OMRON

E3X-ECT

EtherCAT Sensor Communication Unit

Operation Manual

SYSMAC always in control

E413–E1

E3X-ECT
EtherCAT Sensor Communication Units

Operation Manual

Revised February 2012

Introduction

Thank you for purchasing a E3X-ECT EtherCAT Sensor communication Unit.
This manual contains information you need to know to use the EtherCAT Slave Unit.
Before use, please make sure that you thoroughly read the manual and have a full understanding of the products functions and performance.
After you finished reading this manual, please keep it in a convenient place.

Intended Readers

This manual is intended for the following individuals.

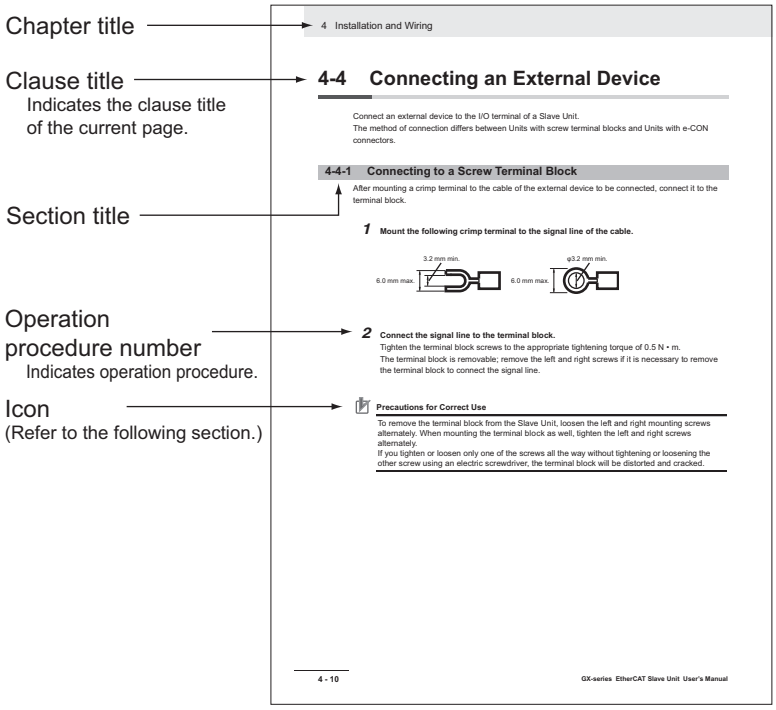
Those having electrical knowledge (certified electricians or individuals having equivalent knowledge) and also being qualified for one of the following:

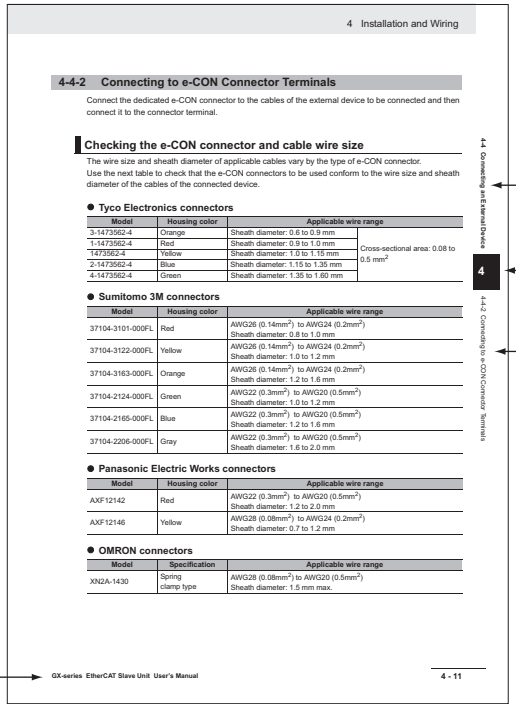
- Introducing FA equipment
- Designing FA systems
- Managing FA sites

How to Read the Manual

Page Structure

This manual's page structure consists of the following.





Icon

The meanings of the icons used in this manual are as follows.

Precautions for Safe Use

Indicates precautions on what to do and what not to do to ensure using the product safely.

Precautions for Correct Use

Indicates precautions on what to do and what not to do to ensure proper operation and performance.

Reference

This explains useful tips and reference information when using the product.

Structure of This Manual

This manual consists of the following chapters.

Chapters		Contents
Chapter 1	EtherCAT Network	Explains about the EtherCAT features and the network configuration.
Chapter 2	EtherCAT Sensor Communication Unit	Overviews the E3X-ECT EtherCAT Sensor Communication Unit and its various types.
Chapter 3	Basic Usage Procedures	Explains the setup method and usage procedures by using simple system setup examples.
Chapter 4	Installation and Wiring	Explains how to install Slave Units, and how to connect and wire the EtherCAT network and power supply.
Chapter 5	EtherCAT Communications	Explains the details of EtherCAT communications.
Chapter 6	E3X-ECT Hardware spesifications	Explains the E3X-ECT Hardware specifications.
Chapter 7	E3X-ECT Functional spesifications	Explains the E3X-ECT Functional specifications.
Chapter 8	Troubleshooting and Maintenance	This contains troubleshooting and inspection methods intended for individuals to handle abnormalities and conduct regular inspections.
Appendix	Appendix	Contains the object overview and explains the precautions.

Read and Understand this Manual

Please read and understand this manual before using the product. Please consult your OMRON representative if you have any questions or comments.

Warranty and Limitations of Liability

WARRANTY

OMRON's exclusive warranty is that the products are free from defects in materials and workmanship for a period of one year (or other period if specified) from date of sale by OMRON.

OMRON MAKES NO WARRANTY OR REPRESENTATION, EXPRESS OR IMPLIED, REGARDING NON-INFRINGEMENT, MERCHANTABILITY, OR FITNESS FOR PARTICULAR PURPOSE OF THE PRODUCTS. ANY BUYER OR USER ACKNOWLEDGES THAT THE BUYER OR USER ALONE HAS DETERMINED THAT THE PRODUCTS WILL SUITABLY MEET THE REQUIREMENTS OF THEIR INTENDED USE. OMRON DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED.

LIMITATIONS OF LIABILITY

OMRON SHALL NOT BE RESPONSIBLE FOR SPECIAL, INDIRECT, OR CONSEQUENTIAL DAMAGES, LOSS OF PROFITS OR COMMERCIAL LOSS IN ANY WAY CONNECTED WITH THE PRODUCTS, WHETHER SUCH CLAIM IS BASED ON CONTRACT, WARRANTY, NEGLIGENCE, OR STRICT LIABILITY.

In no event shall the responsibility of OMRON for any act exceed the individual price of the product on which liability is asserted.

IN NO EVENT SHALL OMRON BE RESPONSIBLE FOR WARRANTY, REPAIR, OR OTHER CLAIMS REGARDING THE PRODUCTS UNLESS OMRON'S ANALYSIS CONFIRMS THAT THE PRODUCTS WERE PROPERLY HANDLED, STORED, INSTALLED, AND MAINTAINED AND NOT SUBJECT TO CONTAMINATION, ABUSE, MISUSE, OR INAPPROPRIATE MODIFICATION OR REPAIR.

Application Considerations

SUITABILITY FOR USE

OMRON shall not be responsible for conformity with any standards, codes, or regulations that apply to the combination of products in the customer's application or use of the products.

At the customer's request, OMRON will provide applicable third party certification documents identifying ratings and limitations of use that apply to the products. This information by itself is not sufficient for a complete determination of the suitability of the products in combination with the end product, machine, system, or other application or use.

The following are some examples of applications for which particular attention must be given. This is not intended to be an exhaustive list of all possible uses of the products, nor is it intended to imply that the uses listed may be suitable for the products:

- Outdoor use, uses involving potential chemical contamination or electrical interference, or conditions or uses not described in this manual.
- Nuclear energy control systems, combustion systems, railroad systems, aviation systems, medical equipment, amusement machines, vehicles, safety equipment, and installations subject to separate industry or government regulations.
- Systems, machines, and equipment that could present a risk to life or property.

Please know and observe all prohibitions of use applicable to the products.

NEVER USE THE PRODUCTS FOR AN APPLICATION INVOLVING SERIOUS RISK TO LIFE OR PROPERTY WITHOUT ENSURING THAT THE SYSTEM AS A WHOLE HAS BEEN DESIGNED TO ADDRESS THE RISKS, AND THAT THE OMRON PRODUCTS ARE PROPERLY RATED AND INSTALLED FOR THE INTENDED USE WITHIN THE OVERALL EQUIPMENT OR SYSTEM.

PROGRAMMABLE PRODUCTS

OMRON shall not be responsible for the user's programming of a programmable product, or any consequence thereof.

Disclaimers

CHANGE IN SPECIFICATIONS

Product specifications and accessories may be changed at any time based on improvements and other reasons.

It is our practice to change model numbers when published ratings or features are changed, or when significant construction changes are made. However, some specifications of the products may be changed without any notice. When in doubt, special model numbers may be assigned to fix or establish key specifications for your application on your request. Please consult with your OMRON representative at any time to confirm actual specifications of purchased products.

DIMENSIONS AND WEIGHTS

Dimensions and weights are nominal and are not to be used for manufacturing purposes, even when tolerances are shown.

PERFORMANCE DATA

Performance data given in this manual is provided as a guide for the user in determining suitability and does not constitute a warranty. It may represent the result of OMRON's test conditions, and the users must correlate it to actual application requirements. Actual performance is subject to the OMRON Warranty and Limitations of Liability.

ERRORS AND OMISSIONS

The information in this manual has been carefully checked and is believed to be accurate; however, no responsibility is assumed for clerical, typographical, or proofreading errors, or omissions.

Safety Precautions

Labels and Meanings to Ensure Safe Usage

To ensure safe usage of the EtherCAT Slave Unit, the precautions in this manual are displayed with the following labels and symbols.
The precautions explained in this section describe important information regarding safety. These precautions must be followed without fail.

⚠ WARNING	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury. Additionally, there may be severe property damage.
⚠ Caution	Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury, or property damage.

Symbols

⃠ This symbol indicates a prohibited item (an item you must not do).

The specific instruction is indicated using text inside the ⃠.
The symbol shown to the left indicates "disassembly prohibited".

△ This symbol indicates caution (warnings included).

The specific instruction is indicated using text inside the △.
The symbol shown to the left indicates "typical cautions".

● This symbol means it is a compulsory item (an item that must be done).

The specific instruction is indicated using text inside the ●.
The symbol shown to the left indicates "typical compulsory items".

⚠ WARNING

Do not attempt to take any Unit apart and do not touch the interior of any Unit while the power is being supplied. Also, do not turn ON the power supply while the cover is open.
Doing any of these may result in electric shock.

Do not attempt to disassemble, repair, or modify any Units.
Doing any of these may result in electric shock.

Do not input voltages or currents exceeding the rated range to the Unit.
Using voltages or currents exceeding the rated range may cause Unit failure or fire.

Provide safety measures in external circuits (i.e., not in the Units), including the following items, to ensure safety in the system if an abnormality occurs due to malfunction of the PLC or another external factor affecting the PLC operation. ("PLC" includes CPU Units, other Units mounted in the PLC, and Remote I/O Terminals.)
Not doing so may result in serious accidents.

Emergency stop circuits, interlock circuits, limit circuits, and similar safety measures must be provided in external control circuits, not in the Units.
The PLC will turn OFF all outputs when its self-diagnosis function detects any error or when a severe failure alarm (FALS) instruction is executed. As a countermeasure for such problems, external safety measures must be provided to ensure safety in the system.
The Slave Unit outputs may remain ON or OFF due to deposits on or burning of the output relays, or destruction of the output transistors. As a countermeasure for such problems, external safety measures must be provided to ensure safety in the system.
When the 24-VDC output (service power supply) is overloaded or short-circuited, the voltage may drop and result in the outputs being turned OFF. As a countermeasure for such problems, external safety measures must be provided to ensure safety in the system.
Implement proper measures as part of your communications system or in your program to ensure safety in the system even when a communications error or malfunction occurs during remote I/O communication.

The CPU Unit refreshes I/O even when the program is stopped (i.e., even in PROGRAM mode). Confirm safety thoroughly in advance before changing the status of any part of memory allocated to I/O Units, Special I/O Units, or CPU Bus Units. Any changes to the data allocated to any Unit specifically the Special I/O Units/CPU Bus Units may result in unexpected operation of the loads connected to the Unit.

- Transferring I/O memory data to the CPU Unit with a Programming Device (PC tool).
- Changing present values in memory with a Programming Device.
- Force-setting/-resetting bits with a Programming Device.
- Transferring I/O memory files from a memory card or EM file memory to the CPU Unit.
- Transferring I/O memory from a host computer or from another PLC on a network.

Fail-safe measures must be taken by the customer to ensure safety in the event of incorrect, missing, or abnormal signals caused by broken signal lines, momentary power interruptions, or other causes. Not doing so may result in serious accidents.

Precautions for Safe Use

Observe the following precautions when using the Unit.

Power Supply

- Always use the power supply voltage specified in this manual. An incorrect voltage may result in malfunction or burning.
- Take appropriate measures to ensure that the specified power with the rated voltage and frequency is supplied. Be particularly careful in places where the power supply is unstable. An incorrect power supply may result in malfunction.
- Always turn OFF the power supply to the PLC, Slave Units and other Units before attempting any of the following. Not turning OFF the power supply may result in malfunction or electric shock.
  - Assembling any Units (Expansion Units).
  - Removing or attaching the terminal blocks or connectors to Slave Unit.
  - Replacing parts (e.g., relays).
  - Setting the DIP switch or the node address switches
  - Connecting cables or wiring the system.

Installation

- Before touching a Unit, be sure to first touch a grounded metallic object in order to discharge any static build-up. Not doing so may result in malfunction or damage.
- Make sure that the terminal blocks, communications cables, and other items with locking devices are properly locked into place. Improver locking may result in malfunction.
- Mount the Units securely using DIN track.
- Make sure that all Slave Unit mounting screws and cable connector screws are tightened to the torque specified in this manual. Incorrect tightening torque may result in malfunction.
- Make sure that all terminal block screws are tightened to the torque specified in this manuals. Incorrect tightening torque may result in fire, malfunction, or failure.
- Always use the specified communications cables and connectors.
- Do not extend connection distances or the number of connected nodes beyond the ranges given in the specifications.
- When there are multiple systems, keep the cables unbundled and separated by at least 5 mm to prevent unstable operation due to interference.

Wiring

- Turn the power on after checking that the wiring and switch settings are correct.
- Use the correct wire tools to wire the Unit.
- Confirm the polarity of all terminals before wiring them.
- Do not allow foreign matter to enter the Units when wiring and installing the Units.
- Observe the following precautions when wiring the communications cable.
  - Separate the communications cables from the power lines or high-tension lines.
  - Do not bend the communications cables past their natural bending radius.
  - Do not pull on the communications cables.
  - Do not place heavy objects on top of the communications cables.
  - Always lay communications cable inside ducts.
- Turn OFF the power of PLC and all the Slave Units before wiring the communication cables.
- Do not apply voltages to the Input Slave Units in excess of the rated input voltage. Excess voltage or loads may result in burning.

- Do not apply voltages or connect loads to the Outputs Slave Units in excess of the maximum switching capacity. Excess voltage or loads may result in burning.

Handling

- When transporting the product, use special packing boxes, and protect it from being exposed to excessive vibration or impact during transportation.
- Do not bend cables past their natural bending radius or pull on cables.
- After replacing Units, resume operation only after transferring to the new CPU Unit and/or Special I/O Units the contents of the DM Area, HR Area, and other data required for resuming operation. Not doing so may result in unexpected operation.
- Check the user program for proper execution before actually running it on the Unit. Not checking the program may result in unexpected operation.
- When replacing relays or other parts, be sure to confirm that the ratings of the new part are correct. Not doing so may result in malfunction or burning.
- Confirm that no adverse effect will occur in the system before attempting any of the following.
  - Changing the operating mode of the PLC.
  - Setting/resetting any bit in memory.
  - Changing the present value of any word or any set value in memory.
- Do not use thinner when cleaning. Use commercially available alcohol.

External Circuits

- Install external breakers and take other safety measures against short-circuiting in external wiring.

Precautions for Correct Use

- Wire all connections correctly according to instructions in this manual.
  Failure to install them may result in serious accidents.
- Do not operate the control system in the following locations:
  - Location subject to direct sunlight.
  - Locations subject to temperatures or humidity outside the range specified in the specifications.
  - Locations subject to condensation as the result of severe changes in temperature.
  - Location subject to corrosive or flammable gases.
  - Location subject to dust (especially iron dust) or salts.
  - Location subject to exposure to water, acid, oil, chemicals, etc.
  - Locations subject to shock or vibration.
- Confirm voltage specifications when wiring communications, the power supply, and I/O crossovers.
  Incorrect wire may result in malfunction.
- Wire all connections correctly according to instructions in this manual.
- Use the correct wiring materials to wire the Unit.
- Take appropriate and sufficient countermeasures when installing systems in the following locations:
  - Locations subject to static electricity or other forms of noise.
  - Locations subject to strong electromagnetic fields.
  - Locations subject to possible exposure to radioactivity.
  - Locations close to power supplies.
- Do not drop any Unit or subject any Unit to excessive shock or vibration. Otherwise, Unit failure or malfunction may occur.

Conformance to EC Directives

Applicable Directives

- EMC Directives
- Low Voltage Directive

Concepts

EMC Directives

The OMRON products described in this manual are designed so that they individually comply with the related EMC Directives so that they can be more easily built into other devices or the overall machine. The actual products have been checked for conformity to EMC Directives (See note)*. Whether the products conform to the standards in the system used by the customer, however, cannot be checked by OMRON and must be checked by the customer. EMC-related performance of the OMRON devices that comply with EC Directives will vary depending on the configuration, wiring, and other conditions of the equipment or control panel on which the OMRON devices are installed. The customer must, therefore, perform the final check to confirm that devices and the overall machine conform to EMC standards.

* Note: Applicable EMC (Electromagnetic Compatibility) standards are as follows:
EMS (Electromagnetic Susceptibility): EN 61131-2 and EN 61000-6-2
EMI (Electromagnetic Interference): EN 61131-2 and EN61000-6-4
(Radiated emission: 10-m regulations)

Low Voltage Directive

Always ensure that devices operating at voltages of 50 to 1,000 VAC and 75 to 1,500 VDC meet the required safety standards.
Applicable standard: EN 61131-2

Conformance to EC Directives

The OMRON products described in this manual comply with the related EMC Directives. To ensure that the machine or device in which the products are used complies with EC Directives, the products must be installed as follows:

- The products must be installed within a control panel.
- A DC power supply with reinforced insulation or double insulation that can maintain a stable output even if the input is interrupted for 10 ms must be used for communications power, internal power, and I/O power. The OMRON S8JX-series Power Supply is recommended. (See note.)*
- Products complying with EC Directives also conform to the Emission Standards (EN 61131-2 and EN 61000-6-4). Radiated emission characteristics (10-m regulations) may vary depending on the configuration of the control panel used, other devices connected to the control panel, wiring, and other conditions. You must therefore confirm that the overall machine or equipment complies with EC Directives.
- Conformance with the EC Directives was confirmed with a system configuration using I/O wiring lengths of less than 30 m.

* Note: Conformance with the EMC Directive was confirmed when using the recommended power supply.

Trademarks

- EtherCAT(R) is a registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany.
- Windows is a registered trademark of Microsoft Corporation in the USA.
- CX-One is a registered trademark for Programming Software made by OMRON Corporation.
- Sysmac Studio is a registered trademark for Automation Software made by OMRON Corporation.

Other system names and product names that appear in this manual are the trademarks or registered trademarks of the relevant companies.

Related Manuals

The following manuals also deal with EtherCAT. Refer to them for details.

Man No.	Name of manuals	Contents
W487	CJ Series Position Control Units Operation Manual	Explains the setup and operation procedures of the EtherCAT Position Control Units (CJ1W-NCx81/x82) which functions as a master.
W446	CX-Programmer Operation Manual	Explains the operations method of the Windows-based programming tool CX-Programmer.
W500	NJ-series CPU Unit Hardware User's Manual	Explains the overall NJ-series System and the following items for the NJ501 CPU Units. • Features and system configuration • Overview • Part names and functions • General specifications • Installation and wiring • Maintenance and inspection Use this manual together with the *NJ-series CPU Unit Software User's Manual* (Cat. No. W501).
W501	NJ-series CPU Unit Software User's Manual	Explains the following items for NJ-series CPU Units. • CPU Unit operation • CPU Unit functions • Initial settings • Languages and programming based on IEC 61131-3. Use this manual together with the *NJ-series CPU Unit Hardware User's Manual* (Cat. No. W500).
W505	NJ-series CPU Unit Built-in EtherCAT Port User's Manual	Explains the built-in EtherCAT port. An overview is provided and the configuration, functions, and setup are described. Use this manual together with the *NJ-series CPU Unit Hardware User's Manual (Cat. No. W500)* and the *NJ-series CPU Unit Software User's Manual* (Cat. No. W501).
W503	NJ-series Troubleshooting Manual	Explains error management concepts and the individual errors that are detected by the NJ-series System. Use this manual together with the *NJ-series CPU Unit Hardware User's Manual (Cat. No. W500)* and the *NJ-series CPU Unit Software User's Manual* (Cat. No. W501).
W504	Sysmac Studio Version 1 Operation Manual	Explains the operating procedures of the Sysmac Studio.

1

EtherCAT Network

This chapter explains the overview of EtherCAT network.

1-1 Overview of EtherCAT Networks

EtherCAT (Ethernet Control Automation Technology) is a high-performance industrial network system based on Ethernet system and can realize faster and more efficient communications.
Each node achieves a short communications cycle time by transmitting Ethernet frames at high speed. Furthermore, even though EtherCAT is a unique protocol, it offers excellent general-purpose applicability. For example, you can use Ethernet cables because EtherCAT utilizes standard Ethernet technology for the physical layer. And the effectiveness of EtherCAT can be fully utilized not only in large control systems that require high processing speeds and system integrity, but also in small and medium control systems.

1-1-1 Features of EtherCAT

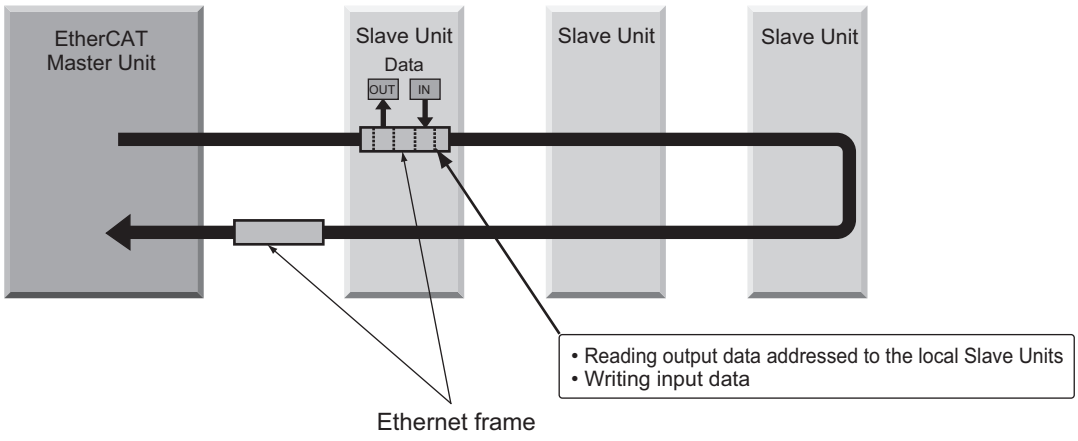
EtherCAT has the following features.

- **Extremely high-speed communications with speed of 100 Mbps**
  It dramatically shortens the I/O response time from generation of input signals to transmission of output signals. By fully utilizing the optimized Ethernet frame bandwidth to transfer data using a high-speed repeat method, it is possible to efficiently transmit a wide variety of data.

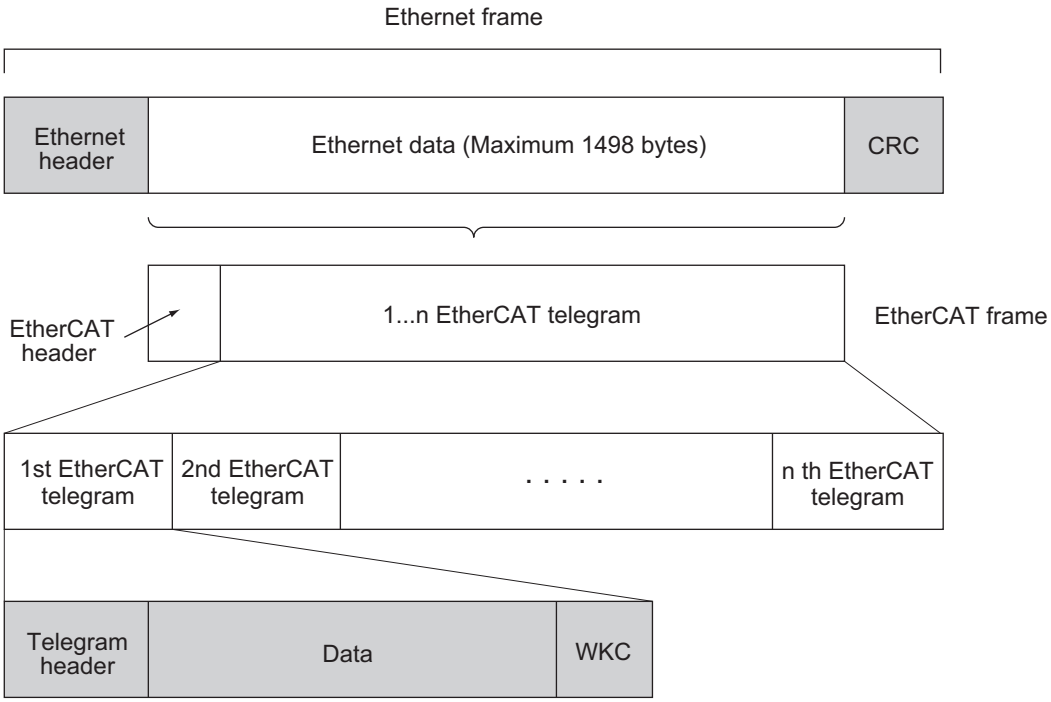
- **Extremely High Compatibility with Ethernet**
  EtherCAT is an open network with extremely high compatibility with conventional Ethernet systems.

1-1-2 Structure of EtherCAT

EtherCAT does not send data to individual slave nodes on the network, instead, it passes Ethernet frames through all of the slave nodes.
When frame passes through a slave node, the slave node reads and writes data in the areas allocated to it in the frames in a few nanoseconds.
Ethernet frames sent from the EtherCAT Master Unit go through all the EtherCAT Sensor Communication Units without stopping on the way. Once they reach the final Slave Unit, they are sent back from the final Slave Unit, pass through all Slave Units again, and return to the EtherCAT Master Unit.
With this structure, EtherCAT secures high-speed and real-time data transmission.



It is the "EtherCAT telegram" stored directly in an Ethernet frame that exchanges data regularly between the EtherCAT Master Unit and Slave Units.
Each "EtherCAT telegram" is configured with telegram header (data length, including address of one or more Slave Units, etc.), data, working counter (check bit).
When an Ethernet frame is compared to a "train", an EtherCAT telegram can be considered as "railway car."



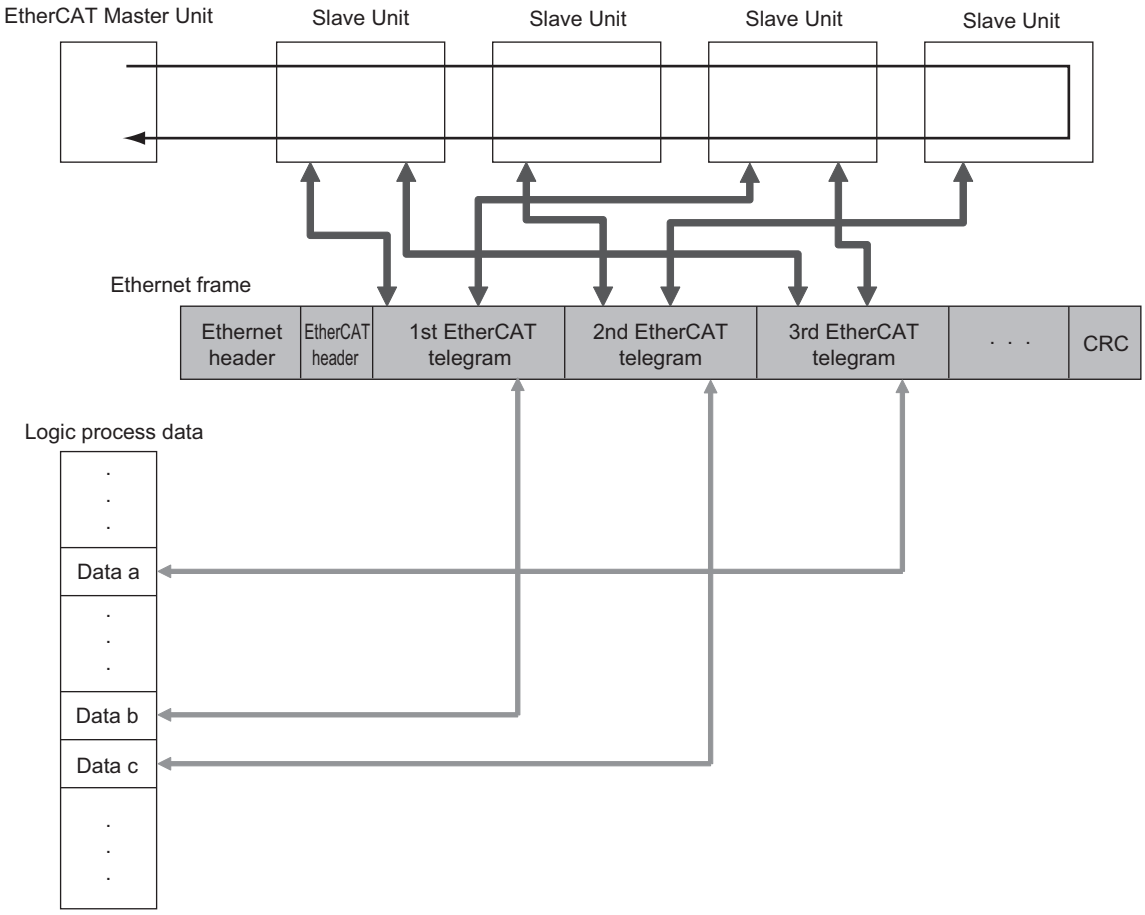
WKC : Working counter

1-1-3 Communications types of EtherCAT

EtherCAT provides the following two types of communication functions.
PDO communications are always updating data per communication cycle on EtherCAT, while SDO communications are processed in between those updates.

Process data communications functions (PDO communications)

This communication function is used to transfer process data in real time in a fixed-cycle.
By mapping logical process data space to each node by the EtherCAT Master Unit, it achieves fixed-cycle communications among the EtherCAT Master Unit and Slave Units.



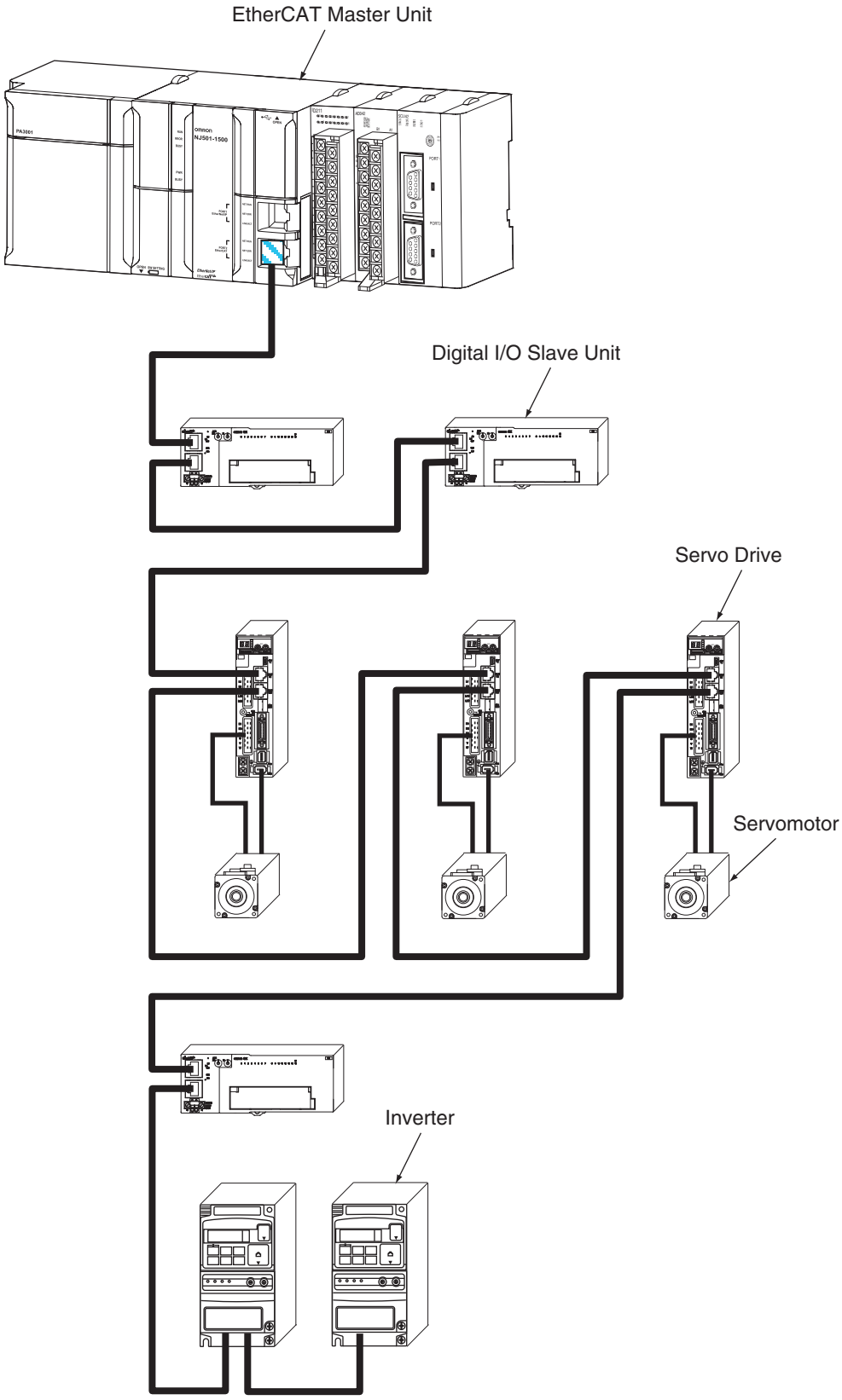
Mailbox communications functions (SDO communications)

It refers to message communications.
At any timing, the EtherCAT Master Unit transmits commands to Slave Units and the Slave Units return responses to the EtherCAT Master Unit.
It performs the following data communications:

- Read and write process data
- Make Slave Unit setting
- Monitor Slave Unit state

1-1-4 Connection Examples of EtherCAT

This section explains the connection examples of EtherCAT network.

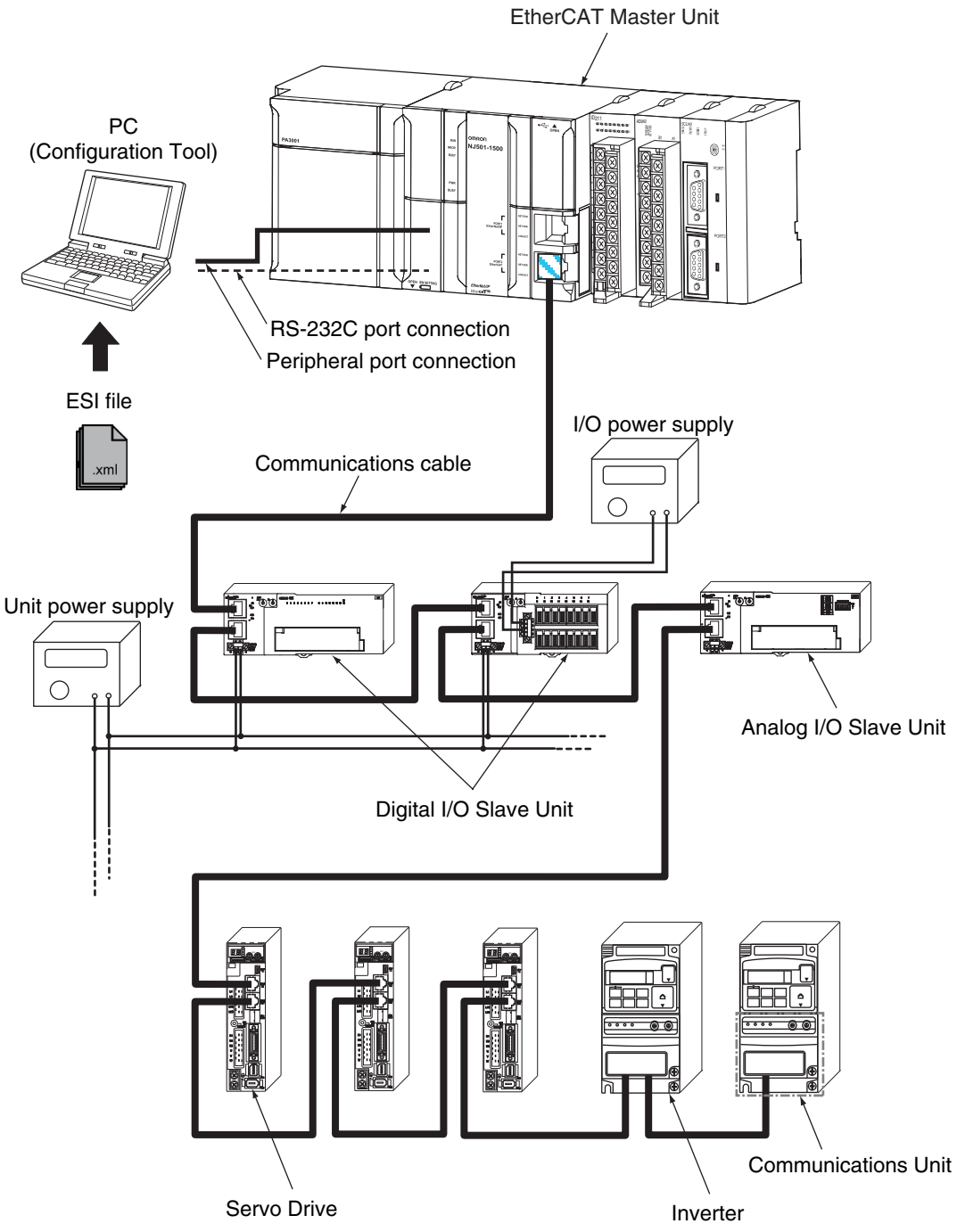


1-2 Configuration Elements of EtherCAT Network

This section explains the configuration devices and usages of EtherCAT network.

1-2-1 Configuration Devices of EtherCAT Network

The devices composing an EtherCAT network are shown in the figure below.



1-2-2 Overview of Configuration Devices

The overview of each configuration device is as follows:

EtherCAT Master Unit

Administers the EtherCAT network, monitors the state of Slave Units, exchanges I/O data with Slave Units.

EtherCAT Slave Unit

Outputs data received from the EtherCAT Master Unit through the EtherCAT network, or sends input data to the EtherCAT Slave Unit through the EtherCAT network.
There are Digital I/O Slave Unit and Analog I/O Slave Unit.

Communications Unit

By mounting to an inverter, sensor and other devices, it is possible to serve as a Slave Unit in the EtherCAT network.

Configuration Tool

It is a PC software for making setting of the EtherCAT network and each Slave Unit.
It can be used either by connecting to the EtherCAT Master Unit or as a substitute of the EtherCAT Master Unit.

Communications cable

Uses cables of Ethernet category 5 (100BASE-TX) or higher, with double-shield (aluminum tape and braided shielding), which are connected straight.

ESI (EtherCAT Slave Information) file

Describes information specific to EtherCAT Sensor Communication Units in XML format.
By reading this file into the Configuration Tool, it is possible to perform various settings such as mapping of Slave Units to I/O memory easily.

Unit power supply

Provides power for communications of each Slave Unit and internal operations.
Separate them from the I/O power supply when wiring.

I/O power supply

Provides power for input/output operations of external devices connected to Slave Units.
Separate from Unit power supply when wiring.

2

EtherCAT Sensor Communication Unit

This chapter explains the overview of EtherCAT Slave Unit.

2-1 Overview of E3X-ECT

This section explains the overview of E3X-ECT.

2-1-1 Features of E3X-ECT EtherCAT Sensor Communication Units

The E3X-ECT EtherCAT Sensor Communication Units have the following features.

- Send sensor outputsto upstreem controller by PDO.
- Send sensor detective level to upstreem controler by PDO and SDO.
- Change the sensor setting from upstreem controler by SDO.
- Excute sensor tuning and teaching from upstreem controler bySDO.
- Connect fiver sensor amplifier, laser sensor amplifier and proxmity sensor amplifier.

Optimum Functionality and Ease of Operation Based on Unified Specifications

The E3X-ECT EtherCAT Sensor Communication Units are Sysmac devices.* You can use them together with NJ-series Controller, other Machine Automation Controllers, and the Sysmac Studio Automation Software to achieve optimum functionality and ease of operation.

* “Sysmac devices” is a generic name for EtherCAT Sensor Communication Units and other OMRON control components that were designed with the same communications and user interface specifications.

2-2 Types of EtherCAT Sensor Communication Units

This section explains the types of connectable sensor amplifiers with EtherCAT Sensor Communication Units.

2-2-1 Slave Units List

List of Sensor Amplifiers

Sensor	Type	
Fiber Sensor	E3X-HD0	Standerd fiber sensor amplifier with GIGA Ray 2
	E3X-MDA0	2CH fiber sensro amplifier
	E3X-DA0-S	2 threshold type fiver sensor amplifier with GIGA Ray
Laser Sensor	E3C-LDA0	Laser sensor amplifier
Proxmity Sensor	E2C-EDA0	High resolution proxmity sensor amolifier

3

Basic Usage Procedures

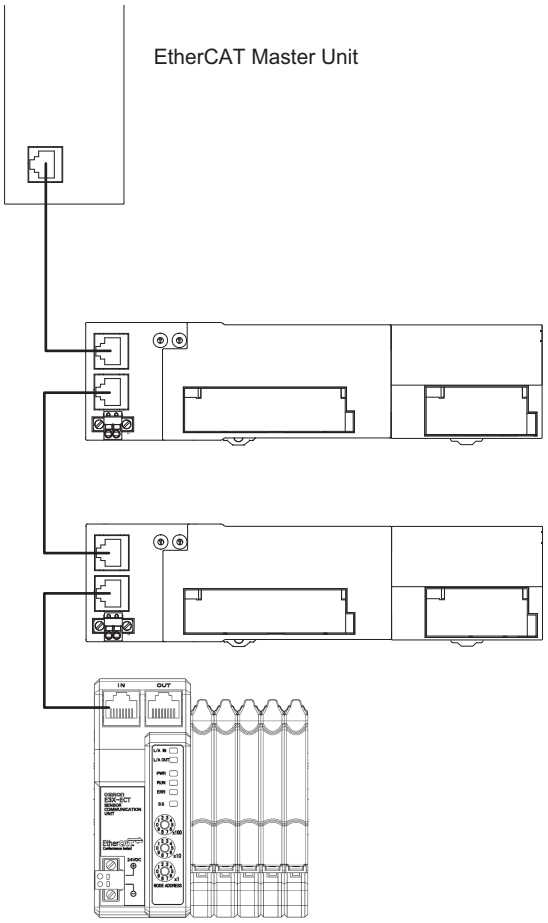
This chapter explains the procedure of using EtherCAT Sensor Communication Units based on specific setting examples.

3-1 Setup Examples and Basic Procedure

This section explains the setup method by using simple system setting examples.

3-1-1 System Setting Examples

Connect each of the following Slave Units to the EtherCAT Master Unit and make the settings.



Digital I/O Slave Unit
GX-ID1611 (16 inputs)
+
Expansion Unit
XWT-ID16 (16 inputs)

Set the node address to 1.

Digital I/O Slave Unit
GX-OD1611 (16 outputs)
+
Expansion Unit
XWT-OD16 (16 outputs)

Set the node address to 2.

Sensor Communication Unit
E3X-ECT

Set the node address to 5.

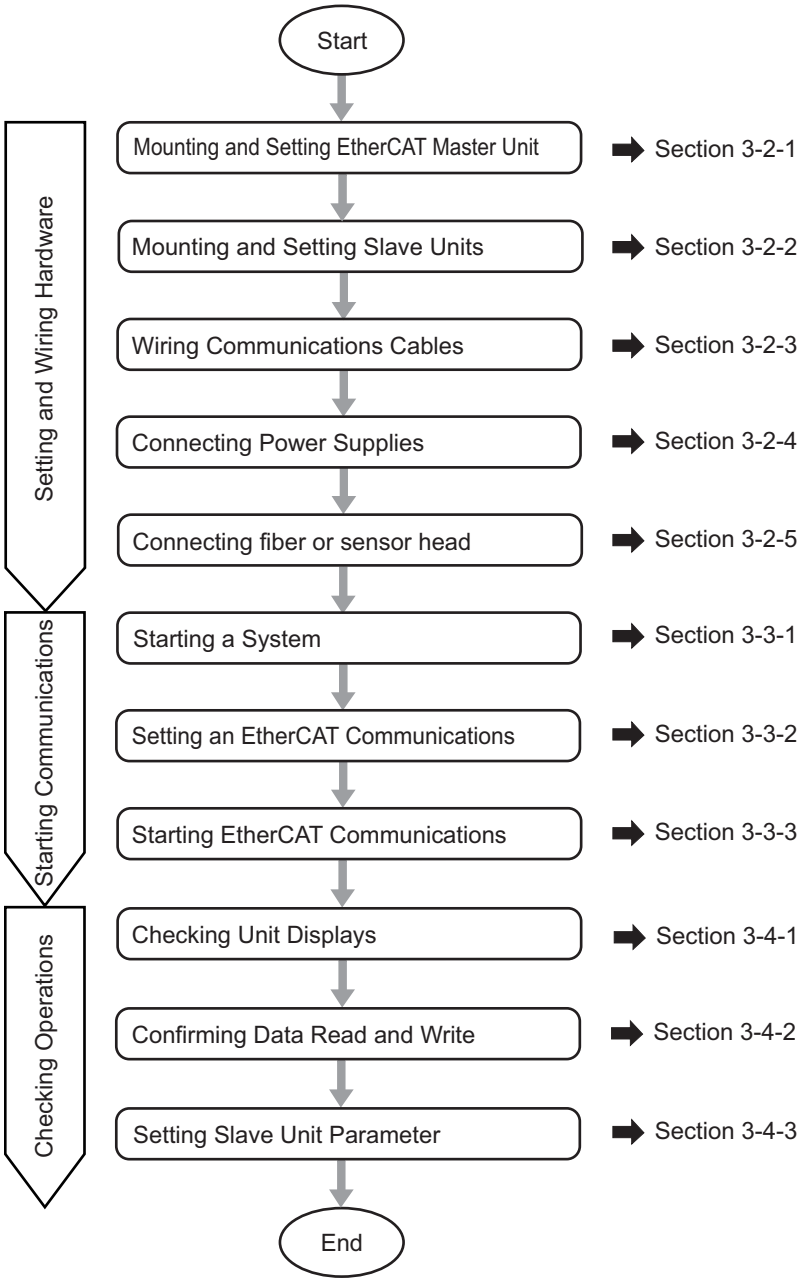
Although it is not shown in the figure above, supply the unit power and the I/O power separately.

Reference

The setting example explained here is the basic setting of E3X-ECT EtherCAT Sensor Communication Units.
If more detailed settings are required in actual operation, refer to the manual of the EtherCAT Master Unit.
Moreover, if your system configuration includes Slave Units other than our products, make the setting upon referring to the manual of the relevant Slave Units.

3-1-2 Basic Procedure

This is the flow of the procedures explained in the following sections.



3-2 Setting and Wiring Hardware

Make settings and wiring of the EtherCAT Master Unit and Slave Units, and power supply.

3-2-1 Mounting and Setting EtherCAT Master Unit

Mount the EtherCAT Master Unit at the prescribed location and make settings of Unit No. and so on.
For the detailed explanation, refer to the manual of the EtherCAT Master Unit to be used.

3-2-2 Mounting and Setting Slave Units

Mount each Slave Unit at the prescribed location and make settings of node address and so on.
For details, refer to each item below.

- **Mounting**
  "4-1 Mounting E3X-ECT and Sensor Amplifiers" in page 4 - 2

- **Setting**
  Pages in Chapter 6 to Chapter 7 which explain the general specification and details of each type of Slave Units.

3-2-3 Wiring Communications Cables

Wire communications cables to the EtherCAT Master Unit and each Slave Unit.
For wiring method, refer to "4-2 Connecting to EtherCAT Network" in page 4 - 4.

3-2-4 Connecting Power Supplies

Connect the unit power supply to the EtherCAT Master Unit and Slave Units.
In addition, connect the I/O power supply to each Slave Unit as required.
For the connection method, refer to "4-3 Connecting to Unit Power Supply and I/O Power Supply" in page 4 - 8 or the wiring diagram of each Slave Unit (in pages explaining the details).

3-2-5 Connecting fiber or Sensors head

Connect fiber or sensor head to sensor amplifier
For the connection method, refer each sensor amplifier manual

3-3 Starting Communications

Start the system, allocate I/O data of Slave Units, and then start the EtherCAT communications.
For operational state and details of it, refer to "5-3 Communications State Transitions" in page 5 - 4.

3-3-1 Starting a System

Turn ON the power supply to each Unit.

(1) Unit power supply of EtherCAT Master Units
(2) Unit power supply of Slave Units (When the power is supplied, Slave Unit's [PWR] indicator is lit.)
(3) I/O power supply of Slave Units

Note that there are no restrictions on the order of turning ON the power supplies.

3-3-2 Setting EtherCAT Communications

The following communications are performed in EtherCAT.

- **PDO communications (remote I/O communications)**
  Allocate I/O data of Slave Units to the EtherCAT Master Unit (PDO mapping) and perform PDO communication (remote I/O communications).
  For the detailed explanation of I/O data of each Slave Unit, refer to "I/O Data Allocation (PDO Mapping)" in Chapter 7.
  Note that the ESI file are used to allocate I/O data.
  For the detailed explanation of the procedure, refer to the manual of the EtherCAT Master Unit to be used and the manual of the Configuration Tool.
  E3X-ECT can allocate PDO 36byte max.

- **SDO communications (message communications)**
  For the method of using, refer to the manual of the EtherCAT Master Unit to be used.
  Refer to "Appendix A - 1 Object Dictionary" for the detailed explanation of objects implemented on E3X-ECT EtherCAT Sensor Communication Units.
  Note that the SDO communications can be used in the pre-operational state or more.

3-3-3 Starting EtherCAT Communications

Shift to the operational state (EtherCAT communications possible) to start the EtherCAT communications.
For how to shift to the operational state, refer to the manual of the EtherCAT Master Unit to be used.

3-4 Checking Operations

Confirm that the LED indicators of the EtherCAT Master Unit and Slave Units are normal status and that I/O data is correctly read and written.
Moreover, make parameter settings for Slave Units as required.

3-4-1 Checking Unit Displays

- **EtherCAT Master Unit**
  Refer to the manual of the EtherCAT Master Unit to be used.

- **EtherCAT Sensor Communication Units**
  Check that the status indicator of each Slave Unit is as follows.

LED	State
PWR	ON
L/A IN	Flickering
L/A OUT	Flickering (turned OFF for the terminal Slave Unit only)
RUN	ON
ERR	OFF

3-4-2 Confirming Data Read and Write

Use the Configuration Tool to read IN data and OUT data of the EtherCAT Master Unit in order to check that the I/O data is correctly read and written.

3-4-3 Setting Slave Unit Parameter

Make parameter settings for each Slave Unit as required via the SDO communications.
For the details of parameters that can be set, refer to the pages explaining details of each Slave Unit in Chapter 7.
E3X-ECT must be set Number of Sensor Setting object (See Appendix1-7).

4

Installation and Wiring

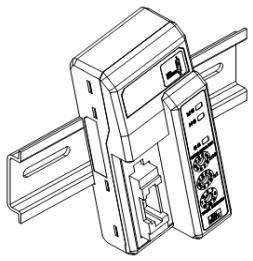
This chapter explains the mounting and wiring methods of the EtherCAT Slave Unit.

4-1 Mounting E3X-ECT and Sensor Amplifiers

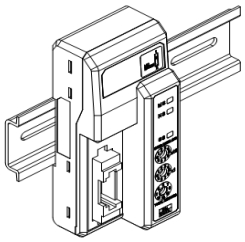
This section explains the mounting methods of E3X-ECT and Sensor Amplifier to the DIN track.

4-1-1 Mounting Method

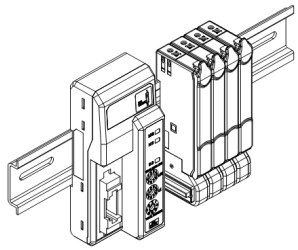
1. Hook the top side of groove on backside of the Slave Unit to the top side of the DIN track.



2. Push bottom side to DIN track

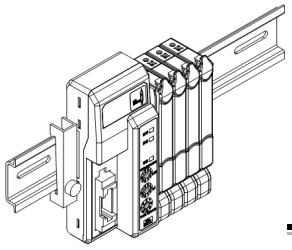


3. Release the cover of E3X-ECT right side. Slide sensor amplifiers and connect each other securely.



4. Set end plates each side, at last set the cover at 3. to the last amplifier.

:

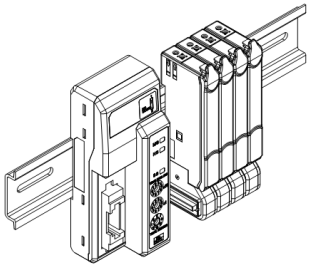


Precautions for Safe Use

After the operation, make sure to check that the Slave Unit is securely mounted.

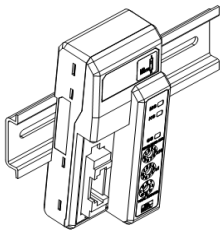
4-1-2 Removal Method

1. Release E3X-ECT form amplifiers to slide sensor amplifiers.

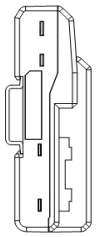


2. Push to DIN track and push up E3X-ECT.

Push to DIN track



Push up E3X-ECT



4-2 Connecting to EtherCAT Network

This section explains how to lay down EtherCAT network.

4-2-1 Precautions for Network Connection

Observe the precautions below when laying down the EtherCAT network.

Precautions at laying down network

- When laying down an EtherCAT network, take sufficient safety measures and construct the network according to the standards. We recommend to request specialized constructors familiar with the safety measures and standards to perform the laying operation.
- Do not lay down EtherCAT network devices near any devices generating noise.
  If there is no choice but to lay them down in a noisy environment, make sure to take noise measures such as housing each device in metal cases.

Precautions at laying down communications cables

- Check the following items for communications cables to be used.
  - Are there any disconnected cables?
  - Are any cables short-circuited?
  - Are there any problems in connector connections?
- To connect a cable to communications connector of each device, insert it securely until the connector of the communications cable is locked.
- Lay down and wire the communications cables separately from high-voltage electrical power lines.
- Do not lay down the cables near devices generating noise.
- Do not lay down the cables in high-temperature and high-humidity environment.
- Use the cables in locations without powder dust and oil mist.
- There is a limit to the bending radius of communications cables. Check the specification of communications cables to be used for the information on bending radius.

4-2-2 Preparation for Connecting Network

Prepare the following devices.

Product name	Comment
Twisted-pair cable (Cables with connectors below are also allowed.)	100BASE-TX (Category 5 or higher) Double-shield (aluminum tape + braided shielding)
RJ45 connector	Category 5 or higher Shielded

Precautions for Correct Use

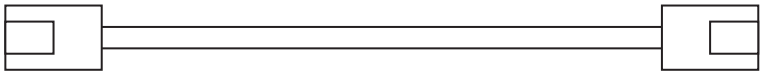
- The maximum cable length between connected nodes is 100 m. Note that some cables do not guarantee 100 m. In general, if the conductors are strand wire, the transmission performance will be lower than solid wire and the operation at 100-m distance cannot be guaranteed. Confirm details with the cable manufacturer.
- When selecting connectors, check that the cables to be used conform to connectors. Items to be checked include conductor size, conductor wire type (solid wire/twisted wire, 2/4 pairs), and outer diameter.

Reference

We recommend cables with double, aluminum tape and braded shielding, taking noise resistance into consideration.

4-2-3 Connecting Communications Cables and Connectors

Connect a communications cable and a connector by wiring them straight as shown below.



Pin No.	Wire color
1	White-Green
2	Green
3	White-Orange
4	Blue
5	White-Blue
6	Orange
7	White-Brown
8	Brown
Connector hood	Shielded cable *

Wire color	Pin No.
White-Green	1
Green	2
White-Orange	3
Blue	4
White-Blue	5
Orange	6
White-Brown	7
Brown	8
Shielded cable*	Connector hood

* Connect both ends of cable shielded wires to the connector hoods.

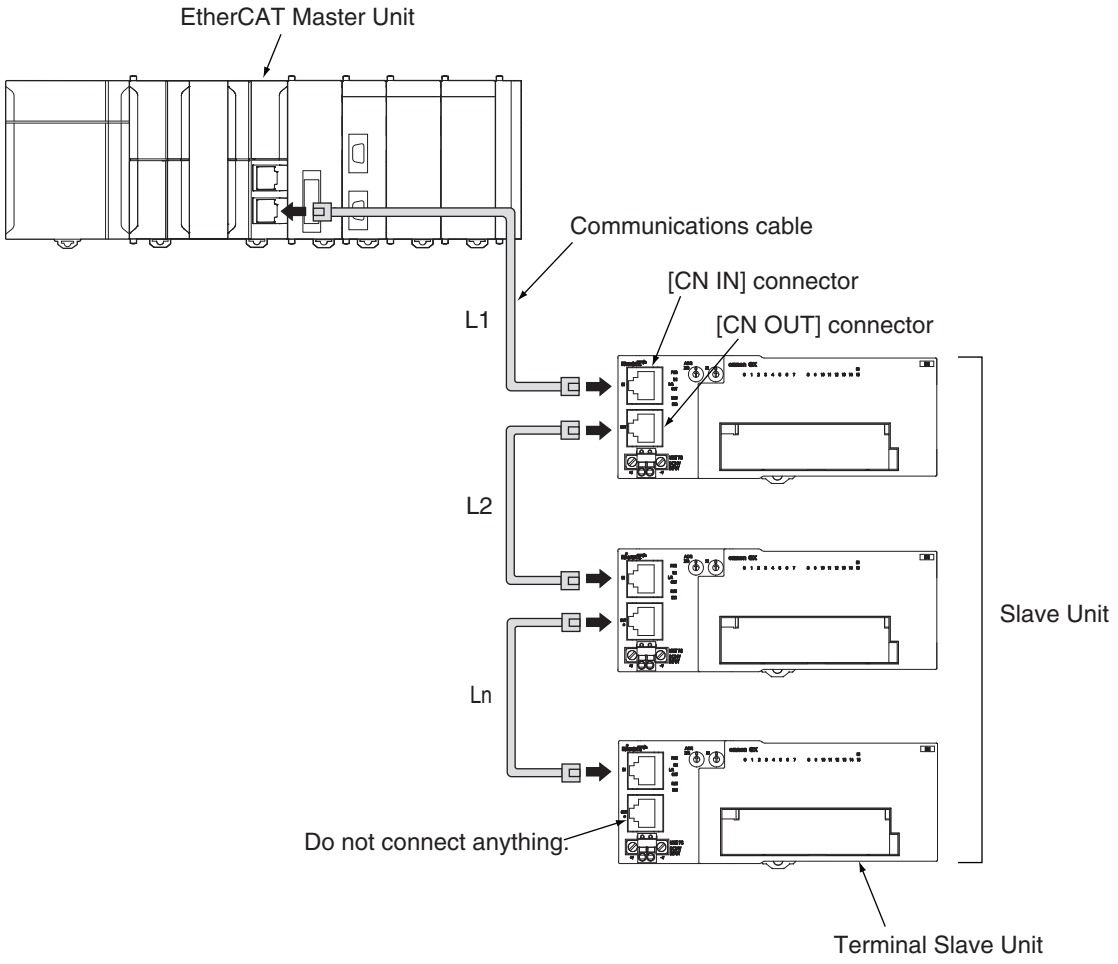
Reference

There are 2 types of wiring standards for Ethernet cables : "T568A" and "T568B."
The figure above shows a wiring method conforming to the standard "T568A". The wiring method conforming to the standard "T568B" can also be used.

4-2-4 Connecting to Communications Cables

EtherCAT networks allow free wiring in any connection forms. Connection before and after the E3X-ECT EtherCAT Sensor Communication Units shall be made in daisy chain connection.

Connect the communications cable from the EtherCAT Master Unit to the [CN IN] connector of the Slave Units. Connect another the communications cable from the [CN OUT] connector of the first Slave Unit to the [CN IN] connector of the next Slave Unit.
Note that nothing should be connected to the [CN OUT] connector of the Slave Unit at the terminal end of the network.



Precautions for Correct Use

- The cable length between each Slave Unit (L1, L2, ... Ln) must be within 100 m.
- Connect cables securely until communications cable connectors click and are fixed in place.
- When you wire the communications cables, observe their specifications (bending radius and so on) defined by the cable manufacturer.

4-3 Connecting to Unit Power Supply and I/O Power Supply

The following power supplies are required to operate the EtherCAT network.

- Unit power supply: For communication and internal operation of Slave Units.
- I/O power supply: For input/output operation of external I/O devices of each Slave Unit.
  E3X-ECT doesn't need I/O power supply.

This section explains how to supply the unit power supply and I/O power supply.

4-3-1 Precautions at Supplying Unit Power and I/O Power

When supplying the unit power supply and I/O power supply, take the followings into consideration for allowable current of cables and connectors, voltage drop, and layout of power supplies.

● Consideration to cable voltage drop

The power supply voltage of a Slave Unit farthest to the power supply must be within the allowable variation range.

● Supplying unit power supply and I/O power supply from multiple sources

When the unit power and I/O power are supplied from multiple power supplies instead of from one power supply, the line current, voltage drop, and cable size can be reduced. Moreover, it is effective to secure safety of the system at power supply errors.

● If power supply errors occur

Consideration on layout and grouping of power supplies differ by whether you want to stop the entire system or not when a power supply error occurs.
If you want to avoid stopping the entire system, we recommend to set power supplies at several locations and supply power to groups of Slave Units, or take similar measures.
This has also the effects of reducing voltage drop and cable size and so on.

4-3-2 Unit Power Supply Specifications

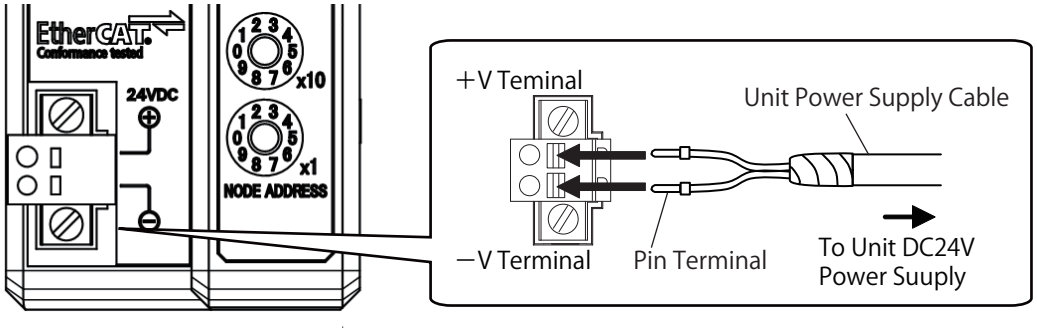
Use a general purpose power supply that satisfies the following specifications.

Item	Specification
Output voltage	24 VDC ± 10%
Output ripple	600 mVp-p
Output current	Has the capacity to supply power more than the total current consumption of each Slave Unit
Isolation	Between output and AC power supply as well as between output and chassis ground

We recommend S8JX series power supplies made by OMRON for the unit power supply for Slave Units.

4-3-3 Connecting the Unit Power Supply

Connect a cable from the 24-VDC unit power supply to the unit power supply connector on each Slave Unit, and supply power to individual Slave Units.



Mount a pin terminal, or equivalent to the unit power supply cable so that it will not be displaced.

Recommended product

The following pin terminals are recommended for the unit power supply cables.

Model	Applicable wire size	Crimping tool	Manufacturer
AI0,5-10WH	0.5 mm/AWG20	CRIMPFOX UD6 (Product No. 1204436) or CRIMPFOX ZA3 series	Phoenix Contact Co., Ltd.
H0.5/16 orange	0.5 mm/AWG20	Crimper PZ1.5 (Product No. 900599)	Weidmueller Japan Co., Ltd.

Also, the following screwdriver is recommended for removing pin terminals.

Model	Manufacturer
XW4Z-00C	OMRON

● Recommended product

The following pin terminals are recommended for the unit power supply cables.

Model	Applicable wire size	Crimping tool	Manufacturer
AI0,5-10WH	0.5 mm/AWG20	CRIMPFOX UD6 (Product No. 1204436) or CRIMPFOX ZA3 series	Phoenix Contact Co., Ltd.
H0.5/16 orange	0.5 mm/AWG20	Crimper PZ1.5 (Product No. 900599)	Weidmueller Japan Co., Ltd.

Also, the following screwdriver is recommended for removing pin terminals.

Model	Manufacturer
XW4Z-00C	OMRON

5

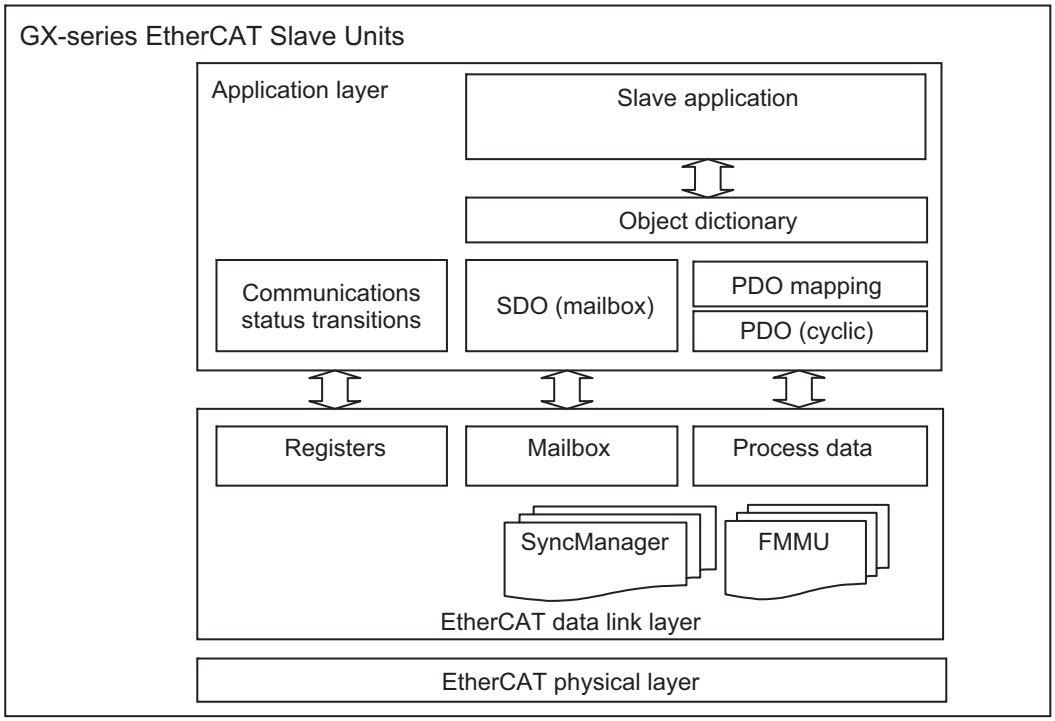
EtherCAT Communications

This chapter explains the overview of EtherCAT communications.

5-1 Structure of CAN application protocol over EtherCAT (CoE)

Normally, multiple protocols can be transferred by EtherCAT. But E3X-ECT EtherCAT Sensor Communication Units use "CAN application protocol over EtherCAT (CoE)", a communication interface to be applied for EtherCAT devices, as the device profile of the open network standard "CAN application protocol."

The figure below shows the structure of CoE in E3X-ECT EtherCAT Sensor Communication Units.

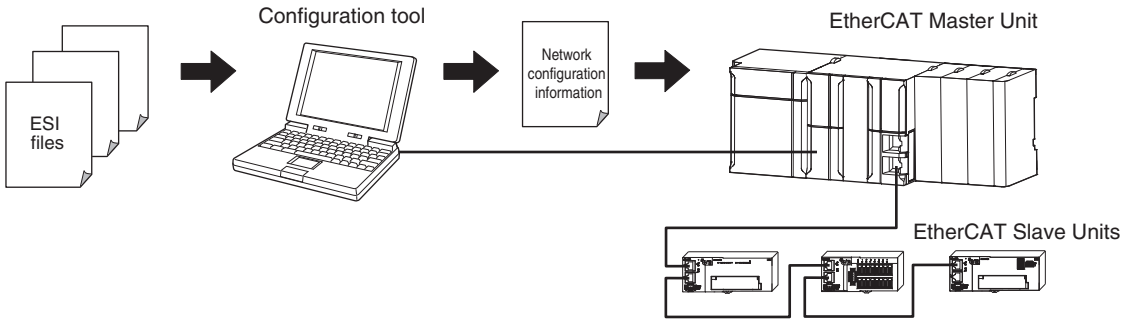


CAN application protocol has two types of object dictionaries, PDO (Process Data Object) and SDO (Service Data Object) .
PDO is composed of object dictionaries that can be mapped. The process data is defined by PDO mapping.
PDO is primarily used in PDO communications for regularly exchanging process data.
Moreover, SDO is able to read and write all object dictionaries and is used in non-fixed-cycle type SDO (event type messages) communications.

By using the CoE interface to set object SDO and PDO dictionaries, EtherCAT can provide EtherCAT devices with the same device profile as CAN application protocol.

5-2 EtherCAT Slave Information File (ESI File)

An EtherCAT Slave Information (ESI) file contains the setting information of an EtherCAT Slave Unit. Various EtherCAT communications setting can be defined from the ESI files of connected Slave Units and the network connection information.
ESI files are installed in the configuration tool to create network configuration information.
You can download the network configuration information to the EtherCAT Master Unit to configure the EtherCAT network.

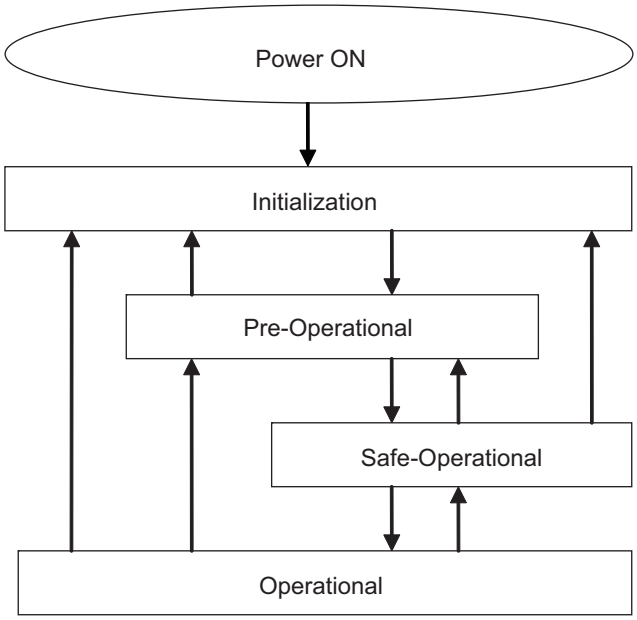


Communications are started according to the communications settings and the network configuration in the ESI files that are installed.

5-3 Communications State Transitions

The EtherCAT State Machine (ESM) indicates the state transition model of EtherCAT Slave Unit communications control. It is controlled by EtherCAT Master Unit.

The following figure shows the communications state transitions from power ON.



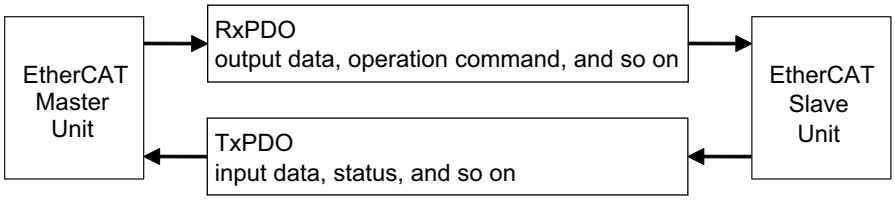
State	SDO communications	PDO transmission	PDO reception	Contents
Initialization (Init)	Not possible.	Not possible.	Not possible.	Communications are being initialized. Communications are not possible.
Pre-Operational (Pre-Op)	Possible	Not possible.	Not possible.	SDO (message) communications are possible in this state. This state is entered after initialization has been completed. It is used to initialize network settings.
Safe-Operational (Safe-Op)	Possible	Possible	Not possible.	In this state, PDO transmissions are possible in addition to SDO (message) communications. PDO sendings can be used to send information such as status from the Slave Unit.
Operational (Op)	Possible	Possible	Possible	Normal communication state PDO communications can be used to control the I/O data.

E3X-ECT can’t trance the state of Operational, when amplifier does not exist.

5-4 Process Data Objects (PDO)

5-4-1 Overview

The process data objects (PDO) are used for real-time data transfer via cyclic communications.
There are two types in PDO: RxPDO that receives data from the EtherCAT Master Unit and TxPDO that sends the present value from a EtherCAT Slave Unit to the EtherCAT Master Unit.

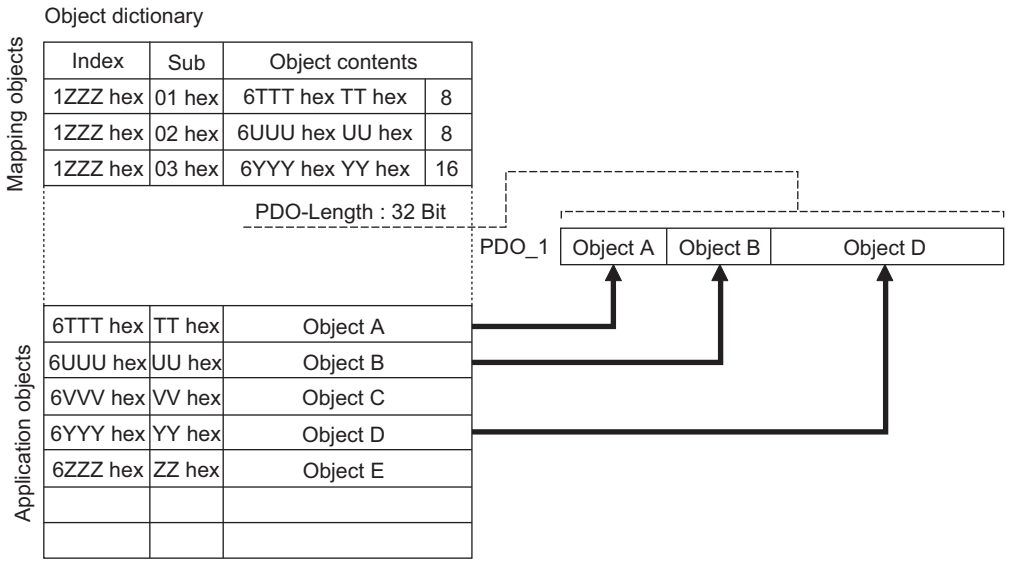


It is possible to hold multiple objects in the EtherCAT application layer so that various process data of EtherCAT Sensor Communication Units can be transferred. The details of process data are described in PDO Mapping Objects and Sync Manager PDO Assignment Objects.
E3X-ECT EtherCAT Sensor Communication Units support PDO mapping for I/O control.

5-4-2 PDO Mapping Settings

The PDO mapping indicates the mapping for application objects (realtime process data) between the object dictionary and PDO.
The number of mapped objects is described in sub-index 0 of the mapping table. In this mapping table, indexes 1600 hex to 17FF hex are used for RxPDO and 1A00 hex to 1BFF hex are used for TxPDO.

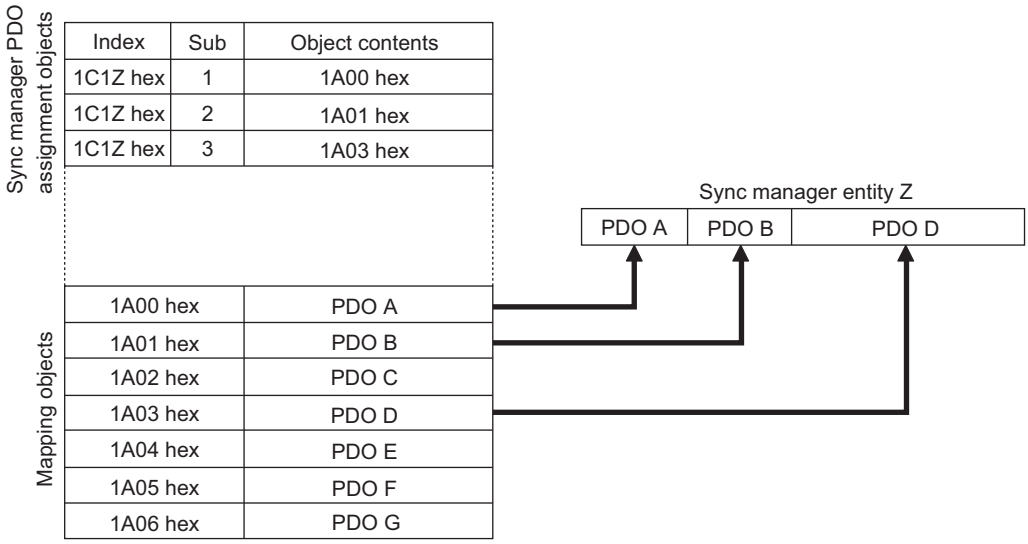
The figure below shows an example of PDO mapping.



5-4-3 Sync Manager PDO Assignment Settings

A sync manager channel consists of several PDOs. The sync manager PDO assignment objects describe how these PDOs are related to the Sync Manager.
The number of PDOs is given in sub-index 0 of the sync manager PDO assignment table.
In this table, index 1C12 hex is for RxPDOs and 1C13 hex is for TxPDOs.

The figure below shows an example of sync manager PDO mapping.



5-4-4 PDO Mapping

The tables below show the details of PDO mapping for E3X-ECT EtherCAT Sensor Communication Units.

● Default PDO mapping with OMRON Sysmac Studio

257th transmit PDO Mapping (1B00 hex)	No.1 Sensor Input 1 No.1 Sensor Input 2 ..... No.8 Sensor Input 1 No.8 Sensor Input 2	Read Input 1st word (6100Hex)
258th transmit PDO Mapping (1B01 hex)	No.9 Sensor Input 1 No.9 Sensor Input 2 ..... No.16 Sensor Input 1 No.16 Sensor Input 2	Read Input 2nd word (6100Hex)
265th transmit PDO Mapping (1B08 hex)	Sensor Status bits (3000Hex)	
267th transmit PDO Mapping (1B0A hex)	Connecting Sensor bits (3001Hex)	
512th transmit PDO Mapping (1BFF hex)	Sysmac Error (2002 hex)	

● Default PDO mapping with OMRON CX-Programmer

257th transmit PDO Mapping (1B00 hex)	No.1 Sensor Input 1 No.1 Sensor Input 2 ..... No.8 Sensor Input 1 No.8 Sensor Input 2	Read Input 1st word (6100Hex)
258th transmit PDO Mapping (1B01 hex)	No.9 Sensor Input 1 No.9 Sensor Input 2 ..... No.16 Sensor Input 1 No.16 Sensor Input 2	Read Input 2nd word (6100Hex)
265th transmit PDO Mapping (1B08 hex)	Sensor Status bits (3000Hex)	
267th transmit PDO Mapping (1B0A hex)	Connecting Sensor bits (3001Hex)	

● Default PDO mapping with Other Company Tool

261th transmit PDO Mapping (1B04 hex)	No.1 Sensor Input 1 No.1 Sensor Input 2 ..... No.8 Sensor Input 1 No.8 Sensor Input 2	Read Input bits (3020Hex)
262th transmit PDO Mapping (1B05 hex)	No.9 Sensor Input 1 No.9 Sensor Input 2 ..... No.16 Sensor Input 1 No.16 Sensor Input 2	Read Input bits (3020Hex)
265th transmit PDO Mapping (1B08 hex)	Sensor Status bits (3000Hex)	
267th transmit PDO Mapping (1B0A hex)	Connecting Sensor bits (3001Hex)	

5-5 Service Data Object (SDO)

5-5-1 Overview

E3X-ECT EtherCAT Sensor Communication Units support the SDO communications.
The EtherCAT Master Unit is able to make parameter settings and monitor status by reading and writing data from and to entries in object dictionaries via the SDO communications.

5-5-2 Abort Codes

The table below shows abort codes of SDO communications errors.

Code	Meaning
05030000 hex	Toggle bit not changed
05040000 hex	SDO protocol timeout
05040001 hex	Client/Server command specifier not valid or unknown
05040005 hex	Out of memory
06010000 hex	Unsupported access to an object
06010001 hex	Attempt to read a write only object
06010002 hex	Attempt to write to a read only object
06020000 hex	The object does not exist in the object directory.
06040041 hex	The object cannot be mapped into the PDO.
06040042 hex	The number and length of the objects to be mapped would exceed the PDO length.
06040043 hex	General parameter incompatibility reason
06040047 hex	General internal incompatibility in the device.
06060000 hex	Access failed due to a hardware error.
06070010 hex	Data type does not match, length of service parameter does not match.
06070012 hex	Data type does not match, length of service parameter too high.
06070013 hex	Data type does not match, length of service parameter too low.
06090011 hex	Sub-index does not exist.
06090030 hex	Value range of parameter exceeded (only for write access)
06090031 hex	Value of parameter written too high
06090032 hex	Value of parameter written too low
06090036 hex	Maximum value is less than minimum value.
08000000 hex	General error
08000020 hex	Data cannot be transferred or stored to the application.
08000021 hex	Data cannot be transferred or stored to the application because of local control.
08000022 hex	Data cannot be transferred or stored to the application because of the present device state.
08000023 hex	Object dictionary dynamic generation fails or no object dictionary is present.

5-6 EtherCAT Master Unit - Slave Unit Communications

This section explains the communication modes between the Master Unit and E3X-ECT EtherCAT Slave Unit.

5-6-1 FREE RUN Mode

In the FREE RUN mode, a Slave Unit operates asynchronously with the EtherCAT Master Unit.
The Digital I/O Slave Units and Analog I/O Slave Units operate in the FREE RUN mode.
Note that Slave Unit's internal processing time varies by the Slave Unit type, refer to the explanation on each Slave Unit in Chapter 7 to Chapter 8.
(Digital I/O Slave Units: ON delay, OFF delay, Analog I/O Slave Units: Cycle time)

To calculate the input and output response time* of the entire system, refer to the relevant values in the manual of the host system (EtherCAT Master or CPU Unit) to be used.

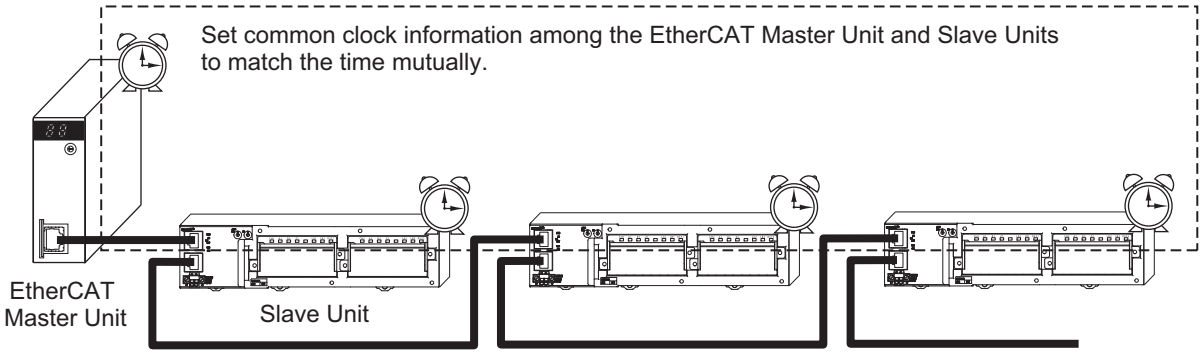
* This is the time which takes for an input signal from an Input Slave Unit to be processed by the PLC of the Master Unit and output to an Output Slave Unit.

5-6-2 DC Mode

In the DC mode, a Slave Unit operates synchronously with the EtherCAT Master Unit.

A mechanism called distributed clock (DC), where the EtherCAT Master Unit and Slave Units share the same clock, is used for synchronization.
Each of DC mode-ready Slave Units connected to EtherCAT shares the clock information.
By generating interrupt signals and executing input/output processing inside each Slave Unit according to the clock, it becomes possible to synchronize the input/output timing with other Slave Units.

The DC mode supported by E3X-ECT Units is DC mode 1.



Communications cycle

The communications cycle is determined by setting output frequency of Sync0 signal (interrupt signal in DC mode 1).

125 μs, 250 μs, 500 μs, 1 ms, 2 ms, 4 ms

The settings are performed on the EtherCAT Master Unit side. For the setting method, refer to the manual of the EtherCAT Master Unit to be used.

5-7 Emergency Messages

E3X-ECT EtherCAT Sensor Communication Units are able to notify emergency messages to the EtherCAT Master Unit by using the SDO communications if they detect errors.

5-7-1 Emergency Message Notification

It is possible to set whether or not to notify emergency messages via the SDO communications.
Target indexes are sub-index 05 hex: (Flags) in 10F3 hex (Diagnostic History).

The setting values are shown in the table below.

Set value	Emergency message notification
0000 hex	Not notify.
0001 hex	Notify.

When the power to it is turned on, a Slave Unit always starts up in the "Not notify" setting. If you want to use a Slave Unit in the "Notify" setting, set it to "Notify" each time you turn on the power.
Note that an emergency message cannot be sent during an EtherCAT communications errors are occurring.

Precautions for Correct Use

Emergency message notification is enabled at startup for unit version 1.0.

An emergency message is composed of 8-byte data as shown below.

Byte	0	1	2	3	4	5	6	7
Contents	Emergency error code		Error register (Object 1001 hex)	Reserved.	Sysmac error status code			

For contents of emergency message, refer to "11-1-5 Emergency Error Code" in page 11 - 15.
For contents of Sysmac error status codes, refer to "11-1-4 Sysmac Error Status Codes" in page 11 - 9.

5-7-2 Diagnosis History

A E3X-ECT EtherCAT Slave Unit can save up to eight emergency messages in non-volatile memory inside the Slave Unit. The saved messages can be read with SDO communications.
Indexes to be read are sub-indexes 06 hex to 0D hex (Diagnosis messages 1 to 8) among 10F3 hex (Diagnosis History).

Diagnosis history is stored from Diagnosis message 1. If 8 errors are stored in order up to Diagnosis message 8, the 9th error onward are saved from Diagnosis message 1 again.

History is saved even if emergency messages cannot be sent to the EtherCAT Master Unit due to EtherCAT communications errors or emergency messages are set to "Not notify."
Errors that occur for non-volatile memory are not saved in the diagnosis history.

5-8 Sysmac Device Functions

“Sysmac devices” is the generic name of control component products that were designed with communications and user interface specifications that are unified for OMRON control components. This functions of these procedures are called Sysmac device functions.
The section explains the functions of Sysmac devices when they are used together with NJ-series Controller or other Machine Automation Controllers, and Automation Software.
Starting with unit version 1.1, the E3X-ECT EtherCAT Sensor Communication Units are Sysmac devices and support Sysmac device functions.

● Sysmac error status

Slaves Units that are Sysmac devices systematically handle errors that occur in the Slave Unit. You can therefore use the Sysmac Studio to check errors and confirm corrections by using the same procedures for all Sysmac devices.
Errors are reported in 2002 hex-01 hex (Sysmac Error Status). To display errors that are detected by a Slave Unit on the Sysmac Studio, you must map 2002 hex-01 hex (Sysmac Error Status) to a PDO. In the Sysmac Studio default settings, 2002 hex-01 hex (Sysmac Error Status) is automatically mapped to a PDO in the 512th Transmit PDO Mapping (1BFF hex) assignments.

Reference

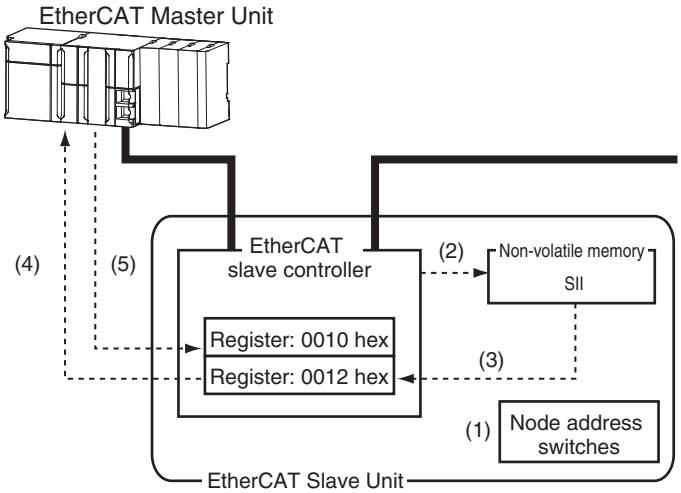
- Refer to "A-1-7 Manufacturer Specific Objects" in page A - 25 for information on 2002 hex-01 hex (Sysmac Error Status).
- Refer to "11-1-4 Sysmac Error Status Codes" in page 11 - 9 for errors that are displayed on the Sysmac Studio.

Saving node address settings

If the node address switches are set to 00, the software setting is enabled and the node address that is set on the Sysmac Studio is used.
To use the software setting, execute the ***Write Slave Node Address*** menu command on the Edit Network Configuration Tab Page for EtherCAT. The software setting will be saved in non-volatile memory in the Slave Unit.

- Software setting

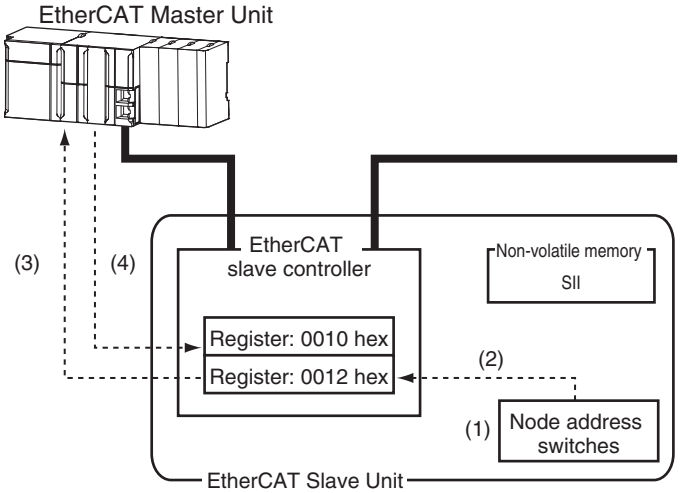
The software setting that is set in the SII (slave information interface) in non-volatile memory in the Slave Unit is used as the node address.



(1) When the power supply is OFF, set the node address switches to 00.
(2) From the master, write the node address to the SII in the Slave Unit.
(3) When the power supply to the Slave Unit is turned ON, the software writes the node address setting to register address 0012 hex.
(4) The EtherCAT Master Unit reads the setting in register address 0012 hex.
(5) The EtherCAT Master Unit writes the value of address 0012 hex to address 0010 hex.

- Node address switch setting

The value that is set on the node address switches on the Slave Unit is used as the node address.



(1) When the power supply is OFF, set the node address switches.
(2) When the power supply to the Slave Unit is turned ON, the value that is set on the node address switches is saved in register address 0012 hex.
(3) The EtherCAT Master Unit reads the setting in register address 0012 hex.
(4) The EtherCAT Master Unit writes the value of address 0012 hex to address 0010 hex.

Displaying serial numbers

The serial number that is stored in non-volatile memory in the Slave Unit is given in 1018 hex-04 hex (Serial number). Controllers that support Sysmac device functions can use serial numbers to verify the network configuration.

To verify the configuration, set the Serial Number Check Method parameter to *Setting = Actual device* on the Edit Network Configuration Tab Page for EtherCAT on the Sysmac Studio.

A Network Configuration Verification Error will occur if verification fails for the specified method.

Reference

This helps prevent forgetting to set the parameters because a slave device that was replaced is detected.

Conformance to ESI specifications (ETG.2000 S (R) V1.0.1)

The ESI specifications define the contents of the EtherCAT slave information (ESI) files.

Controllers that support Sysmac device functions can use an optional function that is defined in the ESI specifications to specify backup parameters in the Slave Units.

You can back up and restore the backup parameters that are defined in the Slave Units from the Sysmac Studio.

SII data checking

The SII (slave information interface) contains specific configuration information on the EtherCAT slave that is written in non-volatile memory in the EtherCAT Slave Unit.

EtherCAT Sensor Communication Units that are Sysmac devices check the information in the SII at the Slave Units.

Precautions for Correct Use

Do not change the SII information with setting software that is produced by other companies.

6

Hardware Specifications of E3X-ECT

This chapter explains EtherCAT communication specifications and Hardware specifications.

6-1 EtherCAT Communications Specifications

This section explains the communications specifications of the E3X-ECT EtherCAT Slave Unit.

Item	Specification
Communication protocol	Dedicated protocol for EtherCAT
Modulation	Base band
Baud rate	100 Mbps
Physical layer	100BASE-TX (IEEE802.3)
Connectors	RJ45 × 2 (Shielded) CN IN: EtherCAT input CN OUT: EtherCAT output
Topology	Daisy chain
Communications media	Category 5 or higher (cable with double, aluminum tape and braided shielding is recommended.)
Communications distance	Distance between nodes (Slave Units): 100 m max.
Noise immunity	Conforms to IEC 61000-4-4, 1 kV or higher
Node address setting method	Set on decimal node address switches or with a Configuration Tool.
Node address range	1 to 999: Node address switch setting 1 to 65535: Set with Configuration Tool
Indicator	PWR × 1 L/A IN (Link/Activity IN) × 1 L/A OUT (Link/Activity OUT) × 1 RUN × 1 ERR × 1
Process data	PDO mapping
PDO size/node	36 byte (max)
Mailbox	Emergency messages, SDO requests, SDO responses, and SDO information
SYNCHRONIZATION mode	Free Run mode (asynchronous) and DC mode 1

6-2 General Specifications

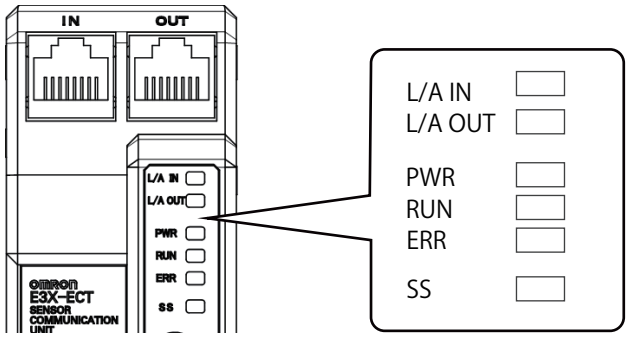
This section explains the general specifications of the E3X-ECT EtherCAT Slave Unit.

Item	Specification
Unit power supply voltage	20.4 to 26.4 VDC (24 VDC −15% to +10%)
I/O power supply voltage	20.4 to 26.4 VDC (24 VDC −15% to +10%)
Noise immunity	Conforms to IEC 61000-4-4, 2 kV (power line).
Vibration resistance	Malfunction 10 to 60 Hz with amplitude of 0.7 mm, 60 to 150Hz and 50 m/s^2 in each of X, Y, and Z directions for 80 minutes
Shock resistance	150 m/s^2 with amplitude of 0.7 mm (3 times each in 6 directions on 3 axes)
Dielectric strength	500 VAC (between isolated circuits)
Insulation resistance	20 MΩ or more (between isolated circuits)
Ambient operating temperature	0 to 55 °C
Ambient operating humidity	25% to 85% (with no condensation)
Ambient operating atmosphere	No corrosive gases
Storage temperature	−25 to 65 °C
Storage humidity	25% to 85% (with no condensation)
Mounting method	35-mm DIN track mounting

6-3 Hardware Specifications

6-3-1 Status Indicators

It indicates the current state of an EtherCAT Slave Unit.



[PWR] indicator

Indicates the unit power supply state.

Color	State	Contents
Green	OFF	Unit power OFF state
	ON	The unit power (24 VDC) is supplied to the Slave Unit.

[L/A IN] indicator

Indicates the communication state (input side).

Color	State	Contents
Green	OFF	Link not established in physical layer
	Flickering	In operation after establishing link
	ON	Link established in physical layer

[L/A OUT] indicator

Indicates the communication state (output side).

Color	State	Contents
Green	OFF	Link not established in physical layer
	Flickering	In operation after establishing link
	ON	Link established in physical layer

[RUN] indicator

It indicates the operation state.

Color	State	Contents
Green	OFF	Init state
	Blinking	Pre-Operational state
	Single flash	Safe-Operational state
	ON	Operational state

For details on each state, refer to "5-3 Communications State Transitions" in page 5 - 4.

[ERR] indicator

It indicates the information of an error.

Color	State	Contents
Red	OFF	No error
	Blinking	Communications setting error
	Single flash	Synchronization error or communications data error
	Double flash	Application WDT timeout
	Flickering	Boot error
	ON	PDI WDT timeout

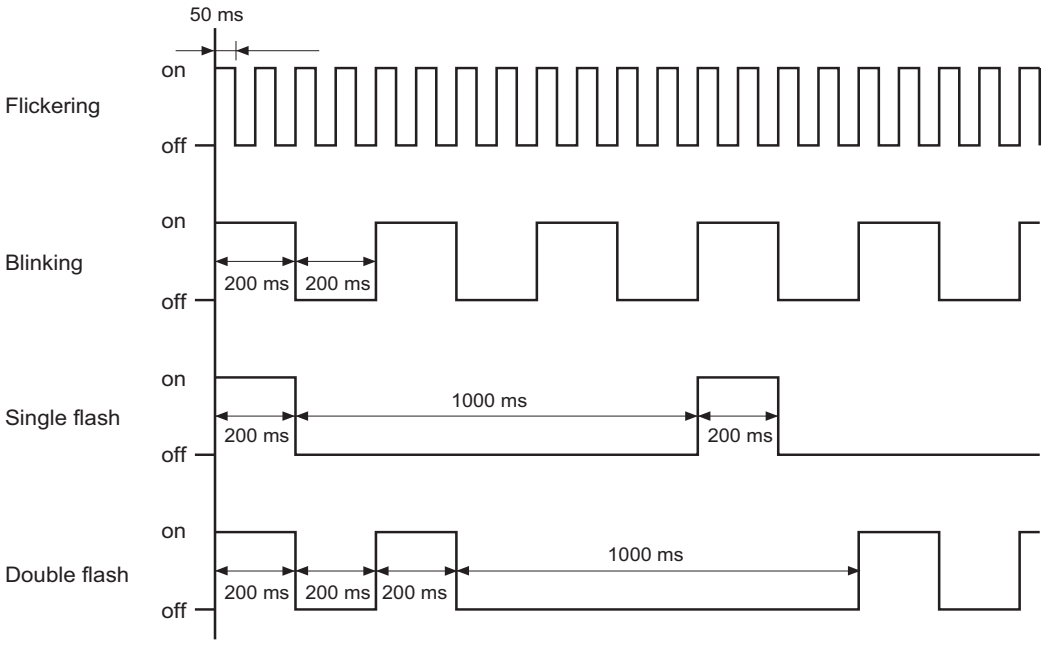
[SS] indicator

It indicates the information of an Sensor Status.

Color	State	Contents
	OFF	Power OFF or Initial satus of sensor connection
Green	ON	Normal
Red	ON	Sensor Error: Connecting Sensors is different form setting.

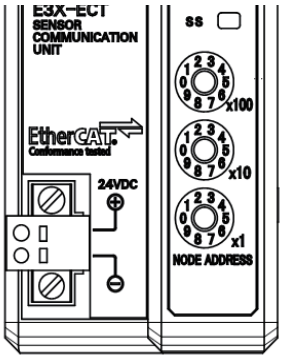
Reference

The timing of each flashing state of indicator is as follows.



6-3-2 Node Address Setting Switches

These switches are used to set node addresses of Slave Units in the EtherCAT network (decimal). Set the tens digit of the node address on the left switch and the ones digit on the right switch. Setting range is 00 to 99. (Default setting: 00)



Setting the node address (×100)

Setting the node address (×10)

Setting the node address (×1)

Note that the node address set values vary as shown below when the EtherCAT Master Unit is made by OMRON or by other manufacturers.

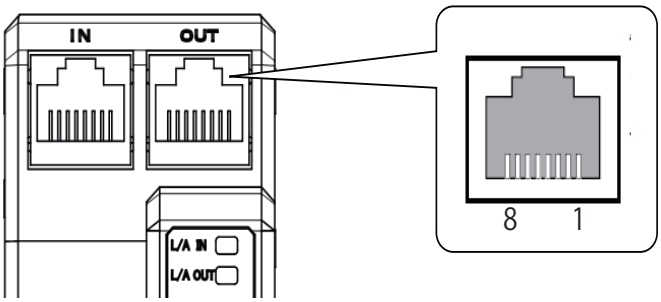
Node address switch setting	Set value for node address	
	OMRON EtherCAT Master Unit NJ501-1@00 or CJ1W-NC@82	EtherCAT Master Unit from another manufacturer
000	Set value according to Configuration Tool (1 to 65535)	Set value according to Configuration Tool (settings by these switches are irrelevant)
001 to 999	Setting on node address switches	

Precautions for Correct Use

- The setting on the node address switches is read only once when the power is turned ON. Even if the settings are changed after turning the power supply ON, they are not reflected in the control. They become effective when the power supply is turned ON the next time.
- If node addresses overlap, an error occurs and the operation stops.

6-3-3 Communications Connectors

The Connectors are used to connect the communications cables.



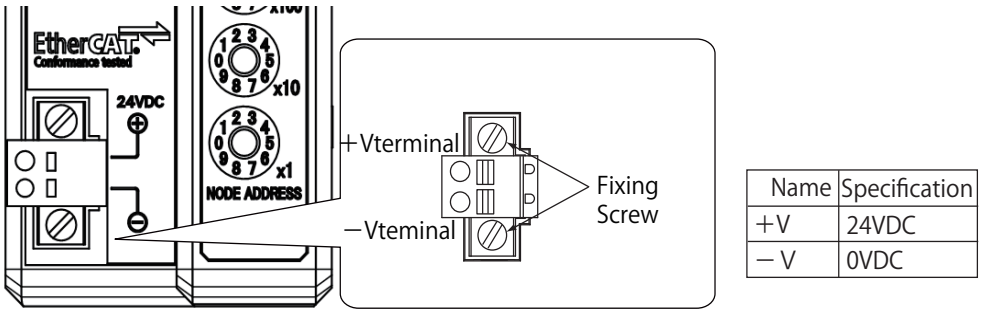
The specifications are shown below.

- Electrical characteristics: Conforms to the IEEE 802.3 standard.
- Connector structure: RJ45 8-pin modular connector (conforms to ISO 8877)
- Terminal arrangement

Pin No.	Signal name	Abbreviation
1	Send data +	TD +
2	Send data –	TD –
3	Receive data +	RD +
4	Not used	–
5	Not used	–
6	Receive data –	RD –
7	Not used	–
8	Not used	–
Hood	Frame ground	FG

6-3-4 Unit Power Supply Connector

The Connector is used to connect the unit power supply (24 VDC).



Name	Specification
+V	24VDC
− V	0VDC

- Connector type: Spring connection connector with fixing screw (2-pin)
- Supported pin terminal diameter: 0.25 mm^2 to 0.5 mm^2/AWG24 to AWG20
  (Pin terminal with isolation sleeve used)

For types of recommended pin terminals, refer to "4-3-3 Connecting the Unit Power Supply" in page 4 - 9.

7

Function Spcifications

This chapter explains the function specifications of E3X-ECT.

7-1 I/O Data Allocation (PDO Mapping)

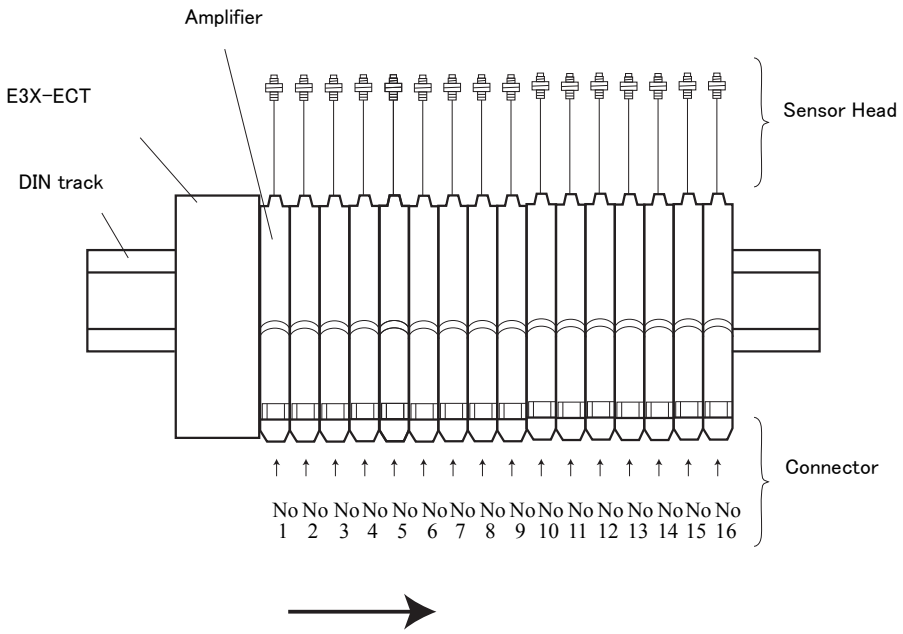
I/O data of Digital I/O Slave Units are allocated to the input/output areas of the I/O memory of the EtherCAT Master Unit, respectively.

For the detailed explanation of allocation method, refer to the manual of EtherCAT Master Unit to be connected.

7-1-1 Input Data Allocation

The input data for E3X-ECT. You can also assign the Sysmac error status.

Sensor Numbers



E3X-ECT recognize the sensor number from left side.
And each sensor has IN1(sensor output1) and IN2(sensor output2).

Input data allocation example

Offset (byte)	7bit	6bit	5bit	4bit	3bit	2bit	1bit	0 bit
0	Sensor4 IN2	Sensor4 IN1	Sensor3 IN2	Sensor3 IN1	Sensor2 IN2	Sensor2 IN1	Sensor1 IN2	Sensor1 IN1
+1	Sensor8 IN2	Sensor8 IN1	Sensor7 IN2	Sensor7 IN1	Sensor6 IN2	Sensor6 IN1	Sensor5 IN2	Sensor5 IN1
+2	Sensor12 IN2	Sensor12 IN1	Sensor11 IN2	Sensor11 IN1	Sensor10 IN2	Sensor10 IN1	Sensor9 IN2	Sensor9 IN1
+3	Sensor16 IN2	Sensor16 IN1	Sensor15 IN2	Sensor15 IN1	Sensor14 IN2	Sensor14 IN1	Sensor13 IN2	Sensor13 IN1
+4	reserved	reserved	reserved	reserved	reserved	reserved	S_ERR	BUSY
+5	Number of Sensors setting							
+6	Number od Sensors with dummy							

7-2 Functions of E3X-ECT

Digital I/O Slave Units have the following convenient functions, in addition to the I/O signal processing.

7-2-1 Input Filter

Overview of functions

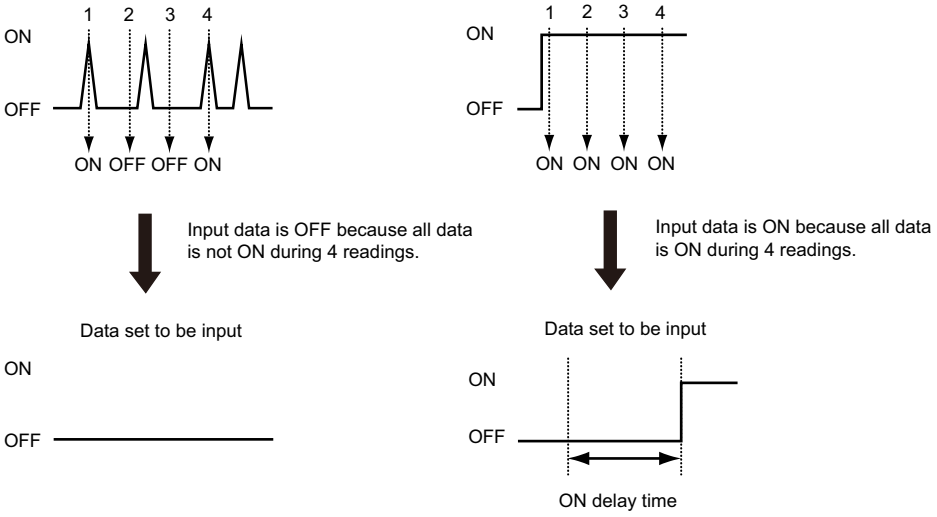
- **Purpose**

  This function prevents data changes and unstable data, which may be caused by fluctuation of input data and unstable contact state due to chattering and noise. This function is available in Free Run Mode.

- **Details of functions**

  This function reads inputs (ON/OFF) within a certain set time and turn ON the inputs if they are all same (all ON or all OFF), and turn them OFF if not.
  Note that this function works for all inputs of Slave Units and Expansion Units at the same time.

  When the input shifts from OFF to ON (or ON to OFF), it is read 4 times from that point at an interval of 1/4 of the set time. When all read results are ON (or OFF), the input is turned ON (or OFF).



Setting method

The settings are made using the SDO communication.
The target index is 3002 hex.
For the set values, refer to the information in the corresponding index of "Appendix A-1 Object Dictionary" in A-1-7.

7-2-2 Dummy Sensor Setting

Overview of functions

- **Purpose**
  This function provides keeping I/O map, when number of sensor change by customer option, sensing point degrees and so on.

- **Details of functions**
  E3X-ECT can be set dummy sensor, so I/O map keep by using dummy sensor setting.

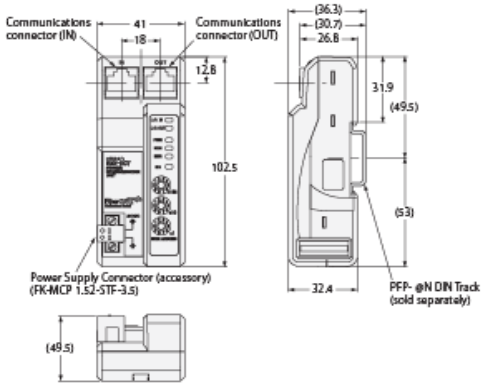
Setting method

The settings are made using the SDO communication.
The target index is 3004 hex.
For the set values, refer to the information in the corresponding index of "Appendix A-1 Object Dictionary" in A-1-7.

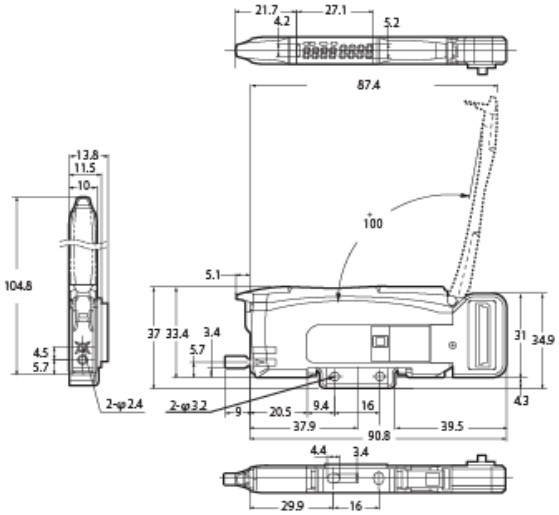
7-3 Mounting Dimensions

The mounting dimensions are shown below.

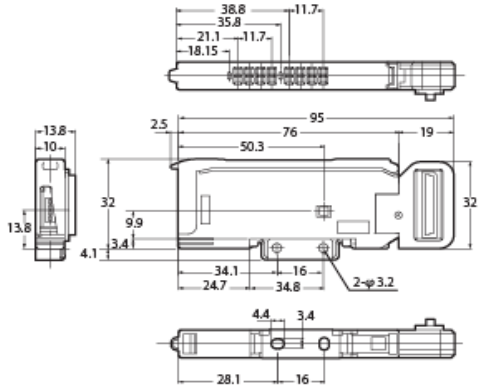
E3X-ECT



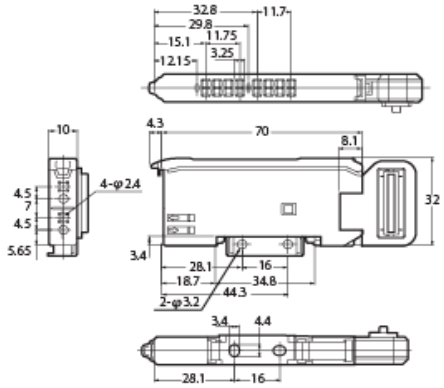
E3X-HD0



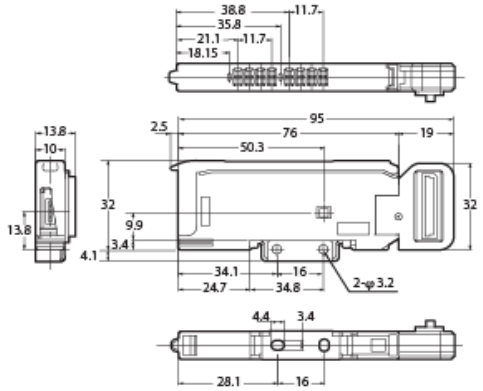
E3X-LDA0



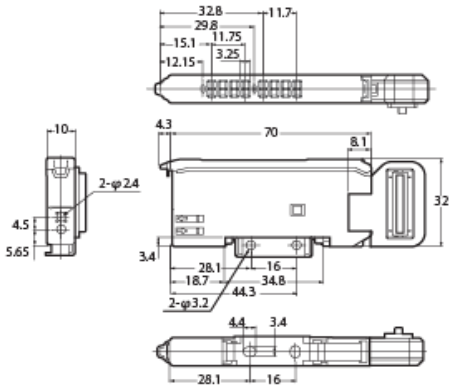
E3X-MDA0



E3X-EDA0



E3X-DA0-S



8

Troubleshooting and Maintenance

This chapter explains actions to be taken at errors, troubleshooting, and equipment maintenance.

8-1 Troubleshooting

8-1-1 Errors that Can be Checked with Status Indicator and Actions to Take

Errors can be notified by status indicators on Slave Units.

In this section, the states of status indicator are indicated using the following abbreviations.

Abbreviation	Definition
On	ON
Off	OFF
F	Flickering (ON (50 ms) - OFF (50 ms) flashing)
B	Blinking (ON (200 ms) - OFF (200 ms) flashing)
SF	Single flash (ON (200 ms) - OFF (1000 ms) flashing)
DF	Double flash (ON (200 ms) - OFF (200 ms) - ON (200 ms) - OFF (1000 ms) flashing)
–	Unknown

For details on definition of each state, refer to "6-3-1 Status Indicators" in page 6 - 4.

● Errors of Slave Unit

[PWR] indicator	[L/A IN] [L/A OUT] LED	[RUN] indicator	[ERR] indicator	Description	Cause	Actions
On	F	On	Off	EtherCAT communication is in progress.	EtherCAT communication is being executed.	PDO communications or both PDO and SDO communications are being executed. State is normal.
Off	Off	Off	Off	Power supply error	The power is not properly supplied to the Slave Unit.	After removing the following factors of power supply shutdown, restart the Slave Unit according to the specification of connected EtherCAT Master Unit. • Are the power supply cables wired correctly? • Are the power supply cables disconnected? • Is the power supply voltage within the specification range? • Is the power supply capacity sufficient? • Is the power supply malfunctioning?

[PWR] indicator	[L/A IN] [L/A OUT] LED	[RUN] indicator	[ERR] indicator	Description	Cause	Actions
On	–	Off	On	Hardware error	A hardware failure occurred.	If the error does not clear even after the power is turned ON again, the Slave Unit hardware is damaged. Replace the Slave Unit.
			F			
			B		The Expansion Unit is disconnected.	Check the Expansion Unit connection.
On	–	–	B	Illegal switch setting	A range setting switch or other switch setting is illegal.	Check the switch settings then restart the Slave Unit according to the specification of connected EtherCAT Master Unit.
				Non-volatile memory data error	A non-volatile memory data error occurred.	Use the Configuration Tool or SDO communications to restore the default data and restart the Slave Unit according to the specification of connected EtherCAT Master Unit.
				Sync manager setting error	The sync manager setting is illegal.	Change to the correct settings.
				Hardware error	A hardware failure occurred.	If the problem is not resolved even after the measures described above are taken, the Slave Unit hardware may be damaged. Replace the applicable Slave Unit.

● Errors of EtherCAT Network

[PWR] indicator	[L/A IN] [L/A OUT] LED	[RUN] indicator	[ERR] indicator	Description	Cause	Actions
On	On	–	–	Link established in physical layer	Operation standby status after establishing link in physical layer.	–
On	Off	–	–	Link not established in physical layer	A link in physical layer has not been established.	After checking the following items, restart the Slave Unit according to the specification of connected EtherCAT Master Unit. • Is the communications cable wired correctly? • Are any cables disconnected or loose in the part that connects to the connector? • Is the cable length appropriate? • Is the communications cable of the recommended specification?
					The host master has not been started.	Check that EtherCAT Master Unit is operating correctly. If using an OMRON EtherCAT Master Unit, check the EtherCAT Master Unit mode and Slave Unit node addresses. If using EtherCAT Master Unit from another manufacturer, refer to the user's manual for that Master Unit.
					A hardware failure occurred.	If the problem is not resolved even after the measures described above are taken, the Slave Unit hardware may be damaged. Replace the applicable Slave Unit.

[PWR] indicator	[L/A IN] [L/A OUT] LED	[RUN] indicator	[ERR] indicator	Description	Cause	Actions
On	–	–	DF	Process data communica-tions timeout *	A communications error occurred.	After checking the following items, restart the Slave Unit according to the specification of connected EtherCAT Master Unit. [Item about communication cable] • Is the communications cable wired correctly? • Are any cables disconnected or loose in the part that connects to the connector? • Is the cable length appropriate? • Is the communications cable of the recommended specification? [Item about power supply] • Is the power supply voltage within the specification range? • Is the power supply capacity sufficient?
					Malfunction due to noise	• If there are devices in the vicinity that generate noise, take necessary measures against the noise to protect the EtherCAT Master Unit and Slave Units and the communications cable. • The noise resistance deteriorates if a cable other than those of the recommended specification is used. Use the communications cable of the recommended specification.
				Link in physical later OFF	Communications cable disconnection occurred.	Check to see if the cable is disconnected or loose in the part that connects to the connector.

[PWR] indicator	[L/A IN] [L/A OUT] LED	[RUN] indicator	[ERR] indicator	Description	Cause	Actions
On	–	SF	–	Safe-Operational state	It is commanded from the EtherCAT Master Unit to shift to the Safe-Operational state.	If the trouble occurred during operating the system, check the state of the connected EtherCAT Master Unit.
On	–	B	–	Pre-Operational state	It is commanded from the EtherCAT Master Unit to shift to the Pre-Operational state.	
On	–	Off	–	Init state	It is commanded from the EtherCAT Master Unit to shift to the Init state.	

* Due to the EtherCAT specification, a communication timeout does not occur with those Slave Units that only handle input data.

● Synchronization Errors

[PWR] indicator	[L/A IN] [L/A OUT] LED	[RUN] indicator	[ERR] indicator	Description	Actions
On	–	B	B	Synchronization frequency (Sync0 frequency) setting error	After checking the following items, restart the Slave Unit according to the specification of connected EtherCAT Master Unit. • Set the correct synchronization frequency.
On	–	B	SF	Synchronization error (at synchronization start)	After checking the following items, restart the Slave Unit according to the specification of connected EtherCAT Master Unit. • Is the communications cable wired correctly? • Is the communications cable exposed to excessive noise? • Review set time of Sync Not Received Timeout Setting (synchronization error setting).
On	–	SF	SF	Communications synchronization error	After checking the following items, restart the Slave Unit according to the specification of connected EtherCAT Master Unit. • Is the communications cable wired correctly? • Is the communications cable exposed to excessive noise? • Review set time of Communication Error Setting .

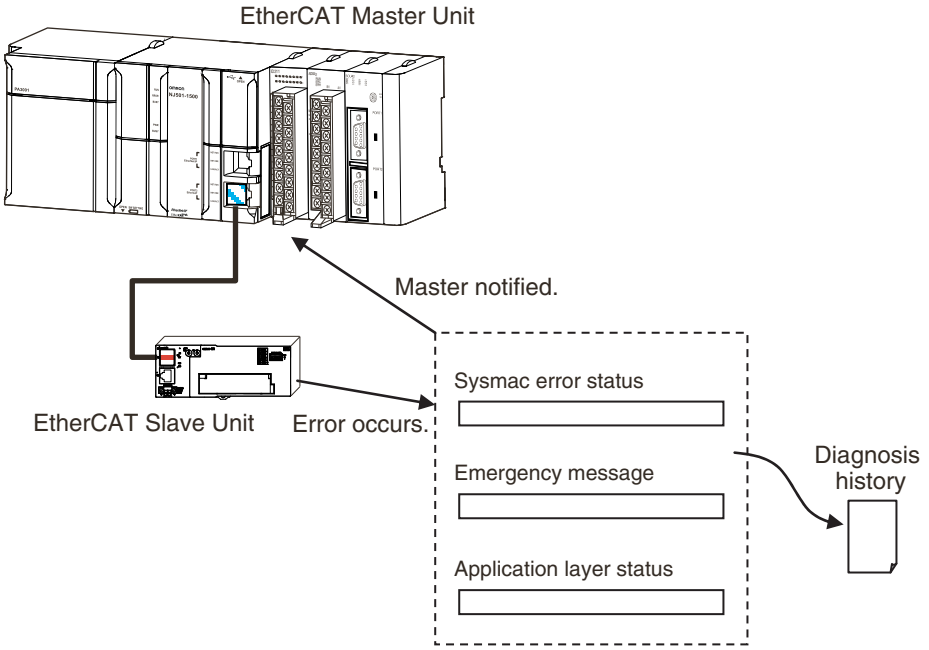
[PWR] indicator	[L/A IN] [L/A OUT] LED	[RUN] indicator	[ERR] indicator	Description	Actions
On	–	SF	SF	Synchronization error (in operation)	After checking the following items, restart the Slave Unit according to the specification of connected EtherCAT Master Unit. • Is the communications cable wired correctly? • Is the communications cable exposed to excessive noise? • Review set time of Communication Error Setting . If this does not improve, the Slave Unit hardware may be damaged. Replace the applicable Slave Unit.

8-1-2 Errors Unique to E3X-ECT

Symptom	Cause	Measures
Some functions are not reflected even after parameters have been set.	The functions enabled by recycling the power were changed.	Turn ON Slave Unit power supply again after changing the setting.
SS LED lights red	Nmber of sensors setting is deffernt from Number of connecting sensors	Set correct number of sensors setting
		When use dummy sensror setting, Set nember of sensors setting as include dummysensors.
		Amplifire connecting is wrong, Check the connecting of E3X-ECT and amplifires.
		If this does not improve, the amplifire hardware may be damaged. Replace the applicable amplifire.

8-1-3 Error Notification Methods and Types

This section describes the notification methods for errors that occur in the Slave Units.



Error notification type	Description	Notification method	Page
Sysmac error status	Notification is provided when an error is detected in the application. These errors are displayed only on the OMRON Sysmac Studio Support Software.	Error status is received by the TxPDO and the master is notified of errors every cycle.	9-14
Emergency messages	Notification is provided of application-level errors. Either CiA-defined error codes are used or error codes are added to vendor-specific areas.	The slave notifies the master when an error occurs.	15
Application layer status	Notification is provided of errors in EtherCAT communications. The error notification method and error codes that are defined by ETG are used.	The master is notified by writing to the application layer status register when an error occurs.	16

8-1-4 Sysmac Error Status Codes

A table that describes the error event codes that are displayed on the Sysmac Studio is given below. Unit version 1.1 or later is required.

Error List

The errors (i.e., events) that can occur in the E3X-ECT EtherCAT Slave Unit are given on the following pages. Event levels are given as following in the tables:
Maj: Major fault level
Prt: Partial fault level
Min: Minor fault level
Obs: Observation
Info: Information
Refer to the *NJ-series Troubleshooting Manual* (Cat. No. W503) for all of the event codes that may occur in an NJ-series Controller.

Event code	Event name	Meaning	Assumed cause	Level					Reference
				Maj	Prt	Min	Obs	Info	
04C40000 hex	Sensor Communications Error	An error occurred in a Sensor connection.	• The Sensor is disconnected.			Ö			11
04C50000 hex	Sensor Communications Has Not Been Established	Communications has not been established with the Sensor.	• A sensor is not connected.			Ö			11
14A00000 hex	Non-volatile Memory Checksum Error	An error occurred in the control parameters.	• Noise			Ö			12
24780000 hex	Number of Sensors Verify Error	The number of Sensors that is connected does not agree with the settings.	• The set value does not match the number of Sensors that are actually connected.			Ö			12
24790000 hex	Number of Sensors Over Limit	Too many Sensors are connected.	• More than the maximum number of Sensors are connected.			Ö			13
34F80000 hex	Dummy Sensors Setting Error	Too many Dummy Units are set.	• There are too many Dummy Units set, so some Sensors are not assigned logical unit numbers.			Ö			13
04A10000 hex	Non-volatile Memory Hardware Error	An error occurred in non-volatile memory.	• Non-volatile memory failure				Ö		14

Error Descriptions

This section describes the information that is given for individual errors.

● Controller Error Descriptions

The items that are used to describe individual errors (events) are described in the following copy of an error table.

<table>
<tr><td>Event name</td><td colspan="2">Gives the name of the error (event).</td><td>Event code</td><td colspan="2">Gives the code of the error (event).</td></tr>
<tr><td>Meaning</td><td colspan="5">Gives a short description of the error (event).</td></tr>
<tr><td>Source</td><td colspan="2">Gives the source of the error (event).</td><td>Source details</td><td>Gives details on the source of the error.</td><td>Detection timing</td><td>Tells when the error is detected.</td></tr>
<tr><td>Error attributes</td><td>Level</td><td>Tells the influence on control.*1</td><td>Recovery</td><td>Gives the recovery method.*2</td><td>Log category</td><td>Tells which log the error is saved in.*3</td></tr>
<tr><td>Effects</td><td>User program</td><td>Tells what will happen to execution of the user program.*4</td><td>Operation</td><td colspan="3">Provides special information on the operation that results from the error (event).</td></tr>
<tr><td>Indicators</td><td colspan="6">Gives the status of the built-in EtherNet/IP port and built-in EtherCAT port indicators. Indicator status is given only for errors in the EtherCAT Master Function Module and the EtherNet/IP Function Module.</td></tr>
<tr><td rowspan="2">System-defined variables</td><td colspan="2">Variable</td><td>Data type</td><td colspan="3">Name</td></tr>
<tr><td colspan="5">Lists the variable names, data types, and meanings for system-defined variables that provide direct error notification, that are directly affected by the error, or that contain settings that cause the error.</td></tr>
<tr><td rowspan="2">Cause and correction</td><td colspan="2">Assumed cause</td><td>Remedy</td><td colspan="3">Prevention</td></tr>
<tr><td colspan="5">Lists the possible causes, remedies, and preventive measures for the error (event).</td></tr>
<tr><td>Attached information</td><td colspan="6">Provides the additional information that is displayed by the Sysmac Studio or an NS-series PT.</td></tr>
<tr><td>Precautions/ Remarks</td><td colspan="6">Provides precautions, restrictions, and supplemental information.</td></tr>
</table>

*1 One of the following:
Major fault: Major fault level
Partial fault: Partial fault level
Minor fault: Minor fault level
Observation
Information

*2 One of the following:
Automatic recovery: Normal status is restored automatically when the cause of the error is removed.
Error reset: Normal status is restored when the error is reset after the cause of the error is removed.
Cycle the power supply: Normal status is restored when the power supply to the Controller is turned OFF and then back ON after the cause of the error is removed.
Controller reset: Normal status is restored when the Controller is reset after the cause of the error is removed.
Depends on cause: The recovery method depends on the cause of the error.

*3 One of the following:
System: System event log
Access: Access event log

*4 One of the following:
Continues: Execution of the user program will continue.
Stops: Execution of the user program stops.
Starts: Execution of the user program starts.

Error Descriptions

Event name	Sensor Communications Error			Event code	04C40000 hex	
Meaning	An error occurred in a Sensor connection.					
Source	EtherCAT Master Function Module		Source details	Slave	Detection timing	Continuously
Error attributes	Level	Minor fault	Recovery	Error reset (after resetting slave or cycling the power)	Log category	System
Effects	User program	Continues.	Operation	Input is not possible from the Sensor. The input data will be 0.		
Indicators	EtherCAT NET RUN		EtherCAT NET ERR		EtherCAT LINK/ACT	
	---		---		---	
System-defined variables	Variable		Data type		Name	
	None		---		---	
Cause and correction	Assumed cause		Correction		Prevention	
	The Sensor is disconnected.		Reconnect the Sensor and then reset the Sensor or cycle the power supply.		Connect the Sensor securely.	
Attached information	None					
Precautions/ Remarks	None					

Event name	Sensor Communications Has Not Been Established			Event code	04C50000 hex	
Meaning	Communications has not been established with the Sensor.					
Source	EtherCAT Master Function Module		Source details	Slave	Detection timing	When establishing communications after turning ON power to the slave or after resetting the Sensor.
Error attributes	Level	Minor fault	Recovery	Error reset (after automatic slave recovery)	Log category	System
Effects	User program	Continues.	Operation	The input data will be 0. Safe-operational state and Operational state cannot be entered.		
Indicators	EtherCAT NET RUN		EtherCAT NET ERR		EtherCAT LINK/ACT	
	---		---		---	
System-defined variables	Variable		Data type		Name	
	None		---		---	
Cause and correction	Assumed cause		Correction		Prevention	
	A sensor is not connected.		Connect at least one Sensor.		Connect at least one Sensor.	
Attached information	None					
Precautions/ Remarks	None					

Event name	Non-volatile Memory Checksum Error			Event code	14A00000 hex	
Meaning	An error occurred in the control parameters.					
Source	EtherCAT Master Function Module		Source details	Slave	Detection timing	When establishing communications after turning ON power to the slave
Error attributes	Level	Minor fault	Recovery	Error reset (after cycling slave power)	Log category	System
Effects	User program	Continues.	Operation	The slave's I/O communications stop and the outputs turn OFF.		
Indicators	EtherCAT NET RUN		EtherCAT NET ERR		EtherCAT LINK/ACT	
	---		Flashes at 1-s intervals.		---	
System-defined variables	Variable		Data type		Name	
	None		---		---	
Cause and correction	Assumed cause		Correction		Prevention	
	Noise		Return the control parameters to their default settings using restore parameters (1011 hex) of the EtherCAT Slave.		Implement noise countermeasures.	
Attached information	None					
Precautions/ Remarks	None					

Event name	Number of Sensors Verify Error			Event code	24780000 hex	
Meaning	The number of Sensors that is connected does not agree with the settings.					
Source	EtherCAT Master Function Module		Source details	Slave	Detection timing	Continuously
Error attributes	Level	Minor fault	Recovery	Error reset (after resetting slave or cycling the power)	Log category	System
Effects	User program	Continues.	Operation	Operation continues with the Sensors that are actually connected.		
Indicators	EtherCAT NET RUN		EtherCAT NET ERR		EtherCAT LINK/ACT	
	---		---		---	
System-defined variables	Variable		Data type		Name	
	None		---		---	
Cause and correction	Assumed cause		Correction		Prevention	
	The set value does not match the number of Sensors that are actually connected.		If the setting of the number of connected Sensors is incorrect, correct the set value. If the number of Sensors that are connected is incorrect, correct the Sensor connections and reset the Sensors or cycle the power supply.		Make sure that the setting of the number of connected Sensors agrees with the number of Sensors that are actually connected.	
Attached information	None					
Precautions/ Remarks	None					

Event name	Number of Sensors Over Limit			Event code	24790000 hex	
Meaning	Too many Sensors are connected.					
Source	EtherCAT Master Function Module		Source details	Slave	Detection timing	Continuously
Error attributes	Level	Minor fault	Recovery	Error reset (after automatic slave recovery)	Log category	System
Effects	User program	Continues.	Operation	The relevant slave will go to the Init state. I/O communications and message communications are not possible for the relevant slave.		
Indicators	EtherCAT NET RUN		EtherCAT NET ERR		EtherCAT LINK/ACT	
	---		---		---	
System-defined variables	Variable		Data type		Name	
	None		---		---	
Cause and correction	Assumed cause		Correction		Prevention	
	More than the maximum number of Sensors are connected.		This event occurs when the cause of the error is removed and communications for the relevant slave recover. Simply reset the error in the Controller.		Do not connect more than the maximum number of Sensors.	
Attached information	None					
Precautions/ Remarks	None					

Event name	Dummy Sensors Setting Error			Event code	34F80000 hex	
Meaning	Too many Dummy Units are set.					
Source	EtherCAT Master Function Module		Source details	Slave	Detection timing	When establishing communications
Error attributes	Level	Minor fault	Recovery	Errors reset	Log category	System
Effects	User program	Continues.	Operation	Not affected.		
Indicators	EtherCAT NET RUN		EtherCAT NET ERR		EtherCAT LINK/ACT	
	---		---		---	
System-defined variables	Variable		Data type		Name	
	None		---		---	
Cause and correction	Assumed cause		Correction		Prevention	
	There are too many Dummy Units set, so some Sensors are not assigned logical unit numbers.		Reduce the number of Dummy Units that is set in the dummy function settings so that logical unit numbers can be assigned to all connected Sensors, and then change the Sensors from the Init state to Pre-operational state or restart the Sensors.		Set Dummy Units so that logical unit numbers can be assigned to all Sensor Amplifiers that are connected.	
Attached information	None					
Precautions/ Remarks	None					

Event name	Non-volatile Memory Hardware Error			Event code	04A10000 hex	
Meaning	An error occurred in non-volatile memory.					
Source	EtherCAT Master Function Module		Source details	Slave	Detection timing	When establishing communications after turning ON power to the slave
Error attributes	Level	Observation	Recovery	---	Log category	System
Effects	User program	Continues.	Operation	Non-volatile memory cannot be written.		
Indicators	EtherCAT NET RUN		EtherCAT NET ERR		EtherCAT LINK/ACT	
	---		---		---	
System-defined variables	Variable		Data type		Name	
	None		---		---	
Cause and correction	Assumed cause		Correction		Prevention	
	Non-volatile memory failure		Replace the EtherCAT Communications Unit or the EtherCAT slave.		None	
Attached information	None					
Precautions/ Remarks	This error is not recorded in the error log of the slave.					

8-1-5 Emergency Error Code

The table below shows types of emergency error codes used in E3X-ECT EtherCAT Sensor Communication Units and corresponding error contents.

Error codes common to E3X-ECT EtherCAT Sensor Communication Units

Error code	Name of error	Contents	Diagnosis history	Notification to EtherCAT Master Unit	Measures
5530 hex	Non-volatile Memory Hardware Error	A timeout was detected when writing data to non-volatile memory during EtherCAT communications.	Not saved	Can be notified	Write the data again.
6140 hex	Slave Unit Verification Error	At turning ON the power supply, a verification error occurred on the Slave Unit information stored in the Slave Unit.	Saved	Cannot be notified	If the error occurs even after restarting the power supply, the Slave Unit is damaged. Replace the Slave Unit.
6330 hex	Non-volatile Memory Checksum Error	An error occurred in non-volatile memory data in the Slave Unit.	Saved	Can be notified	A non-volatile memory data error occurred. Initialize non-volatile memory from a Configuration Tool or with SDO communications, and then restart the Slave Unit. (Target indexes: 1011 hex Restore default parameters (parameter restore))
7030 hex	Slave Hardware Error	A hardware error occurred in the EtherCAT communications area.	Saved	Cannot be notified	If the error occurs even after restarting the power supply, the Slave Units is damaged. Replace the Slave Units.

8-1-6 Application Layer Status Codes

The AL status codes that are used by the E3X-ECT EtherCAT Sensor Communication Units are described in the following table.

AL status codes of E3X-ECT EtherCAT Sensor Communication Units

AL status code	Name of error	Contents	Diagnosis history	Notification to EtherCAT Master Unit	Measures
0001 hex	Non-volatile Memory Control Data Error	An error was detected in non-volatile memory data in the Slave Unit.	Saved	Can be notified	Initialize non-volatile memory (execute restore parameter), and then restart the Slave Unit.
0011 hex	Illegal State Transition Request Received	An illegal state transition request was received.	Not saved	Can be notified	None
0012 hex	Error State Transition Received	A transition request to an unknown state was received.	Not saved	Can be notified	None
0014 hex	Slave Unit Verification Error	A verification error occurred in the slave information stored in the Slave Units when the power supply was turned ON.	Saved	Can be notified	If cycling the power supply does not solve the problem, the Slave Unit has failed. Replace the Slave Unit.
0016 hex	Mailbox Setting Error	An incorrect setting was detected in the mailbox of the Sync Manager.	Not saved	Can be notified	Check the mailbox settings in the Master Unit.
001B hex	Process Data WDT Error	A timeout was detected for an I/O data transmission frame.	Not saved	Can be notified	Check the WDT settings in the Master Unit.
001D hex	RxPDO Setting Error	An error was detected in the RxPDO settings (e.g., a logic setting error in the Sync Manager).	Not saved	Can be notified	Check the Sync Manager settings in the Master Unit.
001E hex	TxPDO Setting Error	An error was detected in the TxPDO settings (e.g., a logic setting error in the Sync Manager).	Not saved	Can be notified	Check the Sync Manager settings in the Master Unit.
001F hex	PDO WDT Setting Error	An incorrect PDO WDT setting was detected.	Not saved	Can be notified	Check the WDT settings in the Master Unit.
0024 hex	TxPDO Assignment Error	An incorrect TxPDO setting was made (e.g., an index, subindex, or size that is out of range was registered).	Not saved	Can be notified	Check the TxPDO assignment settings in the Master Unit.
0025 hex	RxPDO Assignment Error	An incorrect RxPDO setting was made (e.g., an index, subindex, or size that is out of range was registered).	Not saved	Can be notified	Check the RxPDO assignment settings in the Master Unit.
002C hex	Synchronization Error	The SYNC0 interrupt stopped during operation in Operational state.	Not saved	Can be notified	Check the synchronization settings. (Encoder Input Slave Units only)

AL status code	Name of error	Contents	Diagnosis history	Notification to EtherCAT Master Unit	Measures
002D hex	SYNC Signal Not Received	No SYNC0 signals have been received since entering DC mode.	Not saved	Can be notified	Check the synchronization settings. (Encoder Input Slave Units only)

8-2 Equipment Maintenance

This section describes routine equipment maintenance, in particular cleaning methods, inspection methods, and handling methods when replacing Slave Units.

8-2-1 Cleaning

Perform the following cleaning regularly to ensure the equipment is kept in the best condition possible.

- Wipe the equipment over with a soft, dry cloth when doing daily cleaning.
- If dirt remains even after wiping with a soft, dry cloth, wipe over with a cloth that has been wet with a sufficiently diluted detergent (2%) and wrung dry.
- Units will become stained if items such as rubber or vinyl products or adhesive tape are left on the Unit for a long period. Remove such items during regular cleaning.

Precautions for Correct Use

Never use benzene, thinners, or other volatile solvents, or chemical cloths.
The unit coating may change if these products are used.

8-2-2 Inspections

Always perform periodic inspections to ensure the equipment is kept in the best possible condition.
Periodic inspections should occur every 6 months to a year.
Periodic inspections should occur more frequently, however, for Units that are used in environments subject to high temperatures, high humidity, or a lot of dust.

Materials required for inspections

The following materials are required to perform periodic inspections.

● Materials used regularly

- Phillips screwdrivers and flat-blade screwdrivers
- Screwdrivers for communications connectors
- Testers (or digital voltmeters)
- Industrial alcohol and pure cotton cloth

● Materials sometimes required

- Synchroscope
- Pen oscilloscope
- Thermometer and hygrometer

Inspection item

Periodically inspect the following items to ensure that they do not deviate from the criteria.
If the items deviate from the criteria, adjust the environment so the criteria are met or adjust the Unit itself.

Inspection item	Inspection details	Criteria	Inspection method
Environment	Are the ambient and in-panel temperatures appropriate?	−10 to 55°C	Thermometer
	Is the ambient and in-panel humidity appropriate?	25 to 85% (with no condensation)	Hygrometer
	Has dust collected?	No dust	Visual inspection
Installation	Has the Slave Unit been secured?	No looseness	Phillips screwdriver
	Are the communications cable connectors inserted properly?	No looseness	Visual inspection
	Are the external wiring screws loose?	No looseness	Phillips screwdriver
	Are the connection cables damaged?	No visible damage	Visual inspection

8-2-3 Handling when Replacing Units

Networks are constructed from an EtherCAT Master Unit and Slave Units.
If a Unit is malfunctioning, the entire network will be affected. The malfunctioning Unit must be replaced quickly.
To restore network functions as quickly as possible, it is recommended that spare Units are kept on hand ready to replace malfunctioning Units immediately.

Precautions when replacing Units

Heed the following precautions when replacing nodes after a periodic inspection has revealed a problem.

- Check that the new Unit does not have errors after replacement.
- If returning malfunctioning devices for repair, attach a detailed description of the malfunction to the device and send the device to the OMRON representative listed at the end of this manual or to your OMRON representative.
- If contacts are defective, wipe them with a clean pure cotton cloth that has been soaked in industrial alcohol.

Settings after Unit replacement

After replacing a Unit, make the switch and other settings the same as before the Unit was replaced.

A

Appendix

A-1 Object Dictionary

A-1-1 Object Dictionary Area

The CAN application protocol over EtherCAT (CoE) protocol uses the object dictionary of CAN application protocol as its base. Each object is assigned with an index of four-digit hexadecimal value. The indexes are configured in the areas below.

Indexes	Area	Contents
0000 hex-0FFF hex	Data Type area	Definitions of data types
1000 hex-1FFF hex	CoE Communications area	Definitions of variables that can be used by all servers for designated communications
2000 hex-2FFF hex	Manufacturer Specific area 1	Variables defined for all OMRON products
3000 hex-5FFF hex	Manufacturer Specific area 2	Variables defined for E3X-ECT EtherCAT Sensor Communication Units
6000 hex-9FFF hex	Device Profile area	Variables defined for CiA401 generic I/O module device profiles (profile specifying the CAN application protocol interface for devices with digital I/Os and analog I/Os)
A000 hex-FFFF hex	Reserved area	Area reserved for future use

A-1-2 Data Types

This profile uses the following data types.

Data Types	Code	Size	Range
Boolean	BOOL	1 bit	true(1), false(0)
Unsigned8	U8	1 byte	0 to 255
Unsigned16	U16	2 bytes	0 to 65535
Unsigned32	U32	4 bytes	0 to 4294967295
Integer8	INT8	1 byte	−128 to 127
Integer16	INT16	2 bytes	−32768 to 32767
Integer32	INT32	4 bytes	−2147483648 to 2147483647
Visible string	VS	−	−

A-1-3 Object Description Format

In this manual, objects are described in the following format.

Object description format

<Index>	<Object name>		
Range: <Setting Range>	Unit: <Unit>	Default: <Default setting>	Attribute: <Data attribute>
Size: <Size>	Access: <Access>	PDO map: <Possible/Not possible>	

Object description format with Sub-indexes

<Index>	<Object name>		
Sub-index 0			
Range: <Setting Range>	Unit: <Unit>	Default: <Default setting>	Attribute: <Data attribute>
Size: <Size>	Access: <Access>	PDO map: <Possible/Not possible>	
•			
•			
•			
Sub-index N			
Range: <Setting Range>	Unit: <Unit>	Default: <Default setting>	Attribute: <Data attribute>
Size: <Size>	Access: <Access>	PDO map: <Possible/Not possible>	

The following values are indicated within the pointed brackets <>.

Indexes : An object index given by a four-digit hexadecimal number
Object name : The object name
Range : The possible Range of settings
Unit : Physical unit
Default : Default value set before product shipment
Attribute : The timing when a change is updated in a writable object
  A: Always enabled
  B: Timing of count stop → operation (Encoder Input Slave Unit only)
  C: Timing of pre-operational state → safe-operational state
  D: Timing of pre-operational state → init state
  R: Updated after the power supply is reset
  -: Read only
Size : The object size is given in bytes
Access : Indicates whether the object is read only, or read and write
  RO: Read only
  RW: Read and write
PDO map : Indicates the PDO mapping possibility

A-1-4 Communication Objects

1000 hex	Device Type		
Range: –	Unit: –	Default: 00****** hex	Attribute: –
Size: 4 bytes (U32)	Access: RO	PDO map: Not possible	

- Indicates the CoE device profile number.

Bits	Name	Contents
0-15	Device profile number	Differ by Slave Unit types*
16-23	Type	Differ by Slave Unit types*
25-31	Mode	0: Manufacturer specific

1001 hex	Error Register		
Range: –	Unit: –	Default: 00 hex	Attribute: –
Size: 1 byte (U8)	Access: RO	PDO map: Not possible	

- Indicates the error type that occurs in a Slave Unit.
- The error kind is allocated in each bit as follows.
  It becomes "0:There is no error" and "1:The error is occurring".

Bits	Name	Bits	Name
0	Generic error	4	Communications error
1	Current error	5	Device profile specific error
2	Voltage error	6	(Reserved)
3	Temperature error	7	Manufacturer specific error

1008 hex	Manufacturer Device Name		
Range: –	Unit: –	Default: Differ by Slave Unit types*	Attribute: –
Size: 20 bytes (VS)	Access: RO	PDO map: Not possible	

- Indicates the Slave Unit model number.

1009 hex	Manufacturer Hardware Version		
Range: –	Unit: –	Default: Differ by Slave Unit types*	Attribute: –
Size: 20 bytes (VS)	Access: RO	PDO map: Not possible	

- Indicates the version of the Slave Unit hardware.

100A hex	Manufacturer Software Version		
Range: –	Unit: –	Default: Differ by Slave Unit types*	Attribute: –
Size: 20 bytes (VS)	Access: RO	PDO map: Not possible	

- Indicates the version of the Slave Unit software.

1011 hex	Restore Default Parameters		
Sub-index 0: Number of entries			
Range: –	Unit: –	Default: 01 hex	Attribute: –
Size: 1 byte (U8)	Access: RO	PDO map: Not possible	
Sub-index 1: Restore Default Parameters			
Range: –	Unit: –	Default: 00000001 hex	Attribute: A
Size: 4 bytes (U32)	Access: RW	PDO map: Not possible	

- Resets the parameters to their default values.
- The parameter is reset only when a specific value is written to Sub-index 1. This prevents parameter values from being accidentally overwritten.
- The specific value is "load".

MSB			LSB
d	a	o	l
64 hex	61 hex	6F hex	6C hex

- The ABORT code is displayed if a value other than the specific is written.
- A value 0000 0001 hex (command valid) is indicated when reading.

1018 hex	Identity Object		
Sub-index 0: Number of entries			
Range: –	Unit: –	Default: 04 hex	Attribute: –
Size: 1 byte (U8)	Access: RO	PDO map: Not possible	
Sub-index 1: Vendor ID			
Range: –	Unit: –	Default: 00000083 hex	Attribute: –
Size: 4 bytes (U32)	Access: RO	PDO map: Not possible	
Sub-index 2: Product Code			
Range: –	Unit: –	Default: Differ by Slave Unit types*	Attribute: –
Size: 4 bytes (U32)	Access: RO	PDO map: Not possible	
Sub-index 3: Revision Number			
Range: –	Unit: –	Default: Differ by Slave Unit types*	Attribute: –
Size: 4 bytes (U32)	Access: RO	PDO map: Not possible	
Sub-index 4: Serial Number			
Range: –	Unit: –	Default: Each Unit	Attribute: –
Size: 4 bytes (U32)	Access: RO	PDO map: Not possible	

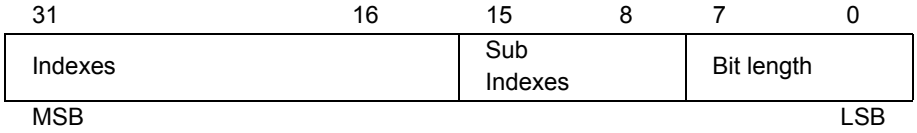
- Indicates the device information.
- Sub-index 1(Vendor ID) gives the manufacturer identifier.
- Sub-index 2 (Product Code) gives the value assigned to each Slave Unit type.
- Sub-index 3 (Revision Number) gives the Unit revision number.
  Bits 0 to 15: Minor revision number of the device
  Bits 16 to 31: Major revision number of the device
- Sub-index 4 (Serial Number) gives a serial number for each product.

10F3 hex	Diagnosis History		
Sub-index 0: Number of entries			
Range: –	Unit: –	Default: 0D hex	Attribute: –
Size: 1 byte (U8)	Access: RO	PDO map: Not possible	
Sub-index 1: Maximum Messages			
Range: –	Unit: –	Default: 00 hex	Attribute: –
Size: 1 byte (U8)	Access: RO	PDO map: Not possible	
Sub-index 2: Newest Message			
Range: –	Unit: –	Default: –	Attribute: –
Size: 1 byte (U8)	Access: RO	PDO map: Not possible	
Sub-index 5: Flags			
Range: 0000 hex- 0001 hex	Unit: –	Default: 0000 hex	Attribute: –
Size: 2 bytes (U16)	Access: RW	PDO map: Not possible	
Sub-index 6 to 13: Diagnosis Message 1-8			
Range: –	Unit: –	Default: –	Attribute: –
Size: 23 bytes (VS)	Access: RO	PDO map: Not possible	

- This object indicates up to 8 diagnosis histories. It also sets whether to notify emergency messages or not.
- Sub-index 1 (Maximum Messages) gives the number of error messages.
- Sub-index 2 (Newest Messages) gives the Sub-index number the latest message in the diagnosis history.
- Sub-index 5 (Flags) is the control flag of diagnosis history. It specifies whether or not to notify error messages via emergency messages. Setting 0001 hex means to notify. It is set to 0001 hex (Emergency notify) when power is turned ON. At startup, the setting is 0000 hex (no emergency notification).
- Sub-indexes 6 to 13 (Diagnosis messages 1 to 8) indicate the diagnosis history.
  From Sub-index 6 (Diagnosis message 1) to Sub-index 13 (Diagnosis message 8) are stored 8 errors. The 9th error and onward are stored from the Sub-index 6 (Diagnosis message 1) again.

A-1-5 PDO Mapping Object

Indexes 1600 hex to 17FF hex are used for Receive PDO mapping, and indexes 1A00 hex to 1BFF hex are used for Transmit PDO mapping. Sub-indexes after Sub-index 1 provide information about the application object being mapped.



Bits 0 to 7 : Bit length of the mapped object.
(For example, for 32 bits, 20 hex is given.)
Bits 8 to 15 : Sub-index of the mapped object.
Bits 16 to 31 : Index of the mapped object.

1B00Hex	257th transmit PDO Mapping		
Sub-index0: Number of objects			
Range: -	Unit: -	Default: 01Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO Map: Disable	
Sub-index1: 1st Input Object to be mapped			
Range: -	Unit: -	Default: 61000110Hex	Attribute: -
Size: 4byte(U32)	Access: RO	PDO Map: Disable	

1B01Hex	258th transmit PDO Mapping		
Sub-index0: Number of objects			
Range: -	Unit: -	Default: 01Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO Map: Disable	
Sub-index1: 1st Input Object to be mapped			
Range: -	Unit: -	Default: 61000210Hex	Attribute: -
Size: 4byte(U32)	Access: RO	PDO Map: Disable	

1B02Hex	259th transmit PDO Mapping		
Sub-index0: Number of objects			
Range: -	Unit: -	Default: 01Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO Map: Disable	
Sub-index1: 1st Input Object to be mapped			
Range: -	Unit: -	Default: 61000310Hex	Attribute: -
Size: 4byte(U32)	Access: RO	PDO Map: Disable	

1B03Hex	260th transmit PDO Mapping		
Sub-index0: Number of objects			
Range: -	Unit: -	Default: 01Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO Map: Disable	
Sub-index1: 1st Input Object to be mapped			
Range: -	Unit: -	Default: 61000410Hex	Attribute: -
Size: 4byte(U32)	Access: RO	PDO Map: Disable	

1B04Hex	261st transmit PDO Mapping		
Sub-index0: Number of objects			
Range: -	Unit: -	Default: 10Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO Map: Disable	
Sub-index1?16: 1st?16th Input Object to be mapped			
Range: -	Unit: -	Default: 30200101Hex 30200201Hex 30200301Hex --- 30200F01Hex 30201001Hex	Attribute: -
Size: 4byte(U32)	Access: RO	PDO Map: Disable	

1B05Hex	262nd transmit PDO Mapping		
Sub-index0: Number of objects			
Range: -	Unit: -	Default: 10Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO Map: Disable	
Sub-index1?16: 1st?16th Input Object to be mapped			
Range: -	Unit: -	Default: 30201101Hex 30201201Hex 30201301Hex --- 30201F01Hex 30202001Hex	Attribute: -
Size: 4byte(U32)	Access: RO	PDO Map: Disable	

1B06Hex	263rd transmit PDO Mapping		
Sub-index0: Number of objects			
Range: -	Unit: -	Default: 10Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO Map: Disable	
Sub-index1?16: 1st?16th Input Object to be mapped			
Range: -	Unit: -	Default: 30202101Hex 30202201Hex 30202301Hex --- 30202F01Hex 30203001Hex	Attribute: -

1B07Hex	264th transmit PDO Mapping		
Sub-index0: Number of objects			
Range: -	Unit: -	Default: 10Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO Map: Disable	
Sub-index1?16: 1st?16th Input Object to be mapped			
Range: -	Unit: -	Default: 30203101Hex 30203201Hex 30203301Hex --- 30203F01Hex 30204001Hex	Attribute: -

1B08Hex	265th transmit PDO Mapping		
Sub-index0: Number of objects			
Range: -	Unit: -	Default: 01Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO Map: Disable	
Sub-index1: 1st Input Object to be mapped			
Range: -	Unit: -	Default: 300A0108Hex	Attribute: -
Size: 4byte(U32)	Access: RO	PDO Map: Disable	

1B09Hex	266th transmit PDO Mapping		
Sub-index0: Number of objects			
Range: -	Unit: -	Default: 02Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO Map: Disable	
Sub-index1: 1st Input Object to be mapped			
Range: -	Unit: -	Default: 30000101Hex	Attribute: -
Size: 4byte(U32)	Access: RO	PDO Map: Disable	
Sub-index2: 2nd Input Object to be mapped			
Range: -	Unit: -	Default: 30000201Hex	Attribute: -
Size: 4byte(U32)	Access: RO	PDO Map: Disable	

1B0AHex	267th transmit PDO Mapping		
Sub-index0: Number of objects			
Range: -	Unit: -	Default: 02Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO Map: Disable	
Sub-index1: 1st Input Object to be mapped			
Range: -	Unit: -	Default: 30010108Hex	Attribute: -
Size: 4byte(U32)	Access: RO	PDO Map: Disable	
Sub-index2: 2nd Input Object to be mapped			
Range: -	Unit: -	Default: 30010208Hex	Attribute: -
Size: 4byte(U32)	Access: RO	PDO Map: Disable	

1B10Hex 1B11Hex 1B12Hex ???? 1B4BHex	273th?332nd transmit PDO Mapping		
Sub-index0: Number of objects			
Range: -	Unit: -	Default: 01Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO Map: Disable	
Sub-index1: 1st Input Object to be mapped			
Range: -	Unit: -	Default: 40010110Hex 40010210Hex 41810110Hex 41810210Hex --- 4E810110Hex 4E810210Hex	Attribute: -
Size: 4byte(U32)	Access: RO	PDO Map: Disable	

1BFFHex	512ndth transmit PDO Mapping		
Sub-index0: Number of objects			
Range: -	Unit: -	Default: 01Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO Map: Disable	
Sub-index1: 1st Input Object to be mapped			
Range: -	Unit: -	Default: 20020108Hex	Attribute: -
Size: 4byte(U32)	Access: RO	PDO Map: Disable	

A-1-6 Sync Manager Communication Object

The communication memory of EtherCAT is set by the objects from 1C00 hex to 1C13 hex.

1C00 hex	Sync Manager Communication Type		
Sub-index 0: Number of used SM channels			
Range: –	Unit: –	Default: 04 hex	Attribute: –
Size: 1 byte (U8)	Access: RO	PDO map: Not possible	
Sub-index 1: Communication Type Sync Manager 0			
Range: –	Unit: –	Default: 01 hex	Attribute: –
Size: 4 bytes (U8)	Access: RO	PDO map: Not possible	
Sub-index 2: Communication Type Sync Manager 1			
Range: –	Unit: –	Default: 02 hex	Attribute: –
Size: 4 bytes (U8)	Access: RO	PDO map: Not possible	
Sub-index 3: Communication Type Sync Manager 2			
Range: -	Unit: -	Default: 03 hex	Attribute: -
Size: 4 bytes (U8)	Access: RO	PDO map: Not possible	
Sub-index 4: Communication Type Sync Manager 3			
Range: -	Unit: -	Default: 04 hex	Attribute: -
Size: 4 bytes (U8)	Access: RO	PDO map: Not possible	

- The sync manager has the following settings.
  - SM0 : Mailbox receive (EtherCAT Master Unit to Slave Unit)
  - SM1 : Mailbox transmit (EtherCAT Slave Unit to Master Unit)
  - SM2 : Process data output (EtherCAT Master Unit to Slave Unit)
  - SM3 : Process data input (EtherCAT Slave Unit to Master Unit)

1C10 hex	Sync Manager 0 PDO Assignment		
Sub-index 0: Number of assigned PDOs			
Range: 00 hex	Unit: –	Default: 00 hex	Attribute: –
Size: 1 byte (U8)	Access: RO	PDO map: Not possible	

- It indicates the number of PDO mappings used by this sync manager.
- Mailbox reception sync manager does not have PDOs.

1C11 hex	Sync Manager 1 PDO Assignment		
Sub-index 0: Number of assigned PDOs			
Range: 00 hex	Unit: –	Default: 00 hex	Attribute: –
Size: 1 byte (U8)	Access: RO		PDO map: Not possible

- It indicates the number of PDO mappings used by this sync manager.
- Mailbox transmit sync manager does not have PDOs.

1C12 hex	Sync Manager 2 PDO Assignment		
Sub-index 0: Number of assigned PDOs			
Range: 00 hex to 08 hex	Unit: –	Default: Differ by Slave Unit types*	Attribute: –
Size: 1 byte (U8)	Access: RW*		PDO map: Not possible
Sub-index 1 to 8: 1st-8th PDO Mapping Object Index of assigned PDO			
Range: 1600 hex to 17FF hex	Unit: –	Default: Differ by Slave Unit types*	Attribute: –
Size: 2 bytes (U16)	Access: RW*		PDO map: Not possible

* "RO" is set if there is no RxPDO.

- It indicates the RxPDOs used by this sync manager.

1C13 hex	Sync Manager 3 PDO Assignment		
Sub-index 0: Number of assigned PDOs			
Range: 00 hex to 08 hex	Unit: –	Default: Differ by Slave Unit types*	Attribute: –
Size: 1 byte (U8)	Access: RW*		PDO map: Not possible
Sub-index 1 to 8: 1st-8th PDO Mapping Object Index of assigned PDO			
Range: 1A00 hex to 1BFF hex	Unit: –	Default: Differ by Slave Unit types*	Attribute: –
Size: 2 bytes (U16)	Access: RW*		PDO map: Not possible

* "RO" is set if there is no TxPDO.

- It indicates the TxPDOs used by this sync manager.

* The default settings for Sync Manager 2 PDO Assignment and Sync Manager 3 PDO Assignment are different for OMRON software and software from other companies. The default settings are given in the following table.

Default Settings for OMRON Software Sysmac Studio

Sync manager 2 PDO assignment		Sync manager 3 PDO assignment					
Number of assigned RxPDOs	Assigned PDO	Number of assigned TxPDOs	Assigned PDO				
			1	2	3	4	4
00Hex	-	05Hex	1B00Hex	1B01Hex	1B08Hex	1B0AHex	1BFFHex

Default Settings for OMRON Software CX-Programmer

Sync manager 2 PDO assignment		Sync manager 3 PDO assignment				
Number of assigned RxPDOs	Assigned PDO	Number of assigned TxPDOs	Assigned PDO			
			1	2	3	4
00Hex	-	04Hex	1B00Hex	1B00Hex	1B09Hex	1B0AHex

Default Settings for Other COmpony tool

Sync manager 2 PDO assignment		Sync manager 3 PDO assignment				
Number of assigned RxPDOs	Assigned PDO	Number of assigned TxPDOs	Assigned PDO			
			1	2	3	4
00Hex	-	04Hex	1B04Hex	1B05Hex	1B09Hex	1B0AHex

Precautions for Correct Use

E3X-ECT can be mapped PDO 36byte maximum

A-1-7 Manufacturer Specific Objects

2100Hex	Error History Clear		
Range: -	Unit: -	Default: 00000000Hex	Attribute: A
Size: 4byte (U32)	Access: RW	PDO map: Not possible	

- This object clears diagnosis history of 10F3 hex (Diagnosis History).
- It clears the history only when specific values are written. The specific value is "elcl".

MSB			LSB
l	c	l	e
6CHex	63Hex	6CHex	65Hex

Writing values other than this is invalid.

2002h	Sysmac Error		
Sub-index0: Number of entries			
Range: -	Unit: -	Default: 02Hex	Attribute: -
Size: 1byte (U8)	Access: RO	PDO map: Not possible	
Sub-index1: Sysmac Error Status			
Range: -	Unit: -	Default: 00Hex	Attribute: -
Size: 1byte (U8)	Access: RO	PDO map: possible	
Sub-index2: Sysmac Error Status Clear			
Range: -	Unit: -	Default: 00Hex	Attribute: A
Size: 1byte (U8)	Access: RW	PDO map: Not possible	

- The mapping is used for Sysmac error status notification and to clear Sysmac error status.
- Sub-index 1: Sysmac Error Status
  - This object is for notification of errors that are detected in the Slave Unit.
  - When connected to an NJ-series Machine Automation Controller (NJ501-1@00), map this object to a PDO.
- Sub-index 2: Sysmac Error Status Clear
  - This object is used by the Controller (a Sysmac device) to reset errors that occur in Slave Units.

Reference

In the default Sysmac Studio settings, sub-index 1 (Sysmac Error Status) is automatically mapped to a PDO because 1BFF hex (512th transmit PDO Mapping) is assigned.

2200Hex	Communication Error Setting		
Range: 00Hex-0FHex	Unit: s	Default: 01Hex	Attribute: C
Size: 1byte (U8)	Access: RW	PDO map: Not possible	

- Object mounted only in the DC mode.
- The number of sequences for detecting communications errors is set with this object.
- The setting range is from 00 to 0F hex and the number of detections is "the set number of times + 1.
- Rewriting value is possible at operation in the DC mode, but the operation is performed with the value set when shifting from the pre-operational state to safe-operational state. Note that at this point, the rewritten value is read.

Note: With the default setting of 01 hex, an error is detected if communications errors occur twice in a row.

2201Hex	Sync Not Received Timeout Setting		
Range: 0000Hex-0258Hex	Unit: s	Default: 0000Hex	Attribute: C
Size: 2byte (U16)	Access: RW	PDO map: Not possible	

- Object mounted only in the DC mode.
- This object is used to set the standby time until the first synchronization interrupt signal (SYNC0) is input after shifting to the safe-operational state (state where a DC mode is confirmed).
- If the first interrupt signal (SYNC0) is not input at all within this setting time, a synchronization error occurs.
- The setting range is from 0000 hex to 0258 hex (600s) and operation is performed at 120s when
- Rewriting value is possible at operation in the DC mode, but the operation is performed with the value set when shifting from the pre-operational state to safe-operational state. Note that at this point, the rewritten value is read.

3000Hex	Sensor Communication Status		
Sub-index0:			
Range: 08Hex	Unit: -	Default: 08Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO map: Not possible	
Sub-index1: Communication Busy			
Range: 00Hex-01Hex	Unit: -	Default: 00Hex	Attribute: A
Size: 1???(BOOL)	Access: RO	PDO map: possible	
Sub-index2: Communication Error			
Range: 00Hex-01Hex	Unit: -	Default: 00Hex	Attribute: A
Size: 1???(BOOL)	Access: RO	PDO map: possible	

- This object detect comunication status with E3X-ECT and sensor amplifiers.
- When communication Busy is on, detect comunicatiing E3X-ECT and Sensor amplifier.
- When communication error is on, the number of sensors setting is defferent from the number of sensors include dummy sensors.

3001Hex	Number of Sensors		
Sub-index0:			
Range: 03Hex	Unit: -	Default: 03Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO map: Not possible	
Sub-index1: Number of Sensors Setting			
Range: 00Hex-1EHex	Unit: -	Default: 00Hex	Attribute: A
Size: 1byte(U8)	Access: RW	PDO map: possible	
Sub-index2: Number of Sensors with Dummy			
Range: 00Hex-01Hex	Unit: -	Default: 00Hex	Attribute: A
Size: 1byte(U8)	Access: RO	PDO map: possible	
Sub-index3: Number of Connected Sensors			
Range: 00Hex-01Hex	Unit: -	Default: 00Hex	Attribute: A
Size: 1byte(U8)	Access: RO	PDO map: possible	

- Sub-index1: Number of Sensors Setting
  - This object use to set sensor number include dummy sensors.
- Sub-index2: Number of Sensors with Dummy
  - This object detect number of sensors recognized by E3X-ECT (with dummy sensors).
- Sub-index3: Number of Connected Sensors
  - This object detect number of sensors recognized by E3X-ECT (without dummy sensors).

3002Hex	Input Filter for Free Run Mode		
Sub-index0:			
Range: 02Hex	Unit: -	Default: 02Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO map: Not possible	
Sub-index1: Input Filter Setting			
Range: 00Hex-01Hex	Unit: -	Default: 00Hex	Attribute: A
Size: 1???(BOOL)	Access: RW	PDO map: Not possible	
Sub-index2: Input Filter Information			
Range: 00Hex-01Hex	Unit: -	Default: 00Hex	Attribute: A
Size: 1???(BOOL)	Access: RO	PDO map: Not possible	

- Sub-index1: Input Filter Setting:
  - This object set Input Filter for free run mode.
    0: disable
    1: enable
- Sub-index2: Input Filter Information:
  - This object detect Input Filter Setting for free run mode.
    0: disable
    1: enable

3004Hex	Dummy Setting		
Sub-index0:			
Range: 03Hex	Unit: -	Default: 03Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO map: Not possible	
Sub-index1: Dummy Sensors Setting			
Range: 00000000Hex-3FFFFFFFHex	Unit: -	Default: 00000000Hex	Attribute: A
Size: 4byte(U32)	Access: RW	PDO map: Not possible	
Sub-index2: Dummy Sensors Information			
Range: 00000000Hex-3FFFFFFFHex	Unit: -	Default: 00000000Hex	Attribute: A
Size: 4byte(U32)	Access: RO	PDO map: Not possible	
Sub-index3: Dummy Sensors Response Setting			
Range: 00Hex-01Hex	Unit: -	Default: 00Hex	Attribute: A
Size: 1byte(U8)	Access: RW	PDO map: Not possible	

- Sub-index1: Dummy Sensors Setting
  - This object set the dummy sensor
    Set the 0bit to ON, No.1 sensor set dummy sensor.
    This function enabled by recycling power were changed.
- Sub-index2: Dummy Sensors Information
  - This object detect dummy sensor setting.
- Sub-index3: Dummy Sensors Response Setting
  - This object set the responce setting when sennding command to dummy sensor.
    0: Dummy sensor reply normal responce.
    (The read data is always “0”)
    1: Dummy sensor reply error responce.

300AHex	Sensor Communication Status?8bit		
Sub-index0:			
Range: 01Hex	Unit: -	Default: 01Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO map: Not possible	
Sub-index1: Communication Busy			
Range: 00Hex-02Hex	Unit: -	Default: 00Hex	Attribute: A
Size: 1byte(U8)	Access: RO	PDO map: possible	

- This object detect comunication status with E3X-ECT and sensor amplifiers.
- When communication Busy is on, detect comunicatiing E3X-ECT and Sensor amplifier.
- When communication error is on, the number of sensors setting is defferent from the number of sensors include dummy sensors.

3010Hex	Restart Sensors		
Sub-index0:			
Range: 01Hex	Unit: -	Default: 01Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO map: Not possible	
Sub-index1: Restart Sensors			
Range: 00Hex-03Hex	Unit: -	Default: 00Hex	Attribute: A
Size: 1byte(U8)	Access: RW	PDO map: Not possible	

- This object execute all sensors restart by writing 01Hex to Sub-index1.

3020Hex	Read input bits		
Sub-index0:			
Range: 40Hex	Unit: -	Default: 40Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO map: Not possible	
Sub-index1?60: Input bit 1?60			
Range: 00Hex-01Hex	Unit: -	Default: 00Hex	Attribute: A
Size: 1???(BOOL)	Access: RO	PDO map: possible	

- This object is Sensor Input 1 to 60.
  Input Bit 1: No.1 sensor input 1
  Input Bit 2: No.1 sensor input 2
  Input Bit 3: No.2 sensor input 1
  Input Bit 4: No.2 sensor input 2
  - - -
  Input Bit 57: No.29 sensor input 1
  Input Bit 58: No.29 sensor input 2
  Input Bit 59: No.30 sensor input 1
  Input Bit 60: No.30 sensor input 2

● The address connection with sensor amplifier

These object to comunication sensor amplifiers.

Each object exist 1 to 30 objects by number of sensors.

The object is offset 80Hex.

Show below number of sensors and index address relation.

Sensor No.	Index
Sensor No.1	4000 - 407F
Sensor No.2	4080 - 40FF
Sensor No.3	4100 - 417F
Sensor No.4	4180 - 41FF
Sensor No.5	4200 - 427F
Sensor No.6	4280 - 42FF
Sensor No.7	4300 - 437F
Sensor No.8	4380 - 43FF
Sensor No.9	4400 - 447F
Sensor No.10	4480 - 44FF
Sensor No.11	4500 - 457F
Sensor No.12	4580 - 45FF
Sensor No.13	4600 - 467F
Sensor No.14	4680 - 46FF
Sensor No.15	4700 - 477F
Sensor No.16	4880 - 48FF
Sensor No.17	4800 - 487F
Sensor No.18	4980 - 49FF
Sensor No.19	4900 - 497F
Sensor No.20	4A80 - 4AFF
Sensor No.21	4A00 - 4A7F
Sensor No.22	4A80 - 4AFF
Sensor No.23	4B00 - 4B7F
Sensor No.24	4B80 - 4BFF
Sensor No.25	4C00 - 4C7F
Sensor No.26	4C80 - 4CFF
Sensor No.27	4D00 - 4D7F
Sensor No.28	4D80 - 4DFF
Sensor No.29	4E00 - 4E7F
Sensor No.30	4E80 - 4EFF

*000 or *800Hex	No.01 to 30 Type of Sensor		
Sub-index0:			
Range: 01Hex	**Unit: -**	**Default: 01Hex**	**Attribute: -**
Size: 1byte(U8)	**Access: RO**	**PDO map: Not possible**	
Sub-index1: No.01 to 30 Type of Sensor			
Range: 0000Hex-FFFFHex	**Unit: -**	**Default: 0000Hex**	**Attribute: A**
Size: 2byte(U16)	**Access: RO**	**PDO map: Not possible**	

- This object detect the sensor type of sensor number by index.

DATA	type
00	E3X-DA0-S
01	E3X-MDA0
02	E3C-LDA0
03	E2C-EDA0
05	E3X-HD0

*001 or *801Hex	No.01 to 30 Detection Level		
Sub-index0:			
Range: 02Hex	Unit: -	Default: 02Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO map: Not possible	
Sub-index1: No.01 to 30 Detection Level IN1			
Range: F831Hex-270FHex	Unit: -	Default: 0000Hex	Attribute: A
Size: 2byte(INT16)	Access: RO	PDO map: possible	
Sub-index1: No.01 to 30 Detection Level IN2			
Range: F831Hex-270FHex	Unit: -	Default: 0000Hex	Attribute: A
Size: 2byte(INT16)	Access: RO	PDO map: possible	

- This object detect the detection level of sensor number by index.

*002 or *802Hex	No.01 to 30 ON Detection Level		
Sub-index0:			
Range: 02Hex	Unit: -	Default: 02Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO map: Not possible	
Sub-index1: No.01 to 30 ON Detection Level IN1			
Range: F831Hex-270FHex	Unit: -	Default: 0000Hex	Attribute: A
Size: 2byte(INT16)	Access: RO	PDO map: Not possible	
Sub-index1: No.01 to 30 ON Detection Level IN2			
Range: F831Hex-270FHex	Unit: -	Default: 0000Hex	Attribute: A
Size: 2byte(INT16)	Access: RO	PDO map: Not possible	

- This object detect the ON dection level of sensor number by index.

*003 or *803Hex	No.01 to 30 OFF Detection Level		
Sub-index0:			
Range: 02Hex	Unit: -	Default: 02Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO map: Not possible	
Sub-index1: No.01 to 30 OFF Detection Level IN1			
Range: F831Hex-270FHex	Unit: -	Default: 0000Hex	Attribute: A
Size: 2byte(INT16)	Access: RO	PDO map: Not possible	
Sub-index1: No.01 to 30 OFF Detection Level IN2			
Range: F831Hex-270FHex	Unit: -	Default: 0000Hex	Attribute: A
Size: 2byte(INT16)	Access: RO	PDO map: Not possible	

- This object detect the OFF detection level of sensor number by index.

*004 or *804Hex	No.01 to 30 Threshold Settings		
Sub-index0:			
Range: 02Hex	Unit: -	Default: 02Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO map: Not possible	
Sub-index1: No.01 to 30 Threshold Settings IN1			
Range: F831Hex-270FHex	Unit: -	Default: 0005Hex	Attribute: A
Size: 2byte(INT16)	Access: RW	PDO map: Not possible	
Sub-index1: No.01 to 30 Threshold Settings IN2			
Range: F831Hex-270FHex	Unit: -	Default: 0005Hex	Attribute: A
Size: 2byte(INT16)	Access: RW	PDO map: Not possible	

- This object set the threshold level of sensor number by index.

*005 or *805Hex	No.01 to 30 Color Ratio(RED)		
Sub-index0:			
Range: 02Hex	Unit: -	Default: 02Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO map: Not possible	
Sub-index1: No.01 to 30 Color Ratio(RED) IN1			
Range: 0000Hex-03E8Hex	Unit: -	Default: 00C8Hex	Attribute: A
Size: 2byte(U16)	Access: RW	PDO map: Not possible	
Sub-index1: No.01 to 30 Color Ratio(RED) IN2			
Range: 0000Hex-03E8Hex	Unit: -	Default: 00C8Hex	Attribute: A
Size: 2byte(U16)	Access: RW	PDO map: Not possible	

- Reserved

*006 or *806Hex	No.01 to 30 Color Ratio(GREEN)		
Sub-index0:			
Range: 02Hex	Unit: -	Default: 02Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO map: Not possible	
Sub-index1: No.01 to 30 Color Ratio(GREEN) IN1			
Range: 0000Hex-03E8Hex	Unit: -	Default: 0190Hex	Attribute: A
Size: 2byte(U16)	Access: RW	PDO map: Not possible	
Sub-index1: No.01 to 30 Color Ratio(GREEN) IN2			
Range: 0000Hex-03E8Hex	Unit: -	Default: 0190Hex	Attribute: A
Size: 2byte(U16)	Access: RW	PDO map: Not possible	

- Reserved

*007 or *807Hex	No.01 to 30 Color Ratio(BLUE)		
Sub-index0:			
Range: 02Hex	Unit: -	Default: 02Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO map: Not possible	
Sub-index1: No.01 to 30 Color Ratio(BLUE) IN1			
Range: 0000Hex-03E8Hex	Unit: -	Default: 0190Hex	Attribute: A
Size: 2byte(U16)	Access: RW	PDO map: Not possible	
Sub-index1: No.01 to 30 Color Ratio(BLUE) IN2			
Range: 0000Hex-03E8Hex	Unit: -	Default: 0190Hex	Attribute: A
Size: 2byte(U16)	Access: RW	PDO map: Not possible	

- Reserved

*008 or *808Hex	No_01??30 Differentiation Threshold Settings		
Sub-index0:			
Range: 02Hex	Unit: -	Default: 02Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO map: Not possible	
Sub-index1: No.01 to 30 Differentiation Threshold Settings IN1			
Range: F831Hex-270FHex	Unit: -	Default: 0005Hex	Attribute: A
Size: 2byte(INT16)	Access: RW	PDO map: Not possible	
Sub-index1: No.01 to 30 Differentiation Threshold Settings IN2			
Range: F831Hex-07CFHex	Unit: -	Default: 0005Hex	Attribute: A
Size: 2byte(INT16)	Access: RW	PDO map: Not possible	

- This object set the dfferentiation threshold level of sensor number by index.

*009 or *809Hex	No_01??30 Difference Threshold Settings		
Sub-index0:			
Range: 02Hex	Unit: -	Default: 02Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO map: Not possible	
Sub-index1: No.01 to 30 Difference Threshold Settings IN1			
Range: F831Hex-270FHex	Unit: -	Default: 0005Hex	Attribute: A
Size: 2byte(INT16)	Access: RW	PDO map: Not possible	
Sub-index1: No.01 to 30 Difference Threshold Settings IN2			
Range: F831Hex-07CFHex	Unit: -	Default: 0005Hex	Attribute: A
Size: 2byte(INT16)	Access: RW	PDO map: Not possible	

- This object set the difference threshold level of sensor number by index.

*00A or *80AHex	No.01 to 30 Operating Mode		
Sub-index0:			
Range: 02Hex	Unit: -	Default: 02Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO map: Not possible	
Sub-index1: No.01 to 30 Operating Mode IN1			
Range: 0000Hex-0001Hex	Unit: -	Default: 0000Hex	Attribute: A
Size: 2byte(U16)	Access: RW	PDO map: Not possible	
Sub-index1: No.01 to 30 Operating Mode IN2			
Range: 0000Hex-0001Hex	Unit: -	Default: 0000Hex	Attribute: A
Size: 2byte(U16)	Access: RW	PDO map: Not possible	

- This object set the oprating mode of sensor number by index.

DATA	Setting
0000Hex	E3X,E3C:Light ON, E2C:Normary Open
0001Hex	E3X,E3C:Dark ON, E2C:Normary Close
0002-FFFFHex	Reserved

*00B or *80BHex	No.01 to 30 Detection Function		
Sub-index0:			
Range: 01Hex	Unit: -	Default: 01Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO map: Not possible	
Sub-index1: No.01 to 30 Detection Function			
Range: 0000Hex-0006Hex	Unit: -	Default: 0000Hex	Attribute: A
Size: 2byte(U16)	Access: RW	PDO map: Not possible	

- This object set the Detection function of sensor number by index.

DATA	Setting
0000Hex	Standerd
0001Hex	High resolution
0002Hex	Defferntiation
0004Hex	High Speed
0005Hex	Tough (Only E3X-DA0-S)
0006-FFFFHex	Reserved

*00C or *80CHex	No.01 to 30 Differentiation Edge		
Sub-index0:			
Range: 01Hex	Unit: -	Default: 01Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO map: Not possible	
Sub-index1: No.01 to 30 Differentiation Response Time			
Range: 0000Hex-0001Hex	Unit: -	Default: 0000Hex	Attribute: A
Size: 2byte(U16)	Access: RW	PDO map: Not possible	

- This object set the defferentiation edge of sensor number by index

DATA	Setting
0000Hex	One-side edge
0001Hex	Double-side edge
0002-FFFFHex	Reserved

*00D or *80DHex	No.01 to 30 Differentiation Response Time		
Sub-index0:			
Range: 01Hex	Unit: -	Default: 01Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO map: Not possible	
Sub-index1: No.01 to 30 Differentiation Response Time			
Range: 0001Hex-0006Hex	Unit: -	Default: 0001Hex	Attribute: A
Size: 2byte(U16)	Access: RW	PDO map: Not possible	

- This object set the defferentiation responce time of sensor number by index

DATA	Setting	E3X-HD0 (Only one-side edge)	DA0,LDA0,EDA	
			one-side edge	double-side edge
0001Hex	differentiation responce 1	defferntiation OFF	250us	500us
0002Hex	differentiation responce 2	250us	500us	1ms
0003Hex	differentiation responce 3	500us	1ms	10ms
0004Hex	differentiation responce 4	1ms	10ms	100ms
0005Hex	differentiation responce 5	10ms	100ms	200ms
0006Hex	differentiation responce 6	100ms	reserved	
0007-FFFFHex	reserved			

*00E or *80EHex	No.01 to 30 Timer Function		
Sub-index0:			
Range: 02Hex	Unit: -	Default: 02Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO map: Not possible	
Sub-index1: No.01 to 30 Timer Function IN1			
Range: 0000Hex-0004Hex	Unit: -	Default: 0000Hex	Attribute: A
Size: 2byte(U16)	Access: RW	PDO map: Not possible	
Sub-index1: No.01 to 30 Timer Function IN2			
Range: 0000Hex-0004Hex	Unit: -	Default: 0000Hex	Attribute: A
Size: 2byte(U16)	Access: RW	PDO map: Not possible	

- This object set the timer function of sensor number by index

DATA	Setting
0000Hex	Disable timer function
0001Hex	OFF-delay timer
0002Hex	ON-delay timer
0003Hex	One shot timer
0004-00FFHex	Reserved

*00F or *80FHex	No.01 to 30 Timer Value		
Sub-index0:			
Range: 02Hex	Unit: -	Default: 02Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO map: Not possible	
Sub-index1: No.01 to 30 Timer Value IN1			
Range: 0000Hex-270FHex	Unit: -	Default: 0040Hex	Attribute: A
Size: 2byte(U16)	Access: RW	PDO map: Not possible	
Sub-index1: No.01 to 30 Timer Value IN2			
Range: 0000Hex-270FHex	Unit: -	Default: 040Hex	Attribute: A
Size: 2byte(U16)	Access: RW	PDO map: Not possible	

- This object set the Timer valu of sensor number by index.

*010 or *810Hex	No.01 to 30 Power Tuning Status		
Sub-index0:			
Range: 02Hex	Unit: -	Default: 02Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO map: Not possible	
Sub-index1: No.01 to 30 Power Tuning Status IN1			
Range: 0000Hex-0001Hex	Unit: -	Default: 0000Hex	Attribute: A
Size: 2byte(U16)	Access: RO	PDO map: Not possible	
Sub-index2: No.01 to 30 Power Tuning Status IN2			
Range: 0000Hex-0001Hex	Unit: -	Default: 0000Hex	Attribute: A
Size: 2byte(U16)	Access: RO	PDO map: Not possible	

- This object detect the power tuning status of sensor number by index.
- 0000Hex：Power tuning Off, 0001Hex：Power tuning ON

*012 or *812Hex	No.01 to 30 Display Mode		
Sub-index0:			
Range: 01Hex	Unit: -	Default: 01Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO map: Not possible	
Sub-index1: No.01 to 30 Display Mode			
Range: 0000Hex-0007Hex	Unit: -	Default: 0001Hex	Attribute: A
Size: 2byte(U16)	Access: RW	PDO map: Not possible	

- This object set the display mode of sensor number by index.

DATA	Setting
0000Hex	Detection level and Detection level (MDA0)
0001Hex	Detection level and Sreshold level
0002Hex	Detection ratio and Sreshold level
0003Hex	Peek and bottom Detection level 1
0004Hex	Peak and bottom Detection level 2
0005Hex	Analog bar
0006Hex	Detection level and Peak Detection level
0007-FFFFHex	Reserved

*013 or *813Hex	No.01 to 30 Display Direction		
Sub-index0:			
Range: 01Hex	Unit: -	Default: 01Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO map: Not possible	
Sub-index1: No.01 to 30 Display Direction			
Range: 0000Hex-0001Hex	Unit: -	Default: 0000Hex	Attribute: A
Size: 2byte(U16)	Access: RW	PDO map: Not possible	

- This object set the display derection of sensor number by index.

DATA	Setting
0000Hex	Normal
0001Hex	Revers
0002-FFFFHex	Reserved

*014 or *814Hex	No.01 to 30 MODE Key Setting		
Sub-index0:			
Range: 01Hex	Unit: -	Default: 01Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO map: Not possible	
Sub-index1: No.01 to 30 MODE Key Setting			
Range: 0000Hex-0004Hex	Unit: -	Default: 0000Hex	Attribute: A
Size: 2byte(U16)	Access: RW	PDO map: Not possible	

- This object set the mode key setting of sensor number by index.

DATA	Setting
0000Hex	Power tuning
0001Hex	Zero reset
0002Hex	Reserved
0003Hex	Teaching for EDA0
0004Hex	Workpeice exist non-exist teaching
0005-FFFFHex	Reserved

*015 or *815Hex	No.01 to 30 Output Setting		
Sub-index0:			
Range: 01Hex	Unit: -	Default: 01Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO map: Not possible	
Sub-index1: No.01 to 30 Output Setting			
Range: 0000Hex-0008Hex	Unit: -	Default: 0000Hex	Attribute: A
Size: 2byte(U16)	Access: RW	PDO map: Not possible	

- This object set the output setting of sensor number by index.

DATA	Setting
0000Hex	each channel
0001Hex	eria output (LDA0,EDA0)
0002Hex	Self-diagnostic (LDA0,EDA0)
0003Hex	AND output (MDA0)
0004Hex	OR output (MDA0)
0005Hex	difference output (MDA0)
0006Hex	low edge sync output (MDA0)
0007Hex	high edge sync output (MDA0)
0007Hex	sensor head error output (EDA0)
0005-FFFFHex	reserved

*016 or *816Hex	No.01 to 30 Output Timer Function		
Sub-index0:			
Range: 01Hex	Unit: -	Default: 01Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO map: Not possible	
Sub-index1: No.01 to 30 Timer Function			
Range: 0000Hex-0004Hex	Unit: -	Default: 0000Hex	Attribute: A
Size: 2byte(U16)	Access: RW	PDO map: Not possible	

- This object set the timer function of sensor number by index.

DATA	Setting
0000Hex	timer disabled
0001Hex	off-delay timer
0002Hex	on-delay timer
0003Hex	one shot timer
04-FFHex	reserved

*017 or *817Hex	No.01 to 30 Output Timer Value		
Sub-index0:			
Range: 01Hex	Unit: -	Default: 01Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO map: Not possible	
Sub-index1: No.01 to 30 Output Timer Value			
Range: 0000Hex-1388Hex	Unit: -	Default: 0040Hex	Attribute: A
Size: 2byte(U16)	Access: RW	PDO map: Not possible	

- This object set the timer value of sensor number by index.

*018 or *818Hex	No.01 to 30 Power Tuning Target Value		
Sub-index0:			
Range: 02Hex	Unit: -	Default: 02Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO map: Not possible	
Sub-index1: No.01 to 30 Power Tuning Target Value IN1			
Range: 0064Hex-270FHex	Unit: -	Default: 07D0Hex	Attribute: A
Size: 2byte(U16)	Access: RW	PDO map: Not possible	
Sub-index1: No.01 to 30 Power Tuning Target Value IN2			
Range: 0064Hex-270FHex	Unit: -	Default: 07D0Hex	Attribute: A
Size: 2byte(U16)	Access: RW	PDO map: Not possible	

- This object set the Power Tuning Target value of sensor number by index.

*019 or *819Hex	No.01 to 30 Power Tuning Threshold		
Sub-index0:			
Range: 02Hex	Unit: -	Default: 02Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO map: Not possible	
Sub-index1: No.01 to 30 Power Tuning Threshold IN1			
Range: 0000Hex-270FHex	Unit: -	Default: 0000Hex	Attribute: A
Size: 2byte(U16)	Access: RW	PDO map: Not possible	
Sub-index1: No.01 to 30 Power Tuning Threshold IN2			
Range: 0000Hex-270FHex	Unit: -	Default: 0000Hex	Attribute: A
Size: 2byte(U16)	Access: RW	PDO map: Not possible	

- This object set the power tuning threshold value of sensor number by index.

*01A or *81AHex	No.01 to 30 Teaching Level without Work piece		
Sub-index0:			
Range: 02Hex	Unit: -	Default: 02Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO map: Not possible	
Sub-index1: No.01 to 30 Teaching Level without Work piece IN1			
Range: FF9DHex-0063Hex	Unit: -	Default: 0006Hex	Attribute: A
Size: 2byte(INT16)	Access: RW	PDO map: Not possible	
Sub-index1: No.01 to 30 Teaching Level without Work piece IN2			
Range: FF9DHex-0063Hex	Unit: -	Default: 0006Hex	Attribute: A
Size: 2byte(INT16)	Access: RW	PDO map: Not possible	

- This object set the teaching level without work piece of sensor number by index.

*01B or *81BHex	No.01 to 30 ATC Power ON Setting		
Sub-index0:			
Range: 01Hex	Unit: -	Default: 01Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO map: Not possible	
Sub-index1: No.01 to 30 ATC Power ON Setting			
Range: 0000Hex-0002Hex	Unit: -	Default: 0000Hex	Attribute: A
Size: 2byte(U16)	Access: RW	PDO map: Not possible	

- This object set the ATC power on setting of sensor number by index.

DATA	Setting
0000Hex	OFF
0001Hex	ATC
0002Hex	ATC + powertuning
0003-FFFFHex	reserved

*00C or *80CHex	No.01 to 30 ATC Setting		
Sub-index0:			
Range: 02Hex	Unit: -	Default: 02Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO map: Not possible	
Sub-index1: No.01 to 30 ATC Setting IN1			
Range: 0000Hex-0001Hex	Unit: -	Default: 0000Hex	Attribute: A
Size: 2byte(U16)	Access: RW	PDO map: Not possible	
Sub-index1: No.01 to 30 ATC Setting IN2			
Range: 0000Hex-0001Hex	Unit: -	Default: 0000Hex	Attribute: A
Size: 2byte(U16)	Access: RW	PDO map: Not possible	

- This object set the ATC setting of sensor number by index.

DATA	Setting
0000Hex	OFF
0001Hex	ON
0002-FFFFHex	Reserved

*01D or *81DHex	No.01 to 30 "Eco" Mode Setting		
Sub-index0:			
Range: 01Hex	Unit: -	Default: 01Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO map: Not possible	
Sub-index1: No.01 to 30 "Eco" Mode Setting			
Range: 0000Hex-0002Hex	Unit: -	Default: 0000Hex	Attribute: A
Size: 2byte(U16)	Access: RW	PDO map: Not possible	

- This object set the “ECO” mode of sensor number by index.

DATA	Setting
0000Hex	OFF
0001Hex	ECO1
0002Hex	ECO2
0003-FFFFHex	Reserved

*01E or *81EHex	No.01 to 30 Zero Reset Level		
Sub-index0:			
Range: 02Hex	Unit: -	Default: 02Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO map: Not possible	
Sub-index1: No.01 to 30 Zero Reset Level IN1			
Range: 0000Hex-0FA0Hex	Unit: -	Default: 0000Hex	Attribute: A
Size: 2byte(U16)	Access: RW	PDO map: Not possible	
Sub-index1: No.01 to 30 Zero Reset Level IN2			
Range: 0000Hex-0FA0Hex	Unit: -	Default: 0000Hex	Attribute: A
Size: 2byte(U16)	Access: RW	PDO map: Not possible	

- This object set the Zero reset level of sensor number by index.

*01F or *81FHex	No.01 to 30 Threshold Ratio		
Sub-index0:			
Range: 02Hex	Unit: -	Default: 02Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO map: Not possible	
Sub-index1: No.01 to 30 Threshold Ratio IN1			
Range: FF9DHex-0063Hex	Unit: -	Default: 0006Hex	Attribute: A
Size: 2byte(INT16)	Access: RW	PDO map: Not possible	
Sub-index1: No.01 to 30 Threshold Ratio IN2			
Range: FF9DHex-0063Hex	Unit: -	Default: 0006Hex	Attribute: A
Size: 2byte(INT16)	Access: RW	PDO map: Not possible	

- This object set the Threshold ratio of sensor number by index.

*020 or *820Hex	No.01 to 30 Number of Interference Prevention		
Sub-index0:			
Range: 01Hex	Unit: -	Default: 01Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO map: Not possible	
Sub-index1: No.01 to 30 Number of Interference Prevention			
Range: 0000Hex-0005Hex	Unit: -	Default: 0000Hex	Attribute: A
Size: 2byte(U16)	Access: RW	PDO map: Not possible	

- This object set the interference prevertion of sensor number by index. (Only E2C-EDA0 のみ)

DATA	Setting
0000Hex	OFF
0001Hex	1 sensor
0002Hex	2 sensors
0003Hex	3 sensors
0004Hex	4 sensors
0005Hex	5 sensors
0006-FFFFHex	Reserved

*021 or *821Hex	No.01 to 30 Key Lock Setting		
Sub-index0:			
Range: 01Hex	Unit: -	Default: 01Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO map: Not possible	
Sub-index1: No.01 to 30 Key Lock Setting			
Range: 0000Hex-0001Hex	Unit: -	Default: 0000Hex	Attribute: A
Size: 2byte(U16)	Access: RW	PDO map: Not possible	

- This object set the Key lock of sensor number by index.

DATA	Setting
0000Hex	OFF
0001Hex	ON
0002-FFFFHex	Reserved

*022 or *822Hex	No.01 to 30 Gain Level		
Sub-index0:			
Range: 02Hex	Unit: -	Default: 02Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO map: Not possible	
Sub-index1: No.01 to 30 Gain Level IN1			
Range: 0000Hex-FFFFHex	Unit: -	Default: 0000Hex	Attribute: A
Size: 2byte(U16)	Access: RW	PDO map: Not possible	
Sub-index1: No.01 to 30 Gain Level IN2			
Range: 0000Hex-FFFFHex	Unit: -	Default: 0000Hex	Attribute: A
Size: 2byte(U16)	Access: RW	PDO map: Not possible	

- Reserved

*023 or *823Hex	No.01 to 30 Distinction Mode		
Sub-index0:			
Range: 02Hex	Unit: -	Default: 02Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO map: Not possible	
Sub-index1: No.01 to 30 Distinction Mode IN1			
Range: 0000Hex-FFFFHex	Unit: -	Default: 0000Hex	Attribute: A
Size: 2byte(U16)	Access: RW	PDO map: Not possible	
Sub-index1: No.01 to 30 Distinction Mode IN2			
Range: 0000Hex-FFFFHex	Unit: -	Default: 0000Hex	Attribute: A
Size: 2byte(U16)	Access: RW	PDO map: Not possible	

- Reserved

*030 or *830Hex	No.01 to 30 Maximum Sensitivity		
Sub-index0:			
Range: 02Hex	Unit: -	Default: 02Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO map: Not possible	
Sub-index1: No.01 to 30 Maximum Sensitivity IN1			
Range: 0000Hex-0001Hex	Unit: -	Default: 0000Hex	Attribute: A
Size: 2byte(U16)	Access: RW	PDO map: Not possible	
Sub-index1: No.01 to 30 Maximum Sensitivity IN2			
Range: 0000Hex-0001Hex	Unit: -	Default: 0000Hex	Attribute: A
Size: 2byte(U16)	Access: RW	PDO map: Not possible	

- This object execute the maxmum sensitivity of sensor number by index.
- Excute, when writing 0001Hex, and a value 0000hex is indicated when reading.

*031 or *831Hex	No.01 to 30 Teaching without Workpiece(Reflective)		
Sub-index0:			
Range: 02Hex	Unit: -	Default: 02Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO map: Not possible	
Sub-index1: No.01 to 30 Teaching without Workpiece(Reflective) IN1			
Range: 0000Hex-0001Hex	Unit: -	Default: 0000Hex	Attribute: A
Size: 2byte(U16)	Access: RW	PDO map: Not possible	
Sub-index1: No.01 to 30 Teaching without Workpiece(Reflective) IN2			
Range: 0000Hex-0001Hex	Unit: -	Default: 0000Hex	Attribute: A
Size: 2byte(U16)	Access: RW	PDO map: Not possible	

- This object execute the teaching without workpiece(reflrctive) of sensor number by index.
- Excute, when writing 0001Hex, and a value 0000hex is indicated when reading.

*032 or *832Hex	No.01 to 30 Teaching without Workpiece(Through beam)		
Sub-index0:			
Range: 02Hex	Unit: -	Default: 02Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO map: Not possible	
Sub-index1: No.01 to 30 Teaching without Workpiece(Through beam) IN1			
Range: 0000Hex-0001Hex	Unit: -	Default: 0000Hex	Attribute: A
Size: 2byte(U16)	Access: RW	PDO map: Not possible	
Sub-index1: No.01 to 30 Teaching without Workpiece(Through beam) IN2			
Range: 0000Hex-0001Hex	Unit: -	Default: 0000Hex	Attribute: A
Size: 2byte(U16)	Access: RW	PDO map: Not possible	

- This object execute the teaching without workpiece(through beam) of sensor number by index.
- Excute, when writing 0001Hex, and a value 0000hex is indicated when reading.

*033 or *833Hex	No.01 to 30 Teaching First Point		
Sub-index0:			
Range: 02Hex	Unit: -	Default: 02Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO map: Not possible	
Sub-index1: No.01 to 30 Teaching First Point IN1			
Range: 0000Hex-0001Hex	Unit: -	Default: 0000Hex	Attribute: A
Size: 2byte(U16)	Access: RW	PDO map: Not possible	
Sub-index1: No.01 to 30 Teaching First Point IN2			
Range: 0000Hex-0001Hex	Unit: -	Default: 0000Hex	Attribute: A
Size: 2byte(U16)	Access: RW	PDO map: Not possible	

- This object execute the teaching first point of sensor number by index.
- Excute, when writing 0001Hex, and a value 0000hex is indicated when reading.

*034 or *834Hex	No.01 to 30 Teaching Secondt Point		
Sub-index0:			
Range: 02Hex	Unit: -	Default: 02Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO map: Not possible	
Sub-index1: No.01 to 30 Teaching Second Point IN1			
Range: 0000Hex-0001Hex	Unit: -	Default: 0000Hex	Attribute: A
Size: 2byte(U16)	Access: RW	PDO map: Not possible	
Sub-index1: No.01 to 30 Teaching Second Point IN2			
Range: 0000Hex-0001Hex	Unit: -	Default: 0000Hex	Attribute: A
Size: 2byte(U16)	Access: RW	PDO map: Not possible	

- This object execute the teaching second point of sensor number by index.
- Excute, when writing 0001Hex, and a value 0000hex is indicated when reading.

*035 or *835Hex	No.01 to 30 Position Teaching		
Sub-index0:			
Range: 02Hex	Unit: -	Default: 02Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO map: Not possible	
Sub-index1: No.01 to 30 Position Teaching IN1			
Range: 0000Hex-0001Hex	Unit: -	Default: 0000Hex	Attribute: A
Size: 2byte(U16)	Access: RW	PDO map: Not possible	
Sub-index1: No.01 to 30 Position Teaching IN2			
Range: 0000Hex-0001Hex	Unit: -	Default: 0000Hex	Attribute: A
Size: 2byte(U16)	Access: RW	PDO map: Not possible	

- This object execute the position teaching of sensor number by index.
- Excute, when writing 0001Hex, and a value 0000hex is indicated when reading.

*036 or *836Hex	No.01 to 30 Auto Teaching Start		
Sub-index0:			
Range: 02Hex	Unit: -	Default: 02Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO map: Not possible	
Sub-index1: No.01 to 30 Auto Teaching Start IN1			
Range: 0000Hex-0001Hex	Unit: -	Default: 0000Hex	Attribute: A
Size: 2byte(U16)	Access: RW	PDO map: Not possible	
Sub-index1: No.01 to 30 Auto Teaching Start IN2			
Range: 0000Hex-0001Hex	Unit: -	Default: 0000Hex	Attribute: A
Size: 2byte(U16)	Access: RW	PDO map: Not possible	

- This object execute the auto teaching start of sensor number by index.
- Excute, when writing 0001Hex, and a value 0000hex is indicated when reading.

*037 or *837Hex	No.01 to 30 Auto Teaching Stop		
Sub-index0:			
Range: 02Hex	Unit: -	Default: 02Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO map: Not possible	
Sub-index1: No.01 to 30 Auto Teaching Stop IN1			
Range: 0000Hex-0001Hex	Unit: -	Default: 0000Hex	Attribute: A
Size: 2byte(U16)	Access: RW	PDO map: Not possible	
Sub-index1: No.01 to 30 Auto Teaching Stop IN2			
Range: 0000Hex-0001Hex	Unit: -	Default: 0000Hex	Attribute: A
Size: 2byte(U16)	Access: RW	PDO map: Not possible	

- This object execute the auto teaching stop of sensor number by index.
- Excute, when writing 0001Hex, and a value 0000hex is indicated when reading.

*038 or *838Hex	No.01 to 30 Power Tuning		
Sub-index0:			
Range: 02Hex	Unit: -	Default: 02Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO map: Not possible	
Sub-index1: No.01 to 30 Power Tuning IN1			
Range: 0000Hex-0001Hex	Unit: -	Default: 0000Hex	Attribute: A
Size: 2byte(U16)	Access: RW	PDO map: Not possible	
Sub-index1: No.01 to 30 Power Tuning IN2			
Range: 0000Hex-0001Hex	Unit: -	Default: 0000Hex	Attribute: A
Size: 2byte(U16)	Access: RW	PDO map: Not possible	

- This object execute the power tunig of sensor number by index.
- Excute, when writing 0001Hex, and a value 0000hex is indicated when reading.

*039 or *839Hex	No.01 to 30 Cancel Power Tuning		
Sub-index0:			
Range: 02Hex	Unit: -	Default: 02Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO map: Not possible	
Sub-index1: No.01 to 30 Cancel Power Tuning IN1			
Range: 0000Hex-0001Hex	Unit: -	Default: 0000Hex	Attribute: A
Size: 2byte(U16)	Access: RW	PDO map: Not possible	
Sub-index1: No.01 to 30 Cancel Power Tuning IN2			
Range: 0000Hex-0001Hex	Unit: -	Default: 0000Hex	Attribute: A
Size: 2byte(U16)	Access: RW	PDO map: Not possible	

- This object execute the power tuning cancel of sensor number by index.
- Excute, when writing 0001Hex, and a value 0000hex is indicated when reading.

*03A or *83AHex	No.01 to 30 Zero Reset		
Sub-index0:			
Range: 02Hex	Unit: -	Default: 02Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO map: Not possible	
Sub-index1: No.01 to 30 Zero Reset IN1			
Range: 0000Hex-0001Hex	Unit: -	Default: 0000Hex	Attribute: A
Size: 2byte(U16)	Access: RW	PDO map: Not possible	
Sub-index1: No.01 to 30 Zero Reset IN2			
Range: 0000Hex-0001Hex	Unit: -	Default: 0000Hex	Attribute: A
Size: 2byte(U16)	Access: RW	PDO map: Not possible	

- This object execute the Zero reset of sensor number by index.
- Excute, when writing 0001Hex, and a value 0000hex is indicated when reading.

*03B or *83BHex	No.01 to 30 Cancel Zero Reset		
Sub-index0:			
Range: 02Hex	Unit: -	Default: 02Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO map: Not possible	
Sub-index1: No.01 to 30 Cancel Zero Reset IN1			
Range: 0000Hex-0001Hex	Unit: -	Default: 0000Hex	Attribute: A
Size: 2byte(U16)	Access: RW	PDO map: Not possible	
Sub-index1: No.01 to 30 Cancel Zero Reset IN2			
Range: 0000Hex-0001Hex	Unit: -	Default: 0000Hex	Attribute: A
Size: 2byte(U16)	Access: RW	PDO map: Not possible	

- This object execute the zero reset cancel of sensor number by index.
- Excute, when writing 0001Hex, and a value 0000hex is indicated when reading.

*03C or *83CHex	No.01 to 30 Projection Lighting OFF		
Sub-index0:			
Range: 02Hex	Unit: -	Default: 02Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO map: Not possible	
Sub-index1: No.01 to 30 Projection Lighting OFF IN1			
Range: 0000Hex-0001Hex	Unit: -	Default: 0000Hex	Attribute: A
Size: 2byte(U16)	Access: RW	PDO map: Not possible	
Sub-index1: No.01 to 30 Projection Lighting OFF IN2			
Range: 0000Hex-0001Hex	Unit: -	Default: 0000Hex	Attribute: A
Size: 2byte(U16)	Access: RW	PDO map: Not possible	

- This object execute the projection lighting OFF of sensor number by index.
- Excute, when writing 0001Hex, and a value 0000hex is indicated when reading.

*03D or *83DHex	No.01 to 30 Cancel Projection Lighting		
Sub-index0:			
Range: 02Hex	Unit: -	Default: 02Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO map: Not possible	
Sub-index1: No.01 to 30 Cancel Projection Lighting IN1			
Range: 0000Hex-0001Hex	Unit: -	Default: 0000Hex	Attribute: A
Size: 2byte(U16)	Access: RW	PDO map: Not possible	
Sub-index1: No.01 to 30 Cancel Projection Lighting IN2			
Range: 0000Hex-0001Hex	Unit: -	Default: 0000Hex	Attribute: A
Size: 2byte(U16)	Access: RW	PDO map: Not possible	

- This object execute the projection lighting OFF cancel of sensor number by index.
- Excute, when writing 0001Hex, and a value 0000hex is indicated when reading.

*03E or *83EHex	No.01 to 30 Display Blinking		
Sub-index0:			
Range: 02Hex	Unit: -	Default: 02Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO map: Not possible	
Sub-index1: No.01 to 30 Display Blinking IN1			
Range: 0000Hex-0001Hex	Unit: -	Default: 0000Hex	Attribute: A
Size: 2byte(U16)	Access: RW	PDO map: Not possible	
Sub-index1: No.01 to 30 Display Blinking IN2			
Range: 0000Hex-0001Hex	Unit: -	Default: 0000Hex	Attribute: A
Size: 2byte(U16)	Access: RW	PDO map: Not possible	

- This object execute the Display Blinking of sensor number by index.
- Excute, when writing 0001Hex, and a value 0000hex is indicated when reading.

*03F or *83FHex	No.01 to 30 Cancel Display Blinking		
Sub-index0:			
Range: 02Hex	Unit: -	Default: 02Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO map: Not possible	
Sub-index1: No.01 to 30 Cancel Display Blinking IN1			
Range: 0000Hex-0001Hex	Unit: -	Default: 0000Hex	Attribute: A
Size: 2byte(U16)	Access: RW	PDO map: Not possible	
Sub-index1: No.01 to 30 Cancel Display Blinking IN2			
Range: 0000Hex-0001Hex	Unit: -	Default: 0000Hex	Attribute: A
Size: 2byte(U16)	Access: RW	PDO map: Not possible	

- This object execute the display blinking cancel of sensor number by index.
- Excute, when writing 0001Hex, and a value 0000hex is indicated when reading.

*040 or *840Hex	No.01 to 30 Sensor Initialization		
Sub-index0:			
Range: 01Hex	Unit: -	Default: 02Hex	Attribute: -
Size: 1byte(U8)	Access: RO	PDO map: Not possible	
Sub-index1: No.01 to 30 Sensor Initialization			
Range: 0000Hex-0001Hex	Unit: -	Default: 0000Hex	Attribute: A
Size: 2byte(U16)	Access: RW	PDO map: Not possible	

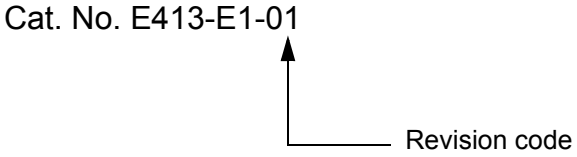
- This object execute the sensor initialization of sensor number by index.
- Excute, when writing 0001Hex, and a value 0000hex is indicated when reading.

Use the following list of EtherCAT terms for reference.

Term	Abbreviation	Description
AL status (application layer status)	–	Status for indicating information on errors that occur in an application on a slave.
CAN application protocol over EtherCAT	CoE	A CAN application protocol service implemented on EtherCAT.
CAN in Automation	CiA	CiA is the international users' and manufacturers' group that develops and supports higher-layer protocols.
device profile	–	Collection of device dependent information and functionality providing consistency between similar devices of the same device type.
distributed clocks	DC	Clock distribution mechanism used to synchronize EtherCAT Sensor Communication Units and the EtherCAT Master Units.
EtherCAT slave controller	ESC	A controller for EtherCAT slave communication.
EtherCAT slave information	ESI	An XML file that contains setting information for an EtherCAT Slave Unit.
EtherCAT state machine	ESM	An EtherCAT communication state machine.
EtherCAT Technology Group	ETG	The ETG is a global organization in which OEM, End Users and Technology Providers join forces to support and promote the further technology development.
index	–	Address of an object within an application process.
network configuration information	–	The EtherCAT network configuration information held by the EtherCAT master.
object	–	Abstract representation of a particular component within a device, which consists of data, parameters, and methods.
object dictionary	OD	Data structure addressed by Index and Sub-index that contains description of data type objects, communication objects and application objects.
operational	–	A state in EtherCAT communications where SDO communications and I/O are possible.
PDO communications	–	An acronym for process data communications.
pre-operational	–	A state in EtherCAT communications where only SDO communications are possible without being able to perform I/O.
Process data	–	Collection of application objects designated to be downloaded cyclically or acyclically for the purpose of measurement and control.
process data communications	–	One type of EtherCAT communications that uses process data objects (PDOs) to exchange information in realtime with a fixed cycle. This is also called PDO communications.
Process data object	PDO	Structure described by mapping parameters containing one or several process data entities.
Receive PDO	RxPDO	A process data object received by an EtherCAT Slave Unit.
safe operational	–	A state in EtherCAT communications where only SDO communications and reading input data from slaves are possible. Outputs from slaves are not performed.
SDO communications	–	One type of EtherCAT communications that uses service data objects (SDOs) for communicating information when required.
service data object	SDO	CoE asynchronous mailbox communications where all objects in the object dictionary can be read and written.
Slave Information Interface	SII	Slave information that is stored in non-volatile memory in the slave.
subindex	–	Sub-address of an object within the object dictionary.
sync manager	SM	Collection of control elements to coordinate access to concurrently used objects.
Transmit PDO	TxPDO	A process data object sent from an EtherCAT Slave Unit.

Revision History

A manual revision code appears as a suffix to the catalog number on the front cover of the manual.



The following table outlines the changes made to the manual during each revision. Page numbers refer to the previous version.

Revision code	Date	Revised content
01	February 2012	Original production

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