SIEMENS

System manual

SIMATIC

ET 200AL

ET 200AL distributed I/O system

Edition 08/2019

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SIEMENS

SIMATIC

ET 200AL
Distributed I/O system

System Manual

08/2019
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Legal information

Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

> **⚠ DANGER**
>
> indicates that death or severe personal injury **will** result if proper precautions are not taken.

> **⚠ WARNING**
>
> indicates that death or severe personal injury **may** result if proper precautions are not taken.

> **⚠ CAUTION**
>
> indicates that minor personal injury can result if proper precautions are not taken.

> **NOTICE**
>
> indicates that property damage can result if proper precautions are not taken.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

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Note the following:

> **⚠ WARNING**
>
> Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be complied with. The information in the relevant documentation must be observed.

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Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

Preface

Purpose of the documentation

This documentation provides you with important information on how to configure, install, wire and commission the SIMATIC ET 200AL distributed I/O system.

Changes compared to previous version

This manual contains additions about the extension of the temperature range to -30 °C compared to the previous version:

Basic knowledge required

A basic knowledge of automation technology is required to understand the documentation.

Validity of the documentation

This documentation is valid for SIMATIC ET 200AL distributed I/O system.

Conventions

Please observe notes labeled as follows:

Note

A note contains important information on the product described in the documentation and on the handling of the product to which particular attention should be paid.

Recycling and disposal

For ecologically sustainable recycling and disposal of your old device, contact a certificated disposal service for electronic scrap and dispose of the device in accordance with the regulations in your country.

Additional support

- Information about Technical Support is available in section Siemens Industry Online Support (Page 5).

- The range of technical documentation for the individual SIMATIC products and systems can be found on the Internet (http://www.siemens.com/simatic-tech-doku-portal).

- Information about the online catalog and online order system is available in section Industry Mall (Page 5).

See also

Safety-related symbols for IP65/IP67 modules (Page 91)

Technical specifications (Page 81)

Security information

Siemens provides products and solutions with industrial security functions that support the secure operation of plants, systems, machines and networks.

In order to protect plants, systems, machines and networks against cyber threats, it is necessary to implement – and continuously maintain – a holistic, state-of-the-art industrial security concept. Siemens' products and solutions constitute one element of such a concept.

Customers are responsible for preventing unauthorized access to their plants, systems, machines and networks. Such systems, machines and components should only be connected to an enterprise network or the internet if and to the extent such a connection is necessary and only when appropriate security measures (e.g. firewalls and/or network segmentation) are in place.

For additional information on industrial security measures that can be implemented, please visit (https://www.siemens.com/industrialsecurity).

Siemens' products and solutions undergo continuous development to make them more secure. Siemens strongly recommends that product updates are applied as soon as they are available and that the latest product versions are used. Use of product versions that are no longer supported, and failure to apply the latest updates may increase customers' exposure to cyber threats.

To stay informed about product updates, subscribe to the Siemens Industrial Security RSS Feed visit (https://www.siemens.com/industrialsecurity).

Siemens Industry Online Support

You can find current information on the following topics quickly and easily here:

- **Product support**

  All the information and extensive know-how on your product, technical specifications, FAQs, certificates, downloads, and manuals.

- **Application examples**

  Tools and examples to solve your automation tasks – as well as function blocks, performance information and videos.

- **Services**

  Information about Industry Services, Field Services, Technical Support, spare parts and training offers.

- **Forums**

  For answers and solutions concerning automation technology.

- **mySupport**

  Your personal working area in Industry Online Support for messages, support queries, and configurable documents.

This information is provided by the Siemens Industry Online Support in the Internet (http://www.siemens.com/automation/service&support).

Industry Mall

The Industry Mall is the catalog and order system of Siemens AG for automation and drive solutions on the basis of Totally Integrated Automation (TIA) and Totally Integrated Power (TIP).

Catalogs for all the products in automation and drives are available on the Internet (https://mall.industry.siemens.com).

Table of contents

System overview

<div style="text-align: right; font-size: 3em;">1</div>

1.1 What is the SIMATIC ET 200AL distributed I/O system?

SIMATIC ET 200AL

The SIMATIC ET 200AL distributed I/O system is a scalable and highly flexible, distributed I/O system for connecting process signals to a higher-level control system with a field bus.

Customer benefits of the system

Compact design

- High IO configuration limits for module widths of 30 mm or 45 mm and up to 32 modules for each ET 200AL
- High degree of protection IP65/IP67
- Adequate for temperatures from -30 °C/-25 °C to +55 °C and accelerations up to 10g

Flexible mounting

- Easy mounting in all mounting positions - even in small spaces
- Spatially separated mounting of the modules by means of a backplane bus designed as a cable (= ET connection)
- Flexible connection to PROFINET, PROFIBUS or integration in SIMATIC ET 200SP
- Integration of sensors and actuators through M8 and M12 connection technology

Easy to use

- Easy wiring thanks to color-coded connectors
- CAx compliant labeling of all interfaces
- Fast, convenient configuration and commissioning with STEP 7 (TIA Portal)
- Configuration customizing for future extension through integrated configuration control

Communication standards

- PROFINET IO
- PROFIBUS DP
- IO-Link

Energy efficiency

- PROFIenergy as integrated function

Powerful technology

- Module with counting function

Figure 1-1   ET 200AL benefits

Area of application

The SIMATIC ET 200AL distributed I/O system is especially well suited for use in tight spaces, moving applications and for assembly and handling technology. Thanks to its scalable construction, you have the option to precisely customize its configuration to your on site needs.

The SIMATIC ET 200AL distributed I/O system features degree of protection IP65/IP67 and is suited to distributed use on a machine or assembly line.

Setup

The SIMATIC ET 200AL distributed I/O system is made up of the following components:

- Interface modules (PROFINET/PROFIBUS)
- Digital and analog I/O modules
- Communication module

After an interface module you can configure 2 lines (ET-Connection), each with 16 modules.

Alternatively, you can configure a line with 16 I/O modules on the SIMATIC ET 200SP distributed I/O system with BaseUnit BU-Send and the BusAdapter BA-Send 1xFC.

The ET-Connection backplane bus is designed as a cable. This allows you to create spatial distances of up to 15 m between the modules.

Configuration example

The figure below shows a configuration example of the SIMATIC ET 200AL distributed I/O system with a PROFINET interface module.
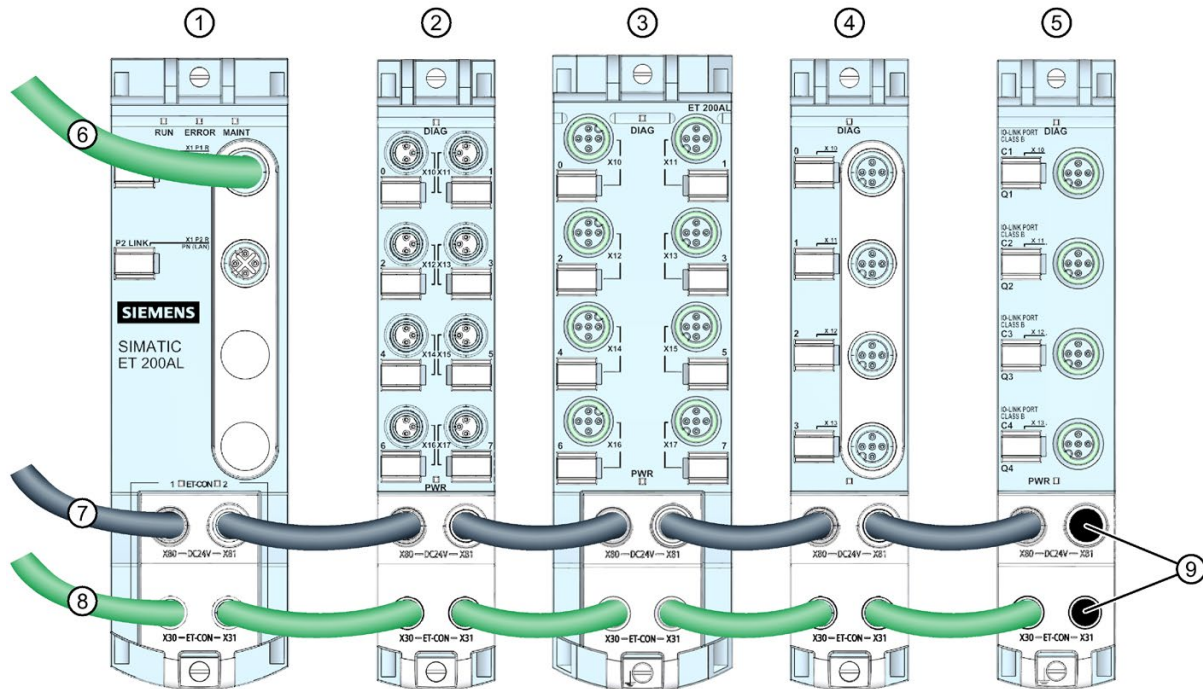
①	Interface module (PROFINET)
②	Digital input/Digital output module
③	Digital output module
④	Analog input module
⑤	Communication module
⑥	PROFINET cable
⑦	Power supply cable
⑧	ET-Connection cable
⑨	Sealing caps
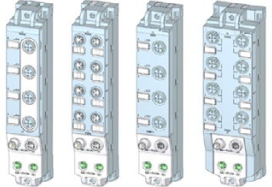
Figure 1-2   Configuration example of the ET 200AL

1.2 Components

Components of the ET 200AL distributed I/O system

The following table shows and explains the function of the most important components of the ET 200AL distributed I/O system.

Table 1- 1   Components of the ET 200AL distributed I/O system

Components	Function	View
Interface module for PROFINET IO	• The interface module connects the ET 200AL distributed I/O system with the IO controller • Exchanges data with the I/O modules via ET-Connection	
Interface module for PROFIBUS DP	• The interface module connects the ET 200AL distributed I/O system with the DP master • Exchanges data with the I/O modules via ET-Connection	
I/O modules	• The I/O modules form the interface to the process • Recording and controlling the current process status via the connected sensors and actuators	
Identification labels	• The identification labels come with the module and can be machine printed • Can be ordered separately	
Bus cable and M8 connector for ET-Connection	• The bus cable creates the bus connection between the modules	
Power cable and M8 connector for power supply	• The power cable provides power to the modules	
Stripping tool ET-Connection	• The stripping tool is used to strip the ET-Connection bus cable	

Documentation guide

<div style="text-align: right; font-size: 3em;">2</div>

The documentation for the SIMATIC ET 200AL distributed I/O system is arranged into three areas.
This arrangement enables you to access the specific content you require.

General information	Information on general topics Examples: • Mixed configuration ET 200AL/ET 200SP • Diagnostic • Communication	• PROFINET • PROFIBUS • Configuring interference-free controllers
Device information	Manuals with detailed information about the modules Examples: • Interface modules • Digital modules	• Analog modules • Communication module
Basic information	Information about the system Examples: • System manual ET 200AL • STEP 7 Professional	• Product information

Basic information

The System Manual and Getting Started describe in detail the configuration, installation, wiring and commissioning of the SIMATIC ET 200AL distributed I/O system. The STEP 7 online help supports you in the configuration and programming.

Device information

Product manuals contain a compact description of the module-specific information, such as properties, terminal diagrams, characteristics and technical specifications.

General information

The function manuals contain detailed descriptions on general topics regarding the SIMATIC ET 200AL distributed I/O system, e.g. diagnostics, communication, Motion Control, Web server.

You can download the documentation free of charge from the Internet (https://support.industry.siemens.com/cs/ww/en/view/109742667).

Manual Collection ET 200AL

The Manual Collection contains the complete documentation on the SIMATIC ET 200AL distributed I/O system gathered together in one file.

You can find the Manual Collection on the Internet (https://support.automation.siemens.com/WW/view/en/95242965).

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You must register once to use the full functionality of "mySupport".

You can find "mySupport" on the Internet (https://support.industry.siemens.com/My/ww/en).

Application examples

The application examples support you with various tools and examples for solving your automation tasks. Solutions are shown in interplay with multiple components in the system - separated from the focus on individual products.

You will find the application examples on the Internet (https://support.industry.siemens.com/sc/ww/en/sc/2054).

Application planning 3

3.1 Hardware configuration

Mechanical maximum configuration

The following tables show the rules of the mechanical configuration. As soon as one of the following rules applies, the maximum configuration has been reached.

Table 3- 1   Maximum mechanical configuration - on ET 200AL interface module

Properties	Rule (max.)	
	Interface modules as of firmware version V1.0.0	Interface modules as of firmware version V1.0.1
Number of ET 200AL I/O modules in the configuration	32	
Number of ET-Connection outlets	2	
Number of I/O modules per ET-Connection outlet	16	
Spatial extension per ET-Connection line	160 m	240 m
Cable length between the modules	10 m	15 m

Table 3- 2   Maximum mechanical configuration - on ET 200SP with interface module

Properties	Rule (max.)	
	Interface modules as of firmware version V3.0.0	Interface modules as of firmware version V3.3.0
Number of ET 200AL I/O modules in the configuration	16	
Number of ET-Connection outlets	1	
Spatial extension ET-Connection line	160 m	240 m
Cable length between the modules	10 m	15 m

Table 3- 3   Maximum mechanical configuration - on ET 200SP with CPU

Properties	Rule (max.)
	CPUs with firmware version as of V2.0.0
Number of ET 200AL I/O modules in the configuration	16
Number of ET-Connection outlets	1
Spatial extension ET-Connection line	240 m
Cable length between the modules	15 m

Electrical maximum configuration

The number of usable I/O modules of a potential group is limited by the following points:

- Power requirements of the I/O modules
- Power requirements of the components supplied via these I/O modules

The maximum infeed current of the I/O modules is 4 A with 1L+ supply voltage (non-switched) and 2L+ load voltage (switched). When the maximum infeed current has been reached, you must open a new potential group.

Reference

You will find more information in the section Connecting cables for ET 200AL (Page 36).

3.2 Configuration variants with ET-Connection

3.2.1 ET 200AL with ET-Connection

Every ET 200AL interface module has 2 ET-Connection connections

From every ET-Connection, you have the option to set up a line with a maximum of 16 ET 200AL I/O modules.

ET-Connection1

The figure below shows a configuration in the IP65/IP67 environment with one ET-Connection line.
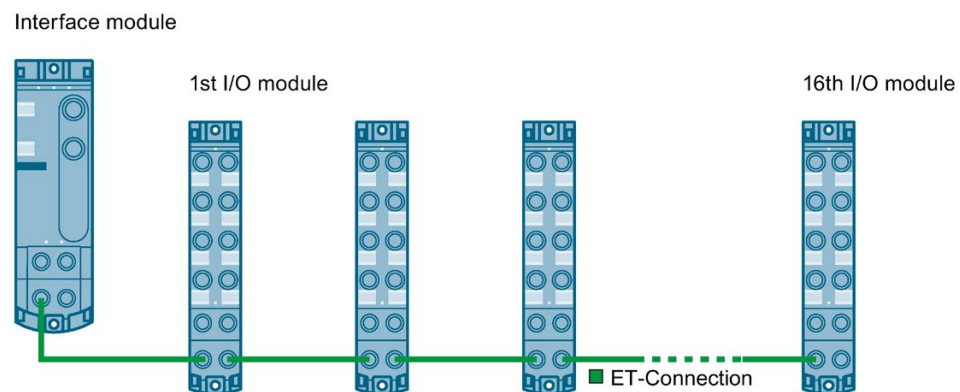
Figure 3-1   ET 200AL with ET-Connection1

ET-Connection1 and ET-Connection2

The figure below shows a configuration in the IP65/IP67 environment with two ET-Connection lines
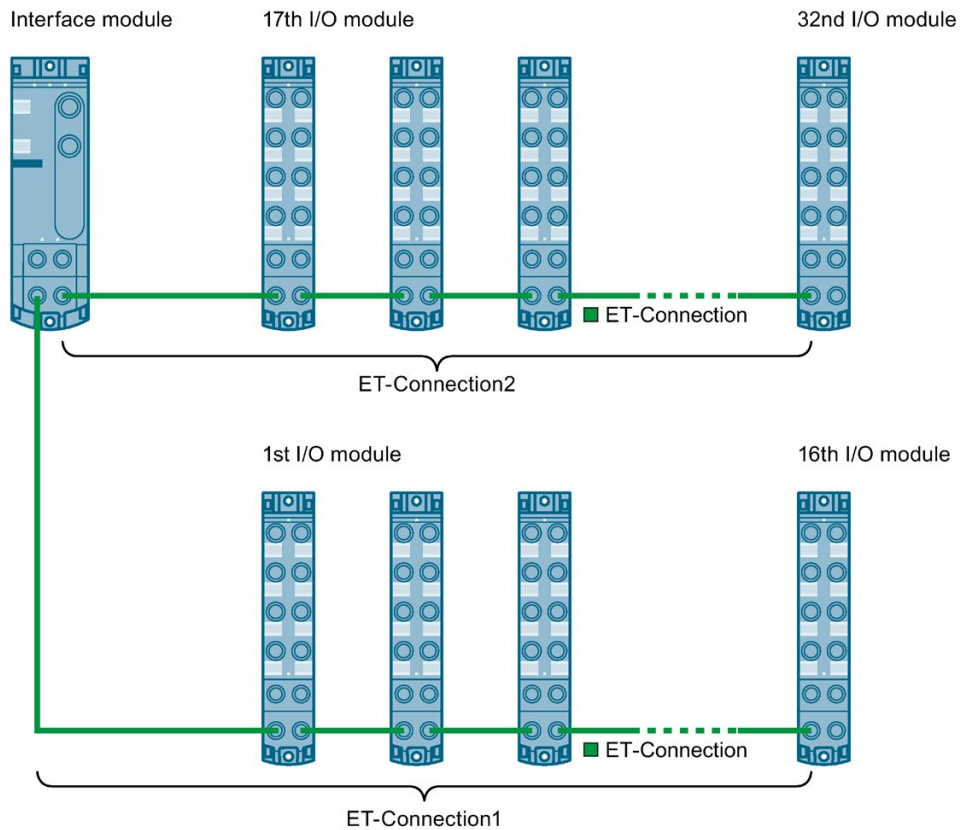
Figure 3-2   ET 200AL with ET-Connection1 and ET-Connection2

3.2.2 Hybrid configuration ET 200AL/ET 200SP with ET-Connection

Hybrid configuration ET 200AL and ET 200SP

You have the option to integrate the I/O modules of the ET 200AL distributed I/O system (IP65/IP67) in a configuration of the ET 200SP distributed I/O system (IP20).

The figure below shows a combination of the modules of the ET 200AL and ET 200SP distributed I/O systems.
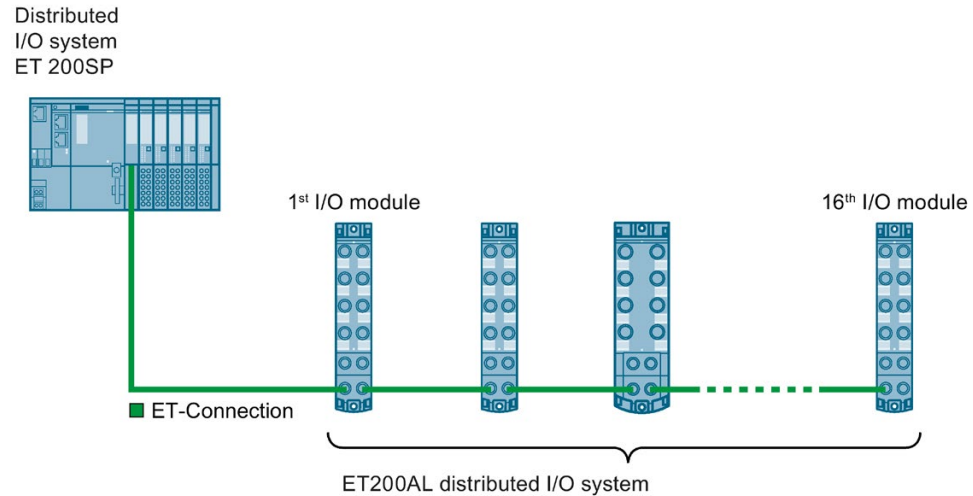
Figure 3-3   Hybrid configuration ET 200SP and ET 200AL with ET-Connection

Requirement

For a hybrid configuration, you need at least the following components:

- Interface module
    - IM 155-6 PN HF (V3.0 or higher)
    - IM 155-6 PN/2 HF (V4.2 or higher)
    - IM 155-6 PN/3 HF (V4.2 or higher)
    - IM 155-6 PN ST (V3.1 or higher)
    - IM 155-6 DP HF (V3.0 or higher)

Note

Using 15 m cable

Keep in mind that you can only use cables with a cable length of 15 m between the modules in combination with interface modules as of firmware version V3.3.0.

- CPU
    - 1510SP-1 PN (V2.0 or higher and STEP 7 (TIA Portal) V14 or higher)
    - 1512SP-1 PN (V2.0 or higher and STEP 7 (TIA Portal) V14 or higher)
    - 1510SP F-1 PN (V2.0 or higher and STEP 7 (TIA Portal) V14 or higher)
    - 1512SP F-1 PN (V2.0 or higher and STEP 7 (TIA Portal) V14 or higher)
- BaseUnit BU-Send with BusAdapter BA-Send 1xFC
- ET-Connection cable pre-assembled on one side
- Power cable pre-assembled on one side

Rules

When putting together a hybrid configuration, you must observe the following rules:

- The bus length of the ET 200SP distributed I/O system is a maximum of 1 m (excluding interface module/CPU, including BU-Send, BA-Send 1×FC and server module).
- A maximum of 16 ET 200AL I/O modules can be connected to ET-Connection.
- The maximum length of the bus cable for ET-Connection between two modules is 15 m.

Procedure

Watch video sequence (https://support.industry.siemens.com/cs/ww/en/view/95886672)

Proceed as follows to put together a multi-tier configuration:

1. Mount the BaseUnit BU-Send directly to the right of the ET 200SP interface module or the ET 200SP CPU.

2. Then install the other BaseUnits/I/O modules for the ET 200SP distributed I/O system and the server module.

3. Connect the bus cable for ET-Connection to the BusAdapter BA-Send 1×FC and install it on the BaseUnit BU-Send.

4. Fasten the BusAdapter BA-Send 1×FC with the BaseUnit BU-Send (1 screw with tightening torque of 0.2 Nm). Use a screwdriver with a 3 to 3.5 mm blade to do this.

5. Connect the other end of the bus cable for ET-Connection (with M8 connector) to the first ET 200AL I/O module (socket X30 ET-Connection IN).

6. Connect the supply voltage (24 V DC) to the ET 200AL I/O modules (X80 connector).

Mounting 4

4.1 Basics

Introduction

All the modules of the ET 200AL distributed I/O system are designed for the degree of protection IP65/IP67. This means that you can directly mount this system in your plant.

Installation position

You can mount the ET 200AL distributed I/O system in any position.

Minimum clearances

At ambient temperatures of 50 °C or higher, please ensure that the module is mounted at a distance of least 1 cm from an adjacent module or another device.

Mounting rules

When mounting the modules, you do not need to following any special rules.

Note

Mounting of the modules

Mount the ET 200AL distributed I/O system only with disconnected supply voltages.

4.2 Mounting modules

Introduction

The modules of the ET 200AL distributed I/O system are designed for installation on a level, firm surface.

Thanks to the axisymmetrical drill holes in the modules, you have the option to fasten the modules on an aluminum profile using tee nuts.

The following images shows the aluminum profile on which you can mount the modules.
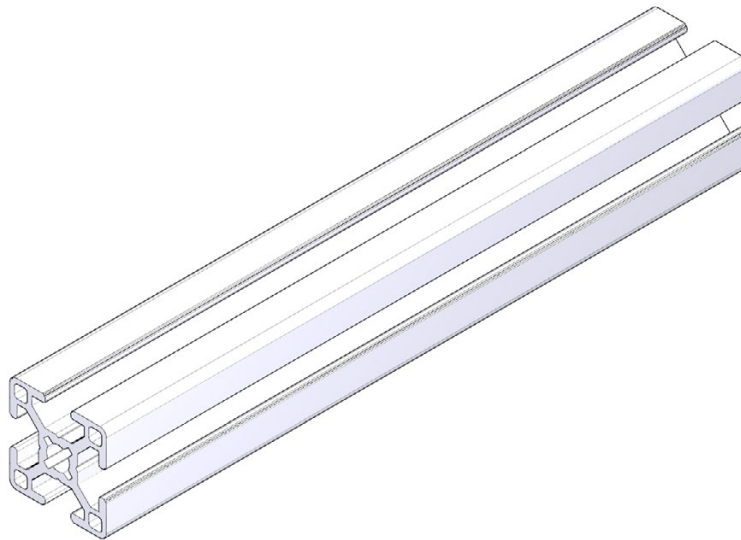
Figure 4-1   Aluminum profile

Required tools

For installation, you need a screwdriver or an Allen wrench.

Required screws

The following table shows and explains the screw types required to mount the modules.

Table 4- 1   Recommended screws

Screw type	Explanation
Socket head cap screw M4 according to DIN EN ISO 1207 / DIN EN ISO 1580	The screw length must be at least 30 mm. If you need washers, use DIN EN ISO 7089/DIN EN ISO 7090 washers.
Hexagon socket head cap screw M4 according to DIN EN ISO 4762	

Drill holes of the modules

All modules of the ET 200AL distributed I/O system feature a uniform drill pattern.

- All module housings are axisymmetrical.
- The distance between the top and bottom drill hole is identical for all modules.

Mounting interface module and 45 mm I/O modules (front)

Watch video sequence (https://support.industry.siemens.com/cs/ww/en/view/95886672)

The interface modules and the 45 mm I/O modules have an attachment point on top and on the bottom.

To mount an interface module or 45 mm I/O module, follow these steps:

1. Drill 2 fastening holes with 4.5 mm diameter at a distance of 149.6 mm.

2. Fasten the interface module or the 45 mm I/O module with the screws to both fastening points (tightening torque 1.2 Nm).

The figure below shows the dimensions for fastening the IM 157-1 PN interface module and the DQ 8x24VDC/2A 8xM12 45 mm I/O module.
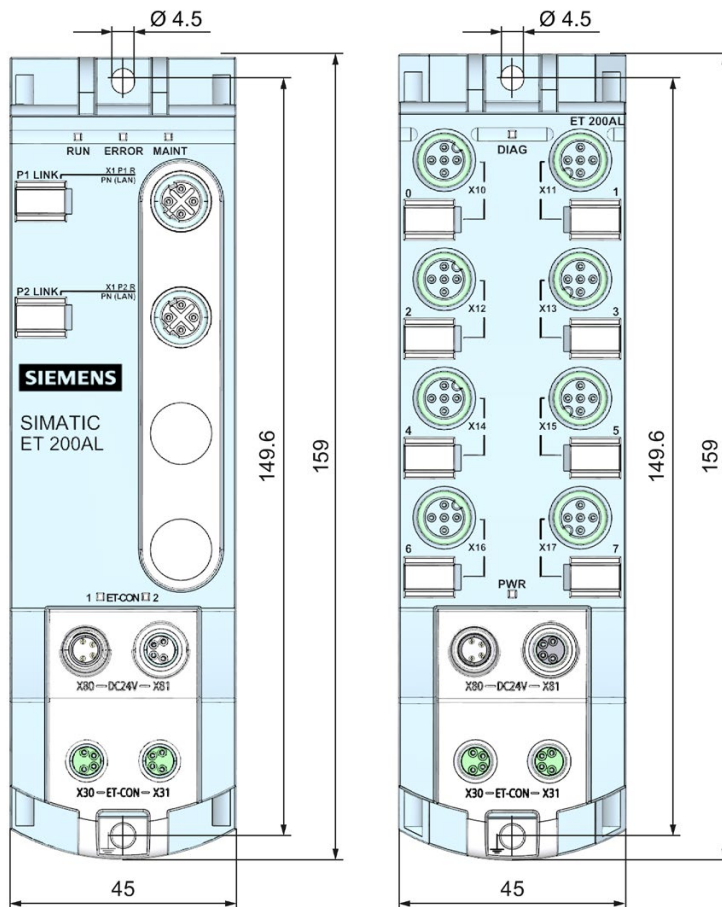
Figure 4-2   Dimensions for mounting interface modules and 45 mm I/O modules

Mounting 30 mm I/O modules (front or side)

Watch video sequence (https://support.industry.siemens.com/cs/ww/en/view/95886672)

The 30 mm I/O modules have an attachment point on top and on the bottom. You also have the option of fastening the 30 mm I/O modules at the side. When fastening them at the side, you must use the supplied spacers.

To mount a 30 mm I/O module, follow these steps:

1. Drill 2 fastening holes with 4.5 mm diameter at a distance of 149.6 mm.

2. Use the supplied spacers for side fastening of the I/O module on the top and bottom (on one side adjacent to the fastening surface).

3. Fasten the I/O module with the screws to both fastening points (tightening torque 1.2 Nm).

The figure below shows the dimensions for fastening the 30 mm I/O modules using the example of the DIQ 4+DQ 4x24VDC/0.5A 8xM8 I/O module.
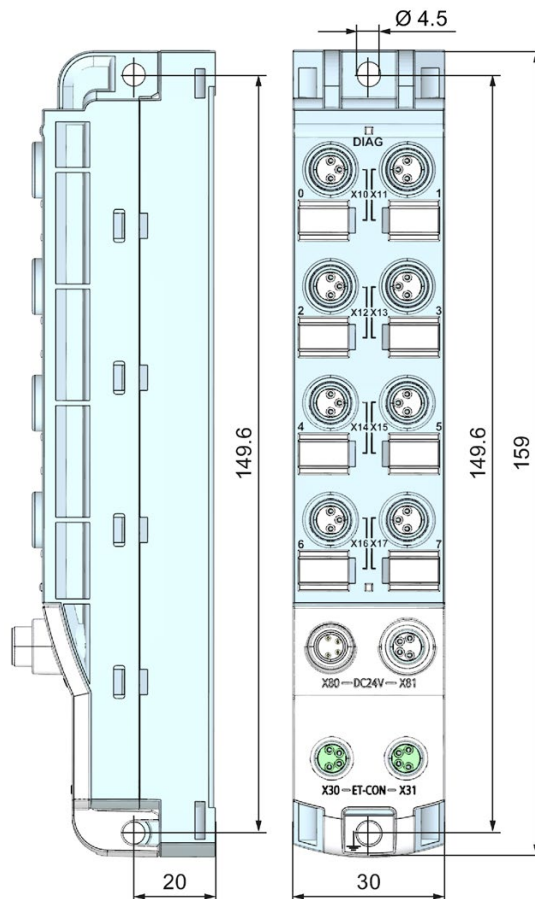
Figure 4-3   Dimensions for mounting 30 mm I/O modules

Fastening for cable ties

All module of the ET 200AL distributed I/O system have an integrated attachment point for cable ties. The attachment points are found on all four corners of the modules.

The figure below shows the top left attachment point for 2.5 mm wide cable ties for fastening the cables.
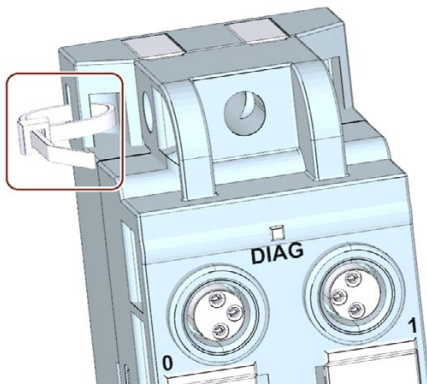
Figure 4-4   Top left attachment point for cable ties

Connecting 5

5.1 Rules and regulations for operation

Introduction

Depending on the area of application, the ET 200AL distributed I/O system, as a component of plants and systems, requires that special rules and specifications be followed.

This section gives an overview of the most important rules to be followed for integration of the ET 200AL distributed I/O system in a plant or in a system.

Specific application

Follow the safety and accident prevention regulations applicable to specific applications, e.g. the machinery directive.

EMERGENCY-STOP device

EMERGENCY-STOP devices according to IEC 60204 (corresponds to DIN VDE 113) must remain in effect in all operating modes of the plant or system.

Excluding hazardous system conditions

Hazardous operating states must not occur in the following situations:

- When the plant restarts after a voltage drop or power outage.
- When the ET 200AL distributed I/O system restarts after interruption of bus communication.

If necessary, EMERGENCY STOP must be forced!

An uncontrolled or undefined startup is not permitted after the "EMERGENCY STOP" is unlocked.

Cables and wires

Make sure that the cables used (incl. connectors) are approved for a continuous operating temperature of at least 70 °C.

Line voltage of the SELV/PELV power supply

The following section describes what you need to pay attention to with respect to the line voltage (you will find additional information in the section Information on insulation, protection class, degree of protection, and rated voltage (Page 90)):

● For stationary plants or systems without an all-pole line disconnector, there must be a disconnector unit (all-pole) fitted in the building installation.

● For load current supplies, the configured rated voltage range must correspond to the local line voltage.

● For all power circuits of the ET 200AL distributed I/O system, the fluctuation/deviation of the line voltage from the rated value must be within the permitted tolerance.

24 V DC supply

Below there is a description of what you need to pay attention to with 24 V DC supply:

● For buildings:
If there is a danger due to overvoltages, you must take lightning protection measures for external lightning protection (e.g. lighting protection elements).

● With 24 V DC supply lines and signal lines:
If there is a danger due to overvoltages, you must take lightning protection measures for internal lightning protection (e.g. lightning protection elements. You will find additional information in the Designing interference-free controllers (https://support.industry.siemens.com/cs/ww/en/view/59193566) function manual).

● For 24 V DC supply:
Ensure that there is a safe (electrical) separation of low voltage (SELV/PELV) according to IEC 61010-2-201 or IEC 60950-1.
You must secure all feeding supply voltages with a UL/IEC approved fuse 24 V DC/4 A (trigger characteristic type B or C).

Protection against outside electrical influences

Below is a description of what you must pay attention to in terms of protection against electrical impacts and/or faults:

● For all plants or systems in which the ET 200AL distributed I/O system is integrated, you must ensure that the equipment or system is functionally grounded to discharge electromagnetic interference.

● For supply, signal and bus cables, you must ensure that the cable routing and installation is correct.

● For signal and bus cables, you must ensure that a wire/cable breakage or a cross-wire does not lead to undefined states of the plant or system.

Reference

Additional information can be found in the function manual Designing interference-free controllers (https://support.industry.siemens.com/cs/ww/en/view/59193566).

5.2 Operation of the ET 200AL on grounded/non-grounded infeed

Introduction

Information is provided below on the overall configuration of an ET 200AL distributed I/O system on a grounded incoming supply (TN-S network). The specific subjects discussed are:

- Disconnecting devices, short-circuit and overload protection to IEC 60364 (corresponding to DIN VDE 0100) and IEC 60204 (corresponding to DIN VDE 0113)
- Load current supplies and load circuits
- Supply voltages of the ET 200AL distributed I/O system

Grounded infeed

In grounded incoming supplies, the neutral conductor of the supply system is grounded. A simple ground fault between a live conductor and ground or a grounded section of the plant causes the protective devices to trip.

Supply voltages

Two SELV/PELV supply voltages are available for the ET 200AL distributed I/O system.

- 1L+: Supply voltage (non-switched)
- 2L+: Load voltage (switched)

Secure electrical separation (SELV/PELV according to IEC 61010-2-201)

Mains devices/power supply modules with secure electrical separation are required for the operation of the ET 200AL distributed I/O system. This protection is designated as SELV (Safety Extra Low Voltage)/PELV (Protective Extra Low Voltage) according to IEC 60364-4-41.

Configuring ET 200AL with grounded reference potential

When configuring the ET 200AL distributed I/O system with grounded reference potential, occurring interference currents are discharged into functional earth. The connections must be externally connected (connection between 1M and FE).

Configuring ET 200AL with ungrounded reference potential

When configuring the ET 200AL distributed I/O system with non-grounded reference potential, occurring interference currents are discharged via an internal RC network to functional earth (no external connection between 1M and FE).

ET 200AL in the overall configuration

The figure below shows the ET 200AL distributed I/O system in the complete electrical configuration using the example of an interface module.
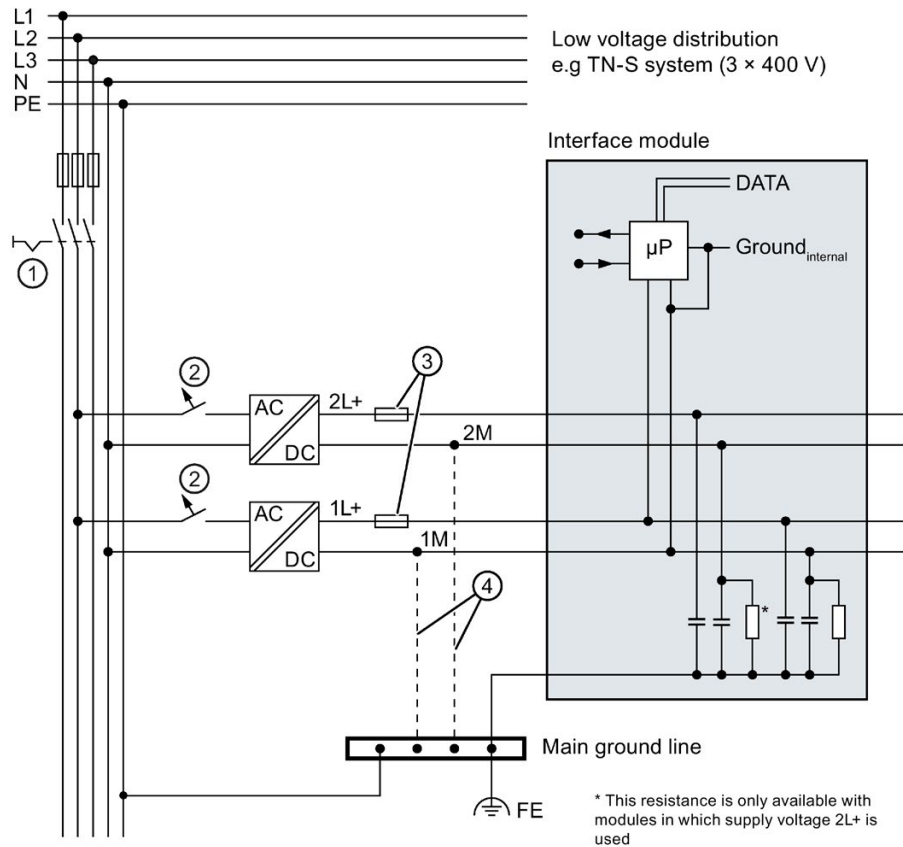
①   Main switch

②   Short-circuit and overvoltage protection

③   Fuses for cable protection (automatic circuit breaker for 4 A)

④   When configuring the ET 200AL distributed I/O system with non-grounded reference potential, no connection is made between 1M, 2M and FE.

Figure 5-1   Electrical configuration

Components and protective measures

Various components and protective measures are stipulated for setting up a complete plant. The types of components and the degree to which the protective measures are mandatory depend on the IEC regulation that applies to your plant setup.

The following table shows the components of the electrical configuration with reference to the previous figure and compares the IEC regulations.

Table 5- 1   Components of electrical configuration

	Reference to illustration	IEC 60364 (DIN VDE 0100)	IEC 60204 (DIN VDE 0113)
Disconnection element for controller, sensors, and actuators	①	Main switch	Disconnector
Short-circuit / overload protection	②	Single-pole protection of circuits Secure all incoming supply cables with a circuit breaker (24 V DC/4 A).	Secure with one pole with a grounded secondary circuit
Cable protection	③	Protection of cables and wires against overcurrent	-

Insulation monitoring

In the following situations, you must provide insulation monitoring.

- When configuring the ET 200AL distributed I/O system with non-grounded reference potential
- When hazardous system conditions may occur due to errors

5.3   Electrical configuration of the ET 200AL

Electrical isolation

When electrically configuring the ET 200AL distributed I/O system, there is electrical isolation between:

- Load voltage 2L+ and all other switching parts

- Communication interfaces (PROFINET/PROFIBUS) of the interface modules and all other switching parts

- ET-Connection and all other switching parts

The following images show the potential conditions of the modules of the ET 200AL distributed I/O system.
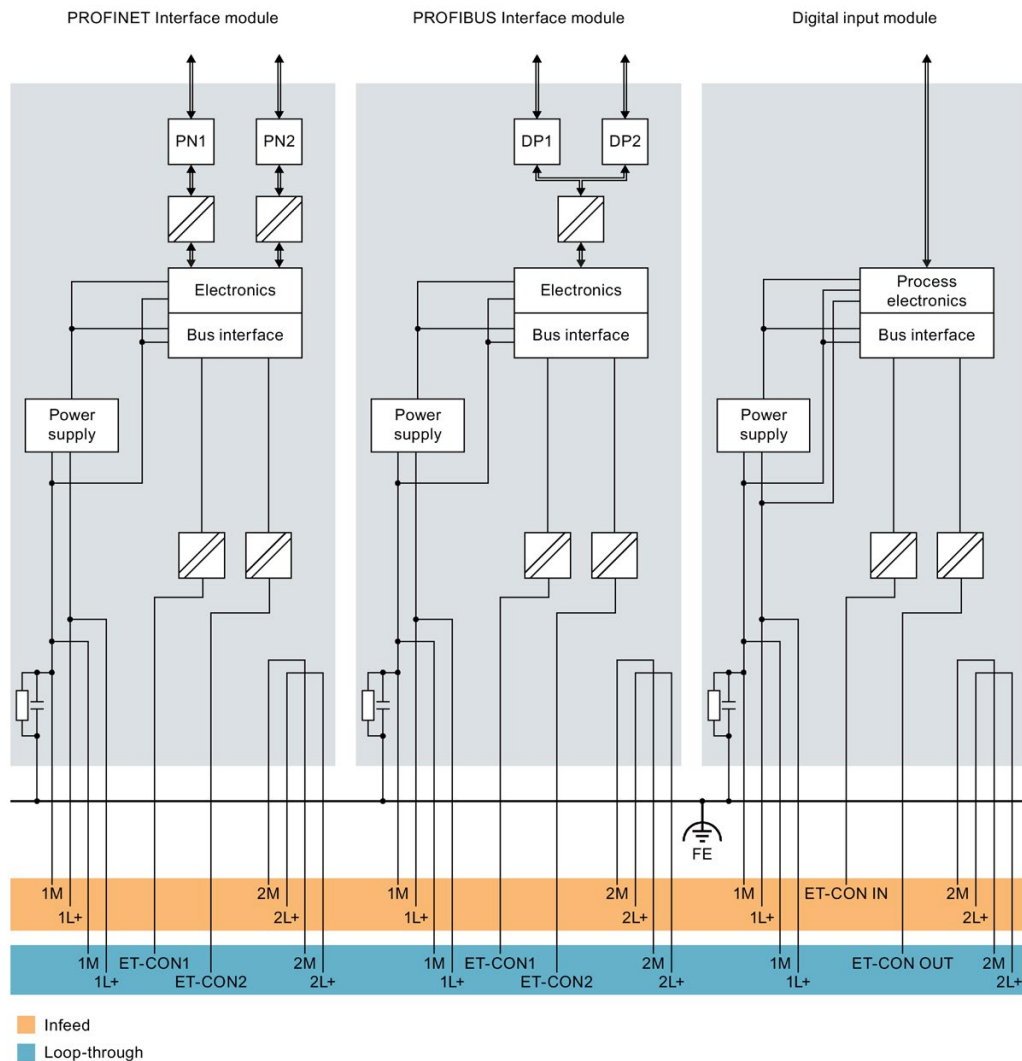
Figure 5-2   Potential conditions of the ET 200AL distributed I/O system (Part 1)
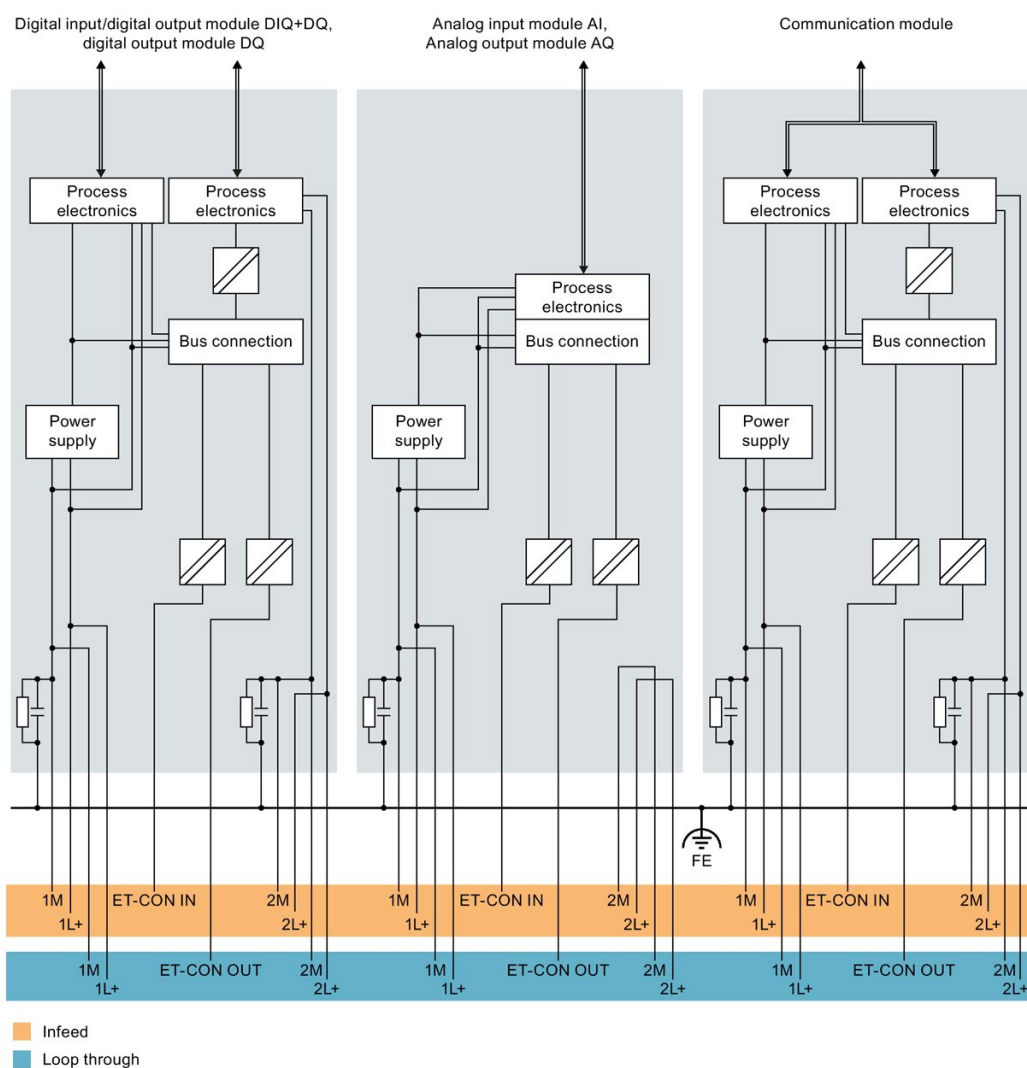
Figure 5-3   Potential conditions of the ET 200AL distributed I/O system (Part 2)

Connection of a digital output with a digital input

⚠ WARNING
Pay attention to the potential group
When a digital output is connected to a digital input, pay attention to the potential groups. Depending on the configuration, 1M and 2M may then be connected, resulting in elimination of the electrical isolation between 1L+ and 2L+. The possible compensating currents can destroy the digital module.

Cable protection

According to IEC 60364, cable protection is required, i.e. you must always secure the incoming lines externally.

You must secure all incoming supply voltages with a UL/IEC approved 24 V DC/4 A fuse (trigger characteristic type B or C).

Power supply of the configuration

Two voltage groups are available for the distributed I/O system ET 200AL: 1L+ (supply voltage) and 2L+ (load voltage)

A second infeed may be needed to supply all the modules of a configuration with the required voltage. Renewed voltage supply of 1L+ and 2L+ can be necessary to configure different potential groups or because the voltage is not sufficient for all modules due to the voltage drop. Create a power balance for the selection of the infeed point of the voltage.

Note

Turning 1L+ and 2L+ on and off

In contrast to the load voltage 2L+, the operational switching on and off of the supply voltage 1L+ results in a restart of the module.

The figure below shows a configuration with a new voltage infeed for the modules. The different potential groups have a gray background.
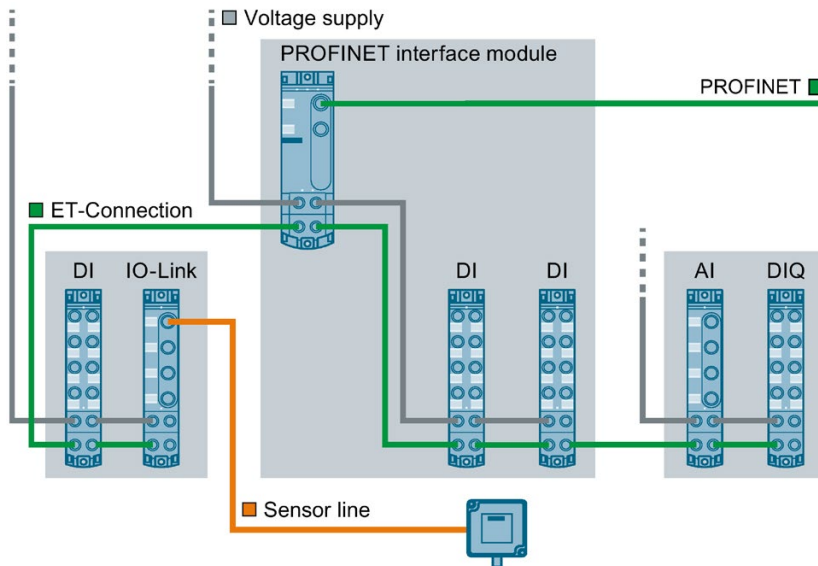
Figure 5-4   Wiring of the power supply

Reference

You will find additional information on electrical configuration and the voltage drop in the section Connecting cables for ET 200AL (Page 36).

5.4 Connecting ET 200AL to functional earth

Introduction

You must connect the distributed I/O system ET 200AL to functional earth (FE)

What is functional earth?

All ET 200AL modules feature a functional earth connection. This connection is used to suppress interference sensitivity, but not for protection purposes. With the functional earth connection, you create an electrical connection directly to a point of your system or shielding. This discharges the EMC interference directly into the earth. By discharging the EMC interference, the interference safety of the entire module is increased.

The figure below shows the symbol with which the functional earth connection is identified on the ET 200AL modules.
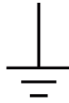
Figure 5-5   Functional earth

5.4.1 Mounting ET 200AL modules on conductive substrate

Requirement

Conductive substrate for mounting of the module

Required tools

To connect to functional earth, you need the following tools:

- Screwdriver

Required accessories:

To connect to functional earth, you need the following accessories:

- 2 x M4 fastening screws.

Mounting

To connect modules of the ET 200AL distributed I/O system to functional earth with a conductive mounting substrate, proceed as follows:

1. Drill two fastening holes.

2. Screw the module with the M4 fastening screws using a torque of 1.2 Nm.

Note

Earthing with conductive mounting substrate

When you fasten a module of the ET 200AL distributed I/O system on a conductive, grounded substrate, the bottom fastening screw provides a conductive connection to the ground potential.

Ensure that there is a low-impedance connection between the module and conductive underground as well as between the conductive underground and functional earth.

Reference

You will find more information on installing the modules in the section Mounting modules (Page 21).

5.4.2 Mounting ET 200AL modules on non-conductive substrate

Requirement

Conductive substrate for mounting of the module

Required tools

To connect to functional earth, you need the following tools:

- Screwdriver
- Stripping tool
- Crimp tool

Required accessories:

To connect to functional earth on a non-conductive fastening substrate, you need the following accessories:

- 2 x M4 fastening screws.
- Cable lug suitable for M4 screws
- Grounding cable (braided copper cable) with a minimum cross section of 4 mm^2

Mounting

To connect modules of the ET 200AL distributed I/O system to functional earth, proceed as follows:

1. Drill two fastening holes.

2. Strip the grounding cable.

3. Fasten the cable lug to the grounding cable.

4. Screw the module and the cable lug with the M4 fastening screws using a torque of 1.2 Nm.

The figure below shows how to connect functional earth using the example of the IM 157-1 PN interface module.
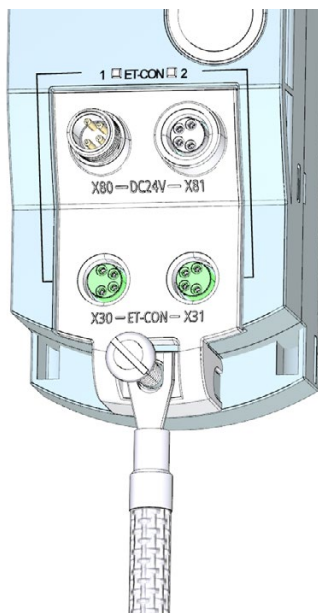
Figure 5-6   Connecting the functional earth

Note

Earthing with non-conductive mounting substrate

Make sure there is a low-impedance connection between the module and the functional earth.

Reference

You will find more information on installing the modules in the section Mounting modules (Page 21).

5.5 Connecting cables for ET 200AL

Impact of cable length on the supply voltage

When wiring your configuration, you must take into account the impact of the cable length on the supply voltage of the ET 200AL distributed I/O system.

> ⚠ **CAUTION**
>
> **Pay attention to maximum incoming currents**
>
> For each power supply (1L+, 2L+), you can feed in a maximum of 4A.
>
> If you exceed the maximum incoming currents and do not comply with the required cable cross sections, an increased incoming current could lead to overheating of the cable insulation and the contacts. This could result in damage to the modules.

The figure below shows the voltage drop depending on the cable length for 4 current strengths, using the example of a copper cable with ∅ 0.5 mm².
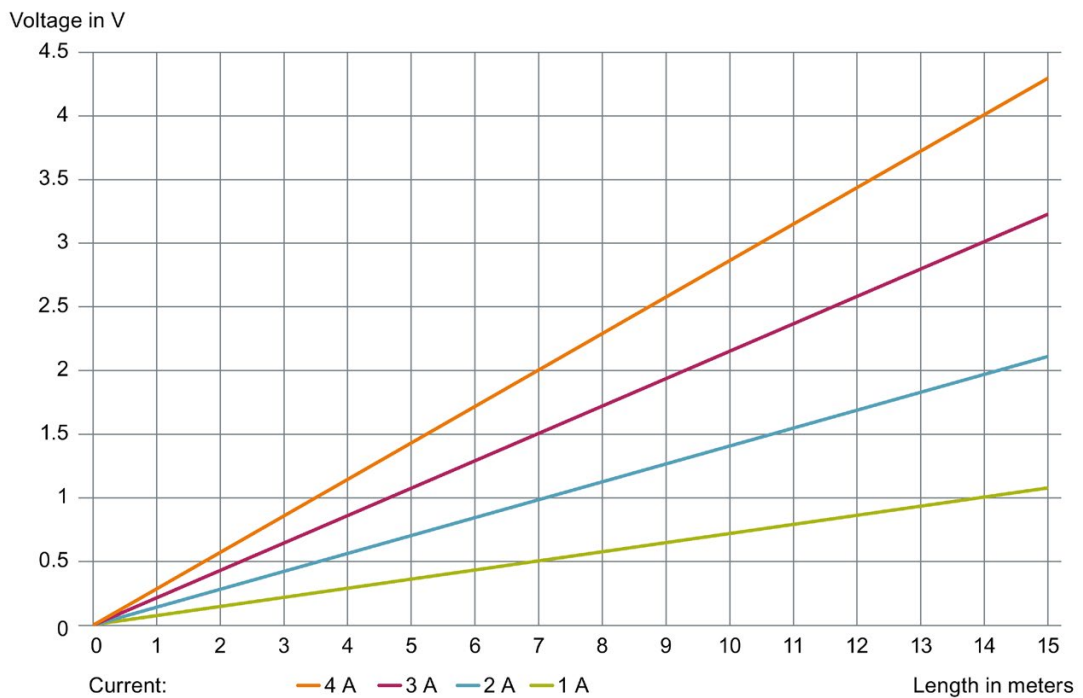
Figure 5-7   Voltage drop with a cable cross-section of 0.5 mm²

To estimate the voltage drop in your ET 200AL distributed I/O system, you must add the voltage drops of the different cables. For every module used, you must add an additional voltage drop of around 0.1 V.

Example

If you have a 7 m power supply cable with ∅ 0.5 mm², the voltage drop is around 1.5 V with a load of 3 A.

5.6 Wiring

Connection

Connect all cables to the front side of the modules:

● Supply voltage and ET-Connection to the 4-pole M8 round sockets and M8 round connectors

● Signal lines to the 3-pole M8 or 4/5-pole M12 round sockets

● Fieldbus lines to the 4/5 pole M12 round sockets and M12 round connectors

---

Note

Color coding

The sockets for ET-Connection and the power supply of the modules are color-coded. These colors correspond to the colors of the offered cables.

Requirement

Wire the modules with the supply voltage off.

Required tools

If you are not using pre-assembled cables, you need the following tools:

● Stripping tool

● Screwdriver to wire the connection plugs

● Stripping Tool for ET-Connection

Required accessories when connecting the supply voltage

You need the following accessories:

● Cables

– pre-assembled power cable, M8, 4-pole, or

– flexible 4-wire copper cable (wire cross section: 0.25 to 0.5 mm^2)

● 4-pole M8 connection plug

Accessories required for the connection of ET-Connection

You need the following accessories:

- ET-Connection cables

- 4-pole M8 connection plug

Note

ET-Connection cables

When connecting ET-Connection **use only** the offered cables.

Connecting M8 connectors

To connect M8 connectors, proceed as follows:

1. Insert the connector in the appropriate round socket on the module.
   Make sure that there is proper locking between the connector and socket.

2. Tighten the connector using the knurled screw with a torque of 0.4 Nm.

The figure below shows the connection of the M8 connectors, using the example of the DIQ 4+DQ 4x24VDC/0.5A 8xM8 digital input/
digital output module.
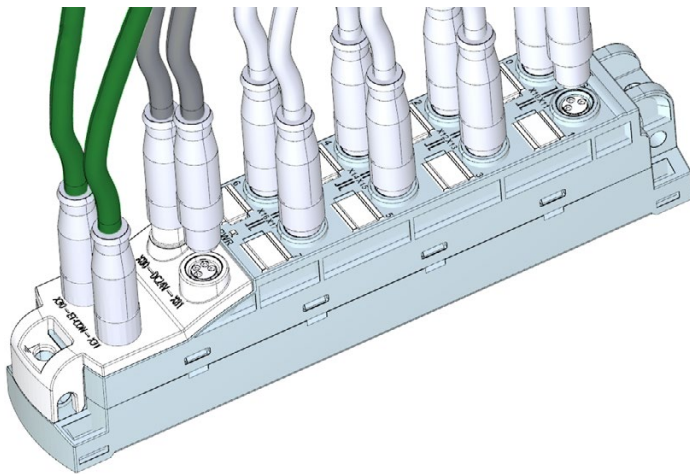
Figure 5-8   Connecting M8 connectors

Connecting M12 connectors

To connect M12 connectors, proceed as follows:

1. Insert the connector in the appropriate round socket on the module.
   Make sure that there is proper locking between the connector and socket (nut and spring).

2. Tighten the connector using the knurled screw with a torque of 1 Nm.

The figure below shows the connection of the M12 connectors, using the example of the analog input module AI 4xU/I/RTD 4xM12.
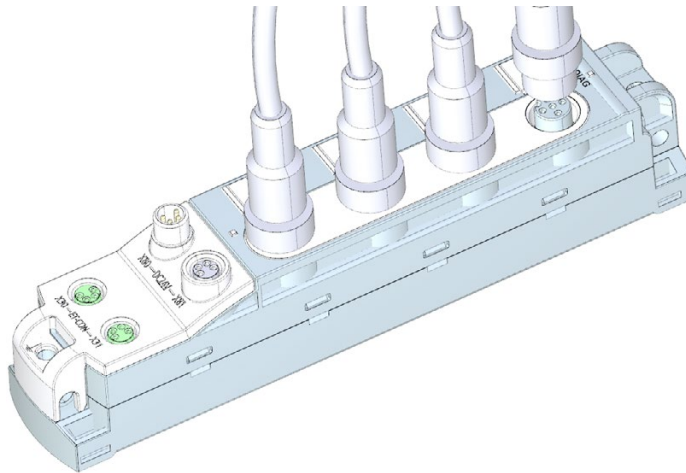
Figure 5-9   Connecting M12 connectors

Pin assignment of the sockets

The pin assignment of the sockets can be found in the manuals for the interface modules (https://support.industry.siemens.com/cs/ww/en/ps/14246/man) and I/O modules (https://support.industry.siemens.com/cs/ww/en/ps/14247/man) in the section on pin assignment and on the side surface of the module.

Y-cable

The Y-cable allows you to connect two actuators or sensors to the inputs or outputs.

The use of a Y-cable is particularly recommended when two channels are occupied for each socket of an I/O device. The Y-cable distributes the channels to two circular connectors.
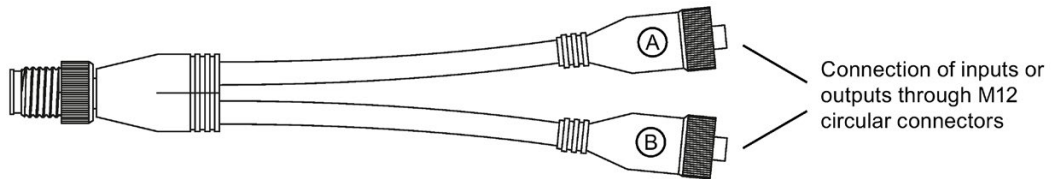
The figure below shows the wiring of the Y-cable.
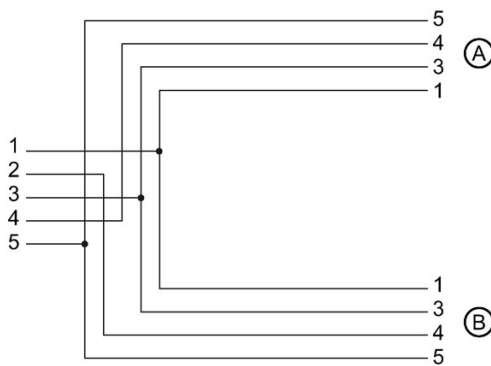
Figure 5-10   Wiring of the Y-cable

Sealing of unused sockets

To ensure IP65 or IP67 degree of protection, seal off all unused sockets with sealing caps.

Article numbers for accessories/spare parts.

You will find the article numbers in the Appendix in section Accessories/spare parts (Page 95).

5.7 ET 200AL marking

5.7.1 Factory markings

Introduction

For better orientation, the ET 200AL distributed I/O system is identified using various markings which will help you when configuring and connecting the modules.

Marking of the interfaces

The interfaces of the modules are factory-labeled.

The table below shows the labeling of the interfaces.

Table 5- 2 Interface labeling

interface	Labeling
PROFINET IO interfaces	X1 P1 R and X1 P2 R
PROFIBUS DP interfaces	X1 DP1 and X1 DP2
I/O input and output interfaces	X10 through X17
ET-Connection interfaces (interface modules)	X30 (ET-CON1) and X31 (ET-CON2)
ET-Connection interfaces (I/O modules)	X30 (ET-CON IN) and X31 (ET-CON OUT)
Power supply interfaces	X80 (IN) and X81 (OUT)

Note
Color coding

The sockets for ET-Connection and the power supply of the modules are color-coded. These colors correspond to the colors of the offered cables.

NOTICE
ET-Connection/supply voltage

Observe the correct wiring of the M8 sockets for ET-Connection and the supply voltage.

Mixing up the ET-Connection connectors and the connectors for the supply voltage can destroy the module.

Pin assignment

The pin assignments of the various interfaces are lasered at the factory, on the side of every module.

5.7.2 Optional markings

Introduction

In addition to the factory markings, there are also optional possibilities for labeling and/or identifying interfaces and modules on the ET 200AL distributed I/O system.

Identification label

The identification labels come with each module as strips and can be machine-printed. A strip has 10 identification labels measuring 10 x 5 mm in the color RAL9016. The identification labels can be inserted into every module at the points provided. The identification labels are used for channel, module and slot labeling.

The figure below shows all points where you can use the identification labels using the example of the IO-Link Master CM 4xIO-Link 4xM12 communication module.
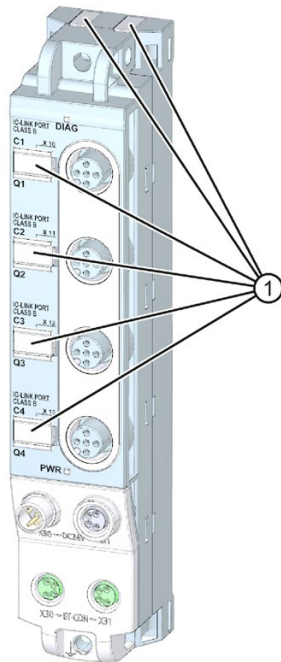
①   Identification labels

Figure 5-11   Optional marking

5.7.3 Mounting identification labels

Introduction

This section describes how to mount or remove identification labels.

Required tools

You need a screwdriver with 3 mm blade width (only to remove identification labels).

Mounting procedure

To mount an identification label, proceed as follows:

1. Print the identification label using commercially available marking systems.

2. Press the identification label out of its holder.

3. Stick the identification labels into the cutouts provided, as shown in the figure Optional marking (Page 42).

Mounting the identification labels is the same for all modules.

Removal procedure

To remove an identification label, proceed as follows:

1. Carefully use a screwdriver to pull out the identification label.

Removing identification labels is the same for all modules.

Configuring

6

Introduction

You configure and assign parameters for the ET 200AL distributed I/O system (interface modules and I/O modules) using STEP 7 or the configuration software of another manufacturer.

Requirements

Table 6- 1   Configuration software and requirements

Configuration software	Requirements	Installation information
STEP 7 (TIA Portal) as of V14 for modules: • DIQ 16x24VDC/0.5A 8xM12 • AQ 4XU/I, 4XM12	• PROFINET IO, PROFIBUS DP: as of Support Package HSP 0194	STEP 7 online help
STEP 7 (TIA Portal) V13 SP1 or higher for modules: • DI 8x24VDC 4xM12 • DI 16x24VDC 8xM12	• PROFINET IO, PROFIBUS DP: as of Support Package HSP 0155	
STEP 7 (TIA Portal) V13 SP1 or higher for modules: • DIQ 4+DQ 4x24VDC/0.5A 4xM12 • DQ 8x24VDC/2A 8xM12	• PROFINET IO, PROFIBUS DP: as of Support Package HSP 0156	
STEP 7 (TIA Portal) V13 SP1 or higher for modules: • IM 157-1 PN • IM 157-1 DP • DI 8x24VDC 8xM8 • DIQ 4+DQ 4x24VDC/0.5A 8xM8 • AI 4xU/I/RTD 4xM12 • CM 4xIO-Link 4xM12	• none, integrated in STEP 7	
STEP 7 as of V5.5 SP4 for modules: • IM 157-1 PN • IM 157-1 DP	• PROFINET IO: as of Support Package HSP 0259 • PROFIBUS DP: as of Support Package HSP 0258	

Configuration software	Requirements	Installation information
STEP 7 as of V5.5 SP4 for all IO modules	• PROFINET IO, PROFIBUS DP: as of Support Package HSP 0260	
STEP 7 (TIA Portal) as of V13 Update 3	• PROFINET IO GSD file: GSDML-Vx.y-Siemens-ET200AL-"Date in format yyyymmdd".xml (https://support.industry.siemens.com/cs/ww/en/view/92346477) for example: GSDML-V2.31-Siemens-ET200AL-20140507.xml	
Software of third-party manufacturer		Manufacturer documentation
	• PROFIBUS DP GSD file: siem81A9.gsg (https://support.industry.siemens.com/cs/ww/en/view/92346281)	

Configuring the ET 200AL distributed I/O system

See the STEP 7 online help or the documentation of the manufacturer of the configuration software.

Configuration - PROFINET maximum configuration

Each of the connections for ET-Connection occupies a slot in the configuration. The slots for ET-Connection1 and ET-Connection2 are specified statically in the PROFINET GSD file. ET-Connection1 is permanently on slot 1 and ET-Connection2 on slot 18.

The fixed slot assignment of ET-Connection1 and ET-Connection2 offers you the following advantages:

● You can expand ET-Connection1 and ET-Connection2 without a high workload

● Transparency in configuration control

● Simplification of diagnostics alarms and troubleshooting

The figure below shows the maximum configuration with modules of the ET 200AL distributed I/O system.
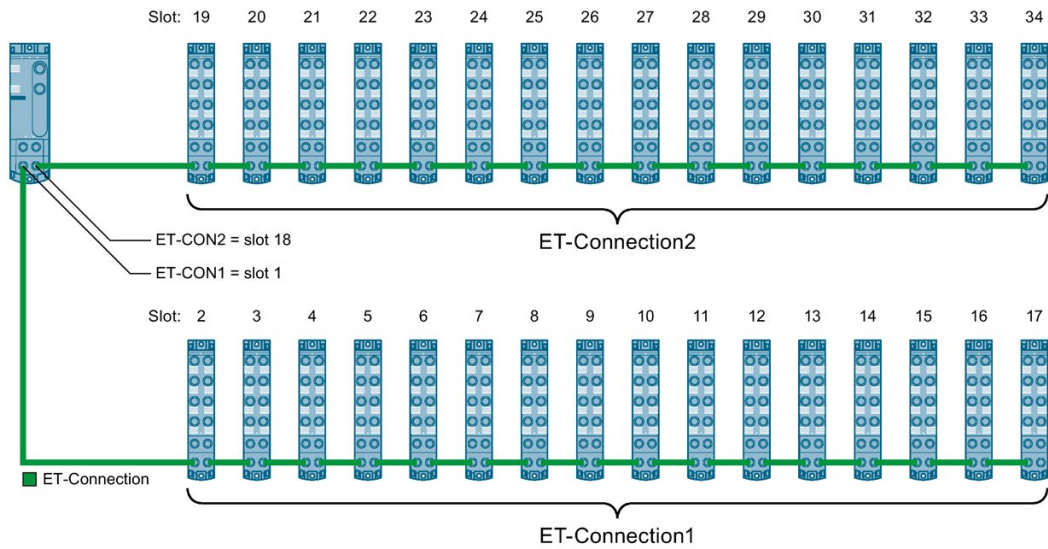
Figure 6-1   PROFINET maximum configuration

Reference

You can find additional information on this topic in section Configuration control (option handling) (Page 48).

Configuration - PROFIBUS maximum configuration

Each of the connections for ET-Connection occupies a slot in the configuration. The slot for ET-Connection1 is statically defined in the PROFIBUS GSD file. ET-Connection1 is always permanently installed in slot 1. Always place the topology module for ET-Connection2 on slot 18. You do not need to fill slots in the configuration for ET-Connection1 with dummy modules.

The fixed slot assignment of ET-Connection1 and ET-Connetion2 offers you the following advantages:

- You can expand ET-Connection1 and ET-Connection2 without a high workload; for ET-Connection1 you need to remove the placeholder, the I/O module is placeable (no placeholders are needed for ET-Connection2)

- You cannot configure more modules on ET-Connection1 or ET-Connection2 than are allowed.

- Transparency in configuration control

- Simplification of diagnostics alarms and troubleshooting

The figure below shows the maximum configuration with modules of the ET 200AL distributed I/O system.
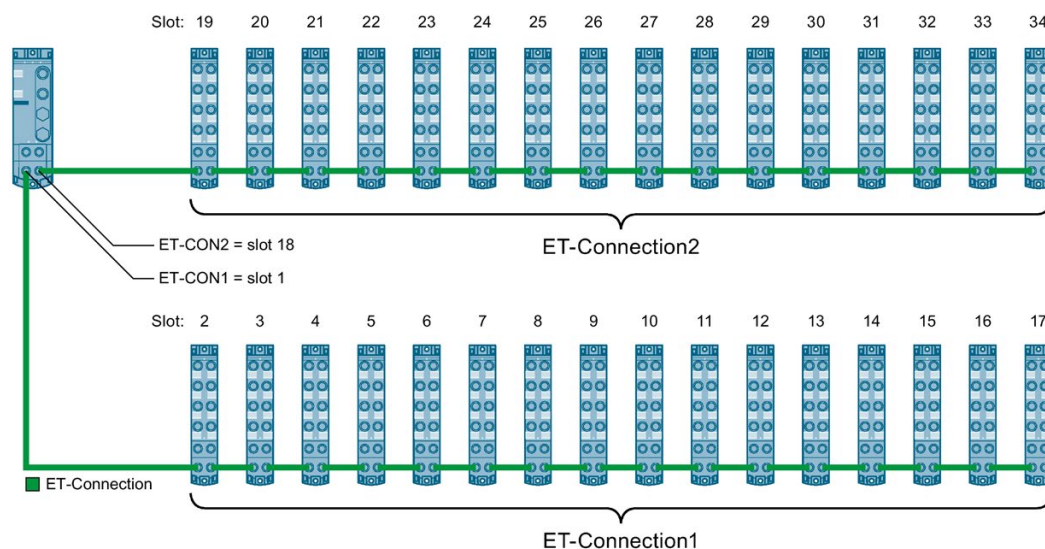
Figure 6-2   PROFIBUS maximum configuration

Reference

You can find additional information on this topic in section Configuration control (option handling) (Page 48).

Configuration control (option handling) 7

7.1 Configuration control

Introduction

With configuration control (option handling), you handle various standard machine configuration levels in one project without having to change the hardware configuration or user program.

Operating principle of configuration control

You can use configuration control to operate different standard machine configurations with a single configuration of the ET 200AL distributed I/O system.

- A station master (maximum configuration) is configured in a project. The station master comprises all modules needed for all possible equipment components of a modular standard machine.

- Provision is made in the user program of the project for various station options for the different configuration levels of the standard machine and for selection of a station option. A station option uses, for example, only some of the modules of the station master and these modules are not inserted in the configured order.

- Manufacturers of standard machines select a station option for a configuration level of the standard machine. They do not have change the project or download the modified configuration.

You use a control data record you have programmed to notify the CPU/interface module as to which modules are missing or located on different slots in a station option as compared to the station master. If a module with the configuration control is moved to another slot, it retains its parameter assignment.

The configuration control allows you to flexibly vary the centralized/distributed configuration. As a precondition for this, the station option must be able to be derived from the station master.

The following figure shows 3 configurations of a standard machine with the corresponding station options of the ET 200AL distributed I/O system.
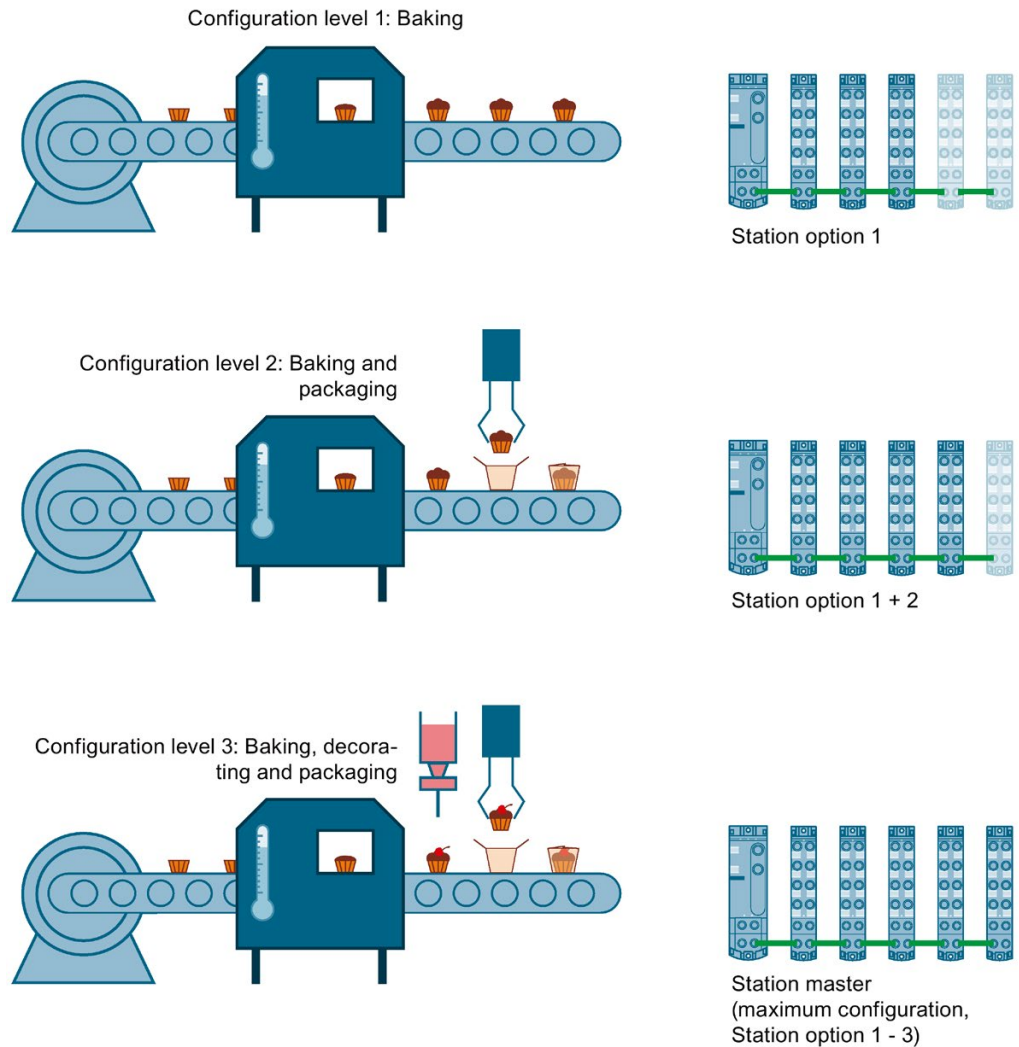
Figure 7-1   Various configuration levels of a standard machine with the corresponding station options of the ET 200AL distributed I/O system.

Benefits

- Easy project handling and commissioning through use of a single STEP 7 project for all station options.

- Easy handling during maintenance, versioning and upgrades.

- Hardware savings: Only the I/O modules needed for the current station option of the machine are installed.

- Potential savings when building, commissioning and creating documentation for standard machines.

Procedure

To set up the configuration control, follow these steps in the order given:

Step	Procedure	See...
1	Enable configuration control in STEP 7	Section Configuring (Page 51)
2	Create control data record	Section Creating the control data record (Page 53)
3	Transfer control data record	Section Transferring the control data record in the user program of the CPU (Page 62)

Library for configuration control

A library for configuration control is available for download (https://support.industry.siemens.com/cs/ww/en/view/29430270) on the internet. The library contains data types with the structure of the control data records for the ET 200AL distributed I/O system. You can implement your flexible automation solution economically with the help of these data types.

7.2 Configuring

Requirements

Via PROFINET IO:

- Configuration software, for example STEP 7 Professional as of V13

- IM 157-1 PN

- You have assigned the interface module to an IO controller in STEP 7

Via PROFIBUS DP:

- Configuration software, for example STEP 7 Professional as of V13

- IM 157-1 DP

- You have assigned the interface module to an DP master in STEP 7

- The parameter "Operation if preset configuration does not match actual configuration" is activated.
  The parameter "Operation if preset configuration does not match actual configuration" is located in STEP 7 in the properties of the interface module under "Module parameters" > "Start-up".

Note

Disabled parameter "Startup if preset configuration does not match actual configuration"

If an I/O module is missing or an incorrect or additional I/O module is plugged in and the "Startup if preset configuration does not match actual configuration" parameter is disabled, the ET 200AL distributed I/O system does not start up.

The diagnostic "Slot x no module" or "Slot x wrong module" is generated.

If the IM 157-1 DP interface module does not start up in this status, the RUN and ERROR LEDs on the interface module flash red. The DIAG LEDs flash green on all I/O modules as well.

Required steps

Enable the "Allow to reconfigure the device via the user program" parameter when configuring the interface module.

● The parameter "Enable reconfiguration of device via user program" is located in the properties of the interface module under "Module parameters" > "Configuration control".
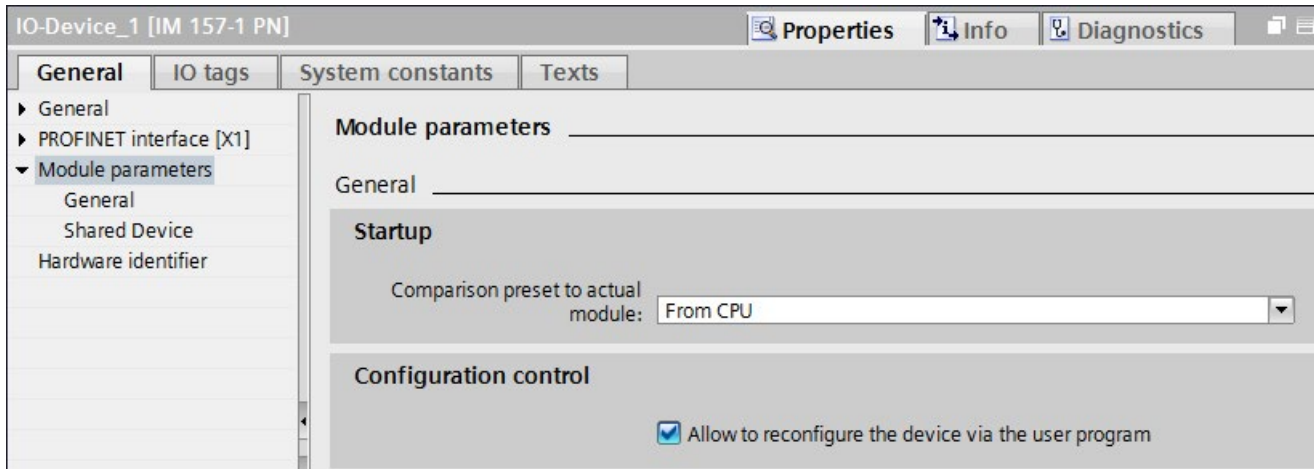
Figure 7-2   Enabling configuration control using the IM 157-1 PN as an example

7.3 Creating the control data record

7.3.1 Introduction

Required steps

The following description shows as an example how you can create a control data record for the configuration control in STEP 7 (TIA Portal).

To create a control data record for the configuration control, follow these steps:

1. Create a PLC data type that contains the structure of the control data record for an ET 200AL interface module.

   You can find the structure of the control data record in section Control data record for the ET 200AL distributed I/O system (Page 55)

		Name	Data type	Default value	A...	W...	V..	S...	Comment
	CTR_REC								
1		Block_Lenght	USInt	76	☑	☑	☑	☐	
2		Block_ID	USInt	196	☑	☑	☑	☐	
3		Version	USInt	2	☑	☑	☑	☐	
4		Subversion	USInt	1	☑	☑	☑	☐	
5	▼	ET-Connection1	Struct		☑	☑	☑	☐	ET-Connection1 slots 2-17
6	▪	Topology module	USInt	1	☑	☑	☑	☐	ET-Connection1 topology module
7	▪	Reserved 1	USInt	0	☑	☑	☑	☐	
8	▪	Slot 2	USInt	2	☑	☑	☑	☐	assigned "real" slot
9	▪	Reserved 2	USInt	0	☑	☑	☑	☐	
10	▪	Slot 3	USInt	3	☑	☑	☑	☐	assigned "real" slot
11	▪	Reserved 3	USInt	0	☑	☑	☑	☐	
12	▪	Slot 4	USInt	4	☑	☑	☑	☐	assigned "real" slot
13	▪	Reserved 4	USInt	0	☑	☑	☑	☐	
14	▪	Slot 5	USInt	5	☑	☑	☑	☐	assigned "real" slot
15	▪	Reserved 5	USInt	0	☑	☑	☑	☐	
			USInt	6	☑	☑	☑	☐	assigned "real" slot

Figure 7-3   Creating control data record 196

2. Create a global data block.

3. Create an array of the data type of the above created PLC data type in the data block.

   The following figure shows a data block containing the control data records for an ET200AL interface module. In this example the data block contains three control data records.

		Name		Data type	Start value	R..	A...	V..	S...	Comment
1		▼ Static				☐	☐	☐	☐	
2			Option	Int	0	☑	☑	☑	☐	Selection of record
3		▼	ConfigControl	Array[0..2] of "CTR_REC"		☐	☑	☑	☐	
4		▶	ConfigControl[0]	"CTR_REC"		☐	☑	☑	☐	
5		▼	ConfigControl[1]	"CTR_REC"		☐	☑	☑	☐	
6			Block_Lenght	USInt	36	☐	☑	☑	☐	4+number of slots

Figure 7-4   Data block for configuration control

4. In the "Start value" column of the control data records, enter which module is located at which slot.

ConfDB

		Name		Data type	Start v..	R...	...	...	...	Comment
1		▼ Static				☐	☐	☐	☐	
2			Option	Int	0	☑	☑	☑	☐	Selection of record
3		▼	ConfigControl	Array[0..2] of "CTR_REC"		☐	☑	☑	☐	
4		▼	ConfigControl[0]	"CTR_REC"		☐	☑	☑	☐	
5			Block_Lenght	USInt	76	☐	☑	☑	☐	
6			Block_ID	USInt	196	☐	☑	☑	☐	
7			Version	USInt	2	☐	☑	☑	☐	
8			Subversion	USInt	1	☐	☑	☑	☐	
9		▼	ET-Connection1	Struct		☐	☑	☑	☐	ET-Connection1 slots 2-17
10			Topology ...	USInt	1	☐	☑	☑	☐	ET-Connection1 topology module
11			Reserved 1	USInt	0	☐	☑	☑	☐	
12			Slot 2	USInt	0	☐	☑	☑	☐	assigned "real" slot
13			Reserved 2	USInt	0	☐	☑	☑	☐	
14			Slot 3	USInt	2	☐	☑	☑	☐	assigned "real" slot
15			Reserved 3	USInt	0	☐	☑	☑	☐	
16			Slot 4	USInt	3	☐	☑	☑	☐	assigned "real" slot

Figure 7-5   Assigning slots

Rules

Observe the following rules:

● Slot entries in the control data record outside the station master are ignored by the interface module.

● The control data record must contain the entries up to the last slot of the station option.

● Each slot of a station option may only be present once in the control data record.

● Each slot of a station option may only be assigned to one slot in the station master.

● The interface module (slot 0) is not an element of the configuration control, but instead controls this.

● The topology modules always have to exist in the data record:

　– The topology module ET-Connection 1 is always located on Slot 1.

　– The topology module ET-Connection 2 is always located on Slot 18.

7.3.2　　Control data record for the ET 200AL distributed I/O system

Slot assignment

Note

Topology modules ET-Connetion1 and ET-Connection2

Both topology modules ET-Connection1 and ET-Connection2 should be treated like real modules during configuration control.

Restriction: ET-Connetion1 is always placed in Slot 1 and ET-Connection2 is always placed in Plot 18.

The following table shows the possible slots for the various modules for an ET 200AL interface module:

Table 7- 1　　Slot assignment

Modules	Possible slots	Comment
Topology ET-Connection1	1	The topology module ET-Connection 1 is always located on Slot 1.
I/O modules ET-Connection1	2-17	-
Topology module ET-Connection2	18	The topology module ET-Connection2 is always located on Slot 18.
I/O modules ET-Connection2	19-34	-

Control data record

For configuration control of the ET 200AL distributed I/O system you define a control data record 196 V2.1, which contains a slot assignment for the modules. The table below shows the structure of a control data record with explanations of the individual elements.

Table 7- 2   Configuration control: Structure of control data record 196

Byte	Element	Code	Explanation
0	Block length	4 + (number of slots x 2)	Header
1	Block ID	196	
2	Version	2	
3	Subversion	1	
4	Slot topology module ET-Connection1	1 The topology module ET-Connection 1 is always located on Slot 1.	**Control element** Contains information on which module is inserted in which slot. The following rule determines which value you must enter in the respective byte:
5	Reserved		• If the module is included in the station option, enter the slot number of the module.
6	Slot 2 of the station master	Slot assignment in the station option	
7	Reserved		• If the module does not exist in the station option, enter 0.
:	:	:	
38	Slot topology module ET-Connection2	18 The topology module ET-Connection2 is always located on Slot 18	
39	Reserved		
40	Slot 19 of the station master	Slot assignment in the station option	
41	Reserved		
:	:	:	
4 + ((max. slot - 1) x 2))	Maximum slot of the station master	Slot assignment in the station option	
5 + ((max. slot - 1) x 2))	Reserved		

Combination of configuration control and shared device (for PROFINET)

The configuration control function in a shared device is therefore only for the I/O modules of the IO controller to which the interface module has subscribed. I/O modules that are assigned to no controller or a different controller behave like a station without activated configuration control.

In the control data record change the slots only for those modules that are assigned to the IO-Controller.

In the control data record do not move modules to slots that are assigned to a different IO controller or no IO controller. The interface module does not check whether a control data record 196 exists for these slots. The interface module assumes a 1-to-1 assignment for these slots.

Combination of configuration control and PROFIenergy (at PROFINET)

You can use configuration control together with PROFIenergy for the ET 200AL distributed I/O system.

Ensure that you use the slots of the used station option when creating Data record 3. Do not use the slots configured in the station master.

Example: You want to set up PROFIenergy for a DQ module of an IM 157-1 PN that works with configuration control. You have configured the DQ module to Slot 5 in the station master. You have moved the DQ module to Slot 2 in the station option. In order to set up PROFIenergy for this module use Slot 2 in Data record 3.

You can find more information about PROFIenergy in the Interface module IM 157-1 PN (https://support.industry.siemens.com/cs/ww/en/view/89254863) Equipment Manual.

7.3.3 Feedback data record at the ET200AL distributed I/O system

Operating principle

The feedback data record informs you about the accuracy of the module assignment and gives you the option of detecting assignment errors in the control data record. The feedback data record is mapped via a separate data record 197 V2.0.

Feedback data record

The feedback data record exists only when configuration control is configured and always refers to the maximum configuration limits **without interface module**, i.e., 34 slots. Partial reading of the feedback data record is possible.

Table 7- 3   Feedback data record

Byte	Element	Code	Explanation
0	Block length	66	Header
1	Block ID	197	
2	Version	2	
3		0	
4	Slot 1 status	0/1	Status = 1:
5	Reserved	0	• Module from station master is inserted in the station option
6	Status slot 2	0/1	• Slot is marked as not available in the control data record
7	Reserved	0	Status = 0:
:	:	:	• Module pulled
70	Status Slot 34	0/1	• Incorrect module inserted in the station option*
71	Reserved	0	

* Not possible if the slot is marked as not available.

Note

The data in the feedback data record is always mapped for all modules. In a Shared Device configuration, it is therefore irrelevant which IO controller the respective modules are assigned to.

As long as no control data record was sent, a one-to-one module assignment is assumed for the compilation of data record 197 (station master → station option).

Error messages

In the case of an error when reading the feedback data record, the RDREC instruction returns the following error messages via the STATUS block parameter:

Table 7- 4   Error messages

Error code	Meaning
80B1$_H$	Invalid length; the length information in data record 197 is not correct.
80B5$_H$	Configuration control not configured
80B8$_H$	Parameter error The following events cause a parameter error: • Incorrect block ID in the header (not equal to 197) • Invalid version identifier in the header • A reserved bit was set • Multiple slots in the station master are assigned to the same slot in the station option

7.3.4   Example of a configuration control

Introduction

Several options/functional variations often exist for machines designed as series products. Or you have a plant that can operate in different modes.
Combine the modules that are needed for a function. With configuration control (option handling), you have the option to switch these functions on and off or expand their configuration.

The following examples show how you can form the control data record for a station option. The station master consists of an interface module IM 157-1 PN and 15 I/O modules in this case.

Station option with associated control data record

The configuration with the station options 2 and 4 differ from the station master as follows:

- The modules for options 1 and 3 do not exist.

Planned configuration / station master

Figure 7-6   Example: Hardware configuration of Station option 2 and 4 with the associated control data record in STEP 7

Extension by a station option

The following figure shows the configuration with the Station options 2 and 4 that has subsequently been extended by the Station option 3.
The modules of option 3 are added to the modules already existing.

Planned configuration / station master
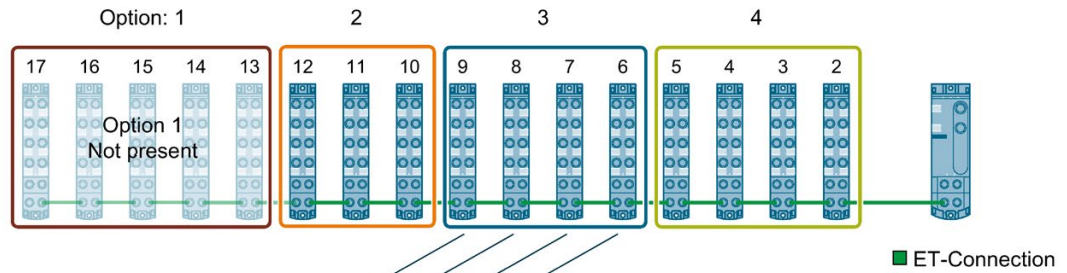
Real configuration/
Station options
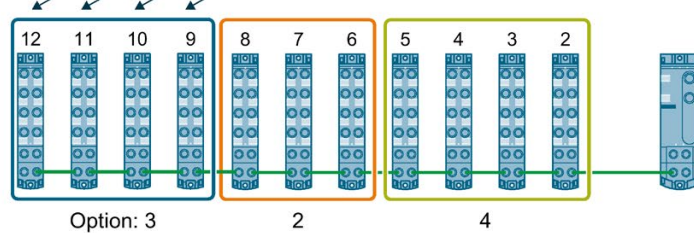
10		▾	ET-Connection1	Struct		ET-Connection1 slots 2-17
11		▪	Topology module	USInt	1	ET-Connection1 topology module
12		▪	Reserved 1	USInt	0	
13		▪	Slot 2	USInt	2	assigned "real" slot
14		▪	Reserved 2	USInt	0	
15		▪	Slot 3	USInt	3	assigned "real" slot
16		▪	Reserved 3	USInt	0	
17		▪	Slot 4	USInt	4	assigned "real" slot
18		▪	Reserved 4	USInt	0	
19		▪	Slot 5	USInt	5	assigned "real" slot
20		▪	Reserved 5	USInt	0	
21		▪	Slot 6	USInt	9	assigned "real" slot
22		▪	Reserved 6	USInt	0	
23		▪	Slot 7	USInt	10	assigned "real" slot
24		▪	Reserved 7	USInt	0	
25		▪	Slot 8	USInt	11	assigned "real" slot
26		▪	Reserved 8	USInt	0	
27		▪	Slot 9	USInt	12	assigned "real" slot
28		▪	Reserved 9	USInt	0	
29		▪	Slot 10	USInt	6	assigned "real" slot
30		▪	Reserved 10	USInt	0	
31		▪	Slot 11	USInt	7	assigned "real" slot
32		▪	Reserved 11	USInt	0	
33		▪	Slot 12	USInt	8	assigned "real" slot
34		▪	Reserved 12	USInt	0	
35		▪	Slot 13	USInt		assigned "real" slot

Figure 7-7   Example: Hardware configuration of station option 2 to 4 with the associated control data record in STEP 7

Detailed application example

You can find a detailed application example for the configuration control in S7-1500 in here under the keyword "Application example for ET 200SP (PROFINET) and S7-1500 based on the library" on the Internet (https://support.industry.siemens.com/cs/ww/en/view/29430270).

7.4 Transferring the control data record in the user program of the CPU

Required steps

Transfer the created control data record 196 to the interface module using the WRREC (Write data record) instruction.

Parameters of the WRREC instruction

Below, you will find explanations of individual parameters of the WRREC instruction which you must supply with specific values in the configuration control context. You can find additional information on the WRREC instruction in the STEP 7 online help.

ID	HW identifier of the interface module.
	If you have selected the interface module in the network view or device view, the HW identifier is available in the **System constants** tab of the Inspector window. Use the value of the system constant "<Name_of_interface_module> Head".
INDEX	Data record number: 196 (decimal)
RECORD	Control data record to be transferred.
	You can find the structure of the control data record in section Control data record for the ET 200AL distributed I/O system (Page 55).

Selection of the station option in the user program

In order for the CPU to know which station option you want to operate, you must set up a possibility to select between the various control data records in the user program. You can implement the selection, for example, via an Int tag that references an array element. Note that the tag for selecting the control data record must be located in the retentive memory area. If the tag is not retentive, it will be initialized during startup of the CPU and will thus be unavailable for selection of the station option.

Special requirements relating to the transfer of the control data record to the interface module

- If you have enabled configuration control, the ET 200AL station is not ready for operation without a control data record. As long as no valid control data record has been transferred, the I/O modules are considered as failed by the CPU and exhibit substitute value behavior. The interface module continues to exchange data.

- The control data record is stored retentively in the interface module. Note:

  – If the configuration is unchanged, you do not have to rewrite the control data record 196 during restart.

  – If you write a control data record with modified configuration, this will result in a station failure in the distributed I/O system. The original data record 196 is deleted and the new data record 196 is saved retentively. The station will then restart with the modified configuration.

Error messages

In case of error, the WRREC instruction returns the following error messages via the STATUS block parameter:

Table 7- 5   Error messages

Error code	Meaning
80B1$_H$	Invalid length; the length information in data record 196 is not correct.
80B2$_H$	Invalid slot: The configured slot is not assigned
80B5$_H$	Configuration control parameters not assigned.
80B8$_H$	Parameter error Reasons for a parameter error are: • Incorrect block ID in the header (not equal to 196) • Invalid version identifier in the header • A reserved bit was set • A station master slot was assigned an invalid slot in the station option • Multiple slots in the station master are assigned to the same slot in the station option • For shared device on submodule level: violation of defined restrictions
80C5$_H$	DP slave or module not available. Indicates that a data record has not been acknowledged due to the system.

If you receive the error code 80A2$_H$, 80B2$_H$ or 80C5$_H$ when writing to control data record 196, check whether the required configuration was accepted despite the error code.

7.5 Behavior during operation

Effect of discrepancy between station master and station option

For the online display and for the display in the diagnostics buffer (module OK or module faulty), the station master is always used and not the differing station option.

Example: A module outputs diagnostics data. This module is configured in slot 4 in the station master, but is inserted in slot 3 in the station option (missing module; see example in the next section). The online view (station master) shows an incorrect module in slot 4. In the real configuration, the module in slot 3 indicates an error via an LED display.

Response to modules that are not present

If modules are entered as not present in the control data record, the automation system behaves as follows:

- Modules designated as not present in the control data record do not supply diagnostics and their status is always OK. The value status is OK.

- Direct writing access to the outputs that are not present or writing access to the process image of outputs that are not present: Remains without effect; no access error is signaled.

- Direct reading access to the inputs that are not present or reading access to the process image of inputs that are not present: Value "0" is supplied; no access error is signaled.

- Write data record to module that is not present: Remains without effect; no error is signaled.

- Read data record from module that is not present: The output parameter STATUS of the instruction RDREC supplies the value $80A3_H$ "General CM error".

Commissioning

<div style="text-align: right; font-size: 3em;">8</div>

8.1 PROFINET IO

8.1.1 Commissioning ET 200AL on PROFINET IO

Introduction

The commissioning of your distributed I/O system depends on the system configuration. The following procedure describes the commissioning of the ET 200AL distributed I/O system on an IO controller.

Requirements for the ET 200AL distributed I/O system on the PROFINET IO

> **Note**
>
> **Performing tests**
>
> You must ensure the safety of your plant. You therefore need to perform a complete functional test and the necessary safety checks before the final commissioning of a plant.
>
> Also plan the tests to include any possible foreseeable errors. This will allow you to prevent people or plants from being placed in danger during operation.

Procedure

The following table shows the chapters/documents in which the required actions are described.

Table 8- 1   Requirements for the ET 200AL distributed I/O system on the PROFINET IO

Step	Procedure	See...
1	Mounting the ET 200AL interface module	Section Mounting (Page 20)
2	Wiring the ET 200AL interface module	Section Connecting (Page 25)
3	Configuring the ET 200AL interface module	Section Configuring (Page 44)
4	Turning on the supply voltage for the ET 200AL interface module	IM 157-1 PN interface module (https://support.industry.siemens.com/cs/ww/en/view/89254863) manual
5	ET 200AL interface module automatically switches to RUN mode	-

Reference

You can find additional information on assigning the PROFINET IO parameters in the PROFINET with STEP 7 V14 (https://support.industry.siemens.com/cs/ww/en/view/49948856) function manual.

8.1.2 Startup on PROFINET IO

Principle of operation

The figure below schematically shows the startup of the ET 200AL distributed I/O system on the PROFINET IO (= IO device) as a flow chart.

Figure 8-1   Startup of the ET 200AL distributed I/O system on the PROFINET IO

The figure below schematically shows the startup of an ET 200AL I/O module after an ET 200AL PROFINET interface module.

```
                    ↓
        ┌──────────────────────────┐
        │  Turn on supply voltage   │
        │     for the I/O module    │
        └──────────────────────────┘
                    │
                    ▼
        ┌──────────────────────────┐
        │ The I/O module goes to    │
        │ non-configured status,    │
        │ LED "DIAG" flashes        │
        └──────────────────────────┘
                    │
                    ▼
              ◇ ET-Connection    ── No ──┐
              ◇ is connected             │ (back up)
                    │
                   Yes
                    ▼
        ┌──────────────────────────┐
        │ Parameter data are        │
        │ distributed               │
        └──────────────────────────┘
                    │
                    ▼
              ◇ Parameter data   ── No ──┐
              ◇ correct                  │
                    │                    │
                   Yes                   ▼
        ┌──────────────────┐   ┌──────────────────────┐
        │ "DIAG" LED is lit │   │ "DIAG" LED flashes   │
        │ green, I/O module │   │ red, Diagnostic      │
        │ goes to data      │   │ alarm: Parameter     │
        │ exchange          │   │ error                │
        └──────────────────┘   └──────────────────────┘
```

Figure 8-2   Startup of the ET 200AL I/O module

8.1.3   PROFIenergy

PROFIenergy (for PROFINET) makes it possible to reduce the energy consumption of the device using the PROFIenergy command during production downtime.

Additional information

You will find more information on the Internet (http://www.profibus.com) under Common Application Profile PROFIenergy; Technical Specification for PROFINET; as well as in the following documentation:

- IM 157-1 PN interface module
  (https://support.industry.siemens.com/cs/ww/en/view/89254863) manual

- I/O modules (https://support.industry.siemens.com/cs/ww/en/ps/14247/man) manuals

- PROFINET System Description
  (https://support.industry.siemens.com/cs/ww/en/view/19292127) system manual

- PROFINET with STEP 7 V14
  (https://support.industry.siemens.com/cs/ww/en/view/49948856), function manual,
  Section: Saving energy with PROFIenergy

- Application guide for implementation of shutdown concepts with PROFIenergy.
  (https://support.industry.siemens.com/cs/ww/en/view/96837137)

- Saving energy with SIMATIC S7 (STEP 7 as of V5.5)
  (https://support.industry.siemens.com/cs/ww/en/view/41986454)

- Saving energy with SIMATIC S7 and SIMATIC HMI (TIA Portal)
  (https://support.industry.siemens.com/cs/ww/en/view/58235225)

- SIMATIC S7 library for simple configuration of PROFIenergy.
  (https://support.industry.siemens.com/cs/ww/en/view/109478388)

- You can find additional information on the PROFIenergy FBs ("PE_START_END" - FB 815, "PE_CMD" - FB 816) in the online help for STEP 7 V5.5 as of SP2, Help on system functions/function blocks.

8.2 PROFIBUS DP

8.2.1 Commissioning ET 200AL on PROFIBUS DP

Introduction

The commissioning of your distributed I/O system depends on the system configuration. The following procedure describes the commissioning of the ET 200AL distributed I/O system on a DP master.

Requirements for the ET 200AL distributed I/O system on a PROFIBUS DP

Note

Performing tests

You must ensure the safety of your plant. You therefore need to perform a complete functional test and the necessary safety checks before the final commissioning of a plant.

Also plan the tests to include any possible foreseeable errors. This helps to avoid endangering persons or equipment during operation.

Procedure

The following table shows the chapters/documents in which the required actions are described.

Table 8- 2   Requirements for the ET 200AL distributed I/O system on a PROFIBUS DP

Step	Procedure	See...
1	Mounting the ET 200AL interface module	Section Mounting (Page 20)
2	Setting the PROFIBUS DP address on the ET 200AL PROFIBUS interface module	IM 157-1 DP interface module (https://support.industry.siemens.com/cs/ww/en/view/89255073) manual, section Setting the PROFIBUS DP address and terminating resistor
3	Wiring the ET 200AL interface module	Section Connecting (Page 25)
4	Configuring the ET 200AL interface module	Section Configuring (Page 44)
5	Turning on the supply voltage for the ET 200AL interface module	IM 157-1 DP interface module (https://support.industry.siemens.com/cs/ww/en/view/89255073) manual
6	ET 200AL interface module automatically switches to RUN mode	-

8.2.2 Startup on PROFIBUS DP

Principle of operation

The figure below schematically shows the startup of the ET 200AL distributed I/O system on the PROFIBUS DP (= DP slave) as a flow chart.
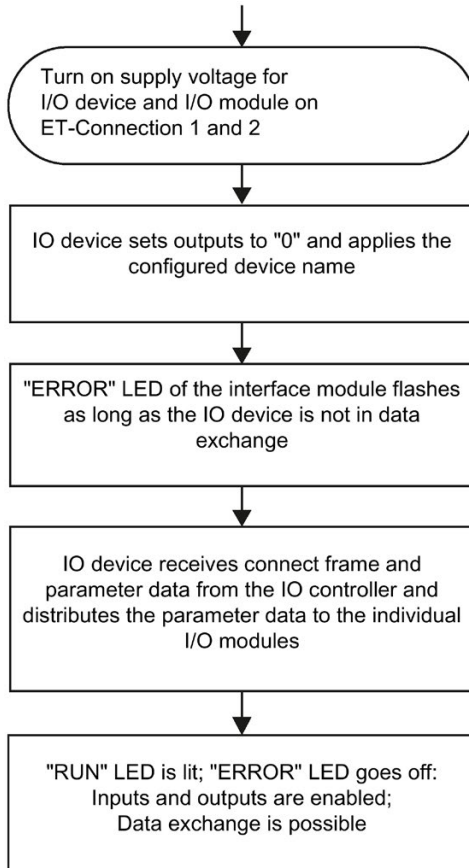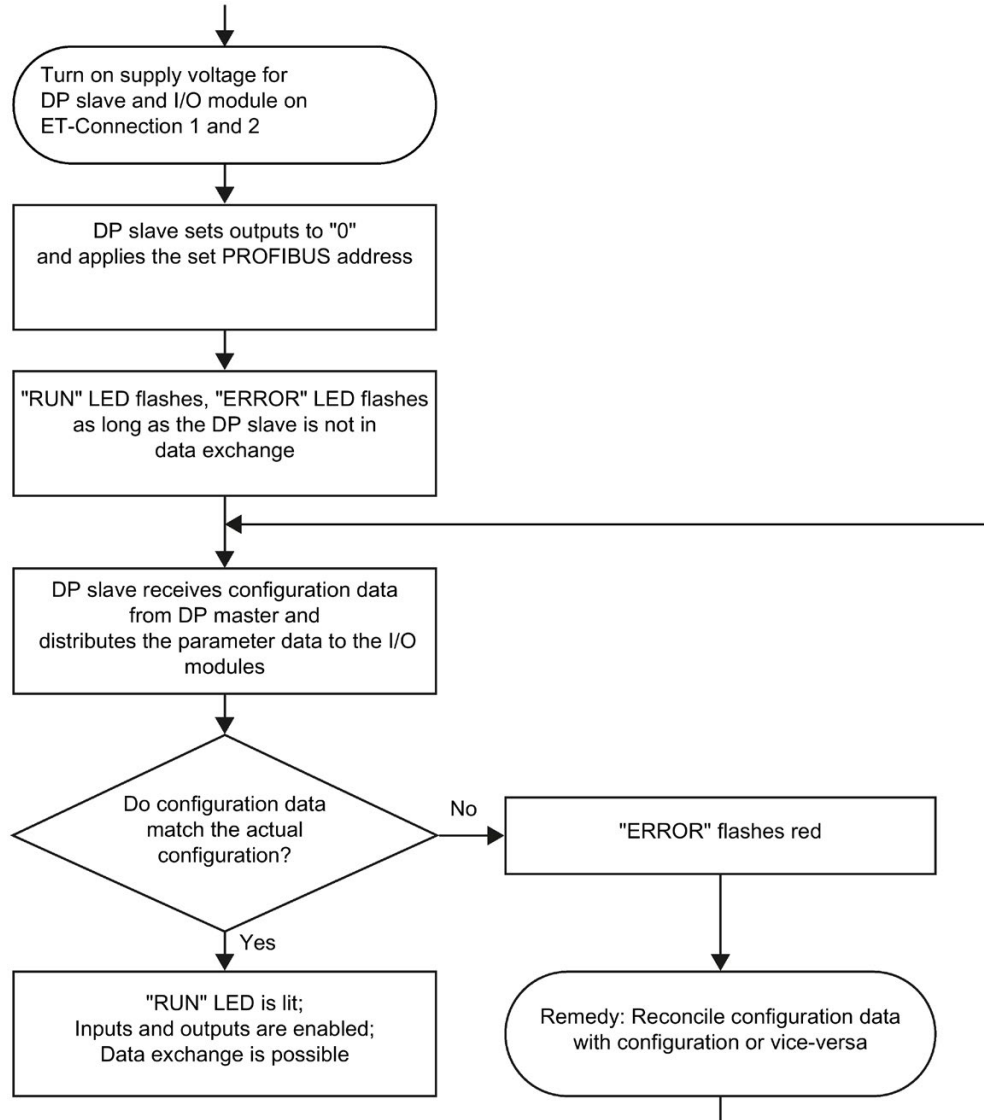

Figure 8-3   Startup of the ET 200AL distributed I/O system on PROFIBUS DP

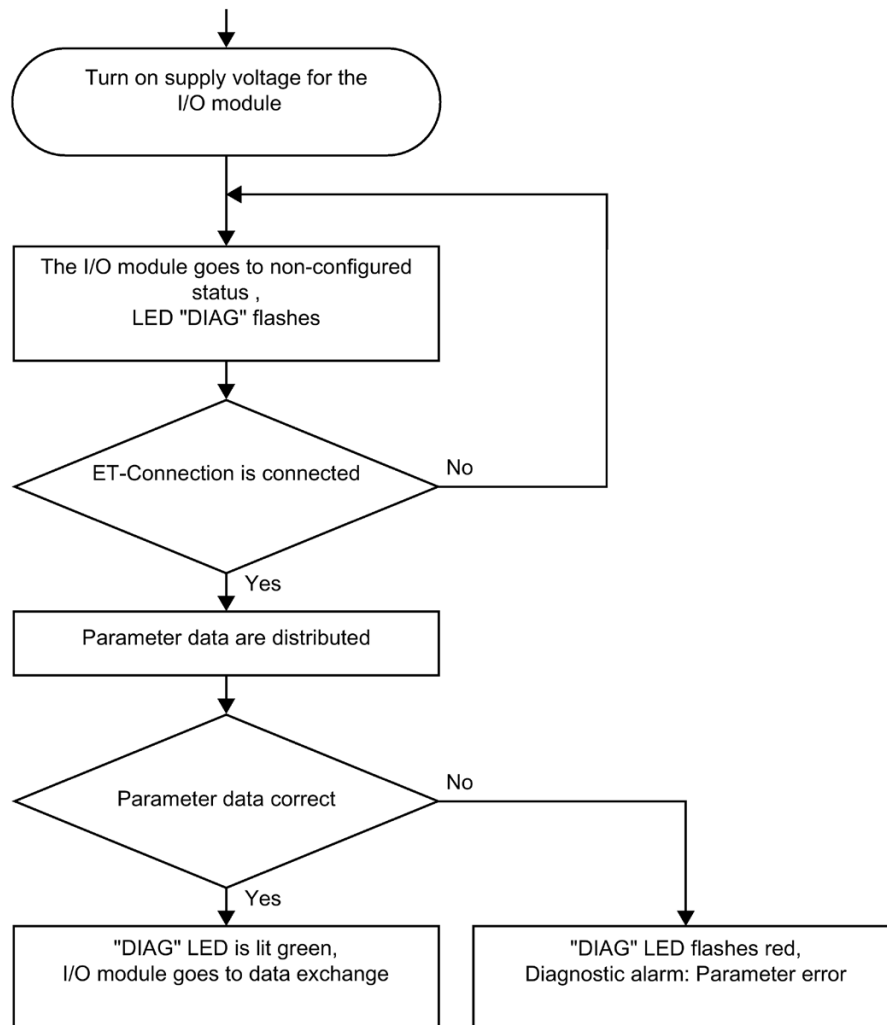The figure below schematically shows the startup of an ET 200AL I/O module after an ET 200AL PROFIBUS interface module as flow chart.

```
                    ┌─────────────────────────┐
                    │  Turn on supply voltage  │
                    │   for the I/O module     │
                    └─────────────────────────┘
                                │
                                ▼
                    ┌─────────────────────────┐
                    │ The I/O module goes to   │
                    │ non-configured status ,  │
                    │   LED "DIAG" flashes      │
                    └─────────────────────────┘
                                │
                                ▼
                      ╱ ET-Connection ╲     No
                      ╲  is connected  ╱ ──────────┐
                            │ Yes                   │
                            ▼                        │
                    ┌─────────────────────────┐     │
                    │ Parameter data are       │     │
                    │     distributed          │     │
                    └─────────────────────────┘     │
                            │                        │
                            ▼                        │
                      ╱ Parameter  ╲       No        │
                      ╲ data correct╱ ──────────┐    │
                            │ Yes               │    │
                            ▼                    ▼    │
        ┌──────────────────────────┐  ┌──────────────────────────┐
        │ "DIAG" LED is lit green,  │  │ "DIAG" LED flashes red,   │
        │ I/O module goes to data   │  │ Diagnostic alarm:         │
        │      exchange             │  │ Parameter error           │
        └──────────────────────────┘  └──────────────────────────┘
```
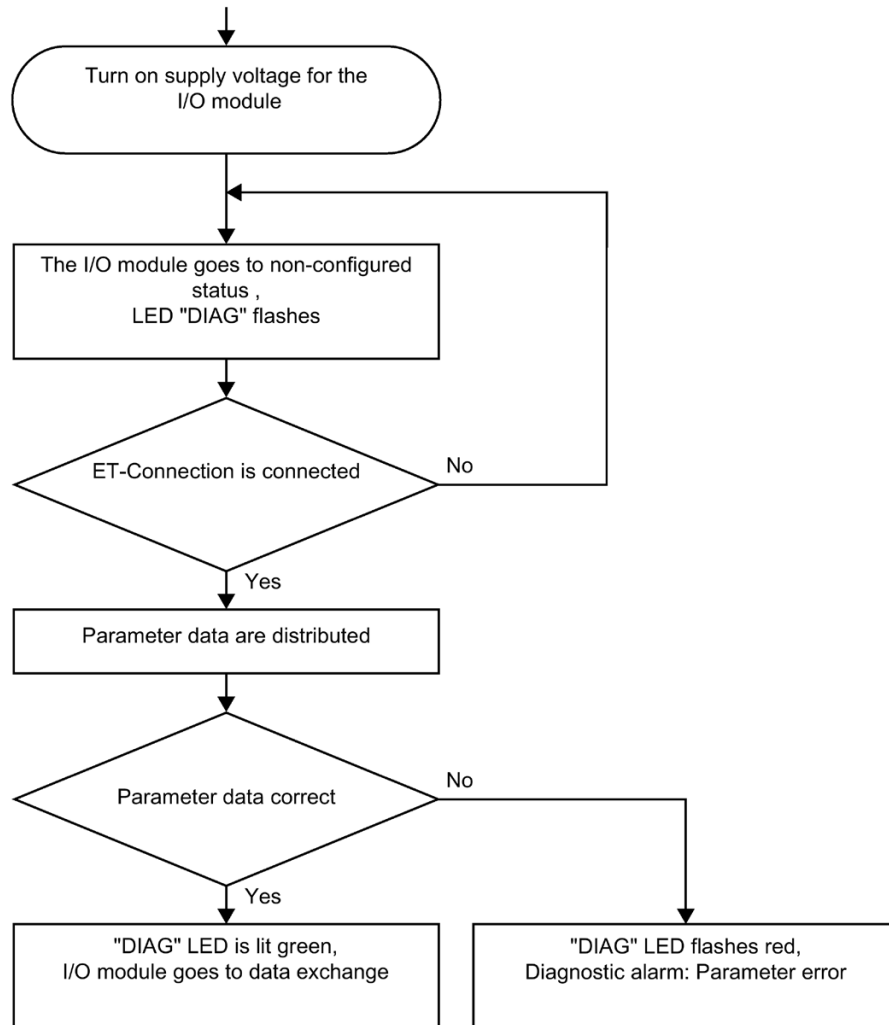
Figure 8-4   Startup of an ET 200AL I/O module

8.3 Identification and maintenance data

8.3.1 Reading out and entering I&M data

Introduction

Identification data I&M is information that is saved either as read-only (I data) or read/write (M data) on the interface module.

Identification data (I&M0): Manufacturer information on the module that is read-only and in some cases is also printed on the module housing, for example, article number, serial number and firmware version.

Maintenance data (I&M1, 2, 3): Plant-dependent information, e.g. installation location. Maintenance data is created during configuration and written to the module.

All modules of the ET 200AL distributed I/O system support identification data (I&M0 to I&M3).

The I&M identification data supports you in the following activities:

- Checking the plant configuration
- Locating hardware changes in a system
- Correcting errors in a system

With the I&M identification data, you have the option of clearly identifying modules online.

In STEP 7, the identification data is displayed in the "Module status - IM 157" and "Properties..." tabs (see STEP 7 online help).

Options for reading out I&M data

You have the following options for reading the I&M data:

- Via the user program
- Via STEP 7 or HMI devices

Procedure for reading I&M data by means of the user program

To read the I&M data of the interface module in the user program, use the instruction "RDREC".

Procedure for reading the I&M data using STEP 7

Requirement: There must be an online connection to the interface module.

1. In the project navigation, under "Distributed I/O", select the I/O device or the DP slave, e.g. "IM 157-1 PN".

2. Select: **IO device/DP slave > Online & Diagnostics > Identification & Maintenance**.

Procedure for input of maintenance data using STEP 7

The default module name is assigned by STEP 7. You have the option to enter the following data:

- Plant designation (I&M1)

- Location identifier (I&M1)

- Installation date (I&M2)

- Additional information (I&M3)

- Signature (I&M4), only for PROFINET

To enter the data, follow these steps:

1. In the device view of the STEP 7 hardware network editor, select the interface module, for example.

2. In the properties under "General", select the "Identification & Maintenance" area and enter the data.

During the loading of the hardware configuration, the I&M data are also loaded.

Reference

You can find additional information on I&M data of the ET 200SP (mixed configuration) in the ET 200SP distributed I/O system (https://support.industry.siemens.com/cs/ww/en/view/58649293) system manual.

8.3.2 Data record structure for I&M data

Reading I&M data records (distributed via PROFINET IO)

You can directly access specific identification data by selecting **Read data record** ("RDREC" instruction). You obtain the corresponding part of the identification data under the associated data record index.

The following table shows the principle behind the structure of data records.

Table 8- 3   Basic structure of data records with I&M identification data

Contents	Length (bytes)	Coding (hex)
Header information		
BlockType	2	I&M0: 0020_H I&M1: 0021_H I&M2: 0022_H I&M3: 0023_H I&M4: 0024_H
BlockLength	2	I&M0: 0038_H I&M1: 0038_H I&M2: 0012_H I&M3: 0038_H I&M4: 0038_H
BlockVersionHigh	1	01
BlockVersionLow	1	00
Identification data		
Identification data (see table below)	54 54 16 54 54	I&M0/Index $AFF0_H$ I&M1/Index $AFF1_H$ I&M2/Index $AFF2_H$ I&M3/Index $AFF3_H$ I&M4/Index $AFF4_H$

The following table shows the structure of data records for I&M identification data.

Table 8- 4   Data record structure for I&M identification data

Identification data	Access	Default	Explanation
Identification data 0: (data record index AFF0 hex)			
VendorIDHigh	read (1 byte)	00$_H$	This is where the name of the manufac-turer is stored (42$_D$ = SIEMENS AG).
VendorIDLow	read (1 byte)	2A$_H$	
Order_ID	read (20 bytes)	6ES7157-1AB00-0AB0	Order number of the module (e.g. of PROFINET interface module)
IM_SERIAL_NUMBER	read (16 bytes)	-	Serial number (device-specific)
IM_HARDWARE_REVISION	read (2 bytes)	1	Corresponding hardware version
IM_SOFTWARE_REVISION	read	Firmware version	Provides information about the firmware version of the module
• SWRevisionPrefix	(1 byte)	V	
• IM_SWRevision_Functional_Enhancement	(1 byte)	00 - FF$_H$	
• IM_SWRevision_Bug_Fix	(1 byte)	00 - FF$_H$	
• IM_SWRevision_Internal_Change	(1 byte)	00 - FF$_H$	
IM_REVISION_COUNTER	read (2 bytes)	0000$_H$	provides information about configured changes on the module (not used)
IM_PROFILE_ID	read (2 bytes)	0000$_H$	Generic device
IM_PROFILE_SPECIFIC_TYPE	read (2 bytes)	0005$_H$	Interface modules
IM_VERSION	read	0101$_H$	provides information about the version of the identification data (0101$_H$ = Version 1.1)
• IM_Version_Major	(1 byte)		
• IM_Version_Minor	(1 byte)		
IM_SUPPORTED	read (2 bytes)	001E$_H$	provides information about the existing identification data (I&M1 though I&M4)
Maintenance data 1: (data record index AFF1 hex)			
IM_TAG_FUNCTION	Read/write (32 bytes)	-	Enter an identifier for the module here, that is unique plant-wide.
IM_TAG_LOCATION	Read/write (22 bytes)	-	Enter the installation location of the mod-ule here.
Maintenance data 2: (data record index AFF2 hex)			
IM_DATE	Read/write (16 bytes)	YYYY-MM-DD HH:MM	Enter the installation date of the module here.
Maintenance data 3: (data record index AFF3 hex)			
IM_DESCRIPTOR	Read/write (54 bytes)	-	Enter a comment describing the module.

Reading I&M data records with data record 255 (distributed via PROFIBUS DP)

The modules support standardized access to identification data using DR 255 (index 65000 to 65003). For additional information on the DR 255 data structure, refer to the specifications of the Profile Guideline - Order No. 3.502.

Maintenance

9

9.1 Replacing modules

Replacing modules

Replacing a module is not permitted during ongoing operation.

⚠ WARNING
Material damage can occur
If you remove/insert modules with the power connected, this can lead to undefined states in your system.
Material damage to the ET 200AL distributed I/O system may occur as a result.
Only remove or replace modules when the power is disconnected.
Always comply with the required standards and safety guidelines when configuring a system.

⚠ WARNING
Mixing up ET-Connection1 and ET-Connection2
When connecting the modules, always ensure that they are properly connected.
If you mix up the lines for ET-Connection1 and ET-Connection2 when connecting the modules, this can lead to undefined states in your system.

Behavior of ET-Connection

During ongoing operation, a module replacement may be necessary, e.g. because the module is defective. If an I/O module fails in an ET-Connection line, the line remains active up to the failed I/O module. After replacing the I/O module, the ET-Connection line starts up by itself.

Procedure

To replace a module, proceed as follows:

1. Disconnect the supply voltage to the module to be replaced.

2. Completely remove all cables connected to the module.

3. Completely remove the fixing screws of the module

4. Replace the module.

Note

"New" module

The removed module may only be replaced by a module of the same type.

---

5. Fasten the module with a torque of 1.2 Nm.

6. Connect all cables.

7. Turn the supply voltage on.

⚠️ **WARNING**

Pay attention to the slot number of the module

If you mix up the ET 200AL I/O modules when connecting them, this can cause personal injury and damage to the machine.

The ET 200AL distributed I/O system cannot distinguish between modules of the same type during the actual/target comparison.

We recommend that you clearly label the ET 200AL I/O modules with the slot number.

The figure below shows a recommendation for labeling the ET 200AL I/O modules with the slot number.
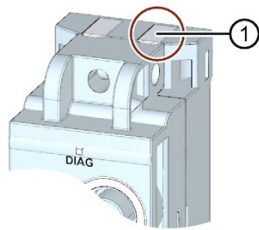
①   Recommendation for labeling the slot number

Figure 9-1   Slot number

Result

The disconnected I/O module and all downstream I/O modules start up again by themselves.

9.2 Firmware update

Introduction

During operation, it can become necessary to update the firmware (e.g. for function extensions).

Firmware updates are used to update the firmware of the interface module and I/O modules.

Note

Temporary bus interruption

When you perform a firmware update of an ET 200AL I/O module, then the ET-Connection is temporarily interrupted due to the restart of I/O module. All downstream ET 200AL I/O modules report a pull/plug interrupt.

Options for the firmware update

There are two ways to perform a firmware update:

- Online with STEP 7, V5.5 or higher
- Online with STEP 7, TIA Portal V13 or higher

Reference

You can find additional information on the procedure in the FAQs on the Internet (https://support.industry.siemens.com/cs/ww/en/view/88778936) and in the online help for STEP 7.

9.3 Resetting interface module to factory settings (PROFINET)

Introduction

When you "Reset to factory settings", the interface module is reset to the delivery state settings. This means that all information that was saved internally on the interface module is deleted.

Result after resetting to factory settings

The following table shows an overview of the contents of the saved items after resetting to factory settings.

Table 9- 1   Result after resetting to factory settings

Memory object	Contents
IP address	Deleted (configurable when resetting: "Retain IP address"/ "Delete IP address")
Device name	Deleted
MAC address	Is not deleted
Identification data (I&M0)	Is not deleted
Maintenance data (I&M1, 2, 3, 4)	Are deleted (optional)
Firmware version	Is not deleted

Note
Failure of downstream stations is possible

Resetting an interface module to factory settings can lead to failure of downstream stations in a line.

Note
Substitute value behavior of I/O modules when resetting to factory settings

When "Resetting to factory settings", the I/O modules in the station take on the non-configured state, which means input data are not entered and output data are not output.

Reset options

There are two ways to reset an interface module to factory settings:

- Online with STEP 7 (TIA Portal)
- Online with STEP 7, V5.5 or higher

Requirement

You need an online connection to reset an interface module to factory settings.

Procedure with STEP 7 (TIA Portal)

Connect the PG/PC to the PROFINET IO interface of the ET 200AL distributed I/O system.

Make sure that there is an online connection to the interface module which is to be reset to factory settings.

1. Open the online and diagnostics view of the interface module.

2. In the "Functions" folder, select the "Reset to factory settings" group.

3. Select the "Retain IP address" option button if you want to retain the IP address, or the "Reset IP address" option button if you want to delete the IP address.

4. Click the "Reset" button.

5. Click "OK" in response to the confirmation prompts.

Result: The interface module performs the "Reset to factory settings" while the RUN LED flashes yellow. When the RUN LED is lit yellow, the interface module has been reset to factory settings and is in the STOP operating mode. The event "Reset to factory settings" is entered in the diagnostics buffer.

Procedure with STEP 7 V5.5 or higher

Connect the PG/PC to the PROFINET IO interface of the ET 200AL distributed I/O system.

Make sure that there is an online connection to the interface module which is to be reset to factory settings.

1. Open the SIMATIC Manager.

2. Select accessible devices.

3. Select the interface module.

4. Navigate through "Menu > Options > Edit Ethernet devices > Reset to factor settings > Reset".

Result: The interface module performs the "Reset to factory settings" while the RUN LED flashes yellow. When the RUN LED is lit yellow, the interface module has been reset to factory settings and is in the STOP operating mode. The event "Reset to factory settings" is entered in the diagnostics buffer.

Reference

You will find more information on the procedure in the STEP 7 online help.

9.4 Cleaning modules

When wired, ET 200AL modules comply with degree of protection IP65/IP67 and do not require any cleaning. If you do have to clean the modules, then use a dry or damp cloth. Please take care to comply with degree of protection IP65/67 when cleaning with liquids.

Technical specifications 10

Introduction

The technical specifications of the system are found in this section:

- The standards and test values that the ET 200AL distributed I/O system complies with and fulfills.

- The test criteria according to which the ET 200AL distributed I/O system was tested.

Technical specifications for the modules

The technical data of the individual modules can be found in the modules' manuals. If there are discrepancies between the statements in this document and the product manuals, the statements in the product manuals take priority.

Reference

The certificates for the markings and approvals can be found on the Internet (https://support.industry.siemens.com).

10.1 Standards and authorizations

Currently valid markings and authorizations

> **Note**
>
> **Details on the components of the ET 200AL distributed I/O system**
>
> The currently valid markings and approvals are printed on the components of the ET 200AL distributed I/O system.

CE mark

The ET 200AL distributed I/O system fulfills the requirements and protection targets of the following directives and complies with the harmonized European standards (ES) which have been promulgated for programmable logic controllers in the official gazettes of the European Community:

- 2014/30/EU "Electromagnetic Compatibility" (EMC directive)
- 2011/65/EU "Restriction of the use of certain hazardous substances in electrical and electronic equipment" (RoHS Directive)

The EC declarations of conformity are available to the responsible authorities at:

Siemens AG
Digital Factory

Factory Automation
DI FA AS SYS
Postfach 1963
D-92209 Amberg

These are also available for download on the Customer Support Internet pages, under the keyword "Declaration of Conformity".

UL approval

Underwriters Laboratories Inc. in accordance with

- UL 61010-2-201
- UL/CSA 61010-1 (Process Control Equipment)
- UL50/NEMA250 Enclosure Type 4X, Indoor use only, watertight

RCM Declaration of conformity for Australia/New Zealand

The ET 200AL distributed I/O system meets the requirements of EN 61000-6-4:2007 Generic standards – Emission standard for industrial environments.

Korea Certificate KCC-REM-S49-ET200

Please note that this device corresponds to limit class A with regard to the emission of radio interference. This device can be used in all areas, except residential areas.

이 기기는 업무용(A급) 전자파 적합기기로서 판매자 또는 사용자는 이 점을 주의하시기 바라며 가정 외의 지역에서 사용하는 것을 목적으로 합니다.

Marking for the Eurasian Customs Union

EAC (Eurasian Conformity)

Customs Union of Russia, Belarus and Kazakhstan

Declaration of conformity with the technical requirements of the Customs Union (TR CU)

IEC 61131-2

The ET 200AL distributed I/O system meets the requirements and criteria of standard IEC 61131-2, excluding the requirements mentioned in section 11 to 14 (programmable logic controllers, part 2: Equipment requirements and tests).

IEC 61010-2-201

The ET 200AL distributed I/O system fulfills the requirements and criteria of standard IEC 61010-2-201.

PROFINET standard

The interface module IM 157-1 PN based on standard IEC 61158 Type 10.

PROFIBUS standard

The interface module IM 157-1 DP based on standard IEC 61158 Type 3.

Marine approval

Classification societies:

- ABS (American Bureau of Shipping)
- BV (Bureau Veritas)
- DNV-GL (Det Norske Veritas - Germanischer Lloyd)
- LRS (Lloyds Register of Shipping)
- Class NK (Nippon Kaiji Kyokai)

IO-Link standard

The communication module CM 4xIO-Link 4xM12 based on standard IEC 61131-9.

Industrial use

The ET 200AL distributed I/O system is suitable for use in industrial environments. It meets the following standards for this type of use:

- Requirements on interference emission EN 61000-6-4: 2007 + A1: 2011

- Requirements on immunity EN 61000-6-2: 2005

Use in mixed areas

Under specific prerequisites you can use the ET 200AL distributed I/O system in a mixed area. A mixed area is used for residential purposes and for commercial operations that do not significantly impact the residential purpose.

If you want to use the ET 200AL distributed I/O system in mixed areas, you must ensure that its radio frequency interference emission complies with the limit classes of the EN 61000-6-3 generic standard. Suitable measures for observing these limits for use in a mixed area are, for example:

- Installation of the ET 200AL distributed I/O system in grounded control cabinets/control boxes

- Use of filters in supply cables

An additional individual acceptance test is also required.

Use in residential areas

Note

ET 200AL distributed I/O system not intended for use in residential areas

The ET 200AL distributed I/O system is not intended for use in residential areas. If you are using the ET 200AL distributed I/O system in residential areas, radio and TV reception may be affected.

Reference

The certificates for the markings and approvals can be found on the Internet under Service&Support (http://www.siemens.com/automation/service&support).

10.2 Electromagnetic compatibility

Definition

Electromagnetic compatibility is the ability of an electrical apparatus to function in a satisfactory manner in its electromagnetic environment without affecting this environment.

An I/O device of the ET 200AL distributed I/O system fulfills the requirements of the EMC law of the European Union. The requirement for this is that an I/O device of the ET 200AL distributed I/O system meets the specifications and guidelines for electrical configuration.

Pulse-shaped disturbance variables

The table below shows the electromagnetic compatibility of the distributed I/O systems compared to pulse-shaped disturbance variables.

Table 10- 1   Pulse-shaped disturbance variables

Pulse-shaped disturbance variable	Tested with	Corresponds to degree of severity
Electrostatic discharge according to IEC 61000-4-2.	Air discharge: ±8 kV	3
	Contact discharge: ±4 kV	2
Burst pulses (rapid transient disturbance values) according to IEC 61000-4-4.	±2 kV (power supply cable)	3
	±2 kV (PROFIBUS-/PROFINET line)	4
	±1 kV (signal line <30 m)	3
	±1 kV (ET-Connection)	3
High-energy surge according to IEC 61000-4-5.		
• Asymmetrical coupling	±2 kV (24 V DC supply cable) with protective element	3
	±0.5 kV (24 V DC supply cable) without protective element	1
	±2 kV (PROFIBUS/PROFINET line) without protective element	3
• Symmetrical coupling	±1 kV (24 V DC supply cable) with protective element	3
	±0.5 kV (24 V DC supply cable) without protective element	2

Sinusoidal disturbance variables

The following tables show the electromagnetic compatibility of the distributed I/O systems to sinusoidal disturbance variables.

Table 10- 2   RF radiation

RF radiation according to IEC 61000-4-3 Electromagnetic RF field, amplitude modulated		Corresponds to degree of severity
80 MHz to 1000 MHz	10 V/m	3
1.4 GHz to 6 GHz	3 V/m	2
80% AM (1 kHz)		

Table 10- 3   RF coupling (signal and supply cables)

RF coupling according to IEC 61000-4-6.	Corresponds to degree of severity
0.15 MHz to 80 MHz	
10 V_{rms} unmodulated	3
80% AM (1 kHz)	
150 Ω source impedance	

Emission of radio frequency interference

The following table shows the interference emission of electromagnetic fields according to 55016: limit class A, group 1.

Table 10- 4   Interference emission of electromagnetic fields

Frequency	Interference emission	Measuring distance
30 MHz to 230 MHz	<40 dB (µV/m) Q	10 m
230 MHz to 1000 MHz	<47 dB (µV/m) Q	10 m
1 GHz to 3 GHz	<76 dB (µV/m) P	3 m
3 GHz to 6 GHz	<80 dB (µV/m) P	3 m

24 V supply connection

The following table shows measurement ranges for low voltage according to EN 55016.

Table 10- 5   Interference emission of electromagnetic fields

Frequency	Interference emission
0.15 MHz to 0.5 MHz	79 dB (µV) Q
	66 dB (µV) M
0.5 MHz to 30 MHz	73 dB (µV) Q
	60 dB (µV) M

10.3 Transport and storage conditions

Transport and storage conditions

The modules of the ET 200AL distributed I/O system exceed the specifications regarding transport and storage conditions pursuant to IEC 61131-2. The following table shows the conditions that apply to modules transported or stored in their original packaging.

Table 10- 6   Transport and storage conditions

Type of condition	Permissible range
Free fall	≤0.3 m
Temperature	-40 °C to +70 °C
Temperature variation	20 K/h
Barometric pressure	from 1140 hPa to 660 hPa
	(corresponds to a height of-1000 to 3500 m)
Relative humidity	from 5 to 95%

10.4 Mechanical and climatic ambient conditions

Operating conditions

The ET 200AL distributed I/O system is suitable for use in weather-proof, fixed locations. The conditions of use exceed the requirements pursuant to IEC 60721-3-3:

- Class 3M3 (mechanical requirements)
- Class 3K3 (climatic requirements)

Mechanical ambient conditions

The following table shows the mechanical ambient conditions, listed in sinusoid vibrations.

Table 10- 7   Mechanical ambient conditions

Frequency band	Tested
5 Hz ≤ f ≤ 8 Hz	15 mm amplitude
8 Hz ≤ f ≤ 150 Hz	10g constant acceleration

Tests of mechanical ambient conditions

The following table shows the type and scope of the tests on mechanical ambient conditions.

Table 10- 8   Tests of mechanical ambient conditions

Condition tested	Test standard	Values
Vibrations	Vibration test according to IEC 60068-2-6.	Type of oscillation: Frequency sweeps with a rate of change of 1 octave/minute.
		5 Hz to 9.1 Hz, constant amplitude 15 mm
		9.1 Hz to 150 Hz, constant acceleration 10g
		Duration of oscillation: 10 frequency sweeps per axis at each of three vertically aligned axes
Shock	Shock, tested according to IEC 60068-2-27	Type of shock: Half-sine
		Shock intensity: 30g peak value, 18 ms duration
		Direction of shock: 3 shocks each in ± direction in each of the 3 axes vertical to one another

Climatic ambient conditions

The following table shows the type and scope of the tests on climatic ambient conditions.

Table 10- 9   Climatic ambient conditions

Ambient conditions	Fields of application	Comments
Temperature	-25 °C to 55 °C	All installation positions
Temperature variation	10 K/h	-
Relative humidity	From 5 to 100%	With condensation
Barometric pressure	From 1140 hPa to 795 hPa	Corresponds to a height of -1000 to 2000 m
Concentration of pollutants	ANSI/ISA-71.04 severity level G1; G2; G3	-

The following table shows the modules with functional versions which are permitted to -30 °C.

Table 10- 10 Extended temperature range to -30 °C

Description	Article number	As of functional version
Interface modules ET 200AL		
IM 157-1 DP interface module	6ES7157-1AA00-0AB0	FS02
DI		
DI 8x24VDC, 8xM8	6ES7141-5BF00-0BA0	FS03
DI 8x24VDC, 4xM12	6ES7141-5AF00-0BA0	FS03
DI 16x24VDC, 8xM12	6ES7141-5AH00-0BA0	FS03
DQ		
DQ 8x24VDC/2A, 8xM12	6ES7142-5AF00-0BA0	FS03
DI/DQ		
DIQ 4+DQ 4x24VDC/0,5A, 8xM8	6ES7143-5BF00-0BA0	FS03
DIQ 4+DQ 4x24VDC/0,5A, 4xM12	6ES7143-5AF00-0BA0	FS03
DIQ 16x24VDC/0,5A, 8xM12	6ES7143-5AH00-0BA0	FS03
AI		
AI 4xU/I/RTD, 4xM12	6ES7144-5KD00-0BA0	FS04
AQ		
AQ 4xU/I, 4xM12	6ES7145-5ND00-0BA0	FS03
Communication modules		
CM 4xIO-LINK, 4xM12	6ES7147-5JD00-0BA0	FS05

10.5 Details on insulation, protection class, degree of protection and rated voltage

Insulation

The insulation is designed in compliance with the requirements of IEC 61010-2-201.

Note

Galvanic isolation with 707 V DC (Type Test) is tested for modules with 24 V DC supply voltage (SELV/PELV).

Pollution class according to IEC 61010-2-201

- Protection class III

Degree of protection IP65 and IP67

Degree of protection IP65 and IP67 according to IEC 60529 for all modules of the ET 200AL distributed I/O system:

- 1. Code number: Dust-proof and complete protection from contact

- 2. Code number: Protection from water

    - IP65: Protection from water jets from any angle
      (The water may not have any damaging effect)

    - IP67: Protection against temporary submersion
      (The water must not enter the enclosure in harmful quantities)

Rated voltage for operation

The following table shows the rated voltage and the corresponding tolerance with which the ET 200AL distributed I/O system operates.

Table 10- 11 Rated voltage for operation

Rated voltage (SELV/PELV)	Tolerance range
24 V DC	20.4 V to 28.8 V DC

10.6 Safety-related symbols for IP65/IP67 modules

The following table contains an explanation of the symbols located on your IP65/67 modules, their packaging or in the accompanying documentation.

Symbol	Meaning
⚠	General warning sign **Caution/Notice** You must read the product documentation. The product documentation contains information about the type of potential hazard and enables you to recognize risks and implement countermeasures.
⚠ Ⓔ ONLY EX MODULES	The assigned safety symbols apply to devices **with Ex approval**. You must read the product documentation. The product documentation contains information about the type of potential hazard and enables you to recognize risks and implement countermeasures.
(symbol)	Read the information provided by the product documentation. ISO 7010 M002
(symbol)	Ensure the device is only installed by an electrically skilled person. IEC 60417 No. 6182
CABLE SPEC.	Note that connected mains lines must be designed according to the expected minimum and maximum ambient temperature.
EMC	Note that the device must be constructed and connected in accordance with EMC regulations.
230V MODULES	Note that a 230 V device can be exposed to electrical voltages which can be dangerous. ANSI Z535.2
◁III▷ 24V MODULES	Note that a device of Protection Class III may only be supplied with a protective low voltage according to the standard SELV/PELV. IEC 60417-1-5180 "Class III equipment"
INDOOR USE ONLY INDUSTRIAL USE ONLY	Be aware that the device is only approved for the industrial field and only for indoor use.

Safety-related shutdown of ET200AL standard modules   A

Introduction

The diagram below illustrates the fail-safe shutdown of ET 200AL standard modules.

In the configuration shown in the diagram below, all digital outputs that are operated with the 2L+ and 2M supply of the ET 200AL standard modules are switched to the safe OFF state. This step achieves the safety class SIL2/category 3/PLd.

Principle of operation

The higher-level safety relay (for example: 3SK1) disconnects the 2L+ and 2M supply. This switches all digital outputs operated with the 2L+ and 2M (switched) supply to the safe state. The digital outputs connected to the 1L+ and 1M (non-switched) supply are not intended for functional switching and therefore cannot be shut down safely.

There is no interaction between the outputs supplied by 1L+ and 2L+.

You can also integrate I/O modules that are operated solely at the supply 1L+ and 1M (non-switched) in the structure of your distributed I/O system. These I/O modules are not affected by a disconnection, they pass on the supply 2L+ and 2M (switched). The following figure shows the modules DI and AI as an example.

Block diagram

ET200AL distributed I/O system
with standard modules

DIQ+
DQ   DI   DQ   AI   IO-Link Master

1L+
1M

Safety
relay,
for example: 3SK1

2L+
2M

2L+ 2M

2M 1M   2M 1M   2M 1M

IO-Link device

electrically isolated, safe shutdown

not electrically isolated, no safe shutdown
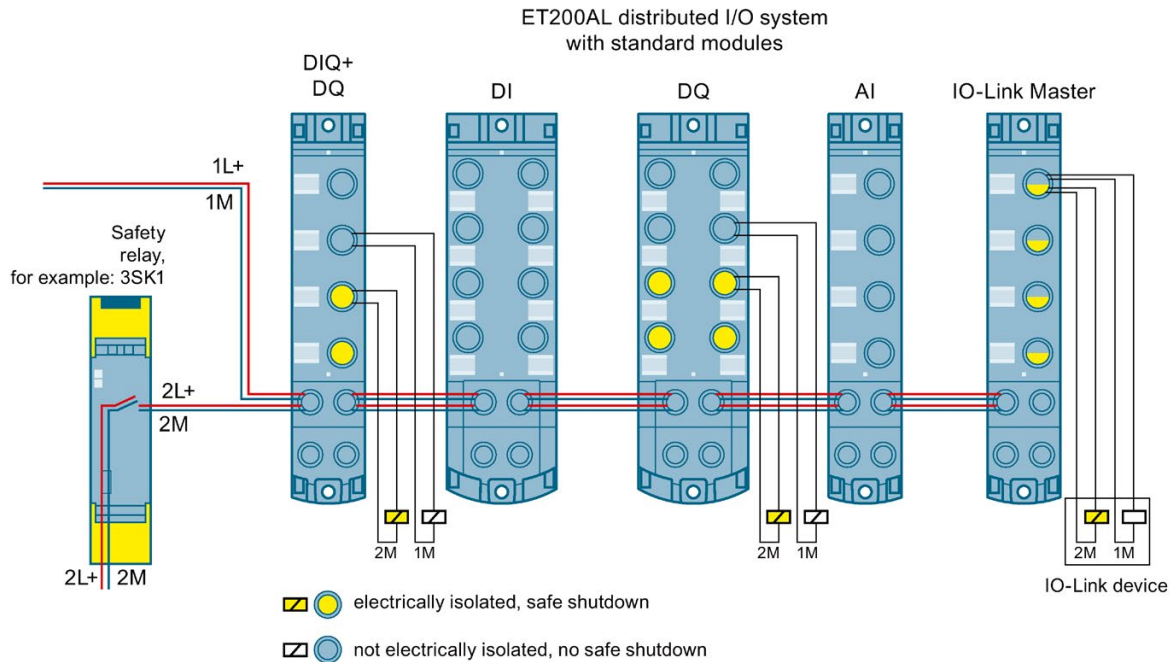
Figure A-1   Higher-level safety circuit with safety relay

Note

Usage of IO-Link devices

Please note that the IO-Link device must have corresponding safety characteristics in order to use safety-oriented tripping.

Requesting TÜV certificate (report no. SN89858T, Revision 1.1 of 10/11/2016)

You can request copies of the TÜV certificate and the accompanying report at the following address:

Siemens AG
Digital Factory
DI FA AS SYS
Postfach 1963
D-92209 Amberg

Reference

You can find additional information as well as an overview of the modules with safety-related shutdown on the Internet (https://support.industry.siemens.com/cs/us/en/view/39198632).

Dimension drawings

<div style="text-align: right; font-size: 3em; font-weight: bold;">B</div>

2 module widths are available with the distributed I/O system.

The figure below shows the height and width of the modules. The depth of the modules ranges from 40 mm to 46 mm. Detailed information on the dimensions of the individual modules can be found in the manuals for the Interface modules (https://support.industry.siemens.com/cs/ww/en/ps/14246/man) and I/O modules (https://support.industry.siemens.com/cs/ww/en/ps/14247/man) in the section "Dimension drawing".

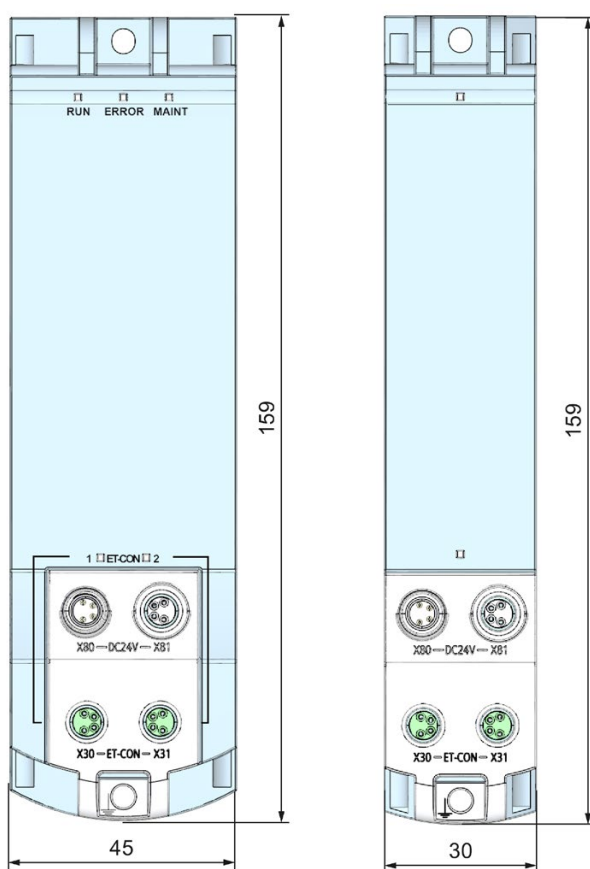Figure B-1   Module dimension drawings (front view)

Accessories/spare parts

C

C.1 Accessories/spare parts

Accessories for the ET 200AL distributed I/O system

Table C- 1   Accessories for ET-Connection

Designation	Length	Article number	
Cable		Standard	PUR
Bus cable for ET-Connection M8, pre-assembled on both sides with 2 x M8 connectors, 4-pole, shielded	0.19 m	6ES7194-2LH02-0AA0	6ES7194-2MH02-0AA0
	0.3 m	6ES7194-2LH03-0AA0	6ES7194-2MH03-0AA0
	1.0 m	6ES7194-2LH10-0AA0	6ES7194-2MH10-0AA0
	2.0 m	6ES7194-2LH20-0AA0	6ES7194-2MH20-0AA0
	5.0 m	6ES7194-2LH50-0AA0	6ES7194-2MH50-0AA0
	10.0 m	6ES7194-2LN10-0AA0	6ES7194-2MN10-0AA0
	15.0 m	6ES7194-2LN15-0AA0	6ES7194-2MN15-0AA0
Bus cable for ET-Connection M8, pre-assembled on both sides with 2 x M8 connectors, angled, 4-pole, shielded	0.3 m	6ES7194-2LH03-0AB0	6ES7194-2MH03-0AB0
	1.0 m	6ES7194-2LH10-0AB0	6ES7194-2MH10-0AB0
	2.0 m	6ES7194-2LH20-0AB0	6ES7194-2MH20-0AB0
	5.0 m	6ES7194-2LH50-0AB0	6ES7194-2MH50-0AB0
	10.0 m	6ES7194-2LN10-0AB0	6ES7194-2MN10-0AB0
	15.0 m	6ES7194-2LN15-0AB0	6ES7194-2MN15-0AB0
Bus cable for ET-Connection M8, pre-assembled on one side with 1 x M8 connector, 4-pole, shielded	2.0 m	6ES7194-2LH20-0AC0	6ES7194-2MH20-0AC0
	5.0 m	6ES7194-2LH50-0AC0	6ES7194-2MH50-0AC0
	10.0 m	6ES7194-2LN10-0AC0	6ES7194-2MN10-0AC0
	15.0 m	6ES7194-2LN15-0AC0	6ES7194-2MN15-0AC0
Connecting cable for bus cable ET-Connection M8, both ends assembled with 2x M8 socket, 4-pole, shielded	0.2 m	6ES7194-2LH02-0AD0	6ES7194-2MH02-0AD0
Connector			
M8 connector for ET-Connection, 4-pole, shielded		6ES7194-2AB00-0AA0	

Table C- 2   Accessories for power supply

Designation	Length	Article number	
		Standard	PUR
Cable			
Power cable M8, pre-assembled on both sides with M8 connector and M8 socket, 4-pole	0.19 m	6ES7194-2LH02-1AA0	6ES7194-2MH02-1AA0
	0.3 m	6ES7194-2LH03-1AA0	6ES7194-2MH03-1AA0
	1.0 m	6ES7194-2LH10-1AA0	6ES7194-2MH10-1AA0
	2.0 m	6ES7194-2LH20-1AA0	6ES7194-2MH20-1AA0
	5.0 m	6ES7194-2LH50-1AA0	6ES7194-2MH50-1AA0
	10.0 m	6ES7194-2LN10-1AA0	6ES7194-2MN10-1AA0
	15.0 m	6ES7194-2LN15-1AA0	6ES7194-2MN15-1AA0
Power cable M8, pre-assembled on both sides with angled M8 connector and angled M8 socket, 4-pole	0.3 m	6ES7194-2LH03-1AB0	6ES7194-2MH03-1AB0
	1.0 m	6ES7194-2LH10-1AB0	6ES7194-2MH10-1AB0
	2.0 m	6ES7194-2LH20-1AB0	6ES7194-2MH20-1AB0
	5.0 m	6ES7194-2LH50-1AB0	6ES7194-2MH50-1AB0
	10.0 m	6ES7194-2LN10-1AB0	6ES7194-2MN10-1AB0
	15.0 m	6ES7194-2LN15-1AB0	6ES7194-2MN15-1AB0
Power cable M8, pre-assembled on one side with M8 socket, 4-pole	2.0 m	6ES7194-2LH20-1AC0	6ES7194-2MH20-1AC0
	5.0 m	6ES7194-2LH50-1AC0	6ES7194-2MH50-1AC0
	10.0 m	6ES7194-2LN10-1AC0	6ES7194-2MN10-1AC0
	15.0 m	6ES7194-2LN15-1AC0	6ES7194-2MN15-1AC0
Connector			
M8 power connector, pin insert, 4-pole		6ES7194-2AA00-0AA0	
M8 power connector, socket insert, 4-pole		6ES7194-2AC00-0AA0	

Table C- 3   M12 connector

Designation		Article number
Non-preassembled connectors for X1 DP1 (pin)		
PROFIBUS M12 plug connector 180° with female insert		6GK1905-0EB00
PROFIBUS M12 plug connector FastConnect 180° with female insert		6GK1905-0EB10
PROFIBUS M12 plug connector, angled with female insert		3RK1902-1DA00
Non-preassembled connectors for X1 DP2 (socket)		
PROFIBUS M12 plug connector 180° with pin insert		6GK1905-0EA00
PROFIBUS M12 plug connector FastConnect 180° with pin insert		6GK1905-0EA10
PROFIBUS M12 plug connector angled with pin insert		3RK1902-1BA00
Non-preassembled connectors for X1 P1R PN (LAN) and X1 P2R PN (LAN) socket		
PROFINET M12 plug connector d-coded with FastConnect connection technology, 180	1 unit/pack	6GK1901-0DB10-6AA0
	8 units/pack	6GK1901-0DB10-6AA8
PROFINET M12 plug connector, D-coded with fast connect technology 180°	1 unit/pack	6GK1901-0DB20-6AA0
	8 units/pack	6GK1901-0DB20-6AA8
PROFINET M12 plug connector, D-coded, angled		3RK1902-2DA00

Table C- 4   Non-preassembled cable M12

Designation	Article number
Non-preassembled cable for X1 DP1 and X1 DP2	
PROFIBUS FC Cable	
FC Standard Cable	6XV1830-0EH10
FC Trailing Cable	6XV1830-3EH10
FC Food Cable (PE sheath)	6XV1830-0GH10
FC Robust Cable (PUR sheath)	6XV1830-0JH10
FC FRNC Cable (FRNC sheath)	6XV1830-0LH10
FC Underground Cable	6XV1830-3FH10
Festoon Cable GP (PVC sheath)	6XV1830-3GH10
FC Flexible Cable GP (PUR sheath)	6XV1831-2K
Non-preassembled connectors for X1 P1R PN (LAN) and X1 P2R PN (LAN)	
PROFIBUS FC Cable	
FC Standard Cable	6XV1840-2AH10
FC TP Trailing Cable	6XV1840-3AH10
FC TP Trailing Cable GP	6XV1870-2D
FC TP Marine Cable	6XV1840-4AH10
FC TP Torsion Cable	6XV1870-2F
FC TP Flexible Cable GP (PVC sheath)	6XV1870-2B
FC TP FRNC Cable (FRNC sheath)	6XV1871-2F
FC TP Food Cable (PE sheath)	6XV1871-2L
FC TP Festoon Cable GP (PVC sheath)	6XV1871-2S

Table C- 5   Pre-assembled cable M12

Designation		Article number
Pre-assembled cable for X1 DP1 and X1 DP2		
PROFIBUS M12 connecting cable, trailing cable, pre-assembled on both sides with PROFIBUS M12 connectors, 180° (one end with socket, one end with pin)	0.3 m	6XV1830-3DE30
	0.5 m	6XV1830-3DE50
	1.0 m	6XV1830-3DH10
	1.5 m	6XV1830-3DH15
	2.0 m	6XV1830-3DH20
	3.0 m	6XV1830-3DH30
	5.0 m	6XV1830-3DH50
	10.0 m	6XV1830-3DN10
	15.0 m	6XV1830-3DN15
PROFIBUS M12 connecting cable, trailing cable, pre-assembled on both sides with PROFIBUS M12 connectors, angled (one end with socket, one end with pin)	1.5 m	6XV1830-3DH15-0SB0
	2.0 m	6XV1830-3DH20-0SB0
	3.0 m	3RK1902-1NB30
	5.0 m	3RK1902-1NB50
	10.0 m	3RK1902-1NC10
	15.0 m	6XV1830-3DN15-0SB0
Pre-assembled cable for X1 P1R PN (LAN) and X1 P2R PN (LAN)		
PROFINET M12 connecting cable, trailing cable, pre-assembled on both ends with M12 connectors 180° (pin)	0.3 m	6XV1870-8AE30
	0.5 m	6XV1870-8AE50
	1.0 m	6XV1870-8AH10
	1.5 m	6XV1870-8AH15
	2.0 m	6XV1870-8AH20
	3.0 m	6XV1870-8AH30
	5.0 m	6XV1870-8AH50
	10.0 m	6XV1870-8AN10
	15.0 m	6XV1870-8AN15
PROFINET M12 connecting cable, trailing cable, pre-assembled on both ends with M12 connectors, angled (pin)	0.3 m	6XV1870-8AE30-0SB0
	0.5 m	6XV1870-8AE50-0SB0
	1.0 m	6XV1870-8AH10-0SB0
	1.5 m	6XV1870-8AH15-0SB0
	2.0 m	6XV1870-8AH20-0SB0
	3.0 m	3RK1902-2NB30
	5.0 m	3RK1902-2NB50
	10.0 m	3RK1902-2NC10
	15.0 m	6XV1870-8AN15-0SB0
PROFINET M12 connecting cable, trailing cable, pre-assembled on both sides with PROFIBUS M12 connectors, angled (one end with pin, one end open)	3.0 m	3RK1902-2HB30
	5.0 m	3RK1902-2HB50
	10.0 m	3RK1902-2HC10
PROFINET M12 connecting cable, trailing cable, pre-assembled on one end with M12 connectors 180° (pin), other end with RJ45 plug 145°	2.0 m	6XV1871-5TH20
	3.0 m	6XV1871-5TH30
	5.0 m	6XV1871-5TH50
	10.0 m	6XV1871-5TN10
	15.0 m	6XV1871-5TN15

Table C- 6   Y cable

Description		Article number
SIMATIC DP, Y cable for distributed I/Os for double connection of I/Os using single cable, 5-pole, M12	0.2 m	6ES7194-6KA00-0XA0

Table C- 7   Additional accessories

Designation	Article number
Identification labels 10 x 5 mm RAL9016, composed of 200 labels on frames, per frame 40 labels	6ES7194-2BA00-0AA0
Sealing cap M8 for modules IP67	3RK1901-1PN00
Sealing cap M12 for modules IP67	3RX9802-0AA00
Bus connection plug PROFIBUS M12, pin insert, 5 units	6GK1905-0EC00
Stripping Tool for ET-Connection	6ES7194-2KA00-0AA0
Stripping Tool for PROFINET	6GK1901-1GA00
Stripping Tool for PROFIBUS	6GK1905-6AA00

Online catalog

Other article numbers for the ET 200AL distributed I/O system can be found on the Internet (https://mall.industry.siemens.com) in the online catalog and the online order system.

C.2   Cables

Cables for ET-Connection standard and PUR cable

The cables for ET-Connection are available in the following versions and lengths:

- Bus cable (4-wire), pre-assembled on both sides with 2 M8 connectors, 4-pole, shielded
  – available lengths: 0.19 m, 0.3 m, 1 m, 2 m, 5 m, 10 m, 15 m
- Bus cable (4-wire), pre-assembled on both sides with 2 M8 connectors, angled, 4-pole, shielded
  – available lengths: 0.3 m, 1 m, 2 m, 5 m, 10 m, 15 m
- Bus cable (4-wire), pre-assembled on one side 1x M8 connector, 4-pole, shielded
  – available lengths: 2 m, 5 m, 10 m, 15 m

The following table shows the technical properties of the bus cable ET-Connection standard.

Table C- 8   Cables for ET-Connection

General information	
Product type designation	BUS CABLE ET-CONNECTION
Function	To connect ET-CONNECTION devices with degree of protection IP65/IP67
Degree of protection and protection class	
IP65	Yes
IP67	Yes
Ambient conditions	
Ambient temperature during mounting	
minimum	-30 °C
maximum	80 °C
Storage/transport temperature	
Ambient temperature during transport and storage	
minimum	-40 °C
maximum	80 °C
Cables	
Cable designation	2Y(ST)CY 1x4x0.5/1.0-100-GN
Number of electrical wires	4
Design of shielding	Overlapped aluminum-lined sheet, coated with shielding made of tin plated copper wires
Outside diameter of the inner conductor	0.5 mm
Outside diameter of the wire insulation	1.0 mm
Outside diameter of the cable sheath	5 mm
Number of bending cycles	1000000; Trailing-chain suitable for 1 million bending cycles with a bending radius of 100 mm, a velocity of 4 m/s and an acceleration of 4 m/s²
Permissible bending radius	
One time bending, min.	20 mm
Multiple bending, min.	40 mm
Constant bending	100 mm
Color of the cable sheath	Green
Color of the wire insulation of the data wires	White, yellow, blue, orange
Weight per length	34 kg/km
Mechanics/material	
Type of cable outlet	180° cable outlet 90° cable outlet (with angled connectors)
Number of connectors	1 or 2
Connector housing material	Metal
Wire insulation material	PE
Cable sheath material	PVC
Material property halogen free	No
Material property silicon free	Yes

* = Applies to cable lengths up to 10 meters.

The following table shows the technical properties of the bus cable ET-Connection, PUR cable.

Table C- 9   Cables for ET-Connection, PUR cable

General information	
Product type designation	BUS CABLE ET-CONNECTION, PUR CABLE
Function	To connect ET-CONNECTION devices with degree of protection IP65/IP67
Degree of protection and protection class	
IP65	Yes
IP67	Yes
Ambient conditions	
Ambient temperature during mounting	
minimum	-30 °C
maximum	80 °C
Storage/transport temperature	
Ambient temperature during transport and storage	
minimum	-40 °C
maximum	80 °C
Cables	
Cable designation	2Y(ST)C11Y 2x2x0.5/1.0-100-GN
Number of electrical wires	4
Design of shielding	Overlapped aluminum-lined sheet, coated with shielding made of tin plated copper wires
Outside diameter of the inner conductor	0.5 mm
Outside diameter of the wire insulation	1.0 mm
Outside diameter of the cable sheath	5 mm
Number of bending cycles	1000000*; trailing-chain suitable for 1 million bending cycles with a bending radius of 100 mm, a velocity of 4 m/s and an acceleration of 4 m/s²
Permissible bending radius	
One time bending, min.	20 mm
Multiple bending, min.	40 mm
Constant bending	100 mm
Color of the cable sheath	Green
Color of the wire insulation of the data wires	White, yellow, blue, orange
Weight per length	34 kg/km
Mechanics/material	
Type of cable outlet	180° cable outlet 90° cable outlet (with angled connectors)
Number of connectors	1 or 2
Connector housing material	Metal
Wire insulation material	PE
Cable sheath material	PUR
Material property halogen free	Yes
Material property silicon free	Yes

* = Applies to cable lengths up to 10 meters.

Connecting cable for ET-Connection standard and PUR cable

You can use the connecting cable between two cables for ET-Connection.

Typical applications for using connecting cable for ET-Connection are:

- Combination of individual cable lengths by joining multiple pre-assembled cables for ET-Connection.

- Selective installation of disconnection points of cables for ET-Connection (for simple changing of cables and cable sections, e.g. with trailing-cable applications).

You can use a maximum of two connecting cables between the two modules.
The length of the cables for ET-Connection is limited to maximum 10 m when connecting cables are used.

The connecting cable for ET-Connection is available in the following design:

- Connecting cable for bus cable ET-Connection M8, both ends assembled with 2x M8 socket, 4-pole, shielded, length 0.2 m

The following table shows the technical properties of the connecting cable for ET-Connection standard.

Table C- 10   Connecting cables for ET-Connection

General information	
Product type designation	CONNECTING CABLE FOR BUS CABLE ET-CONNECTION, CABLE 0.2 M
Function	To connect two bus cables ET-CONNECTION
Degree of protection and protection class	
IP65	Yes
IP67	Yes
Ambient conditions	
Ambient temperature during mounting	
minimum	-30 °C
maximum	80 °C
Storage/transport temperature	
Ambient temperature during transport and storage	
minimum	-40 °C
maximum	80 °C
Cables	
Cable designation	2Y(ST)CY 1x4x0.5/1.0-100-GN
Number of electrical wires	4
Design of shielding	Overlapped aluminum-lined sheet, coated with shielding made of tin plated copper wires
Cable length	0.2 m
Outside diameter of the inner conductor	0.5 mm
Outside diameter of the wire insulation	1.0 mm
Outside diameter of the cable sheath	5 mm
Permissible bending radius	
One time bending, min.	20 mm
Multiple bending, min.	40 mm
Constant bending	100 mm
Color of the cable sheath	Green
Color of the wire insulation of the data wires	White, yellow, blue, orange
Weight per length	34 kg/km
Mechanics/material	
Type of cable outlet	180° cable outlet
Connector housing material	Metal
Wire insulation material	PE
Cable sheath material	PVC
Material property halogen free	No
Material property silicon free	Yes

The following table shows the technical properties of the connecting cable for ET-Connection, PUR cable.

Table C- 11   Connecting cables for ET-Connection, PUR cable

General information	
Product type designation	CONNECTING CABLE FOR BUS CABLE ET-CONNECTION, PUR CABLE 0.2 M
Function	To connect two bus cables ET-CONNECTION
Degree of protection and protection class	
IP65	Yes
IP67	Yes
Ambient conditions	
Ambient temperature during mounting	
minimum	-30 °C
maximum	80 °C
Storage/transport temperature	
Ambient temperature during transport and storage	
minimum	-40 °C
maximum	80 °C
Cables	
Cable designation	2Y(ST)C11Y 2x2x0.5/1.0-100-GN
Number of electrical wires	4
Design of shielding	Overlapped aluminum-lined sheet, coated with shielding made of tin plated copper wires
Cable length	0.2 m
Outside diameter of the inner conductor	0.5 mm
Outside diameter of the wire insulation	1.0 mm
Outside diameter of the cable sheath	5 mm
Permissible bending radius	
One time bending, min.	20 mm
Multiple bending, min.	40 mm
Constant bending	100 mm
Color of the cable sheath	Green
Color of the wire insulation of the data wires	White, yellow, blue, orange
Weight per length	34 kg/km
Mechanics/material	
Type of cable outlet	180° cable outlet
Connector housing material	Metal
Wire insulation material	PE
Cable sheath material	PUR
Material property halogen free	Yes
Material property silicon free	Yes

Cables of power supply standard and PUR cable

The cables for the power supply are available in the following versions and lengths:

- Power cable (4-wire), pre-assembled on both sides with a 4-pole M8 pin connector/socket connector

  - available lengths: 0.19 m, 0.3 m, 1 m, 2 m, 5 m, 10 m, 15 m

- Power cable (4-wire), pre-assembled on both sides with a 4-pole M8 pin connector/socket connector, angled

  - available lengths: 0.3 m, 1 m, 2 m, 5 m, 10 m, 15 m

- Power cable (4-wire), pre-assembled on one side with 1x M8 socket connector

  - available lengths: 2 m, 5 m, 10 m, 15 m

The following table shows the technical properties of the power supply cable, standard.

Table C- 12   Cables for power supply

General information	
Product type designation	POWER CABLE M8
Function	For connection of ET 200AL for 24 V DC power supply
Degree of protection and protection class	
IP65	Yes
IP67	Yes
Ambient conditions	
Ambient temperature during mounting	
minimum	-30 °C
maximum	80 °C
Storage/transport temperature	
Ambient temperature during transport and storage	
minimum	-40 °C
maximum	80 °C
Cables	
Cable designation	4 Li9Y 0.50 mm² Y
Number of electrical wires	4
Outside diameter of the inner conductor	0.8 mm
Outside diameter of the wire insulation	1.46 mm
Outside diameter of the cable sheath	5.2 mm
Number of bending cycles	2500000; Trailing-chain suitable for 2.5 million bending cycles with a bending radius of 52 mm, a speed of 3 m/s² and an acceleration of 10 m/s²
Permissible bending radius	
One time bending, min.	26 mm
Multiple bending, min.	52 mm
Constant bending	52 mm
Color of the cable sheath	Gray

General information	
Color of the wire insulation of the power wires	White, brown, blue black
Weight per length	44 kg/km
Mechanics/material	
Type of cable outlet	180° cable outlet
	90° cable outlet (with angled connectors)
Number of connectors	1 or 2
Connector housing material	Plastic
Wire insulation material	PP
Cable sheath material	PVC
Material property halogen free	No
Material property silicon free	Yes

The following table shows the technical properties of the power supply, PUR cable

Table C- 13   Cables for power supply, PUR cable

General information	
Product type designation	POWER CABLE M8, PUR CABLE
Function	For connection of ET 200AL for 24 V DC power supply
Degree of protection and protection class	
IP65	Yes
IP67	Yes
Ambient conditions	
Ambient temperature during mounting	
minimum	-30 °C
maximum	80 °C
Storage/transport temperature	
Ambient temperature during transport and storage	
minimum	-40 °C
maximum	80 °C
Cables	
Cable designation	LIF9Y11YFHF 4x0.50 mm²
Number of electrical wires	4
Outside diameter of the inner conductor	1 mm
Outside diameter of the wire insulation	1.46 mm
Outside diameter of the cable sheath	5.1 mm
Number of bending cycles	2000000; trailing-chain suitable for 2 million bending cycles with a bending radius of 51 mm, a velocity of 5 m/s and an acceleration of 5 m/s²
Permissible bending radius	
One time bending, min.	26 mm
Multiple bending, min.	51 mm
Constant bending	51 mm

General information	
Color of the cable sheath	Gray
Color of the wire insulation of the power wires	White, brown, blue black
Weight per length	44 kg/km
Mechanics/material	
Type of cable outlet	180° cable outlet
	90° cable outlet (with angled connectors)
Number of connectors	1 or 2
Connector housing material	Plastic
Wire insulation material	PP
Cable sheath material	PE-PUR
Material property halogen free	Yes
Material property silicon free	Yes

C.3 Pin assignment and core color

Pin assignment of the sockets for ET-Connection

The tables below shows the pin assignments of the 2 sockets for the connection of ET-Connection.

Table C- 14 Pin assignment for ET-Connection (interface modules)

Pin	Assignment		Assignment of the core color of the bus cable for ET-Connection	Front view of the sockets	
	X30 socket (ET-Connection1)	X31 socket (ET-Connection2)		X30	X31
1	RXP	RXP	yellow		
2	TXP	TXP	white		
3	TXN	TXN	blue		
4	RXN	RXN	orange		
Shield-ing	Functional earth FE		-		
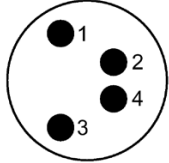
Table C- 15 Pin assignment for ET-Connection (I/O modules)

Pin	Assignment		Assignment of the core color of the bus cable for ET-Connection	Front view of the sockets	
	X30 socket (ET-Connection IN)	X31 socket (ET-Connection OUT)		X30	X31
1	TXP	RXP	yellow		
2	RXP	TXP	white		
3	RXN	TXN	blue		
4	TXN	RXN	orange		
Shield-ing	Functional earth FE		-		

Pin assignment of the connector for infeed of the supply voltage

The table below shows the pin assignment for infeed of the supply voltage.
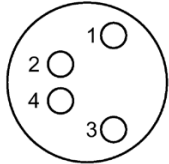
Table C- 16   Pin assignment of the supply voltage connector

Pin	Assignment X80 connector (power input)	Assignment of the core color of the power cable	Front view of the connector
1	Supply voltage 1L+ (non-switched)	brown	
2	Ground 2M (switched)	white	
3	Ground 1M (non-switched)	blue	
4	Load voltage 2L+ (switched)	black	

Pin assignment of the socket for loop-through of the supply voltage

The table below shows the pin assignment for loop-through of the supply voltage.

Table C- 17   Pin assignment of the supply voltage socket

Pin	Assignment X81 Socket (power output)	Assignment of the core color of the power cable	Front view of the socket
1	Supply voltage 1L+ (non-switched)	brown	
2	Ground 2M (switched)	white	
3	Ground 1M (non-switched)	blue	
4	Load voltage 2L+ (switched)	black	

Glossary

Bus

A common transfer route to which all devices are connected; it has two defined ends.

Configuration

Systematic arrangement of individual modules (design).

Connection plug

Physical connection between device and cable.

Device

Device that can send, receive or amplify data via the bus, e.g. IO device via PROFINET IO.

Diagnostics

Monitoring functions for the detection, localization, classification, display, and further evaluation of errors, faults, and alarms. They run automatically while the system is in operation. This increases the availability of systems by reducing commissioning times and downtimes.

Distributed I/O system

System with input and output modules that are configured on a distributed basis, far away from the CPU controlling them.

ET-Connection

Backplane bus through which a connection is made. This allows bus participants to be installed several meters from each other.

Firmware update

Upgrade of firmware for modules (interface modules, I/O modules etc.), e.g. after functional enhancements, to the newest firmware version (update).

Ground

Conductive earth whose electrical potential can be set equal to zero at any point.

All interconnected, inactive parts of a piece of equipment that cannot accept any dangerous contact voltage, even in the event of a fault.

Ground

Conductive earth whose electrical potential can be set equal to zero at any point.

All interconnected, inactive parts of a piece of equipment that cannot accept any dangerous contact voltage, even in the event of a fault.

GSD file

As a generic station description, this file in XML format has all the properties of a PROFINET or PROFIBUS device that are required for its configuration.

I/O modules

All modules that can be operated with a CPU or an interface module.

Identification data

Information that is saved in modules and that supports the user in checking the plant configuration and locating hardware changes.

Interface module

Module in the distributed I/O system. The interface module connects the distributed I/O system via a field bus with the CPU (I/O) controller and prepared the data for the/from the I/O modules.

Parameter assignment

Parameter assignment is the transfer of parameters from the IO controller to the IO device.

PELV

Protective Extra Low Voltage = protective extra-low voltage

PROFINET

PROcess FIeld NETwork, open Industrial Ethernet standard, which continues PROFIBUS and Industrial Ethernet. A cross-manufacturer communication, automation and engineering model, defined as an automation standard by PROFIBUS International e.V.

PROFINET IO controller

Device used to address connected I/O devices (e.g. distributed I/O systems). This means that: The IO controller exchanges input and output signals with assigned I/O devices. The IO controller often corresponds with the CPU in which the automation program is running.

PROFINET IO device

Distributed field device that can be assigned to one or more IO controllers (e.g. distributed I/O system, valve terminals, frequency converters, switches).

PROFINET IO

Communication concept for the realization of modular, distributed applications in the framework of PROFINET.

Reference potential

Potential from which the voltages of the circuits involved are observed and/or measured.

SELV

Safety **E**xtra **L**ow **V**oltage = Safety extra-low voltage

TIA Portal

Totally Integrated Automation Portal

The TIA Portal is the key to the full performance capability of Totally Integrated Automation. The software optimizes operating, machine and process sequences.

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