sets the lower limit for PID output. The drive uses the largest value of *b5-91*, *b5-34 [PID Out Low Limit Level]*, and *d2-02 [FRef Lower Limit]* to internally set the lower limit of PID output. The *b5-89* setting does not have an effect.
b5-92 [EZsleep Level]	When the output frequency or motor speed is less than the value of *b5-92* for longer than the value of *b5-93 [EZsleep Time]*, the drive does to sleep.

Configuration Parameter	Description
b5-95 = 1 [EZsleep Wake Mode = Absolute]	When the PID feedback is less than the value of *b5-94 [EZsleep Wake Level]* for longer than the time set in *b5-96 [EZsleep Wake Time]*, the drive restarts operation from sleep.
b5-95 = 0 [EZsleep Wake Mode = Setpoint Delta]	When the PID feedback is less than the value set as the PID setpoint value minus *b5-94* for the time set in *b5-96*, the drive restarts operation from sleep.

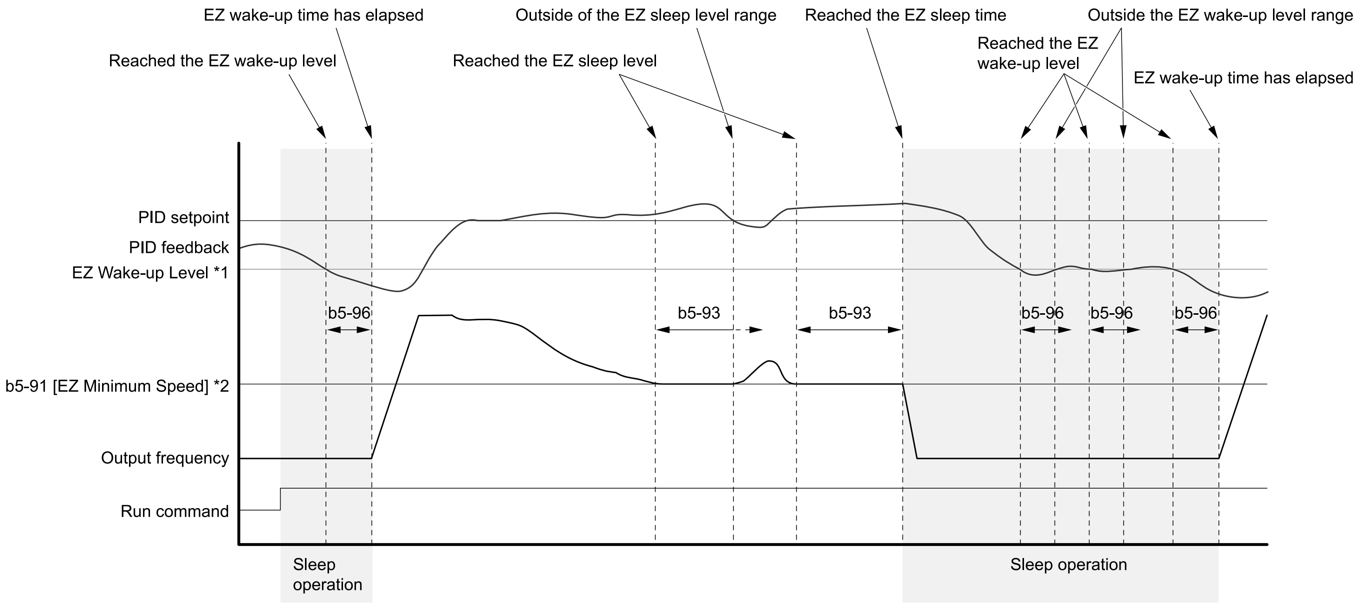


Figure 12.32 EZ Sleep/Wake-up Operation: PID Output is Normal and b5-92 = 0.0 Hz

*1 The values of *b5-94* and *b5-95* set operation.

*2 In the example, *b5-92* is at the default setting of 0.0 Hz. *b5-91* is the EZ sleep level.

■ b5-01 PID Enable

No. (Hex.)	Name	Description	Default (Range)
b5-01 (01A5)	PID Enable	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Enables PID control.	0 (0,1)

0 : Disabled

1 : Enabled

The drive does D control on the difference between the feedback value and the PID setpoint output through *U5-02 [PID Input]*.

■ b5-70 PID MainRefMode

No. (Hex.)	Name	Description	Default (Range)
b5-70 (01E5)	PID MainRefMode	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the PID main reference mode.	0 (0, 1)

0 : PID only

The drive does D control on the difference between the feedback value and the PID setpoint output through *U5-02 [PID Input]*.

1 : Fref + PID

The drive adds the frequency reference to the PID output. The drive does D control on the feedback output through *U5-06 [PID AdjustFeedback]*.

■ b5-71 PID Fdbk 1/2 Selection

No. (Hex.)	Name	Description	Default (Range)
b5-71 (01E6)	PID Fdbk 1/2 Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Selects the feedback configuration for PID control.	0 (0, 1)

0 : Feedback 1

The drive does D control on the difference between the feedback value and the PID setpoint output through *U5-01 [PID Feedback]*.

1 : Feedback 2

The drive does D control on the difference between the feedback value and the PID setpoint output through *U5-05 [PID Diff.Feedbk]*.

■ b5-72 PID D-FF Mode

No. (Hex.)	Name	Description	Default (Range)
b5-72 (01E7)	PID D-FF Mode	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Determines whether the D part is in the feedback path or used for feed forward control.	0 (0, 1)

0 : D=Fdback

The drive does D control on the feedback output through *U5-06 [PID AdjustFeedback]*.

1 : D=FdFwd

The drive adds the frequency reference to the PID output. The drive does D control on the feedback output through *U5-06 [PID AdjustFeedback]*.

■ b5-02 Proportional Gain (P)

No. (Hex.)	Name	Description	Default (Range)
b5-02 (01A6) RUN	Proportional Gain (P)	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the proportional gain (P) that is applied to PID input.	1.00 (0.00 - 25.00)

Larger values decrease errors, but can cause oscillations. Smaller values let too much offset between the setpoint and feedback.

Set *b5-02 = 0.00* to disable P control.

■ b5-03 Integral Time (I)

No. (Hex.)	Name	Description	Default (Range)
b5-03 (01A7) RUN	Integral Time (I)	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the integral time (I) that is applied to PID input.	1.0 s (0.0 - 360.0 s)

Set a short integral time in *b5-03* to remove the offset more quickly. If the integral time is too short, overshoot or oscillation can occur.

Set *b5-03 = 0.00* to disable I control.

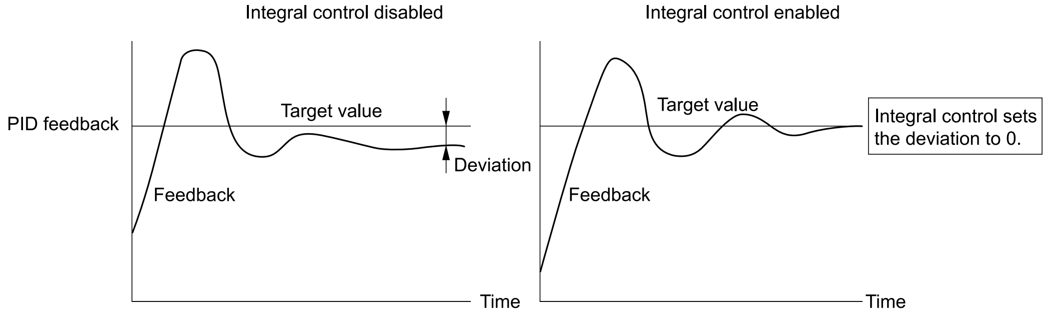


Figure 12.33 Integral Time and Deviation

■ b5-04 Integral Limit

No. (Hex.)	Name	Description	Default (Range)
b5-04 (01A8) RUN	Integral Limit	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the upper limit for I control as a percentage of *E1-04 [Max Output Frequency]*.	100.0% (0.0 - 100.0%)

Applications with loads that quickly change will cause the output of the PID function to oscillate. Set this parameter to a low value to prevent oscillation, mechanical loss, and motor speed loss.

■ b5-05 Derivative Time (D)

No. (Hex.)	Name	Description	Default (Range)
b5-05 (01A9) RUN	Derivative Time (D)	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the derivative time (D) for PID control. This parameter adjusts system responsiveness.	0.00 s (0.00 - 10.00 s)

Increase the time setting to increase controller responsiveness and possibly cause vibrations. Decrease the time setting to decrease overshoot and decrease controller responsiveness.

Set *b5-05 = 0.00* to disable D control.

■ b5-06 PID Output Limit

No. (Hex.)	Name	Description	Default (Range)
b5-06 (01AA) RUN	PID Output Limit	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the maximum possible output from the PID controller as a percentage of *E1-04 [Max Output Frequency]*.	100.0% (0.0 - 100.0%)

■ b5-07 PID Offset Adjustment

No. (Hex.)	Name	Description	Default (Range)
b5-07 (01AB) RUN	PID Offset Adjustment	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the offset for the PID control output as a percentage of *E1-04 [Max Output Frequency]*.	0.0% (-100.0 - +100.0%)

■ b5-08 PID Primary Delay Time Constant

No. (Hex.)	Name	Description	Default (Range)
b5-08 (01AC) Expert	PID Primary Delay Time Constant	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the primary delay time constant for the PID control output. Usually it is not necessary to change this setting.	0.00 s (0.00 - 10.00 s)

Prevents resonance if there is a large quantity of mechanical friction or if rigidity is unsatisfactory. Set the value larger than the resonant frequency cycle. A value that is too large will decrease drive responsiveness.

■ b5-09 PID Output Level Selection

No. (Hex.)	Name	Description	Default (Range)
b5-09 (01AD)	PID Output Level Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the polarity of the PID output.	0 (0, 1)

Use this parameter in applications that decrease the drive output frequency when you increase the PID setpoint.

0 : Normal output

A positive PID input increases the PID output (direct acting).

1 : Reverse output

A positive PID input decreases the PID output (reverse acting).

■ b5-10 PID Output Gain Setting

No. (Hex.)	Name	Description	Default (Range)
b5-10 (01AE) RUN	PID Output Gain Setting	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the amount of gain to apply to the PID output.	1.00 (0.00 - 25.00)

Applies a gain to the PID output and can help when *b5-01 = 1 [PID Enable = Enabled]* and *b5-72 = 0 [PID D-FF Mode = D=Fdback]*.

■ b5-11 PID Output Reverse Selection

No. (Hex.)	Name	Description	Default (Range)
b5-11 (01AF)	PID Output Reverse Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function that enables and disables reverse motor rotation for negative PID control output.	0 (0, 1)

This parameter is disabled when *b5-01 = 3, 4 [Disabled = Fref + PID Trim, Fref + PID Trim (D on feedback)]*. There is no limit for PID output (PID output can be positive or negative). Operates the same as setting "1: Negative lower limit".

0 : 0 lower limit

When PID output is negative, PID output is limited to 0 and drive output is shut off.

1 : Negative lower limit

When the PID output is negative, the motor will rotate in reverse.

■ b5-12 Fdback Loss Select Mode

No. (Hex.)	Name	Description	Default (Range)
b5-12 (01B0)	Fdback Loss Select Mode	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the drive response to PID feedback loss. Sets drive operation after the drive detects PID feedback loss.	0 (0 - 5)

0 : DO Only Always

The MFDO terminal set for *PID Feedback Low* or *PID Feedback High [H2-01 to H2-03 = 3E, 3F]* activates. When the drive detects feedback loss, the keypad will not show an alarm and the drive will continue operation.

When the feedback signal is less than the level set in *b5-13 [Fdback Loss Lvl]* for longer than the time set in *b5-14 [Fdback Loss Time]*, the MFDO terminal set for a *PID Feedback Low* activates.

When the feedback signal is more than the level set in *b5-36 [PID HiHi Limit Level]* for longer than the time set in *b5-37 [PID HiHi Time]* the MFDO terminal set for a *PID Feedback High* activates.

When the feedback value is not in the detection range, the drive resets the fault output.

1 : AL+DO Always

The drive detects *FbL [PID Feedback Loss]* and *FbH [Excessive PID Feedback]*. The MFDO terminal set for *PID Feedback Low* or *PID Feedback High [H2-01 to H2-03 = 3E, 3F]* activates. The output terminal set for *Alarm [H2-01 to H2-03 = 4]* activates and the drive continues operation.

When the feedback signal is less than the level set in *b5-13* for longer than the time set in *b5-14*, the MFDO terminal set for a *PID Feedback Low* activates.

When the feedback signal is more than the level set in *b5-36* for longer than the time set in *b5-37*, the MFDO terminal set for a *PID Feedback High* activates.

When the feedback value is not in the detection range, the drive resets the fault output.

2 : FLT+DO Always

The drive detects *FbL* and *FbH*. The output terminal set for *Fault [H2-01 to H2-03 = 3]* activates and the motor coasts to stop.

When the feedback signal is less than the level set in *b5-13* for the time set in *b5-14*, the drive detects *FbL*.

When the feedback signal is more than the level set in *b5-36* for the time set in *b5-37*, the drive detects *FbH* .

3 : DO Only@PID Enable

The MFDO terminal set for *PID Feedback Low* or *PID Feedback High* activates. When the drive detects feedback loss, the keypad will not show an alarm and the drive will continue operation.

When the MFDI terminal set to *PID Disable [H1-xx = 6A]* activates, the drive disables fault detection.

4 : AL+DO@PID Enable

The drive detects *FbL* and *FbH*. The MFDO terminal set for *PID Feedback Low* or *PID Feedback High* activates. The output terminal set for *Alarm [H2-01 to H2-03 = 4]* activates and the drive continues operation.

When the MFDI terminal set to *PID Disable [H1-xx = 6A]* activates, the drive disables fault detection.

5 : FLT+DO@PID Enable

The drive detects *FbL* and *FbH*. The output terminal set for *Fault [H2-01 to H2-03 = 3]* activates and the motor coasts to stop.

When the MFDI terminal set to *PID Disable [H1-xx = 6A]* activates, the drive disables fault detection.

■ b5-13 Fdback Loss Lvl

No. (Hex.)	Name	Description	Default (Range)
b5-13 (01B1)	Fdback Loss Lvl	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the level that triggers *PID Feedback Loss [FbL]* as a percentage of *E1-04 [Max Output Frequency]*.	0% (0 - 100%)

The drive detects *PID Feedback Loss [FbL]* when the feedback signal decreases to less than the level set in *b5-13* for longer than the time set in *b5-14 [Fdback Loss Time]*.

■ b5-14 Fdback Loss Time

No. (Hex.)	Name	Description	Default (Range)
b5-14 (01B2)	Fdback Loss Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the length of time that PID Feedback must be less than *b5-13 [Fdback Loss Lvl]* to detect *PID Feedback Loss [FbL]*.	1.0 s (0.0 - 25.5 s)

■ b5-15 Sleep Start Level

No. (Hex.)	Name	Description	Default (Range)
b5-15 (01B3)	Sleep Start Level	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the output level that triggers the PID Sleep function.	Determined by A1-02 (0.0 - 590.0)

The drive goes into Sleep mode when the PID output or frequency reference is less than *b5-15* for longer than the time set to *b5-16 [Sleep Delay Time]*. The drive continues operation when the PID output or frequency reference is more than *b5-15* for longer than the time set to *b5-16*.

■ b5-16 Sleep Delay Time

No. (Hex.)	Name	Description	Default (Range)
b5-16 (01B4)	Sleep Delay Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets a delay time to start or stop the PID Sleep function.	0.0 s (0.0 - 25.5 s)

■ b5-17 PID Accel/Decel Time

No. (Hex.)	Name	Description	Default (Range)
b5-17 (01B5)	PID Accel/Decel Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Raises or lowers the PID setpoint using the acceleration and deceleration times set to the drive. This is a soft-starter for the PID setpoint.	0.5 s (0.0 - 6000.0 s)

The drive usually uses the acceleration and deceleration times set in *C1: ACCEL / DECEL*, but when PID control is enabled, the drive applies *C1-xx* after PID output. If you frequently change the PID setpoint, the drive responsiveness decreases. When resonance with PID control causes hunting, overshoot, or undershoot, set *b5-17* for longer acceleration and deceleration times.

Decrease *C1-xx* until hunting stops, then use *b5-17* to check the acceleration and deceleration. To enable and disable the setting in *b5-17* through an MFDI terminal, set *PID SS Cancel [H1-xx = 75]*.

■ b5-18 b5-19 PID SP Selection

No. (Hex.)	Name	Description	Default (Range)
b5-18 (01DC)	b5-19 PID SP Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function that enables and disables *b5-19 [PID Setpoint Value]*.	0 (0, 1)

0 : Disabled

The drive does not use the value set in *b5-19* as the PID setpoint.

1 : Enabled

The drive uses the value set in *b5-19* as the PID setpoint.

b5-19 PID Setpoint Value

No. (Hex.)	Name	Description	Default (Range)
b5-19 (01DD) RUN	PID Setpoint Value	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the PID setpoint when *b5-18 = 1 [b5-19 PID SP Selection = Enabled]*.	0.00% (0.00 - 100.00%)

b5-20 PID Unit Selection

No. (Hex.)	Name	Description	Default (Range)
b5-20 (01E2)	PID Unit Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the units to set and show *b5-19 [PID Setpoint Value]*.	1 (0 - 3)

0 : 1 : 0.01Hz units

The drive uses 0.01 Hz units.

1 : 0.01% units

The drive uses 0.01% units. Set the value as a percentage of *E1-04 [Max Output Frequency]*.

2 : rpm

The drive uses 1 min^{-1} unit. Set *E2-04*, *E4-04*, or *E5-04 [PM Mot Pole Count]*.

3 : User Units

The drive uses units set in *b5-38 [PID SP User Scale for Display]* and *b5-39 [PID SP User digits for Display]* to show the PID setpoint in *U5-01, U5-04, U5-06 [PID Feedback, PID Setpoint, PID AdjustFeedback]*.

b5-34 PID Out Low Limit Level

No. (Hex.)	Name	Description	Default (Range)
b5-34 (019F) RUN	PID Out Low Limit Level	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the output lower limit for the PID control as a percentage of *E1-04 [Max Output Frequency]*.	0.0% (-100.0 - +100.0%)

Use a lower limit to keep PID control output from dropping below a fixed level.

Set this parameter to 0.0% to disable this function.

b5-35 PID In Hi Limit Level

No. (Hex.)	Name	Description	Default (Range)
b5-35 (01A0) RUN	PID In Hi Limit Level	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the input upper limit for the PID control as a percentage of *E1-04 [Max Output Frequency]*.	1000.0% (0.0 - 1000.0%)

A large input value for PID control makes a high output. The drive applies this limit to the negative and positive domains.

b5-36 PID HiHi Limit Level

No. (Hex.)	Name	Description	Default (Range)
b5-36 (01A1)	PID HiHi Limit Level	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the level that triggers *Excessive PID Feedback [FbH]* as a percentage of *E1-04 [Max Output Frequency]*.	100% (0 - 100%)

When the feedback signal increases to more than the level set in *b5-36* for the time set in *b5-37 [PID HiHi Time]*, the drive will detect *Excessive PID Feedback [FbH]*.

b5-37 PID HiHi Time

No. (Hex.)	Name	Description	Default (Range)
b5-37 (01A2)	PID HiHi Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the length of time that the feedback signal must be more than the level set in *b5-36 [PID HiHi Limit Level]* to cause *Excessive PID Feedback [FbH]*.	1.0 s (0.0 - 25.5 s)

b5-38 PID SP User Scale for Display

No. (Hex.)	Name	Description	Default (Range)
b5-38 (01FE)	PID SP User Scale for Display	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the display for *U5-01, U5-04* when the drive operates at the maximum output frequency.	Determined by b5-20 (1 - 60000)

The drive uses this parameter and *b5-39 [PID SP User digits for Display]* together.

When *b5-20 = 4 [PID Unit Selection =]*, the drive applies user-set PID setpoint and display units to *U5-01 [PID Feedback]* and *U5-04 [PID Setpoint]*.

b5-39 PID SP User digits for Display

No. (Hex.)	Name	Description	Default (Range)
b5-39 (01FF)	PID SP User digits for Display	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the number of digits to set and show the PID setpoint.	2 (0 - 3)

The drive uses this parameter and *b5-38 [PID SP User Scale for Display]* together.

When parameter *b5-20 = 4 [PID Unit Selection =]*, the drive applies user-set PID setpoint and display units to *U5-01 [PID Feedback]* and *U5-04 [PID Setpoint]*

0 : No Decimal Places

1 : 1 Decimal Place

2 : 2 decimal places

3 : 3 Decimal Places

b5-40 Fref Mon@PID

No. (Hex.)	Name	Description	Default (Range)
b5-40 (017F)	Fref Mon@PID	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the contents for monitor *U1-01 [Frequency Reference]* in PID control.	0 (0, 1)

0 : U1-01 with PID Output

Monitor *U1-01* shows the frequency reference that was increased or decreased by the PID output.

1 : U1-01 without PID Output

Monitor *U1-01* shows the actual frequency reference.

b5-47 PID Out Rev Operation Mode

No. (Hex.)	Name	Description	Default (Range)
b5-47 (017D)	PID Out Rev Operation Mode	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets reverse motor rotation when the PID control output is negative.	1 (0, 1)

Set *b5-01 = 3 or 4 [PID Enable = Fref + PID Trim, Fref + PID Trim (D on feedback)]* to enable this parameter.

0 : Lower Limit is Zero

When PID output is negative, PID output is limited to 0 and drive output is shut off.

1 : Negative Output Accepted

When the PID output is negative, the motor will rotate in reverse.

b5-53 PID I Ramp Limit

No. (Hex.)	Name	Description	Default (Range)
b5-53 (0B8F) RUN	PID I Ramp Limit	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the responsiveness of PID control when the PID feedback changes quickly.	0.0 Hz (0.0 - 10.0 Hz)

Note:
- This parameter is disabled when set to 0.0 Hz.
- When the integrator ramp limit is enabled (*b5-53 > 0.0 Hz*), the PID integrator value limit is the range set by the output frequency ±*b5-53*.
- When the PID feedback changes quickly, gradually decrease the value of this parameter in increments of 0.1 Hz to decrease the speed of the response of PID control.

■ b5-55 PID Fback Mon Selection

No. (Hex.)	Name	Description	Default (Range)
b5-55 (0BE1)	PID Fback Mon Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the monitor for PID Feedback (*Ux-xx*).	000 (000 - 999)

Note:
- You cannot select *parameter U5-xx*.
- This parameter is disabled when set to *000*.

■ b5-56 PID FdbkMon Gain

No. (Hex.)	Name	Description	Default (Range)
b5-56 (0BE2)	PID FdbkMon Gain	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the gain for the monitor specified in *b5-55 [PID Fback Mon Selection]*.	1.00 (0.00 - 10.00)

Note:
Set *b5-18 = 1 [b5-19 PID SP Selection = Enabled]* to enable this parameter.

■ b5-57 PID FdbkMon Bias

No. (Hex.)	Name	Description	Default (Range)
b5-57 (11DD)	PID FdbkMon Bias	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the bias for the monitor specified in *b5-55 [PID Fback Mon Selection]*.	0.00 (-10.00 - +10.00)

■ b5-58 to b5-60 PID Setpoint 2 to PID Setpoint 4

No. (Hex.)	Name	Description	Default (Range)
b5-58 to b5-60 (1182 - 1184) RUN	PID Setpoint 2 to PID Setpoint 4	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the PID setpoint when *H1-xx = 77 or 78 [MFDI Function Select = PID SP Selection 1/2]*. This value is a percentage where *E1-04 [Max Output Frequency]* setting = a setting value of 100%.	0.00% (0.00 - 100.00%)

Table 12.13 shows how the different MFDI *H1-xx* values (*77 and 78*) have an effect on the PID setpoint value.

Table 12.13 Switching of MFDI and PID Setpoint Value

H1-xx = 77	H1-xx = 78	PID Setpoint Value
OFF	OFF	No switch
ON	OFF	b5-58 [PID Setpoint 2]
OFF	ON	b5-59 [PID Setpoint 3]
ON	ON	b5-60 [PID Setpoint 4]

■ b5-61 PID LoLim Select for Trim Mode

No. (Hex.)	Name	Description	Default (Range)
b5-61 (119A)	PID LoLim Select for Trim Mode	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function that adjusts the PID output in relation to the frequency reference.	0 (0, 1)

0 : Disabled

Does not adjust the PID output with the frequency reference.

1 : Enabled

Adjusts the PID output in relation to the frequency reference. The setting value of *b5-62 [PID LoLim Value for Trim Mode]* sets the lower limit of the post-adjustment value. The maximum output frequency sets the upper limit.

Note:
- Set *b5-01 = 3, 4, 7, or 8* to enable this parameter.
- When *b5-61 = 1*, you can use this formula to adjust PID output proportional to the frequency reference:

$$U5\text{-}03 = U5\text{-}03 \times \left| \frac{Fref}{Fmax} \right|^{*1}$$

U5-03 [PID Output], *Fref [Frequency Reference]*, and *Fmax [Maximum Output Frequency]*

*1 Lower limit = *b5-62*, Upper limit = Maximum output frequency

■ b5-62 PID LoLim Value for Trim Mode

No. (Hex.)	Name	Description	Default (Range)
b5-62 (119B)	PID LoLim Value for Trim Mode	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the lower limit of the PID frequency reference trim as a percentage where *E1-04 [Max Output Frequency]* setting = a setting value of 100%.	0.00% (0.00 - 100.00%)

Note:

Set *b5-01 = 3, 4, 7, or 8* to enable this parameter.

■ b5-63 PID DifFB Mon Selection

No. (Hex.)	Name	Description	Default (Range)
b5-63 (119C)	PID DifFB Mon Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the monitor for PID Differential Feedback (*Ux-xx*).	000 (000 - 999)

Note:
- You cannot select *parameter U5-xx*.
- This parameter is disabled when set to *000*.

■ b5-64 PID DifFB Mon Gain

No. (Hex.)	Name	Description	Default (Range)
b5-64 (119D)	PID DifFB Mon Gain	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the gain for the monitor specified in *b5-63 [PID DifFB Mon Selection]*.	1.00 (0.00 - 10.00)

Set *b5-18 = 1 [b5-19 PID SP Selection = Enabled]* to enable this parameter.

■ b5-65 PID DifFB Mon Bias

No. (Hex.)	Name	Description	Default (Range)
b5-65 (119F)	PID DifFB Mon Bias	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the bias for the monitor specified in *b5-63 [PID DifFB Mon Selection]*.	0.00 (-10.00 - +10.00)

Set *b5-18 = 1 [b5-19 PID SP Selection = Enabled]* to enable this parameter.

■ b5-66 PID Fback Mon Level

No. (Hex.)	Name	Description	Default (Range)
b5-66 (11DE)	PID Fback Mon Level	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the signal level for the monitor specified in *b5-55 [PID Fback Mon Selection]*.	0 (0, 1)

0 : Absolute

1 : Bi-directional (+/-)

■ b5-67 PID DifFB Mon Level

No. (Hex.)	Name	Description	Default (Range)
b5-67 (11DF)	PID DifFB Mon Level	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the signal level for the monitor specified in *b5-63 [PID DifFB Mon Selection]*.	0 (0, 1)

0 : Absolute

1 : Bi-directional (+/-)

■ b5-89 Sleep Method Selection

No. (Hex.)	Name	Description	Default (Range)
b5-89 (0B89) RUN	Sleep Method Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets sleep and wake up operation when using PID.	0 (0, 1)

0 : Standard

1 : EZ Sleep/Wake-up

■ b5-90 EZsleep Unit

No. (Hex.)	Name	Description	Default (Range)
b5-90 (0B90)	EZsleep Unit	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the measurement units for *b5-91 [EZsleep Min Spd]* and *b5-92 [EZsleep Level]*.	1 (0, 1)

0 : rpm

1 : 0.1Hz units

■ b5-91 EZsleep Min Spd

No. (Hex.)	Name	Description	Default (Range)
b5-91 (0B91) RUN	EZsleep Min Spd	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the minimum speed for the EZ Sleep/Wakeup function. This parameter uses the largest value from *b5-91*, *b5-34 [PID Out Low Limit Level]*, and *d2-02 [FRef Lower Limit]*.	0.0 Hz or 0 rpm (r/min) (0.0 to 590.0 Hz or 0 to 35400 rpm (r/min))

Note:

The value of *b5-90 [EZsleep Unit]* sets the units. When *b5-90* changes, this parameter does not automatically update. Set this parameter again after you change *b5-90* is changed.

■ b5-92 EZsleep Level

No. (Hex.)	Name	Description	Default (Range)
b5-92 (0B92) RUN	EZsleep Level	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the value that the output frequency or motor speed must be less than for longer than *b5-93 [EZsleep Time]* to enter Sleep Mode.	0.0 Hz or 0 rpm (r/min) (0.0 to 590.0 Hz or 0 to 35400 rpm (r/min))

Note:

When *b5-90 [EZsleep Unit]* changes, this parameter does not automatically update. Set this parameter again after you change *b5-90*.

■ b5-93 EZsleep Time

No. (Hex.)	Name	Description	Default (Range)
b5-93 (0B93) RUN	EZsleep Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the length of time that the output frequency or motor speed must be less than *b5-92 [EZsleep Level]* to enter Sleep Mode.	5.0 s (0.0 - 1000.0 s)

■ b5-94 EZsleep Wake Level

No. (Hex.)	Name	Description	Default (Range)
b5-94 (0B94) RUN	EZsleep Wake Level	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the level at which the drive resumes operation when exiting Sleep Mode.	0.00% (0.00 - 600.00%)

Note:

The values of *b5-20 [PID Unit Selection]*, *b5-38 [PID SP User Scale for Display]*, and *b5-39 [PID SP User digits for Display]* set the units. When *b5-20*, *b5-38*, and *b5-39* change, this parameter does not automatically update. Set this parameter again after you change *b5-20*, *b5-38*, and *b5-39* are changed.

- When *b5-95 = 1 [EZsleep Wake Mode = Absolute]*:

When *b5-09 = 0 [PID Output Level Selection = Normal output]*, and the PID Feedback *[H3-xx = F]* is less than the value of *b5-94* for a time longer than the value of *b5-96 [EZsleep Wake Time]*, the drive will exit sleep and start operation again. When *b5-09 = 1 [Reverse output]*, and the PID feedback is more than setting value of *b5-94* for a time longer than the setting value of *b5-96*, the drive will exit sleep and start operation again.

- When *b5-95 = 0 [Setpoint Delta]*:
  When *b5-09 = 0*, and the PID feedback is less than the value of "PID setpoint value - *b5-94*" for a time longer than the value of *b5-96*, the drive will exit sleep and start operation again. When *b5-09 = 1*, and the PID feedback is more than the value of "PID setpoint value + *b5-94*" for a time longer than the setting value of *b5-96*, the drive will exit sleep and start operation again.

■ b5-95 EZsleep Wake Mode

No. (Hex.)	Name	Description	Default (Range)
b5-95 (0B95)	EZsleep Wake Mode	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the wake-up mode to use when exiting Sleep Mode.	1 (0, 1)

0 : Setpoint Delta

1 : Absolute

■ b5-96 EZsleep Wake Time

No. (Hex.)	Name	Description	Default (Range)
b5-96 (0B96)	EZsleep Wake Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the EZ Wake-up time.	1.0 s (0.0 - 1000.0 s)

When the PID feedback is less than the value of *b5-94 [EZsleep Wake Level]* continuously for the time set in *b5-96*, the drive will exit sleep and start operation again.

◆ b6: DWELL FUNCTION

The Dwell function momentarily holds the output frequency at start and stop.

This prevents motor speed loss when you start and stop heavy loads. The Dwell function is also enabled when backlash on the machine side causes sudden movement at the start of acceleration and deceleration.

At the start of acceleration, the drive uses the output frequency and acceleration time set for the Dwell function to automatically operate at low speed to minimize the effects of backlash. Then, the drive can accelerate again. The Dwell function operates the same for deceleration.

For conveyor applications, the Dwell function also lets the drive interlock the output frequency and a delay time for the holding brake on the load side.

The Dwell function momentarily stops during acceleration to prevent a PM motor from stepping out. Figure 12.34 shows how the Dwell function works.

Note:

When you use the Dwell function at stop, set *b1-03 = 0 [Stopping Method Selection = Ramp to Stop]*.

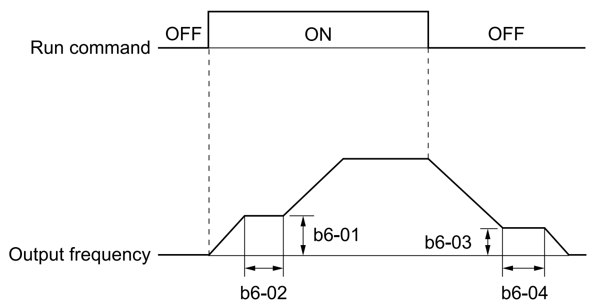


Figure 12.34 Time Chart for the Dwell Function at Start/Stop

■ b6-01 Dwell Ref.@Start

No. (Hex.)	Name	Description	Default (Range)
b6-01 (01B6)	Dwell Ref.@Start	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the output frequency that the drive will hold momentarily when the motor starts.	0.0 (Determined by A1-02)

When the drive accelerates to the output frequency set in *b6-01*, it holds that frequency for the time set in *b6-02 [Dwell Time@Start]*, and starts to accelerate again.

■ b6-02 Dwell Time@Start

No. (Hex.)	Name	Description	Default (Range)
b6-02 (01B7)	Dwell Time@Start	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the length of time that the drive will hold the output frequency when the motor starts.	0.0 s (0.0 - 10.0 s)

■ b6-03 Dwell Ref@Stop

No. (Hex.)	Name	Description	Default (Range)
b6-03 (01B8)	Dwell Ref@Stop	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the output frequency that the drive will hold momentarily when ramping to stop the motor.	0.0 (Determined by A1-02)

When the drive decelerates to the output frequency set in *b6-03*, it holds that frequency for the time set in *b6-04 [Dwell Time@Stop]* and starts to decelerate again.

■ b6-04 Dwell Time@Stop

No. (Hex.)	Name	Description	Default (Range)
b6-04 (01B9)	Dwell Time@Stop	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the length of time for the drive to hold the output frequency when ramping to stop the motor.	0.0 s (0.0 - 10.0 s)

◆ b7: DROOP CONTROL

Droop control automatically balances the load level between two motors that operate the same load.

Droop control decreases motor speed as the load changes. You must enable the Droop control function for each motor it is operating.

To decrease motor speed, the Droop control function decreases the speed reference when an increase in the load increases the torque reference. To increase motor speed, the Droop control function increases the speed reference when a decrease in the load decreases the torque reference. The Droop control function adjusts motor speed as the torque reference changes to balance the load between the motors.

Note:

When you use Droop control, set *n5-01 = 0 [FF Control Selection = Disabled]*.

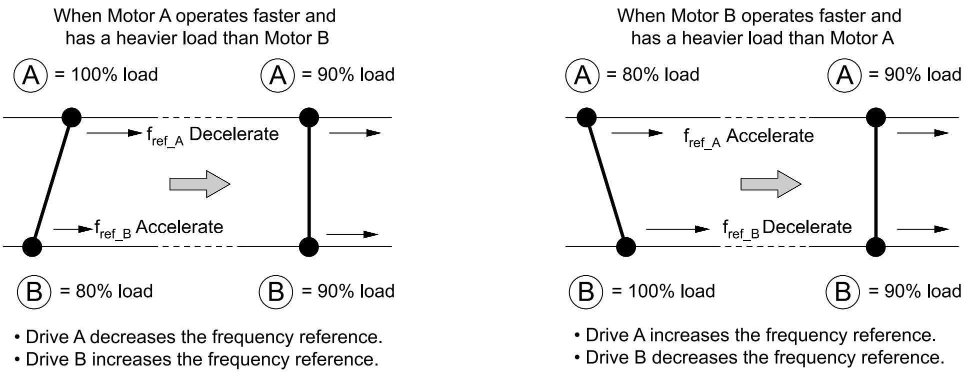


Figure 12.35 Droop Control Application

■ b7-01 Droop Ctrl Gain

No. (Hex.)	Name	Description	Default (Range)
b7-01 (01CA) RUN	Droop Ctrl Gain	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the amount of deceleration when the torque reference is at 100% of Maximum Output Frequency.	0.0% (0.0 - 100.0%)

To disable Droop control, set this parameter to 0.0%.

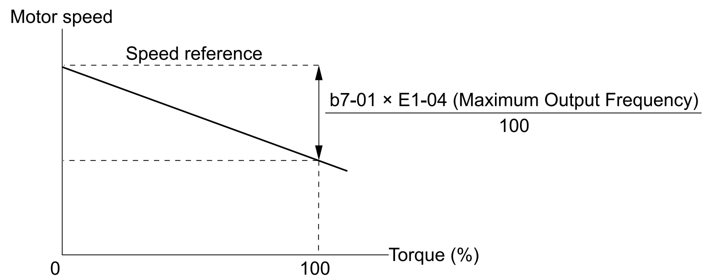


Figure 12.36 Droop Control Gain

■ b7-02 Droop Ctrl Delay Time

No. (Hex.)	Name	Description	Default (Range)
b7-02 (01CB) RUN	Droop Ctrl Delay Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the responsiveness of Droop control. Decrease this setting when drive response is slow. Increase this setting when hunting or oscillation occur.	0.05 s (0.03 - 2.00 s)

■ b7-03 Droop Ctrl Limit Selection

No. (Hex.)	Name	Description	Default (Range)
b7-03 (017E)	Droop Ctrl Limit Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Droop control limit function.	1 (0, 1)

0 : Disabled

1 : Enabled

◆ b8: ENERGY SAVING

Energy-saving control improves overall system operating efficiency by operating the motor at its most efficient level.

Set *b8-01* and the following parameters according to the control mode and the motor.

- Set parameters *b8-04, b8-05, and b8-06* when using V/f Control or Closed Loop V/f Control.
- Set parameters *b8-02, b8-03* when using vector control with an induction motor.
- Set parameters *b8-16, b8-17* when using a PM motor.

Note:
- Energy-saving control is not appropriate for applications with sudden changes in the load, or applications driving heavy loads such as a traverse car application.
- Energy-saving control maximizes operation based on precise motor data set to the drive. Be sure to perform Auto-Tuning and enter the correct information about the motor before using the Energy-saving control.

■ b8-01 eSave Ctrl Selection

No. (Hex.)	Name	Description	Default (Range)
b8-01 (01CC)	eSave Ctrl Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Energy-saving control function.	0 (Determined by A1-02)

0 : Disabled

1 : Enabled

2 : Search Enabled

■ b8-02 eSave Ctrl Gain

No. (Hex.)	Name	Description	Default (Range)
b8-02 (01CD) RUN Expert	eSave Ctrl Gain	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the gain for Energy-saving control.	Determined by A1-02 (0.0 - 10.0)

Increase the setting value to increase energy saving. If the setting value is too large, the motor will stall.

b8-03 eSave Filter Time

No. (Hex.)	Name	Description	Default (Range)
b8-03 (01CE) RUN Expert	eSave Filter Time	V/f CL-V/f **OLV** **CLV** **AOLV** OLV/PM AOLV/PM CLV/PM EZOLV Sets the responsiveness for Energy-saving control.	Determined by A1-02, C6-01, and o2-04 (0.00 - 10.00 s)

Decrease the setting value to increase responsiveness. If the setting value is too low, operation will not be stable.

b8-04 eSave Coef. Value

No. (Hex.)	Name	Description	Default (Range)
b8-04 (01CF) Expert	eSave Coef. Value	**V/f** **CL-V/f** OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Energy-saving control coefficient to maintain maximum motor efficiency. The default setting is for Yaskawa motors.	Determined by C6-01, E2-11, o2-04 (0.00 - 655.00)

When you use a motor from a different manufacturer, increase the setting value in 5% increments to find the minimum value for *U1-08 [Output Power]* at light loads.

When you decrease the setting value, it decreases the output voltage and decreases power consumption. If the setting value is too low, the motor will stall.

Note:

When you do Rotational Auto-Tuning, the drive will automatically set the energy-saving coefficient.

b8-05 Power Det.Filter Time

No. (Hex.)	Name	Description	Default (Range)
b8-05 (01D0) Expert	Power Det.Filter Time	**V/f** **CL-V/f** OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the time constant to measure output power.	20 ms (0 - 2000 ms)

Decrease the setting value to increase responsiveness to load changes. If you set the value too low during operation at light loads, motor speed is not stable.

b8-06 Srch Op.Volt Limit

No. (Hex.)	Name	Description	Default (Range)
b8-06 (01D1) Expert	Srch Op.Volt Limit	**V/f** **CL-V/f** OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the voltage limit for Search Operation as a percentage where motor rated voltage is a setting value of 100%.	0% (0 - 100%)

The Search Operation changes the output voltage in small increments to find a setpoint at which the drive can use minimum power to operate.

Set this parameter to *0* to disable Search Operation. This will not disable Energy-saving control.

If the setting value is too low, the motor will stall when loads suddenly increase.

b8-16 PM eSave Coef.Ki

No. (Hex.)	Name	Description	Default (Range)
b8-16 (01F8) Expert	PM eSave Coef.Ki	V/f CL-V/f OLV CLV AOLV OLV/PM **AOLV/PM** **CLV/PM** EZOLV Sets torque linearity. This parameter uses the Ki value from the motor nameplate. Usually it is not necessary to change this setting.	1.00 (0.00 - 3.00)

When *b8-16 = 1.00* (default), the drive will automatically calculate and control the energy-saving coefficient. If the motor nameplate has a description for “Ki”, set this parameter to the Ki value.

Do this procedure to prevent oscillation when you set *b8-01 = 1 [eSave Ctrl Selection = Enabled]*.

1. Check *U5-21 [Energy Save Ki Coeff]* and make sure that it aligns with the Ki value on the motor nameplate.
2. If the numbers are different, set *b8-16* to the Ki value on the motor nameplate.

b8-17 PM eSave Coef.Kt

No. (Hex.)	Name	Description	Default (Range)
b8-17 (01F9) Expert	PM eSave Coef.Kt	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets torque linearity. This parameter uses the Kt value from the motor nameplate. Usually it is not necessary to change this setting.	1.00 (0.00 - 3.00)

When *E5-01 = 1xxx, 2xxx [PM Mot Code Selection = Yaskawa SSR1 or SST4 series IPM motor]*, the drive automatically calculates the energy-saving coefficient Kt and uses that value to control operation.

Do this procedure to prevent oscillation when you set *b8-01 = 1 [eSave Ctrl Selection = Enabled]*.

1. Check *U5-22 [Energy Save Kt Coeff]* and make sure that it aligns with the Kt value on the motor nameplate.
2. If the numbers are different, set *b8-17* to the Kt value on the motor nameplate.

b8-18 eSave d-Axis Filter Time

No. (Hex.)	Name	Description	Default (Range)
b8-18 (01FA) Expert	eSave d-Axis Filter Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the d-axis current reference filter time constant.	100 ms (0 - 5,000 ms)

b8-19 eSave Search Frequency

No. (Hex.)	Name	Description	Default (Range)
b8-19 (0B40) Expert	eSave Search Frequency	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the frequency of Energy-saving control search operations. Usually it is not necessary to change this setting.	Determined by A1-02 (20 - 300 Hz)

Note:
- If low inertia causes vibration in the machine, increase the setting value in 10 Hz increments and check the response. If *A1-02 = 8 [Control Method = EZ Vector]*, increase the setting value in 1 Hz increments.
- To make the motor more efficient, decrease the setting value in 1 Hz increments until the point immediately before machine vibration starts to occur.

b8-20 PM eSave Width for Test

No. (Hex.)	Name	Description	Default (Range)
b8-20 (0B41) Expert	PM eSave Width for Test	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the amplitude of Energy-saving control search operations.	1.0 degrees (0.1 - 5.0 degrees)

An increase in the value can make the operational efficiency better. However, if the load inertia is small, it may be necessary to adjust the value to prevent machine vibration.

Note:
- If low inertia causes vibration in the machine, decrease the setting value in 1.0-degree increments and check the response.
- To make the motor more efficient, increase the setting value in 1.0-degreee increments until the point immediately before machine vibration starts to occur.

b8-21 PM eSave Gain for Test

No. (Hex.)	Name	Description	Default (Range)
b8-21 (0B42) Expert	PM eSave Gain for Test	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the gain of Energy-saving control search operations.	0.3Hz (0.1 - 20.0 Hz)

When you decrease the value of *C5-01 [ASR PGain 1]*, also decrease the value of *b8-21* to keep the correct ratio.

b8-22 PM eSave LPF Cutoff Frq

No. (Hex.)	Name	Description	Default (Range)
b8-22 (0B43) Expert	PM eSave LPF Cutoff Frq	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the frequency of the filter used to extract the high-efficiency phase from search operations. Usually it is not necessary to change this setting.	10.0 Hz (1.0 - 30.0 Hz)

b8-23 PM eSave Srch Limit

No. (Hex.)	Name	Description	Default (Range)
b8-23 (0B44) Expert	PM eSave Srch Limit	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the search operations output limit. Usually it is not necessary to change this setting.	15.0 degrees (0.0 - 30.0 degrees)

When the motor characteristics are correct, increase this value to make the motor more efficient.

b8-24 PM eSave HiF Gain for ACR

No. (Hex.)	Name	Description	Default (Range)
b8-24 (0B45) Expert	PM eSave HiF Gain for ACR	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the gain for high-frequency current control.	200.0 Hz (100.0 - 1000.0 Hz)

Note:

If the drive detects *oC [Overcurrent]*, decrease the value.

b8-25 PM eSave Srch Start Level

No. (Hex.)	Name	Description	Default (Range)
b8-25 (0B46) Expert	PM eSave Srch Start Level	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the start level for search operations.	10.0% (0.0 - 100.0%)

Note:

If there is vibration in the machine, increase the value.

b8-26 PM eSave Pwr SP Setpoint

No. (Hex.)	Name	Description	Default (Range)
b8-26 (0B47) Expert	PM eSave Pwr SP Setpoint	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets a value to increase torque accuracy.	0.0% (-10.0 - +10.0%)

b8-28 OverExc Action Selection

No. (Hex.)	Name	Description	Default (Range)
b8-28 (0B8B) Expert	OverExc Action Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function for excitation operation.	0 (0, 1)

When operation is not stable at low speeds, set this parameter to 1 to enable the function.

0 : Disabled

1 : Enabled

b8-29 eSave Priority Mode

No. (Hex.)	Name	Description	Default (Range)
b8-29 (0B8C)	eSave Priority Mode	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the priority of drive response between changes to the load or Energy-saving control.	0 (0, 1)

Enable this parameter when there are small changes in the load. It is possible that the motor cannot respond correctly to changes in the load.

0 : Priority: Drive Response

1 : Priority: Energy Savings

■ b8-50 Standby Mode Selection

No. (Hex.)	Name	Description	Default (Range)
b8-50 (0B0D)	Standby Mode Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Standby Mode function.	0 (0, 1)

0 : Disabled

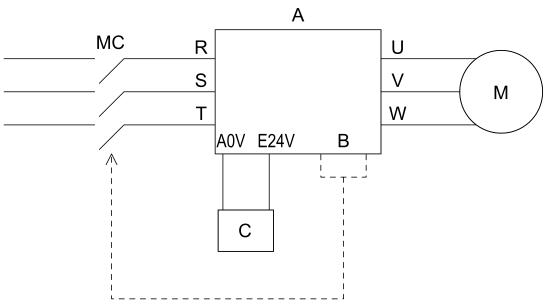
1 : Enabled

Standby Mode decreases how much power the drive consumes when it is in standby.

Standby Mode waits for the drive to stop, then uses the relay output of an MFDO terminal to shut off the input side electromagnetic contactor (MC) and then shut off the main circuit power supply.

Note:

These conditions are also necessary for Standby Mode:
- Connect an external 24 V power supply.
- Connect a electromagnetic contactor to the drive input side and connect the MFDO terminal set for *H2-xx = C [@Standby]*. When the MFDO terminal is OFF, the electromagnetic contactor must be OFF.
- Frequently starting and stopping the drive and regularly opening and closing the electromagnetic contactor will decrease the service life of the drive.



A - Drive
B - MFDO Terminal
C - External 24 V power supply

■ b8-51 Standby Mode Wait Time

No. (Hex.)	Name	Description	Default (Range)
b8-51 (0B01)	Standby Mode Wait Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the delay time before turning off the electromagnetic contactor after the drive stops.	600 s (0 - 6000 s)

◆ b9: ZERO SERVO

Zero Servo is a position control function that stops and holds the motor shaft. The drive safeties the stopped motor and an external force will not move the motor.

When you enable the Zero Servo function, the drive will save the home position. The drive can correct the motor position and put the motor into the home position when the load rotates the motor.

To enable Zero Servo, set *H1: DIGITAL INPUTS = 31 [Zero Servo]*. The drive starts Zero Servo when the MFDI terminal set for *Zero Servo [H1-xx = 31]* activates and the motor speed decreases to less than the value set in *b2-01 [ZSpd/DCI Threshold]*. The drive stops and holds the motor in the Zero Servo start position. When Zero Servo is enabled, the drive will hold the motor in position when the frequency reference increases to more than the value set in *b2-01*. The drive accelerates to the frequency reference when the MFDI terminal set to trigger the Zero Servo function is released and there is a Run command.

Note:

Zero Servo is available when *A1-02 = 3, 7 [Control Method = CLVector, PM CLVector]*.

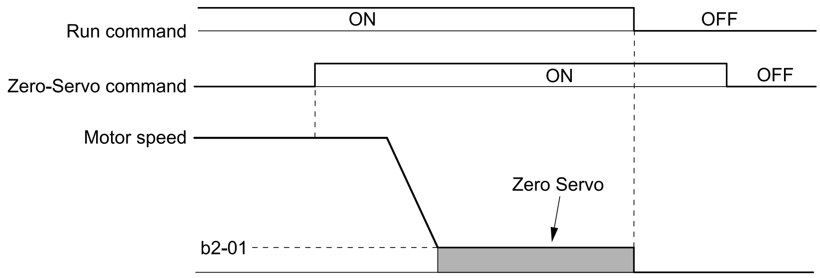


Figure 12.37 Zero Servo Time Chart

Monitor *U6-22 [Pulse Move@Zero Servo]* shows the difference between the position of the motor shaft and the Zero Servo start position when Zero Servo is enabled. To find the difference, divide the number of pulses shown in *U6-22* by 4.

When the position of the motor shaft is in the range of "Zero Servo start position ± *b9-02 [Zero Servo Width for Completion]*", the drive will activate the MFDO set for *ZeroServo ok [H2-xx = 8]*.

NOTICE: *Do not let the Zero Servo function hold 100% load for long periods of time. When the application must use Zero Servo to hold 100% load for long periods, operate in less than 50% of the drive rated output current or use a larger capacity drive. Failure to obey will cause damage to the drive.*

Note:
- When you use the Zero Servo function, keep the Run command ON. If the Run command is OFF, the drive will not hold the motor shaft in position.
- When you turn oFF the Zero-Servo command, the terminal set for Zero Servo Complete will deactivate.
- If *A1-02 = 7 [PM CLVector]* and an external force rotates the motor during Zero Servo, the drive will detect *dv4 [Inversion Prevention Detection]*. To prevent *dv4* detection, increase *b9-01 [Zero Servo Gain]* or increase the number of pulses set in *F1-19 [Dev4 Mode Selection]*.

■ b9-01 Zero Servo Gain

No. (Hex.)	Name	Description	Default (Range)
b9-01 (01DA)	Zero Servo Gain	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the responsiveness for the Zero Servo function.	5 (0 - 100)

If the drive is not responsive, or if there is too much deviation from the Zero Servo start point when you increase the load, increase this setting. If oscillation or hunting occurs, decrease this setting.

Note:
- Set *C5-xx [C5: ASR - SPEED REGULATION]* parameters correctly before you adjust the Zero Servo gain.
- When you operate with the Zero Servo command enabled, oscillation and hunting must not occur.

■ b9-02 Zero Servo Width for Completion

No. (Hex.)	Name	Description	Default (Range)
b9-02 (01DB)	Zero Servo Width for Completion	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the range to trigger an output terminal set for "Zero Servo Complete" during Zero Servo operation. Be sure to set the deviation from the Zero Servo start position.	10 (0 - 16383)

When the position of the motor shaft is in the range of "Zero Servo start position ± *b9-02*", the drive will activate a MFDO set for *ZeroServo ok [H2-xx = 8]*.

12.3 C: TUNING

The parameter group *C: TUNING* adjusts drive operation, including:

- Acceleration Time
- Deceleration Time
- Slip Compensation
- Torque Compensation
- Carrier Frequency

◆ C1: ACCEL / DECEL

You can set four different acceleration and deceleration time pairs in the drive. When you activate and deactivate *H1-xx = 18, 19, 61 [MFDI Function Select = Ac/Dec Time1, Ac/Dec Time2, Motor 2 Select]*, you can switch acceleration and deceleration times during run.

Acceleration time parameters always set the time to accelerate from 0 Hz to *E1-04 [Max Output Frequency]*. Deceleration time parameters always set the time to decelerate from *E1-04* to 0 Hz.

C1-01 [Accel Time 1] and *C1-02 [Decel Time 1]* are the default active accel/decel settings.

Parameters	Setting Range
C1-01 [Accel Time 1]	0.0 to 6000.0 s
C1-02 [Decel Time 1]	
C1-03 [Accel Time 2]	
C1-04 [Decel Time 2]	
C1-05 [Accel Time 3]	
C1-06 [Decel Time 3]	
C1-07 [Accel Time 4]	
C1-08 [Decel Time 4]	

Note:
When *C1-10 = 0 [Ac/Dec Units = 0.01s]*, the setting range for acceleration and deceleration times is 0.00 s to 600.00 s.

■ Use MFDIs to Switch Acceleration Times

Select the different acceleration and deceleration times as shown in Table 12.14.

Table 12.14 Accel/Decel Times and Active Parameters

H1-xx = 7 [Accel/Decel Time Selection 1]	H1-xx = 1A [Accel/Decel Time Selection 2]	Active Parameter	
		Acceleration Time	Deceleration Time
OFF	OFF	C1-01 [Accel Time 1]	C1-02 [Decel Time 1]
ON	OFF	C1-03 [Accel Time 2]	C1-04 [Decel Time 2]
OFF	ON	C1-05 [Accel Time 3]	C1-06 [Decel Time 3]
ON	ON	C1-07 [Accel Time 4]	C1-08 [Decel Time 4]

Figure 12.38 shows an operation example to change acceleration and deceleration times. It is necessary to set *b1-03 = 0 [Stopping Method Selection = Ramp->Stop]* for this example.

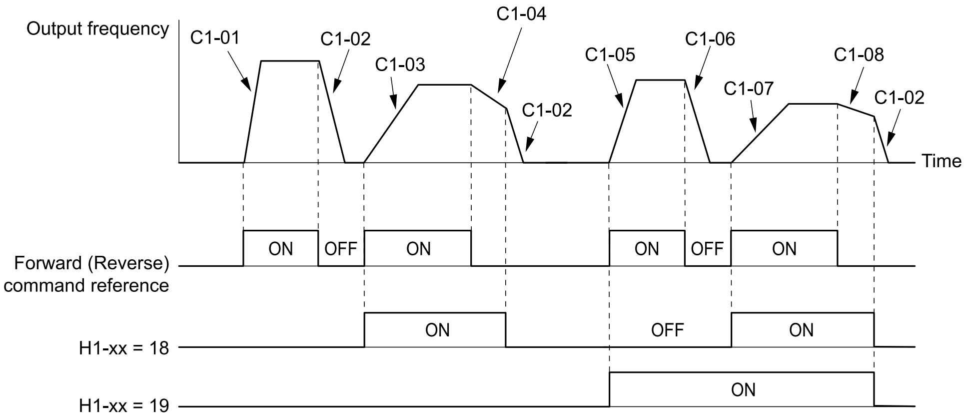


Figure 12.38 Timing Diagram of Acceleration and Deceleration Times

■ Use Motor Selection to Switch Acceleration and Deceleration Times

When you set *H1-xx = 61 [MFDI Function Select = Motor 2 Select]*, you can activate and deactivate the input terminal to switch between motor 1 and motor 2.

Note:

You cannot use the Motor 2 Selection function with PM motors.

Table 12.15 shows the possible acceleration and deceleration time combinations when you use the Motor 2 Selection function.

Table 12.15 Motor Selection and Acceleration and Deceleration Times

H1-xx = 18 [Ac/Dec Time1]	H1-xx = 61 [Motor 2 Select]			
	Motor 2 Selection: OFF		Motor 2 Selection: ON	
	Acceleration Time	Deceleration Time	Acceleration Time	Deceleration Time
OFF	C1-01	C1-02	C1-05	C1-06
ON	C1-03	C1-04	C1-07	C1-08

■ Use Output Frequency Level to Switch Acceleration and Deceleration Times

The drive can use output frequency to automatically switch between different acceleration and deceleration times. The acceleration and deceleration times for the drive are switched automatically. When the output frequency = *C1-11 [Ac/Dec Switch Frequency]*, the drive automatically switches the acceleration and deceleration times. Set *C1-11 = 0.0 Hz* to disable this function.

Note:
- Acceleration and deceleration times set to MFDIs are more important than the automatic switch using the frequency level set in *C1-11*. For example, if the MFDI set for *Ac/Dec Time1 [H1-xx = 18]* is activated, the drive will use only accel/decel time 2 (or accel/decel time 4 for motor 2). If you use a frequency level set in *C1-11*, the drive will not automatically switch acceleration and deceleration times.
- If Motor 2 Selection *[H1-xx = 61]* is activated, the drive will set the acceleration/deceleration time to *C1-05* and *C1-06* for motor 2 when the output frequency is more than the frequency level set in *C1-11*.

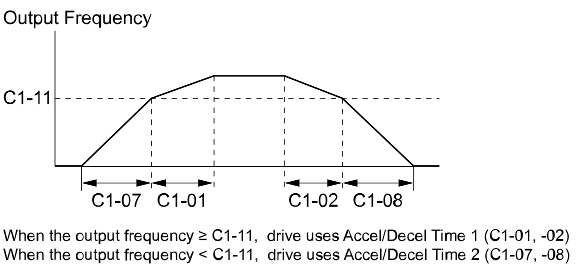


Figure 12.39 Accel/Decel Time Switchover Freq

C1-01 Accel Time 1

No. (Hex.)	Name	Description	Default (Range)
C1-01 (0200) RUN	Accel Time 1	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the length of time to accelerate from zero to maximum output frequency.	10.0 s (0.0 - 6000.0 s)

Note:

When *C1-10 = 0 [Ac/Dec Units = 0.01s]*, the setting range is 0.00 to 600.00 s.

C1-02 Decel Time 1

No. (Hex.)	Name	Description	Default (Range)
C1-02 (0201) RUN	Decel Time 1	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the length of time to decelerate from maximum output frequency to zero.	10.0 s (0.0 - 6000.0 s)

Note:

When *C1-10 = 0 [Ac/Dec Units = 0.01s]*, the setting range is 0.00 to 600.00 s.

C1-03 Accel Time 2

No. (Hex.)	Name	Description	Default (Range)
C1-03 (0202) RUN	Accel Time 2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the length of time to accelerate from zero to maximum output frequency.	10.0 s (0.0 - 6000.0 s)

Note:

When *C1-10 = 0 [Ac/Dec Units = 0.01s]*, the setting range is 0.00 to 600.00 s.

C1-04 Decel Time 2

No. (Hex.)	Name	Description	Default (Range)
C1-04 (0203) RUN	Decel Time 2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the length of time to decelerate from maximum output frequency to zero.	10.0 s (0.0 - 6000.0 s)

Note:

When *C1-10 = 0 [Ac/Dec Units = 0.01s]*, the setting range is 0.00 to 600.00 s.

C1-05 Accel Time 3

No. (Hex.)	Name	Description	Default (Range)
C1-05 (0204) RUN	Accel Time 3	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the length of time to accelerate from zero to maximum output frequency.	10.0 s (0.0 - 6000.0 s)

Note:

When *C1-10 = 0 [Ac/Dec Units = 0.01s]*, the setting range is 0.00 to 600.00 s.

C1-06 Decel Time 3

No. (Hex.)	Name	Description	Default (Range)
C1-06 (0205) RUN	Decel Time 3	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the length of time to decelerate from maximum output frequency to zero.	10.0 s (0.0 - 6000.0 s)

Note:

When *C1-10 = 0 [Ac/Dec Units = 0.01s]*, the setting range is 0.00 to 600.00 s.

■ C1-07 Accel Time 4

No. (Hex.)	Name	Description	Default (Range)
C1-07 (0206) RUN	Accel Time 4	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the length of time to accelerate from zero to maximum output frequency.	10.0 s (0.0 - 6000.0 s)

Note:

When *C1-10 = 0 [Ac/Dec Units = 0.01s]*, the setting range is 0.00 to 600.00 s.

■ C1-08 Decel Time 4

No. (Hex.)	Name	Description	Default (Range)
C1-08 (0207) RUN	Decel Time 4	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the length of time to decelerate from maximum output frequency to zero.	10.0 s (0.0 - 6000.0 s)

Note:

When *C1-10 = 0 [Ac/Dec Units = 0.01s]*, the setting range is 0.00 to 600.00 s.

■ C1-09 Fast Stop Time

No. (Hex.)	Name	Description	Default (Range)
C1-09 (0208)	Fast Stop Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the length of time that the drive will decelerate to zero for a Fast Stop.	10.0 s (0.0 - 6000.0 s)

Note:
- When *C1-10 = 0 [Ac/Dec Units = 0.01s]*, the setting range is 0.00 to 600.00 s.
- When *L2-29 = 1 [KEB Method = Single KEB1 Ride-Thru]* and you do KEB Auto-Tuning, the drive will automatically set *C1-09*. If you must not change the Fast Stop time, do not do KEB Auto-Tuning.

The Fast Stop function will be triggered in the following circumstances.

- The Fast Stop operation will be triggered by the input of the Fast Stop command via the multi-function digital input terminal.
- The Fast Stop operation is will be triggered when by the input of the Fast Stop command is input via the multi-function digital input terminal.

Set *H1-xx = 34, 35 [MFDI Function Select = Fast Stop (NO), Fast Stop (NC)]*.

When the Fast Stop command is input, the Fast Stop operation will be triggered at the deceleration time set to *C1-09*. The drive cannot be restarted after initiating a Fast Stop operation until deceleration is complete. Complete deceleration and cycle the Run command to clear the Fast Stop input.

The terminal set for *H2-xx = 17 [MFDO Function Select = @Fast Stop]* will be ON during Fast Stop.

Note:

Decelerating too quickly can cause an *ov [Overvoltage]* fault that shuts off the drive while the motor to coasts to a stop. Set a Fast Stop time in *C1-09* that prevents motor coasting and makes sure that the motor stops quickly and safely.

■ C1-10 Ac/Dec Units

No. (Hex.)	Name	Description	Default (Range)
C1-10 (0209)	Ac/Dec Units	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the setting units for *C1-01 to C1-08 [Accel/Decel Times 1 to 4]*, *C1-09 [Fast Stop Time]*, *L2-06 [KEB Decel Time]*, and *L2-07 [KEB Accel Time]*.	1 (0, 1)

0 : 0.01s

Sets acceleration and deceleration times in 0.01 s units. The setting range is 0.0 to 6000.0 s.

If one of these parameters is set to 1000.0 s or longer, you cannot set *C1-10 = 0*:

- *C1-01 to C1-09*
- *L2-06*
- *L2-07*

When one of those parameters is set to a value between 600.1 s and 1000.0 s, you can set *C1-10 = 0*, but the time will change to 600.00 s.

1 : 0.1s

Sets acceleration and deceleration times in 0.1 s units. The setting range is 0.0 to 6000.0 s.

■ C1-11 Ac/Dec Switch Frequency

No. (Hex.)	Name	Description	Default (Range)
C1-11 (020A)	Ac/Dec Switch Frequency	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the frequency at which the drive will automatically change acceleration and deceleration times.	Determined by A1-02 (0.0 - 590.0 Hz)

When output frequency get *C1-11* value, the drive automatically switches the acceleration and deceleration times. Set this parameter to *0.0* to disable this function.

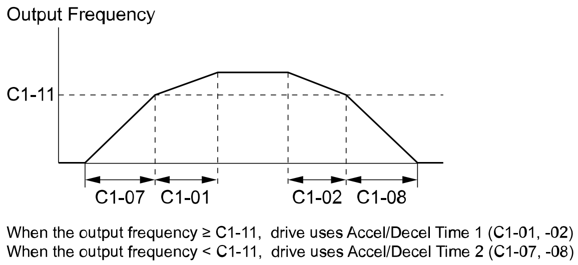


Figure 12.40 Accel/Decel Time Switching Frequency

Table 12.16 lists the possible combinations of acceleration and deceleration time switchover frequencies and the acceleration times for the Motor 2 Selection function.

Table 12.16 Motor and Acceleration and Deceleration Time Combination

C1-11	Motor 1		Motor 2	
	Acceleration Time	Deceleration Time	Acceleration Time	Deceleration Time
Less than the setting value	C1-07 [Accel Time 4]	C1-08 [Decel Time 4]	C1-07 [Accel Time 4]	C1-08 [Decel Time 4]
Equal to or more than the setting value	C1-01 [Accel Time 1]	C1-02 [Decel Time 1]	C1-05 [Accel Time 3]	C1-06 [Decel Time 3]

■ C1-14 Ac/Dec Base Frequency

No. (Hex.)	Name	Description	Default (Range)
C1-14 (0264)	Ac/Dec Base Frequency	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the base frequency used to calculate acceleration and deceleration rates.	0.0 Hz (0.0 - 590.0 Hz)

The acceleration and deceleration rates set in *C1-01 to C1-09 [Accel Time 1 to Decel Time 4, Fast Stop Time]* will change when the value of *C1-14* changes.

- When *C1-14 = 0.0 Hz*
  - *C1-01, C1-03, C1-05, C1-07 [Accel Time 1 to Accel Time 4]:* Time to accelerate from 0 Hz to *E1-04 [Max Output Frequency]*
  - *C1-02, C1-04, C1-06, C1-08 [Decel Time 1 to Decel Time 4], C1-09 [Fast Stop Time]:* Time to decelerate from *E1-04* to 0 Hz.

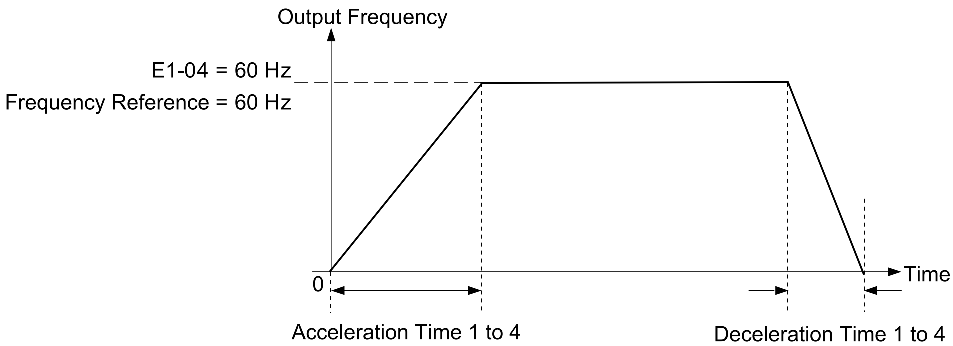


Figure 12.41 Example 1: Acceleration/Deceleration Rate (When C1-14 = 0 Hz, E1-04 = 60 Hz, and the Frequency Reference is 60 Hz)

- When *C1-14 ≠ 0.0 Hz*

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– *C1-01, C1-03, C1-05, C1-07:* Time to accelerate from 0 Hz to *C1-14*

– *C1-02, C1-04, C1-06, C1-08, C1-09:* Time to decelerate from *C1-14* to 0 Hz

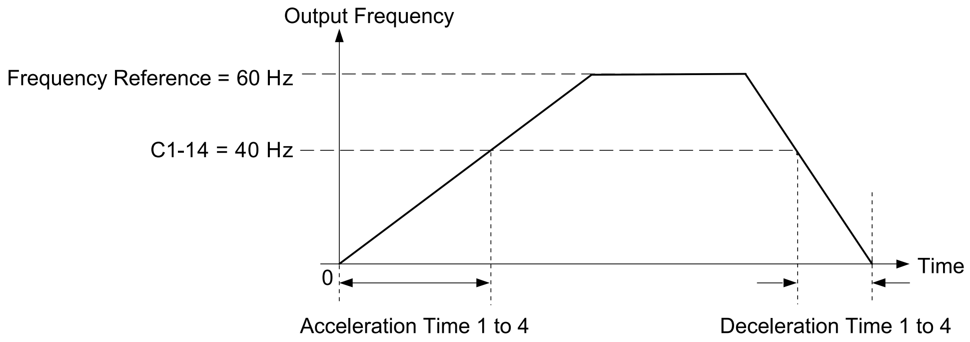

Figure 12.42 Example 2: Acceleration/Deceleration Rate (When C1-14 = 40 Hz, E1-04 = 60 Hz, and the Frequency Reference is 60 Hz)

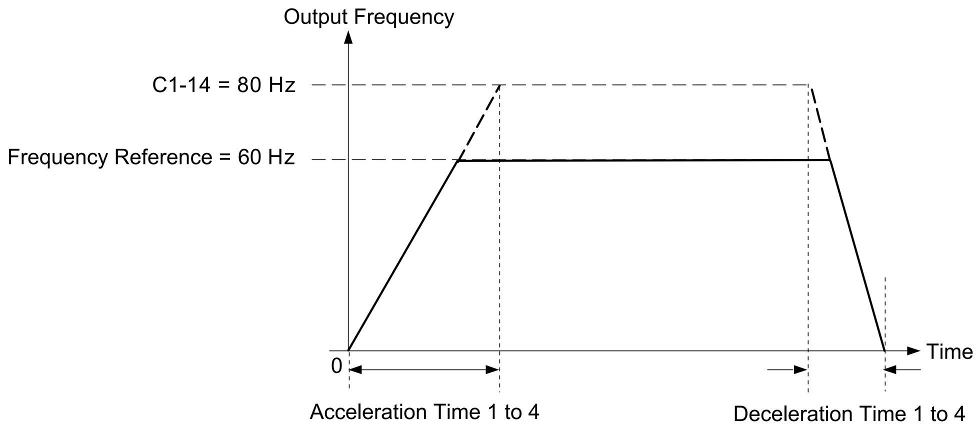

Figure 12.43 Example 3: Acceleration/Deceleration Rate (When C1-14 = 80 Hz, E1-04 = 60 Hz, and the Frequency Reference is 60 Hz)

Note:

- Figure 12.41 to Figure 12.43 show the accel/decel times when *C2-01 to C2-04 [Jerk@Start of Accel, Jerk@End of Accel, Jerk@Start of Decel, Jerk@End of Decel] = 0.00 s*.
- When *L3-01 ≠ 1 [StallP Mode@Accel ≠ Disabled]*, Stall Prevention could cause the acceleration time to be longer than the set value.
- When *L3-04 = 1 [StallP@Decel Enable = Enabled]*, Stall Prevention could cause the deceleration time to be longer than the set value.

◆ C2: JERK CONTROL

Use S-curve characteristics to smooth acceleration and deceleration and to minimize abrupt shock to the load. Set S-curve characteristic time during acceleration/deceleration at start and acceleration/deceleration at stop. The following figure explains how S-curves are applied.

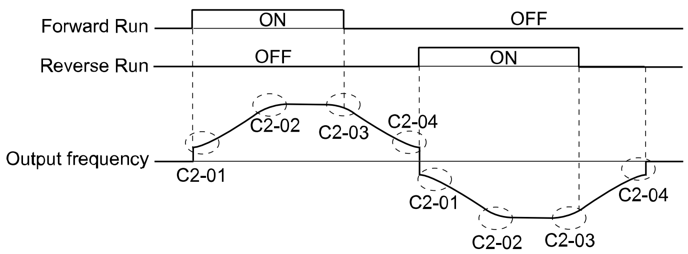

Figure 12.44 S-Curve Timing Diagram - Forward/Reverse Operation

Note:
- If *STPo [Motor Step-Out Detected]* occurs when starting a PM motor, try increasing the value set to *C2-01*.
- Setting the S-curve will increase the acceleration and deceleration times.

$$\text{Acceleration time} = \text{Selected acceleration time} + \frac{\text{C2-01} + \text{C2-02}}{2}$$

$$\text{Deceleration time} = \text{Selected deceleration time} + \frac{\text{C2-03} + \text{C2-04}}{2}$$

■ C2-01 Jerk@Start of Accel

No. (Hex.)	Name	Description	Default (Range)
C2-01 (020B)	Jerk@Start of Accel	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the jerk acceleration time at start.	Determined by A1-02 (0.00 - 10.00 s)

■ C2-02 Jerk@End of Accel

No. (Hex.)	Name	Description	Default (Range)
C2-02 (020C)	Jerk@End of Accel	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the jerk acceleration time at completion.	0.20 s (0.00 - 10.00 s)

■ C2-03 Jerk@Start of Decel

No. (Hex.)	Name	Description	Default (Range)
C2-03 (020D)	Jerk@Start of Decel	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the jerk deceleration time at start.	0.20 s (0.00 - 10.00 s)

■ C2-04 Jerk@End of Decel

No. (Hex.)	Name	Description	Default (Range)
C2-04 (020E)	Jerk@End of Decel	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the jerk deceleration time at completion.	0.00 s (0.00 - 10.00 s)

◆ C3: SLIP COMPENSATION

The Slip Compensation function improves the speed accuracy of an induction motor. As loads on induction motors increase, motor slip increases and motor speed decreases. By adjusting the output frequency in accordance with the motor load, it compensates the slip and makes the motor speed equal to the frequency reference.

■ C3-01 Slip Comp Gain

No. (Hex.)	Name	Description	Default (Range)
C3-01 (020F) RUN	Slip Comp Gain	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the gain for the slip compensation function. Usually it is not necessary to change this setting.	Determined by A1-02 (0.0 - 2.5)

Note:
- Correctly set these parameters before changing the slip compensation gain:
  – *E2-01 [Mot Rated Current (FLA)]*
  – *E2-02 [Mot Rated Slip]* (Set during Auto-Tuning when *A1-02 = 2 [Control Method = OLVector]*)
  – *E2-03 [Mot No-Load Current]*
- When *A1-02 = 3 [CLVector]*, the slip compensation gain becomes the motor temperature compensation gain. When the motor temperature increases, the motor internal constant changes and increases the slip. When you set this parameter, the drive adjusts the slip with the increase in temperature. Adjust the parameter in these conditions. When the setting value increases, the compensation also increases:
  – The drive is doing torque control.
  – There are torque limits.
  – Output torque changes when the temperature changes.

It can be necessary to adjust the parameter in these conditions:

- If the motor speed is slower than the frequency reference, increase this parameter by 0.1.

- If the motor at constant speed is faster than the frequency reference, decrease this parameter by 0.1.

■ C3-02 Slip Comp Delay Time

No. (Hex.)	Name	Description	Default (Range)
C3-02 (0210) RUN	Slip Comp Delay Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the slip compensation delay time when speed is unstable or when the slip compensation response is too slow. Usually it is not necessary to change this setting.	Determined by A1-02 (0 - 10000 ms)

It can be necessary to adjust the parameter in these conditions:

- If the speed is not stable, increase this parameter.
- If the slip compensation response is too slow, decrease the setting.

■ C3-03 Slip Comp Limit

No. (Hex.)	Name	Description	Default (Range)
C3-03 (0211)	Slip Comp Limit	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the upper limit for the slip compensation function as a percentage of the motor rated slip.	200% (0 - 250%)

If you increase the value of *C3-01 [Slip Comp Gain]* and the motor speed is slow, use this parameter. The drive uses this parameter when the slip is at the upper limit of slip compensation. Make sure that you measure the motor speed when you increase this parameter value. Set this parameter to make the frequency reference and the slip compensation limit less than the permitted range of the machine.

The slip compensation limit is constant in the constant torque range (frequency reference ≤ *E1-06 [Base Frequency]*). In the constant power range, the frequency reference > *E1-06* increases with the *C3-03* value and the output frequency as shown in Figure 12.45.

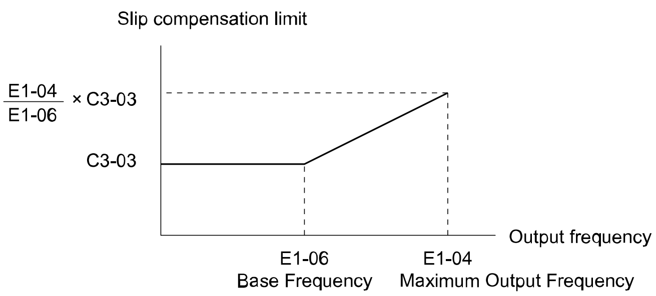

Figure 12.45 Slip Compensation Limit

■ C3-04 Slip Comp@Regen

No. (Hex.)	Name	Description	Default (Range)
C3-04 (0212)	Slip Comp@Regen	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the slip compensation function during regenerative operation.	0 (0 - 2)

If you apply a regenerative load when slip compensation during regeneration is active, it can be necessary to use a dynamic braking option (braking resistor or braking resistor unit).

0 : Disabled

The drive does not provide slip compensation.

The load and operation status (regenerative operation) can cause the motor speed to be higher or lower than the frequency reference.

1 : Enable>6 Hz

Slip compensation function is enabled during regenerative operation. Slip compensation is disabled at output frequencies of 6 Hz or less.

2 : Enable>C3-15

The drive uses *E2-02 [Mot Rated Slip]* to automatically calculate the frequency range where it will disable slip compensation function during regenerative operation.

Slip compensation is enabled at frequencies as low as 2 Hz.

■ C3-05 Vout Limit Selection

No. (Hex.)	Name	Description	Default (Range)
C3-05 (0213)	Vout Limit Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the automatic reduction of motor magnetic flux when the output voltage is saturated.	0 (0, 1)

Make sure that the drive has sufficient output current capacity before you enable this parameter. When this parameter is *0 [Disabled]*, the drive increases the output current to a maximum of 10% when the motor is running at constant speed. The drive will also decrease flux and increase current to compensate torque.

Enable this parameter to increase speed precision when you move heavy loads at high speeds in these conditions:

- Power supply voltage is low
- Motor rated voltage is high

Do not enable this parameter in these conditions:

- Operating a motor in the middle speed range or low speed range
- Power supply voltage is a minimum of 10% more than the motor rated voltage

When this parameter is enabled, you could possibly not have accurate torque control if the power supply voltage is much less than the motor rated voltage.

0 : Disabled

1 : Enabled

■ C3-16 Vout Limit Start Level

No. (Hex.)	Name	Description	Default (Range)
C3-16 (0261) Expert	Vout Limit Start Level	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the modulation factor that starts the output voltage limit operation when *C3-05 = 1 [Vout Limit Selection = Enabled]*.	90.0% (70.0 - 90.0%)

■ C3-17 Vout Limit Max Level

No. (Hex.)	Name	Description	Default (Range)
C3-17 (0262) Expert	Vout Limit Max Level	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the modulation factor used with *C3-18 [Vout Limit Level]* for the output voltage limit operation when *C3-05 = 1 [Vout Limit Selection = Enabled]*.	100.0% (85.0 - 100.0%)

■ C3-18 Vout Limit Level

No. (Hex.)	Name	Description	Default (Range)
C3-18 (0263) Expert	Vout Limit Level	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the maximum drop width of the voltage reference when *C3-05 = 1 [Vout Limit Selection = Enabled]*.	90.0% (50.0 - 100.0%)

■ C3-21 M2 Slip Comp Gain

No. (Hex.)	Name	Description	Default (Range)
C3-21 (033E) RUN	M2 Slip Comp Gain	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the gain for the motor 2 slip compensation function. Usually it is not necessary to change this setting.	Determined by E3-01 (0.0 - 2.5)

Note:

Correctly set these parameters before changing the slip compensation gain:

- *E4-01 [M2 Rated Current (FLA)]*
- *E4-02 [M2 Rated Slip]* (Set during Auto-Tuning when *E3-01 = 2 [M2 Control Method Selection = OLVector]*)
- *E4-03 [M2 No-Load Current]*

It can be necessary to adjust this parameter in these conditions:

- If the motor speed is slower than the frequency reference, increase *C3-01* in 0.1 unit increments.
- If the motor at constant speed is faster than the frequency reference, decrease *C3-01* in 0.1 unit increments.

■ C3-22 M2 Slip Comp DelayTime

No. (Hex.)	Name	Description	Default (Range)
C3-22 (0241) RUN	M2 Slip Comp DelayTime	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the slip compensation delay time for motor 2 when speed is unstable or when the slip compensation response is too slow. Usually it is not necessary to change this setting.	Determined by E3-01 (0 - 10000 ms)

It can be necessary to adjust this parameter in these conditions:

- When the speed is not stable, increase the setting.
- When the slip compensation response is too slow, decrease the setting.

■ C3-23 M2 Slip Comp Limit

No. (Hex.)	Name	Description	Default (Range)
C3-23 (0242)	M2 Slip Comp Limit	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the upper limit for the slip compensation function as a percentage of the motor 2 rated slip.	200% (0 - 250%)

If you increase the value of *C3-21 [M2 Slip Comp Gain]* and the motor speed is slow, use this parameter. The drive uses this parameter when the slip is at the upper limit of slip compensation. Make sure that you measure the motor speed when you increase this parameter value. Set this parameter to make the frequency reference and the slip compensation limit less than the permitted range of the machine.

The slip compensation limit is constant in the constant torque range (frequency reference ≤ *E3-06 [M2 Base Frequency]*). In the constant power range, the frequency reference > *E3-06* increases with the *C3-23* value and the output frequency as shown in Figure 12.46.

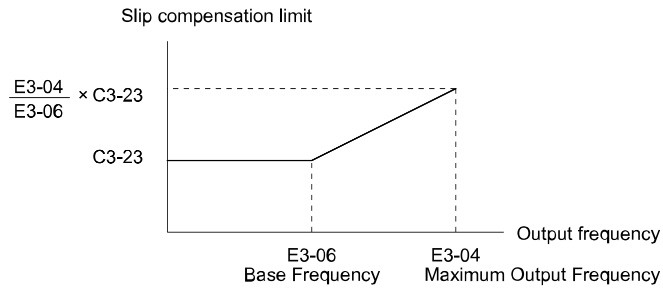

Figure 12.46 Motor 2 Slip Compensation Limit

■ C3-24 M2 Slip Comp Regen Condition

No. (Hex.)	Name	Description	Default (Range)
C3-24 (0243)	M2 Slip Comp Regen Condition	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the slip compensation during regenerative operation function for motor 2.	0 (0 - 2)

If you apply a regenerative load when slip compensation during regeneration is active, it can be necessary to use a dynamic braking option (braking resistor or braking resistor unit).

0 : Disabled

The drive does not provide slip compensation.

The load and operation status (regenerative operation) can cause the motor speed to be higher or lower than the frequency reference.

1 : Enable>6 Hz

Slip compensation function is enabled during regenerative operation. Slip compensation is disabled at output frequencies of 6 Hz or less.

2 : Enable>C3-15

The drive uses *E2-02 [Mot Rated Slip]* to automatically calculate the frequency range where it will disable slip compensation function during regenerative operation.

Slip compensation is enabled at frequencies as low as 2 Hz.

■ C3-28 Adaptative Slip Control Mode

No. (Hex.)	Name	Description	Default (Range)
C3-28 (1B5B) Expert	Adaptative Slip Control Mode	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the slip compensation function mode.	0 (0, 1)

0 : Normal

1 : Advanced

Note:

Set *C3-28 = 0* for better torque precision. If the torque precision does is not better, set *C3-28 = 1* and increase the value of *n4-65 [HF FlxEstim Response]* or *n4-66 [LF FlxEstim Response]* in 0.1-unit increments. Then, you must do Rotational Auto-Tuning.

◆ C4: TORQUE COMPENSATION

Torque compensation is a function that increases voltage to increase output torque as compensation for insufficient torque production at start-up or low-speed operation.

Voltage drops due to motor winding resistance cause torque generating voltage to decrease, which causes insufficient torque. If the main circuit cable connecting the drive and motor is long, this can also cause insufficient torque due to voltage drops.

Note:

Set the motor parameters and V/f pattern properly before setting *C4 parameters*.

■ C4-01 Trq Comp Gain

No. (Hex.)	Name	Description	Default (Range)
C4-01 (0215) RUN	Trq Comp Gain	**V/f** **CL-V/f** **OLV** CLV AOLV **OLV/PM** AOLV/PM CLV/PM **EZOLV** Sets the gain for the torque compensation function. Use this parameter value for motor 1 when operating multiple motors.	Determined by A1-02 (0.00 - 2.50)

In V/f Control or CL-V/f Control, adjust the value in 0.05 unit increments for these conditions:

- When torque is not sufficient during low-speed operation of 10 Hz or less, increase the setting value
- When there is vibration in the motor or when the motor hunts when operating the drive with a light load, decrease the setting value
- When you use a long motor cable, increase the setting value.

Note:
- Adjust *C4-01* to make sure that the output current is not more than the drive rated current during low-speed operation.
- In usual conditions, do not change this parameter in Open Loop Vector Control. It can have a negative effect on torque precision.
- In usual conditions, do not change this parameter in PM Open Loop Vector Control. Setting this value too high can cause overcompensation and motor oscillation.

■ C4-02 Trq Comp Delay Time

No. (Hex.)	Name	Description	Default (Range)
C4-02 (0216) RUN	Trq Comp Delay Time	**V/f** **CL-V/f** **OLV** CLV AOLV **OLV/PM** AOLV/PM CLV/PM **EZOLV** Sets the torque compensation delay time. Usually it is not necessary to change this setting.	Determined by A1-02 (0 - 60000 ms)

It can be necessary to adjust this parameter in these conditions:

- If there is vibration in the motor, increase the setting.
- If the motor speed or motor torque response is too slow, decrease the setting.

■ C4-03 Trq Comp@FWD Start

No. (Hex.)	Name	Description	Default (Range)
C4-03 (0217)	Trq Comp@FWD Start	V/f CL-V/f **OLV** CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the amount of torque reference for forward start as a percentage of the motor rated torque.	0.0% (0.0 - 200.0%)

The drive uses the time constant set in *C4-05 [Trq Comp Time]* to apply compensation.

When you start the motor with a forward Run command, enable this parameter. Set this parameter to 0.0 to disable this function.

■ C4-04 Trq Comp@REV Start

No. (Hex.)	Name	Description	Default (Range)
C4-04 (0218)	Trq Comp@REV Start	V/f CL-V/f **OLV** CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the amount of torque reference for reverse start as a percentage of the motor rated torque.	0.0% (-200.0 - 0.0%)

The drive uses the time constant set in *C4-05 [Trq Comp Time]* to apply compensation.

When you start the motor with a reverse Run command, enable this parameter. Set this parameter to 0.0 to disable this function.

■ C4-05 Trq Comp Time

No. (Hex.)	Name	Description	Default (Range)
C4-05 (0219)	Trq Comp Time	V/f CL-V/f **OLV** CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the starting torque constant to use with *C4-03 and C4-04 [Trq Comp@FWD Start and Trq Comp@REV Start]*.	10 ms (0 - 200 ms)

■ C4-06 M2 Trq Comp Delay Time

No. (Hex.)	Name	Description	Default (Range)
C4-06 (021A)	M2 Trq Comp Delay Time	V/f CL-V/f **OLV** CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the value if *ov [Overvoltage]* occurs with sudden changes in the load, at the end of acceleration, or at the start of deceleration.	150 ms (0 - 10000 ms)

Sets the time constant used during Speed Search or during regenerative operation when *ov* occurs.

Adjust this parameter in the following circumstances.

- Gradually reduce the setting in 10 ms increments and check the performance to improve motor torque speed response when *ov* occurs.

Note:
- Ensure that *C4-06 ≥ C4-02 [Trq Comp Delay Time]*.
- Increase the setting value of *n2-03 [AFR Time 2]* proportional to *C4-06*.

■ C4-07 M2 Trq Comp Gain

No. (Hex.)	Name	Description	Default (Range)
C4-07 (0341) RUN	M2 Trq Comp Gain	**V/f** **CL-V/f** **OLV** CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the gain for motor 2 torque compensation function when using the Motor Switch function.	1.00 (0.00 - 2.50)

In V/f Control or CL-V/f Control, adjust the value in 0.05 unit increments for these conditions:

- When torque is not sufficient during low-speed operation of 10 Hz or less, increase the setting value
- When there is vibration in the motor or when the motor hunts when operating the drive with a light load, decrease the setting value
- When you use a long motor cable, increase the setting value.

Note:
- Adjust *C4-07* to make sure that the output current is not more than the drive rated current when operating the drive with a light load.
- In usual conditions, do not change this parameter in OLV Control. It can have a negative effect on torque precision. Setting this value too high can cause overcompensation and motor oscillation.

■ C4-19 Torque Ripple Suppress Min Freq

No. (Hex.)	Name	Description	Default (Range)
C4-19 (0B8D) Expert	Torque Ripple Suppress Min Freq	**V/f** **CL-V/f** **OLV** **CLV** **AOLV** **OLV/PM** **AOLV/PM** CLV/PM **EZOLV** Sets a frequency to limit current and torque ripple. Increase this parameter in 1.0 Hz increments when current ripples and torque ripples occur during low-speed operation. Set this parameter to 0.0 to disable the function if increasing the value does not fix the problem. Usually it is not necessary to change this setting.	0.1 Hz (0.0 - 10.0 Hz)

Note:

Set *C4-20 [Vcomp Adjust 1] ≠ 0* to enable this parameter.

■ C4-20 Vcomp Adjust 1

No. (Hex.)	Name	Description	Default (Range)
C4-20 (0BCB) Expert	Vcomp Adjust 1	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets voltage precision compensation. Usually it is not necessary to change this setting.	120 (0 - 200)

Note:

When there is audible noise during low-speed operation, set this parameter to *0*.

■ C4-21 Vcomp Adjust 2

No. (Hex.)	Name	Description	Default (Range)
C4-21 (0BCC) Expert	Vcomp Adjust 2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets voltage precision compensation. Usually it is not necessary to change this setting.	5 (0 - 10)

Note:

When there is audible noise during high-speed operation, set this parameter to *0*.

◆ C5: ASR - SPEED REGULATION

The ASR adjusts the output frequency or torque reference to decrease the difference between frequency reference and motor speed. The control method sets the parameter that you must adjust.

Control Method	Targets of Adjustment
Closed Loop V/f Control (CL-V/f)	Output frequency
• Closed Loop Vector Control (CLV) • Advanced Open Loop Vector Control (AOLV) • Closed Loop Vector Control for PM (CLV/PM) • PM Advanced Open Loop Vector (AOLV/PM) • EZ Vector Control (EZOLV)	Torque Reference

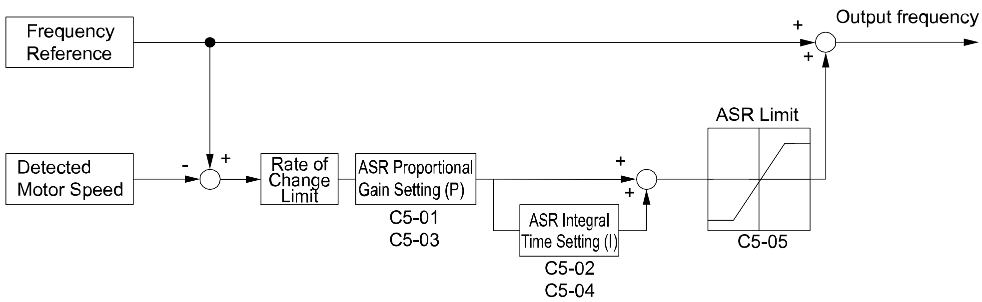

Figure 12.47 Speed Control Block Diagram for Closed Loop V/f Control (CL-V/f)

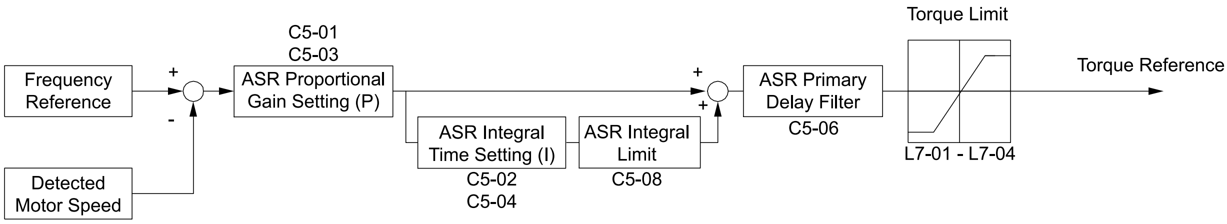

Figure 12.48 Speed Control Block Diagram for CLV, AOLV, CLV/PM, AOLV/PM, and EZOLV

Note:

The detected speed is the speed estimation value when configured such that *A1-02 = 4, 6, or 8 [Control Method = Adv OLVector, PM AOLVector, or EZ Vector]*.

■ Before You Adjust ASR Parameters

• Do Auto-Tuning and set up all motor data correctly.

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- Always make adjustments with the load connected to the motor.
- Use analog output signals to monitor *U1-16 [SFS Output Frequency]* and *U1-05 [Motor Speed]* when you adjust the ASR.

■ ASR Adjustment Procedure for Closed Loop V/f Control (CL-V/f)

Do this procedure to adjust ASR parameters:

1. Run the motor at minimum speed and increase *C5-03 [ASR PGain 2]* as much as possible without oscillation.

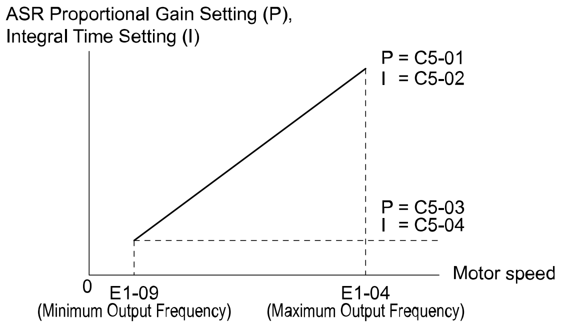

Figure 12.49 ASR Gain and Integral Time Adjustment

2. Run the motor at minimum speed and decrease *C5-04 [ASR ITime 2]* as much as possible without oscillation.
3. Check the output current monitor to make sure that the output current is less than 50% of the drive rated current. If the setting value is higher than 50%, decrease *C5-03* and increase *C5-04*.
4. Run the motor at maximum speed and increase *C5-01 [ASR PGain 1]* as much as possible without oscillations.
5. Run the motor at maximum speed and decrease *C5-02 [ASR ITime 1]* as much as possible without oscillations.
6. If higher speed precision and faster response during acceleration or deceleration are necessary, set *C5-12 = 1 [Integral@Ac/Dec Operation = Enabled]* to enable integral control during acceleration/decel.

Note:
- If overshooting occurs when acceleration ends, decrease the value set in *C5-01* and increase the value set in *C5-02*.
- If undershoot occurs at stop, decrease *C5-03* and increase *C5-04*.
- If you adjust the gain and it does not correct overshooting and undershooting, decrease the value set in *C5-05 [ASR Limit]* to decrease the upper limit of the frequency reference compensation.

■ ASR Adjustment Procedure for CLV, AOLV, AOLV/PM, CLV/PM, and EZOLV

Do this procedure to adjust ASR parameters:

1. Run the motor at zero speed or low speed and increase *C5-01 [ASR PGain 1]* until immediately before vibration starts to occur.
2. Run the motor at zero speed or low speed and decrease *C5-02 [ASR ITime 1]* until immediately before vibration starts to occur.
3. Check for oscillation when you run the motor at maximum speed.
4. If oscillation occurs, increase *C5-02* and decrease *C5-01*. When there is no oscillation, the adjustment procedure is complete.
5. Set the low-speed gain. Run the motor at zero speed or low speed and increase *C5-03 [ASR PGain 2]* until immediately before vibration starts to occur.

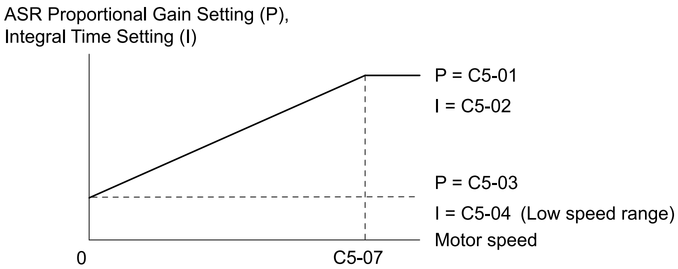

Figure 12.50 Low-speed/High-speed Gain Settings

6. Set the low-speed integral time. Run the motor at zero speed or low speed and decrease *C5-04 [ASR ITime 2]* until immediately before vibration starts to occur.
7. Set *C5-07 [ASR Gain Switch Frequency]*.

8. Check for oscillation when you run the motor at speeds more than the setting in *C5-07*.

Note:
- If overshooting occurs when acceleration ends, decrease the value set in *C5-01* and increase the value set in *C5-02*.
- If undershoot occurs at stop, decrease *C5-03* and increase *C5-04*.

■ Use MFDI Switch for Proportional Gain

Note:
If *A1-02 = 1 [Control Method = PG V/f Control]*, you cannot use this function.

You can use the input terminals set for ASR Gain (C5-03) Select *[H1-xx = 45]* to switch the proportional gains set with *C5-01* and *C5-03*. When the configured input terminal is deactivated, the proportional gain set for *C5-01* is selected. When the terminal is activated, the proportional gain set for *C5-03* is selected. The proportional gain changes linearly over the time set in *C5-02 [ASR ITime 1]*. The signals from this MFDI are more important than *C5-07 [ASR Gain Switch Frequency]*.

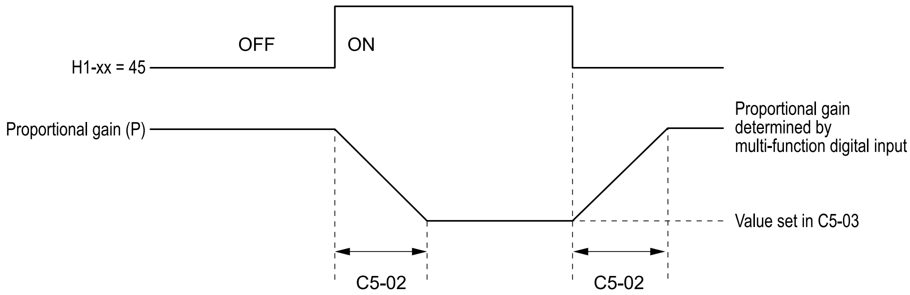

Figure 12.51 Proportional Gain through Multi-function Digital Input Switch

■ Speed Waveform Monitoring Method

To make small adjustments of ASR parameters, monitor the speed waveforms when you make the adjustments. Table 12.17 shows example settings of parameters to monitor speed waveforms.

Table 12.17 Example Settings of MFAO Terminals to Monitor Speed Waveforms

No.	Name	Setting Value	Description
H4-01	AO1 An.Out Select	116	Lets you use terminal FM to monitor *U1-16 [SFS Output Frequency]*.
H4-02	AO1 An.Out Gain	100.0%	
H4-03	AO1 An.Out Bias	0.0%	
H4-04	AO2 An.Out Select	105	Lets you use the terminal AM to monitor *U1-05 [Motor Speed]*.
H4-05	AO2 An.Out Gain	50.0%	
H4-06	AO2 An.Out Bias	0.0%	
H4-07	AO1 Signal Level Select	1	Lets you monitor in a -10 to +10 V range.
H4-08	AO2 Signal Level Select	1	

These settings cause this MFAO configuration. The MFAO common is terminal A0V:
- Terminal AO1: Outputs the output frequency after SFS in a -10 to +10 V (-100 to +10) range.
- Terminal AO2: Outputs the motor speed in a -10 to +10 V (-200 to +20) range.

The manufacturer recommends that you monitor the output frequency after SFS and the motor speed for delays in response and differences in reference values.

■ Adjust ASR Parameters

Use Table 12.18 to adjust ASR. The table lists parameters for motor 1, but you can make the same changes to motor 2 parameters when you run a second motor.

Note:
When adjusting the proportional gain and integral time, adjust the proportional gain first.

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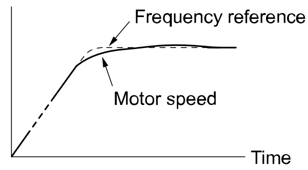
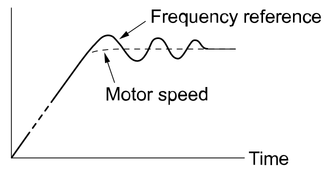
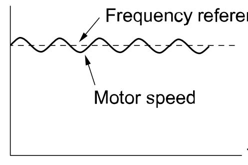
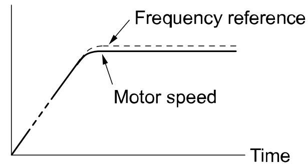
Table 12.18 ASR Response and Possible Solutions

Problem		Possible Solutions
Speed response is slow.		• Increase *C5-01/C5-03 [ASR PGain 1/ASR PGain 2]*. • Decrease *C5-02/C5-04 [ASR ITime 1/ASR ITime 2]*.
Overshoot or undershoot occurs at the end of acceleration or deceleration.		• Decrease *C5-01/C5-03*. • Increase *C5-02/C5-04*.
Vibration and oscillation occur at constant speed.		• Decrease *C5-01/C5-03*. • Increase *C5-02/C5-04*. • Increase *C5-06 [ASR Delay Time]*.
Speed accuracy is unsatisfactory when you operate a motor that has a large quantity of rated slip in Closed Loop V/f Control.		• Check the pulse number set to *F1-01 [Enc1 Pulse Count (PPR)]* and the gear ratio to *F1-12 [Enc1 Gear Teeth1]* and *F1-13 [Enc1 Gear Teeth2]*. • Make sure that you correctly set the pulse signal from the encoder. • Check *U6-04 [ASR Output]* to make sure that the ASR operates at its output limit set to *C5-05 [ASR Limit]*. If the ASR is at the output limit, increase *C5-05*.
If *C5-12 = 1* or *C5-32 = 1 [Enabled]* in Closed Loop V/f Control and over/undershoot occurs when you change speeds.	-	• Decrease *C5-01/C5-03*. • Increase *C5-02/C5-04*. • Decrease the value set to *C5-05*.
Oscillation at low speed and response is too slow at high speed. Oscillation at high speed and response is too slow at low speed.	-	• Closed Loop V/f Control Mode: Use *C5-03* and *C5-04* at maximum speed and *C5-01* and *C5-02* at minimum speed to set different ASR settings. • Closed Loop Vector Control, PM Advanced Open Loop Vector Control, and PM Closed Loop Vector Control: Use *C5-01* to *C5-04* to set the best ASR settings for high and low speed. Use *C5-07 [ASR Gain Switch Frequency]* to switch the ASR proportional gain and ASR integral time as specified by the output frequency.

■ C5-01 ASR PGain 1

No. (Hex.)	Name	Description	Default (Range)
C5-01 (021B) RUN	ASR PGain 1	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the gain to adjust ASR response.	Determined by A1-02 (0.00 - 300.00)

The speed response increases as the gain increases. Usually, the gain increases with larger loads. Too much gain causes vibration.

Note:

- The drive usually sets Motor 1 ASR with *C5-01* and *C5-02 [ASR ITime 1]*. To use *C5-03 [ASR PGain 2]* as an alternative to *C5-01* set *H1-xx = 45 [MFDI Function Select = ASR Gain Switch]*. You can also use *C5-01* as an alternative to *C5-04 [ASR ITime 2]* when the speed is less than or equal to the frequency set in *C5-07 [ASR Gain Switch Frequency]*.
- The drive automatically adjusts *C5-01* in ASR Tuning.

■ C5-02 ASR ITime 1

No. (Hex.)	Name	Description	Default (Range)
C5-02 (021C) RUN	ASR ITime 1	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the ASR integral time.	Determined by A1-02 (0.000 - 60.000 s)

An integral time that is too long will decrease the responsiveness of the speed control and decrease drive response to dynamic changes in motor load. An integral time that is too short can cause oscillation.

■ C5-03 ASR PGain 2

No. (Hex.)	Name	Description	Default (Range)
C5-03 (021D) RUN	ASR PGain 2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the gain to adjust ASR response.	Determined by A1-02 (0.00 - 300.00)

The speed response increases as the weight of the load increases. Usually, the gain increases with larger loads. Too much gain will cause vibration.

■ C5-04 ASR ITime 2

No. (Hex.)	Name	Description	Default (Range)
C5-04 (021E) RUN	ASR ITime 2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the ASR integral time.	Determined by A1-02 (0.000 - 60.000 s)

An integral time that is too long will decrease the responsiveness of the speed control and decrease drive response to dynamic changes in motor load. An integral time that is too short can cause oscillation.

■ C5-05 ASR Limit

No. (Hex.)	Name	Description	Default (Range)
C5-05 (021F)	ASR Limit	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the ASR output limit as a percentage of *E1-04 [Max Output Frequency]*.	5.0% (0.0 - 20.0%)

If the motor rated slip is high, it could be necessary to increase the setting to provide correct motor speed control. Use *U6-04 [ASR Output]* to make sure that ASR is operating at the limit set in this parameter. When ASR is operating at the limit, correctly set the PG signal and these parameters before you make changes to *C5-05*:

- *F1-01 [Enc1 Pulse Count (PPR)]*
- *F1-12 [Enc1 Gear Teeth1]*
- *F1-13 [Enc1 Gear Teeth2]*

■ C5-06 ASR Delay Time

No. (Hex.)	Name	Description	Default (Range)
C5-06 (0220)	ASR Delay Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the filter time constant for the time from the speed loop to the torque command output. Usually it is not necessary to change this setting.	Determined by A1-02 (0.000 - 0.500 s)

If you have a load with low rigidity or if oscillation is a problem, increase this setting in 0.01 unit increments.

■ C5-07 ASR Gain Switch Frequency

No. (Hex.)	Name	Description	Default (Range)
C5-07 (0221)	ASR Gain Switch Frequency	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the frequency where the drive will switch between these parameters: *C5-01 and C5-03 [ASR PGain 1 and ASR PGain 2]* *C5-02 and C5-04 [ASR ITime 1 and ASR ITime 2]*	Determined by A1-02 (Determined by A1-02)

Switching the proportional gain and integral time in the low or high speed range can help operation become stable. A good switching point is 80% of the frequency where oscillation occurs or at 80% of the maximum output frequency.

Note:

An MFDI set for *H1-xx = 45 [MFDI Function Select = ASR Gain Switch]* will have priority over the ASR gain switching frequency.

■ C5-08 ASR Integral Limit

No. (Hex.)	Name	Description	Default (Range)
C5-08 (0222)	ASR Integral Limit	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the upper limit for ASR as a percentage of the rated load.	400% (0 - 400%)

C5-12 Integral@Ac/Dec Operation

No. (Hex.)	Name	Description	Default (Range)
C5-12 (0386)	Integral@Ac/Dec Operation	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets integral operation during acceleration and deceleration.	0 (0, 1)

If you enable integral operation when you are driving a heavy load or a high inertia load, it could cause problems with overshoot or undershoot at the end of acceleration and deceleration. If there are problems with overshooting and undershooting, set this parameter to

0 : Disabled

Integral operation is not enabled during acceleration or deceleration. Integral operation is always enabled during constant speed.

1 : Enabled

Integral operation is always enabled.

C5-17 Motor Inertia

No. (Hex.)	Name	Description	Default (Range)
C5-17 (0276) Expert	Motor Inertia	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the motor inertia.	Determined by o2-04, C6-01, and E5-01 (0.0001 - 6.0000 kgm²)

When *A1-02 = 3 or 7 [Control Method = CLVector or PM CLVector]*, the drive automatically sets *C5-17* to the value of [Control Method] when you do Inertia Tuning or ASR Tuning.

C5-18 Inertia Ratio of Load

No. (Hex.)	Name	Description	Default (Range)
C5-18 (0277) Expert	Inertia Ratio of Load	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the load inertia ratio for the motor inertia.	1.0 (0.0 - 6000.0)

When *A1-02 = 3 or 7 [Control Method = CLVector or PM CLVector]*, the drive automatically sets *C5-18* to the load inertia ratio when you do Inertia Tuning or ASR Tuning.

C5-21 M2 ASR PGain 1

No. (Hex.)	Name	Description	Default (Range)
C5-21 (0356) RUN	M2 ASR PGain 1	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the gain to adjust ASR response for motor 2.	Determined by E3-01 (0.00 - 300.00)

The speed response increases as the weight of the load increases. Usually, the gain increases with larger loads. Too much gain causes vibration.

Note:
- The drive usually sets Motor 2 ASR with *C5-21 and C5-22 [M2 ASR PGain 1 and M2 ASR ITime 1]*. You can also use *C5-23 [M2 ASR PGain 2]* as an alternative to *C5-21* when the speed is less than or equal to the frequency set in *C5-27 [M2 ASR Gain Switchover Freq]*. To use *C5-23* as an alternative to *C5-21*, set *H1-xx = 45 [MFDI Function Select = ASR Gain Switch]*.
- The drive automatically adjusts *C5-21* in ASR Tuning.

C5-22 M2 ASR ITime 1

No. (Hex.)	Name	Description	Default (Range)
C5-22 (0357) RUN	M2 ASR ITime 1	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the ASR integral time for motor 2.	Determined by E3-01 (0.000 - 60.000 s)

An integral time that is too long will decrease the responsiveness of the speed control and decrease drive response to dynamic changes in motor load. An integral time that is too short can cause oscillation.

Note:

The drive usually sets Motor 2 ASR with *C5-21 [M2 ASR PGain 1]* and *C5-22*. You can also use *C5-24 [M2 ASR ITime 2]* as an alternative to *C5-22* when the speed is less than or equal to the frequency set in *C5-27 [M2 ASR Gain Switchover Freq]*.

■ C5-23 M2 ASR PGain 2

No. (Hex.)	Name	Description	Default (Range)
C5-23 (0358) RUN	M2 ASR PGain 2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the gain to adjust ASR response for motor 2.	Determined by E3-01 (0.00 - 300.00)

The speed response increases as the weight of the load increases. Usually, the gain increases with larger loads. Too much gain causes vibration.

■ C5-24 M2 ASR ITime 2

No. (Hex.)	Name	Description	Default (Range)
C5-24 (0359) RUN	M2 ASR ITime 2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the ASR integral time for motor 2.	Determined by E3-01 (0.000 - 60.000 s)

An integral time that is too long will decrease the responsiveness of the speed control and decrease drive response to dynamic changes in motor load. An integral time that is too short can cause oscillation.

Note:

The drive usually sets Motor 2 ASR with *C5-21 [M2 ASR PGain 1]* and *C5-22 [M2 ASR ITime 1]*. You can also use *C5-24* can also be used instead of *C5-22* when the speed is less than or equal to the frequency set in *C5-27 [M2 ASR Gain Switchover Freq]*.

■ C5-25 M2 ASR Limit

No. (Hex.)	Name	Description	Default (Range)
C5-25 (035A)	M2 ASR Limit	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the ASR output limit for motor 2 as a percentage of *E1-04 [Max Output Frequency]*.	5.0% (0.0 - 20.0%)

If the motor rated slip is high, it could be necessary to increase the setting to provide correct motor speed control. Use *U6-04 [ASR Output]* to make sure that ASR is operating at the limit set in this parameter. When ASR is operating at the limit, correctly set the PG signal and these parameters before you make changes to *C5-25*:

- *F1-31 [Enc2 Pulse Count (PPR)]*
- *F1-33 [Enc2 Gear Teeth1]*
- *F1-34 [Enc2 Gear Teeth2]*

■ C5-26 M2 ASR Delay Time

No. (Hex.)	Name	Description	Default (Range)
C5-26 (035B)	M2 ASR Delay Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the filter time constant for the time from the speed loop to the torque command output for motor 2. Usually it is not necessary to change this setting.	Determined by E3-01 (0.000 - 0.500 s)

If you have a load with low rigidity or if oscillation is a problem, increase this setting in 0.01 unit increments.

■ C5-27 M2 ASR Gain Switchover Freq

No. (Hex.)	Name	Description	Default (Range)
C5-27 (035C)	M2 ASR Gain Switchover Freq	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the frequency where the drive will switch between these parameters: *C5-21 and C5-23 [M2 ASR PGain 1 and M2 ASR PGain 2]* *C5-22 and C5-24 [M2 ASR ITime 1 and M2 ASR ITime 2]*	0.0 (0.0 - 400.0)

Switching the proportional gain and integral time in the low or high speed range can help operation become stable. A good switching point is 80% of the frequency where oscillation occurs or at 80% of the maximum output frequency.

Note:

An MFDI set for *H1-xx = 45 [MFDI Function Select = ASR Gain Switch]* will have priority over the ASR gain switching frequency.

■ C5-28 M2 ASR Intgl Limit

No. (Hex.)	Name	Description	Default (Range)
C5-28 (035D)	M2 ASR Intgl Limit	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the upper limit for ASR for motor 2 as a percentage of the rated load.	400% (0 - 400%)

■ C5-29 Speed Ctrl Response Mode

No. (Hex.)	Name	Description	Default (Range)
C5-29 (0B18) Expert	Speed Ctrl Response Mode	**V/f** **CL-V/f** **OLV** **CLV** **AOLV** **OLV/PM** **AOLV/PM** **CLV/PM** **EZOLV** Sets the level of speed control responsiveness. Usually it is not necessary to change this setting.	0 (0, 1)

If a high level of speed control responsiveness is necessary, set *C5-29 = 1*,then adjust the speed control (ASR) parameter.

0 : Standard

1 : High Perf 1

■ C5-32 M2 I Oper@Ac/Dec

No. (Hex.)	Name	Description	Default (Range)
C5-32 (0361)	M2 I Oper@Ac/Dec	V/f **CL-V/f** OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets integral operation during acceleration and deceleration for motor 2.	0 (0, 1)

If you enable integral operation when you are driving a heavy load or a high inertia load, it could cause problems with overshoot or undershoot at the end of acceleration and deceleration. If there are problems with overshooting and undershooting, set this parameter to 0.

0 : Disabled

Integral operation is not enabled during acceleration or deceleration. Integral operation is always enabled during constant speed.

1 : Enabled

Integral operation is always enabled.

■ C5-37 M2 Inertia

No. (Hex.)	Name	Description	Default (Range)
C5-37 (0278) Expert	M2 Inertia	V/f CL-V/f OLV **CLV** **AOLV** OLV/PM AOLV/PM CLV/PM EZOLV Sets the motor inertia for motor 2.	Determined by o2-04 and C6-01 (0.0001 - 6.0000 kgm^2)

The drive automatically sets *C5-37* to the value of [Motor Inertia] when you do Inertia Tuning or ASR Tuning.

■ C5-38 M2 Inertia Ratio of load

No. (Hex.)	Name	Description	Default (Range)
C5-38 (0279) Expert	M2 Inertia Ratio of load	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the load inertia ratio for the motor 2 inertia.	1.0 (0.0 - 6000.0)

The drive automatically sets *C5-38* to the value of [Load Inertia Ratio] when you do Inertia Tuning or ASR Tuning.

■ C5-39 ASR Delay Time 2

No. (Hex.)	Name	Description	Default (Range)
C5-39 (030D)	ASR Delay Time 2	V/f CL-V/f OLV CLV AOLV OLV/PM **AOLV/PM** **CLV/PM** EZOLV Sets the filter time constant for the time from the speed loop to the torque command output for motor 2. Usually it is not necessary to change this setting.	0 ms (0 - 500 ms)

If you have a load with low rigidity or if oscillation is a problem, increase this setting in 0.01 unit increments.

■ C5-50 Notch Filter Frequency

No. (Hex.)	Name	Description	Default (Range)
C5-50 (0B14) Expert	Notch Filter Frequency	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the machine resonance frequency.	0 Hz (0, or 2 to 100 Hz)

Machine resonance can cause high-frequency noise and vibration during operation. A notch filter can help prevent the noise and vibration. Notch filters set the resonant frequency of the machine to remove specific vibrational frequency components caused by machine resonance.

Note:
- Correctly set the value for the notch filter frequency. If the frequency value is too low in regards to the speed loop response frequency, it could have an effect on the speed control functionality. Set the frequency to be a minimum of 4 times the speed loop response frequency.
- Set this parameter to 0 Hz to disable the notch filter.

■ C5-51 Notch Filter Bandwidth

No. (Hex.)	Name	Description	Default (Range)
C5-51 (0B15) Expert	Notch Filter Bandwidth	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the notch width of the notch filter.	1.0 (0.5 - 5.0)

◆ C6: DUTY AND CARRIER

C6 parameters are used to set the selection of drive duty rating, selection of carrier frequency, and upper and lower limits of carrier frequencies.

■ C6-01 ND/HD Duty Selection

No. (Hex.)	Name	Description	Default (Range)
C6-01 (0223)	ND/HD Duty Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the drive duty rating.	0 (0, 1)

0 : HD Rating

The overload tolerance is 150% of the rated output current for 60 seconds.

1 : ND Rating

The overload tolerance is 110% of the rated output current for 60 seconds.

There are two types of load ratings for this product depending on the load characteristics of the application: Heavy Duty Rating (HD) and Normal Duty Rating (ND).

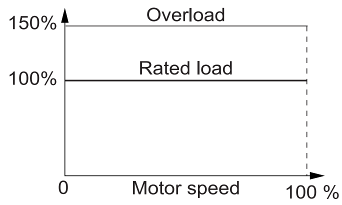
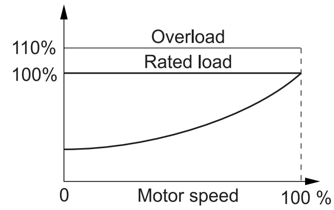
The drive rated output current, overload tolerance, and acceleration stall prevention level change when the duty rating changes. Set the drive to agree with the duty rating of the selected drive capacity. In HD, the tolerance is 150% overload for 60 seconds. In ND, the tolerance is 110% overload for 60 seconds. The rated output current for ND drives is higher than the rated output current for HD drives. Refer to“Model Specifications (400 V Class)” for more information about rated output current.

Note:

This product has two more load characteristic types: HD2 and ND2. When the value of *E1-01 [Input AC Supply Voltage]* is 460 V or more, the load characteristic level automatically changes from HD1 to HD2 or from ND1 to ND2.

Table 12.19 Differences between Heavy Duty Rating and Normal Duty Rating

Item	Heavy Duty Rating 1 (HD1)	Heavy Duty Rating 2 (HD2)	Normal Duty Rating 1 (ND1)	Normal Duty Rating 2 (ND2)
E1-01 Setting	380 V ≤ E1-01 < 460 V	460 V ≤ E1-01 < 480 V	380 V ≤ E1-01 < 460 V	460 V ≤ E1-01 < 480 V
C6-01 Setting	0		1	

Item	Heavy Duty Rating 1 (HD1)	Heavy Duty Rating 2 (HD2)	Normal Duty Rating 1 (ND1)	Normal Duty Rating 2 (ND2)
Load Characteristics				
Application	A high overload tolerance is necessary during start up, acceleration, deceleration, and equivalent conditions. • Extruder • Conveyor • Cranes and hoists • Constant torque or high overload capacity are necessary.		Overload tolerance is not necessary. • Fan • Pump • Blower	
Overload Tolerance	150% - 60 seconds		110% - 60 seconds	
Stall Prevent Level during Accel	150%		110%	
Stall Prevent Level during Run	150%		110%	
Carrier Frequency	2 kHz		2 kHz Swing-PWM	

Note:
- Set the stall prevention level during acceleration with *L3-02* and the stall prevention level during run with *L3-06*.
- Changing *C6-01* also changes the maximum capacity of applicable drive motors. The drive automatically changes the setting values *E2-xx* and *E4-xx* to applicable values. The drive also automatically changes these parameters that depend on motor output:
  – b8-04 [eSave Coef. Value]
  – C5-17 [Motor Inertia]
  – C5-37 [M2 Inertia]
  – L2-03 [Min Baseblck Time]
  – L3-24 [Acc@Rated Torque]
  – n5-02 [Mot Inertia Acceleration Time]

■ C6-02 Carrier Frequency Selection

No. (Hex.)	Name	Description	Default (Range)
C6-02 (0224)	Carrier Frequency Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the carrier frequency for the transistors in the drive.	Determined by A1-02, C6-01, and o2-04 (Determined by A1-02)

Changes to the switching frequency will decrease audible noise and decrease leakage current.

Note:

Increasing the carrier frequency to more than the default setting will automatically decrease the drive current rating.

1 : 2.0 kHz

2 : 5.0 kHz (4.0 kHz for AOLV/PM)

3 : 8.0 kHz (6.0 kHz for AOLV/PM)

4 : 10.0 kHz (8.0 kHz for AOLV/PM)

5 : 12.5 kHz (10.0 kHz for AOLV/PM)

6 : 15.0 kHz (12.0 kHz AOLV/PM)

7 : Swing PWM 1 (Audible Sound 1)

8 : Swing PWM 2 (Audible Sound 2)

9 : Swing PWM 3 (Audible Sound 3)

A : Swing PWM 4 (Audible Sound 4)

F : User (C6-03 to C6-05)

Use *C6-03 to C6-05* to set detailed setting values.

Note:

The carrier frequency for Swing PWM 1 is equivalent to 2.0 kHz. Swing PWM applies a special PWM pattern to decrease the audible noise.

Table 12.20 Guidelines for Carrier Frequency Parameter Setup

Symptom	Remedy
Speed and torque are not stable at low speed.	Decrease the carrier frequency.
Audible noise from the drive has an effect on peripheral devices.	Decrease the carrier frequency.
Too much leakage current from the drive.	Decrease the carrier frequency.
Wiring between the drive and motor is too long.	Decrease the carrier frequency. **Note:** If the motor cable is too long, it can be necessary to decrease the carrier frequency. Refer to Table 12.21 for the wiring distance and decrease the carrier frequency.
Audible motor noise is too loud.	Increase the carrier frequency. Use Swing PWM. **Note:** The default carrier frequency in ND is Swing PWM 1 (*C6-02 = 7*), with a 2 kHz base. You can increase the carrier frequency in Normal Duty mode, but this will also decrease the drive rated current.

Table 12.21 Wiring Distance

Wiring Distance	Up to 50 m	Up to 100 m	Greater than 100 m
C6-02 [Carrier Frequency Selection]	1 to F (up to 15 kHz)	1 to 2 (up to 5 kHz), 7	1 (up to 2 kHz), 7

Note:

The maximum cable length is 100 m when using *A1-02 = 5 or 6 [Control Method = PM OLVector or PM AOLVector]*.

■ C6-03 Carrier Upper Frequency Limit

No. (Hex.)	Name	Description	Default (Range)
C6-03 (0225)	Carrier Upper Frequency Limit	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the upper limit of the carrier frequency. Set *C6-02 = F [Carrier Frequency Selection = User (C6-03 to C6-05)]* to set this parameter.	Determined by C6-02 (1.0 - 15.0 kHz)

Setting a Fixed User-Defined Carrier Frequency

When you cannot use *C6-02* to set a carrier frequency between set selectable values, you can set the value in *C6-03*. The carrier frequency will be fixed to the value set to *C6-03*.

When *A1-02 = 0, 1 [Control Method = V/f Control, PG V/f Control]*, set *C6-03 = C6-04 [Carrier Lower Frequency Limit]* to fix the carrier frequency.

Setting a Variable Carrier Frequency to Agree with the Output Frequency

When *A1-02 = 0, 1*, set *C6-03*, *C6-04*, and *C6-05 [Carrier Freq Proportional Gain]* as shown in Figure 12.52 to make the carrier frequency change linearly with the output frequency.

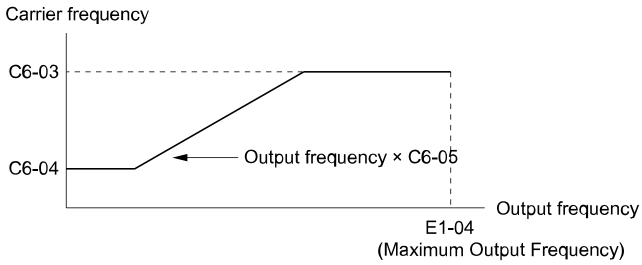


Figure 12.52 Setting a Variable Carrier Frequency to Agree with the Output Frequency

Note:

- When *C6-05 ≤ 7*, the drive disables *C6-04*. The carrier frequency is fixed to the value set to *C6-03*.
- The drive detects *oPE11 [Carrier Frequency Setting Error]* when these conditions are correct at the same time:
  – *C6-05 ≥ 6*
  – *C6-04 ≥ C6-03*

■ C6-04 Carrier Lower Frequency Limit

No. (Hex.)	Name	Description	Default (Range)
C6-04 (0226)	Carrier Lower Frequency Limit	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the lower limit of the carrier frequency. Set *C6-02 = F [Carrier Frequency Selection = User Defined (C6-03 to C6-05)]* to set this parameter.	Determined by C6-02 (1.0 - 15.0 kHz)

Set *C6-03 [Carrier Upper Frequency Limit]*, *C6-04*, and *C6-05 [Carrier Freq Proportional Gain]* to make the carrier frequency change linearly with the output frequency.

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Note:

The drive detects *oPE11 [Carrier Frequency Setting Error]* when these conditions are correct at the same time:

- *C6-04 ≥ C6-03*
- *C6-05 ≥ 6*

■ C6-05 Carrier Freq Proportional Gain

No. (Hex.)	Name	Description	Default (Range)
C6-05 (0227)	Carrier Freq Proportional Gain	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the proportional gain for the carrier frequency. Set *C6-02 = F [Carrier Frequency Selection = User Defined (C6-03 to C6-05)]* to set this parameter.	Determined by C6-02 (0 - 99)

Set *C6-03 [Carrier Upper Frequency Limit]*, *C6-04 [Carrier Lower Frequency Limit]*, and *C6-05* to make the carrier frequency change linearly with the output frequency.

■ C6-09 Carrier@Autotune Rotational

No. (Hex.)	Name	Description	Default (Range)
C6-09 (022B)	Carrier@Autotune Rotational	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Auto-Tuning carrier frequency. Usually it is not necessary to change this setting.	0 (0, 1)

If you do Auto-Tuning to a high-frequency motor or low-impedance motor and set a low carrier frequency, *oC [Overcurrent]* can occur. To prevent *oC* , you can set the carrier frequency to a high value, then set *C6-09 = 1*.

The procedure to set the carrier frequency when the *A1-02 [Control Method]* setting changes.

- When *A1-02 = 2 to 4 [OLVector, CLVector, or Adv OLVector]*, set *C6-02 = F [Carrier Frequency Selection = User (C6-03 to C6-05)]* and then increase the value set to *C6-03 [Carrier Upper Frequency Limit]*.
- When *A1-02 = 5 to 7 [PM OLVector, PM AOLVector, or PM CLVector]*, use *C6-02* to increase the carrier frequency.

0 : 5kHz

Note:

When *A1-02 = 5, 6, or 7*, the carrier frequency is 2 kHz.

1 : use C6-03

Note:

When *A1-02 = 5, 6, or 7*, the carrier frequency is the value set to *C6-02*.

12.4 d: REFERENCE

d parameters set the frequency reference input method and dead band range. They also set torque control, field weakening, and field forcing functions.

WARNING! *Sudden Movement Hazard. Always check the operation of any fast stop circuits after they are wired. Fast stop circuits are required to provide safe and quick shutdown of the drive. Prepare to initiate an emergency stop during the test run. Operating a drive with untested emergency circuits could result in death or serious injury.*

WARNING! *Crush Hazard. Do not use this drive in lifting applications without installing external safety circuitry to prevent accidental dropping of the load. The drive does not possess built-in load drop protection for lifting applications. Install electrical and/or mechanical safety circuit mechanisms independent of drive circuitry. Failure to comply could result in death or serious injury from falling loads.*

◆ d1: FREQUENCY REFERENCE

Figure 12.53 shows the frequency reference input method, command source selection method and priority descriptions.

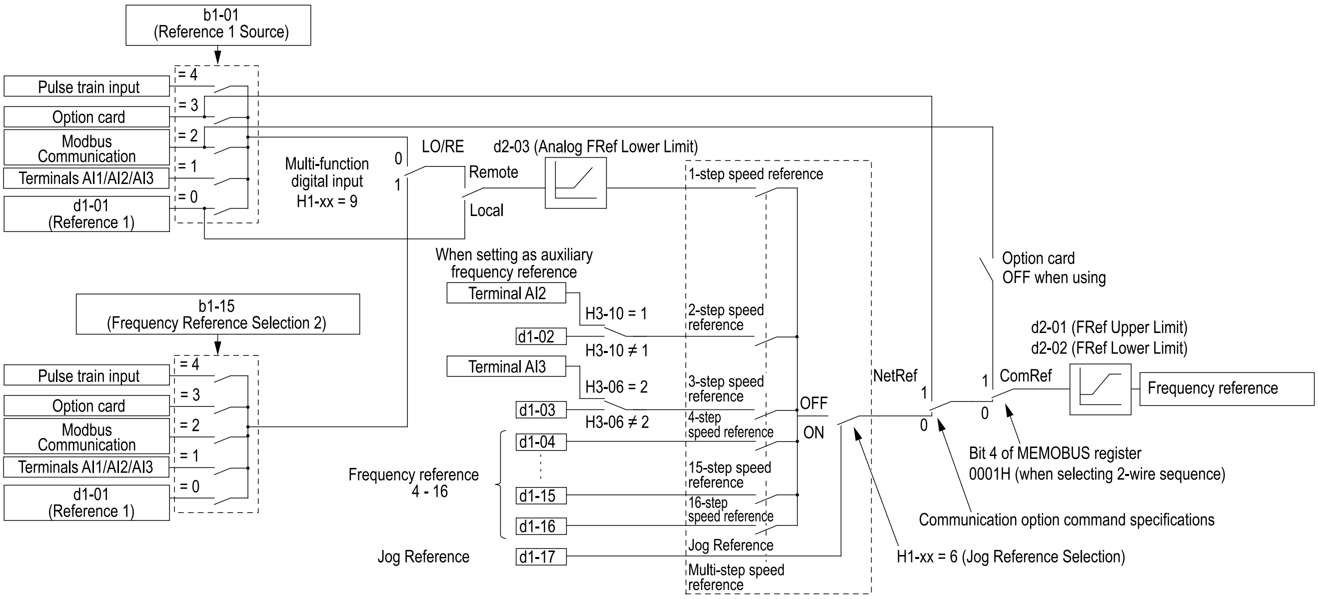

Figure 12.53 Frequency Reference Setting Hierarchy

■ Multi-Step Speed Operation

The drive has a multi-step speed operation function that can set many frequency references in advance. Set frequency references in *d1-xx* parameters. You can select the set frequency references with MFDI signals from an external source. Activate and deactivate the digital input to select the frequency reference to change the motor speed in steps. You can use the 16-step frequency reference and one Jog Frequency Reference (JOG command) to switch the speed to the maximum 17-step speeds.

Note:
- The Jog Frequency Reference (JOG command) overrides all other frequency references.
- You can use the MFDI to switch the frequency reference when the motor is running. The drive will apply the enabled acceleration and deceleration times.
- The default settings for Multi-Step Speed Reference 1 (master frequency reference) and Multi-Step Speed Reference 2 (auxiliary frequency reference) are the analog frequency reference.
  Also, voltage command input terminal A1 and current input terminal A2 for Multi-Step Speed Reference 1 (master frequency reference) are added internally by default. The drive uses Multi-Step Speed Reference 1 when the signal is connected to an analog input terminal.

■ Setting Procedures for Multi-step Speed Operation

Use an Analog Input as Reference 1 and 2

This section gives information about the procedures to set these examples:

- Multi-Step Speed 6 (6 types of frequency references)
- When you set the voltage input of analog inputs from terminals AI1 and AI3 to -10 V to +10 V

Procedure	Configuration Parameter	Task Contents
1	Reference 1	1. Sets *b1-01 = 1 [Freq. Ref. Sel. 1 = Analog Input]*. 2. Sets *H3-02 = 3 [AI1 Function Selection = FrqBIAS Frq]*. 3. Sets *H3-01 = 1 [AI1 Signal Level Select = -10 to +10V (Bipolar Reference) (Q2V: 0 to 10 V without zero limit)]*.
2	Reference 2	1. Sets *H3-06 = 1 [AI3 Function Selection = AuxFreqRef1]*. 2. Sets *H3-05 = 1 [AI3 Signal Level Select = -10 to +10V (Bipolar Reference)]*.
3	Signal type of analog input	Set DIP switches *S1-1* and *S1-3* on the control circuit board to the V-side (voltage). **Note:** Set this before you energize the drive.
4	Reference 3	Sets the value of *d1-03 [Reference 3]*.
5	Reference 4	Sets the value of *d1-04 [Reference 4]*.
6	Reference 5	Sets the value of *d1-05 [Reference 5]*.
7	Jog Reference	Sets *d1-17 [Jog Reference]* to the jog speed.
8	External digital input (3 inputs)	Set *Multi-Step Speed Reference 1 to 3 [H1-xx = A, B, C]* to one of the MFDI terminals DI1 to DI8.
9	JOG command	Set *H1-xx = 6 [Jog Reference]* to one of the MFDI terminals DI1 to DI8.

Use the Maximum 17-Step Speed with All Digital Inputs

This section is the procedure to set the 17-step speeds (17 types of frequency references) without an analog input.

Procedure	Configuration Parameter	Task Contents
1	Reference 1	1. Set *b1-01 = 0 [Freq. Ref. Sel. 1 = Keypad]*. 2. Sets the value of *d1-01 [Reference 1]*.
2	Reference 2	1. Sets *H3-06 = 0 [AI3 Function Selection = Through Mode]*, and disables the analog reference. 2. Set *d1-02 [Reference 2]*.
3	Reference 3	1. Sets *H3-10 = 0 [AI2 Function Selection = Through Mode]*, and disables the analog reference. 2. Set *d1-03 [Reference 3]*.
4	Reference 4	Set *d1-04 [Reference 4]*.
5	Reference 5 to 16	Sets the values of *d1-05 to d1-16 [Reference 5 to Reference 16]*.
6	Jog Reference	Sets *d1-17 [Jog Reference]* to the jog speed.
7	External digital input (4 inputs)	Set *Multi-Step Speed Reference 1 to 4 [H1-xx = A, B, C, D]* to one of the multi-function digital input terminals DI1 to DI8.
8	JOG command	Set *H1-xx = 6 [Jog Reference]* to one of the multi-function digital input terminals DI1 to DI8.

Multi-step Speed Operation Combinations

Refer to Table 12.22 and Figure 12.54 for information about multi-step speed reference combinations. The selected frequency reference changes when the combination of digital input signals from an external source changes.

Table 12.22 Multi-step Speed Reference and MFDI Terminal Combinations

Related Parameters	MultSpd Ref1 *H1-xx = A*	MultSpd Ref2 *H1-xx = B*	MultSpd Ref3 *H1-xx = C*	MultSpd Ref4 *H1-xx = D*	Jog Reference *H1-xx = 6*
Reference 1 (set in *b1-01*)	OFF	OFF	OFF	OFF	OFF
Reference 2 (*d1-02* or terminals AI1, AI2, AI3)	ON	OFF	OFF	OFF	OFF
Reference 3 (*d1-03* or terminals AI1, AI2, AI3)	OFF	ON	OFF	OFF	OFF
Reference 4 (*d1-04*)	ON	ON	OFF	OFF	OFF
Reference 5 (*d1-05*)	OFF	OFF	ON	OFF	OFF
Reference 6 (*d1-06*)	ON	OFF	ON	OFF	OFF
Reference 7 (*d1-07*)	OFF	ON	ON	OFF	OFF
Reference 8 (*d1-08*)	ON	ON	ON	OFF	OFF
Reference 9 (*d1-09*)	OFF	OFF	OFF	ON	OFF
Reference 10 (*d1-10*)	ON	OFF	OFF	ON	OFF
Reference 11 (*d1-11*)	OFF	ON	OFF	ON	OFF
Reference 12 (*d1-12*)	ON	ON	OFF	ON	OFF

Related Parameters	MultSpd Ref1 *H1-xx = A*	MultSpd Ref2 *H1-xx = B*	MultSpd Ref3 *H1-xx = C*	MultSpd Ref4 *H1-xx = D*	Jog Reference *H1-xx = 6*
Reference 13 (*d1-13*)	OFF	OFF	ON	ON	OFF
Reference 14 (*d1-14*)	ON	OFF	ON	ON	OFF
Reference 15 (*d1-15*)	OFF	ON	ON	ON	OFF
Reference 16 (*d1-16*)	ON	ON	ON	ON	OFF
Jog Reference (*d1-17*) *1	-	-	-	-	ON

*1 Jog Reference (JOG command) is more important than all other frequency references.

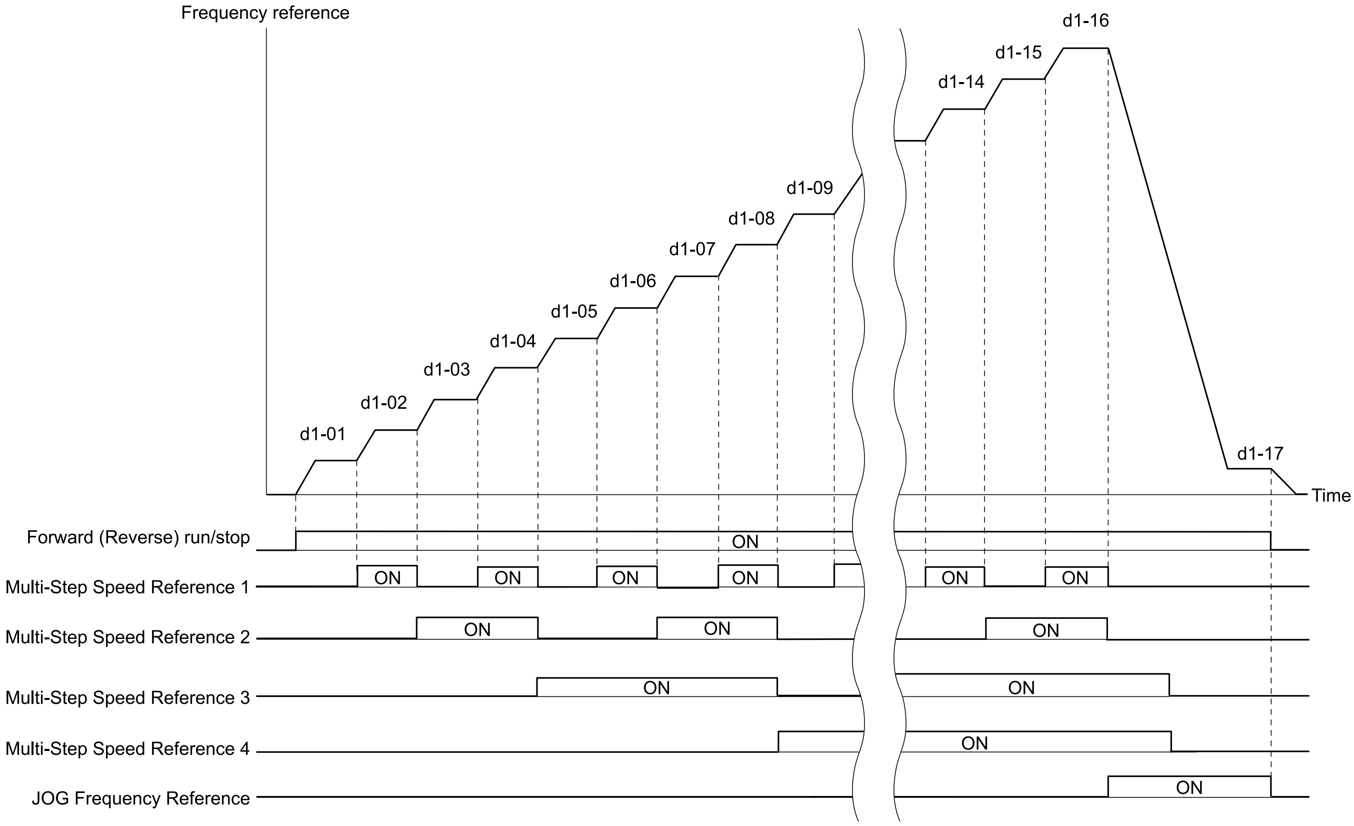

Figure 12.54 Time Chart for Multi-step Speed Reference/JOG Reference

■ d1-01 Reference 1

No. (Hex.)	Name	Description	Default (Range)
d1-01 (0280) RUN	Reference 1	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the frequency reference in the units from *o1-03 [FrqDisplay Unit Selection]*.	0.00 Hz (0.00 - 590.00 Hz)

Note:
- The upper limit value changes when the *E1-04 [Max Output Frequency]* and *d2-01 [FRef Upper Limit]* values change. Calculate the upper limit value with this formula:
  Upper limit value = (*E1-04*) × (*d2-01*) / 100
- When *A1-02 = 6, 7 [Control Method = PM AOLVector, PM CLVector]*, the drive changes *o1-03 = 1 [0.01% (100%=E1-04)]*.
- To set *d1-01* to 1-step speed parameter in a multi-step speed operation, set *b1-01 = 0 [Freq. Ref. Sel. 1 = Keypad]*.

■ d1-02 Reference 2

No. (Hex.)	Name	Description	Default (Range)
d1-02 (0281) RUN	Reference 2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the frequency reference in the units from *o1-03 [FrqDisplay Unit Selection]*.	0.00 Hz (0.00 - 590.00 Hz)

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Note:
- The upper limit value changes when the *E1-04 [Max Output Frequency]* and *d2-01 [FRef Upper Limit]* values change.
- When *A1-02 = 6, 7 [Control Method = PM AOLVector, PM CLVector]*, the drive changes *o1-03 = 1 [0.01% (100%=E1-04)]*.
- To set *d1-02* to Multi-Step Speed 2, set *H3-02, H3-06, and H3-10 ≠ 1 [MFAI Function Select ≠ AuxFreqRef1]*. When the status is the default setting, set *H3-06 = 0 [AI3 Function Selection = Through Mode]*.

■ d1-03 Reference 3

No. (Hex.)	Name	Description	Default (Range)
d1-03 (0282) RUN	Reference 3	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the frequency reference in the units from *o1-03 [FrqDisplay Unit Selection]*.	0.00 Hz (0.00 - 590.00 Hz)

Note:
- The upper limit value changes when the *E1-04 [Max Output Frequency]* and *d2-01 [FRef Upper Limit]* values change.
- When *A1-02 = 6, 7 [Control Method = PM AOLVector, PM CLVector]*, the drive changes *o1-03 = 1 [0.01% (100%=E1-04)]*.
- To set *d1-03* to Multi-Step Speed 3, set *H3-02, H3-06, and H3-10 ≠ 2 [AuxFreqRef2]*.

■ d1-04 Reference 4

No. (Hex.)	Name	Description	Default (Range)
d1-04 (0283) RUN	Reference 3	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the frequency reference in the units from *o1-03 [FrqDisplay Unit Selection]*.	0.00 Hz (0.00 - 590.00 Hz)

Note:
- The upper limit value changes when the *E1-04 [Max Output Frequency]* and *d2-01 [FRef Upper Limit]* values change.
- When *A1-02 = 6, 7 [Control Method = PM AOLVector, PM CLVector]*, the drive changes *o1-03 = 1 [0.01% (100%=E1-04)]*.
- This parameter sets the frequency reference of Multi-Step Speed 4.

■ d1-05 Reference 5

No. (Hex.)	Name	Description	Default (Range)
d1-05 (0284) RUN	Reference 5	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the frequency reference in the units from *o1-03 [FrqDisplay Unit Selection]*.	0.00 Hz (0.00 - 590.00 Hz)

Note:
- The upper limit value changes when the *E1-04 [Max Output Frequency]* and *d2-01 [FRef Upper Limit]* values change.
- When *A1-02 = 6, 7 [Control Method = PM AOLVector, PM CLVector]*, the drive changes *o1-03 = 1 [0.01% (100%=E1-04)]*.
- This parameter sets the frequency reference of Multi-Step Speed 5.

■ d1-06 Reference 6

No. (Hex.)	Name	Description	Default (Range)
d1-06 (0285) RUN	Reference 6	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the frequency reference in the units from *o1-03 [FrqDisplay Unit Selection]*.	0.00 Hz (0.00 - 590.00 Hz)

Note:
- The upper limit value changes when the *E1-04 [Max Output Frequency]* and *d2-01 [FRef Upper Limit]* values change.
- When *A1-02 = 6, 7 [Control Method = PM AOLVector, PM CLVector]*, the drive changes *o1-03 = 1 [0.01% (100%=E1-04)]*.
- This parameter sets the frequency reference of Multi-Step Speed 6.

■ d1-07 Reference 7

No. (Hex.)	Name	Description	Default (Range)
d1-07 (0286) RUN	Reference 7	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the frequency reference in the units from *o1-03 [FrqDisplay Unit Selection]*.	0.00 Hz (0.00 - 590.00 Hz)

Note:
- The upper limit value changes when the *E1-04 [Max Output Frequency]* and *d2-01 [FRef Upper Limit]* values change.
- When *A1-02 = 6, 7 [Control Method = PM AOLVector, PM CLVector]*, the drive changes *o1-03 = 1 [0.01% (100%=E1-04)]*.
- This parameter sets the frequency reference of Multi-Step Speed 7.

■ d1-08 Reference 8

No. (Hex.)	Name	Description	Default (Range)
d1-08 (0287) RUN	Reference 8	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the frequency reference in the units from *o1-03 [FrqDisplay Unit Selection]*.	0.00 Hz (0.00 - 590.00 Hz)

Note:
- The upper limit value changes when the *E1-04 [Max Output Frequency]* and *d2-01 [FRef Upper Limit]* values change.
- When *A1-02 = 6, 7 [Control Method = PM AOLVector, PM CLVector]*, the drive changes *o1-03 = 1 [0.01% (100%=E1-04)]*.
- This parameter sets the frequency reference of Multi-Step Speed 8.

■ d1-09 Reference 9

No. (Hex.)	Name	Description	Default (Range)
d1-09 (0288) RUN	Reference 9	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the frequency reference in the units from *o1-03 [FrqDisplay Unit Selection]*.	0.00 Hz (0.00 - 590.00 Hz)

Note:
- The upper limit value changes when the *E1-04 [Max Output Frequency]* and *d2-01 [FRef Upper Limit]* values change.
- When *A1-02 = 6, 7 [Control Method = PM AOLVector, PM CLVector]*, the drive changes *o1-03 = 1 [0.01% (100%=E1-04)]*.
- This parameter sets the frequency reference of Multi-Step Speed 9.

■ d1-10 Reference 10

No. (Hex.)	Name	Description	Default (Range)
d1-10 (028B) RUN	Reference 10	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the frequency reference in the units from *o1-03 [FrqDisplay Unit Selection]*.	0.00 Hz (0.00 - 590.00 Hz)

Note:
- The upper limit value changes when the *E1-04 [Max Output Frequency]* and *d2-01 [FRef Upper Limit]* values change.
- When *A1-02 = 6, 7 [Control Method = PM AOLVector, PM CLVector]*, the drive changes *o1-03 = 1 [0.01% (100%=E1-04)]*.
- This parameter sets the frequency reference of Multi-Step Speed 10.

■ d1-11 Reference 11

No. (Hex.)	Name	Description	Default (Range)
d1-11 (028C) RUN	Reference 11	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the frequency reference in the units from *o1-03 [FrqDisplay Unit Selection]*.	0.00 Hz (0.00 - 590.00 Hz)

Note:
- The upper limit value changes when the *E1-04 [Max Output Frequency]* and *d2-01 [FRef Upper Limit]* values change.
- When *A1-02 = 6, 7 [Control Method = PM AOLVector, PM CLVector]*, the drive changes *o1-03 = 1 [0.01% (100%=E1-04)]*.
- This parameter sets the frequency reference of Multi-Step Speed 11.

■ d1-12 Reference 12

No. (Hex.)	Name	Description	Default (Range)
d1-12 (028D) RUN	Reference 12	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the frequency reference in the units from *o1-03 [FrqDisplay Unit Selection]*.	0.00 Hz (0.00 - 590.00 Hz)

Note:
- The upper limit value changes when the *E1-04 [Max Output Frequency]* and *d2-01 [FRef Upper Limit]* values change.
- When *A1-02 = 6, 7 [Control Method = PM AOLVector, PM CLVector]*, the drive changes *o1-03 = 1 [0.01% (100%=E1-04)]*.
- This parameter sets the frequency reference of Multi-Step Speed 12.

■ d1-13 Reference 13

No. (Hex.)	Name	Description	Default (Range)
d1-13 (028E) RUN	Reference 13	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the frequency reference in the units from *o1-03 [FrqDisplay Unit Selection]*.	0.00 Hz (0.00 - 590.00 Hz)

Note:
- The upper limit value changes when the *E1-04 [Max Output Frequency]* and *d2-01 [FRef Upper Limit]* values change.
- When *A1-02 = 6, 7 [Control Method = PM AOLVector, PM CLVector]*, the drive changes *o1-03 = 1 [0.01% (100%=E1-04)]*.
- This parameter sets the frequency reference of Multi-Step Speed 13.

■ d1-14 Reference 14

No. (Hex.)	Name	Description	Default (Range)
d1-14 (028F) RUN	Reference 14	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the frequency reference in the units from *o1-03 [FrqDisplay Unit Selection]*.	0.00 Hz (0.00 - 590.00 Hz)

Note:
- The upper limit value changes when the *E1-04 [Max Output Frequency]* and *d2-01 [FRef Upper Limit]* values change.
- When *A1-02 = 6, 7 [Control Method = PM AOLVector, PM CLVector]*, the drive changes *o1-03 = 1 [0.01% (100%=E1-04)]*.
- This parameter sets the frequency reference of Multi-Step Speed 14.

■ d1-15 Reference 15

No. (Hex.)	Name	Description	Default (Range)
d1-15 (0290) RUN	Reference 15	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the frequency reference in the units from *o1-03 [FrqDisplay Unit Selection]*.	0.00 Hz (0.00 - 590.00 Hz)

Note:
- The upper limit value changes when the *E1-04 [Max Output Frequency]* and *d2-01 [FRef Upper Limit]* values change.
- When *A1-02 = 6, 7 [Control Method = PM AOLVector, PM CLVector]*, the drive changes *o1-03 = 1 [0.01% (100%=E1-04)]*.
- This parameter sets the frequency reference of Multi-Step Speed 15.

■ d1-16 Reference 16

No. (Hex.)	Name	Description	Default (Range)
d1-16 (0291) RUN	Reference 16	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the frequency reference in the units from *o1-03 [FrqDisplay Unit Selection]*.	0.00 Hz (0.00 - 590.00 Hz)

Note:
- The upper limit value changes when the *E1-04 [Max Output Frequency]* and *d2-01 [FRef Upper Limit]* values change.
- When *A1-02 = 6, 7 [Control Method = PM AOLVector, PM CLVector]*, the drive changes *o1-03 = 1 [0.01% (100%=E1-04)]*.
- This parameter sets the frequency reference of Multi-Step Speed 16.

■ d1-17 Jog Reference

No. (Hex.)	Name	Description	Default (Range)
d1-17 (0292) RUN	Jog Reference	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the JOG frequency reference in the units from *o1-03 [FrqDisplay Unit Selection]*. Set *H1-xx: MFDI Function Select = 6 [Jog Reference]* to use the Jog frequency reference.	6.00 Hz (0.00 - 590.00 Hz)

Note:
- The upper limit value changes when the *E1-04 [Max Output Frequency]* and *d2-01 [FRef Upper Limit]* values change.
- When *A1-02 = 6, 7 [Control Method = PM AOLVector, PM CLVector]*, the drive changes *o1-03 = 1 [0.01% (100%=E1-04)]*.

◆ d2: REFERENCE LIMITS

d2 parameters set the upper and lower frequency limits to control the motor speed. Apply these parameters to for example, run the motor at low-speed due to mechanical strength concerns, or if the motor should not be run at low speed because of lubrication issues with the gears and bearings.

The upper frequency limit is set in *d2-01 [FRef Upper Limit]* and the lower limit is set in *d2-02 [FRef Lower Limit]*.

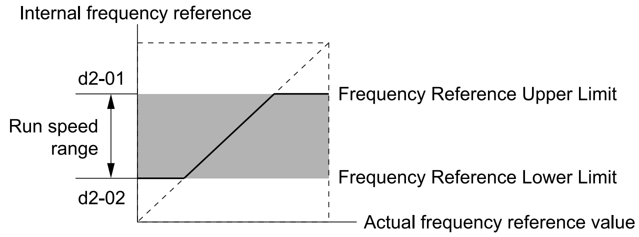


Figure 12.55 Upper and Lower Frequency Limits

■ d2-01 FRef Upper Limit

No. (Hex.)	Name	Description	Default (Range)
d2-01 (0289)	FRef Upper Limit	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets maximum limit for all frequency references. This value is a percentage of *E1-04 [Max Output Frequency]*.	100.0% (0.0 - 110.0%)

When the frequency reference is more than the value set in *d2-01* the drive will continue to operate at the value set in *d2-01*.

■ d2-02 FRef Lower Limit

No. (Hex.)	Name	Description	Default (Range)
d2-02 (028A)	FRef Lower Limit	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets minimum limit for all frequency references. This value is a percentage of *E1-04 [Max Output Frequency]*.	0.0% (0.0 - 110.0%)

When the frequency reference is less than the value set in *d2-02*, the drive will continue to operate at the value set in *d2-02*. The motor will accelerate to the *d2-02* value after the drive receives a Run command and a lower frequency reference than *d2-02* has been entered.

■ d2-03 Analog FRef Lower Limit

No. (Hex.)	Name	Description	Default (Range)
d2-03 (0293)	Analog FRef Lower Limit	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the lower limit of the master frequency reference (Multi-Step Speed 1) as a percentage of *E1-04 [Max Output Frequency]*.	0.0% (0.0 - 110.0%)

This parameter does not change the lower limit of Jog reference, frequency reference for multi-step speed operation, or the auxiliary frequency reference.

The drive operates at the value set in *d2-03* when the frequency reference decreases to less than the value set in *d2-03*.

Note:

When lower limits are set to parameters *d2-02 [FRef Lower Limit]* and *d2-03*, the drive uses the larger value as the lower limit.

◆ d3: JUMP FREQUENCY

The Jump frequency is a function that sets the dead band to a specified frequency band. If a machine that operated at constant speed is operated with variable speed, it can make resonance. To operate the machine without resonance from the natural frequency of the machinery mechanical system, use a frequency band jump.

You can program the drive to have three different Jump frequencies. Set *d3-01 to d3-03 [Jump Frequency 1 to Jump Frequency 3]* to the median value for the jumped frequency and set *d3-04 [Jump Frequency Width]* to the Jump frequency width.

When you input a frequency reference that is the same as or near the Jump frequency width, the frequency reference changes automatically.

The drive accelerates or decelerates the motor smoothly until the frequency reference is not in the range of the Jump frequency band. The drive will use the active accel/decel time to go through the specified dead band range. If the frequency reference is not in the range of the Jump frequency band, switch to constant speed operation.

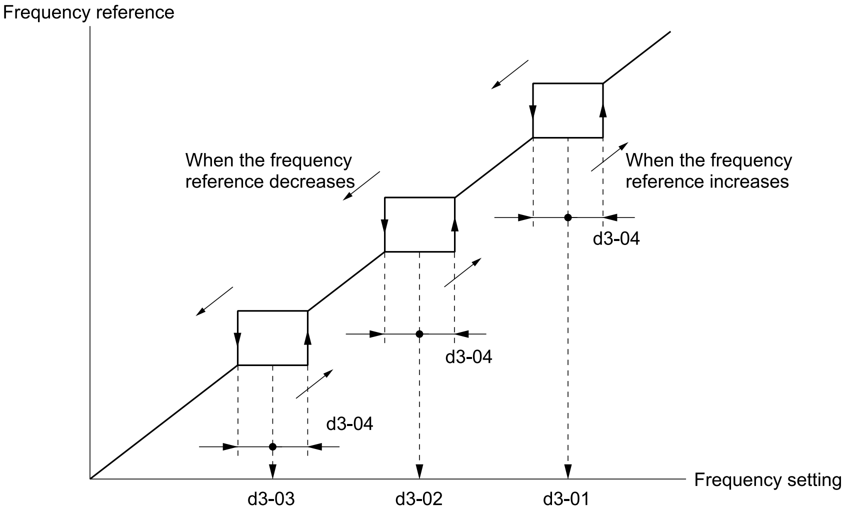


Figure 12.56 Jump Frequency

Note:
- When you set Jump Frequencies 1 to 3, make sure that the parameters do not overlap.
- When the drive is in the range of the Jump frequency, the frequency reference changes automatically. When Jump is executed, the output frequency changes smoothly as specified by the values set in *C1-01 [Accel Time 1]* and *C1-02 [Decel Time 1]*.

■ d3-01 Jump Frequency 1

No. (Hex.)	Name	Description	Default (Range)
d3-01 (0294)	Jump Frequency 1	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the median value of the frequency band that the drive will avoid.	0.0 Hz (Determined by A1-02)

Note:
Set this parameter to 0.0 Hz to disable the Jump frequency.

■ d3-02 Jump Frequency 2

No. (Hex.)	Name	Description	Default (Range)
d3-02 (0295)	Jump Frequency 2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the median value of the frequency band that the drive will avoid.	0.0 Hz (Determined by A1-02)

Note:
Set this parameter to 0.0 Hz to disable the Jump frequency.

■ d3-03 Jump Frequency 3

No. (Hex.)	Name	Description	Default (Range)
d3-03 (0296)	Jump Frequency 3	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the median value of the frequency band that the drive will avoid.	0.0 Hz (Determined by A1-02)

Note:
Set this parameter to 0.0 Hz to disable the Jump frequency.

■ d3-04 Jump Frequency Width

No. (Hex.)	Name	Description	Default (Range)
d3-04 (0297)	Jump Frequency Width	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the width of the frequency band that the drive will avoid.	1.0 Hz (Determined by A1-02)

◆ d4: FREQUENCY UP/DOWN

The *d4 parameters* set the Frequency Reference Hold function and the Up/Down and Up/Down 2 commands.

WARNING! *Crush Hazard. In hoist applications, use the applicable safety precautions to prevent the load from falling. Failure to obey can cause death or serious injury from falling loads.*

WARNING! *Sudden Movement Hazard. When you use the Baseblock command with hoist applications, make sure that you close the holding brake when you input the Baseblock command and the drive shuts off its output. Failure to do obey can cause death or serious injury if the load moves or falls when motor suddenly coasts after you input the Baseblock command.*

WARNING! *Sudden Movement Hazard. When you use a mechanical holding brake with the drive in a lifting application, close the brake when an input terminal triggers the Baseblock command to stop drive output. Failure to obey can cause death or serious injury if a load moves because the motor suddenly coasts after you enter the Baseblock command.*

- Frequency Reference Hold Function Command: This acceleration/deceleration ramp hold command uses an MFDI to momentarily stop the acceleration/deceleration of the motor, and continues to operate the motor at the output frequency at which the command reference was input. Turn OFF the acceleration/deceleration ramp hold command to continue acceleration/deceleration.
  With a crane for example, use the function and a 2-stage push button to stop acceleration and operate at low speed with one of the output frequencies.
- Up/Down command: The Up/Down command is a function to activate and deactivate an MFDI to increase and decrease the frequency reference. The Up/Down command overrides frequency references from the analog input terminal, pulse train input terminal, and keypad.
- Up/Down 2 command: The Up/Down 2 command is a function that adds a set bias value to the frequency reference to accelerate or decelerate. The Up/Down 2 command activates and deactivates the MFDI to add a bias value.

■ d4-01 FRef Hold Selection

No. (Hex.)	Name	Description	Default (Range)
d4-01 (0298)	FRef Hold Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function that saves the frequency reference or the frequency bias (Up/Down 2) after a Stop command or when de-energizing the drive.	0 (0, 1)

Set *H1-xx [MFDI Function Select]* to one of the these values to operate this parameter:

- *17 [Ac/Dec Hold]*
- *62/63 [Up Command/Down Command]*
- *65/66 [Up2 Command/Dw2 Command]*

0 : Disabled

- Acceleration/Deceleration Ramp Hold
  When you enter a Stop command or de-energize the drive, the hold value is reset to 0 Hz. The drive will use the active frequency reference when it restarts.
- Up/Down Command
  When you enter a Stop command or de-energize the drive, the frequency reference value is reset to 0 Hz. The drive will start from 0 Hz when it restarts.
- Combined with the Up/Down 2 Command
  When you enter the Stop command or 5 s after you release the Up/Down 2 command, the drive does not save the frequency bias. The Up/Down 2 function will start with a bias of 0% when the drive restarts.

1 : Enabled

- Acceleration/Deceleration Ramp Hold
  When you clear the Run command or de-energize the drive, it will save the last hold value. The drive will use the saved value as the frequency reference when it restarts.

  Note:

  When you energize the drive, continuously enable the MFDI terminal set for *AAc/Dec Hold [H1-xx = 17]* when energizing the drive. If the digital input does not activate, the drive will clear the hold value and set it to 0 Hz.

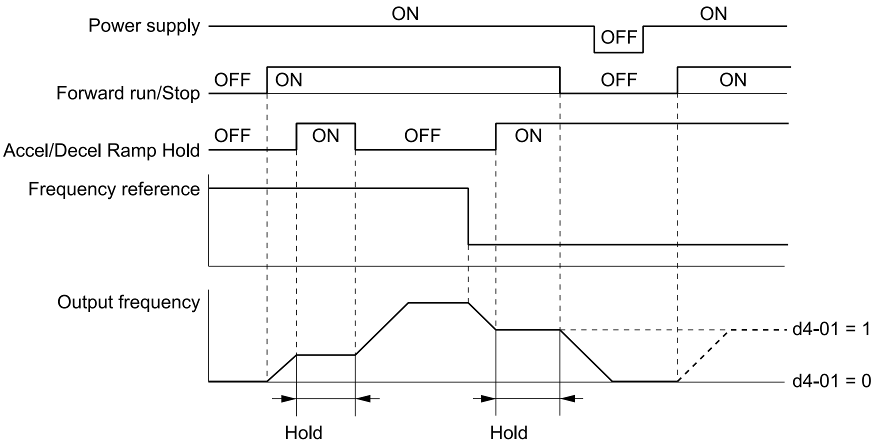


Figure 12.57 Frequency Reference Hold with Accel/Decel Hold Function

- Up/Down Command
  When you clear the Run command or de-energize the drive, it will save the frequency reference value. The drive will use the saved value as the frequency reference when it restarts.
- Up/Down 2 Command with Frequency Reference from Keypad
  When a Run command is active and you release the Up/Down 2 command for longer than 5 s, the drive adds the Up/Down 2 bias value to the frequency reference and sets it to 0. The drive saves the frequency reference value to which the bias value was added. The drive will use the new value as the frequency reference when it restarts.

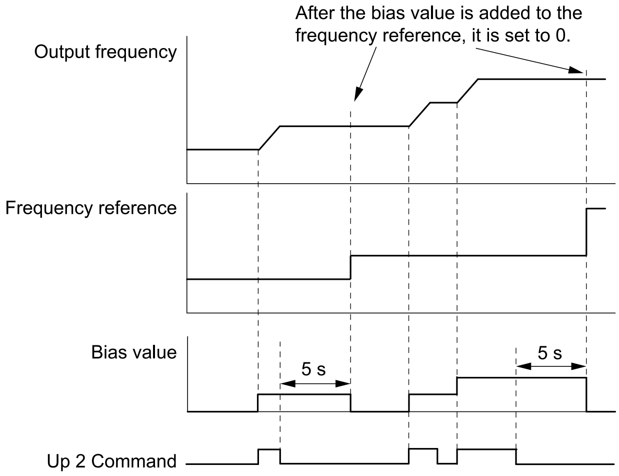


Figure 12.58 Up/Down 2 Example with Reference from Keypad and d4-01 = 1

- Up/Down 2 Command with Frequency Reference from Input Sources Other Than the Keypad
  When a Run command is active and you release the Up/Down 2 command for longer than 5 s, the drive will save the bias value in *d4-06 [FRef Bias(Up/Dw2)]*. The drive saves the frequency reference + *d4-06* as a frequency reference value. The drive will use the new value as the frequency reference when it restarts.

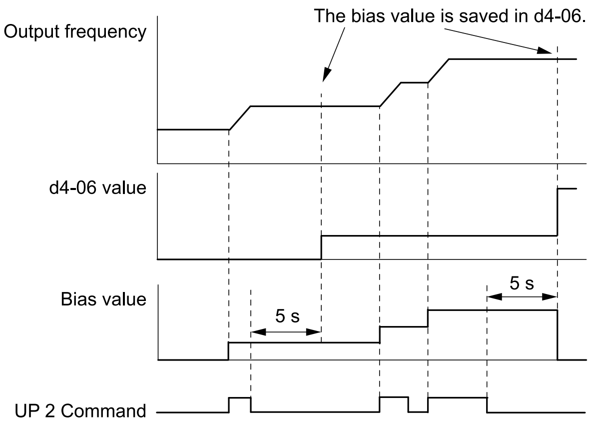


Figure 12.59 Up/Down 2 Example with Other Reference than Keypad and d4-01 = 1

Note:

Set the Up/Down 2 upper limit *[d4-08]* and lower limit *[d4-09]* correctly to use the frequency reference hold function and the Up/Down 2 function.

Remove the Saved Frequency Reference Value

The procedure to remove the saved frequency reference value is different for different functions. Use these methods to remove the value:

- Release the input programmed for *Ac/Dec Hold [H1-xx = 17]*.
- Set an Up or Down command while no Run command is active.
- Use the Up/Down 2 Command to set *d4-06 = 0.0* or set *d4-06 = 0.0* during stop.

■ d4-03 Up/Dw2 Bias Step Frequency

No. (Hex.)	Name	Description	Default (Range)
d4-03 (02AA) RUN	Up/Dw2 Bias Step Frequency	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the bias that the Up/Down 2 function adds to or subtracts from the frequency reference.	0.00 Hz (0.00 - 99.99 Hz)

The operation is different for different setting values:

- **Setting d4-03 = 0.00 Hz**
  When *H1-xx = 65, 66 [Up2 Command, Dw2 Command]* is active, the drive uses the accel/decel times set in *d4-04 [Up/Dw2 Ramp Selection]* to increase or decrease the bias value.

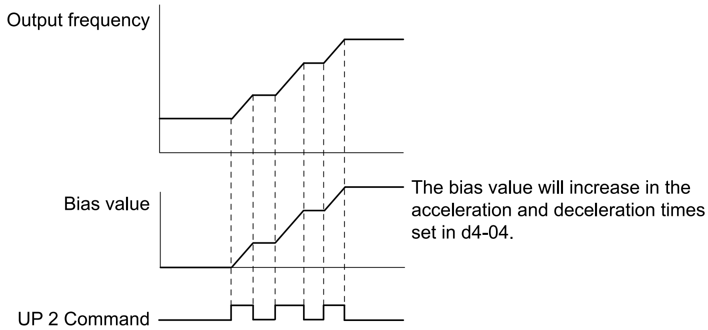


Figure 12.60 Up/Down 2 Bias when d4-03 = 0.00 Hz

- **Setting d4-03 ≠ 0.00 Hz**
  When the *H1-xx = 65, 66 [Up2 Command, Dw2 Command]* is active, the drive increases or decreases the bias in steps for the value set in *d4-03*. The drive uses the acceleration and deceleration times set in *d4-04*.

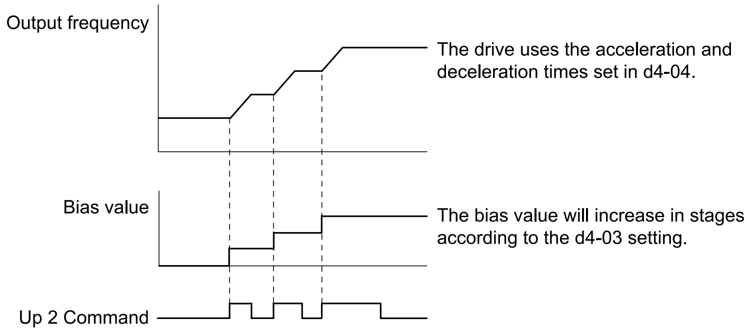


Figure 12.61 Up/Down 2 Bias when d4-03 ≠ 0.00 Hz

■ d4-04 Up/Dw2 Ramp Selection

No. (Hex.)	Name	Description	Default (Range)
d4-04 (02AB) RUN	Up/Dw2 Ramp Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the acceleration and deceleration times for the Up/Down 2 function to apply the bias to the frequency reference.	0 (0, 1)

0 : Current Ac/Dec Time

Use the active acceleration and deceleration times to increase or decrease the bias.

1 : Ac/Dec 4

Use *C1-07 [Accel Time 4]* and *C1-08 [Decel Time 4]* to increase or decrease the bias.

■ d4-05 Up/Dw2 Bias Mode Selection

No. (Hex.)	Name	Description	Default (Range)
d4-05 (02AC) RUN	Up/Dw2 Bias Mode Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function that saves the bias value to the drive when you open or close the two *H1-xx = 65, 66 [Up2 Command, Dw2 Command]*. Set *d4-03 [Up/Dw2 Bias Step Frequency] = 0.00* before you set this parameter.	0 (0, 1)

0 : Hold@Up=Dw=0

When the two MFDI terminals set for *H1-xx = 65, 66 [Up2 Command, Dw2 Command]* activate or deactivate, the drive will hold the bias value.

1 : Reset@Up=Dw

When the two MFDI terminals set for *H1-xx = 65, 66 [Up2 Command, Dw2 Command]* activate or deactivate, the drive will reset the bias value to 0. The drive will use the acceleration and deceleration times set in *d4-04 [Up/Dw2 Ramp Selection]* to accelerate and decelerate the motor to the selected output frequency.

■ d4-06 FRef Bias(Up/Dw2)

No. (Hex.)	Name	Description	Default (Range)
d4-06 (02AD)	FRef Bias(Up/Dw2)	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Saves the bias value from the Up/Down 2 Command when the value set in *E1-04* is 100%.	0.0% (-99.9 - +100.0%)

The Up/Down 2 function setting changes the function of *d4-06*:

Note:

When the keypad sets the frequency reference, you do not usually use parameter *d4-06*.

- When *d4-01 = 0 [FRef Hold Selection = Disabled]* and a source other than the keypad sets the frequency reference, the drive adds the value set in *d4-06* to the frequency reference. If the value set in *d4-06* is a negative number, the drive will subtract it from frequency reference.
- When *d4-01 = 1 [Enabled]* and a source other than the keypad sets the frequency reference, the drive will store the bias value adjusted with the Up/Down 2 command in *d4-06* 5 seconds after you release the Up/Down 2 command. The drive adds or subtracts the value set in *d4-06* to the frequency reference.

Conditions that Reset or Disable d4-06

The drive resets and disables the bias value in these conditions:

- *d4-01 = 0* and the Run command was cleared.
- *H1-xx = 65, 66 [Up2 Command, Dw2 Command]* is not set.
- The frequency reference source was changed.
  This includes switching LOCAL/REMOTE and multi-step speed reference.
- A digital input changed the frequency reference value.
- *d4-03 [Up/Dw2 Bias Step Frequency] = 0* and *d4-05 = 1 [Up/Dw2 Bias Mode Selection = Reset@Up=Dw]*, and the two DI terminals set for *H1-xx = 65, 66 [Up2 Command, Dw2 Command]* are activated or deactivated.
- The value of *E1-04 [Max Output Frequency]* was changed.

■ d4-07 Analog FRef Fluctuate Limit

No. (Hex.)	Name	Description	Default (Range)
d4-07 (02AE) RUN	Analog FRef Fluctuate Limit	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV If the frequency reference changes for more than the level set to this parameter, then the bias value will be held. Parameter *E1-04 [Max Output Frequency]* is 100%.	1.0% (0.1 - 100.0%)

Handles frequency reference changes while *H1-xx = 65, 66 [Up2 Command, Dw2 Command]* is activated. When the frequency reference changes for more than the level set in *d4-07*, the drive will hold the bias value, and the drive will accelerate or decelerate to the frequency reference. When the drive is at the frequency reference, it releases the bias hold and the bias follows the Up/Down 2 input commands.

This parameter is applicable only when an analog or pulse input sets the frequency reference.

■ d4-08 Up/Dw2 Bias Upper Limit

No. (Hex.)	Name	Description	Default (Range)
d4-08 (02AF) RUN	Up/Dw2 Bias Upper Limit	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the upper limit of the Up/Down 2 bias as a percentage of *E1-04 [Max Output Frequency]*.	100.0% (0.0 - 100.0%)

The drive saves the set bias upper limit in *d4-06 [FRef Bias(Up/Dw2)]*. Set *d4-08* an applicable value before you use the Up/Down 2 function.

Note:

When *d4-01 = 1 [FRef Hold Selection = Enabled]* and *b1-01 = 0 [Freq. Ref. Sel. 1 = Keypad]*, the drive will add the bias value to the frequency reference when it does not receive an Up/Down 2 command for 5 s. Then the drive will reset the value to 0 at which time you can increase the bias to the limit set in *d4-08* again.

■ d4-09 Up/Dw2 Bias Lower Limit

No. (Hex.)	Name	Description	Default (Range)
d4-09 (02B0) RUN	Up/Dw2 Bias Lower Limit	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the lower limit of the Up/Down 2 bias as a percentage of *E1-04 [Max Output Frequency]*.	0.0% (-99.9 - 0.0%)

The drive saves the set bias lower limit in *d4-06 [FRef Bias(Up/Dw2)]*. Set *d4-09* to an applicable value before you use the Up/Down 2 function.

Note:

When *d4-01 = 1 [FRef Hold Selection = Enabled]* and *b1-01 = 0 [Freq. Ref. Sel. 1 = Keypad]*, the drive will add the bias value to the frequency reference when it does not receive an Up/Down 2 command for 5 s. Then the drive will reset the value to 0.

If you increase the bias with the Up 2 command and *d4-09 = 0*, you cannot use a Down 2 command to decrease the frequency reference. To decrease speed in this condition, set a negative lower limit in *d4-09*.

■ d4-10 Up/Dw Frq Low Limit Select

No. (Hex.)	Name	Description	Default (Range)
d4-10 (02B6)	Up/Dw Frq Low Limit Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the lower frequency limit for the Up/Down function.	0 (0, 1)

0 : d2-02/Analog (larger level)

The higher value between *d2-02 [FRef Lower Limit]* and an analog input programmed for *Frequency Reference [H3-02, H3-06, H3-10 = 0]* sets the lower frequency reference limit.

Note:

When you use *Ext Ref 1/2 [H1-xx = 9]* to switch between the Up/Down function and an analog input as the reference source, the analog value becomes the lower reference limit when the Up/Down command is active. Set *d4-10 = 1* to isolate the Up/Down function and the analog input value.

1 : d2-02

You can only use *d2-02* to set the lower limit of the frequency reference.

■ d4-11 Bi-Dir Out Selection

No. (Hex.)	Name	Description	Default (Range)
d4-11 (02B7)	Bi-Dir Out Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function that changes the frequency reference to a Bi-Directional internal frequency reference.	0 (0, 1)

0 : Disabled

The drive will not change the frequency reference or PID output value to Bi-Directional internal frequency reference.

When the frequency reference or PID output value is 0% to 100% of the maximum output frequency, the drive runs the motor in the set direction.

1 : Enabled

Changes the frequency reference or PID output value to Bi-Directional output.

When the frequency reference or PID output value is 0% to 50%, the drive reverses the motor in the set direction. When the frequency reference or PID output value is 50% to 100%, the drive operates the motor in the set direction.

Note:

When you use the Bi-Directional function with PID control, you can use an MFDI terminal set for *PID BiDir [H1-xx = 7A]* to enable/disable the Bi-Directional function.

Table 12.23 shows how the drive operates when you use the PID control function with the Bi-Directional function and *d4-11 = 1*:

Table 12.23 Bi-Directional Function Operation Conditions

b5-01 [PID Enable] Setting	Status of MFDI Terminal Set for 7F [PID Bi-Directional Enable]	
	ON	OFF
b5-01 = 0 [Disabled]	Bi-Directional function enabled	Bi-Directional function enabled
b5-01 ≠ 0 [Enabled]	Bi-Directional function enabled	Normal operation (Bi-Directional function disables)

- **When PID Control is Disabled or *H1-xx = 6A [DI Function Select = PID Disable]* is Activated**
  When the frequency reference is 0% to 50%, the drive reverses the motor in the set direction. When the frequency reference is 50% to 100%, the drive operates the motor in the set direction. Figure 12.62 shows the frequency reference change at this time. This is an example of operation when the Forward Run command is input.

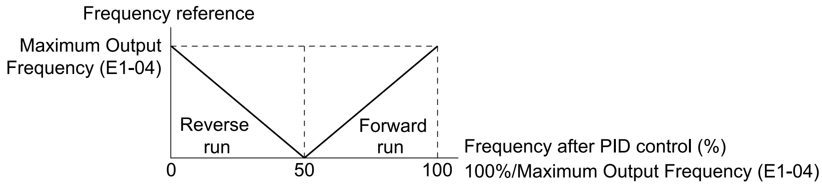


Figure 12.62 Frequency Reference Transition when PID Control is Disabled or PID Disable is ON

Note:

When *b1-04 = 1 [Reverse Operation Selection = Disabled]*, the drive will not run in Reverse. The frequency reference limit is 0 Hz.

- **When PID Control is Enabled and *H1-xx = 7A [PID BiDir]* is Activated**
  The Bi-Directional function is enabled. When the frequency reference is 0% to 50% after PID control execution, the drive runs the motor opposite of the set direction. When the frequency reference is 50% to 100%, the drive runs the motor in the set direction. Figure 12.63 shows the frequency reference change at this time. This is an example of the operation when the Forward Run command is input.

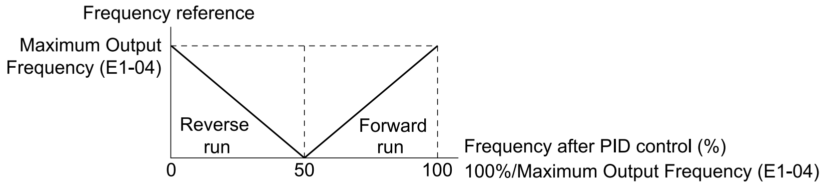


Figure 12.63 Frequency Reference Transition when PID Control and PID Bi-Directional are Enabled

Note:

When *b1-04 = 1*, the drive will not run the motor in Reverse. The frequency reference limit is 0 Hz.

- **When PID Control is Enabled and *H1-xx = 7A* is Deactivated**
  The Bi-Directional function is disabled. When the frequency reference is a negative value after PID control execution, the drive runs the motor opposite of the set direction. The frequency reference value is an absolute value.

■ d4-12 Stop Position Gain

No. (Hex.)	Name	Description	Default (Range)
d4-12 (02B8)	Stop Position Gain	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the gain to adjust the stopping accuracy. Set this parameter when *b1-03 = 9 [Stopping Method Selection = Distance Stop]*.	1.00 (0.50 - 2.55)

If the motor stops before the necessary stop position, increase the setting value. If the length of time for the motor to stop is too long, decrease the setting value.

◆ d5: TORQUE CONTROL

d5 parameters set the Torque Control function.

The Torque Control function controls the output torque of the motor. You can use Torque Control for roller drives, winders, unwinders, conveyors and other machines that use tension control and push/pull applications. When there is no more material and the machine suddenly has no load, the drive uses Torque Control and the speed limit function to keep the rotation speed of the motor from increasing.

Set *A1-02 [Control Method]* to one of these values to use Torque Control:

- 3 [CLVector]
- 4 [Adv OLVector]
- 6 [PM AOLVector]
- 7 [PM CLVector]

Note:

When you use Torque Control and *A1-02 = 4*, use a motor designed for winding applications.

Use one of these methods to enable Torque Control:

- Set *d5-01 = 1 [Torque Ctrl Selection = Torque Control]*.
- Set *H1-xx = 13 [Spd/Trq Switch]* ON.

■ Torque Control Operation

Figure 12.64 shows the operation principle of Torque Control:

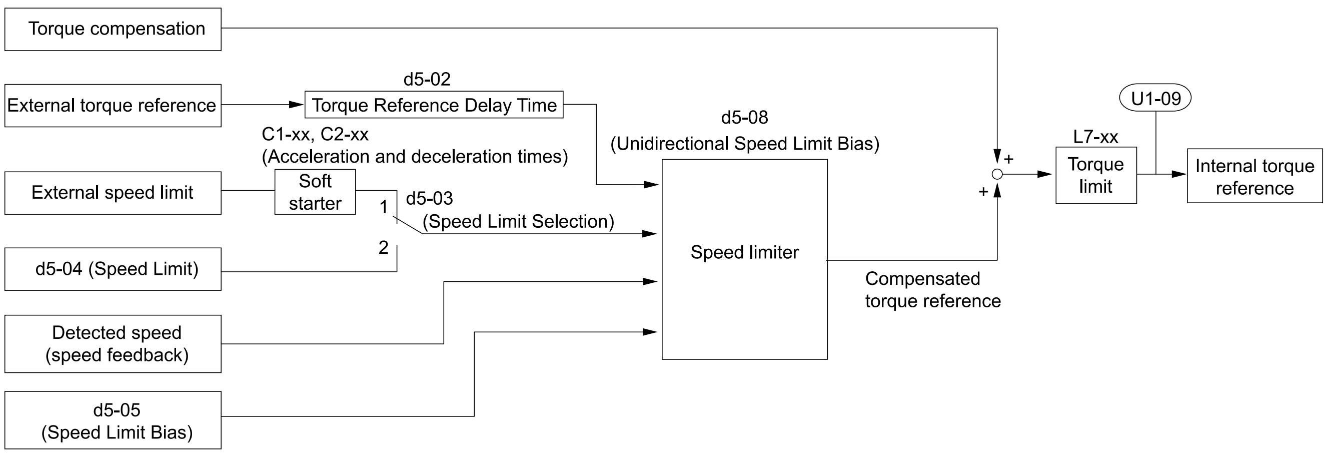


Figure 12.64 Torque Control Block Diagram

The externally input torque reference is the target value for the motor output torque. If the motor output torque and load torque are not balanced during Torque Control, the motor accelerates or decelerates. To prevent operation at more than the speed limit, compensate the external torque reference value if the motor speed is at the limit. The speed limit, speed feedback, and the speed limit bias are the values that calculate the compensation value.

When an external torque compensation value is input, the drive adds that value to the speed limit compensated torque reference value. The values *L7-01 to L7-04 [FW Torque Limit to RV Reg. TrqLimit]* limit the value. The drive uses the value as the internal torque reference. You can use *U1-09 [Torque Reference]* to monitor the calculated torque reference. The torque limit values set in *L7-01 to L7-04* are most important. Although you can set a higher external torque reference from an external source, the motor will not operate a torque output higher than values set in *L7-01 to L7-04*.

■ Setting the Torque Reference, Speed Limit, and Torque Compensation Values

Torque Control Input Value Selection

Table 12.24 lists the method for torque control input signals.

Table 12.24 The Method for Torque Control Input Signals

Configuration Parameter	Signal Input Method	Parameter Settings	Notes
Torque Reference	Drive analog input terminals AI1, AI2, AI3	*H3-02, H3-10, H3-06 = 8 [AI Function Select= TorqRef/Lim]* *1	The level of the set input signal must align with the polarity of the external signals.
	Analog reference option cards AI-A3	• *F2-01 = 0 [An.In Funct.Selection = 3 Independent Channels]* • *H3-02, H3-10, and H3-06 = 8 [TorqRef/Lim]* *1	*H3-02, H3-10,* or *H3-06* settings are enabled for the option card input terminal. The level of the set input signal must align with the polarity of the external signals.
	Modbus register 0004H	• *b1-01 = 2 [Freq. Ref. Sel. 1 = Modbus]* • When register bit 2 of 000FH = 1, the torque reference and torque limit from register 0004H is enabled.	-
	Communication option card	• *b1-01 = 3 [Option PCB]* • *F6-06 = 1 [Trq Ref/Lim Comms = Enabled]* Refer to the communication option card manual for more information about the torque reference setting.	-
Speed Limit	Frequency Reference Selection (Reference source selected with b1-01)	*d5-03 = 1 [Speed Limit Selection = Active Freq Reference]* The drive gets the speed limit from the frequency reference source input in *b1-01* or *b1-15 [Freq. Ref. Sel. 2]*. *1	The drive applies the settings in *C1-01 to C1-08 [Accel Time 1 to Decel Time 4]* and *C2-01 to C2-04 [Jerk@Start of Accel, Jerk@End of Accel, Jerk@Start of Decel, Jerk@End of Decel]* to the speed limit.
	d5-04 [Speed Limit]	*d5-03 = 2 [d5-04 Setting]*	-
Torque Compensation	Drive analog input terminals AI1, AI2, AI3	*H3-02, H3-10,* or *H3-06 = 7 [TorqCompensation]* *1	The level of the set input signal must align with the polarity of the external signals.
	Analog reference option cards AI-A3	• *F2-01 = 0* • *H3-02, H3-10,* or *H3-06 = 7* *1	*H3-02, H3-10,* or *H3-06* settings are enabled for the option card input terminal. The level of the set input signal must align with the polarity of the external signals.
	Modbus register 0005H	• *b1-01 = 2* • When register bit 3 of 000FH = 1, the torque reference and torque limit from register 0005H is enabled.	-
	Communication option card	*b1-01 = 3* Refer to the communication option card manual for more information about the torque reference setting.	-

*1 Sets analog input terminals AI1, AI2, and AI3 to supply the speed limit, torque reference, or torque compensation. If you set the same function to AI1 to AI3 terminals with *H3-02, H3-10,* or *H3-06*, the drive will detect *oPE07 [Analog Input Selection Error]*.

Input Signal Polarity

The positive and negative torque references set the motor rotation direction. The direction of the Run command does not set it. The positive and negative torque reference signals and the direction of the Run command have an effect on the internal torque reference.

Table 12.25 Torque Control Signal Polarity

Run Command Direction	Torque Reference Signal Polarity	Direction of Motor Rotation	Polarity of the Internal Torque Reference [U1-09]
Forward run	+ (Positive)	Forward direction	+ (Positive)
	- (Negative)	Reverse direction	- (Negative)
Reverse run	+ (Positive)	Reverse direction	- (Negative)
	- (Negative)	Forward direction	+ (Positive)

Note:

For Yaskawa motors, the forward run direction is counterclockwise direction when seen from the load shaft.

When you use analog inputs, you can get negative input values with these methods:

- Apply negative voltage input signals.
- Use positive voltage input signals and set the analog input bias to negative values.
- Apply positive voltage input signals and use a digital input programmed for *AI Trq Polarity [H1-xx = 14]*.

When you use Modbus communication or a communication option card, set the positive or negative signed torque reference.

When the level of the analog signal input is 0 V to 10 V or 4 mA to 20 mA, the torque reference is the forward direction. To reverse the polarity of the torque reference, use one of these two methods:

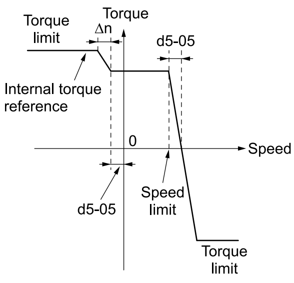
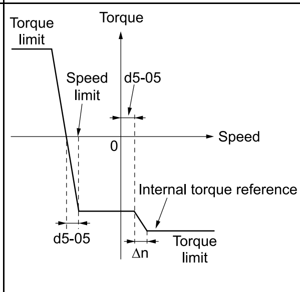
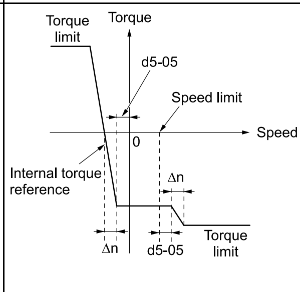
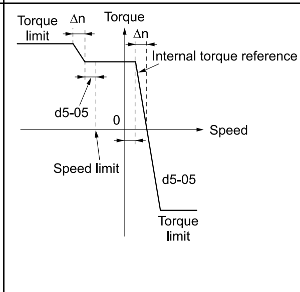
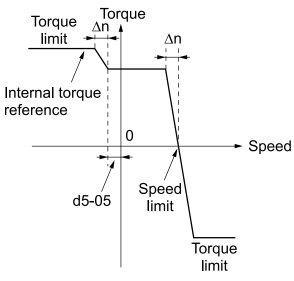
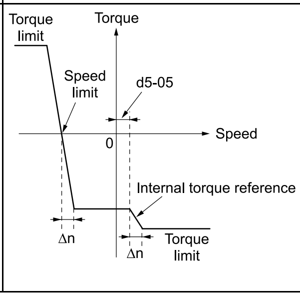
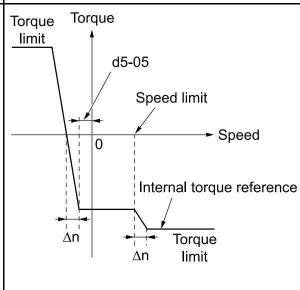
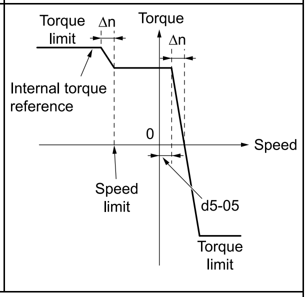
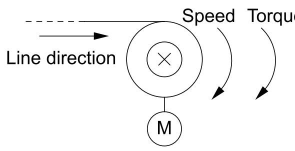
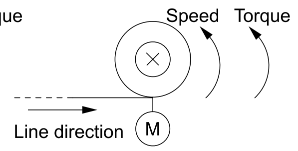
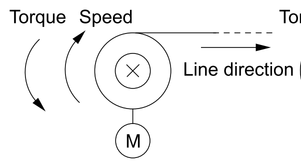
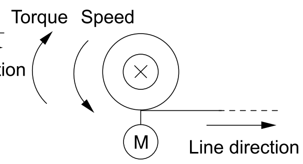
- Use a -10 V to +10 V voltage input
- Set *H1-xx = 14 [DI Function Select = AI Trq Polarity]*.

■ Speed Limit and Speed Limit Bias

The drive reads the speed limit setting from the input selected in *d5-03 [Speed Limit Selection]*. You can use *d5-05 [Speed Limit Bias]* to add a bias to this speed. Parameter *d5-08 [UniDir Speed Bias]* sets how the drive applies bias to the speed limit.

Table 12.26 shows the relation between these settings:

Table 12.26 Speed Limit, Speed Bias and Speed Limit Priority Selection

	Operating Conditions							
Run command	Forward	Reverse	Forward	Reverse	Forward	Reverse	Forward	Reverse
Torque reference direction	+ (Positive)	+ (Positive)	- (Negative)	- (Negative)	- (Negative)	- (Negative)	+ (Positive)	+ (Positive)
Speed limit direction	+ (Positive)	- (Negative)	- (Negative)	+ (Positive)	+ (Positive)	- (Negative)	- (Negative)	+ (Positive)
Direction of motor rotation	Forward		Reverse		Forward		Reverse	
Generated torque (d5-08 = 0 [Disabled]) *1								
Generated torque (d5-08 = 1 [Enabled]) *1								
Application example	Wind up  				Rewind  			

*1 The *C5 parameter* set the Δn value.

■ Show Speed Limit Operation

When the motor is at the speed limit or more than the speed limit, the drive sends a signal to the PLC or other such control devices to tell you that an error has occurred. To enable this function, set an DO function *[H2-01 to H2-03]* to *31 [@SpdLim@Trq]*.

■ Switch Between Torque Control and Speed Control

Use a digital input to switch Torque Control and Speed Control. To enable this function, set *H1-xx = 13 [DI Function Select = Spd/Trq Switch]* to enable this function.

When you switch from Speed Control to Torque Control, the torque limit becomes the torque reference and the speed reference becomes the speed limit. When you switch from Torque Control to Speed Control, the torque reference becomes the torque limit and the speed limit becomes the speed reference. When you must use a delay time to switch between Speed Control and Torque Control, set *d5-06 [Spd/Trq Chg Time]*. During this switch delay time, the drive keeps the reference value of the Torque Control and Speed Control when the switch signal was input. Change the reference values from an external control device during this delay time.

Note:
- When you switch between Torque Control and Speed Control, set *d5-01 = 0 [Torque Ctrl Selection = Speed Control]*. If *d5-01 = 1 [Torque Control]* and *H1-xx = 13* at the same time, the drive will detect *oPE15 [Torque Control Setting Error]*.
- If the Stop command is input, the drive will not apply the delay time set in *d5-06*. Torque Control will immediately switch to Speed Control and ramp to stop.

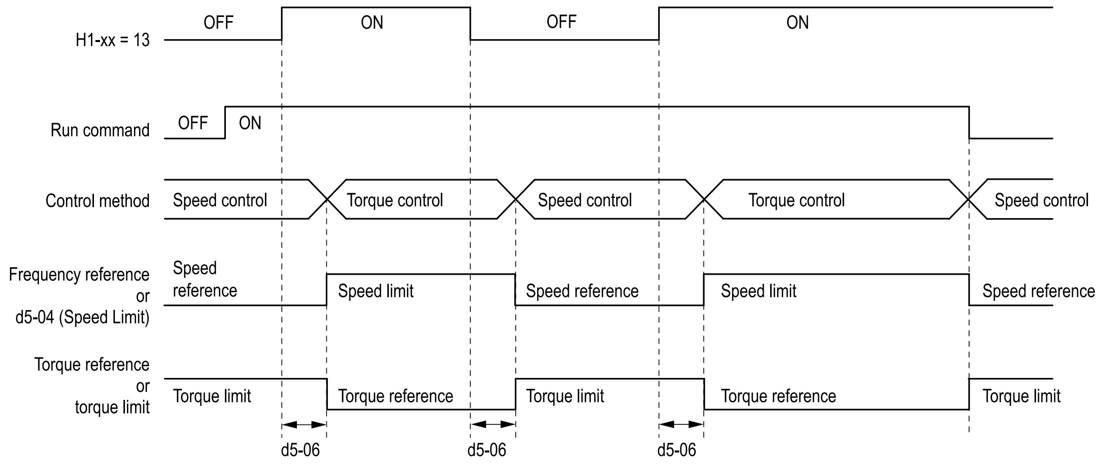


Figure 12.65 Speed/Torque Control Switching Time

■ d5-01 Torque Ctrl Selection

No. (Hex.)	Name	Description	Default (Range)
d5-01 (029A)	Torque Ctrl Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the drive for torque control or speed control.	0 (0, 1)

0 : Speed Control

Enables Speed Control. The drive controls the speed as specified by *C5-01 to C5-07 [Speed Control (ASR) Setting Parameters]*.

Also use this setting when you use *H1-xx = 13 [DI Function Select = Spd/Trq Switch]* to change between Speed Control and Torque Control.

1 : Torque Control

Always enables Torque Control.

■ d5-02 Torque Ref Delay Time

No. (Hex.)	Name	Description	Default (Range)
d5-02 (029B)	Torque Ref Delay Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the primary delay time constant for the torque reference filter.	Determined by A1-02 (0 - 1000 ms)

This parameter applies a primary delay filter to the torque reference signal to stop oscillation caused by a torque reference signal that is not stable. This also helps remove electrical interference from the torque reference signal and helps adjust the responsiveness between host controllers.

If oscillation occurs during Torque Control, increase the setting value. If the setting value is too high, responsiveness becomes unsatisfactory.

■ d5-03 Speed Limit Selection

No. (Hex.)	Name	Description	Default (Range)
d5-03 (029C)	Speed Limit Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the torque control speed limit method.	1 (1, 2)

1 : Active Freq Reference

The enabled frequency reference set in *b1-01 [Freq. Ref. Sel. 1]* or *b1-15 [Freq. Ref. Sel. 2]* will be the speed limit. The drive applies the values set in *C1-01 to C1-08 [Accel Time 1 to Decel Time 4]* and *C2-01 to C2-04 [Jerk@Start of Accel to Jerk@End of Decel]* as speed limits.

2 : d5-04 Setting

The speed limit is the value set in *d5-04*.

■ d5-04 Speed Limit

No. (Hex.)	Name	Description	Default (Range)
d5-04 (029D)	Speed Limit	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the speed limit during Torque Control as a percentage of *E1-04 [Max Output Frequency]*. Set *d5-03 = 2 [Speed Limit Selection = d5-04 Setting]* before you set this parameter.	0% (-120 - +120%)

The speed limit is a positive value when it is in the same direction as the Run command. The speed limit is a negative value when it is in the opposite direction of the Run command.

■ d5-05 Speed Limit Bias

No. (Hex.)	Name	Description	Default (Range)
d5-05 (029E)	Speed Limit Bias	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets a bias to the speed limit as a percentage of *E1-04 [Max Output Frequency]*.	10% (0 - 120%)

Adjusts the margin for the speed limit.

■ d5-06 Spd/Trq Chg Time

No. (Hex.)	Name	Description	Default (Range)
d5-06 (029F)	Spd/Trq Chg Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the delay time to switch between Speed Control and Torque Control. Set *H1-xx = 13 [H1-xx: MFDI Function Select = Spd/Trq Switch]* before you set this parameter.	0 ms (0 - 1000 ms)

The analog input (torque reference, speed limit value) holds at the value when the drive switched between Speed and Torque Control in the time of the Speed/Torque Changeover Timer. During this time, prepare to switch to an external source.

■ d5-08 UniDir Speed Bias

No. (Hex.)	Name	Description	Default (Range)
d5-08 (02B5)	UniDir Speed Bias	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the direction of the speed limit reference to which Speed Limit Bias *[d5-05]* applies.	1 (0, 1)

0 : Disabled

The drive applies the speed limit bias in the speed limit direction and the opposite direction.

1 : Enabled

The drive applies the speed limit bias in the opposite direction of the speed limit only.

◆ d6: FIELD WEAKENING / FORCING

d6 parameters set the field weakening and field forcing functions.

The field weakening function decreases the energy consumption of the motor. It decreases the output voltage of the drive to a set level. The function decreases the motor excitation current inversely proportional to speed in a constant output range, and does not let the induced voltage of the motor become more than the power supply voltage. To enable this function, set *H1-xx = 44 [Field weakening]* ON.

Note:

Use the Field Weakening function in constant light-load applications. To control the energy consumption of the motor for other load conditions, use the *b8 parameters*.

The Field Forcing function adjusts the delaying influence of the motor time constant when the drive changes the excitation current reference and it also increases motor responsiveness. This function uses a high motor excitation current reference for drive start-up only to help develop actual motor excitation current. Enable the Field Forcing function to increase motor responsiveness.

Note:

You cannot use Field Forcing during DC Injection Braking.

■ d6-01 Field Weak Level

No. (Hex.)	Name	Description	Default (Range)
d6-01 (02A0)	Field Weak Level	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the drive output voltage as a percentage of *E1-05 [Max Output Voltage]* when *H1-xx = 44 [Field Weakening]* is activated.	80% (0 - 100%)

■ d6-02 Field Weak FqLimit

No. (Hex.)	Name	Description	Default (Range)
d6-02 (02A1)	Field Weak FqLimit	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the minimum output frequency to start field weakening.	0.0 Hz (0.0 - 590.0 Hz)

Make sure that these two conditions are correct to enable the Field Weakening command:

- The output frequency ≥ *d6-02*.
- There is a speed agreement status.

■ d6-03 Field Force Selection

No. (Hex.)	Name	Description	Default (Range)
d6-03 (02A2)	Field Force Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the field forcing function.	0 (0, 1)

0 : Disabled

1 : Enabled

■ d6-06 Field Force Limit

No. (Hex.)	Name	Description	Default (Range)
d6-06 (02A5)	Field Force Limit	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the maximum level that Field Forcing can increase the excitation current reference as a percentage of *E2-03 [Mot No-Load Current]*. Usually it is not necessary to change this setting.	400% (100 - 400%)

Note:

You cannot use Field Forcing during DC Injection Braking.

◆ d7: OFFSET FREQUENCY

The drive will use 3 digital signal inputs, to add or subtract the set frequency (Offset frequency) to/from the frequency reference and correct the speed. The drive uses the terminal set in *H1-xx = E, F, 10 [DI Function Select = Offset Frq 1 to Offset Frq 3]* to set the Offset frequency. When you close more than one input at the same time, the drive adds the selected offset values together.

Figure 12.66 shows the Offset frequency function:

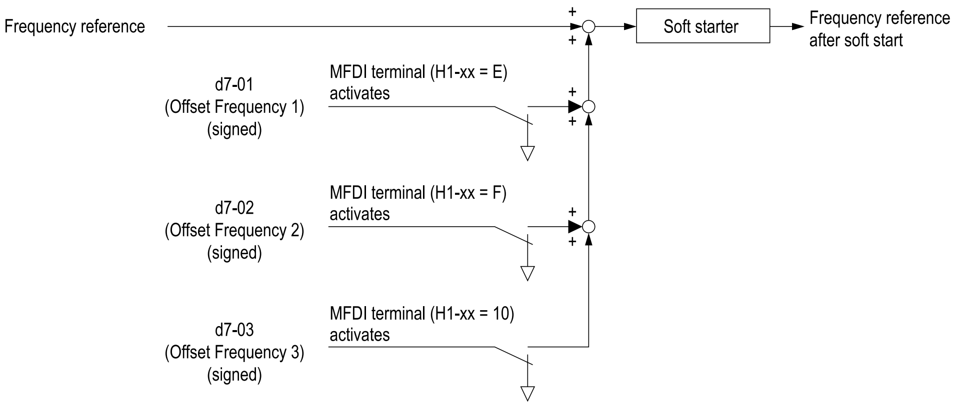


Figure 12.66 Offset Frequency Operation

d7-01 Offset Frq 1

No. (Hex.)	Name	Description	Default (Range)
d7-01 (02B2) RUN	Offset Frq 1	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the value to add to or subtract from the frequency reference when *H1-xx = 0E [H1-xx: MFDI Function Select = Offset Frq 1]* as a percentage of *E1-04 [Max Output Frequency]*.	0.0% (-100.0 - +100.0%)

d7-02 Offset Frq 2

No. (Hex.)	Name	Description	Default (Range)
d7-02 (02B3) RUN	Offset Frq 2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the value to add to or subtract from the frequency reference when *H1-xx = 0F [H1-xx: MFDI Function Select = Offset Frq 2]* as a percentage of *E1-04 [Max Output Frequency]*.	0.0% (-100.0 - +100.0%)

d7-03 Offset Frq 3

No. (Hex.)	Name	Description	Default (Range)
d7-03 (02B4) RUN	Offset Frq 3	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the value to add to or subtract from the frequency reference when *H1-xx = 10 [H1-xx: MFDI Function Select = Offset Frq 3]* as a percentage of *E1-04 [Max Output Frequency]*.	0.0% (-100.0 - +100.0%)

12.5 E: MOTOR

E parameters cover drive input voltage, V/f pattern, and motor parameters.

◆ E1: V/F PARAMETER MOTOR 1

E1 parameters are used to set the drive input voltage and motor V/f characteristics. To switch drive operation from one motor to another motor, set the V/f characteristics for motor 1.

■ V/f Pattern Settings

The drive uses a V/f pattern to adjust the output voltage relative to the frequency reference.

This product has been preconfigured with 15 voltage/frequency (V/f) patterns. Use *E1-03 [V/f Pattern Selection]* to select the V/f pattern that is appropriate for the application.

Additionally, one custom V/f pattern is available. Set *E1-03 = F [Custom]* and then manually set parameters *E1-04 to E1-10*.

Table 12.27 Predefined V/f Patterns

Setting	Specification	Characteristic	Application
0	Const Trq, 50Hz base, 50Hz max	Constant torque	For general purpose applications. This pattern is used when the load torque is constant without any rotation speed such as that used for linear conveyor systems.
1	Const Trq, 60Hz base, 60Hz max		
2	Const Trq, 50Hz base, 60Hz max		
3	Const Trq, 60Hz base, 72Hz max		
4	VT, 50Hz, 65% Vmid reduction	Variable torque	This pattern is used for torque loads proportional to 2 or 3 times the rotation speed, such as is the case with fans and pumps.
5	VT, 50Hz, 50% Vmid reduction		
6	VT, 60Hz, 65% Vmid reduction		
7	VT, 60Hz, 50% Vmid reduction		
8	High Trq, 50Hz, 25% Vmin boost	High starting torque	This pattern is used when strong torque is required during startup.
9	High Trq, 50Hz, 65% Vmin boost		
A	High Trq, 60Hz, 25% Vmin boost		
B	High Trq, 60Hz, 65% Vmin boost		
C	High Freq, 60Hz base, 90Hz max	Constant output	This pattern is used to rotate motors at greater than 60 Hz. Output voltage is constant when operating at greater than 60 Hz.
D	High Freq, 60Hz base, 120Hz max		
E	High Freq, 60Hz base, 180Hz max		
F	Custom	Constant torque	Enables a custom V/f pattern by changing *E1-04 to E1-13 [V/f Pattern for Motor 1]*. The default settings for *E1-04 to E1-13* are equivalent to *Setting Value 1 [Const Trq, 60Hz base, 60Hz max]*.

Note:

Be aware of the following points when manually setting V/f patterns.

- To set linear V/f characteristics at frequencies lower than that of *E1-06*, set *E-07 = E1-09*. In this case, the setting for *E1-08* will be disregarded.
- Ensure that the five frequencies are set according to the following rules to prevent triggering *oPE10 [V/f Data Setting Error]*; *E1-09 ≤ E1-07 < E1-06 ≤ E1-11 ≤ E1-04*
- Setting *E1-11 = 0 [Mid B Frequency = 0 Hz]* disables *E1-12 [Min Output Voltage]*. Ensure that the four frequencies are set according to the following rules; *E1-09 ≤ E1-07 < E1-06 ≤ E1-04*
- Parameter *E1-03* is not reset when the drive is initialized using *A1-03*.

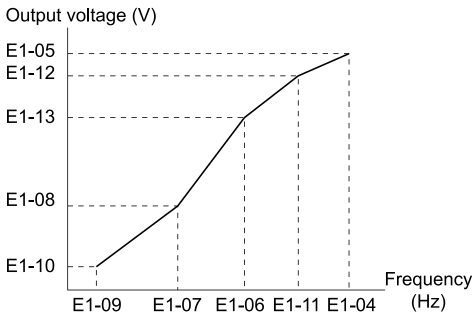


Figure 12.67 V/f Pattern

E1-01 Input AC Supply Voltage

No. (Hex.)	Name	Description	Default (Range)
E1-01 (0300)	Input AC Supply Voltage	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the drive input voltage.	400 V: 400 V (400 V Class: 310 to 510 V)

NOTICE: *Set this parameter to align with the drive input voltage (not motor voltage). The protective features of the drive will not function if this parameter is incorrect. Failure to obey will cause incorrect drive operation.*

Values Related to the Drive Input Voltage

The value set in *E1-01* is the base value used for the motor protective functions in Table 12.28. With a 400 V class drive, the detection level changes for some motor protective functions.

Table 12.28 Values Related to the Drive Input Voltage

Voltage	E1-01 Setting	Approximate Values				
		ov Detection Level	BTR Operation Level (rr Detection Level) *1	L2-05 [UV Detection Lvl (Uv1)]	L2-11 [KEB DC Volt Setpoint]	L3-17 [DCBus Regul. Level]
400 V class	Setting value ≥ 400 V	820 V	788 V	380 V	500 V	750 V
	Setting value < 400 V	820 V	788 V	350 V	460 V	750 V

*1 This is the protection function enabled in drives with built-in braking transistors. These values show the level that will trigger the built-in braking transistor. Refer to ""Braking Unit, Braking Resistor Unit Instruction Manual (TOBPC72060001)"" for more information.

E1-03 V/f Pattern Selection

No. (Hex.)	Name	Description	Default (Range)
E1-03 (0302)	V/f Pattern Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the V/f pattern for the drive and motor. You can use one of the preset patterns or you can make a custom pattern.	F (Determined by A1-02)

Note:

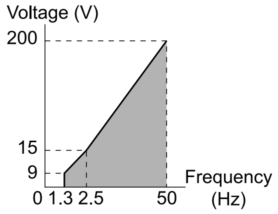
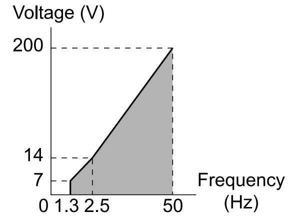
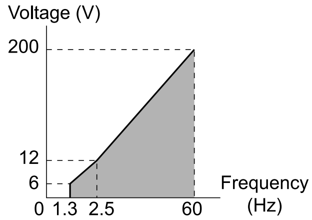
- When *A1-02 = 2 [Control Method = OLVector]*, settings *0* through *E* are not available.
- Set the correct V/f pattern for the application and operation area. An incorrect V/f pattern can decrease motor torque and increase current from overexcitation.
- Parameter *A1-03 [Init Parameters]* will not initialize the value *E1-03*.

0 : CT_50-50Hzmax

Use this constant torque pattern for general applications. Use this pattern when the load torque is constant and there is no rotation speed. For example, linear conveyor systems.

Note:

The voltage values in the figures are for 200 V class drives. Multiply the values by 2 for 400 V class drives.

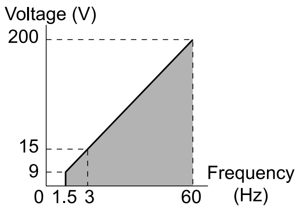
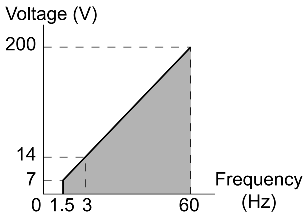
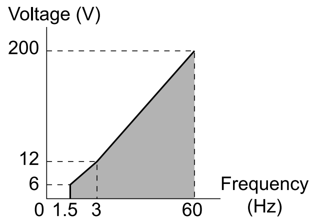
<table>
<tr><th>HD: 4002 - 4012
ND: 4002 - 4009</th><th>HD: 4018 - 4103
ND: 4012 - 4089</th><th>HD: 4140 - 4675
ND: 4103 - 4675</th></tr>
<tr><td></td><td></td><td></td></tr>
</table>

1 : CT_60-60Hzmax

Use this constant torque pattern for general applications. Use this pattern when the load torque is constant and there is no rotation speed. For example, linear conveyor systems.

Note:

The voltage values in the figures are for 200 V class drives. Multiply the values by 2 for 400 V class drives.

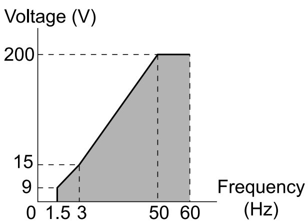
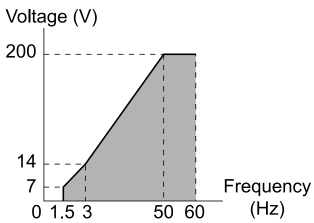
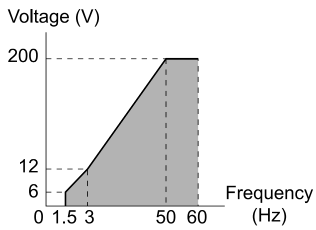
<table>
<tr><th>HD: 4002 - 4012
ND: 4002 - 4009</th><th>HD: 4018 - 4103
ND: 4012 - 4089</th><th>HD: 4140 - 4675
ND: 4103 - 4675</th></tr>
<tr><td></td><td></td><td></td></tr>
</table>

2 : CT_50-60Hzmax

Use this constant torque pattern for general applications. Use this pattern when the load torque is constant and there is no rotation speed. For example, linear conveyor systems.

Note:

The voltage values in the figures are for 200 V class drives. Multiply the values by 2 for 400 V class drives.

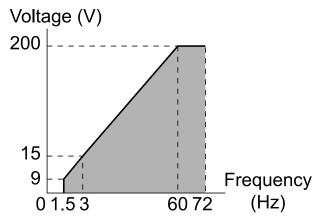
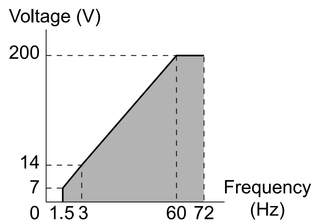
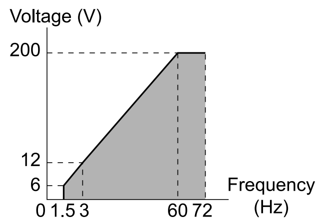
<table>
<tr><th>HD: 4002 - 4012
ND: 4002 - 4009</th><th>HD: 4018 - 4103
ND: 4012 - 4089</th><th>HD: 4140 - 4675
ND: 4103 - 4675</th></tr>
<tr><td></td><td></td><td></td></tr>
</table>

3 : CT_60-72Hzmax

Use this constant torque pattern for general applications. Use this pattern when the load torque is constant and there is no rotation speed. For example, linear conveyor systems.

Note:

The voltage values in the figures are for 200 V class drives. Multiply the values by 2 for 400 V class drives.

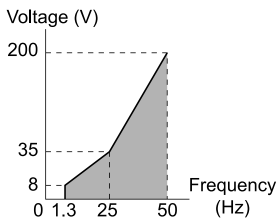
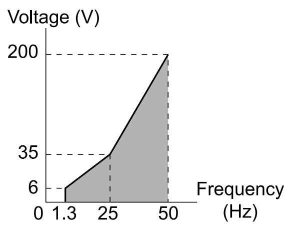
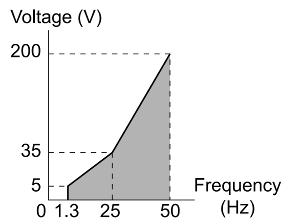
HD: 4002 - 4012 ND: 4002 - 4009	HD: 4018 - 4103 ND: 4012 - 4089	HD: 4140 - 4675 ND: 4103 - 4675
		

4 : VT_50-35HzmidV

Use this derated torque pattern for torque loads proportional to three times the rotation speed. For example, fans and pumps.

Note:

The voltage values in the figures are for 200 V class drives. Multiply the values by 2 for 400 V class drives.

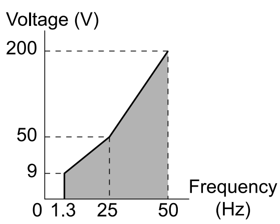
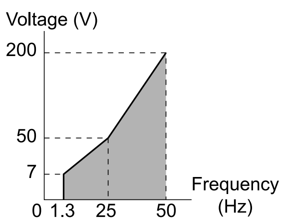
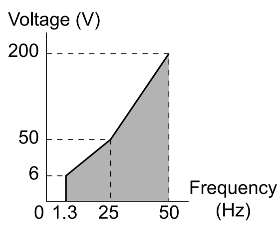
HD: 4002 - 4012 ND: 4002 - 4009	HD: 4018 - 4103 ND: 4012 - 4089	HD: 4140 - 4675 ND: 4103 - 4675
		

5 : VT_50-50HzmidV

Use this derated torque pattern for torque loads proportional to two times the rotation speed. For example, fans and pumps.

Note:

The voltage values in the figures are for 200 V class drives. Multiply the values by 2 for 400 V class drives.

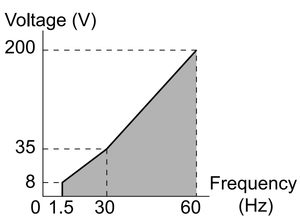
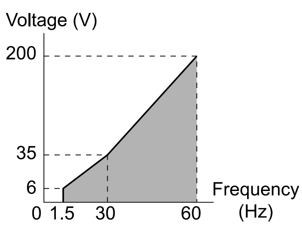
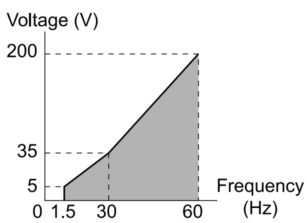
HD: 4002 - 4012 ND: 4002 - 4009	HD: 4018 - 4103 ND: 4012 - 4089	HD: 4140 - 4675 ND: 4103 - 4675
		

6 : VT_60-35HzmidV

Use this derated torque pattern for torque loads proportional to three times the rotation speed. For example, fans and pumps.

Note:

The voltage values in the figures are for 200 V class drives. Multiply the values by 2 for 400 V class drives.

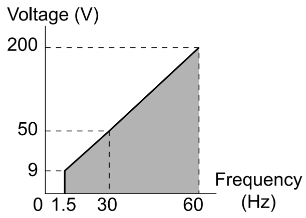
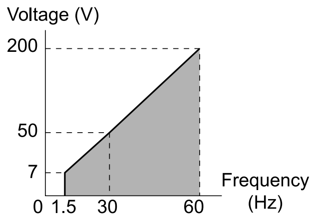
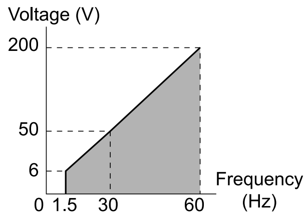
HD: 4002 - 4012 ND: 4002 - 4009	HD: 4018 - 4103 ND: 4012 - 4089	HD: 4140 - 4675 ND: 4103 - 4675
		

7 : VT_60-50HzmidV

Use this derated torque pattern for torque loads proportional to two times the rotation speed. For example, fans and pumps.

Note:

The voltage values in the figures are for 200 V class drives. Multiply the values by 2 for 400 V class drives.

<table>
<tr><th>HD: 4002 - 4012
ND: 4002 - 4009</th><th>HD: 4018 - 4103
ND: 4012 - 4089</th><th>HD: 4140 - 4675
ND: 4103 - 4675</th></tr>
<tr><td>
</td><td>
</td><td>
</td></tr>
</table>

8 : HT_50Hz_125 V

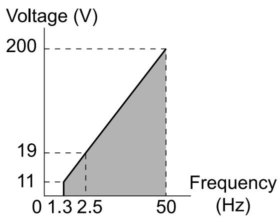
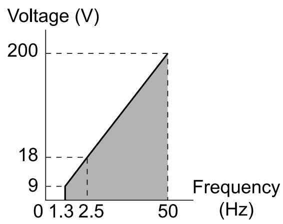
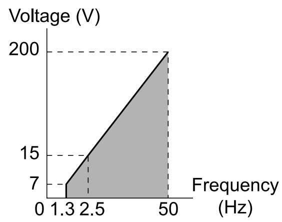
Use this pattern when moderate torque is necessary during start up.

Select this pattern only in these conditions:

- The wiring distance between the drive and motor is 150 m (492.1 ft.) minimum.
- There is an AC reactor connected to the drive output.

Note:

The voltage values in the figures are for 200 V class drives. Multiply the values by 2 for 400 V class drives.

<table>
<tr><th>HD: 4002 - 4012
ND: 4002 - 4009</th><th>HD: 4018 - 4103
ND: 4012 - 4089</th><th>HD: 4140 - 4675
ND: 4103 - 4675</th></tr>
<tr><td>
</td><td>
</td><td>
</td></tr>
</table>

9 : HTrq50Hz-165 V

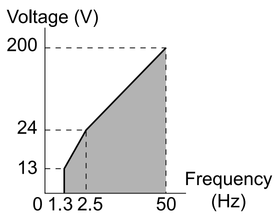
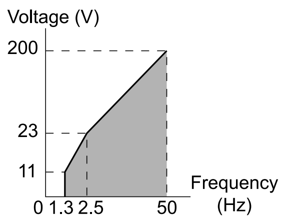
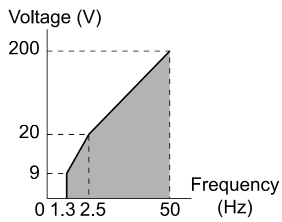
Use this pattern when high torque is necessary during start up.

Select this pattern only in these conditions:

- The wiring distance between the drive and motor is 150 m (492.1 ft.) minimum.
- There is an AC reactor connected to the drive output.

Note:

The voltage values in the figures are for 200 V class drives. Multiply the values by 2 for 400 V class drives.

<table>
<tr><th>HD: 4002 - 4012
ND: 4002 - 4009</th><th>HD: 4018 - 4103
ND: 4012 - 4089</th><th>HD: 4140 - 4675
ND: 4103 - 4675</th></tr>
<tr><td>
</td><td>
</td><td>
</td></tr>
</table>

A : HTrq60Hz-125V

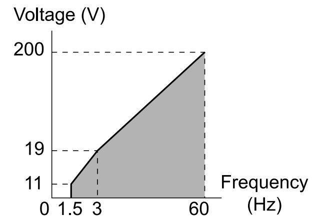
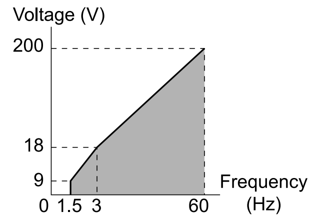
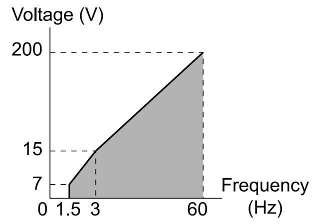
Use this pattern when moderate torque is necessary during start up.

Select this pattern only in these conditions:

- The wiring distance between the drive and motor is 150 m (492.1 ft.) minimum.
- There is an AC reactor connected to the drive output.

Note:

The voltage values in the figures are for 200 V class drives. Multiply the values by 2 for 400 V class drives.

<table>
<tr><th>HD: 4002 - 4012
ND: 4002 - 4009</th><th>HD: 4018 - 4103
ND: 4012 - 4089</th><th>HD: 4140 - 4675
ND: 4103 - 4675</th></tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</table>

B : HT_60Hz-165V

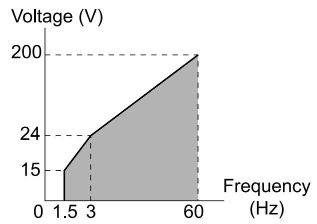
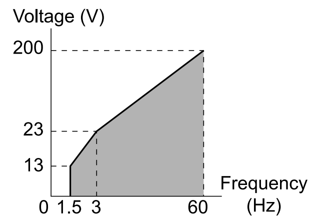
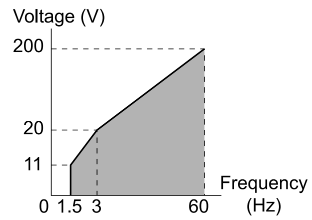
Use this pattern when high torque is necessary during start up.

Select this pattern only in these conditions:

- The wiring distance between the drive and motor is 150 m (492.1 ft.) minimum.
- There is an AC reactor connected to the drive output.

Note:

The voltage values in the figures are for 200 V class drives. Multiply the values by 2 for 400 V class drives.

<table>
<tr><th>HD: 4002 - 4012
ND: 4002 - 4009</th><th>HD: 4018 - 4103
ND: 4012 - 4089</th><th>HD: 4140 - 4675
ND: 4103 - 4675</th></tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</table>

C : HF_60-90Hzmax

Use this constant output pattern to rotate motors at more than 60 Hz. Output voltage is constant when you operate at more than 60 Hz.

Note:

The voltage values in the figures are for 200 V class drives. Multiply the values by 2 for 400 V class drives.

<table>
<tr><th>HD: 4002 - 4012
ND: 4002 - 4009</th><th>HD: 4018 - 4103
ND: 4012 - 4089</th><th>HD: 4140 - 4675
ND: 4103 - 4675</th></tr>
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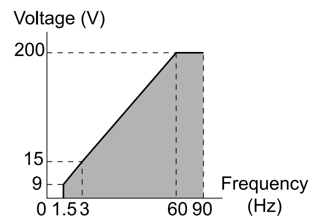
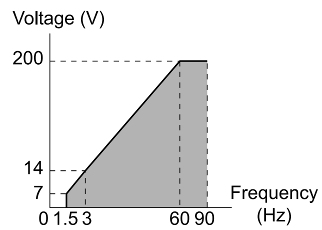
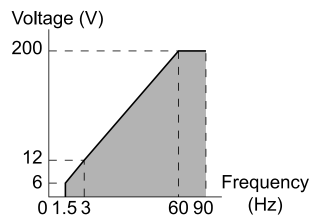
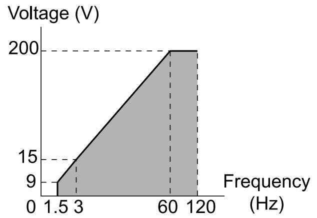
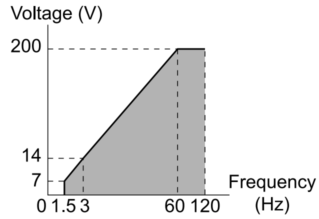
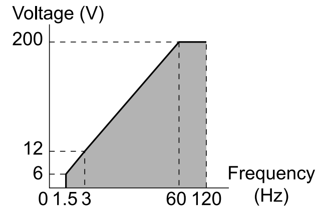
<td></td>
<td></td>
<td></td>
</tr>
</table>

D : HF_60-120Hzmax

Use this constant output pattern to rotate motors at more than 60 Hz. Output voltage is constant when you operate at more than 60 Hz.

Note:

The voltage values in the figures are for 200 V class drives. Multiply the values by 2 for 400 V class drives.

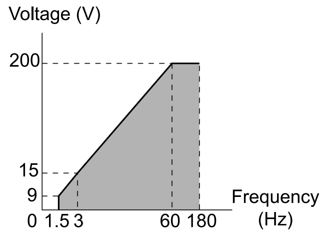
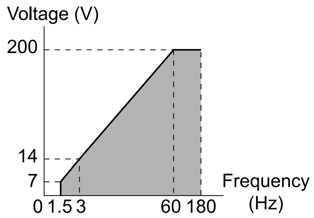
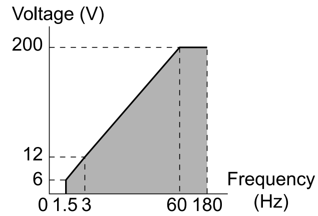
HD: 4002 - 4012 ND: 4002 - 4009	HD: 4018 - 4103 ND: 4012 - 4089	HD: 4140 - 4675 ND: 4103 - 4675
		

E : HF_60-180Hzmax

Use this constant output pattern to rotate motors at more than 60 Hz. Output voltage is constant when you operate at more than 60 Hz.

Note:

The voltage values in the figures are for 200 V class drives. Multiply the values by 2 for 400 V class drives.

HD: 4002 - 4012 ND: 4002 - 4009	HD: 4018 - 4103 ND: 4012 - 4089	HD: 4140 - 4675 ND: 4103 - 4675
		

F : (F) : Custom

Set *E1-04* to *E1-13 [Base Voltage]* to set the values for this custom pattern.

The default settings are the same as setting value *1 [CT_60-60Hzmax]*.

■ E1-04 Max Output Frequency

No. (Hex.)	Name	Description	Default (Range)
E1-04 (0303)	Max Output Frequency	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the maximum output frequency for the V/f pattern.	Determined by A1-02 and E5-01 (Determined by A1-02 and E5-01)

■ E1-05 Max Output Voltage

No. (Hex.)	Name	Description	Default (Range)
E1-05 (0304)	Max Output Voltage	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the maximum output voltage for the V/f pattern.	Determined by A1-02 (400 V Class: 0.0 - 510.0 V)

■ E1-06 Base Frequency

No. (Hex.)	Name	Description	Default (Range)
E1-06 (0305)	Base Frequency	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the base frequency for the V/f pattern.	Determined by A1-02 and E5-01 (0.0 - E1-04)

■ E1-07 Mid A Frequency

No. (Hex.)	Name	Description	Default (Range)
E1-07 (0306)	Mid A Frequency	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets a middle output frequency for the V/f pattern.	Determined by A1-02 (0.0 - E1-04)

■ E1-08 Mid A Voltage

No. (Hex.)	Name	Description	Default (Range)
E1-08 (0307)	Mid A Voltage	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets a middle output voltage for the V/f pattern.	Determined by A1-02 , C6-01 and o2-04 (400 V Class: 0.0 to 510.0 V)

Note:

Default setting is determined by *A1-02 [Control Method]*, *C6-01 [ND/HD Duty Selection]*, and *o2-04 [Drive KVA Selection]*.

■ E1-09 Min Output Frequency

No. (Hex.)	Name	Description	Default (Range)
E1-09 (0308)	Min Output Frequency	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the minimum output frequency for the V/f pattern.	Determined by A1-02 and E5-01 (Determined by A1-02, E1-04, and E5-01)

■ E1-10 Min Output Voltage

No. (Hex.)	Name	Description	Default (Range)
E1-10 (0309)	Min Output Voltage	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the minimum output voltage for the V/f pattern.	Determined by A1-02

■ E1-11 Mid B Frequency

No. (Hex.)	Name	Description	Default (Range)
E1-11 (030A) Expert	Mid B Frequency	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets a middle output frequency for the V/f pattern.	0.0 Hz (0.0 - E1-04)

Note:

Set this parameter to *0.0* to disable the function.

■ E1-12 Min Output Voltage

No. (Hex.)	Name	Description	Default (Range)
E1-12 (030B) Expert	Min Output Voltage	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets minimum output voltage for the V/f pattern.	0.0 V

Note:

Set this parameter to *0.0* to disable the function.

■ E1-13 Base Voltage

No. (Hex.)	Name	Description	Default (Range)
E1-13 (030C) Expert	Base Voltage	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the base voltage for the V/f pattern.	0.0 V

Note:

- The setting value of *E1-13 = E1-05 [Max Output Voltage]* after you do Auto-Tuning.
- When *E1-13 = 0.0*, use the value of *E1-05* to control the voltage.

◆ E2: MOTOR 1 PARAMETERS

E2 parameters are used to set induction motor data. To switch drive operation from one motor to another motor, configure the first motor (motor 1).

Performing Auto-Tuning automatically sets the *E2 parameters* to the optimal values. If Auto-Tuning cannot be performed, set the *E2 parameters* manually.

Parameter Details

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Note:

If *A1-02 [Control Method]* is set to the following control modes, the keypad does not display *E2-xx*.

- 5 [PM OLVector]
- 6 [PM AOLVector]
- 7 [PM CLVector]
- 8 [EZ Vector]

■ E2-01 Mot Rated Current (FLA)

No. (Hex.)	Name	Description	Default (Range)
E2-01 (030E)	Mot Rated Current (FLA)	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the motor rated current in amps.	Determined by o2-04 and C6-01 (10% to 200% of the drive rated current)

Note:

- If *E2-01 < E2-03 [Mot Rated Current (FLA) < Mot No-Load Current]* the drive will detect *oPE02 [Parameter Range Setting Error]*.
- The default settings and setting ranges are in these units:
  – 0.01 A: 4002 to 4023
  – 0.1 A: 4031 to 4675

The value set for *E2-01* becomes the reference value for motor protection, the torque limit, and torque control. Enter the motor rated current as written on the motor nameplate. The value of *E2-01* is automatically set to the value input for “Motor Rated Current” by the Auto-Tuning process.

■ E2-02 Mot Rated Slip

No. (Hex.)	Name	Description	Default (Range)
E2-02 (030F)	Mot Rated Slip	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets motor rated slip.	Determined by o2-04, C6-01 (0.000 - 20.000 Hz)

This parameter value becomes the base slip compensation value. The drive automatically sets this parameter during Auto-Tuning. When you cannot do Auto-Tuning, calculate the motor rated slip with the information on the motor nameplate and this formula:

E2-02 = f - (n × p) / 120

- f: Motor rated frequency (Hz)
- n: Rated motor speed (min^{-1} (r/min))
- p: Number of motor poles

■ E2-03 Mot No-Load Current

No. (Hex.)	Name	Description	Default (Range)
E2-03 (0310)	Mot No-Load Current	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the no-load current for the motor in amps when operating at the rated frequency and the no-load voltage.	Determined by o2-04 and C6-01 (0 to E2-01)

Note:

The default settings and setting ranges are in these units:

- 0.01 A: 4002 to 4023
- 0.1 A: 4031 to 4675

The drive automatically sets this parameter during Auto-Tuning. When you cannot do Auto-Tuning, you can also use the motor no-load current on the motor test report to enter this value manually. Contact the motor manufacturer to receive a copy of the motor test report.

Note:

The default setting of the no-load current is for operation with a 4-pole motor recommended by the manufacturer.

■ E2-04 Motor Pole Count

No. (Hex.)	Name	Description	Default (Range)
E2-04 (0311)	Motor Pole Count	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the number of motor poles.	4 (2 - 120)

Note:
- When *A1-02 = 0, 1, 3 [Control Method = V/f Control, PG V/f Control, CLVector]*, the maximum value is 120.
- When *A1-02 = 2, 4 [OLVector, Adv OLVector]*, the maximum value is 48.

Auto-Tuning automatically sets this parameter to the value of [Number of Motor Poles].

■ E2-05 Motor L-L Resistance

No. (Hex.)	Name	Description	Default (Range)
E2-05 (0312)	Motor L-L Resistance	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the line-to-line resistance for the motor stator windings.	Determined by o2-04 and C6-01 (0.000 - 65.000 Ω)

Note:
This value is the motor line-to-line resistance. Do not set this parameter with the single-phase resistance.

Auto-Tuning automatically sets this parameter. If you cannot do Auto-Tuning, use the test report from the motor manufacturer. You can calculate the motor line-to-line resistance with one of these formulas:

- E-type insulation: [the resistance value (Ω) shown on the test report at 75 °C] × 0.92
- B-type insulation: [the resistance value (Ω) shown on the test report at 75 °C] × 0.92
- F-type insulation: [the resistance value (Ω) shown on the test report at 115 °C] × 0.87

■ E2-06 Motor Leak Inductance

No. (Hex.)	Name	Description	Default (Range)
E2-06 (0313)	Motor Leak Inductance	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the voltage drop from motor leakage inductance when the motor is operating at the rated frequency and rated current. This value is a percentage of Motor Rated Voltage.	Determined by o2-04 and C6-01 (0.0 - 60.0%)

The drive automatically sets this parameter during Auto-Tuning.

Note:
The motor nameplate does not usually show the quantity of voltage drop. If you do not know the value of the motor leakage inductance, contact the motor manufacturer to receive a copy of the motor test report.

■ E2-07 Mot Sat Coeff 1

No. (Hex.)	Name	Description	Default (Range)
E2-07 (0314)	Mot Sat Coeff 1	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Set the motor iron-core saturation coefficient when the magnetic flux is 50%.	0.50 (0.00 - 0.50)

Rotational Auto-Tuning automatically sets this parameter. The drive uses this coefficient when it operates with constant output.

■ E2-08 Mot Sat Coeff 2

No. (Hex.)	Name	Description	Default (Range)
E2-08 (0315)	Mot Sat Coeff 2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the motor iron-core saturation coefficient at 75% of the magnetic flux.	0.75 (E2-07 - 0.75)

Rotational Auto-Tuning automatically sets this parameter. The drive uses this coefficient when it operates with constant output.

■ E2-09 Motor Mech Loss

No. (Hex.)	Name	Description	Default (Range)
E2-09 (0316) Expert	Motor Mech Loss	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the mechanical loss of the motor. Motor rated power (kw) = 100.0%. Usually it is not necessary to change this setting.	0.0% (0.0 - 10.0%)

Adjust this parameter in these conditions. The drive adds the configured mechanical loss to the torque reference value as a torque compensation value:

- There is a large quantity of torque loss from motor bearing friction.
- There is a large quantity of torque loss in fans and pumps.

■ E2-10 Motor Iron Loss

No. (Hex.)	Name	Description	Default (Range)
E2-10 (0317)	Motor Iron Loss	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the motor iron loss.	Determined by o2-04 and C6-01 (0 - 65535 W)

■ E2-11 Motor Rated Power (kW)

No. (Hex.)	Name	Description	Default (Range)
E2-11 (0318)	Motor Rated Power (kW)	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the motor rated output in 0.01 kW increments.	Determined by o2-04, C6-01 (0.00 - 650.00)

The drive automatically sets this parameter to the value input for "Motor Rated Power" during Auto-Tuning.

Note:
- When the maximum applicable motor output ≤ 300 kW, the drive uses 0.01 kW units.
- When the maximum applicable motor output > 300 kW, the drive uses 0.1 kW units.
- The maximum applicable motor output changes when the value for *C6-01 [ND/HD Duty Selection]* changes.

◆ E3: V/F PARAMETER MOTOR 2

E3 parameters set the control mode and V/f pattern used for motor 2.

Note:
V/f preset patterns equivalent to those set with *E1-03 [V/f Pattern Selection]* are not available for *E3 parameters*. Use *E3-04 [M2 Max Out Frequency]* to *E3-10 [Min Output Voltage]* to manually set the V/f pattern.

■ Notes on Manually Setting V/f Patterns

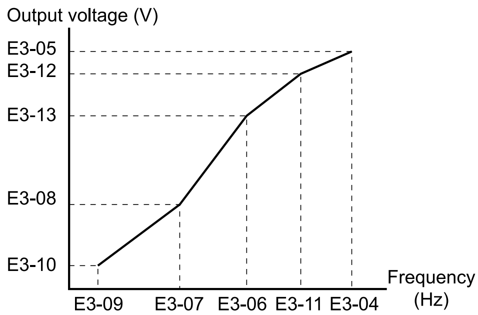


Figure 12.68 Motor 2 V/f Pattern Diagram

- To configure a linear V/f pattern at frequencies lower than *E3-06 [M2 Base Frequency]*, set *E3-07 = E3-09 [M2 Mid A Frequency = M2 Min Out Frequency]*. In this application, the drive ignores *E1-08 [Mid A Voltage]*.
- Set the five frequencies as specified by these rules:
  E3-09 ≤ E3-07 < E3-06 ≤ E3-11 ≤ E3-04 [M2 Min Out Frequency ≤ M2 Mid A Frequency < M2 Base Frequency ≤ M2 Mid B Frequency ≤ M2 Max Out Frequency]
  Incorrect settings will trigger *oPE10 [V/f Data Setting Error]*.
- If *E3-11 = 0.0 Hz*, the drive will ignore the V/f pattern settings.
- When you use *A1-03 [Init Parameters]* to initialize the drive, the drive will reset the manually set values for *E3-04 to E3-13 [M2 Max Out Frequency to M2 Base Voltage]* to default values.

■ E3-01 M2 Control Method Selection

No. (Hex.)	Name	Description	Default (Range)
E3-01 (0319)	M2 Control Method Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the control method for motor 2.	0 (0 - 3)

Note:
- When you change this setting, the drive will set all parameters that are dependent on this parameter to their default settings.
- Parameter *L1-01 [Motor Cool Type for OL1 Calc]* sets the protection operation of *oL1 [Motor Overload]* the same as Motor 1.
- When you use parameter *A1-03 [Init Parameters]* to initialize the drive, this parameter is not reset.

0 : V/f Control

1 : PG V/f Control

2 : OLVector

3 : CLVector

■ E3-04 M2 Max Out Frequency

No. (Hex.)	Name	Description	Default (Range)
E3-04 (031A)	M2 Max Out Frequency	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Set the maximum output frequency for the motor 2 V/f pattern.	Determined by E3-01 (40.0 - 590.0 Hz)

■ E3-05 M2 Max Out Voltage

No. (Hex.)	Name	Description	Default (Range)
E3-05 (031B)	M2 Max Out Voltage	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the maximum output voltage for the motor 2 V/f pattern.	Determined by E3-01 (400 V Class: 0.0 - 510.0 V)

■ E3-06 M2 Base Frequency

No. (Hex.)	Name	Description	Default (Range)
E3-06 (031C)	M2 Base Frequency	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the base frequency for the motor 2 V/f pattern.	Determined by E3-01 (0.0 - E3-04)

■ E3-07 M2 Mid A Frequency

No. (Hex.)	Name	Description	Default (Range)
E3-07 (031D)	M2 Mid A Frequency	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets a middle output frequency for the motor 2 V/f pattern.	Determined by E3-01 (0.0 - E3-04)

■ E3-08 M2 Mid A Voltage

No. (Hex.)	Name	Description	Default (Range)
E3-08 (031E)	M2 Mid A Voltage	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets a middle output voltage for the motor 2 V/f pattern.	Determined by E3-01 (400 V Class: 0.0 - 510.0 V)

■ E3-09 M2 Min Out Frequency

No. (Hex.)	Name	Description	Default (Range)
E3-09 (031F)	M2 Min Out Frequency	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the minimum output frequency for the motor 2 V/f pattern.	Determined by E3-01 (0.0 - E3-04)

■ E3-10 M2 Min Out Voltage

No. (Hex.)	Name	Description	Default (Range)
E3-10 (0320)	M2 Min Out Voltage	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the minimum output voltage for the motor 2 V/f pattern.	Determined by E3-01 (400 V Class: 0.0 - 510.0 V)

■ E3-11 M2 Mid B Frequency

No. (Hex.)	Name	Description	Default (Range)
E3-11 (0345) Expert	M2 Mid B Frequency	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets a middle output frequency for the motor 2 V/f pattern. Set this parameter to adjust the V/f pattern for the constant output range. Usually it is not necessary to change this setting.	0.0 Hz (0.0 - E3-04)

Note:
- Set this parameter to *0.0* to disable the function.
- When you initialize the drive, this parameter is reset to the default value.

■ E3-12 M2 Min Out Voltage

No. (Hex.)	Name	Description	Default (Range)
E3-12 (0346) Expert	M2 Min Out Voltage	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets a middle output voltage for the motor 2 V/f pattern. Set this parameter to adjust the V/f pattern for the constant output range. Usually it is not necessary to change this setting.	0.0 V (400 V Class: 0.0 - 510.0 V)

Note:
- Set this parameter to *0.0* to disable the function.
- When you initialize the drive, this parameter is reset to the default value.
- The setting value changes automatically when you do Auto-Tuning (rotational and stationary 1 or 2).

■ E3-13 M2 Base Voltage

No. (Hex.)	Name	Description	Default (Range)
E3-13 (0347) Expert	M2 Base Voltage	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the base voltage for the motor 2 V/f pattern. Set this parameter to adjust the V/f pattern for the constant output range. Usually it is not necessary to change this setting.	0.0 V (400 V Class: 0.0 - 510.0 V)

Note:
- When you initialize the drive, this parameter is reset to the default value.
- The setting value changes automatically when you do Auto-Tuning (rotational and stationary 1 or 2).

◆ E4: MOTOR 2 PARAMETERS

E4 parameters set induction motor data. To switch drive operation from one motor to a different motor, configure motor 2.

Auto-Tuning automatically sets the *E4 parameters* to the best values for the application. If you cannot do Auto-Tuning, set the *E4 parameters* manually.

Note:

E3-xx and *E4-xx* are available when *H1-xx = 61 [DI Function Select = Motor 2 Select]*.

■ E4-01 M2 Rated Current (FLA)

No. (Hex.)	Name	Description	Default (Range)
E4-01 (0321)	M2 Rated Current (FLA)	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the motor rated current for motor 2 in amps.	Determined by o2-04 and C6-01 (10% to 200% of the drive rated current)

Note:
- If *E4-01 ≤ E4-03 [M2 No-Load Current]*, the drive will detect *oPE02 [Parameter Range Setting Error]* will be detected.
- The default settings and setting ranges are in these units:
  - 0.01 A: 4002 to 4023
  - 0.1 A: 4031 to 4675

The value set for *E4-01* becomes the reference value for motor protection, the torque limit, and torque control. Enter the motor rated current written on the motor nameplate. Auto-Tuning automatically sets the value of *E4-01* to the value input for [Motor Rated Current].

■ E4-02 M2 Rated Slip

No. (Hex.)	Name	Description	Default (Range)
E4-02 (0322)	M2 Rated Slip	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the motor rated slip for motor 2.	Determined by o2-04 and C6-01 (0.000 - 20.000 Hz)

The value set in *E4-02* becomes the base slip compensation value. The drive sets this parameter during Rotational Auto-Tuning and Stationary Auto-Tuning. If you cannot do Auto-Tuning, use the information written on the motor nameplate and this formula to calculate the motor rated slip:

E4-02 = f - (n × p) / 120

- f: Motor rated frequency (Hz)
- n: Rated motor speed (min^{-1} (r/min))
- p: Number of motor poles

■ E4-03 M2 No-Load Current

No. (Hex.)	Name	Description	Default (Range)
E4-03 (0323)	M2 No-Load Current	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the no-load current for motor 2 in amps when operating at the rated frequency and the no-load voltage.	Determined by o2-04 and C6-01 (0 to E4-01)

Note:

The default settings and setting ranges are in these units:
- 0.01 A: 4002 to 4023
- 0.1 A: 4031 to 4675

The drive sets this parameter during Rotational Auto-Tuning and Stationary Auto-Tuning. You can also enter the motor no-load current shown on the motor test report to *E4-03* manually. Contact the motor manufacturer to receive a copy of the motor test report.

Note:

The default setting of the no-load current is for a 4-pole motor recommended by the manufacturer.

■ E4-04 M2 Pole Count

No. (Hex.)	Name	Description	Default (Range)
E4-04 (0324)	M2 Pole Count	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the number of poles for motor 2.	4 (2 - 120)

Auto-Tuning automatically sets *E4-04* to the value input for [Number of Motor Poles].

■ E4-05 M2 L-L Resistance

No. (Hex.)	Name	Description	Default (Range)
E4-05 (0325)	M2 L-L Resistance	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the line-to-line resistance for the motor 2 stator windings.	Determined by o2-04 and C6-01 (0.000 - 65.000 Ω)

Note:

This value is the line-to-line resistance for motor 2. Do not use the single-phase resistance to set this parameter.

The drive automatically calculates this value when Auto-Tuning completes successfully. If you cannot do Auto-Tuning, get the test report from the motor manufacturer. To calculate the motor line-to-line resistance, use the information shown on the motor nameplate with one of these formulas:

- E-type insulation: the resistance value (Ω) shown on the test report at 75 °C × 0.92
- B-type insulation: the resistance value (Ω) shown on the test report at 75 °C × 0.92
- F-type insulation: the resistance value (Ω) shown on the test report at 115 °C × 0.87

■ E4-06 M2 Leak Inductance

No. (Hex.)	Name	Description	Default (Range)
E4-06 (0326)	M2 Leak Inductance	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the voltage drop from motor 2 leakage inductance as a percentage of Motor Rated Voltage when motor 2 operates at the rated frequency and rated current.	Determined by o2-04, C6-01 (0.0 - 60.0%)

The drive sets this parameter during Rotational Auto-Tuning and Stationary Auto-Tuning.

Note:

You cannot usually find the quantity of voltage drop on the motor nameplate. If you do not know the value of the motor 2 leakage inductance, get the test report from the motor manufacturer.

■ E4-07 M2 Satur Coeff 1

No. (Hex.)	Name	Description	Default (Range)
E4-07 (0343)	M2 Satur Coeff 1	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the motor 2 iron-core saturation coefficient at 50% of the magnetic flux.	0.50 (0.00 - 0.50)

The drive sets this parameter during Rotational Auto-Tuning. The drive uses this coefficient when it operates with constant output.

■ E4-08 M2 Satur Coeff 2

No. (Hex.)	Name	Description	Default (Range)
E4-08 (0344)	M2 Satur Coeff 2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the motor 2 iron-core saturation coefficient at 75% of the magnetic flux.	0.75 (E4-07 - 0.75)

The drive sets this parameter during Rotational Auto-Tuning. The drive uses this value to operate the motor at constant output.

■ E4-09 M2 Mech Loss

No. (Hex.)	Name	Description	Default (Range)
E4-09 (033F) Expert	M2 Mech Loss	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the mechanical loss of motor 2. Motor rated power (kW) is 100%. Usually it is not necessary to change this setting.	0.0% (0.0 - 10.0%)

Adjust this parameter in these conditions. The drive adds the configured mechanical loss to the torque reference value as a torque compensation value:

- There is a large quantity of torque loss from motor bearing friction.
- There is a large quantity of torque loss in fans and pumps.

■ E4-10 M2 Iron Loss

No. (Hex.)	Name	Description	Default (Range)
E4-10 (0340)	M2 Iron Loss	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the motor iron loss for motor 2.	Determined by o2-04 and C6-01 (0 - 65535 W)

■ E4-11 M2 Rated Power (kW)

No. (Hex.)	Name	Description	Default (Range)
E4-11 (0327)	M2 Rated Power (kW)	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the motor 2 rated power in 0.01 kW increments (1 HP = 0.746 kW).	Determined by o2-04 and C6-01 (0.00 - 650.00 kW)

Auto-Tuning automatically sets this parameter to the value input for [Motor Rated Power].

Note:

When the maximum applicable motor output < 300 kW, the drive uses 0.01 kW units. When the maximum applicable motor output > 300 kW, the drive uses 0.1 kW units.

The maximum applicable motor output changes when the value for *C6-01 [ND/HD Duty Selection]* changes.

◆ E5: PM MOTOR SETTINGS

E5 parameters are used to set PM motor data.

Set *E5-01* to the motor code when using PM motors recommended by the manufacturer. *E5* and other related motor parameters will be automatically set to the optimal values.

Perform Auto-Tuning for all other PM motors. If information from motor nameplates or test reports is available, the *E5 parameters* can be manually entered.

Note:

- The keypad displays *E5-xx* only when *A1-02 = 5, 6, 7 [Control Method = PM OLVector, PM AOLVector, PM CLVector]*.
- *E5-xx parameters* are not reset when the drive is initialized using parameter *A1-03 [Init Parameters]*.

■ E5-01 PM Mot Code Selection

No. (Hex.)	Name	Description	Default (Range)
E5-01 (0329)	PM Mot Code Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the motor code for Yaskawa PM motors. The drive uses the motor code to set some parameters to their correct settings automatically.	Determined by A1-02, o2-04, and C6-01 (0000 - FFFF)

Note:
- If the drive hunts or shows an alarm after you use a motor code, use the keypad to enter the value shown on the nameplate to *E5-xx*.
- When you use a PM motor other than a Yaskawa SMRA, SSR1, or SST4 series, set *E5-01 = FFFF*.

Figure 12.69 gives information about the motor code setting digits.

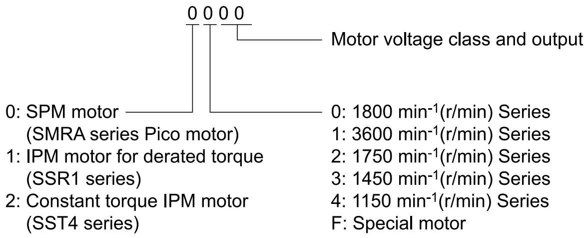


Figure 12.69 PM Motor Code

■ E5-02 PM Mot Rated Power (kW)

No. (Hex.)	Name	Description	Default (Range)
E5-02 (032A)	PM Mot Rated Power (kW)	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the PM motor rated power.	Determined by E5-01 (0.10 - 650.00 kW)

These types of Auto-Tuning will automatically set this parameter:

- PM Motor Parameter Settings
- PM Stationary Auto-Tuning
- PM Rotational Auto-Tuning

■ E5-03 PM Mot Rated Current (FLA)

No. (Hex.)	Name	Description	Default (Range)
E5-03 (032B)	PM Mot Rated Current (FLA)	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the PM motor rated current (FLA).	Determined by E5-01 (10% to 200% of the drive rated current)

Note:

When the drive model changes, the display units for this parameter also change.
- 0.01 A: 4002 to 4023
- 0.1 A: 4031 to 4675

The drive automatically sets *E5-03* to the value input for “PM Motor Rated Current” after you do these types of Auto-Tuning:

- PM Motor Parameter Settings
- PM Stationary Auto-Tuning
- PM StaTun for Stator Resistance
- PM Rotational Auto-Tuning

■ E5-04 PM Mot Pole Count

No. (Hex.)	Name	Description	Default (Range)
E5-04 (032C)	PM Mot Pole Count	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the number of PM motor poles.	Determined by E5-01 (2 - 120)

Note:
- When *A1-02 = 7 [Control Method = PM CLVector]*, the maximum value is 120.
- When *A1-02 = 5, 6 or 8 [PM OLVector, PM AOLVector or EZ Vector]*, the maximum value is 48.

These types of Auto-Tuning will automatically set this parameter to the value of [Number of Motor Poles]:

- PM Motor Parameter Settings
- PM Stationary Auto-Tuning
- PM Rotational Auto-Tuning

■ E5-05 PM Mot Resistance (Ohms/Phase)

No. (Hex.)	Name	Description	Default (Range)
E5-05 (032D)	PM Mot Resistance (Ohms/ Phase)	V/f CL-V/f OLV CLV AOLV **OLV/PM** **AOLV/PM** **CLV/PM** EZOLV Sets the resistance per phase of the PM motors. Set 50% of the line-to-line resistance.	Determined by E5-01 (0.000 - 65.000 Ω)

PM motor Auto-Tuning automatically sets this parameter to the value of [PM Motor Stator Resistance].

Note:

Do not change the setting calculated by Auto-Tuning unless it is necessary.

■ E5-06 PM d-Axis Inductance (mH/Phase)

No. (Hex.)	Name	Description	Default (Range)
E5-06 (032E)	PM d-Axis Inductance (mH/Phase)	V/f CL-V/f OLV CLV AOLV **OLV/PM** **AOLV/PM** **CLV/PM** EZOLV Sets the PM motor d-axis inductance.	Determined by E5-01 (0.00 - 300.00 mH)

PM motor Auto-Tuning automatically sets this parameter to the value of [PM Motor d-Axis Inductance].

Note:

Do not change the setting calculated by Auto-Tuning unless it is necessary.

■ E5-07 PM q-Axis Inductance (mH/Phase)

No. (Hex.)	Name	Description	Default (Range)
E5-07 (032F)	PM q-Axis Inductance (mH/Phase)	V/f CL-V/f OLV CLV AOLV **OLV/PM** **AOLV/PM** **CLV/PM** EZOLV Sets the PM motor q-axis inductance.	Determined by E5-01 (0.00 - 600.00 mH)

PM motor Auto-Tuning automatically sets this parameter to the value of [PM Motor q-Axis Inductance].

Note:

Do not change the setting calculated by Auto-Tuning unless it is necessary.

■ E5-09 PM BackEMF Vpeak (mV/(rad/ s))

No. (Hex.)	Name	Description	Default (Range)
E5-09 (0331)	PM BackEMF Vpeak (mV/ (rad/ s))	V/f CL-V/f OLV CLV AOLV **OLV/PM** **AOLV/PM** **CLV/PM** EZOLV Sets the peak value of PM motor induced voltage.	Determined by E5-01 (0.0 - 2000.0 mV/(rad/s))

Set this parameter when you use an IPM motor with derated torque (SSR1-series) or an IPM motor with constant torque (SST4-series).

PM motor Auto-Tuning automatically sets this parameter to the value of [Back-EMF Voltage Constant (Ke)].

When *E5-01 = FFFF*, only set *E5-09* or *E5-24 [PM BackEMF L-L Vrms (mV/rpm)]* as the induced voltage constant.

Note:

When you set this parameter, also set *E5-24 = 0.0*. The drive will detect *oPE08 [Parameter Selection Error]* in these conditions:

- *E5-09 = 0.0* and *E5-24 = 0.0*
- *E5-09 ≠ 0.0* and *E5-24 ≠ 0.0*

■ E5-11 Enc ZPulse Offset

No. (Hex.)	Name	Description	Default (Range)
E5-11 (0333)	Enc ZPulse Offset	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM **CLV/PM** EZOLV Sets the encoder Z-pulse offset.	0.0 degrees (-180.0 - +180.0 degrees)

The drive uses the PM motor parameter settings and PM Stationary Auto-Tuning to set *E5-11* to the value input for "Encoder Z-Pulse Offset" automatically. The drive uses Z Pulse Offset Tuning or the Rotational Auto-Tuning to set *E5-11*.

■ E5-24 PM BackEMF L-L Vrms (mV/rpm)

No. (Hex.)	Name	Description	Default (Range)
E5-24 (0353)	PM BackEMF L-L Vrms (mV/rpm)	V/f CL-V/f OLV CLV AOLV **OLV/PM** **AOLV/PM** **CLV/PM** EZOLV Sets the RMS value for PM motor line voltage.	Determined by E5-01 (0.0 - 6500.0 mV/min^{-1})

Set this parameter when you use an SPM motor (e.g. SMRA-Series Pico motor).

PM motor Auto-Tuning automatically sets this parameter to the value of [Back-EMF Voltage Constant (Ke)].

When *E5-01 = FFFF*, only set *E5-09 [PM BackEMF Vpeak (mV/(rad/ s))]* or *E5-24* as the induced voltage constant.

Note:

When you set this parameter, also set *E5-09 = 0.0*. The drive will detect *oPE08 [Parameter Selection Error]* in these conditions:

- *E5-09 = 0.0* and *E5-24 = 0.0*
- *E5-09 ≠ 0.0* and *E5-24 ≠ 0.0*

■ E5-25 Polar Est Timeout

No. (Hex.)	Name	Description	Default (Range)
E5-25 (035E) Expert	Polar Est Timeout	V/f CL-V/f OLV CLV AOLV **OLV/PM** **AOLV/PM** **CLV/PM** EZOLV Sets the function that switches polarity for initial polarity estimation. Usually it is not necessary to change this setting.	0 (0, 1)

When "Sd = 1" is shown on the motor nameplate or test report for Yaskawa motors, set this parameter to *1*.

0 : Disabled

1 : Enabled

◆ E9: SIMPLE VECTOR SETTINGS

E9 parameters are used to configure induction motors, PM motors, and SynRM motors. Configure these parameters only for derating torque applications in which a high level of responsiveness and accurate speed control are not required.

E9 parameters are automatically configured with values input by the Auto-Tuning process for motor parameter settings. *E9 parameters* can be manually configured when the EZ Tuning process cannot be performed.

■ E9-01 Motor Type Selection

No. (Hex.)	Name	Description	Default (Range)
E9-01 (11E4)	Motor Type Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM **EZOLV** Sets the type of motor.	0 (0 - 2)

EZ Tuning automatically sets this parameter to the value of [Motor Type Selection].

0 : IM (Induction)

1 : PM (Permanent Magnet)

2 : SynRM (Synchronous Reluctance)

■ E9-02 Maximum Speed

No. (Hex.)	Name	Description	Default (Range)
E9-02 (11E5)	Maximum Speed	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM **EZOLV** Sets the maximum speed of the motor.	Determined by E9-01 (40.0 - 120.0 Hz)

Note:

The unit of measure changes when the setting of *o1-04 [V/f Pattern Unit for Display]*.

EZ Tuning automatically sets this parameter to the value of [Motor Max Revolutions].

E9-03 Rated Speed

No. (Hex.)	Name	Description	Default (Range)
E9-03 (11E6)	Rated Speed	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the rated rotation speed of the motor.	Determined by E9-01 (100 - 7200 min^{-1})

EZ Tuning automatically sets this parameter to the value of [Rated Speed].

Note:

Set *E9-01 = 0 [Motor Type Selection = IM]* before you set this parameter.

E9-04 Base Frequency

No. (Hex.)	Name	Description	Default (Range)
E9-04 (11E7)	Base Frequency	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the rated frequency of the motor.	Determined by E9-01 (40.0 - 120.0 Hz)

Note:

The unit of measure changes when the setting of *o1-04 [V/f Pattern Unit for Display]*.

EZ Tuning automatically sets this parameter to the value of [Base Frequency].

E9-05 Base Voltage

No. (Hex.)	Name	Description	Default (Range)
E9-05 (11E8)	Base Voltage	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the rated voltage of the motor.	Determined by E9-01 (400 V Class: 0.0 to 510.0 V)

EZ Tuning automatically sets this parameter to the value of [Base Voltage].

E9-06 Motor Rated Current

No. (Hex.)	Name	Description	Default (Range)
E9-06 (11E9)	Motor Rated Current	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the motor rated current in amps.	Determined by E9-01 and o2-04 (10% to 200% of the drive rated current)

Note:

When the drive model changes, the display units for this parameter also change.

- 0.01 A: 4002 to 4023
- 0.1 A: 4031 to 4675

The setting value of *E9-06* is the reference value for motor protection. Enter the motor rated current shown on the motor nameplate. Auto-Tuning the drive will automatically set *E9-06* to the value input for “Motor Rated Current”.

E9-07 Motor Rated Power (kW)

No. (Hex.)	Name	Description	Default (Range)
E9-07 (11EA)	Motor Rated Power (kW)	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the motor rated power in 0.01 kW increments (1 HP = 0.746 kW).	Determined by E9-02 and o2-04 (0.00 - 650.00 kW)

Auto-Tuning automatically sets this parameter to the value of [Motor Rated Power (kW)].

Note:

When the maximum applicable motor output larger than 300 kW, the parameter value is in 0.1 kW units.

E9-08 Motor Pole Count

No. (Hex.)	Name	Description	Default (Range)
E9-08 (11EB)	Motor Pole Count	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the number of motor poles.	4 (2 - 120)

Auto-Tuning automatically sets this parameter to the value of [Number of Motor Poles].

■ E9-09 Motor Rated Slip

No. (Hex.)	Name	Description	Default (Range)
E9-09 (11EC)	Motor Rated Slip	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the motor rated slip.	0.0 Hz (0.0 - 20.0 Hz)

The setting value of this parameter is the slip compensation reference value.

The drive uses the setting values of *E9-03*, *E9-04*, and *E9-08* to calculate this parameter. When Motor Rated Slip = 0, Auto-Tuning automatically sets this parameter to the value of [Motor Rated Slip].

Note:

Set *E9-01 = 0 [Motor Type Selection = IM (Induction)]* before you set this parameter.

■ E9-10 Motor L-L Resistance

No. (Hex.)	Name	Description	Default (Range)
E9-10 (11ED)	Motor L-L Resistance	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the line-to-line resistance for the motor stator windings.	Determined by o2-04 (0.000 - 65.000 Ω)

Note:

This value is the motor line-to-line resistance. Do not set this parameter with the single-phase resistance.

Stationary Auto-Tuning automatically sets this parameter. If you cannot do Stationary Auto-Tuning, use the test report from the motor manufacturer. You can calculate the motor line-to-line resistance with one of these formulas:

- E-type insulation: [the resistance value (Ω) shown on the test report at 75 °C] × 0.92
- B-type insulation: [the resistance value (Ω) shown on the test report at 75 °C] × 0.92
- F-type insulation: [the resistance value (Ω) shown on the test report at 115 °C] × 0.87

12.6 F: OPTIONS

F parameters are used to set option cards, which function as interfaces for encoders, analog I/O, digital I/O, and fieldbus communication.

◆ F1: ENCODER

F1 parameters are used to set the operation of and protective function for the encoder option card. The following table lists the setting parameters available for each option card.

Refer to the instruction manual packaged with the encoder option card for more information on installing, wiring, and setting the encoder option cards.

WARNING! *Sudden Movement Hazard. Do test runs and examine the drive to make sure that command references are configured correctly. If you set the command reference incorrectly, it can cause death, serious injury, or equipment damage from unwanted motor rotation.*

WARNING! *Sudden Movement Hazard. Conduct proper host controller safety design to prevent motors from running uncontrolled when there is a loss of speed feedback. The motor has a potential to run uncontrolled.*

Table 12.29 Encoder Option Card Setting Parameters

Setting Parameter	Encoder Option Card			
	PG-B3	PG-X3	PG-F3	PG-RT3
F1-01	x	x	x	-
F1-02	x	x	x	x
F1-03	x	x	x	x
F1-04	x	x	x	x
F1-05	x	x	x	x
F1-06	x	x	x	-
F1-08	x	x	x	x
F1-09	x	x	x	x
F1-10	x	x	x	x
F1-11	x	x	x	x
F1-12 *1	x	x	-	-
F1-13 *1	x	x	-	-
F1-14	x	x	x	x
F1-18	x	x	x	x
F1-19	x	x	x	x
F1-20	-	x	x	-
F1-21	x	x	-	-
F1-30	x	x	-	-
F1-31 *2	x	x	-	-
F1-32 *2	x	x	-	-
F1-33 *1 *2	x	x	-	-
F1-34 *1 *2	x	x	-	-
F1-35 *2	x	x	-	-
F1-36	-	x	-	-
F1-37 *2	x	x	-	-
F1-50	-	-	x	-
F1-51	-	-	x	-
F1-52	-	-	x	-
Number of cards that can be installed in a drive	2	2	1	1

*1 Parameters set when using the Closed Loop V/f Control method.
*2 Parameters to set an option card connected to CN5-B.

F1-01 Enc1 Pulse Count (PPR)

No. (Hex.)	Name	Description	Default (Range)
F1-01 (0380)	Enc1 Pulse Count (PPR)	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the number of output pulses for each motor revolution.	1024 ppr (1 - 60000 ppr)

F1-02 PGOpen Detection Select

No. (Hex.)	Name	Description	Default (Range)
F1-02 (0381)	PGOpen Detection Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the method to stop the motor or let the motor continue operating when the drive detects a *PGo [Encoder (PG) Feedback Loss]*.	1 (0 - 4)

When the drive does not detect ouput pulses from the encoder for the time set in *F1-14 [Enc PGOpen Time for Detection]*, it will trigger *PGo*.

Note:
- Motor speed and load conditions can cause *ov [Overvoltage]* and *oC [Overcurrent]* faults.
- In AOLV control, set *n4-72 = 2 [Spd Fbk Mode = With PG]*.

0 : Ramp->Stop

The drive ramps to stop in the set deceleration time. Fault relay output terminal 1NO-1CM activates and terminal 1NC-1CM deactivates.

1 : Coast->Stop

The drive output shuts off and the motor coasts to stop. Fault relay output terminal 1NO-1CM activates and terminal 1NC-1CM deactivates.

2 : Fast Stop (C1-09)

The drive stops the motor in the deceleration time set in *C1-09 [Fast Stop Time]*. Fault relay output terminal 1NO-1CM activates and terminal 1NC-1CM deactivates.

3 : Alarm Only

The keypad shows *PGo* and the drive continues operation. Only use this setting in special conditions to prevent damage to the motor and machinery. The output terminal set for *Alarm [H2-01 to H2-03 = 4]* activates.

4 : No Alarm Display

The drive continues operation and does not show *PGo* on the keypad. Only use this setting in special conditions to prevent damage to the motor and machinery.

F1-03 Overspeed Detection Selection

No. (Hex.)	Name	Description	Default (Range)
F1-03 (0382)	Overspeed Detection Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the method to stop the motor or let the motor continue operating when the drive detects a *oS [Overspeed]*.	1 (0 - 3)

When the motor speed is more than the value set in *F1-08 [Overspeed Level]* for longer than the time set in *F1-09 [Overspeed Delay Time]* trigger *oS*.

0 : Ramp->Stop

The drive ramps to stop in the set deceleration time. Fault relay output terminal 1NO-1CM activates and terminal 1NC-1CM deactivates.

1 : Coast->Stop

The drive output shuts off and the motor coasts to stop. Fault relay output terminal 1NO-1CM activates and terminal 1NC-1CM deactivates.

2 : Fast Stop (C1-09)

The drive stops the motor in the deceleration time set in *C1-09 [Fast Stop Time]*. Fault relay output terminal 1NO-1CM activates and terminal 1NC-1CM deactivates.

3 : Alarm Only

The keypad shows *oS* and the drive continues operation. Only use this setting in special conditions to prevent damage to the motor and machinery. The output terminal set for *Alarm [H2-01 to H2-03 = 4]* activates.

Note:

When *A1-02 = 6 [Control Method = PM AOLVector]*, the drive will automatically set *F1-03 = 1 [Coast->Stop]*. You cannot change this value.

■ F1-04 Speed Dev Detection Select

No. (Hex.)	Name	Description	Default (Range)
F1-04 (0383)	Speed Dev Detection Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the method to stop the motor or let the motor continue operating when the drive detects a *dEv [Speed Deviation]*.	3 (0 - 3)

When the difference between the frequency reference and the motor speed is more than the value set in *F1-10 [Speed Dev Level]* for longer than the time set in *F1-11 [Speed Dev Delay Time]*, it will trigger *dEv*.

0 : Ramp->Stop

The drive ramps to stop in the set deceleration time. Fault relay output terminal 1NO-1CM activates and terminal 1NC-1CM deactivates.

1 : Coast->Stop

The drive output shuts off and the motor coasts to stop. Fault relay output terminal 1NO-1CM activates and terminal 1NC-1CM deactivates.

2 : Fast Stop (C1-09)

The drive stops the motor in the deceleration time set in *C1-09 [Fast Stop Time]*. Fault relay output terminal 1NO-1CM activates and terminal 1NC-1CM deactivates.

3 : Alarm Only

The keypad shows *dEv* and the drive continues operation. Only use this setting in special conditions to prevent damage to the motor and machinery. The output terminal set for *Alarm [H2-01 to H2-03 = 4]* activates.

■ F1-05 Enc1 Rotat Selection

No. (Hex.)	Name	Description	Default (Range)
F1-05 (0384)	Enc1 Rotat Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the output sequence for the A and B pulses from the encoder, assuming that the motor is operating in the forward direction.	Determined by A1-02 (0, 1)

Refer to the option card installation manual for more information about how to set the encoder pulse output sequence and make sure that it is correct.

0 : A Leads in FWD Direction

1 : B Leads in FWD Direction

■ F1-06 Enc1 Pulse Scaling for Monitor

No. (Hex.)	Name	Description	Default (Range)
F1-06 (0385)	Enc1 Pulse Scaling for Monitor	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the ratio between the pulse input and the pulse output of the encoder as a 3-digit number. The first digit is the numerator and the second and third digits set the denominator.	001 (001 - 032, 102 - 132 (1 - 1/32))

When the setting value is a 3-digit value (xyz), the dividing ratio is (1 + x)/yz

For example, when *F1-06 = 032*, the dividing ratio is 1/32.

Note:

When you use a single-pulse encoder, the dividing ratio for the monitor signal is 1:1

■ F1-08 Overspeed Level

No. (Hex.)	Name	Description	Default (Range)
F1-08 (0387)	Overspeed Level	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the detection level of *oS [Overspeed]* as a percentage when the maximum output frequency is 100%.	115% (0 - 120%)

When the motor speed is more than the value set in *F1-08* for longer than the time set in *F1-09 [Overspeed Delay Time]*, the drive will detect *oS*.

F1-09 Overspeed Delay Time

No. (Hex.)	Name	Description	Default (Range)
F1-09 (0388)	Overspeed Delay Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the length of time that the speed feedback must be more than the *F1-08* level to cause an *oS [Overspeed]*.	Determined by A1-02 (0.0 - 2.0 s)

When the motor speed is more than the value set in *F1-08 [Overspeed Level]* for longer than the time set in *F1-09*, the drive will detect *oS*.

F1-10 Speed Dev Level

No. (Hex.)	Name	Description	Default (Range)
F1-10 (0389)	Speed Dev Level	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the detection level of *dEv [Speed Deviation]* as a percentage when the maximum output frequency is 100%.	10% (0 - 50%)

When the speed deviation between the frequency reference and the actual motor speed is more than the value set in *F1-10* for longer than the time set in *F1-11 [Speed Dev Delay Time]*, the drive will detect *dEv*.

F1-11 Speed Dev Delay Time

No. (Hex.)	Name	Description	Default (Range)
F1-11 (038A)	Speed Dev Delay Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the length of time that the difference between the frequency reference and speed feedback must be more than the level in *F1-10* to cause a *dEv [Speed Deviation]*.	0.5 s (0.0 - 10.0 s)

When the speed deviation between the frequency reference and the actual motor speed is more than the value set in *F1-10 [Speed Dev Level]* for longer than the time set in *F1-11*, the drive will detect *dEv*.

F1-12 Enc1 Gear Teeth1

No. (Hex.)	Name	Description	Default (Range)
F1-12 (038B)	Enc1 Gear Teeth1	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the number of gear teeth on the motor side. This parameter and *F1-13 [Enc1 Gear Teeth2]* set the gear ratio between the motor and encoder.	0 (0 - 1000)

After you set the number of gear teeth, the drive uses this formula to calculate the motor speed:

$$\text{Motor speed (min}^{-1}\text{ or r/min)} = \frac{\text{Number of pulses from the encoder} \times 60}{\text{F1-01}} \times \frac{\text{F1-13}}{\text{F1-12}}$$

Note:

When *F1-12 = 0* or *F1-13 = 0*, the gear ratio is 1.

F1-13 Enc1 Gear Teeth2

No. (Hex.)	Name	Description	Default (Range)
F1-13 (038C)	Enc1 Gear Teeth2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the number of gear teeth on the load side. This parameter and *F1-12 [Enc1 Gear Teeth1]* set the gear ratio between the motor and encoder.	0 (0 - 1000)

After you set the number of gear teeth, the drive uses this formula to calculate the motor speed:

$$\text{Motor speed (min}^{-1}\text{ or r/min)} = \frac{\text{Number of pulses from the encoder} \times 60}{\text{F1-01}} \times \frac{\text{F1-13}}{\text{F1-12}}$$

Note:

When *F1-12 = 0* or *F1-13 = 0*, the gear ratio is 1.

F1-14 Enc PGOpen Time for Detection

No. (Hex.)	Name	Description	Default (Range)
F1-14 (038D)	Enc PGOpen Time for Detection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the length of time that the drive must not receive a pulse signal to cause a *PGo [Encoder (PG) Feedback Loss]*.	2.0 s (0.0 - 10.0 s)

If the drive does not detect output pulses from the encoder for longer than the time set in *F1-14*, the drive will detect *PGo*.

Note:

Motor speed and load conditions can cause *ov [Overvoltage]* and *oC [Overcurrent]* faults.

■ F1-18 Dev3 Mode Selection

No. (Hex.)	Name	Description	Default (Range)
F1-18 (03AD)	Dev3 Mode Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the number of rotations necessary to detect conditions that invert the torque reference and rate of acceleration and cause *dv3 [Inversion Detection]*.	10 (0 - 10)

When the drive detects these two conditions at the same time for the number of times set in *F1-18*, the drive will detect *dv3*.

- The torque reference and acceleration are in opposite directions. For example, torque reference is in forward run and the acceleration is in a negative direction.
- The difference between the speed reference and the actual motor speed is more than 30%.

Note:

- Reference the setting value for *E5-11 [Enc ZPulse Offset]* and the δθ value found on the motor nameplate. A usual cause for a *dv3* fault is an incorrect *E5-11* setting.
- Set *F1-18 = 0* to disable the function.

■ F1-19 Dev4 Mode Selection

No. (Hex.)	Name	Description	Default (Range)
F1-19 (03AE)	Dev4 Mode Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the number of pulses necessary to cause *dv4 [Inversion Prevention Detection]*.	128 (0 - 5000)

The drive detects a *dv4 [Inversion Prevention Detection]* fault when the pulses in a reverse direction to the speed reference are input for longer than the time set in *F1-19*.

Note:

- Refer to the *E5-11 [Enc ZPulse Offset]* value and the Δθ value shown on the motor nameplate. An incorrect *E5-11* value will frequently be the cause of a *dv4* fault.
- When you use the drive in an application that rotates the motor from the load side in the reverse direction of the speed reference, set *F1-19 = 0*.

■ F1-20 Enc1 PCB Disconnect Detect

No. (Hex.)	Name	Description	Default (Range)
F1-20 (03B4)	Enc1 PCB Disconnect Detect	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function that enables and disables detection of a disconnected encoder connection cable to cause *PGoH [Encoder (PG) Hardware Fault]*.	1 (0, 1)

0 : Disabled

1 : Enabled

■ F1-21 Enc1 Signal Selection

No. (Hex.)	Name	Description	Default (Range)
F1-21 (03BC)	Enc1 Signal Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the number of channels for the signal to the encoder option card.	0 (0, 1)

0 : A Pulse Detection

1 : AB Pulse Detection

■ F1-30 M2 Enc PCB Port Select

No. (Hex.)	Name	Description	Default (Range)
F1-30 (03AA)	M2 Enc PCB Port Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the drive port to install the motor 2 encoder option card.	1 (0, 1)

0 : CN5-C

One option card receives the speed feedback signals from motor 1 and motor 2.

1 : CN5-B

Two option cards receive the speed feedback signals from motor 1 and motor 2.

■ F1-31 Enc2 Pulse Count (PPR)

No. (Hex.)	Name	Description	Default (Range)
F1-31 (03B0)	Enc2 Pulse Count (PPR)	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the number of output pulses for each motor revolution for motor 2.	1024 ppr (1 - 60000 ppr)

■ F1-32 Enc2 Rotat Selection

No. (Hex.)	Name	Description	Default (Range)
F1-32 (03B1)	Enc2 Rotat Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the output sequence for the A and B pulses from the encoder for motor 2. This parameter assumes that the motor is operating in the forward direction.	0 (0, 1)

Refer to the option card installation manual for more information about how to set the encoder pulse output sequence and make sure that it is correct.

0 : A leads in FWD Direction

1 : B leads in FWD Direction

■ F1-33 Enc2 Gear Teeth1

No. (Hex.)	Name	Description	Default (Range)
F1-33 (03B2)	Enc2 Gear Teeth1	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the number of gear teeth on the motor side for motor 2. This parameter and *F1-34 [Enc2 Gear Teeth2]* set the gear ratio between the motor and encoder.	0 (0 - 1000)

After you set the number of gear teeth, the drive uses this formula to calculate the motor speed:

$$\text{Motor speed (min}^{-1}\text{ or r/min)} = \frac{\text{Number of pulses from the encoder} \times 60}{\text{F1-31}} \times \frac{\text{F1-33}}{\text{F1-34}}$$

Note:

When *F1-33 = 0* or *F1-34 = 0*, the gear ratio is 1.

■ F1-34 Enc2 Gear Teeth2

No. (Hex.)	Name	Description	Default (Range)
F1-34 (03B3)	Enc2 Gear Teeth2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the number of gear teeth on the load side for motor 2. This parameter and *F1-33 [Enc2 Gear Teeth1]* set the gear ratio between the motor and encoder.	0 (0 - 1000)

After you set the number of gear teeth, the drive uses this formula to calculate the motor speed:

$$\text{Motor speed (min}^{-1}\text{ or r/min)} = \frac{\text{Number of pulses from the encoder} \times 60}{\text{F1-31}} \times \frac{\text{F1-33 (load-side PG gear teeth)}}{\text{F1-34 (motor-side PG gear teeth)}}$$

Note:

When *F1-33 = 0* or *F1-34 = 0*, the gear ratio is 1.

■ F1-35 Enc2 Pulse Scaling for Monitor

No. (Hex.)	Name	Description	Default (Range)
F1-35 (03BE)	Enc2 Pulse Scaling for Monitor	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the ratio between the pulse input and the pulse output of the encoder as a 3-digit number for motor 2. The first digit is the numerator and the second and third digits set the denominator.	001 (001 - 032, 102 - 132 (1 - 1/32))

When the setting value is a 3-digit value (xyz), the dividing ratio is (1 + x)/yz.

For example, when *F1-35 = 032*, the dividing ratio is 1/32.

Note:

For a single-pulse encoder, the dividing ratio for the monitor signal is 1:1.

■ F1-36 Enc2 PCB Disconnect Detect

No. (Hex.)	Name	Description	Default (Range)
F1-36 (03B5)	Enc2 PCB Disconnect Detect	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function that enables and disables detection of a disconnected encoder connection cable to cause *PGoH [Encoder (PG) Hardware Fault]* for motor 2.	1 (0, 1)

0 : Disabled

1 : Enabled

■ F1-37 Enc2 Signal Selection

No. (Hex.)	Name	Description	Default (Range)
F1-37 (03BD)	Enc2 Signal Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the number of channels for the signal to the encoder option card for motor 2.	0 (0, 1)

0 : A Pulse Detection

1 : AB Pulse Detection

■ F1-50 Enc Selection

No. (Hex.)	Name	Description	Default (Range)
F1-50 (03D2)	Enc Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the type of encoder connected to the PG-F3 option.	0 (0 - 2)

0 : EnDat Sin/Cos

1 : EnDat Serial Only

2 : Hiperface

■ F1-51 PGoH Detect Level

No. (Hex.)	Name	Description	Default (Range)
F1-51 (03D3)	PGoH Detect Level	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The drive will detect *PGoH [Encoder (PG) Hardware Fault]* when the value of this parameter is less than the value of $\sqrt{\sin^2\theta + \cos^2\theta}$.	80% (1 - 100%)

The drive will detect *PGoH* when the value of this parameter is less than the value of $\sqrt{\sin^2\theta + \cos^2\theta}$.

For expression $\sqrt{\sin^2\theta + \cos^2\theta}$, Sin θ is the single-track (phase B) output from the encoder and Cos θ is the single-track (phase A) output from the encoder.

Note:

This function is enabled when *F1-20 = 1 [Enc1 PCB Disconnect Detect = Enabled]*.

■ F1-52 Serial Enc bps for Communication

No. (Hex.)	Name	Description	Default (Range)
F1-52 (03D4)	Serial Enc bps for Communication	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the communication speed between the PG-F3 option and the serial encoder.	0 (0 - 2)

Note:

Set *F1-50 = 1 or 2 [Enc Selection = EnDat Serial Only or Hiperface]* to enable this function.

0 : 1M/9600bps

1 : 500k/19200bps

2 : 1M/38400bps

◆ F2: ANALOG INPUT

F2 parameters set the operation of the drive when you use analog input option card AI-A3. The AI-A3 card has 3 input terminals that accept voltages of -10 V to +10 V (20 kΩ) or currents of 4 mA to 20 mA (250 Ω). Install the AI-A3 card to enable setting very accurate analog references with high resolution.

Refer to the AI-A3 card manual for more information about how to install, wire, and set the AI-A3 card.

WARNING! *Sudden Movement Hazard. Do test runs and examine the drive to make sure that command references are configured correctly. If you set the command reference incorrectly, it can cause death, serious injury, or equipment damage from unwanted motor rotation.*

■ F2-01 An.In Funct.Selection

No. (Hex.)	Name	Description	Default (Range)
F2-01 (038F)	An.In Funct.Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the input method for the analog reference used with AI-A3.	0 (0, 1)

Note:

When the AI-A3 card is not mounted in the drive, analog input terminals AI1 to AI3 on the drive are always enabled. The setting of this parameter does not have an effect.

0 : 3 Independent Channels

Set *F2-01 = 0* to increase the precision of A/D conversion when you use the functions for terminals AI1 to AI3 on the drive as they are. You can input the MFAI signal from terminals V1 through V3 for AI-A3. The functions for terminals AI1, AI2, and AI3 on the drive are sent to terminals V1, V2, and V3 for AI-A3. Use gain and bias adjustment when you input current to set signals to have negative numbers.

Note:
- Set *b1-01 = 1 [Freq. Ref. Sel. 1 = Analog Input]* to set inputs individually.
- If *F2-01 = 0* and *b1-01 = 3 [Option PCB]*, the drive will detect *oPE05 [Run Cmd/Freq Ref Source Sel Err]*.

Figure 12.70 shows the individual input of analog inputs. *H3-xx parameters* set the function to input the analog reference received from the AI-A3 card and to adjust the gain and bias of these signals.

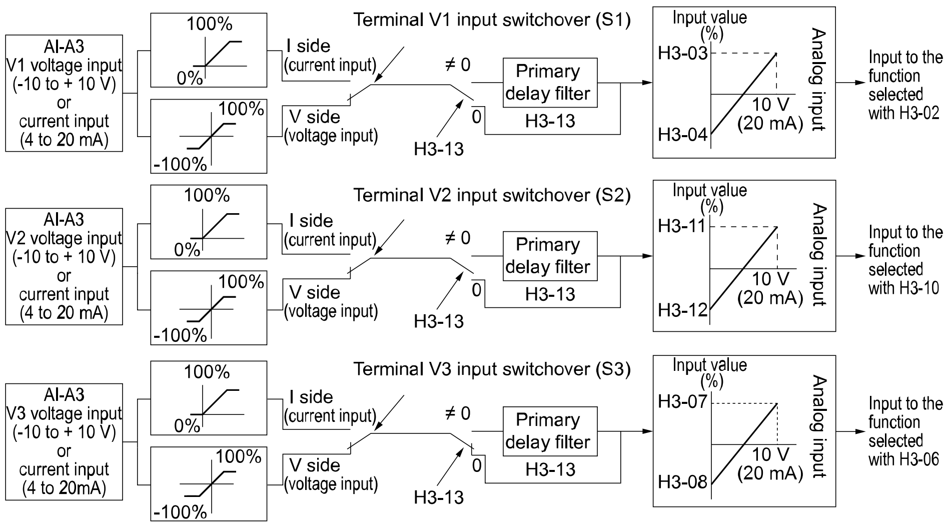


Figure 12.70 Analog Input Reference Individual Input Block Diagram

1 : 3 Channels Added Together

Set *b1-01 = 3 [Option PCB]* to set addition input.

You can input the frequency reference directly. The sum value when you add the input from terminals V1 to V3 becomes the frequency reference.

Set *F2-01 = 1* to use the AI-A3 card as addition input.

Figure 12.71 shows addition input. Use *F2-02 [An.In Option Gain]* and *F2-03 [An.In Option Bias]* to adjust the analog reference gain and bias for addition input.

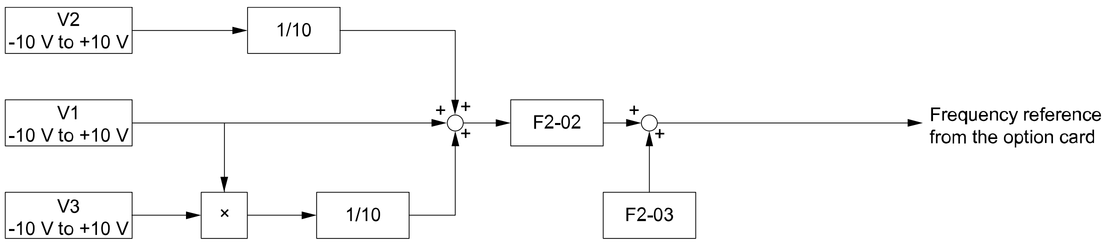


Figure 12.71 Analog Input Reference Addition Input Block Diagram

Use F2-02 and F2-03 to Adjust the Input Status

When the bias set in *F2-03* is 0%, the gain in *F2-02* and the addition input value set the ratio (%) of the maximum output frequency output as the frequency reference.

Note:

A voltage input of 10 V or a current input of 20 mA is the 100% value for each channel.

The bias set in *F2-03* sets the ratio (%) of the maximum output frequency output as the frequency reference when the addition input value is 0%.

Note:

A voltage input of 0 V or a current input of 4 mA is the 0% value for each channel.

- Example 1:
  When the gain set in *F2-02* is 50%, the bias set in *F2-03* is 0%, and the addition input value is 100%, the frequency reference is 50% of the maximum output frequency. When the addition input value is 200%, the frequency reference is 100% of the maximum output frequency.
- Example 2:
  When the gain set in *F2-02* is 200%, the bias set in *F2-03* is 0%, and the addition input value is 50%, the frequency reference is equivalent to the maximum output frequency. The frequency reference will not be more than the maximum output frequency, although the addition input value is 50% or higher.
- Example 3:
  When the gain set in *F2-02* is 100%, the bias set in *F2-03* is 30%, and the addition input value is 0%, the frequency reference is 30% of the maximum output frequency. When the addition input value is 70%, the frequency reference will be equivalent to the maximum output frequency. The frequency reference will not be more than the maximum output frequency, although the addition input value is 70% or higher.

■ F2-02 An.In Option Gain

No. (Hex.)	Name	Description	Default (Range)
F2-02 (0368) RUN	An.In Option Gain	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the analog reference gain as a percentage when the maximum output frequency is 100%.	100.0% (-999.9 - +999.9%)

Note:

Set *F2-01 = 1 [An.In Funct.Selection = 3 Channels Added Together]* to enable this function.

■ F2-03 An.In Option Bias

No. (Hex.)	Name	Description	Default (Range)
F2-03 (0369) RUN	An.In Option Bias	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the analog reference bias as a percentage when the maximum output frequency is 100%.	0.0% (-999.9 - +999.9%)

Note:

Set *F2-01 = 1 [An.In Funct.Selection = 3 Channels Added Together]* to enable this function.

◆ F3: DIGITAL INPUT

F3 parameters set the type of input signal to use with digital input option card DI-A3.

Use these digital inputs to set the frequency reference when you install the DI-A3 card in a drive. Set *b1-01 = 3 [Freq. Ref. Sel. 1 = Option PCB]* to use this card as the frequency reference input. The input signal is isolated input of 24 Vdc and 8 mA.

- Binary, 16-bit/BCD, 4-digit input
- Binary, 12-bit/BCD, 3-digit input

- Binary, 8-bit/BCD, 2-digit input

You can also use the DI-A3 card as an MFDI, if the setting of *F3-01* is correct.

WARNING! *Sudden Movement Hazard. Do test runs and examine the drive to make sure that command references are configured correctly. If you set the command reference incorrectly, it can cause death, serious injury, or equipment damage from unwanted motor rotation.*

■ DI for DI-A3

Set *F3-01 = 8 [D.In Funct Selection = MF Digital Input]* and *b1-01 ≠ 3 [Freq. Ref. Sel. 1 ≠ Option PCB]* to use digital input option DI-A3 as an DI.

Use *F3-10 to F3-25 [D0 Function Selection to DF Function Selection]* to set the function for the DI-A3 terminals.

Note:
- Refer to *H1-xx* "Multi-function Digital Input Setting Values" for more information about DI setting values.
- Values *0 [3-Wire Sequence]* and *20 to 2F [External Fault]* for *F3-10 to F3-25*.
- When you do not use DI-A3 as an DI, set *F3-10 to F3-25 = F [Not Used]*.
- The drive reads DI-A3 terminal Dx two times as specified by parameter *b1-06 [Double Scan DI Inputs Select]*.
- Configuring such that *F3-01 = 8* when DI-A3 is the frequency reference source (*b1-01 or b1-15 = 3 [Freq. Ref. Sel. 1 or Freq. Ref. Sel. 2 = Option PCB]*) results in the detection of *oPE05 [Run Cmd/Freq Ref Source Sel Err]*.
- You can use these functions with the DI-A3 DI:
  –*H1-40 to H1-42 [Mbus 15C0h b0 Input Function to Mbus 15C0h b2 Input Function]*
  –*H7-01 to H7-04 [Virtual In1 Select Function to Virtual In4 Select Function]*

■ F3-01 D.In Funct Selection

No. (Hex.)	Name	Description	Default (Range)
F3-01 (0390)	D.In Funct Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the data format of digital input signals. Set *o1-03 = 0 or 1 [FrqDisplay Unit Selection = 0.01 Hz or 0.01% (100%=E1-04)]* to enable this function.	0 (0 - 8)

Note:
The input signal type is BCD when *o1-03 = 2 or 3 [rpm or User-selected units]*. The *o1-03* value sets the setting units.

0 : BCD, 1% units

1 : BCD, 0.1% units

2 : BCD, 0.01% units

3 : BCD, 1 Hz units

4 : BCD, 0.1 Hz units

5 : BCD, 0.01 Hz units

6 : BCD (5-digit), 0.01 Hz

7 : Binary Input

The setting unit and setting range vary depending on the value set in *F3-03 [D.In Data Length Select]*.
- *F3-03 = 0 [8-bit]*: 100%/255 (-255 to +255)
- *F3-03 = 1 [12-bit]*: 100%/4095 (-4095 to +4095)
- *F3-03 = 2 [16-bit]*: 100%/30000 (-33000 to +33000)

8 : MF Digital Input

The DI-A3 card is also used as a multi-function digital input terminal.

■ F3-03 D.In Data Length Select

No. (Hex.)	Name	Description	Default (Range)
F3-03 (03B9)	D.In Data Length Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the number of bits to set the frequency reference with *DI-A3*.	2 (0 - 2)

0 : 8-bit

1 : 12-bit

2 : 16-bit

Table 12.30 DI-A3 Terminal Function Selection

Terminal Block	Terminal Name	BCD, Signed [F3-01 = 0 to 5]						BCD, Unsigned [F3-01 = 6] *1		Binary, Signed [F3-01 = 7]		
		8-bit [F3-03 = 0]		12-bit [F3-03 = 1]		16-bit [F3-03 = 2]				8-bit [F3-03 = 0]	12-bit [F3-03 = 1]	16-bit [F3-03 = 2]
TB2	DI0	1 digit (0 - 9)	1	1 digit (0 - 9)	1	1 digit (0 - 9)	1	1 digit (0, 2, 4, 6, 8)	2	bit 0	bit 0	bit 0
	DI1		2		2		2		4	bit 1	bit 1	bit 1
	DI2		4		4		4		8	bit 2	bit 2	bit 2
	DI3		8		8		8	2 digits (0 - 9)	1	bit 3	bit 3	bit 3
	DI4	2 digits (0 - 15) *2	1	2 digits (0 - 9)	1	2 digits (0 - 9)	1		2	bit 4	bit 4	bit 4
	DI5		2		2		2		4	bit 5	bit 5	bit 5
	DI6		4		4		4		8	bit 6	bit 6	bit 6
	DI7		8		8		8	3 digits (0 - 9)	1	bit 7	bit 7	bit 7
TB3	DI8	-	-	3 digits (0 - 15) *2	1	3 digits (0 - 9)	-		2	-	bit 8	bit 8
	DI9		-		2		-		4	-	bit 9	bit 9
	DIA		-		4		-		8	-	bit 10	bit 10
	DIB		-		8		-	4 digits (0 - 9)	1	-	bit 11	bit 11
	DIC	-	-	-	-	4 digits (0 - 15) *2	-		2	-	-	bit 12
	DID		-		-		-		4	-	-	bit 13
	DIE		-		-		-		8	-	-	bit 14
	DIF		-		-		-	5 digits (0 - 3)	1	-	-	bit 15
TB1	SI	SIGN (encoded) signal 0: Forward run, 1: Reverse run							2	SIGN (encoded) signal 0: Forward run, 1: Reverse run		
	SE	SET (loaded) signal 1: Loads the value set for DI0 to DIF and SI.										
	D24V	Internal power supply: 24 V ± 5%										
	DIC	Input signal common										
	D0V	Internal power supply common: 0 V										
	SD	Cable sheath connection terminal (ungrounded)										
	FE	Cable sheath connection terminal (grounded)										

*1 Setting *F3-03 = 2 [D.In Data Length Select = 16-bit]* enables *F3-01 = 6 [D.In Funct Selection = BCD (5-digit), 0.01 Hz]* and a frequency between 0.00 Hz to 399.8 Hz can be set by the BCD. Note that terminal SI is also used as for data bits. Negative commands cannot be input as encoding information (positive/negative) cannot be added to the data.

The minimum bit value for the first BCD digit is 2. For this reason, 0.02 Hz is the smallest setting unit available for this frequency setting. An *oPE05 [Run Cmd/Freq Ref Source Sel Err]* occurs when *F3-03 ≠ 2* while *F3-01 = 6*.

*2 The most significant digit can be set to a value between 0 to 15 when using “BCD, Signed”. Other digits can be set to a value between 0 to 9.

■ F3-10 D0 Function Selection

No. (Hex.)	Name	Description	Default (Range)
F3-10 (0BE3) Expert	D0 Function Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function for terminal D0 of the DI-A3 when *F3-01 = 8 [D.In Funct Selection = MF Digital Input]*.	0 (0 - 4, 6 - 19F)

■ F3-11 D1 Function Selection

No. (Hex.)	Name	Description	Default (Range)
F3-11 (0BE4) Expert	D1 Function Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function for terminal D1 of the DI-A3 when *F3-01 = 8 [D.In Funct Selection = MF Digital Input]*.	0 (0 - 4, 6 - 19F)

F3-12 D2 Function Selection

No. (Hex.)	Name	Description	Default (Range)
F3-12 (0BE5) Expert	D2 Function Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function for terminal D2 of the DI-A3 when *F3-01 = 8 [D.In Funct Selection = MF Digital Input]*.	0 (0 - 4, 6 - 19F)

F3-13 D3 Function Selection

No. (Hex.)	Name	Description	Default (Range)
F3-13 (0BE6) Expert	D3 Function Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function for terminal D3 of the DI-A3 when *F3-01 = 8 [D.In Funct Selection = MF Digital Input]*.	0 (0 - 4, 6 - 19F)

F3-14 D4 Function Selection

No. (Hex.)	Name	Description	Default (Range)
F3-14 (0BE7) Expert	D4 Function Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function for terminal D4 of the DI-A3 when *F3-01 = 8 [D.In Funct Selection = MF Digital Input]*.	0 (0 - 4, 6 - 19F)

F3-15 D5 Function Selection

No. (Hex.)	Name	Description	Default (Range)
F3-15 (0BE8) Expert	D5 Function Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function for terminal D5 of the DI-A3 when *F3-01 = 8 [D.In Funct Selection = MF Digital Input]*.	0 (0 - 4, 6 - 19F)

F3-16 D6 Function Selection

No. (Hex.)	Name	Description	Default (Range)
F3-16 (0BE9) Expert	D6 Function Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function for terminal D6 of the DI-A3 when *F3-01 = 8 [D.In Funct Selection = MF Digital Input]*.	0 (0 - 4, 6 - 19F)

F3-17 D7 Function Selection

No. (Hex.)	Name	Description	Default (Range)
F3-17 (0BEA) Expert	D7 Function Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function for terminal D7 of the DI-A3 when *F3-01 = 8 [D.In Funct Selection = MF Digital Input]*.	0 (0 - 4, 6 - 19F)

F3-18 D8 Function Selection

No. (Hex.)	Name	Description	Default (Range)
F3-18 (0BEB) Expert	D8 Function Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function for terminal D8 of the DI-A3 when *F3-01 = 8 [D.In Funct Selection = MF Digital Input]*.	0 (0 - 4, 6 - 19F)

F3-19 D9 Function Selection

No. (Hex.)	Name	Description	Default (Range)
F3-19 (0BEC) Expert	D9 Function Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function for terminal D9 of the DI-A3 when *F3-01 = 8 [D.In Funct Selection = MF Digital Input]*.	0 (0 - 4, 6 - 19F)

■ F3-20 DA Function Selection

No. (Hex.)	Name	Description	Default (Range)
F3-20 (0BED) Expert	DA Function Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function for terminal DA of the DI-A3 when *F3-01 = 8 [D.In Funct Selection = MF Digital Input]*	0 (0 - 4, 6 - 19F)

■ F3-21 DB Function Selection

No. (Hex.)	Name	Description	Default (Range)
F3-21 (0BEE) Expert	DB Function Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function for terminal DB of the DI-A3 when *F3-01 = 8 [D.In Funct Selection = MF Digital Input]*.	0 (0 - 4, 6 - 19F)

■ F3-22 DC Function Selection

No. (Hex.)	Name	Description	Default (Range)
F3-22 (0BEF) Expert	DC Function Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function for terminal DC of the DI-A3 when *F3-01 = 8 [D.In Funct Selection = MF Digital Input]*.	0 (0 - 4, 6 - 19F)

■ F3-23 DD Function Selection

No. (Hex.)	Name	Description	Default (Range)
F3-23 (0BF0) Expert	DD Function Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function for terminal DD of the DI-A3 when *F3-01 = 8 [D.In Funct Selection = MF Digital Input]*.	0 (0 - 4, 6 - 19F)

■ F3-24 DE Function Selection

No. (Hex.)	Name	Description	Default (Range)
F3-24 (0BF1) Expert	DE Function Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function for terminal DE of the DI-A3 when *F3-01 = 8 [D.In Funct Selection = MF Digital Input]*.	0 (0 - 4, 6 - 19F)

■ F3-25 DF Function Selection

No. (Hex.)	Name	Description	Default (Range)
F3-25 (0BF2) Expert	DF Function Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function for terminal DF of the DI-A3 when *F3-01 = 8 [D.In Funct Selection = MF Digital Input]*.	0 (0 - 4, 6 - 19F)

◆ F4: ANALOG OUTPUT

F4 parameters set drive operation when you use analog monitor option card AO-A3. The AO-A3 card has 2 output terminals (terminals V1 and V2) for signals with an Output resolution of 11 bits (1/2048) + encoding and that have an output voltage range of -10 V to +10 V. Install the AO-A3 card to a drive to output analog signals that monitor the output status of the drive (output frequency and output current).

Refer to the AO-A3 card manual for more information about how to install, wire, and set the AO-A3 card.

Use the *U monitor* number to set the monitor data to be output from terminals V1 and V2 on the AO-A3 card. Enter the last three digits of *Ux-xx* as the setting value.

- Use Gain and Bias to Adjust the Output Signal Level of Terminal V1

You must stop the drive to adjust the output signal. Use this procedure to calibrate the drive:

1. View the *F4-02 [Term.V1 Gain]* value on the keypad.
   Terminal V1 will output a voltage = 100% of the monitor set in *F4-01 [Term.V1 Funct Selection]*.
2. View the monitor connected to terminal V1 and adjust *F4-02*.
3. View the *F4-05 [Term.V1 Bias]* value on the keypad.

Terminal V1 will output an analog signal = 100% of the parameter set in *F4-01*.
4. View the monitor connected to terminal V1 and adjust *F4-05*.

- Use Gain and Bias to Adjust the Output Signal Level of Terminal V2

You must stop the drive to adjust the output signal. Use this procedure to calibrate the drive:

1. View the *F4-04 [Term.V2 Gain]* value on the keypad.
   Terminal V2 will output a voltage = 100% of the monitor set in *F4-03 [Term.V2 Function Selection]*.
2. View the monitor connected to terminal V2 and adjust *F4-04*.
3. View the *F4-06 [Term.V2 Bias]* value on the keypad.
   The analog signal equal to 0% of the parameter being set in *F4-03* will be output from terminal V2.
4. View the monitor connected to terminal V2 and adjust *F4-06*.

■ F4-01 Term.V1 Funct Selection

No. (Hex.)	Name	Description	Default (Range)
F4-01 (0391)	Term.V1 Funct Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the monitor signal output from terminal V1.	102 (000 - 999)

Enter the last three digits of *Ux-xx [MONITORS]* to set monitor data to output from the option card. For example, set *x-xx* to *102* to monitor *U1-02 [Output Frequency]*.

Note:
- You cannot use all of the monitors in all of the control methods.
- When you use the terminal in through mode, set *000* or *031*. You can use this setting to adjust the V1 terminal output from PLC through Modbus communications or a communications option.

■ F4-02 Term.V1 Gain

No. (Hex.)	Name	Description	Default (Range)
F4-02 (0392) RUN	Term.V1 Gain	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the gain of the monitor signal that is sent from terminal V1. Sets the analog signal output level from the terminal V1 at 10 V or 20 mA as 100% when an output for monitoring items is 100%.	100.0% (-999.9 - +999.9%)

The maximum output voltage output from terminal V1 is ±10 V. Use *F4-07 [Term.V1 Level of Signal]* to set the signal level.

Example settings:

When you use these settings, and the monitored output voltage is at 100% (drive rated current), the output voltage of terminal V1 is 5 V (50% of 10 V). The output current is 200% of the drive rated current when terminal V1 outputs a maximum voltage of 10 V.

- F4-01 [Term.V1 Funct Selection] = 102 (U1-02: Output Frequency)
- F4-02 = 50.0%
- F4-05 [Term.V1 Bias] = 0.0%
- F4-07 = 0 (0 to 10V)

■ F4-03 Term.V2 Function Selection

No. (Hex.)	Name	Description	Default (Range)
F4-03 (0393)	Term.V2 Function Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the number for monitor item of output from terminal V2.	103 (000 - 999)

Enter the last three digits of *Ux-xx [MONITORS]* to set monitor data to output from the option card. For example, set *x-xx* to *103* to monitor *U1-03 [Output Current]*.

Note:
- You cannot use all of the monitors in all of the control methods.
- When you use the terminal in through mode, set *000* or *031*. You can use this setting to adjust the V2 terminal output from PLC through Modbus communications or a communications option.

■ F4-04 Term.V2 Gain

No. (Hex.)	Name	Description	Default (Range)
F4-04 (0394) RUN	Term.V2 Gain	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the gain of the monitor signal that is sent from terminal V2.	50.0% (-999.9 - +999.9%)

The maximum output voltage output from terminal V2 is ±10 V. Use *F4-08 [Term.V2 Level of Signal]* to set the signal level.

Example settings:

When you use these settings, and the monitored output voltage is at 100% (drive rated current), the output voltage of terminal V2 is 5 V (50% of 10 V). The output current is 200% of the drive rated current when terminal V2 outputs a maximum voltage of 10 V.

- F4-03 [Term.V2 Function Selection] = 103 (U1-03: Output Current)
- F4-04 = 50.0%
- F4-06 [Term.V2 Bias] = 0.0%
- F4-08 = 0 (0 to 10V)

■ F4-05 Term.V1 Bias

No. (Hex.)	Name	Description	Default (Range)
F4-05 (0395) RUN	Term.V1 Bias	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the bias of the monitor signal that is sent from terminal V1. Set the level of the analog signal sent from the V1 terminal at 10 V or 20 mA as 100% when an output for monitoring items is 0%.	0.0% (-999.9 - +999.9%)

The maximum output voltage output from terminal V1 is ±10 V. Use *F4-07 [Term.V1 Level of Signal]* to set the signal level.

■ F4-06 Term.V2 Bias

No. (Hex.)	Name	Description	Default (Range)
F4-06 (0396) RUN	Term.V2 Bias	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the bias of the monitor signal that is sent from terminal V2. Set the level of the analog signal sent from the V2 terminal at 10 V or 20 mA as 100% when an output for monitoring items is 0%.	0.0% (-999.9 - +999.9%)

The maximum output voltage output from terminal V2 is ±10 V. Use *F4-08 [Term.V2 Level of Signal]* to set the signal level.

■ F4-07 Term.V1 Level of Signal

No. (Hex.)	Name	Description	Default (Range)
F4-07 (0397)	Term.V1 Level of Signal	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the output signal level for terminal V1.	0 (0, 1)

0 : 0 to 10V

1 : -10 to 10V

■ F4-08 Term.V2 Level of Signal

No. (Hex.)	Name	Description	Default (Range)
F4-08 (0398)	Term.V2 Level of Signal	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the output signal level for terminal V2.	0 (0, 1)

0 : 0 to 10V

1 : -10 to 10V

◆ F5: DIGITAL OUTPUT

F5 parameters set the output mode and function of output signals when you use digital output option card DO-A3.

When you install a DO-A3 to the drive, you can output isolated digital signals to monitor the drive operation status.

- 6 points of photocoupler output (48 V, 50 mA or less)
- 2 points of relay contact output (250 Vac, 30 Vdc: 1 A or less)

Refer to the DO-A3 option manual for more information about how to install, wire, and set the DO-A3 card.

■ Use Parameters to Select Output Modes

Use parameter *F5-09 [DO-A3 Output Mode Selection]* to set signal output from the DO-A3 card.

Table 12.31 Details of F5-09 and the DO-A3 Terminal Output

DO-A3 Terminal Block	DO-A3 Terminal Name	F5-09 = 0 [8 CH Individual] (Default)	F5-09 = 1 [Bin Code Output]	F5-09 = 2 [8 CH Sel (F5-01 to F5-08)]
TB1	M1-M2	Zero speed detection in progress	During run	Depending on the setting of F5-07 [Term.M1-M2 Function Select]
	M3-M4	During speed agreement	Minor fault (excluding bb [Baseblock])	Depending on the setting of F5-08 [Term.M3-M4 Function Select]
TB2	P1-PC	oC [Overcurrent], GF [Ground Fault]	Coded output **Note:** Refer to Table 12.32 for details.	Depending on the setting of F5-01 [Term.P1-PC Function Select]
	P2-PC	ov [Overvoltage]		Depending on the setting of F5-02 [Term.P2-PC Function Select]
	P3-PC	oL2 [Drive Overload] or oH2 [Heatsink Overheat]		Depending on the setting of F5-03 [Term.P3-PC Function Select]
	P4-PC	Not used		Depending on the setting of F5-04 [Term.P4-PC Function Select]
	P5-PC	oS [Overspeed]	Zero speed detection in progress	Depending on the setting of F5-05 [Term.P5-PC Function Select]
	P6-PC	oH, oH1 [Heatsink Overheat] or oL1 [Motor Overload]	During speed agreement	Depending on the setting of F5-06 [Term.P6-PC Function Select]

Table 12.32 Binary Output [F5-09 = 1]

Coded Output (Binary)	Description	DO-A3 Terminal Block TB2			
		Terminal P1-PC	Terminal P2-PC	Terminal P3-PC	Terminal P4-PC
0	No fault	0	0	0	0
1	oC [Overcurrent], GF [Ground Fault]	1	0	0	0
2	ov [Overvoltage]	0	1	0	0
3	oL2 [Drive Overloaded]	1	1	0	0
4	oH, oH1 [Heatsink Overheat]	0	0	1	0
5	oS [Overspeed]	1	0	1	0
6	Not used	0	1	1	0
7	rr [Dynamic Braking Transistor Fault], rH [Braking Resistor Overheat]	1	1	1	0
8	External fault [EF1 to EF8]	0	0	0	1
9	CPFxx, oFAxx, oFbxx, oFCxx [Drive Hardware Fault] *1	1	0	0	1
A	oL1 [Motor Overload]	0	1	0	1
B	Not used	1	1	0	1
C	Uv1, Uv2 [Undervoltage], Uv3 [Soft Charge Answerback Fault]	0	0	1	1
D	dEv [Speed Deviation]	1	0	1	1
E	PGo [Encoder (PG) Feedback Loss]	0	1	1	1
F	Not used	1	1	1	1

*1 The “xx” characters are different for different faults.

Digital Output Card Selection

Refer to "H2: DIGITAL OUTPUTS" for more information about the functions that output from the terminals when *F5-09 = 2 [DO-A3 Output Mode Selection = 8 CH Sel (F5-01 to F5-08)]*. Use *F5-01 to F5-08* to set the output items.

No.	Name	Setting Range	Default
F5-01	Term.P1-PC Function Select	0 - 192	5: @Run
F5-02	Term.P2-PC Function Select	0 - 192	7: Zero Speed
F5-03	Term.P3-PC Function Select	0 - 192	F: SpeedAgree1
F5-04	Term.P4-PC Function Select	0 - 192	13: FreqDetect 1
F5-05	Term.P5-PC Function Select	0 - 192	1: Drive Ready
F5-06	Term.P6-PC Function Select	0 - 192	B: @FreqOutput
F5-07	Term.M1-M2 Function Select	0 - 192	0: Through Mode
F5-08	Term.M3-M4 Function Select	0 - 192	0: Through Mode

F5-01 Term.P1-PC Function Select

No. (Hex.)	Name	Description	Default (Range)
F5-01 (0399)	Term.P1-PC Function Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function of terminal P1-PC on the DO-A3 option. Set *F5-09 = 2 [DO-A3 Output Mode Selection = 8 CH Sel (F5-01 to F5-08)]* to enable this function.	5 (0 - 1A7)

F5-02 Term.P2-PC Function Select

No. (Hex.)	Name	Description	Default (Range)
F5-02 (039A)	Term.P2-PC Function Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function of terminal P2-PC on the DO-A3 option. Set *F5-09 = 2 [DO-A3 Output Mode Selection = 8 CH Sel (F5-01 to F5-08)]* to enable this function.	7 (0 - 1A7)

F5-03 Term.P3-PC Function Select

No. (Hex.)	Name	Description	Default (Range)
F5-03 (039B)	Term.P3-PC Function Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function of terminal P3-PC on the DO-A3 option. Set *F5-09 = 2 [DO-A3 Output Mode Selection = 8 CH Sel (F5-01 to F5-08)]* to enable this function.	F (0 - 1A7)

F5-04 Term.P4-PC Function Select

No. (Hex.)	Name	Description	Default (Range)
F5-04 (039C)	Term.P4-PC Function Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function of terminal P4-PC on the DO-A3 option. Set *F5-09 = 2 [DO-A3 Output Mode Selection = 8 CH Sel (F5-01 to F5-08)]* to enable this function.	13 (0 - 1A7)

F5-05 Term.P5-PC Function Select

No. (Hex.)	Name	Description	Default (Range)
F5-05 (039D)	Term.P5-PC Function Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function of terminal P5-PC on the DO-A3 option. Set *F5-09 = 2 [DO-A3 Output Mode Selection = 8 CH Sel (F5-01 to F5-08)]* to enable this function.	1 (0 - 1A7)

F5-06 Term.P6-PC Function Select

No. (Hex.)	Name	Description	Default (Range)
F5-06 (039E)	Term.P6-PC Function Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function of terminal P6-PC on the DO-A3 option. Set *F5-09 = 2 [DO-A3 Output Mode Selection = 8 CH Sel (F5-01 to F5-08)]* to enable this function.	B (0 - 1A7)

F5-07 Term.M1-M2 Function Select

No. (Hex.)	Name	Description	Default (Range)
F5-07 (039F)	Term.M1-M2 Function Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function of terminal 2NO-2CM on the DO-A3 option. Set *F5-09 = 2 [DO-A3 Output Mode Selection = 8 CH Sel (F5-01 to F5-08)]* to enable this function.	0 (0 - 1A7)

F5-08 Term.M3-M4 Function Select

No. (Hex.)	Name	Description	Default (Range)
F5-08 (03A0)	Term.M3-M4 Function Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function of terminal 3NO-3CM on the DO-A3 option. Set *F5-09 = 2 [DO-A3 Output Mode Selection = 8 CH Sel (F5-01 to F5-08)]* to enable this function.	0 (0 - 1A7)

F5-09 DO-A3 Output Mode Selection

No. (Hex.)	Name	Description	Default (Range)
F5-09 (03A1)	DO-A3 Output Mode Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the output mode of signals from the DO-A3 option.	0 (0 - 2)

Refer to Table 12.31 for more information.

0 : 8 CH Individual

1 : Bin Code Output

2 : 8 CH Sel (F5-01 to F5-08)

F6: COMMUNICATIONS, F7: ETHERNET

F6 and F7 parameters are used to set the basic communication settings and method of fault detection for the communication option card. The communication option card parameters include common option card parameters and communication protocol-specific parameters.

The following table lists the parameters that need to be set for each communication option card.

Refer to the technical manual for each communication option card for more information on installing, wiring, and configuring the details needed before starting communication.

WARNING! *Sudden Movement Hazard. Do test runs and examine the drive to make sure that command references are configured correctly. If you set the command reference incorrectly, it can cause death, serious injury, or equipment damage from unwanted motor rotation.*

Table 12.33 Correspondence Between Communication Protocols and Parameters (SI-CB, SI-T3, SI-ET3, SI-P3, SI-S3, and SI-ES3)

Parameters	CC-Link SI-C3	MECHATROLINK-II SI-T3	MECHATROLINK-III SI-ET3	PROFIBUS-DP SI-P3	CANopen SI-S3	EtherCAT SI-ES3
F6-01 to F6-03	x	x	x	x	x	x
F6-04	x	-	-	-	-	-
F6-06 to F6-08	x	x	x	x	x	x
F6-10 and F6-11	x	-	-	-	-	-
F6-14	x	x	x	x	x	x
F6-16	x	x	x	x	x	x
F6-20 and F6-21	-	x	x	-	-	-
F6-22	-	x	-	-	-	-
F6-23 to F6-26	-	x	x	-	-	-
F6-30 to F6-32	-	-	-	x	-	-
F6-35 and F6-36	-	-	-	-	x	-
F6-45 to F6-49	-	-	-	-	-	-
F6-50 to F6-71	-	-	-	-	-	-
F7-01 to F7-15	-	-	-	-	-	-
F7-16	-	-	-	-	-	-

Parameters	CC-Link SI-C3	MECHATROLINK-II SI-T3	MECHATROLINK-III SI-ET3	PROFIBUS-DP SI-P3	CANopen SI-S3	EtherCAT SI-ES3
F7-17 to F7-42	-	-	-	-	-	-
F7-60 to F7-79	-	-	-	x	-	-

Table 12.34 Correspondence Between Communication Protocols and Parameters (SI-CB, SI-N3, SI-W3, SI-EM3, SI-EP3, and SI-EN3)

Parameters	DeviceNet SI-N3	LonWorks SI-W3	Modbus TCP/IP SI-EM3	PROFINET SI-EP3	EtherNet/IP SI-EN3
F6-01 to F6-03	x	x	x	x	x
F6-04	-	-	-	-	-
F6-06 to F6-08	x	x	x	x	x
F6-10 and F6-11	-	-	-	-	-
F6-14	x	x	x	x	x
F6-16	x	x	x	x	x
F6-20 and F6-21	-	-	-	-	-
F6-22	-	-	-	-	-
F6-23 to F6-26	-	-	-	-	-
F6-30 to F6-32	-	-	-	-	-
F6-35 and F6-36	-	-	-	-	-
F6-45 to F6-49	-	-	-	-	-
F6-50 to F6-71	x	-	-	-	-
F7-01 to F7-15	-	-	x	x	x
F7-16	-	-	x	-	-
F7-17 to F7-42	-	-	-	x	x
F7-60 to F7-79	-	-	-	-	-

■ F6-01 Comm.Error Selection

No. (Hex.)	Name	Description	Default (Range)
F6-01 (03A2)	Comm.Error Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the method to stop the motor or let the motor continue operating when the drive detects a *bUS [Option Communication Error]*.	1 (0 - 5)

0 : Ramp->Stop

The drive ramps to stop in the set deceleration time. Fault relay output terminal 1NO-1CM activates and terminal 1NC-1CM deactivates.

1 : Coast->Stop

The drive output shuts off and the motor coasts to stop. Fault relay output terminal 1NO-1CM activates and terminal 1NC-1CM deactivates.

2 : Fast Stop (C1-09)

The drive stops the motor in the deceleration time set in *C1-09 [Fast Stop Time]*. Fault relay output terminal 1NO-1CM activates and terminal 1NC-1CM deactivates.

3 : Alarm Only

The keypad shows *bUS* and the drive continues operation at the current frequency reference.

Note:

Separately prepare safety protection equipment and systems, for example fast stop switches.

The output terminal set for *Alarm [H2-01 to H2-03 = 4]* activates.

4 : AL-Run at d1-04

The keypad shows *bUS* and the drive continues operation at the speed set in *d1-04 [Reference 4]*.

Note:

Separately prepare safety protection equipment and systems, for example fast stop switches.

5 : AL-Ramp Stop

The drive stops the motor during the deceleration time set in *C1-02 [Decel Time 1]*.
After you remove the *bUS* alarm, the motor will accelerate to the previous frequency reference.

■ F6-02 Comm Ext Flt Detect (EF0)

No. (Hex.)	Name	Description	Default (Range)
F6-02 (03A3)	Comm Ext Flt Detect (EF0)	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets when the drive will detect *EF0 [Option Card External Fault]* is detected.	0 (0, 1)

0 : Always Detected

1 : Detect@RUN Only

■ F6-03 Comm Ext Flt Select (EF0)

No. (Hex.)	Name	Description	Default (Range)
F6-03 (03A4)	Comm Ext Flt Select (EF0)	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the method to stop the motor or let the motor continue operating when the drive detects an *EF0 [Option Card External Fault]*.	1 (0 - 3)

0 : Ramp->Stop

The drive ramps to stop in the set deceleration time. Fault relay output terminal 1NO-1CM activates and terminal 1NC-1CM deactivates.

1 : Coast->Stop

The drive output shuts off and the motor coasts to stop. Fault relay output terminal 1NO-1CM activates and terminal 1NC-1CM deactivates

2 : Fast Stop (C1-09)

The drive stops the motor in the deceleration time set in *C1-09 [Fast Stop Time]*. Fault relay output terminal 1NO-1CM activates and terminal 1NC-1CM deactivates.

3 : Alarm Only

The keypad shows *EF0* and the drive continues operation at the current frequency reference.

Note:

Separately prepare safety protection equipment and systems, for example fast stop switches.

The output terminal set for *Alarm [H2-01 to H2-03 = 4]* activates.

■ F6-04 bUS Err Det.Time

No. (Hex.)	Name	Description	Default (Range)
F6-04 (03A5)	bUS Err Det.Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the delay time for the drive to detect *bUS [Option Communication Error]*.	2.0 s (0.0 - 5.0 s)

Note:

When you install an option card in the drive, the parameter value changes to 0.0 s.

■ F6-06 Trq Ref/Lim Comms

No. (Hex.)	Name	Description	Default (Range)
F6-06 (03A7)	Trq Ref/Lim Comms	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function that enables and disables the torque reference and torque limit received from the communication option.	0 (0, 1)

0 : Disabled

1 : Enabled

■ F6-07 Multi-Ref@NetRef/ComRef

No. (Hex.)	Name	Description	Default (Range)
F6-07 (03A8)	Multi-Ref@NetRef/ ComRef	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function that enables and disables the multi-step speed reference when the frequency reference source is NetRef or ComRef (communication option card or Modbus communications).	0 (0, 1)

0 : Disable MultiStep References

When NetRef or ComRef are the frequency reference source, the multi-step speed reference (2-step speed to 16-step speed references) and the Jog Frequency Reference (JOG command) are disabled.

1 : Enable MultiStep References

When NetRef or ComRef are the frequency reference source, the multi-step speed reference (2-step speed through 16-step speed references) and the Jog Frequency Reference (JOG command) are enabled, and you can change the frequency reference.

■ F6-08 Comm Par RST@Initialize

No. (Hex.)	Name	Description	Default (Range)
F6-08 (036A)	Comm Par RST@Initialize	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function to initialize *F6-xx and F7-xx parameters* when the drive is initialized with *A1-03 [Init Parameters]*.	0 (0, 1)

0 : Retain Pars - No Reset

1 : Factory Default - Reset

Note:

When you use *A1-03* to initialize the drive, this setting will not change.

■ F6-10 CCLink Node Address

No. (Hex.)	Name	Description	Default (Range)
F6-10 (03B6)	CCLink Node Address	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the node address for CC-Link communication. Restart the drive after changing this setting.	0 (0 - 64)

Note:

Be sure to set a node address that is different than all other node addresses. Do not set this parameter to *0*. Incorrect parameter settings will cause *AEr [Station Address Setting Error]* errors and the L.ERR LED on the option will come on.

When the only drive is connected, you can connect a maximum of 42 nodes. Follow these rules to connect devices that are not drives:

- $\{(1 \times a) + (2 \times b) + (3 \times c) + (4 \times d)\} \leq 64$
  (a: number of units that occupies 1 node, b: number of units that occupies 2 nodes, c: number of units that occupies 3 nodes, d: number of units that occupies 4 nodes)
- $\{(16 \times A) + (54 \times B) + (88 \times C)\} \leq 2304$
  (A: number of remote I/O nodes (64 max.), B: number of remote device nodes (42 max.), C: number of local nodes (26 max.))

■ F6-11 CCLink Comm Speed

No. (Hex.)	Name	Description	Default (Range)
F6-11 (03B7)	CCLink Comm Speed	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the communication speed for CC-Link communication. Restart the drive after you change this setting.	0 (0 - 4)

0 : 156 kbps

1 : 625 kbps

2 : 2.5 Mbps

3 : 5 Mbps

4 : 10 Mbps

■ F6-14 BUS Err. AutoReset

No. (Hex.)	Name	Description	Default (Range)
F6-14 (03BB)	BUS Err. AutoReset	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the automatic reset function for *bUS [Option Communication Errors]*.	0 (0, 1)

0 : Disabled

1 : Enabled

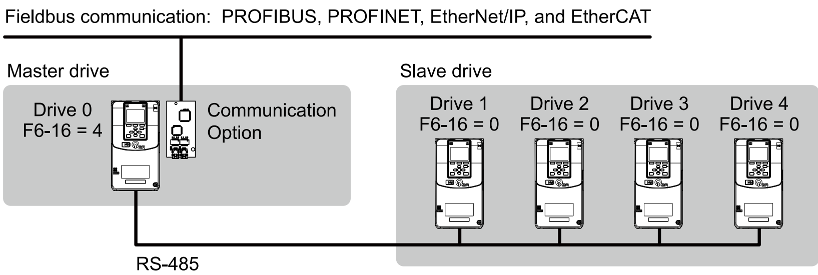
■ F6-16 Gateway Mode

No. (Hex.)	Name	Description	Default (Range)
F6-16 (0B8A)	Gateway Mode	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the gateway mode operation and the number of connected slave drives.	0 (0 - 4)

0 : Disabled
1 : 1 Slave Drive
2 : 2 Slave Drives
3 : 3 Slave Drives
4 : 4 Slave Drives

Gateway Mode processes communications through internal the RS-485 communication function to relay data from a drive that has the communication option to more than one drive that does not have the communication option. This function lets you use fieldbus communication to connect a maximum of 5 drives with only one communication option. The drive sends these commands and responses between the controller (Host device), master drive (Drive 0), and the slave drives (Drive 1 to Drive 4).

- Commands: Run command and frequency reference
- Output frequency and drive status (during run, faults)
- Read and write parameters
- Read monitors



NOTICE: *When you use Gateway Mode, do not install the communication option in slave drives. Failure to obey can cause problems with synchronization of drive commands and responses.*

Note:
- Response speed with the communication option is slower than with point-to-point communications.
- Set *H5-03 [Communication Parity Selection]* to the same value on the master drive and slave drives.

Table 12.35 shows the parameter settings when you connect 4 slave drives:

Table 12.35 Parameter Settings to Connect 4 Slave Drives

	F6-16 [Gateway Mode]	H5-01 [Mbus Address]	H5-02 [Mbus BaudRate]	H5-03 [Mbus Parity]	H5-06 [Mbus Tx Wait Time]	H5-09 [Mbus CE Detect Time]	b1-01 [Freq. Ref. Sel. 1]	b1-02 [Run Comm. Sel 1]
Drive0 (Master Drive)	1 - 4	1F (Default)	*2	*2	5 ms *3	2.0 s minimum *4	3 [Option PCB]	3 [Option PCB]
Drive1 (Slave Drive 1)	0	01	*2	*2	5 ms *3	0.9 s minimum *4	2 [Modbus Communications] *5	2 [Modbus Communications] *5
Drive2 (Slave Drive 2)	0	02	*2	*2	5 ms *3	0.9 s minimum *4	2 [Modbus Communications] *5	2 [Modbus Communications] *5
Drive3 (Slave Drive 3)	0	03	*2	*2	5 ms *3	0.9 s minimum *4	2 [Modbus Communications] *5	2 [Modbus Communications] *5
Drive4 (Slave Drive 4)	0	04	*2	*2	5 ms *3	0.9 s minimum *4	2 [Modbus Communications] *5	2 [Modbus Communications] *5

*1 Set the number of connected slave drives.
*2 Make sure that you set the communications speed and communications parity to the same value on the master drive and slave drives.
*3 To correctly detect the response timeout, do not change the value of *H5-06* from the default value.
*4 Set $H5\text{-}09 \geq 0.9$ s. When $H5\text{-}09 < 0.9$, the drive will detect *CE* before it detects a response timeout.
*5 Set the Run command and frequency reference source on slave drives to Modbus communications.

Note:
- If the timeout or message occurs 10 consecutive times, the master drive stops transmitting to the slave drives. Reset the fault to restart communication.
- If you change the access command before the Modbus access completion flag turns on, the drive will not execute the command from before.

Special Register Specifications

Table 12.36 Command Data

Register No.	Description		
1	Command source update (15C5H)		This flag enables command updates.
	bit 0	Drive 1 Update Command Enabled	To input the Run command and frequency reference at the same time, change the bit value from 0 to 1 after you write all commands.
	bit 1	Drive 2 Update Command Enabled	
	bit 2	Drive 3 Update Command Enabled	
	bit 3	Drive 4 Update Command Enabled	
	bit 4	Update Register Access Command Enabled	
	bit 5 - F	Reserved	
2	Run Command (Drive 1) (15C6H)		
	bit 0	H5-12 = 0: FWD/Stop 0 = Stop 1 = Forward run	
		H5-12 = 1: Run/Stop 0 = Stop 1 = Run	
	bit 1	H5-12 = 0: REV/Stop 0 = Stop 1 = Reverse run	
		H5-12 = 1: FWD/REV 0 = Forward run 1 = Reverse run	
	bit 2	External Fault	
	bit 3	Fault Reset	
	bit 4	ComRef	
	bit 5	ComCtrl	
	bit 6 - F	Reserved	
3	Frequency Reference (Drive 1) (15C7H)		The unit of measure changes when *o1-03* changes.
4	Run Command (Drive 2) (15C8H)		
5	Frequency Reference (Drive 2) (15C9H)		
6	Run Command (Drive 3) (15CAH)		
7	Frequency Reference (Drive 3) (15CBH)		
8	Run Command (Drive 4) (15CCH)		
9	Frequency Reference (Drive 4) (15CDH)		
10	Slave Address for Reg. Access + Read/Write (15CEH)		
	bit 0 bit 1 bit 2 bit 3	Slave address 0: Broadcast Messages (Modbus) 1: Drive 1 2: Drive 2 3: Drive 3 4: Drive 4 5: Broadcast Messages (run command and frequency reference)	When bit 0 to 3 = 0, access is enabled for broadcast messages only. When bit 0 to 3 = 5, access is enabled for Run command and frequency reference broadcast messages only. Drive 0 is excluded.
	bit 4	0: Read, 1: Write	
	bit 5 - F	Reserved	
11	Register number (15CFH)		
12	Data (write register) (15D0H)		

Table 12.37 Monitor Data

Register No.	Description		
1	Command source update (15E7H)		
	bit 0	During Run	
	bit 1	During Reverse Run	
	bit 2	Drive Ready	
	bit 3	Fault	
	bit 4	Frequency Command Setting Fault	1: Upper/Lower Limit Fault
	bit 5	No response from slave	1: Response has timed out.
	bit 6	Communication Error	1: A fault has been detected from a slave.
	bit 7	No response from slave 10 consecutive attempts.	1: Timeout has occurred 10 consecutive times.
	bit 8	Communication fault has occurred 10 consecutive times.	1: Fault has occurred from a slave 10 consecutive times.
	bit 9	Receive broadcast command while drive is running	1: Drive operates in as specified by the broadcast message command.
	bit A	Communication error with master drive	1: The slave cannot communicate with the master because of a communication error.
	bit B - D	Reserved	
	bit E	ComRef status	
	bit F	ComCtrl status	
2	Output frequency or frequency reference (Drive Status Bit 4: ON) (Drive 1) (15E8) Drive Status Bit 4 = 0 [Output Frequency] Drive Status Bit 4 = 1 [Frequency Reference]		The unit of measure changes when *o1-03* changes.
3	Drive Status (Drive 2) (15E9H)		
4	Output frequency or frequency reference (Drive Status Bit 4: ON) (Drive 2) (15EAH)		
5	Drive Status (Drive 3) (15EBH)		
6	Output frequency or frequency reference (Drive Status Bit 4: ON) (Drive 3) (15ECH)		
7	Drive Status (Drive 4) (15EDH)		
8	Output frequency or frequency reference (Drive Status Bit 4: ON) (Drive 4) (15EEH)		
9	Slave Address for Reg. Access + During Modbus process & ErrCode (15EFH)		
	bit 0 bit 1 bit 2 bit 3 bit 4 bit 5 bit 6 bit 7	00H: Modbus Communication Complete 02H: Register number not registered 21H: Upper/Lower Limit Fault 22H: Write Mode Error 23H: Write performed during occurrence of *Uv* 24H: Write performed while writing parameter settings FFH: During Modbus Communication	
	bit 8 bit 9 bit A	Slave address 0: Modbus command ignored 1: Drive 1 2: Drive 2 4: Drive 3 5: Drive 4	
11	Register number (15F0H)		
12	Data (write register) (15F1H)		

■ F6-20 MLII Address

No. (Hex.)	Name	Description	Default (Range)
F6-20 (036B)	MLII Address	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the station address for MECHATROLINK communication. Restart the drive after changing this setting.	0021h (MECHATROLINK-II : 0020h - 003Fh , MECHATROLINK-III : 0003h - 00EFh)

Note:
- The setting range changes if using MECHATROLINK-II or MECHATROLINK-III:
  - –MECHATROLINK-II (SI-T3) range: 20 to 3F
  - –MECHATROLINK-III (SI-ET3) range: 03 to EF
- Be sure to set a node address that is different than all other node addresses. Incorrect parameter settings will cause *AEr [Station Address Setting Error]* errors and the L.ERR LED on the option will come on.
- The drive detects *AEr* errors when the station address is 20 or 3F.

■ F6-21 MLII Frame Size

No. (Hex.)	Name	Description	Default (Range)
F6-21 (036C)	MLII Frame Size	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the frame size for MECHATROLINK communication. Restart the drive after you change this setting.	0 (0, 1)

0 : 32-byte

1 : 17-byte

■ F6-22 MLII Link Speed

No. (Hex.)	Name	Description	Default (Range)
F6-22 (036D)	MLII Link Speed	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the communications speed for MECHATROLINK-II. Restart the drive after you change this setting.	0 (0, 1)

Note:
This parameter is only available with the MECHATROLINK-II option.

0 : 10 Mbps

1 : 4 Mbps

■ F6-23 MLII Mon Sel (E)

No. (Hex.)	Name	Description	Default (Range)
F6-23 (036E)	MLII Mon Sel (E)	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Modbus register used for the monitor functions of INV_CTL (drive operation control command) and INV_I/O (drive I/O control command). Restart the drive after you change this setting.	0000h (0000h - FFFFh)

To enable the Modbus register set in *F6-23*, set SEL_MON2/1 to 0EH or set SEL_MON 3/4 and SEL_MON 5/6 to 0EH. Bytes of the response data enable the Modbus register content that was set in *F6-23*.

■ F6-24 MLII Mon Sel (F)

No. (Hex.)	Name	Description	Default (Range)
F6-24 (036F)	MLII Mon Sel (F)	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Modbus register used for the monitor functions of INV_CTL (drive operation control command) and INV_I/O (drive I/O control command). Restart the drive after you change this setting.	0000h (0000h - FFFFh)

To enable the Modbus register set in *F6-24*, set SEL_MON2/1 to 0FH or set SEL_MON3/4 and SEL_MON 5/6 to 0FH. Bytes of the response data enable the Modbus register content that was set *F6-24*.

■ F6-25 MLII Watchdog Error Sel

No. (Hex.)	Name	Description	Default (Range)
F6-25 (03C9)	MLII Watchdog Error Sel	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the method to stop the motor or let the motor continue operating when the drive detects an *E5 [MECHATROLINK Watchdog Timer Err]*.	1 (0 - 3)

0 : Ramp->Stop

The drive ramps to stop in the set deceleration time. Fault relay output terminal 1NO-1CM will activate, and 1NC-1CM will deactivate.

1 : Coast->Stop

The drive output shuts off and the motor coasts to stop. Fault relay output terminal 1NO-1CM will activate, and 1NC-1CM will deactivate.

2 : Fast Stop (C1-09)

The drive uses the deceleration time set in *C1-09 [Fast Stop Time]*. Fault relay output terminal 1NO-1CM will activate, and 1NC-1CM will deactivate.

3 : Alarm Only

The keypad shows *E5*, and the drive continues to operate.

Note:

Separately prepare safety protection equipment and systems, for example fast stop switches.

The output terminal set for *Alarm [H2-01 to H2-03 = 4]* activates.

■ F6-26 MLII bUS Err Detected

No. (Hex.)	Name	Description	Default (Range)
F6-26 (03CA)	MLII bUS Err Detected	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the number of times that the option must detect a *bUS* alarm to cause a *bUS [Option Communication Error]*.	2 times (2 - 10 times)

■ F6-30 PROFI-DP Address

No. (Hex.)	Name	Description	Default (Range)
F6-30 (03CB)	PROFI-DP Address	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the node address for PROFIBUS-DP communication. Restart the drive after changing this setting.	0 (0 - 125)

Note:
- Be sure to set a node address that is different than all other node addresses.
- Node addresses 0, 1, and 2 are usually reserved for control, maintenance, and device self-diagnosis.

■ F6-31 PROFI-DP Clear Command Mode

No. (Hex.)	Name	Description	Default (Range)
F6-31 (03CC)	PROFI-DP Clear Command Mode	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets what the drive will do after it receives the Clear Mode command.	0 (0, 1)

0 : Reset

Resets drive settings, for example frequency reference and I/O settings.

1 : Hold Previous State

The drive keeps the same status as before it received the command.

■ F6-32 PROFI-DP Data Format Select

No. (Hex.)	Name	Description	Default (Range)
F6-32 (03CD)	PROFI-DP Data Format Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the data format of PROFIBUS-DP communication. Restart the drive after changing this setting.	0 (0 - 5)

Note:

The *H5-11 [Mbus ENTER Command Mode]* setting makes the RAM enter command necessary or not necessary to write parameters over network communication. When *F6-32 = 0, 1, or 2*, the *H5-11* setting does not have an effect. The RAM enter command is always necessary to write parameters.

0 : PPO Type

1 : Conventional

2 : PPO (bit0)

This function operates when bit 0 and bit 4 in the register STW have values of 1 (operate). Refer to the PROFIBUS-DP communication manual for more information.

3 : PPO (Enter)

4 : Conv (Enter)

5 : PPO (bit0,Enter)

This function operates when bit 0 and bit 4 in the register STW have values of 1 (operate). Refer to the PROFIBUS-DP communication manual for more information.

■ F6-35 CANopen Address

No. (Hex.)	Name	Description	Default (Range)
F6-35 (03D0)	CANopen Address	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the node address for CANopen communication. Restart the drive after changing this setting.	0 (0 - 126)

Note:

Be sure to set an address that is different than all other node addresses. Do not set this parameter to *0*. Incorrect parameter settings will cause *AEr [Station Address Setting Error]* errors and the L.ERR LED on the option will come on.

■ F6-36 CANopen BaudRate

No. (Hex.)	Name	Description	Default (Range)
F6-36 (03D1)	CANopen BaudRate	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the CANopen communications speed. Restart the drive after you change this setting.	0 (0 - 8)

0 : Auto-Detection

The drive detects the network communication speed and automatically adjusts the communications speed.

1 : 10 kbps

2 : 20 kbps

3 : 50 kbps

4 : 125 kbps

5 : 250 kbps

6 : 500 kbps

7 : 800 kbps

8 : 1 Mbps

■ F6-45 BACnet Address

No. (Hex.)	Name	Description	Default (Range)
F6-45 (02FB)	BACnet Address	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the node address for BACnet communication.	1 (0 - 127)

■ F6-46 BACnet BaudRate

No. (Hex.)	Name	Description	Default (Range)
F6-46 (02FC)	BACnet BaudRate	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the BACnet communications speed.	3 (0 - 8)

0 : 1200 bps

1 : 2400 bps

2 : 4800 bps

3 : 9600 bps

4 : 19.2 kbps

5 : 38.4 kbps

6 : 57.6 kbps

7 : 76.8 kbps

8 : 115.2 kbps

■ F6-47 BACNet Rx-Tx Wait Time

No. (Hex.)	Name	Description	Default (Range)
F6-47 (02FD)	BACNet Rx-Tx Wait Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the wait time for the drive to receive and send BACnet communication.	5 ms (5 - 65 ms)

■ F6-48 BACnet DevOb Id0

No. (Hex.)	Name	Description	Default (Range)
F6-48 (02FE)	BACnet DevOb Id0	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the last word of BACnet communication addresses.	0 (0 - FFFF)

■ F6-49 BACnet DevOb Id1

No. (Hex.)	Name	Description	Default (Range)
F6-49 (02FF)	BACnet DevOb Id1	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the last word of BACnet communication addresses.	0 (0 - 3F)

■ F6-50 DNet MAC Address

No. (Hex.)	Name	Description	Default (Range)
F6-50 (03C1)	DNet MAC Address	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the MAC address for DeviceNet communication. Restart the drive after you change this setting.	0 (0 - 64)

Note:

Be sure to set a MAC address that is different than all other node addresses. Do not set this parameter to 0. Incorrect parameter settings will cause *AEr [Station Address Setting Error]* errors and the MS LED on the option will flash.

■ F6-51 DNet Baud Rate

No. (Hex.)	Name	Description	Default (Range)
F6-51 (03C2)	DNet Baud Rate	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the DeviceNet communications speed. Restart the drive after you change this setting.	0 (0 - 4)

0 : 125 kbps

1 : 250 kbps

2 : 500 kbps

3 : Adjustable from Network

The controller sets the communications speed.

4 : Detect Automatically

The drive detects the network communication speed and automatically adjusts the communications speed.

■ F6-52 DNet PCA Setting

No. (Hex.)	Name	Description	Default (Range)
F6-52 (03C3)	DNet PCA Setting	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the format of data that the DeviceNet communication master sends to the drive.	21 (0 - 255)

Note:

If *F6-52 [DNet PCA Setting]* and *F6-53 [DNet PPA Setting]* are not correct, the value is reset to default.

■ F6-53 DNet PPA Setting

No. (Hex.)	Name	Description	Default (Range)
F6-53 (03C4)	DNet PPA Setting	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the format of data that the drive sends to the DeviceNet communication master.	71 (0 - 255)

Note:

If *F6-52 [DNet PCA Setting]* and *F6-53 [DNet PPA Setting]* are not correct, the value is reset to default.

F6-54 DNet Idle Fault Detection

No. (Hex.)	Name	Description	Default (Range)
F6-54 (03C5)	DNet Idle Fault Detection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function to detect *EF0 [Option Card External Fault]* when the drive does not receive data from the DeviceNet master.	0 (0 - 4)

0 : Enabled

1 : Disabled, No Fault Detection

Does not detect *EF0* issues.

2 : Vendor Specific

3 : RUN Forward

4 : RUN Reverse

F6-55 DNet Baud Monitor

No. (Hex.)	Name	Description	Default (Range)
F6-55 (03C6)	DNet Baud Monitor	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function to see the actual DeviceNet communications speed using the keypad. This parameter functions as a monitor only.	0 (0 - 2)

0 : 125 kbps

1 : 250 kbps

2 : 500 kbps

F6-56 DNet Speed Scale Factor

No. (Hex.)	Name	Description	Default (Range)
F6-56 (03D7)	DNet Speed Scale Factor	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the speed scale for DeviceNet communication.	0 (-15 - +15)

F6-57 DNet Current Scale Factor

No. (Hex.)	Name	Description	Default (Range)
F6-57 (03D8)	DNet Current Scale Factor	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the current scale of the DeviceNet communication master.	0 (-15 - +15)

F6-58 DNet Torque Scale Factor

No. (Hex.)	Name	Description	Default (Range)
F6-58 (03D9)	DNet Torque Scale Factor	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the torque scale of the DeviceNet communication master.	0 (-15 - +15)

F6-59 DNet Power Scaling

No. (Hex.)	Name	Description	Default (Range)
F6-59 (03DA)	DNet Power Scaling	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the power scale of the DeviceNet communication master.	0 (-15 - +15)

F6-60 DNet Voltage Scale

No. (Hex.)	Name	Description	Default (Range)
F6-60 (03DB)	DNet Voltage Scale	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the voltage scale of the DeviceNet communication master.	0 (-15 - +15)

F6-61 DNet Time Scale

No. (Hex.)	Name	Description	Default (Range)
F6-61 (03DC)	DNet Time Scale	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the time scale of the DeviceNet communication master.	0 (-15 - +15)

F6-62 DNet Heartbeat Interval

No. (Hex.)	Name	Description	Default (Range)
F6-62 (03DD)	DNet Heartbeat Interval	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the heartbeat for DeviceNet communication. Set this parameter to 0 to disable the heartbeat function.	0 (0 - 10)

F6-63 DNet Network MAC ID

No. (Hex.)	Name	Description	Default (Range)
F6-63 (03DE)	DNet Network MAC ID	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function to see the actual DeviceNet MAC address using the keypad. This parameter functions as a monitor only.	0 (0 - 63)

F6-64 to F6-67 DynOut.Ass109 P1 to P4

No. (Hex.)	Name	Description	Default (Range)
F6-64 to F6-67 (03DF - 03E2)	DynOut.Ass109 P1 to P4	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets Configurable Outputs 1 to 4 written to the Modbus register.	0000h (0000h - FFFFh)

F6-68 to F6-71 DynIn.Ass159 P1 to 4

No. (Hex.)	Name	Description	Default (Range)
F6-68 to F6-71 (03E3, 03E4, 03C7, and 03C8)	DynIn.Ass159 P1 to 4	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets Configurable Inputs 1 to 4 written to the Modbus register.	0000h (0000h - FFFFh)

F6-72 PowerLink Address

No. (Hex.)	Name	Description	Default (Range)
F6-72 (081B)	PowerLink Address	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the node ID for PowerLink communication.	0 (0 - 255)

F7-01 IP Address 1

No. (Hex.)	Name	Description	Default (Range)
F7-01 (03E5)	IP Address 1	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the first octet of the IP Address for the device that is connecting to the network. Restart the drive after you change this parameter.	192 (0 - 255)

Note:

When *F7-13 = 0 [Addr Mode@Startup = Static]*:

- Use parameters *F7-01 to F7-04 [IP Address 1 to IP Address 4]* to set the IP Address. Be sure to set a different IP address for each drive on the network.
- Also set parameters *F7-01 to F7-12*.

F7-02 IP Address 2

No. (Hex.)	Name	Description	Default (Range)
F7-02 (03E6)	IP Address 2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the second octet of the IP Address for the device that is connecting to the network. Restart the drive after you change this parameter.	168 (0 - 255)

Note:

When *F7-13 = 0 [Addr Mode@Startup = Static]*:
- Use parameters *F7-01 to F7-04 [IP Address 1 to IP Address 4]* to set the IP Address. Be sure to set a different IP address for each drive on the network.
- Also set parameters *F7-01 to F7-12*.

■ F7-03 IP Address 3

No. (Hex.)	Name	Description	Default (Range)
F7-03 (03E7)	IP Address 3	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the third octet of the IP Address for the device that is connecting to the network. Restart the drive after you change this parameter.	1 (0 - 255)

Note:

When *F7-13 = 0 [Addr Mode@Startup = Static]*:
- Use parameters *F7-01 to F7-04 [IP Address 1 to IP Address 4]* to set the IP Address. Be sure to set a different IP address for each drive on the network.
- Also set parameters *F7-01 to F7-12*.

■ F7-04 IP Address 4

No. (Hex.)	Name	Description	Default (Range)
F7-04 (03E8)	IP Address 4	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the fourth octet of the IP Address for the device that is connecting to the network. Restart the drive after you change this parameter.	20 (0 - 255)

Note:

When *F7-13 = 0 [Addr Mode@Startup = Static]*:
- Use parameters *F7-01 to F7-04 [IP Address 1 to IP Address 4]* to set the IP Address. Be sure to set a different IP address for each drive on the network.
- Also set parameters *F7-01 to F7-12*.

■ F7-05 Subnet Mask 1

No. (Hex.)	Name	Description	Default (Range)
F7-05 (03E9)	Subnet Mask 1	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the first octet of the subnet mask of the connected network.	255 (0 - 255)

Note:

Set this parameter when *F7-13 = 0 [Addr Mode@Startup = Static]*.

■ F7-06 Subnet Mask 2

No. (Hex.)	Name	Description	Default (Range)
F7-06 (03EA)	Subnet Mask 2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the second octet of the subnet mask of the connected network.	255 (0 - 255)

Note:

Set this parameter when *F7-13 = 0 [Addr Mode@Startup = Static]*.

■ F7-07 Subnet Mask 3

No. (Hex.)	Name	Description	Default (Range)
F7-07 (03EB)	Subnet Mask 3	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the third octet of the subnet mask of the connected network.	255 (0 - 255)

Note:

Set this parameter when *F7-13 = 0 [Addr Mode@Startup = Static]*.

■ F7-08 Subnet Mask 4

No. (Hex.)	Name	Description	Default (Range)
F7-08 (03EC)	Subnet Mask 4	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the fourth octet of the subnet mask of the connected network.	0 (0 - 255)

Note:

Set this parameter when *F7-13 = 0 [Addr Mode@Startup = Static]*.

■ F7-09 Gateway Addr 1

No. (Hex.)	Name	Description	Default (Range)
F7-09 (03ED)	Gateway Addr 1	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the first octet of the gateway address of the connected network.	192 (0 - 255)

Note:

Set this parameter when *F7-13 = 0 [Addr Mode@Startup = Static]*.

■ F7-10 Gateway Addr 2

No. (Hex.)	Name	Description	Default (Range)
F7-10 (03EE)	Gateway Addr 2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the second octet of the gateway address of the connected network.	168 (0 - 255)

Note:

Set this parameter when *F7-13 = 0 [Addr Mode@Startup = Static]*.

■ F7-11 Gateway Addr 3

No. (Hex.)	Name	Description	Default (Range)
F7-11 (03EF)	Gateway Addr 3	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the third octet of the gateway address of the connected network.	1 (0 - 255)

Note:

Set this parameter when *F7-13 = 0 [Addr Mode@Startup = Static]*.

■ F7-12 Gateway Addr 4

No. (Hex.)	Name	Description	Default (Range)
F7-12 (03F0)	Gateway Addr 4	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the fourth octet of the gateway address of the connected network.	1 (0 - 255)

Note:

Set this parameter when *F7-13 = 0 [Addr Mode@Startup = Static]*.

■ F7-13 Addr Mode@Startup

No. (Hex.)	Name	Description	Default (Range)
F7-13 (03F1)	Addr Mode@Startup	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the method to set option card IP addresses.	2 (0 - 2)

0 : Static

1 : BOOTP

2 : DHCP

Note:

- The following setting values are available when using the PROFINET communication option card (SI-EP3).
  - –0: Static
  - –2: DHCP
- When *F7-13 = 0*, set parameters *F7-01 to F7-12 [IP Address 1 to Gateway Addr 4]* to set the IP Address. Be sure to set a different IP address for each drive on the network.

■ F7-14 Duplex Mode Selection

No. (Hex.)	Name	Description	Default (Range)
F7-14 (03F2)	Duplex Mode Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the duplex mode setting method.	1 (0 - 8)

0 : Half/Half

1 : Auto/Auto

2 : Full/Full

3 : Half/Auto

Port 1 is set to “Half” and port 2 is set to “Auto”.

4 : Half/Full

Port 1 is set to “Half” and port 2 is set to “Full”.

5 : Auto/Half

Port 1 is set to “Auto” and port 2 is set to “Half”.

6 : Auto/Full

Port 1 is set to “Auto” and port 2 is set to “Full”.

7 : Full/Half

Port 1 is set to “Full” and port 2 is set to “Half”.

8 : Full/Auto

Port 1 is set to “Full” and port 2 is set to “Auto”.

■ F7-15 Comm. BaudRate

No. (Hex.)	Name	Description	Default (Range)
F7-15 (03F3)	Comm. BaudRate	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the communications speed.	10 (10, 102)

10 : 10/10 Mbps

102 : 100/10 Mbps

Note:

Set this parameter when *F7-14 = 0 or 2 [Duplex Mode Selection = Half/Half or Full/Full]*.

■ F7-16 Timeout Value

No. (Hex.)	Name	Description	Default (Range)
F7-16 (03F4)	Timeout Value	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the detection time for a communications timeout.	0.0 s (0.0 - 30.0 s)

Note:

Set this parameter to 0.0 to disable the connection timeout function.

■ F7-17 E/IP Speed Scale Factor

No. (Hex.)	Name	Description	Default (Range)
F7-17 (03F5)	E/IP Speed Scale Factor	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the scaling factor for the speed monitor in the EtherNet/IP Class ID 2AH Object.	0 (-15 - +15)

■ F7-18 E/IP Current Scale Factor

No. (Hex.)	Name	Description	Default (Range)
F7-18 (03F6)	E/IP Current Scale Factor	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the scaling factor for the output current monitor in the EtherNet/IP Class ID 2AH Object.	0 (-15 - +15)

■ F7-19 E/IP Torque Scale Factor

No. (Hex.)	Name	Description	Default (Range)
F7-19 (03F7)	E/IP Torque Scale Factor	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the scaling factor for the torque monitor in the EtherNet/IP Class ID 2AH Object.	0 (-15 - +15)

F7-20 E/IP Power Scale Factor

No. (Hex.)	Name	Description	Default (Range)
F7-20 (03F8)	E/IP Power Scale Factor	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the scaling factor for the power monitor in the EtherNet/IP Class ID 2AH Object.	0 (-15 - +15)

F7-21 E/IP Voltage Scale Factor

No. (Hex.)	Name	Description	Default (Range)
F7-21 (03F9)	E/IP Voltage Scale Factor	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the scaling factor for the voltage monitor in the EtherNet/IP Class ID 2AH Object.	0 (-15 - +15)

F7-22 E/IP Time Scale Factor

No. (Hex.)	Name	Description	Default (Range)
F7-22 (03FA)	E/IP Time Scale Factor	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the scaling factor for the time monitor in the EtherNet/IP Class ID 2AH Object.	0 (-15 - +15)

F7-23 to F7-32 DynOut.Ass116 P1 to 5 for CommCard and DynOut.Ass116 P6 to 10 for CommCard

No. (Hex.)	Name	Description	Default (Range)
F7-23 to F7-27 (03FB - 03FF) F7-28 to F7-32 (0370 - 0374)	DynOut.Ass116 P1 to 5 for CommCard DynOut.Ass116 P6 to 10 for CommCard	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets Output Assembly 116. The drive writes the values from Output Assembly 116 to the Modbus address register that is stored for each parameter. The drive will not write the values from Output Assembly 116 to the registers when the Modbus address is 0.	0

F7-33 to F7-42 DynIn.Ass166 P1 to 10 for CommCard

No. (Hex.)	Name	Description	Default (Range)
F7-33 to F7-42 (0375 - 037E)	DynIn.Ass166 P1 to 10 for CommCard	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets Input Assembly 166. The drive sends the values from the Modbus address registers stored for each parameter to Input Assembly 166. The drive returns the default register value for the option card when the Modbus address is 0 and the value sent to Input Assembly 166 is not defined.	0

F7-60 PZD1 WR(CtrlWrd)

No. (Hex.)	Name	Description	Default (Range)
F7-60 (0780)	PZD1 WR(CtrlWrd)	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Modbus address for PZD1 (PPO output). PZD1 (PPO output) functions as the STW when *F7-60 = 0, 1, or 2*.	0

F7-61 PZD2 WR(FRef)

No. (Hex.)	Name	Description	Default (Range)
F7-61 (0781)	PZD2 WR(FRef)	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Modbus address for PZD2 (PPO output). PZD2 (PPO output) functions as the HSW when *F7-61 = 0, 1, or 2*.	0

F7-62 PZD3 Write

No. (Hex.)	Name	Description	Default (Range)
F7-62 (0782)	PZD3 Write	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Modbus address for PZD3 (PPO output). A value of 0, 1, or 2 will disable the PZD3 (PPO output) write operation to the Modbus register.	0

F7-63 PZD4 Write

No. (Hex.)	Name	Description	Default (Range)
F7-63 (0783)	PZD4 Write	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Modbus address for PZD4 (PPO output). A value of 0, 1, or 2 will disable the PZD4 (PPO output) write operation to the Modbus register.	0

F7-64 PZD5 Write

No. (Hex.)	Name	Description	Default (Range)
F7-64 (0784)	PZD5 Write	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Modbus address for PZD5 (PPO output). A value of 0, 1, or 2 will disable the PZD5 (PPO output) write operation to the Modbus register.	0

F7-65 PZD6 Write

No. (Hex.)	Name	Description	Default (Range)
F7-65 (0785)	PZD6 Write	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Modbus address for PZD6 (PPO output). A value of 0, 1, or 2 will disable the PZD6 (PPO output) write operation to the Modbus register.	0

F7-66 PZD7 Write

No. (Hex.)	Name	Description	Default (Range)
F7-66 (0786)	PZD7 Write	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Modbus address for PZD7 (PPO output). A value of 0, 1, or 2 will disable the PZD7 (PPO output) write operation to the Modbus register.	0

F7-67 PZD8 Write

No. (Hex.)	Name	Description	Default (Range)
F7-67 (0787)	PZD8 Write	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Modbus address for PZD8 (PPO output). A value of 0, 1, or 2 will disable the PZD8 (PPO output) write operation to the Modbus register.	0

F7-68 PZD9 Write

No. (Hex.)	Name	Description	Default (Range)
F7-68 (0788)	PZD9 Write	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Modbus address for PZD9 (PPO output). A value of 0, 1, or 2 will disable the PZD9 (PPO output) write operation to the Modbus register.	0

F7-69 PZD10 Write

No. (Hex.)	Name	Description	Default (Range)
F7-69 (0789)	PZD10 Write	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Modbus address for PZD10 (PPO output). A value of 0, 1, or 2 will disable the PZD10 (PPO output) write operation to the Modbus register.	0

F7-70 PZD1 RD (StatWord)

No. (Hex.)	Name	Description	Default (Range)
F7-70 (078A)	PZD1 RD (StatWord)	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Modbus address for PZD1 (PPO Read). PZD1 (PPO input) functions as the ZSW when *F7-70 = 0*.	0

F7-71 PZD2 RD (OutFreq)

No. (Hex.)	Name	Description	Default (Range)
F7-71 (078B)	PZD2 RD (OutFreq)	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Modbus address for PZD2 (PPO Read). PZD2 (PPO input) functions as the HIW when *F7-71 = 0*.	0

F7-72 PZD3 Read

No. (Hex.)	Name	Description	Default (Range)
F7-72 (078C)	PZD3 Read	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Modbus address for PZD3 (PPO Read). A value of 0 will disable the PZD3 (PPO input) load operation from the Modbus register.	0

F7-73 PZD4 Read

No. (Hex.)	Name	Description	Default (Range)
F7-73 (078D)	PZD4 Read	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Modbus address for PZD4 (PPO Read). A value of 0 will disable the PZD4 (PPO input) load operation from the Modbus register.	0

F7-74 PZD5 Read

No. (Hex.)	Name	Description	Default (Range)
F7-74 (078E)	PZD5 Read	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Modbus address for PZD5 (PPO Read). A value of 0 will disable the PZD5 (PPO input) load operation from the Modbus register.	0

F7-75 PZD6 Read

No. (Hex.)	Name	Description	Default (Range)
F7-75 (078F)	PZD6 Read	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Modbus address for PZD6 (PPO Read). A value of 0 will disable the PZD6 (PPO input) load operation from the Modbus register.	0

F7-76 PZD7 Read

No. (Hex.)	Name	Description	Default (Range)
F7-76 (0790)	PZD7 Read	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Modbus address for PZD7 (PPO Read). A value of 0 will disable the PZD7 (PPO input) load operation from the Modbus register.	0

F7-77 PZD8 Read

No. (Hex.)	Name	Description	Default (Range)
F7-77 (0791)	PZD8 Read	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Modbus address for PZD8 (PPO Read). A value of 0 will disable the PZD8 (PPO input) load operation from the Modbus register.	0

F7-78 PZD9 Read

No. (Hex.)	Name	Description	Default (Range)
F7-78 (0792)	PZD9 Read	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Modbus address for PZD9 (PPO Read). A value of 0 will disable the PZD9 (PPO input) load operation from the Modbus register.	0

■ F7-79 PZD10 Read

No. (Hex.)	Name	Description	Default (Range)
F7-79 (0793)	PZD10 Read	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Modbus address for PZD10 (PPO Read). A value of 0 will disable the PZD10 (PPO input) load operation from the Modbus register.	0

12.7 H: TERMINALS

H parameters are used to assign functions to external input and output terminals.

◆ H1: DIGITAL INPUTS

H1 Parameters set the DI terminal functions.

■ H1-01 to H1-08 Terminal DI1 to DI8 Function Selection

The drive has 8 DI terminals. Refer to Table 12.38 for drive default settings and functions.

Table 12.38 MFDI Default Settings and Functions

No.	Name	Default	Function
H1-01	DI1 Function Selection	1 (0) *1	Forward Run
H1-02	DI2 Function Selection	2 (0) *1	Reverse Run
H1-03	DI3 Function Selection	24	ExF NO-AlCoast
H1-04	DI4 Function Selection	7B	Fault Reset
H1-05	DI5 Function Selection	A (5) *1	MultSpd Ref1
H1-06	DI6 Function Selection	B (A) *1	MultSpd Ref2
H1-07	DI7 Function Selection	6 (B) *1	Jog Reference
H1-08	DI8 Function Selection	1B	MultSpd Ref2

*1 The value in parentheses identifies the default setting when you set *A1-03 = 3330 [Init Parameters = 3-Wire Initialization]*.

Refer to Table 12.39 the and use *H1-xx [DI Function Select]* to set the function.

Table 12.39 DI Setting Values

Setting	Function	Setting	Function
1 *1	Forward Run	1E *1	Baseblock NC
2 *1	Reverse Run	20 to 2F *1	External Fault
3 *1	Run Command	34 *1	Fast Stop NO
4 *1	FWD/REV Cmd	35 *1	Fast Stop NC
5 *1	3-Wire Seq.	3F *1	SCBraking NC
9	Ext Ref 1/2	40 *1	KEB Thru1 NC
A	MultSpd Ref1	41 *1	KEB Thru1 NO
B	MultSpd Ref2	42 *1	KEB Thru2 NC
C	MultSpd Ref3	43 *1	KEB Thru2 NO
D	MultSpd Ref4	44	Field weakening
E	Offset Frq 1	61	Motor 2 Select
F	Offset Frq 2	62	Up Command
10	Offset Frq 3	63	Down Command
11	LOC/REM Sel.	65	Up2 Command
12	AI Input Sel	66	Dw2 Command
15	FWD/REV Det	67	SpdSrch Fmax
16	Ref Sample	68	SpdSrch Fref
1A	Drive Enable	9F	Q2pack Disable

*1 Inverse input is not available.

■ H1-01 DI1 Function Selection

No. (Hex.)	Name	Description	Default (Range)
H1-01 (0438)	DI1 Function Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function for MFDI terminal DI1.	1 (1 - 4, 6 - 19F)

Note:

The default setting is *0* when the drive is initialized for *3-Wire Initialization [A1-03 = 3330]*.

■ H1-02 DI2 Function Selection

No. (Hex.)	Name	Description	Default (Range)
H1-02 (0439)	DI2 Function Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function for MFDI terminal DI2.	2 (1 - 4, 6 - 19F)

Note:

The default setting is *0* when the drive is initialized for *3-Wire Initialization [A1-03 = 3330]*.

■ H1-03 DI3 Function Selection

No. (Hex.)	Name	Description	Default (Range)
H1-03 (0400)	DI3 Function Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function for MFDI terminal DI3.	24 (0 - 19F)

■ H1-04 DI4 Function Selection

No. (Hex.)	Name	Description	Default (Range)
H1-04 (0401)	DI4 Function Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function for MFDI terminal DI4.	7B (0 - 19F)

■ H1-05 DI5 Function Selection

No. (Hex.)	Name	Description	Default (Range)
H1-05 (0402)	DI5 Function Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function for MFDI terminal DI5.	A (0 - 19F)

Note:

The default setting is *5* when the drive is initialized for *3-Wire Initialization [A1-03 = 3330]*.

■ H1-06 DI6 Function Selection

No. (Hex.)	Name	Description	Default (Range)
H1-06 (0403)	DI6 Function Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function for MFDI terminal DI6.	B (0 - 19F)

Note:

The default setting is *A* when the drive is initialized for *3-Wire Initialization [A1-03 = 3330]*.

■ H1-07 DI7 Function Selection

No. (Hex.)	Name	Description	Default (Range)
H1-07 (0404)	DI7 Function Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function for MFDI terminal DI7.	6 (0 - 19F)

Note:

The default setting is *B* when the drive is initialized for *3-Wire Initialization [A1-03 = 3330]*.

■ H1-08 DI8 Function Selection

No. (Hex.)	Name	Description	Default (Range)
H1-08 (0405)	DI8 Function Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function for MFDI terminal DI8. **Note:** The default setting is *6* when the drive is initialized for *3-Wire Initialization [A1-03 = 3330]*.	1B (0 - 19F)

Note:

The default setting is *6* when the drive is initialized for *3-Wire Initialization [A1-03 = 3330]*.

H1-21 DI1 Funct.Sel 2

No. (Hex.)	Name	Description	Default (Range)
H1-21 (0B70)	DI1 Funct.Sel 2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the second function for MFDI terminal DI1.	0 (1 - 4, 6 - 19F)

When MFDI terminal DI1 activates, it will operate the function set to *H1-01 [DI1 Function Selection]* and the function set to *H1-21* at the same time.

When the setting value is *0*, the function is disabled.

H1-22 DI2 Funct.Sel 2

No. (Hex.)	Name	Description	Default (Range)
H1-22 (0B71)	DI2 Funct.Sel 2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the second function for MFDI terminal DI2.	0 (1 - 4, 6 - 19F)

When MFDI terminal DI2 activates, it will operate the function set to *H1-02 [DI2 Function Selection]* and the function set to *H1-22* at the same time.

When the setting value is *0*, the function is disabled.

H1-23 DI3 Funct.Sel 2

No. (Hex.)	Name	Description	Default (Range)
H1-23 (0B72)	DI3 Funct.Sel 2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the second function for MFDI terminal DI3.	0 (1 - 4, 6 - 19F)

When MFDI terminal DI3 activates, it will operate the function set to *H1-03 [DI3 Function Selection]* and the function set to *H1-23* at the same time.

When the setting value is *0*, the function is disabled.

H1-24 DI4 Funct.Sel 2

No. (Hex.)	Name	Description	Default (Range)
H1-24 (0B73)	DI4 Funct.Sel 2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the second function for MFDI terminal DI4.	0 (1 - 4, 6 - 19F)

When MFDI terminal DI4 activates, it will operate the function set to *H1-04 [DI4 Function Selection]* and the function set to *H1-24* at the same time.

When the setting value is *0*, the function is disabled.

H1-25 DI5 Funct.Sel 2

No. (Hex.)	Name	Description	Default (Range)
H1-25 (0B74)	DI5 Funct.Sel 2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the second function for MFDI terminal DI5.	0 (1 - 4, 6 - 19F)

When MFDI terminal DI5 activates, it will operate the function set to *H1-05 [DI5 Function Selection]* and the function set to *H1-25* at the same time.

When the setting value is *0*, the function is disabled.

H1-26 DI6 Funct.Sel 2

No. (Hex.)	Name	Description	Default (Range)
H1-26 (0B75)	DI6 Funct.Sel 2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the second function for MFDI terminal DI6.	0 (1 - 4, 6 - 19F)

When MFDI terminal DI6 activates, it will operate the function set to *H1-06 [DI6 Function Selection]* and the function set to *H1-26* at the same time.

When the setting value is *0*, the function is disabled.

H1-27 DI7 Funct.Sel 2

No. (Hex.)	Name	Description	Default (Range)
H1-27 (0B76)	DI7 Funct.Sel 2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the second function for MFDI terminal DI7.	0 (1 - 4, 6 - 19F)

When MFDI terminal DI7 activates, it will operate the function set to *H1-07 [DI7 Function Selection]* and the function set to *H1-27* at the same time.

When the setting value is *0*, the function is disabled.

H1-28 DI8 Funct.Sel 2

No. (Hex.)	Name	Description	Default (Range)
H1-28 (0B77)	DI8 Funct.Sel 2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the second function for MFDI terminal DI8.	0 (1 - 4, 6 - 19F)

When MFDI terminal DI8 activates, it will operate the function set to *H1-08 [DI8 Function Selection]* and the unction set to *H1-28* at the same time.

When the setting value is *0*, the function is disabled.

Modbus MFDI 1 to 3 Function Selection

You can set the function for the MFDI to Modbus register *bit 0 to 2 of [15C0(Hex.)]*. Use *H1-40* to *H1-42 [Mbus 15C0h b0 Input Function to Mbus 15C0h b2 Input Function]* to select the function.

Note:
- Refer to H1-xx “MFDI setting values” for the setting values of the MFDI.
- You cannot set *5 [3-Wire Seq.]* or *20 to 2F [External fault]* in *H1-40* to *H1-42*.
- When you will not use *H1-40* to *H1-42*, set them to *0 [Through Mode]*.
- You cannot use MFDI for digital input option D1-A3 at the same time as function selection for Modbus MFDI 1 to 3.

H1-40 Mbus 15C0h b0 Input Function

No. (Hex.)	Name	Description	Default (Range)
H1-40 (0B54)	Mbus 15C0h b0 Input Function	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the MFDI function for *bit 0* of Modbus register *15C0 (Hex.)*.	0 (1 - 4, 6 - 19F)

H1-41 Mbus 15C0h b1 Input Function

No. (Hex.)	Name	Description	Default (Range)
H1-41 (0B55)	Mbus 15C0h b1 Input Function	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the MFDI function for *bit 1* of Modbus register *15C0 (Hex.)*.	0 (1 - 4, 6 - 19F)

H1-42 Mbus 15C0h b2 Input Function

No. (Hex.)	Name	Description	Default (Range)
H1-42 (0B56)	Mbus 15C0h b2 Input Function	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the MFDI function for *bit 2* of Modbus register *15C0 (Hex.)*.	0 (1 - 4, 6 - 19F)

Multi-Function Digital Input Setting Values

Selects a function set with *H1-01 to H1-42*.

0: Through Mode

Setting	Function	Description
0	Through Mode	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Setting for terminals that are not being used or terminals being used in through mode.

Through Mode uses the signal input to the terminal as a digital input for the upper sequence through a communication option or Modbus communications. This input signal does not have an effect on drive operation.

1: Forward Run

Setting	Function	Description
1	Forward Run	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Forward Run command for 2-wire sequence 1. Set this function and *H1-xx = 2 [Reverse Run]* together.

ON : Forward Run
OFF : Run Stop

Note:
- Turning ON the Forward Run command terminal and the Reverse Run command terminal will cause alarm *EF [FWD/REV Run Command Input Error]* and the motor will ramp to stop.
- Initialize the drive with a 2-wire sequence to set the Forward Run command to terminal DI1.
- This function will not operate at the same time as *H1-xx = 3, 4 [Run Command, FWD/REV Cmd]*.

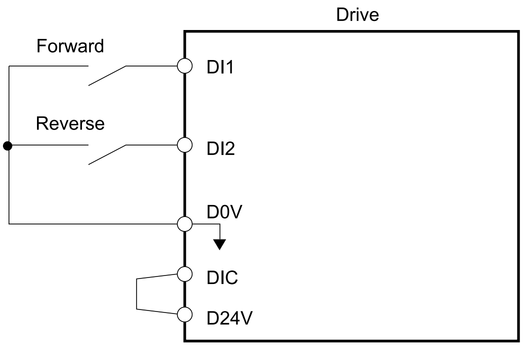


Figure 12.72 2-Wire Sequence Wiring Example

2: Reverse Run

Setting	Function	Description
2	Reverse Run	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Reverse Run command for 2-wire sequence 1. Set this function and *H1-xx = 1 [Forward Run]* together.

ON : Reverse Run
OFF : Run Stop

Note:
- Turning ON the Forward Run command terminal and the Reverse Run command terminal will cause alarm EF [FWD/REV Run Command Input Error] and the motor will ramp to stop.
- Initialize the drive with a 2-wire sequence to set the Reverse Run command to terminal DI2.
- This function will not operate at the same time as *H1-xx = 3, 4 [Run Command, FWD/REV Cmd]*.

3: Run Command

Setting	Function	Description
3	Run Command	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Run command for 2-wire sequence 2. Set this function and *H1-xx = 4 [FWD/REV Cmd]* together.

ON : Run
OFF : Stop

Note:
This function will not operate at the same time as *H1-xx = 1, 2 [Forward Run, Reverse Run]*.

4: FWD/REV Cmd

Setting	Function	Description
4	FWD/REV Cmd	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the direction of motor rotation for 2-wire sequence 2. Set this function and *H1-xx = 3 [Run Command]* together.

ON : Reverse
OFF : Forward

Note:
- You must input the Run command to rotate the motor.
- This function will not operate at the same time as *H1-xx = 1, 2 [Forward Run, Reverse Run]*.

■ 5: 3-Wire Seq.

Setting	Function	Description
5	3-Wire Seq.	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the direction of motor rotation for 3-wire sequence.

If the 3-wire sequence is set to a terminal that is not MFDI terminals DI1 and DI2, these terminals will be the input terminals for Forward run/Reverse run command.

The drive will automatically set terminal DI1 to Run command (RUN) and terminal DI2 to Stop command (STOP). When terminal DI1 (Run command) activates for 1 ms minimum, the drive rotates the motor. When terminal DI2 (Stop command) deactivates, the drive stops. When terminal DIx that is set in 3-wire sequence deactivates, the drive operates in the forward direction, and when it activates, the drive operates in the reverse direction.

WARNING! *Sudden Movement Hazard. Set the MFDI terminal parameters before you close the control circuit wiring. Incorrect Run/Stop circuit sequence settings can cause death or serious injury from moving equipment.*

WARNING! *Sudden Movement Hazard.*
When using a 3-Wire sequence:
- *Set the drive for 3-Wire sequence.*
- *Set b1-17 = 1 [RUN@PowerUp Selection = Disregard RUN]*
- *Wire the drive for 3-Wire sequence.*

If these three conditions are correct, the motor can rotate in reverse when energizing the drive:
- *The drive is wired for 3-Wire sequence.*
- *The drive is set for a 2-Wire sequence (default).*
- *b1-17 = 2 [Accept RUN]*

Failure to obey can cause death or serious injury from moving equipment.

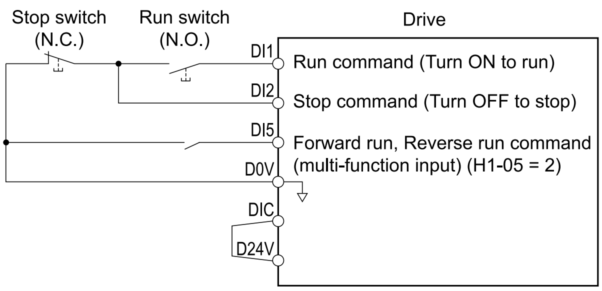


Figure 12.73 3-Wire Sequence Wiring Example

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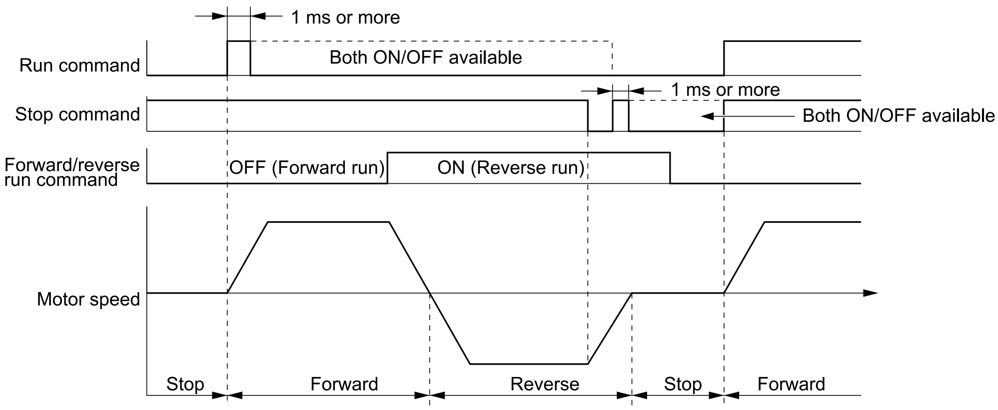

Figure 12.74 3-Wire Sequence Time Chart

Note:
- To input the Run command, activate the terminal for 1 ms minimum.
- The default setting for *b1-17 [RUN@PowerUp Selection]* is *1 [Disregard RUN]*. If you enable the Run command when the drive is energized, the protective function will activate and the RUN will flash quickly. If Run is permitted in the application, set *b1-17 = 2 [Accept RUN]*.

■ 6: Jog Reference

Setting	Function	Description
6	Jog Reference	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the drive to use the JOG Frequency Reference (JOG command) set in *d1-17*. The JOG Frequency Reference (JOG command) overrides Frequency References 1 to 16 (d1-01 to d1-16).

7: Jog Forward

Setting	Function	Description
7	Jog Forward	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the command to operate the motor in the forward direction at the Jog Frequency set in *d1-17 [Jog Reference]*.

Note:
- It is not necessary to input the Run command.
- The Forward JOG command has priority over all other frequency references.
- When the Forward JOG and Reverse JOG commands are activated at the same time for 500 ms or longer, the drive will ramp to stop.

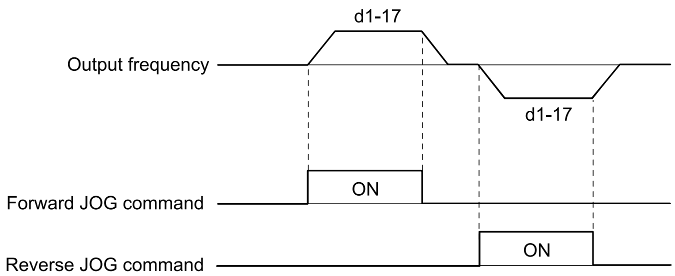

Figure 12.75 JOG Operation Pattern

8: Jog Reverse

Setting	Function	Description
8	Jog Reverse	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the command to operate the motor in the reverse direction at the Jog Frequency set in *d1-17 [Jog Reference]*.

Note:
- It is not necessary to input the Run command.
- The Reverse JOG command has priority over all other frequency references.
- When the Forward JOG and Reverse JOG commands are activated at the same time for 500 ms or longer, the drive will ramp to stop.

9: Ext Ref 1/2

Setting	Function	Description
9	Ext Ref 1/2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the drive to use Run command source 1/2 or Reference command source 1/2 when in REMOTE Mode.

Note:
When the drive is receiving a Run command, you cannot switch between reference sources.

ON : *b1-15 [Freq. Ref. Sel. 2], b1-16 [Run Comm. Sel 2]*

OFF : *b1-01 [Freq. Ref. Sel. 1], b1-02 [Run Comm. Sel 1]*

A: MultSpd Ref1

Setting	Function	Description
A	MultSpd Ref1	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Uses speed references *d1-01 to d1-08 [Reference 1 to Reference 8]* to set a multi-step speed reference.

Note:
Refer to “Setting Procedures for Multi-step Speed Operation” in “d: REFERENCE” for more information.

B: MultSpd Ref2

Setting	Function	Description
B	MultSpd Ref2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Uses speed references *d1-01 to d1-08 [Reference 1 to Reference 8]* to set a multi-step speed reference.

Note:
Refer to “Setting Procedures for Multi-step Speed Operation” in “d: REFERENCE” for more information.

■ C: MultSpd Ref3

Setting	Function	Description
C	MultSpd Ref3	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Uses speed references *d1-01 to d1-08 [Reference 1 to Reference 8]* to set a multi-step speed reference.

Note:

Refer to “Setting Procedures for Multi-step Speed Operation” in “d: REFERENCE” for more information.

■ D: MultSpd Ref4

Setting	Function	Description
D	MultSpd Ref4	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the command to switch *d1-09 to d1-16 [Reference 9 to Reference 16]* with multi-step speed references 1, 2 and 3.

Note:

Refer to “Setting procedure for the multi-step speed operation” for more information.

■ E: Offset Frq 1

Setting	Function	Description
E	Offset Frq 1	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function to add the offset frequency set in *d7-01 [Offset Frq 1]* to the frequency reference when the terminal activates.

Note:

Refer to “d7: OFFSET FREQUENCY” for more information.

■ F: Offset Frq 2

Setting	Function	Description
F	Offset Frq 2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function to add the offset frequency set in *d7-02 [Offset Frq 2]* to the frequency reference when the terminal activates.

Note:

Refer to “d7: OFFSET FREQUENCY” for more information.

■ 10: Offset Frq 3

Setting	Function	Description
10	Offset Frq 3	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function to add the offset frequency set in *d7-03 [Offset Frq 3]* to the frequency reference when the terminal activates.

Note:

Refer to “d7: OFFSET FREQUENCY” for more information.

■ 11: LOC/REM Sel.

Setting	Function	Description
11	LOC/REM Sel.	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets drive control for the keypad (LOCAL) or an external source (REMOTE).

Note:

- When the MFDI terminal sets the LOCAL/REMOTE selection, LO/RE on the keypad is disabled.
- When LOCAL Mode is selected, the green light for LO/RE comes on.
- When the Run command is ON, you cannot switch between LOCAL Mode and REMOTE Mode.

ON : LOCAL

The keypad is the Frequency reference source and Run command source.

OFF : REMOTE

The frequency reference and Run command settings are set in *b1-01*, *b1-02 [Run Comm. Sel 1]* or *b1-15*, *b1-16 [Run Comm. Sel 2]*.

■ 12: AI Input Sel

Setting	Function	Description
12	AI Input Sel	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the command that enables or disables the terminals selected in *H3-14 [An.In Term.Enable Sel]*.

ON : Terminal selected with *H3-14* is enabled

OFF : Terminal selected with *H3-14* is disabled

■ 13: Spd/Trq Switch

Setting	Function	Description
13	Spd/Trq Switch	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function to switch between torque control and speed control.

ON : Torque control

OFF : Speed control

Note:

When this function is enabled, set *d5-01 = 0 [Torque Ctrl Selection = Speed Control]*.

Input the Speed/Torque Control Switchover Time

Use parameter *d5-06 [Spd/Trq Chg Time]* to set the length of time, in milliseconds, that the drive will wait to switch between speed and torque control. When the speed/torque control switchover signal changes in the time set in *d5-06*, the three analog inputs will keep their present value. Complete the signal switchover with an external source in this time.

Note:

Refer to “Switch Speed Control and Torque Control” for more information.

■ 14: AI Trq Polarity

Setting Value	Function	Description
14	AI Trq Polarity	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the rotation direction of the external torque reference.

ON : External torque reference reverse direction

OFF : External torque reference forward direction

■ 15: FWD/REV Det

Setting	Function	Description
15	FWD/REV Det	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the rotation direction of the motor when in Simple Closed Loop V/f Control method and *F1-21, F1-37 = 0 [Encoder Option Function Selection = A Pulse Detection]*, or when in Closed Loop V/f Control method.

ON : Reverse

Detects if the motor is rotating in the reverse direction.

OFF : Forward

Detects if the motor is rotating in the forward direction.

■ 16: Ref Sample

Setting	Function	Description
16	Ref Sample	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the command to sample the frequency reference at terminals AI1, AI2, or AI3 and hold the frequency reference at that frequency.

When the terminal is active for 100 ms, this function reads a sample of the analog frequency reference and holds that sample. When you input the sample/hold command again, the function again reads a sample of the analog frequency reference and holds that sample. When you turn off the power, the drive erases the saved analog frequency and resets the frequency reference to 0.

Figure 12.76 shows an example of how the function operates.

Parameter Details

12

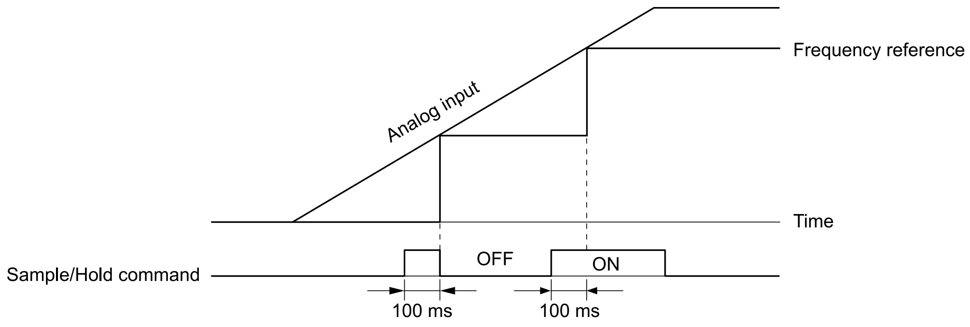

Figure 12.76 Reference Sample Hold

You cannot set the Reference Sample Hold function at the same time as these functions:

- *H1-xx = 17 [Ac/Dec Hold]*
- *H1-xx = 62, 63 [Up Command, Down Command]*
- *H1-xx = 0E to 10 [to Offset Frq 3]*
- *H1-xx = 65, 66 [Up2 Command, Dw2 Command]*

If you set them at the same time, the drive will detect *oPE03 [Multi-Function Input Setting Err]*.

■ 17: Ac/Dec Hold

Setting	Function	Description
17	Ac/Dec Hold	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Momentarily pauses motor acceleration and deceleration when the terminal is turned ON, retains the output frequency that was stored in the drive at the time of the pause, and restarts motor operation.

If the terminal is deactivated, the drive restarts acceleration and deceleration.

When the acceleration/deceleration ramp hold terminal is activated and *d4-01 = 1 [FRef Hold Selection = Enabled]*, the drive will store the output frequency in memory. While the acceleration/deceleration ramp hold command is activated, the drive will always restart the motor at this output frequency.

Note:

Refer to "*d4-01 FRef Hold Selection on page 617*" for more information.

■ 18: Ac/Dec Time1

Setting	Function	Description
18	Ac/Dec Time1	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the drive to use *C1-01, C1-02 [Accel Time 1, Decel Time 1]* or *C1-03, C1-04 [Accel Time 2, Decel Time 2]*.

Note:

Refer to "C1: ACCEL / DECEL" for more information.

■ 19: Ac/Dec Time2

Setting	Function	Description
19	Ac/Dec Time2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Set this function and *H1-xx = 18 [Ac/Dec Time1]* together. Sets the drive to use *C1-05, C1-06 [Accel Time 3, Decel Time 3]* or *C1-07, C1-08 [Accel Time 4, Decel Time 4]*.

Note:

Refer to "C1: ACCEL / DECEL" for more information.

■ 1A: Drive Enable

Setting	Function	Description
1A	Drive Enable	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function to show *dnE [Drive Enabled]* on the keypad and ignore Run commands when the terminal is OFF.

If you input the Run command before you turn ON the Drive Enable terminal, you must input the Run command again to operate the drive. When the terminal set for Drive Enable is turned OFF when the drive is operating, the drive will use the stopping method set in *b1-03 [Stopping Method Selection]* to stop the motor.

ON : Run command is accepted.

OFF : Run command is disabled. When the drive is running, it stops according to *b1-03* setting.

■ 1B: Baseblock NO

Setting	Function	Description
1B	Baseblock NO	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the command that stops drive output and coasts the motor to stop when the input is ON.

The keypad flashes *bb [Baseblock]*. If you cancel the baseblock command when the Run command is active, the drive will restart the motor and use the speed search function.

WARNING! *Sudden Movement Hazard. When you use the Baseblock command with hoist applications, make sure that you close the holding brake when you input the Baseblock command and the drive shuts off its output. Failure to do obey can cause death or serious injury if the load moves or falls when motor suddenly coasts after you input the Baseblock command.*

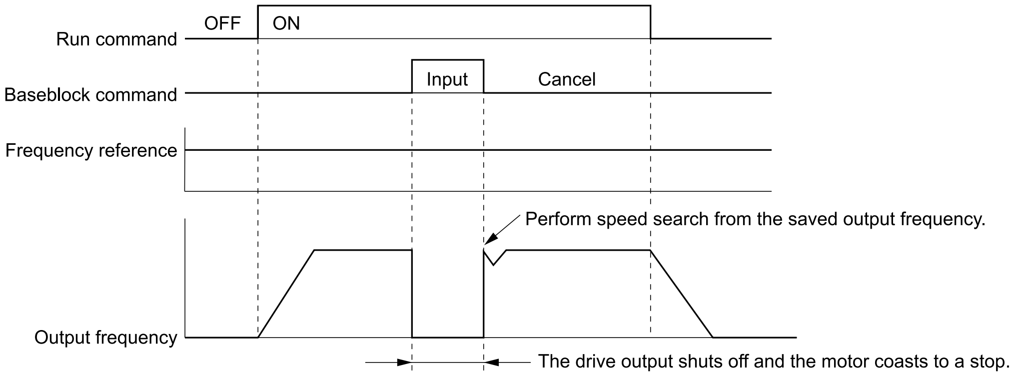

Figure 12.77 Baseblock Command Time Chart

ON : Baseblock (drive output stop)

OFF : Normal operation

■ 1E: Baseblock NC

Setting	Function	Description
1E	Baseblock NC	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the command that stops drive output and coasts the motor to stop when the input terminal is OFF.

The keypad flashes *bb [Baseblock]*. If you cancel the baseblock command when the Run command is active, the drive will restart the motor and use the speed search function.

ON : Normal operation

OFF : Baseblock (drive output stop)

WARNING! *Sudden Movement Hazard. When you use the Baseblock command with hoist applications, make sure that you close the holding brake when you input the Baseblock command and the drive shuts off its output. Failure to do obey can cause death or serious injury if the load moves or falls when motor suddenly coasts after you input the Baseblock command.*

■ 20 to 2F: External Fault

Setting	Function	Description
20 to 2F	External Fault	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets a command to stop the drive when a failure or fault occurs on an external device.

If an external fault is input to the drive, the keypad will show *EFx [ExtFault DIx]*, where x is the number of the terminal (terminal DIx) to which the external fault signal is assigned. For example, when an external fault signal is input to terminal DI3, the keypad will show EF3.

Use these conditions to select the value to set in *H1-xx*:

- Signal input method from peripheral devices
- External fault detection method
- Motor stopping method (operation after external fault detection)

Table 12.40 shows the relation between the conditions and the value set to *H1-xx*.

Table 12.40 Stopping Methods for External Fault

Setting	Signal Input Method from Peripheral Devices *1		External Fault Detection Method *2		Stopping Method			
	N.O.	N.C.	Always Detected	Detected during RUN Only	Ramp to Stop (Fault)	Coast to Stop (Fault)	Fast Stop (Fault)	Continuous Operation (Alarm Only)
20	x	-	x	-	x	-	-	-
21	-	x	x	-	x	-	-	-
22	x	-	-	x	x	-	-	-
23	-	x	-	x	x	-	-	-
24	x	-	x	-	-	x	-	-
25	-	x	x	-	-	x	-	-
26	x	-	-	x	-	x	-	-
27	-	x	-	x	-	x	-	-
28	x	-	x	-	-	-	x	-
29	-	x	x	-	-	-	x	-
2A	x	-	-	x	-	-	x	-
2B	-	x	-	x	-	-	x	-
2C	x	-	x	-	-	-	-	x
2D	-	x	x	-	-	-	-	x
2E	x	-	-	x	-	-	-	x
2F	-	x	-	x	-	-	-	x

*1 Set the terminal to N.O. (detects external fault when switched ON) or N.C. (detects external fault when switched OFF).
*2 Set the drive to always detect each fault or to detect only during run.

■ 30: DCInj Cmd

Setting	Function	Description
30	DCInj Cmd	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the command to use DC Injection Braking to stop the motor.

If you input the Run command or JOG command, it will cancel DC Injection Braking.
Figure 12.78 shows the DC Injection Braking function:

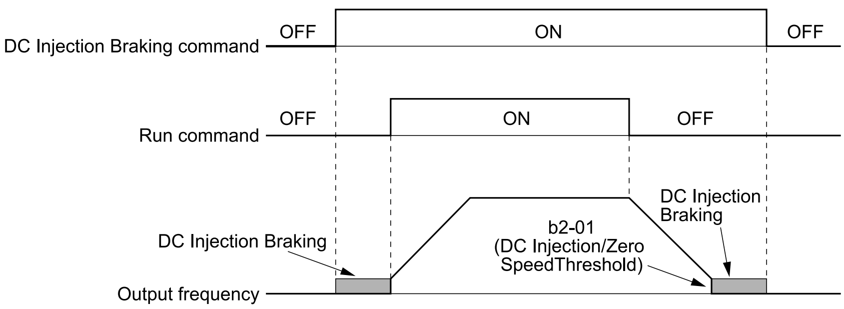

Figure 12.78 DC Injection Braking Time Chart

Note:
- When *A1-02 = 8 [Control Method = EZ Vector]*, this function is available if you use a PM motor.
- Refer to "b2: DC INJ / SHORT CKT BRAKE" for more information.

■ 31: Zero Servo

Setting	Function	Description
31	Zero Servo	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function to hold a stopped motor.

This function will hold a stopped motor if an external force is applied or an analog reference is offset.

Note:
- Refer to "b9: ZERO SERVO" for more information.
- When you use the Zero Servo function, keep the Run command ON. Zero servo stops the motor and if you turn OFF the Run command, it will not have power.

■ 32: HiSlipBraking

Setting	Function	Description
32	HiSlipBraking	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the command to use high-slip braking to stop the motor.

Note:
- When you restart the drive after you use high-slip braking, make sure that the drive fully stops the motor then clear the high-slip braking input.
- Refer to "n3: HIGHSLIP/OVEREXCITATION BRAKE" for more information.

■ 34: Fast Stop NO

Setting	Function	Description
34	Fast Stop NO	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the command to ramp to stop in the deceleration time set in *C1-09 [Fast Stop Time]* when the input terminal is ON while the drive is operating.

If you cancel the fast stop input, the drive will not restart the motor until you meet these conditions:

- Fully stop the motor
- Cancel the Run command
- Cancel the fast stop command

Note:
- To use the N.C. switch to input the fast stop command, set 35 [Fast Stop NC].
- Refer to "*C1-09 Fast Stop Time on page 588*" for more information.

NOTICE: *Fast deceleration can trigger an overvoltage fault. To prevent and uncontrolled motor and to make sure that the motor stops quickly and safely, set an applicable Fast Stop time in C1-09 [Fast Stop Time]. When there is a fault, the drive output will turn off and the motor will coast to stop.*

■ 35: Fast Stop NC

Setting	Function	Description
35	Fast Stop NC	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the command to ramp to stop in the deceleration time set in *C1-09 [Fast Stop Time]* when the input terminal is ON while the drive is operating.

If you cancel the fast stop input, the drive will not restart the motor until you meet these conditions:

- Fully stop the motor
- Cancel the Run command
- Cancel the fast stop command

Note:
- To use the N.O. switch to input the fast stop command, set 34 [Fast Stop NO].
- Refer to "*C1-09 Fast Stop Time on page 588*" for more information.

NOTICE: *Fast deceleration can trigger an overvoltage fault. To prevent and uncontrolled motor and to make sure that the motor stops quickly and safely, set an applicable Fast Stop time in C1-09 [Fast Stop Time]. When there is a fault, the drive output will turn off and the motor will coast to stop.*

Figure 12.79 shows an example of how fast stop operates.

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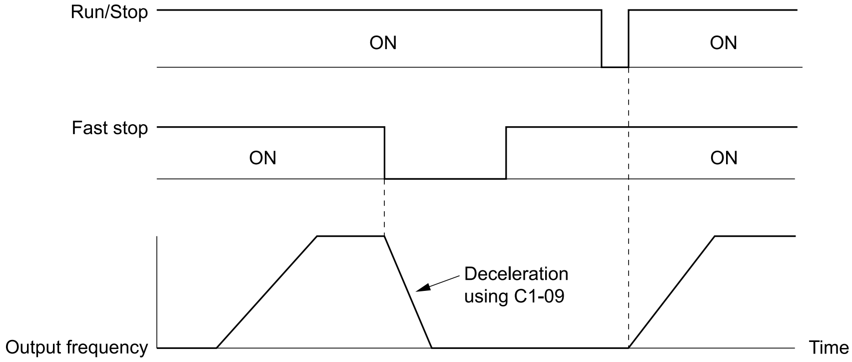


Figure 12.79 Fast Stop Time Chart

■ 3E: SCBraking NO

Setting	Function	Description
3E	SCBraking NO	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets operation of Short Circuit Braking (N.O.).

If a three-phase PM motor short circuits, the drive will generate braking torque in the spinning motor. This will stop motor rotation and also prevent external forces from spinning the motor.

Note:
- When *A1-02 = 8 [Control Method = EZ Vector]*, this function is available if you use a PM motor.
- Refer to “b2: DC INJ / SHORT CKT BRAKE” for more information.

ON : Short Circuit Braking is enabled.

OFF : Normal operation

■ 3F: SCBraking NC

Setting	Function	Description
3F	SCBraking NC	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets operation of Short Circuit Braking (N.C.).

If a three-phase PM motor short circuits, the drive will generate braking torque in the spinning motor. This will stop motor rotation and also prevent external forces from spinning the motor.

Note:
- When *A1-02 = 8 [Control Method = EZ Vector]*, this function is available if you use a PM motor.
- Refer to “b2: DC INJ / SHORT CKT BRAKE” for more information.

ON : Normal operation

OFF : Short Circuit Braking is enabled.

■ 40: KEB Thru1 NC

Setting	Function	Description
40	KEB Thru1 NC	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets operation of the KEB1 function through the KEB Ride-Thru 1 (N.C.).

ON : Normal operation

OFF : Deceleration during momentary power loss

When you enable KEB Ride-Thru 1, set *L2-29 [KEB Method]*. The drive operates with the selected KEB method.

Note:
- If you set *KEB Ride-Thru 1 [H1-xx = 40, 41]* and *KEB Ride-Thru 2 [H1-xx = 42, 43]* at the same time, the drive will detect *oPE03 [Multi-Function Input Setting Err]*.
- Refer to “KEB Ride-Thru function” for more information.

■ 41: KEB Thru1 NO

Setting	Function	Description
41	KEB Thru1 NO	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets operation of the KEB1 function through the KEB Ride-Thru 1 (N.O.).

ON : Deceleration during momentary power loss

OFF : Normal operation

When you enable KEB Ride-Thru 1, set *L2-29 [KEB Method]*. The drive operates with the selected KEB method.

Note:
- If you set *KEB Ride-Thru 1 [H1-xx = 40, 41]* and *KEB Ride-Thru 2 [H1-xx = 42, 43]* at the same time, the drive will detect *oPE03 [Multi-Function Input Setting Err]*.
- Refer to "KEB Ride-Thru function" for more information.

■ 42: KEB Thru2 NC

Setting	Function	Description
42	KEB Thru2 NC	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets operation of the KEB2 function through the KEB Ride-Thru 2 (N.C.).

ON : Normal operation

OFF : Deceleration during momentary power loss

When KEB Ride-Thru 2 is input, the drive will use Single Drive KEB Ride-Thru 2 for KEB operation. The *L2-29 [KEB Method]* setting will not have an effect.

Note:
- If you set *KEB Ride-Thru 1 [H1-xx = 40, 41]* and *KEB Ride-Thru 2 [H1-xx = 42, 43]* at the same time, the drive will detect *oPE03 [Multi-Function Input Setting Err]*.
- Refer to “KEB Ride-Thru function” for more information.

■ 43: KEB Thru2 NO

Setting	Function	Description
43	KEB Thru2 NO	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets operation of the KEB2 function through the KEB Ride-Thru 2 (N.O.).

ON : Deceleration during momentary power loss

OFF : Normal operation

When KEB Ride-Thru 2 is input, the drive will use Single Drive KEB Ride-Thru 2 for KEB operation. The *L2-29 [KEB Method]* setting will not have an effect.

Note:
- If you set *KEB Ride-Thru 1 [H1-xx = 40, 41]* and *KEB Ride-Thru 2 [H1-xx = 42, 43]* at the same time, the drive will detect *oPE03 [Multi-Function Input Setting Err]*.
- Refer to “KEB Ride-Thru function” for more information.

■ 44: Field weakening

Setting	Function	Description
44	Field weakening	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function to send the Field Weakening Level and Field Weakening Frequency Limit commands set in *d6-01[Field Weak Level] and d6-02 [Field Weak FqLimit]* when the input terminal is activated.

Note:

Refer to “d6: FIELD WEAKENING / FORCING” for more information.

■ 45: ASR Gain Switch

Setting	Function	Description
45	ASR Gain Switch	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function to switch the ASR proportional gain set in *C5-01 [ASR PGain 1] and C5-03 [ASR PGain 2]*.

ON : C5-03

Switches the proportional gain to *C5-03 [ASR PGain 2]*.

OFF : C5-01

Switches the proportional gain to *C5-01 [ASR PGain 1]*.

Note:

Refer to “C5: ASR - SPEED REGULATION” for more information.

46: ASR I Reset

Setting	Function	Description
46	ASR I Reset	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the command to reset the integral value and use PI control or P control for the speed control loop.

ON : P control

OFF : PI control

47: PG Enc Disable

Setting	Function	Description
47	PG Enc Disable	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the command to disable speed feedback control and run the drive in V/f control or use speed feedback from the encoder.

ON : Speed feedback control disable (V/f Control)

OFF : Speed feedback control enable (Closed Loop V/f Control)

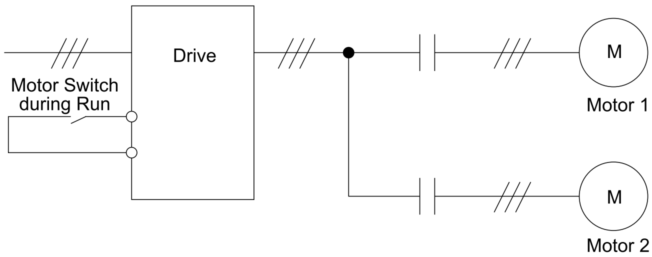
61: Motor 2 Select

Setting	Function	Description
61	Motor 2 Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the command for the drive to operate motor 1 or motor 2. Stop the motors before switching.

You can use an external input to switch operation between two induction motors. The drive will save the control methods, V/f patterns, and motor parameters for the two motors.

ON : Selects motor 2

OFF : Selects motor 1



When you select motor 2, the drive will switch to motor 2 parameters.

Table 12.41 Parameters that Switch between Motor 1 and Motor 2

Parameters	Motor 2 Selection	
	OFF (Motor 1)	ON (Motor 2)
C1-xx [Accel & Decel Time]	C1-01 to C1-04	C1-05 to C1-08
C3-xx [Slip Compensation]	C3-01 to C3-04	C3-21 to C3-24
C4-xx [Torque Compensation]	C4-01	C4-07
C5-xx [Automatic Speed Regulator (ASR)]	C5-01 to C5-08, C5-12, C5-17, C5-18	C5-21 to C5-28, C5-32, C5-37, C5-38
E1-xx, E3-xx [V/f Patterns] E2-xx, E-4xx [Motor Parameters]	E1-xx, E2-xx	E3-xx, E4-xx
F1-xx [Number of PG pulses per Revolution]	F1-01 to F1-21	F1-02 to F1-04, F1-08 to F1-11, F1-14, F1-31 to F1-37

Note:
- When you use 2 motors, the drive applies the protective function set in *L1-01 [Motor Cool Type for OL1 Calc]* to motor 1 and motor 2.
- You cannot switch between motors 1 and 2 during run. If you try to switch motors when they are running, it will cause a *rUn* error.
- After you switch between encoder motors, you must wait 500 ms minimum to input a Run command. You must wait 200 ms minimum for other control methods.

60: Timer Fn Input

Setting	Function	Description
60	Timer Fn Input	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the command to start the timer function. Use this setting with *Timer Output [H2-xx = 39]*.

Note:
Refer to "b4: TIMER" for more information.

■ 62: Up Command

Setting	Function	Description
62	Up Command	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the command to use a button to increase the drive frequency reference. You must also set Setting 63 *[Down Command]*.

ON : Raises the frequency reference.

OFF : Holds the current frequency reference.

Note:
- If you only set the Up command or only set the Down command, the drive will detect *oPE03 [Multi-Function Input Setting Err]*.
- If you set two or more of these functions at the same time, *oPE03* occurs:
  - –Up/Down command
  - –Accel/Decel Ramp Hold
  - –Reference sample hold
  - –Offset Frequency 1, 2, 3 addition
  - –Up/Down 2 Command
- You can use the Up/Down command when the keypad is in REMOTE mode and when *b1-01 ≠ 0 [Freq. Ref. Sel. 1 ≠ Keypad]*.
- The Up/Down command does not function when you use *Ext Ref 1/2 [H1-xx = 9]* to switch to parameter *b1-15 [Freq. Ref. Sel. 2]*.

When you input the Up command, the frequency reference increases. When you input the Down command, the frequency reference decreases.

The Up and Down commands are more important than all other frequency references. When the Up/Down command is enabled, the drive will ignore these frequency references:

- Frequency reference from Keypad *[b1-01 = 0]*
- Frequency reference from Analog Input *[b1-01 = 1]*
- Frequency reference from Pulse Train Input *[b1-01 = 4]*

Table 12.42 shows the Up and Down commands with their operation.

Table 12.42 Up Command and Down Command

Command status		Drive operation
Up command (62)	Down command (63)	
OFF	OFF	Keeps the current frequency reference.
ON	OFF	Increases the frequency reference.
OFF	ON	Decreases the frequency reference.
ON	ON	Keeps the current frequency reference.

Combine Frequency Reference Hold Functions and Up/Down Commands

- When you clear the Run command or when d4-01 = 0 [FRef Hold Selection = Disabled] and you restart the drive, the Up/Down command resets to 0.
- When *d4-01 = 1 [Enabled]*, the drive saves the frequency reference set during the Up/Down command. When you cycle the Run command or restart the drive, the drive saves the frequency reference value and restarts the motor at this frequency value. After you clear the Run command, activate the terminal set for the Up command or Down command to set the saved reference value to 0.

Note:
Refer to "*d4-01 FRef Hold Selection on page 617*" for more information.

Combine Upper/Lower Limits of the Frequency Reference and the Up/Down Commands

Set the upper limit value of the frequency reference to *d2-01 [FRef Upper Limit]*.

Use an analog input or *d2-02 [FRef Lower Limit]* to set the lower limit value of the frequency reference. The configurable values change when the setting for *d4-10 [Up/Dw Frq Low Limit Select]* changes. When you input a Run command, these are the lower limits of the frequency reference:

- When the lower limit of the frequency reference is set only for *d2-02*, the drive accelerates the motor to the lower limit value of the frequency reference at the same time that you input the Run command.
- When the lower limit of the frequency reference is set only for analog input, the drive accelerates the motor to the lower limit value of the frequency reference when the Run command, and Up command or Down command for the drive is enabled. When only the Run command is enabled, the motor does not start.

- When these conditions occur, the drive accelerates the motor to the *d2-02* setting value when the Run command is input. When the motor accelerates to the setting value of *d2-02*, if the Up/Down command is enabled, the motor accelerates to the lower limit value of the analog input.
  – The lower limit value of the frequency reference is set for the analog input and *d2-02*
  – The lower limit value of the analog input is higher than the setting value of *d2-02*

Note:
Refer to "*d4-10 Up/Dw Frq Low Limit Select on page 621*" for details.

Figure 12.80 shows an example of how Up/Down command operates. In this example, the lower limit value of the frequency reference is set in *d2-02*. The time chart when FRef Hold Selection [d4-01] is enabled and disabled is shown in Figure 12.80.

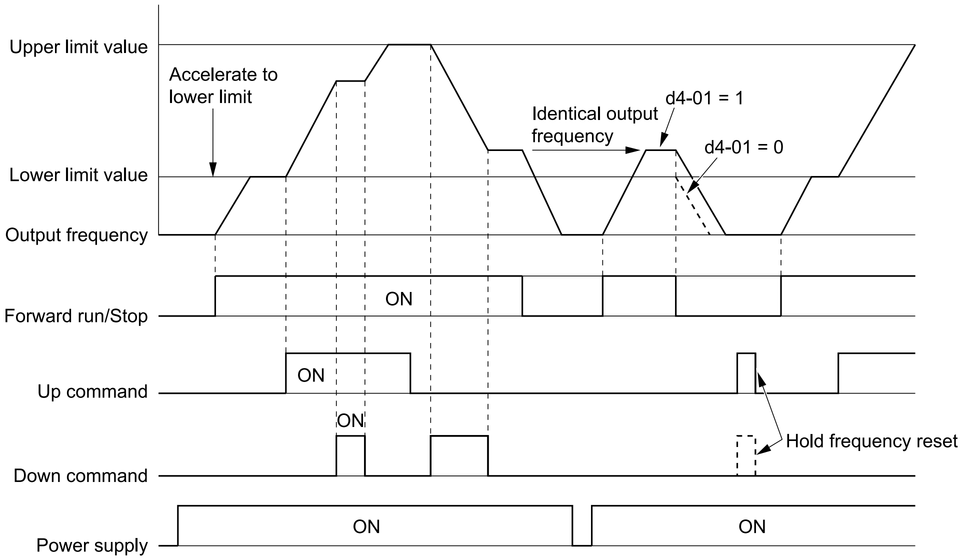


Figure 12.80 Up/Down Command Time Chart

■ 63: Down Command

Setting	Function	Description
63	Down Command	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the command to decrease the drive frequency reference using a button. Users must also set *Setting 62 [Up Command]*.

ON : Decreases the frequency reference.

OFF : Holds the current frequency reference.

Note:
- If you set only the Up command or only the Down command, the drive will detect *oPE03 [Multi-Function Input Setting Err]*.
- If you set two or more of these functions at the same time, the drive will detect *oPE03*:
  –Up/Down command
  –Accel/Decel Ramp Hold
  –Reference sample hold
  –Offset Frequency 1, 2, 3 addition
  –Up/Down 2 Command
- To use the Up/Down command when the keypad is in REMOTE mode or *b1-01 ≠ 0 [Freq. Ref. Sel. 1 ≠ Keypad]*. If you use *Ext Ref 1/2 [H1-xx = 9]* to switch to parameter *b1-15 [Freq. Ref. Sel. 2]*, the Up/Down command will not function.

When you input the Up command, the frequency reference will increase. When you input the Down command, the frequency reference will decrease.

The Up and Down commands have priority over all other frequency references. When you enable the Up/Down command, the drive will ignore these frequency references:

- Frequency reference from Keypad *[b1-01 = 0]*
- Frequency reference from Analog Input *[b1-01 = 1]*
- Frequency reference from Pulse Train Input *[b1-01 = 4]*

■ 65: Up2 Command

Setting	Function	Description
65	Up2 Command	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function to increase the frequency reference bias value to accelerate the motor when the terminal is activated. Set this function and *H1-xx = 66 [Dw2 Command]* together.

When you activate the terminal set for Up2 Command, the bias will increase. When you activate the terminal set for Down 2 Command, the bias will decrease. When you activate or deactivate the two commands, the drive will hold the frequency reference. Table 12.43 gives information about the relation between operation of the Up/Down 2 Command and *d4-01*, *d4-03*, *d4-05*.

Note:
- When using this function, set the optimal bias limit value with *d4-08 and d4-09 [Up/Dw2 Bias Upper Limit and Up/Dw2 Bias Lower Limit]*.
- Refer to "d4: FREQUENCY UP/DOWN" for more information.

Table 12.43 Up 2 Command, Down 2 Command

<table>
<tr><th>Func tion</th><th>Frequency Reference Source</th><th>d4-03</th><th>d4-05</th><th>d4-01</th><th>Operation</th><th>Storing the Frequency Reference or Frequency Bias</th></tr>
<tr><td>1</td><td rowspan="3">Multi-step speed reference</td><td rowspan="3">0.00</td><td rowspan="2">0</td><td>0</td><td rowspan="2">When the Up 2 Command is active, the drive accelerates the motor (increases the bias value).
When the Down 2 Command is active, the drive decelerates the motor (decreases the bias value)
When the Up 2 Command and Down 2 Command are not active and when the Up 2 Command and Down 2 Command are active, the drive holds the output frequency (holds the bias value).
When the frequency changes, it will reset the bias.
For all other statuses, the drive will follow the frequency reference.</td><td>Not stored.</td></tr>
<tr><td>2</td><td>1</td><td>When the bias value and frequency reference are constant for 5 seconds after the frequency reference hold starts, the drive will add the bias value to the enabled frequency reference, then reset.</td></tr>
<tr><td>3</td><td>1</td><td>-</td><td>When the Up 2 Command is active, the drive accelerates the motor.
When the Down 2 Command is active, the drive decelerates the motor.
For all other statuses, the drive will follow the frequency reference.</td><td>Not stored.</td></tr>
<tr><td>4</td><td rowspan="2">Multi-step speed reference</td><td rowspan="2">> 0</td><td rowspan="2">-</td><td>0</td><td rowspan="2">When the Up 2 Command is active, the drive accelerates the motor to "Freq Reference + d4-03" (the bias value will increase to the value set in d4-03).
When the Down 2 Command is active, the drive decelerates the motor to "Freq Reference - d4-03" (the bias value will decrease to the value set in d4-03).
When the Up 2 Command and Down 2 Command are not active and when the Up 2 Command and Down 2 Command are active, the drive holds the output frequency (holds the bias value).
When the frequency changes, it will reset the bias.
For all other statuses, the drive will follow the frequency reference.</td><td>Not stored.</td></tr>
<tr><td>5</td><td>1</td><td>When the bias value and frequency reference are constant for 5 seconds after the frequency reference hold starts, the drive will add the bias value to the enabled frequency reference, then reset.</td></tr>
<tr><td>6</td><td rowspan="2">Others
(Analog input, transmission)</td><td rowspan="2">0</td><td rowspan="2">0</td><td>0</td><td rowspan="2">When the Up 2 Command is active, the drive accelerates the motor (increases the bias value).
When the Down 2 Command is active, the drive decelerates the motor (decreases the bias value).
When the Up 2 Command and Down 2 Command are not active and when the Up 2 Command and Down 2 Command are active, the drive holds the output frequency (holds the bias value).
During acceleration or deceleration, when the frequency reference increases or decreases more than d4-07 [Analog FRef Fluctuate Limit], the drive holds the bias value until the output frequency and the actual frequency reference agree (speed agreement).</td><td>Not stored.</td></tr>
<tr><td>7</td><td>1</td><td>When the bias value is constant for 5 seconds after the frequency reference hold starts, the drive will store the bias value in d4-06. You cannot rewrite the frequency reference is not possible. The drive will store only the bias value.</td></tr>
</table>

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Function	Frequency Reference Source	d4-03	d4-05	d4-01	Operation	Storing the Frequency Reference or Frequency Bias
8	Others (Analog input, transmission)	0	1	-	• When the Up 2 Command is active, the drive accelerates the motor. • When the Down 2 Command is active, the drive decelerates the motor. • For all other statuses, the drive will follow the frequency reference.	Not stored.
9		> 0	-	0	• When the Up 2 Command is active, the drive accelerates the motor to "Freq Reference + *d4-03*" (the bias value will increase to the value set in *d4-03*). • When the Down 2 Command is active, the drive decelerates the motor to "Freq Reference - *d4-03*" (the bias value will decrease to the value set in *d4-03*). • During acceleration or deceleration, when the frequency reference increases or decreases more than *d4-07 [Analog FRef Fluctuate Limit]*, the drive holds the bias value until the output frequency and the actual frequency reference agree (speed agreement).	Not stored.
10				1		When the bias value is constant for 5 seconds after the frequency reference hold starts, the drive will store the bias value in d4-06. You cannot rewrite the frequency reference is not possible. The drive will store only the bias value.

■ 66: Dw2 Command

Setting	Function	Description
66	Dw2 Command	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function to increase the frequency reference bias value to accelerate the motor when the terminal is activated. Set this function and *H1-xx = 65 [Up2 Command]* together.

When you activate the terminal set for Up2 Command, the bias will increase. When you activate the terminal set for Down 2 Command, the bias will decrease. When you activate or deactivate the two commands, the drive will hold the frequency reference.

Note:
- When using this function, set the optimal bias limit value with *d4-08 and d4-09 [Up/Dw2 Bias Upper Limit and Up/Dw2 Bias Lower Limit]*.
- Refer to "d4: FREQUENCY UP/DOWN" for more information.

■ 67: SpdSrch Fmax

Setting	Function	Description
67	SpdSrch Fmax	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function to start speed search using an external reference although *b3-01 = 0 [SpSrch@Start Selection = Disabled]*.

When the terminal is turned ON for *b3-24 = 2 [SpSrch Method Selection = Current Det2]*, the drive starts speed search from the maximum output frequency.

Note:
- The drive will detect *oPE03 [Multi-Function Input Setting Err]* when *H1-xx = 67 and 68* are set at the same time.
- Refer to "b3: SPEED SEARCH" for more information.

■ 68: SpdSrch Fref

Setting	Function	Description
68	SpdSrch Fref	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function to start speed search using an external reference although *b3-01 = 0 [SpSrch@Start Selection = Disabled]*.

When the terminal is turned ON for *b3-24 = 2 [SpSrch Method Selection = Current Det2]*, the drive starts speed search from the frequency reference.

Note:
- The drive will detect *oPE03 [Multi-Function Input Setting Err]* when *H1-xx = 67 and 68* are set at the same time.
- Refer to "b3: SPEED SEARCH" for more information.

■ 6A: PID Disable

Setting	Function	Description
6A	PID Disable	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the command to disable PID control when *b5-01 = 1 [PID Enable = Enabled]*.

ON : PID control disabled

OFF : PID control enabled

■ 71: PID I Reset

Setting	Function	Description
71	PID I Reset	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the command to reset and hold the PID control integral to 0 when the terminal is ON.

Note:

Refer to “PID control block diagram” for more information.

■ 72: PID I Hold

Setting	Function	Description
72	PID I Hold	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the command to hold the integral value of the PID control while the terminal is activated.

When you turn off the input terminal, PID control restarts the integral.

Note:

Refer to “PID control block diagram” for more information.

■ 75: PID SS Cancel

Setting	Function	Description
75	PID SS Cancel	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the PID soft starter function.

ON : Disabled

Disables *b5-17 [PID Accel/Decel Time]*.

OFF : Enabled

Enables *b5-17 [PID Accel/Decel Time]*.

Note:

Refer to “PID control block diagram” for more information.

■ 76: PID InLv Select

Setting	Function	Description
76	PID InLv Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the command to turn the terminal ON and OFF to switch the PID input level (polarity).

Note:

Refer to “PID control block diagram” for more information.

■ 77: PID SP 1

Setting	Function	Description
77	PID SP 1	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Set this function and *H1-xx = 78 [PID SP 2]* together. Sets the function to switch the PID setpoint to *b5-58 to b5-60 [PID Setpoint 2 to PID Setpoint 4]*.

Refer to “*b5-58 to b5-60 PID Setpoint 2 to PID Setpoint 4 on page 574*” for more information.

■ 78: PID SP 2

Setting	Function	Description
78	PID SP 2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Set this function and *H1-xx = 77 [PID SP 1]* together. Sets the function to switch the PID setpoint to *b5-58 to b5-60 [PID Setpoint 2 to PID Setpoint 4]*.

Refer to “*b5-58 to b5-60 PID Setpoint 2 to PID Setpoint 4 on page 574*” for more information.

■ 7A: PID BiDir

Setting	Function	Description
7A	PID BiDir	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets operation of the PID Bi-Directional function.

ON : Enabled

OFF : Disabled

■ 7B: Fault Reset

Setting	Function	Description
7B	Fault Reset	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the command to reset the current fault when the Run command is inactive.

If the drive detects a fault, the drive will activate the fault relay output, turn off the output, and the motor will coast to stop.

If the drive detects a fault for which you can set the stopping method, apply the appropriate Stopping Method. Then push (RESET) on the keypad to turn the Run command OFF, or activate the fault reset terminal to reset the fault.

Note:

The drive ignores the fault reset command when the Run command is active. Remove the Run command before trying to reset a fault.

■ 7C: Prg Lock

Setting	Function	Description
7C	Prg Lock	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the command to prevent parameter changes when the terminal is OFF.

You can continue to view parameter setting values when the terminal is *OFF [Parameters Cannot be Edited]*.

ON : Program Lockout

OFF : Parameter Write Prohibit

■ 7D: Drive OH2

Setting	Function	Description
7D	Drive OH2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the drive to display an *oH2 [Drive Overheat Warning]* alarm when the input terminal is ON. The alarm does not have an effect on drive operation.

■ 7E: Node Setup

Setting	Function	Description
7E	Node Setup	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function in CANopen communications to start the Node Setup function to set the drive node address from the host controller.

■ 7F: Comms Test

Setting	Function	Description
7F	Comms Test	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Set the function for the drive to self-test RS-485 serial communications operation.

The Self-Diagnostics function connects the transmission terminal of the control terminal block to the reception terminal. The function transmits the data that the drive sent to make sure that the drive can communicate correctly.

Note:

Refer to Modbus communications “Self-Diagnostics” for the self-diagnostics procedure.

■ 90 to 97: Q2pack DI1 to 8

Setting	Function	Description
90 to 97	Q2pack DI1 to 8	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets digital inputs used with Q2pack. Refer to the Q2pack Online Manual for more information.

Note:

You cannot set values 90 to 97 for inverse output.

■ 9F: Q2pack Disable

Setting	Function	Description
9F	Q2pack Disable	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets operation of the Q2pack program saved in the drive.

Note:

Set *A1-07 = 2 [Q2pack Enable = With DI]* to use this function.

ON : Disabled

OFF : Enabled

■ 101 to 19F: Inverse Input of 1 to 9F

Setting Value	Function	Description
101 to 19F	Inverse Input of 1 to 9F	Sets the function of the selected MFDI to operate inversely. To select the function, enter “1xx”, where the “xx” is the function setting value.

For example, to use the inverse input of *46 [ASR I Reset]*, set *H1-xx = 146*.

Note:

You cannot use inverse input for all functions. Refer to Table 12.39 for more information.

◆ H2: DIGITAL OUTPUTS

■ Multi-Function Digital Outputs

H2 parameters set the MFDO terminal functions.

H2-01 Multi-Function Digital Output 1, H2-02 Multi-Function Digital Output 2, H2-03 Multi-Function Digital Output 3

The drive has three MFDO terminals. Table 12.44 shows the default function settings for the terminals.

Table 12.44 MFDO Terminals Default Function Settings

No.	Name	Default Setting	Function
H2-01	Multi-Function Digital Output 1	5	@Run
H2-02	Multi-Function Digital Output 2	7	Zero Speed
H2-03	Multi-Function Digital Output 3	F	SpeedAgree1

Refer to Table 12.45 to set *H2-xx [DO Function Select]*.

Table 12.45 MFDO Setting Value

Setting Value	Function	Setting Value	Function
0 *1	Through Mode	15	FreqDetect 3
1	Drive Ready	16	FreqDetect 4
2	Drive Enable	17	@Fast Stop
3	Fault	18	@KEBridethru
4	Alarm	19	@ShortCBraking
5	@Run	1A	@BaseblockNO
6	@Reverse	1B	@BaseblockNC
7	Zero Speed	1C	FreqRefSource
8	ZeroServo ok	1D	RunCmdSource
9	@Regeneration	1E	Motor2 Select
A	@SpeedLimit	1F	Restart Enable
B	@FreqOutput	20	FltReset Active
C	@Standby	21	PolePos Detection
D	LO/RE Status	22	Ext 24V Supply
E	EDM Safety	2F	@SpeedSearch
F	SpeedAgree1	30	@TorqueLimit
10	USpeedAgree1	31	@SpdLim@Trq
11	SpeedAgree2	32	TrqDetect1NO
12	USpeedAgree2	33	TrqDetect1NC
13	FreqDetect 1	37	TrqDetect2NO
14	FreqDetect 2	38	TrqDetect2NC

Setting Value	Function
39	Timer Output
3C	Comparator 1
3D	Comparator 2
3E	PID Fbk Low
3F	PID Fbk High
4A	DC Bus Undervolt
4B	FreqRef Loss
4C	BrkRes Fault
4D	Motor OL1
4E	Drive PreOH
4F	PreOHTimeLim
60 *2	BrkTransFault

Setting Value	Function
61 *2	BrkTransOH
62	Fan Alarm
63	Maintenance
65	WattH Pulse
66	MechWeakDetect
67	ModbusReg 1
69	ModbusReg 2
90 to 93	Q2pack DO1 to 4
A0 to A7	Q2pack ExDO1 to 8
100 to 1A7	Inverse output of 0 to A7 Sets an inverse output of the function for the MFDO. Put a 1 at the front of the function setting to set inverse output. For example, set *138* for inverse output of *38 [TrqDetect2NC]*.

*1 Inverse output is not available.
*2 You cannot set this parameter on models 4089 to 4675.

■ Extend MFDO1 to MFDO3 Function Selection

You can set MFDO functions to *bit 0 to bit 2 [Mbus MFDO1 to 3]* of Modbus register 15E0 (Hex.). Use *H2-40 to H2-42 [Mbus 15E0h b0 Output Function to Mbus 15E0h b2 Output Function]* to select the function.

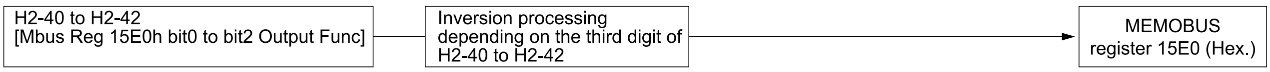


Figure 12.81 Functional Block Diagram of Modbus Multi-function Output

Table 12.46 Modbus MFDO Registers

Register No. (Hex.)	Name	
15E0	bit0	Mbus MFDO 1
	bit1	Mbus MFDO 2
	bit2	Mbus MFDO 3

Note:
- Refer to H2-xx “MFDO Setting Values” for more information about MFDO setting values.
- When you do not set functions to *H2-40 to H2-42*, set them to *0*.

■ Output of Logical Operation Results of MFDO

This enables the logical operation results of two MFDOs to be output to one MFDO terminal.

Use *H2-60, H2-63, and H2-66 [2NO-2CM 2nd Function, 3NO-3CM 2nd Function, 4NO-4CM 2nd Function]* to set the function of the output signal for which logical operations are performed.

Use *H2-61, H2-64, H2-67 [2NO-2CM Logic Operation, 3NO-3CM Logic Operation, 4NO-4CM Logic Operation]* to set the logical operation.

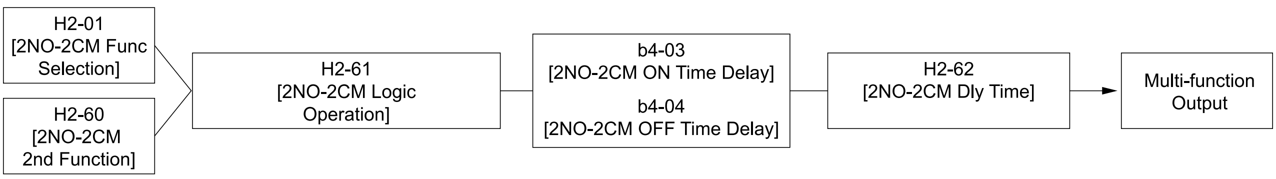


Figure 12.82 Functional Block Diagram of Logical Operation Output for MFDO 1

Table 12.47 MFDO Logical Operation Table

Logical Operation Selection H2-61, H2-64, H2-67	Logical Operation Expression	Logical Operation Notation
1	A=B=1	A B AND Out
2	A=1 or B=1	A B OR Out
3	A=0 or B=0	A B NAND Out
4	A=B=0	A B NOR Out
5	A=B	A=B
6	A != B	A B XOR Out
7	AND(A, B̄)	A B AND Out
8	OR(A, B̄)	A B OR Out
9	-	On

Note:
- If you use the function to output logical calculation results, you cannot set *H2-01 to H2-03 = 1xx [Inverse Output of xx]*. If you do, the drive will detect *oPE33 [Digital Output Selection Error]*.
- When you do not use *H2-60, H2-63, and H2-66*, set them to *0*. The Through Mode function is not supported.

■ H2-01 Multi-Function Digital Output 1

No. (Hex.)	Name	Description	Default (Range)
H2-01 (040B)	Multi-Function Digital Output 1	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function for MFDO terminal 2NO-2CM.	0 (0 - 1FF)

Note:

Set this parameter to *0* when not using the terminal or to use the terminal in through mode.

■ H2-02 Multi-Function Digital Output 2

No. (Hex.)	Name	Description	Default (Range)
H2-02 (040C)	Multi-Function Digital Output 2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function for MFDO terminal 3NO-3CM.	1 (0 - 1FF)

Note:

Set this parameter to *0* when not using the terminal or to use the terminal in through mode.

■ H2-03 Multi-Function Digital Output 3

No. (Hex.)	Name	Description	Default (Range)
H2-03 (040D)	Multi-Function Digital Output 3	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function for MFDO terminal 4NO-4CM.	2 (0 - 1FF)

Note:

Set this parameter to *0* when not using the terminal or to use the terminal in through mode.

■ H2-06 kWH Out Unit Selection

No. (Hex.)	Name	Description	Default (Range)
H2-06 (0437)	kWH Out Unit Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the unit for the output signal when *H2-01 to H2-03 = 65 [xNO-xCM Func Selection = WattH Pulse]*.	1 (1 - 5)

This output is input to the Watt hour meter or PLC through a 200 ms pulse signal. This parameter sets the kWh unit for each pulse output.

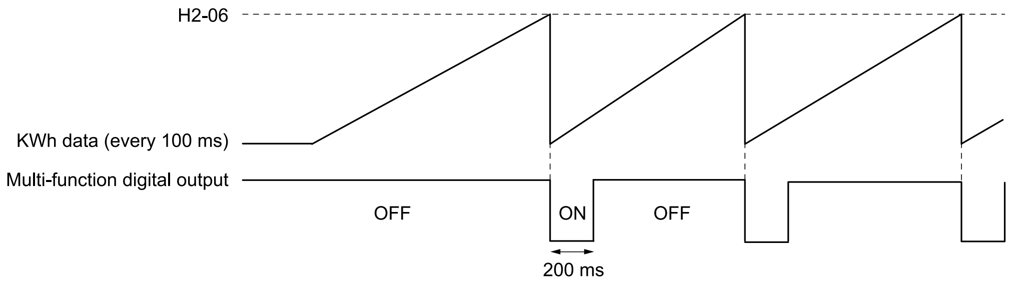


Figure 12.83 Example MFDO when Configured for Watt Hours

Note:
- When the power value is a negative value (regenerative state), the drive does not count Watt hours.
- When the control power supply to the drive is operating, the drive will keep the Watt hours. If a momentary power loss causes the drive to lose control power, the Watt hour count will reset.

1 : 0.1 kWh units

2 : 1 kWh units

3 : 10 kWh units

4 : 100 kWh units

5 : 1000 kWh units

■ H2-07 Mbus Reg1 Address Select

No. (Hex.)	Name	Description	Default (Range)
H2-07 (0B3A)	Mbus Reg1 Address Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the address of the Modbus register output to the MFDO terminal.	0001 (0001 - 1FFF)

Configures *H2-07* with the address of the register that is output to *ModbusReg 1 [H2-01 to H2-03 = 67]* and configures *H2-08* with the bit.

■ H2-08 Mbus Reg1 Bit Select

No. (Hex.)	Name	Description	Default (Range)
H2-08 (0B3B)	Mbus Reg1 Bit Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the bit of the Modbus register output to the MFDO terminal.	0000 (0000 - FFFF)

Sets the bit of the register that is output to *ModbusReg 1 [H2-01 to H2-03 = 67]* and uses the address in *H2-07 [Mbus Reg1 Address Select]*.

■ H2-09 Mbus Reg2 Address Select

No. (Hex.)	Name	Description	Default (Range)
H2-09 (0B3C)	Mbus Reg2 Address Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the address of the Modbus register output to the MFDO terminal.	0001 (0001 - 1FFF)

Sets *H2-09* with the address of the register that is output to *ModbusReg 2 [H2-01 to H2-04 = 69]* and uses the bit in *H2-10 [Mbus Reg2 Bit Select]*.

■ H2-10 Mbus Reg2 Bit Select

No. (Hex.)	Name	Description	Default (Range)
H2-10 (0B3D)	Mbus Reg2 Bit Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the bit of the Modbus register output to the MFDO terminal.	0000 (0000 - FFFF)

Sets the bit of the register that is output to *ModbusReg 2 [H2-01 to H2-03 = 69]* and uses the address in *H2-09 [Mbus Reg2 Address Select]*.

H2-20 Compare1 Mon.Selection

No. (Hex.)	Name	Description	Default (Range)
H2-20 (1540)	Compare1 Mon.Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the monitor number for comparator 1. Set the *x-xx* part of the *Ux-xx [MONITOR]*. For example, set *x-xx* to 102 to monitor *U1-02 [Output Frequency]*.	102 (000 - 999)

Note:

- The configurable monitor changes when the control method changes.
- To use in through mode, set this parameter to *000* or *031*. You can set the terminal output level from the PLC through Modbus communications or the communication option.
- Refer to *H2-xx = 3C and 3D [MFDO Function Select = Comparator 1 and Comparator 1]* for more information about the comparator function.

H2-21 Compare1 Low Limit

No. (Hex.)	Name	Description	Default (Range)
H2-21 (1541)	Compare1 Low Limit	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the lower limit detection level for comparator 1 when the full scale analog output for the monitor selected in *H2-20 [Compare1 Mon.Selection]* is the 100% value.	0.0% (0.0 - 300.0%)

Note:

Refer to *H2-xx = 3C and 3D [MFDO Function Select = Comparator 1 and Comparator 2]* for more information about the comparator function.

H2-22 Compare1 Up Limit

No. (Hex.)	Name	Description	Default (Range)
H2-22 (1542)	Compare1 Up Limit	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the upper limit detection level for comparator 1 when the full scale analog output for the monitor selected in *H2-20 [Compare1 Mon.Selection]* is the 100% value.	0.0% (0.0 - 300.0%)

Note:

Refer to *H2-xx = 3C and 3D [MFDO Function Select = Comparator 1 and Comparator 2]* for more information about the comparator function.

H2-23 Compare1 Hysteresis

No. (Hex.)	Name	Description	Default (Range)
H2-23 (1543)	Compare1 Hysteresis	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the hysteresis level for comparator 1 when the full scale analog output for the monitor selected in *H2-20 [Compare1 Mon.Selection]* is the 100% value.	0.0% (0.0 - 10.0%)

Note:

Refer to *H2-xx = 66 and 67 [MFDO Function Select = Comparator1 and Comparator2]* for more information about the comparator function.

H2-24 Compare1 On-Delay Time

No. (Hex.)	Name	Description	Default (Range)
H2-24 (1544)	Compare1 On-Delay Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the on-delay time for comparator 1.	0.0 s (0.0 - 600.0 s)

Note:

Refer to *H2-xx = 66 and 67 [MFDO Function Select = Comparator1 and Comparator2]* for more information about the comparator function.

H2-25 Compare1 Off-Delay Time

No. (Hex.)	Name	Description	Default (Range)
H2-25 (1545)	Compare1 Off-Delay Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the off-delay time for comparator 1.	0.0 s (0.0 - 600.0 s)

Note:

Refer to *H2-xx = 66 and 67 [MFDO Function Select = Comparator1 and Comparator2]* for more information about the comparator function.

H2-26 Compare2 Mon.Selection

No. (Hex.)	Name	Description	Default (Range)
H2-26 (1546)	Compare2 Mon.Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the monitor number for comparator 2. Set the *x-xx* part of the *Ux-xx [MONITOR]*. For example, set *x-xx* to 102 to monitor *U1-02 [CF Error Code]*.	103 (000 - 999)

Note:

- The configurable monitor changes when the control method changes.
- To use in through mode, set this parameter to *000* or *031*. You can set the terminal output level from the PLC through Modbus communications or the communication option.
- Refer to *H2-xx = 3C and 3D [MFDO Function Select = Comparator 1 and Comparator 1]* for more information about the comparator function.

H2-27 Compare2 Low Limit

No. (Hex.)	Name	Description	Default (Range)
H2-27 (1547)	Compare2 Low Limit	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the lower limit detection level for comparator 1 when the full scale analog output for the monitor selected in *H2-26 [Compare2 Mon.Selection]* is the 100% value.	0.0% (0.0 - 300.0%)

Note:

Refer to *H2-xx = 66 and 67 [MFDO Function Select = Comparator1 and Comparator2]* for more information about the comparator function.

H2-28 Compare2 Up Limit

No. (Hex.)	Name	Description	Default (Range)
H2-28 (1548)	Compare2 Up Limit	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the upper limit detection level for comparator 1 when the full scale analog output for the monitor selected in *H2-26 [Compare2 Mon.Selection]* is the 100% value.	0.0% (0.0 - 300.0%)

Note:

Refer to *H2-xx = 66 and 67 [MFDO Function Select = Comparator1 and Comparator2]* for more information about the comparator function.

H2-29 Compare2 Hysteresis

No. (Hex.)	Name	Description	Default (Range)
H2-29 (1549)	Compare2 Hysteresis	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the hysteresis level for comparator 2 when the full scale analog output for the monitor selected in *H2-26 [Compare2 Mon.Selection]* is the 100% value.	0.0% (0.0 - 10.0%)

Note:

Refer to *H2-xx = 66 and 67 [Multi-Function Digital Out Function Select = Comparator1 and Comparator 2]* for more information about the comparator function.

H2-30 Compare2 On-Delay Time

No. (Hex.)	Name	Description	Default (Range)
H2-30 (154A)	Compare2 On-Delay Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the on-delay time for comparator 2.	0.0 s (0.0 - 600.0 s)

Note:

Refer to *H2-xx = 66 and 67 [Multi-Function Digital Out Function Select = Comparator 1 and Comparator 2]* for more information about the comparator function.

H2-31 Compare2 Off-Delay Time

No. (Hex.)	Name	Description	Default (Range)
H2-31 (154B)	Compare2 Off-Delay Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the off-delay time for comparator 2.	0.0 s (0.0 - 600.0 s)

Note:

Refer to *H2-xx = 66 and 67 [MFDO Function Select = Comparator1 and Comparator2]* for more information about the comparator function.

H2-32 Compare1 Filter Time

No. (Hex.)	Name	Description	Default (Range)
H2-32 (159A)	Compare1 Filter Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the time constant that is applied to the primary delay filter used for the analog output of the monitor selected with *H2-20 [Compare1 Mon.Selection]*.	0.0s (0.0 - 10.0 s)

H2-33 Compare1 Protection Selection

No. (Hex.)	Name	Description	Default (Range)
H2-33 (159B)	Compare1 Protection Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets drive operation when it detects *CP1 [Comparator1 Limit Fault]*.	4 (0 - 4)

0 : Ramp->Stop

The drive ramps to stop in the set deceleration time. Fault relay output terminal 1NO-1CM activates and terminal 1NC-1CM deactivates.

1 : Coast->Stop

The drive output shuts off and the motor coasts to stop. Fault relay output terminal 1NO-1CM activates and terminal 1NC-1CM deactivates.

2 : Fast Stop (C1-09)

The drive stops the motor in the deceleration time set in *C1-09 [Fast Stop Time]*. Fault relay output terminal 1NO-1CM activates and terminal 1NC-1CM deactivates.

3 : Alarm Only

The keypad shows “CP1” and the drive continues operation at the current frequency reference.

Note:

The output terminal set for Alarm *[H2-01 to H2-03 = 10]* activates.

4 : Low Speed (L8-19)

H2-34 Compare2 Filter Time

No. (Hex.)	Name	Description	Default (Range)
H2-34 (159C)	Compare2 Filter Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the time constant that is applied to the primary delay filter used for the analog output of the monitor selected with *H2-26 [Compare2 Mon.Selection]*.	0.0s (0.0 - 10.0 s)

H2-35 Compare2 Protection Selection

No. (Hex.)	Name	Description	Default (Range)
H2-35 (159D)	Compare2 Protection Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets drive operation when it detects *CP2 [Comparator2 Limit Fault]*.	4 (0 - 4)

0 : Ramp->Stop

The drive ramps to stop in the set deceleration time. Fault relay output terminal 1NO-1CM activates and terminal 1NC-1CM deactivates.

1 : Coast->Stop

The drive output shuts off and the motor coasts to stop. Fault relay output terminal 1NO-1CM activates and terminal 1NC-1CM deactivates.

2 : Fast Stop (C1-09)

The drive stops the motor in the deceleration time set in *C1-09 [Fast Stop Time]*. Fault relay output terminal 1NO-1CM activates and terminal 1NC-1CM deactivates.

3 : Alarm Only

The keypad shows “CP2” and the drive continues operation at the current frequency reference.

Note:

The output terminal set for *Alarm [H2-01 to H2-03 = 4]* activates.

4 : Low Speed (L8-19)

■ H2-36 Compare1 HoldTime

No. (Hex.)	Name	Description	Default (Range)
H2-36 (159E)	Compare1 HoldTime	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the length of time that *CP1 [Comparator1 Limit Fault]* is disabled.	0.0 s (0.0 - 10.0 s)

Note:

- After you enter a Run command and wait for the time set in this parameter, the drive will monitor operation and make sure that it is in the Comparator 1 range until you enter the Stop command.
- When *CP1* detection is disabled, the drive will trigger a digital output.

■ H2-37 Compare2 HoldTime

No. (Hex.)	Name	Description	Default (Range)
H2-37 (159F)	Compare2 HoldTime	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the length of time that *CP2 [Comparator2 Limit Fault]* is disabled.	0.0 s (0.0 - 10.0 s)

Note:

- After you enter a Run command and wait for the time set in this parameter, the drive will monitor operation and make sure that it is in the Comparator 2 range until you enter the Stop command.
- When *CP2* detection is disabled, the drive will trigger a digital output.

■ H2-40 Mbus 15E0h b0 Output Function

No. (Hex.)	Name	Description	Default (Range)
H2-40 (0B58)	Mbus 15E0h b0 Output Function	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the MFDO for bit 0 of Modbus register 15E0 (Hex.).	0 (0 - 1A7)

■ H2-41 Mbus 15E0h b1 Output Function

No. (Hex.)	Name	Description	Default (Range)
H2-41 (0B59)	Mbus 15E0h b1 Output Function	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the MFDO for bit 1 of Modbus register 15E0 (Hex.).	0 (0 - 1A7)

■ H2-42 Mbus 15E0h b2 Output Function

No. (Hex.)	Name	Description	Default (Range)
H2-42 (0B5A)	Mbus 15E0h b2 Output Function	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the MFDO for bit 2 of Modbus register 15E0 (Hex.).	0 (0 - 1A7)

■ H2-60 2NO-2CM 2nd Function

No. (Hex.)	Name	Description	Default (Range)
H2-60 (1B46) Expert	2NO-2CM 2nd Function	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Selects the second function for terminal 2NO-2CM. The logical calculation results of the terminals assigned to functions by *H2-01 [Multi-Function Digital Output 1]* is output.	0 (0 - A7)

■ H2-61 2NO-2CM Logic Operation

No. (Hex.)	Name	Description	Default (Range)
H2-61 (1B47) Expert	2NO-2CM Logic Operation	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the logical operation for the functions set in *H2-01 [Multi-Function Digital Output 1]* and *H2-60 [2NO-2CM 2nd Function]*.	1 (1 - 9)

Note:

Refer to *Output of Logical Operation Results of MFDO on page 710* for more information about the relation between parameter settings and logical operations.

■ H2-62 2NO-2CM Dly Time

No. (Hex.)	Name	Description	Default (Range)
H2-62 (1B48) Expert	2NO-2CM Dly Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the minimum on time used to output the logical calculation results from terminal 2NO-2CM.	0.1 s (0.0 - 25.0 s)

■ H2-63 3NO-3CM 2nd Function

No. (Hex.)	Name	Description	Default (Range)
H2-63 (1B49) Expert	3NO-3CM 2nd Function	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Selects the second function for terminal 3NO-3CM. The logical calculation results of the terminals assigned to functions by *H2-02 [Multi-Function Digital Output 2]* is output.	0 (0 - A7)

■ H2-64 3NO-3CM Logic Operation

No. (Hex.)	Name	Description	Default (Range)
H2-64 (1B4A) Expert	3NO-3CM Logic Operation	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the logical operation for the functions set in *H2-02 [Multi-Function Digital Output 2]* and *H2-63 [3NO-3CM 2nd Function]*.	1 (1 - 9)

Note:

Refer to *Output of Logical Operation Results of MFDO on page 710* for more information about the relation between parameter settings and logical operations.

■ H2-65 3NO-3CM Dly Time

No. (Hex.)	Name	Description	Default (Range)
H2-65 (1B4B) Expert	3NO-3CM Dly Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the minimum on time used to output the logical calculation results from terminal 3NO-3CM.	0.1 s (0.0 - 25.0 s)

■ H2-66 4NO-4CM 2nd Function

No. (Hex.)	Name	Description	Default (Range)
H2-66 (1B4C) Expert	4NO-4CM 2nd Function	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Selects the second function for terminal 4NO-4CM. The logical calculation results of the terminals assigned to functions by *H2-03 [Multi-Function Digital Output 3]* is output.	0 (0 - A7)

■ H2-67 4NO-4CM Logic Operation

No. (Hex.)	Name	Description	Default (Range)
H2-67 (1B4D) Expert	4NO-4CM Logic Operation	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the logical operation for the functions set in *H2-03 [Multi-Function Digital Output 3]* and *H2-66 [4NO-4CM 2nd Function]*.	1 (1 - 9)

Note:

Refer to *Output of Logical Operation Results of MFDO on page 710* for more information about the relation between parameter settings and logical operations.

H2-68 4NO-4CM Dly Time

No. (Hex.)	Name	Description	Default (Range)
H2-68 (1B4E) Expert	4NO-4CM Dly Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the minimum on time used to output the logical calculation results from terminal 4NO-4CM.	0.1 s (0.0 - 25.0 s)

Multi-Function Digital Output Setting Value

Selects the function configured to MFDO.

0: Through Mode

Setting	Function	Description
0	Through Mode	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Use this setting for unused terminals or to use terminals in through mode. Also use this setting as the PLC contact output via Modbus or the communication option. This signal does not function if signals from the PLC are not configured.

1: Drive Ready

Setting	Function	Description
1	Drive Ready	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal activates when the drive is ready and running.

The terminal deactivates in these conditions:

- When the power supply is OFF
- During a fault
- When there is problem with the control power supply
- When there is a parameter configuration error and the drive cannot operate although there is a Run command
- When you enter a Run command and it immediately triggers an overvoltage or undervoltage fault
- When the drive is in Programming Mode and will not accept a Run command

2: Drive Enable

Setting	Function	Description
2	Drive Enable	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV This terminal activates when the *H1-xx = 1A [Drive Enable]* terminal activates.

3: Fault

Setting	Function	Description
3	Fault	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal activates when the drive detects a fault.

Note:

The terminal will not turn on for *CPF00* and *CPF01 [Control Circuit Error]* faults.

4: Alarm

Setting	Function	Description
4	Alarm	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal turns on when the drive detects a minor fault.

5: @Run

Setting	Function	Description
5	@Run	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal activates when the Run command is input and when the drive is making voltage.

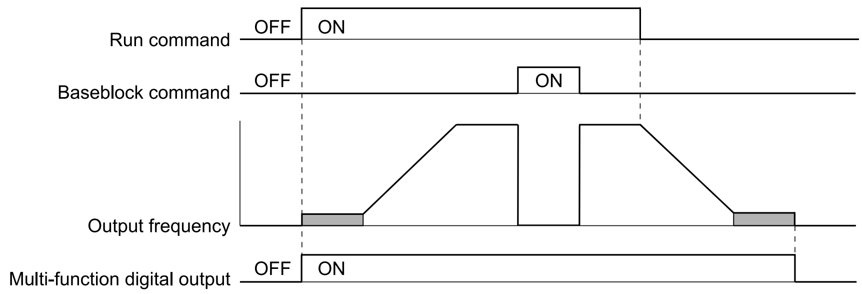


Figure 12.84 Drive Running Time Chart

ON : Drive is running

Drive is operating or making voltage.

OFF : Drive is stopping

Drive is stopped.

■ 6: @Reverse

Setting	Function	Description
6	@Reverse	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal activates when the motor operates in the reverse direction.

ON : The motor is operating in the reverse direction.

OFF : The motor is operating in the forward direction or the motor stopped.

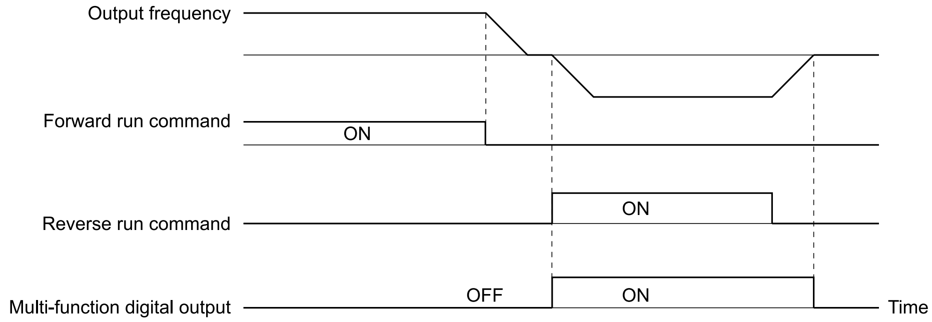


Figure 12.85 Reverse Operation Output Time Chart

■ 7: Zero Speed

Setting	Function	Description
7	Zero Speed	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal activates when the output frequency is less than the value of *E1-09 [Min Output Frequency]* or *b2-01 [ZSpd/DCI Threshold]*.

Note:

A1-02 [Control Method] selects which parameter is the reference.

A1-02 Setting	Control Method	Parameter Used as the Reference
0	V/f Control	*E1-09*
1	PG V/f Control	*E1-09*
2	OLVector	*b2-01*
3	CLVector	*E1-09*
4	Adv OLVector	*E1-09*
5	PM OLVector	*E1-09*
6	PM AOLVector	*E1-09*
7	PM CLVector	*b2-01*
8	EZ Vector	*E1-09*

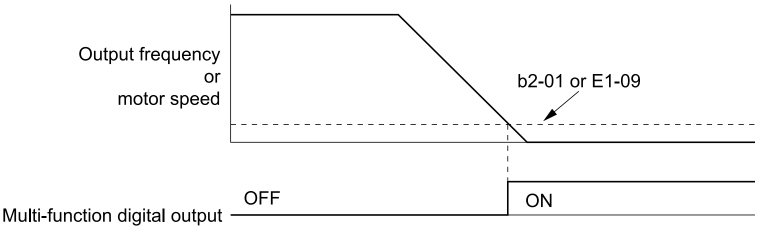


Figure 12.86 Zero Speed Time Chart

ON : Output frequency < value of *E1-09* or *b2-01*.

OFF : Output frequency ≥ value of *E1-09* or *b2-01*.

■ 8: ZeroServo ok

Setting	Function	Description
8	ZeroServo ok	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM **CLV/PM** EZOLV The terminal activates when positioning in the range set with *b9-02 [Zero Servo Width for Completion]* completes after sending the Zero-Servo command.

Note:

Refer to “b9: ZERO SERVO” for more information.

■ 9: @Regeneration

Setting	Function	Description
9	@Regeneration	V/f CL-V/f OLV **CLV** **AOLV** OLV/PM AOLV/PM **CLV/PM** EZOLV The terminal activates on when the motor is regenerating.

ON : Motor is regenerating.

OFF : Motor is operating or stopped.

■ A: @SpeedLimit

Setting	Function	Description
A	@SpeedLimit	V/f CL-V/f OLV **CLV** **AOLV** OLV/PM AOLV/PM **CLV/PM** EZOLV The terminal activates when the speed limit is active.

The frequency limit activates and the terminal activates in these conditions:

- The frequency reference ≥ *d2-01 [FRef Upper Limit]*
- The frequency reference ≤ *d2-02 [FRef Lower Limit]* or *d2-03 [Analog FRef Lower Limit]*.
- The frequency reference ≤ *E1-09 [Min Output Frequency]* when *b1-05 = 2, 3, or 4 [Below Min. Freq. Operation = Baseblock coast, Min. Frequency, or Zero Speed]*.
- The frequency reference ≤ *FW Trq Lim [H3-xx = 9]* through analog input.

■ B: @FreqOutput

Setting	Function	Description
B	@FreqOutput	**V/f** **CL-V/f** **OLV** **CLV** **AOLV** **OLV/PM** **AOLV/PM** **CLV/PM** **EZOLV** The terminal activates when the drive outputs frequency.

ON : The drive outputs frequency.

OFF : The drive does not output frequency.

Note:

The terminal deactivates in these conditions:
- During Stop
- During baseblock
- During DC Injection Braking (initial excitation)
- During Short Circuit Braking

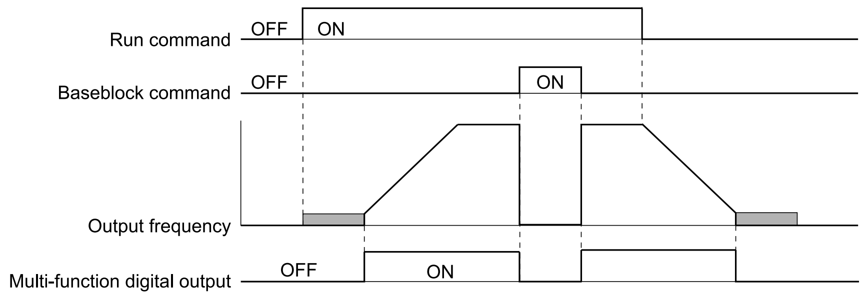
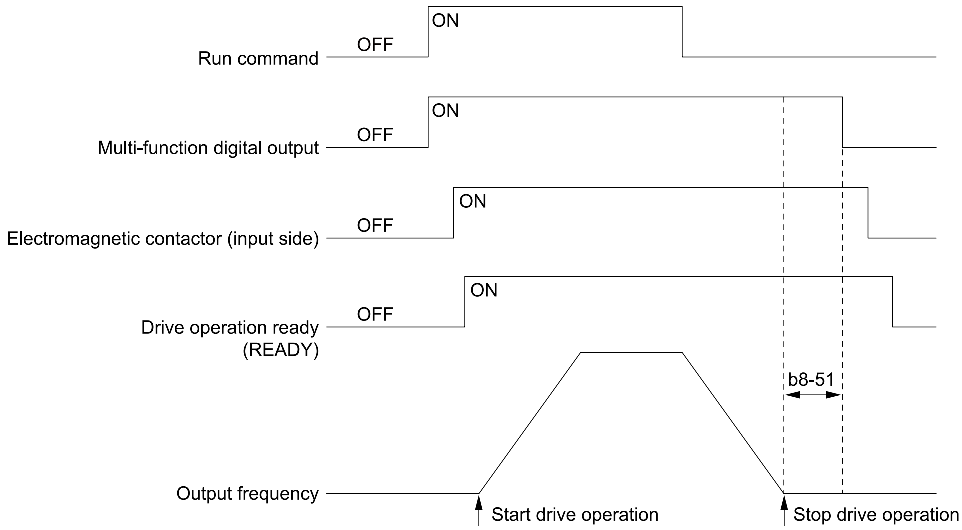


Figure 12.87 Active Frequency Output Time Chart

■ C: @Standby

Setting	Function	Description
C	@Standby	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal deactivates after the drive stops operating and after the time set with *b8-51 [Standby Mode Wait Time]*.



ON : The Run command turns on and the magnetic contactor on the input side turns on.

OFF : The Run command turns off and the drive stops operating. Then, the magnetic contactor on the input side turns off after the time set with *b8-51 [Standby Mode Wait Time]* elapses.

■ D: LO/RE Status

Setting	Function	Description
D	LO/RE Status	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal activates when the Run command source or frequency reference source is LOCAL.

ON : LOCAL

The keypad is the Run command source or the frequency reference source.

OFF : REMOTE

The Run command source or frequency reference source is an external source set with *b1-01 [Freq. Ref. Sel. 1]*, *b1-15 [Freq. Ref. Sel. 2]*, *b1-02 [Run Comm. Sel 1]*, or *b1-16 [Run Comm. Sel 2]*.

■ E: EDM Safety

Setting	Function	Description
E	EDM Safety	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal turns on (safety stop state) when the safety circuit and safety diagnosis circuit are operating correctly and when terminals H1-HC and H2-HC are off (released).

Note:

EDM = External Device Monitor

ON : Safety stop state

Terminals H1-HC and H2-HC are OFF or released (safety stop state).

OFF : Safety circuit fault or RUN/READY

Terminal H1-HC or terminal H2-HC is OFF or released (safety circuit fault), or the two terminals are ON or have short circuited (RUN/READY).

■ F: SpeedAgree1

Setting	Function	Description
F	SpeedAgree1	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal turns on when the output frequency is in the range of the frequency reference ± *L4-02 [SpAgree Det.Width]*.

Note:
- The motor rotation direction does not have an effect on the detection function.
- CLV control uses motor speed as the reference.

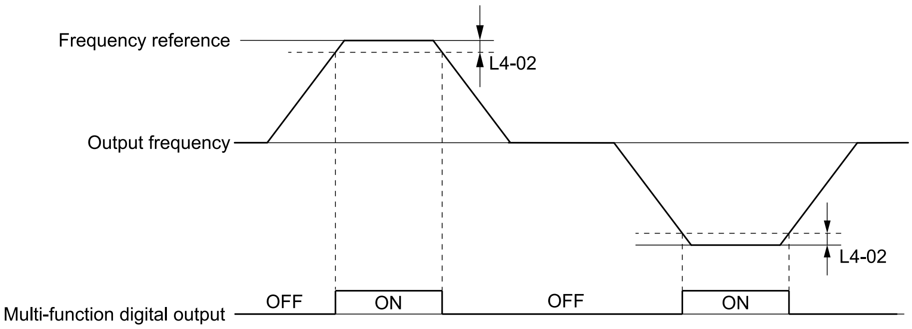


Figure 12.88 Speed Agree 1 Time Chart

ON : The output frequency is in the range of "frequency reference ± *L4-02*."

OFF : The output frequency does not align with the frequency reference although the drive is running.

■ 10: USpeedAgree1

Setting	Function	Description
10	USpeedAgree1	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal activates when the output frequency is in the range of *L4-01 [SpAgree Det.Level]* ± *L4-02 [SpAgree Det.Width]* and in the range of the frequency reference ± *L4-02*.

Note:
- The motor rotation direction does not have an effect on the detection function. The drive uses the *L4-01* value as the forward/reverse detection level.
- CLV control uses motor speed as the reference.

ON : The output frequency is in the range of "*L4-01* ± *L4-02*" and the range of frequency reference ± *L4-02*.

OFF : The output frequency is not in the range of "*L4-01* ± *L4-02*" or the in the range of frequency reference ± *L4-02*.

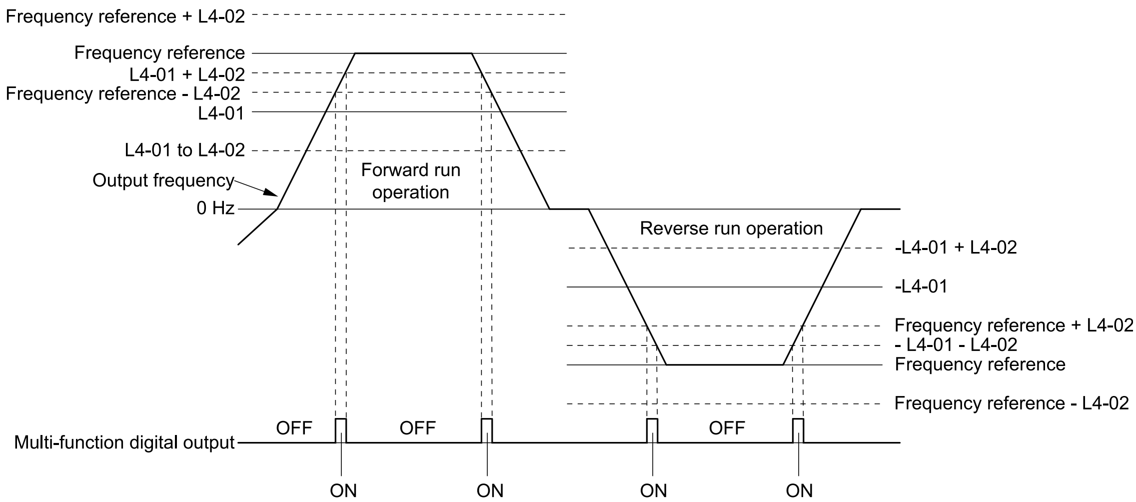


Figure 12.89 User-Defined Speed Agree 1 Time Chart

■ 11: SpeedAgree2

Setting	Function	Description
11	SpeedAgree2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal activates when the output frequency is in the range of the frequency reference ± *L4-04 [SpAgree Det.Width(+/-)]*.

Note:
- The motor rotation direction does not have an effect on the detection function. The drive uses the *L4-01* value as the forward/reverse detection level.
- CLV and CLV/PM control use motor speed as the reference.

ON : The output frequency is in the range of "frequency reference ± *L4-04*".

OFF : The output frequency is not in the range of "frequency reference ± *L4-04*".

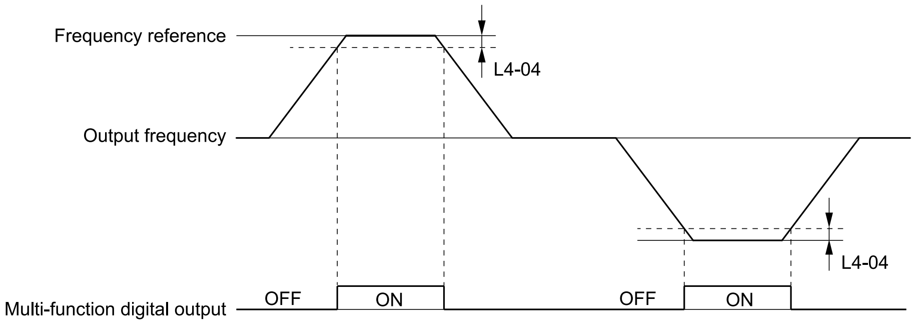


Figure 12.90 Speed Agree 2 Time Chart

■ 12: USpeedAgree2

Setting	Function	Description
12	USpeedAgree2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal activates when the output frequency is in the range of *L4-03 [SpAgree Det.Level(+/-)]* ± *L4-04 [SpAgree Det. Width(+/-)]* and in the range of the frequency reference ± *L4-04*.

Note:
- The detection level configured with *L4-03* is a signed value. The drive will only detect in one direction.
- CLV and CLV/PM control use motor speed as the reference.

ON : The output frequency is in the range of "*L4-03* ± *L4-04*" and the range of frequency reference ± *L4-04*.

OFF : The output frequency is not in the range of "*L4-03* ± *L4-04*" or the in the range of frequency reference ± *L4-04*.

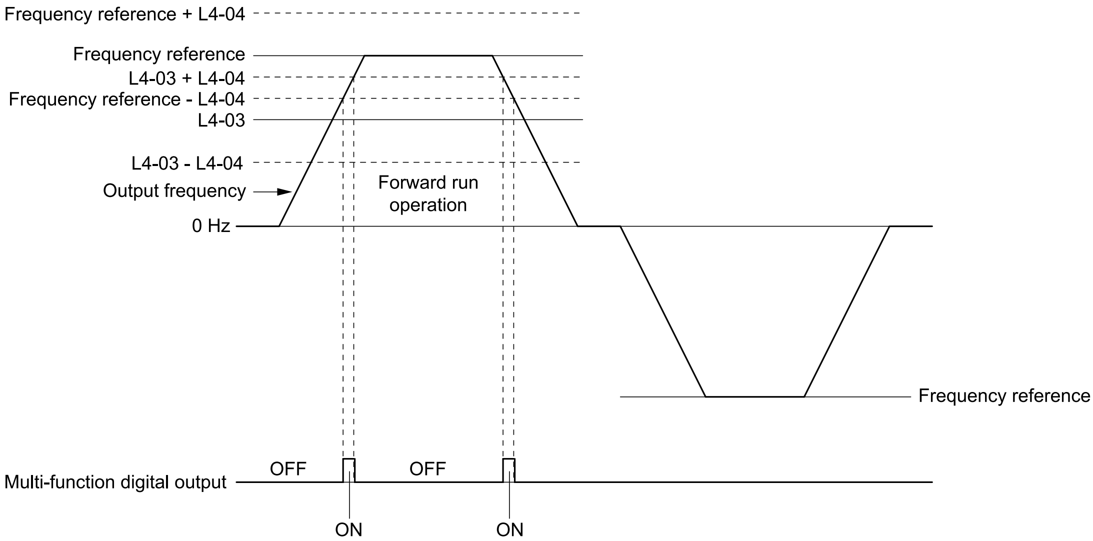


Figure 12.91 Example of User-set Speed Agree 2 (L4-03 Is Positive)

Parameter Details

12

■ 13: FreqDetect 1

Setting Value	Function	Description
13	FreqDetect 1	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal turns off when the output frequency is higher than the value of *L4-01 [SpAgree Det.Level]* + *L4-02 [SpAgree Det. Width]*. After the terminal turns off, the terminal continues to remain off until the output frequency reaches the level set with *L4-01*.

Note:
- The motor rotation direction does not have an effect on the detection function. The drive uses the *L4-01* value as the forward/reverse detection level.
- CLV control uses motor speed as the reference.

ON : The output frequency is less than the value of *L4-01* or is not more than the value of *L4-01* + *L4-02*.

OFF : The output frequency is higher than the value of *L4-01* + *L4-02*.

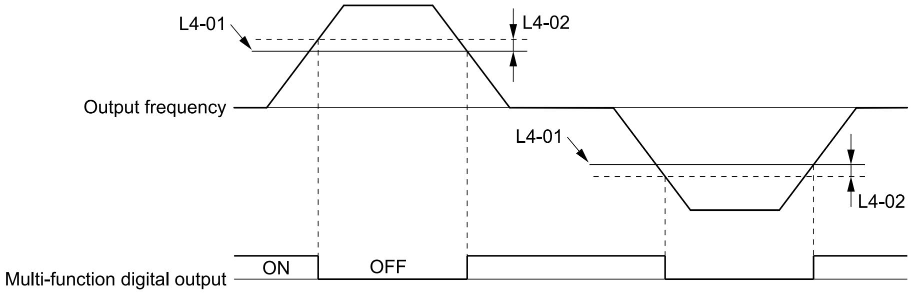


Figure 12.92 Frequency Detection 1 Time Chart

Note:

Figure 12.92 shows the result of the configuration when *L4-07 = 2 [SpAgree Det.Selection = Always Detect]*. The default setting of *L4-07* is *1 [No Detect@BB]*. When the speed agreement detection selection is "No Detect@BB", the terminal is deactivated when the drive output stops.

■ 14: FreqDetect 2

Setting	Function	Description
14	FreqDetect 2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal activates when the output frequency is higher than the setting value of *L4-01 [SpAgree Det.Level]*. After the terminal activates, the terminal stays on until the output frequency is at the value of *L4-01 - L4-02*.

Note:
- The motor rotation direction does not have an effect on the detection function. The drive uses the *L4-01* value as the forward/reverse detection level.
- CLV control uses motor speed as the reference.

ON : The output frequency is higher than the value of *L4-01*.

OFF : The output frequency is less than the value of "*L4-01 - L4-02*", or is less than the value of *L4-01*.

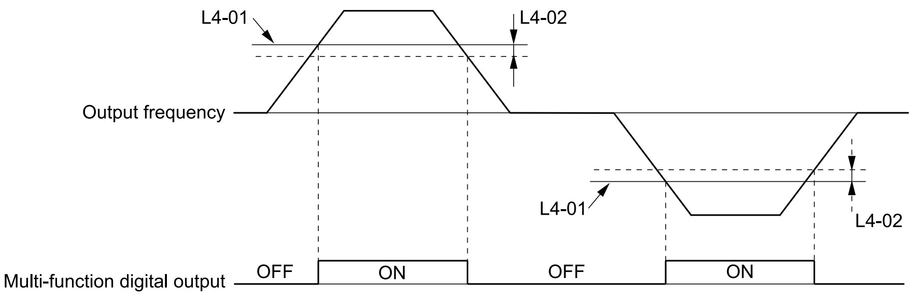


Figure 12.93 Frequency Detection 2 Time Chart

■ 15: FreqDetect 3

Setting	Function	Description
15	FreqDetect 3	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal deactivates when the output frequency is higher than the setting value of "*L4-03 [SpAgree Det.Level(+/-)]* + *L4-04 [SpAgree Det.Width(+/-)]*". After the terminal deactivates, the terminal stays off until the output frequency is at the value of *L4-03*.

Note:
- The detection level set with *L4-03* is a signed value. The drive will only detect in one direction.
- CLV and CLV/PM control use motor speed as the reference.

ON : The output frequency is less than the value of *L4-03* or is not higher than the value of *L4-03 + L4-04*.

OFF : The output frequency is higher than the value of *L4-03 + L4-04*.

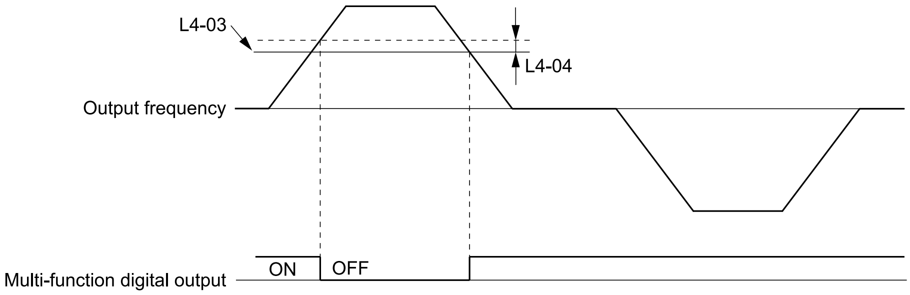


Figure 12.94 Example of Frequency Detection 3 (value of L4-03 Is Positive)

Note:

Figure 12.94 shows the result of the configuration when *L4-07 = 1 [Speed Agree Detection Selection = Detection Always Enabled]*. The default setting of *L4-07* is *0 [No Detection during Baseblock]*. When the speed agreement detection selection is "No Detection during Baseblock", the terminal is deactivated when the drive output stops.

■ 16: FreqDetect 4

Setting	Function	Description
16	FreqDetect 4	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal activates when the output frequency is higher than the value of *L4-03 [SpAgree Det.Level(+/-)]*. After the terminal activates, the terminal stays on until the output frequency is at the value of *L4-03 - L4-04*.

Note:
- The detection level set with *L4-03* is a signed value. The drive will only detect in one direction.
- CLV control uses motor speed as the reference.

ON : The output frequency is higher than the value of *L4-03*.

OFF : The output frequency is less than the value of "*L4-03 - L4-04*", or it is not higher than the value of *L4-03*.

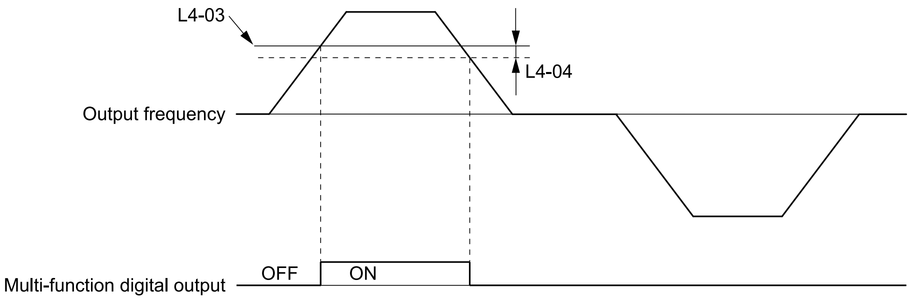


Figure 12.95 Example of Frequency Detection 4 (value of L4-03 Is Positive)

■ 17: @Fast Stop

Setting	Function	Description
17	@Fast Stop	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal activates when the fast stop is in operation.

■ 18: @KEBridethru

Setting	Function	Description
18	@KEBridethru	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The activates during KEB Ride-Thru.

Note:

Refer to "KEB Ride-Thru function" for more information.

19: @ShortCBraking

Setting	Function	Description
19	@ShortCBraking	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal activates during Short Circuit Braking.

Note:
- When *A1-02 = 8 [Control Method = EZ Vector]*, this function is available if you use a PM motor.
- Refer to "b2: DC INJ / SHORT CKT BRAKE" for more information.

1A: @BaseblockNO

Setting	Function	Description
1A	@BaseblockNO	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal turns on during baseblock. When the drive is in baseblock, the drive output transistor stops switching and the drive will not make DC bus voltage.

ON : During baseblock

OFF : The drive is not in baseblock.

1B: @BaseblockNC

Setting	Function	Description
1B	@BaseblockNC	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal deactivates during baseblock. When the drive is in baseblock, the drive output transistor stops switching and does not make DC bus voltage.

ON : The drive is not in baseblock.

OFF : During baseblock

1C: FreqRefSource

Setting	Function	Description
1C	FreqRefSource	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Shows the selected frequency reference source.

ON : The keypad is the frequency reference source.

OFF : *b1-01 or b1-15 [Freq. Ref. Sel. 1 or Freq. Ref. Sel. 2]* is the frequency reference source.

1D: RunCmdSource

Setting	Function	Description
1D	RunCmdSource	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Shows the selected Run command source.

ON : The keypad is the Run command source.

OFF : *b1-02* or *b1-16* [Run Comm. Sel 1 or Run Comm. Sel 2] is the Run command source.

1E: Motor2 Select

Setting	Function	Description
1E	Motor2 Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal activates when motor 2 is selected.

ON : Motor 2 Selection

OFF : Motor 1 Selection

1F: Restart Enable

Setting	Function	Description
1F	Restart Enable	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal activates when the Auto Restart function is trying to restart after a fault.

The terminal deactivates when the Auto Restart function automatically resets a fault. The terminal deactivates when the Auto Restart function detects the fault again because the Auto Restart function cannot operate when the drive reaches the number of attempts set with *L5-01 [Auto-Reset Attempts]*.

Note:

Refer to "L5: FAULT RESTART" for more information.

20: FltReset Active

Setting	Function	Description
20	FltReset Active	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal turns on when the drive receives the Reset command from the control circuit terminal, serial communications, or the communication option.

21: PolePos Detection

Setting	Function	Description
21	PolePos Detection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal activates when drive receives a Run command and the drive detects the motor magnetic pole position of the PM motor.

22: Ext 24V Supply

Setting	Function	Description
22	Ext 24V Supply	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal activates when there is an external 24V power supply between terminals E24V-A0V.

ON : An external 24V power supply supplies power.

OFF : An external 24V power supply does not supply power.

2F: @SpeedSearch

Setting	Function	Description
2F	@SpeedSearch	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal activates when the drive is doing speed search.

Note:

Refer to "b3: SPEED SEARCH" for more information.

30: @TorqueLimit

Setting	Function	Description
30	@TorqueLimit	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal activates when the torque reference is the torque limit set with *L7 parameters*, *H3-02 [AI1 Function Selection]*, *H3-06 [AI3 Function Selection]*, or *H3-10 [AI2 Function Selection]*.

Note:

Refer to "L7: TORQUE LIMIT" for more information.

31: @SpdLim@Trq

Setting	Function	Description
31	@SpdLim@Trq	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The motor accelerates in the forward direction or the reverse direction after enabling torque control and the externally input torque reference is disproportionate to the load. The output terminal activates when this speed is not higher than a constant speed and the motor speed is at the speed limit. This does not include operation when the drive is stopped.

Note:

Refer to "*d5-03 Speed Limit Selection on page 626*" for more information.

32: TrqDetect1NO

Setting	Function	Description
32	TrqDetect1NO	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal activates when the drive detects overtorque or undertorque.

ON : The output current/torque is more than the torque value set with *L6-02 [Trq Det1 Level]*, or the level is less than the torque value set with *L6-02* for longer than the time set with *L6-03 [Trq Det1 Time]*.

Parameter Details

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Note:
- When *L6-01* ≥ *5*, the drive will detect when the output current/torque is less than the detection level of *L6-02* for longer than the time set in *L6-03*.
- Refer to "L6: TORQUE DETECTION" for more information.

■ 33: TrqDetect1NC

Setting	Function	Description
33	TrqDetect1NC	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal deactivates when the drive detects overtorque or undertorque.

Use the *L6 [Torque Detection]* parameters to set torque detection.

OFF : The output current/torque is more than the torque value set with *L6-02 [Trq Det1 Level]*, or the level is less than the torque value set with *L6-02* for longer than the time set with *L6-03 [Trq Det1 Time]*.

Note:
- When *L6-01* ≥ *5*, the drive will detect when the output current/torque is less than the detection level of *L6-02* for longer than the time set in *L6-03*.
- Refer to "L6: TORQUE DETECTION" for more information.

■ 37: TrqDetect2NO

Setting	Function	Description
37	TrqDetect2NO	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal activates when the drive detects overtorque or undertorque.

Use the *L6 [Torque Detection]* parameters to set torque detection.

ON : The output current/torque is more than the torque value set with *L6-05 [Trq Det2 Level]*, or the level is less than the torque value set with *L6-05* for longer than the time set with *L6-06 [Trq Det2 Time]*.

Note:
- When *L6-04* ≥ *5*, the drive will detect when the output current/torque is less than the detection level of *L6-05* for longer than the time set in *L6-06*.
- Refer to "L6: TORQUE DETECTION" for more information.

■ 38: TrqDetect2NC

Setting	Function	Description
38	TrqDetect2NC	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal deactivates when the drive detects overtorque or undertorque.

Use the *L6 [Torque Detection]* parameters to set torque detection.

OFF : The output current/torque is more than the torque value set with *L6-05 [Trq Det2 Level]*, or the level is less than the torque value set with *L6-05* for longer than the time set with *L6-06 [Trq Det2 Time]*.

Note:
- When *L6-04* ≥ *5*, the drive will detect when the output current/torque is less than the detection level of *L6-05* for longer than the time set in *L6-06*.
- Refer to "L6: TORQUE DETECTION" for more information.

■ 39: Timer Output

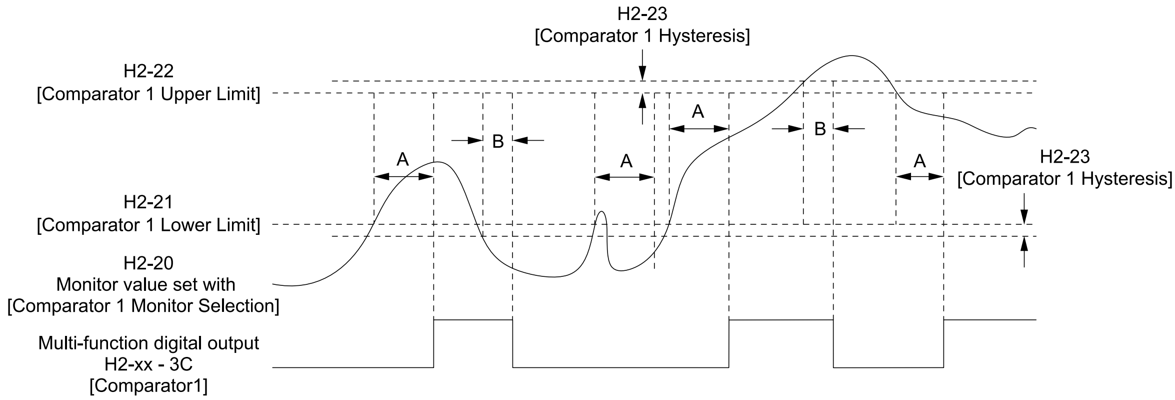
Setting	Function	Description
39	Timer Output	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Use this setting when the drive uses the timer function as an output terminal.

Note:

Refer to "b4: TIMER" for more information.

■ 3C: Comparator 1

Setting	Function	Description
3C	Comparator 1	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The monitor value set with *H2-20 [Compare1 Mon.Selection]* is on while in range of the time set with *H2-24 [Compare1 On-Delay Time]* and the values of *H2-21 [Compare1 Low Limit] and H2-22 [Compare1 Up Limit]* are in range.



A - H2-24 [Compare1 On-Delay Time]   **B - H2-25 [Compare1 Off-Delay Time]**

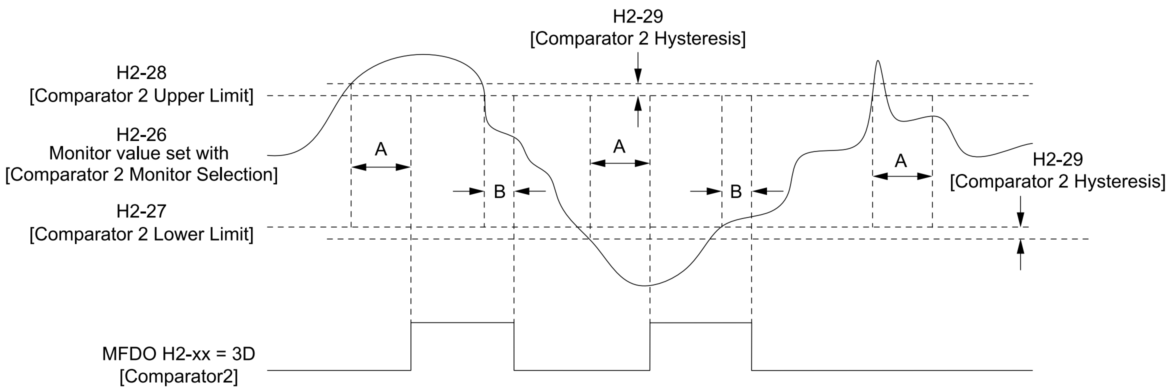
Figure 12.96 Comparator 1 Output Time Chart

Note:

The drive compares the monitors set with *H2-20* as absolute values.

■ 3D: Comparator 2

Setting	Function	Description
3D	Comparator 2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The monitor value set with *H2-26 [Compare2 Mon.Selection]* is on while in range of the time set with *H2-30 [Compare2 On-Delay Time]* and the values of *H2-27 [Compare2 Low Limit] and H2-28 [Compare2 Up Limit]* are in range.



A - H2-30 [Compare2 On-Delay Time]   **B - H2-31 [Compare2 Off-Delay Time]**

Figure 12.97 Comparator 2 Output Time Chart

Note:

The drive compares the monitors set with *H2-26* as absolute values.

■ 3E: PID Fbk Low

Setting	Function	Description
3E	PID Fbk Low	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The activates when the drive detects *FbL [PID Feedback Loss]*.

The drive detects *FbL [PID Feedback Loss]* when the PID feedback value < *b5-13 [Fdback Loss Lvl]* for longer than the time set in *b5-14 [Fdback Loss Time]*.

Note:

Refer to “PID Feedback Loss Detection” for more information.

■ 3F: PID Fbk High

Setting	Function	Description
3F	PID Fbk High	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal activates when the drive detects *FbH [Excessive PID Feedback]*.

The drive detects *FbH [Excessive PID Feedback]* when the PID feedback value > *b5-36 [PID HiHi Limit Level]* for longer than the time set in *b5-37 [PID HiHi Time]*.

Note:

Refer to “PID Feedback Loss Detection” for more information.

■ 4A: DC Bus Undervolt

Setting	Function	Description
4A	DC Bus Undervolt	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal activates when the DC bus voltage or control circuit power supply is less than the voltage set with *L2-05 [UV Detection Lvl (Uv1)]*. The terminal also turns on when there is a fault with the DC bus voltage.

ON : The DC bus voltage is less than the setting value of *L2-05*.

OFF : The DC bus voltage is more than the setting value of *L2-05*.

■ 4B: FreqRef Loss

Setting	Function	Description
4B	FreqRef Loss	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal activates when the drive detects a loss of frequency reference.

Note:

Refer to “*L4-05 FrefLoss Det.Selection on page 784*” for more information.

■ 4C: BrkRes Fault

Setting	Function	Description
4C	BrkRes Fault	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal activates when the mounting-type braking resistor is overheating or when there is a braking transistor fault.

■ 4D: Motor OL1

Setting	Function	Description
4D	Motor OL1	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal activates when the electronic thermal protection value of the motor overload protective function is a minimum of 90% of the detection level.

Note:

Refer to “*L1-01 Motor Cool Type for OL1 Calc on page 759*” for more information.

■ 4E: Drive PreOH

Setting	Function	Description
4E	Drive PreOH	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal activates when the drive heatsink temperature is at the level set with *L8-02 [Overheat Alm Level]*.

Note:

Refer to “*L8-02 Overheat Alm Level on page 795*” for more information.

■ 4F: PreOHTimeLim

Setting	Function	Description
4F	PreOHTimeLim	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal activates when *L8-03 = 4 [Overheat Pre-Alarm Selection = Run@L8-19 Rate]* and *oH [Heatsink Overheat]* does not clear after the drive decreases the frequency for 10 cycles.

Note:

Refer to “*L8-03 Overheat Pre-Alarm Selection on page 795*” for more information.

■ 60: BrkTransFault

Setting	Function	Description
60	BrkTransFault	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal activates when the internal braking transistor overheats and the drive detects an *rr [Dynamic Braking Transistor Fault]* fault.

■ 61: BrkTransOH

Setting	Function	Description
61	BrkTransOH	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal activates when the braking resistor overheats and the drive detects an *rH [Braking Resistor Overheat]* fault.

The braking resistor overheats when the deceleration time is short and there is too much motor regeneration energy.

■ 62: Fan Alarm

Setting	Function	Description
62	Fan Alarm	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal activates when the drive detects a cooling fan failure in the drive.

■ 63: Maintenance

Setting	Function	Description
63	Maintenance	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal activates when drive components are at their estimated maintenance period.

Tells the user about the maintenance period for these items:

- IGBT
- Cooling fan
- Capacitor
- Soft charge bypass relay

Note:

Refer to “Alarm Outputs for Maintenance Monitors” for more information.

■ 65: WattH Pulse

Setting	Function	Description
65	WattH Pulse	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Outputs the pulse that shows the watt hours.

Note:

Refer to “*H2-06 kWH Out Unit Selection on page 711*” for more information.

■ 66: MechWeakDetect

Setting	Function	Description
66	MechWeakDetect	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal activates when the drive detects mechanical weakening.

Note:

Refer to “Mechanical Weakening Detection Function” for more information.

■ 67: ModbusReg 1

Setting	Function	Description
67	ModbusReg 1	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal activates when the bit specified by *H2-08 [Mbus Reg1 Bit Select]* for the Modbus register address set with *H2-07 [Mbus Reg1 Address Select]* activates.

■ 69: ModbusReg 2

Setting	Function	Description
69	ModbusReg 2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal activates when the bit specified by *H2-10 [Mbus Reg2 Bit Select]* for the Modbus register address set with *H2-09 [Mbus Reg2 Address Select]* activates.

6A: DataLog Error

Setting	Function	Description
6A	DataLog Error	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The terminal activates when the drive detects a *LoG [Com Error / Abnormal SD card]*.

90 to 93: Q2pack DO1 to 4

Setting	Function	Description
90 to 93	Q2pack DO1 to 4	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Q2pack digital output. Refer to the Q2pack online manual for more information.

A0 to A7: Q2pack ExDO1 to 8

Setting Value	Function	Description
A0 to A7	Q2pack ExDO1 to 8	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the digital output for the Q2pack DO-A3 option card. Refer to the Q2pack online manual for more information.

100 to 1A7: Inverse Output of 0 to A7

Setting	Function	Description
100 to 1A7	Inverse Output of 0 to A7	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Causes inverse output of the function for the selected MFDO. Uses the last two digits of 1xx to select which function to inversely output.

For example, set *H2-xx = 103* for the inverse output of *3 [Fault]*.

◆ H3: ANALOG INPUTS

Multi-Function Analog Inputs

WARNING! *Sudden Movement Hazard. Do test runs and examine the drive to make sure that command references are configured correctly. If you set the command reference incorrectly, it can cause death, serious injury, or equipment damage from unwanted motor rotation.*

Drives have three analog input terminals, terminals AI1, AI2, and AI3. *H3* parameters select the functions set to these analog input terminals and adjust signal levels.

Table 12.48 shows the functions that you can set to analog input terminals. Use *H3-02 [AI1 Function Selection]*, *H3-06 [AI3 Function Selection]*, and *H3-10 [AI2 Function Selection]* to set functions.

Table 12.48 AI Setting Values

Setting	Function	Setting	Function
0	Through Mode	E	OvUntrq Level
1	AuxFreqRef1	F	PID Fbk
2	AuxFreqRef2	10	PID SetPoint
3	FrqBIAS Frq	11	Diff PIDFbk
4	Freq Ref/BIAS	12	AcDcTimeGain
5	Freq Gain	13	DCInjBrakCurr
6	OutVolt Bias	14	StallPLev@Rn
7	TorqCompensation	15	OutFLowLimSel
8	TorqRef/Lim	16	Mot PTC Input
9	FW Trq Lim	30	Q2pack AI1
B	Rev Trq Lim	31	Q2pack AI2
C	RegenTrqLim	32	Q2pack AI3
D	GenerTrqLim		

Note:

All analog input scaling uses gain and bias for adjustment. Set the gain and bias values correctly.

Example Analog Input Settings

- The function set for terminal AI1 is set with *Freq Ref/BIAS [H3-02 = 4]*, the gain is 200% *[H3-03 = 200.0]*, and the bias is 0% *[H3-04 = 0.0]*.
  When you input a 10 V signal, the frequency reference will be 200%.
  When you input a 5 V signal, the frequency reference will be 100%. Parameter *E1-04 [Max Output Frequency]* restricts drive output. When you input a 5 V or more signal, the frequency reference will be 100%.

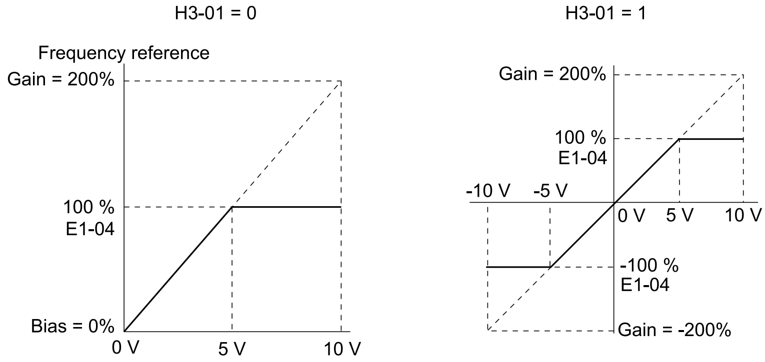


Figure 12.98 Freq Reference When the Analog Input Gain Setting Is Adjusted

- The function set for terminal AI1 is set with *Freq Ref/BIAS [H3-02 = 4]*, the gain is 100% *[H3-03 = 100.0]*, and the bias is -25% *[H3-04 = -25.0]*.
  When you input a 0 V signal, the frequency reference will be -25%.
  When *H3-01 = 2 [AI1 Signal Level Select = 4 to 20 mA (Q2A Only)]*, when you input a 0 V to 2 V signal, the frequency reference will be 0%. When you input a 2 V to 10 V signal, the frequency reference will be 0% to 100%.
  When *H3-01 = 1 [-10 to +10V (Bipolar Reference) (Q2V: 0 to 10 V without zero limit)]*, it enables signals of positive and negative polarities. When you input a 0 V to 2 V signal, and the motor rotates in reverse.

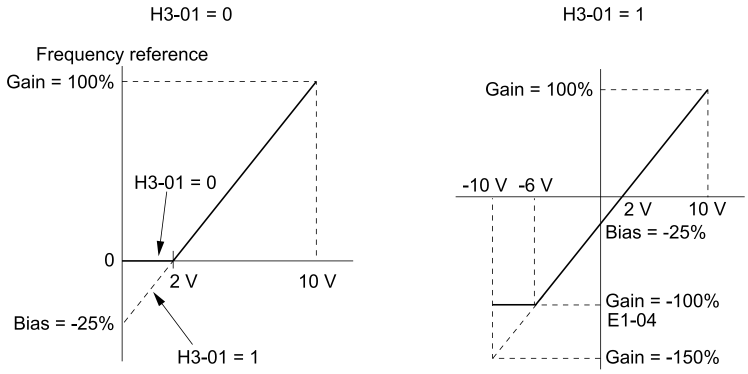


Figure 12.99 Frequency Reference When Negative Number Bias Is Configured

■ Modbus Multi-Function AI1 to 3 Function Selection

Let the MFAI function be assigned to Modbus register *15C1 to 15C3 (Hex.) [Mbus Reg 15C1h through 15C3h Input Function]*. Use *H3-40* to *H3-42 [15C1h Input Function to 15C3h Input Function]* to set the function and use *H3-43 [Mbus In FilterTime Const]* to set the input filter.

Table 12.49 Modbus Multi-Function AI Command Register

Register No. (Hex.)	Name	Range *1	Parameter
15C1	15C1h Input Function	-32767 to 32767	H3-40
15C2	15C2h Input Function	-32767 to 32767	H3-41
15C3	15C3h Input Function	-32767 to 32767	H3-42

*1 Set as 100% = 4096.

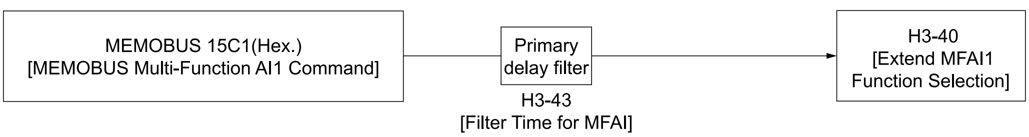


Figure 12.100 Functional Block Diagram for Modbus Multi-Function AI Command 1

Note:

- Refer to H3-xx "MFAI Setting Values" for the analog input setting values.
- When you will not use the terminal, set *H3-40 to H3-42 = 0*. The through mode function is not supported.
- You cannot use *H3-40 to H3-42* to set these MFAI terminals:

H3-xx Setting Value	Function
1	AuxFreqRef1
2	AuxFreqRef2
4	Freq Ref/BIAS
5	Freq Gain
30	Q2pack AI1
31	Q2pack AI2
32	Q2pack AI3

■ H3-01 AI1 Signal Level Select

No. (Hex.)	Name	Description	Default (Range)
H3-01 (0410)	AI1 Signal Level Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the input signal level for MFAI terminal AI1.	0 (0 - 3)

0 : 0 to 10V (Lower Limit at 0) (Q2V: 0 to 10 V with zero limit)

The voltage signal is 0 Vdc to 10 Vdc. The minimum input level limit is 0%. The drive will read a negative input signal caused by gain and bias settings as 0%.

1 : -10 to +10V (Bipolar Reference) (Q2V: 0 to 10 V without zero limit)

The voltage signal is -10 Vdc to 10 Vdc. This setting enables positive and negative polarity signals. When the drive uses this setting as the frequency reference, a Forward Run command will run the motor in reverse and a Reverse Run command will run the motor forward. The gain and bias settings will cause the signal to be a negative number.

2 : 4 to 20 mA (Q2A Only)

The current signal is 4 mA to 20 mA. The minimum input level limit is 0%. The drive will read a negative input signal caused by gain and bias settings as 0%.

3 : 0 to 20 mA (Q2A Only)

The current signal is 0 mA to 20 mA. The minimum input level limit is 0%. The drive will read a negative input signal caused by gain and bias settings as 0%.

Note:

When *H3-01 = 0, 1*, set DIP switch S1-1 to the V side (voltage). When *H3-01 = 2, 3*, set DIP switch S1-1 to the I side (current). The default setting is the V side (voltage).

■ H3-02 AI1 Function Selection

No. (Hex.)	Name	Description	Default (Range)
H3-02 (0434)	AI1 Function Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets a function for MFAI terminal AI1.	4 (0 - 32)

■ H3-03 AI1 Gain Setting

No. (Hex.)	Name	Description	Default (Range)
H3-03 (0411) RUN	AI1 Gain Setting	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the gain of the analog signal input to MFAI terminal AI1.	100.0% (-999.9 - +999.9%)

This parameter sets the quantity of reference for the function set for terminal AI1 as a percentage when 10 V (or 20 mA) is input.

Use this parameter and *H3-04 [AI1 Bias Setting]* to adjust the characteristics of the analog input signal to terminal AI1.

H3-04 AI1 Bias Setting

No. (Hex.)	Name	Description	Default (Range)
H3-04 (0412) RUN	AI1 Bias Setting	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the bias of the analog signal input to MFAI terminal AI1.	0.0% (-999.9 - +999.9%)

This parameter sets the bias for the function set for terminal AI1 as a percentage when 0 V (4 mA or 0 mA) is input.

Use this parameter and *H3-03 [AI1 Gain Setting]* to adjust the characteristics of the analog input signal to terminal AI1.

H3-05 AI3 Signal Level Select

No. (Hex.)	Name	Description	Default (Range)
H3-05 (0413)	AI3 Signal Level Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the input signal level for MFAI terminal AI3.	0 (0 - 3)

0 : 0 to 10V (Lower Limit at 0)

The voltage signal is 0 Vdc to 10 Vdc. The minimum input level limit is 0%. The drive will read a negative input signal caused by gain and bias settings as 0%.

1 : -10 to +10V (Bipolar Reference)

The voltage signal is -10 Vdc to 10 Vdc. This setting enables positive and negative polarity signals. When the drive uses this setting as the frequency reference, a Forward Run command will run the motor in reverse and a Reverse Run command will run the motor forward. The gain and bias settings will cause the signal to be a negative number.

2 : 4 to 20 mA

The current signal is 4 mA to 20 mA. The minimum input level limit is 0%. The drive will read a negative input signal caused by gain and bias settings as 0%.

3 : 0 to 20 mA

The current signal is 0 mA to 20 mA. The minimum input level limit is 0%. The drive will read a negative input signal caused by gain and bias settings as 0%.

Note:

When *H3-05 = 0, 1*, set DIP switch S1-3 to the V side (voltage). When *H3-05 = 2, 3*, set DIP switch S1-3 to the I side (current). The default setting is the V side (voltage).

H3-06 AI3 Function Selection

No. (Hex.)	Name	Description	Default (Range)
H3-06 (0414)	AI3 Function Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets a function for MFAI terminal AI3.	1 (0 - 32)

Note:

When terminal AI3 is the PTC input terminal:
- Set H3-06 = 16 [Mot PTC InputMotor Temperature (PTC input)]
- Set DIP switch S4 to the PTC side
- Set DIP switch S1-3 to the V side

H3-07 AI3 Gain Setting

No. (Hex.)	Name	Description	Default (Range)
H3-07 (0415) RUN	AI3 Gain Setting	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the gain of the analog signal input to MFAI terminal AI3.	100.0% (-999.9 - +999.9%)

When 10 V (or 20 mA) is input, this parameter sets the reference quantity for the function set for terminal AI3 as a percentage.

Use this parameter and *H3-08 [AI3 Bias Setting]* to adjust the characteristics of the analog input signal to terminal AI3.

■ H3-08 AI3 Bias Setting

No. (Hex.)	Name	Description	Default (Range)
H3-08 (0416) RUN	AI3 Bias Setting	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the bias of the analog signal input to MFAI terminal AI3.	0.0% (-999.9 - +999.9%)

When 0 V (4 mA or 0 mA) is input, this parameter sets the bias for the function set for terminal AI3 as a percentage.

Use this parameter and *H3-07 [AI3 Gain Setting]* to adjust the characteristics of the analog input signal to terminal AI3.

■ H3-09 AI2 Signal Level Select

No. (Hex.)	Name	Description	Default (Range)
H3-09 (0417)	AI2 Signal Level Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the input signal level for MFAI terminal AI2.	2 (0 - 3)

0 : 0 to 10V (Lower Limit at 0) (Q2V: 0 to 10 V with zero limit)

The voltage signal is 0 Vdc to 10 Vdc. The minimum input level is limited to 0%, so that a negative input signal due to gain and bias settings will be read as 0%.

1 : -10 to +10V (Bipolar Reference) (Q2V: 0 to 10 V without zero limit)

The voltage signal is -10 Vdc to 10 Vdc. Signals of both positive and negative polarities are enabled. When this setting is used as the frequency reference, the motor runs reverse when the Forward run command is input, or runs forward when the Reverse run signal is input, while the signal is a negative number due to gain and bias.

2 : 4 to 20 mA (Q2A Only)

The current signal is 4 mA to 20 mA. The minimum input level is limited to 0%, so that a negative input signal due to gain and bias settings will be read as 0%.

3 : 0 to 20 mA (Q2A Only)

The current signal is 0 mA to 20 mA. The minimum input level is limited to 0%, so that a negative input signal due to gain and bias settings will be read as 0%.

Note:

When *H3-09 = 0, 1*, set DIP switch S1-2 to the V side (voltage). When *H3-09 = 2, 3*, set DIP switch S1-2 to the I side (current). The default setting is the I side (current).

■ H3-10 AI2 Function Selection

No. (Hex.)	Name	Description	Default (Range)
H3-10 (0418)	AI2 Function Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets a function for MFAI terminal AI2.	4 (0 - 32)

■ H3-11 AI2 Gain Setting

No. (Hex.)	Name	Description	Default (Range)
H3-11 (0419) RUN	AI2 Gain Setting	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the gain of the analog signal input to MFAI terminal AI2.	100.0% (-999.9 - +999.9%)

When 10 V (or 20 mA) is input, this parameter sets the reference quantity for the function set for terminal AI2 as a percentage.

Use this parameter and *H3-12 [AI2 Gain Setting]* to adjust the characteristics of the analog input signal to terminal AI2.

■ H3-12 AI2 Bias Setting

No. (Hex.)	Name	Description	Default (Range)
H3-12 (041A) RUN	AI2 Bias Setting	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the bias of the analog signal input to MFAI terminal AI2.	0.0% (-999.9 - +999.9%)

When 0 V (4 mA or 0 mA) is input, this parameter sets the bias for the function set for terminal AI2 as a percentage.

Use this parameter and *H3-11 [AI2 Gain Setting]* to adjust the characteristics of the analog input signal to terminal AI2.

■ H3-13 An.In FilterTime Constant

No. (Hex.)	Name	Description	Default (Range)
H3-13 (041B)	An.In FilterTime Constant	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the time constant to apply a primary delay filter to the MFAI terminal.	0.03 s (0.00 - 2.00 s)

Apply the primary delay filter to the analog input to enable an analog input signal without the use of high-frequency noise components. An analog input filter prevents irregular drive control. Drive operation becomes more stable as the programmed time becomes longer, but it also becomes less responsive to quickly changing analog signals.

■ H3-14 An.In Term.Enable Sel

No. (Hex.)	Name	Description	Default (Range)
H3-14 (041C)	An.In Term.Enable Sel	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the enabled terminal or terminals when *H1-xx: MFDI Function Select = 12 [AI Input Sel]* is ON.	7 (1 - 7)

Input signals do not have an effect on terminals not set as targets.

1 : AI1 only

2 : AI2 only

3 : AI1 and AI2

4 : AI3 only

5 : AI1 and AI3

6 : AI2 and AI3

7 : AI1, AI2, and AI3

Note:
- The ON/OFF operation of terminal DIx set in *AI Input Sel [H1-xx = 12]* has an effect on only the analog input terminal selected with *H3-14*.
- When *H1-xx ≠ 12*, the functions set to terminals AI1 to AI3 are always enabled.

■ H3-16 AI1 Offset

No. (Hex.)	Name	Description	Default (Range)
H3-16 (02F0)	AI1 Offset	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the offset level for analog signals input to terminal AI1. Usually it is not necessary to change this setting.	0 (-500 - +500)

Adds the offset value for the analog input value. For voltage input, this parameter will set the offset when a signal of 0 V is input. For current input, this parameter will set the offset when a signal of *4 mA [H3-01= 2]* or *0 mA [H3-01 = 3]* is input.

■ H3-17 AI2 Offset

No. (Hex.)	Name	Description	Default (Range)
H3-17 (02F1)	AI2 Offset	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the offset level for analog signals input to terminal AI2. Usually it is not necessary to change this setting.	0 (-500 - +500)

Adds the offset value for the analog input value. For voltage input, this parameter will set the offset when a signal of 0 V is input. For current input, this parameter will set the offset when a signal of *4 mA [H3-09 = 2]* or *0 mA [H3-09 = 3]* is input.

■ H3-18 AI3 Offset

No. (Hex.)	Name	Description	Default (Range)
H3-18 (02F2)	AI3 Offset	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the offset level for analog signals input to terminal AI3. Usually it is not necessary to change this setting.	0 (-500 - +500)

Adds the offset value for the analog input value. For voltage input, this parameter will set the offset when a signal of 0 V is input. For current input, this parameter will set the offset when a signal of *4 mA [H3-05 = 2]* or *0 mA [H3-05 = 3]* is input.

■ H3-40 15C1h Input Function

No. (Hex.)	Name	Description	Default (Range)
H3-40 (0B5C)	15C1h Input Function	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Modbus AI1 function.	0 (0, 3, 6 - 2F)

You can use the MFAI function from Modbus communications. Use this parameter to set the function. Sets the input for the function in Modbus register 15C1. Refer to H3-xx “MFAI Setting Values” for the setting values.

■ H3-41 15C2h Input Function

No. (Hex.)	Name	Description	Default (Range)
H3-41 (0B5F)	15C2h Input Function	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Modbus AI2 function.	0 (0, 3, 6 - 2F)

Refer to H3-xx “MFAI Setting Values” for the setting values.

■ H3-42 15C3h Input Function

No. (Hex.)	Name	Description	Default (Range)
H3-42 (0B62)	15C3h Input Function	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Modbus AI3 function.	0 (0, 3, 6 - 2F)

Refer to H3-xx “MFAI Setting Values” for the setting values.

■ H3-43 Mbus In FilterTime Const

No. (Hex.)	Name	Description	Default (Range)
H3-43 (117F)	Mbus In FilterTime Const	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the time constant to apply a primary delay filter to the Modbus analog input terminal.	0.00 s (0.00 - 2.00 s)

◆ Multi-Function Analog Input Setting Values

This section gives information about the functions set with *H3-02, H3-06, and H3-10*.

■ 0: Through Mode

Setting	Function	Description
0	Through Mode	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Value for terminals that are not being used or terminals being used in through mode.

When you set a terminal that is not in use to 0, you can use the signal input to the terminal as PLC analog signal input through Modbus communications or the communication option. This input signal does not have an effect on drive operation. This functions the same as setting 100 (Through Mode).

■ 1: AuxFreqRef1

Setting	Function	Description
1	AuxFreqRef1	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets Reference 2 through multi-step speed reference to enable the command reference (Auxiliary Frequency Reference 1) from the analog input terminal set here. This value is a percentage where *E1-04 [Max Output Frequency]* setting is a setting value of 100%.

■ 2: AuxFreqRef2

Setting	Function	Description
2	AuxFreqRef2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets Reference 3 through multi-step speed reference to enable the command reference (Auxiliary Frequency Reference 2) from the analog input terminal set here. This value is a percentage where *E1-04 [Max Output Frequency]* setting is a setting value of 100%.

■ 3: FrqBIAS Frq

Setting	Function	Description
3	FrqBIAS Frq	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Enters the bias value added to the frequency reference if *E1-04 [Max Output Frequency]* is 100%.

The drive adds the input value from the MFAI terminal set with this function to the frequency reference as the bias value. If you select *d1-xx* as the frequency reference, it will disable this function.

■ 4: Freq Ref/BIAS

Setting	Function	Description
4	Freq Ref/BIAS	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The input value from the MFAI terminal set with this function becomes the master frequency reference.

- You can copy the configuration to more than one of the analog input terminals AI1 through AI3. When you set more than one analog input terminal with the master frequency reference, the sum value becomes the frequency bias.
- If you use this function to set the analog input value as the master frequency reference, set *b1-01 = 1 [Freq. Ref. Sel. 1 = Analog Input]*. This setting value is the default value for terminals AI1 and AI2.
- The frequency reference is the sum of the input values for terminals AI1 and AI2 when they are used at the same time. For example, when a 20% bias is input to terminal AI2 while a frequency reference of 50% is input from terminal AI1, the calculated frequency reference will be 70% of the maximum output frequency.

■ 5: Freq Gain

Setting	Function	Description
5	Freq Gain	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV The drive multiplies the analog frequency reference with the input value from the MFAI set with this function.

Example:

- A 50% frequency gain is input to terminal AI2
- A frequency reference of 80% is input from terminal AI1
- The frequency gain is set to terminal 2

The calculated frequency reference is 40% of the maximum output frequency.

■ 6: OutVolt Bias

Setting	Function	Description
6	OutVolt Bias	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Set this parameter to input a bias signal and amplify the output voltage.

The gain (%) for the MFAI terminals AI1, AI2, and AI3 is 100% of the voltage class standard, which 400 V for 400 V class drives. The bias (%) for MFAI terminals AI1, AI2, and AI3 is 100% of the voltage configured for *E1-05 [Max Output Voltage]*.

Note:

The gain for each terminal AI1, AI2, and AI3 is configured independently with *H3-03 [AI1 Gain Setting], H3-11 [AI2 Gain Setting], and H3-07 [AI3 Gain Setting]*. The bias for each terminal AI1, AI2, and AI3 is configured independently with *H3-04 [AI1 Bias Setting], H3-12 [AI2 Bias Setting], and H3-08 [AI3 Bias Setting]*.

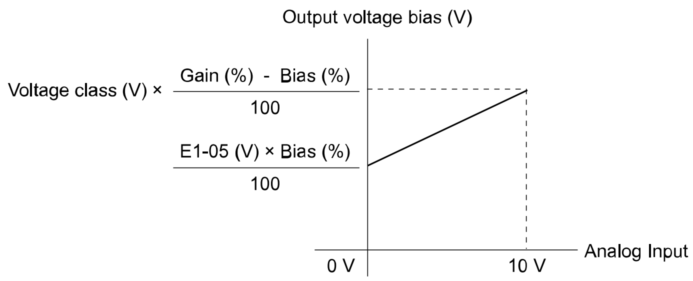


Figure 12.101 Output Voltage Bias through Analog Input

■ 7: TorqCompensation

Setting	Function	Description
7	TorqCompensation	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Enters the torque compensation value if the motor rated torque is 100%.

■ 8: TorqRef/Lim

Setting	Function	Description
8	TorqRef/Lim	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Enters the torque reference if the motor rated torque is 100%. This setting is the torque limit for speed control.

Note:

When you use *L7-01 to L7-04* and analog inputs to set torque limits for the same quadrant, it will enable the lower torque limit.

■ 9: FW Trq Lim

Setting	Function	Description
9	FW Trq Lim	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Enters the forward torque limit if the motor rated torque is 100%.

WARNING! *Sudden Movement Hazard. Set correct torque limits for applications, for example elevator applications. If you set torque limits incorrectly, motor torque that is not sufficient can cause damage to equipment and cause serious injury or death.*

Torque Limit Configuration Method

Use one of these methods to set torque limits:

- Use *L7-01 to L7-04 [FW Torque Limit to RV Reg. TrqLimit]* to set each of the 4 torque limit quadrants.
- Use MFAIs to set each of the 4 torque limit quadrants. Set *H3-02, H3-06, or H3-10 [MFAI Function Select]* to *9, B, or C [FW Trq Lim, Rev Trq Lim, RegenTrqLim]*.
- Use MFAIs to set all 4 torque limit quadrants at one time. Set *H3-02, H3-06, or H3-10 to D [GenerTrqLim]*.

Figure 12.102 shows the configuration method for each quadrant.

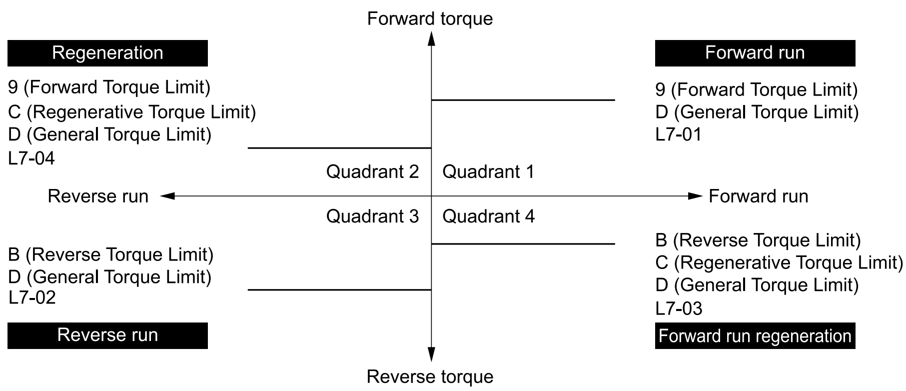


Figure 12.102 Torque Limits and Analog Input Settings Parameters

Note:

- When you use *L7-01 to L7-04* and analog inputs to set torque limits for the same quadrant, it will enable the lower torque limit. In this example of parameter settings, the torque limit for quadrant 1 is 130% and the torque limit for quadrants 2, 3, and 4 is 150%: Settings: *L7-01 = 130%*; *L7-02 to L7-04 = 200%*; and MFAI torque limit = 150%
- The output current of the drive limits the maximum output torque. The torque limit is 150% of the rated output current for HD and to 120% of the rated output current for ND. The actual output torque cannot be more than the limit of the drive rated output current, although the torque limit is high.

If you use drives in applications where the vertical axis can fall, make sure that you know these items:

- Correctly configure drives and motors.
- Correctly set parameters.
- You can change parameter values after you do Auto-Tuning.
- Use a system that will not let the vertical axis fall if the drive fails.

Figure 12.103 shows the relation between torque limits from parameters and torque limits from analog input.

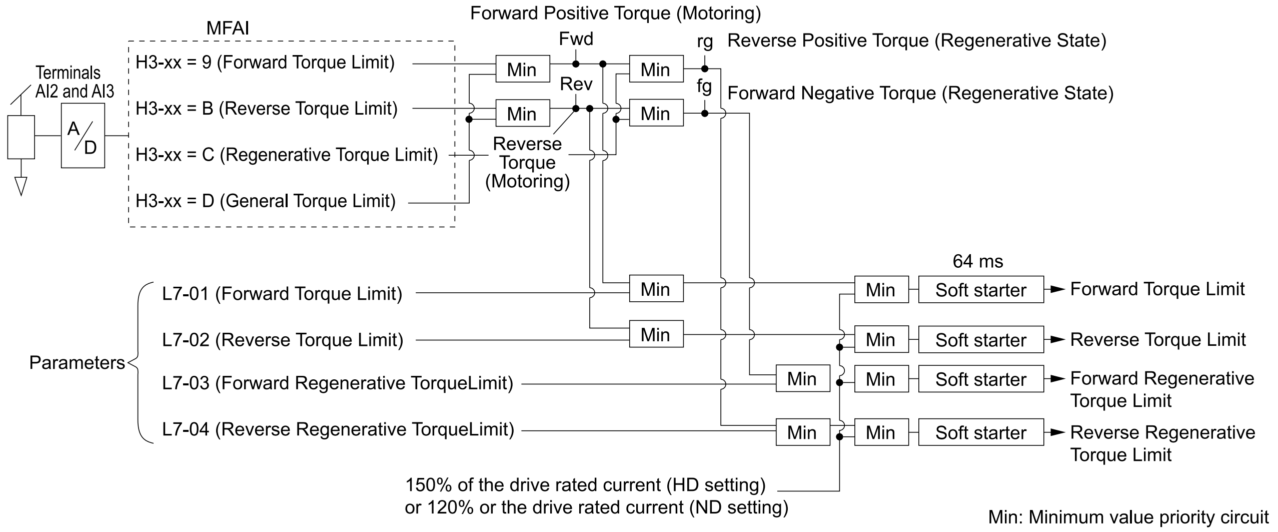


Figure 12.103 Torque Limits from Parameters and Analog Inputs

■ B: Rev Trq Lim

Setting	Function	Description
B	Rev Trq Lim	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Enters the load torque limit if the motor rated torque is 100%.

Note:

When you use *L7-01 to L7-04* and analog inputs to set torque limits for the same quadrant, it will enable the lower torque limit.

■ C: RegenTrqLim

Setting	Function	Description
C	RegenTrqLim	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Enters the regenerative torque limit if the motor rated torque is 100%.

Note:

When you use *L7-01 to L7-04* and analog inputs to set torque limits for the same quadrant, it will enable the lower torque limit.

■ D: GenerTrqLim

Setting	Function	Description
D	GenerTrqLim	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Enters the torque limit that is the same for all quadrants for forward, reverse, and regenerative operation if the motor rated torque is 100%.

■ E: OvUntrq Level

Setting	Function	Description
E	OvUntrq Level	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Enters a signal to adjust the overtorque/undertorque detection level.

When *A1-02 = 0, 1, 5 [Control Method = V/f Control, PG V/f Control, PM OLVector]*, the drive rated current is 100%. When *A1-02 = 2, 3, 4, 6, 7, 8 [OLVector, CLVector, Adv OLVector, PM AOLVector, PM CLVector, EZ Vector]*, the motor rated current is 100%.

Note:

Use this function with *L6-01 [Trq Det1 Select]*. This parameter functions as an alternative to *L6-02 [Trq Det1 Level]*.

■ F: PID Fbk

Setting	Function	Description
F	PID Fbk	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Enters the PID feedback value.

Sets the current PID feedback value when the 10 V (or 20 mA) analog signal is input as 100%.

When you use this function, set *b5-01 = 1 to 8 [PID Enable = Enabled]*.

■ 10: PID SetPoint

Setting	Function	Description
10	PID SetPoint	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Enters the PID setpoint.

Sets the current PID setpoint value when the 10 V (or 20 mA) analog signal is input as 100%.

Set *b5-01 = 1 [PID Enable = Enabled]* when using this function.

Note:

Configuring this function disables the frequency reference set with *b1-01 [Freq. Ref. Sel. 1]*.

■ 11: Diff PIDFbk

Setting	Function	Description
11	Diff PIDFbk	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Enters the PID differential feedback value if the full scale analog signal (10 V or 20 mA) is 100%.

The drive uses the deviation between the PID feedback and the differential feedback value signals to calculate the PID input.

■ 12: AcDcTimeGain

Setting	Function	Description
12	AcDcTimeGain	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Enters a signal to adjust the gain used for *C1-01 to C1-08 [Accel Time 1 to Decel Time 4]* if the full scale analog signal (10 V or 20 mA) is 100%.

When you enable *C1-01 [Accel Time 1]*, the acceleration time is:

Acceleration Time 1 = *C1-01* setting × acceleration and deceleration time gain / 100

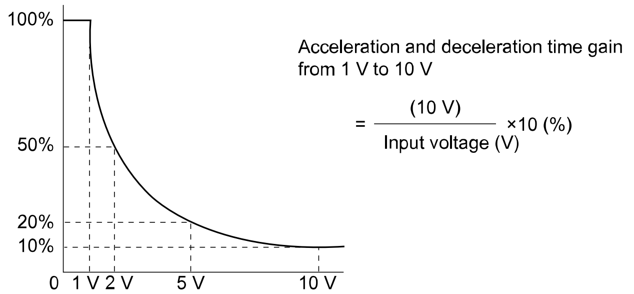


Figure 12.104 Acceleration/Deceleration Time Gain through Analog Input

■ 13: DCInjBrakCurr

Setting	Function	Description
13	DCInjBrakCurr	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Enters a signal to adjust the current level used for DC Injection Braking if the drive rated output current is 100%.

Note:

When you set this function, it will disable the setting value of *b2-02 [DCI Braking Current]*.

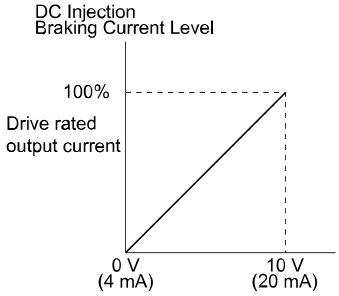


Figure 12.105 DC Injection Braking Current through Analog Input

■ 14: StallPLev@Rn

Setting Value	Function	Description
14	StallPLev@Rn	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Enters a signal to adjust the stall prevention level during run if the drive rated current is 100%.

Note:

The correct stall prevention level during run is the lower value between:

- The analog input value for the MFAI terminal, or
- The value of *L3-06 [StallP Level@Run]*.

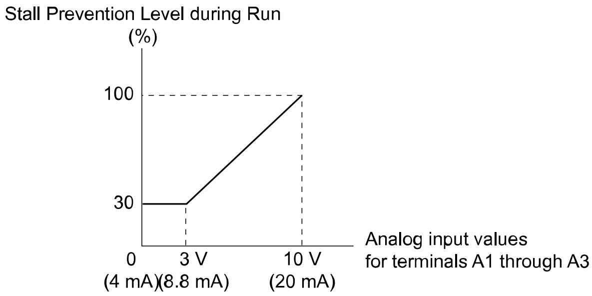


Figure 12.106 Stall Prevention Level during Run through Analog Input

■ 15: OutFLowLimSel

Setting	Function	Description
15	OutFLowLimSel	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Enters a signal to adjust the output frequency lower limit level if *E1-04 [Max Output Frequency]* = 100%.

■ 16: Mot PTC Input

Setting	Function	Description
16	Mot PTC Input	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Uses the motor Positive Temperature Coefficient (PTC) thermistor to prevent heat damage to the motor if the current value when the 10 V (or 20 mA) analog signal is input is 100%.

- You can use the Positive Temperature Coefficient (PLC) thermistor as an auxiliary or alternative detection function for *oL1 [Motor Overload]* problems to help prevent heat damage to motors. If the PTC input signal is more than the overload alarm level, *oH3 [Motor Overheating Alarm]* will flash on the keypad.
- When the drive detects *oH3*, the motor stops with the setting in *L1-03*. When the drive detects *oH4*, the motor stops with the setting in *L1-04*. When the drive incorrectly detects motor overheating problems, set *L1-05*.

■ 30: Q2pack AI1

Setting	Function	Description
30	Q2pack AI1	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Use with Q2pack. Refer to the Q2pack online manual for more information.

■ 31: Q2pack AI2

Setting	Function	Description
31	Q2pack AI1	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Use with Q2pack. Refer to the Q2pack online manual for more information.

■ 32: Q2pack AI3

Setting	Function	Description
32	Q2pack AI3	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Use with Q2pack. Refer to the Q2pack online manual for more information.

◆ H4: ANALOG OUTPUTS

H4 parameters set the drive analog monitors. These parameters select monitor parameters, adjust gain and bias, and select output signal levels.

■ Calibrate Meters Connected to MFAO Terminals AO1 and AO2

You can use *H4-02, H4-03, H4-05, and H4-06 [AO1 An.Out Gain, AO1 An.Out Bias, AO2 An.Out Gain, and AO2 An.Out Bias]* to calibrate meters connected to terminals AO1 and AO2.

No.	Name	Setting Range	Default Setting
H4-02	AO1 An.Out Gain	-999.9 - 999.9%	100.0%
H4-03	AO1 An.Out Bias	-999.9 - 999.9%	0.0%
H4-05	AO2 An.Out Gain	-999.9 - 999.9%	50.0%
H4-06	AO2 An.Out Bias	-999.9 - 999.9%	0.0%
H4-07	AO1 Signal Level Select	0: 0-10 VDC 1: -10 +10 VDC 2: 4-20 mA	0
H4-08	AO2 Signal Level Select	0: 0-10 VDC 1: -10 +10 VDC 2: 4-20 mA	0

Figure 12.107 shows the gain and bias.

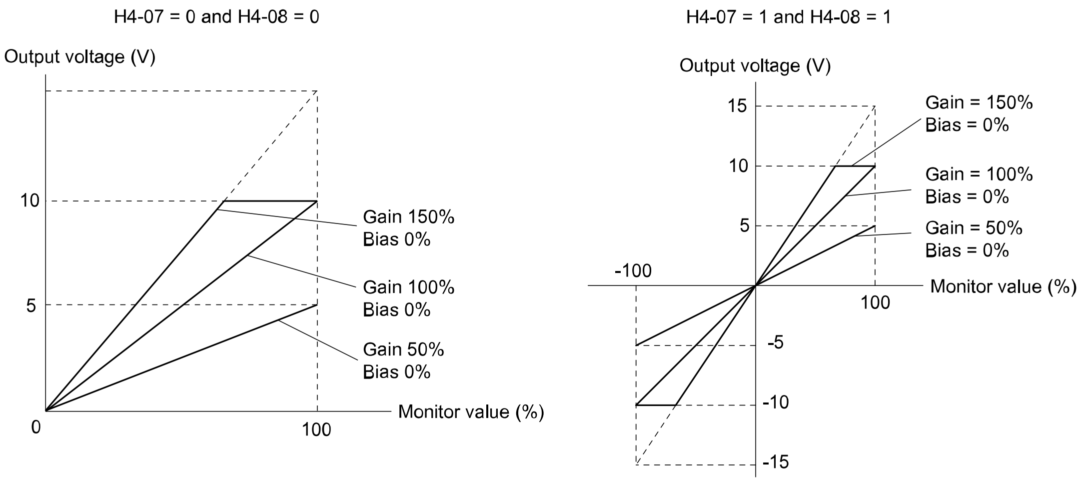


Figure 12.107 Analog Output Gain/Bias Configuration Example 1

For example, when the parameter value set to analog output is 0, and a 3 V signal is output to terminal AO1, *H4-03 [AO1 An.Out Bias]* is set to 30%.

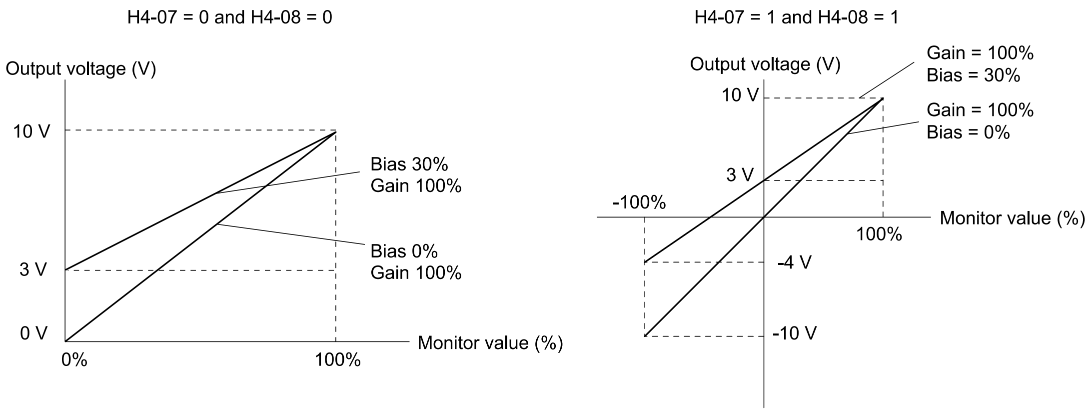


Figure 12.108 Analog Output Gain/Bias Configuration Example 2

Calibrate Terminal AO1

Stop the drive to calibrate meters. Use this procedure to calibrate:

1. Show *H4-02 [AO1 An.Out Gain]* on the keypad.
   Terminal AO1 outputs the analog signal when the monitor item that you set in *H4-01 [AO1 An.Out Select]* is 100%.
2. Adjust *H4-02* and monitor the meter scale connected to terminal AO1.
3. Show H4-03 [AO1 An.Out Bias] on the keypad.
   The analog signal at the time when the monitor item selected with *H4-01* is 0% is output from terminal AO1.
4. Adjust *H4-03* while referencing the meter scale connected to terminal AO1.

Calibrate Terminal AO2

Stop the drive to calibrate meters. Use this procedure to calibrate:

1. Show *H4-05 [AO2 An.Out Gain]* on the keypad.
   Terminal AO2 outputs the analog signal when the monitor item that you set in *H4-04 [AO2 An.Out Select]* is 100%.
2. Adjust *H4-05* and monitor the meter scale connected to terminal AO2.
3. Show *H4-06 [AO2 An.Out Bias]* on the keypad.
   Terminal AO2 outputs the analog signal when the monitor item that you set in *H4-04 [AO2 An.Out Select]* is 0%.
4. Adjust *H4-03* and monitor the meter scale connected to terminal AO1.

■ H4-01 AO1 An.Out Select

No. (Hex.)	Name	Description	Default (Range)
H4-01 (041D)	AO1 An.Out Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the monitor number to send from MFAO terminal AO1.	102 (000 - 999)

Set the *x-xx* part of the *U: MONITORS*. For example, set *H4-01* to *102* to monitor *U1-02 [Output Frequency]*.

Note:
- The configurable monitor changes when the control method changes.
- To use in through mode, set this parameter to *000* or *031*. You can set the terminal AO1 output level from the PLC through Modbus communications or the communication option.

■ H4-02 AO1 An.Out Gain

No. (Hex.)	Name	Description	Default (Range)
H4-02 (041E) RUN	AO1 An.Out Gain	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the gain of the monitor signal that is sent from MFAO terminal AO1.	100.0% (-999.9 - +999.9%)

The analog signal output from the AO1 terminal is a maximum of ±10 V (or 20 mA). Select the signal level with *H4-07 [AO1 Signal Level Select]*.

H4-03 AO1 An.Out Bias

No. (Hex.)	Name	Description	Default (Range)
H4-03 (041F) RUN	AO1 An.Out Bias	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the bias of the monitor signal that is sent from MFAO terminal AO1.	0.0% (-999.9 - +999.9%)

The analog signal output from the AO1 terminal is a maximum of ±10 V (or 20 mA). Select the signal level with *H4-07 [AO1 Signal Level Select]*.

H4-04 AO2 An.Out Select

No. (Hex.)	Name	Description	Default (Range)
H4-04 (0420)	AO2 An.Out Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the monitoring number to be output from the MFAO terminal AO2.	103 (000 - 999)

Set the *x-xx* part of the *U: MONITORS*. For example, set *H4-04* to *102* to monitor *U1-02 [Output Frequency]*.

Note:
- The configurable monitor changes when the control method changes.
- To use in through mode, set this parameter to *000* or *031*. You can set the terminal AO2 output level from the PLC through Modbus communications or the communication option.

H4-05 AO2 An.Out Gain

No. (Hex.)	Name	Description	Default (Range)
H4-05 (0421) RUN	AO2 An.Out Gain	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the gain of the monitor signal that is sent from MFAO terminal AO2.	50.0% (-999.9 - +999.9%)

The analog signal output from the AO2 terminal is a maximum of ±10 V (or 20 mA). Select the signal level with *H4-08 [AO2 Signal Level Select]*.
Examples of possible settings:

When the output current of a monitoring item is 100% (drive rated current) in these examples, the voltage of AO2 terminal outputs at 5 V (50% of 10 V). Subsequently, the output current at the time the AO2 terminal outputs a maximum voltage of 10 V will be 200% of the drive rated current.

- *H4-04 = 103 [AO2 An.Out Select = Output Current]*
- *H4-05 = 50.0%*
- *H4-06 = 0.0% [AO2 An.Out Bias = 0.0%]*
- *H4-08 = 0 [0 to 10 V]*

H4-06 AO2 An.Out Bias

No. (Hex.)	Name	Description	Default (Range)
H4-06 (0422) RUN	AO2 An.Out Bias	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the bias of the monitor signal that is sent from MFAO terminal AO2.	0.0% (-999.9 - +999.9%)

The analog signal output from the AO2 terminal is a maximum of ±10 V (or 20 mA). Select the signal level with *H4-08 [AO2 Signal Level Select]*.

H4-07 AO1 Signal Level Select

No. (Hex.)	Name	Description	Default (Range)
H4-07 (0423)	AO1 Signal Level Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the MFAO terminal AO1 output signal level.	1 (1 - 3)

Note:
Set jumper S5 on the control circuit terminal block accordingly when changing these parameters.

1 : 0 to 10 Vdc

2 : -10 to +10 Vdc

3 : 4 to 20 mA

■ H4-08 AO2 Signal Level Select

No. (Hex.)	Name	Description	Default (Range)
H4-08 (0424)	AO2 Signal Level Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the MFAO terminal AO2 output signal level.	1 (1 - 3)

Note:

Set jumper S5 on the terminal board to the correct position after changing this parameter.

1 : 0 to 10 Vdc

2 : -10 to +10 Vdc

3 : 4 to 20 mA

■ H4-20 An.Pwr Mon 100% Level

No. (Hex.)	Name	Description	Default (Range)
H4-20 (0B53)	An.Pwr Mon 100% Level	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the level at 10 V when *U1-08 [Output Power]* is set for analog output.	0.00 kW (0.00 - 650.00 kW)

Note:

- When *H4-20 = 0.00 kW*, the output power monitor 10 V level = motor rated power (kW). The *A1-02 [Control Method]* setting sets the motor rated power:
  - –*A1-02 = 0, 1 [V/f Control, PG V/f Control]*: *E2-11 [Motor Rated Power (kW)]*
  - –*A1-02 = 2, 3, 4 [OLVector, CLVector, Adv OLVector]*: *E2-11 [Motor Rated Power (kW)]*
  - –*A1-02 = 5, 6, 7 [PM OLVector, PM AOLVector, PM CLVector]*: *E5-02 [PM Mot Rated Power (kW)]*
  - –*A1-02 = 8 [EZ Vector]*: *E9-07 [Motor Rated Power (kW)]*

◆ H5: MODBUS PORTS

H5 parameters configure the drive to use Modbus communications.

You can use the Modbus protocol over the RS-485 port (terminals RS485+ and RS485-) in the drive to use serial communication with programmable controllers (PLC).

■ H5-01 Mbus Address

No. (Hex.)	Name	Description	Default (Range)
H5-01 (0425)	Mbus Address	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the communication slave address for drives.	1FH (0 - FFH)

Note:

- Restart the drive after changing the parameter setting.
- Setting 0 will not let the drive respond to Modbus communications.

To enable the drive to communicate with the controller (master) over Modbus communications, you must set the drive with a slave address. Set *H5-01 ≠ 0*.

Set a slave address that is different from other slave devices.

■ H5-02 Mbus BaudRate

No. (Hex.)	Name	Description	Default (Range)
H5-02 (0426)	Mbus BaudRate	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the communications speed for Modbus communications.	4 (1 - 9)

Note:

Restart the drive after you change the parameter setting.

1 : 1200 bps

2 : 2400 bps

3 : 4800 bps

4 : 9600 bps

5 : 19.2 kbps

6 : 38.4 kbps

7 : 57.6 kbps

8 : 76.8 kbps

9 : 115.2 kbps

■ H5-03 Mbus Parity

No. (Hex.)	Name	Description	Default (Range)
H5-03 (0427)	Mbus Parity	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the communications parity used for Modbus communications.	3 (1 - 3)

Note:

Restart the drive after you change the parameter setting.

1 : Even parity

2 : Odd parity

3 : No parity

■ H5-04 Mbus Error Stop

No. (Hex.)	Name	Description	Default (Range)
H5-04 (0428)	Mbus Error Stop	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the motor Stopping Method when the drive detects *CE [Modbus Communication Error]* issues.	3 (0 - 3)

0 : Ramp->Stop

The drive ramps to stop in the selected deceleration time. Fault relay output terminal 1NO-1CM will activate, and 1NC-1CM will deactivate.

1 : Coast->Stop

The drive output shuts off and the motor coasts to stop. Fault relay output terminal 1NO-1CM will activate, and 1NC-1CM will deactivate.

2 : Fast Stop (C1-09)

The drive uses the deceleration time set in *C1-09 [Fast Stop Time]* to stop the motor. Fault relay output terminal 1NO-1CM will activate, and 1NC-1CM will deactivate.

3 : Alarm Only

CE is shown on the keypad and operation continues. The output terminal set for *Alarm [H2-01 to H2-03 = 4]* activates.

■ H5-05 Mbus Fault Detection Selection

No. (Hex.)	Name	Description	Default (Range)
H5-05 (0429)	Mbus Fault Detection Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function that detects *CE [Modbus Communication Error]* issues during Modbus communications.	1 (0, 1)

If the drive does not receive data from the master during the time set in *H5-09 [Mbus CE Detect Time]*, it will detect a *CE* error.

0 : Disabled

Does not detect *CE*. The drive continues operation.

1 : Enabled

Detects *CE*. If the drive detects *CE*, it will operate as specified by the setting of *H5-04 [Mbus Error Stop]*.

■ H5-06 Mbus Tx Wait Time

No. (Hex.)	Name	Description	Default (Range)
H5-06 (042A)	Mbus Tx Wait Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the time to wait to send a response message after the drive receives a command message from the master.	5 ms (0 - 65 ms)

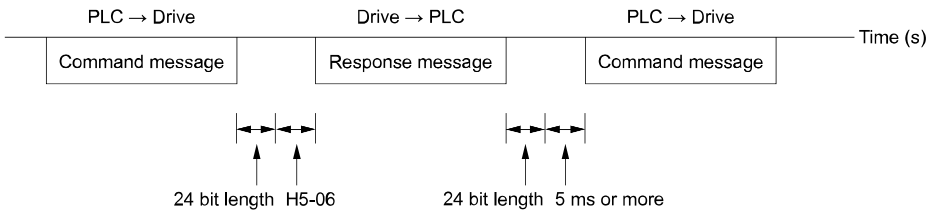


Figure 12.109 Drive Transmit Wait Time

■ H5-09 Mbus CE Detect Time

No. (Hex.)	Name	Description	Default (Range)
H5-09 (0435)	Mbus CE Detect Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the detection time for *CE [Modbus Communication Error]* issues when communication stops.	2.0 s (0.0 - 10.0 s)

■ H5-10 Mbus 0025H Unit Sel

No. (Hex.)	Name	Description	Default (Range)
H5-10 (0436)	Mbus 0025H Unit Sel	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the unit of measure used for the Modbus communications monitor register 0025H (output voltage reference monitor).	0 (0, 1)

0 : 0.1 V units

1 : 1 V units

■ H5-11 Mbus ENTER Command Mode

No. (Hex.)	Name	Description	Default (Range)
H5-11 (043C)	Mbus ENTER Command Mode	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function to make the Enter command necessary to change parameters through Modbus communications.	0 (0, 1)

0 : Enter Required

You must use the Enter command to enable changes to parameters. Make all parameter changes then input the Enter command.

1 : No Enter Required

It is not necessary to input the Enter command to change parameters.

■ H5-12 Mbus Run Command Method Sel

No. (Hex.)	Name	Description	Default (Range)
H5-12 (043D)	Mbus Run Command Method Sel	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the input method for the Run command when *b1-02 = 2 [Run Comm. Sel 1 = Modbus]* or *b1-16 = 2 [Run Comm. Sel 2 = Modbus]*.	0 (0, 1)

0 : F/ST R/ST

The drive uses bit 0 in command data 0001H of the Modbus register in the motor forward Run command (bit 0 = 1) and the stop command (bit 0 = 0). The drive uses bit 1 in the motor reverse Run command (bit 1 = 1) and the stop command (bit 1 = 0).

1 : RUN/ST F/R

The drive uses bit 0 in command data 0001H of the Modbus register in the motor Run command (bit 0 = 1) and the stop command (bit 0 = 0). The drive uses bit 1 in the direction of motor rotation command (Forward run (bit1 = 0) or Reverse run (bit 1 = 1)).

■ H5-17 ENTER@CPU Busy Response

No. (Hex.)	Name	Description	Default (Range)
H5-17 (11A1) Expert	ENTER@CPU Busy Response	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets operation when the EEPROM write command is sent without EEPROM write available. Usually it is not necessary to change this setting.	1 (1, 2)

1 : Ignore (No Write)

2 : Write RAM Only

■ H5-18 Mbus Speed Filter over Comms

No. (Hex.)	Name	Description	Default (Range)
H5-18 (11A2)	Mbus Speed Filter over Comms	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the filter time constant used when monitoring motor speed during Modbus communications or with a communication option.	0 ms (0 - 100 ms)

Sets the filter time constant when you monitor the output frequency or motor speed during Modbus communications or use of the communication option.

These are the Modbus registers:

- 003EH (Output Frequency)
- 003FH (Output Frequency)
- 0044H (*U1-05*: Motor Speed)
- 00ACH (*U1-05*: Motor Speed)
- 00ADH (*U1-05*: Motor Speed)

■ H5-20 Mbus Par Reload Mode

No. (Hex.)	Name	Description	Default (Range)
H5-20 (0B57)	Mbus Par Reload Mode	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function to immediately enable updated Modbus communications parameters.	1 (1, 2)

1 : Reload@Power Cycle

2 : Reload Now

Note:

- The setting value automatically returns to *H5-20 = 1* after you enable Modbus communications parameter changes.
- The setting values of these parameters are enabled:
  –*H5-01 [Mbus Address]*
  –*H5-02 [Mbus BaudRate]*
  –*H5-03 [Mbus Parity]*
  –*H5-06 [Mbus Tx Wait Time]*

■ H5-25 Mbus 5A Reg1 Selection

No. (Hex.)	Name	Description	Default (Range)
H5-25 (1589) RUN	Mbus 5A Reg1 Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Returns the contents of the specified Modbus communications register when responding to the master device.	0044H (U1-05) (0000H - FFFFH)

■ H5-26 Mbus 5A Reg2 Selection

No. (Hex.)	Name	Description	Default (Range)
H5-26 (158A) RUN	Mbus 5A Reg2 Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Returns the contents of the specified Modbus communications register when responding to the master device.	0045H (U1-06) (0000H - FFFFH)

■ H5-27 Mbus 5A Reg3 Selection

No. (Hex.)	Name	Description	Default (Range)
H5-27 (158B) RUN	Mbus 5A Reg3 Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Returns the contents of the specified Modbus communications register when responding to the master device.	0042H (U1-03) (0000H - FFFFH)

■ H5-28 Mbus 5A Reg4 Selection

No. (Hex.)	Name	Description	Default (Range)
H5-28 (158C) RUN	Mbus 5A Reg4 Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Returns the contents of the specified Modbus communications register when responding to the master device.	0049H (U1-10) (0000H - FFFFH)

◆ H6: PULSE INPUT OUTPUT

H6 parameters set the drive pulse train input and pulse train monitor. These parameters select input and monitor parameters and adjust the pulse train frequency.

A pulse train signal with a maximum single pulse of 32 kHz can be input to the drive input terminal PI. You can use the pulse train signal as the frequency reference, PID feedback value, PID setpoint value, and speed feedback for V/f Control mode.

A pulse train signal with a maximum frequency of 32 kHz can be output from the drive output terminal PO as the monitor value. Sinking mode and sourcing mode are supported.

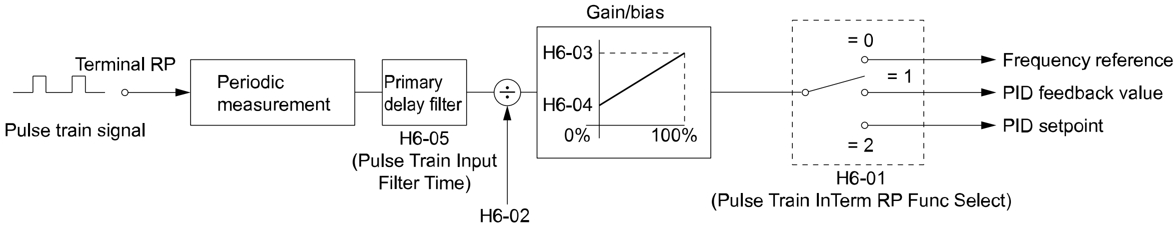


Figure 12.110 Pulse Train Input Block Diagram

■ H6-01 PI Pulse Train Function

No. (Hex.)	Name	Description	Default (Range)
H6-01 (042C)	PI Pulse Train Function	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function for pulse train input terminal RP.	0 (0 - 3)

0 : Freq Ref

When *b1-01 [Freq. Ref. Sel. 1]* or *b1-15 [Freq. Ref. Sel. 2] = 4 [Pulse Train Input]*, the drive inputs the frequency reference received from terminal RP.

1 : PIDFbk Value

The drive inputs the PID control feedback value received from terminal PI.

2 : PID SP Value

The drive inputs the PID control target value received from terminal PI.

3 : PG Feedback

Select V/f Control method to enable simple encoder feedback.

Use motor speed feedback for better speed control precision. The drive compares the frequency reference to the motor speed feedback received from the encoder, and uses the ASR function to compensates for motor slip. You cannot use input terminal RP used for the simple encoder to detect the direction of motor rotation. Use a different method to detect motor rotation.

Use these methods to detect the direction of motor rotation.

- Use DI
  Set DI *H1-xx = 15 [FWD/REV Det]*. When the configured terminal is activated, the motor operates in Reverse run. When the terminal is deactivated, the motor operates in Forward run.
  Use an encoder that outputs 2-tracks (phase A, B) to detect the direction of motor rotation.

- Use the frequency reference
  When the you do not use the DI, the Forward/Reverse run command is the same as the direction of motor rotation.

Figure 12.111 shows speed control in Simple Closed Loop V/f Mode.

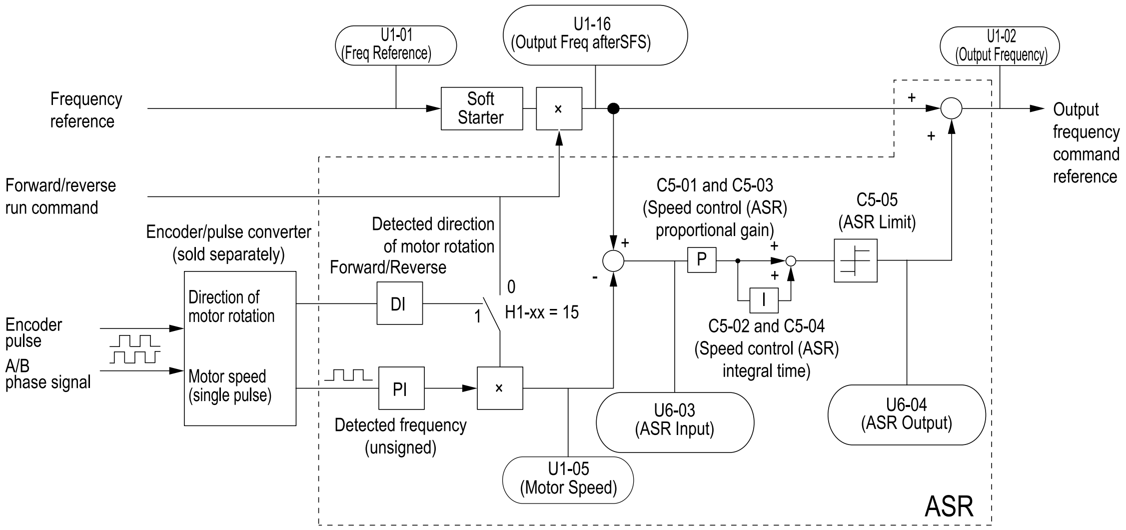


Figure 12.111 Simple Closed Loop Speed Control Block Diagram

Enable Simple Closed Loop V/f Mode

1. Connect the encoder output pulse wiring to terminal PI.
2. Set *A1-02 = 0 [Control Method = V/f Control]*.
3. Set *H6-01 = 3*.
4. Set *H6-02 [PI Frequency Scale]* to the speed feedback (pulse train input signal) frequency at the time when the frequency reference is 100%.
   Make sure that *H6-04 [PI Function Bias]* = 0% and *H6-03 [PI Function Gain]* = 100%.
5. Select the detection method for the direction of motor rotation.
   When you use an MFDI, set *H1-xx = 15*.
6. Set *C5 parameters* related to ASR gain and integral time to adjust responsiveness.

Note:
- Set *A1-02 = 0* and *H6-01 = 3* to show *C5 parameters*.
- You cannot use Closed Loop V/f Control mode with the Motor Switch function.

■ H6-02 PI Frequency Scale

No. (Hex.)	Name	Description	Default (Range)
H6-02 (042D) RUN	PI Frequency Scale	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the frequency of the pulse train input signal used when the function set with *H6-01 [PI Pulse Train Function]* is 100%.	1440 Hz (100 - 32000 Hz)

■ H6-03 PI Function Gain

No. (Hex.)	Name	Description	Default (Range)
H6-03 (042E) RUN	PI Function Gain	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the gain used when the function in *H6-01 [PI Pulse Train Function]* is input to terminal PI.	100.0% (0.0 - 1000.0%)

■ H6-04 PI Function Bias

No. (Hex.)	Name	Description	Default (Range)
H6-04 (042F) RUN	PI Function Bias	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the bias used when the function in *H6-01 [PI Pulse Train Function]* is input to terminal PI. Sets a value when the pulse train is 0 Hz.	0.0% (-100.0 - 100.0%)

H6-05 PI Filter Time

No. (Hex.)	Name	Description	Default (Range)
H6-05 (0430) RUN	PI Filter Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the time constant for the primary delay filters of the pulse train input.	0.10 s (0.00 - 2.00 s)

H6-06 PO Mon.Selection

No. (Hex.)	Name	Description	Default (Range)
H6-06 (0431) RUN	PO Mon.Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets a function for pulse train monitor output terminal PO. Sets the “x-xx” part of the *Ux-xx* monitor.	102 (000, 031, 101, 102, 105, 116, 501, 502, 801 - 809, 821 - 825, 831 - 839, 851 - 855)

Note:

To use in through mode or when terminal PO is not used, set this parameter to 000 or 031.

When you use the pulse train monitor, make sure that you connect peripheral devices as specified by these load conditions:

Incorrect connections can make the characteristics not sufficient or cause mechanical damage.

- Use the pulse train monitor as the sourcing output.

Output Voltage VRL(V)	Load Impedance (kΩ)
5 V or more	1.5 kΩ or more
8 V or more	4.0 kΩ or more
10 V or more	10 kΩ or more

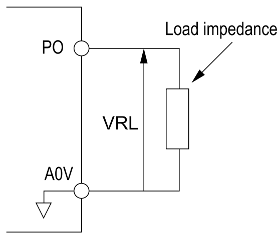


Figure 12.112 Circuit Diagram When Used as the Sourcing Output

- Use the pulse train monitor as the sinking input

External Power Supply (V)	12 VDC ± 10%, 15 VDC ± 10%
Sinking current (mA)	16 mA or less

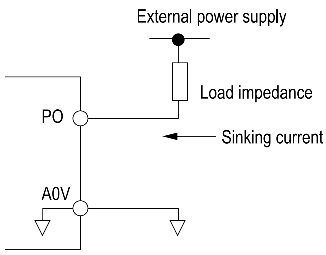


Figure 12.113 Circuit Diagram When Used as the Sinking Input

H6-07 PO Freq.Scaling

No. (Hex.)	Name	Description	Default (Range)
H6-07 (0432) RUN	PO Freq.Scaling	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the frequency of the pulse train output signal used when the monitor set with *H6-06 [PO Mon.Selection]* is 100%.	1440 Hz (0 - 32000 Hz)

When *H6-06 = 102 [PO Mon.Selection = Output Frequency]* and *H6-07 = 0*, the pulse train output terminal MP outputs the same frequency as the drive output frequency.

■ H6-08 PI Minimum Frequency

No. (Hex.)	Name	Description	Default (Range)
H6-08 (043F)	PI Minimum Frequency	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the minimum frequency of the pulse train signal that terminal PI can detect.	0.5 Hz (0.1 - 1000.0 Hz)

- When you input a pulse train frequency that is less than the value of *H6-08*, the pulse train input is 0.0 Hz.
- Set *H6-01 = 0, 1, or 2 [PI Pulse Train Function = Freq Ref, PIDFbk Value, or PID SP Value]* to enable this parameter.
- When *H6-01 = 3 [PG Feedback]*, the drive applies the setting of *F1-14 [Enc PGOpen Time for Detection]* to the minimum frequency.

■ H6-09 PO Volt.PhaseSync Selection

No. (Hex.)	Name	Description	Default (Range)
H6-09 (156E)	PO Volt.PhaseSync Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Set whether to output the pulse synchronized with drive output voltage phase from the pulse train monitor output terminal PO. This parameter is only enabled when *H6-06 = 102 [PO Mon. Selection = Output Frequency]* and *H6-07 = 0 [PO Freq.Scaling = 0 Hz]*.	0 (0, 1)

0 : Disabled

1 : Enabled

◆ H7: VIRTUAL INPUT OUTPUT

The virtual I/O function performs the following.

- Inputs the result of the output from the DO terminal to the DI terminal without external wiring.
- Inputs the result of the output from the AO terminal to the AI terminal without external wiring.

WARNING! *Sudden Movement Hazard. Make sure to confirm the setting values for virtual input and output function parameters before performing drive test runs. Virtual input and output functions may have different default settings and operation even though the input and output terminals are not wired as the drive input and output terminals are virtually wired internally. Failure to obey can cause death or serious injury.*

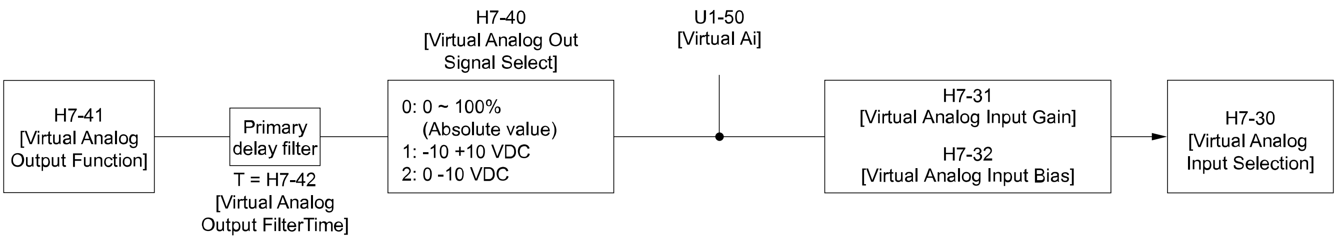


Figure 12.114 Virtual Analog I/O Functional Block Diagram

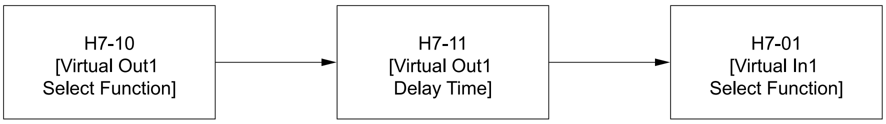


Figure 12.115 Virtual Digital I/O Functional Block Diagram

Note:

- Refer to H1-xx "DI Setting Values" for more information on the virtual digital input setting values.
- Refer to H2-xx "DO Setting Values" for more information on the virtual digital output setting values.
- Refer to H3-xx "AI Setting Values" for more information on the virtual analog input setting values.
- Refer to H4-xx "AO Setting Values" for more information on the virtual analog output setting values.
- *5 [3-Wire Seq.]* and *20 to 2F [External Fault]* cannot be selected in *H7-01 to H7-04 [Virtual In1 Select Function to Virtual In4 Select Function]*.
- If the terminal is not used, set *H7-01 to H7-04 = 0*. However, the through mode function is not supported.
- The virtual I/O function selection and the multi-function input for DI-A3 cannot be used simultaneously.

■ H7-00 Virtual MFIO Selection

No. (Hex.)	Name	Description	Default (Range)
H7-00 (116F) Expert	Virtual MFIO Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function to enable and disable the virtual I/O function. Set this parameter to 1 to operate the virtual I/O function.	0 (0, 1)

0 : Disabled

1 : Enabled

■ H7-01 Virtual In1 Select Function

No. (Hex.)	Name	Description	Default (Range)
H7-01 (1185) Expert	Virtual In1 Select Function	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function that enters the virtual input set in *H7-10 [Virtual Out1 Select Function]*.	0 (0 - 4, 6 - 19F)

■ H7-02 Virtual In2 Select Function

No. (Hex.)	Name	Description	Default (Range)
H7-02 (1186) Expert	Virtual In2 Select Function	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function that enters the virtual input set in *H7-12 [Virtual Out2 Select Function]*.	0 (0 - 4, 6 - 19F)

■ H7-03 Virtual In3 Select Function

No. (Hex.)	Name	Description	Default (Range)
H7-03 (1187) Expert	Virtual In3 Select Function	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function that enters the virtual input set in *H7-14 [Virtual Out3 Select Function]*.	0 (0 - 4, 6 - 19F)

■ H7-04 Virtual In4 Select Function

No. (Hex.)	Name	Description	Default (Range)
H7-04 (1188) Expert	Virtual In4 Select Function	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function that enters the virtual input set in *H7-16 [Virtual Out4 Select Function]*.	0 (0 - 4, 6 - 19F)

■ H7-10 Virtual Out1 Select Function

No. (Hex.)	Name	Description	Default (Range)
H7-10 (11A4) Expert	Virtual Out1 Select Function	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function for virtual digital output 1.	0 (0 - 1A7)

■ H7-11 Virtual Out1 Delay Time

No. (Hex.)	Name	Description	Default (Range)
H7-11 (11A5) Expert	Virtual Out1 Delay Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the minimum ON time for virtual digital output 1.	0.1 s (0.0 - 25.0 s)

■ H7-12 Virtual Out2 Select Function

No. (Hex.)	Name	Description	Default (Range)
H7-12 (11A6) Expert	Virtual Out2 Select Function	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function for virtual digital output 2.	0 (0 - 1A7)

H7-13 Virtual Out2 Delay Time

No. (Hex.)	Name	Description	Default (Range)
H7-13 (11A7) Expert	Virtual Out2 Delay Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the minimum ON time for virtual digital output 2.	0.1 s (0.0 - 25.0 s)

H7-14 Virtual Out3 Select Function

No. (Hex.)	Name	Description	Default (Range)
H7-14 (11A8) Expert	Virtual Out3 Select Function	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function for virtual digital output 3.	0 (0 - 1A7)

H7-15 Virtual Out3 Delay Time

No. (Hex.)	Name	Description	Default (Range)
H7-15 (11A9) Expert	Virtual Out3 Delay Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the minimum ON time for virtual digital output 3.	0.1 s (0.0 - 25.0 s)

H7-16 Virtual Out4 Select Function

No. (Hex.)	Name	Description	Default (Range)
H7-16 (11AA) Expert	Virtual Out4 Select Function	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function for virtual digital output 4.	0 (0 - 1A7)

H7-17 Virtual Out4 Delay Time

No. (Hex.)	Name	Description	Default (Range)
H7-17 (11AB) Expert	Virtual Out4 Delay Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the minimum ON time for virtual digital output 4.	0.1 s (0.0 - 25.0 s)

H7-30 Virtual AIn Select Function

No. (Hex.)	Name	Description	Default (Range)
H7-30 (1177)	Virtual AIn Select Function	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the virtual analog input function.	0 (0 - 32)

H7-31 Virtual AIn Gain

No. (Hex.)	Name	Description	Default (Range)
H7-31 (1178) RUN Expert	Virtual AIn Gain	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the virtual analog input gain.	100.0% (-999.9 - 999.9%)

H7-32 Virtual AIn Bias

No. (Hex.)	Name	Description	Default (Range)
H7-32 (1179) RUN Expert	Virtual AIn Bias	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the virtual analog input bias.	0.0% (-999.9 - 999.9%)

■ H7-40 Virtual AOut Enable

No. (Hex.)	Name	Description	Default (Range)
H7-40 (1163)	Virtual AOut Enable	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the signal level of the virtual analog output.	1 (1 - 3)

1 : 0-100 (Absolute Value)

2 : -10 +10 VDC

3 : 0-10 VDC

■ H7-41 Virtual AOut Select Function

No. (Hex.)	Name	Description	Default (Range)
H7-41 (1164)	Virtual AOut Select Function	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the monitor to be output from the virtual analog output. Set the *x-xx* part of the *Ux-xx [MONITOR]*. For example, set *x-xx* to *102* to monitor *U1-02 [Output Frequency]*.	102 (0 - 999)

■ H7-42 Virtual AOut Filter Time

No. (Hex.)	Name	Description	Default (Range)
H7-42 (1165)	Virtual AOut Filter Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the time constant for a primary filter of the virtual analog output.	0.00 s (0.00 - 2.00 s)

12.8 L: PROTECTION

L parameters set the following functions.

- Motor Overload Protection
- Operation During Momentary Power Loss
- Stall Prevention
- Speed Detection
- Auto Restart
- Detection of Overtorque/Undertorque
- Torque Limit
- Hardware Protection

◆ L1: MOTOR PROTECTION

L1 parameters set the motor overload protection function.

■ Motor Protection Using Positive Temperature Coefficient (PTC) Thermistors

The temperature resistance characteristics of three PTC thermistors in the motor stator winding protect the motor from overheat.

The PTC thermistors must have the characteristics in motor 1 phase as shown in Figure 12.116.

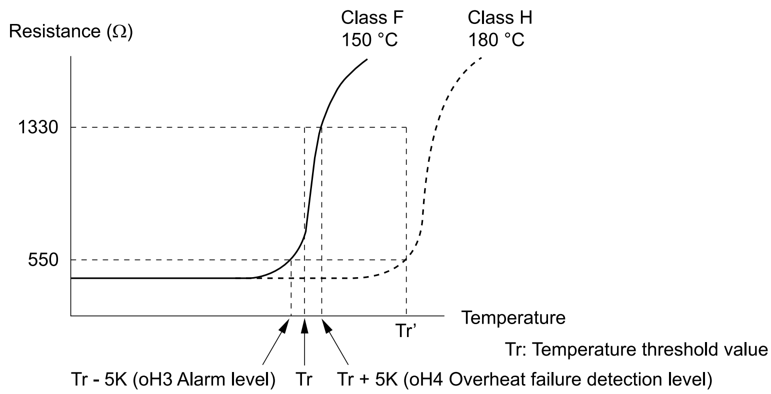


Figure 12.116 PTC Thermistor Temperature and Resistance

When the PTC input signal input to the drive is more than the overload alarm level, the drive detects *oH3 [Motor Overheat (PTC Input)]* and flashes it on the keypad. The drive continues the operation set in *L1-03 [Motor oH AL Reaction Select]*.

The overheat fault level triggers an *oH4 [Motor Overheat Fault (PTC Input)]* fault, and outputs a fault signal. The drive outputs a fault signal, and stops the motor with the stop method set in *L1-04 [Motor oH FLT Reaction Select]*.

Note:

PTC is an acronym for Positive Temperature Coefficient.

Figure 12.117 shows the configuration procedure when you use terminal A3.

1. Connect the PTC thermistor input from the motor to analog input terminal A3 on the drive.

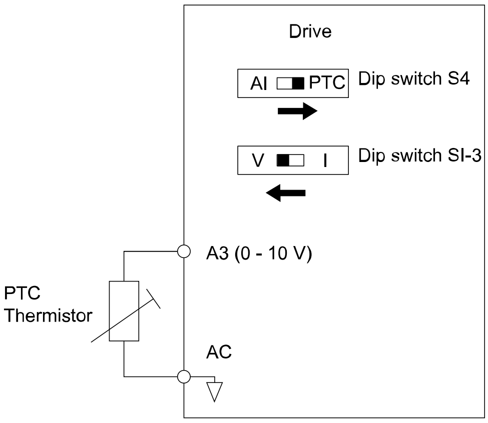


Figure 12.117 Connect Motor PTC

2. Set drive DIP switch S1-3 to V (voltage) and set DIP switch S4 to PTC.
3. Set these MFAI terminals:
   - Set *H3-05 = 0 [AI3 Signal Level Select = 0 to 10V (Lower Limit at 0)]*.
   - Set *H3-06 = 16 [AI3 Function Selection = Mot PTC Input]*.
4. Set these *L1 parameters*:
   - *L1-03 [Motor oH AL Reaction Select]*
   - *L1-04 [Motor oH FLT Reaction Select]*
   - *L1-05 [Motor Therm.Filter Time]*

■ L1-01 Motor Cool Type for OL1 Calc

No. (Hex.)	Name	Description	Default (Range)
L1-01 (0480)	Motor Cool Type for OL1 Calc	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the motor overload protection with electronic thermal protectors.	Determined by A1-02 (0 - 6)

This parameter enables and disables the motor overload protection with electronic thermal protectors.

The cooling capability of the motor changes when the speed control range of the motor changes. Use an electronic thermal protector that aligns with the permitted load characteristics of the motor to select motor protection.

The electronic thermal protector of the drive uses these items to calculate motor overload tolerance and supply overload protection for the motor:

- Output current
- Output frequency
- Motor thermal characteristics
- Time characteristics

If the drive detects motor overload, the drive will trigger an *oL1 [Motor Overload]* and stop the drive output.

Set *H2-01 = 4E [Multi-Function Digital Output 1 = Drive PreOH]* to set a motor overload alarm. If the motor overload level is more than 90% of the *oL1* detection level, the output terminal turns ON and triggers an overload alarm.

0 : Disabled

Disable motor protection when motor overload protection is not necessary or when the drive is operating more than one motor.

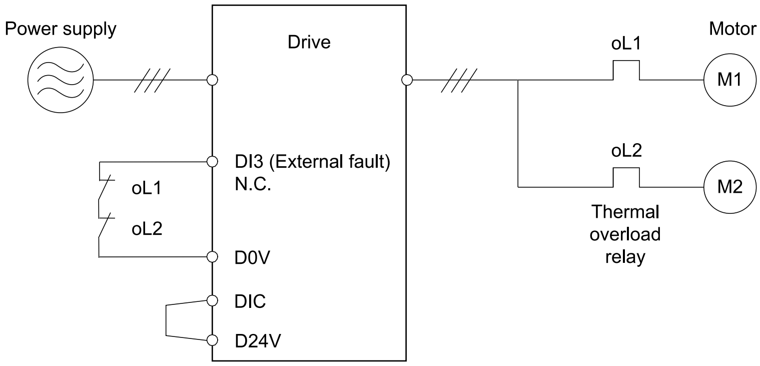


Figure 12.118 Example: Protection Circuit Configuration to Connect More than One Motor to One Drive

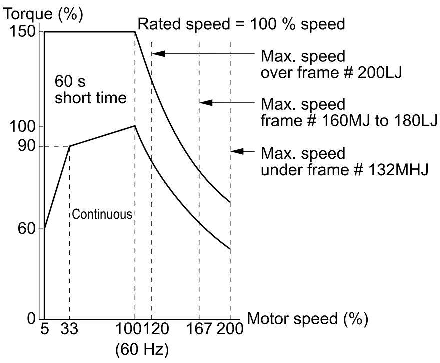
NOTICE: *When one drive is operating more than one motor at the same time or when the rated current of the motor is much larger than rated current of a standard motor, you cannot protect the motor with electronic thermal protection. To protect each motor, set L1-01 =1 [Motor Cool Type for OL1 Calc = VTorque], configure the circuits, then add thermal relays to each motor. The magnetic contactor installed for motor protection cannot be switched ON/OFF during run. Failure to obey can cause motor failure.*

1 : VTorque

Use this setting for general-purpose motors with a 60 Hz base frequency.

The overload tolerance decreases as motor speed decreases because the cooling fan speed decreases and the ability of the motor to cool decreases in the low speed range.

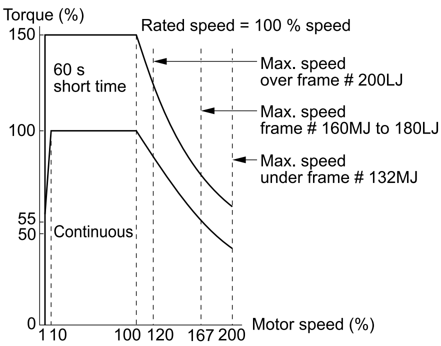
The overload tolerance characteristics of the motor change the trigger point for the electronic thermal protector. This provides motor overheat protection from low speed to high speed across the full speed range.

Load Tolerance	Cooling Capability	Overload Characteristics (at 100% motor load)
	This motor is designed to operate with commercial line power. Operate at a 60 Hz base frequency to maximize the motor cooling ability.	If the motor operates at frequencies less than 60 Hz, the drive will detect *oL1*. The drive triggers a fault relay output and the motor coasts to stop.

2 : CT 10:1 Speed Range

Use this setting for drive-dedicated motors with a speed range for constant torque of 1:10.

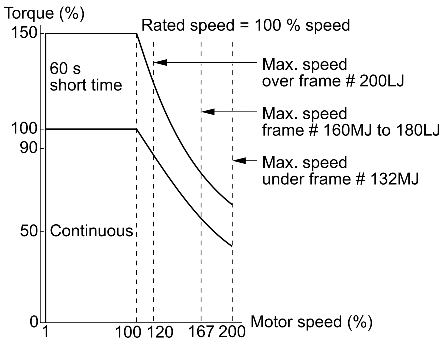
The speed control for this motor is 10% to 100% when at 100% load. Operating slower than 10% speed at 100% load will cause motor overload.

Load Tolerance	Cooling Capability	Overload Characteristics (at 100% motor load)
	This motor is designed to withstand increased temperatures during continuous operation in the low speed range (10% base frequency).	The motor operates continuously at 10% to 100% base frequency. Operating slower than 10% speed at 100% load will cause motor overload.

3 : CT 100:1 SpeedRange

Use this setting for vector motors with a speed range for constant torque of 1:100.

The speed control for this motor is 1% to 100% when at 100% load. Operating slower than 1% speed at 100% load will cause motor overload.

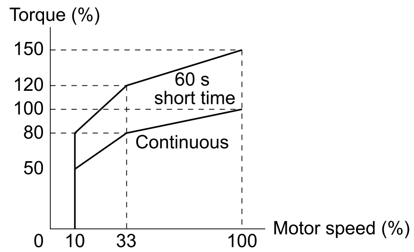
Load Tolerance	Cooling Capability	Overload Characteristics (at 100% motor load)
	This motor is designed to withstand increased temperatures during continuous operation in the low speed range (1% base frequency).	The motor operates continuously at 1% to 100% base frequency. Operating slower than 1% speed at 100% load will cause motor overload.

4 : PM VTorque

Use this setting for PM motors with derated torque characteristics.

The overload tolerance decreases as motor speed decreases because the cooling fan speed decreases and the ability of the motor to cool decreases in the low speed range.

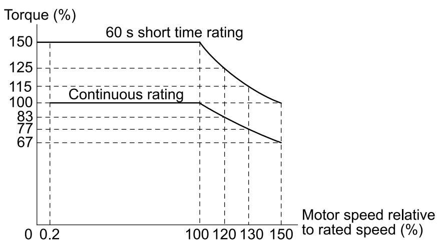
The overload tolerance characteristics of the motor change the trigger point for the electronic thermal protector. This provides motor overheat protection from low speed to high speed across the full speed range.

Load Tolerance	Cooling Capability	Overload Characteristics (at 100% motor load)
	This motor is designed to withstand increased temperatures during continuous operation at rated speed and rated torque.	If the motor operates continuously at lower speed than rated rotation speed at more than 100% torque, the drive will detect *oL1*. The drive triggers a fault relay output and the motor coasts to stop.

5 : PM CTorque

Use this setting with a PM motor for constant torque that has a speed range for constant torque of 1:500.

The speed control for this motor is 0.2% to 100% when at 100% load. Operating slower than 0.2% speed at 100% load will cause motor overload.

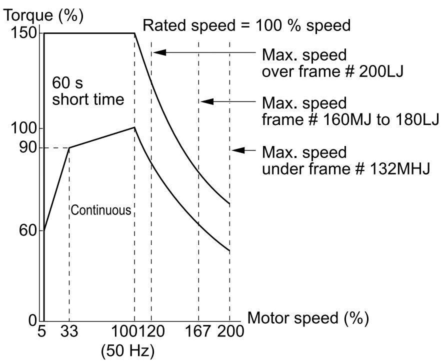
Load Tolerance	Cooling Capability	Overload Characteristics (at 100% motor load)
	This motor is designed to withstand increased temperatures during continuous operation in the low speed range (0.2% base frequency).	The motor operates continuously at 0.2% to 100% rated speed. Operating slower than 0.2% speed at 100% load will cause motor overload.

6 : VT (50Hz)

Use this setting for general-purpose motors with a 50 Hz base frequency.

The overload tolerance decreases as motor speed decreases because the cooling fan speed decreases and the ability of the motor to cool decreases in the low speed range.

The overload tolerance characteristics of the motor change the trigger point for the electronic thermal protector. This provides motor overheat protection from low speed to high speed across the full speed range.

Load Tolerance	Cooling Capability	Overload Characteristics (at 100% motor load)
	This motor is designed to operate with commercial line power. Operate at a 50 Hz base frequency to maximize the motor cooling ability.	If the motor operates at frequencies less than commercial line power, the drive will detect *oL1*. The drive triggers a fault relay output and the motor coasts to stop.

■ L1-02 OL1 Protect Time

No. (Hex.)	Name	Description	Default (Range)
L1-02 (0481)	OL1 Protect Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the operation time for the electronic thermal protector of the drive to prevent damage to the motor. Usually it is not necessary to change this setting.	1.0 min (0.1 - 5.0 min)

Set the overload tolerance time to the length of time that the motor can operate at 150% load from continuous operation at 100% load.

When the motor operates at 150% load continuously for 1 minute after continuous operation at 100% load (hot start), the default setting triggers the electronic thermal protector.

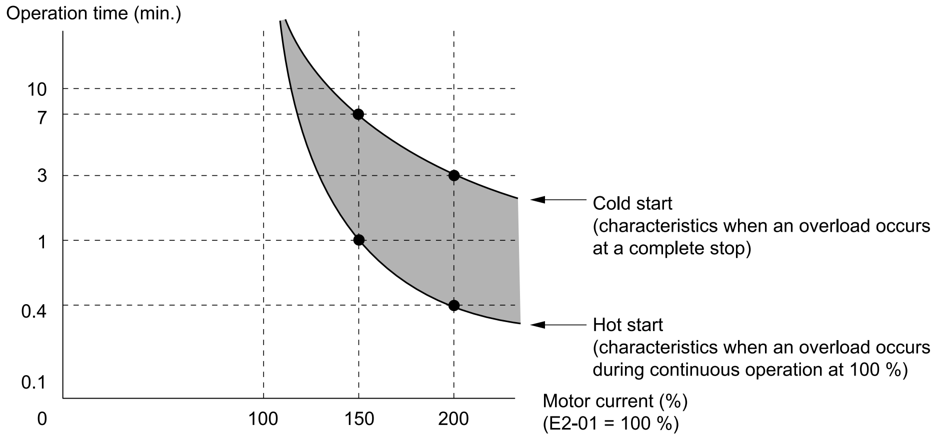


Figure 12.119 Example: Protection Operation Time for a General-purpose Motor at Rated Output Frequency

Motor overload protection operates in the range between a cold start and a hot start.

This example shows a general-purpose motor operating at the base frequency with *L1-02* set to 1.0 min.

- Cold start
  Shows the motor protection operation time characteristics when the overload occurs immediately after starting operation from a complete stop.
- Hot start
  Shows the motor protection operation time characteristics when overload occurs from continuous operation below the motor rated current.

■ L1-03 Motor oH AL Reaction Select

No. (Hex.)	Name	Description	Default (Range)
L1-03 (0482)	Motor oH AL Reaction Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets drive operation when the PTC input signal entered into the drive is at the *oH3 [Motor Overheat Alarm] detection level.*	3 (0 - 3)

0 : Ramp->Stop

The drive ramps the motor to stop in the deceleration time. Fault relay output terminal 1NO-1CM turns ON and 1NC-1CM turns OFF.

1 : Coast->Stop

The output turns OFF and the motor coasts to stop. Fault relay output terminal 1NO-1CM turns ON, and 1NC-1CM turns OFF.

2 : Fast Stop (C1-09)

The drive stops the motor in the deceleration time set in *C1-09 [Fast Stop Time]*. Fault relay output terminal 1NO-1CM turns ON, and 1NC-1CM turns OFF.

3 : Alarm Only

The keypad shows *oH3*, and operation continues. The output terminal set for *Alarm [H2-01 to H2-03 = 4]* turns ON.

■ Motor oH FLT Reaction Select

No. (Hex.)	Name	Description	Default (Range)
L1-04 (0483)	Motor oH FLT Reaction Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the drive operation when the PTC input signal to the drive is at the *oH4 [Motor Overheat Fault (PTC Input)]* detection level.	1 (0 - 2)

0 : Ramp->Stop

The drive ramps the motor to stop in the deceleration time. Fault relay output terminal 1NO-1CM turns ON and 1NC-1CM turns OFF.

1 : Coast->Stop

The output turns OFF and the motor coasts to stop. Fault relay output terminal 1NO-1CM turns ON, and 1NC-1CM turns OFF.

2 : Fast Stop (C1-09)

The drive stops the motor in the deceleration time set in *C1-09 [Fast Stop Time]*. Fault relay output terminal 1NO-1CM turns ON, and 1NC-1CM turns OFF.

■ L1-05 Motor Therm.Filter Time

No. (Hex.)	Name	Description	Default (Range)
L1-05 (0484)	Motor Therm.Filter Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the primary delay time constant for the PTC input signal entered to the drive. This parameter prevents accidental motor overheat faults.	0.20 s (0.00 - 10.00 s)

■ L1-08 oL1 Current Level

No. (Hex.)	Name	Description	Default (Range)
L1-08 (1103)	oL1 Current Level	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the reference current for the motor 1 thermal overload detection.	0.0 A (0.0 A or 10% to 150% of the drive rated current)

When *L1-08 = 0.0 A*, the drive uses *E2-01 [Mot Rated Current (FLA)]* to detect the motor overload protection. In PM control mode, the drive uses *E5-03 [PM Mot Rated Current (FLA)]* to detect the motor overload protection.

When *L1-08 ≠ 0.0 A*, the set value is the reference for motor overload protection.

Note:
- Display is in these units:
  - Models 4002 to 4023: 0.01 A
  - Models 4031 to 4675: 0.1 A
- When the current level > 0.0 A, you cannot set this value < 10% of drive rated current.

■ L1-09 M2 oL1 Curr.Level

No. (Hex.)	Name	Description	Default (Range)
L1-09 (1104)	M2 oL1 Curr.Level	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the reference current for the motor 2 thermal overload detection.	0.0 A (0.0 A or 10 to 150% of the drive rated current)

When *L1-09 = 0.0 A*, the drive uses *E4-01 [M2 Rated Current (FLA)]* to detect the motor overload protection.

When *L1-09 ≠ 0.0 A*, the set value is the reference for motor overload protection.

Note:
- Display is in these units:
  - Models4002 to 4023: 0.01 A
  - Models 4031 to 4675: 0.1 A
- When the current level > 0.0 A, you cannot set this value < 10% of drive rated current.

■ L1-13 Motor oL1 Memory Selection

No. (Hex.)	Name	Description	Default (Range)
L1-13 (046D)	Motor oL1 Memory Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function that keeps the current electronic thermal protector value when the drive stops receiving power.	1 (0, 1)

0 : Disabled

1 : Enabled

Sets if the drive will calculate the motor again when the drive is energized again.

◆ L2: POWER LOSS RIDE THROUGH

L2 parameters set the drive operation during momentary power loss and the KEB Ride-Thru function method of operation.

■ KEB Ride-Thru Function

KEB is an acronym for Kinetic Energy Backup. If the drive detects a power loss or momentary power loss, it will quickly decelerate the motor. The drive uses regenerative energy from the motor to keep the main circuit operating. When you return power during motor deceleration, the drive returns operation to the status before the power loss.

The KEB Ride-Thru function is different than other functions for continuous operation. If the drive detects momentary power loss, the motor will ramp to stop. It will not coast to stop. This function is applicable for applications in which it is necessary to prevent materials from running out, for example control for film and fiber lines. The KEB Ride-Thru function has 4 methods of operation. Parameter *L2-29 [KEB Method]* sets the method.

When you use the KEB Ride-Thru function with one drive, set *L2-29 = 1, 2 [Single KEB1 Ride-Thru, Single KEB2 Ride-Thru]*.

If deceleration in coordination with more than one drive is necessary, for example textile machinery line systems, set *L2-29 = 3, 4 [System KEB1 Ride-Thru, System KEB2 Ride-Thru]*.

Table 12.50 KEB Ride-Thru Function Operation Method

L2-29	KEB Method	Operation	Configuration Precautions
1	Single KEB1 Ride-Thru	The drive uses regenerative energy from the motor to keep the DC bus voltage at the level set in *L2-11 [KEB DC Volt Setpoint]* while it adjusts the rate of deceleration. The KEB operation continues while the drive adjusts the deceleration rate with the setting of *C1-09 [Fast Stop Time]*.	• Set *C1-09* correctly to prevent *Uv1 [DC Bus Undervoltage]* and *ov [Overvoltage]*. • If the drive detects *Uv1* during the KEB operation, decrease the value set in *C1-09*. • If the drive detects ov during the KEB operation, increase the value set in *C1-09*.
2	Single KEB2 Ride-Thru	The drive uses information about the inertia of the connected machinery to find the deceleration rate necessary to keep the DC bus voltage at the level set in parameter *L2-11*. The drive uses system inertia to calculate the deceleration time. You cannot adjust this value.	• If the drive detects Uv1 during the KEB operation, increase the setting value of *L3-20 [DCBus VoltAdj Gain]* and *L3-21 [OVSup Acc/Dec Gain]*. • If the drive detects ov during the KEB operation, decrease the setting value of *L3-20* and *L3-21*.
3	System KEB1 Ride-Thru	The drive does not monitor the DC bus voltage. The drive decelerates at the KEB deceleration time set in *L2-06*. Use *L2-06* to set the time necessary to decelerate from the current frequency reference to 0 Hz. More than one drive can decelerate and keep a constant speed ratio between drives.	Use the dynamic braking option with System KEB Ride-Thru 1.
4	System KEB2 Ride-Thru	The drive uses the KEB deceleration time set in *L2-06* to decelerate and it also monitors the DC bus voltage. If the voltage level increases, the drive momentarily holds the frequency to prevent an *ov* before it continues to decelerate.	If you cannot use the dynamic braking option, use System KEB Ride-Thru 2.

■ KEB Ride-Thru Start

When *L2-01 = 1 [RideThru@PwrLoss = Enabled] and L2-50 = 2, 3, 4 [RidThruMode@PwrLoss = KEB Mode, KEB Stop Mode, KEB Decel to Stop]*, the drive starts the KEB operation immediately after it detects a momentary power loss. When one of these conditions occur, the drive will activate KEB Ride-Thru:

- KEB Ride-Thru 1 set for the MFDI terminal becomes enabled (terminal is deactivated when *H1-xx = 40* or terminal is activated when *H1-xx = 41*).
  The drive uses the mode selected *L2-29 [KEB Method]* to start KEB operation.
- KEB Ride-Thru 2 set for the MFDI terminal becomes enabled (terminal is deactivated when *H1-xx = 42* or terminal is activated when *H1-xx = 43*).
  The drive automatically starts Single KEB Ride-Thru 2 and it ignores the setting of L2-29.
- The DC bus voltage is less than the level set in *L2-05 [RidThruMode@PwrLoss]*.
  The KEB operation will start as specified in *L2-29*.

Note:

If you try to set KEB Ride-Thru 1 and 2 to the MFDI terminals at the same time, it will trigger *oPE03 [Multi-Function Input Setting Err]*.

In this example, the drive detects that the DC bus voltage is less than the level set in *L2-05* and starts the KEB operation. When you return power during KEB operation, the drive will continue KEB operation when the KEB Ride-Thru is input, although the time set in *L2-10 [Minimum KEB Time]* expired. The motor accelerates again after you cancel the KEB Ride-Thru.

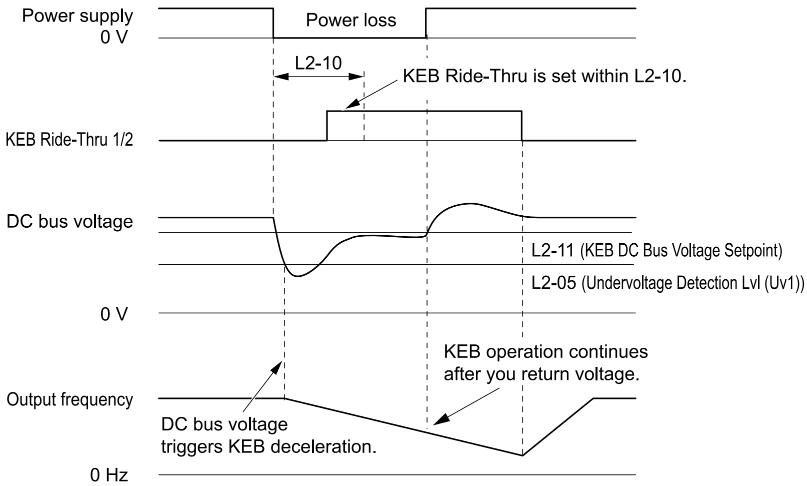


Figure 12.120 KEB Operation through KEB Ride-Thru Input

■ KEB Ride-Thru End Detection

Parameter *L2-01* and a digital input programmed for KEB set the KEB function end detection.

Use the Momentary Power Loss Ride-Thru Time to Cancel KEB Operation

Figure 12.121 shows an example that uses this configuration:

- *L2-01 = 1 [RideThru@PwrLoss = Enabled] and L2-50 = 2 [RidThruMode@PwrLoss = KEB Mode].*
- KEB Ride-Thru is not used.

The drive starts deceleration through KEB operation. The drive stops the KEB operation. When the time set in *L2-10 [Minimum KEB Time]* expires, the drive stops the KEB operation and then it accelerates the motor again until it is at the frequency reference value used before the power loss.

If you do not return the DC bus voltage in the time set in *L2-02 [RideThrough Time@Power Loss]*, the drive detects *Uv1 [DC Bus Undervoltage]* and the drive turns off its output.

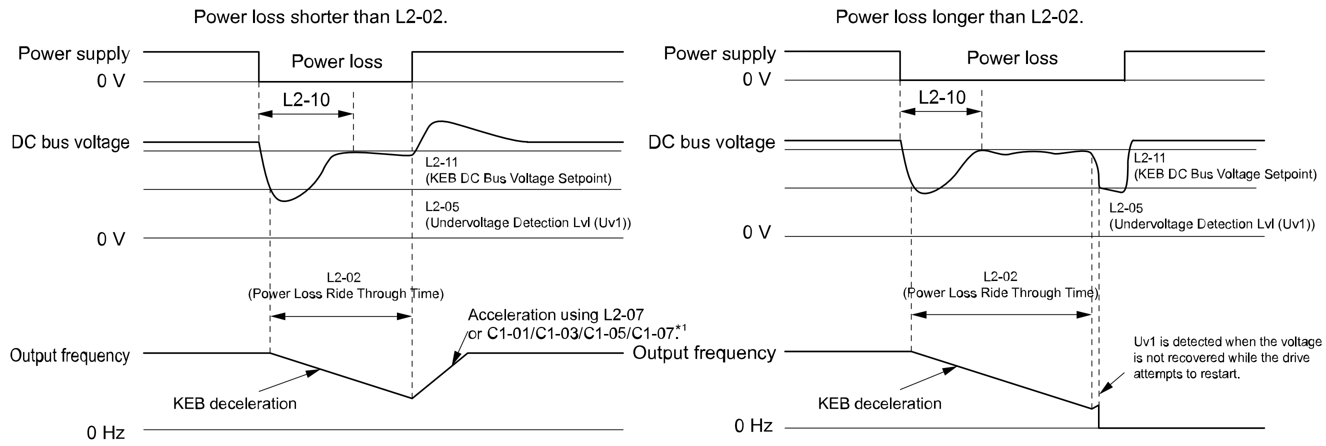


Figure 12.121 Cancel the KEB Operation after the Momentary Power Loss Ride-Thru Time Is Expired without KEB Ride-Thru

*1 When *L2-07 = 0.00 [KEB Accel Time = 0.00 s]*, the drive accelerates again as specified by the applicable *Acceleration Time [C1-01, C1-03, C1-05, C1-07]*, and usual operation continues.

Use the Momentary Power Loss Ride-Thru Time and KEB Ride-Thru to Cancel KEB Operation

Figure 12.122 shows an example that uses this configuration:

- *L2-01 = 3*.
- Use *KEB Ride-Thru 1 [H1-xx = 40, 41]* or *KEB Ride-Thru 2 [H1-xx = 42, 43]*.

The drive starts deceleration through KEB operation. The drive decelerates for the time set in parameter *L2-10*, then it measures the DC bus voltage and the status of the digital input terminal set for KEB Ride-Thru. When the DC bus voltage is less than the level set in *L2-11 [KEB DC Volt Setpoint]* or if the KEB digital input is active, KEB deceleration continues. If the voltage level is more than the level set in *L2-11*, it continues usual operation. The drive accelerates the motor to the frequency reference value used before the power loss, and usual operation continues. If the time set in *L2-02* is expired, the drive detects *Uv1*. When you cancel the KEB Ride-Thru, the motor accelerates again, and usual operation continues.

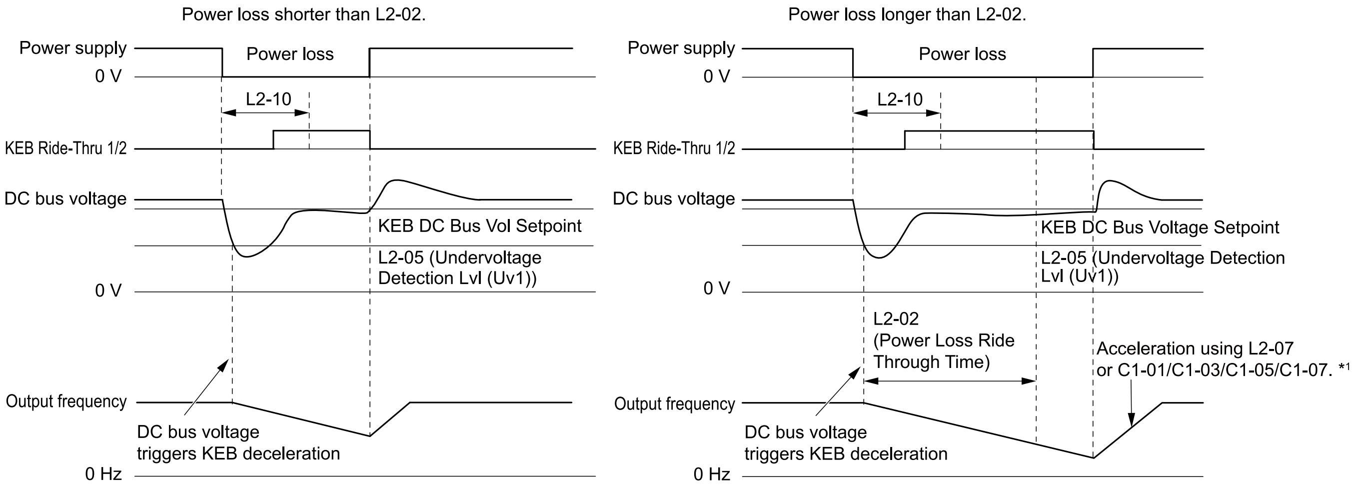


Figure 12.122 Use the Momentary Power Loss Ride-Thru Time and KEB Ride-Thru to Cancel KEB Operation

*1 When *L2-07 = 0.00*, the drive accelerates again as specified by the applicable *Acceleration Time [C1-01, C1-03, C1-05, C1-07]*, and usual operation continues.

Cancel KEB Operation When Restoration of Power Occurs while the Control Power (Power Supply to the Control Board) is Maintained

Figure 12.123 shows an example with this configuration:

- *L2-01 = 1, and L2-50 = 3 [KEB Stop Mode]* is set.
- KEB Ride-Thru is not used.

The drive starts deceleration through KEB operation. The drive decelerates for the time set in parameter *L2-10*, and then measures the DC bus voltage level. When the DC bus voltage is lower than the level set in *L2-11*, the drive uses the KEB Ride-Thru function to continue deceleration. When the DC bus voltage is more than the level set in *L2-11*, usual operation continues. The drive accelerates the motor to the frequency reference value before the power loss, and usual operation continues.

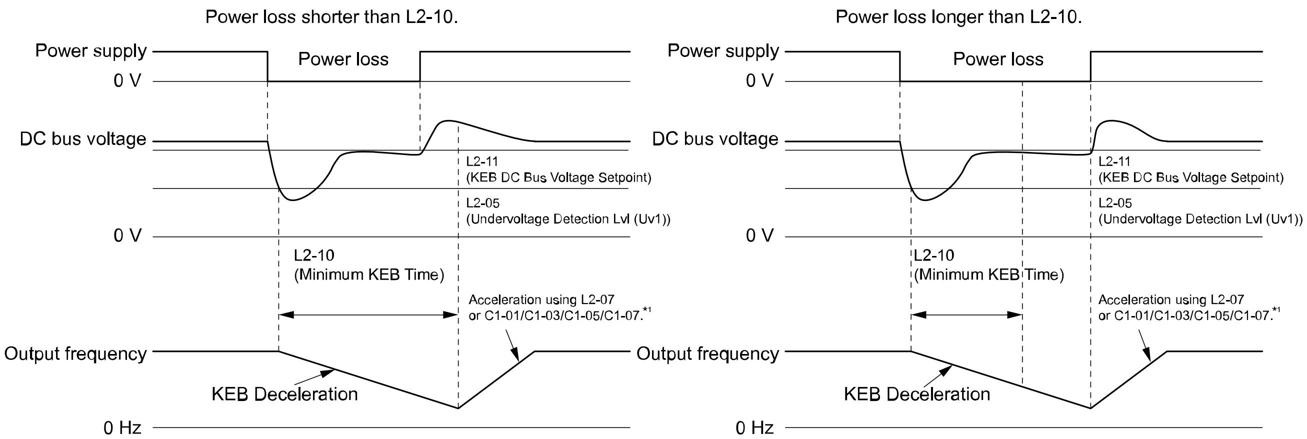


Figure 12.123 Cancel KEB Operation without Using the KEB Ride-Thru if Restoration of Power Occurs while the Control Power (Power Supply to the Control Board) is Maintained

*1 When setting *L2-07 = 0.00*, the drive reaccelerates in accordance with the valid *Acceleration Time [C1-01, C1-03, C1-05, C1-07]*, and normal operation resumes.

Use the KEB Ride-Thru to Cancel KEB Operation when Restoration of Power Occurs while the Control Power (Power Supply to the Control Board) is Maintained

Figure 12.124 shows an example with this configuration:

- *L2-01 = 4*.
- Use *KEB Ride-Thru 1 [H1-xx = 40, 41]* or *KEB Ride-Thru 2 [H1-xx = 42, 43]*.

The drive starts deceleration through KEB operation. When the motor decelerates for the time set in *L2-10*, the drive measures the DC bus voltage and the status of the digital input set for KEB Ride-Thru. When the DC bus voltage is less than the level set in *L2-11*, or if the digital input set to KEB Ride-Thru is active, deceleration continues. When the voltage level is more than the value set to *L2-11*, usual operation continues. The drive accelerates the motor to the frequency reference value before the power loss, and usual operation continues. When the KEB Ride-Thru continues to be input after the time set in *L2-02* is expired, the drive uses the KEB Ride-Thru function to continue to decelerate. When you cancel the KEB Ride-Thru, the motor accelerates again, and usual operation continues.

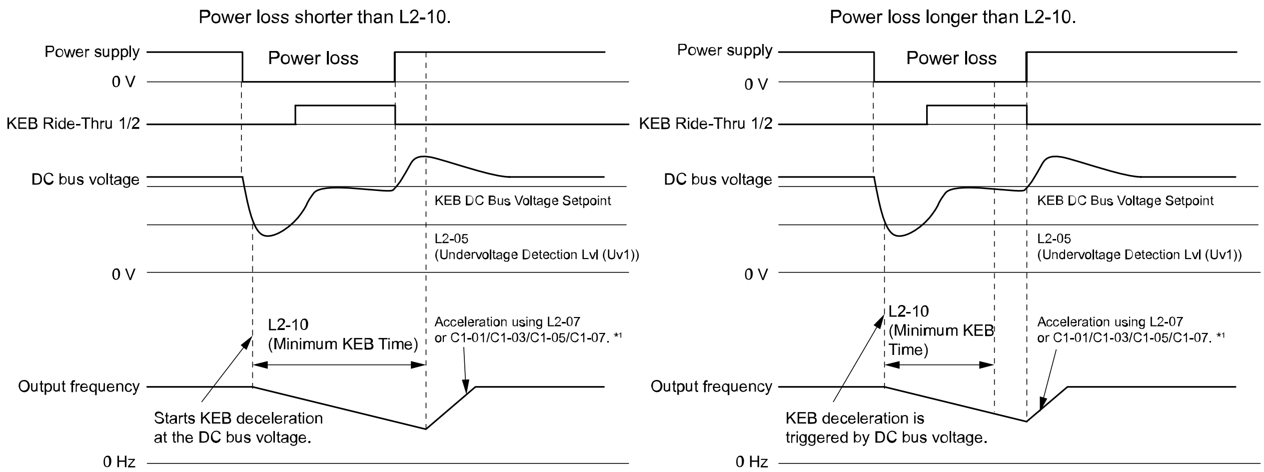


Figure 12.124 Use the KEB Ride-Thru to Cancel KEB Operation when Restoration of Power Occurs while the Control Power (Power Supply to the Control Board) is Maintained

*1 When *L2-07 = 0.00*, the drive accelerates again as specified by the applicable *Acceleration Time [C1-01, C1-03, C1-05, C1-07]*, and usual operation continues.

KEB Operation when L2-01 = 5 [Kinetic Energy Backup: DecelStop]

The drive starts deceleration through KEB operation. The drive will continue to decelerate until the motor comes to the minimum output frequency or a complete stop. If you return power during deceleration, the drive continues to decelerate. If you do not input the Run command, the motor cannot restart.

■ KEB Operation Wiring Example

Figure 12.125 shows an example that uses an undervoltage relay to trigger the KEB Ride-Thru at power loss. When a power loss occurs, the undervoltage relay triggers *KEB Ride-Thru [H1-06 = 40, 41, 42, 43]* at terminal DI6.

Note:
- A dynamic braking option is necessary for *System KEB1 Ride-Thru [L2-29 = 3]*.
- If you turn off the Run command, the drive will not accelerate back to speed when you return power.

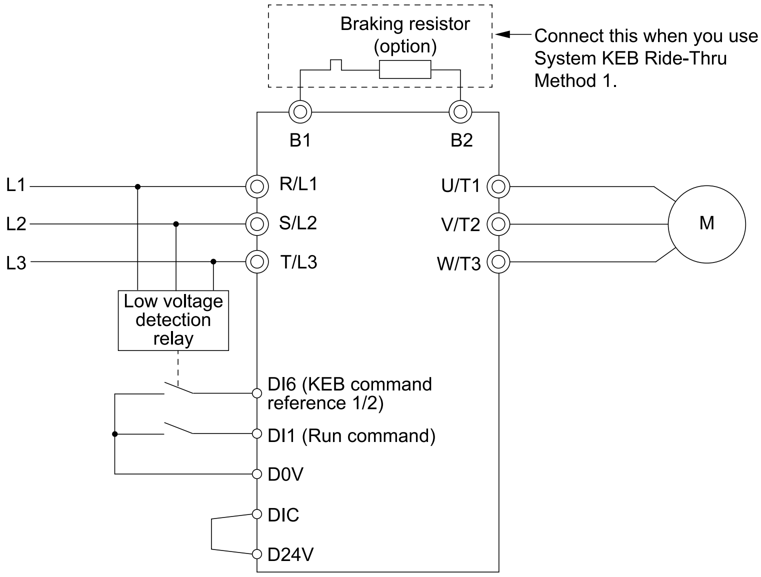


Figure 12.125 KEB Function Wiring Example

■ Parameters for KEB Ride-Thru

Table 12.51 shows the parameters that adjust the KEB Ride-Thru function. Parameter settings are different for the different KEB methods set in *L2-29 [KEB Method]*.

Table 12.51 Parameters for KEB Ride-Thru

No.	Name	Setting Method	L2-29 [KEB Method]			
			1	2	3	4
C1-09	Fast Stop Time	• If *ov [Overvoltage]* occurs during KEB deceleration, increase the setting value. • If *Uv1 [DC Bus Undervoltage]* occurs during KEB deceleration, decrease the setting value.	x *1	-	-	-
C2-03	Jerk@Start of Decel	• If *ov [Overvoltage]* occurs immediately after you start KEB deceleration, increase the setting value. • If *Uv1 [DC Bus Undervoltage]* occurs immediately after you start KEB deceleration, decrease the setting value.	x	-	x	x
L2-05	UV Detection Lvl (Uv1)	If *Uv1 [DC Bus Undervoltage]* occurs immediately after you start KEB deceleration, increase the setting value to detect power loss more quickly.	x	x	x	x
L2-06	KEB Decel Time	• Does KEB Tuning. • If *ov* or *Uv1* occur during KEB deceleration after the KEB Tuning, set *L2-06* as follows: – If *ov* occurs, increase the setting value – If *Uv1* occurs, decrease the setting value	-	-	x *2	x *2
L2-07	KEB Accel Time	Sets the acceleration time to return to the frequency reference value before a power loss, after you cancel the KEB operation. When *L2-07 = 0*, the drive uses standard acceleration times set in *C1-01*, *C1-03*, *C1-05*, and *C1-07 [Accel Time 1, Accel Time 2, Accel Time 3, and Accel Time 4]*.	x	x	x	x
L2-08	Frq.Gain@KEB Start	• If *ov [Overvoltage]* occurs immediately after you start operation, decrease the setting value. • If *Uv1 [DC Bus Undervoltage]* occurs immediately after you start operation, increase the setting value.	x	-	x	x
L2-10	Minimum KEB Time	• With KEB Ride-Thru There is *Uv1* because you set a digital input for KEB Ride-Thru and the device that controls the input operated too slowly after power loss. • Without KEB Ride-Thru If the DC bus voltage overshoots immediately after KEB Ride-Thru starts, increase *L2-10* to longer than the overshoot.	x	x	x	x

No.	Name	Setting Method	L2-29 [KEB Method]			
			1	2	3	4
L2-11	KEB DC Volt Setpoint	• Single Drive KEB Ride-Thru 2 Set to approximately 1.22 x input voltage. • Single Drive KEB Ride-Thru 1, System KEB Ride-Thru 1, or System KEB Ride-Thru 2 Set to approximately 1.4 x input voltage.	x	x	x	x
L3-20	DCBus VoltAdj Gain	• If *ov* or *Uv1* occur at the start of deceleration when you use KEB operation, increase this value in 0.1 unit increments. • If there is torque ripple during deceleration when you use KEB Ride-Thru, decrease the value.	-	x	-	-
L3-21	OVSup Acc/Dec Gain	If there is large speed or current ripple, decrease the value in 0.05 unit increments. **Note:** If the setting value is too low, then the drive will have unsatisfactory DC bus voltage control response. The drive can detect *ov* or *Uv1*.	-	x	-	-
L3-24	Acc@Rated Torque	Set the motor acceleration time to the maximum frequency at the motor rated torque.	-	x	-	-
L3-25	Load Inertia Ratio	Sets the ratio between motor inertia and machine inertia.	-	x *3	-	-

*1 When *L2-29 = 1 [KEB Method = Single KEB1 Ride-Thru]*, the drive will automatically set *C1-09 [Fast Stop Time]* in KEB Tuning. If you must not change the Fast Stop time, do not do KEB Tuning.
*2 If you do KEB Tuning when *L2-29 = 2, 3, or 4 [KEB Method = Single KEB2 Ride-Thru, System KEB1 Ride-Thru, or System KEB2 Ride-Thru]*, the drive will automatically set *L2-06 [KEB Decel Time]*.
*3 The drive sets this value automatically when KEB Tuning completes correctly.

■ L2-01 RideThru@PwrLoss

No. (Hex.)	Name	Description	Default (Range)
L2-01 (0485)	RideThru@PwrLoss	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the drive operation after a momentary power loss.	0 (0, 1)

The drive detects momentary power loss when the drive DC bus voltage is less than the value set in *L2-05 [UV Detection Lvl (Uv1)]*.

0 : Disabled

1 : Enabled

The mode is defined using *L2-50 [RidThruMode@PwrLoss]*.

Note:

When you set *L2-01 and L2-50*, make sure that you know these items:

- You can use a Momentary Power Loss Unit on models 2004 to 2056 and 4002 to 4031 for a longer momentary power loss ride through time. A Momentary Power Loss Unit makes it possible to continue operation of the drive after a maximum of 2 seconds of power loss.
- When you set *L2-01 = 1 and L2-50 = 0 to 3*, keep the magnetic contactor between the motor and the drive closed and keep the control signal while the drive does KEB operation.
- When you set *L2-01 = 1 and L2-50 = 1 to 4*, *Uv [Undervoltage]* will flash on the keypad while the drive tries to recover from a momentary power loss. The drive will not output a fault signal at this time.
- When you use a magnetic contactor between the motor and the drive, keep the magnetic contactor closed while the drive does KEB operation or tries to restart with Speed Search.
- Keep the Run command active during KEB operation. The drive cannot accelerate back to the frequency reference when the power returns.
- When you set *L2-01 = 1 and L2-50 = 2 to 4*, if the control power supply voltage is less than the CPU operation level during KEB Ride-Thru, it will trigger *Uv1*.

■ L2-02 RideThrough Time@Power Loss

No. (Hex.)	Name	Description	Default (Range)
L2-02 (0486)	RideThrough Time@Power Loss	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the maximum time that the drive will wait until trying to restart after power loss.	Determined by o2-04 and C6-01 (0.0 - 25.5 s)

This function is applicable when *L2-01 = 1 [RideThru@PwrLoss = Enabled] and L2-50 = 0, 2 [RidThruMode@PwrLoss = Timer Controlled, KEB Mode]*. If power loss operation is longer than the time set in this parameter, the drive will detect *Uv1 [DC Bus Undervoltage]*, turn OFF output, and the motor will coast to stop.

Note:

- The length of time that the drive can recover after a power loss changes when drive capacity changes.
- The upper limit of the possible momentary power loss Ride-Thru time changes when drive capacity changes.

■ L2-03 Min Baseblck Time

No. (Hex.)	Name	Description	Default (Range)
L2-03 (0487)	Min Baseblck Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the minimum baseblock time when the drive restores power after a momentary power loss.	Determined by o2-04 and C6-01 (0.1 - 5.0 s)

Sets the length of time that the drive will wait for the residual voltage in the motor to dissipate in estimation to the secondary circuit time constant of the motor. If *oC [Overcurrent]* or *ov [DC Bus Overvoltage]* occur at the start of Speed Search, after a power loss, or during DC Injection Braking, increase this setting.

■ L2-04 Powloss Ramp Time@recovery

No. (Hex.)	Name	Description	Default (Range)
L2-04 (0488)	Powloss Ramp Time@recovery	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the time for the drive output voltage to go back to correct voltage after completing speed searches.	Determined by o2-04 and C6-01 (0.0 - 5.0 s)

Sets the time for voltage to recover from 0 V to the value set in *E1-05 [Max Output Voltage]*.

■ L2-05 UV Detection Lvl (Uv1)

No. (Hex.)	Name	Description	Default (Range)
L2-05 (0489)	UV Detection Lvl (Uv1)	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the voltage at which a *Uv1 [DC Bus Undervoltage]* fault is triggered or at which the KEB function is activated. Usually it is not necessary to change this setting.	Determined by E1-01 (Determined by E1-01)

NOTICE: *Damage to Equipment. Install an AC reactor option on the input side of the power supply when setting this parameter lower than the default value. Failure to obey will cause damage to drive circuitry.*

Note:

If the low voltage detection level is near the lower limit value of *L2-05*, the drive will detect *Uv1* during KEB Ride-Thru operation. Do not set the value too low when you use the KEB Ride-Thru function.

■ L2-06 KEB Decel Time

No. (Hex.)	Name	Description	Default (Range)
L2-06 (048A) Expert	KEB Decel Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the deceleration time during KEB operation used to decrease the maximum output frequency to 0.	0.0 s (0.0 to 6000.0 s)

Set *L2-29 = 3 or 4 [KEB Method = System KEB1 Ride-Thru or System KEB2 Ride-Thru]* to enable this function. When *L2-29 = 2, 3 , 4 [KEB Method = Single KEB2 Ride-Thru, System KEB1 Ride-Thru, System KEB2 Ride-Thru]* and you do KEB Auto-Tuning, the drive will automatically set this value.

Sets the deceleration time necessary to decelerate from the frequency reference to 0 Hz when the drive detects a momentary power loss. If a *Uv1 [DC Bus Undervoltage]* fault occurs during KEB operation, decrease the deceleration time. If an *ov [Overvoltage]* fault occurs, increase the deceleration time.

- *L2-06 = 0*
  The drive automatically decreases *C1-09 [Fast Stop Time]* to the base value to keep the DC bus voltage above the low voltage detection level. The drive ignores *L2-02 [RideThrough Time@Power Loss]* in this condition.
- *L2-06 ≠ 0*
  As shown in Figure 12.126, the frequency reference decelerates to the KEB frequency level as specified by the deceleration rate set in *L2-06* and then returns to the initial frequency reference as specified by *C1-01 [Accel Time 1]*. The drive uses the setting value of the KEB frequency rate as shown in the this formula to set the KEB frequency level:
  KEB frequency level = Output frequency before power loss × (1 - *(L2-02)*/ *(L2-06)*)

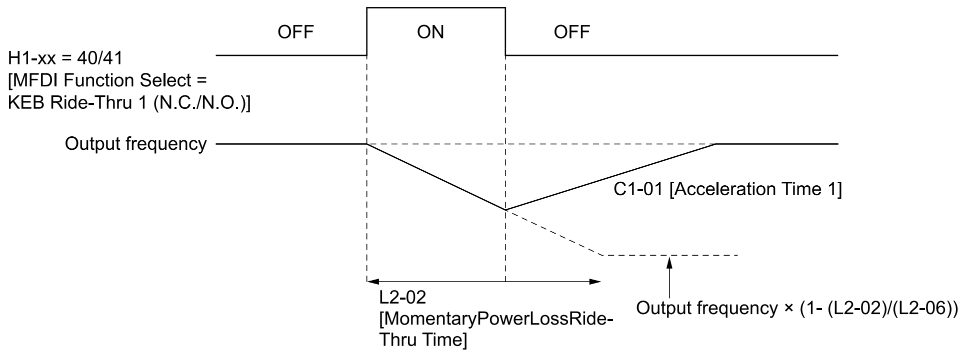


Figure 12.126 Kinetic Energy Backup Decel Time

■ L2-07 KEB Accel Time

No. (Hex.)	Name	Description	Default (Range)
L2-07 (048B) Expert	KEB Accel Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the acceleration time to return the frequency to the frequency reference before a power loss after canceling KEB operation.	0.0 s (0.0 to 6000.0 s)

Set this parameter to 0.0 to disable the function. The drive uses the acceleration time in *C1-01, C1-03, C1-05, and C1-07* to accelerate again after KEB operation completes.

■ L2-08 Frq.Gain@KEB Start

No. (Hex.)	Name	Description	Default (Range)
L2-08 (048C) Expert	Frq.Gain@KEB Start	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the quantity of output frequency reduction used when KEB operation starts as a percentage of the motor rated slip before starting KEB operation.	100% (0 - 300%)

Decreases the output frequency in steps to quickly set the motor to a regenerative condition. Use this formula to calculate the value:

Output frequency reduction = Motor rated slip before KEB operation × (*L2-08*/100) × 2

■ L2-09 KEB Min.Frq Level

No. (Hex.)	Name	Description	Default (Range)
L2-09 (048D) Expert	KEB Min.Frq Level	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the quantity of output frequency reduction used when KEB operation starts as a percentage of the motor rated slip.	20% (0 - 100%)

These conditions set the quantity of decrease:

- Motor rated slip × (*L2-09*/100)
- The larger value between the value calculated with *L2-08* and the value calculated with *L2-09*

■ L2-10 Minimum KEB Time

No. (Hex.)	Name	Description	Default (Range)
L2-10 (048E) Expert	Minimum KEB Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the minimum length of time to operate the KEB after the drive detects a momentary power loss.	50 ms (0 - 25500 ms)

When you return power while KEB is operating, the drive continues KEB operation until the time set in *L2-10* is expired. When the DC bus voltage is less than the level of *L2-05 [UV Detection Lvl (Uv1)]* in one of these conditions, KEB operation continues until the time set in *L2-10* is expired:

- L2-01 = 1 and L2-50 = 2 [RideThru@PwrLoss = Enabled] and [RidThruMode@PwrLoss = KEB Mode].
- L2-01 = 1 and L2-50 = 3 [KEB Stop Mode]
- L2-01 = 1 and L2-50 = 4 [KEB Decel to Stop].
- KEB Ride-Thru 1/2 [H1-xx = 40, 41, 42, or 43] is input into the drive.

When you input KEB Ride-Thru, KEB operation continues after the time set in *L2-10* is expired. When you cancel KEB Ride-Thru, the motor accelerates again. When you do not input KEB Ride-Thru during the time set in *L2-10*, the drive accelerates to the frequency reference that the drive had before power loss in the applicable acceleration time.

When *L2-01 = 1 and L2-50 = 2, 3, or 4*, and the DC bus voltage is a minimum of the value of *L2-11 [KEB DC Volt Setpoint]*, the drive accelerates again after the time set in *L2-10* is expired. If the DC bus voltage is less than the *L2-11* value, KEB operation continues after the time set in *L2-10* is expired.

Note:
- When *L2-01 = 0 [Disabled], or L2-01 = 1 and L2-50 = 0 or 1 [Timer Controlled or While CPU Active]*, increase the value of *L2-10*. Set *L2-10* to cancel KEB operation if the KEB Ride-Thru is not input
- Set this parameter to 0 to disable the function.

■ L2-11 KEB DC Volt Setpoint

No. (Hex.)	Name	Description	Default (Range)
L2-11 (0461) Expert	KEB DC Volt Setpoint	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the target value that controls the DC bus voltage to a constant level in Single Drive KEB Ride-Thru 2. Sets the DC bus voltage level that completes the KEB operation for all other KEB methods.	Determined by E1-01 (Determined by E1-01)

■ L2-29 KEB Method

No. (Hex.)	Name	Description	Default (Range)
L2-29 (0475) Expert	KEB Method	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the KEB function operation mode.	1 (1 - 4)

Set *L2-01 = 1 [RideThru@PwrLoss = Enabled], and set L2-50 = 2, 3, or 4 [RidThruMode@PwrLoss = KEB Mode, KEB Stop Mode, or KEB Decel to Stop]* or *KEB Ride-Thru 1/2 [H1-xx = 40, 41, 42, or 43]*, to enable the KEB function.

1 : Single KEB1 Ride-Thru

The drive monitors the DC bus voltage and uses regenerative energy from the motor to hold the DC bus voltage at the level set in *L2-11 [KEB DC Volt Setpoint]*.

The KEB operation continues and the deceleration rate changes as specified by *C1-09 [Fast Stop Time]*.

Note:
- If the drive detects *Uv1 [DC Bus Undervoltage]* during KEB operation, decrease the value of *C1-09*.
- If the drive detects *ov [Overvoltage]* during KEB operation, increase the value of *C1-09*.

2 : Single KEB2 Ride-Thru

The drive does KEB operation and automatically calculates the deceleration rate to make sure that the main circuit electrical energy and main current voltage from motor regenerative energy is equal to *L2-11 [KEB DC Volt Setpoint]*.

3 : System KEB1 Ride-Thru

The drive does not monitor the DC bus voltage and decelerates as specified by the KEB deceleration time set in *L2-06*.

Set *L2-06* to the time necessary to decelerate from the frequency reference to 0 Hz when the drive detects a momentary power loss. The drive can decelerate and keep constant deceleration rates for more than one drive.

Note:

If you keep constant deceleration rates for more than one drive, it can trigger *ov* faults. Use the dynamic braking option with System KEB Ride-Thru 1 to prevent *ov* faults.

4 : System KEB2 Ride-Thru

The drive monitors the DC bus voltage and decelerates for the deceleration time set in *L2-06*.

If the DC bus voltage increases, the drive momentarily holds the frequency to prevent *ov* while deceleration continues.

Note:

When you cannot use a dynamic braking option, use System KEB Ride-Thru.

L2-30 KEB ZeroSpeed Operation

No. (Hex.)	Name	Description	Default (Range)
L2-30 (045E) Expert	KEB ZeroSpeed Operation	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the operation when the output frequency decreases below the zero level (DC braking injection starting frequency) during *KEB deceleration when L2-01 = 1 [RideThru@PwrLoss = Enabled* and *L2-50 = 2 to 4 [RidThruMode@PwrLoss= KEB Mode, KEB Stop Mode, or KEB Decel to Stop]*.	1 (1, 2)

1 : Baseblock

2 : DC/SC Braking

Does DC injection braking and short circuit braking as specified by *b2-04 [DCInj Time@Stop]* and *b2-13 [SCB Time@Stop]*.

L2-31 KEB StartV Offset Level

No. (Hex.)	Name	Description	Default (Range)
L2-31 (045D) Expert	KEB StartV Offset Level	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the KEB start voltage offset.	Determined by A1-02 (400 V Class: 0 - 200 V)

The drive uses this formula to calculate the KEB start voltage:

KEB start voltage = *L2-31 + L2-05 [UV Detection Lvl (Uv1)]*

L2-50 RidThruMode@PwrLoss

No. (Hex.)	Name	Description	Default (Range)
L2-50 0453	RidThruMode@PwrLoss	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the drive operation after a momentary power loss..	0 (0 - 4)

0 : Timer Controlled

When power returns in the time set in *L2-02 [RideThrough Time@Power Loss]*, the drive will restart. If power does not return in the time set in *L2-02*, the drive will detect *Uv1*.

The drive momentarily turns OFF its output after a power loss. If the power returns in the time set to *L2-02*, the drive will do Speed Search and try to continue operation.

If the DC bus voltage is less than or equal to the *Uv1* detection level for the time set in *L2-02*, the drive will detect *Uv1* and output a fault signal.

Note:
- The necessary time for the drive to restart after power returns is different for different drive capacities.
- The upper limit of the possible momentary power loss Ride-Thru time is different for different drive models.

1 : While CPU Active

When power returns and the drive control circuit has power, the drive will restart. This will not trigger *Uv1*.

When there is a momentary power loss, the drive output will turn OFF. If the power returns and the drive control circuit has power, the drive will do Speed Search and try to continue operation. This will not trigger *Uv1*. This function lets the power loss be longer than when *L2-01 = 1*.

2 : KEB Mode

If power does not return in the time set in *L2-02*, the drive will detect *Uv1*.

When the drive detects momentary power loss, the drive will use regenerative energy from the motor through KEB operation to decelerate. When you return power in the time set in *L2-02*, the drive will accelerate to the frequency reference value that was used before the power loss. If you do not return power in the time set to *L2-02*, the drive will detect *Uv1* and the drive output will turn OFF. *L2-29 [Kinetic Energy Backup Method]* sets the type of KEB operation.

3 : KEB Stop Mode

When power returns and the drive control circuit has power, the drive will restart.

The drive decelerates using regenerative energy from the motor until the power returns and then restarts when a momentary power loss is detected. When power is restored during deceleration, the drive accelerates the motor again to the frequency reference value used before the power loss. If the motor comes to a stop before the power returns, the drive loses control power and the drive output shuts off. A *Uv1* is not triggered when power is restored while power to the CPU in the drive is maintained. The type of KEB operation is determined by *L2-29*.

4 : KEB Decel to Stop

When power returns, the drive will continue to decelerate until the motor fully stops.

If the drive detects momentary power loss, the drive will use regenerative energy from the motor and ramp to stop. When you return power to the drive, the drive will continue to decelerate until the motor comes to a full stop. After you return power, the drive will ramp to stop in the set deceleration time. *L2-29* sets the type of KEB operation.

Note:

When you set *L2-01 and L2-50*, make sure that you know these items:

- You can use a Momentary Power Loss Unit on models 2004 to 2056 and 4002 to 4031 for a longer momentary power loss ride through time. A Momentary Power Loss Unit makes it possible to continue operation of the drive after a maximum of 2 seconds of power loss.
- When you set *L2-01 = 1 and L2-50 = 0 to 3*, keep the magnetic contactor between the motor and the drive closed and keep the control signal while the drive does KEB operation.
- When you set *L2-01 = 1 and L2-50 = 1 to 4*, *Uv [Undervoltage]* will flash on the keypad while the drive tries to recover from a momentary power loss. The drive will not output a fault signal at this time.
- When you use a magnetic contactor between the motor and the drive, keep the magnetic contactor closed while the drive does KEB operation or tries to restart with Speed Search.
- Keep the Run command active during KEB operation. The drive cannot accelerate back to the frequency reference when the power returns.
- When you set *L2-01 = 1 and L2-50 = 2 to 4*, if the control power supply voltage is less than the CPU operation level during KEB Ride-Thru, it will trigger *Uv1*.

◆ L3: STALL PREVENTION

L3 parameters set the Stall Prevention function and overvoltage suppression function.

■ Stall Prevention

If the load is too heavy or the acceleration and deceleration times are too short, the motor can slip too much because it cannot work at the same rate as the frequency reference. If the motor stalls during acceleration, current increases as the slip increases to cause an *oC [Overcurrent]*, *oL2 [Drive Overload]*, or *oL1 [Motor Overload]* and the drive will stop. If the motor stalls during deceleration, too much regenerative power will flow back into the DC bus capacitors, and cause the drive to fault out from *ov [Overvoltage]* and the drive will stop.

The stall prevention function will let the motor get to the set speed without stalling and it is not necessary for you to change the acceleration or deceleration time settings. You can set a separate stall prevention functions for acceleration, operating at constant speeds, and deceleration.

■ Overvoltage Suppression Function

Decreases the regenerative torque limit and increases the output frequency when the DC bus voltage increases to prevent *ov*. This function can drive loads with cyclic regenerative operation, for example punch presses or other applications with repeated crank movements. When you use this function, set *L3-11 = 1 [Overvolt Supression Select = Enabled]*.

The drive adjusts the regenerative torque limit and the output frequency during overvoltage suppression to make sure that the DC bus voltage is not more than the level set in *L3-17 [DCBus Regul.Level]*.

Set these parameters as necessary when you use the overvoltage suppression function:

- *L3-20 [DCBus VoltAdj Gain]*
- *L3-21 [OVSup Acc/Dec Gain]*
- *L3-24 [Acc@Rated Torque]*
- *L3-25 [Load Inertia Ratio]*

Note:

- When overvoltage suppression is triggered, the motor speed is more than the frequency reference. Do not use overvoltage suppression for applications where the frequency reference and the motor speed must align.
- When you use a braking resistor, set *L3-11 = 0 [Disabled]*.
- The overvoltage suppression function is enabled only when you operate immediately below the maximum frequency. Overvoltage suppression does not increase the output frequency to more than the maximum frequency. Make sure that the motor and machine specifications are correct for the application, then increase the maximum frequency.
- If there is a sudden increase to a regenerative load, *ov* can occur.

■ L3-01 StallP Mode@Accel

No. (Hex.)	Name	Description	Default (Range)
L3-01 (048F)	StallP Mode@Accel	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the method of the Stall Prevention During Acceleration.	2 (1 - 4)

Note:

When *A1-02 = 5 [Control Method = PM OLVector],* the setting range is *0* and *1* .

Stall prevention during acceleration will not let motors stall or stop when the drive detects *oC [Overcurrent]*, *oL2 [Drive Overload]*, or *oL1 [Motor Overload]* and large loads are applied during acceleration or when setting sudden acceleration times regarding load inertia.

1 : Disabled

The Stall Prevention function does not operate during acceleration, and acceleration occurs for the set acceleration time. If the acceleration time is too short, the motor does not fully accelerate during the set time, which causes the drive to detect *oL1* or *oL2* and the motor to stop.

2 : General Purpose

Enables the Stall Prevention During Acceleration function. Operation is different for different control methods.

- **V/f Control, Open Loop Vector Control, or EZ Open Loop Vector Control**
  When the output current is more than the value set in *L3-02 [StallP Level@Accel]*, the drive stops acceleration. When the output current is less than the value set in *L3-02* - 15%, the drive starts to accelerate again. The Stall Prevention function level automatically falls for constant output ranges.

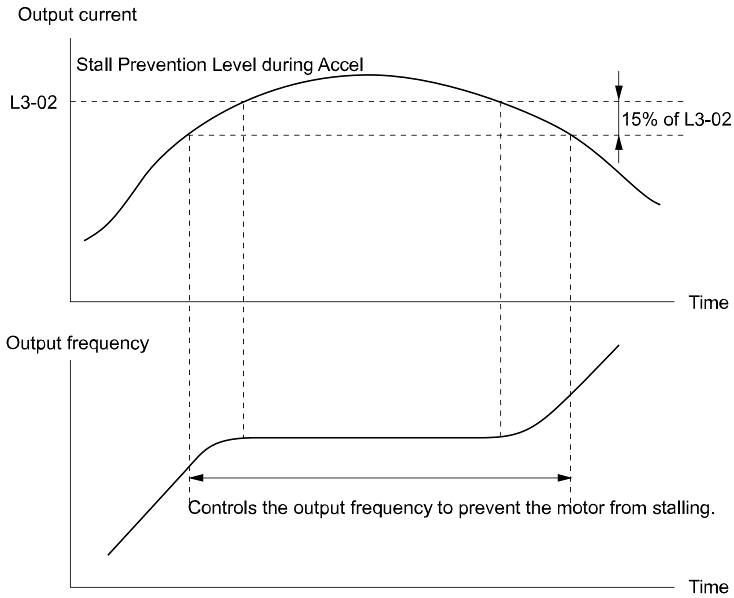


Figure 12.127 Stall Prevention During Acceleration when Using Induction Motors

- **Open Loop Vector Control for PM**
  When the output current is more than the value set in *L3-02*, the drive stops acceleration. When the time set in *L3-27 [StallP Detect Time]* is expired and the output current is the value set in *L3-02* at a minimum, the drive will start deceleration in as specified by the value set in *L3-22 [StallP@Acc Deceleration Time]*. When the output current is less than the value set in *L3-02* - 15%, the drive stops deceleration. When the time set in *L3-27* is expired, the drive starts acceleration again.

Parameter Details

12

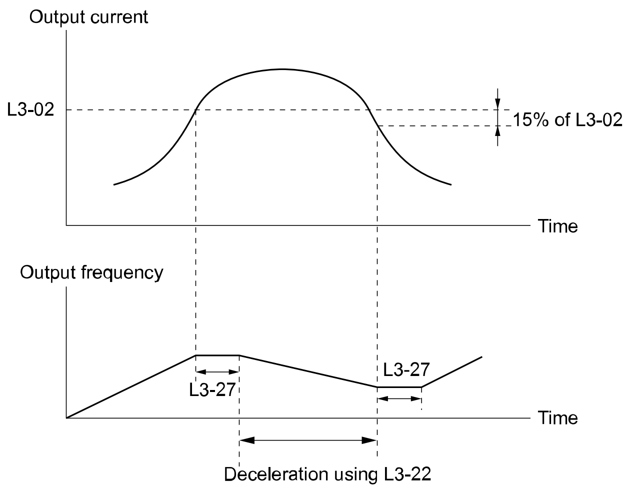


Figure 12.128 Stall Prevention During Acceleration Function in OLV/PM

3 : Intelligent Accel

The drive ignores the acceleration time setting and the drive starts to accelerate in the minimum length of time. The drive automatically adjusts the acceleration rate and the output current will not be more than the value set in *L3-02*.

4 : ILim Mode

This function limits the output current with the value set for *L3-02* and automatically adjusts the acceleration rate. When the load (output current) increases to more than the current limit level during acceleration, the drive automatically adjusts the acceleration rate.

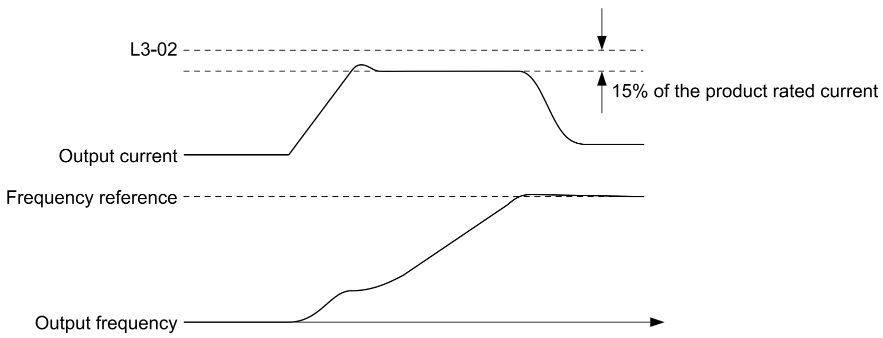


Figure 12.129 Current Limit Acceleration

■ L3-02 StallP Level@Accel

No. (Hex.)	Name	Description	Default (Range)
L3-02 (0490)	StallP Level@Accel	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the output current level to start Stall Prevention during acceleration as a percentage of the drive rated output current.	Determined by C6-01 and L8-38 (0 - 150%)

Note:
- If you use a motor that is small compared to the drive and the motor stalls, decrease the setting value.
- When you operate the motor in the constant power range, set *L3-03 [StallP Limit@Accel]*.

■ L3-03 StallP Limit@Accel

No. (Hex.)	Name	Description	Default (Range)
L3-03 (0491)	StallP Limit@Accel	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the lower limit for the stall prevention level during acceleration used for constant output ranges as a percentage of the drive rated output current.	50% (0 - 100%)

The stall prevention level set in *L3-02 [StallP Level@Accel]* is automatically reduced when the motor is running within the constant output range. Parameter *L3-03* is the limit value used to prevent the stall prevention level during constant output ranges to fall below the minimum required level.

Note:
The function to automatically reduce the stall prevention level does not operate when *L3-01 = 4 [StallP Mode@Accel = ILim Mode]*.

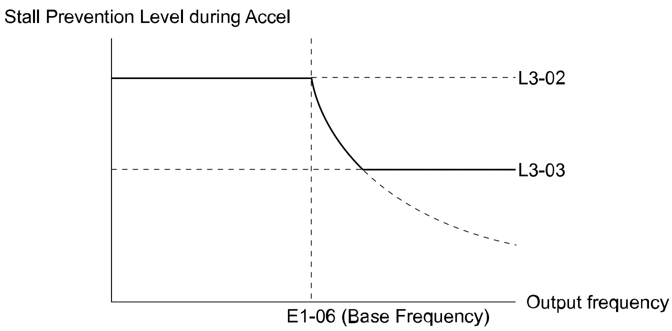


Figure 12.130 Stall Prevent Level during Accel/Limit

■ L3-04 StallP@Decel Enable

No. (Hex.)	Name	Description	Default (Range)
L3-04 (0492)	StallP@Decel Enable	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Enables Stall Prevention during deceleration.	1 (0-1)

■ L3-05 StallP@RUN Enable

No. (Hex.)	Name	Description	Default (Range)
L3-05 (0493)	StallP@RUN Enable	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Enables Stall Prevention during Run.	Determined by A1-02 (0 - Determined by A1-02)

When the drive detects *oL1 [Motor Overload]* while the motor is operating at constant speed, the Stall Prevention function during run automatically decreases the speed to prevent motor stalling.

Note:

An output frequency less than 6 Hz will disable Stall Prevention during Run regardless of *L3-05* and *L3-06 [StallP Level@Run]* settings.

0 : Disabled

1 : Enabled

Select the stall prevention mode using *L3-51 [StallP@RUNDecTime]*.

■ L3-06 StallP Level@Run

No. (Hex.)	Name	Description	Default (Range)
L3-06 (0494)	StallP Level@Run	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the current level that starts Stall Prevention during run. A setting of 100% is equal to the drive rated current.	Determined by C6-01 and L8-38 (30 - 150%)

Note:

- This parameter is applicable if *L3-05 = 1 [StallP@RUN Enable = Enabled]* and *L3-51 = 0, 1 [StallP@RUNDecTime= Dec Time 1 (C1-02), Dec Time 2 (C1-04)]*.
- When *L3-23 = 2 [CHP Stall P Selection = Automatic Reduction]*, the drive will automatically decrease the level in the constant power range.

Use an Analog Input to Change the Stall Prevent Level during Run

When *H3-xx = 14 [AI Function Select = StallPLev@Rn]*, you can change the stall prevention level during run through the input gain and bias settings for terminals AI1, AI2, and AI3.

If you set the input level for terminals AI1, AI2, and AI3 *[H3-xx = 14]* and *L3-06*, the drive will use the smaller value for Stall Prevent Level during Run.

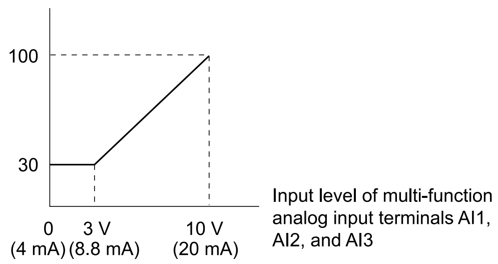


Figure 12.131 Stall Prevention Level during Run with Analog Input

■ L3-11 Overvolt Supression Select

No. (Hex.)	Name	Description	Default (Range)
L3-11 (04C7)	Overvolt Supression Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the overvoltage suppression function.	0 (0, 1)

0 : Disabled

The drive does not adjust the regenerative torque limit or the output frequency. If you apply a regenerative load, the drive can detect an *ov [Overvoltage]* fault. Use this setting with a dynamic braking option.

1 : Enabled

When a regenerative load increases the DC bus voltage, the drive decreases the regenerative torque limit and increases the output frequency to prevent *ov*

■ L3-17 DCBus Regul.Level

No. (Hex.)	Name	Description	Default (Range)
L3-17 (0462)	DCBus Regul.Level	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the target value for the DC bus voltage when the overvoltage suppression function and the Decel Stall Prevention function (Intelligent Stall Prevention) are active.	400 V Class: 750 V (400 V Class: 300 - 800 V)

Note:

This value is initialized when *E1-01 [Input AC Supply Voltage]* is changed.

Sets this parameter for any of the following circumstances.

- *L3-11 = 1 [Overvolt Supression Select = Enabled]*.
- *L3-04 = 1 [StallP@Decel Enable = Enabled] and L3-50 = 1 [StallP@Decel Mode = Automatic Decel Reduction]*.

■ L3-20 DCBus VoltAdj Gain

No. (Hex.)	Name	Description	Default (Range)
L3-20 (0465) Expert	DCBus VoltAdj Gain	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the proportional gain used to control the DC bus voltage.	Determined by A1-02 (0.00 - 5.00)

Set one of these parameters to enable L3-20:

- *L2-29 = 2 [KEB Method = Single KEB2 Ride-Thru]*
- *L3-04 = 1 [StallP@Decel Enable = Enabled]* and *L3-50 = 1 [StallP@Decel Mode = Automatic Decel Reduction]*
- *L3-11 = 1 [Overvolt Supression Select = Enabled]*
- *H1-xx = 42 or 43 [DI Function Select = KEB Thru2 NC or KEB Thru2 NO]*

Note:

- If stall prevention during deceleration function causes *ov [Overvoltage]* and *Uv1 [DC Bus Undervoltage]* faults when you start deceleration and *L2-29 = 1, H1-xx = 42 or 43*, or *L3-04 = 2*, gradually increase this parameter in 0.1-unit increments. If the setting value is too high, it can cause large speed or current ripples.
- If sudden increases in the regenerative load cause *ov* faults and *L3-11* = 1, gradually increase this parameter in 0.1-unit increments. If the setting value is too high, it can cause large speed or current ripples.

■ L3-21 OVSup Acc/Dec Gain

No. (Hex.)	Name	Description	Default (Range)
L3-21 (0466) Expert	OVSup Acc/Dec Gain	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the proportional gain to calculate acceleration and deceleration rates.	Determined by A1-02 (0.10 - 10.00)

Set one of these parameters to enable L3-21:

- *L2-29 = 2 [KEB Method = Single KEB2 Ride-Thru]*
- *L3-04 = 1 [StallP@Decel Enable = Enabled]* and *L3-50 = 1 [StallP@Decel Mode = Automatic Decel Reduction]*
- *L3-11 = 1 [Overvolt Supression Select = Enabled]*
- *H1-xx = 42 or 43 [DI Function Select = KEB Thru2 NC or KEB Thru2 NO]*

Note:
- If stall prevention during deceleration function causes large speed or current ripples and *L2-29 = 1, H1-xx = 42 or 43*, or *L3-04 = 2*, gradually decrease this parameter in 0.05-unit increments. If the drive detects *ov [Overvoltage]* or *oC [Overcurrent]*, decrease this parameter. If you decrease the gain too much, it can cause a delay in control in the DC bus voltage or the deceleration time could be longer than the best deceleration time.
- If sudden increases in the regenerative load cause *ov* faults and *L3-11 = 1*, gradually increase this parameter in 0.1-unit increments. If there are large speed ripples, gradually decrease this parameter in 0.05-unit increments.

■ L3-22 StallP@Acc Deceleration Time

No. (Hex.)	Name	Description	Default (Range)
L3-22 (04F9)	StallP@Acc Deceleration Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the momentary deceleration time that the drive will use when it tries to accelerate a PM motor and detected motor stalls. This function is applicable when *L3-01 = 2 [StallP Mode@Accel = General Purpose]*.	0.0 s (0.0 - 6000.0 s)

Set this parameter to 0.0 s to disable this function. The drive will decelerates in the deceleration time applicable at the time when a motor stall occurs.

■ L3-23 CHP Stall P Selection

No. (Hex.)	Name	Description	Default (Range)
L3-23 (04FD)	CHP Stall P Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function to automatically decrease the Stall Prevention Level during Run for constant output ranges.	1 (1, 2)

1 : Level@L3-06

The drive uses the level set in *L3-06 [StallP Level@Run]* through the full speed range.

2 : Automatic Reduction

The drive decreases the Stall Prevention level during run in the constant power range. The lower limit is 40% of the *L3-06* value.

■ L3-24 Acc@Rated Torque

No. (Hex.)	Name	Description	Default (Range)
L3-24 (046E) Expert	Acc@Rated Torque	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the motor acceleration time to reach the maximum frequency at the motor rated torque for stopped single-drive motors.	Determined by o2-04, C6-01, E2-11, and E5-01 (0.001 - 10.000 s)

Set one of these parameters to enable *L3-24*:

- *L2-29 = 2 [KEB Method = Single KEB2 Ride-Thru]*
- *L3-04 = 1 [StallP@Decel Enable = Enabled]* and *L3-50 = 1 [StallP@Decel Mode = Automatic Decel Reduction]*
- *L3-11 = 1 [Overvolt Supression Select = Enabled]*
- *H1-xx = 42 or 43 [DI Function Select = KEB Thru2 NC or KEB Thru2 NO]*

Note:

When Auto-Tuning changes the value of *E2-11 [Motor Rated Power (kW)]*, the drive will automatically set this parameter to the value for a Yaskawa standard motor (4 poles). When you use a PM motor, the drive uses the value in *E5-01 [PM Mot Code Selection]* to change this parameter.

Automatically Adjust Parameters

Execute the Inertia Tuning process when *A1-02 = 3 or 7 [Control Method = CLVector or PM CLVector]*. Parameters are automatically adjusted.

Manually Adjust Parameters

Use this formula to find the motor acceleration time:

$$L3\text{-}24 = \frac{2\pi \cdot J_{Motor} \cdot n_{rated}}{60 \cdot T_{rated}}$$

- J_{Motor} = Moment of inertia of motor (kg m^2)
- n_{rated} = Motor rated speed (min^{-1}, r/min)
- T_{rated} = Motor rated torque (N·m)

The rated torque is calculated using the following expression.

$$T_{rated} = \frac{60 \cdot P_{Motor} \cdot 10^3}{2\pi \cdot n_{rated}}$$

P_{Motor} = Motor Rated Power (kW)

■ L3-25 Load Inertia Ratio

No. (Hex.)	Name	Description	Default (Range)
L3-25 (046F) Expert	Load Inertia Ratio	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the ratio between motor inertia and machine inertia.	1.0 (1.0 - 1000.0)

Set one of these parameters to enable *L3-25*:

- *L2-29 = 2 [KEB Method = Single KEB2 Ride-Thru]*
- *L3-04 = 1 [StallP@Decel Enable = Enabled]* and *L3-50 = 1 [StallP@Decel Mode = Automatic Decel Reduction]*
- *L3-11 = 1 [Overvolt Supression Select = Enabled]*
- *H1-xx = 42 or 43 [DI Function Select = KEB Thru2 NC or KEB Thru2 NO]*

Note:
- If you set this value incorrectly when *L2-29 = 1, H1-xx = 42 or 43*, or *L3-11 = 1*, it can cause large current ripples and *ov [Overvoltage]*, *Uv1 [DC Bus Undervoltage]*, or *oC [Overcurrent]* faults.
- KEB Tuning will automatically set this value.

Automatically Adjust Parameters

Do Inertia Tuning when *A1-02 = 3 or 7 [Control Method = CLVector or PM CLVector]*. The drive will automatically adjust parameters.

Manually Adjust Parameters

Use this formula to find the load inertia ratio:

$$\text{Load inertia ratio} = \frac{\text{Machine inertia (Motor shaft conversion value)}}{\text{Motor inertia}}$$

■ L3-26 DC Bus Capacitors Extension

No. (Hex.)	Name	Description	Default (Range)
L3-26 (0455) Expert	DC Bus Capacitors Extension	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the capacity for external main circuit capacitors. Sets this parameter when you use the KEB Ride-Thru function. Usually it is not necessary to change this setting.	0 µF (0 to 65000 µF)

■ L3-27 StallP Detect Time

No. (Hex.)	Name	Description	Default (Range)
L3-27 (0456)	StallP Detect Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets a delay time between reaching the Stall Prevention level and starting the Stall Prevention function.	50 ms (0 - 5000 ms)

■ L3-34 Torque Lim.Delay Time

No. (Hex.)	Name	Description	Default (Range)
L3-34 (016F) Expert	Torque Lim.Delay Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the filter time constant that returns the torque limit to its initial value when KEB operation operates in Single Drive KEB Ride-Thru mode.	Determined by A1-02 (0.000 - 1.000 s)

When vibration occurs during operation of Single Drive KEB Ride-Thru 2, increase this parameter in 0.010-unit increments.

Note:

The Single Drive KEB Ride-Thru 2 mode operates when *L2-29 = 2 [KEB Method = Single KEB2 Ride-Thru]* and *H1-xx = 42 or 43 [DI Function Selection = KEB Thru2 NC or KEB Thru2 NO]*.

■ L3-35 SpAgree Width@StallP

No. (Hex.)	Name	Description	Default (Range)
L3-35 (0747) Expert	SpAgree Width@StallP	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the width for speed agreement when *L3-04 = 1 [StallP@Decel Enable = Enabled]* and *L3-50 = 1 [StallP@Decel Mode = Automatic Decel Reduction]*. Usually it is not necessary to change this setting.	0.00 Hz (0.00 - 1.00 Hz)

Set this parameter when hunting occurs while you use a frequency reference through an analog input.

■ L3-36 VibSup Gain@Accel

No. (Hex.)	Name	Description	Default (Range)
L3-36 (11D0)	VibSup Gain@Accel	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the gain to suppress current and motor speed hunting during operation when *L3-01 = 4 [StallP Mode@Accel = ILim Mode]*. Usually it is not necessary to change this setting.	Determined by A1-02 (0.0 - 100.0)

If there is vibration in the output current during acceleration, increase the setting value.

Note:

Set *L3-01 = 4 [StallP Mode@Accel = ILim Mode]* to enable this function.

■ L3-37 CurLim ITime@Accel

No. (Hex.)	Name	Description	Default (Range)
L3-37 (11D1) Expert	CurLim ITime@Accel	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Usually it is not necessary to change this setting.	5 ms (0 - 100 ms)

Note:

Set *L3-01 = 3 [StallP Mode@Accel = Intelligent Accel]* to enable this function.

■ L3-38 CurLim PGain@Accel

No. (Hex.)	Name	Description	Default (Range)
L3-38 (11D2) Expert	CurLim PGain@Accel	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Suppresses current hunting and overshooting that occurs when the drive stalls during acceleration. Usually it is not necessary to change this setting.	10.0 (0.0 - 100.0)

Note:

Set *L3-01 = 4 [StallP Mode@Accel = ILim Mode]* to enable this function.

■ L3-39 CurLim Filt@Accel

No. (Hex.)	Name	Description	Default (Range)
L3-39 (11D3)	CurLim Filt@Accel	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the time constant to adjust the acceleration rate when *L3-01 = 4 [StallP Mode@Accel = ILim Mode]*. Usually it is not necessary to change this setting.	100.0 ms (1.0 - 1000.0 ms)

Note:

Set *L3-01 = 4 [StallP Mode@Accel = ILim Mode]* to enable this function.

■ L3-40 CurLim SCurve@Acc/Dec

No. (Hex.)	Name	Description	Default (Range)
L3-40 (11D4)	CurLim SCurve@Acc/Dec	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function to enable and disable the best Jerk Control Settings used for current-limited acceleration.	0 (0, 1)

Makes the best motor acceleration rate for start up. If you set this parameter to *1*, it will make acceleration more stable, but it can also increase the acceleration time to be longer than the set time. If the drive detects *oC [Overcurrent]* faults immediately after acceleration starts, set this parameter.

0 : Disabled

1 : Enabled

Note:

Set *L3-01 = 4 [StallP Mode@Accel = ILim Mode]* to enable this function.

■ L3-50 StallP@Decel Mode

No. (Hex.)	Name	Description	Default (Range)
L3-50 (0458)	StallP@Decel Mode	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the method that the drive will use to prevent overvoltage faults when decelerating.	0 (Determined by A1-02)

Note:

1. To connect a dynamic braking option (braking resistor or braking resistor unit) to the drive, set this parameter to *0 or 3*. Parameter values *1, 2, 4, and 5* will enable Stall Prevention function during deceleration, and the dynamic braking option will not function.
2. The setting range changes when the *A1-02 [Control Method]* value changes:
   - When *A1-02 = 5 [PM OLVector]*, setting range is *0 to 2*
   - When *A1-02 = 6, 7, or 8 [PM AOLVector, PM CLVector, or EZ Vector]*, setting range is *0, 1*.

Stall Prevention during deceleration controls the deceleration as specified by the DC bus voltage and does not let high inertia or fast deceleration cause *ov [Overvoltage]* faults.

0 : General Purpose

The drive decelerates as specified by the deceleration time. When the DC bus voltage is more than the Stall Prevention level, the drive stops deceleration until the DC bus voltage is less than the Stall Prevention Level. The drive then starts to decelerate at the set deceleration time. Frequent use of Stall Prevention will help prevent *ov* faults when the deceleration time is shorter than the drive can usually accept.

Note:

The Decel Stall Prevention function will increase the deceleration time to stop and the deceleration time will be longer than the setting. This function is not applicable for conveyor applications because the precision of the stop position is very important. As an alternative, use a dynamic braking option in these applications.

The input voltage setting of *E1-01 [Input AC Supply Voltage]* sets the DC bus voltage level for Stall Prevention.

Table 12.52 Stall Prevention Level during Deceleration

Drive Input Voltage	Stall Prevention Level during Deceleration
400 V class	754 V

Figure 12.132 shows the Stall Prevention during deceleration function.

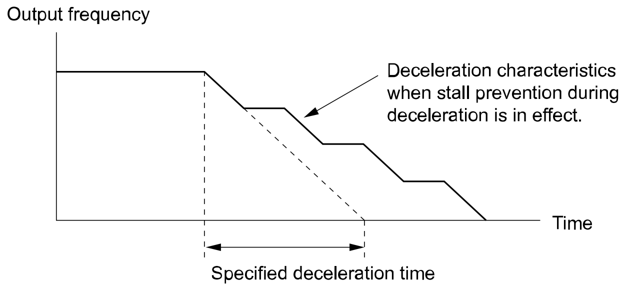


Figure 12.132 Stall Prevention Operation during Deceleration

1 : Automatic Decel Reduction

The drive adjusts the deceleration rate to keep the DC bus voltage at the *L3-17 [DCBus Regul.Level]* level. This makes the shortest possible deceleration time and will not let the motor stall. The drive ignores the selected deceleration time and the possible deceleration time cannot be less than 1/10 of the set deceleration time.

This function uses these parameters to adjust the deceleration rate:

- *L3-20 [DCBus VoltAdj Gain]*
- *L3-21 [OVSup Acc/Dec Gain]*
- *L3-24 [Acc@Rated Torque]*
- *L3-25 [Load Inertia Ratio]*

Note:

The deceleration time is not constant. For applications where the precision of the stop position is very important, use a dynamic braking option and set *L3-04 = 0*. If an *ov* occurs, set *L3-04 = 3*.

2 : Gen Purpose w/ DB Resistor

A braking resistor is necessary for this setting. The braking resistor and the drive work together for the Stall Prevention during deceleration function.

3 : HiFlux Overexcitation

Enables Overexcitation/High Flux and enables a shorter deceleration time than when *L3-04 = 0*.

Note:
- If the overexcitation time is long and you decelerate frequently, the drive can detect *oL1 [Motor Overload]* faults. If the drive detects *oL1*, decrease the deceleration time or install a braking resistor to the drive.
- The deceleration time during Overexcitation Deceleration changes when the motor characteristics and machine inertia change. Adjust the *n3-13 [OverExcBr Gain]* and *n3-23 [OverExcBr Operation]* levels. Refer to "n3: HIGHSLIP/OVEREXCITATION BRAKE" for more information.

4 : HiFlux2 Overexcitation

Enables Overexcitation/High Flux 2. This function decreases the possible deceleration time more than Overexcitation/High Flux.

The drive decreases motor speed and tries to keep the DC bus voltage at the *L3-17* level.

If the drive detects *oL1*, decrease the values set in *n3-13* and *n3-21*. If the drive detects *ov*, increase the values set in *C1-02, C1-04, C1-06, and C1-08 [Decel Time 4]*.

Note:
- During Overexcitation/High Flux 2, the drive disables Hunting Prevention in V/f Control and also disables Speed Control that uses torque limit in OLV Control.
- Refer to "n3: HIGHSLIP/OVEREXCITATION BRAKE" for more information.

■ L3-51 StallP@RUNDecTime

No. (Hex.)	Name	Description	Default (Range)
L3-51 (0459)	StallP@RUNDecTime	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function to enable and disable Stall Prevention During Run.	0 (Determined by A1-02)

0 : Dec Time 1 (C1-02)

1 : Dec Time 2 (C1-04)

◆ L4: SPEED DETECTION

L4 parameters set the output of signals to the MFDO terminals, for example frequency agree and speed detection. The drive detects motor speed in CLV or CLV/PM control methods.

■ L4-01 SpAgree Det.Level

No. (Hex.)	Name	Description	Default (Range)
L4-01 (0499)	SpAgree Det.Level	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the level to detect speed agree or motor speed.	Determined by A1-02 (Determined by A1-02)

Sets the level to detect speed agree or motor speed when *H2-01 to H2-03 = F, 10, 13, 14 [DO Function Select = SpeedAgree1, USpeedAgree1, FreqDetect 1, FreqDetect 2]*.

■ L4-02 SpAgree Det.Width

No. (Hex.)	Name	Description	Default (Range)
L4-02 (049A)	SpAgree Det.Width	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the width to detect speed agree or motor speed.	Determined by A1-02 (Determined by A1-02)

Sets the width to detect speed agree or motor speed when *H2-01 to H2-03 = F, 10, 13, 14 [DO Function Select = SpeedAgree1, USpeedAgree1, FreqDetect 1, FreqDetect 2]*.

■ L4-03 SpAgree Det.Level(+/-)

No. (Hex.)	Name	Description	Default (Range)
L4-03 (049B)	SpAgree Det.Level(+/-)	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the level to detect speed agree or motor speed.	Determined by A1-02 (Determined by A1-02)

Sets the level to detect speed agree or motor speed when *H2-01 to H2-03 = 11, 12, 15, 16 [DO Function Select = SpeedAgree2, USpeedAgree2, FreqDetect 3, FreqDetect 4]*.

■ L4-04 SpAgree Det.Width(+/-)

No. (Hex.)	Name	Description	Default (Range)
L4-04 (049C)	SpAgree Det.Width(+/-)	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the width to detect speed agree or motor speed.	Determined by A1-02 (Determined by A1-02)

Sets the width to detect speed agree or motor speed when *H2-01 to H2-03 = 11, 12, 15, 16 [DO Function Select = SpeedAgree2, USpeedAgree2, FreqDetect 3, FreqDetect 4]*.

■ L4-05 FrefLoss Det.Selection

No. (Hex.)	Name	Description	Default (Range)
L4-05 (049D)	FrefLoss Det.Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the operation when the drive detects a loss of frequency reference.	1 (1, 2)

Enables the detection of a loss of an analog frequency reference when the frequency reference is input from the MFAI terminals (AI1, AI2, and AI3). Set *H2-01 to H2-03 = 4B [DO Function Select = FreqRef Loss]* to enable this function.

If the frequency reference is less than 10% in 400 ms, the drive detects frequency reference loss.

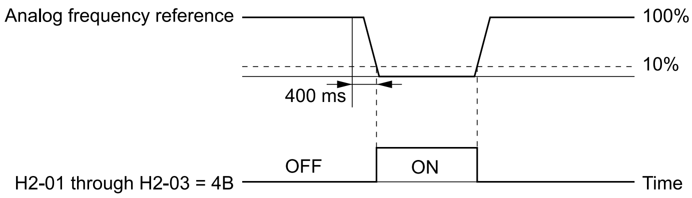


Figure 12.133 Detection of Frequency Reference Loss

1 : Stop

The drive follows the frequency reference and stops the motor.

2 : Run@L4-06PrevRef

The drive continues to operate at the frequency reference value set in *L4-06 [Freq.Ref@RefLoss]*. When you return the external frequency reference value, the drive continues to operate with the frequency reference.

■ L4-06 Freq.Ref@RefLoss

No. (Hex.)	Name	Description	Default (Range)
L4-06 (04C2)	Freq.Ref@RefLoss	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the frequency reference as a percentage to continue drive operation after it detects a frequency reference loss. The value is a percentage of the frequency reference before the drive detected the loss.	80.0% (0.0 - 100.0%)

Set *L4-05 = 2 [FrefLoss Det.Selection = Run@L4-06PrevRef]* to enable this parameter.

■ L4-07 SpAgree Det.Selection

No. (Hex.)	Name	Description	Default (Range)
L4-07 (0470)	SpAgree Det.Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the condition that activates speed detection.	1 (1, 2)

1 : No Detect@BB

Detects the frequency while the drive is operating. When the drive turns off its output, it will not detect frequency.

2 : Always Detect

◆ L5: FAULT RESTART

The Auto Restart function tries to keep machines operating when the drive detects a transient fault.

The drive can do a self-diagnostic check and continue the operation after a fault has occurred. If the cause of the fault goes away, the drive does speed search and restarts. It will not stop and the drive will not record a fault history. Use *L5-02 [Fault@Reset Select]* to select the operation of fault relay signals during Auto Restart operation.

Sets if the drive will do Auto Restart and the number of times the drive will try to do Auto Restart in a set time. If the number of Auto Restart tries is more than the set value during the set time, drive output shuts off and operation stops. If this happens, remove the cause of the fault and manually restart the drive.

DANGER! *Sudden Movement Hazard. Failure to obey can cause death or serious injury. Do not use the fault restart function in hoist or lifting applications.*

The drive can do Auto Restart when these faults occur:

Note:

You can disable Auto Restart for faults if you must not restart the machine after the fault.

Table 12.53 List of Faults during which Auto Restart is Available

Fault	Name	Parameters to Disable Auto Restart
GF	Ground Fault	L5-08
LF	Output Phase Loss	-
oC	Overcurrent	-
oH1	Heatsink Overheat	L5-08
oL1	Motor Overload	L5-07
oL2	Drive Overload	L5-07
oL3	Overtorque Detection 1	L5-07
oL4	Overtorque Detection 2	L5-07
ov	Overvoltage	L5-08
PF	Input Phase Loss	-
rH	Braking Resistor Overheat	-
rr	Dynamic Braking Transistor Fault	-
STPo	Motor Step-Out Detected	-
Uv1	DC Bus Undervoltage *1	L5-08

*1 *Uv1* is the target for the auto restart process when *L2-01 = 1 [RideThru@PwrLoss = Enabled], and L2-50 = 0, 1, 2, 3 [RidThruMode@PwrLoss = Timer Controlled, While CPU Active, KEB Mode, KEB Stop Mode]*.

■ L5-01 Auto-Reset Attempts

No. (Hex.)	Name	Description	Default (Range)
L5-01 (049E)	Auto-Reset Attempts	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the number of times that the drive will try to restart.	0 (0 - 10 times)

The drive resets the number of Auto Restart attempts to 0 in these conditions:

- The drive operates correctly for 10 minutes after a fault restart.

- When you manually clear a fault after the drive triggers protective functions.
- When you re-energize the drive.

■ L5-02 Fault@Reset Select

No. (Hex.)	Name	Description	Default (Range)
L5-02 (049F)	Fault@Reset Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function that sends signals to the MFDO terminal set for *Fault [H2-xx = 3]* while the drive is automatically restarting.	1 (1, 2)

1 : Disable Fault Output

2 : Enable Fault Output

■ L5-04 Interval Reset Time

No. (Hex.)	Name	Description	Default (Range)
L5-04 (046C)	Interval Reset Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the time interval between each Auto Restart attempt. Set *L5-05 = 1 [Reset Method = Continuous]* to enable this function.	10.0 s (0.5 - 600.0 s)

■ L5-05 Reset Method

No. (Hex.)	Name	Description	Default (Range)
L5-05 (0467)	Reset Method	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the count method for the Auto Restart operation.	1 (1, 2)

1 : Continuous

Counts the number of successful fault resets through Auto Restart.

When this value > *L5-01*, the drive will send a fault signal and fault code to the keypad and the motor will coast to stop.

2 : Use L5-04 Time

Counts the number of successful and unsuccessful fault resets through Auto Restart. The drive does the Auto Restart process again in the intervals set in *L5-04 [Interval Reset Time]*.

When this value > *L5-01*, the drive will send a fault signal and fault code to the keypad and the motor will coast to stop.

■ L5-07 OL1-4 Auto-Reset Select

No. (Hex.)	Name	Description	Default (Range)
L5-07 (0B2A)	OL1-4 Auto-Reset Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Use these 4 digits to set the Auto Restart function for *oL1* to *oL4*. From left to right, the digits set *oL1*, *oL2*, *oL3*, and *oL4*, in order.	1111 (0000 - 1111)

0 : Disabled

1 : Enabled(—/—/—/oL4)

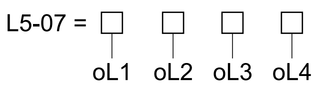


Figure 12.134 Setting Digits and Fault Code

■ L5-08 U/OV,OH,GF A-Reset Select

No. (Hex.)	Name	Description	Default (Range)
L5-08 (0B2B)	U/OV,OH,GF A-Reset Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Use these 4 digits to set the Auto Restart function for *Uv1*, *ov*, *oH1*, and *GF*. From left to right, the digits set *Uv1*, *ov*, *oH1*, and *GF*, in order.	1111 (0000 - 1111)

0 : Disabled

1 : Enabled(—/–/—/GF)

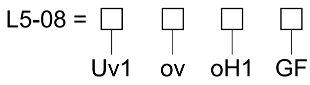


Figure 12.135 Setting Digits and Fault Code

◆ L6: TORQUE DETECTION

The overtorque/undertorque detection function prevents damage to machinery and loads.

Overtorque is the when there is too much load on the machine. If the motor current or output torque is at the overtorque detection level for the overtorque detection time, the drive will output an alarm and turn off the output.

Undertorque is the when a load suddenly decreases. When the motor current or output torque is at the undertorque detection level for the undertorque detection time, the drive will output an alarm and turn off the output.

You can use the undertorque detection function to detect these conditions, for example:

- Machine belt cuts
- Unusual operation of the electromagnetic contactor on the drive output side
- Clogged output side air filters in fans and blowers
- Damage to blade tips and broken string

Note:

If there is *oC [Overcurrent]* or *oL1 [Motor Overload]*, the drive can stop during overtorque conditions. Use torque detection to identify overload conditions before the drive detects *oC* or *oL1* and stops. Use this function to detect issues that occur in the application.

■ Parameter Settings

You can individually set the two overtorque/undertorque detection functions with the drive. Use the information in Table 12.54 to set the parameters.

Table 12.54 Overtorque/Undertorque Detection Parameters

Configuration Parameter	Overtorque/Undertorque Detection 1	Overtorque/Undertorque Detection 2
DO Function Select • Terminals 2NO-2CM • Terminals 3CO-3CM • Terminals 4NO-4CM	H2-01, H2-02, and H2-03 = 32 N.O.: Activated when detected	H2-01, H2-02, and H2-03 = 37 N.O.: Activated when detected
	H2-01, H2-02, and H2-03 = 33 N.C.: Disactivated when detected	H2-01, H2-02, and H2-03 = 38 N.C.: Disactivated when detected
Detection conditions and selection of operation after detection	L6-01	L6-04
Detection Level	L6-02	L6-05
	Analog Input Terminal *1 H3-xx = E	-
Detection Time	L6-03	L6-06

*1 An analog input terminal can also supply the torque detection level. Set *H3-xx = E [AI Function Select = OvUntrq Level]* to enable this function. If *L6-02 and H3-xx = E*, the analog input is more important, and the drive disables *L6-02*.

You cannot use Overtorque/Undertorque Detection 2 to set the detection level for the analog input terminals.

Note:

In V/f Control, the drive uses the current level (100% of the drive rated output current) to detect overtorque/undertorque. In vector control, the drive uses the motor torque (100% of the motor rated torque)to detect overtorque/undertorque. When you enable the mechanical weakening detection function, the overtorque/undertorque detection level for all control modes is the current level (100% of the drive rated output current).

■ Time Chart for Detection of Overtorque/Undertorque

Overtorque Detection Time Chart

When you use Overtorque/Undertorque Detection 1, the drive detects overtorque if the motor current or motor torque is at the detection level set in *L6-02 [Trq Det1 Level]* for the set in *L6-03 [Trq Det1 Time]*. Parameter *L6-01 [Trq Det1 Select]* sets the operation after detection.

When you use Overtorque/Undertorque Detection 2, seet *L6-05 [Trq Det2 Level]*, *L6-06 [Trq Det2 Time]*, and *L6-04 [Trq Det2 Select]*.

Set the terminal that outputs the alarm in *H2-01 to H2-03 [DO Function Select]*.

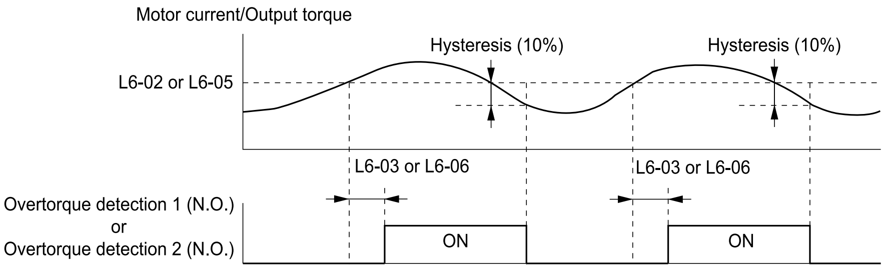


Figure 12.136 Overtorque Detection Time Chart

Note:

The drive applies a hysteresis of approximately 10% of the drive rated output current or the motor rated torque to the overtorque/ undertorque detection function.

Undertorque Detection Time Chart

When you use Overtorque/Undertorque Detection 1, the drive detects undertorque if the motor current or motor torque is less than or equal to the detection level set in *L6-02* for the time set in *L6-03*.

Parameter *L6-01* sets the operation after detection. When you use Overtorque/Undertorque Detection 2, set the operation in *L6-05*, *L6-06*, and *L6-04*.

Set the terminal that outputs an alarm in *H2-01 to H2-03*.

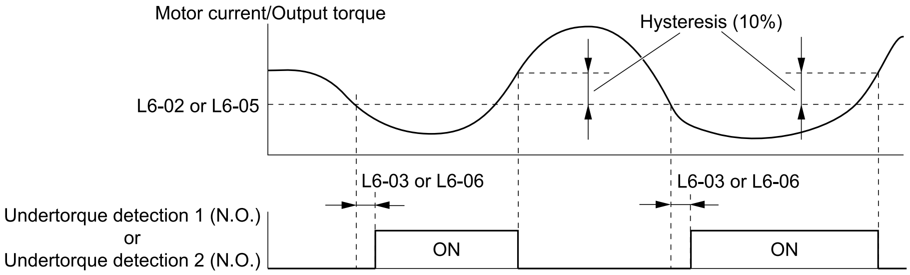


Figure 12.137 Undertorque Detection Time Chart

Note:

The drive applies a hysteresis of approximately 10% of the drive rated output current or the motor rated torque to the overtorque/ undertorque detection function.

■ Mechanical Weakening Detection

The Mechanical Weakening Detection function detects the mechanical weakening of a machine that can cause overtorque or undertorque because of motor speed and total drive operation time.

The drive activates the function if the drive total operation time is longer than the time set in *L6-11 [MechFatigue Hold Off Time]*. You can use *U4-01 [Cumulative OpeTime]* to monitor the total operation time.

Parameter Settings

The drive detects Mechanical Weakening if overtorque or undertorque occur during the speed range set in *L6-08 [MechF Enable]* and *L6-09 [MechFatigue Speed Detect Level]* for the length of time set in *L6-10 [MechFatigue Delay Time]*. The drive uses *L6-01 to L6-03 [Trq Det1 Select to Trq Det1 Time]* to detect *oL5 [Mechanical Weakening Detection 1]* or *UL5 [Mechanical Weakening Detection 2]*. Parameter *L6-08* sets the operation after detection.

Set the terminal that outputs the fault in *H2-01 to H2-03 [DO Function Select]*.

Table 12.55 Mechanical Weakening Detection Settings Parameters

Configuration Parameter		Mechanical Deterioration Detection
DO Function Select • Terminals 2NO-2CM • Terminals 3NO-3CM • Terminals 4NO-4CM		H2-01, H2-02, and H2-03 = 66
Operation Selection after Detection		L6-08
Detection Start Time		L6-11
Speed Range	Detection Criteria	L6-08
	Detection Level	L6-09
	Detection Time	L6-10

Configuration Parameter		Mechanical Deterioration Detection
Overtorque	Detection Criteria	L6-01
	Detection Level	L6-02
	Detection Time	L6-03

■ L6-01 Trq Det1 Select

No. (Hex.)	Name	Description	Default (Range)
L6-01 (04A1)	Trq Det1 Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Enables overtorque and undertorque detection and the operation of drives (operation status) after detection.	0 (0, 1)

The drive detects overtorque if the motor current or output torque is more than the level set in *L6-02 [Trq Det1 Level]* for the length of time set in *L6-03 [Trq Det1 Time]*. The drive detects undertorque if the motor current or output torque is less than the level set in *L6-02* for the length the time set in *L6-03*.

0 : Disabled

1 : Enabled

The behavior is adjusted using parameters *L6-50 [Trq Det1 Type]*, *L6-51 [Trq Det1 Action]*, and *L6-52 [Trq Det1 Condition]*.

■ L6-02 Trq Det1 Level

No. (Hex.)	Name	Description	Default (Range)
L6-02 (04A2)	Trq Det1 Level	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the detection level for Overtorque/Undertorque Detection 1. In V/f control, drive rated output current = 100% value. In vector control, motor rated torque = 100% value.	150% (0 - 300%)

Note:
- Set the torque detection level as a percentage of the drive rated output current in all control methods to set the mechanical weakening detection level.
- You can also use an analog input terminal to supply the torque detection level. To enable this function, set *H3-xx = E [AI Function Select = OvUntrq Level]*. If you set *L6-02* and *H3-x = E*, the analog input is most important and the drive disables *L6-02*.

■ L6-03 Trq Det1 Time

No. (Hex.)	Name	Description	Default (Range)
L6-03 (04A3)	Trq Det1 Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the detection time for Overtorque/Undertorque Detection 1.	0.1 s (0.0 - 10.0 s)

■ L6-04 Trq Det2 Select

No. (Hex.)	Name	Description	Default (Range)
L6-04 (04A4)	Trq Det2 Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the speed range that detects overtorque and undertorque and the operation of drives (operation status) after detection.	0 (0, 1)

The drive detects overtorque if the motor current or output torque is more than the level set in *L6-05 [Trq Det2 Level]* for the length of time set in *L6-06 [Trq Det2 Time]*. The drive detects undertorque if the motor current or output torque is less than the level set in *L6-05* for the length the time set in *L6-06*. Adjust the conditions using parameters *L6-53, L6-54, and L6-55 [Trq Det2 Type, Trq Det2 Action, and Trq Det2 Condition]*.

0 : Disabled

1 : Enabled

■ L6-05 Trq Det2 Level

No. (Hex.)	Name	Description	Default (Range)
L6-05 (04A5)	Trq Det2 Level	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the detection level for Overtorque/Undertorque Detection 2. In V/f control, drive rated output current = 100% value. In vector control, motor rated torque = 100% value.	150% (0 - 300%)

Note:

Overtorque/Undertorque Detection 2 cannot set the detection level for the analog input terminal.

■ L6-06 Trq Det2 Time

No. (Hex.)	Name	Description	Default (Range)
L6-06 (04A6)	Trq Det2 Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the detection time for Overtorque/Undertorque Detection 2.	0.1 s (0.0 - 10.0 s)

■ L6-07 Trq Detect Filter Time

No. (Hex.)	Name	Description	Default (Range)
L6-07 (04E5)	Trq Detect Filter Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the time constant for a primary filter to the torque reference or to the output current used to detect overtorque/undertorque.	0 ms (0 - 1000 ms)

■ L6-08: Mechanical Fatigue Detect Select

No. (Hex.)	Name	Description	Default (Range)
L6-08 (0468)	MechF Enable	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the speed where the drive detects mechanical deterioration and how the drive operates (operation status) after detection.	0 (0, 1)

The drive detects mechanical weakening through overtorque or undertorque as specified by the conditions set in *L6-08 to L6-11 [MechFatigue Hold Off Time], and L6-56 to L6-58 [MechF Action to MechF Method]*. Set overtorque/undertorque detection conditions in *L6-01 to L6-03 [Trq Det1 Select to Trq Det1 Time]*. The drive disables the operation selection set in *L6-01 [Trq Det1 Select]*.

0 : Disabled

The drive does not detect mechanical weakening.

1 : Enabled

The drive detects mechanical weakening. Use parameters *L6-56 [MechF Action]*, *L6-57 [MechF AbsSpeed]*, and *L6-58 [MechF Method]* to adjust the conditions.

■ L6-09 MechFatigue Speed Detect Level

No. (Hex.)	Name	Description	Default (Range)
L6-09 (0469)	MechFatigue Speed Detect Level	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the speed level as a percentage where the drive will operate the mechanical deterioration detection function, with *E1-04 [Max Output Frequency]* is the 100% value.	110.0% (-110.0 - +110.0%)

Parameters *L6-01 to L6-03 [Trq Det1 Select to Trq Det1 Time]* set the overtorque/undertorque detection conditions.

When *L6-08 = 2, 4, 6, 8 [MechF Enable = Speed : unsigned]*, the setting value of *L6-09* is the absolute value. When *L6-09* is set to a negative number, the drive processes this value as a positive number.

■ L6-10 MechFatigue Delay Time

No. (Hex.)	Name	Description	Default (Range)
L6-10 (046A)	MechFatigue Delay Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the time for mechanical deterioration detection.	0.1 s (0.0 - 10.0 s)

When the detection conditions set in *L6-08 [MechF Enable]* continue for the time set in *L6-10*, the drive will detect mechanical weakening.

■ L6-11 MechFatigue Hold Off Time

No. (Hex.)	Name	Description	Default (Range)
L6-11 (046B)	MechFatigue Hold Off Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the time that the drive will start mechanical deterioration detection triggered by the cumulative operation time of the drive.	0 h (0 - 65535 h)

When the total operation time of the drive is more than the value set in *L6-11*, the drive will detect mechanical weakening. Use *U4-01 [Cumulative OpeTime]* to monitor the drive total operation time.

■ L6-50 Trq Det1 Type

No. (Hex.)	Name	Description	Default (Range)
L6-50 (04CC)	Trq Det1 Type	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the speed range that detects overtorque and undertorque.	0 (0, 1)

■ L6-51 Trq Det1 Action

No. (Hex.)	Name	Description	Default (Range)
L6-51 (04CD)	Trq Det1 Action	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets operation of drives (operation status) after detection.	0 (0, 1)

■ L6-52 Trq Det1 Condition

No. (Hex.)	Name	Description	Default (Range)
L6-52 (04CE)	Trq Det1 Condition	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets operation of drives (operation status) after detection.	0 (0, 1)

■ L6-53 Trq Det2 Type

No. (Hex.)	Name	Description	Default (Range)
L6-53 (04CF)	Trq Det2 Type	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the speed range that detects overtorque and undertorque.	0 (0, 1)

■ L6-54 Trq Det2 Action

No. (Hex.)	Name	Description	Default (Range)
L6-54 (04D0)	Trq Det2 Action	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets operation of drives (operation status) after detection.	0 (0, 1)

■ L6-55 Trq Det2 Condition

No. (Hex.)	Name	Description	Default (Range)
L6-55 (04D1)	Trq Det2 Condition	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets operation of drives (operation status) after detection.	0 (0, 1)

■ L6-56 MechF Action

No. (Hex.)	Name	Description	Default (Range)
L6-56 (04D2)	MechF Action	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the speed where the drive detects mechanical deterioration and how the drive operates (operation status) after detection. Only available when *L6-08 = 1 [MechF Enable = Enabled]*.	0 (0, 1)

■ L6-57 MechF AbsSpeed

No. (Hex.)	Name	Description	Default (Range)
L6-57 (04D3)	MechF AbsSpeed	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the speed where the drive detects mechanical deterioration and how the drive operates (operation status) after detection. Only available when *L6-08 = 1 [MechF Enable = Enabled]*.	0 (0, 1)

L6-58 MechF Method

No. (Hex.)	Name	Description	Default (Range)
L6-58 (04D4)	MechF Method	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the speed where the drive detects mechanical deterioration and how the drive operates (operation status) after detection. Only available when *L6-08 = 1 [MechF Enable = Enabled]*. Use parameter L6-57 [MechF AbsSpeed] to either use absolute speed or signed speed value.	0 (0, 1)

L7: TORQUE LIMIT

The torque limit function limits the internal torque reference for the drive to limit the quantity of torque generated by the motor to a constant quantity This function keeps the torque applied to loads and regenerative torque less than a set quantity. This function also prevents damage to machinery and increases the reliability of continuous operation. You can set torque limits individually for the four quadrants, which include torque direction (motoring/ regeneration) and direction of motor rotation (forward/reverse). When the torque reference value is at the set torque limit, the MFDO terminal set for During Torque Limit *[H2-xx = 30]* activates.

Note:
- The drive output current limits maximum output torque. The drive limits torque to 150% of the rated output current for Heavy Duty Rating (HD) and to 120% of the rated output current for Normal Duty Rating (ND). The actual output torque is not more than the limits of the drive rated output current when you set the torque limit to a high value.
- When you use torque limits for lifting applications, do not lower the torque limit value too much. When the torque limit function is triggered, falls and rollbacks can occur because of sudden acceleration stops and stalls of the motor.

Configuring Settings

Use one of these methods to set torque limits:

- Use *L7-01* to *L7-04 [FW Torque Limit to RV Reg. TrqLimit]* to individually set the four torque limit quadrants.
- Use MFAI to individually set the four torque limit quadrants. Set *H3-02, H3-06, H3-10 = 9, B, C [AI Function Select = FW Trq Lim, Rev Trq Lim, RegenTrqLim]*.
- Use MFAI to set all four torque limit quadrants together. Set *H3-02, H3-06, H3-10 = D [GenerTrqLim]*.
- Use a communication option to set all four torque limit quadrants together.

Figure 12.138 shows the configuration method for each quadrant.

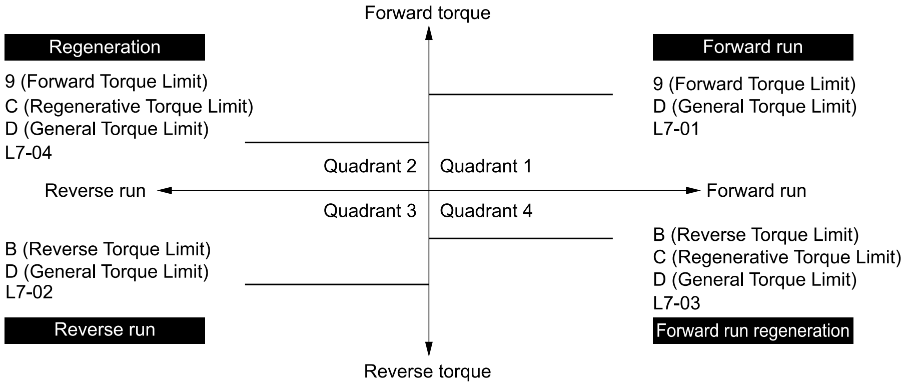


Figure 12.138 Torque Limits and Analog Input Setting Parameters

Note:

When *L7-01 to L7-04* and analog inputs or communication option torque limits set torque limits for the same quadrant, the lower value is enabled.

In this example of parameter settings, the torque limit for quadrant 1 is 130% and the torque limit for quadrants 2, 3, and 4 is 150%.

Settings: *L7-01* = 130%, *L7-02, L7-03, L7-04* = 200%, MFAI torque limit = 150%

L7-01 FW Torque Limit

No. (Hex.)	Name	Description	Default (Range)
L7-01 (04A7) RUN	FW Torque Limit	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the torque limit value for forward motoring as a percentage, where motor rated torque is the 100% value.	200% (0 - 300%)

Note:
- The lower torque limit is enabled when you set the torque limit by the following method.
  - Set *H3-02*, *H3-06*, or *H3-10 = 9, D [AI Function Select = FW Trq Lim, GenerTrqLim]*.
  - Use a communication option to set the torque limits
- You must think about drive capacity when a large quantity of torque is necessary. If you set the value too high, the drive can detect *oC [Overcurrent]*.
- If you set the value too low with large loads, the motor can stall.

■ L7-02 RV Torque Limit

No. (Hex.)	Name	Description	Default (Range)
L7-02 (04A8) RUN	RV Torque Limit	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the torque limit value for reversed motoring as a percentage, where motor rated torque is the 100% value.	200% (0 - 300%)

Note:
- The lower torque limit is enabled when you set the torque limit by the following method.
  - Set *H3-02*, *H3-06*, or *H3-10 = 9, D [AI Function Select = FW Trq Lim, GenerTrqLim]*.
  - Use a communication option to set the torque limits
- You must think about drive capacity when a large quantity of torque is necessary. If you set the value too high, the drive can detect *oC [Overcurrent]*.
- If you set the value too low with large loads, the motor can stall.

■ L7-03 FW Reg. TrqLimit

No. (Hex.)	Name	Description	Default (Range)
L7-03 (04A9) RUN	FW Reg. TrqLimit	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the torque limit value for forward regenerative conditions as a percentage of the motor rated torque.	200% (0 - 300%)

Note:
- The lower torque limit is enabled when you set the torque limit by the following method.
  - Set *H3-02*, *H3-06*, or *H3-10 = 9, D [AI Function Select = FW Trq Lim, GenerTrqLim]*.
  - Use a communication option to set the torque limits
- You must think about drive capacity when a large quantity of torque is necessary. If you set the value too high, the drive can detect *oC [Overcurrent]*.
- If you set the value too low with large loads, the motor can stall.

■ L7-04 RV Reg. TrqLimit

No. (Hex.)	Name	Description	Default (Range)
L7-04 (04AA) RUN	RV Reg. TrqLimit	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the torque limit value for reversed regenerative conditions as a percentage of the motor rated torque.	200% (0 - 300%)

Note:
- The lower torque limit is enabled when you set the torque limit by the following method.
  - Set *H3-02*, *H3-06*, or *H3-10 = 9, D [AI Function Select = FW Trq Lim, GenerTrqLim]*.
  - Use a communication option to set the torque limits
- You must think about drive capacity when a large quantity of torque is necessary. If you set the value too high, the drive can detect *oC [Overcurrent]*.
- If you set the value too low with large loads, the motor can stall.

■ L7-06 TrqLimit Integral Time

No. (Hex.)	Name	Description	Default (Range)
L7-06 (04AC)	TrqLimit Integral Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the integral time constant for the torque limit function.	200 ms (5 - 10000 ms)

Decrease the setting value to increase torque limit responsiveness when you use torque limits and *L7-07 = 1 [TrqLimit@Acc/Decel = P-ctrl@Ac/Dec]*.

If there is hunting when torque limits are active, increase the setting value.

■ L7-07 TrqLimit@Acc/Decel

No. (Hex.)	Name	Description	Default (Range)
L7-07 (04C9)	TrqLimit@Acc/Decel	V/f CL-V/f **OLV** CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the torque limit function during acceleration and deceleration.	1 (1, 2)

1 : P-ctrl@Ac/Dec

The torque limit function works with proportional control during acceleration and deceleration, and switches to integral control at constant speed. Use this setting when acceleration and deceleration to the correct speed is more important than the torque limit during speed changes.

2 : I-ctrl@Ac/Dec

The torque limit function always uses integral control. Use this setting when a very accurate torque limit is necessary during speed changes, for example in winding machine applications.

If you make the torque limit the most important, it can:

- Increase the acceleration and deceleration times.
- Not let the motor speed reach the frequency reference value during run at constant speed.

■ L7-16 TrqLimit@Start

No. (Hex.)	Name	Description	Default (Range)
L7-16 (044D)	TrqLimit@Start	V/f CL-V/f **OLV** **CLV** **AOLV** OLV/PM **AOLV/PM** **CLV/PM** **EZOLV** Assigns a time filter to allow the torque limit to build at start.	1 (0, 1)

0 : Disabled

There is torque limit at start without a delay time.

Use this setting to maximize the response time when sudden acceleration or deceleration at start is necessary.

1 : Enabled

There is a delay time of 64 ms at start to build the torque limit.

■ L7-35 LowF Reg.TrqLimit Lvl

No. (Hex.)	Name	Description	Default (Range)
L7-35 (1B57) Expert	LowF Reg.TrqLimit Lvl	V/f CL-V/f OLV CLV **AOLV** OLV/PM AOLV/PM CLV/PM EZOLV Sets the torque limit used during low-speed regeneration. Usually it is not necessary to change this setting.	50.00% (0.00 - 200.00%)

Decreases the regenerative torque limit to the level set in *L7-35* when you use a low frequency and the output frequency is less than *L7-36 [Reg.TrqLimit Derate Freq]*. The drive does not decrease torque limits during ramp to stop operation. If the drive detects *oC [Overcurrent]* when you input a regenerative load and the speed reference is constant, decrease this parameter.

Note:
- If the drive detects faults during regenerative loads at low speed, decrease this parameter in 10.00% increments and decrease the setting of *L7-36* in 2.00 Hz increments.
- Setting values that are too high can cause faults.
- If you set this parameter > *L7-03 [FW Reg. TrqLimit]* or *L7-04 [RV Reg. TrqLimit]*, the torque limit reduction function will not operate.
- If you input a regenerative load at low speeds and set this parameter to a small value, it can cause the motor to rotate faster than the speed reference.

■ L7-36 Reg.TrqLimit Derate Freq

No. (Hex.)	Name	Description	Default (Range)
L7-36 (1B58) Expert	Reg.TrqLimit Derate Freq	V/f CL-V/f OLV CLV **AOLV** OLV/PM AOLV/PM CLV/PM EZOLV Sets the frequency width at which *L7-35 [LowF Reg.TrqLimit Lvl]* operates.	6.00 Hz (0.00 - 30.00 Hz)

If the drive detects *oC [Overcurrent]* faults when you connect regenerative loads at low speed, increase the setting value. Decreases the torque limit as specified by the setting of *L7-35* in a range of 0 ≤ output frequency < *L7-36*. When the torque limit gradually changes as specified by the output frequency until the output frequency = *L7-36*, the value changes to the settings of *L7-03 [FW Reg. TrqLimit]* and *L7-04 [RV Reg. TrqLimit]*.

Note:

If you input a regenerative load at low speeds and set this parameter to a large value, it can cause the motor to rotate faster than the speed reference. Do not set the value higher than necessary.

◆ L8: DRIVE PROTECTION

L8 parameters set protective functions that prevent faults such as overheating, phase loss, and ground faults.

■ L8-01 3%ERF DBR Protection

No. (Hex.)	Name	Description	Default (Range)
L8-01 (04AD)	3%ERF DBR Protection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function to enable braking resistor protection with a Yaskawa ERF series braking resistor (3% ED) installed on the heatsink.	0 (0, 1)

0 : Disabled

Disables braking resistor protection. Use this setting for dynamic braking options that are not Yaskawa ERF series braking resistors.

1 : Enabled

Enables protection for Yaskawa ERF series braking resistors.

Note:

Set *L8-01 = 1* and *H2-01 to H2-03 = 4C [DO Function Select = BrkRes Fault]*. Use a sequence to turn OFF power with MFDO.

■ L8-02 Overheat Alm Level

No. (Hex.)	Name	Description	Default (Range)
L8-02 (04AE)	Overheat Alm Level	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the *oH* detection level.	Determined by o2-04 and C6-01 (50 - 150 °C)

If the heatsink temperature is more than the temperature set in this parameter, the drive detects an overheat pre-alarm. To enable this function, set one of *H2-01* to *H2-03 [DO Function Select]* to *4E [Drive PreOH]*.

If the temperature increases to the overheat fault level, the drive will trigger an *oH1 [Heatsink Overheat]* fault and stop operation.

■ L8-03 Overheat Pre-Alarm Selection

No. (Hex.)	Name	Description	Default (Range)
L8-03 (04AF)	Overheat Pre-Alarm Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets operation after the drive detects an *oH* alarm.	3 (0 - 4)

0 : Ramp->Stop

The drive ramps to stop in the selected deceleration time. Fault relay output terminal 1NO-1CM will activate, and 1NC-1CM will deactivate.

1 : Coast->Stop

The drive output shuts off and the motor coasts to stop. Fault relay output terminal 1NO-1CM will activate, and 1NC-1CM will deactivate.

2 : Fast Stop (C1-09)

The drive uses the deceleration time set in *C1-09 [Fast Stop Time]* to stop the motor. Fault relay output terminal 1NO-1CM will activate, and 1NC-1CM will deactivate.

3 : Alarm Only

oH is shown on the keypad and operation continues. The output terminal set for *Alarm [H2-01 to H2-03 = 4]* activates.

4 : Run@L8-19 Rate

The drive decelerates to the level set in *L8-19 [Frq Reduct@oHPre-Alarm]* and continues operation. *oH* flashes on the keypad.

If the *oH* alarm continues for 10 seconds, the drive decelerates again. When the alarm is output, the drive decelerates each 10 seconds. If the drive decelerates 10 times and the alarm continues to be output, the output terminal set for *oH Pre-Alarm Reduction Limit [H2-01 to H2-03 = 4F]* activates. When the alarm is not output during deceleration, the drive accelerates until it is at the frequency reference that was applicable before the alarm was turned off. Figure 12.139 shows the output of the alarm and the drive operation at a decreased output frequency.

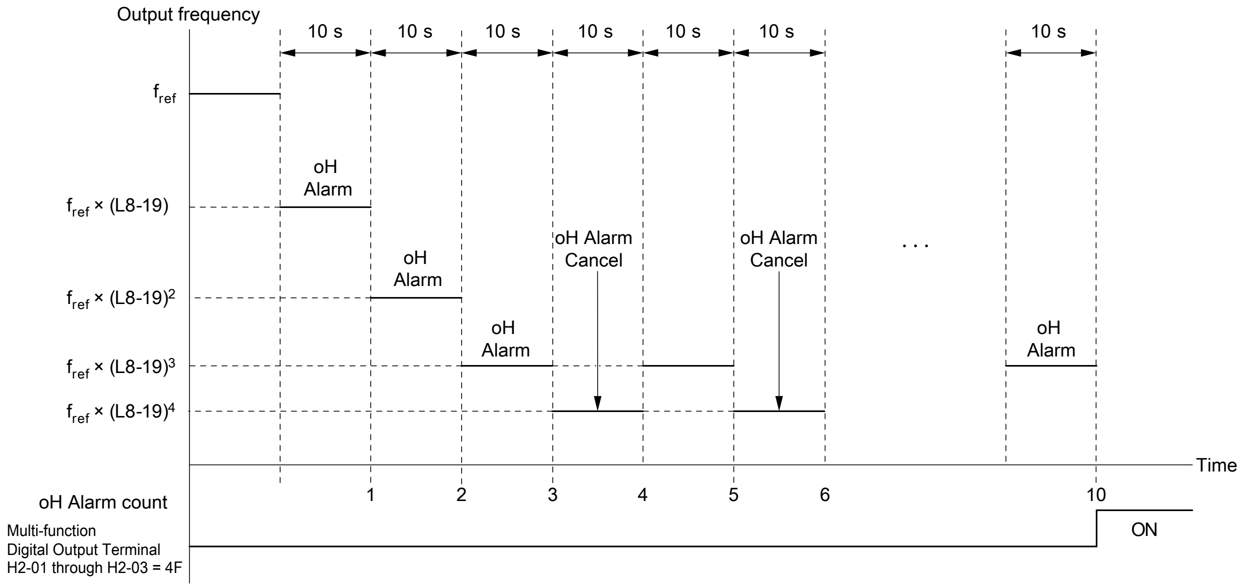


Figure 12.139 Drive Operation at a Decreased Output Frequency when the Overheat Alarm is Output

■ L8-05 In PhaseLoss Selection

No. (Hex.)	Name	Description	Default (Range)
L8-05 (04B1)	In PhaseLoss Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function to enable and disable input phase loss detection.	1 (0, 1)

0 : Disabled

1 : Enabled

The drive measures ripples in DC bus voltage to detect input phase loss.

The drive detects phase loss when power supply phase loss occurs or the main circuit capacitor becomes unusable, which causes *PF [Input Phase Loss]* to show on the keypad.

Disable the detection of the input power supply phase loss function in these conditions:

- During deceleration
- The run command is not input
- The output current is less than 30% of the drive rated current.

■ L8-07 Out PhaseLoss Selection

No. (Hex.)	Name	Description	Default (Range)
L8-07 (04B3)	Out PhaseLoss Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function to enable and disable output phase loss detection. The drive starts output phase loss detection when the output current decreases to less than 5% of the drive rated current.	0 (0 - 2)

Note:

The drive can incorrectly start output phase loss detection in these conditions:

- The motor rated current is very small compared to the drive rating.
- The drive is operating a PM motor with a small load.

0 : Disabled

1 : 1PH Loss Det

If the drive loses one output phase, it will trigger *LF [Output Phase Loss]*.

The output turns off and the motor coasts to stop.

2 : 2/3PH Loss Det

If the drive loses more than one output phase, it will trigger *LF [Output Phase Loss]*.

The output turns off and the motor coasts to stop.

■ L8-09 Ground Fault Selection

No. (Hex.)	Name	Description	Default (Range)
L8-09 (04B5)	Ground Fault Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function to enable and disable ground fault protection.	Determined by o2-04 (0, 1)

0 : Disabled

The drive will not detect ground faults.

1 : Enabled

If there is high leakage current or a ground short circuit in one or two output phases, the drive will detect *GF [Ground Fault]*.

Note:

If the ground path impedance is low, *oC [Overcurrent]*, *SC [Out Short Circuit or IGBT Fault]*, or *ov [DC Bus Overvoltage]* can stop the motor.

■ L8-10 Fan Operate Selection

No. (Hex.)	Name	Description	Default (Range)
L8-10 (04B6)	Fan Operate Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets operation of the heatsink cooling fan.	1 (1 - 3)

1 : Dur Run (OffDly)

The drive turns on the fan when a Run command is active.

2 : Always On

The fan turns on when you supply power to the drive. When you release the Run command and the delay time set in *L8-11 [Fan Off-Delay Time]* is expired, the fan stops. his setting extends the fan lifetime.

3 : Fan ON @Heating of Drive

The fan turns on when the drive detects that the main circuit is overheating.

■ L8-11 Fan Off-Delay Time

No. (Hex.)	Name	Description	Default (Range)
L8-11 (04B7)	Fan Off-Delay Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the length of time that the drive will wait before stopping the cooling fan after cancelling the Run command when *L8-10 = 1 [Fan Operate Selection = Dur Run (OffDly)]*.	60 s (0 - 300 s)

■ L8-12 Ambient Temperature Setting

No. (Hex.)	Name	Description	Default (Range)
L8-12 (04B8)	Ambient Temperature Setting	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the ambient temperature of the drive installation area.	40 °C (-10 - +50 °C)

The drive automatically adjusts the drive rated current to the best value as specified by the set temperature. Set the ambient temperature of the area where you install the drive to a value that is more than the drive rating.

■ L8-15 oL2@LoSpeed Selection

No. (Hex.)	Name	Description	Default (Range)
L8-15 (04BB)	oL2@LoSpeed Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function to decrease drive overload at low speeds to prevent damage to the main circuit transistor during low speed operation (at 6 Hz or slower) to prevent *oL2 [Drive Overloaded]*.	1 (0, 1)

Note:

Contact Yaskawa or your nearest sales representative for consultation before disabling this function at low speeds. Frequent operation of drives under conditions of high output current in low speed ranges may shorten the service life of the drive IGBT due to heat stress.

0 : Disabled

The drive does not decrease the overload protection level.

1 : Enabled

When the drive detects *oL2* during low speed operation, it automatically decreases the overload detection level.

At zero speed, the drive derates the overload by 50%.

■ L8-18 Soft CurrLim Selection

No. (Hex.)	Name	Description	Default (Range)
L8-18 (04BE)	Soft CurrLim Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Set the software current limit selection function to prevent damage to the main circuit transistor caused by too much current.	0 (0, 1)

0 : Disabled

When the output current is at the software current limit value, the drive does not restrict the output voltage.

Note:

The drive may detect an *oC [Overcurrent]* when loads are particularly heavy or the acceleration time is particularly short.

1 : Enabled

When the output current is at the software current limit value, the drive decreases output voltage to decrease output current.

When the output current decreases to the software current limit level, the drive starts usual operation.

■ L8-19 Frq Reduct@oHPre-Alarm

No. (Hex.)	Name	Description	Default (Range)
L8-19 (04BF)	Frq Reduct@oHPre-Alarm	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the ratio at which the drive derates the frequency reference when during an *oH* alarm.	0.8 (0.1 to 0.9)

When these two conditions are correct, this function is enabled:

- *L8-03 = 4 [Overheat Pre-Alarm Selection = Run@L8-19 Rate]*
- *oH* alarm is output

■ L8-20 CF / STPo Selection

No. (Hex.)	Name	Description	Default (Range)
L8-20 (04C0) Expert	CF / STPo Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets operation after the drive detects a *CF* fault when *A1-02 = 4 [Control Method = Adv OLVector]*.	Determined by A1-02 (1 - 3)

If you enter a Stop command but it cannot stop drive operation, the drive will detect CF.

1 : Disabled

2 : CF/STPo Detection Enabled

3 : CF ALM/Stop

The drive stops DC injection braking as specified by the value of *b2-03 [DCInj Time@Start]*.

Note:

- If *A1-02 = 4* and you do not do Rotational Auto-Tuning, control will not be stable. This can cause *CF* faults when you ramp to stop. If the drive detects *CF*, do Rotational Auto-Tuning and Line-to-Line Resistance Tuning.
- If you input a Stop command while the motor rotates on the load side and *A1-02 = 4* to use torque control, load conditions can cause operation to not stop and can also cause *CF* faults. Make sure that you do Rotational Auto-Tuning and Line-to-Line Resistance Tuning correctly and then set *L8-20 = 0*.

■ L8-27 OverCurr Det Gain

No. (Hex.)	Name	Description	Default (Range)
L8-27 (04DD)	OverCurr Det Gain	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the PM motor overcurrent detection level as a percentage of the motor rated current value.	300.0% (0.0 - 400.0%)

If the drive rated current is much higher than the motor rated current, PM motor magnets can demagnetize when current flows at the drive overcurrent detection level. When the overcurrent detection level is low, adjust this parameter to prevent motor demagnetization.

If you set *L7: TORQUE LIMIT* and *L8-27* to the same value or almost the same value, the drive can detect *oC [Overcurrent]*. Lower the torque limit when you use a Yaskawa motor. When you use a non-Yaskawa motor, measure the irreversible demagnetization resistance before you adjust this parameter.

Note:

The overcurrent detection function detects the lower of these two values:
- Drive overcurrent level
- Motor rated current × *L8-27* / 100

■ L8-29 LF2 Unbalance Selection

No. (Hex.)	Name	Description	Default (Range)
L8-29 (04DF)	LF2 Unbalance Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function to detect *LF2*.	1 (0, 1)

This function prevents damage to PM motors. Current unbalance can heat a PM motor and demagnetize the magnets. When the current is unbalanced, the drive will detect *LF2* to stop the motor and prevent damage to the motor.

0 : Disabled

1 : Enabled

■ L8-31 LF2 Detect Time

No. (Hex.)	Name	Description	Default (Range)
L8-31 (04E1)	LF2 Detect Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the LF2 [Output Current Imbalance] detection time.	3 (1 to 100)

When the output current is unbalanced for longer than the time set in *L8-31*, the drive detects *LF2*.

Note:
- Set *L8-29 = 1 [LF2 Unbalance Selection = Enabled]* to enable this parameter.
- If the drive detects *LF2* by error, increase the setting value of *L8-31* in 5-unit increments.
- The keypad shows this parameter when *E9-01 = 1 [Motor Type Selection = PM]* under EZ Open Loop Vector Control.

■ L8-32 Fan Failure Selection

No. (Hex.)	Name	Description	Default (Range)
L8-32 (04E2)	Fan Failure Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets operation when the drive detects *FAn [Internal Agitating Fan Fault]*.	1 (0 - 4)

0 : Ramp->Stop

The drive ramps to stop in the selected deceleration time. Fault relay output terminal 1NO-1CM will activate, and 1NC-1CM will deactivate.

1 : Coast->Stop

The drive output shuts off and the motor coasts to stop. Fault relay output terminal 1NO-1CM will activate, and 1NC-1CM will deactivate.

2 : Fast Stop (C1-09)

The drive uses the deceleration time set in *C1-09 [Fast Stop Time]* to stop the motor. Fault relay output terminal 1NO-1CM will activate, and 1NC-1CM will deactivate.

3 : Alarm Only

oH is shown on the keypad and operation continues. The output terminal set for Alarm *[H2-01 to H2-03 = 10]* activates.

4 : Run@L8-19 Rate

The drive decelerates to the level set in *L8-19 [Frq Reduct@oHPre-Alarm]* and continues operation. *FAn* flashes on the keypad. Refer to "L8-03 Overheat Pre-Alarm Selection" for more information about drive derating operation.

■ L8-35 Installation Selection

No. (Hex.)	Name	Description	Default (Range)
L8-35 (04EC)	Installation Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the type of drive installation.	Determined by the drive model (0 - 3)

Note:
- Parameter *A1-03 [Init Parameters]* does not initialize this parameter.
- This parameter is set to the correct value when the drive is shipped. Change the value only in these conditions:
  – Side-by-Side installation
  – Mounting a standard drive with the heatsink outside the enclosure panel.

The overload protection detection level for the drive is automatically adjusted to the optimal value in accordance with the setting value. Change this setting when drives are installed Side-by-Side or when mounting a standard drive with the heatsink outside the enclosure panel.

0 : IP00/IP20/Open-Chassis

Use this setting to install an IP20 Open Type enclosure drive.

Make sure that there is 30 mm (1.18 in) minimum of space between drives or between the drive and side of the enclosure panel.

1 : Side-by-Side Mounting

Use this setting to install more than one drive Side-by-Side.

Make sure that there is 2 mm (0.08 in) minimum of space between drives.

2 : IP21/NEMA Type 1/IP55

Use this setting to install UL Type 1 enclosed wall-mounted type drives or IP55 drives.

3 : Finless/Ext.Heatsink

Use this setting to install finless type drives or when the heatsink (cooling fin) is outside the enclosure panel.

■ L8-38 Carrier Reduction Mode

No. (Hex.)	Name	Description	Default (Range)
L8-38 (04EF)	Carrier Reduction Mode	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the carrier frequency reduction function. The drive reduces the carrier frequency when the output current is more than a specified level.	Determined by A1-02, C6-01, and o2-04 (0 - 2)

If you decrease the carrier frequency, it increases the overload tolerance. The overload capacity increases temporarily for *oL2 [Drive Overloaded]* and lets the drive operate through transient load peaks and not trip.

1 : Enable<6 Hz

The drive will not decrease the carrier frequency at high current.

2 : Enab@AllSpeed

The drive decreases the carrier frequency at speeds less than 6 Hz when the current is more than 100% of the drive rated current.

When the current is less than 88% or the output frequency is more than 7 Hz, the drive goes back to the usual carrier frequency.

3 :

The drive decreases the carrier frequency at these speeds:

- Output current is a minimum of 100% of the drive rated current and the frequency reference is less than 6 Hz.
- Output current is a minimum of 109% of the drive rated current, the drive is in Normal Duty mode, and the frequency reference is 7 Hz or more.
- Output current is a minimum of 112% of the drive rated current, the drive is in Heavy Duty mode, and the frequency reference is 7 Hz or more.

When the drive switches the carrier frequency to the set value, it uses the delay time set in *L8-40 [Carrier Red Off-Delay Time]* and a hysteresis of 12%.

L8-40 Carrier Red Off-Delay Time

No. (Hex.)	Name	Description	Default (Range)
L8-40 (04F1)	Carrier Red Off-Delay Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the length of time until the automatically reduced carrier frequency returns to the condition before the reduction.	Determined by A1-02 (0.00 - 2.00 s)

Set *L8-40 ≠ 0.00* to enable the carrier frequency reduction function during start-up. When operation starts, the drive automatically decreases the carrier frequency. When the time set in *L8-40* is expired, the carrier frequency returns to the value set in *C6-02 [Carrier Frequency Selection]*.

When *L8-38 ≠ 1 [Carrier Reduction Mode = Enabled]*, the drive applies *L8-40* as the time for the carrier frequency to return to its configured value after it is decreased.

L8-41 HCA alarm Selection

No. (Hex.)	Name	Description	Default (Range)
L8-41 (04F2)	HCA alarm Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function to cause an *HCA [Current Alarm]* when the output current is more than 150% of the drive rated current.	0 (0, 1)

0 : Disabled

The drive will not detect *HCA [Current Alarm]*.

1 : Enabled

If the output current is more than 150% of the drive rated current, the drive will detect *HCA*.

The MFDO terminal set for an alarm *[H2-01 to H2-03 = 4]* activates.

L8-51 STPo Current Level

No. (Hex.)	Name	Description	Default (Range)
L8-51 (0471) Expert	STPo Current Level	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the *STPo [Desynchronization Error]* detection level as a percentage of the output current.	0.0% (0.0 - 300.0%)

The detection level is automatically calculated when *L8-51 = 0*.

L8-52 STPo Integral Level

No. (Hex.)	Name	Description	Default (Range)
L8-52 (0472) Expert	STPo Integral Level	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the detection level for *STPo [Desynchronization Error]* related to the ACR integral value.	1.0 (0.1 - 2.0)

L8-53 STPo Integral Time

No. (Hex.)	Name	Description	Default (Range)
L8-53 (0473) Expert	STPo Integral Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the length of time until the drive detects *STPo* after exceeding the value of *L8-51 [STPo Current Level]*.	1.0 s (1.0 - 10.0 s)

L8-54 STPo Id Diff Detection

No. (Hex.)	Name	Description	Default (Range)
L8-54 (0474) Expert	STPo Id Diff Detection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Id deviation detection function for *STPo [Desynchronization Error]*.	1 (0, 1)

0 : Disable

1 : Enabled

■ L8-55 DB IGBT Protection

No. (Hex.)	Name	Description	Default (Range)
L8-55 (045F)	DB IGBT Protection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the protection function for the internal braking transistor.	1 (0, 1)

0 : Disable

Disables braking transistor protection.

Use this setting, if enabling the braking transistor can cause an *rF [Braking Resistor Fault]* in these conditions:

- With a regenerative converter, for example D1000.
- With a regenerative unit, for example R1000.
- When connecting braking resistor options to the drive, for example CDBR units.
- Without an internal braking transistor.

1 : Enabled

Prevents damage to the internal braking transistor when using a braking transistor or optional braking resistors.

These models have a built-in braking transistor:

- 4002 to 4168

■ L8-56 StallP@Acc Activation Time

No. (Hex.)	Name	Description	Default (Range)
L8-56 (047D) Expert	StallP@Acc Activation Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the length time that the acceleration stall prevention function can continue to operate before the drive detects an *STPo [Desynchronization Error]*.	5000 ms (100 - 5000 ms)

Note:

If this value is too small, it can cause incorrect detection of *STPo*. If this value is too large, the drive will not detect *STPo*.

■ L8-57 StallP Retry Counts

No. (Hex.)	Name	Description	Default (Range)
L8-57 (047E) Expert	StallP Retry Counts	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the number of times the acceleration stall prevention function can operate until speeds match before the drive detects an *STPo [Desynchronization Error]*.	10 times (1 - 10 times)

Note:

If this value is too small, it can cause incorrect detection of *STPo*. If this value is too large, the drive will not detect *STPo*.

■ L8-90 STPo Detect Level

No. (Hex.)	Name	Description	Default (Range)
L8-90 (0175) Expert	STPo Detect Level	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the detection level that the control fault must be equal to or more than to cause an *STPo [Desynchronization Error]*.	Determined by A1-02 (0 - 5000 times)

This function detects when PM motors are not synchronized.

The drive cannot detect when motors are not synchronized because the frequency reference is low during start up and the motor is locked. If fault detection is necessary in these conditions, set the control fault detection level to enable detection of desynchronization because of motor locking. Increase the setting in 5-unit increments.

■ L8-93 Lso Detect Time

No. (Hex.)	Name	Description	Default (Range)
L8-93 (073C) Expert	Lso Detect Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the length of time the drive will wait to start baseblock after detecting *LSo [LSo Fault]*.	1.0 s (0.0 - 10.0 s)

Set this parameter to 0.0 to disable the function.

■ L8-94 Lso Detect Level

No. (Hex.)	Name	Description	Default (Range)
L8-94 (073D) Expert	Lso Detect Level	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the detection level for *LSo [Low Speed Motor Step-Out]* as a percentage of *E1-04 [Max Output Frequency]*.	3% (0 - 10%)

■ L8-95 Lso Amount

No. (Hex.)	Name	Description	Default (Range)
L8-95 (077F) Expert	Lso Amount	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the average count of *LSo [Low Speed Motor Step-Out]* detections.	10 times (1 - 50 times)

◆ L9: DRIVE PROTECTION 2

L9 parameters are used to configure the protection function used to detect cooling fan faults.

■ L9-16 FAn1 Detect Time

No. (Hex.)	Name	Description	Default (Range)
L9-16 (11DC) Expert	FAn1 Detect Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the detection time for *FAn1 [Drive Cooling Fan Failure]*. The manufacturer recommends that you do not change this parameter value.	4.0 s (0.0 - 30.0 s)

Parameter Details

12

12.9 n: SPECIAL

n parameters set these functions:

- Function to prevent hunting
- High-slip braking
- Motor line-to-line resistance online tuning
- Fine-tune the parameters that adjust motor control

◆ n1: HUNTING PREVENTION

The Hunting Prevention function will not let low inertia or operation with a light load cause hunting. Hunting frequently occurs when you have a high carrier frequency and an output frequency less than 30 Hz.

■ n1-01 HuntPrev Selection

No. (Hex.)	Name	Description	Default (Range)
n1-01 (0580)	HuntPrev Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function to prevent hunting.	Determined by o2-04 (0 - 2)

When drive response is more important than the decrease of motor vibration, disable this function.

If hunting occurs, or if you use a high carrier frequency or SwingPWM, set this parameter to 2 for better hunting prevention.

1 : Enabled

2 : Enabled (High Carrier)

3 :

■ n1-02 HuntPrev Gain Setting

No. (Hex.)	Name	Description	Default (Range)
n1-02 (0581) Expert	HuntPrev Gain Setting	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Adjusts the behavior of the hunting prevention function. Usually it is not necessary to change this setting.	1.00 (0.00 - 2.50)

Adjust this parameter in these conditions:

- When *n1-01 = 2, 3 [HuntPrev Selection = Enabled (High Carrier),]*: If oscillation occurs when you operate a motor with a light load, increase the setting value in 0.1-unit increments.
- When *n1-01 = 2, 3*, if the motor stalls: Decrease the setting value in 0.1-unit increments.

■ n1-03 HuntPrev Time Constant

No. (Hex.)	Name	Description	Default (Range)
n1-03 (0582) Expert	HuntPrev Time Constant	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the primary delay time constant of the hunting prevention function. Usually it is not necessary to change this setting.	Determined by o2-04 (0 - 500 ms)

Adjust this parameter in these conditions:

- Load inertia is large: Increase the setting value. If the setting value is too high, response will be slower. Also, there will be oscillation when the frequency is low.
- Oscillation occurs at low frequencies: Decrease the setting value.

■ n1-05 HuntPrev Gain Reverse Mode

No. (Hex.)	Name	Description	Default (Range)
n1-05 (0530) Expert	HuntPrev Gain Reverse Mode	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the performance of the hunting prevention function. This parameter adjusts Reverse run. Usually it is not necessary to change this setting.	0.00 (0.00 - 2.50)

Note:

When you set this parameter to 0, the value set in *n1-02 [HuntPrev Gain Setting]* is effective when the motor rotates in reverse.

Adjust this parameter in these conditions:

- When *n1-01 = 2, 3 [HuntPrev Selection = Enabled (High Carrier),]*: If oscillation occurs when you operate a motor with a light load, increase the setting value in 0.1-unit increments.
- When *n1-01 = 2, 3*, if the motor stalls: Decrease the setting value in 0.1-unit increments.

■ n1-08 CurrDetect Method

No. (Hex.)	Name	Description	Default (Range)
n1-08 (1105) Expert	CurrDetect Method	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets how the drive decreases the motor vibration that is caused by leakage current. Usually it is not necessary to change this setting.	1 (1, 2)

1 : 2-Phases

2 : 3-Phases

Note:

Set this parameter to 2 to suppress motor vibrations caused by leakage current when the wiring distance is long.

■ n1-13 DCBus Stab.Control

No. (Hex.)	Name	Description	Default (Range)
n1-13 (1B59) Expert	DCBus Stab.Control	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the oscillation suppression function for the DC bus voltage.	0 (0, 1)

0 : Disabled

1 : Enabled

Note:

If the DC bus voltage does not become stable with light loads and the drive detects *ov [Overvoltage]*, set this parameter to 1.

■ n1-14 DCBus Stab Time

No. (Hex.)	Name	Description	Default (Range)
n1-14 (1B5A) Expert	DCBus Stab Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets a length of time for the drive to suppress oscillation in relation to the DC bus voltage. Set *n1-13 = 1 [DCBus Stab.Control = Enabled]* to enable this parameter.	100.0 ms (50.0 - 500.0 ms)

Note:

Adjust this parameter in 100 ms increments.

■ n1-15 PWM VOffset Calibration

No. (Hex.)	Name	Description	Default (Range)
n1-15 (0BF8) Expert	PWM VOffset Calibration	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the calibration method that the drive uses to decrease torque/current ripple.	Determined by A1-02 (1 - 3)

This calibration function lets the drive suppress the torque ripple of a motor. Usually it is not necessary to change this setting.

1 : No Calibration

2 : Calib@Next Start

3 : Calib@Every Start

■ n1-16 HuntPrev HiFc Gain

No. (Hex.)	Name	Description	Default (Range)
n1-16 (0BFB)	HuntPrev HiFc Gain	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the gain for the hunting prevention function. This parameter functions best with a high carrier frequency. Usually it is not necessary to change this setting.	Determined by o2-04 (0.00 - 2.50)

Set *n1-01 = 3 [HuntPrev Selection =]* to enable this function.

If the motor oscillates, set *n1-01 = 2*. If that does not have an effect, increase this parameter in 0.2-unit increments.

■ n1-17 HuntPrev HiFc Filter

No. (Hex.)	Name	Description	Default (Range)
n1-17 (0BFC) Expert	HuntPrev HiFc Filter	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the responsiveness of the hunting prevention function. Usually it is not necessary to change this setting.	500 ms (0 - 1000 ms)

When *n1-01 = 3 [HuntPrev Selection =]*, if the motor stalls when the load changes, increase the value set in this parameter in 100 ms increments.

If you set *n1-01 = 3* and you cannot suppress hunting, increase the value set in this parameter in 100 ms increments.

◆ n2: AFR - AUTO FREQ REGULATION

The speed feedback detection reduction function (or AFR: Automatic Frequency Regulator) helps the speed become stable when you suddenly apply or remove a load.

Note:

Before you change *n2-xx parameters*, do one of these procedures:
- Set the motor parameters and V/f pattern correctly.
- Do Rotational Auto-Tuning.

■ n2-01 AFR Gain

No. (Hex.)	Name	Description	Default (Range)
n2-01 (0584)	AFR Gain	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the gain of the AFR function as a magnification value. Usually it is not necessary to change this setting.	1.00 (0.00 - 10.00)

Adjust this parameter in these conditions:

- If hunting or oscillation occurs with light loads, increase the setting value in 0.05-unit increments and examine the response.
- When torque is not sufficient with heavy loads or to make the torque or speed response better, decrease the setting value in 0.05-unit increments and examine the response.

■ n2-02 AFR Time 1

No. (Hex.)	Name	Description	Default (Range)
n2-02 (0585)	AFR Time 1	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the time constant that sets the rate of change for the AFR function. Usually it is not necessary to change this setting.	50 ms (0 - 2000 ms)

Adjust this parameter in these conditions:

- If there is hunting or oscillation with a light load, increase the setting value in 50 ms increments and examine the response. If the load inertia is large, increase the setting value in 50 ms increments and examine the response.
- If torque is not sufficient with a heavy load or if you must increase torque or speed responsiveness, decrease the setting value in 10 ms increments and examine the response.

Note:
- Set *n2-02 ≤ n2-03 [AFR Time 2 ≤ AFR Time 2]*. If *n2-02 > n2-03*, the drive will detect *oPE08 [Parameter Selection Error]*.
- When you change the value in *n2-02*, also change the value in *C4-02 [Trq Comp Delay Time]* by the same ratio.

■ n2-03 AFR Time 2

No. (Hex.)	Name	Description	Default (Range)
n2-03 (0586)	AFR Time 2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the time constant that sets the speed difference of the AFR function. Use this parameter for speed searches or regeneration. Usually it is not necessary to change this setting.	750 ms (0 - 2000 ms)

Adjust this parameter in these conditions:

- If the drive detects *ov [Overvoltage]* when acceleration stops under high-inertia loads, increase the setting value in 50 ms increments.
  If the drive detects *ov* when the load changes suddenly, increase the setting value in 50 ms increments.
- To increase the responsiveness of torque and speed, decrease the setting value in 10 ms increments and examine the response.

Note:
- Set *n2-02 ≤ n2-03 [AFR Time 1 ≤ AFR Time 1]*. If *n2-02 > n2-03*, the drive will detect *oPE08 [Parameter Selection Error]*.
- When you change the value in *n2-03*, also change the value in *C4-06 [M2 Trq Comp Delay Time]* by the same ratio.

◆ n3: HIGHSLIP/OVEREXCITATION BRAKE

n3 parameters configure High Slip Braking and Overexcitation Deceleration.

■ High Slip Braking

High slip braking quickly decelerates motors without braking resistors.

This lets you stop a motor more quickly than with the ramp to stop processes. This function is best for applications that do not frequently stop the motor, for example the fast stop function for high-inertia loads. Braking starts when the MFDI for *H1-xx = 32 [HiSlipBraking]* activates.

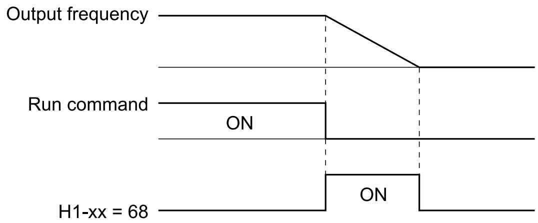


Figure 12.140 High Slip Braking Time Chart

An induction motor is necessary to use high slip braking.

Set *A1-02 [Control Method]* to one of these values to enable high slip braking:

- 0 [V/f Control]
- 1 [PG V/f Control]

Principles of Operation

HSB increases motor slip by significantly decreasing the frequency supplied to the motor at the same time that deceleration starts. A large quantity of current flows through the motor to increase the motor loss, and the motor decelerates while the motor windings consume the regenerative energy.

The drive keeps the motor current at a constant level during deceleration to prevent overvoltage and do automatic braking and it also keeps a slip level that causes the maximum quantity of deceleration torque.

High Slip Braking Precautions

- Do not use the high slip braking function in these applications:
  – Frequent deceleration
  – Deceleration time differences
  – Continuous regenerative loads
  – It is necessary to accelerate again during deceleration
- Motor loss increases during high slip braking. Use this function when the duty time factor is 5% ED or less and the braking time is 90 seconds or less. The load inertia and motor characteristics have an effect on the braking time.
- The drive ignores the configured deceleration time during high slip braking. To stop motors in the configured deceleration time, set *L3-04 = 1 [StallP@Decel Enable = Enabled] and L3-50 = 3 [StallP@Decel Mode = HiFlux Overexcitation]*.
- You cannot use high slip braking to decelerate deceleration at user-defined speeds. To decelerate at user-defined speeds, use the overexcitation deceleration function.
- You cannot accelerate the motor again during high slip braking until you fully stop the motor and input the Run command again.
- You cannot use high slip braking and the KEB Ride-Thru function at the same time. If you enable those two functions, the drive will detect *oPE03 [Multi-Function Input Setting Err]*.

■ Overexcitation Deceleration

Overexcitation deceleration quickly decelerates motors without braking resistors. This lets you stop a motor more quickly than with the ramp to stop processes.

Overexcitation deceleration increases excitation current during deceleration to cause a large quantity of braking torque through motor overexcitation. You can set the deceleration speed to adjust the deceleration time for overexcitation deceleration.

Overexcitation deceleration lets you accelerate the motor again during deceleration.

Enter the Run command during overexcitation deceleration to cancel overexcitation deceleration and accelerate the drive to the specified speed.

To enable this function, set *L3-04 = 1 [StallP@Decel Enable = Enabled]and L3-50 = 3, 4 [StallP@Decel Mode = HiFlux Overexcitation, HiFlux2 Overexcitation]*.

When *L3-04 = 1 and L3-50 = 3*, the motor will decelerate for the deceleration time set in *C1-02, C1-04, C1-06, or C1-08*. If the drive detects *ov [Overvoltage]*, increase the deceleration time.

When *L3-04 = 1 and L3-50 = 4*, the drive uses the value in *C1-02, C1-04, C1-06, or C1-08* to decelerate and it adjusts the deceleration rate to keep the DC bus voltage at the level set in *L3-17 [DCBus Regul.Level]*. The load inertia and motor characteristics have an effect on the braking time.

Notes on Overexcitation Deceleration

- Do not use Overexcitation Deceleration with a braking resistor.
- Do not use Overexcitation Deceleration for these applications. Connect a braking resistor to the drive as an alternative to Overexcitation Deceleration.
  - Frequent sudden decelerations
  - Continuous regenerative loads
  - Low inertia machines
  - Machines that have no tolerance for torque ripples
- Motor loss increases during overexcitation deceleration. Use this function when the duty time factor is 5% ED or less and the braking time is 90 seconds or less. The load inertia and motor characteristics have an effect on the braking time. You can use overexcitation deceleration in OLV control and CLV control, but those control methods decrease the precision of torque control and braking efficiency. Use V/f control for the best results.
- The drive disables these functions during braking with Overexcitation Deceleration 2:
  - Hunting Prevention Function (V/f Control)
  - Torque Limit Speed Control (OLV Control)

■ n3-01 HSB Dec Freq Width

No. (Hex.)	Name	Description	Default (Range)
n3-01 (0588) Expert	HSB Dec Freq Width	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets how much the drive lowers the output frequency during high-slip braking as a percentage where *E1-04 [Max Output Frequency]* = 100%.	5% (1 - 20%)

When you must detect *ov [DC Bus Overvoltage]* during high-slip braking, set this parameter to a large value.

■ n3-02 HSB CurrLim Level

No. (Hex.)	Name	Description	Default (Range)
n3-02 (0589) Expert	HSB CurrLim Level	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the maximum current output during high-slip braking as a percentage where *E2-01 [Mot Rated Current (FLA)]* = 100%. Also set the current suppression to prevent exceeding drive overload tolerance.	Determined by C6-01, L8-38 (0 - 200%)

When you decrease the setting value for current suppression, it will make the deceleration time longer.

- When you must detect *ov [DC Bus Overvoltage]* during high-slip braking, set this parameter to a low value.
- If the motor current increases during high-slip braking, decrease the setting value to prevent burn damage in the motor.
- The overload tolerance for the drive is 150% for Heavy Duty Rating (HD) and 110% for Normal Duty Rating (ND).

n3-03 HSB DwellTime@Stop

No. (Hex.)	Name	Description	Default (Range)
n3-03 (058A) Expert	HSB DwellTime@Stop	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the dwell time, a length of time when high-slip braking is ending and during which the motor speed decreases and runs at a stable speed. For a set length of time, the drive will hold the actual output frequency at the minimum output frequency set in *E1-09*.	1.0 s (0.0 - 10.0 s)

If there is too much inertia or when the motor is coasting to a stop after high-slip braking is complete, increase the setting value. If the setting value is too low, machine inertia can cause the motor to rotate after high-slip braking is complete.

n3-04 HSB Overload Time

No. (Hex.)	Name	Description	Default (Range)
n3-04 (058B) Expert	HSB Overload Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the time used to detect *oL7 [High Slip Braking Overload]*, which occurs when the output frequency does not change during high-slip braking. Usually it is not necessary to change this setting.	40 s (30 - 1200 s)

If a force on the load side is rotating the motor or if there is too much load inertia connected to the motor, the drive will detect *oL7*.

The current flowing to the motor from the load can overheat the motor and cause burn damage to the motor. Set this parameter to prevent burn damage to the motor.

n3-13 OverExcBr Gain

No. (Hex.)	Name	Description	Default (Range)
n3-13 (0531)	OverExcBr Gain	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the gain value that the drive multiplies by the V/f pattern output value during overexcitation deceleration to calculate the overexcitation level.	1.10 (1.00 - 1.40)

The V/f pattern output value goes back to its usual level after the motor stops or accelerates again to the frequency reference speed.

The best value of this parameter changes when the flux saturation characteristics of the motor change.

- Gradually increase the value of *n3-13* to 1.25 or 1.30 to increase the braking power of Overexcitation Deceleration. If the gain is too much, the motor can have flux saturation and cause a large quantity of current to flow. This can increase the deceleration time.
- Decrease the setting value if flux saturation causes overcurrent. If you increase the setting value, the drive can detect *oC [Overcurrent]*, *oL1 [Motor Overload]*, and *oL2 [Drive Overload]*. Decrease the value of *n3-21 [OverExcBr Current Level]* to prevent *oC* and *oL*.
- Regular use of overexcitation deceleration or extended periods of overexcitation deceleration can increase internal motor temperatures. Decrease the setting value in these conditions.
- If *ov [Overvoltage]* occurs, increase the deceleration time.

n3-14 OverExcBr Harmonics Selection

No. (Hex.)	Name	Description	Default (Range)
n3-14 (0532) Expert	OverExcBr Harmonics Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function that injects harmonic signals during overexcitation deceleration.	0 (0, 1)

Enable this parameter to set a shorter deceleration time.

Note:
- If you frequently use overexcitation deceleration on a motor, the motor loss will increase the risk of burn damage.
- When you set this parameter to *1*, the motor can make a loud excitation sound during overexcitation deceleration. If the excitation sound is unwanted, set this parameter to *0* to disable the function.

0 : Disabled

1 : Enabled

The drive injects harmonic signals at the time of overexcitation deceleration. You can decrease the deceleration time because motor loss increases.

n3-21 OverExcBr Current Level

No. (Hex.)	Name	Description	Default (Range)
n3-21 (0579)	OverExcBr Current Level	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the upper limit of the current that is suppressed at the time of overexcitation deceleration, where the drive rated current = 100% value.	100% (0 - 150%)

If flux saturation during Overexcitation Deceleration makes the motor current become more than the value set in this parameter, the drive will automatically decrease the overexcitation gain. If *oC [Overcurrent]*, *oL1 [Motor Overload]*, or *oL2 [Drive Overloaded]* occur during overexcitation deceleration, decrease the setting value.

If repetitive or long overexcitation deceleration cause the motor to overheat, decrease the setting value.

n3-23 OverExcBr Operation

No. (Hex.)	Name	Description	Default (Range)
n3-23 (057B)	OverExcBr Operation	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the direction of motor rotation where the drive will enable overexcitation.	1 (1 - 3)

1 : Enabled@Both directions

2 : Enabled@FW direction

3 : Enabled@REV direction

Note:

When *n3-23 = 2, 3*, the drive enables overexcitation only in the direction of motor rotation in which a regenerative load is applied. Increased motor loss can decrease *ov [Overvoltage]* faults.

◆ n4: ADV. OPEN LOOP VECTOR TUNING

The following explains how to make special adjustments for *Advanced Open Loop Vector [A1-02 = 4]*.

- First, perform Rotational Auto-Tuning.
- Operation that fluctuates around zero speed cannot be carried out when there is a load. For applications of this sort, set *A1-02 = 3 [CLVector]*.
- The tolerance of regenerative torque at low speeds is diminished. If regenerative torque is required in the low speed range, set *A1-02 = 3*.
- This cannot be used for elevators or similar applications. There is a risk that the load could slip.

n4-60 LoSpeed Comp Gain

No. (Hex.)	Name	Description	Default (Range)
n4-60 (1B80)	LoSpeed Comp Gain	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets a compensation gain to improve the control qualities for motoring loads in the low speed range.	1.000 (0.500 - 2.000)

Note:

- To increase the torque precision in the motoring direction when you operate at low speeds, do Stationary Auto-Tuning for Line-to-Line Resistance only, or increase the value of this parameter in 5% increments.
- If the output frequency changes when you operate at low speeds, do Stationary Auto-Tuning for Line-to-Line Resistance only. If it is not better, increase this parameter in 10% increments. The recommended setting is 50% to 100%.

n4-61 LoSpeed Comp Frequency Level

No. (Hex.)	Name	Description	Default (Range)
n4-61 (1B81)	LoSpeed Comp Frequency Level	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets a frequency at which the settings for *n4-60 [LoSpeed Comp Gain]*, *n4-62 [Reg LoSpd Cmp Gain]* are enabled. When the output frequency < *n4-61*, the drive adjusts the torque to agree with the settings for *n4-60* and *n4-62*. Usually it is not necessary to change this setting.	6.00 Hz (0.50 - 12.00 Hz)

n4-62 Reg LoSpd Cmp Gain

No. (Hex.)	Name	Description	Default (Range)
n4-62 (1B82)	Reg LoSpd Cmp Gain	V/f CL-V/f OLV CLV **AOLV** OLV/PM AOLV/PM CLV/PM EZOLV Sets a compensation gain to improve the control qualities for regenerative loads in the low speed range.	1.000% (0.500 - 2.000%)

Note:

If you do not apply a regenerative load when you operate at low speeds, do stationary Auto-Tuning for Line-to-Line Resistance only. If it is not better, increase this parameter in 5% increments. The recommended setting is 100% to 150%. If you set this parameter too high, the drive will detect *CF [Control Fault]* at stop.

n4-63 HF SpdEstim Response

No. (Hex.)	Name	Description	Default (Range)
n4-63 (1B83)	HF SpdEstim Response	V/f CL-V/f OLV CLV **AOLV** OLV/PM AOLV/PM CLV/PM EZOLV Sets the responsiveness of the speed estimation in high speed ranges, where the output frequency is ≥ *n4-67 [SpEstim Gain SwFrequency]*.	1.000 (0.001 - 5.000)

If better response of speed estimation is necessary, or if the motor oscillates, or if there is a large quantity of torque ripple, increase the setting value in 10.0 unit increments. If this does not make it better, decrease the setting value in 10.0 unit increments.

Note:

Do rotational Auto-Tuning before you adjust *n4-63*, *n4-64 [LF SpdEstim Response]*, *n4-65 [HF FlxEstim Response]*, and *n4-66 [LF FlxEstim Response]*.

n4-64 LF SpdEstim Response

No. (Hex.)	Name	Description	Default (Range)
n4-64 (1B84)	LF SpdEstim Response	V/f CL-V/f OLV CLV **AOLV** OLV/PM AOLV/PM CLV/PM EZOLV Sets the responsiveness of the speed estimation in low speed ranges, where 0 ≤ the output frequency, which is < *n4-67 [SpEstim Gain SwFrequency]*.	1.000 (0.001 - 5.000)

If better response of speed estimation is necessary, or if the motor oscillates, or if there is a large quantity of torque ripple, increase the setting value in 10.0 unit increments.

Note:

Do rotational Auto-Tuning before you adjust *n4-63 [HF SpdEstim Response]*, *n4-64*, *n4-65 [HF FlxEstim Response]*, and *n4-66 [LF FlxEstim Response]*.

n4-65 HF FlxEstim Response

No. (Hex.)	Name	Description	Default (Range)
n4-65 (1B85)	HF FlxEstim Response	V/f CL-V/f OLV **CLV** **AOLV** OLV/PM AOLV/PM CLV/PM EZOLV Sets the responsiveness of the magnetic flux estimation in high speed ranges, where the output frequency is ≥ *n4-67 [SpEstim Gain SwFrequency]*. Usually it is not necessary to change this setting.	0.90 (0.50 - 1.50)

If the drive detects *oS [Overspeed]* in no-load conditions, or if the speed does not become stable in the high speed range, increase or decrease the setting value in 0.05 unit increments.

n4-66 LF FlxEstim Response

No. (Hex.)	Name	Description	Default (Range)
n4-66 (1B86)	LF FlxEstim Response	V/f CL-V/f OLV **CLV** **AOLV** OLV/PM AOLV/PM CLV/PM EZOLV Sets the responsiveness of the magnetic flux estimation in low speed ranges, where 0 ≤ the output frequency, which is < *n4-67 [SpEstim Gain SwFrequency]*. Usually it is not necessary to change this setting.	0.90 (0.50 - 1.50)

If the drive detects *oS [Overspeed]* in no-load conditions, or if the speed does not become stable in the low speed range, increase or decrease the setting value in 0.05 unit increments.

■ n4-67 SpEstim Gain SwFrequency

No. (Hex.)	Name	Description	Default (Range)
n4-67 (1B87)	SpEstim Gain SwFrequency	V/f CL-V/f OLV **CLV** **AOLV** OLV/PM AOLV/PM CLV/PM EZOLV Sets the switching frequency for estimation gain for these parameters: *n4-63 [HF SpdEstim Response]* *n4-64 [LF SpdEstim Response]* *n4-65 [HF FlxEstim Response]* *n4-66 [LF FlxEstim Response]*	6.00 Hz (0.00 - E1-04)

If the output frequency > *n4-67*, the drive will select *n4-63* and *n4-65*. If the output frequency < *n4-67*, the drive will select *n4-64* and *n4-66*.

■ n4-68 SpEstim Filter Time Constant

No. (Hex.)	Name	Description	Default (Range)
n4-68 (1B88)	SpEstim Filter Time Constant	V/f CL-V/f OLV CLV **AOLV** OLV/PM AOLV/PM CLV/PM EZOLV Sets the primary delay time constant for the speed estimation value. Usually it is not necessary to change this setting.	1 ms (1 - 10 ms)

If the motor speed oscillates in the high speed range, set the value to 0.010 s.

■ n4-69 Flux Control Response

No. (Hex.)	Name	Description	Default (Range)
n4-69 (1B89)	Flux Control Response	V/f CL-V/f OLV CLV **AOLV** OLV/PM AOLV/PM CLV/PM EZOLV Unifies control of magnetic flux to make motor vibrations more stable.	1.00 (0.00 - 60.00)

If step-out occurs when the load changes, decrease the setting value in 1.00 increments.

Note:

If heavy loads decrease motor speed, increase the setting value in 1.00 increments. If it does not get better, increase *n4-74 [Flux Control Limit]* in 20% increments.

■ n4-70 Speed Comp@LowFrequency

No. (Hex.)	Name	Description	Default (Range)
n4-70 (1B8A)	Speed Comp@LowFrequency	V/f CL-V/f OLV CLV **AOLV** OLV/PM AOLV/PM CLV/PM EZOLV Sets the function to make the drive more stable when operating at low speeds. Usually it is not necessary to change this setting.	0.60 Hz (0.00 - 1.50 Hz)

This function makes the control more stable when operating at low speeds. Increase the setting in 0.3 Hz increments at the time of low-speed references with no load.

Note:

If you increase this parameter to make the speed references for low speeds more stable, it can make the speed control less accurate.

■ n4-71 Flux Detect Method

No. (Hex.)	Name	Description	Default (Range)
n4-71 (1B8B)	Flux Detect Method	V/f **CL-V/f** OLV CLV **AOLV** OLV/PM AOLV/PM CLV/PM EZOLV Chooses the method of estimating the magnetic flux.	1 (1, 2)

1 : Method 1

Estimates magnetic flux by voltage command.

2 : Method 2

Estimates magnetic flux by voltage detection.

■ n4-72 Spd Fbk Mode

No. (Hex.)	Name	Description	Default (Range)
n4-72 (1B8C)	Spd Fbk Mode	V/f CL-V/f OLV CLV **AOLV** OLV/PM AOLV/PM CLV/PM EZOLV Sets the requirement for an encoder option when *A1-02 = 4 [Control Method = Adv OLVector]*.	1 (1, 2)

You can connect a PG-B3 or PG-X3 encoder option in AOLV control. You can use the encoder option for better speed control precision.

Note:
- When you use an encoder option in AOLV control to operate machinery, specialized tuning of the drive can be necessary. You should usually set *A1-02 = 3 [Control Method = CLVector]* when you use an encoder option.
- When you set this parameter to 1, also set the number of PG pulses in *F1-01 [Enc1 Pulse Count (PPR)]*.

1 : Without PG

2 : With PG

■ n4-73 PGO Recover Selection

No. (Hex.)	Name	Description	Default (Range)
n4-73 (1B8D)	PGO Recover Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the restart mode to Without Encoder Mode or the With Encoder Mode when an encoder is disconnected.	1 (1, 2)

Set *A1-02 = 4 [Control Method = Adv OLVector]* and *n4-72 = 1 [Spd Fbk Mode = Without PG]* to use this parameter.

Parameter *F1-02 [PGOpen Detection Select]*, sets the drive response when the drive detects a disconnected encoder. This parameter sets the drive to start up in the Without Encoder Mode or With Encoder Mode when the drive detects *PGo [Encoder (PG) Feedback Loss]*.

Note:

A PG-B3 encoder option is necessary to use this parameter. When you use a PG-X3 option, it is not necessary to set this parameter.

If the drive detects *PGo*, de-energize the drive and examine the wiring for the encoder.

1 : Without PG

2 : With PG

■ n4-74 Flux Control Limit

No. (Hex.)	Name	Description	Default (Range)
n4-74 (1B8E)	Flux Control Limit	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the control level for flux loop control output.	160% (100 - 500%)

If the torque is not sufficient because of 100% or more loads, increase the setting value in 20% increments. If the setting is too high, overexcitation could occur and overheat the motor.

◆ n5: FEED FORWARD CONTROL

Feed forward control increases the responsiveness of acceleration and deceleration as specified by the speed reference.

Increase the values set in *C5-01 [ASR PGain 1]* and *C5-03 [ASR PGain 2]* to apply feed forward control to machines that have low rigidity and are possible to have hunting and vibration or to machines that have a large quantity of inertia. When you use this function in CLV control, it also helps prevent overshoot. Refer to Figure 12.141 for more information. Refer to Figure 12.142 for more information about parameters related to feed forward control.

Set *A1-02 [Control Method]* is set to one of these values to enable feed forward control:

- 3: CLVector
- 4: Adv OLVector
- 6: PM AOLVector
- 7: PM CLVector

Note:
- You cannot use feed forward control to increase responsiveness in applications where you apply loads externally during run at constant speed.
- When you use the Droop control function, set *n5-01 = 0 [FF Control Selection = Disabled]*.
- You cannot use feed forward control with motor 2.

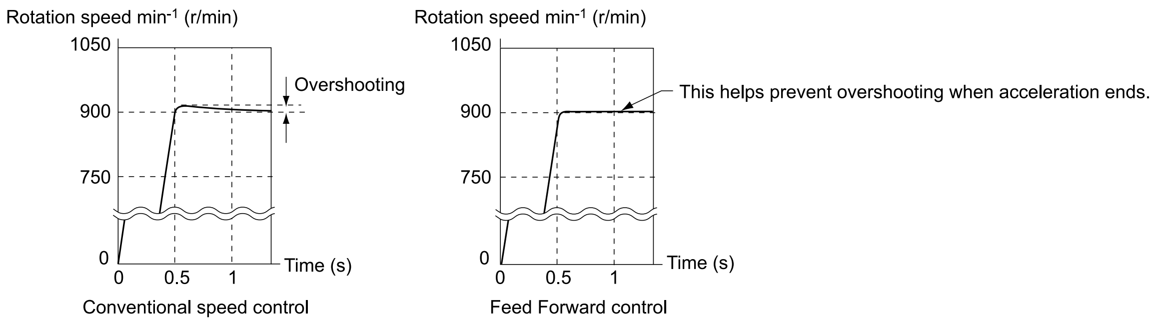


Figure 12.141 Suppress Overshooting with Feed Forward Control

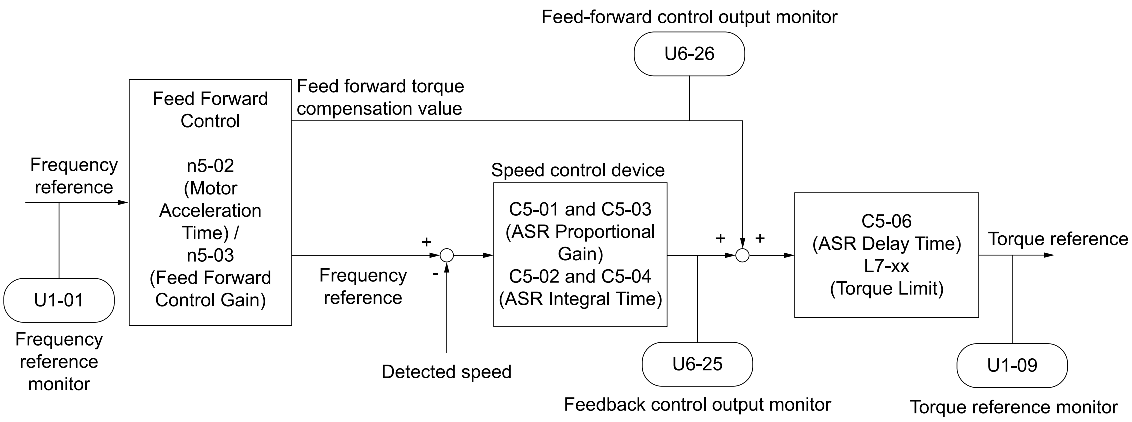


Figure 12.142 Configure Feed Forward Control

■ Before You Use Feed Forward Control

Do one of these procedures before you use feed forward control.

- Run Auto-Tuning to set motor parameters.
  When you cannot do Auto-Tuning, manually set motor parameters with the information on the motor nameplate or test reports. Set the *E2 parameters* for induction motors. Set the *E5 parameters* for PM motors.
- Set parameters *C5: ASR - SPEED REGULATION* individually to adjust the speed control loop (ASR).
- If you can connect a motor to a machine and rotate it during Auto-Tuning, do Inertia Tuning.
  The drive automatically adjusts feed forward parameters during Inertia Tuning.
- If you cannot do Inertia Tuning, refer to Figure 12.142 and set the parameters related to feed forward control individually.

■ n5-01 FF Control Selection

No. (Hex.)	Name	Description	Default (Range)
n5-01 (05B0)	FF Control Selection	V/f CL-V/f OLV **CLV** **AOLV** OLV/PM **AOLV/PM** **CLV/PM** EZOLV Sets the feed forward function.	0 (0, 1)

0 : Disabled

1 : Enabled

■ n5-02 Mot Inertia Acceleration Time

No. (Hex.)	Name	Description	Default (Range)
n5-02 (05B1)	Mot Inertia Acceleration Time	V/f CL-V/f OLV **CLV** **AOLV** OLV/PM **AOLV/PM** **CLV/PM** EZOLV Sets the length of time for the motor to accelerate from the stopped to the maximum frequency with a single motor at the rated torque. Inertia Tuning automatically sets the motor acceleration time.	Determined by C6-01, E5-01, and o2-04 (0.001 - 10.000 s)

If you cannot do Inertia Tuning, calculate the motor acceleration time as shown here or measure the motor acceleration time and set *n5-02* to this value.

Calculate the Motor Acceleration Time

Use this formula to find the motor acceleration time:

$$n5\text{-}02 = \frac{2\pi \cdot J_{Motor} \cdot n_{rated}}{60 \cdot T_{rated}}$$

- J_{Motor} = Moment of inertia of motor (kg m^2)
- n_{rated} = Motor rated speed (min^{-1}, r/min)
- T_{rated} = Motor rated torque (N m)

You can also use this formula to find the motor acceleration time:

$$n5\text{-}02 = \frac{4\pi \cdot J_{Motor} \cdot f_{rated}}{p \cdot T_{rated}}$$

- f_{rated} = Motor rated frequency (Hz)
- P = Number of motor poles

Calculate the Motor Acceleration Time

Use this procedure to calculate the motor acceleration time:

1. Use *A1-02 [Control Method]* to set the control method.
2. Disconnect the motor and load.
3. Run Auto-Tuning to set motor parameters.
   When you cannot do Auto-Tuning, manually set motor parameters with the information on the motor nameplate or test reports. Set the *E2 parameters* for induction motors. Set the *E5 parameters* for PM motors.
4. Set *C5 parameters [C5: ASR - SPEED REGULATION]*.
5. Set *C1-01 [Accel Time 1] = 0*.
6. Set *L7-01 [FW Torque Limit]* to 100%.
7. Set the frequency reference to the same value as the motor rated speed.
8. Measure the length of time for the motor to reach the rated speed.
   Show *U1-05 [Motor Speed]* on the keypad and enter the Run command (forward run).
9. Stop the motor.
10. Set *n5-02* to the measured motor acceleration time value.

Reset all of the parameters that you changed to the previous setting values.

■ n5-03 FF Control Gain

No. (Hex.)	Name	Description	Default (Range)
n5-03 (05B2)	FF Control Gain	V/f CL-V/f OLV **CLV** **AOLV** OLV/PM **AOLV/PM** **CLV/PM** EZOLV Sets the ratio between load inertia and motor inertia. Inertia Tuning automatically sets the Feedforward Control Gain value.	1.00 (0.00 - 100.00)

When you cannot do Inertia Tuning, use this procedure to set *n5-03*:

1. Set *n5-02 [Mot Inertia Acceleration Time]*.
2. Connect the motor and load.
3. Set *C1-01 [Accel Time 1] = 0*.
4. Use *L7-01 to L7-04 [FW Torque Limit to RV Reg. TrqLimit]* to set the expected test run torque limit levels.
5. Set the frequency reference as specified by the high speed range of the machine.
6. Measure the length of time for the motor to reach the command reference speed.
   Show *U1-05 [Motor Speed]* on the keypad and enter the Run command.
7. Stop the motor.
8. Replace the values in the this formula and set *n5-03* to the value of the formula.

$$n5\text{-}03 = \frac{t_{accel} \cdot T_{Lim\_Test} \cdot f_{rated}}{n5\text{-}02 \cdot f_{ref\_Test} \cdot 100} - 1$$

   - t_{accel} = Acceleration time (s)
   - f_{rated} = Motor rated frequency (Hz)
   - T_{Lim_Test} = Test run torque limit (%)
   - f_{ref_Test} = Test run frequency reference (Hz)

WARNING! *Sudden Movement Hazard. Machinery can accelerate suddenly. Do not use this function with machinery that must not accelerate suddenly. Failure to obey can cause death or serious injury.*

Reset all of the parameters that you changed to the previous setting values.

Note:
- If response to the speed reference is slow, increase the setting value.
- Decrease the setting value in these conditions:
  - –The speed is overshooting.
  - –A negative torque reference is output when acceleration ends.

■ n5-04 Speed Response Frequency

No. (Hex.)	Name	Description	Default (Range)
n5-04 (05B3) RUN Expert	Speed Response Frequency	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the response frequency for the speed reference. Usually it is not necessary to change this setting.	Determined by A1-02 (0.00 - 500.00 Hz)

If you set *n5-03 [FF Control Gain]* too high, the motor speed will momentarily increase to more than the set frequency.

◆ n6: ONLINE TUNING

n6 parameters are used to set the online tuning function for motor line-to-line resistance.

The Online Tuning for motor line-to-line resistance is used to prevent degradation of speed control accuracy due to motor temperature fluctuation and motor stalls due to insufficient torque.

■ n6-01 Online Tune Selection

No. (Hex.)	Name	Description	Default (Range)
n6-01 (0570)	Online Tune Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the type of motor data that Online Tuning uses for OLV control.	0 (0 - 2)

0 : Disabled

1 : Line-to-Line Resistance Tuning

The drive adjusts the motor line-to-line resistance during run. This procedure is applicable for speed values 6 Hz and less. It also adjusts the motor resistance value to increase the overload capacity in the low speed range.

2 : VoltageAdjustment

The drive adjusts the output voltage during run to increase overload tolerance and minimize the effects of high temperatures on speed precision.

Note:

Setting 2 is enabled only when *b8-01 = 0 [eSave Ctrl Selection = Disabled]*.

■ n6-05 Online Tune Gain

No. (Hex.)	Name	Description	Default (Range)
n6-05 (05C7) Expert	Online Tune Gain	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the compensation gain when *n6-01 = 2 [Online Tune Selection = VoltageAdjustment]*. Usually it is not necessary to change this setting.	1.0 (0.1 - 50.0)

When you use a motor that has a large secondary circuit time constant, decrease the setting value.

If the drive detects *oL1 [Motor Overload]*, increase the setting value in 0.1-unit increments.

■ n6-11 Online Resist Tuning

No. (Hex.)	Name	Description	Default (Range)
n6-11 (1B56) Expert	Online Resist Tuning	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the responsiveness for online resistor tuning. Set this parameter to approximately *1.000* to enable the function. The function is disabled when the value is *0.000*.	0.000 (0.000 - 1.000)

◆ n7: SIMPLE VECTOR TUNING

The *n7 parameters* provide special adjustments for Simple Vector Tuning.

n7-01 LoFreq Damping Gain

No. (Hex.)	Name	Description	Default (Range)
n7-01 (3111) Expert	LoFreq Damping Gain	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the oscillation suppression gain for the low speed range.	1.0 (0.1 - 10.0)

Note:
- If oscillation occurs in the low speed range, increase the acceleration time or increase the setting value in 0.5-unit increments.
- To get starting torque with the setting for *C4-01 [Trq Comp Gain]*, decrease the setting value in 0.3-unit increments.

n7-05 TrqCtrl Response Gain

No. (Hex.)	Name	Description	Default (Range)
n7-05 (3115) Expert	TrqCtrl Response Gain	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the response gain related to changes in the load.	1.00 (0.10 - 10.00)

Note:

To make tracking related to load changes better, increase the setting value in 5-unit increments. If oscillation occurs during load changes, decrease the setting value in 5-unit increments.

n7-07 Speed Calc.Gain1

No. (Hex.)	Name	Description	Default (Range)
n7-07 (3117) Expert	Speed Calc.Gain1	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the speed calculation gain during usual operation.	15.0 Hz (1.0 - 50.0 Hz)

n7-08 Speed Calc.Gain2

No. (Hex.)	Name	Description	Default (Range)
n7-08 (3118) Expert	Speed Calc.Gain2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the speed calculation gain during a speed search.	25.0 Hz (1.0 - 50.0 Hz)

Note:

When you increase the setting value, you can do a speed search of a motor rotating at a high frequency. If the setting value is too high, the calculated speed will oscillate and a restart will fail. Decrease the setting value in these conditions.

n7-10 Pull-in SwitchSpeed

No. (Hex.)	Name	Description	Default (Range)
n7-10 (311A) Expert	Pull-in SwitchSpeed	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets a speed range proportional to the rated frequency that enables pull-in current commands.	10.0% (0.0 - 100.0%)

Note:
- The value set in *n8-51 [Ac/Dec Pull-In Current]* is enabled for speeds that are not higher than the value set in *n7-10*. The value set in *b8-01 [eSave Ctrl Selection]* is enabled for speeds higher than the value set in *n7-10*.
- If there is a large quantity of oscillation when you operate in the low speed range, increase the setting value.
- When it is most important to save energy in the low speed range, decrease the setting value.

n7-17 Resist.Temp.Compensation

No. (Hex.)	Name	Description	Default (Range)
n7-17 (3122)	Resist.Temp.Compensation	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function to adjust for changes in the motor resistance value caused by changes in the temperature.	2 (1 - 3)

1 : Invalid
2 : Valid (1 Time)
3 : Valid (Every Time)

Note:
- For settings 2 and 3, the adjustment time can cause a delay before startup.
- For settings 2 and 3, the drive can set the line-to-line resistance value of *E9-10 [Motor L-L Resistance]*.
- When the temperature will change at startup, use setting 3.
- To decrease the startup time, set this parameter to 1, then do line-to-line resistance tuning.
- If you will start from coasting, set this parameter to 1, then do line-to-line resistance tuning.

◆ n8: PM MOTOR CONTROL TUNING

n8 parameters are used to make adjustments when controlling PM motors.

■ n8-01 PolPos Detection Current

No. (Hex.)	Name	Description	Default (Range)
n8-01 (0540) Expert	PolPos Detection Current	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Initial Rotor Position Estimated Current as a percentage where *E5-03 [PM Mot Rated Current (FLA)]* = 100%. Usually it is not necessary to change this setting.	50% (0 - 100%)

The drive uses the Initial Rotor Position Estimated Current to detect the initial position of rotors.

If the motor nameplate has an “Si” item, use that value.

■ n8-02 Pole Align Current Level

No. (Hex.)	Name	Description	Default (Range)
n8-02 (0541) Expert	Pole Align Current Level	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the current at the time of polar attraction as a percentage where motor rated current = 100%. Usually it is not necessary to change this setting.	80% (0 - 150%)

The drive uses the polar pull-in current to attract the rotor after it detects the initial rotor position. When you increase the value of this parameter, the starting torque also increases.

- If the motor does not track correctly at the time of the polar attraction, increase the value in 10% increments. If you set the value too high, the drive will detect *oL2 [Drive Overloaded]*.
- If the motor oscillates at the time of the polar attraction, decrease the value in 10% increments.

Note:

Set *A1-02 = 7 [Control Method = PM CLVector]* and do Rotational Auto-Tuning or Z Pulse Offset Tuning to use this function.

■ n8-03 Current Start Time

No. (Hex.)	Name	Description	Default (Range)
n8-03 (0542)	Current Start Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the length of the Current Starting Time, which is used for Z Pulse Offset Tuning. Usually it is not necessary to change this parameter.	1.5 s (1.5 - 5.0 s)

Sets the length of time of pull-in current when the drive detects the motor magnetic pole of the rotors.

Note:

If the motor oscillates at the time of the polar attraction, increase the value in 0.5 s increments. If the value is too high, the drive can detect *oL2 [Drive Overloaded]*.

■ n8-04 Pole Align Time

No. (Hex.)	Name	Description	Default (Range)
n8-04 (0543) Expert	Pole Align Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the length of the Polar Attraction Time, which is used for Z Pulse Offset Tuning. Usually it is not necessary to change this setting.	1.5 s (1.5 - 5.0 s)

Sets the length of time that the pull-in current flows when the drive detects the motor magnetic pole of the rotors.

Note:

If the motor oscillates at the time of the polar attraction, increase the value in 0.5 s increments. If you set the value too high, the drive will detect *oL2 [Drive Overloaded]*.

■ n8-11 Observ.Calc Gain2

No. (Hex.)	Name	Description	Default (Range)
n8-11 (054A)	Observ.Calc Gain2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the gain for speed estimation. Usually it is not necessary to change this setting.	Determined by n8-72 (0.0 - 1000.0)

Note:

When *n8-72 = 1 [Spd Obs. Method Selection = Method 1]*, the default value is 50.0. When *n8-72 = 2 [Method 2]*, the default value is 30.0 for drives that have a maximum capacity of 4023. The default is 50.0 for 4031 and larger models.

■ n8-14 Polar Comp Gain3

No. (Hex.)	Name	Description	Default (Range)
n8-14 (054D) Expert	Polar Comp Gain3	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the gain for speed estimation. Usually it is not necessary to change this setting.	2.000 (0.000 - 20.000)

■ n8-15 Polar Comp Gain4

No. (Hex.)	Name	Description	Default (Range)
n8-15 (054E) Expert	Polar Comp Gain4	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the gain for speed estimation. Usually it is not necessary to change this setting.	2.000 (0.000 - 20.000)

■ n8-21 Mot Back-EMF (Ke) Gain

No. (Hex.)	Name	Description	Default (Range)
n8-21 (0554) Expert	Mot Back-EMF (Ke) Gain	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the gain for speed estimation. Usually it is not necessary to change this setting.	0.90 (0.80 - 1.00)

■ n8-35 InitRotorPos Selection

No. (Hex.)	Name	Description	Default (Range)
n8-35 (0562)	InitRotorPos Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets how the drive detects the position of the rotor at start.	Determined by A1-02 (1 - 3)

When *A1-02 = 7 [Control Method = PM CLVector]*, the initial motor magnetic pole detection operates the first time after the drive is energized. After that, the drive uses the encoder signal to calculate the rotor position and the drive saves the value until the drive is de-energized.

1 : Pull-In

Starts the rotor with pull-in current.

2 : HiFreq Injection

Injects high frequency to detect the rotor position. This setting can cause a loud excitation sound when the motor starts.

3 : Pulse Injection

Inputs the pulse signal to the motor to detect the rotor position.

Note:

- When you use an SPM motor, set this parameter to 1. Values between 1 to 3 can be selected if using IPM motors.
- If the drive incorrectly detects the polarity direction, the motor can rotate in the opposite direction of the Run command.

■ n8-36 HFI Signal Frequency

No. (Hex.)	Name	Description	Default (Range)
n8-36 (0563)	HFI Signal Frequency	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the injection frequency for high frequency injection.	500 Hz (200 - 5000 Hz)

PM Rotational Auto-Tuning and PM Stationary Auto-Tuning automatically calculate this parameter value.

■ n8-37 HFI Voltage Amplitude Level

No. (Hex.)	Name	Description	Default (Range)
n8-37 (0564) Expert	HFI Voltage Amplitude Level	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the high frequency injection amplitude as a percentage where 400 V = 100% for a 400 V class drives. Usually it is not necessary to change this setting.	20.0% (0.0 - 50.0%)

Set *n8-57 = 1 [High-Freq Injection = Enabled]* to enable this parameter. When you do Auto-Tuning or Rotational Auto-Tuning, the drive will automatically set this parameter.

Note:

When you change *C6-02 [Carrier Frequency Selection]*, the drive automatically initializes this parameter. Set the carrier frequency you will use, then do Auto-Tuning.

■ n8-41 HFI PoleDet Pgain

No. (Hex.)	Name	Description	Default (Range)
n8-41 (0568) Expert	HFI PoleDet Pgain	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the speed estimation response for high frequency injection. Usually it is not necessary to change this setting.	3.0 (1.0 - 100.0)

Note:

Set *n8-57 = 1 [High-Freq Injection = Enabled]* or *n8-35 = 2[InitRotorPos Selection = HiFreq Injection]* to enable this parameter.

■ n8-42 HFI PoleDet iTime

No. (Hex.)	Name	Description	Default (Range)
n8-42 (0569) Expert	HFI PoleDet iTime	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the oscillation suppression gain of the speed estimation for high frequency injection. Usually it is not necessary to change this setting.	1.0 (0.1 - 5.0)

Note:

Set *n8-57 = 1 [High-Freq Injection = Enabled]* or *n8-35 = 2 [InitRotorPos Selection = HiFreq Injection]* to enable this parameter.

■ n8-45 SpdFbck Det.Gain

No. (Hex.)	Name	Description	Default (Range)
n8-45 (0538)	SpdFbck Det.Gain	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the internal speed feedback detection reduction unit gain as a magnification value. Usually it is not necessary to change this parameter.	0.80 (0.00 - 10.00)

Adjust this parameter in these conditions:

- If vibration or hunting occur, increase the setting value in 0.05 unit increments.
- If the responsiveness of torque and speed is unsatisfactory, decrease the setting value 0.05 unit increments and examine the response.

■ n8-47 Pull-In Comp.Time Constant

No. (Hex.)	Name	Description	Default (Range)
n8-47 (053A)	Pull-In Comp.Time Constant	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the time constant the drive uses to align the pull-in current reference value with the actual current value. Usually it is not necessary to change this parameter.	5.0 s (0.0 - 100.0 s)

Adjust this parameter in these conditions:

- If the time for the reference value of the pull-in current to align with the target value is too long, increase the setting value.
- If vibration or hunting occur, decrease the setting value in 0.2 unit increments.
- If the motor stalls during run at constant speed, decrease the setting value in 0.2 unit increments.

n8-48 Pull-In Current (for PM Motors)

No. (Hex.)	Name	Description	Default (Range)
n8-48 (053B)	Pull-In Current (for PM Motors)	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the d-axis current that flows to the motor during run at constant speed as a percentage where *E5-03 [PM Mot Rated Current (FLA)]* = 100%.	30% (20 - 200%)

Adjust in the following situations.

- Slightly reduce this value if there is too much current when driving a light load at a constant speed.
- Increase the setting value in steps of 5% when hunting or vibration occurs during run at constant speed.
- Increase the setting value in steps of 5% if the motor stalls during run at constant speed.

n8-49 Heavy Load Id Current

No. (Hex.)	Name	Description	Default (Range)
n8-49 (053C) Expert	Heavy Load Id Current	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the d-axis current to that the drive will supply to the motor to run it at a constant speed with a heavy load. This parameter is a percentage where *E5-03 [PM Mot Rated Current (FLA)] = 100%.* Usually it is not necessary to change this setting.	Determined by E5-01 (-200.0 - 0.0%)

When you use an IPM motor, you can use the reluctance torque of the motor to make the motor more efficient and help conserve energy.

When you operate an SPN motor, set this parameter to 0.

Adjust this parameter in these conditions:

- If the load is large and motor rotation is not stable, decrease the setting value.
- If you change the *parameters E5: PM MOTOR SETTINGS*, set *n8-49 = 0*, then adjust this parameter.

n8-51 Ac/Dec Pull-In Current

No. (Hex.)	Name	Description	Default (Range)
n8-51 (053E)	Ac/Dec Pull-In Current	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the pull-in current that can flow during acceleration/deceleration as a percentage where *E5-03 [PM Mot Rated Current (FLA)]* = 100%.	Determined by A1-02 (0 - 200%)

Adjust this parameter in these conditions:

- When the motor does not smoothly because of large loads, increase the setting value in 5% increments.
- If too much current flows during acceleration, decrease the setting value.

Note:

When *A1-02 = 8 [Control Method = EZ Vector]*, this parameter will always be in effect for speed ranges less than *n7-10 [Pull-in SwitchSpeed]*.

n8-54 Volt-Err Compensation Time

No. (Hex.)	Name	Description	Default (Range)
n8-54 (056D) Expert	Volt-Err Compensation Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the time constant that the drive uses when adjusting for voltage errors.	1.00 s (0.00 - 10.00 s)

Adjust this parameter in these conditions:

- If oscillation occurs at the time of start up, increase the setting value.
- If hunting occurs when operating at low speed, increase the setting value.
- If fast changes in the load cause hunting, increase the setting value in 0.1-unit increments. If you cannot stop hunting, set *n8-51 [Ac/Dec Pull-In Current]* to 0% and set *n8-54* to 0.00 s, and disable compensation for voltage errors.

n8-55 Load Inertia

No. (Hex.)	Name	Description	Default (Range)
n8-55 (056E)	Load Inertia	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the ratio between motor inertia and machine inertia.	1 (1 - 4)

Adjust this parameter in the these conditions:

- If torque and speed response is unsatisfactory, gradually increase the setting.
- If motors do not start smoothly, gradually increase the setting.
- If the motor stalls during run at constant speed, gradually increase the setting.
- If there is vibration or hunting, decrease the setting.

Note:
- If the value too low, the drive will detect *STPo [Motor Step-Out Detected]*.
- If you use one motor or more than motor at low inertia and the value is too high, there can be vibration in the motor.

1 : <1:10

Use this setting in these conditions:

- The ratio between the motor inertia and machine inertia is less than 1:10
- There are large current ripples

2 : 1:10-1:30

Use this setting in these conditions:

- The ratio between the motor inertia and machine inertia is approximately 1:10 to 1:30
- Parameter *n8-55 = 0* and the drive detects *STPo* because of an impact load or sudden acceleration/deceleration.

3 : 1:30-1:50

Use this setting in these conditions:

- The ratio between the motor inertia and machine inertia is approximately 1:30 to 1:50
- Parameter *n8-55 = 1* and the drive detects *STPo* because of an impact load or sudden acceleration/deceleration.

4 : >1:50

Use this setting in these conditions:

- The ratio between the motor inertia and machine inertia is more than 1:50
- Parameter *n8-55 = 2* and the drive detects *STPo* because of an impact load or sudden acceleration/deceleration.

■ n8-57 High-Freq Injection

No. (Hex.)	Name	Description	Default (Range)
n8-57 (0574)	High-Freq Injection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function that detects motor speed with high frequency injection.	0 (0, 1)

Note:
- When there is high frequency injection, the motor will make an excitation sound.
- When you use Zero Speed Control, set *E1-09 [Min Output Frequency] = 0.0*.

0 : Disabled

Use this setting with SPM motors. The speed control range is approximately 1:20.

When *n8-57 = 0*, you cannot set *E1-09 [Min Output Frequency]* ≤ 1/20 of the value of *E1-06 [Base Frequency]*.

1 : Enabled

Use this setting with IPM motors. The speed control range changes to 1:100 for very accurate speed detection.

■ n8-62 Output Volt Limit Level

No. (Hex.)	Name	Description	Default (Range)
n8-62 (057D) Expert	Output Volt Limit Level	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the output voltage limit to prevent saturation of the output voltage. Usually it is not necessary to change this setting.	400 V Class: 400.0 V (400 V Class: 0.0 - 460.0 V)

Set this parameter lower than the input power supply voltage.

■ n8-65 SpdFbk Gain@OV Suppression

No. (Hex.)	Name	Description	Default (Range)
n8-65 (065C) Expert	SpdFbk Gain@OV Suppression	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the gain of internal speed feedback detection suppression while the overvoltage suppression function is operating as a magnification value. Usually it is not necessary to change this parameter.	1.50 (0.00 - 10.00)

Adjust this parameter in these conditions:

- If there is resonance or hunting when you use the overvoltage suppression function, increase the setting value.
- If motor response is low when you use the overvoltage suppression function, decrease the setting value in 0.05-unit increments.

n8-69 Spd Obs. P Gain Control

No. (Hex.)	Name	Description	Default (Range)
n8-69 (065D) Expert	Spd Obs. P Gain Control	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the gain that the drive uses for speed estimation. Usually it is not necessary to change this setting.	1.00 (0.00 - 20.00)

n8-72 Spd Obs. Method Selection

No. (Hex.)	Name	Description	Default (Range)
n8-72 (0655) Expert	Spd Obs. Method Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Selects the speed estimation method. Usually it is not necessary to change this setting.	2 (1, 2)

1 : Method 1

2 : Method 2

n8-74 Light Load Iq Level

No. (Hex.)	Name	Description	Default (Range)
n8-74 (05C3) Expert	Light Load Iq Level	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Set *n8-48 [Pull-In Current (for PM Motors)]* to the level of the load current (q-axis current) to be applied.	30% (0 - 255%)

Note:
- If *n8-74* > *n8-75 [Mid Load Iq Level (Low)]*, the drive will detect *oPE08 [Parameter Selection Error]*.
- The change is linear between *n8-74* and *n8-75* and the level of the pull-in current from *n8-48* to *n8-78 [Mid Load Id Current]*.

n8-75 Mid Load Iq Level (Low)

No. (Hex.)	Name	Description	Default (Range)
n8-75 (05C4) Expert	Mid Load Iq Level (Low)	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Set *n8-78 [Mid Load Id Current]* to the level of the load current (q-axis current) to be applied.	50% (0 - 255%)

Note:
- If *n8-74 [Light Load Iq Level]* > *n8-75*, the drive will detect *oPE08 [Parameter Selection Error]*.
- The change is linear between *n8-74* and *n8-75* and the level of the pull-in current from *n8-48* to *n8-78 [Mid Load Id Current]*.

n8-77 Hvy Load Iq Level

No. (Hex.)	Name	Description	Default (Range)
n8-77 (05CE) Expert	Hvy Load Iq Level	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Set *n8-49 [Heavy Load Id Current]* to the level of the load current (q-axis current) to be applied.	90% (0 - 255%)

Note:

The change is linear between *n8-75 [Mid Load Iq Level (Low)]* and *n8-77* and the level of the pull-in current from *n8-78 [Mid Load Id Current]* to *n8-49 [Heavy Load Id Current]*.

n8-78 Mid Load Id Current

No. (Hex.)	Name	Description	Default (Range)
n8-78 (05F4) Expert	Mid Load Id Current	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the level of the pull-in current for mid-range loads.	0% (0 - 255%)

■ n8-79 Pull-In Curr@Deceleration

No. (Hex.)	Name	Description	Default (Range)
n8-79 (05FE)	Pull-In Curr@Deceleration	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets, the pull-in current allowed to flow during deceleration as a percentage of the motor rated current.	0% (0 - 200%)

If overcurrent occurs during deceleration, slowly decrease the setting in 5% increments.

Note:

When *n8-79 = 0*, the drive will use the value set in *n8-51 [Ac/Dec Pull-In Current]*

■ n8-84 Polarity Det Current

No. (Hex.)	Name	Description	Default (Range)
n8-84 (02D3) Expert	Polarity Det Current	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the current that the drive uses to estimate the initial motor magnetic pole as a percentage where *E5-03 [PM Mot Rated Current (FLA)]* = 100%.	100% (0 - 150%)

If you use a Yaskawa motor, and the motor nameplate has an “Si” item, set this parameter to a value equivalent to Si × 2.

Find the Polarity of Magnetic Poles

When you start operation (only the first time when *A1-02 = 7 [Control Method = PM CLVector]*, the drive estimates the magnetic poles and finds the polarity of the magnetic poles.

Check monitor *U6-57 [PoleDis IdDifVal]* to make sure that the drive correctly estimated the polarity of the magnetic poles.

When you do Stationary Auto-Tuning or Rotational Auto-Tuning, the drive automatically sets this parameter.

WARNING! *Sudden Movement Hazard. Make sure that the polarity is correct before you send a Run command. If the drive incorrectly detects the polarity, the drive can rotate in the direction opposite of the Run command. Failure to obey can cause death or serious injury.*

■ n8-94 FluxPos Est.Method

No. (Hex.)	Name	Description	Default (Range)
n8-94 (012D) Expert	FluxPos Est.Method	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the criteria that the drive uses to find changes in speed or load. Usually it is not necessary to change this setting.	Determined by d5-01 (1, 2)

1 : Softstarter

2 : Speed Feedback

Set *n8-57 = 1 [High-Freq Injection = Enabled]* to enable this parameter. Increases the stability when the speed or load suddenly change, for example with rapid acceleration/deceleration or impact loads.

■ n8-95 FluxPos Est.Filter Time

No. (Hex.)	Name	Description	Default (Range)
n8-95 (012E) Expert	FluxPos Est.Filter Time	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the time constant of the filter used for the recognition criteria value for speed and load changes. Usually it is not necessary to change this setting.	30 ms (0 - 100 ms)

Note:

Enabled when *n8-94 = 2 [FluxPos Est.Method = Speed Feedback]*.

12.10 o: KEYPAD

o parameters set keypad functions.

Note:

You cannot set the parameters in Table 12.56 with the optional LED keypad.

Table 12.56 Parameters that You Cannot Set with the LED Keypad

No.	Name	No.	Name
o1-05	LCD Contrast Adjustment	o3-04	COPY Memory Selection
o1-24 to o1-35	Cust.Monitor 1 to 12	o3-05	COPY Items Selection
o1-36	LCD Backlight Brightness	o3-06	AutoBackup Selection
o1-37	LCD Blight ON/OFF Selection	o3-07	AutoBackup Lapse
o1-38	LCD Blight Off-Delay	o4-22	Time Format
o1-39	Show Init Screen	o4-23	Date Format
o1-40	Home Screen Selection Mode	o5-01	Log Start Selection
o1-41 to o1-46	1st to 3rd Monitor Area Selections/Settings	o5-02	Log Sample Lapse
o1-47 to o1-51	Trend Plot 1 or 2 Scale Settings	o5-03 to o5-12	Log Monitor Data 1 to 10
o1-55 to o1-56	Analog Gauge Area Selection/Setting		

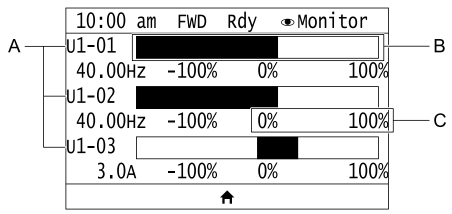
◆ o1: KEYPAD DISPLAY

o1 parameters select the parameters shown on the initial keypad screen and to configure the parameter setting units and display units. These parameters also adjust the backlight and contrast of the LCD display.

■ Home Screen Display Format

o1-40 [Home Screen Selection Mode] changes the display of the monitor shown on the Home screen. You can show numerical values or one of these three displays on the Home screen monitor:

Bar Graph Display

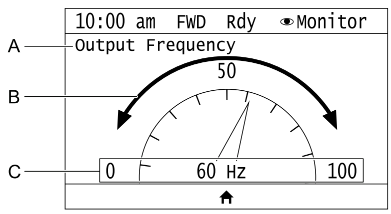


A - **Select *Ux-xx [MONITORS]* with *o1-24*, *o1-25*, and *o1-26*.**

B - **Configure display regions with *o1-41*, *o1-43*, and *o1-45*.**

C - **Select display ranges with *o1-42*, *o1-44*, and *o1-46*.**

Analog Gauge Display

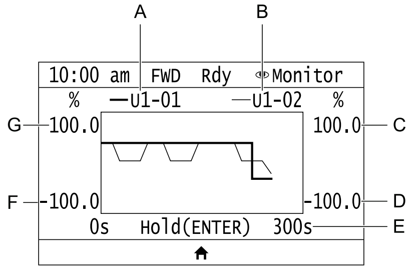


A - **Select *Ux-xx [MONITORS]* with *o1-24*.**

B - **Configure display regions with *o1-56*.**

C - **Select display ranges with *o1-55*.**

Trend Plot Display



A - Select *Ux-xx [MONITORS]* (Monitor 1) with *o1-24*.

B - Select *Ux-xx [MONITORS]* (Monitor 2) with *o1-25*.

C - Set the maximum value of Monitor 2 with *o1-50*

D - Set the minimum value of Monitor 2 with *o1-49*

E - Set the time scale with *o1-51*

F - Set the minimum value of Monitor 1 with *o1-47*

G - Set the maximum value of Monitor 1 with *o1-48*

■ o1-02 Mon.Sel@Power-Up

No. (Hex.)	Name	Description	Default (Range)
o1-02 (0501) RUN	Mon.Sel@Power-Up	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the monitor item that the keypad screen shows after energizing the drive. Refer to "U: Monitors" for information about the monitor items that the keypad screen can show. This parameter is only available when using an LED keypad.	1 (1 - 5)

1 : FreqReference (U1-01)

2 : Direction

3 : OutFrequency (U1-02)

4 : OutCurrent (U1-03)

5 : User Monitor (o1-01)

Shows the monitor item selected in *o1-01 [User Monitor Selection]*.

■ o1-03 FrqDisplay Unit Selection

No. (Hex.)	Name	Description	Default (Range)
o1-03 (0502)	FrqDisplay Unit Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the display units for the frequency reference and output frequency.	Determined by A1-02 (0 - 3)

Note:

When you change ths parameter, these monitor and parameter units also change:
- *U1-01 [Frequency Reference]*
- *U1-02 [Output Frequency]*
- *U1-05 [Motor Speed]*
- *U1-16 [SFS Output Frequency]*
- *d1-01 to d1-17 [Reference 1 to Jog Reference]*

0 : 0.01 Hz

1 : 0.01% (100%=E1-04)

The maximum output frequency is 100%.

2 : rpm

The drive uses the maximum output frequency and number of motor poles calculate this value automatically.

Note:

When you use this setting, make sure that you set the number of motor poles in these parameters:
- *E2-04 [Motor Pole Count]*
- *E4-04 [M2 Pole Count]*
- *E5-04 [PM Mot Pole Count]*
- *E9-08 [Motor Pole Count]*

3 : User-selected units

Uses *o1-10* and *o1-11* to set the unit of measure. The value of parameter *o1-10* is the value when you remove the decimal point from the maximum output frequency. Parameter *o1-11* is to the number of digits after the decimal point in the maximum output frequency.

To show a maximum output frequency of 100.00, set the parameters to these values:

- *o1-10 = 10000*
- *o1-11 = 2 [FrqDisplay Decimal Places = (XXX.XX) 2 Decimal Places]*

■ o1-04 V/f Pattern Unit for Display

No. (Hex.)	Name	Description	Default (Range)
o1-04 (0503)	V/f Pattern Unit for Display	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the setting unit for parameters that set the V/f pattern frequency.	Determined by A1-02 (0, 1)

Note:
- Select the setting unit of these parameters for motor 1:
  - *E1-04 [Max Output Frequency]*
  - *E1-06 [Base Frequency]*
  - *E1-07 [Mid A Frequency]*
  - *E1-09 [Min Output Frequency]*
  - *E1-11 [Mid B Frequency]*
  - *E9-02 [Maximum Speed]*
  - *E9-04 [Base Frequency]*
- Select the setting unit of these parameters for motor 2:
  - *E3-04 [M2 Max Out Frequency]*
  - *E3-06 [M2 Base Frequency]*
  - *E3-07 [M2 Mid A Frequency]*
  - *E3-09 [M2 Min Out Frequency]*
  - *E3-11 [M2 Mid B Frequency]*

0 : Hz

1 : rpm

Set the number of motor poles in these parameters:

- *E2-04 [Motor Pole Count]*
- *E4-04 [M2 Pole Count]*
- *E5-04 [PM Mot Pole Count]*
- *E9-08 [Motor Pole Count]*

■ o1-05 LCD Contrast Adjustment

No. (Hex.)	Name	Description	Default (Range)
o1-05 (0504) RUN	LCD Contrast Adjustment	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the contrast of the LCD display on the keypad.	5 (0 - 10)

When you decrease the setting value, the contrast of the LCD display decreases. When you increase the setting value, the contrast increases.

■ o1-10 FrqDisplay Max Value

No. (Hex.)	Name	Description	Default (Range)
o1-10 (0520)	FrqDisplay Max Value	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the value that the drive shows as the maximum output frequency.	Determined by o1-03 (1 - 60000)

To display a maximum output frequency of 100.00, set parameters to these values:

- *o1-10 = 10000*
- *o1-11 = 2 [FrqDisplay Decimal Places = (XXX.XX) 2 Decimal Places]*

Note:
Set *o1-03 = 3 [FrqDisplay Unit Selection = User-selected units]* before you set *o1-10* and *o1-11*.

■ o1-11 FrqDisplay Decimal Places

No. (Hex.)	Name	Description	Default (Range)
o1-11 (0521)	FrqDisplay Decimal Places	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the number of decimal places for frequency reference and monitor values.	Determined by o1-03 (0 - 3)

0 : (XXXXX) No Decimal Places
1 : (XXXX.X) 1 Decimal Place
2 : (XXX.XX) 2 Decimal Places
3 : (XX.XXX) 3 Decimal Places

Note:

Set *o1-03 = 3 [FrqDisplay Unit Selection = User-selected units]* before you set *o1-10 [FrqDisplay Max Value]* and *o1-11*.

■ o1-24 to o1-35 Cust.Monitor 1 to 12

No. (Hex.)	Name	Description	Default (Range)
o1-24 to o1-35 (11AD - 11B8) RUN	Cust.Monitor 1 to 12	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets a maximum of 12 monitors as user monitors. This parameter is only available with an LED keypad.	o1-24: 101 o1-25: 102 o1-26: 103 o1-27 to o1-35: 0 (0, 101 - 999)

These parameters save the monitor items selected by the LCD keypad [Custom Monitor].

Note:

- You can show a maximum of three selected monitors on one LCD keypad screen.
  - When you select only one monitor, the text size of this monitor increases. For example, when *o1-25* to *o1-35 = 0*, the text size of the monitor saved in *o1-24* increases.
  - When you select two monitors, the text size of these monitors increase.
  - When you select four or more monitors, the fourth monitor and all additional monitors are shown on the next screens.
- You can show the monitors that you select with *o1-24* to *o1-26* as a bar graph, analog gauge, or trend plot.
  - Bar graph display: 3 monitors maximum
    Select with *o1-24*, *o1-25*, and *o1-26*.
  - Analog gauge display: 1 monitor
    Select with *o1-24*.
  - Trend plot display: 2 monitors
    Select with *o1-24* and *o1-25*.
- You can only set parameters *o1-24* to *o1-26* with analog output monitors.
- You can set parameters *o1-27* to *o1-35* with all monitors.

■ o1-36 LCD Backlight Brightness

No. (Hex.)	Name	Description	Default (Range)
o1-36 (11B9) RUN	LCD Backlight Brightness	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the intensity of the LCD keypad backlight.	3 (1 - 5)

When you decrease the setting value, the intensity of the backlight decreases. When you increase the setting value, the intensity of the backlight increases.

■ o1-37 LCD Blight ON/OFF Selection

No. (Hex.)	Name	Description	Default (Range)
o1-37 (11BA) RUN	LCD Blight ON/OFF Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the automatic shut off function for the LCD backlight.	1 (0, 1)

Note:

Use *o1-36 [LCD backlight adjustment]* to adjust the intensity of the LCD backlight.

0 : OFF
1 : ON

Enables the automatic shut off function. The time at which the LCD backlight automatically turns off is configured with *o1-38 [LCD Blight Off-Delay]*.

■ o1-38 LCD Blight Off-Delay

No. (Hex.)	Name	Description	Default (Range)
o1-38 (11BB) RUN	LCD Blight Off-Delay	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the time until the LCD backlight automatically turns off.	60 s (10 - 300 s)

When *o1-37 = 1 [LCD Blight ON/OFF Selection = ONON]*, the backlight will automatically turn off after the time set in *o1-38* is expired.

When the backlight is off, push a key on the keypad to temporarily turn the backlight on. After the backlight turns on, it will turn off automatically after the time set in *o1-38* is expired.

■ o1-40 Home Screen Selection Mode

No. (Hex.)	Name	Description	Default (Range)
o1-40 (11BD) RUN	Home Screen Selection Mode	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the monitor display mode for the Home screen. This parameter is only available when using an LCD keypad.	0 (0, 8 - 10)

0 : Custom Monitors

8 : Bar Graph

9 : Analog Gauge

10 : Trend Plot

■ o1-41 1stMon Area Selection

No. (Hex.)	Name	Description	Default (Range)
o1-41 (11C1) RUN	1stMon Area Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the horizontal axis used to show the monitor that was set in *o1-24 [Cust.Monitor 1]* as a bar graph. This parameter is only available with an LCD keypad.	0 (0 - 1)

0 : +/- Area (- o1-42 - o1-42)

1 : + Area (0 - o1-42)

2 : - Area (- o1-42 - 0)

■ o1-42 1stMon Area Setting

No. (Hex.)	Name	Description	Default (Range)
o1-42 (11C2) RUN	1stMon Area Setting	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the horizontal axis value used to display the monitor that was set in *o1-24 [Cust.Monitor 1]* as a bar graph. This parameter is only available with an LCD keypad.	100.0% (0.0 - 100.0%)

■ o1-43 2ndMon Area Selection

No. (Hex.)	Name	Description	Default (Range)
o1-43 (11C3) RUN	2ndMon Area Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the horizontal axis used to show the monitor that was set in *o1-25* as a bar graph. This parameter is only available with an LCD keypad.	0 (0 - 1)

0 : + - Area (- o1-44 - o1-44)

1 : + Area (0 - o1-44)

2 : - Area (- o1-44 - 0)

■ o1-44 2ndMon Area Setting

No. (Hex.)	Name	Description	Default (Range)
o1-44 (11C4) RUN	2ndMon Area Setting	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the horizontal axis value used to display the monitor that was set in *o1-25 [Cust.Monitor 2]* as a bar graph. This parameter is only available with an LCD keypad.	100.0% (0.0 - 100.0%)

■ o1-45 3rdMon Area Selection

No. (Hex.)	Name	Description	Default (Range)
o1-45 (11C5) RUN	3rdMon Area Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the horizontal axis used to show the monitor that was set in *o1-26* as a bar graph. This parameter is only available with an LCD keypad.	0 (0 - 1)

0 : + - Area (- o1-46 - o1-46)

1 : + Area (0 - o1-46)

2 : - Area (- o1-46 - 0)

■ o1-46 3rdMon Area Setting

No. (Hex.)	Name	Description	Default (Range)
o1-46 (11C6) RUN	3rdMon Area Setting	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the horizontal axis value used to display the monitor that was set in *o1-26 [Cust.Monitor 3]* as a bar graph. This parameter is only available with an LCD keypad.	100.0% (0.0 - 100.0%)

■ o1-47 Trend Plot 1 Min Scale Value

No. (Hex.)	Name	Description	Default (Range)
o1-47 (11C7) RUN	Trend Plot 1 Min Scale Value	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the minimum value for the vertical axis used to display the monitor that was set in *o1-24 [Cust.Monitor 1]* as a trend plot. This parameter is only available with an LCD keypad.	100% (-300 - +300%)

■ o1-48 Trend Plot 1 Max Scale Value

No. (Hex.)	Name	Description	Default (Range)
o1-48 (11C8) RUN	Trend Plot 1 Max Scale Value	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the maximum value for the vertical axis used to display the monitor that was set in *o1-24 [Cust.Monitor 1]* as a trend plot. This parameter is only available with an LCD keypad.	100.0% (-99.9 - +300.0%)

■ o1-49 Trend Plot 2 Min Scale Value

No. (Hex.)	Name	Description	Default (Range)
o1-49 (11C9) RUN	Trend Plot 2 Min Scale Value	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the minimum value for the vertical axis used to display the monitor that was set in *o1-25 [Cust.Monitor 2]* as a trend plot. This parameter is only available with an LCD keypad.	100% (-300 - +300%)

■ o1-50 Trend Plot 2 Max Scale Value

No. (Hex.)	Name	Description	Default (Range)
o1-50 (11CA) RUN	Trend Plot 2 Max Scale Value	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the maximum value for the vertical axis used to display the monitor that was set in *o1-25 [Cust.Monitor 2]* as a trend plot. This parameter is only available with an LCD keypad.	100.0% (-99.9 - +300.0%)

■ o1-51 Trend Plot Time Scale Setting

No. (Hex.)	Name	Description	Default (Range)
o1-51 (11CB) RUN	Trend Plot Time Scale Setting	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the time scale (horizontal axis) to display the trend plot. When you change this setting, the drive automatically adjusts the data sampling time. This parameter is only available with an LCD keypad.	5 s (1 - 3600 s)

■ o1-55 AnGauge Area Selection

No. (Hex.)	Name	Description	Default (Range)
o1-55 (11EE) RUN	AnGauge Area Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the range used to display the monitor set in *o1-24 [Cust.Monitor 1]* as an analog gauge. This parameter is only available with an LCD keypad.	1 (0, 1)

0 : + - Area (- o1-56 - o1-56)

1 : + Area (0 - o1-56)

■ o1-56 AnGauge Area Setting

No. (Hex.)	Name	Description	Default (Range)
o1-56 (11EF) RUN	AnGauge Area Setting	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the value used to display the monitor set in *o1-24 [Cust.Monitor 1]* as an analog meter. This parameter is only available with an LCD keypad.	100.0% (0.0 - 100.0%)

◆ o2: KEYPAD OPERATION

■ o2-01 LO/RE Key Selection of Function

No. (Hex.)	Name	Description	Default (Range)
o2-01 (0505)	LO/RE Key Selection of Function	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function that lets the drive switch between LOCAL and REMOTE Modes using the LO/RE button.	1 (0, 1)

0 : Disabled

You cannot use LO/RE to switch between LOCAL and REMOTE Modes.

1 : Enabled

You can use LO/RE to switch between LOCAL and REMOTE Modes when the drive is stopped. When LOCAL Mode is selected, LO/RE on the keypad will come on.

WARNING! *Sudden Movement Hazard. The drive may start unexpectedly if switching control sources when setting b1-07 = 2 [LO/RE Run Selection = Accept RUN]. Clear all personnel from rotating machinery and electrical connections prior to switching control sources. Failure to comply may cause death or serious injury.*

WARNING! *Sudden Movement Hazard. Fully examine all mechanical and electrical connections before you change o2-01 [LO/RE Key Selection of Function] or b1-07 [LO/RE Run Selection]. If b1-07 = 2 [Accept RUN] and there is an active Run command when you switch from LOCAL to REMOTE Mode, the drive can start suddenly. Failure to obey can cause serious injury or death.*

Table 12.57 Function Settings via o2-01 through b1-07

LO/RE Function Selection	LOCAL/REMOTE Run Selection	Switching from LOCAL Mode to REMOTE Mode	Switching from REMOTE Mode to LOCAL Mode
o2-01 = 0 [Disabled]	b1-07 = 1 [Cycle RUN]	The drive will not switch modes.	The drive will not switch modes.
	b1-07 = 2 [Accept RUN]		
o2-01 = 1 [Enabled]	b1-07 = 1 [Cycle RUN]	The drive will not start operating although the Run command is active. When you set Run command to active again, the drive will start to run.	The drive cannot operate because the Run command is not enabled.
	b1-07 = 2 [Accept RUN]	When the Run command is active, the drive will start to run immediately when the mode switches from LOCAL to REMOTE.	The drive cannot operate because the Run command is not enabled.

■ o2-02 STOP Key Selection of Function

No. (Hex.)	Name	Description	Default (Range)
o2-02 (0506)	STOP Key Selection of Function	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function to stop the drive with the STOP button on the keypad when the Run command source for the drive is REMOTE (external) and not assigned to the keypad.	1 (0, 1)

0 : Disabled

1 : Enabled

STOP stays enabled when the Run command source has not been assigned to the keypad.

To start the drive again after you push STOP to stop operation, turn the external Run command OFF and ON again.

■ o2-03 UserPar Set Default Values

No. (Hex.)	Name	Description	Default (Range)
o2-03 (0507)	UserPar Set Default Values	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function to keep the settings of changed parameters as user parameter defaults to use during initialization.	0 (0 - 2)

When you set this parameter to 1, the drive saves changed parameter settings as user parameter setting values in a part of the memory that is isolated from drive parameters.

When you set *A1-03 = 1110 [Init Parameters = User / Solution Initialization]* to initialize the drive, the drive resets the internal parameter setting values to those user parameter setting values.

0 : No change

1 : Set defaults

Saves changed parameter settings as user-set default for User Initialization.

Set *o2-03 = 1 [Set defaults]*, then push ↵ on the keypad to save the user parameter setting values. After the drive saves the setting value, *o2-03* automatically resets to *0*.

2 : Clear all

Deletes all of the saved user parameter setting values.

To delete the user parameter setting values, set this parameter to 2 and push ↵ on the keypad. The drive will automatically reset *o2-03* to *0*. If you delete the user parameter setting values, you cannot set *A1-03 = 1110* to initialize parameters.

■ o2-04 Drive KVA Selection

No. (Hex.)	Name	Description	Default (Range)
o2-04 (0508)	Drive KVA Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the Drive Model code. Set this parameter after replacing the control board.	Determined by the drive (-)

NOTICE: *Set o2-04 [Drive KVA Selection] correctly. Failure to obey will decrease drive performance, cause the protection function to operate incorrectly, and cause damage to the drive.*

Note:

When the setting value of *o2-04* changes, related parameter setting values also change. Refer to *Defaults by Drive Model and Duty Rating ND/HD on page 511* for more information.

These tables list the relation between *o2-04* setting values and drive models.

o2-04 Setting	Drive Model
62	2004
63	2006
65	2010
66	2012
67	2018

o2-04 Setting	Drive Model
68	2021
6A	2030
6B	2042
6D	2056
6E	2070

o2-04 Setting	Drive Model
6F	2082
70	2110
72	2138
73	2169
74	2211
75	2257
76	2313
77	2360
78	2415
92	4002
93	4004
94	4005
95	4007
96	4009
97	4012
99	4018
9A	4023
9C	4031
9D	4038
9E	4044
9F	4060
A1	4075
A2	4089
A3	4103
A4	4140
A5	4168
A6	4208
A7	4250
A8	4296
A9	4371
AA	4389
AC	4453
AD	4568
AE	4675

■ o2-05 LCD FreqRef Mode@Home Screen

No. (Hex.)	Name	Description	Default (Range)
o2-05 (0509)	LCD FreqRef Mode@Home Screen	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function that makes it necessary to push the button to change the frequency reference value with the keypad when in Drive Mode.	0 (0, 1)

0 : Disabled

You must push to use the keypad to change the frequency reference value.

1 : Enabled

The frequency reference changes when you enter it with the keypad. This then changes the output frequency. It is not necessary to push . The drive keeps the frequency reference for 5 seconds after you use and on the keypad to change the frequency reference value.

■ o2-06 Keypad Disconnect Detection

No. (Hex.)	Name	Description	Default (Range)
o2-06 (050A)	Keypad Disconnect Detection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function that stops the drive if you disconnect the keypad connection cable from the drive or if you damage the cable while the keypad is the Run command source.	Determined by o2-09 (0, 1)

This parameter continues to operate if the keypad installed to the drive becomes disconnected.

This parameter is enabled in these conditions:

- When *b1-02 = 0 [Run Comm. Sel 1 = Keypad]* or *b1-16 = 0 [Run Comm. Sel 2 = Keypad]*
- In LOCAL Mode

0 : Disabled

The drive continues operation when it detects a keypad disconnection.

1 : Enabled

The drive stops operation, detects *oPr [Keypad Connection Fault]*, and the motor coasts to stop when the drive detects a keypad disconnection.

■ o2-07 Keypad Dir@Power-Up

No. (Hex.)	Name	Description	Default (Range)
o2-07 (0527)	Keypad Dir@Power-Up	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the direction of motor rotation when the drive is energized and the keypad is the Run command source.	0 (0, 1)

This parameter is enabled in these conditions:

- When *b1-02 = 0 [Run Comm. Sel 1 = Keypad]* or *b1-16 = 0 [Run Comm. Sel 2 = Keypad]*
- In LOCAL Mode

0 : Forward

1 : Reverse

■ o2-09 Region Code for Initialization

No. (Hex.)	Name	Description	Default (Range)
o2-09 (050D)	Region Code for Initialization	-	-

■ o2-23 Ext24V Off Warning Display

No. (Hex.)	Name	Description	Default (Range)
o2-23 (11F8)	Ext24V Off Warning Display	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function to give a warning when the backup external 24 V power supply turns off when the main circuit power supply is in operation.	0 (0, 1)

Note:

The drive will not run when it is operating from one 24-V external power supply.

0 : Disabled

The drive does not detect the loss of the 24-V external power supply.

1 : Enabled

The keypad shows the *L24v [Ext. 24-V Power Supply Lost]* indicator when the drive detects the loss of the 24-V external power supply.

Note:

The minor fault signal is not output from *H2-xx = 4 [Multi-Function Digital Out = Alarm]*.

■ o2-26 Ext24V Mode Warning Display

No. (Hex.)	Name	Description	Default (Range)
o2-26 (1563)	Ext24V Mode Warning Display	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV When you connect a backup external 24 V power supply, this parameter sets the function to trigger an alarm when the main circuit power supply voltage decreases.	0 (0, 1)

0 : Disabled

The drive will not detect *EP24v [External Power 24V Supply]* if the main circuit power supply voltage decreases. The [Ready] light on the LED Status Ring flashes quickly to identify that drive operation is not possible.

1 : Enabled

The drive detects *EP24v* when the main circuit power supply voltage decreases.

Note:

The minor fault signal is not output from *H2-xx = 4 [Multi-function Digital Out = Alarm]*.

■ o2-27 BLE Disconn.Selection@BLE Ctrl

No. (Hex.)	Name	Description	Default (Range)
o2-27 (1565)	BLE Disconn. Selection@BLE Ctrl	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets drive operation if the Bluetooth device is disconnected when you operate the drive in Bluetooth Mode.	3 (0 - 4)

0 : Ramp->Stop

1 : Coast->Stop

2 : Fast Stop (C1-09)

3 : Alarm Only

4 : No Alarm Display

◆ o3: COPY FUNCTION

o3 parameters set the operation of the parameter backup function.

■ o3-01 COPY Keypad Selection of Mode

No. (Hex.)	Name	Description	Default (Range)
o3-01 (0515)	COPY Keypad Selection of Mode	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function that saves and copies drive parameters to a different drive with the keypad.	0 (0 - 4)

0 : Copy Select

1 : Bck (Drive->OPE)

The parameter setting values are read from the drive and saved in the keypad.

2 : Res (OPE->Drive)

Copies the parameter setting values saved in the keypad to a different drive.

3 : Verify (Check)

Makes sure that the parameter setting values in the drive agree with the parameters saved in the keypad.

4 : Del (Clear OPE Memory)

Deletes the parameter setting values saved in the keypad.

■ o3-02 COPY Allow Selection

No. (Hex.)	Name	Description	Default (Range)
o3-02 (0516)	COPY Allow Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the copy function when *o3-01 = 1 [COPY Keypad Selection of Mode = Bck (Drive->OPE)]*.	0 (0, 1)

Note:

When you select [Parameter Backup] on the keypad menu screen to do the backup function, the drive automatically sets *o3-02 = 1*.

0 : Disabled

1 : Enabled

■ o3-04 COPY Memory Selection

No. (Hex.)	Name	Description	Default (Range)
o3-04 (0B3E)	COPY Memory Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the storage location for drive parameters when you back up and restore parameters. This parameter is only available with an LCD keypad.	0 (0 - 3)

You can use the LCD keypad to make a maximum of 4 parameter backup sets.

0 : Memory 1

1 : Memory 2

2 : Memory 3

3 : Memory 4

■ o3-05 COPY Items Selection

No. (Hex.)	Name	Description	Default (Range)
o3-05 (0BDA)	COPY Items Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets which parameters are backed up, restored, and referenced. This parameter is only available with an LED keypad.	0 (0, 1)

0 : Std

1 : Std+Solution

Note:
- The *qx-xx* and *rx-xx* parameters appear when *A1-07 = 1 or 2 [Q2pack Enable = Enable Q2pack or With DI]*.
- When *o3-05 = 1*, parameters are only restored and verified.

■ o3-06 AutoBackup Selection

No. (Hex.)	Name	Description	Default (Range)
o3-06 (0BDE)	AutoBackup Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function that automatically backs up parameters. This parameter is only available when using an LCD keypad.	1 (0, 1)

When you connect the drive and keypad, parameters set to the drive are automatically backed up to the keypad as specified by the setting of parameters *o3-06* and *o3-07*.

0 : Disabled

1 : Enabled

Note:
When you replace the LCD keypad then energize the drive, the keypad shows the restore operation screen automatically to restore the drive configuration with the parameters backed up to the LCD keypad. If you connect an LCD keypad that does not have parameter backup data, the keypad will not show the restore operation screen.

■ o3-07 AutoBackup Lapse

No. (Hex.)	Name	Description	Default (Range)
o3-07 (0BDF)	AutoBackup Lapse	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the interval at which the automatic parameter backup function saves parameters from the drive to the keypad.	2 (1 - 4)

The drive saves parameter settings to the keypad at these times:

1. After you energize the drive and the auto backup period passes.
2. When you use ROM enter or the keypad to change parameters, the drive saves those changes in the drive, waits for the auto backup period to pass, then saves those parameters in the keypad.

NOTICE: *Think about this limit when you set the auto backup period. You can write data to the keypad a maximum of 100,000 times. If you write data to the keypad more than 100,000 times, it can cause data access errors and keypad failure.*

1 : 10 minutes

2 : 30 minutes

3 : 60 minutes

4 : 12 hours

◆ o4: MAINTENANCE MONITORS

o4 parameters set the expected service life to help you know when to replace parts. The drive will show an alarm to tell you when the replacement part interval is near.

■ o4-01 Cum.Oper TimeSetting

No. (Hex.)	Name	Description	Default (Range)
o4-01 (050B)	Cum.Oper TimeSetting	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the initial value of the cumulative drive operation time in 10-hour units.	0 h (0 - 9999 h)

When you select *o4-01* on the keypad, it will show the current value of *U4-01* in units of 10 hours (h). When you change the setting of *o4-01* through the monitor, the *U4-01* count starts again as specified by the setting of *o4-01*.

Note:
Set this parameter in 10-hour (h) units. When *o4-01 = 30*, *U4-01 [Cumulative OpeTime] = 300 h*.

■ o4-02 Cum.Oper TimeSelect

No. (Hex.)	Name	Description	Default (Range)
o4-02 (050C)	Cum.Oper TimeSelect	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the condition that counts the cumulative operation time.	1 (1, 2)

1 : Log Power-On Time

Counts the time from when the drive is energized to when it is de-energized.

2 : Log Run Time

Counts the time that the drive outputs voltage.

■ o4-03 Fan.Oper Setting

No. (Hex.)	Name	Description	Default (Range)
o4-03 (050E)	Fan.Oper Setting	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the value from which to start the cumulative drive cooling fan operation time in 10-hour units.	0 h (0 - 9999 h)

Use monitor *U4-03 [Fan Oper.Time]* to view the total operation time of the cooling fan. When you replace a cooling fan, set *o4-03 = 0* and reset the value of *U4-03*. Select *o4-03* on the keypad to show the current value of *U4-03* in 10-hour (h) units. If you use the monitor to change the *o4-03* setting, the recount of *U4-03* starts with the *o4-03* setting.

Note:

The drive sets *o4-03* in 10-hour (h) units. When *o4-03 = 30*, *U4-03 [Fan Oper.Time]* will show "300 h".

■ o4-05 Cap.Maint.Setting

No. (Hex.)	Name	Description	Default (Range)
o4-05 (051D)	Cap.Maint.Setting	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the *U4-05 [Capacitor Maintenance]* monitor value.	0% (0 - 150%)

When you replace a drive, *set o4-05 = 0* to reset the value of *U4-05*. When the *o4-05* setting changes, the count of *U4-05* starts again as specified by the setting of *o4-05*. After you complete the configuration, the setting value of *o4-05* automatically resets to *0*.

Note:

The maintenance period changes for different operating environments.

■ o4-07 PreChgRly Preset Maintenance Cnt

No. (Hex.)	Name	Description	Default (Range)
o4-07 (0523)	PreChgRly Preset Maintenance Cnt	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the *U4-06 [SoftChgRelay Maint]* monitor value.	0% (0 - 150%)

When you replace a drive, set *o4-07 = 0* to reset the value of *U4-06*. When the *o4-07* setting changes the count of *U4-06* starts again as specified by the setting of *o4-07*. After you complete the configuration, the setting value of *o4-07* automatically resets to *0*.

Note:

The maintenance period changes for different operating environments.

■ o4-09 IGBT Preset Maintenance Cnt

No. (Hex.)	Name	Description	Default (Range)
o4-09 (0525)	IGBT Preset Maintenance Cnt	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the *U4-07 [IGBT Maintenance]* monitor value.	0% (0 - 150%)

When you replace a drive, set *o4-09 = 0* to reset the value of *U4-07*. When the *o4-09* setting changes the count of *U4-07* starts again as specified by the setting of *o4-09*. After you complete the configuration, the setting value of *o4-09* automatically resets to *0*.

Note:

The maintenance period changes for different operating environments.

■ o4-11 Flt.History Initialization

No. (Hex.)	Name	Description	Default (Range)
o4-11 (0510)	Flt.History Initialization	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Resets the records of Monitors *[U2: FAULT]* and *[U3: FAULT HISTORY]*.	0 (0, 1)

Note:

When you initialize the drive with *A1-03 [Init Parameters]*, the drive will not reset the records for *U2-xx* and *U3-xx*.

0 : No Reset

Keeps the records of Monitors *U2-xx* and *U3-xx*.

1 : Reset

Resets the records for Monitors *U2-xx* and *U3-xx*. After the reset, the drive automatically resets *o4-11* to *0*.

■ o4-12 kWh Monitor Initialization

No. (Hex.)	Name	Description	Default (Range)
o4-12 (0512)	kWh Monitor Initialization	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Resets the monitor values for *U4-10 [kWh Lower 4Digits]* and *U4-11 [kWh Upper 5Digits]*.	0 (0, 1)

Note:

When you initialize the drive with *A1-03 [Initialize Parameters]*, the drive will not reset *U4-10* and *U4-11*.

0 : No Reset

Keeps the monitor values for *U4-10* and *U4-11*.

1 : Reset

Resets the values of *U4-10* and *U4-11*. After the reset, the drive automatically resets *o4-12* to *0*.

■ o4-13 NumOfRunCom Init Counter

No. (Hex.)	Name	Description	Default (Range)
o4-13 (0528)	NumOfRunCom Init Counter	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Resets the monitor values for *U4-02 [Num of Run Commands]*, *U4-24 [No of Travels(L)]*, and *U4-25 [No of Travels(H)]*.	0 (0, 1)

0 : No Reset

Keeps the monitor values for *U4-02*, *U4-24, and U4-25*.

1 : No Reset

Resets the values of *U4-02*, *U4-24*, and *U4-25*. After the reset, the drive automatically resets *o4-13* to *0*.

■ o4-22 Time Format

No. (Hex.)	Name	Description	Default (Range)
o4-22 (154F) RUN	Time Format	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the time display format. This parameter is only available when using an LCD keypad.	0 (0 - 2)

Sets the display of the time shown in the upper-left of the LCD keypad screen.

0 : 24 Hour Clock

1 : 12 Hour Clock

2 : 12 Hour JP Clock

■ o4-23 Date Format

No. (Hex.)	Name	Description	Default (Range)
o4-23 (1550) RUN	Date Format	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the date display format. This parameter is only available when using an LED keypad.	0 (0 - 2)

Sets the date format that the drive uses for the fault history and other records.

0 : YYYY/MM/DD

1 : DD/MM/YYYY

2 : MM/DD/YYYY

Note:

The Fault History in the Monitor Mode shows when faults occurred. Refer to *Show Fault History on page 142* for more information.

■ o4-24 bAT Detection Selection

No. (Hex.)	Name	Description	Default (Range)
o4-24 (310F) RUN	bAT Detection Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets operation when the drive detects *bAT [Keypad Battery Low Voltage]* and *TiM [Keypad Time Not Set]*.	0 (0 - 2)

0 : Disabled

The drive will not detect *bAT* or *TiM*.

1 : Enable (Alarm Detected)

TiM or *bAT* shows on the keypad, and operation continues. The output terminal set for Alarm *[H2-01* to *H2-03 = 4]* activates.

2 : Enable (Fault Detected)

The drive output shuts off and the motor coasts to stop. Fault relay output terminal 1NO-1CM activates, and 1NC-1CM deactivates.

◆ o5: DATA LOGGER

The data log function saves drive status information as a CSV file in the micro SD memory card in the keypad. *Monitors Ux-xx* are the source of data log information. You can record a maximum of 10 monitors.

Change the LCD keypad screen from the main menu to the Diagnostic Tools screen and select the data log function. Set the number of the monitor to record and the sampling time, then start to record the data log.

Table 12.58 Setting Parameters for Data Log Items

No.	Name	Default	Data Log Monitors
o5-03	Log Mon Data 1	101	*U1-01 [Frequency Reference]*
o5-04	Log Mon Data 2	102	*U1-02 [Output Frequency]*
o5-05	Log Mon Data 3	103	*U1-03 [Output Current]*
o5-06	Log Mon Data 4	107	*U1-07 [DC Bus Voltage]*
o5-07	Log Mon Data 5	108	*U1-08 [Output Power]*
o5-08	Log Mon Data 6	000	Not selected
o5-09	Log Mon Data 7	000	Not selected
o5-10	Log Mon Data 8	000	Not selected
o5-11	Log Mon Data 9	000	Not selected
o5-12	Log Mon Data 10	000	Not selected

NOTICE: *Do not de-energize the drive or disconnect the keypad from the drive during log transfer communication. Failure to obey can cause the log function to fail after you restore power or connect the keypad.*

Note:

You can use a Micro SDHC card a maximum of 32 GB capacity.

■ Log File Specifications

Item	Specification
File storage location	A folder called [Log_File] is created in the root directory of the micro SD card.
Filename	Q0xxx.csv **Note:** [xxx] identifies a 3-digit decimal number
Maximum number of files	999 (Q0001.csv through Q0999.csv)
Character code	ASCII code

Item	Specification
Line break code	<CR><LF>
Separating character	Commas
Header rows	First row: Drive information including Drive Model, software version, control method, and sampling time Second row: Log data information including the monitor number, number decimal points, and unit code

■ Log File Configuration

The [Log_Files] folder is created in the root directory of the micro SD card. This is where the log data is stored as CSV files. Log data files are created in this configuration. The number of rows changes when the number of selected monitors change.

First row	Drive information
Second row	Log data information
Third row	Log data 1
:	Log data 2
:	Log data 3
:	:
Last row	Log data n

First Row: Drive Information

This example shows the data text strings and data generated for the first row of log data.

Example of generated data: 00,0012,160107111230,Q2A,VSAA01010,2,62,1000,000001

No.	Item	Number of Characters	Example	Description
1	Attribute	2	00	[00] shows that the record is a drive information record.
2	File number	4	0012	The [xxx] part of the [Q0xxx.csv] filename is a 3-digit decimal number in hexadecimal format. Example filename of [Q0018.csv]: 018 (Dec.) = 0012 (Hex.)
3	Time stamp *1	12	160107111230	Date file was generated ・ Date: 20YY/MM/DD ・ Time in 24-hour format: HH:MM:SS Example data of [160107111230]: 11:12:30 on January 7, 2016
4	Model	3	Q2A	Drive model information
5	Software number	9	VSAA01010	Drive software number
6	Control method	1	2	Setting value (Hex.) of *A1-02 [Control Method]*
7	Drive capacity	2	62	Setting value (Hex.) of *o2-04 [Drive KVA Selection]*
8	Sampling time	5 (maximum)	1000	Setting value (Dec.) of *o5-02 [Log Sample Lapse]* Unit: ms
9	Row number	6	000001	Row number (Hex.) in the data log file

*1 If you do not set the time in the keypad, the text string of [000000000000] is generated to show the time.

Second Row: Log Data Information

This example shows the data text strings and data generated for the second row of log data.

Example of generated data:
01,0012,160107111230,0101,0201,0102,0201,0103,0206,0107,0005,0108,0209,0000,0000,0000,0000,0000,0000,0000,0000,0000,0000,0000,0000,0000,0000,000002

No.	Item	Number of Characters	Description
1	Attribute	2	[01] shows that the record is a log data information record.
2	File number	4	The [xxx] part of the [Q0xxx.csv] filename is a 3-digit decimal number in hexadecimal format.
3	Time stamp	12	Date file was generated
4	Monitor number 1 *1	4	Monitor number selected by *o5-03 [Log Mon Data 1]* Ex.: 0101 (Dec.) for *U1-01*

No.	Item	Number of Characters	Description
5	Monitor Unit 1 *2	4	Unit code and number of decimal places used for the monitor selected with *o5-03* Example when *U1-01 = 30.00 Hz*: Number of decimal places = 2, Hz unit code = 01, monitor unit 1 = 0201 (Hex.)
6	Monitor number 2	4	Monitor number (Dec.) selected by *o5-04 [Log Mon Data 2]*
7	Monitor Unit 2	4	Unit code and number of decimal places used for the monitor selected with *o5-04*
:	:	:	:
22	Monitor number 10	4	Monitor number (Dec.) selected by *o5-12 [Log Mon Data 10]*
23	Monitor Unit 10	4	Unit code and number of decimal places used for the monitor selected with *o5-12*
24 to 27	Reserved	4	-
28	Row number	6	Row number (Hex.) in the data log file

*1 If there is no data log monitor selected, the text string of [0000] is generated.
*2 Refer to Table 12.59 for information about unit codes.

Table 12.59 Unit Codes

Unit Code (Hex.)	Unit	Unit Code (Hex.)	Unit	Unit Code (Hex.)	Unit	Unit Code (Hex.)	Unit
00	–	08	PPR	10	H	18	0H
01	Hz	09	kW	11	V	19	–
02	RPM	0A	Ω	12	us	1A	–
03	%	0B	ms	13	min	1B	–
04	VAC	0C	kHz	14	°C	1C	–
05	VDC	0D	PSI	15	W	1D	–
06	A	0E	MPM	16	kWH	1E	–
07	sec	0F	FPM	17	MWH	1F	–

Third and Subsequent Rows: Log Data

This example shows the data text strings and data generated for the third row of log data.

Example of generated data:
02,0012,160107111239,1770,1770,00BE,0118,0028,0000,0000,0000,0000,0000,0000,0000,00000C

No.	Item	Number of Characters	Description
1	Attribute	2	[02] shows that the record is a monitor data record.
2	File number	4	The [xxx] part of the [Q0xxx.csv] filename is a 3-digit decimal number in hexadecimal format.
3	Time stamp	12	Data log data was retrieved (YYMMDDHHMMSS)
4	Log Monitor Data 1	4	Log monitor data (Hex.) of the monitor selected with *o5-03 [Log Mon Data 1]*
5	Log Monitor Data 2	4	Log monitor data (Hex.) of the monitor selected with *o5-04 [Log Mon Data 2]*
:	:	:	:
13	Log Monitor Data 10	4	Log monitor data (Hex.) of the monitor selected with *o5-12 [Log Mon Data 10]*
14	Reserved	4	-
15	Encoding data	4	Encoding data for log monitor data 1 through 10 (Hex.) Bits 0 through 9 show the encoding of log monitor data 1 1 through 10. A bit value of 1 shows that the data represents a negative value. (Log monitor data 1 through 10 is absolute value data without encoding) Example when log monitor data 2, 5, and 8 show negative values: Bits 1, 4, and 7 have values of 1, and the encoding data = 0010010010 (Bin.) = 0092 (Hex.)
16	Row number	6	Row number (Hex.) in the data log file

■ o5-01 Log Start Selection

No. (Hex.)	Name	Description	Default (Range)
o5-01 (1551) RUN	Log Start Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the data log function. This parameter is only available on an LCD keypad.	0 (0 - 1)

0 : OFF

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Stops the data log.

1 : ON (Data Logging)

Starts the data log as specified by the sampling cycle set in *o5-02 [Log Sample Lapse]*.

■ o5-02 Log Sample Lapse

No. (Hex.)	Name	Description	Default (Range)
o5-02 (1552) RUN	Log Sample Lapse	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the data log sampling cycle. This parameter is only available on an LCD keypad.	1000 ms (100 - 6000 ms)

■ o5-03 Log Mon Data 1

No. (Hex.)	Name	Description	Default (Range)
o5-03 (1553) RUN	Log Mon Data 1	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the data log monitor. This parameter is only available on an LCD keypad.	101 (000,101 - 855)

Note:

Set the log data with values *101 to 999 [U1-01 to U9-99]*.

For example, to show *U1-05 [Motor Speed]*, set *o5-03 = 105*. When it is not necessary to set data log monitors, set this parameter to *000*. You cannot set *U2: FAULT* or *U3: FAULT HISTORY*.

■ o5-04 Log Mon Data 2

No. (Hex.)	Name	Description	Default (Range)
o5-04 (1554) RUN	Log Mon Data 2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the data log monitor. This parameter is only available on an LCD keypad.	102 (000,101 - 855)

Note:

Set the log data with values *101 to 999 [U1-01 to U9-99]*.

For example, to show *U1-05 [Motor Speed]*, set *o5-03 = 105*. When it is not necessary to set data log monitors, set this parameter to *000*. You cannot set *U2: FAULT* or *U3: FAULT HISTORY*.

■ o5-05 Log Mon Data 3

No. (Hex.)	Name	Description	Default (Range)
o5-05 (1555) RUN	Log Mon Data 3	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the data log monitor. This parameter is only available on an LCD keypad.	103 (000,101 - 855)

Note:

Set the log data with values *101 to 999 [U1-01 to U9-99]*.

For example, to show *U1-05 [Motor Speed]*, set *o5-03 = 105*. When it is not necessary to set data log monitors, set this parameter to *000*. You cannot set *U2: FAULT* or *U3: FAULT HISTORY*.

■ o5-06 Log Mon Data 4

No. (Hex.)	Name	Description	Default (Range)
o5-06 (1556) RUN	Log Mon Data 4	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the data log monitor. This parameter is only available on an LCD keypad.	107 (000,101 - 855)

Note:

Set the log data with values *101 to 999 [U1-01 to U9-99]*.

For example, to show *U1-05 [Motor Speed]*, set *o5-03 = 105*. When it is not necessary to set data log monitors, set this parameter to *000*. You cannot set *U2: FAULT* or *U3: FAULT HISTORY*.

o5-07 Log Mon Data 5

No. (Hex.)	Name	Description	Default (Range)
o5-07 (1557) RUN	Log Mon Data 5	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the data log monitor. This parameter is only available on an LCD keypad.	108 (000,101 - 855)

Note:

Set the log data with values *101 to 999 [U1-01 to U9-99]*.

For example, to show *U1-05 [Motor Speed]*, set *o5-03 = 105*. When it is not necessary to set data log monitors, set this parameter to *000*. You cannot set *U2: FAULT* or *U3: FAULT HISTORY*.

o5-08 Log Mon Data 6

No. (Hex.)	Name	Description	Default (Range)
o5-08 (1558) RUN	Log Mon Data 6	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the data log monitor. This parameter is only available on an LCD keypad.	000 (000,101 - 855)

Note:

Set the log data with values *101 to 999 [U1-01 to U9-99]*.

For example, to show *U1-05 [Motor Speed]*, set *o5-03 = 105*. When it is not necessary to set data log monitors, set this parameter to *000*. You cannot set *U2: FAULT* or *U3: FAULT HISTORY*.

o5-09 Log Mon Data 7

No. (Hex.)	Name	Description	Default (Range)
o5-09 (1559) RUN	Log Mon Data 7	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the data log monitor. This parameter is only available on an LCD keypad.	000 (000,101 - 855)

Note:

Set the log data with values *101 to 999 [U1-01 to U9-99]*.

For example, to show *U1-05 [Motor Speed]*, set *o5-03 = 105*. When it is not necessary to set data log monitors, set this parameter to *000*. You cannot set *U2: FAULT* or *U3: FAULT HISTORY*.

o5-10 Log Mon Data 8

No. (Hex.)	Name	Description	Default (Range)
o5-10 (155A) RUN	Log Mon Data 8	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the data log monitor. This parameter is only available on an LCD keypad.	000 (000,101 - 855)

Note:

Set the log data with values *101 to 999 [U1-01 to U9-99]*.

For example, to show *U1-05 [Motor Speed]*, set *o5-03 = 105*. When it is not necessary to set data log monitors, set this parameter to *000*. You cannot set *U2: FAULT* or *U3: FAULT HISTORY*.

o5-11 Log Mon Data 9

No. (Hex.)	Name	Description	Default (Range)
o5-11 (155B) RUN	Log Mon Data 9	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the data log monitor. This parameter is only available on an LCD keypad.	000 (000,101 - 855)

Note:

Set the log data with values *101 to 999 [U1-01 to U9-99]*.

For example, to show *U1-05 [Motor Speed]*, set *o5-03 = 105*. When it is not necessary to set data log monitors, set this parameter to *000*. You cannot set *U2: FAULT* or *U3: FAULT HISTORY*.

■ o5-12 Log Mon Data 10

No. (Hex.)	Name	Description	Default (Range)
o5-12 (155C) RUN	Log Mon Data 10	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the data log monitor. This parameter is only available on an LCD keypad.	000 (000,101 - 855)

Note:

Set the log data with values *101 to 999 [U1-01 to U9-99]*.

For example, to show *U1-05 [Motor Speed]*, set *o5-03 = 105*. When it is not necessary to set data log monitors, set this parameter to *000*. You cannot set *U2: FAULT* or *U3: FAULT HISTORY*.

12.11 T: AUTOTUNING

Numbers identifying the *T parameters* are displayed when an LED keypad is used. The names of the parameters are displayed on the LCD screen of the LCD keypad. Set the following.

- Induction Motor Auto-Tuning
- PM Motor Auto-Tuning
- ASR and Inertia Tuning

◆ T0: TUNE MODE

■ T0-00 Tune Mode Selection

When your control method supports Control Tuning, set *T0-00* first. Then, set *T1-00 [Mot1/Mot2 Selection]* to select the motor you will tune. Then, set the tuning mode in *T2-01 [PM AutoTune Mode Select]* or *T3-00 [Control Loop Tune Selection]*.

No. (Hex.)	Name	Description	Default (Range)
T0-00 (1197)	Tune Mode Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the type of Auto-Tuning.	0 (0, 1)

0 : Motor Parameter Tuning

1 : Control Tuning

Note:

The available tuning modes are different for different control methods.

◆ T1: INDUCTION MOTOR

T1 parameters set the Auto-Tuning input data for induction motor tuning.

Note:

- The base frequency of drive dedicated motors and special motors for use with vector control may be lower than the base frequency of general-purpose motors, which is 50 Hz or 60 Hz. In such cases, this lower frequency is used as the value for *E1-06 [Base Frequency]* and *E1-04 [Max Output Frequency]* after Auto-Tuning completes. If the maximum output frequency is too low and causes problems, change the setting of *E1-04* after Auto-Tuning completes.
- The following induction motor parameters are set automatically.
  - *E1: V/F PARAMETER MOTOR 1*
  - *E2: MOTOR 1 PARAMETERS*
  - *E3: V/F PARAMETER MOTOR 2*
  - *E4: MOTOR 2 PARAMETERS*
  - *F1: ENCODER* (only with Closed Loop Vector Control)

■ T1-00 Mot1/Mot2 Selection

No. (Hex.)	Name	Description	Default (Range)
T1-00 (0700)	Mot1/Mot2 Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets which motor to tune when motor 1/2 switching is enabled. You can only use the keypad to set this parameter. You cannot use external input terminals to set it.	1 (1, 2)

Note:

Set *H1-xx = 16 [Motor 2 Selection]* ON to set this parameter. The keypad will not show this parameter when *H1-xx = 16* is OFF.

1 : Motor 1 (sets E1-xx, E2-xx)

Auto-Tuning automatically sets parameters *E1-xx* and *E2-xx* for motor 1.

2 : Motor 2 (sets E3-xx, E4-xx)

Auto-Tuning automatically sets parameters *E3-xx* and *E4-xx* for motor 2. Make sure that you connect motor 2 to the drive for Auto-Tuning.

■ T1-01 Auto-tuning Mode Selection

No. (Hex.)	Name	Description	Default (Range)
T1-01 (0701)	Auto-tuning Mode Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the type of Auto-Tuning.	Determined by A1-02 (Determined by A1-02)

0 : Rotary Auto Tune

1 : Static1 AutoTune

2 : Static (R)

■ T1-02 Motor Rated Power

No. (Hex.)	Name	Description	Default (Range)
T1-02 (0702)	Motor Rated Power	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the rated output power (kW) of the motor.	Determined by o2-04 and C6-01 (0.00 - 650.00 kW)

Note:

Capacities 300 kW and smaller are set in units of 0.01 kW. Capacities larger than 300 kW are set in units of 0.1 kW. The maximum applicable motor output changes when the setting of *C6-01 [ND/HD Duty Selection]* changes.

■ T1-03 Motor Rated Voltage

No. (Hex.)	Name	Description	Default (Range)
T1-03 (0703)	Motor Rated Voltage	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the rated voltage (V) of the motor. Enter the base speed voltage for constant output motors.	Determined by o2-04 and C6-01 (400 V Class: 0.0 - 511.0 V)

If you do Auto-Tuning on a drive-dedicated motor or a specialized motor for vector control, the voltage or frequency can be lower than that of a general-purpose motor. Always compare the data from the nameplate or test report with the Auto-Tuning results and check for differences. Enter the voltage necessary to operate the motor in no-load conditions at rated speed for better control precision around rated speed. If the motor test report or the motor nameplate is not available, enter approximately 90% of the motor rated voltage.

If the drive input power supply voltage is low, enter approximately 90% of the input voltage. When the input power supply voltage is low, the current will increase. Make sure that the main power supply capacity is correct and use a molded-case circuit breaker for the drive.

■ T1-04 Motor Rated Current

No. (Hex.)	Name	Description	Default (Range)
T1-04 (0704)	Motor Rated Current	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the rated current (A) of the motor.	Determined by o2-04 (10% to 200% of the drive rated current)

Set the motor rated current between 50% and 100% of the drive rated current for the best performance. Enter the current at the motor base speed.

■ T1-05 Motor Base Frequency

No. (Hex.)	Name	Description	Default (Range)
T1-05 (0705)	Motor Base Frequency	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the base frequency (Hz) of the motor.	50.0 Hz (0.0 - 590.0 Hz)

Auto-Tuning sets *T1-05 = E1-04 [Max Output Frequency]*. If *T1-05* < 40 Hz, *E1-04* = 40 Hz. If you operate the drive at a speed that is higher than the base frequency, or if you operate in the field weakening range, set *E1-04* (*E3-04* for motor 2) to the maximum output frequency after you complete Auto-Tuning.

■ T1-06 Motor Poles Number

No. (Hex.)	Name	Description	Default (Range)
T1-06 (0706)	Motor Poles Number	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the number of motor poles.	4 (2 - 48)

T1-07 Motor Base Speed

No. (Hex.)	Name	Description	Default (Range)
T1-07 (0707)	Motor Base Speed	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the motor base speed for Auto-Tuning (min^{-1} (r/min)).	1450 min^{-1} (r/min) (0 - 35400 min^{-1} (r/min))

T1-08 PG PulsePerRevolution

No. (Hex.)	Name	Description	Default (Range)
T1-08 (0708)	PG PulsePerRevolution	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the number of PG (pulse generator, encoder) pulses.	1024 ppr (0 - 60,000 ppr)

Set the actual number of pulses for one full motor rotation.

T1-09 Motor NoLoad Current

No. (Hex.)	Name	Description	Default (Range)
T1-09 (0709)	Motor NoLoad Current	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the no-load current of the motor.	- (0A - T1-04; max. of 2999.9)

Note:

The display units are different for different models:
- 4002 to 4023: 0.01 A
- 4031 to 4675: 0.1 A

The value shown is the no-load current that is automatically calculated from the values set in *T1-02 [Motor Rated Power]* and *T1-04 [Motor Rated Current]*. Set the no-load current shown on the motor test report. If the motor test report is not available, do not change this parameter.

T1-10 Motor Rated Slip Frequency

No. (Hex.)	Name	Description	Default (Range)
T1-10 (070A)	Motor Rated Slip Frequency	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the motor rated slip.	- (0.000 - 20.000 Hz)

Shows 0.000 Hz as the default value. Set the rated slip shown on the motor test report. If the motor test report is not available, do not change this parameter.

T1-11 Motor Iron Loss

No. (Hex.)	Name	Description	Default (Range)
T1-11 (070B)	Motor Iron Loss	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the iron loss for calculating the energy-saving coefficient.	Determined by E2-11 or E4-11 (0 - 65535 W)

Note:

The default setting is different for different motor codes and motor parameter settings.

The value shown is the *E2-10 [Motor Iron Loss]* or *E4-10 [M2 Iron Loss]* for the motor output set in *T1-02 [Motor Rated Power]*. If the motor test report is available, enter the motor iron loss value to *T1-11*.

T1-12 Test Mode Selection

No. (Hex.)	Name	Description	Default (Range)
T1-12 (0BDB)	Test Mode Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the function to enable Test Mode after Stationary Auto-Tuning. When you can operate the motor with a light load attached after Stationary Auto-Tuning is complete, enable this parameter.	0 (0, 1)

0 : No

1 : Yes

After Auto-Tuning, the drive automatically sets *E2-02 [Mot Rated Slip]* and *E2-03 [Mot No-Load Current]* when you operate the motor for the first time in Drive Mode.

Note:

After Auto-Tuning is complete and you set the drive to Drive Mode, operate the motor in these conditions:
- Make sure that you connect all wiring between the drive and motor
- Make sure that a mechanical brake on the motor shaft is not locked
- Keep the motor-load ratio at 30%
- Hold constant speed for longer than 1 second at a minimum of 30% of the speed set in *E1-06 [Base Frequency]* (the default setting is the same as the maximum frequency).

■ T1-13 No-load Voltage

No. (Hex.)	Name	Description	Default (Range)
T1-13 (0BDC)	No-load Voltage	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the no-load voltage of the motor. If no-load voltage is necessary at rated speed for the motor test report, set the voltage in this parameter. If the motor test report is not available, do not change this parameter.	90% of T1-03 (400 V Class: 0.0 - 510.0 V)

◆ T2: PM MOTOR

T2 parameters set the Auto-Tuning input data for PM motor tuning.

Note:

The drive automatically sets these PM motor parameters:
- E1-xx [E1: V/F PARAMETER MOTOR 1]
- E5-xx [E5: PM MOTOR SETTINGS]
- F1-xx [F1: ENCODER] (CLV only)

■ T2-01 PM AutoTune Mode Select

No. (Hex.)	Name	Description	Default (Range)
T2-01 (0750)	PM AutoTune Mode Select	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the type of Auto-Tuning for PM motors.	0 (Determined by A1-02)

Note:

For specialized motors, Rotational (Ld, Lq, R, back-EMF) tuning is recommended. Rotational Auto-Tuning rotates the motor to measure the actual induction voltage constants for more accurate control than Stationary Auto-Tuning.

0 : PM Motor Parameter Settings

1 : PM Static Full AutoTune

2 : PM Static R Autotune

3 : Encoder Offset Autotune

4 : PM Rotary Autotune

■ T2-02 PMMot Code Selection

No. (Hex.)	Name	Description	Default (Range)
T2-02 (0751)	PMMot Code Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the PM motor code for drives operating SMRA, SSR1, or SST4-series Yaskawa PM motors.	Determined by A1-02 and o2-04 (0000 - FFFF)

Enter the motor code in *T2-02* to automatically set parameters *T2-03* to *T2-14*. When you are operating a specialized motor or a non-Yaskawa motor designed, set *T2-02 = FFFF* and enter the data from the motor nameplate or the motor test report.

You can only enter the permitted PM motor codes. Different drive control methods will accept different PM motor codes.

■ T2-03 PMMot Motor Type

No. (Hex.)	Name	Description	Default (Range)
T2-03 (0752)	PMMot Motor Type	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the type of PM motor the drive will operate.	1 (0, 1)

0 : IPM Motor

1 : SPM Motor

T2-04 PMMot Rated Power

No. (Hex.)	Name	Description	Default (Range)
T2-04 (0730)	PMMot Rated Power	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the rated output power (kW) of a PM motor.	Determined by o2-04 and C6-01 (0.00 - 650.00 kW)

Note:

Capacities 300 kW and less are set in units of 0.01 kW. Capacities above 300 kW are set in units of 0.1 kW. The maximum applicable motor output varies depending on the setting of *C6-01 [ND/HD Duty Selection]*.

T2-05 PMMot Rated Voltage

No. (Hex.)	Name	Description	Default (Range)
T2-05 (0732)	PMMot Rated Voltage	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the rated voltage (V) of the motor.	400 V Class: 400.0 V (400 V Class: 0.0 - 510.0 V)

T2-06 PMMot Rated Current

No. (Hex.)	Name	Description	Default (Range)
T2-06 (0733)	PMMot Rated Current	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the rated current (A) of the motor.	Determined by o2-04 (10% to 200% of the drive rated current)

T2-07 PMMot Base Frequency

No. (Hex.)	Name	Description	Default (Range)
T2-07 (0753)	PMMot Base Frequency	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the base frequency (Hz) of the motor.	87.5 Hz (0.0 - 590.0 Hz)

T2-08 PMMot Poles Number

No. (Hex.)	Name	Description	Default (Range)
T2-08 (0734)	PMMot Poles Number	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the number of motor poles.	6 (2 - 48)

T2-09 PMMot Base Speed

No. (Hex.)	Name	Description	Default (Range)
T2-09 (0731)	PMMot Base Speed	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the motor base speed (min^{-1} (r/min)).	1750 min^{-1} (r/min) (0 - 34500 min^{-1} (r/min))

T2-10 PMMot Stator Resistance

No. (Hex.)	Name	Description	Default (Range)
T2-10 (0754)	PMMot Stator Resistance	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the stator resistance for each motor phase.	Determined by T2-02 (0.000 - 65.000 Ω)

Note:

This parameter does not set line-to-line resistance.

T2-11 PMMot dAxis Inductance

No. (Hex.)	Name	Description	Default (Range)
T2-11 (0735)	PMMot dAxis Inductance	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the d-axis inductance of the motor on a per phase basis.	Determined by T2-02 (0.00 - 600.00 mH)

■ T2-12 PMMot qAxis Inductance

No. (Hex.)	Name	Description	Default (Range)
T2-12 (0736)	PMMot qAxis Inductance	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the q-Axis inductance of the motor on a per phase basis.	Determined by T2-02 (0.00 - 600.00 mH)

■ T2-13 KE Unit Selection

No. (Hex.)	Name	Description	Default (Range)
T2-13 (0755)	KE Unit Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the units that the drive uses to set the induced voltage constant.	1 (0, 1)

0 : mV/rpm

1 : mV/(rad/sec)

Note:

- When *T2-13 = 0*, the drive will use *E5-24 [PM BackEMF L-L Vrms (mV/rpm)]* and will automatically set *E5-09 [PM BackEMF Vpeak (mV/(rad/ s))] = 0.0*.
- When *T2-13 = 1*, the drive will use *E5-09* and will automatically set *E5-24 = 0.0*.

■ T2-14 PMMot KE Voltage Constant

No. (Hex.)	Name	Description	Default (Range)
T2-14 (0737)	PMMot KE Voltage Constant	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the motor induced voltage constant (Ke).	Determined by T2-13 (0.0 - 2000.0)

■ T2-15 PullInCurrLv@PM Motor Tuning

No. (Hex.)	Name	Description	Default (Range)
T2-15 (0756)	PullInCurrLv@PM Motor Tuning	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the level of the pull-in current as a percentage, where 100% = motor rated current. Usually it is not necessary to change this setting.	30% (0 - 120%)

If the load inertia is high, increase the setting value.

■ T2-16 PMMot PG PulsePerRevolution

No. (Hex.)	Name	Description	Default (Range)
T2-16 (0738)	PMMot PG PulsePerRevolution	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the number of PG (pulse generator, encoder) pulses.	1024 ppr (1 - 15000 ppr)

Set the actual number of pulses for one full motor rotation.

■ T2-17 Enc Z-Pulse Offset

No. (Hex.)	Name	Description	Default (Range)
T2-17 (0757)	Enc Z-Pulse Offset	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the encoder Z-pulse offset ($\Delta\theta$) (pulse generator, encoder) that is listed on the motor nameplate.	0.0° (-180.0 - +180.0°)

If you do not know the quantity of encoder (pulse generator, encoder) Z-pulse offset, or if you replaced the encoder, do Z Pulse Offset Tuning and correct for the offset ($\Delta\theta$) from the Z phase.

◆ T3: ASR

■ T3-00 Control Loop Tune Selection

No. (Hex.)	Name	Description	Default (Range)
T3-00 (1198)	Control Loop Tune Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the type of Control Auto-Tuning.	0 (0 - 3)

0 : Inertia Tuning

1 : ASR (Speed Regulator)

2 : Dec Rate Tuning

3 : KEB Tuning

Note:

Settings *0 and 1* are available only when *A1-02 = 3, 7 [Control Method = CLVector, PM CLVector]*.

■ T3-01 Inertia Test Frequency

No. (Hex.)	Name	Description	Default (Range)
T3-01 (0760)	Inertia Test Frequency	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the frequency of the test signal applied to the motor during Inertia Tuning. Usually it is not necessary to change this setting.	3.0 Hz (0.1 - 20.0 Hz)

If the load inertia is too large and the drive detects a fault after Inertia Tuning, decrease the setting.

■ T3-02 Inertia Test Amplitude

No. (Hex.)	Name	Description	Default (Range)
T3-02 (0761)	Inertia Test Amplitude	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the amplitude of the test signal applied to the motor during Inertia Tuning. Usually it is not necessary to change this setting.	0.5 rad (0.1 - 10.0 rad)

If the load inertia is too large and the drive detects a fault after Inertia Tuning, decrease the setting. If the drive detects a fault when *T3-01 [Inertia Test Frequency]* is set to a low value, adjust this parameter.

■ T3-03 Motor Inertia

No. (Hex.)	Name	Description	Default (Range)
T3-03 (0762)	Motor Inertia	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the inertia of the motor. This value uses the test signal response to calculate the load inertia.	Determined by o2-04, C6-01, and E5-01 (0.0001 - 6.0000 kgm^2)

The default setting is for a Yaskawa standard motor as shown in the motor inertia table. Actual values will be different when you use induction motors or PM motors.

Note:

Capacities smaller than 37 kW are set in units of 0.0001 kgm^2. Capacities 37 kW and larger are set in units of 0.001 kgm^2.

■ T3-04 System ResponseFrequency

No. (Hex.)	Name	Description	Default (Range)
T3-04 (0763)	System ResponseFrequency	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV This parameter uses the load inertia value from the Inertia Tuning process to automatically calculate and set *C5-01 [ASR PGain 1]*.	10.0 Hz (0.1 - 50.0 Hz)

If this input value is too high, it can cause oscillation.

◆ T4: SIMPLE VECTOR

Use *T4 parameters* to input the data necessary for motor parameter Auto-Tuning when *A1-02 = 8 [Control Method = EZ Vector]*. These two modes are available:

Value set in T4-01	Operational overview	Items input for tuning	Items tuned
0	Follow the instructions in the setup wizard on the keypad to manually enter the necessary motor parameters.	• T4-02 [Motor Type Selection] • T4-03 [Motor Max Revolutions] • T4-04 [Motor Rated Revolutions] • T4-05 [Motor Rated Frequency] • T4-06 [Motor Rated Voltage] • T4-07 [Motor Rated Current] • T4-08 [Motor Rated Capacity] • T4-09 [Motor Poles Number]	• E9-01 [Motor Type Selection] • E9-02 [Maximum Speed] • E9-03 [Rated Speed] • E9-04 [Base Frequency] • E9-05 [Base Voltage] • E9-06 [Motor Rated Current] • E9-07 [Motor Rated Power (kW)] • E9-08 [Motor Pole Count] • E9-09 [Motor Rated Slip] • E9-10 [Motor L-L Resistance]
1	Do only line-to-line resistance tuning.	Motor Rated Current (FLA)	E9-10 [Motor L-L Resistance]

*1 When you use a PM motor or a synchronous reluctance motor, it is not necessary to use the setup wizard. The drive will use the rated rotation speed and number of motor poles to automatically calculate the rated frequency.

■ T4-01 EZ Tune Mode Selection

No. (Hex.)	Name	Description	Default (Range)
T4-01 (3130)	EZ Tune Mode Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the type of Auto-Tuning for EZOLV control.	0 (0, 1)

0 : Motor Constant

1 : Static R Autotune

■ T4-02 Motor Type Selection

No. (Hex.)	Name	Description	Default (Range)
T4-02 (3131)	Motor Type Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the type of motor.	0 (0, 1, 2)

0 : IM (Induction)

1 : PM (Permanent Magnet)

2 : SynRM (Synchronous Reluctance)

■ T4-03 Motor Max Revolutions

No. (Hex.)	Name	Description	Default (Range)
T4-03 (3132)	Motor Max Revolutions	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the maximum motor revolutions (rpm).	- ((40 to 120 Hz) × 60 × 2 / E9-08)

■ T4-04 Motor Rated Revolutions

No. (Hex.)	Name	Description	Default (Range)
T4-04 (3133)	Motor Rated Revolutions	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets rated rotation speed (rpm) of the motor.	- ((40 to 120 Hz) × 60 × 2 / E9-08)

■ T4-05 Motor Rated Frequency

No. (Hex.)	Name	Description	Default (Range)
T4-05 (3134)	Motor Rated Frequency	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the rated frequency (Hz) of the motor.	Determined by E9-01 and o2-04 (40.0 - 120.0 Hz)

Note:

When *T4-02 = 1, 2 [Motor Type Selection = PM, SynRM]*, input is not necessary because it assumes: Motor Rated Revolutions/60 × Number of Motor Poles/2.

T4-06 Motor Rated Voltage

No. (Hex.)	Name	Description	Default (Range)
T4-06 (3135)	Motor Rated Voltage	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the rated voltage (V) of the motor.	400 V Class: 400.0 V (400 V Class: 0.0 - 510.0 V)

T4-07 Motor Rated Current

No. (Hex.)	Name	Description	Default (Range)
T4-07 (3136)	Motor Rated Current	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the rated current (A) of the motor.	Determined by o2-04 and C6-01 (10% to 200% of the drive rated current)

Note:

The value set here becomes the base value for motor protection, the torque limit, and torque control.

T4-08 Motor Rated Capacity

No. (Hex.)	Name	Description	Default (Range)
T4-08 (3137)	Motor Rated Capacity	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the motor rated capacity in 0.01 kW units.	Determined by E9-10 (0.10 - 650.00 kW)

T4-09 Motor Poles Number

No. (Hex.)	Name	Description	Default (Range)
T4-09 (3138)	Motor Poles Number	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the number of motor poles.	Determined by E9-01 (2 - 48)

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Glossary

Phrase	Definition
AOLV	Advanced Open Loop Vector Control
AOLV/PM	Advanced Open Loop Vector Control for Permanent Magnet Motors
CLV	Closed Loop Vector Control
CL-V/f	Closed Loop V/f Control
CLV/PM	Closed Loop Vector Control for Permanent Magnet Motors
Drive	Q2A
EDM	External Device Monitor
EZOLV	EZ Open Loop Vector Control
HD	Heavy Duty
IPM Motor	Interior Permanent Magnet Motor
MFAI	Multi-Function Analog Input
MFAO	Multi-Function Analog Output
MFDI	Multi-Function Digital Input
MFDO	Multi-Function Digital Output
ND	Normal Duty
OLV	Open Loop Vector Control
OLV/PM	Open Loop Vector Control for Permanent Magnet Motors
PM motor	Permanent Magnet Synchronous motor (generic name for IPM motors and SPM motors)
SIL	Safety Integrity Level
SPM Motor	Surface Permanent Magnet Motor
V/f	V/f Control

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Revision History

Date of Publication	Revision Number	Section	Revised Content
June 2018	A	-	First Edition
December 2018	B	All	Added information for 200 V devices Parameter b5-54 removed Fixed naming of some parameters
October 2019	C	All	Fixed naming of some parameters Added explanation for PWEr error

Q2A

Driving Quality

Technical Manual

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In the event that the end user of this product is to be the military and said product is to be employed in any weapons systems or the manufacture thereof, the export will fall under the relevant regulations as stipulated in the Foreign Exchange and Foreign Trade Regulations. Therefore, be sure to follow all procedures and submit all relevant documentation according to any and all rules, regulations and laws that may apply. Specifications are subject to change without notice for ongoing product modifications and improvements.

Original Instructions

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