OMRON

Inverter

MX2 Series
EtherCAT Communication Unit

User's Manual

3G3AX-MX2-ECT

EtherCAT Communication Unit

Introduction

Thank you for choosing the EtherCAT Communication Unit 3G3AX-MX2-ECT. This User's Manual (hereinafter called this manual) describes the parameter setting methods required for installation/wiring and operation of the 3G3AX-MX2-ECT, as well as troubleshooting and inspection methods.

This manual should be delivered to the actual end user of the product.
After reading this manual, keep it handy for future reference.
This manual describes the specifications and functions of the product as well as the relations between them. You should assume that anything not described in this manual is not possible with the product.

Intended Readers

This manual is intended for those with knowledge of the workings of electricity (qualified electric engineers or the equivalent), and also in charge of:

- Introducing the control equipment
- Designing the control system
- Installing and/or connecting the control equipment
- Field management

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

Indications and Meanings of Safety Information

In this manual, the following precautions and signal words are used to provide information to ensure the safe use of the EtherCAT Communication Unit 3G3AX-MX2-ECT.
The information provided here is vital to safety. Strictly observe the precautions provided.
The precautions and symbols are as follows.

Meanings of Signal Words

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

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 that the product does not become inoperative, malfunction, or disrupt functionality and performance.

Additional Information

Additional information to increase understanding or make operation easier.

Example of Symbols

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

The specific instruction is indicated using an illustration or text inside or near ⊘.
The symbol shown to the left indicates "disassembly prohibited".

△ This symbol indicates danger and caution.

The specific instruction is indicated using an illustration or text inside or near △.
The symbol shown to the left indicates "beware of electric shock".

● This symbol indicates a compulsory item (an item that must be done).

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

⚠ WARNING

⚡ Do not remove the terminal block cover or the EtherCAT Communication Unit while the power is being supplied, and within 10 minutes after the power is turned off.

⚠ Caution

❗ The inverter has high voltage parts inside which, if short-circuited, might cause damage to itself or other property. Place covers on the openings or take other precautions to make sure that no metal objects such as cutting bits or lead wire scraps go inside when installing and wiring.

🚫 Do not disassemble, repair, or modify the inverter. Failure to follow this guideline may result in injury.

Precautions for Safe Use

Installation and Storage

Do not store or use the product in the following places.
- Locations subject to direct sunlight.
- Locations subject to ambient temperature exceeding the specifications.
- Locations subject to relative humidity exceeding the specifications.
- Locations subject to condensation due to severe temperature fluctuations.
- Locations subject to corrosive or flammable gases.
- Locations subject to exposure to combustibles.
- Locations subject to dust (especially iron dust) or salts.
- Locations subject to exposure to water, oil, or chemicals.
- Locations subject to direct vibration or shock.

Transportation, Installation, and Wiring

- Do not drop or apply strong impact on the product. Doing so may result in damaged parts or malfunction.
- If you are transporting the product installed to the inverter, be sure to carry it by holding an inverter radiation fin.
- Do not remove the cover of the EtherCAT Communication Unit. Also, make sure that the unit fastening screws are tightened to the specified torque.
- Install a stop motion device to ensure safety. In particular, when it is set to continue operation when a communications error occurs, the inverter may not stop and damage to the equipment.
- Take sufficient shielding measures when using the product in the following locations. Not doing so may result in damage to the product.
  Locations subject to static electricity or other forms of noise.
  Locations subject to strong magnetic fields.
  Locations close to power lines.

Operation and Adjustment

- Be sure to confirm the permissible range of motors and machines before operation because the inverter speed can be changed easily from low to high.

Maintenance and Inspection

- Be sure to confirm safety before conducting maintenance, inspection or parts replacement.

Precautions for Correct Use

Installation

Follow the inverter mounting direction restrictions.

Modbus-RTU communication

If this EtherCAT Communication Unit is installed, the inverter Modbus-RTU communication becomes disabled.

Product Disposal

Comply with the local ordinance and regulations when disposing of the product.

Warning Label Location

- After installing this EtherCAT Communication Unit to the inverter, warning labels are pasted on the product as shown in the following illustration.
- Be sure to follow the instructions.

(Notes)   The overall appearance varies depending on the inverter capacity.
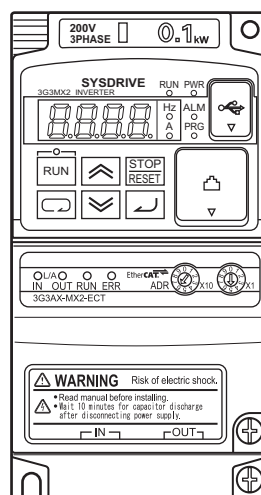
Warning Description

The warning description is written in English when it is shipped from the factory.
Affix the Japanese warning label included with the product if necessary.
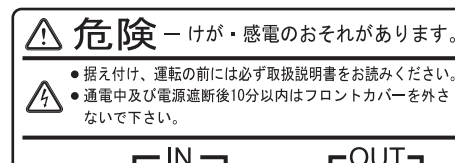
Inverter Version

This EtherCAT Communication Unit can be used with the inverter of unit version 1.1 or higher.

Make sure that the unit version of the inverter is 1.1 or higher.

The unit version of the inverter can be checked on the nameplate of the inverter.

(The unit version can not be checked on the CX-Drive.)

Applicable Standards

EC Directives

EC Directives	Applicable Standard
EMC Directive	EN61800-3
Low Voltage Directive	EN61800-5-1

(Notes) To conform to EMC Directives, the product must be installed under the conditions described in "2-5-3 Wiring Conforming to EMC Directives".

UL/cUL Standards

Standards	Applicable Standard
UL/cUL	UL508c

Functional Safety

When the EtherCAT Communication Unit is mounted on the inverter unit, inverter's conformance to the Machinery Directive becomes invalid.

EtherCAT Conformance Test

This product is conformance tested.

Trademarks

- EtherCAT is a registered trademark of Beckhoff Automation GmbH (Germany). EtherCAT technology is protected by patents.

   EtherCAT$^®$ is a registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany.
- Windows, Windows 98, Windows XP, Windows Vista and Windows 7 are registered trademarks of Microsoft Corporation in the USA and other countries.
- Sysmac is a FA product of OMRON and a trademark or registered trademark of OMRON in Japan and other countries.
- CX-One is a registered trademark of OMRON's FA Integrated Tool Package.
- Other system names and product names that appear in this manual are the trademarks or registered trademarks of the relevant companies.

Checking Before Unpacking

Checking the Product

On delivery, be sure to check that the delivered product is the EtherCAT Communication Unit 3G3AX-MX2-ECT model that you ordered. Should you find any problems with the product, immediately contact your nearest local sales representative or OMRON sales office.

Checking the Nameplate

The nameplate is affixed to the back side of the product.
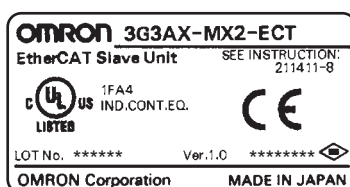
Checking the Model

3 G 3 A X - M X 2 - E C T

EtherCAT Communications Unit

For 3G3MX2 series only
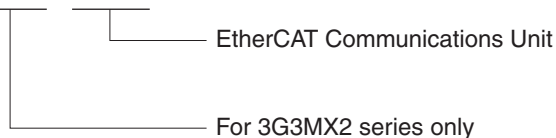
Checking the Accessories

Note that the Instruction manual and the Japanese warning label accessories are included with the EtherCAT Communication Unit 3G3AX-MX2-ECT.

Revision History

A manual revision code appears as a suffix to the catalog number located at the top left of the front and lower right of the back covers.

Man.No. I574-E1-02

Revised symbols

Revision code	Revision date	Changes and revision pages
01	August 2010	First printing
02	July 2011	Added information on Machine Automation Controller NJ501-1x00 series.

Related Manuals

When operating this product, it is necessary to have information about the device you are connecting. Please see the manuals below for related product information.

Model/Name	Manual number
Multi-function Compact Inverter SYSDRIVE MX2 SERIES USER'S MANUAL	I570

* Refer to the user's manual of the Inverter for information on Inverter operation.

EtherCAT Master manual

Model/Name	Manual number
Position Control Units CJ1W-NC281/NC481/NC881/NCF81/NC482/NC882 OPERATION MANUAL	W487
NJ-series CPU Unit Software User's Manual	W501

* When using the Master Unit other than as specified above, refer to the manual (operation manual) for that Master Unit.

About This Manual

This User's Manual consists of chapters listed below.
Understanding the following configuration ensures more effective use of the product.

		Overview
Chapter 1	EtherCAT Network	This chapter explains the overview, features and specifications of the EtherCAT Communication Unit.
Chapter 2	Starting a Sample System	This chapter explains information such as the mounting, wiring and setting methods for the EtherCAT Communication Unit.
Chapter 3	Common Slave Specifications	This chapter explains the common slave specifications during EtherCAT communication, and about the ESIs, PDOs and SDOs.
Chapter 4	Inverter Control	This chapter describes the profiles that are used to control inverters.
Chapter 5	CiA402 Drive Profile	This chapter explains about the CiA402 drive profile.
Chapter 6	Handling of Errors and Maintenance	This chapter explains how to handle any errors that occur in the EtherCAT Communication Unit.
Appendix		The appendix provides a list of objects.

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1

EtherCAT Network

This chapter explains the overview and features of the EtherCAT Communication Unit and the EtherCAT network.

1-1 Overview of the EtherCAT Communication Unit

The EtherCAT Communication Unit is an interface unit. When installed to a SYSDRIVE MX2-series multi-function compact inverter, it provides support for 100-Mbps EtherCAT.

Support for EtherCAT enables operating and stopping with high-speed communication, monitoring the operation status, and changing the various set values, and provides support for a wide range of applications.

1-1-1 Features of the EtherCAT Communication Unit

The EtherCAT Communication Unit has the features shown below.

Optimal functionality and ease of operation by standardizing specifications

As a Sysmac Device, you can use the MX2 Series EtherCAT Communication Unit together with the NJ-series Machine Automation Controller and the Sysmac Studio Automation Software to achieve optimum functionality and ease of operation.

* Sysmac Device is a generic term for OMRON control devices such as an EtherCAT Slave, designed with unified communications specifications and user interface specifications.

Communication function as easy as I/O control

When the CJ1W-NCx82 Master Unit, or Machine Automation Contoroller NJ501-1x00 series is used, the basic control function, frequency setting function and output frequency monitor function are assigned to the process data. This means that the inverter can be controlled as easily as normal I/O control.

Supports the Velocity mode of CiA402

The Velocity mode of the CANopen drive profile (CiA402) enables common control that does not vary with the manufacturer.

PDO free format

When a communication master that supports the process data mapping is used, user can assign the inverter parameters to the process data.
This product can be used when the communication master is a Machine Automation Controller NJ501-1x00 series.

Using together with slaves

EtherCAT supports connection with Servo Drives and digital I/O slaves,as well as Inverters,allowing flexible network building.

1-2　Overview of EtherCAT

Ethernet Control Automation Technology (EtherCAT) is a high-performance industrial network system based on Ethernet system and can realize faster and more efficient communications.
Each node achieves a short cycle time by transmitting Ethernet frames at high speed.
In addition, even though EtherCAT has its own communication protocol, it uses standard Ethernet technology in its physical layer. This provides a universal design feature because commercially available Ethernet cables can be used. Its effectiveness can be fully utilized not only in large control systems where high processing speed and system integration are required, but also in small to medium-sized systems.

1-2-1　Features of EtherCAT

EtherCAT has the features shown below.

● Ultra high-speed communication of 100 Mbps

The I/O response time from the generation of the input signal to the transmission of the output signal is greatly reduced. The optimized Ethernet frame band is fully utilized and transfer is performed with the high-speed repeat method, which enables the highly efficient transmission of various types of data.

● Use of standard Ethernet technology

EtherCAT is a global open network that uses standard Ethernet technology in its physical layer. This means that universally available parts can be used, such as commercially available Ethernet cables, connectors and tools.

1-2-2   EtherCAT System

In EtherCAT, data is not sent to each node in the network, but the Ethernet frame is made to pass through each node.

As the frame passes through, data is read and written at each node in the node's own area inside the frame in several nanoseconds.

The Ethernet frame that was sent by the EtherCAT master passes through all the EtherCAT slaves without stopping midway. Then, the frame is sent back by the final slave, and passes through all the slaves again before returning to the EtherCAT master.

This system ensures high-speed data transmission and realtime performance.
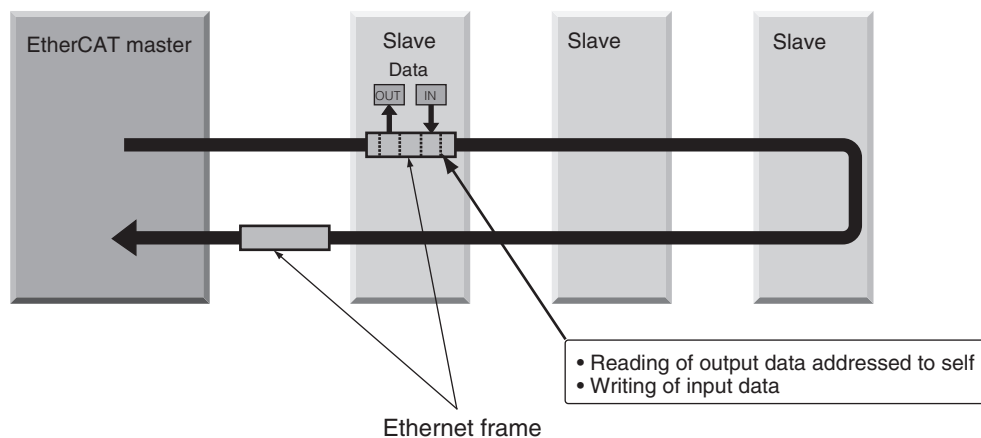
Ethernet frame

The periodic data exchange between the EtherCAT master and EtherCAT slaves is performed with the "EtherCAT telegrams" that are stored directly inside the Ethernet frame.

Each "EtherCAT telegram" consists of an address, data and working counter (check bit) for one or more slaves.

If we compare an Ethernet frame to a train, EtherCAT telegrams can be considered as the carriages.
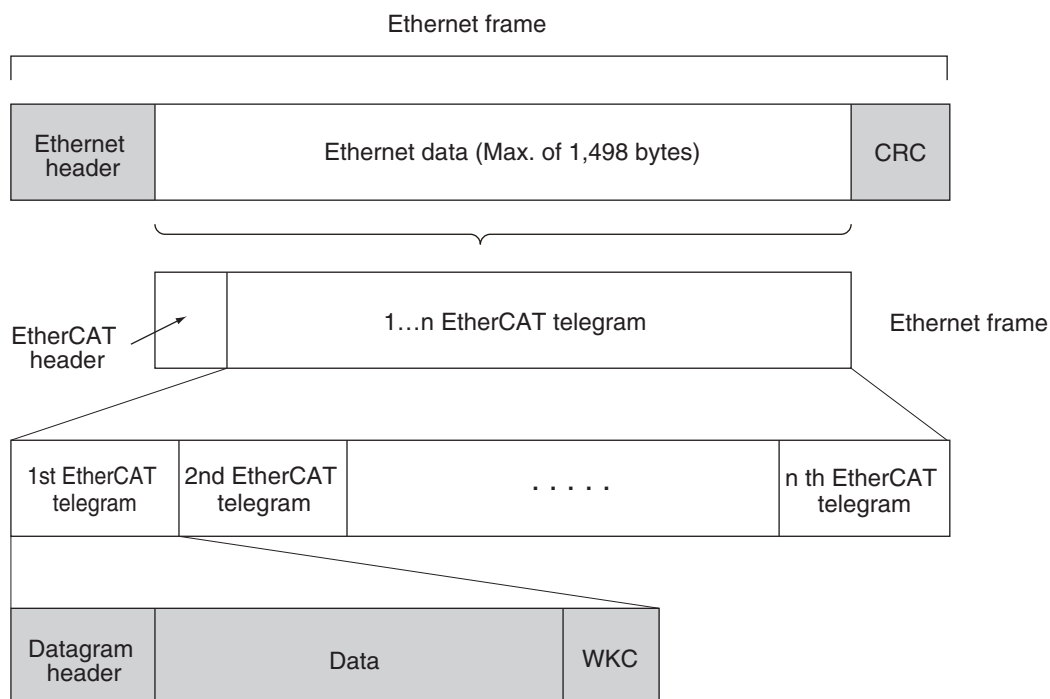
WKC: Working counter

1-2-3   EtherCAT Communication Types

EtherCAT provides the following two types of communication functions.

Process data communications functions (PDO communications)

This is cyclic (I/O) communication.
The EtherCAT Master Unit maps logical process data space (cyclic data space) to each slave node, and realizes cyclic (I/O) communications with Slave Units.
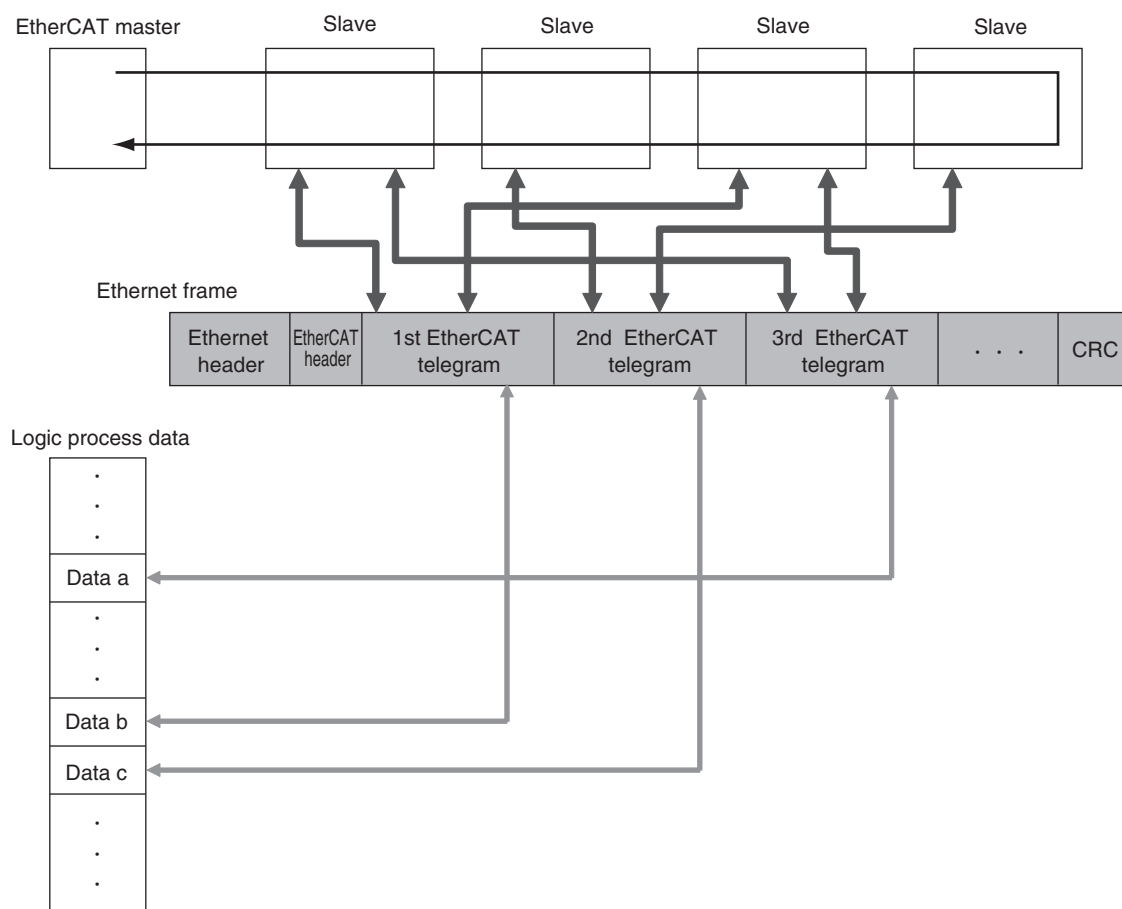
Mailbox communication function (SDO communications)

This is message communication.
The EtherCAT Master Unit transmits commands to Slave Units, and the sSave Units return responses to the EtherCAT Master Unit.
The data below is sent and received.

• Read and write process data
• Slave settings
• Monitor slave state

1-3   EtherCAT System Configuration

1-3-1   System Configuration

A typical system configuration is shown below.

EtherCAT master

Programmable
Controller
SYSMAC CJ2

Position Control
Unit
CJ1W-NCx82

or

Machine Automation Controller
NJ501-1x00 series

Configuration Tool

CX-One FA Integrated
Tool Package

or

Sysmac Studio

Communications
cable

EtherCAT slave

SYSDRIVE
3G3MX2 series

EtherCAT
Communication Unit
3G3AX-MX2-ECT

EtherCAT slave

Other slaves

Servo Drive
Digital I/O
Analog I/O
Pulse input, etc

1-3-2 Overview of Component Equipment

The overview of each structural device is as follows.

● EtherCAT master

Manages the EtherCAT network, and performs slave status monitoring and data exchange with the slaves.

● EtherCAT slave

Receives data from the Master Unit and sends data to the Master Unit across the EtherCAT network. The sent and received data can be output externally, input from an external source, or used to perform various types of control for slave equipment.

The EtherCAT slave types shown below are available.

- Field network slaves

  Slave devices that perform sequence control.

  Examples: Digital I/O slaves, analog I/O slaves

- Motion network slaves

  Slave devices that perform motion control.

  Examples: Servo Units, Inverter Units

When this 3G3AX-MX2-ECT EtherCAT Communication Unit is installed on an inverter, it can be operated as a motion network slave inverter.

● Configuration tool

Computer software for setting the EtherCAT network and each slave.

● Communications cable

The communications cable that connects the Master Unit with the Slave Units, and the Slave Units to each other.

In an EtherCAT network, use an STP double-shield cable of Ethernet category 5 or higher.

● EtherCAT Slave Information (ESI) file

A file in XML format that contains the information unique to the EtherCAT slave.

When this ESI file is loaded into the tool, it makes it easy to perform the various settings, such as the mapping of the EtherCAT slave's I/O memory.

If OMRON's Configuration Tool is used, the ESI file is used together with the Configuration Tool, so you need not worry about installing this file.

If a master by other manufacturer is connected, the ESI file must be loaded into a Configuration Tool supporting that master.

2

Starting a Sample System

This chapter explains information such as the mounting, wiring and setting methods for the EtherCAT Communication Unit.

2-1   Part Names and Settings for the EtherCAT Communication Unit

2-1-1   Part Names

Status indicator
(L/A IN, L/A OUT,
RUN, ERR)

Rotary switches
for node address
setting (× 10, × 1)

L/A ○   ○
IN OUT RUN ERR

EtherCAT.

ADR X10 X1

3G3AX-MX2-ECT

⚠ WARNING   Risk of electric shock.

• Read manual before installing.
⚠ • Wait 10 minutes for capacitor discharge
  after disconnecting power supply.

IN   OUT

Communications connector
(IN, OUT)

FG cable
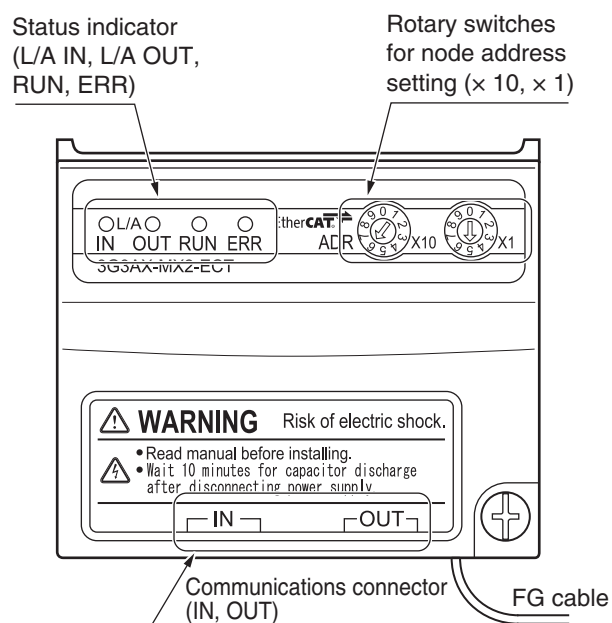
2-1-2   Status Indicator Names

The following table shows the EtherCAT status indicators and their meanings.

○L/A○   ○   ○
IN   OUT RUN ERR
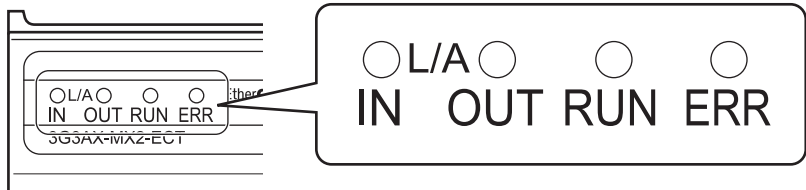
Name	Color	State	Meaning
L/A IN	Green	OFF	Link not established in physical layer
		ON	Link established in physical layer
		Flickering	In operation after establishing link
L/A OUT	Green	OFF	Link not established in physical layer
		ON	Link established in physical layer
		Flickering	In operation after establishing link
RUN	Green	OFF	Init state
		Blinking	Pre-operational state
		Single flash	Safe-operational state
		ON	Operational state
ERR	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

📑 **Additional Information**

The timing of each flashing state of indicator is as follows.
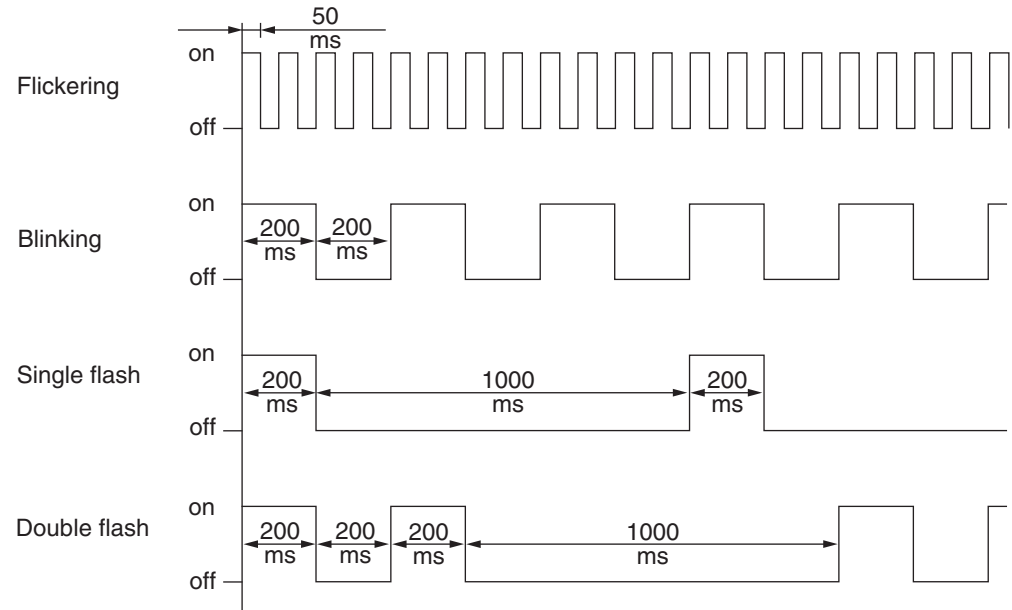
2-1-3   Rotary Switches for Node Address Setting

These switches are used to set the node addresses of slaves in the EtherCAT network (decimal).
The 10s digit is set on the left rotary switch and the 1s digit is set on the right rotary switch.
The setting range is 00 to 99.
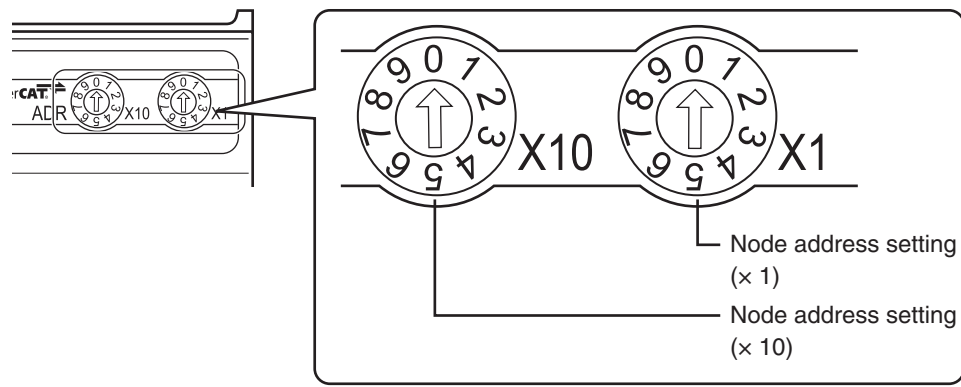
Note that the node address settings vary as shown below when the Host Controller is made by OMRON and when it is made by other manufacturers.

Set value for rotary switch	Set value for node address	
	OMRON Host Controller	**Host Controller from another manufacturer**
00	The Host Controller set value is used as the node address.	The Host Controller set value is used regardless of the rotary switch set value.
01 to 99	The rotary switch set value is used as the node address.	

📝 **Precautions for Correct Use**

- The set node address is read only once when the inverter power supply is turned ON.
  If the setting is changed after the power supply is turned ON, the new setting will not be used until the next time that the power is turned ON.
- Do not change the setting on the rotary switches after the power supply has been turned ON.
- If node addresses overlap, an error occurs and the operation stops.

2-1-4   Communications Connector

An Ethernet twisted-pair cable is connected to this connector.

Communications
connector (IN)

Communications
connector (OUT)

8   1
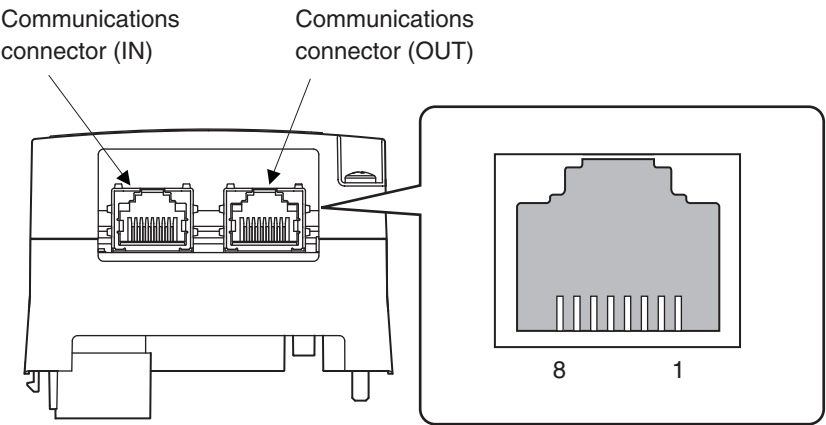
The EtherCAT connector specifications are shown below.
- Electrical characteristics   : Conform to IEEE 802.3.
- Connector structure   : RJ45 8-pin modular connector (conforms to ISO 8877)
- Terminal arrangement   :

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

2-1-5   Recommended Products

Connection cables and RJ45 connectors

For the communications cable, use a category 5 or higher straight type cable that is double-shielded with aluminum tape and braided shielding. Use a shielded connector of category 5 or higher.

Precautions for Correct Use

- The maximum cable length between nodes is 100 m. However, some cables are specified for less than 100 m. Generally, transmission performance of twisted wire condactor is lower than that of solid wire. Confirm the details with the cable manufacturer.
- Use the shielded-type RJ45 connectors. When selecting a connector, confirm if it can be used with the recommended cable. Confirm the following items: conductor size, conductor type (solid wire or twisted wire), number of twisted pairs (2 or 4), outer diameter, etc.

Additional Information

If an Ethernet cable of category 5 or higher is used, communications will be possible even if the cable is not shielded. However, we recommend a cable with double, aluminum tape and braided shielding to ensure sufficient noise immunity.

2-1-6 Connection between Communications Cables and Connectors

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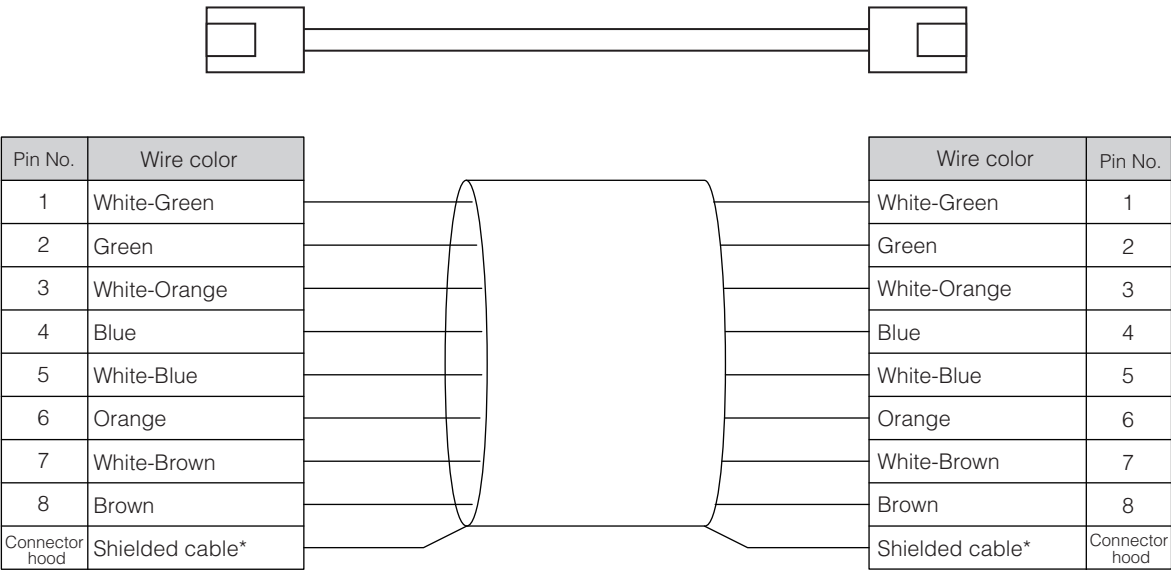
* Connect both ends of cable shielded wires to the connector hoods.

Additional Information

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," but a wiring method conforming to the standard "T568B" can also be used.

2-2   Basic Usage Procedures and Configuration Example

2-2-1   Basic Usage Procedures

The basic usage procedures are shown below. For details on settings and connections, refer to the manual for each Master Unit, and the slave manuals.

		CJ1W-NCx82 Master	NJ501-1x00 Master
1	Master Unit setting		
	Master Unit setting	Ref section 2-3-1.	Ref section 2-4-1.
	ESI file setting	Ref section 2-3-2.	Ref section 2-4-2.

2	Mounting and wiring of EtherCAT Communications Unit		
	Mounting of EtherCAT Communications Unit	Ref section 2-5-1.	
	Wiring of EtherCAT Communications Unit	Ref section 2-5-2.	
	Setting the node address of the EtherCAT Communications Unit	Ref section 2-5-3.	

3	Setting SYSDRIVE MX2 series		
	Setting RUN command	Ref section 2-6-1.	
	Setting frequency reference	Ref section 2-6-2.	
	Setting reset selection	Ref section 2-6-3.	

4	Checking communication start/operation		
	Starting system	Ref section 2-7-1.	Ref section 2-8-1.
	Network setup	Ref section 2-7-2.	Ref section 2-8-2.
	Checking Master Unit	Ref section 2-7-3.	Ref section 2-8-3.
	Checking Inverter and EtherCAT Communications Unit	Ref section 2-7-4.	Ref section 2-8-4.
	Checking operation	Ref section 2-7-5.	Ref section 2-8-5.

2-2-2   System Configuration Example

This chapter describes the usage procedures using the system configuration example shown below. When configuring your actual system, select the units that are required for your system.

CJ1W-NCx82 Master

Master Unit   : CJ2-series PLC + CJ1W-NCx82
Slave Unit (× 2) : 3G3MX2-A2001 + 3G3AX-MX2-ECT (× 2 sets)

(Notes) This Communication Unit can be used with all the capacities in the SYSDRIVE MX2 series.
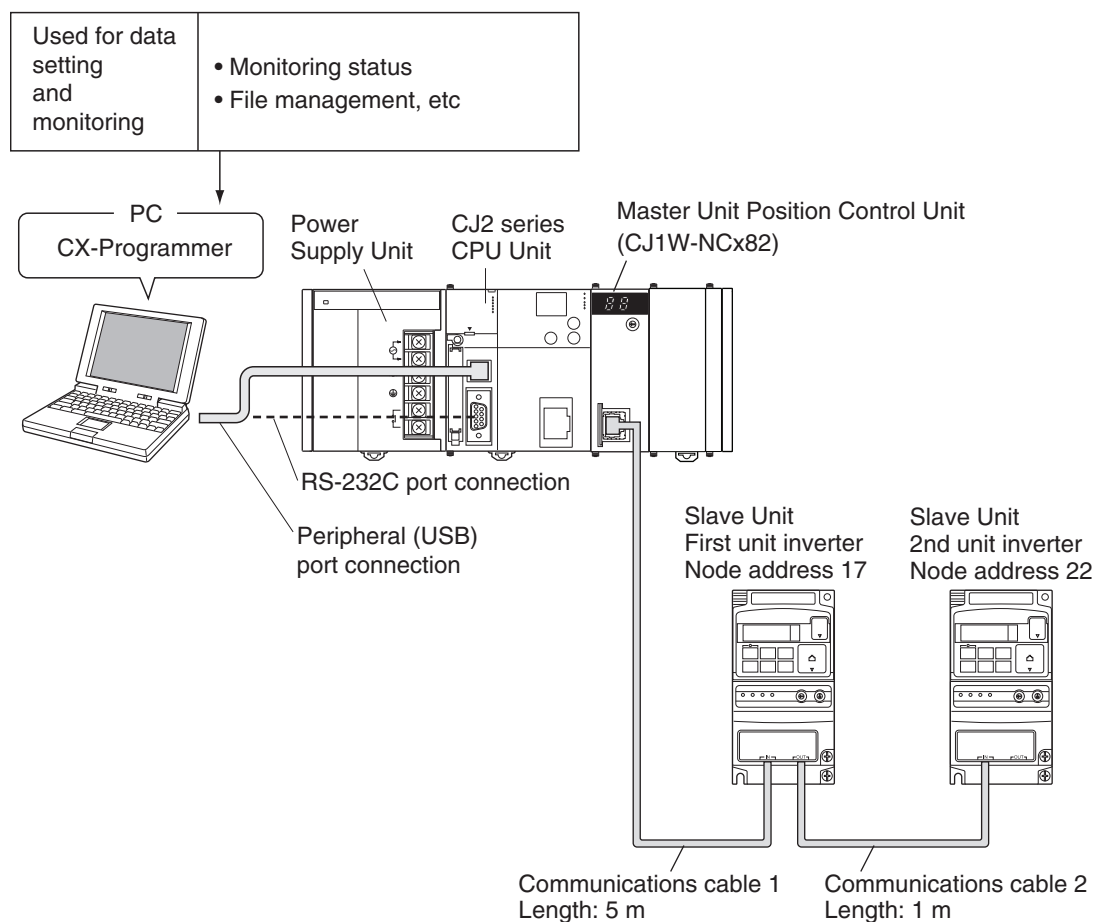
Refer to *2-3 CJ1W-NCx82 Master Setting* on page 2-11 for details on Unit installation and setting method.

NJ501-1x00 Master

Master Unit   : Machine Automation Controller NJ501-1x00 series
Slave Unit ($\times$ 2) : 3G3MX2-A2001 + 3G3AX-MX2-ECT ($\times$ 2 sets)

(Notes) This Communication Unit can be used with all the capacities in the SYSDRIVE MX2 series.
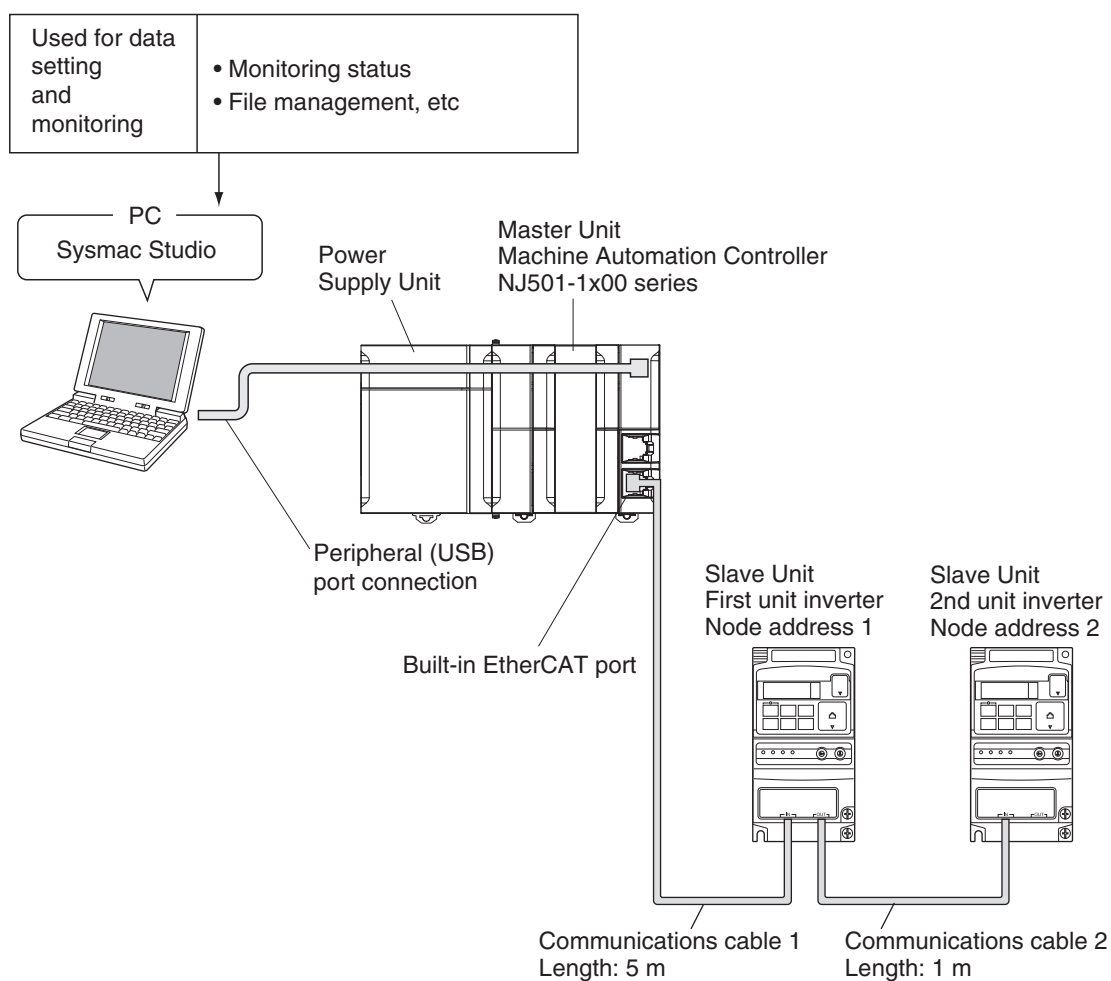
Refer to *2-4 NJ501-1x00 Master Setting* on page 2-12 for details on Unit installation and setting method.

2-3   CJ1W-NCx82 Master Setting

2-3-1   Mounting the CJ1W-NCx82

Connect the SYSMAC CJ2-series PLC and the CJ1W-NCx82 Master Unit by fitting their connectors together. For specific details on mounting onto the SYSMAC Unit and the control panel of the SYSMAC Unit, refer to the User Manual for the SYSMAC CJ2 series.

2-3-2   CJ1W-NCx82 Setting

Perform the settings for the CJ1W-NCx82 Master Unit. For the setting method of each component, refer to the manual for the Master Unit.
For the setting tool, use CX-Programmer Ver. 9.2 or later.

2-4   NJ501-1x00 Master Setting

2-4-1   Mounting the NJ501-1x00

Perform configuration of the NJ501-1x00 Master rack. For the specific configuration method, refer to *NJ-series CPU Unit Software User's Manual* (Cat No.W501).

2-4-2   NJ501-1x00 Setting

Set the NJ501-1x00 Master. For the setting method for each part, refer to *NJ-series CPU Unit Software User's Manual* (Cat No.W501).

2-5   Mounting and Wiring for the EtherCAT Communication Unit

Mount the EtherCAT Communication Unit onto the inverter. Before performing this procedure, turn OFF the main power supply of the inverter. Wait at least 10 minutes after the inverter's LED indicator lamp and charge indicator have turned OFF, and then start the procedure.

This Communication Unit can be used with the inverter of unit version 1.1 or higher.

Make sure that the unit version of the inverter is 1.1 or higher.

The unit version of the inverter can be checked on the nameplate of the inverter.

(The unit version can not be checked on the CX-Drive.)

2-5-1   Mounting the EtherCAT Communication Unit

Removing the optional board cover from the inverter front panel

1 **Loosen the mounting screw (× 1) from the optional board cover of the inverter front panel.**

2 **Remove the optional board cover.**
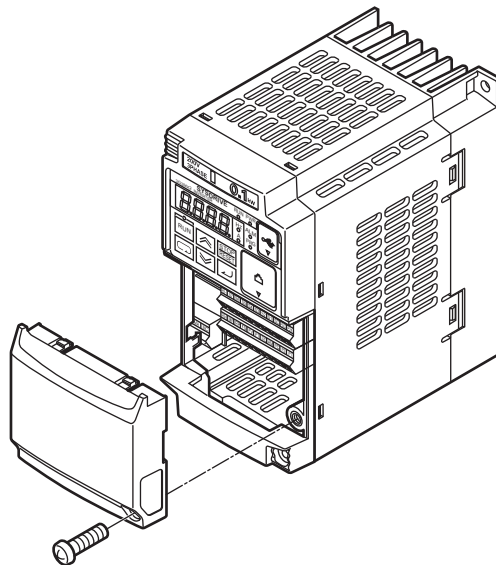
Mounting the EtherCAT Communication Unit onto the inverter

1   **Mount the EtherCAT Communication Unit onto the location where the inverter optional board cover that you removed was attached. Check that the connector is firmly connected.**
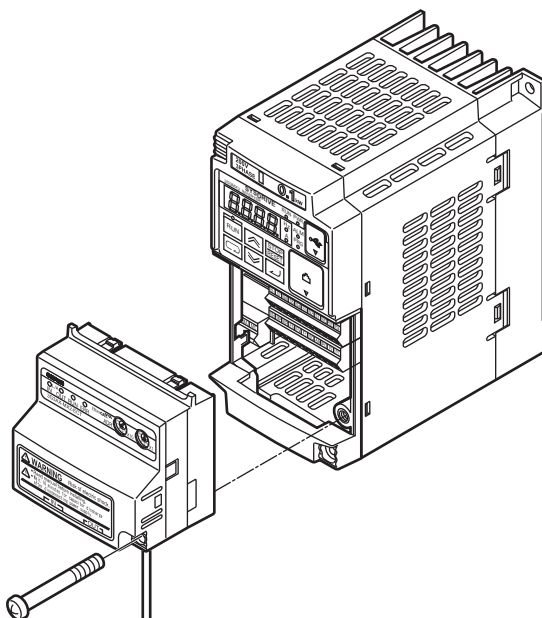
(Notes) When the EtherCAT Communication Unit is mounted, the main circuit and control circuit terminals of the inverter are hidden. For this reason, be sure to wire the main circuit and control circuit terminals before mounting the EtherCAT Communication Unit.

2   **Tighten the mounting screw of the EtherCAT Communication Unit.**
Tighten the bottom right screw of the EtherCAT Communication Unit with the specified torque (46 N•cm, 4.7 kgf•cm).
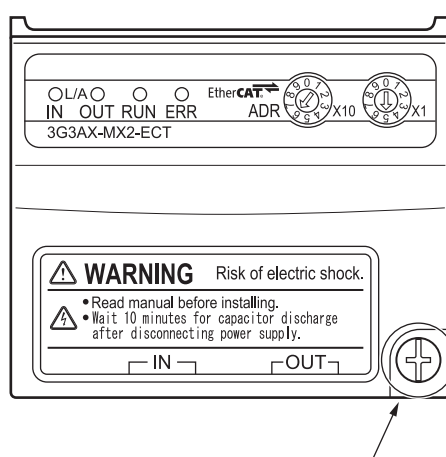
Connecting the ground cable of the EtherCAT Communication Unit

1 **Ground the FG cable of the EtherCAT Communication Unit.**
Cut the ground wire of the unit's FG cable to an appropriate length and ground it to the closest possible ground location. Also refer to the inverter manual.
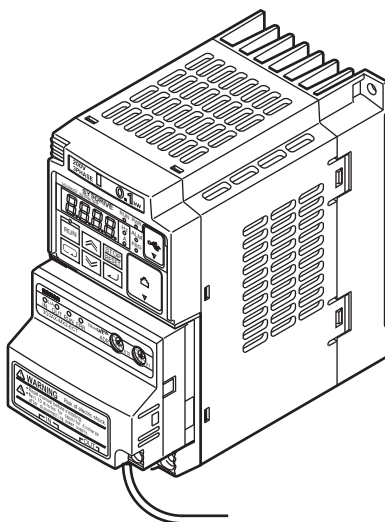
2-5-2   Wiring the EtherCAT Communication Unit

Perform the wiring for the communications cables.

Preparing the communications cables

Determine the number and length of communications cables that are appropriate for your system configuration.

Each communications cable between the nodes (and between the master and the nodes) must be no longer than 100 m.

In the system configuration example used in this chapter, a cable of 5 m is prepared for communications cable 1, and a cable of 1 m is prepared for communications cable 2.Connect an RJ45 connector to both ends of the communications cable by wiring them straight. Connect both ends of the shielded wires of the cable to the hoods.

For details on preparing the cables, refer to *2-1-6 Connection between Communications Cables and Connectors* on page 2-7.

Wiring the communications cables
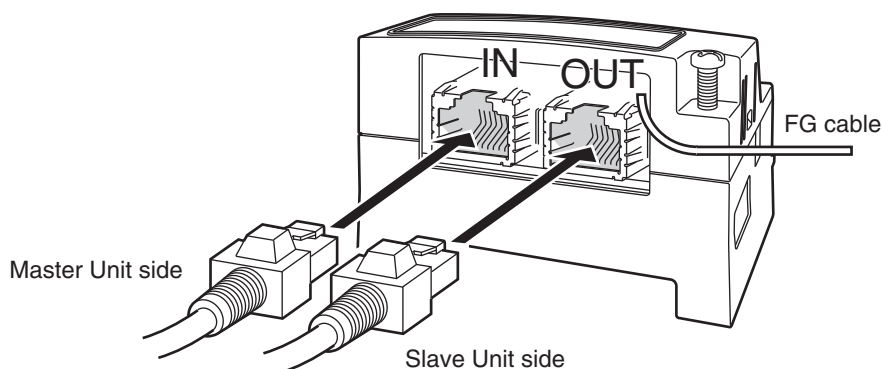
Securely connect the EtherCAT communication cable connector to the EtherCAT Communication Unit by inserting the connector all the way until it clicks.

Connect the communication cable from the EtherCAT master side to the communication connector IN of the Communication Unit.

Connect the communication connector OUT to the communication connector IN of the next EtherCAT slave.

Do not connect the communication connector OUT of the last EtherCAT slave.

Data will not be communicated correctly if the input/output are connected in reverse.

In the system configuration example used in this chapter, the connectors below are connected with the communications cables.

	Connecting from	Connecting to
Communications cable 1	Master Unit	1st inverter IN
Communications cable 2	1st inverter OUT	2nd inverter IN

(Notes) Do not connect anything to 2nd inverter OUT.

If a slave other than this product is used in your system configuration, set the unit in the same way by referring to its User Manual.

Precautions when constructing the network

• When constructing an EtherCAT network, take sufficient safety measures according to the standards. We recommend that specialized constructors familiar with the safety measures and standards be requested to perform the construction.

• Do not install EtherCAT network devices near devices generating noise.
   If there is no choice but to install them down in an environment with a high level of noise, be sure to take measures against the noise, such as covering each device in metal cases.

Precautions when installing communications cables

• To connect a cable to the communications connector of a device, insert it securely until the connector of the communications cable is locked.

• Install and wire the communications cables separately from high-voltage electrical power lines.

• Do not install the cables near devices generating noise.

• Do not install the cables in high-temperature and high-humidity environments.

• Use the cables in locations without powder dust or oil mist.

2-5-3 Wiring Conforming to EMC Directives

To conform to the EMC directives (EN61800-3), conduct the wiring work for the EtherCAT Communication Unit, so that it meets the wiring conditions described in this section. These conditions are for conformance of products to the EMC directives when an EtherCAT Communication Unit is installed on a SYSDRIVE MX2-series inverter. The installation and wiring conditions, however, may be affected by the devices that are connected and wiring of the system where the EtherCAT Communication Unit is installed. It is necessary to conform to the EMC directives as an overall system. This section describes only the parts related to the addition of the EtherCAT Communication Unit. Follow the instructions in the inverter manual for the inverter installation conditions, such as the power supply line wiring, filter installation, and motor wiring clamps.

Wiring the communications cables

Install the 3 clamp cores shown below near the communications connectors of the communications cables that are connected to the communications connector (IN) and the communications connector (OUT). (If the communications cable on the OUT side is not connected, install them for the IN side only.)

Symbol	Name	Manufacturer	Model
FC1, FC2, FC3	Clamp core	NEC TOKIN	ESD-SR-160

Wiring the FG cable

Install the FG cable with the shortest possible wiring.
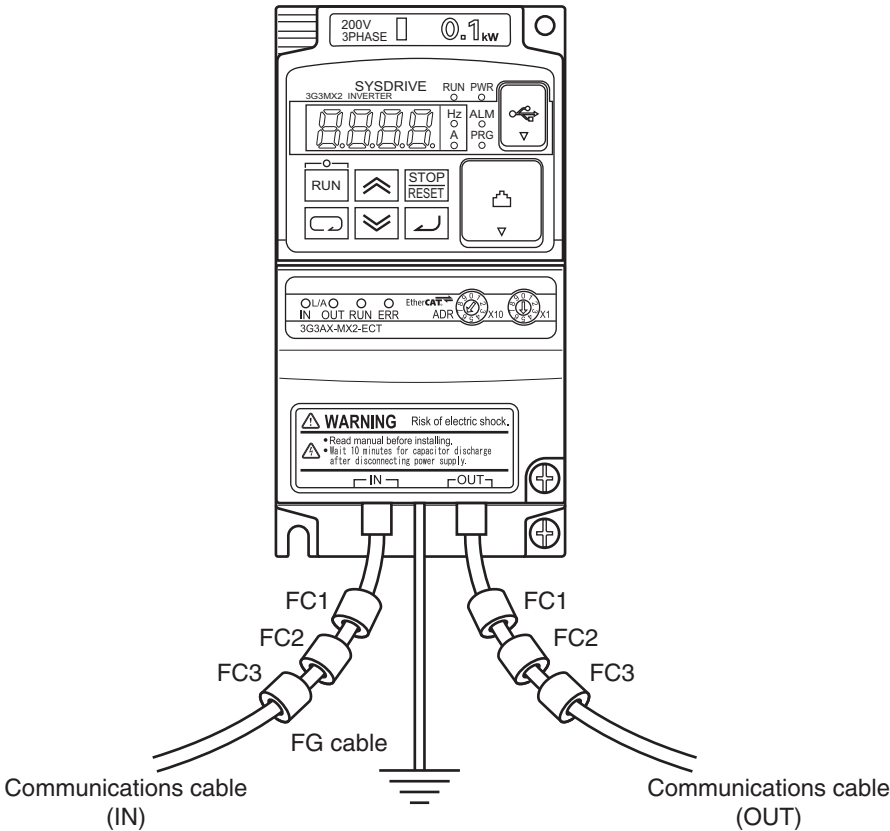
(Notes) The overall mounting appearance varies depending on the inverter capacity. Do not squeeze the FG cable into the EtherCAT Communication Unit.

2-5-4   Node Address Settings for the EtherCAT Communication Unit

Node address settings

Set the rotary switches of the EtherCAT Communication Unit to determine the node address.
In the system configuration example used in this chapter, the settings are as follows.

		Inverter	CJ1W-NCx82 Master	NJ501-1x00 Master
1st unit	Node address	17	1
	Rotary switch x 10	Set to the 1 position.	Set to the 0 position.
	Rotary switch x 1	Set to the 7 position.	Set to the 1 position.
2nd unit	Node address	22	2
	Rotary switch x 10	Set to the 2 position.	Set to the 0 position.
	Rotary switch x 1	Set to the 2 position.	Set to the 2 position.

Notes on setting are provided below for each Master Unit.

<CJ1W-NCx82 Master>

1   The EtherCAT Communication Unit uses input and output areas for 5 node addresses.
    For this reason, when using the inverter with a fixed allocation, set 5 or larger number to the node address of the next unit.
2   Node addresses can be set in a range of 17 to 80. Make sure the node addresses set for the Unit do not overlap with other slave.
3   For the restrictions related to CJ1W-NCx82 Master, refer to *Position Control Units CJ1W-NC281/NC481/NC881/NCF81/NC482/NC882 OPERATION MANUAL* (Cat No.W487).

<NJ501-1x00 Master>

1   Node addresses can be set in a range of 1 to 99. Make sure the node addresses set for the Unit do not overlap with other slave.
2   Unlike with the CJ1W-NCx82 master, the node address of the next unit can be set without intervals.
3   For the restrictions related to your NJ501-1x00, refer to *NJ-series CPU Unit Software User's Manual* (Cat No.W501).

(Notes)   If a slave other than this product is also connected to the same network, set the unit by referring to its User Manual. In such cases, check that the node addresses do not overlap with other units.

2-6   SYSDRIVE MX2 Series Settings

To perform control from the Communication Unit, the parameter settings must be changed from the front panel digital operator of the inverter.

In this procedure, the inverter power supply must be turned ON. When the power supply is turned ON, the inverter may operate in unintended way. Check the condition of the wiring and system carefully before starting the procedure.

Refer to the User Manual (Cat No.I570) for the SYSDRIVE MX2-series inverter for details on operating the inverter parameter settings and for the meaning of the parameter values.

2-6-1   RUN Command Setting

Change the control method for the RUN command.

Parameter No.	Function name	Data	Default value
A002	RUN Command Selection 1	04 (Optional boad)	02 (Digital Operator)

2-6-2   Frequency Reference Setting

Change the control method for the frequency reference.

Parameter No.	Function name	Data	Default value
A001	Frequency Reference Selection 1	04 (Optional boad)	02 (Digital Operator)

2-6-3   Reset Selection Setting

Set the operation of the reset signal.

Parameter No.	Function name	Data	Default value
C102	Reset Selection	03 (Trip reset only)	00 (Trip reset at power-ON)

* If parameter C102 is not displayed, first set parameter b037 to 01.

2-7   Communication Starting and Operation Checking with CJ1W-NCx82 Master

After completing the settings and wiring, turn ON the power and check that the communication starts. The inverter power supply must be turned ON to set the inverter. When the power supply is turned ON, the inverter may operate in unintended way. Check the condition of the wiring and system carefully before starting the operation.

2-7-1   Starting the System

Check the condition of the wiring and system carefully, and then turn ON the power supply for all the inverters and PLC. It does not matter whether the inverter or PLC power supply is turned ON first. However, an error occurs unless the power supply for all the inverters is turned ON within a certain time (All Registered Slave Participation Standby Time parameter of CJ1W-NCx82, default value is 10 seconds) after turning ON the PLC power supply.

2-7-2   Network Setup

Firstly,enter the network settings. Until the settings are performed, the indicators show "Initial processing status" in the table below for both the Master Unit and the EtherCAT Communication Unit. Start CX-Programmer, and double-click the target CJ1W-NCx82 in the I/O table to start the support tool. When the support tool starts, the Network Auto Setup dialog box is displayed. Perform the network setup in accordance with the dialog box instructions. If the Network Auto Setup dialog box is not displayed automatically, start the dialog box by selecting Network Auto Setup from Network in the support tool menu.
For details on network setting, refer to *Position Control Units CJ1W-NC281/NC481/NC881/NCF81/NC482/NC882 OPERATION MANUAL* (Cat No.W487).

2-7-3   Checking the Master Unit

Check that the Master Unit has transitioned to normal operation from initial processing.
The indicators of the CJ1W-NCx82 make it easy to check the changes in status.

	7-segment display	RUN	ERC	ERH	ECAT RUN	ECAT ERR	L/A
Initial processing	Flashing	ON	OFF	OFF	OFF	OFF	ON
Normal operation	"00"	ON	OFF	OFF	ON	OFF	Flashing

For details, refer to *Position Control Units CJ1W-NC281/NC481/NC881/NCF81/NC482/NC882 OPERATION MANUAL* (Cat No.W487).

2-7-4   Checking the Inverter and EtherCAT Communication Unit

Check the POWER indicator and other indications of the inverter to confirm that power is being supplied to the inverter.
Check the status indicators of the EtherCAT Communication Unit to see that the status has changed to normal operation from initial processing.

1st unit

	L/A IN	L/A OUT	RUN	ERR
Initial processing	ON	ON	OFF	OFF
Normal operation	Flashing	Flashing	ON	OFF

2nd unit

	L/A IN	L/A OUT	RUN	ERR
Initial processing	ON	OFF	OFF	OFF
Normal operation	Flashing	OFF	ON	OFF

* If three or more units are connected, the status LEDs behave in the same way as the LEDs on the first unit, except for the last unit.
  L/A OUT on the last unit is always unlit.

2-7-5   Checking the Operation

Execute the PLC control program and check that the operation is normal.

2-8 Communication Starting and Operation Checking with NJ501-1x00 Master

After completing the settings and wiring, turn ON the power and check that the communication starts. The inverter power supply must be turned ON to set the inverter. When the power supply is turned ON, the inverter may operate in unintended way. Check the condition of the wiring and system carefully before starting the operation.

2-8-1 Starting the System

Check the condition of the wiring and system carefully, and then turn ON the power supply for all the inverters and NJ501-1x00 Master. It does not matter whether the inverter or NJ501-1x00 Master power supply is turned ON first. However, an error occurs unless the power supply for all the inverters is turned ON within a certain time (Wait time for slave startup parameter of NJ501-1x00, default value is 30 seconds) after turning ON the NJ501-1x00 power supply.

2-8-2 Network Setup

Firstly, enter the network settings. How to set the network is explained below by taking the "MX2-ECT sample" project as an example.

1 **Starting the Sysmac Studio**

<Project Window>
Click the **New Project** Button, enter **MX2-ECT sample** under the **Project name**, and then click the **Create** Button.
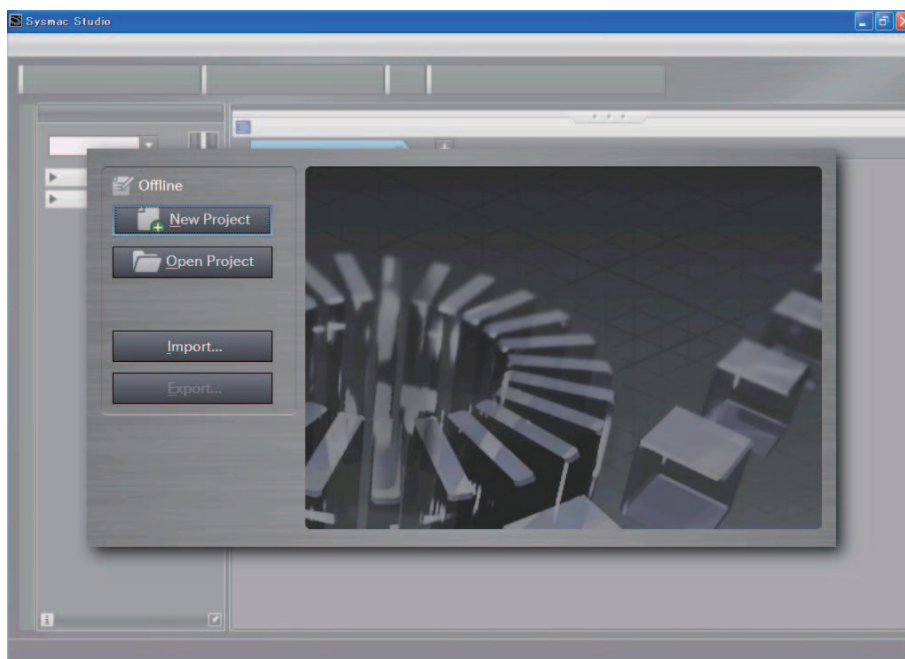
2   Registering an EtherCAT slave

<Controller Configurations and Setup Pane>
Right-click **EtherCAT** under the **Configurations and Setup** menu on the left side of the pane, and open the **Edit** Pane.
When a group of items that can be registered as an EtherCAT slave appears on the right side of the pane, select *Frequency Inverter*.
From the slave list on the right side of the pane, drag and drop **3G3AX-MX2-ECT** onto **Master** at the center of the pane, and the Unit will be registered as an EtherCAT slave.
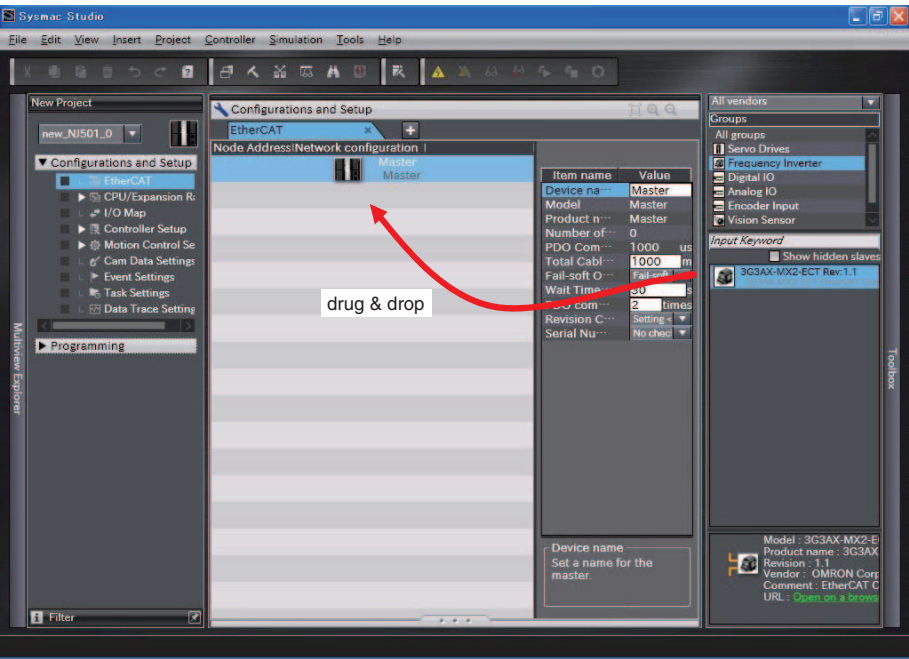
<Pane when 2 inverters are registered>
The pane after 2 inverters are registered is shown below.
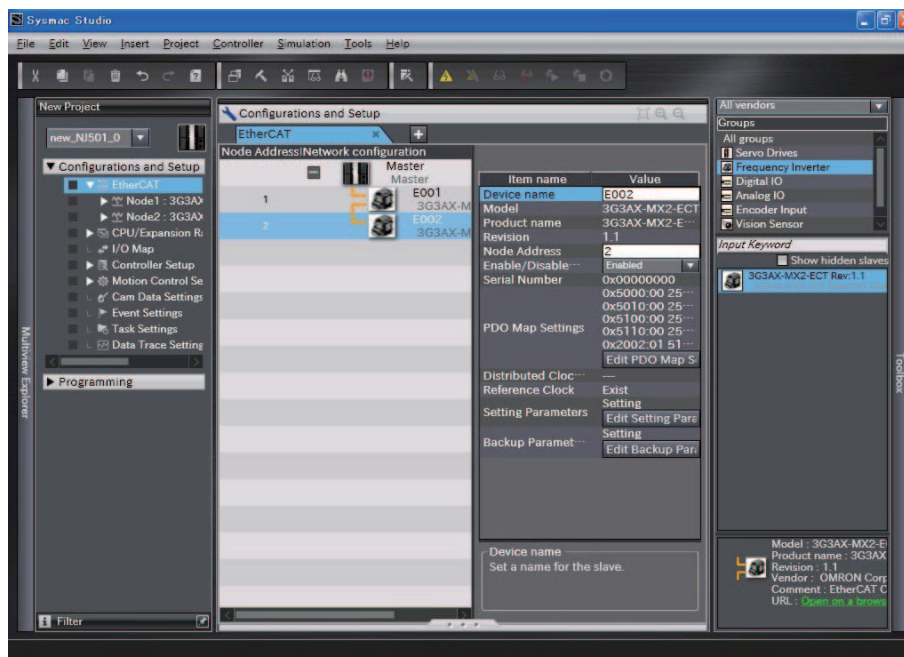
3   **Registering an IO map**

Right-click **I/O Map** under the **Configurations and Setup** menu on the left side of the pane, and open the **Edit** Pane.

With the NJ501-1x00 Master, data used in the control algorithms is treated as a set of variables. If you want to assign a variable to each object that controls the inverter and use the assigned variables in the control algorithms, define the variables on this pane.

<I/O Map Pane>
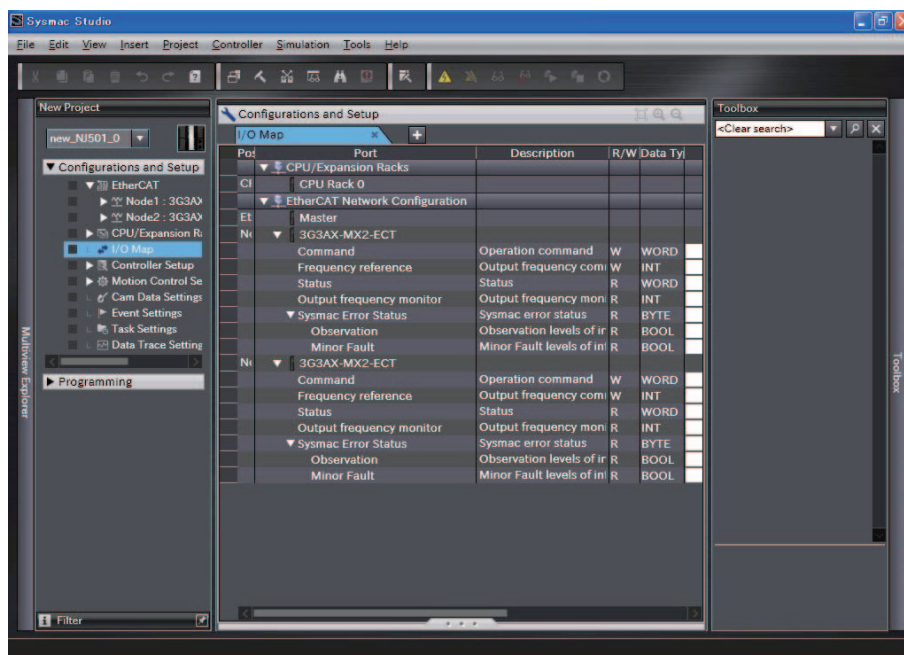
4 Building a program

Build the project program you created, so as to convert it to the format supported by the NJ501-1x00 Master.

Select **Build Controller** from the Project Menu.

Confirm that the program that is built is with no errors.

5 Synchronizing with the CPU Unit

Transfer the program and settings created in Sysmac Studio to the NJ501-1x00 Master.

Go online and select **Synchronization** from the Controller Menu.

Click **Transfer To Controller** to transfer the program data.

When the transfer is completed successfully, the RUN LED indicator on the inverter turns ON. The inverter is now ready.

<Synchronization Pane>
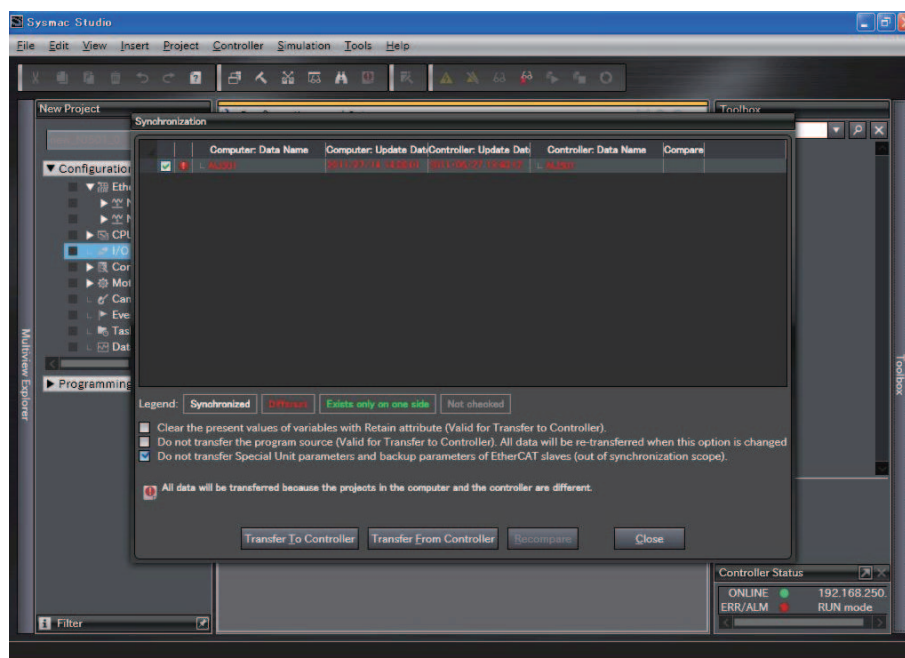
2-8-3   Checking the NJ501-1x00 Master

Check that the NJ501-1x00 Master is operating normally in the RUN Mode.

Status of NJ501-1x00 Master		Operating normally	
		User program is running	User program is stopped
Front LED indicators	PWR (Green)	ON	ON
	RUN (Green)	ON	OFF
	ERROR (Red)	OFF	OFF

2-8-4   Checking the Inverter and EtherCAT Communication Unit

Check the POWER indicator and other indications of the inverter to confirm that power is being supplied to the inverter.
Check the status indicators of the EtherCAT Communication Unit to see that the status has changed to normal operation from initial processing.

1st unit

	L/A IN	L/A OUT	RUN	ERR
Initial processing	ON	ON	OFF	OFF
Normal operation	Flashing	Flashing	ON	OFF

2nd unit

	L/A IN	L/A OUT	RUN	ERR
Initial processing	ON	OFF	OFF	OFF
Normal operation	Flashing	OFF	ON	OFF

* If three or more units are connected, the status LEDs behave in the same way as the LEDs on the first unit, except for the last unit.
    L/A OUT on the last unit is always unlit.

2-8-5   Checking the Operation

Execute the NJ501-1x00 Master control program and check that the operation is normal.

3

Common Slave Specifications

This chapter explains the common slave specifications during EtherCAT communication, and about the PDOs and SDOs.

3-1   Structure of CANopen over EtherCAT

The figure below shows the structure of CANopen over EtherCAT (CoE).

```
┌─────────────────────────────────────────────────────────────┐
│ Inverter                                                      │
│  ┌─────────────────────────────────────────────────────────┐ │
│  │ Application layer      ┌───────────────────────────────┐ │ │
│  │                        │      Inverter application     │ │ │
│  │                        └───────────────────────────────┘ │ │
│  │                                     ⇕                     │ │
│  │                        ┌───────────────────────────────┐ │ │
│  │                        │       Object dictionary       │ │ │
│  │                        └───────────────────────────────┘ │ │
│  │  ┌───────────────┐  ┌─────────────┐ ┌─────────────────┐  │ │
│  │  │Communications │  │     SDO     │ │   PDO mapping   │  │ │
│  │  │status         │  │  (Mailbox)  │ ├─────────────────┤  │ │
│  │  │transitions    │  │             │ │   PDO (Cyclic)  │  │ │
│  │  └───────────────┘  └─────────────┘ └─────────────────┘  │ │
│  └──────────⇕───────────────⇕─────────────────⇕─────────────┘ │
│  ┌─────────────────────────────────────────────────────────┐ │
│  │  ┌───────────────┐  ┌─────────────┐ ┌─────────────────┐  │ │
│  │  │   Register    │  │   Mailbox   │ │  Process data   │  │ │
│  │  └───────────────┘  └─────────────┘ └─────────────────┘  │ │
│  │                     ┌─────────────┐ ┌─────────────────┐  │ │
│  │                     │ SyncManager │ │      FMMU       │  │ │
│  │                     └─────────────┘ └─────────────────┘  │ │
│  │              EtherCAT data link layer                    │ │
│  └─────────────────────────────────────────────────────────┘ │
│  ┌─────────────────────────────────────────────────────────┐ │
│  │              EtherCAT physical layer                     │ │
│  └─────────────────────────────────────────────────────────┘ │
└───────────────────────────────────────────────────────────────┘
```
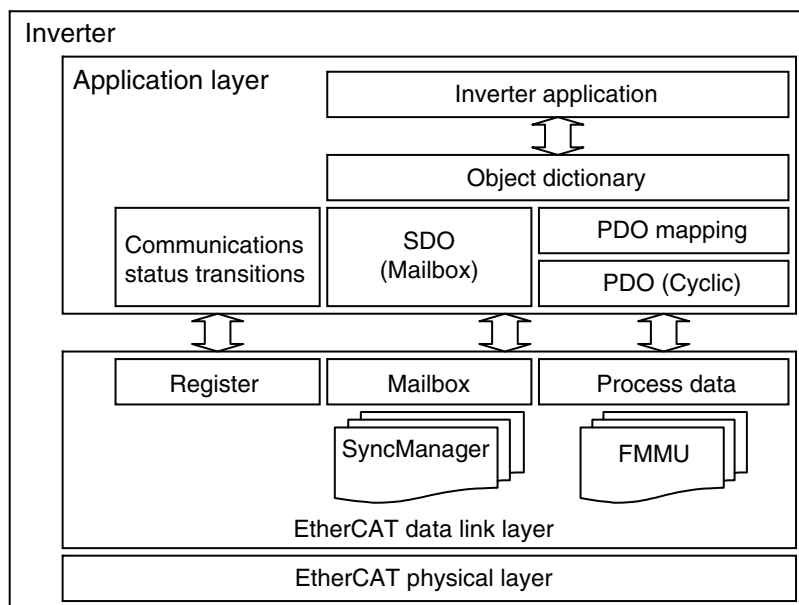
Normally, multiple protocols can be transmitted using EtherCAT. In the EtherCAT Communication Unit for MX2 inverters, the CANopen communication profile (CiA 301) that is popular in Europe, and the drive profile (CiA 402) are used.

The object dictionary in the application layer contains parameters and application data as well as information on the PDO mapping between the process data and inverter application.

The process data object (PDO) consists of objects in the object dictionary that can be mapped to the PDO. The contents of the process data are defined by the PDO mapping.

Process data communications cyclically reads and writes the PDO. Mailbox communications (SDO) uses asynchronous message communications where all objects in the object dictionary can be read and written.

3-2 Communications Status Transitions

The EtherCAT State Machine (ESM) of the EtherCAT slave is controlled by the EtherCAT Master.
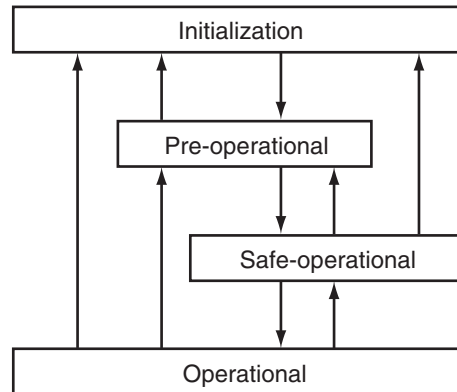
State	SDO communications	PDO reception	PDO transmission	Details
Initialization (Init)	Not supported	Not supported	Not supported	Communications are being initialized. Communications are not possible.
Pre-Operational (Pre-Op)	Supported	Not supported	Not supported	Only mailbox communications are possible in this state. This state is entered after initialization has been completed. It is used to initialize network settings.
Safe-Operational (Safe-Op)	Supported	Not supported	Supported	In this state, PDO transmissions are possible in addition to mailbox communications. Cyclic communications can be used to send information such as status from the inverter.
Operational (Op)	Supported	Supported	Supported	This is a normal operating state. Cyclic communications can be used to control the motor.

3-3   Process Data Objects (PDO)

3-3-1   Outline

The process data objects (PDOs) are used to transfer data during cyclic communications in realtime. There are two types of PDOs: reception PDOs (RxPDOs) which receive data from the controller, and transmission PDOs (TxPDOs) which send statuses from the inverter to the Host Controller.
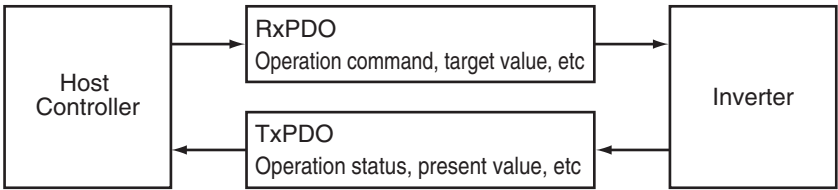
The EtherCAT application layer can hold multiple objects to enable the transferring of inverter process data. The contents of the process data are described in the PDO mapping object and the Sync Manager PDO assignment object.

3-3-2   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 00 hex of the mapping table. In this mapping table, 1600 to 17FF hex are for RxPDOs and 1A00 to 1BFF hex are for TxPDOs.

The following table is an example of PDO mapping.
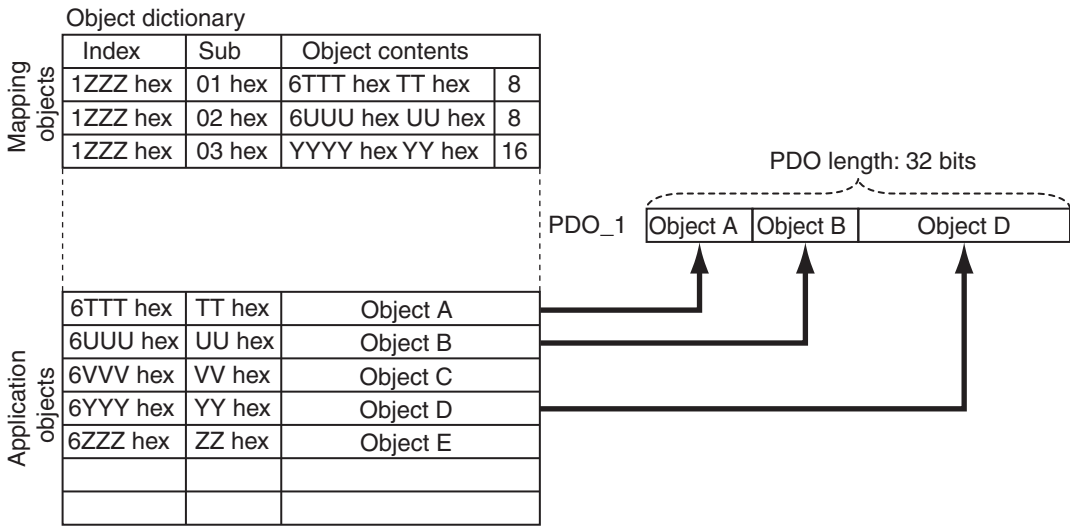
3-3-3   Sync Manager PDO Assignment Settings

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 00 hex of the Sync Manager PDO assignment table. In this table, index 1C12 hex is for RxPDOs and 1C13 hex is for TxPDOs.
The following table is an example of Sync Manager PDO mapping.

Object dictionary

Index	Sub	Object contents
1C1Z hex	1 hex	1A00 hex
1C1Z hex	2 hex	1A01 hex
1C1Z hex	3 hex	1A03 hex

Sync Manager entity Z

| PDO A | PDO B | PDO D |

Sync Manager PDO assignment objects

Mapping objects

1A00 hex	PDO A
1A01 hex	PDO B
1A02 hex	PDO C
1A03 hex	PDO D
1A04 hex	PDO E
1A05 hex	PDO F
1A06 hex	PDO G
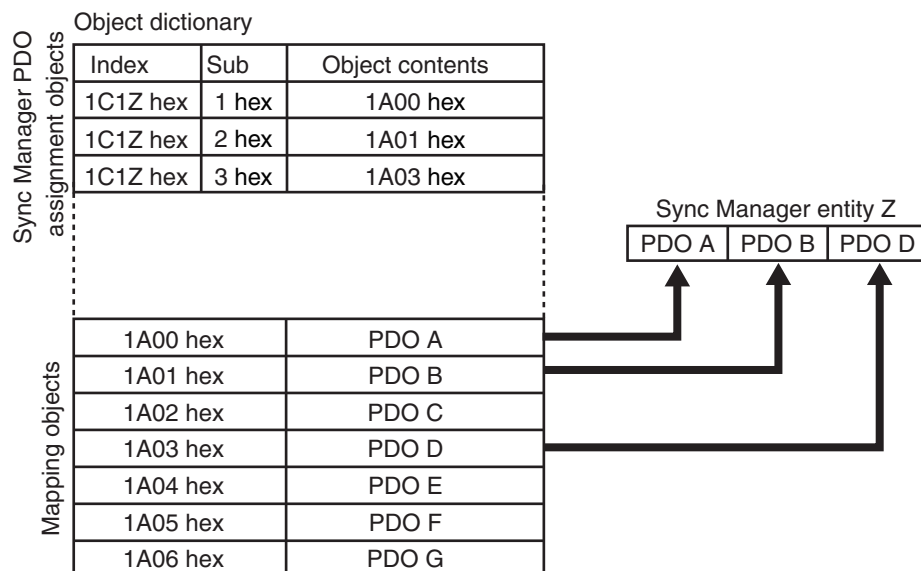
3-3-4   Fixed PDO Mapping

This section describes the contents of fixed PDO mapping for MX2 inverters. The contents of fixed PDOs cannot be changed.

PDO mapping for speed control (independent profile)

RxPDO (1701 hex)	5000 hex Command 5010 hex Frequency reference
TxPDO (1B01 hex)	5100 hex Status 5110 hex Output frequency monitor

PDO mapping for speed control (CiA402 profile)

RxPDO (1700 hex)	6040 hex Controlword 6042 hex vl target velocity
TxPDO (1B00 hex)	6041 hex Statusword 6043 hex vl velocity demand

3-4   Service Data Objects (SDO)

3-4-1   Outline

The EtherCAT Communication Unit for MX2 inverters supports SDO communications as message communications. SDO communications are used for setting objects and monitoring the status of MX2 inverters. Objects can be set and the status monitored by reading and writing data to the entries in the object dictionary of the Host Controller.

3-4-2   Abort Codes

The following table lists the abort codes for when an SDO communications error occurs.

Value	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 can not 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	Subindex 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

3-5   Emergency Messages

3-5-1   Outline

When an error or warning occurs in an MX2 inverter, an emergency message is sent to the master using mailbox communications. An emergency message is not sent for a communications error.
You can select whether to send emergency messages by setting Diagnosis history (10F3 hex).
The default setting is to send emergency messages. (10F3 hex, sub-index: 05 hex (Flags) = 1)
Set the sub-index 05 hex (Flags) in object 10F3 hex to 0 every time the power is turned ON to disable the sending of emergency messages.

Emergency messages consist of 8 bytes of data.

Byte	0	1	2	3	4	5	6	7
Meaning	Error code		Error register (Object 1001 hex)	Manufacturer specific error field (reserved)				

3-5-2   Error Code List

Error code	Meaning	Possible correction
5300 hex	Error in the option and inverter connection	• Check that the Communication Unit is mounted correctly onto the inverter. • The Communication Unit is faulty. Replace the Communication Unit. • If a trip reset was performed with the inverter, set the inverter C102 to 3: Trip reset only, and turn the power supply OFF and ON again. • If an initialization mode change was performed with the inverter, turn the inverter power supply OFF and ON again.
6341 hex	PDO setting error	A set value in PDO mapping is invalid. Check the value of object 5200 and the AL Status code, and then review the PDO assignment settings.
6331 hex	EEPROM data error	• An error was detected in data inside EEPROM when the power supply was turned ON. Replace the Communication Unit. • The Diagnosis history cannot be saved because the EEPROM has reached the end of its service life. There is no effect on operations, but if you want to use the Diagnosis history, replace the unit.
FF00 hex	A warning occurred for the inverter	Eliminate the cause and turn on the bit 7: Fault reset of 5000 hex (Command) or 6040 hex (Controlword).
FF01 hex	A trip occurred for the inverter	Eliminate the cause and turn on the bit 7: Fault reset of 5000 hex (Command) or 6040 hex (Controlword).

3-6   Sysmac Device Functions

The control device products designed according to the unified communication specifications and user interface specifications applicable to OMRON's control devices are called Sysmac devices.
In addition, the functions of these devices are called Sysmac device functions.
The following explains the functions available when this product is combined with the Machine Automation Controller including NJ Series or automation software.

The EtherCAT Communication Unit 3G3AX-MX2-ECT is a Sysmac device that, if the unit version is 1.1 or later, supports Sysmac device functions.

● Sysmac error status

Errors generated by slaves are systematically defined in Sysmac devices. When Sysmac Studio is used, error messages and remedial actions can be checked by following common operating procedures.
Errors are notified by 2002 hex-01 hex: Sysmac Error status. If errors detected by the EtherCAT Communication Unit are to be displayed in Sysmac Studio, 2002 hex-01 hex: Sysmac Error status must be mapped to the PDO. By default, Sysmac Studio automatically maps 2002 hex-01 hex: Sysmac Error status to the PDO by allocation of 1BFF hex : 512th transmit PDO Mapping.

Additional Information

- For the Sysmac error status, refer to *5-6-1 Manufacturer Specific Objects* on page 5-16.
- For the errors displayed in Sysmac Studio, refer to *A-5 Sysmac Error Status Codes* on page A-36.

● Saving the node address settings

When the node address switch is set to 00, it means that the system is in the software setting mode and the node address values set by Sysmac Studio become effective.
In the software setting mode, execute **Write Slave Node Address** on the **EtherCAT** Edit Screen of Sysmac Studio to save the set values to the nonvolatile memory on the EtherCAT Communication Unit side.

Software setting

The value saved in the non-volatile memory on the slave side as SII (Slave Information Interface) information becomes the node address.

(1) While the power is off, set the node address switches to 00.
(2) Write the set value of node address to SII on the slave, from the master side.
(3) When the slave power is turned on, the set value of node address is reflected in the register address 0012 hex by the software.
(4) The EtherCAT master reads the set value at the register address 0012 hex.
(5) The EtherCAT master writes the value at the address 0012 hex to the address 0010 hex as the node address.

Node address switch setting

The value set by the node address switches on the slave becomes the node address.

(1) While the power is off, set the node address switches.
(2) When the slave power is turned on, the value set by the node address switches is reflected in the register address 0012 hex.
(3) The EtherCAT master reads the set value at the register address 0012 hex.
(4) The EtherCAT master writes the value at the address 0012 hex to the address 0010 hex as the node address.
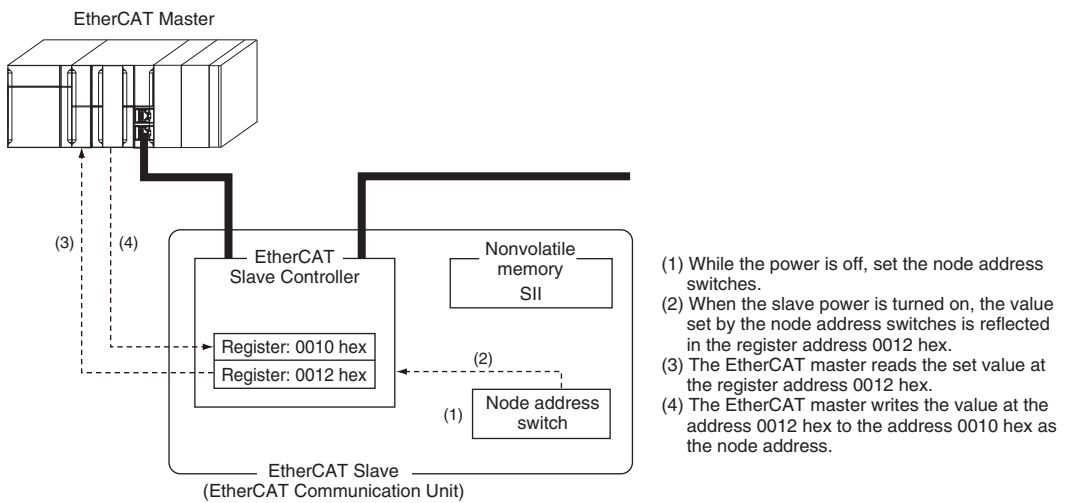
● Displaying the serial number

The serial number saved in the nonvolatile memory on the Servo Drive side is displayed under 1018 hex-04 hex: Serial number. With controllers conforming to the Sysmac device functions, the network configuration can be checked using this serial number.
To check the network configuration, set **Setting = Actual device** under **Serial Number Check Method** on the **EtherCAT** Edit Screen of Sysmac Studio.
If the specified criteria cannot be met, a Network Configuration Verification Error will occur.

📑 **Additional Information**

Since replacement of slave device can be detected, all slave parameters will be set without fail.

● Conforming to the ESI Specification (ETG.2000 S (R) V1.0.1)

The ESI Specification is a specification document defining the items described in the EtherCAT Slave Information (ESI) file.
With controllers conforming to the Sysmac device functions, optional functions defined in the ESI Specification can be used to specify backup parameters on the slave side.
Specified backup parameters on the slave side can be backed up and restored by Sysmac Studio.

● SII data check

SII (Slave Information Interface) represents configuration information specific to each EtherCAT slave, which is written to the nonvolatile memory in the EtherCAT slave.

With Sysmac device EtherCAT slaves, SII information is checked on the slave side.
If the slave cannot operated based on the SII information written, a SII verification error will occur. If the error still occurs after turning the power OFF and then ON again, contact your OMRON sales representative.

Precautions for Correct Use

Do not modify the SII information using a setting tool by other manufacturer.

4

Inverter Control

This chapter describes the profiles that are used to control inverters.

4-1   Outline

This section describes how to use the EtherCAT Communication Unit to control the inverter.

4-1-1   Function Selection

Inverter control is performed by allocating a function object to a PDO.
These functions are limited depending on the combination with the used Master Unit.

Type	Details
Allocation when using CJ1W-NCx82	The fixed allocation when connected with OMRON's CJ1W-NCx82.
Independent profile	OMRON's independently-developed function object. Enables easy control of the inverter.
CiA402 drive profile	A function object that conforms to the CiA402 drive profile.
PDO free format	Objects can be freely allocated, including the above objects.

*1   When using a Master Unit from another manufacturer, check yourself whether it supports the above functions.
*2   If you are using your NJ501-1x00 as the master, refer to the explanation on allocation in PDO free format.

4-1-2   Object Mapping

Allocate the object that you want to use to a PDO with the procedure below.

1   **Allocate the object to a PDO.**

2   **Assign the PDO to Sync Manager.**

Use the tool of the Master Unit for allocation.

PDO Mapping

This unit uses the PDOs below to allocate the objects.

● RxPDO (master to slave)

PDO	Details
1600 hex to 1604 hex (1st receive PDO Mapping to 5th receive PDO Mapping)	Objects can be freely allocated. Up to 2 objects (maximum size of 4 bytes) can be allocated to each PDO.
1700 hex (257th receive PDO Mapping)	The fixed allocation that conforms to the CiA402 drive profile.
1701 hex (258th receive PDO Mapping)	The fixed allocation of the independent profile.

● TxPDO (slave to master)

PDO	Details
1A00 to 1A04 hex (1st transmit PDO Mapping to 5th transmit PDO Mapping)	Objects can be freely allocated. Up to 2 objects (maximum size of 4 bytes) can be allocated to each PDO.
1B00 hex (257th transmit PDO Mapping)	The fixed allocation that conforms to the CiA402 drive profile.
1B01 hex (258th transmit PDO Mapping)	The fixed allocation of the independent profile.
1BFF hex (512th transmit PDO Mapping)	By default, Sysmac Studio assigns 2002 hex: Sysmac error status.

Sync ManagerAssignment

In this unit, specify the PDOs that you want to use as follows.

● Sync Manager

Sync Manager PDO assignment	Details
1C12 hex	Allocate RxPDO (master to slave). Up to 5 RxPDOs can be allocated.
1C13 hex	Allocate TxPDO (slave to master). Up to 5 TxPDOs can be allocated.

4-2   Control with the Position Control Unit

This section describes how to connect the OMRON CJ1W-NCx82 and the EtherCAT Communication Unit to control the inverter.

4-2-1   Inverter Setting

Set the inverter parameters as follows.

Parameter	Description
A001 Frequency Reference Selection 1	04: Optional board
A002 RUN Command Selection 1	04: Optional board
C102 Reset Selection	03: Trip reset only
P012 Simple Position Control Selection	00: Simple position control disabled 02: Simple position control enabled

* Select speed control or Simple position control by setting inverter parameter P012: Simple Position Control Selection.
  To use the Simple position control function, set the required parameters in accordance with the inverter manual.
* If parameter C102 is not displayed, set b037 to 01.
* Do not use motor 2 control of the inverter. The motor 1 control only can be used.

4-2-2   Object Mapping

The object that will be used is allocated with the fixed settings below.

● PDO mapping

PDO	Description
1701 hex	5000 (Command) 5010 (Frequency reference)
1600 hex	4016.6B (P060 Multi-step position command 0)
1601 hex	301F.40 (Multi-function input (Modbus communication register 1F01 hex coil data 0))
1B01 hex	5100 (Status) 5110 (Output frequency monitor)
1A00 hex	4010.59 (d030 Current position monitor)
1A01 hex	3010.29 (d006 Multi-function output monitor)

● Sync Manager assignment

Sync Manager PDO assignment	Description
1C12 hex	1701 (Fixed allocation of the independent profile) 1600 (Setting as above) 1601 (Setting as above)
1C13 hex	1B00 (Fixed allocation of the independent profile) 1A00 (Setting as above) 1A01 (Setting as above)

4-2-3   Control Method

Control the inverter by operating the fixed mapping PDOs.

● Control information (master to slave)

Word	Meaning
n	Control command
n + 1	Frequency reference
n + 2	Multi-step position command 0 (LSW)
n + 3	Multi-step position command 0 (MSW)
n + 4	Multi-function input

(Notes) n: Start address of the remote I/O output relay area that is assigned to the unit.

● Status information (slave to master)

Word	Meaning
m	Status
m + 1	Output frequency monitor
m + 2	Current position monitor (LSW)
m + 3	Current position monitor (MSW)
m + 4	Multi-function output monitor

(Notes) m: Start address of the remote I/O input relay area that is assigned to the unit.

Bit and data information

● Command

The bit data for the command is shown below.

–	–	–	–	–	–	–	–	7	–	–	–	–	–	1	0

Bit	Name	Meaning
0	Forward/stop *1	0: Stop 1: Forward command
1	Reverse/stop *1	0: Stop 1: Reverse command
7	Fault reset	⬆: Resets an error or trip for the unit or inverter.
-	(Reserved)	The reserved area. Set 0.

*1   Operates as a start bit when Simple position control is enabled.

● Frequency reference

Name	Meaning
Frequency reference	Specify the reference frequency in increments of 0.01 Hz. When a value is set that exceeds the maximum frequency, operation is performed at the maximum frequency. Setting range: 0 to maximum frequency

● Multi-step Position command 0

Name	Meaning
Multi-step position command 0	Specify the value of inverter parameter P060: Multi-step position command 0. Values outside the range are not applied and operation is performed with the previous value. Setting range: Position range setting (reverse side) to position range setting (forward side)

● **Multi-function input**

The bit data for the multi-function input information is shown below.

–	–	13	12	11	10	9	8	7	–	–	–	–	–	–	–

Bit	Name	Meaning
7	Multi-function input 1	0: OFF
8	Multi-function input 2	1: ON
9	Multi-function input 3	
10	Multi-function input 4	
11	Multi-function input 5	
12	Multi-function input 6	
13	Multi-function input 7	
–	(Reserved)	The reserved area. Set 0.

* Use by assigning a function to the multi-function input with the inverter parameters.

● **Status**

The bit data for the status information is shown below.

15	–	–	12	–	–	9	–	7	–	–	–	3	–	1	0

Bit	Name	Meaning
0	Forward operation in progress	0: Stopped/during reverse operation 1: During forward operation
1	Reverse operation in progress	0: Stopped/during forward operation 1: During reverse operation
3	Fault	0: No error or trip occurred for the unit or inverter 1: Error or trip occurred for the unit or inverter
7	Warning	0: No warning occurred for the unit or inverter 1: Warning occurred for the unit or inverter
9	Remote	0: Local (Operations from EtherCAT are disabled) 1: Remote (Operations from EtherCAT are enabled)
12	Frequency matching	0: During acceleration/deceleration 1: Frequency matched
15	Connection error between the Optional Unit and inverter	0: Normal 1: Error (Cannot update data for the inverter. To restore, turn the power OFF and then ON again.)
–	(Reserved)	The reserved area. Set 0.

● **Output frequency monitor**

Name	Meaning
Output frequency monitor	Displays the output frequency in increments of 0.01 Hz.

● **Current position monitor**

Name	Meaning
Current position monitor	Displays the value of inverter parameter d030: Current position monitor.

● **Multi-function output monitor**

The bit data for the multi-function output monitor information is shown below.

–	–	–	–	–	–	–	–	–	6	–	–	–	–	1	0

Bit	Name	Meaning
0	Multi-function output P1/EDM	0: OFF
1	Multi-function output P2	1: ON
6	Multi-function relay output	
–	(Reserved)	The reserved area. Set 0.

* Use by assigning a function to the multi-function output with the inverter parameters.

4-2-4   Sample Program

Configuration

This section explains a configuration that uses CJ1W-NCx82 as the master, and one MX2 inverter on which an EtherCAT Communication Unit (node address: 17) is mounted as the slave.

Parameter settings

The shared parameter settings of CJ1W-NCx82 are as follows.

Parameter name	Set value
Remote I/O Output Memory Area Selection	CIO area
First word of remote I/O Output memory area	3800
Remote I/O Input Memory Area Selection	CIO area
First word of remote I/O Input memory area	3900

The control information and status information of the EtherCAT Communication Unit is allocated to the addresses below.

• Control information (master to slave)

Word	Address	Meaning

n	CIO 3800	Command
		  Bit 0: Forward/stop
		  Bit 1: Reverse/stop
		  Bit 7: Fault reset

n + 1	CIO 3801	Frequency reference (increments of 0.01 Hz)

• Status information (slave to master)

Word	Address	Meaning

m	CIO 3900	Command
		  Bit 0: During forward operation
		  Bit 1: During reverse operation
		  Bit 3: Fault

m + 1	CIO 3901	Output frequency monitor (increments of 0.01 Hz)

Ladder program example

Time chart
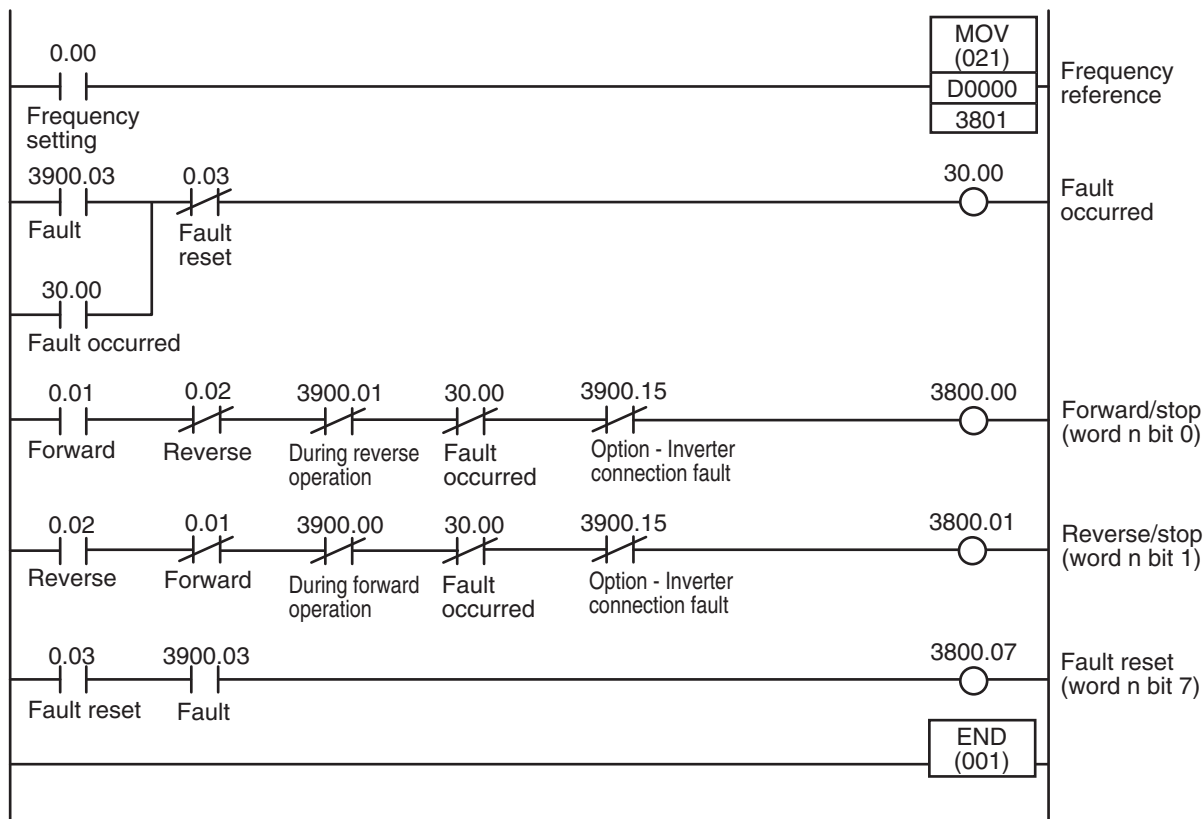
EtherCAT Communication Unit USER'S MANUAL (3G3AX-MX2-ECT)
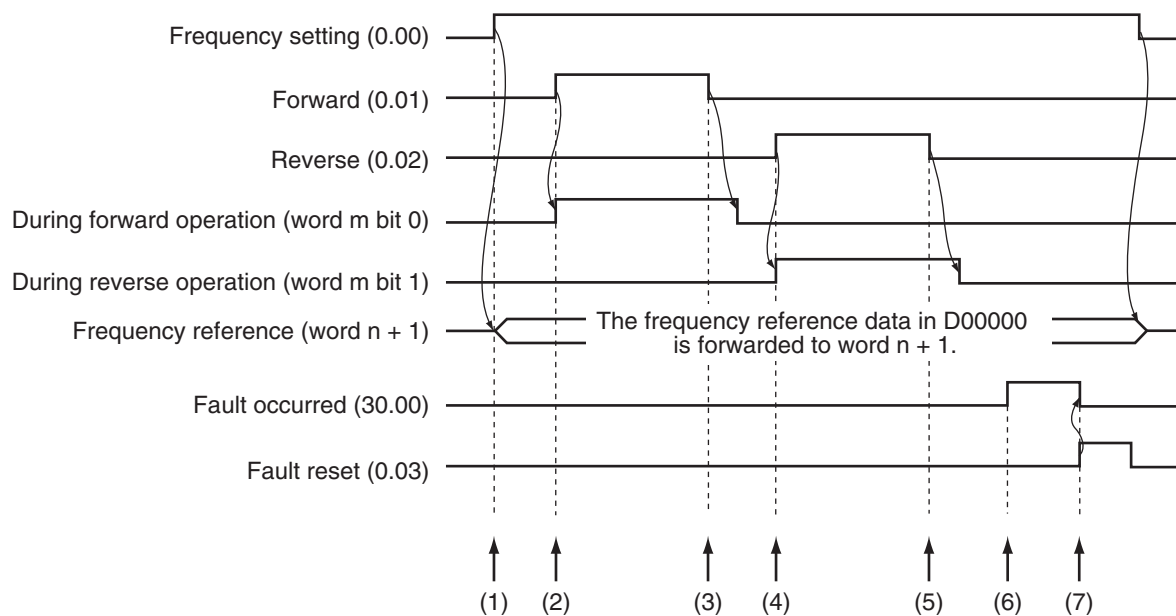
Explanation of operations

(1) When the "Frequency setting" contact is turned ON, the frequency reference data that is set in D00000 is forwarded to the remote I/O output relay area (word n + 1).

(2) When the "Forward" contact is turned ON, "Forward/stop (word n bit 0)" of the remote I/O output relay area turns ON and forward operation starts. During forward operation, "During forward operation (word m bit 0)" of the remote I/O input relay area turns ON.

(3) When the "Forward" contact is turned OFF and after decelerating and stopping, "During forward operation (word m bit 1)" of the remote I/O input relay area turns OFF.

(4) When the "Reverse" contact is turned ON, "Reverse/stop (word n bit 1)" of the remote I/O output relay area turns ON and reverse operation starts. During reverse operation, "During reverse operation (word m bit 1)" of the remote I/O input relay area turns ON.

(5) When the "Reverse" contact is turned OFF and after decelerating and stopping, "During reverse operation (word m bit 1)" of the remote I/O input relay area turns OFF.

(6) When "Fault (word m bit 3)" of the remote I/O input relay area turns ON, "Fault occurred" turns ON.

(7) When the "Fault reset" contact is turned ON, "Fault reset (word n bit 7)" of the remote I/O output relay area turns ON and the fault is cancelled.

4-2 Control with the Position Control Unit

4

4-2-4 Sample Program

4-3   Control with the Independent Profile

This section describes how to use the OMRON profile to control the inverter.

4-3-1   Inverter Setting

The inverter parameters must be set to match the profile.
With the independent profile, set as follows.

Parameter	Description
A001 Frequency Reference Selection 1	04: Optional boad
A002 RUN Command Selection 1	04: Optional boad
C102 Reset Selection	03: Trip reset only

* If parameter C102 is not displayed, set b037 to 01.

4-3-2   Profile Allocation

Assign the PDOs of the independent profile to Sync Manager.

Sync Manager PDO assignment	Description
1C12 hex	1701 hex (Fixed allocation of the independent profile)
1C13 hex	1B01 hex (Fixed allocation of the independent profile)

The values below are the fixed mapping for the PDOs.

PDO	Description
1701 hex	5000 hex (Command) 5010 hex (Frequency reference)
1B01 hex	5100 hex (Status) 5110 hex (Output frequency monitor)

4-3-3   Control Method

Control the inverter by operating the PDOs that allocate the profile.

IO format

● Control information (master to slave)

Word	Meaning
n	Command
n + 1	Frequency reference

● Status information (slave to master)

Word	Meaning
m	Status
m + 1	Output frequency monitor

Bit and data information

● Command

–	–	–	–	–	–	–	–	7	–	–	–	–	–	1	0

Bit	Name	Meaning
0	Forward/stop	0: Stop 1: Forward command
1	Reverse/stop	0: Stop 1: Reverse command
7	Fault reset	↑: Resets an error or trip for the unit or inverter.
-	Reserved	Set 0.

● Frequency reference

Name	Meaning
Frequency reference	Specify the frequency reference in increments of 0.01 Hz. When a value is set that exceeds the maximum frequency, operation is performed at the maximum frequency. Setting range: 0 to maximum frequency

● Status

The 16-bit data is as shown below.

15	–	–	12	–	–	9	–	7	–	–	–	3	–	1	0

Bit	Name	Meaning
0	During forward operation	0: Stopped/during reverse operation 1: During forward operation
1	During reverse operation	0: Stopped/during forward operation 1: During reverse operation
3	Fault	0: No error or trip occurred for the unit or inverter 1: No error or trip occurred for the unit or inverter
7	Warning	0: No warning occurred for the unit or inverter 1: Warning occurred for the unit or inverter
9	Remote	0: Local (Operations from EtherCAT are disabled) 1: Remote (Operations from EtherCAT are enabled)
12	Frequency matching	0: During acceleration/deceleration or stopped 1: Frequency matched
15	Connection error between the Optional Unit and inverter	0: Normal 1: Error (Cannot update data for the inverter. To restore, turn the power supply OFF and then ON again.)
–	Reserved	Set 0.

● Output frequency monitor

Name	Meaning
Output frequency monitor	Displays the output frequency in increments of 0.01 Hz.

4-4   Control with the CiA402 Profile

This section describes how to use the Velocity mode of the CiA402 drive profile to control the inverter.

4-4-1   Inverter Setting

The inverter parameters must be set to match the profile.
With the CiA402 profile, set as follows.

Parameter	Description
A001 Frequency Reference Selection 1	04: Optional boad
A002 RUN Command Selection 1	04: Optional boad
H004 Motor Pole Number 1	2/4/6/8/10(Set to match the system.)
C102 Reset Selection	03 (Trip reset only)

* After changing H004, turn the inverter power supply OFF and ON again.

* If parameter C102 is not displayed, set b037 to 01.

* Do not use motor 2 control of the inverter. The motor 1 control only can be used.

4-4-2   Profile Allocation

Assign the PDOs of the CiA402 profile to Sync Manager.

Sync Manager PDO assignment	Description
1C12 hex	1700 hex (Fixed allocation conforming to the CiA402 drive profile)
1C13 hex	1B00 hex (Fixed allocation conforming to the CiA402 drive profile)

The values below are the fixed mapping for the PDOs.

PDO	Description
1700 hex	6040 hex (Controlword) 6042 hex (vl target velocity)
1B00 hex	6041 hex (Statusword) 6043 hex (vl velocity demand)

4-4-3   Control Method

Control the inverter by operating the PDOs that allocate the profile.

IO format

● Control information (master to slave)

Word	Meaning
n	Controlword
n + 1	vl target velocity

● Status information (slave to master)

Word	Meaning
m	Statusword
m + 1	vl velocity demand

Bit and data information

● Controlword

The 16-bit data is as shown below.

–	–	–	–	–	–	–	–	7	–	–	–	3	2	1	0

Bit	Name	Meaning
0	Switch on	The state is controlled by these bits.
1	Enable voltage	For details, refer to *5-1-3 Command Coding* on page 5-3.
2	Quick stop	
3	Enable operation	
7	Fault reset	Faults and warnings are cleared when this bit turns ON.
–	Reserved	Set 0.

* When Quick stop is set to 0 during operation, deceleration stop is made. After completely stopping, the next operation is accepted.

● vl target velocity

Name	Meaning
vl target velocity	Specify the command speed in rpm. Setting range: −maximum speed to +maximum speed Specify the operation direction with a symbol (−/+). When a value is set that exceeds the maximum frequency, operation is performed at the maximum frequency.

● Statusword

The 16-bit data is as shown below.

–	–	–	–	–	–	9	–	7	6	5	4	3	2	1	0

Bit	Name	Meaning
0	Ready to switch on	These bits indicate the state.
1	Switched on	For details, refer to *5-1-4 State Coding* on page 5-3.
2	Operation enabled	
3	Fault	
4	Voltage enabled	
5	Quick stop	
6	Switch on disabled	
7	Warning	0: No warning occurred for the unit or inverter. 1: Warning occurred for the unit or inverter.
9	Remote	0: Control from Controlword is disabled. 1: Control from Controlword is enabled.
–	Reserved	Not used.

● vl velocity demand

Name	Meaning
vl velocity demand	Displays the operation speed in rpm. The operation direction is expressed with a symbol (−/+).

4-5 Control with the PDO Free Format

Objects can be freely allocated to PDOs to create an independent profile.
If you use in combination with the OMRON independent profile or the CiA402 drive profile, you can perform advanced control and monitoring.
To use your OMRON NJ501-1x00 as the master, allocate desired objects by referring to this section.

4-5-1 Inverter Setting

When using the OMRON independent profile, set A001, A002 and C102.
When using the CiA402 drive profile, set A001, A002, H004 and C102.
For details, refer to the previous sections.

4-5-2 Object Mapping

Allocate the objects that you want to use to PDOs.

Setting example

Set as follows to allocate the acceleration time and deceleration time to RxPDO and the current monitor to TxPDO, based on the OMRON independent profile.

● PDO mapping

PDO	Description
1600 hex (1st receive PDO Mapping)	4011.26 (F002 Acceleration time setting 1)
1601 hex (2nd receive PDO Mapping)	4011.28 (F003 Deceleration time setting 1)
1A00 hex (1st transmit PDO Mapping)	3010.24 (d002 Output current monitor)

● Sync Manager assignment

Sync Manager PDO assignment	Description
1C12 hex	1701 hex (Fixed allocation of the independent profile) 1600 hex (Setting as above) 1601 hex (Setting as above)
1C13 hex	1B01 hex (Fixed allocation of the independent profile) 1A00 hex (Setting as above)

Following from the above allocations, the IO format is as follows.

● Control information (master to slave)

Word	Meaning
n	Command
n + 1	Frequency reference
n + 2	Acceleration time setting 1 (LSW)
n + 3	Acceleration time setting 1 (MSW)
n + 4	Deceleration time setting 1 (LSW)
n + 5	Deceleration time setting 1 (MSW)

● **Status information (slave to master)**

Word	Meaning
m	Status
m + 1	Output frequency monitor
m + 2	Output current monitor

4-5-3   Objects Allocation in Sysmac Studio

In Sysmac Studio, you can edit the PDO map settings for each slave.
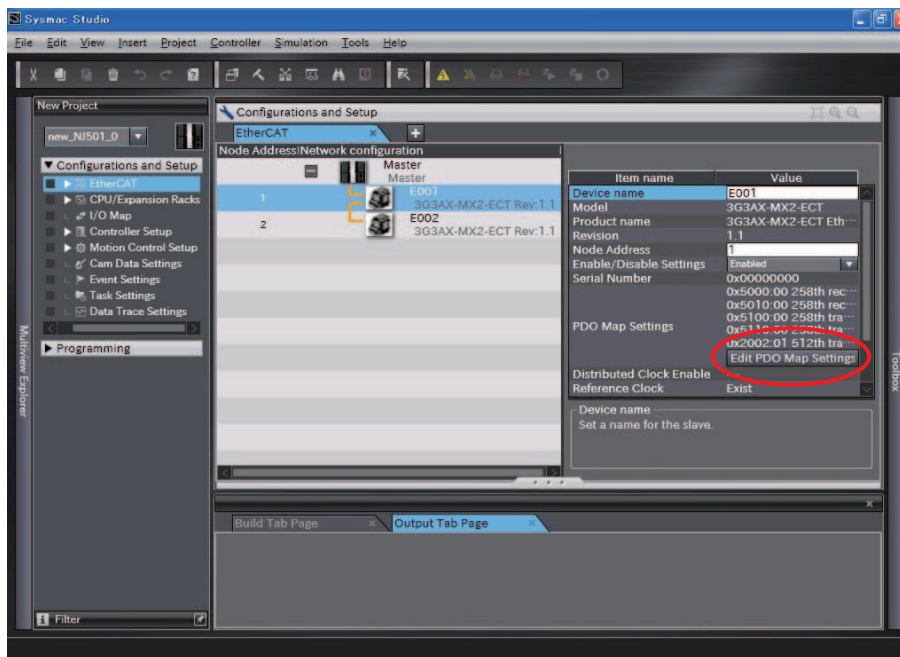
Click **Edit PDO Map Settings** in the **Configurations and Setup** of the EtherCAT slave to open the **Edit PDO Map Settings** pane.
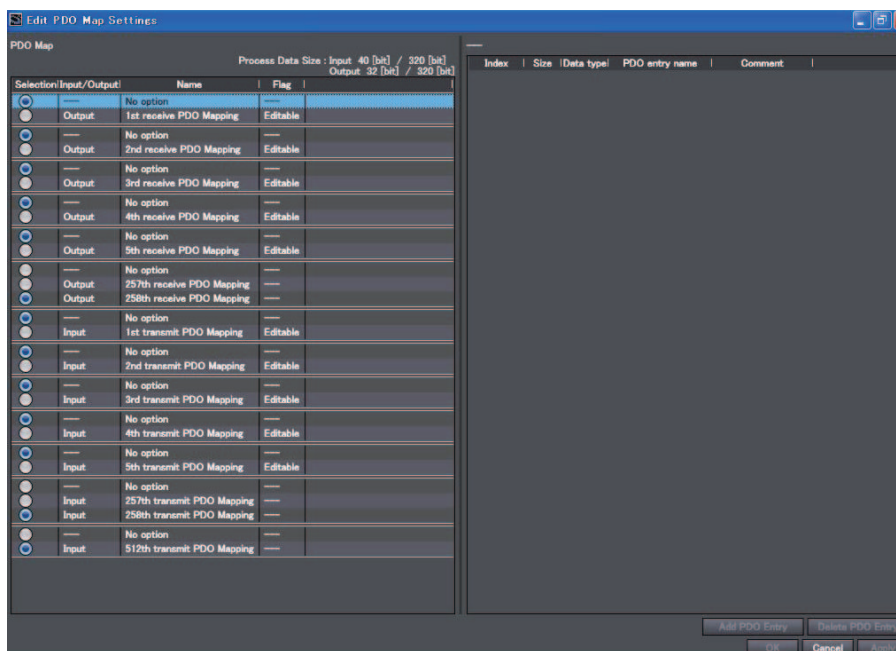
To allocate an object to a PDO in Sysmac Studio, select **Output** (or **Input**) for one of *1st receive PDO Mapping* to *5th receive PDO Mapping* (or *1st transmit PDO Mapping* to *5th transmit PDO Mapping*), right-click **Add PDO Entry** on the right side of the screen, and then select a desired object from the list. When **Output** (or **Input**) is selected, the applicable PDO among *1st receive PDO Mapping* to *5th receive PDO Mapping* (or *1st transmit PDO Mapping* to *5th transmit PDO Mapping*) will be allocated to Sync Manager.

Note that up to 5 PDOs can be selected each for the target of **Output** (or **Input**).

Add PDO Entry

In the example shown below, **Jogging Frequency** (Index: 3012.5Dh) and **Manual Torque Boost Frequency 1** (Index: 3012.62h) are allocated to **1st receive PDO Mapping**.
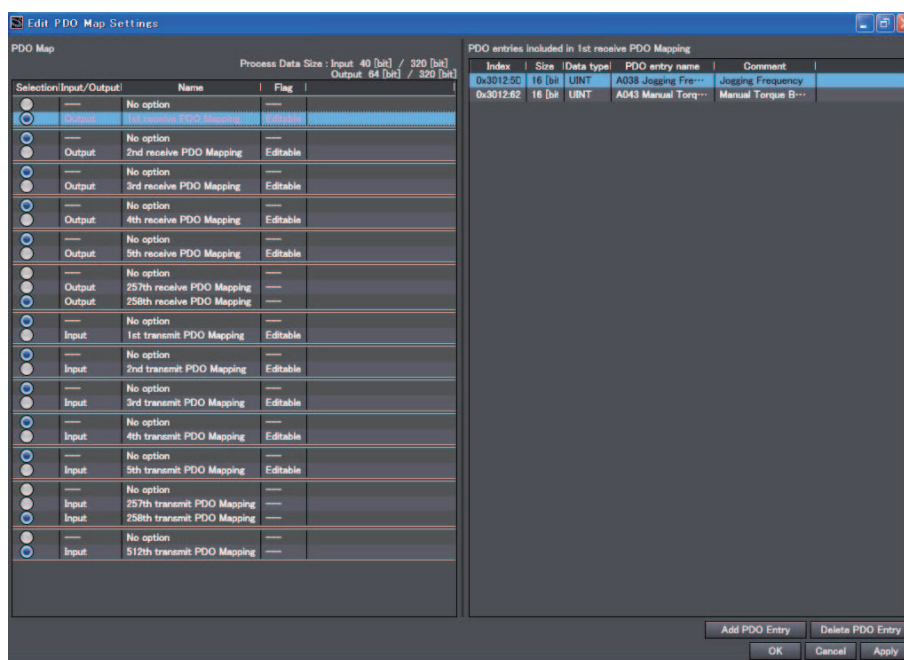
4-5-4   Restrictions

The PDO free format has the restrictions that are described below.

- Up to 2 objects can be allocated to each PDO from 1600 to 1604 hex and 1A00 to 1A04 hex. Keep the total size of the allocated objects to within 4 bytes.
- Up to 5 PDOs each can be allocated to 1C12 and 1C13.
- An object from 5000 to 5999 cannot be allocated to RxPDO (master to slave) together with an object from 6000 to 6999.
- An RxPDO that combines an object from 5000 to 5999 with an object from 6000 to 6999 cannot be allocated to 1C12 hex of Sync Manager.
- The inverter parameters (objects 3000 to 3999 and 4000 to 4999) that can be allocated to RxPDO (master to slave) are limited to those that can be changed during operation.
- It is not possible to allocate only the LSW or only the MSW to RxPDO or TxPDO.
- The greater the number of RxPDOs or TxPDOs is, the longer the data updating cycle becomes. Normally the data is updated every 4 ms, but it can increase to every 6 ms depending on the number.

4-6 Trial operation via EtherCAT Communication Unit

You can use the "Test Operation" function of your parameter setting tool (CX-Drive, etc.) to operate the inverter on a trial basis.

Before performing trial operation of the inverter via the EtherCAT Communication Unit, make sure EtherCAT network communications have been established properly. The main purpose of trial operation is to confirm that the system operates correctly from the electrical viewpoint. Perform trial operation after confirming safety around the devices.

If an error occurs during trial operation, remove the error by referring to Chapter 6, *Handling of Errors and Maintenance* or the User's Manual for MX2 Series, and resume operation after conforming safety.

● **How to perform trial operation using a parameter setting tool**

1 **Start your parameter setting tool and make online connection via EtherCAT.**

2 **Select the Test Operation function.**

3 **Set a desired frequency, acceleration time and deceleration time, and then select Forward or Reverse and run the motor.**
The motor will keep running until Stop is selected.

4

5

CiA402 Drive Profile

This chapter explains about the CiA402 drive profile.

5-1   Inverter State Control

The state of the MX2 inverter is controlled by using the Controlword (6040 hex). Control state is given in the Statusword (6041 hex).

5-1-1   State Machine

The state of the MX2 inverter changes as shown below.
Each box indicates a state, while numbers 2 to 10 and 15 indicate the state control commands.
For details on the states, refer to *5-1-2 State Descriptions* on page 5-3, and for details on the command codings, refer to *5-1-3 Command Coding* on page 5-3.
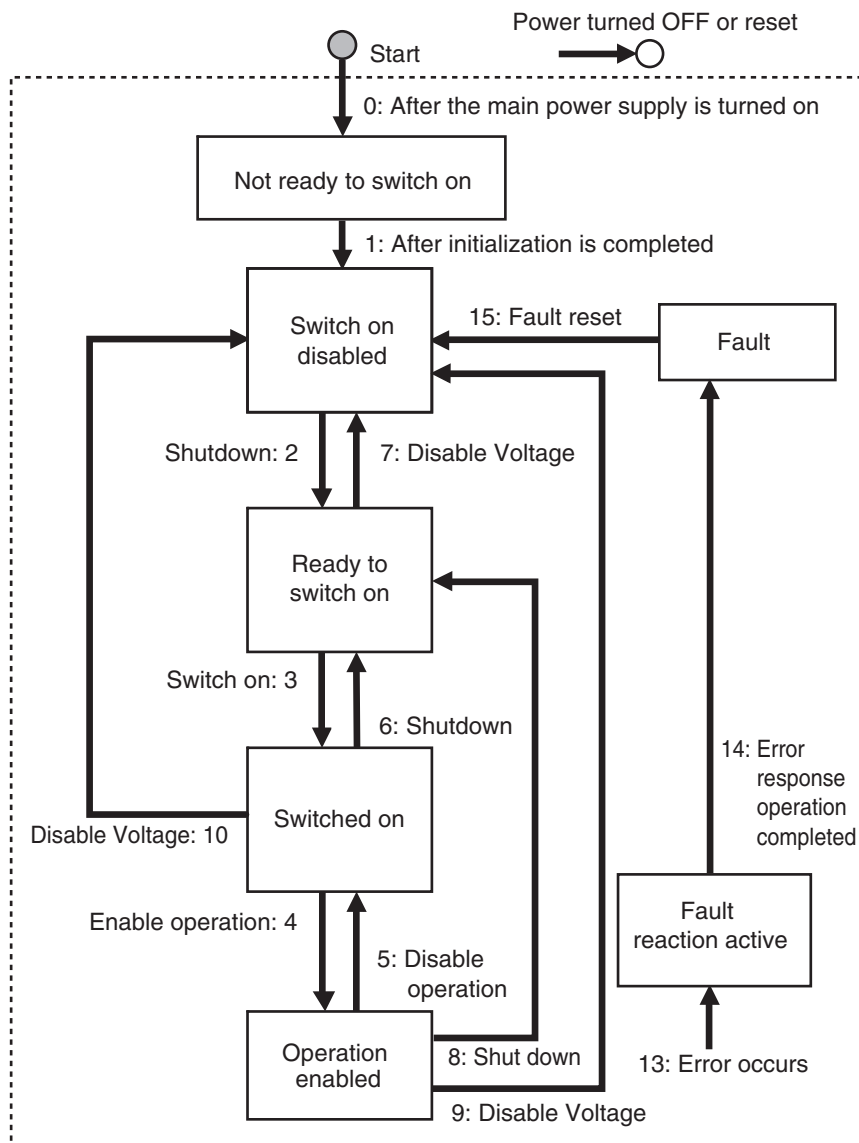
(Notes)   The Quick stop active state is not supported. If Quick stop is enabled in the Operation enable state, transition 9 is executed.

5-1-2   State Descriptions

State	Details
Not ready to switch on	The power supply is turned ON and initialization is being executed.
Switch on disabled	Initialization has been completed. Parameters can be set.
Ready to switch on	Parameters can be set.
Switched on	Parameters can be set.
Operation enabled	Inverter can be controlled. Parameters can be set.
Fault reaction active	There was an error in the inverter and the cause is being determined. Parameters can be set.
Fault	There is an error in the inverter. Parameters can be set.

5-1-3   Command Coding

The state is controlled by combining the bits in Controlword (6040 hex), as shown in the following table.

Command	Controlword bit					Transition
	Bit 7 fr	Bit 3 eo	Bit 2 qs	Bit 1 ev	Bit 0 so	
Shutdown	-	-	1	1	0	2, 6, 8
Switch on	-	0	1	1	1	3
Switch on + enable operation	-	1	1	1	1	3 + 4[*1]
Disable voltage	-	-	-	0	-	7, 9, 10
Quick stop	-	-	0	1	-	7, 9, 10
Disable operation	-	0	1	1	1	5
Enable operation	-	1	1	1	1	4
Fault reset	$0 \rightarrow 1$[*2][*3]	-	-	-	-	15

(Notes)   fr = Fault reset, eo = Enable operation, qs = Quick stop, ev = Enable voltage, so = Switch on

*1   The state automatically transitions to the Enable operation state after the Switch on state.

*2   Operation when bit 7: Fault reset turns ON.

    Fault state   : Fault are cleared and the state transitions to Switch on disabled.

                             : If there are any warnings (6401 hex: Statusword bit 7), they are reset.

    State other than Fault   : If there are any warnings (6041 hex: Statusword bit 7), they are reset.

                             : The state will change according to command bits 0 to 3.

*3   When Fault reset is executed with bit 7, set the bit back to 0 before giving the next command.

5-1-4   State Coding

The state is indicated by the combination of bits in Statusword (6041 hex), as shown in the following table.

State	Bit 6 sod	Bit 5 qs	Bit 4 ve	Bit 3 f	Bit 2 oe	Bit 1 so	Bit 0 rtso
Not ready to switch on	0	0	-	0	0	0	0
Switch on disabled	1	1	-	0	0	0	0
Ready to switch on	0	1	-	0	0	0	1
Switched on	0	1	1	0	0	1	1
Operation enabled	0	1	1	0	1	1	1
Fault reaction active	0	1	-	1	1	1	1
Fault	0	1	-	1	0	0	0

(Notes)   sod = Switch on disabled, qs = Quick stop, ve = Voltage enabled, f = Fault, oe = Operation enabled,
          so = Switched on, rtso = Ready to switch on

5-2   Modes of Operation

The operation mode indicated below is supported.

* vl: Velocity mode

The operation mode is set in Modes of operation (6060 hex). In addition, the operation mode is given in Modes of operation display (6061 hex).
The operation modes supported by the inverter can be checked in Supported drive modes (6502 hex).

5-3 Velocity Mode

In this operation mode, the output speed of the inverter can be controlled.
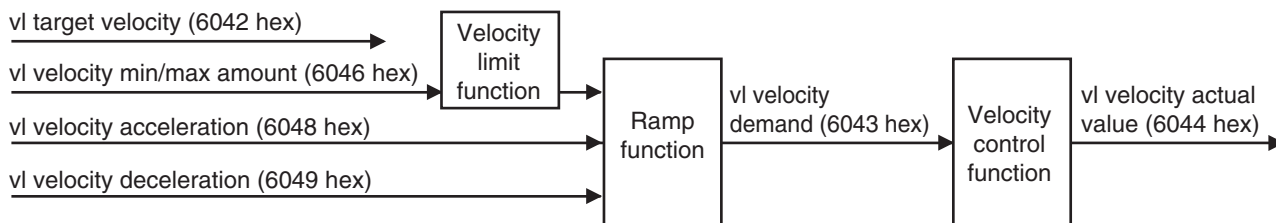
- Related objects

Index	Name	Details
6040 hex	Controlword	Gives commands to the inverter.
6042 hex	vl target velocity	Gives speed commands to the inverter.
6046 hex	vl velocity min max amount	Sets the maximum speed and minimum speed that can be output.
6048 hex	vl velocity acceleration	Sets the acceleration time.
6049 hex	vl velocity deceleration	Sets the deceleration time.
6041 hex	Statusword	Sets the status of the inverter.
6043 hex	vl velocity demand	Gives the command speed.
6044 hex	vl velocity actual value	Gives the output speed.

5-4   Object Dictionary

5-4-1   Object Dictionary Area

CANopen over EtherCAT (CoE) protocol uses the CANopen object dictionary as its base. All objects are assigned four-digit hexadecimal numbers in the areas shown in the following table.

Index	Area	Meaning
0000 to 0FFF hex	Data Type area	Definitions of data types.
1000 to 1FFF hex	CoE Communications area	Definitions of variables that can be used by all servers for designated communications.
2000 to 2FFF hex	Manufacturer Specific area 1	Variables with common definitions for all OMRON products.
3000 to 5FFF hex	Manufacturer Specific area 2	Variables with definitions for this unit. (Inverter parameters, independent profile)
6000 to 9FFF hex	Device Profile area	Variables defined in the inverter's CiA402 drive profile.
A000 to FFFF hex	Reserved area	Area reserved for future use.

5-4-2   Data Types

The data types shown in the following table are used in this profile.

Data type	Code	Size	Range
Boolean	BOOL	1 bit	0 to 1
Unsigned8	U8	1 byte	0 to 255
Unsigned16	U16	2 bytes	0 to 65,535
Unsigned32	U32	4 bytes	0 to 4,294,967,295
Integer8	INT8	1 byte	−128 to 127
Integer16	INT16	2 bytes	−32,768 to 327,671
Integer32	INT32	4 bytes	−2,147,483,648 to 2,147,483,647
Visible string	VS	–	–

5-4-3   Object Description Format

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

- Object description format

<Index>	<Object name>		Operating Mode
Setting range: <Setting range>	Unit: <Unit>	Default setting: <Default setting>	
Size: <Size>	Access: <Access>		PDO map: <Possible/Not possible>

- Object description format when there is a sub-index

<Index>	<Object name>		Operating Mode
Sub-index 0			
Setting range: <Setting range>	Unit: <Unit>	Default setting: <Default setting>	
Size: <Size>	Access: <Access>		PDO map: <Possible/Not possible>

- •
- •
- •

Sub-index N			
Setting range: <Setting range>	Unit: <Unit>	Default setting: <Default setting>	
Size: <Size>	Access: <Access>		PDO map: <Possible/Not possible>

- Index : Object index given by a four-digit hexadecimal number.
- Object name : The object name.
- Operating mode : Related operating modes.
- Setting range : The possible range of settings.
- Unit : Physical units.
- Default setting : The default value set before shipment.
- Size : The object size is given in bytes.
- Access : Indicates whether the object is read only, or read and write.
    RO: Read only.
    WO: Write only.
    RW: Read and write.
- PDO map : Indicates the PDO mapping attribute.

5-5   CoE Communications Area

5-5-1   Communication Objects

1000 hex	Device type		All
Setting range: –	Unit: –	Default setting: 00010192 hex	
Size: 4 bytes (U32)	Access: RO		PDO map: Not possible

- Gives the CoE device profile number.
- Explanation of set values

Bit	Name	Meaning
0 to 15	Device profile number	402 (192 hex): Drive profile
16 to 23	Type	01: Inverter
25 to 31	Mode	0: Manufacturer specific

1001 hex	Error register		All
Setting range: –	Unit: –	Default setting: 0	
Size: 1 byte (U8)	Access: RO		PDO map: Not possible

- Gives the error type that occurred.
- Explanation of set values

Bit	Details	Bit	Details
0	Generic error	4	Communication error
1	(Reserved)	5	Device profile specific error
2	(Reserved)	6	(Reserved)
3	(Reserved)	7	Manufacturer specific error

1008 hex	Manufacturer device name		All
Setting range: –	Unit: –	Default setting: 3G3AX-MX2-ECT	
Size: 20 bytes (VS)	Access: RO		PDO map: Not possible

- Gives the model.

1009 hex	Manufacturer hardware version		All
Setting range: –	Unit: –	Default setting: [1]	
Size: 20 bytes (VS)	Access: RO		PDO map: Not possible

1 "V.**" which shows the hardwave version is saved.
- Gives the Manufacturer hardware version of the EtherCAT Communication Unit.

100A hex	Manufacturer software version		All
Setting range: –	Unit: –	Default setting: [1]	
Size: 20 bytes (VS)	Access: RO		PDO map: Not possible

1 The version number is saved in "v.**".
- Gives the Manufacturer software version of the EtherCAT Communication Unit.

1010 hex	Store parameters	All

Sub-index 0: Number of entries		
Setting range: −	Unit: −	Default setting: 01 hex
Size: 1 byte (U8)	Access: RO	PDO map: Not possible

Sub-index 1: Save all parameters		
Setting range: −	Unit: −	Default setting: 00000001 hex
Size: 4 bytes (U32)	Access: RW	PDO map: Not possible

- All savable parameters are saved in the Inverter EEPROM.
- Saving is executed only when a specific value is written to sub-index 1. This prevents parameter values from being accidentally overwritten.
- The specific value means "save".

MSB			LSB
e	v	a	s
65 hex	76 hex	61 hex	73 hex

- A value of 00000001 hex (command valid) is given when reading.
- Parameters cannot be saved to the EEPROM during inverter operation.
- In the following cases, an ABORT code is returned.
  - Writing with CompleteAccess.
  - Writing a value other than 65766173 hex.
- Writing to the EEPROM may take up to 1 second. (This is when all objects are changed.)
- There is a limit to the number of times you can write to the EEPROM.

1011 hex	Restore default parameters	All

Sub-index 0: Number of entries		
Setting range: −	Unit: −	Default setting: 01 hex
Size: 1 byte (U8)	Access: RO	PDO map: Not possible

Sub-index 1: Restore all default parameters		
Setting range: −	Unit: −	Default setting: 00000001 hex
Size: 4 bytes (U32)	Access: RW	PDO map: Not possible

- Inverter parameters are reset to their default settings.
- A restoration operation is executed only when a specific value is written to sub-index 1. This prevents parameter values from being accidentally overwritten.
- The specific value means "load."

MSB			LSB
d	a	o	l
64 hex	61 hex	6f hex	6c hex

- A value of 00000001 hex (command valid) is given when reading.
- In the following cases, an ABORT code is returned.
  - Writing with CompleteAccess.
  - Writing a value other than 64616F6C hex.
- Writing to the EEPROM may take up to 3 seconds. (This is when all objects are changed.)
- There is a limit to the number of times you can write to the EEPROM.

1018 hex	Identity object		All
Sub-index 0: Number of entries			
Setting range: –	Unit: –	Default setting: 04 hex	
Size: 1 byte (U8)	Access: RO		PDO map: Not possible
Sub-index 1: Vendor ID			
Setting range: –	Unit: –	Default setting: 00000083 hex	
Size: 4 bytes (U32)	Access: RO		PDO map: Not possible
Sub-index 2: Product code			
Setting range: –	Unit: –	Default setting: 00000053 hex	
Size: 4 bytes (U32)	Access: RO		PDO map: Not possible
Sub-index 3: Revision number			
Setting range: –	Unit: –	Default setting: Refer to the table.	
Size: 4 bytes (U32)	Access: RO		PDO map: Not possible
Sub-index 4: Serial number			
Setting range: –	Unit: –	Default setting: 00000000 hex	
Size: 4 bytes (U32)	Access: RO		PDO map: Not possible

- This object contains device information.
- Sub-index 1 (Vendor ID) gives the manufacturer identifier.
- Sub-index 2 (Product code) gives the product's identifier.
- Sub-index 3 (Revision number) gives the device revision number.
- Explanation of set values

Bit	Details
0 to 15	Device's minor revision number
16 to 31	Device's major revision number

- Sub-index 4 (Revision number) gives the serial number for each product. (This is not used by MX2 inverters.)

10F3 hex	Diagnosis history		All
Sub-index 0: Number of entries			
Setting range: –	Unit: –	Default setting: 0D hex	
Size: 1 byte (U8)	Access: RO		PDO map: Not possible
Sub-index 1: Maximum messages			
Setting range: 00 to 08 hex	Unit: –	Default setting: 00 hex	
Size: 1 byte (U8)	Access: RO		PDO map: Not possible
Sub-index 2: Newest message			
Setting range: 06 to 0D hex	Unit: –	Default setting: 06 hex	
Size: 1 byte (U8)	Access: RO		PDO map: Not possible
Sub-index 5: Flags			
Setting range: 0000 to 0001 hex	Unit: –	Default setting: 0001 hex	
Size: 2 bytes (U16)	Access: RW		PDO map: Not possible
Sub-indexes 6 to 13: Diagnosis messages 1 to 8			
Setting range: –	Unit: –	Default setting: –	
Size: 23 bytes (VS)	Access: RO		PDO map: Not possible

- This object gives up to 8 diagnosis history items. It also enables or disables emergency messages.
- Sub-index 1 (Maximum messages) gives the number of error messages.
- Sub-index 2 (Newest message) gives the sub index where the latest diagnosis message is saved.
- Sub-index 5 (Flags) sets whether or not to give notification of the diagnosis history as an emergency message. It is set to Emergency Message Enabled (0001 hex) when the power supply is turned ON.
- Sub-indexes 6 to 13 (Diagnosis messages 1 to 8) give the diagnosis history. The diagnosis history is saved in Diagnosis messages 1 to 8 in ascending order. When the 9th error is reached, it is saved as Diagnosis message 1 and the sequence starts again.
- The diagnosis history is retained even when the power supply is turned OFF.

Diagnosis history details

Meaning	Size	Details
Error code	4 bytes (U32)	The upper byte is the error code that is defined with CiA301 and CiA402. The lower 2 bytes are the code type and are fixed at E800 hex.

Error flag	2 bytes (U16)	Gives the error type.
		  Bit 1: Warning
		  Bit 2: Error
		Other bits: Reserved

(Reserved)	17 bytes	The reserved area.

5-5-2 PDO Mapping Objects

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

```
31              16  15        8 7      0
[    Index    ][  Sub-index  ][Bit length]
MSB                                    LSB
```
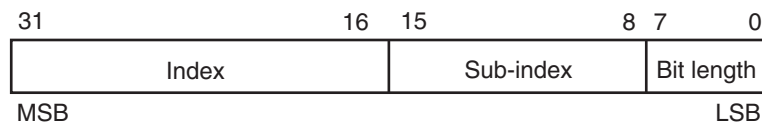
Bit 0 to 7   : Bit length of the mapped object. (For example, for 32 bits, 20 hex is given.)
Bit 8 to 5   : Sub-index of the mapped object.
Bit 16 to 31 : Index of the mapped object.

1600 to 1604 hex	1st to 5th receive PDO mapping		All
Sub-index 0: Number of objects			
Setting range: -	Unit: -	Default setting: 0	
Size: 1 byte (U8)	Access: RW		PDO map: Not possible
Sub-index 1: 1st Output Object to be mapped			
Setting range: -	Unit: -	Default setting: 00000000 hex	
Size: 4 bytes (U32)	Access: RW		PDO map: Not possible
Sub-index 2: 2nd Output Object to be mapped			
Setting range: -	Unit: -	Default setting: 00000000 hex	
Size: 4 bytes (U32)	Access: RW		PDO map: Not possible

- The PDO mapping when freely allocated objects are used.
- Objects can be allocated up to a total bit length of 32 bits.

1700 hex	257th fixed receive PDO mapping		All
Sub-index 0: Number of objects			
Setting range: −	Unit: −	Default setting: 2	
Size: 1 byte (U8)	Access: RO		PDO map: Not possible
Sub-index 1: 1st Output Object to be mapped			
Setting range: −	Unit: −	Default setting: 60400010 hex	
Size: 4 bytes (U32)	Access: RO		PDO map: Not possible
Sub-index 2: 2nd Output Object to be mapped			
Setting range: −	Unit: −	Default setting: 60420010 hex	
Size: 4 bytes (U32)	Access: RO		PDO map: Not possible

- The PDO mapping when Velocity mode is used.
- The following objects are mapped.
  - Controlword (6040 hex), vl target velocity (6042 hex)

1701 hex	258th fixed receive PDO mapping		All
Sub-index 0: Number of objects			
Setting range: −	Unit: −	Default setting: 2	
Size: 1 byte (U8)	Access: RO		PDO map: Not possible
Sub-index 1: 1st Output Object to be mapped			
Setting range: −	Unit: −	Default setting: 50000010 hex	
Size: 4 bytes (U32)	Access: RO		PDO map: Not possible
Sub-index 2: 2nd Output Object to be mapped			
Setting range: −	Unit: −	Default setting: 50100010 hex	
Size: 4 bytes (U32)	Access: RO		PDO map: Not possible

- The PDO mapping when a fixed profile is used.
- The following objects are mapped.
    - Command (5000 hex), Frequency reference (5010 hex)

1A00 to 1A04 hex	1st to 5th transmit PDO mapping		All
Sub-index 0: Number of objects			
Setting range: −	Unit: −	Default setting: 2	
Size: 1 byte (U8)	Access: RW		PDO map: Not possible
Sub-index 1: 1st Input Object to be mapped			
Setting range: −	Unit: −	Default setting: 00000000 hex	
Size: 4 bytes (U32)	Access: RW		PDO map: Not possible
Sub-index 2: 2nd Input Object to be mapped			
Setting range: −	Unit: −	Default setting: 00000000 hex	
Size: 4 bytes (U32)	Access: RW		PDO map: Not possible

- The PDO mapping when freely allocated objects are used.
- Objects can be allocated up to a total bit length of 32 bits.

1B00 hex	257th fixed transmit PDO mapping		All
Sub-index 0: Number of objects			
Setting range: −	Unit: −	Default setting: 2	
Size: 1 byte (U8)	Access: RO		PDO map: Not possible
Sub-index 1: 1st Input Object to be mapped			
Setting range: −	Unit: −	Default setting: 60410010 hex	
Size: 4 bytes (U32)	Access: RO		PDO map: Not possible
Sub-index 2: 2nd Input Object to be mapped			
Setting range: −	Unit: −	Default setting: 60430010 hex	
Size: 4 bytes (U32)	Access: RO		PDO map: Not possible

- The PDO mapping when Velocity mode is used.
- The following objects are mapped.
    - Statusword (6041 hex), vl velocity demand (6043 hex)

1B01 hex	258th fixed transmit PDO mapping		All
Sub-index 0: Number of objects			
Setting range: −	Unit: −	Default setting: 2	
Size: 1 byte (U8)	Access: RO		PDO map: Not possible
Sub-index 1: 1st Input Object to be mapped			
Setting range: −	Unit: −	Default setting: 51000010 hex	
Size: 4 bytes (U32)	Access: RO		PDO map: Not possible
Sub-index 2: 2nd Input Object to be mapped			
Setting range: −	Unit: −	Default setting: 51100010 hex	
Size: 4 bytes (U32)	Access: RO		PDO map: Not possible

- The PDO allocation when a fixed profile is used.
- The following objects are mapped.
  - Status information (5100 hex), Output frequency monitor (5110 hex)

1BFF hex	512th transmit PDO mapping		All
Sub-index 0: Number of objects in this PDO			
Setting range: −	Unit: −	Default setting: 01 hex	
Size: 1 byte (U8)	Access: RO		PDO map: Not possible
Sub-index 1: 1st Input Object to be mapped			
Setting range: −	Unit: −	Default setting: 20020108 hex	
Size: 4 bytes (U32)	Access: RO		PDO map: Not possible

- This is a mapping object to notify that the EtherCAT Communication Unit has detected an error.
- 2002 hex-01 hex: Sysmac Error Status has been mapped.
- When the Machine Automation Controller NJ501-1x00 series is connected, assign this object to 1C13 hex: Sync manager 3 PDO assignment.
- By default, Sysmac Studio assigns this object automatically.

5-5-3 Sync Manager Communication Objects

Objects 1C00 to 1C33 hex set how to use the EtherCAT communications memory.

1C00 hex	Sync Manager communication type		All
Sub-index 0: Number of used SM channels			
Setting range: −	Unit: −	Default setting: 04 hex	
Size: 1 byte (U8)	Access: RO		PDO map: Not possible
Sub-index 1: Communication Type SM0			
Setting range: −	Unit: −	Default setting: 01 hex	
Size: 4 bytes (U8)	Access: RO		PDO map: Not possible
Sub-index 2: Communication type SM1			
Setting range: −	Unit: −	Default setting: 02 hex	
Size: 4 bytes (U8)	Access: RO		PDO map: Not possible
Sub-index 3: Communication type SM2			
Setting range: −	Unit: −	Default setting: 03 hex	
Size: 4 bytes (U8)	Access: RO		PDO map: Not possible
Sub-index 4: Communication type SM3			
Setting range: −	Unit: −	Default setting: 04 hex	
Size: 4 bytes (U8)	Access: RO		PDO map: Not possible

- The Sync Manager has the following settings.
  - SM0   : Mailbox reception (master to slave)
  - SM1   : Mailbox send (slave to master)
  - SM2   : Process data output (master to slave)
  - SM3   : Process data input (slave to master)

1C10 hex	Sync Manager 0 PDO assignment		All
Sub-index 0: Number of assigned RxPDOs			
Setting range: −	Unit: −	Default setting: 00 hex	
Size: 1 byte (U8)		Access: RO	PDO map: Not possible

- The PDO mapping used by this Sync Manager is given. Mailbox reception Sync Manager does not have PDOs.

1C11 hex	Sync Manager 1 PDO assignment		All
Sub-index 0: Number of assigned PDOs			
Setting range: −	Unit: −	Default setting: 00 hex	
Size: 1 byte (U8)		Access: RO	PDO map: Not possible

- The PDO mapping used by this Sync Manager is given. Mailbox send Sync Manager does not have PDOs.

1C12 hex	Sync Manager 2 PDO assignment		All
Sub-index 0: Number of assigned RxPDOs			
Setting range: −	Unit: −	Default setting: 00 hex	
Size: 1 byte (U8)		Access: RW	PDO map: Not possible
Sub-index 1: 1st PDO Mapping object index of assigned PDO			
Setting range: −	Unit: −	Default setting: 1701 hex	
Size: 2 bytes (U16)		Access: RW	PDO map: Not possible
Sub-index 2: 2nd PDO Mapping object index of assigned PDO			
Setting range: −	Unit: −	Default setting: 0000 hex	
Size: 2 bytes (U16)		Access: RW	PDO map: Not possible
Sub-index 3: 3rd PDO Mapping object index of assigned PDO			
Setting range: −	Unit: −	Default setting: 0000 hex	
Size: 2 bytes (U16)		Access: RW	PDO map: Not possible
Sub-index 4: 4th PDO Mapping object index of assigned PDO			
Setting range: −	Unit: −	Default setting: 0000 hex	
Size: 2 bytes (U16)		Access: RW	PDO map: Not possible
Sub-index 5: 5th PDO Mapping object index of assigned PDO			
Setting range: −	Unit: −	Default setting: 0000 hex	
Size: 2 bytes (U16)		Access: RW	PDO map: Not possible

- The receive PDOs used by this Sync Manager are given.
- Up to 5 PDOs can be assigned.
- An object from 5000 to 5999 cannot be allocated at the same time as an object from 6000 to 6999.

1C13 hex	Sync Manager 3 PDO assignment		All

Sub-index 0: Number of assigned TxPDOs

Setting range: −	Unit: −	Default setting: 00 hex	
Size: 1 byte (U8)	Access: RW		PDO map: Not possible

Sub-index 1: 1st PDO Mapping object index of assigned PDO

Setting range: −	Unit: −	Default setting: 1B01 hex	
Size: 2 bytes (U16)	Access: RW		PDO map: Not possible

Sub-index 2: 2nd PDO Mapping object index of assigned PDO

Setting range: −	Unit: −	Default setting: 0000 hex	
Size: 2 bytes (U16)	Access: RW		PDO map: Not possible

Sub-index 3: 3rd PDO Mapping object index of assigned PDO

Setting range: −	Unit: −	Default setting: 0000 hex	
Size: 2 bytes (U16)	Access: RW		PDO map: Not possible

Sub-index 4: 4th PDO Mapping object index of assigned PDO

Setting range: −	Unit: −	Default setting: 0000 hex	
Size: 2 bytes (U16)	Access: RW		PDO map: Not possible

Sub-index 5: 5th PDO Mapping object index of assigned PDO

Setting range: −	Unit: −	Default setting: 0000 hex	
Size: 2 bytes (U16)	Access: RW		PDO map: Not possible

- The transmit PDOs used by this Sync Manager are given.
- Up to 5 PDOs can be assigned.

1C32 hex	SM 2 synchronization		All

Sub-index 0: Number of synchronization parameters

Setting range: −	Unit: −	Default setting: 20 hex	
Size: 1 byte (U8)	Access: RO		PDO map: Not possible

Sub-index 1: Synchronization type

Setting range: −	Unit: −	Default setting: 0000 hex	
Size: 2 bytes (U16)	Access: RW		PDO map: Not possible

Sub-index 4: Synchronization types supported

Setting range: −	Unit: −	Default setting: 0001 hex	
Size: 2 bytes (U16)	Access: RO		PDO map: Not possible

- Synchronization type (1C32 to 01 hex) indicates the Synchronization mode of Sync Manager 2.
  - 0000 hex: Free Run mode
- Synchronization types supported (1C32 to 04 hex) indicates the types of synchronization supported.
  - 0001 hex: Free Run mode

1C33 hex	SM 3 synchronization		All

Sub-index 0: Number of synchronization parameters

Setting range: −	Unit: −	Default setting: 20 hex	
Size: 1 byte (U8)	Access: RO		PDO map: Not possible

Sub-index 1: Synchronization type

Setting range: −	Unit: −	Default setting: 0000 hex	
Size: 2 bytes (U16)	Access: RW		PDO map: Not possible

Sub-index 4: Synchronization types supported

Setting range: −	Unit: −	Default setting: 0001 hex	
Size: 2 bytes (U16)	Access: RO		PDO map: Not possible

- Synchronization type (1C33 to 01 hex) indicates the Synchronization mode of Sync Manager 2.
  - 0000 hex: Free Run mode
- Synchronization types supported (1C33 to 04 hex) indicates the types of synchronization supported.
  - 0001 hex: Free Run mode

5-6   Manufacturer Specific Area

5-6-1   Manufacturer Specific Objects

2002 hex	Sysmac Error		All

Sub-index 0: Number of entries			
Setting range: –	Unit: –	Default setting: 02 hex	
Size: 1 byte (U8)	Access: RO		PDO map: Not possible

Sub-index 1: Sysmac Error Status			
Setting range: –	Unit: –	Default setting: 00 hex	
Size: 1 byte (U8)	Access: RO		PDO map: Possible

Sub-index 2: Sysmac Error Status Clear			
Setting range: –	Unit: –	Default setting: 00 hex	
Size: 1 byte (U8)	Access: RW		PDO map: Not possible

- Notify and clear the Sysmac Error Status.
- Sub-index 1: Sysmac Error Status
    - This object is used to notify that the EtherCAT Communication Unit has detected an error.
    - When the Machine Automation Controller NJ501-1x00 series, etc., is connected, this object is mapped to the PDO.
- Sub-index 2: Sysmac Error Status Clear
    - This object is used to allow the Sysmac product controller to reset the error present in the EtherCAT Communication Unit.

Additional Information

By default, Sysmac Studio automatically maps sub-index 01 hex: Sysmac Error status to the PDO by allocation of 1BFF hex: 512th transmit PDO Mapping.

2100 hex	Error history clear		All
Setting range: 6C636C65 hex	Unit: –	Default setting: 00000000 hex	
Size: 4 bytes (U32)	Access: RW		PDO map: Not possible

- This object clears the contents of Diagnosis history (10F3 hex).
- This function can be executed by writing 6C636C65 hex using SDO mailbox communications.
- In the following cases, an abort code is returned.
    - Writing with CompleteAccess
    - Writing a value other than 6C636C65 hex

5-6-2 Inverter Parameter Objects

Inverter parameters are allocated to objects 3000 to 3102 hex and 4000 to 4102 hex.
3000 to 3102 hex are 16-bit parameters and 4000 to 4102 hex are 32-bit parameters.

● Index and sub-index calculation method

Index: 3000 hex + (N/254), Sub-index: 1 + (N%254)

Index: 4000 hex + (N/254), Sub-index: 1 + (N%254)

    N: Inverter register number

    (N/254): Integer part after N is divided by 254

    (N%254): Remainder after N is divided by 254

3000 hex	Inverter parameter object 1 (16-bit access)		All
Sub-index 0: Number of assigned			
Setting range: −	Unit: −	Default setting: FE hex	
Size: 1 byte (U8)	Access: RO	PDO map: Not possible	
Sub-index 1: Inverter register 0000 hex			
Setting range: −	Unit: −	Default setting: −	
Size: 2 bytes (U16)	Access: RW	PDO map: *	
Sub-index 2: Inverter register 0001 hex			
Setting range: −	Unit: −	Default setting: −	
Size: 2 bytes (U16)	Access: RW	PDO map: *	
•			
•			
•			
Sub-index 253 hex: Inverter register 00FC hex			
Setting range: −	Unit: −	Default setting: −	
Size: 2 bytes (U16)	Access: RW	PDO map: *	

    * PDO mapping can only be performed for parameters that exist in the inverter. Only parameters that can be set during operation can be mapped to RxPDO.

3001 to 3101 hex	Inverter parameter objects 2 to 258 (16-bit access)	All
Same format as 3000 hex, inverter registers 00FD to FFFB hex		

3102 hex	Inverter parameter object 259 (16-bit access)		All
Sub-index 0: Number of assigned			
Setting range: –	Unit: –	Default setting: 04 hex	
Size: 1 byte (U8)	Access: RO	PDO map: Not possible	
Sub-index 1: Inverter register FFFC hex			
Setting range: –	Unit: –	Default setting: –	
Size: 2 bytes (U16)	Access: RW	PDO map: *	
Sub-index 2: Inverter register FFFD hex			
Setting range: –	Unit: –	Default setting: –	
Size: 2 bytes (U16)	Access: RW	PDO map: *	
Sub-index 3: Inverter register FFFE hex			
Setting range: –	Unit: –	Default setting: –	
Size: 2 bytes (U16)	Access: RW	PDO map: *	
Sub-index 4: Inverter register FFFF hex			
Setting range: –	Unit: –	Default setting: –	
Size: 2 bytes (U16)	Access: RW	PDO map: *	

* PDO mapping can only be performed for parameters that exist in the inverter. Only parameters that can be set during operation can be mapped to RxPDO.

4000 hex	Inverter parameter object 1 (32-bit access)		All
Sub-index 0: Number of assigned			
Setting range: –	Unit: –	Default setting: FE hex	
Size: 1 byte (U8)	Access: RO	PDO map: Not possible	
Sub-index 1: Inverter register 0000 hex			
Setting range: –	Unit: –	Default setting: –	
Size: 2 bytes (U32)	Access: RW	PDO map: *	
Sub-index 2: Inverter register 0001 hex			
Setting range: –	Unit: –	Default setting: –	
Size: 2 bytes (U32)	Access: RW	PDO map: *	
• • •			
Sub-index 253 hex: Inverter register 00FC hex			
Setting range: –	Unit: –	Default setting: –	
Size: 2 bytes (U32)	Access: RW	PDO map: *	

* PDO mapping can only be performed for parameters that exist in the inverter. Only parameters that can be set during operation can be mapped to RxPDO.

4001 to 4101 hex	Inverter parameter objects 2 to 258 (32-bit access)	All
Same format as 3000 hex, inverter registers 00FD to FFFB hex		

4102 hex	Inverter parameter object 259 (32-bit access)		All

Sub-index 0: Number of assigned			
Setting range: −	Unit: −	Default setting: 04 hex	
Size: 1 byte (U8)	Access: RO		PDO map: Not possible

Sub-index 1: Inverter register FFFC hex			
Setting range: −	Unit: −	Default setting: −	
Size: 2 bytes (U32)	Access: RW		PDO map: *

Sub-index 2: Inverter register FFFD hex			
Setting range: −	Unit: −	Default setting: −	
Size: 2 bytes (U32)	Access: RW		PDO map: *

Sub-index 3: Inverter register FFFE hex			
Setting range: −	Unit: −	Default setting: −	
Size: 2 bytes (U32)	Access: RW		PDO map: *

Sub-index 4: Inverter register FFFF hex			
Setting range: −	Unit: −	Default setting: −	
Size: 2 bytes (U32)	Access: RW		PDO map: *

* PDO mapping can only be performed for parameters that exist in the inverter. Only parameters that can be set during operation can be mapped to RxPDO.

5-6-3   Independent Profile Objects

This section explains about OMRON's independent profile objects.

5000 hex	Command		All
Setting range: 0000 to FFFF hex	Unit: −	Default setting: 0000 hex	
Size: 2 bytes (U16)	Access: RW		PDO map: Possible

- This object gives an operation command to the inverter.
- Bit descriptions

Bit	Meaning	Details
0	Forward/stop	0: Stop 1: Forward
1	Reverse/stop	0: Stop 1: Reverse
2 to 6	Reserved	Not used. Always keep at 0.
7	Fault reset	Faults and warnings are cleared when this bit turns ON.
8 to 15	Reserved	Not used. Always keep at 0.

5010 hex	Frequency reference		All
Setting range: 0000 to FFFF hex	Unit: 0.01 Hz (0.1 Hz)	Default setting: 0000 hex	
Size: 2 bytes (U16)	Access: RW		PDO map: Possible

- This object gives an output frequency command to the inverter.
- The value in parenthesis indicates the unit when the inverter mode selection is High frequency mode.

5100 hex	Status		All
Setting range: 0000 to FFFF hex	Unit: −	Default setting: 0000 hex	
Size: 2 bytes (U16)		Access: RO	PDO map: Possible

- This object gives the present state of the unit.
- Bit descriptions

Bit	Meaning	Details
0	During forward operation	0: Stop/reverse 1: During Forward operation
1	During reverse operation	0: Stop/forward 1: During Reverse operation
2	Reserved	Not used.
3	Fault	1: A fault (inverter trip) occurred.
4 to 6	Reserved	Not used.
7	Warning	1: A warning occurred.
9	Remote	0: Commands other than those from the EtherCAT Communication Unit are enabled. 1: Commands from the EtherCAT Communication Unit are enabled.
10 to 11	Reserved	Not used.
12	Frequency matching	0: During Acceleration/deceleration or stopped 1: Frequency matching
13 to 14	Reserved	Not used.
15	Connection error between the Optional Unit and inverter	1: Error (Cannot update data for the inverter. To reset the error, turn the power supply OFF and then ON again.)

5110 hex	Output frequency monitor		All
Setting range: 0000 to FFFF hex	Unit: 0.01 Hz (0.1 Hz)	Default setting: 0000 hex	
Size: 2 bytes (U16)		Access: RO	PDO map: Possible

- This object gives the output frequency of the inverter.
- The value in parenthesis indicates the unit when the inverter mode selection is High frequency mode.

5200 hex	PDO mapping error history		All
Sub-index 0: Number of entries			
Setting range: −	Unit: −	Default setting: 0A hex	
Size: 1 byte (U8)		Access: RO	PDO map: Not possible
Sub-index 1: Newest PDO mapping error cause			
Setting range: −	Unit: −	Default setting: 0000 hex	
Size: 2 bytes (U16)		Access: RO	PDO map: Not possible
Sub-index 4: Number of error message			
Setting range: −	Unit: −	Default setting: 00 hex	
Size: 2 bytes (U16)		Access: RO	PDO map: Not possible
Sub-indexes 5 to A: PDO mapping error message 1 to 6			
Unit: −	Unit: −	Default setting: 0000 hex	
Size: 2 bytes (U16)		Access: RO	PDO map: Not possible

- Gives the cause of not being able to transit to Op when PDOs are freely mapped.
- Gives up to 6 PDO mapping error messages.
- Sub-index 1 (error cause) gives the latest cause code.
- Sub-index 4 (number of error messages) gives the number of error messages that are registered.
- Sub-indexes 5 to 10 (PDO mapping error message 1 to 6) give the cause codes when errors occur in PDO mapping. Messages are saved in sequence from 1 to 6, and no more are saved. The history is cleared when the power supply is turned OFF or the state transitions from initialization (Init) to pre-operational (Pre-Op) is made.

Cause code list

Cause code	Meaning
0001 hex	Busy
0002 hex	Device busy
0003 hex	Unexpectedly received data
0020 hex	Sync Manager assignment exceeded
0021 hex	PDO map number is invalid (outside the range, does not exist)
0022 hex	RxPDO map overlap
0023 hex	Object specified for RxPDO mapping is invalid
0024 hex	Total number of assignment exceeded
0040 hex	RxPDO object overlap
0041 hex	Number of PDO mapping exceeded
0042 hex	PDO map size exceeded (more than 32 bits)
0043 hex	Incorrect object specification (sub-index 0 is mapped)
0044 hex	Object not supported
0045 hex	5000 to 5999 and 6000 to 6999 objects mixed
0046 hex	Object specified for PDO map is invalid
0047 hex	Incorrect data size for specified object
0048 hex	PDO mapping exists but size is 0
004F hex	Specified access method not supported
0050 hex	Specified object mapping is invalid
0060 hex	RxPDO object overlap (MX2 registers are overlapping)
0061 hex	Unsupported data type is specified
0070 hex	Unsupported mode (mode other than FreeRun is specified)
00E0 hex	Start address of the Refresh area is 1000 hex or lower, or an odd number
00E1 hex	Specified size of the Refresh area exceeds the range
00E2 hex	Start address of the Refresh area is different from the value in pre-operational (Pre-Op)
00E3 hex	Sync Manager buffer overlap
00E4 hex	Map size and Sync Manager size are different
00E5 hex	Sync Manager operation invalid
00E6 hex	Sync Manager size is 0
00E7 hex	Incorrect direction setting
00E8 hex	Buffer mode is incorrect
8000 hex	Resource depletion
8001 hex	Internal inconsistency
8002 hex	Other error
FFFF hex	No error

For details, refer to *Chapter 6 Handling of Errors and Maintenance*.

5-6 Manufacturer Specific Area

5

5-6-3 Independent Profile Objects

5-7   Device Profile area

5-7-1   Drive Profile Objects

This chapter explains about the supported CiA402 drive profile.

603F hex	Error code	All
Setting range: 0000 to FFFF hex	Unit: −	Default setting: 0000 hex
Size: 2 bytes (U16)	Access: RO	PDO map: Possible

- This object gives the latest error code or warning code that occurred in the unit.

Index	Name	Data type	Specifications
603F hex	Error code	U16	0000 hex: No error 5300 hex: No response from the inverter 6331 hex: EEPROM data error 6341 hex: PDO setting error FF00 hex: Warning occurred for the inverter FF01 hex: Trip occurred for the inverter

6040 hex	Controlword	All
Setting range: 0000 to FFFF hex	Unit: −	Default setting: 0000 hex
Size: 2 bytes (U16)	Access: RW	PDO map: Possible

- This object controls the state transitions of the unit.
- Bit descriptions

Bit	Name	Details
0	Switch on	The state is controlled by these bits.
1	Enable voltage	Quick stop is not supported. Even when the bit 2 is set to 0, it is ignored.
2	Quick stop	For details, refer to *5-1-3 Command Coding* on page 5-3.
3	Enable operation	
4 to 6	Reserved	Not used. Always keep at 0.
7	Fault reset	Faults and warnings are cleared when this bit turns ON.
8 to 15	Reserved	Not used. Always keep at 0.

6041 hex	Statusword	All
Setting range: 0000 to FFFF hex	Unit: −	Default setting: 0000 hex
Size: 2 bytes (U16)	Access: RO	PDO map: Possible

- This object gives the present state of the unit.
- Bit descriptions

Bit	Name	Details
0	Ready to switch on	These bits give the state.
1	Switched on	For details, refer to *5-1-4 State Coding* on page 5-3.
2	Operation enabled	
3	Fault	
4	Voltage enabled	
5	Quick stop	
6	Switch on disabled	
7	Warning	0: No warning occurred for the unit or inverter. 1: Warning occurred for the unit or inverter.
8	Reserved	Not used.
9	Remote	0: Control from Controlword is disabled. 1: Indicates that control is being performed by Controlword.
10 to 15	Reserved	Not used.

6042 hex	vl target velocity		vl
Setting range: 8000 to 7FFF hex	Unit: rpm	Default setting: 0000 hex	
Size: 2 bytes (INT16)	Access: RW	PDO map: Possible	

- This object gives a command speed and rotation direction command to the inverter.

6043 hex	vl velocity demand		vl
Setting range: 8000 to 7FFF hex	Unit: rpm	Default setting: 0000 hex	
Size: 2 bytes (INT16)	Access: RO	PDO map: Possible	

- This object gives the operating speed that is sent to the inverter.

6044 hex	vl velocity actual value		vl
Setting range: 8000 to 7FFF hex	Unit: rpm	Default setting: 0000 hex	
Size: 2 bytes (INT16)	Access: RO	PDO map: Possible	

- This object gives the output speed of the inverter.

6046 hex	vl velocity min max amount		vl
Sub-index 0: Number of entries			
Setting range: −	Unit: Command unit	Default setting: 02 hex	
Size: 1 byte (U8)	Access: RO	PDO map: Not possible	
Sub-index 1: vl velocity min amount			
Setting range: 00000000 to FFFFFFFF hex	Unit: rpm	Default setting: 0000000F hex	
Size: 4 bytes (U32)	Access: RW	PDO map: Not possible	
Sub-index 2: vl velocity max amount			
Setting range: 00000000 to FFFFFFFF hex	Unit: rpm	Default setting: 00000708 hex	
Size: 4 bytes (U32)	Access: RW	PDO map: Not possible	

- This object sets the maximum speed and minimum speed.
- To read and write the minimum speed, read or write the inverter parameter b082: Starting Frequency.
- To read and write the maximum speed, read or write the inverter parameter A004: Maximum Frequency.

6048 hex	vl velocity acceleration		vl
Sub-index 0: Number of entries			
Setting range: −	Unit: Command unit	Default setting: 02 hex	
Size: 1 byte (U8)	Access: RO	PDO map: Not possible	
Sub-index 1: Delta speed			
Setting range: 00000000 to FFFFFFFF hex	Unit: rpm	Default setting: 00000708 hex	
Size: 4 bytes (U32)	Access: RO	PDO map: Not possible	
Sub-index 2: Delta time			
Setting range: 0000 to FFFF hex	Unit: s	Default setting: 000A hex	
Size: 2 bytes (U16)	Access: RW	PDO map: Not possible	

- This object sets the acceleration time.
- To read the Speed (6048 to 01 hex), read the inverter parameter A004: Maximum Frequency.
- To read and write the Time (6048 to 02 hex), read and write the inverter parameter F002: Acceleration Time Setting.

6049 hex	vl velocity deceleration		vl
Sub-index 0: Number of entries			
Setting range: −	Unit: Command unit	Default setting: 02 hex	
Size: 1 byte (U8)	Access: RO		PDO map: Not possible
Sub-index 1: Delta speed			
Setting range: 00000000 to FFFFFFFF hex	Unit: rpm	Default setting: 00000708 hex	
Size: 4 bytes (U32)	Access: RO		PDO map: Not possible
Sub-index 2: Delta time			
Setting range: 0000 to FFFF hex	Unit: s	Default setting: 000A hex	
Size: 2 bytes (U16)	Access: RW		PDO map: Not possible

- This object sets the deceleration time.
- To read the Speed (6049 to 01 hex), read the inverter parameter A004: Maximum Frequency.
- To read and write the Time (6049 to 02 hex), read and write the inverter parameter F003: Deceleration Time Setting.

605B hex	Shutdown option code		All
Setting range: 1	Unit: −	Default setting: 1	
Size: 2 bytes (Int16)	Access: RW		PDO map: Not possible

- This object sets the behavior during Shutdown (Operation enable → Ready to switch on) .
- Explanation of set values

Set value	Stop method
1	Deceleration stop

605C hex	Disable operation option code		All
Setting range: 1	Unit: −	Default setting: 1	
Size: 2 bytes (Int16)	Access: RW		PDO map: Not possible

- This object sets the behavior during Disable operation (Operation enable → Switched on).
- Explanation of set values

Set value	Stop method
1	Deceleration stop

605E hex	Fault reaction option code		All
Setting range 1:	Unit: −	Default setting: 1	
Size: 2 bytes (Int16)	Access: RW		PDO map: Not possible

- This object sets the behavior when an error occurs.
- Explanation of set values

Set value	Stop method
1	Deceleration stop

6060 hex	Modes of operation		All
Setting range: 2	Unit: −	Default setting: 02 hex	
Size: 1 byte (Int8)		Access: RW	PDO map: Possible

- This object sets the operation mode.
- Explanation of set values

Value	Details
1	Velocity mode

6061 hex	Modes of operation display		All
Setting range: 0 to 10	Unit: −	Default setting: 02 hex	
Size: 1 byte (Int8)		Access: RO	PDO map: Possible

- This object gives the present operation mode.
- The value definitions are the same as for Modes of operation (6060 hex).

6502 hex	Supported drive modes		All
Setting range: −	Unit: −	Default setting: 00000002 hex	
Size: 4 bytes (U32)		Access: RO	PDO map: Not possible

- This object indicates the supported operation modes.
- Bit descriptions

Bit	Supported mode	Definition
0	pp (Profile Position mode)	0: Not supported
1	vl (Velocity mode)	1: Supported
2	pv (Profile Velocity mode)	0: Not supported
3	t q (Profile Torque mode)	0: Not supported
4	Reserved	0
5	hm (Homing mode)	0: Not supported
6	ip (Interpolated Position mode)	0: Not supported
7	csp (Cyclic Sync Position mode)	0: Not supported
8	csv (Cyclic Sync Velocity mode)	0: Not supported
9	cst (Cyclic Sync Torque mode)	0: Not supported
10 to 31	Reserved	0

6

Handling of Errors and Maintenance

This chapter explains how to handle errors that occur in the EtherCAT Communication Unit.

6

6-1   Communication Line Errors

6-1-1   Status IndicatorExplanations and Error Handling

The 7 types of indicator lighting status are shown below.

Abbreviation	Name and status
ON	ON
OFF	OFF
F	Flickering ON (50 ms) and OFF (50 ms)
B	Blinking ON (200 ms) and OFF (200 ms)
SF	Single flash ON (200 ms) and OFF (1,000 ms)
D	Double flash ON (200 ms), OFF (200 ms), ON (200 ms) and OFF (1,000 ms)
−	Undefined

RUN	ERR	L/A IN L/A OUT	Meaning		Remarks
ON	OFF	ON	During EtherCAT communications	EtherCAT communications are being executed.	The status is normal if either process data communications, message communications, or both are being executed.
−	−	F	Link established in physical layer	The operation waiting status after the link is established in the physical layer.	• There was a status transition instruction from the host system during operation, and a transition was made to a status other than Operational. Check that the Master Unit is operating correctly.Refer to the manual for the Master Unit.
−	−	OFF	Link not established in physical layer	The link is not established in the physical layer (cannot participate in the network).	• Check that the communications cable is connected correctly to the connector. • Check that the communications cable is wired correctly. • Check that the Master Unit is operating correctly. If using an OMRON Master Unit, check the Master Unit mode and the node address-setting rotary switches of the Communication Unit. • If using a Master Unit from another manufacturer, refer to the user's manual for that master. • If there are devices that generate noise, take necessary measures against the noise to protect the Master Unit, Communication Unit and communications cables.
OFF	OFF	OFF	Power supply error	Power is not supplied correctly to the Communication Unit.	• Check that power is supplied correctly to the inverter (for example, check whether the wiring of the inverter main power supply is correct, the power supply voltage has dropped, and the inverter is operating normally). • Check that the Communication Unit is mounted correctly onto the inverter. • Eliminate the cause of the error, and then turn the inverter power supply OFF and ON again.
OFF	ON	−	Hardware error	A hardware error has occurred.	• Check that the Communication Unit is mounted correctly onto the inverter. • Replace the Communication Unit.
	F				
	B				

RUN	ERR	L/A IN L/A OUT	Meaning		Remarks
–	B	–	Invalid node address setting	The setting of the node address-setting rotary switches is invalid.	• Check the setting of the node address-setting rotary switches, turn OFF the power supply of the inverter, and then restart it.
			EEPROM data error	This is an EEPROM data error.	Use the tool to restore the default data, and restart.
			Sync Manager setting error	The Sync Manager setting is invalid.	Change to a correct setting.
–	D	–	Process data communications timeout	An error occurred in communications.	Check the items below, turn OFF the power supply of the inverter, and then restart it. • Is the cable length OK? (Max. 100 m) • Is the cable disconnected or loosen? • Is there too much noise?
SF	–	–	Safe-operational state	An instruction to transition to safe-operational state was generated by the master.	If it was generated during system operation, check the status of the host master.
B	–	–	Pre-operational state	An instruction to transition to pre-operational state was generated by the master.	
OFF	–	–	Init state	An instruction to transition to init state was generated by the master.	

6-1-2   Troubleshooting

Errors related to the EtherCAT Communication Unit

Problem	Cause and possible corrections
Both the RUN and ERR indicators are OFF	Power is not supplied correctly to the Communication Unit. Check that the Communication Unit is mounted correctly onto the inverter, and that the inverter power supply is wired correctly.Eliminate the cause of the power supply interruption, turn the inverter power supply OFF, and then restart it.
ERR indicator is lit red	• Check that the Communication Unit is mounted correctly onto the inverter. • The Communication Unit is faulty. Replace the Communication Unit.
ERR indicator is flashing red	• The setting of the rotary switches for node address setting is invalid. Check the setting of the rotary switches for node address setting, turn OFF the power supply of the inverter, and then restart it. • There is an error in the Slave Unit's EEPROM memory data. Use the tool to initialize the settings. • The Sync Manager setting is invalid. Change to a correct setting. • An error occurred in communications. Check the connection of the communications cables and the length of the cables. If the ERR indicator remains flashing even after checking the above items, replace the slave.
RUN indicator remains flashing green and status does not change	There was a status transition instruction from the host system during operation, and a transition was made to a status other than Operational. Refer to the Master Unit's manual, and check that the host Master Unit is operating correctly.

Errors related to the network

Problem	Cause and possible corrections
L/A IN and L/A OUT indicators remain OFF	Slaves are not connected to the network. • Check that the Master Unit is operating correctly. If using an OMRON Master Unit, check the Master Unit mode and the slave node addresses. • If using a Master Unit from another manufacturer, refer to the user's manual for that master. • Check that the communications cable is wired correctly. • Check that the Communication Unit is mounted correctly onto the inverter, and that the power supply is wired correctly. Eliminate the cause of the power supply interruption, turn the inverter power supply OFF, and then restart it. • Check the connector wiring to make sure that the communications cables are not disconnected. • If the L/A IN and L/A OUT indicators of a certain slave remain OFF, replace the corresponding slave. • If there are devices that generate noise, take necessary measures against the noise to protect the Master Unit, Communication Unit and communications cables.
L/A IN and L/A OUT indicators remain flashing green	• The slave status has not transitioned to Operational. Refer to the Master Unit's manual, and check that the Master Unit is operating correctly. • If the L/A IN and L/A OUT indicators of a certain slave remain flashing, replace the corresponding slave.

6-2   Message Errors

The abort codes for when an SDO communications error occurs are shown below.

Value	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 can not 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	Subindex 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

6-3   Application Errors

6-3-1   Error Statuses

The statuses change as follows when an error is detected in the unit or inverter.

Function	Status when error occurs
Status display	An error is notified with bit 3: Fault or bit 7: Warning of the Status object (5100 hex) and bit 3: Fault or bit 7: Warning of the Statusword object (6041 hex). When a trip occurs for the inverter, Fault bit it turned ON, and when a warning occurs for the inverter, Warning bit is turned ON. To cancel the error, eliminate the cause and set bit 7: Fault reset of 5000 hex Command or bit 7: Fault reset of 6040 hex Controlword to ON.
Error code display	The error codes are notified to the object 603F hex. Read with the SDO. To check the error that occurred for the inverter, check the inverter front panel, or read object 3000 hex sub-index 13 hex with the SDO.
Diagnosis history	Errors that were detected in the unit and inverter are stored in the Diagnosis history object (10F3 hex) (up to 8 errors). If a trip occurred for the inverter, check the trip history of the inverter.

6-3-2 Error Code List

Error code	Meaning	Possible correction
5300 hex	Error in the communication unit and inverter connection	• Check that the Communication Unit is mounted correctly onto the inverter. • The Communication Unit is faulty. Replace the Communication Unit. • A connection error occurred because a trip reset was performed with the inverter. Set the inverter C102 to 3: Trip reset only, and turn the power supply OFF and ON again. • A connection error occurred because an initialization or mode change was performed with the inverter. Turn the inverter power supply OFF and ON again.
6341 hex	PDO setting error	A set value in PDO mapping is invalid. Check the value of object 5200 and the AL Status code, and then review the PDO mapping settings.
6331 hex	EEPROM data error	• An error was detected in data inside EEPROM when the power supply was turned ON. Replace the Communication Unit. • The Diagnosis history cannot be saved because the EEPROM has reached the end of its service life. There is no effect on operations, but if you want to use the Diagnosis history, replace the unit.
FF00 hex	A warning occurred for the inverter	Eliminate the cause and set bit 7: Fault reset of Command (5000 hex) or bit 7: Fault reset of Controlword (6040 hex) to ON.
FF01 hex	A trip occurred for the inverter	Eliminate the cause and set bit 7: Fault reset of Command (5000 hex) or bit 7: Fault reset of Controlword (6040 hex) to ON.

6-3-3 List of Cause Codes for PDO Mapping Errors

Cause code	Meaning	Cause and possible corrections
0000 hex	No registered error	–
0001 hex	Busy	Cannot accept the PDO allocation because the internal status is busy. Transition again to safe-operational.
0002 hex	Device busy	Cannot accept the PDO allocation because the internal status is busy. Transition again to safe-operational.
0003 hex	Unexpectedly received data	Wrote to sub-index 0 of the PDO mapping in a size other than 1 byte. Write in a 1-byte data size. Wrote to sub-index 0 of Sync Manager in a size other than 1 byte. Write in a 1-byte data size. Wrote to sub-indexes 1 to 5 of Sync Manager in a size other than 2 bytes. Write in a 2-byte data size.
0020 hex	Sync Manager assignment exceeded	Allocated more than 5 PDOs to Sync Manager. Allocate 5 PDOs or less to Sync Manager.
0021 hex	PDO map number is invalid (outside the range, does not exist)	An object was assigned that cannot be assigned to Sync Manager. Assign within the ranges below. Sync Manager 2PDO assignment (1C12 hex): 1600 to 1604 hex, 1700 to 1701 hex Sync Manager 3PDO assignment (1C13 hex): 1A00 to 1A04 hex, 1B00 to 1B01 hex
0022 hex	RxPDO map overlap	The same PDO is assigned more than once to Sync Manager 2PDO assignment (1C12 hex). Correct the assignment.
0023 hex	Object specified for RxPDO mapping is invalid	An object was allocated that cannot be allocated to RxPDO. Correct the RxPDO mapping.
0024 hex	Total number of assignment exceeded	The total size of the objects specified with the Sync Manager PDO mapping exceeds 20 bytes. Correct the PDO mapping.
0040 hex	RxPDO object overlap	The same object is mapped more than once to RxPDO. Change the RxPDO mapping.
0041 hex	Number of PDO mapping exceeded	3 or more objects are allocated to a single PDO. Allocate a maximum of 2 objects to a PDO.
0042 hex	PDO map size exceeded (more than 32 bits)	The total size of the objects mapped to a single PDO exceeds 4 bytes. Keep the total object size that is mapped to a PDO to within 4 bytes.
0043 hex	Incorrect object specification (sub-index 0 is mapped)	An object of sub-index 0 (number of entries, etc.) that cannot be allocated to a PDO was mapped. Remove the corresponding object from the mapping.
0044 hex	Object not supported	An object that does not exist was mapped. Correct the PDO mapping. A sub-index of an object that does not exist was mapped. Correct the PDO mapping.
0045 hex	5000 to 5999 and 6000 to 6999 objects mixed	An object from 5000 to 5999 was allocated to RxPDO mapping at the same time as an object from 6000 to 6999.Objects from 5000 to 5999 and 6000 to 6999 cannot be mixed in RxPDO, so change the mapping to only one of the ranges. When a PDO was assigned to Sync Manager 2PDO assignment (1C12 hex), objects from 5000 to 5999 and 6000 to 6999 were mixed in the assignment. Correct the assignment so that they are not mixed.
0046 hex	Object specified for PDO map is invalid	An object that cannot be allocated to a PDO was mapped. Correct the PDO mapping.
0047 hex	Incorrect data size for specified object	The specified object data size is incorrect. Change to a correct size.
0048 hex	PDO mapping exists but size is 0	Cannot assign to Sync Manager because the PDO mapping is invalid. Correct the PDO mapping.
004F hex	Specified access method not supported	PDO mapping writing was performed with complete access which is not supported. Write with single access. There was an error in the values written with complete access. Correct the values and perform the writing.
0050 hex	Specified object mapping is invalid	An object that does not exist was allocated to a PDO. Correct the PDO mapping. An object that cannot be mapped was mapped to a PDO. Correct the PDO mapping.
0060 hex	RxPDO object overlap (MX2 registers are overlapping)	The objects allocated to RxPDO are different, but the same function, such as a start command or speed reference, is allocated more than once. Change the PDO mapping.

Cause code	Meaning	Cause and possible corrections
0061 hex	Unsupported data type is specified	The data type of the allocated object is invalid. Change to a correct data type.
0070 hex	Unsupported mode (mode other than FreeRun is specified)	An operation mode other than FreeRun is set. Set FreeRun mode.
00E0 hex	Start address of the Refresh area is 1000 hex or lower, or an odd number	The start address of Sync Manager is set to a value lower than 1000 hex. Change the start address to 1000 hex or higher. The start address of Sync Manager is set to an odd number. Change the start address to an even number.
00E1 hex	Specified size of the Refresh area exceeds the range	The used area of Sync Manager exceeds 2FFF hex. Change the start address.
00E2 hex	Start address of the Refresh area is different from the value in pre-operational (Pre-Op)	The start address of Sync Manager is different from the value set during pre-operational. Transition again from pre-operational to safe-operational.
00E3 hex	Sync Manager buffer overlap	Sync Manager areas are overlapping. Correct the start address.
00E4 hex	Map size and Sync Manager size are different	The assignment size and Sync Manager area size do not match. Match the sizes. The mapping size is set to 0.Correct the mapping.
00E5 hex	Sync Manager operation invalid	Cannot operate Sync Manager because the PDO mapping is invalid. Correct the PDO mapping.
00E6 hex	Sync Manager size is 0	The size assigned to Sync Manager was set to 0 because the PDO mapping is invalid. Correct the PDO mapping.
00E7 hex	Incorrect direction setting	The access direction (read/write) setting of Sync Manager is incorrect. Change the setting.
00E8 hex	Buffer mode is incorrect	The Butter mode setting of Sync Manager is incorrect. Change the setting.
8000 to 8002 hex	Other error	An error other than those above occurred. Turn the power supply OFF and ON again. If the problem persists, replace the unit.
FFFF hex	No error	–

6-3-4 AL Status Code List

Code	Meaning	Cause and possible corrections
0011 hex	Invalid status transition request received	An impossible status transition request was received. Perform the status transition again.
0012 hex	Error status transition received	A transition request to an unknown status was received. Perform the status transition again.
0014 hex	SII verification error	The data written in SII and the data inside the unit do not match. Rewrite the SII data to the correct values. If the problem persists, replace the unit.
0016 hex	Mailbox setting error	A mailbox setting is invalid. Set to the correct value.
001B hex	Process data WDT error	In the operational state, the data set with RxPDO was not received for a certain time. Check that the network is connected correctly. Check that RxPDO is being refreshed on the master.
001D hex	RxPDO setting error	An RxPDO (Sync Manager) setting error was detected. Correct the RxPDO mapping setting. For the detailed cause, check the contents of object 5200 hex.
001E hex	TxPDO setting error	A TxPDO (Sync Manager) setting error was detected. Correct the TxPDO mapping setting. For the detailed cause, check the contents of object 5200 hex.
001F hex	PDO WDT setting error	The WDT setting of a PDO is invalid. Set a correct value.
0024 hex	TxPDO mapping error	An invalid TxPDO is set. Correct the TxPDO mapping setting. For the detailed cause, check the contents of object 5200 hex.
0025 hex	RxPDO mapping error	An invalid RxPDO is set. Correct the RxPDO mapping setting. For the detailed cause, check the contents of object 5200 hex.
0028 hex	SM event mode setting error	Set to an unsupported SM event mode. Set a correct value.

6-3 Application Errors

6

6-3-4 AL Status Code List

6-4   Inverter Errors

The trips that occur for inverters when using an optional board are as follows.

Name	Meaning	Error code	Check point and remedy
Option error	When an unrecoverable error is detected in the optional board, a trip is generated for the inverter.	E60.□	The inverter unit version is old. → Check that the unit version of the inverters is 1.1 or higher (1.0 or lower do not operate).Replace the inverter. Generated when a trip reset was performed with the inverter. → Set C102 to 3: Trip reset only, and turn the power supply OFF and ON again. Generated when an initialization or mode change was performed with the inverter. → Turn the power supply OFF and ON again. The optional board is disconnected. → Check that the optional board case and inverter are fitted together correctly, and check for looseness in the fastening screw. The inverter or optional board is faulty. → If they are fitted together correctly, the inverter or optional PCB may be faulty. Replace the inverter or optional board.
Option timeout	A trip occurs when a timeout is generated in communication between the inverter and optional PCB.	E69.□	The optional board is disconnected. → Check that the optional board case and inverter are fitted together correctly, and check for looseness in the fastening screw. The optional board is faulty. → If they are fitted together correctly, the optional PCB may be faulty. Replace the optional board.

*A*pp

Appendices

This chapter explains the specifications of the EtherCAT Communication Unit as well as objects and inverter parameters handled by/set in the EtherCAT Communication Unit.

App

A-1   Specifications

A-1-1   Appearance and Dimensions

Status Indicator
Rotary switches for node address setting

67.6

44.9

28.6

60.0

27.9

53.1

Communications connector (IN)
Communications connector (OUT)

10.3 10.3

26.4mm *1   D *1

FG cable

28.2

FG cable
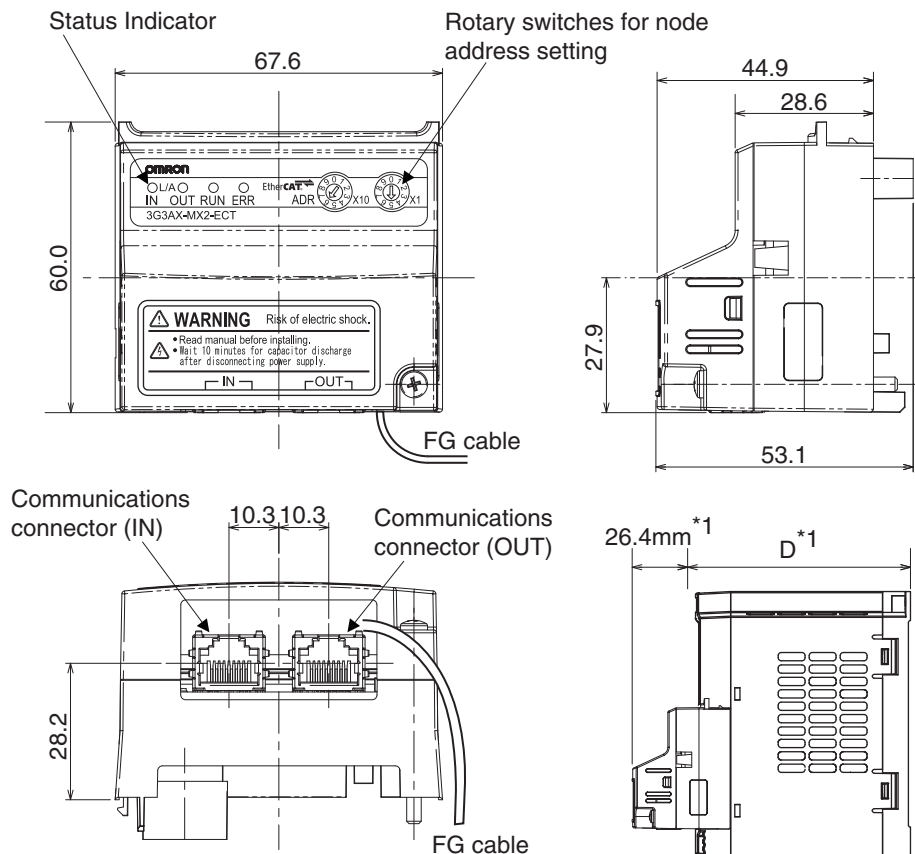
*1   After the EtherCAT Communication Unit is installed, dimension D of the inverter increases by 26.4 mm.
      (Dimension D of the inverter varies depending on the capacity. Refer to the manual for the inverter.)

A-1-2   Common Specifications

Item	Specifications
Model	3G3AX-MX2-ECT
Power supply	Supplied from the inverter
Protective structure	Open type (IP20)
Temperature	−10 to 50°C
Storage temperature	−20 to 65°C
Humidity	20% to 90% RH (with no condensation)
Vibration	5.9 m/s^2 (0.6 G), 10 to 55 Hz
Application environment	At a maximum altitude of 1,000 m; indoors (without corrosive gases or dust)
Weight	100 g max.

A-1-3   EtherCAT Communications Specifications

Item	Specifications
Communications standard	IEC 61158 Type12, IEC 61800-7 CiA 402 drive profile
Physical layer	100BASE-TX (IEEE802.3)
Connector	RJ45 × 2 (shielded type) ECAT IN: EtherCAT input ECAT OUT: EtherCAT output
Communications media	Category 5 or higher (cable with double, aluminum tape and braided shielding) is recommended.
Communications distance	Distance between nodes: 100 m max.
Process data	Fixed PDO mapping PDO mapping
Mailbox (CoE)	Emergency messages, SDO requests, SDO responses, and SDO information
Distributed clock	FreeRun mode (asynchronous)
LED display	L/A IN (Link/Activity IN) × 1 L/A OUT (Link/Activity OUT) × 1 RUN × 1 ERR × 1
CiA402 drive profile	Velocity mode

A-2   Communications Response Time

The table below lists the communications response time.

● **CJ1W-NCx82 Master**

Meaning		Performance	Conditions
Starting time		Approx. 10 to 14 ms	Time after the inverter is started from the PLC until the motor produces output * CJ1W-NCx82 When the communication cycle is 250 μs
Data transmitting time	Write	Approx. 27 ms/pc	Time needed to write/read inverter parameters from the PLC CJ1W-NCx82 When the communication cycle is 250 μs
	Read	Approx. 24 ms/pc	
IO data updating cycle		4 ms or 6 ms	Varies depending on the number of allocated PDOs

* Due to the characteristics of EtherCAT, the result will become the same with any node as long as the communication cycle is the same.

● **NJ501-1x00 Master**

Meaning		Performance	Conditions
Starting time		Approx. 6 to 10 ms	Time after the inverter is started from the PLC until the motor produces output * NJ501-1x00 When the communication cycle is 500 μs
Data transmitting time	Write	Approx. 7 ms/pc	Time needed to write/read inverter parameters from the PLC NJ501-1x00 When the communication cycle is 500 μs
	Read	Approx. 6 ms/pc	
IO data updating cycle		4 ms or 6 ms	Varies depending on the number of allocated PDOs

* Due to the characteristics of EtherCAT, the result will become the same with any node as long as the communication cycle is the same.

A-3　Object List

A-3-1　Object List

Index	Sub-index	Object name	Setting range	Unit	Default setting	Size	Access	PDO map
1000 hex	0	Device type	–	–	00010192 hex	4 bytes (U32)	RO	Not possible
1001 hex	0	Error register	–	–	0	1 byte (U8)	RO	Not possible
1008 hex	0	Manufacturer device name	–	–	3G3AX-MX2-ECT	20 bytes (VS)	RO	Not possible
1009 hex	0	Manufacturer hardware version	–	–	*1	20 bytes (VS)	RO	Not possible
100A hex	0	Manufacturer software version	–	–	*1	20 bytes (VS)	RO	Not possible
1010 hex		Store parameters	–	–	–	–	–	–
		Number of entries	–	–	01 hex	1 byte (U8)	RO	Not possible
		Save all parameters	–	–	00000001 hex	4 bytes (U32)	RW	Not possible
1011 hex		Restore default parameters	–	–	–	–	–	–
		Number of entries	–	–	01 hex	1 byte (U8)	RO	Not possible
		Restore all default parameters	–	–	00000001 hex	4 bytes (U32)	RW	Not possible
1018 hex		Identity object	–	–	–	–	–	–
	0	Number of entries	–	–	04 hex	1 byte (U8)	RO	Not possible
	1	Vendor ID	–	–	00000083 hex	4 bytes (U32)	RO	Not possible
	2	Product code	–	–	00000053 hex	4 bytes (U32)	RO	Not possible
	3	Revision number	–	–	XXXXXXXX hex	4 bytes (U32)	RO	Not possible
	4	Serial number	–	–	00000000 hex	4 bytes (U32)	RO	Not possible
10F3 hex		Diagnosis history	–	–	–	–	–	–
	0	Number of entries	–	–	00 hex	1 byte (U8)	RO	Not possible
	1	Maximum messages	00 to 08 hex	–	00 hex	1 byte (U8)	RO	Not possible
	2	Newest message	06 to 0D hex	–	06 hex	1 byte (U8)	RO	Not possible
	5	Flags	0000 to 0001 hex	–	0001 hex	2 bytes (U16)	RW	Not possible
	6 to 13	Diagnosis message 1 to 8	–	–	–	23 bytes (VS)	RO	Not possible
1600 to 1604 hex		1st to 5th receive PDO mapping	–	–	–	–	–	–
	0	Number of objects	–	–	0	1 byte (U8)	RW	Not possible
	1	1st object (1st Output Object to be mapped)		–	00000000 hex	4 bytes (U32)	RW	Not possible
	2	2nd object (2nd Output Object to be mapped)		–	00000000 hex	4 bytes (U32)	RW	Not possible

1　"V.**" which shows the hardware version is saved.

Index	Sub-index	Object name	Setting range	Unit	Default setting	Size	Access	PDO map
1700 hex		257th fixed receive PDO mapping	–	–	–	–	–	–
	0	Number of objects	–	–	2	1 byte (U8)	RO	Not possible
	1	1st object (1st Output Object to be mapped)	–	–	60400010 hex	4 bytes (U32)	RO	Not possible
	2	2nd object (2nd Output Object to be mapped)	–	–	60420010 hex	4 bytes (U32)	RO	Not possible
1701 hex		258th fixed receive PDO mapping	–	–	–	–	–	–
	0	Number of objects	–	–	2	1 byte (U8)	RO	Not possible
	1	1st object (1st Output Object to be mapped)	–	–	50000010 hex	4 bytes (U32)	RO	Not possible
	2	2nd object (2nd Output Object to be mapped)	–	–	50100010 hex	4 bytes (U32)	RO	Not possible
1A00 to 1A04 hex		1st to 5th transmit PDO mapping	–	–	–	–	–	–
	0	Number of objects	–	–	2	1 byte (U8)	RW	Not possible
	1	1st object (1st Input Object to be mapped)	–	–	00000000 hex	4 bytes (U32)	RW	Not possible
	2	2nd object (2nd Input Object to be mapped)	–	–	00000000 hex	4 bytes (U32)	RW	Not possible
1B00 hex		257th fixed transmit PDO mapping	–	–	–	–	–	–
	0	Number of objects	–	–	2	1 byte (U8)	RO	Not possible
	1	1st object (1st Input Object to be mapped)	–	–	60410010 hex	4 bytes (U32)	RO	Not possible
	2	2nd object (2nd Input Object to be mapped)	–	–	60430010 hex	4 bytes (U32)	RO	Not possible
1B01 hex		258th fixed transmit PDO mapping	–	–	–	–	–	–
	0	Number of objects	–	–	2	1 byte (U8)	RO	Not possible
	1	1st object (1st Input Object to be mapped)	–	–	51000010 hex	4 bytes (U32)	RO	Not possible
	2	2nd object (2nd Input Object to be mapped)	–	–	51100010 hex	4 bytes (U32)	RO	Not possible
1BFF hex		512th transmit PDO Mapping	–	–	–	–	–	–
	0	Number of objects in this PDO	–	–	01 hex	1 byte (U8)	RO	Not possible
	1	1st Input Object to be mapped	–	–	20020108 hex	4 bytes (U8)	RO	Not possible
1C00 hex		Sync manager communication type	–	–	–	–	–	–
	0	Number of used SM channels	–	–	04 hex	1 byte (U8)	RO	Not possible
	1	Communication type SM0	–	–	01 hex	4 bytes (U8)	RO	Not possible
	2	Communication type SM1	–	–	02 hex	4 bytes (U8)	RO	Not possible
	3	Communication type SM2	–	–	03 hex	4 bytes (U8)	RO	Not possible
	4	Communication type SM3	–	–	04 hex	4 bytes (U8)	RO	Not possible
1C10 hex		Sync Manager 0 PDO assignment	–	–	–	–	–	–
	0	Number of assigned PDOs	–	–	00 hex	1 byte (U8)	RO	Not possible
1C11 hex		Sync Manager 1 PDO assignment	–	–	–	–	–	–
	0	Number of assigned PDOs	–	–	00 hex	1 byte (U8)	RO	Not possible

Index	Sub-index	Object name	Setting range	Unit	Default setting	Size	Access	PDO map
1C12 hex		Sync manager 2 PDO assignment	–	–	–	–	–	–
	0	Number of assigned RxPDOs	–	–	01 hex	1 byte (U8)	RW	Not possible
	1	Assigned PDO 1 (1st PDO Mapping object index of assigned PDO)	–	–	1701 hex	2 bytes (U16)	RW	Not possible
	2	Assigned PDO 2 (2nd PDO Mapping object index of assigned PDO)	–	–	0000 hex	2 bytes (U16)	RW	Not possible
	3	Assigned PDO 3 (3rd PDO Mapping object index of assigned PDO)	–	–	0000 hex	2 bytes (U16)	RW	Not possible
	4	Assigned PDO 4 (4th PDO Mapping object index of assigned PDO)	–	–	0000 hex	2 bytes (U16)	RW	Not possible
	5	Assigned PDO 5 (5th PDO Mapping object index of assigned PDO)	–	–	0000 hex	2 bytes (U16)	RW	Not possible
1C13 hex		Sync Manager 3 PDO assignment	–	–	–	–	–	–
	0	Number of assigned TxPDOs	–	–	01 hex	1 byte (U8)	RW	Not possible
	1	Assigned PDO 1 (1st PDO Mapping object index of assigned PDO)	–	–	1B01 hex	2 bytes (U16)	RW	Not possible
	2	Assigned PDO 2 (2nd PDO Mapping object index of assigned PDO)	–	–	0000 hex	2 bytes (U16)	RW	Not possible
	3	Assigned PDO 3 (3rd PDO Mapping object index of assigned PDO)	–	–	0000 hex	2 bytes (U16)	RW	Not possible
	4	Assigned PDO 4 (4th PDO Mapping object index of assigned PDO)	–	–	0000 hex	2 bytes (U16)	RW	Not possible
	5	Assigned PDO 5 (5th PDO Mapping object index of assigned PDO)	–	–	0000 hex	2 bytes (U16)	RW	Not possible
1C32 hex		SM2 synchronization	–	–	–	–	–	–
	0	Number of synchronization parameter	–	–	20 hex	1 byte (U8)	RO	Not possible
	1	Synchronization type	–	–	0000 hex	2 bytes (U16)	RW	Not possible
	4	Synchronization types supported	–	–	0001 hex	2 bytes (U16)	RO	Not possible
1C33 hex		SM3 synchronization	–	–	–	–	–	–
	0	Number of synchronization parameter	–	–	20 hex	1 byte (U8)	RO	Not possible
	1	Synchronization type	–	–	0000 hex	2 bytes (U16)	RW	Not possible
	4	Synchronization types supported	–	–	0001 hex	2 bytes (U16)	RO	Not possible
2002 hex		Sysmac Error	–	–	–	–	–	–
	0	Number of entries	–	–	02 hex	1 byte (U8)	RO	Not possible
	1	Sysmac Error Status	–	–	00 hex	1 byte (U8)	RO	Possible (TxPDO)
	2	Sysmac Error Status Clear	–	–	00 hex	1 byte (U8)	RW	Not possible
2100 hex	0	Error history clear	6C636C65 hex	–	00000000 hex	4 bytes (U32)	RW	Not possible
5000 hex	0	Command	0000 to FFFF hex	–	0000 hex	2 bytes (U16)	RW	Possible
5010 hex	0	Frequency reference	0000 to FFFF hex	0.01 Hz (0.1 Hz)	0000 hex	2 bytes (U16)	RW	Possible
5100 hex	0	Status	0000 to FFFF hex	–	0000 hex	2 bytes (U16)	RO	Possible (TxPDO)

App

A-3 Object List

A-3-1 Object List

Index	Sub-index	Object name	Setting range	Unit	Default setting	Size	Access	PDO map
5110 hex	0	Output frequency monitor	0000 to FFFF hex	Unit: 0.01 Hz (0.1 Hz)	0000 hex	2 bytes (U16)	RO	Possible (TxPDO)
5200 hex		PDO mapping error history	–	–	–	–	–	–
	0	Number of entries	–	–	0A hex	1 byte (U8)	RO	Not possible
	1	Newest PDO mapping error code	–	–	FFFF hex	2 bytes (U16)	RO	Not possible
	4	Number of error messages	–	–	00 hex	2 bytes (U16)	RO	Not possible
	5 to A	PDO mapping error message 1 to 6	–	–	0000 hex	2 bytes (U16)	RO	Not possible
603F hex	0	Error code	0000 to FFFF hex	–	0000 hex	2 bytes (U16)	RO	Possible (TxPDO)
6040 hex	0	Controlword	0000 to FFFF hex	–	0000 hex	2 bytes (U16)	RW	Possible
6041 hex	0	Statusword	0000 to FFFF hex	–	0000 hex	2 bytes (U16)	RO	Possible (TxPDO)
6042 hex	0	vl target velocity	8000 to 7FFF hex	rpm	0000 hex	2 bytes (INT16)	RW	Possible
6043 hex	0	vl velocity demand	8000 to 7FFF hex	rpm	0000 hex	2 bytes (INT16)	RO	Possible (TxPDO)
6044 hex	0	vl velocity actual value	8000 to 7FFF hex	rpm	0000 hex	2 bytes (INT16)	RO	Possible (TxPDO)
6046 hex		vl velocity min max amount	–	–	–	–	–	–
	0	Number of entries	–	Command unit	02 hex	1 byte (U8)	RO	Not possible
	1	vl velocity min amount	00000000 to FFFFFFFF hex	rpm	0000000F hex	4 bytes (U32)	RW	Not possible
	2	vl velocity max amount	00000000 to FFFFFFFF hex	rpm	00000708 hex	4 bytes (U32)	RW	Not possible
6048 hex		vl velocity acceleration	–	–	–	–	–	–
	0	Number of entries	–	Command unit	02 hex	1 byte (U8)	RO	Not possible
	1	Delta speed	00000000 to FFFFFFFF hex	rpm	00000708 hex	4 bytes (U32)	RO	Not possible
	2	Delta time	0000 to FFFF hex	s	000A hex	2 bytes (U16)	RW	Not possible
6049 hex		vl velocity deceleration	–	–	–	–	–	–
	0	Number of entries	–	Command unit	02 hex	1 byte (U8)	RO	Not possible
	1	Delta speed	00000000 to FFFFFFFF hex	rpm	00000708 hex	4 bytes (U32)	RO	Not possible
	2	Delta time	0000 to FFFF hex	s	000A hex	2 bytes (U16)	RW	Not possible
605B hex	0	Shutdown option code	1	–	1	2 bytes (INT16)	RW	Not possible
605C hex	0	Disable operation option code	1	–	1	2 bytes (INT16)	RW	Not possible
605E hex	0	Fault reaction option code	1	–	1	2 bytes (INT16)	RW	Not possible
6060 hex	0	Modes of operation	2	–	02 hex	1 byte (INT8)	RW	Possible
6061 hex	0	Modes of operation display	0 to 10	–	02 hex	1 byte (INT8)	RO	Possible (TxPDO)
6502 hex	0	Supported drive modes	–	–	00000002 hex	4 bytes (U32)	RO	Not possible

A-4   Inverter Parameter List

Inverter parameters are allocated to objects 3000 to 3102 hex and 4000 to 4102 hex.

3000 to 3102 hex are 16-bit parameters and 4000 to 4102 hex are 32-bit parameters.

● Index and sub-index calculation method

Index: 3000 hex + (N/254), Sub-index: 1 + (N%254)

Index: 4000 hex + (N/254), Sub-index: 1 + (N%254)

N: Inverter register number

(N/254): Integer part after N is divided by 254

(N%254): Remainder after N is divided by 254

● Holding register number list (frequency reference and fault monitor)

Index	Sub-index	Register No.	Function name	Parameter No.	R/W	Monitor and setting items	Data resolution	PDO map
4000 hex	02 hex	0001 hex	Output Frequency Setting	F001	RW	0 to maximum frequency (enabled when A001 = 03)	0.01 [Hz]	Possible (TxPDO)
3000 hex	05 hex	0004 hex	Inverter Status B	–	RO	0: Stopped 1: During operation 2: During trip	–	Possible (TxPDO)
3000 hex	06 hex	0005 hex	Inverter Status C	–	RO	0: – 1: Stop 2: Deceleration 3: Constant speed 4: Acceleration 5: Forward 6: Reverse 7: Forward to reverse 8: Reverse to forward 9: Forward run start 10: Reverse run start	–	Possible (TxPDO)
3000 hex	07 hex	0006 hex	PID Feedback	–	RO	0 to 10000	0.01 [%]	Possible (TxPDO)
3000 hex	12 hex	0011 hex	Fault Counter	d080	RO	0 to 65530	1 [time]	Possible (TxPDO)
3000 hex	13 hex	0012 hex	Fault Monitor 1 Cause	d081	RO	Refer to *Inverter Fault Factor List* in the operation manual for the MX2 inverter.	–	Possible (TxPDO)
3000 hex	14 hex	0013 hex	Fault Monitor 1 Inverter Status			Refer to *Inverter Fault Factor List* in the operation manual for the MX2 inverter.	–	Possible (TxPDO)
4000 hex	15 hex	0014 hex	Fault Monitor 1 Frequency			0 to 100000	0.01 [Hz]	Possible (TxPDO)
3000 hex	17 hex	0016 hex	Fault Monitor 1 Current			Output current value at the time of tripping	0.01 [A]	Possible (TxPDO)
3000 hex	18 hex	0017 hex	Fault Monitor 1 Voltage			DC input voltage at the time of tripping	0.1 [V]	Possible (TxPDO)
4000 hex	19 hex	0018 hex	Fault Monitor 1 RUN Time			Total RUN time at the time of tripping	1 [h]	Possible (TxPDO)
4000 hex	1B hex	001A hex	Fault Monitor 1 ON Time			Power ON time at the time of tripping	1 [h]	Possible (TxPDO)

Index	Sub-index	Register No.	Function name	Parameter No.	R/W	Monitor and setting items	Data resolution	PDO map
3000 hex	1D hex	001C hex	Fault Monitor 2 Cause	d082	RO	Refer to *Inverter fault factor list* on page A-12.	–	Possible (TxPDO)
3000 hex	1E hex	001D hex	Fault Monitor 2 Inverter Status			Refer to *Inverter fault factor list* on page A-12.	–	Possible (TxPDO)
4000 hex	1F hex	001E hex	Fault Monitor 2 Frequency			0 to 100000	0.01 [Hz]	Possible (TxPDO)
3000 hex	21 hex	0020 hex	Fault Monitor 2 Current			Output current value at the time of tripping	0.01 [A]	Possible (TxPDO)
3000 hex	22 hex	0021 hex	Fault Monitor 2 Voltage			DC input voltage at the time of tripping	0.1 [V]	Possible (TxPDO)
4000 hex	23 hex	0022 hex	Fault Monitor 2 RUN Time			Total RUN time at the time of tripping	1 [h]	Possible (TxPDO)
4000 hex	25 hex	0024 hex	Fault Monitor 2 ON Time			Power ON time at the time of tripping	1 [h]	Possible (TxPDO)
3000 hex	27 hex	0026 hex	Fault Monitor 3 Cause	d083	RO	Refer to *Inverter fault factor list* on page A-12.	–	Possible (TxPDO)
3000 hex	28 hex	0027 hex	Fault Monitor 3 Inverter Status			Refer to *Inverter fault factor list* on page A-12.	–	Possible (TxPDO)
4000 hex	29 hex	0028 hex	Fault Monitor 3 Frequency			0 to 100000	0.01 [Hz]	Possible (TxPDO)
3000 hex	2B hex	002A hex	Fault Monitor 3 Current			Output current value at the time of tripping	0.01 [A]	Possible (TxPDO)
3000 hex	2C hex	002B hex	Fault Monitor 3 Voltage			DC input voltage at the time of tripping	0.1 [V]	Possible (TxPDO)
4000 hex	2D hex	002C hex	Fault Monitor 3 RUN Time			Total RUN time at the time of tripping	1 [h]	Possible (TxPDO)
4000 hex	2F hex	002E hex	Fault Monitor 3 ON Time			Power ON time at the time of tripping	1 [h]	Possible (TxPDO)
3000 hex	31 hex	0030 hex	Fault Monitor 4 Cause	d084	RO	Refer to *Inverter fault factor list* on page A-12.	–	Possible (TxPDO)
3000 hex	32 hex	0031 hex	Fault Monitor 4 Inverter Status			Refer to *Inverter fault factor list* on page A-12.	–	Possible (TxPDO)
4000 hex	33 hex	0032 hex	Fault Monitor 4 Frequency			0 to 100000	0.01 [Hz]	Possible (TxPDO)
3000 hex	35 hex	0034 hex	Fault Monitor 4 Current			Output current value at the time of tripping	0.01 [A]	Possible (TxPDO)
3000 hex	36 hex	0035 hex	Fault Monitor 4 Voltage			DC input voltage at the time of tripping	0.1 [V]	Possible (TxPDO)
4000 hex	37 hex	0036 hex	Fault Monitor 4 RUN Time			Total RUN time at the time of tripping	1 [h]	Possible (TxPDO)
4000 hex	39 hex	0038 hex	Fault Monitor 4 ON Time			Power ON time at the time of tripping	1 [h]	Possible (TxPDO)
3000 hex	3B hex	003A hex	Fault Monitor 5 Cause	d085	RO	Refer to *Inverter fault factor list* on page A-12.	–	Possible (TxPDO)
3000 hex	3C hex	003B hex	Fault Monitor 5 Inverter Status			Refer to *Inverter fault factor list* on page A-12.	–	Possible (TxPDO)
4000 hex	3D hex	003C hex	Fault Monitor 5 Frequency			0 to 100000	0.01 [Hz]	Possible (TxPDO)
3000 hex	3F hex	003E hex	Fault Monitor 5 Current			Output current value at the time of tripping	0.01 [A]	Possible (TxPDO)
3000 hex	40 hex	003F hex	Fault Monitor 5 Voltage			DC input voltage at the time of tripping	0.1 [V]	Possible (TxPDO)
4000 hex	41 hex	0040 hex	Fault Monitor 5 RUN Time			Total RUN time at the time of tripping	1 [h]	Possible (TxPDO)
4000 hex	43 hex	0042 hex	Fault Monitor 5 ON Time			Power ON time at the time of tripping	1 [h]	Possible (TxPDO)

Index	Sub-index	Register No.	Function name	Parameter No.	R/W	Monitor and setting items	Data resolution	PDO map
3000 hex	45 hex	0044 hex	Fault Monitor 6 Cause	d086	RO	Refer to *Inverter fault factor list* on page A-12.	–	Possible (TxPDO)
3000 hex	46 hex	0045 hex	Fault Monitor 6 Inverter Status			Refer to *Inverter fault factor list* on page A-12.	–	Possible (TxPDO)
4000 hex	47 hex	0046 hex	Fault Monitor 6 Frequency			0 to 100000	0.01 [Hz]	Possible (TxPDO)
3000 hex	49 hex	0048 hex	Fault Monitor 6 Current			Output current value at the time of tripping	0.01 [A]	Possible (TxPDO)
3000 hex	4A hex	0049 hex	Fault Monitor 6 Voltage			DC input voltage at the time of tripping	0.1 [V]	Possible (TxPDO)
4000 hex	4B hex	004A hex	Fault Monitor 6 RUN Time			Total RUN time at the time of tripping	1 [h]	Possible (TxPDO)
4000 hex	4D hex	004C hex	Fault Monitor 6 ON Time			Power ON time at the time of tripping	1 [h]	Possible (TxPDO)
3000 hex	4F hex	004E hex	Warning Monitor	d090	RO	Warning code	–	Possible (TxPDO)
3009 hex	13 hex	0900 hex	EEPROM Write	–	WO	0: Motor parameter recalculation 1: Set value storage in EEPROM Other: Motor parameter recalculation and EEPROM	–	Not possible
3009 hex	15 hex	0902 hex	EEPROM Write Mode Selection	–	WO	0: Write disabled 1: Write enabled	–	Not possible

A-4 Inverter Parameter List

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Inverter fault factor list

Trip factor high-order (factor)		Trip factor low-order (Inverter status)	
Name	Code	Name	Code
No trip factor	0	During reset	0
Overcurrent protection during constant speed	1	During stop	1
Overcurrent protection during deceleration	2	During deceleration	2
Overcurrent protection during acceleration	3	At a constant speed	3
Overcurrent protection during stop	4	During acceleration	4
Overload protection	5	Operates at frequency = 0	5
Braking resistor overload protection	6	During startup	6
Overvoltage protection	7	DB active (DC injection braking active)	7
EEPROM error	8	During overload limit	8
Undervoltage protection	9		
Current detector error	10		
CPU error	11		
External trip	12		
USP error	13		
Grounding protection	14		
Incoming overvoltage protection	15		
Abnormal temperature	21		
Main circuit error	25		
Driver error	30		
Thermistor error	35		
Brake error	36		
Emergency shutoff	37		
Overload protection in a low speed range	38		
Digital operator connection error	40		
Modbus communication (Modbus-RTU) error	41		
Internal data error	43 to 45 50 to 69		
Encoder disconnection	80		
Overspeed	81		
Position control range trip	83		

● Holding register number list (monitor)

Index	Sub-index	Register No.	Function name	Parameter No	R/W	Monitor and setting items	Data resolution	PDO map
4010 hex	22 hex	1001 hex	Output Frequency Monitor	d001	RO	0 to 40000 (100000)	0.01 [Hz]	Possible (TxPDO)
3010 hex	24 hex	1003 hex	Output current monitor	d002	RO	0 to 65530	0.01 [A]	Possible (TxPDO)
3010 hex	25 hex	1004 hex	Rotation Direction Monitor	d003	RO	0: Stop 1: Forward 2: Reverse	–	Possible (TxPDO)
4010 hex	26 hex	1005 hex	PID Feedback Value Monitor	d004	RO	0 to 1000000	0.1	Possible (TxPDO)
3010 hex	28 hex	1007 hex	Multi-function Input Monitor	d005	RO	2^0: Terminals S1 2^1 to 2^6: Terminals S7/EB	Bit	Possible (TxPDO)
3010 hex	29 hex	1008 hex	Multi-function output monitor	d006	RO	2^0: Terminals P1/EDM to 2^1: Terminal P2 2^6: Relay output terminal	Bit	Possible (TxPDO)
4010 hex	2A hex	1009 hex	Output Frequency Monitor (after conversion)	d007	RO	0 to 4000000 (10000000)	0.01	Possible (TxPDO)
4010 hex	2C hex	100B hex	Real Frequency Monitor	d008	RO	−100000 to +100000	0.01 [Hz]	Possible (TxPDO)
3010 hex	2E hex	100D hex	Torque Reference Monitor	d009	RO	−200 to +200	1 [%]	Possible (TxPDO)
3010 hex	2F hex	100E hex	Torque Bias Monitor	d010	RO	−200 to +200	1 [%]	Possible (TxPDO)
3010 hex	31 hex	1010 hex	Output Torque Monitor	d012	RO	−200 to +200	1 [%]	Possible (TxPDO)
3010 hex	32 hex	1011 hex	Output Voltage Monitor	d013	RO	0 to 6000	0.1 [V]	Possible (TxPDO)
3010 hex	33 hex	1012 hex	Input Power Monitor	d014	RO	0 to 9999	0.1 [kW]	Possible (TxPDO)
4010 hex	34 hex	1013 hex	Integrated Power Monitor	d015	RO	0 to 9999000	–	Possible (TxPDO)
4010 hex	36 hex	1015 hex	Total RUN Time Monitor	d016	RO	0 to 999000	1 [h]	Possible (TxPDO)
4010 hex	38 hex	1017 hex	Power ON Time Monitor	d017	RO	0 to 999000	1 [h]	Possible (TxPDO)
3010 hex	3A hex	1019 hex	Fin Temperature Monitor	d018	RO	−200 to 1500	0.1 [°C]	Possible (TxPDO)
3010 hex	3E hex	101D hex	Life Assessment Monitor	d022	RO	2^0: Capacitor on main circuit board 2^1: Cooling fan	Bit	Possible (TxPDO)
3010 hex	47 hex	1026 hex	DC Voltage Monitor	d102	RO	0 to 10000	0.1 [V]	Possible (TxPDO)
3010 hex	48 hex	1027 hex	Regenerative Braking Load Rate Monitor	d103	RO	0 to 1000	0.1 [%]	Possible (TxPDO)
3010 hex	49 hex	1028 hex	Electronic Thermal Load Rate Monitor	d104	RO	0 to 1000	0.1 [%]	Possible (TxPDO)
4010 hex	57 hex	1036 hex	Position Reference Monitor	d029	RO	−268435455 to 268435455	1	Possible (TxPDO)
4010 hex	59 hex	1038 hex	Current position monitor	d030	RO	−268435455 to 268435455	1	Possible (TxPDO)
3010 hex	78 hex	1057 hex	Inverter Mode Monitor	d060	RO	0: I-C (IM heavy load) 1: I-V (IM light load) 2: H-I (IM power supply harmonics)	–	Possible (TxPDO)

● Holding register number list (F group)

Index	Sub-index	Register No.	Function name	Parameter No.	R/W	Monitor and setting items	Data resolution	PDO map
4011 hex	26 hex	1103 hex	Acceleration Time Setting 1	F002	RW	1 to 360000	0.01 [s]	Possible
4011 hex	28 hex	1105 hex	Deceleration Time Setting 1	F003	RW	1 to 360000	0.01 [s]	Possible
3011 hex	2A hex	1107 hex	RUN Direction Selection	F004	RW	0: Forward 1: Reverse	–	Possible (TxPDO)

● Holding register number list (A, b, C, H, P group)

Index	Sub-index	Register No.	Function name	Parameter No.	R/W	Monitor and setting items	Data resolution	PDO map
3012 hex	26 hex	1201 hex	Frequency Reference Selection 1	A001	RW	00: Volume 01: Control circuit terminal block 02: Digital operator 03: Modbus communication (Modbus-RTU) 04: Optional board 06: Pulse train frequency 07: Do not set. 10: Operation function output	–	Possible (TxPDO)
3012 hex	27 hex	1202 hex	RUN Command Selection 1*	A002	RW	01: Control circuit terminal block 02: Digital operator 03: Modbus communication (Modbus-RTU) 04: Optional board	–	Possible (TxPDO)
3012 hex	28 hex	1203 hex	Base Frequency 1	A003	RW	300 to Maximum Frequency 1	0.1 [Hz]	Possible (TxPDO)
3012 hex	29 hex	1204 hex	Maximum Frequency 1	A004	RW	300 to 4000 (10000)	0.1 [Hz]	Possible (TxPDO)
3012 hex	2A hex	1205 hex	FV/FI Selection	A005	RW	00: Switch between FV/FI 02: Switch between FV/volume 03: Switch between FI/volume	–	Possible (TxPDO)
4012 hex	30 hex	120B hex	FV Start Frequency	A011	RW	0 to 40000 (100000)	0.01 [Hz]	Possible (TxPDO)
4012 hex	32 hex	120D hex	FV End Frequency	A012	RW	0 to 40000 (100000)	0.01 [Hz]	Possible (TxPDO)
3012 hex	34 hex	120F hex	FV Start Ratio	A013	RW	0 to 100	1 [%]	Possible (TxPDO)
3012 hex	35 hex	1210 hex	FV End Ratio	A014	RW	0 to 100	1 [%]	Possible (TxPDO)
3012 hex	36 hex	1211 hex	FV Start Selection	A015	RW	00: Start frequency 01: 0 Hz	–	Possible (TxPDO)
3012 hex	37 hex	1212 hex	FV, FI sampling	A016	RW	1 to 30/31 (with 500 ms filter ± 0.1 Hz hysteresis)	1	Possible (TxPDO)
3012 hex	3A hex	1215 hex	Multi-step Speed Selection	A019	RW	00: Binary 16-step selection with 4 terminals 01: Bit 8-step selection with 7 terminals	–	Possible (TxPDO)
4012 hex	3B hex	1216 hex	Multi-step Speed 1 Reference 0	A020	RW	0 Starting Frequency to Maximum Frequency 1	0.01 [Hz]	Possible

* After changing the RUN Command Selection 1, provide an interval of at least 40 ms before the RUN command is actually executed.

Index	Sub-index	Register No.	Function name	Parameter No.	R/W	Monitor and setting items	Data resolution	PDO map
4012 hex	3D hex	1218 hex	Multi-step Speed Reference 1	A021	RW	0 Starting Frequency to nth Maximum Frequency	0.01 [Hz]	Possible
4012 hex	3F hex	121A hex	Multi-step Speed Reference 2	A022	RW	0 Starting Frequency to nth Maximum Frequency	0.01 [Hz]	Possible
4012 hex	41 hex	121C hex	Multi-step Speed Reference 3	A023	RW	0 Starting Frequency to nth Maximum Frequency	0.01 [Hz]	Possible
4012 hex	43 hex	121E hex	Multi-step Speed Reference 4	A024	RW	0 Starting Frequency to nth Maximum Frequency	0.01 [Hz]	Possible
4012 hex	45 hex	1220 hex	Multi-step Speed Reference 5	A025	RW	0 Starting Frequency to nth Maximum Frequency	0.01 [Hz]	Possible
4012 hex	47 hex	1222 hex	Multi-step Speed Reference 6	A026	RW	0 Starting Frequency to nth Maximum Frequency	0.01 [Hz]	Possible
4012 hex	49 hex	1224 hex	Multi-step Speed Reference 7	A027	RW	0 Starting Frequency to nth Maximum Frequency	0.01 [Hz]	Possible
4012 hex	4B hex	1226 hex	Multi-step Speed Reference 8	A028	RW	0 Starting Frequency to nth Maximum Frequency	0.01 [Hz]	Possible
4012 hex	4D hex	1228 hex	Multi-step Speed Reference 9	A029	RW	0 Starting Frequency to nth Maximum Frequency	0.01 [Hz]	Possible
4012 hex	4F hex	122A hex	Multi-step Speed Reference 10	A030	RW	0 Starting Frequency to nth Maximum Frequency	0.01 [Hz]	Possible
4012 hex	51 hex	122C hex	Multi-step Speed Reference 11	A031	RW	0 Starting Frequency to nth Maximum Frequency	0.01 [Hz]	Possible
4012 hex	53 hex	122E hex	Multi-step Speed Reference 12	A032	RW	0 Starting Frequency to nth Maximum Frequency	0.01 [Hz]	Possible
4012 hex	55 hex	1230 hex	Multi-step Speed Reference 13	A033	RW	0 Starting Frequency to nth Maximum Frequency	0.01 [Hz]	Possible
4012 hex	57 hex	1232 hex	Multi-step Speed Reference 14	A034	RW	0 Starting Frequency to nth Maximum Frequency	0.01 [Hz]	Possible
4012 hex	59 hex	1234 hex	Multi-step Speed Reference 15	A035	RW	0 Starting Frequency to nth Maximum Frequency	0.01 [Hz]	Possible
3012 hex	5D hex	1238 hex	Jogging Frequency	A038	RW	Starting Frequency to 999 (10000)	0.01 [Hz]	Possible
3012 hex	5E hex	1239 hex	Jogging Stop Selection	A039	RW	00: Free run on jogging stop/Disabled in operation 01: Deceleration stop on jogging stop/Disabled in operation 02: DC injection braking on jogging stop/Disabled in operation 03: Free run on jogging stop/Enabled in operation 04: Deceleration stop on jogging stop/Enabled in operation 05: DC injection braking on jogging stop/Enabled in operation	–	Possible (TxPDO)
3012 hex	60 hex	123B hex	Torque Boost Selection 1	A041	RW	00: Manual torque boost 01: Automatic torque boost	–	Possible (TxPDO)
3012 hex	61 hex	123C hex	Manual Torque Boost Voltage 1	A042	RW	0 to 200	0.1 [%]	Possible
3012 hex	62 hex	123D hex	Manual Torque Boost Frequency 1	A043	RW	0 to 500	0.1 [%]	Possible
3012 hex	63 hex	123E hex	Control Method 1	A044	RW	00: Constant torque characteristics 01: Reduced torque characteristics 02: Free V/f setting 03: Sensorless vector control	–	Possible (TxPDO)
3012 hex	64 hex	123F hex	Output Voltage Gain 1	A045	RW	20 to 100	1 [%]	Possible

Index	Sub-index	Register No.	Function name	Parameter No.	R/W	Monitor and setting items	Data resolution	PDO map
3012 hex	65 hex	1240 hex	Automatic Torque Boost Voltage Compensation Gain 1	A046	RW	0 to 255	1 [%]	Possible
3012 hex	66 hex	1241 hex	Automatic Torque Boost Slip Compensation Gain 1	A047	RW	0 to 255	1 [%]	Possible
3012 hex	6A hex	1245 hex	Internal DC Injection Braking Selection	A051	RW	00: Disabled 01: Enabled during stop 02: Output frequency (at A052)	–	Possible (TxPDO)
3012 hex	6B hex	1246 hex	Internal DC Injection Braking Frequency	A052	RW	0 to 6000	0.01 [Hz]	Possible (TxPDO)
3012 hex	6C hex	1247 hex	DC Injection Braking Delay Time	A053	RW	0 to 50	0.1 [s]	Possible (TxPDO)
3012 hex	6D hex	1248 hex	DC Injection Braking Power	A054	RW	0 to 100	1 [%]	Possible (TxPDO)
3012 hex	6E hex	1249 hex	DC Injection Braking Time	A055	RW	0 to 600	0.1 [s]	Possible (TxPDO)
3012 hex	6F hex	124A hex	DC Injection Braking Edge/Level Selection	A056	RW	00: Edge operation 01: Level operation	–	Possible (TxPDO)
3012 hex	70 hex	124B hex	Startup DC Injection Braking Power	A057	RW	0 to 100	1 [%]	Possible (TxPDO)
3012 hex	71 hex	124C hex	Startup Internal DC Injection Braking Time	A058	RW	0 to 600	0.1 [s]	Possible (TxPDO)
3012 hex	72 hex	124D hex	DC Injection Braking Carrier Frequency	A059	RW	20 to 150	0.1 [kHz]	Possible (TxPDO)
4012 hex	74 hex	124F hex	Frequency Upper Limit 1	A061	RW	0 Frequency Lower Limit 1 to Maximum Frequency 1	0.01 [Hz]	Possible (TxPDO)
4012 hex	76 hex	1251 hex	Frequency Lower Limit 1	A062	RW	0 Starting Frequency to Frequency Upper Limit 1	0.01 [Hz]	Possible (TxPDO)
4012 hex	78 hex	1253 hex	Jump Frequency 1	A063	RW	0 to 40000 (100000)	0.01 [Hz]	Possible (TxPDO)
3012 hex	7A hex	1255 hex	Jump Frequency Width 1	A064	RW	0 to 1000 (10000)	0.01 [Hz]	Possible (TxPDO)
4012 hex	7B hex	1256 hex	Jump Frequency 2	A065	RW	0 to 40000 (100000)	0.01 [Hz]	Possible (TxPDO)
3012 hex	7D hex	1258 hex	Jump Frequency Width 2	A066	RW	0 to 1000 (10000)	0.01 [Hz]	Possible (TxPDO)
4012	7E hex	1259 hex	Jump Frequency 3	A067	RW	0 to 40000 (100000)	0.01 [Hz]	Possible (TxPDO)
3012 hex	80 hex	125B hex	Jump Frequency Width 3	A068	RW	0 to 1000 (10000)	0.01 [Hz]	Possible (TxPDO)
4012 hex	81 hex	125C hex	Acceleration Stop Frequency	A069	RW	0 to 40000	0.01 [Hz]	Possible (TxPDO)
3012 hex	83 hex	125E hex	Acceleration Stop Time	A070	RW	0 to 600	0.1 [s]	Possible (TxPDO)
3012 hex	84 hex	125F hex	PID Selection	A071	RW	00: Disabled 01: Enabled 02: Reverse output enabled	–	Possible (TxPDO)
3012 hex	85 hex	1260 hex	PID P Gain	A072	RW	2 to 2500	0.01	Possible
3012 hex	86 hex	1261 hex	PID I Gain	A073	RW	0 to 36000	0.1 [s]	Possible
3012 hex	87 hex	1262 hex	PID D Gain	A074	RW	0 to 10000	0.01 [s]	Possible
3012 hex	88 hex	1263 hex	PID Scale	A075	RW	1 to 9999	0.01	Possible (TxPDO)
3012 hex	89 hex	1264 hex	PID Feedback Selection	A076	R/W	00: Current (FI) 01: Voltage (FV) 02: Modbus communication (Modbus-RTU) 03: Pulse train frequency 10: Operation function output	–	Possible (TxPDO)
3012 hex	8A hex	1265 hex	PID Deviation Reverse Output	A077	RW	00: Disabled 01: Enabled	–	Possible (TxPDO)
3012 hex	8B hex	1266 hex	PID Variable Range Limit	A078	RW	0 to 1000	0.1 [%]	Possible (TxPDO)

Index	Sub-index	Register No.	Function name	Parameter No.	R/W	Monitor and setting items	Data resolution	PDO map
3012 hex	8C hex	1267 hex	PID Feedforward Selection	A079	RW	00: Disabled 01: Voltage (FV) 02: Current (FI)	–	Possible (TxPDO)
3012 hex	8E hex	1269 hex	AVR Selection 1	A081	RW	00: Always ON 01: Always OFF 02: OFF during deceleration	–	Possible (TxPDO)
3012 hex	8F hex	126A hex	Motor Incoming Voltage Selection 1	A082	RW	200-V class: 00 (200) 01 (215) 02 (220) 03 (230) 04 (240) 400-V class: 05 (380) 06 (400) 07 (415)		Possible (TxPDO)
3012 hex	90 hex	126B hex	AVR Filter Time Parameter	A083	RW	0 to 1000	0.01 [s]	Possible (TxPDO)
3012 hex	91 hex	126C hex	AVR Deceleration Voltage Gain	A084	RW	50 to 200	1 [%]	Possible (TxPDO)
3012 hex	92 hex	126D hex	RUN Mode Selection	A085	RW	00: Normal operation 01: Energy-saving operation	–	Possible (TxPDO)
3012 hex	93 hex	126E hex	Energy-saving Response/Accuracy Adjustment	A086	RW	0 to 1000	0.1 [%]	Possible
4012 hex	99 hex	1274 hex	1st Acceleration Time 2	A092	RW	1 to 360000	0.01 [s]	Possible
4012 hex	9B hex	1276 hex	1st Deceleration Time 2	A093	RW	1 to 360000	0.01 [s]	Possible
3012 hex	9D hex	1278 hex	2-step Acceleration/Deceleration Selection 1	A094	RW	00: Switched via word 2 terminal 01: Switched by setting 02: Switched only when switching forward/reverse	–	Possible (TxPDO)
4012 hex	9E hex	1279 hex	2-step Acceleration Frequency 1	A095	RW	0 to 40000 (100000)	0.01 [Hz]	Possible (TxPDO)
4012 hex	A0 hex	127B hex	2-step Deceleration Frequency 1	A096	RW	0 to 40000 (100000)	0.01 [Hz]	Possible (TxPDO)
3012 hex	A2 hex	127D hex	Acceleration Pattern Selection	A097	RW	00: Linear 01: S shape curve 02: U shape curve 03: Inverted U shape curve 04: EL-S shape curve	–	Possible (TxPDO)
3012 hex	A3 hex	127E hex	Deceleration Pattern Selection	A098	RW	00: Linear 01: S shape curve 02: U shape curve 03: Inverted U shape curve 04: EL-S shape curve	–	Possible (TxPDO)
4012 hex	A6 hex	1281 hex	FI Start Frequency	A101	RW	0 to 40000 (100000)	0.01 [Hz]	Possible (TxPDO)
4012 hex	A8 hex	1283 hex	FI End Frequency	A102	RW	0 to 40000 (100000)	0.01 [Hz]	Possible (TxPDO)
3012 hex	AA hex	1285 hex	FI Start Ratio	A103	RW	0 to 100	1 [%]	Possible (TxPDO)
3012 hex	AB hex	1286 hex	FI End Ratio	A104	RW	0 to 100	1 [%]	Possible (TxPDO)
3012 hex	AC hex	1287 hex	FI Start Selection	A105	RW	00: Start frequency 01: 0 Hz	–	Possible (TxPDO)
3012 hex	CA hex	12A5 hex	Acceleration Curve Parameter	A131	RW	01 (small curve) to 10 (large curve)	–	Possible (TxPDO)
3012 hex	CB hex	12A6 hex	Deceleration Curve Parameter	A132	RW	01 (small curve) to 10 (large curve)	–	Possible (TxPDO)
3012 hex	D4 hex	12AF hex	Operation Frequency Selection 1	A141	RW	00: Digital Operator 01: Volume 02: Voltage (FV) input 03: Current (FI) input 04: Modbus communication (Modbus-RTU) 05: Do not set. 07: Pulse train frequency	–	Possible (TxPDO)

A-4 Inverter Parameter List

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Index	Sub-index	Register No.	Function name	Parameter No.	R/W	Monitor and setting items	Data resolution	PDO map
3012 hex	D5 hex	12B0 hex	Operation Frequency Selection 2	A142	RW	00: Digital Operator 01: Volume 02: Voltage (FV) input 03: Current (FI) input 04: Modbus communication (Modbus-RTU) 05: Do not set. 07: Pulse train frequency	–	Possible (TxPDO)
3012 hex	D6 hex	12B1 hex	Operation Function Operator Selection	A143	RW	00: Addition (A141 + A142) 01: Subtraction (A141 − A142) 02: Multiplication (A141 × A142)	–	Possible (TxPDO)
4012 hex	D8 hex	12B3 hex	Frequency Addition Amount Setting	A145	RW	0 to 40000 (100000)	0.01 [Hz]	Possible (TxPDO)
3012 hex	DA hex	12B5 hex	Frequency Addition Sign Selection	A146	RW	00: Frequency reference + A145 01: Frequency reference − A145	–	Possible (TxPDO)
3012 hex	DE hex	12B9 hex	EL-S Shape Acceleration Curve Ratio 1	A150	RW	0 to 50	1 [%]	Possible (TxPDO)
3012 hex	DF hex	12BA hex	EL-S Shape Acceleration Curve Ratio 2	A151	RW	0 to 50	1 [%]	Possible (TxPDO)
3012 hex	E0 hex	12BB hex	EL-S Shape Deceleration Curve Ratio 1	A152	RW	0 to 50	1 [%]	Possible (TxPDO)
3012 hex	E1 hex	12BC hex	EL-S Shape Deceleration Curve Ratio 2	A153	RW	0 to 50	1 [%]	Possible (TxPDO)
4012 hex	E2 hex	12BD hex	Deceleration Stop Frequency	A154	R/W	0 to 40000 (100000)	0.01 [Hz]	Possible (TxPDO)
3012 hex	E4 hex	12BF hex	Deceleration Stop Time	A155	RW	0 to 600	0.1 [s]	Possible (TxPDO)
4012 hex	E5 hex	12C0 hex	PID Sleep Function Operation Level	A156	RW	0 to 40000 (100000)	0.01 [Hz]	Possible (TxPDO)
3012 hex	E7 hex	12C2 hex	PID Sleep Operation Delay Time	A157	RW	0 to 255	0.1 [s]	Possible (TxPDO)
4012 hex	EB hex	12C6 hex	VR Start Frequency	A161	RW	0 to 40000 (100000)	0.01 [Hz]	Possible (TxPDO)
4012 hex	ED hex	12C8 hex	VR End Frequency	A162	RW	0 to 40000 (100000)	0.01 [Hz]	Possible (TxPDO)
3012 hex	EF hex	12CA hex	VR Start Ratio	A163	RW	0 to VR End Ratio	1 [%]	Possible (TxPDO)
3012 hex	F0 hex	12CB hex	VR End Ratio	A164	RW	VR Start Ratio to 100	1 [%]	Possible (TxPDO)
3012 hex	F1 hex	12CC hex	VR Start Selection	A165	RW	00: Start Frequency A161 01: 0 Hz	–	Possible (TxPDO)
3013 hex	28 hex	1301 hex	Retry Selection	b001	RW	00: Trip 01: 0 Hz restart 02: Frequency matching restart 03: Trip after frequency matching deceleration stop 04: Frequency pull-in restart	–	Possible (TxPDO)
3013 hex	29 hex	1302 hex	Allowable Momentary Power Interruption Time	b002	RW	3 to 250	0.1 [s]	Possible (TxPDO)
3013 hex	2A hex	1303 hex	Restart Standby Time	b003	RW	3 to 1000	0.1 [s]	Possible (TxPDO)
3013 hex	2B hex	1304 hex	Momentary Power Interruption/Undervoltage Trip During Stop Selection	b004	RW	00: Disabled 01: Enabled 02: Disabled during stop and deceleration stop	–	Possible (TxPDO)
3013 hex	2C hex	1305 hex	Restart During Momentary Power Interruption Selection	b005	RW	00: 16 times 01: No limit	–	Possible (TxPDO)
4013 hex	2E hex	1307 hex	Frequency Matching Lower Limit Frequency Setting	b007	RW	0 to 40000 (100000)	0.01 [Hz]	Possible (TxPDO)
3013 hex	30 hex	1309 hex	Overvoltage/Overcurrent Restart Selection	b008	RW	00: Trip 01: 0 Hz restart 02: Frequency matching restart 03: Trip after frequency matching deceleration stop 04: Frequency pull-in restart	–	Possible (TxPDO)

Index	Sub-index	Register No.	Function name	Parameter No.	R/W	Monitor and setting items	Data resolution	PDO map
3013 hex	32 hex	130B hex	Overvoltage/Overcurrent Restart Count Selection	b010	RW	1 to 3	1 [time]	Possible (TxPDO)
3013 hex	33 hex	130C hex	Overvoltage/Overcurrent Restart Standby Time	b011	RW	3 to 1000	0.1 [s]	Possible (TxPDO)
3013 hex	34 hex	130D hex	Electronic Thermal Level 1	b012	RW	200 to 1000	0.1 [%]	Possible (TxPDO)
3013 hex	35 hex	130E hex	Electronic Thermal Characteristics Selection 1	b013	RW	00: Reduced torque characteristics 01: Constant torque characteristics 02: Free setting	–	Possible (TxPDO)
3013 hex	37 hex	1310 hex	Free-electronic Thermal Frequency 1	b015	RW	0 to Free-electronic Thermal Frequency 2	1 [Hz]	Possible (TxPDO)
3013 hex	38 hex	1311 hex	Free-electronic Thermal Current 1	b016	RW	0.00 to rated current	0.01 [%]	Possible (TxPDO)
3013 hex	39 hex	1312 hex	Free-electronic Thermal Frequency 2	b017	RW	Free-electronic Thermal Frequency 1 to Free Setting, Electric Thermal Frequency 3	1 [Hz]	Possible (TxPDO)
3013 hex	3A hex	1313 hex	Free-electronic Thermal Current 2	b018	RW	0.00 to rated current	0.01 [%]	Possible (TxPDO)
3013 hex	3B hex	1314 hex	Free-electronic Thermal Frequency 3	b019	RW	Free-electronic Thermal Frequency 2 to 400 (1000)	1 [Hz]	Possible (TxPDO)
3013 hex	3C hex	1315 hex	Free-electronic Thermal Current 3	b020	RW	0.00 to rated current	0.01 [%]	Possible (TxPDO)
3013 hex	3D hex	1316 hex	Overload Limit 1 Selection	b021	RW	00: Disabled 01: Enabled during acceleration/constant speed 02: Enabled during constant speed 03: Enabled during acceleration/constant speed (accelerated during regeneration)	–	Possible (TxPDO)
3013 hex	3E hex	1317 hex	Overload Limit 1 Level	b022	RW	200 to 2000	0.01 [%]	Possible (TxPDO)
3013 hex	3F hex	1318 hex	Overload Limit 1 Parameter	b023	RW	1 to 30000	0.1 [s]	Possible (TxPDO)
3013 hex	40 hex	1319 hex	Overload Limit 1 Selection 2	b024	RW	00: Disabled 01: Enabled during acceleration/constant speed 02: Enabled during constant speed 03: Enabled during acceleration/constant speed (accelerated during regeneration)	–	Possible (TxPDO)
3013 hex	41 hex	131A hex	Overload Limit 1 Level 2	b025	RW	200 to 2000	0.01 [%]	Possible (TxPDO)
3013 hex	42 hex	131B hex	Overload Limit 1 Parameter 2	b026	RW	1 to 30000	0.1 [s]	Possible (TxPDO)
3013 hex	43 hex	131C hex	Overcurrent Suppression Selection	b027	RW	00: Disabled 01: Enabled	–	Possible (TxPDO)
3013 hex	44 hex	131D hex	Frequency Pull-in Restart Level	b028	RW	200 to 2000	0.01 [%]	Possible (TxPDO)
3013 hex	45 hex	131E hex	Frequency Pull-in Restart Parameter	b029	RW	1 to 30000	0.1 [s]	Possible (TxPDO)
3013 hex	46 hex	131F hex	Starting Frequency at Frequency Pull-in Restart Selection	b030	RW	00: Frequency at interruption 01: Max. frequency 02: Set frequency	–	Possible (TxPDO)
3013 hex	47 hex	1320 hex	Soft Lock Selection	b031	RW	00: Data other than b031 cannot be changed when terminal SFT is ON. 01: Data other than b031 and the set frequency cannot be changed when terminal SFT is ON. 02: Data other than b031 cannot be changed. 03: Data other than b031 and the set frequency cannot be changed. 10: Data can be changed during RUN.	–	Possible (TxPDO)
3013 hex	49 hex	1322 hex	Motor Cable Length Code Selection	b033	RW	5 to 20	–	Possible (TxPDO)

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4013 hex	4A hex	1323 hex	RUN Time/Power ON Time Level	b034	RW	0 to 65535	10 [h]	Possible (TxPDO)
3013 hex	4C hex	1325 hex	Rotation Direction Limit Selection	b035	RW	00: No direction limit 01: Only Forward is enabled. (Reverse is limited.) 02: Only Reverse is enabled. (Forward is limited.)	–	Possible (TxPDO)
3013 hex	4D hex	1326 hex	Reduced Voltage Startup Selection	b036	RW	0 (Reduced voltage startup time: small) to 255 (Reduced voltage startup time: large)	–	Possible (TxPDO)
3013 hex	4E hex	1327 hex	Display Selection	b037	RW	00: Complete display 01: Individual display of functions 02: User setting, this setting 03: Data comparison display 04: Basic display 05: Monitor display only	–	Possible (TxPDO)
3013 hex	4F hex	1328 hex	Initial Screen Selection	b038	RW	00: Screen on which the Entry was last pressed 001 to 060: (d001 to d060) 201: F001	–	Possible (TxPDO)
3013 hex	50 hex	1329 hex	User Parameter Automatic Setting Function	b039	RW	00: Disabled 01: Enabled	–	Possible (TxPDO)
3013 hex	51 hex	132A hex	Torque Limit Selection	b040	RW	00: Four-quadrant separate setting 01: Terminal switching 02: Analog voltage input 03: Do not set.	–	Possible (TxPDO)
3013 hex	52 hex	132B hex	Torque Limit 1 (four-quadrant mode forward power running)	b041	RW	0 to 200/255 (no)	1 [%]	Possible (TxPDO)
3013 hex	53 hex	132C hex	Torque Limit 2 (four-quadrant mode reverse regeneration)	b042	RW	0 to 200/255 (no)	1 [%]	Possible (TxPDO)
3013 hex	54 hex	132D hex	Torque Limit 3 (four-quadrant mode reverse power running)	b043	RW	0 to 200/255 (no)	1 [%]	Possible (TxPDO)
3013 hex	55 hex	132E hex	Torque Limit 4 (four-quadrant mode forward regeneration)	b044	RW	0 to 200/255 (no)	1 [%]	Possible (TxPDO)
3013 hex	56 hex	132F hex	Torque LADSTOP Selection	b045	RW	00: Disabled 01: Enabled	–	Possible (TxPDO)
3013 hex	57 hex	1330 hex	Reverse Rotation Prevention Selection	b046	RW	00: Disabled 01: Enabled	–	Possible (TxPDO)
3013 hex	5A hex	1333 hex	Heavy Load/Light Load Selection	b049	RW	00: Heavy load mode 01: Light load mode	–	Possible (TxPDO)
3013 hex	5B hex	1334 hex	Controlled Deceleration on Power Loss	b050	RW	00: Disabled 01: Deceleration stop 02: Constant voltage (without recovery) 03: Constant voltage (with recovery)	–	Possible (TxPDO)
3013 hex	5C hex	1335 hex	DC Bus Voltage Trigger Level of Ctrl. Decel	b051	RW	0 to 10000	0.1 [V]	Possible (TxPDO)
3013 hex	5D hex	1336 hex	Deceleration Hold Level of Ctrl. Decel	b052	RW	0 to 10000	0.1 [V]	Possible (TxPDO)
4013 hex	5E hex	1337 hex	Deceleration Time of Ctrl. Decel	b053	RW	1 to 360000	0.01 [s]	Possible (TxPDO)
3013 hex	60 hex	1339 hex	Freq. Drop to start Ctrl. Decel	b054	RW	0 to 1000	0.01 [Hz]	Possible (TxPDO)
3013 hex	66 hex	133F hex	Window Comparator FV Upper Limit Level	b060	RW	0. to 100. (Lower limit: b061 + b062 × 2)	1 [%]	Possible
3013 hex	67 hex	1340 hex	Window Comparator FV Lower Limit Level	b061	RW	0. to 100. (Upper limit: b060 - b062 × 2)	1 [%]	Possible
3013 hex	68 hex	1341 hex	Window Comparator FV Hysteresis Width	b062	RW	0. to 10. (Upper limit: (b060 − b061) / 2)	1 [%]	Possible
3013 hex	69 hex	1342 hex	Window Comparator FI Upper Limit Level	b063	RW	0. to 100. (Lower limit: b064 + b065 × 2)	1 [%]	Possible
3013 hex	6A hex	1343 hex	Window Comparator FI Lower Limit Level	b064	RW	0. to 100. (Upper limit: b063 − b065 × 2	1 [%]	Possible

Index	Sub-index	Register No.	Function name	Parameter No.	R/W	Monitor and setting items	Data resolution	PDO map
3013 hex	6B hex	1344 hex	Window Comparator FI Hysteresis Width	b065	RW	0. to 10. (Upper limit: (b063 − b064) / 2)	1 [%]	Possible
3013 hex	70 hex	1349 hex	Analog Operation Level at FV Disconnection	b070	RW	0 to 100/255 (no)	1 [%]	Possible (TxPDO)
3013 hex	71 hex	134A hex	Analog Operation Level at FI Disconnection	b071	RW	0 to 100/255 (no)	1 [%]	Possible (TxPDO)
3013 hex	75 hex	134E hex	Ambient Temperature	b075	RW	−10 to 50	1 [°C]	Possible
3013 hex	78 hex	1351 hex	Integrated Power Clear	b078	RW	00: Disabled 01: Clear (Return to 00 after clear)	–	Possible
3013 hex	79 hex	1352 hex	Integrated Power Display Scale	b079	RW	1 to 1000	1	Possible
3013 hex	7C hex	1355 hex	Starting Frequency	b082	RW	10 to 999 (10000)	0.01 [Hz]	Possible (TxPDO)
3013 hex	7D hex	1356 hex	Carrier Frequency	b083	RW	20 to 150	0.1 [kHz]	Possible (TxPDO)
3013 hex	7E hex	1357 hex	Initialization Selection	b084	RW	00: Initialization disabled 01: Clear fault monitor 02: Initialize data 03: Clear fault monitor + initialize data 04: Do not set.	–	Possible (TxPDO)
3013 hex	7F hex	1358 hex	Initialization Data Selection	b085	RW	00: Do not change.	–	Possible (TxPDO)
3013 hex	80 hex	1359 hex	Frequency Conversion Coefficient	b086	RW	1 to 9999	0.01	Possible
3013 hex	81 hex	135A hex	STOP Key Selection	b087	RW	00: Enabled 01: Disabled 02: Only reset is enabled	–	Possible (TxPDO)
3013 hex	82 hex	135B hex	Free-run Stop Selection	b088	RW	00: 0 Hz restart 01: Frequency matching restart 02: Frequency pull-in restart	–	Possible (TxPDO)
3013 hex	83 hex	135C hex	Automatic Carrier Reduction	b089	RW	00: Disabled 01: Enabled, depends on the current 02: Enabled, depends on the fin temperature	–	Possible (TxPDO)
3013 hex	84 hex	135D hex	Usage Rate of Regenerative Braking	b090	RW	0 to 1000	0.1 [%]	Possible (TxPDO)
3013 hex	85 hex	135E hex	Stop Selection	b091	RW	00: Deceleration stop 01: Free-run stop	–	Possible (TxPDO)
3013 hex	86 hex	135F hex	Cooling Fan Operation	b092	RW	00: Always 01: Only during operation (Including 5 minutes after the power is turned on and also after the inverter stops) 02: Depends on the fin temperature	–	Possible (TxPDO)
3013 hex	87 hex	1360 hex	Cooling Fan Total Operating Time Clear	b093	RW	00: Operating time count 01: Clear (Return to 00 after clear)	–	Possible (TxPDO)
3013 hex	88 hex	1361 hex	Initialization Target Selection	b094	RW	00: All data 01: Data other than terminal/communications 02: U*** registration function only 03: Other than U*** registration function	–	Possible (TxPDO)
3013 hex	89 hex	1362 hex	Regenerative Braking Selection	b095	RW	00: Disabled 01: Enabled (Disabled during stop) 02: Enabled (Enabled during stop)	–	Possible (TxPDO)
3013 hex	8A hex	1363 hex	Regenerative Braking ON Level	b096	RW	330 to 380/660 to 760	1 [V]	Possible (TxPDO)
3013 hex	8E hex	1367 hex	Free V/f Frequency 1	b100	RW	0 to Free V/f Frequency 2	1 [Hz]	Possible (TxPDO)
3013 hex	8F hex	1368 hex	Free V/f Voltage 1	b101	RW	0 to 8000	0.1 [V]	Possible (TxPDO)
3013 hex	90 hex	1369 hex	Free V/f Frequency 2	b102	RW	0 to Free V/f Frequency 3	1 [Hz]	Possible (TxPDO)
3013 hex	91 hex	136A hex	Free V/f Voltage 2	b103	RW	0 to 8000	0.1 [V]	Possible (TxPDO)

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Index	Sub-index	Register No.	Function name	Parameter No.	R/W	Monitor and setting items	Data resolution	PDO map
3013 hex	92 hex	136B hex	Free V/f Frequency 3	b104	RW	0 to Free V/f Frequency 4	1 [Hz]	Possible (TxPDO)
3013 hex	93 hex	136C hex	Free V/f Voltage 3	b105	RW	0 to 8000	0.1 [V]	Possible (TxPDO)
3013 hex	94 hex	136D hex	Free V/f Frequency 4	b106	RW	0 to Free V/f Frequency 5	1 [Hz]	Possible (TxPDO)
3013 hex	95 hex	136E hex	Free V/f Voltage 4	b107	RW	0 to 8000	0.1 [V]	Possible (TxPDO)
3013 hex	96 hex	136F hex	Free V/f Frequency 5	b108	RW	0 to Free V/f Frequency 6	1 [Hz]	Possible (TxPDO)
3013 hex	97 hex	1370 hex	Free V/f Voltage 5	b109	RW	0 to 8000	0.1 [V]	Possible (TxPDO)
3013 hex	98 hex	1371 hex	Free V/f Frequency 6	b110	RW	0 to Free V/f Frequency 7	1 [Hz]	Possible (TxPDO)
3013 hex	99 hex	1372 hex	Free V/f Voltage 6	b111	RW	0 to 8000	0.1 [V]	Possible (TxPDO)
3013 hex	9A hex	1373 hex	Free V/f Frequency 7	b112	RW	0 to 400 (1000) (Hz)	1 [Hz]	Possible (TxPDO)
3013 hex	9B hex	1374 hex	Free V/f Voltage 7	b113	RW	0 to 8000	0.1 [V]	Possible (TxPDO)
3013 hex	A2 hex	137B hex	Brake Control Function Selection	b120	RW	00: Disabled 01: Enabled	–	Possible (TxPDO)
3013 hex	A3 hex	137C hex	Brake Release Wait Time	b121	RW	0 to 500	0.01 [s]	Possible (TxPDO)
3013 hex	A4 hex	137D hex	Acceleration Wait Time	b122	RW	0 to 500	0.01 [s]	Possible (TxPDO)
3013 hex	A5 hex	137E hex	Stop Wait Time	b123	RW	0 to 500	0.01 [s]	Possible (TxPDO)
3013 hex	A6 hex	137F hex	Brake Wait Time for Confirmation	b124	RW	0 to 500	0.01 [s]	Possible (TxPDO)
3013 hex	A7 hex	1380 hex	Brake Release Frequency	b125	RW	0 to 40000	0.01 [Hz]	Possible (TxPDO)
3013 hex	A8 hex	1381 hex	Brake Release Current	b126	RW	0 to 20000	0.01 [%]	Possible (TxPDO)
3013 hex	A9 hex	1382 hex	Break ON Frequency	b127	RW	0 to 40000	0.01 [Hz]	Possible (TxPDO)
3013 hex	AC hex	1385 hex	Overvoltage Suppression Function Selection During Deceleration	b130	RW	00: Disabled 01: DC voltage kept constant 02: Acceleration enabled	–	Possible (TxPDO)
3013 hex	AD hex	1386 hex	Overvoltage Suppression Level During Deceleration	b131	RW	200-V class: 330 to 390 400-V class: 660 to 780	1 [V]	Possible (TxPDO)
3013 hex	AE hex	1387 hex	Overvoltage Suppression Parameter	b132	RW	10 to 3000	0.01 [s]	Possible (TxPDO)
3013 hex	AF hex	1388 hex	Overvoltage Suppression Proportional Gain Setting	b133	RW	0 to 500	0.01	Possible
3013 hex	B0 hex	1389 hex	Overvoltage Suppression Integral Time Setting	b134	RW	0 to 1500	0.1 [s]	Possible
3013 hex	BB hex	1394 hex	GS Input Operation Selection	b145	RW	00: No tripping 01: Tripping	–	Possible (TxPDO)
3013 hex	C0 hex	1399 hex	Main Panel Display Selection	b150	RW	0 to 60 hex (BCD) (d001 to d060)	–	Possible
3013 hex	CA hex	13A3 hex	d050 Monitor Target 1	b160	RW	0 to 30 hex (BCD) (d001 to d030)	–	Possible
3013 hex	CB hex	13A4 hex	d050 Monitor Target 2	b161	RW	0 to 30 hex (BCD) (d001 to d030)	–	Possible
3013 hex	CD hex	13A6 hex	d001/d007 Frequency Setting Mode Selection	b163	RW	00: Disabled 01: Enabled	–	Possible
3013 hex	CE hex	13A7 hex	Initial Screen Automatic Switching Function	b164	RW	00: Disabled 01: Enabled	–	Possible

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3013 hex	CF hex	13A8 hex	Selection of Operating Level on Digital Operator Disconnection	b165	RW	00: Trip 01: Trip after deceleration stop 02: Ignore 03: Free-run stop 04: Deceleration stop	–	Possible
3013 hex	D5 hex	13AE hex	Inverter Mode Selection	b171	RW	00: Selection disabled 01: Induction motor 02: High frequency induction motor	–	Possible (TxPDO)
3013 hex	DE hex	13B7 hex	Perform Initialization/ Mode Selection Execution	b180	RW	00: Function disabled 01: Initialization/Mode Selection Execution	–	Possible (TxPDO)

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Index	Sub-index	Register No.	Function name	Parameter No.	R/W	Monitor and setting items	Data resolution	PDO map
3014 hex	2A hex	1401 hex	Multi-function Input 1 Selection	C001	RW	00: FW (Forward) 01: RV (Reverse) 02: CF1 (Multi-step speed 1) 03: CF2 (Multi-step speed 2) 04: CF3 (Multi-step speed 3) 05: CF4 (Multi-step speed 4) 06: JG (Jogging) 07: DB (External DC injection braking) 08: SET (Motor 2 control) 09: 2CH (2-step acceleration/deceleration) 11: FRS (Free-run stop) 12: EXT (External trip) 13: USP (USP function) 14: CS (Commercial switch) 15: SFT (Soft lock) 16: FV/FI (Analog input switch) 18: RS (Reset) 19: TH (PTC thermistor thermal protection) 20: STA (3-wire start) 21: STP (3-wire stop) 22: F/R (3-wire forward/reverse) 23: PID (PID disabled) 24: PIDC (PID integral reset) 27: UP (UP/DWN function accelerated) 28: DWN (UP/DWN function decelerated) 29: UDC (UP/DWN function data clear) 31: OPE (Forced operator) 32: SF1 (Multi-step speed bit 1) 33: SF2 (Multi-step speed bit 2) 34: SF3 (Multi-step speed bit 3) 35: SF4 (Multi-step speed bit 4) 36: SF5 (Multi-step speed bit 5) 37: SF6 (Multi-step speed bit 6) 38: SF7 (Multi-step speed bit 7) 39: OLR (Overload limit switching) 40: TL (Torque limit enabled/disabled) 41: TRQ1 (Torque limit switching 1) 42: TRQ2 (Torque limit switching 2) 44: BOK (Brake confirmation) 46: LAC (LAD cancel) 47: PCLR (Position deviation clear) 50: ADD (Frequency addition) 51: F-TM (Forced terminal block) 52: ATR (Torque reference input permission) 53: KHC (Integrated power clear) 56: Reserved. 57: Reserved. 58: Reserved. 59: Reserved. 60: Reserved. 61: Reserved. 62: Reserved. 65: AHD (Analog command held) 66: CP1 (Position command selection 1) 67: CP2 (Position command selection 2) 68: CP3 (Position command selection 3) 69: ORL (Zero return limit signal) 70: ORG (Zero return startup signal) 73: SPD (Speed/position switching) 77: GS1 (GS1 input (C003 only)) 78: GS2 (GS2 input (C004 only)) 81: 485 (Start co-inverter communication) 82: Reserved. 83: HLD (Retain output frequency) 84: ROK (Permission of RUN command) 85: EB (Rotation direction detection (C007 only)) 86: DISP (Display fixed) no: NO (Not assigned)	–	Possible (TxPDO)
3014 hex	2B hex	1402 hex	Multi-function Input 2 Selection	C002	RW		–	Possible (TxPDO)
3014 hex	2C hex	1403 hex	Multi-function Input 3 Selection	C003	RW		–	Possible (TxPDO)
3014 hex	2D hex	1404 hex	Multi-function Input 4 Selection	C004	RW		–	Possible (TxPDO)
3014 hex	2E hex	1405 hex	Multi-function Input 5 Selection	C005	RW		–	Possible (TxPDO)
3014 hex	2F hex	1406 hex	Multi-function Input 6 Selection	C006	RW		–	Possible (TxPDO)
3014 hex	30 hex	1407 hex	Multi-function Input 7 Selection	C007	RW		–	Possible (TxPDO)

Index	Sub-index	Register No.	Function name	Parameter No.	R/W	Monitor and setting items	Data resolution	PDO map
3014 hex	34 hex	140B hex	Multi-function Input Terminal 1 Operation Selection	C011	RW	00: NO (NO contact) 01: NC (NC contact)	–	Possible (TxPDO)
3014 hex	35 hex	140C hex	Multi-function Input Terminal 2 Operation Selection	C012	RW		–	Possible (TxPDO)
3014 hex	36 hex	140D hex	Multi-function Input Terminal 3 Operation Selection	C013	RW		–	Possible (TxPDO)
3014 hex	37 hex	140E hex	Multi-function Input Terminal 4 Operation Selection	C014	RW		–	Possible (TxPDO)
3014 hex	38 hex	140F hex	Multi-function Input Terminal 5 Operation Selection	C015	RW		–	Possible (TxPDO)
3014 hex	39 hex	1410 hex	Multi-function Input Terminal 6 Operation Selection	C016	RW		–	Possible (TxPDO)
3014 hex	3A hex	1411 hex	Multi-function Input Terminal 7 Operation Selection	C017	RW		–	Possible (TxPDO)
3014 hex	3E hex	1415 hex	Multi-function Output Terminal P1/EDM Selection	C021	RW	00: RUN (During RUN) 01: FA1 (Constant speed reached) 02: FA2 (Set frequency min. reached) 03: OL (Overload warning) 04: OD (PID excessive deviation) 05: AL (Alarm output) 06: FA3 (Meet designated frequency during accel./decel.) 07: OTQ (Overtorque/Undertorque) 09: UV (Signal during undervoltage) 10: TRQ (During torque limit) 11: RNT (RUN time over) 12: ONT (Power on time over) 13: THM (Thermal warning) 19: BRK (Brake release) 20: BER (Brake error) 21: ZS (0Hz) 22: DSE (Excessive speed deviation) 23: POK (Position ready) 24: FA4 (Set frequency exceeded 2) 25: FA5 (Meet designated frequency 2 during accel./decel.) 26: OL2 (Overload warning 2) 27: FVdc (Analog FV disconnection detection) 28: FIdc (Analog FI disconnection detection)	–	Possible (TxPDO)
3014 hex	3F hex	1416 hex	Multi-function Output Terminal P2 Selection	C022	RW	31: FBV (PID FB status output) 32: NDc (Communication disconnection detection) 33: LOG1 (Logic operation output 1) 34: LOG2 (Logic operation output 2) 35: LOG3 (Logic operation output 3) 39: WAC (Capacitor life warning) 40: WAF (Cooling fan life warning signal) 41: FR (Starting contact signal) 42: OHF (Fin overheat warning) 43: LOC (Low current signal) 44: Reserved. 45: Reserved. 46: Reserved. 50: IRDY (Operation ready) 51: FWR (During forward operation) 52: RVR (During reverse operation) 53: MJA (Fatal fault signal) 54: WCFV (Window comparator FV) 55: WCFI (Window comparator FI) 58: FREF (Frequency command source) 59: REF (RUN command source) 60: SETM (Motor 2 selection) 62: EDM (Safety device monitor) 63: Reserved. no: NO (Not assigned)	–	Possible (TxPDO)

Index	Sub-index	Register No.	Function name	Parameter No.	R/W	Monitor and setting items	Data resolution	PDO map
3014 hex	43 hex	141A hex	Multi-function Relay Output (MA, MB) Function Selection	C026	RW	00: RUN (During RUN) 01: FA1 (Constant speed reached) 02: FA2 (Set frequency min. reached) 03: OL (Overload warning) 04: OD (PID excessive deviation) 05: AL (Alarm output) 06: FA3 (Meet designated frequency during accel./decel.) 07: OTQ (Overtorque/Undertorque) 09: UV (Signal during undervoltage) 10: TRQ (During torque limit) 11: RNT (RUN time over) 12: ONT (Power on time over) 13: THM (Thermal warning) 19: BRK (Brake release) 20: BER (Brake error) 21: ZS (0Hz) 22: DSE (Excessive speed deviation) 23: POK (Position ready) 24: FA4 (Set frequency exceeded 2) 25: FA5 (Meet designated frequency 2 during accel./decel.) 26: OL2 (Overload warning 2) 27: FVdc (Analog FV disconnection detection) 28: FIdc (Analog FI disconnection detection) 31: FBV (PID FB status output) 32: NDc (Communication disconnection detection) 33: LOG1 (Logic operation output 1) 34: LOG2 (Logic operation output 2) 35: LOG3 (Logic operation output 3) 39: WAC (Capacitor life warning) 40: WAF (Cooling fan life warning signal) 41: FR (Starting contact signal) 42: OHF (Fin overheat warning) 43: LOC (Low current signal) 44: Reserved. 45: Reserved. 46: Reserved. 50: IRDY (Operation ready) 51: FWR (During forward operation) 52: RVR (During reverse operation) 53: MJA (Fatal fault signal) 54: WCFV (Window comparator FV) 55: WCFI (Window comparator FI) 58: FREF (Frequency command source) 59: REF (RUN command source) 60: SETM (Motor 2 selection) 62: EDM (Safety device monitor) 63: Reserved. no: NO (Not assigned)	–	Possible (TxPDO)
3014 hex	44 hex	141B hex	MP Selection	C027	RW	00: Output frequency 01: Output current 02: Output torque 03: Digital output frequency 04: Output voltage 05: Input power 06: Electronic thermal load rate 07: LAD frequency 08: Digital current monitor 10: Cooling fin temperature 12: Do not set. 15: Pulse train input monitor 16: Do not set.	–	Possible (TxPDO)
3014 hex	45 hex	141C hex	AM Selection	C028	RW	00: Output frequency 01: Output current 02: Output torque 04: Output voltage 05: Input power 06: Electronic thermal load rate 07: LAD frequency 10: Cooling fin temperature 11: Output torque (signed) 13: Do not set. 16: Do not set.	–	Possible (TxPDO)

Index	Sub-index	Register No.	Function name	Parameter No.	R/W	Monitor and setting items	Data resolution	PDO map
3014 hex	47 hex	141E hex	Digital Current Monitor Reference Value	C030	RW	2000 to 20000	0.01 [%]	Possible
3014 hex	48 hex	141F hex	Multi-function Output P1/EDM Contact Selection	C031	RW	00: NO (NO contact) 01: NC (NC contact)	–	Possible (TxPDO)
3014 hex	49 hex	1420 hex	Multi-function Output P2 Contact Selection	C032	RW	00: NO (NO contact) 01: NC (NC contact)	–	Possible (TxPDO)
3014 hex	4D hex	1424 hex	Multi-function Relay Output (MA, MB) Contact Selection	C036	RW	00: NO (NO contact) 01: NC (NC contact)	–	Possible (TxPDO)
3014 hex	4F hex	1426 hex	Low Current Signal Output Mode Selection	C038	RW	00: During acceleration/deceleration/ constant speed 01: Only during constant speed	–	Possible (TxPDO)
3014 hex	50 hex	1427 hex	Low Current Detection Level	C039	RW	0 to 20000	0.01 [%]	Possible
3014 hex	51 hex	1428 hex	Overload Warning Signal Output Mode Selection	C040	RW	00: During acceleration/deceleration/ constant speed 01: Only during constant speed	–	Possible (TxPDO)
3014 hex	52 hex	1429 hex	Overload Warning Level 1	C041	RW	0 to 20000	0.01 [%]	Possible
4014 hex	53 hex	142A hex	Arrival Frequency During Acceleration	C042	RW	0 to 40000 (100000)	0.01 [Hz]	Possible (TxPDO)
4014 hex	55 hex	142C hex	Arrival Frequency During Deceleration	C043	RW	0 to 40000 (100000)	0.01 [Hz]	Possible (TxPDO)
3014 hex	57 hex	142E hex	PID Deviation Excessive Level	C044	RW	0 to 1000	0.1 [%]	Possible (TxPDO)
4014 hex	58 hex	142F hex	Arrival Frequency During Acceleration 2	C045	RW	0 to 40000 (100000)	0.01 [Hz]	Possible (TxPDO)
4014 hex	5A hex	1431 hex	Arrival Frequency During Deceleration 2	C046	RW	0 to 40000 (100000)	0.01 [Hz]	Possible (TxPDO)
3014 hex	5C hex	1433 hex	Pulse Train Output Coefficient	C047	RW	0001 to 9999	–	Possible
3014 hex	61 hex	1438 hex	Feedback Comparison Signal Off Level	C052	RW	0 to 1000	0.1 [%]	Possible (TxPDO)
3014 hex	62 hex	1439 hex	Feedback Comparison Signal On Level	C053	RW	0 to 1000	0.1 [%]	Possible (TxPDO)
3014 hex	63 hex	143A hex	Overtorque/Undertorque Selection	C054	RW	00: Overtorque 01: Undertorque	–	Possible (TxPDO)
3014 hex	64 hex	143B hex	Overtorque Level (Forward Power Running)	C055	RW	0 to 200	1 [%]	Possible (TxPDO)
3014 hex	65 hex	143C hex	Overtorque Level (Reverse Regeneration)	C056	RW	0 to 200	1 [%]	Possible (TxPDO)
3014 hex	66 hex	143D hex	Overtorque Level (Reverse Power Running)	C057	RW	0 to 200	1 [%]	Possible (TxPDO)
3014 hex	67 hex	143E hex	Overtorque Level (Forward Regeneration)	C058	RW	0 to 200	1 [%]	Possible (TxPDO)
3014 hex	68 hex	143F hex	Overtorque/Undertorque Signal Output Mode Selection	C059	RW	00: During acceleration/deceleration/ constant speed 01: Only during constant speed	–	Possible (TxPDO)
3014 hex	6A hex	1441 hex	Electronic Thermal Warning Level	C061	RW	0 to 100	1 [%]	Possible (TxPDO)
3014 hex	6C hex	1443 hex	0 Hz Detection Level	C063	RW	0 to 10000	0.01 [Hz]	Possible (TxPDO)
3014 hex	6D hex	1444 hex	Cooling Fin Overheat Warning Level	C064	RW	0 to 110	1 [°C]	Possible (TxPDO)
3014 hex	74 hex	144B hex	Communication Speed Selection	C071	RW	03 (2,400 bps) 04 (4,800 bps) 05 (9,600 bps) 06 (19.2 kbps) 07 (38.4 kbps) 08 (57.6 kbps) 09 (76.8 kbps) 10 (115.2 kbps)	–	Possible (TxPDO)

Index	Sub-index	Register No.	Function name	Parameter No.	R/W	Monitor and setting items	Data resolution	PDO map
3014 hex	75 hex	144C hex	Communication Station No. Selection	C072	RW	1 to 247	–	Possible (TxPDO)
3014 hex	77 hex	144E hex	Communication Parity Selection	C074	RW	00: Disabled 01: Even 02: Odd	–	Possible (TxPDO)
3014 hex	78 hex	144F hex	Communication Stop Bit Selection	C075	RW	1: 1 bit 2: 2 bits	–	Possible (TxPDO)
3014 hex	79 hex	1450 hex	Operation Selection on Communication Error	C076	RW	00: Trip 01: Trip after deceleration stop 02: Ignore 03: Free-run stop 04: Deceleration stop	–	Possible (TxPDO)
3014 hex	7A hex	1451 hex	Communication Error Timeout Period	C077	RW	0: Timeout disabled 1 to 9999	0.01 [s]	Possible (TxPDO)
3014 hex	7B hex	1452 hex	Communication Wait Time	C078	RW	0 to 1000	1 [ms]	Possible (TxPDO)
3014 hex	7E hex	1455 hex	FV Adjustment	C081	RW	0 to 2000	0.1 [%]	Possible
3014 hex	7F hex	1456 hex	FI Adjustment	C082	RW	0 to 2000	0.1 [%]	Possible
3014 hex	82 hex	1459 hex	Thermistor Adjustment	C085	RW	0 to 2000	0.1 [%]	Possible
3014 hex	88 hex	145F hex	Debug Mode Selection	C091	RW	For factory adjustment (Do not change.)	–	Possible
3014 hex	8D hex	1464 hex	Communication Selection	C096	RW	00: Modbus communication (Modbus-RTU) 01: Communication between inverters 02: Communication between inverters (management)	–	Possible (TxPDO)
3014 hex	8F hex	1466 hex	Co-inverter Communication Starting Station Number	C098	RW	1 to 8	–	Possible (TxPDO)
3014 hex	90 hex	1467 hex	Co-inverter Communication Ending Station Number	C099	RW	1 to 8	–	Possible (TxPDO)
3014 hex	91 hex	1468 hex	Co-inverter Communication Starting Selection	C100	RW	00: 485 terminals start 01: Always started	–	Possible (TxPDO)
3014 hex	92 hex	1469 hex	UP/DWN Storage Selection	C101	RW	00: Do not store frequency data 01: Store frequency data	–	Possible (TxPDO)
3014 hex	93 hex	146A hex	Reset selection	C102	RW	00: Trip reset at power-ON 01: Trip reset at power-OFF 02: Enabled only during trip (Reset when the power is ON.) 03: Trip reset only	–	Possible
3014 hex	94 hex	146B hex	Reset Restart Selection	C103	RW	00: 0 Hz restart 01: Frequency matching restart 02: Frequency pull-in restart	–	Possible (TxPDO)
3014 hex	95 hex	146C hex	UP/DWN Clear Terminal Mode	C104	RW	00: 0 Hz 01: EEPROM data at power ON	–	Possible (TxPDO)
3014 hex	96 hex	146D hex	MP Gain Setting	C105	RW	50 to 200	1 [%]	Possible
3014 hex	97 hex	146E hex	AM Gain Setting	C106	RW	50 to 200	1 [%]	Possible
3014 hex	9A hex	1471 hex	AM Bias Setting	C109	RW	0 to 100	1 [%]	Possible
3014 hex	9C hex	1473 hex	Overload 1 Warning Signal Level 2	C111	RW	0 to 20000	0.01 [%]	Possible
3014 hex	AF hex	1486 hex	Output P1/EDM ON Delay Time	C130	RW	0 to 1000	0.1 [s]	Possible (TxPDO)
3014 hex	B0 hex	1487 hex	Output P1/EDM OFF Delay Time	C131	RW	0 to 1000	0.1 [s]	Possible (TxPDO)
3014 hex	B1 hex	1488 hex	Output P2 ON Delay Time	C132	RW	0 to 1000	0.1 [s]	Possible (TxPDO)
3014 hex	B2 hex	1489 hex	Output P2 OFF Delay Time	C133	RW	0 to 1000	0.1 [s]	Possible (TxPDO)

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Index	Sub-index	Register No.	Function name	Parameter No.	R/W	Monitor and setting items	Data resolution	PDO map
3014 hex	B9 hex	1490 hex	Output RY ON Delay Time	C140	RW	0 to 1000	0.1 [s]	Possible (TxPDO)
3014 hex	BA hex	1491 hex	Output RY OFF Delay Time	C141	RW	0 to 1000	0.1 [s]	Possible (TxPDO)
3014 hex	BB hex	1492 hex	Logic Output Signal 1 Selection 1	C142	RW	Same as C021 and C022 (excluding LOG1 to LOG3)	–	Possible (TxPDO)
3014 hex	BC hex	1493 hex	Logic Output Signal 1 Selection 2	C143	RW	Same as C021 and C022 (excluding LOG1 to LOG3)	–	Possible (TxPDO)
3014 hex	BD hex	1494 hex	Logic Output Signal 1 Operator Selection	C144	RW	00: AND 01: OR 02: XOR	–	Possible (TxPDO)
3014 hex	BE hex	1495 hex	Logic Output Signal 2 Selection 1	C145	RW	Same as C021 and C022 (excluding LOG1 to LOG3)	–	Possible (TxPDO)
3014 hex	BF hex	1496 hex	Logic Output Signal 2 Selection 2	C146	RW	Same as C021 and C022 (excluding LOG1 to LOG3)	–	Possible (TxPDO)
3014 hex	C0 hex	1497 hex	Logic Output Signal 2 Operator Selection	C147	RW	00: AND 01: OR 02: XOR	–	Possible (TxPDO)
3014 hex	C1 hex	1498 hex	Logic Output Signal 3 Selection 1	C148	RW	Same as C021 to C022 (excluding LOG1 to LOG3)	–	Possible (TxPDO)
3014 hex	C2 hex	1499 hex	Logic Output Signal 3 Selection 2	C149	RW	Same as C021 to C022 (excluding LOG1 to LOG3)	–	Possible (TxPDO)
3014 hex	C3 hex	149A hex	Logic Output Signal 3 Operator Selection	C150	RW	00: AND 01: OR 02: XOR	–	Possible (TxPDO)
3014 hex	CD hex	14A4 hex	Input Terminal 1 Response Time	C160	RW	0 to 200	1	Possible (TxPDO)
3014 hex	CE hex	14A5 hex	Input Terminal 2 Response Time	C161	RW	0 to 200	1	Possible (TxPDO)
3014 hex	CF hex	14A6 hex	Input Terminal 3 Response Time	C162	RW	0 to 200	1	Possible (TxPDO)
3014 hex	D0 hex	14A7 hex	Input Terminal 4 Response Time	C163	R/W	0 to 200	1	Possible (TxPDO)
3014 hex	D1 hex	14A8 hex	Input Terminal 5 Response Time	C164	RW	0 to 200	1	Possible (TxPDO)
3014 hex	D2 hex	14A9 hex	Input Terminal 6 Response Time	C165	RW	0 to 200	1	Possible (TxPDO)
3014 hex	D3 hex	14AA hex	Input Terminal 7 Response Time	C166	RW	0 to 200	1	Possible (TxPDO)
3014 hex	D6 hex	14AD hex	Multi-step Speed/Position Determination Time	C169	RW	0 to 200	1	Possible (TxPDO)
3015 hex	2C hex	1501 hex	Auto-tuning Selection	H001	RW	00: Disabled 01: Enabled (motor does not rotate) 02: Enabled (motor rotates)	–	Possible (TxPDO)
3015 hex	2D hex	1502 hex	Motor Parameter 1	H002	RW	00: Standard motor parameter 02: Auto-tuning data	–	Possible (TxPDO)
3015 hex	2E hex	1503 hex	Motor Capacity 1	H003	RW	00: 0.1 01: 0.2 02: 0.4 03: 0.55 04: 0.75 05: 1.1 06: 1.5 07: 2.2 08: 3.0 09: 3.7 10: 4.0 11: 5.5 12: 7.5 13: 11.0 14: 15.0 15: 18.5	–	Possible (TxPDO)
3015 hex	2F hex	1504 hex	Motor Pole Number 1	H004	RW	00: 2P 01: 4P 02: 6P 03: 8P 04: 10P	–	Possible (TxPDO)
3015 hex	31 hex	1506 hex	Speed Response	H005	RW	0 to 1000	1 [%]	Possible

Index	Sub-index	Register No.	Function name	Parameter No.	R/W	Monitor and setting items	Data resolution	PDO map
3015 hex	32 hex	1507 hex	Stabilization Parameter 1	H006	RW	0 to 255	1	Possible
3015 hex	41 hex	1516 hex	Motor 1 Parameter R1	H020	RW	1 to 65530	0.001 [Ω]	Possible (TxPDO)
3015 hex	43 hex	1518 hex	Motor 1 Parameter R2	H021	RW	1 to 65530	0.001 [Ω]	Possible (TxPDO)
3015 hex	45 hex	151A hex	Motor 1 Parameter L	H022	RW	1 to 65530	0.01 [mH]	Possible (TxPDO)
3015 hex	47 hex	151C hex	Motor 1 Parameter Io	H023	RW	1 to 65530	0.01 [A]	Possible (TxPDO)
4015 hex	48 hex	151D hex	Motor 1 Parameter J	H024	RW	1 to 9999000	0.01 [kgm^2]	Possible (TxPDO)
3015 hex	50 hex	1525 hex	Motor 1 Parameter R1 (Auto-tuning Data)	H030	RW	1 to 65530	0.001 [Ω]	Possible (TxPDO)
3015 hex	52 hex	1527 hex	Motor 1 Parameter R2 (Auto-tuning Data)	H031	RW	1 to 65530	0.001 [Ω]	Possible (TxPDO)
3015 hex	54 hex	1529 hex	Motor 1 Parameter L (Auto-tuning Data)	H032	RW	1 to 65530	0.01 [mH]	Possible (TxPDO)
3015 hex	56 hex	152B hex	Motor 1 Parameter Io (Auto-tuning Data)	H033	RW	1 to 65530	0.01 [A]	Possible (TxPDO)
4015 hex	57 hex	152C hex	Motor 1 Parameter J (Auto-tuning Data)	H034	RW	1 to 9999000	0.01 [kgm^2]	Possible (TxPDO)
3015 hex	68 hex	153D hex	V/f Control With Speed Feedback Slip Compensation Proportional Gain	H050	RW	0 to 1000	0.1 [%]	Possible
3015 hex	69 hex	153E hex	V/f Control With Speed Feedback Slip Compensation Integral Gain	H051	RW	0 to 1000	0.1 [%]	Possible
3016 hex	30 hex	1603 hex	Pulse Train Input Terminal RP Selection	P003	RW	00: Frequency setting (including PID) 01: Feedback pulse (Enabled only when motor 1 control is selected) 02: Do not set.	–	Possible (TxPDO)
3016 hex	31 hex	1604 hex	Feedback Pulse Train Input Type Selection	P004	RW	00: Single-phase pulse input 01: 2-phase pulse 1 02: 2-phase pulse 2 03: Single-phase pulse train + direction	–	Possible (TxPDO)
3016 hex	38 hex	160B hex	Number of Encoder Pulses	P011	RW	32 to 1024	1	Possible (TxPDO)
3016 hex	39 hex	160C hex	Simple Position Control Selection	P012	RW	00: Simple position control disabled 02: Simple position control enabled	–	Possible (TxPDO)
3016 hex	3C hex	160F hex	Creep Speed Setting	P015	RW	Starting frequency to 1000	0.01 [Hz]	Possible (TxPDO)
3016 hex	47 hex	161A hex	Overspeed Error Detection Level	P026	RW	0 to 1500	0.1 [%]	Possible (TxPDO)
3016 hex	48 hex	161B hex	Speed Deviation Error Detection Level	P027	RW	0 to 12000	0.01 [Hz]	Possible (TxPDO)
3016 hex	4C hex	161F hex	Acceleration/ Deceleration Time Input Type	P031	RW	00: Digital Operator 03: Do not set.	–	Possible (TxPDO)
3016 hex	4E hex	1621 hex	Torque Reference Input Selection	P033	RW	00: Terminal FV 01: Terminal FI 03: Digital Operator 06: Do not set.	–	Possible (TxPDO)
3016 hex	4F hex	1622 hex	Torque Reference Setting	P034	RW	0 to 200	1 [%]	Possible
3016 hex	51 hex	1624 hex	Torque Bias Mode	P036	RW	00: Disabled 01: Digital Operator 05: Do not set.	–	Possible (TxPDO)
3016 hex	52 hex	1625 hex	Torque Bias Value	P037	RW	−200 to +200	1 [%]	Possible
3016 hex	53 hex	1626 hex	Torque Bias Polarity Selection	P038	RW	00: As per sign 01: Depends on the RUN direction	–	Possible (TxPDO)

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Index	Sub-index	Register No.	Function name	Parameter No.	R/W	Monitor and setting items	Data resolution	PDO map
3016 hex	55 hex	1628 hex	Speed Limit Value in Torque Control (Forward)	P039	RW	0 to 12000	0.01 [Hz]	Possible (TxPDO)
3016 hex	57 hex	162A hex	Speed Limit Value in Torque Control (Reverse)	P040	RW	0 to 12000	0.01 [Hz]	Possible (TxPDO)
3016 hex	58 hex	162B hex	Speed/Torque Control Switching Time	P041	RW	0 to 1000	1 [ms]	Possible (TxPDO)
3016 hex	66 hex	1639 hex	Pulse Train Frequency Scale	P055	RW	10 to 320 *Input frequency at maximum frequency	0.1 [kHz]	Possible (TxPDO)
3016 hex	67 hex	163A hex	Pulse Train Frequency Filter Time Constant	P056	RW	1 to 200	0.01 [s]	Possible (TxPDO)
3016 hex	68 hex	163B hex	Pulse Train Bias Amount	P057	RW	-100 to +100	1 [%]	Possible (TxPDO)
3016 hex	69 hex	163C hex	Pulse Train Limit	P058	RW	0 to 100	1 [%]	Possible (TxPDO)
4016 hex	6B hex	163E hex	Multi-step Position Command 0	P060	RW	Position range setting (reverse) to position range setting (forward) (Displays MSB 4 digits including "–")	1	Possible
4016 hex	6D hex	1640 hex	Multi-step Position Command 1	P061	R/W	Position range setting (reverse) to position range setting (forward) (Displays MSB 4 digits including "–")	1	Possible
4016 hex	6F hex	1642 hex	Multi-step Position Command 2	P062	RW	Position range setting (reverse) to position range setting (forward) (Displays MSB 4 digits including "–")	1	Possible
4016 hex	71 hex	1644 hex	Multi-step Position Command 3	P063	RW	Position range setting (reverse) to position range setting (forward) (Displays MSB 4 digits including "–")	1	Possible
4016 hex	73 hex	1646 hex	Multi-step Position Command 4	P064	RW	Position range setting (reverse) to position range setting (forward) (Displays MSB 4 digits including "–")	1	Possible
4016 hex	75 hex	1648 hex	Multi-step Position Command 5	P065	RW	Position range setting (reverse) to position range v (forward) (Displays MSB 4 digits including "–")	1	Possible
4016 hex	77 hex	164A hex	Multi-step Position Command 6	P066	RW	Position range setting (reverse) to position range setting (forward) (Displays MSB 4 digits including "–")	1	Possible
4016 hex	79 hex	164C hex	Multi-step Position Command 7	P067	RW	Position range setting (reverse) to position range setting (forward) (Displays MSB 4 digits including "–")	1	Possible
3016 hex	7B hex	164E hex	Zero Return Mode	P068	RW	00: Zero return mode 1 01: Zero return mode 2	–	Possible
3016 hex	7C hex	164F hex	Zero Return Direction Selection	P069	RW	00: Forward 01: Reverse	–	Possible
3016 hex	7D hex	1650 hex	Zero Return Mode 1 Frequency	P070	RW	0 to 1000	0.01 [Hz]	Possible
3016 hex	7E hex	1651 hex	Zero Return Mode 2 Frequency	P071	RW	0 to 4000	0.01 [Hz]	Possible
4016 hex	7F hex	1652 hex	Position Range setting (Forward side)	P072	RW	0 to 268435455	1	Possible
4016 hex	81 hex	1654 hex	Position Range setting (Reverse side)	P073	RW	−268435455 to 0	1	Possible
3016 hex	84 hex	1657 hex	Positioning Mode Selection	P075	RW	00: Limit 01: Do not limit	–	Possible (TxPDO)
3016 hex	86 hex	1659 hex	Encoder Disconnection Detection Time	P077	RW	0 to 100	0.1 [s]	Possible
3016 hex	BB hex	168E hex	Number of Send Data of All Stations in Co-inverter Communication	P140	RW	1 to 5	–	Possible
3016 hex	BC hex	168F hex	Recipient Station Number of All Stations in Co-inverter Communication 1	P141	RW	1 to 247	–	Possible
3016 hex	BD hex	1690 hex	Recipient Register of All Stations in Co-inverter Communication 1	P142	RW	0000 to FFFF hex	–	Possible
3016 hex	BE hex	1691 hex	Sender Register of All Stations in Co-inverter Communication 1	P143	RW	0000 to FFFF hex	–	Possible

A-4 Inverter Parameter List

App

Index	Sub-index	Register No.	Function name	Parameter No.	R/W	Monitor and setting items	Data resolution	PDO map
3016 hex	BF hex	1692 hex	Recipient Station Number of All Stations in Co-inverter Communication 2	P144	RW	1 to 247	–	Possible
3016 hex	C0 hex	1693 hex	Recipient Register of All Stations in Co-inverter Communication 2	P145	RW	0000 to FFFF hex	–	Possible
3016 hex	C1 hex	1694 hex	Sender Register of All Stations in Co-inverter Communication 2	P146	RW	0000 to FFFF hex	–	Possible
3016 hex	C2 hex	1695 hex	Recipient Station Number of All Stations in Co-inverter Communication 3	P147	RW	1 to 247	–	Possible
3016 hex	C3 hex	1696 hex	Recipient Register of All Stations in Co-inverter Communication 3	P148	RW	0000 to FFFF hex	–	Possible
3016 hex	C4 hex	1697 hex	Sender Register of All Stations in Co-inverter Communication 3	P149	RW	0000 to FFFF hex	–	Possible
3016 hex	C5 hex	1698 hex	Recipient Station Number of All Stations in Co-inverter Communication 4	P150	RW	1 to 247	–	Possible
3016 hex	C6 hex	1699 hex	Recipient Register of All Stations in Co-inverter Communication 4	P151	RW	0000 to FFFF hex	–	Possible
3016 hex	C7 hex	169A hex	Sender Register of All Stations in Co-inverter Communication 4	P152	RW	0000 to FFFF hex	–	Possible
3016 hex	C8 hex	169B hex	Recipient Station Number of All Stations in Co-inverter Communication 5	P153	RW	1 to 247	–	Possible
3016 hex	C9 hex	169C hex	Recipient Register of All Stations in Co-inverter Communication 5	P154	RW	0000 to FFFF hex	–	Possible
3016 hex	CA hex	169D hex	Sender Register of All Stations in Co-inverter Communication 5	P155	RW	0000 to FFFF hex	–	Possible
301E hex	3E hex	1E01 hex	Coil Data 1[*]	–	RO	2^0: Coil No. 0010 hex to 2^{15}: Coil No. 001F hex	–	Possible (TxPDO)
301E hex	3F hex	1E02 hex	Coil Data 2[*]	–	RO	2^0: Coil No. 0020 hex to 2^{15}: Coil No. 002F hex	–	Possible (TxPDO)
301E hex	40 hex	1E03 hex	Coil Data 3[*]	–	RO	2^0: Coil No. 0030 hex to 2^{15}: Coil No. 003F hex	–	Possible (TxPDO)
301E hex	41 hex	1E04 hex	Coil Data 4[*]	–	RO	2^0: Coil No. 0040 hex to 2^{15}: Coil No. 004F hex	–	Possible (TxPDO)
301E hex	42 hex	1E05 hex	Coil Data 5[*]	–	RO	2^0: Coil No. 0050 hex to 2^8: Coil No. 0058 hex	–	Possible (TxPDO)
301F hex	40 hex	1F01 hex	Coil Data 0[*]	–	RW	2^1: Coil No. 0001 hex to 2^{15}: Coil No. 000F hex	–	Possible

* Each of the above holding registers (Coil Data 0 to 5) consists of 16 sets of coil data. Since coils are not supported in communication between inverters (only holding registers are supported), use the above holding registers if you want to access the coil.

● **Holding register number list (2nd setting F group)**

Index	Sub-index	Register No.	Function name	Parameter No.	R/W	Monitor and setting items	Data resolution	PDO map
4021 hex	46 hex	2103 hex	Acceleration Time 2 Setting	F202	RW	1 to 360000	0.01 [s]	Possible
4021 hex	48 hex	2105 hex	Deceleration Time 2 Setting	F203	RW	1 to 360000	0.01 [s]	Possible

● **Holding register number list (2nd setting, Group A, b, C, H, and P)**

Index	Sub-index	Register No.	Function name	Parameter No.	R/W	Monitor and setting items	Data resolution	PDO map
3022 hex	46 hex	2201 hex	Frequency Reference Selection 2	A201	RW	00: Volume 01: Control circuit terminal block 02: Digital Operator 03: Modbus communication (Modbus-RTU) 04: Optional boad 06: Pulse train frequency 07: Do not set. 10: Operation function output	–	Possible (TxPDO)
3022 hex	47 hex	2202 hex	RUN Command Selection 2*	A202	RW	01: Control circuit terminal block 02: Digital operator 03: Modbus communication (Modbus-RTU) 04: Optional boad	–	Possible (TxPDO)
3022 hex	48 hex	2203 hex	Base Frequency 2	A203	RW	300 to Maximum Frequency 2	0.1 [Hz]	Possible (TxPDO)
3022 hex	49 hex	2204 hex	Maximum Frequency 2	A204	RW	300 to 4000 (10000)	0.1 [Hz]	Possible (TxPDO)
3022 hex	80 hex	223B hex	Torque Boost Selection 2	A241	RW	00: Manual torque boost 01: Automatic torque boost	–	Possible (TxPDO)
3022 hex	81 hex	223C hex	Manual Torque Boost Voltage 2	A242	RW	0 to 200	0.1 [%]	Possible
3022 hex	82 hex	223D hex	Manual Torque Boost Frequency 2	A243	RW	0 to 500	0.1 [%]	Possible

* If the RUN Command 2 Selection has been changed, wait for at least 40 ms before an actual RUN command is issued.

A-4 Inverter Parameter List

App

Index	Sub-index	Register No.	Function name	Parameter No.	R/W	Monitor and setting items	Data resolution	PDO map
3022 hex	83 hex	223E hex	Control Method 2	A244	RW	00: Constant torque characteristics 01: Reduced torque characteristics 02: Free V/f setting 03: Sensorless vector control	–	Possible (TxPDO)
3022 hex	84 hex	223F hex	Output Voltage Gain 2	A245	RW	20 to 100	1 [%]	Possible
3022 hex	85 hex	2240 hex	Automatic Torque Boost Voltage Compensation Gain 2	A246	RW	0 to 255	1 [%]	Possible
3022 hex	86 hex	2241 hex	Automatic Torque Boost Slip Compensation Gain 2	A247	RW	0 to 255	1 [%]	Possible
4022 hex	94 hex	224F hex	Frequency Upper Limit 2	A261	RW	0 Frequency Lower Limit 2 to Maximum Frequency 2	0.01 [Hz]	Possible (TxPDO)
4022 hex	96 hex	2251 hex	Frequency Lower Limit 2	A262	RW	0 Starting Frequency to Frequency Upper Limit 2	0.01 [Hz]	Possible (TxPDO)
3022 hex	AE hex	2269 hex	AVR Selection 2	A281	RW	00: Always ON 01: Always OFF 02: OFF during deceleration	–	Possible (TxPDO)
3022 hex	AF hex	226A hex	Motor Incoming Voltage Selection 2	A282	RW	200-V class: 00 (200) 01 (215) 02 (220) 03 (230) 04 (240) 400-V class: 05 (380) 06 (400) 07 (415)	–	Possible (TxPDO)
4022 hex	B4 hex	226F hex	2nd Acceleration Time 2	A292	RW	1 to 360000	0.01 [s]	Possible
4022 hex	B6 hex	2271 hex	2nd Deceleration Time 2	A293	RW	1 to 360000	0.01 [s]	Possible
3022 hex	B8 hex	2273 hex	2-step Acceleration/Deceleration Selection 2	A294	RW	00: Switched by 2 word terminal 01: Switched by setting 02: Switched only when switching forward/reverse	–	Possible (TxPDO)
4022 hex	B9 hex	2274 hex	2-step Acceleration Frequency 2	A295	RW	0 to 40000 (100000)	0.01 [Hz]	Possible (TxPDO)
4022 hex	BB hex	2276 hex	2-step Deceleration Frequency 2	A296	RW	0 to 40000 (100000)	0.01 [Hz]	Possible (TxPDO)
3023 hex	53 hex	230C hex	Electronic Thermal Level 2	b212	RW	2000 to 10000	0.01 [%]	Possible (TxPDO)
3023 hex	54 hex	230D hex	Electronic Thermal Characteristics Selection 2	b213	RW	00: Reduced torque characteristics 01: Constant torque characteristics 02: Free setting	–	Possible (TxPDO)
3023 hex	5D hex	2316 hex	Overload Limit 2 Selection	b221	RW	00: Disabled 01: Enabled during acceleration/constant speed 02: Enabled during constant speed 03: Enabled during acceleration/constant speed (accelerated during regeneration)	–	Possible (TxPDO)
3023 hex	5E hex	2317 hex	Overload Limit Level 2	b222	RW	100 to 2000	0.1 [%]	Possible (TxPDO)
3023 hex	5F hex	2318 hex	Overload Limit 2 Parameter	b223	RW	1 to 30000	0.1 [s]	Possible (TxPDO)
3024 hex	72 hex	2429 hex	Overload Warning Level 2	C241	RW	0 to 2000	0.1 [%]	Possible
3025 hex	4D hex	2502 hex	Motor Parameter 2	H202	RW	00: Standard motor parameter 02: Auto-tuning data	–	Possible (TxPDO)

Index	Sub-index	Register No.	Function name	Parameter No.	R/W	Monitor and setting items	Data resolution	PDO map
3025 hex	4E hex	2503 hex	Motor Capacity 2	H203	RW	00: 0.1 01: 0.2 02: 0.4 03: 0.55 04: 0.75 05: 1.1 06: 1.5 07: 2.2 08: 3.0 09: 3.7 10: 4.0 11: 5.5	-	Possible (TxPDO)
3025 hex	4F hex	2504 hex	Motor Pole Number 2	H204	RW	00: 2P 01: 4P 02: 6P 03: 8P 04: 10P	–	Possible (TxPDO)
3025 hex	51 hex	2506 hex	Speed Response 2	H205	RW	1 to 1000	1 [%]	Possible
3025 hex	52 hex	2507 hex	Stabilization Parameter 2	H206	RW	0 to 255	1	Possible
3025 hex	61 hex	2516 hex	Motor 2 Parameter R1	H220	RW	1 to 65530	0.001 [Ω]	Possible (TxPDO)
3025 hex	63 hex	2518 hex	Motor 2 Parameter R2	H221	RW	1 to 65530	0.001 [Ω]	Possible (TxPDO)
3025 hex	65 hex	251A hex	Motor 2 Parameter L	H222	RW	1 to 65530	0.01 [mH]	Possible (TxPDO)
3025 hex	67 hex	251C hex	Motor 2 Parameter Io	H223	RW	1 to 65530	0.01 [A]	Possible (TxPDO)
4025 hex	68 hex	251D hex	Motor 2 Parameter J	H224	RW	1 to 9999000	0.01	Possible (TxPDO)
3025 hex	70 hex	2525 hex	Motor 2 Parameter R1 (Auto-tuning Data)	H230	RW	1 to 65530	0.001 [Ω]	Possible (TxPDO)
3025 hex	72 hex	2527 hex	Motor 2 Parameter R2 (Auto-tuning Data)	H231	RW	1 to 65530	0.001 [Ω]	Possible (TxPDO)
3025 hex	74 hex	2529 hex	Motor 2 Parameter L (Auto-tuning Data)	H232	RW	1 to 65530	0.01 [mH]	Possible (TxPDO)
3025 hex	76 hex	252B hex	Motor 2 Parameter Io (Auto-tuning Data)	H233	RW	1 to 65530	0.01 [A]	Possible (TxPDO)
4025 hex	77 hex	252C hex	Motor 2 Parameter J (Auto-tuning Data)	H234	RW	1 to 9999000	0.01	Possible (TxPDO)

A-5 Sysmac Error Status Codes

A list and descriptions of the error event codes that display in Sysmac Studio are provided.

A-5-1 Error Table

The errors that may occur for this Unit are listed below. Event levels are given in the table as follows:

Abbreviation	Name
Maj	Major fault level
Prt	Partial fault level
Min	Minor fault level
Obs	Observation
Info	Information

Event code	Event name	Meaning	Assumed cause	Level					Reference
				Maj	Prt	Min	Obs	Info	
04A10000 hex	Non-volatile Memory Hardware Error	An error occurred in non-volatile memory.	• Non-volatile memory failure			√			
04BA0000 hex	Connection Error between Inverter and Communications Unit	An error occurred in the connection between the Inverter and the EtherCAT Communications Unit for the Inverter.	• Contact failure between the Inverter and the EtherCAT Communications Unit for the Inverter. • Inverter trip was reset. • The Inverter was initialized or the mode was changed. • The EtherCAT Communications Unit for the Inverter failed.			√			
04BB0000 hex	Inverter Warning	An Inverter warning was detected.	• An Inverter warning was detected.			√			
04BC0000 hex	Inverter Trip	An Inverter trip was detected.	• An Inverter trip was detected.			√			
34F00000 hex	PDO Setting Error	There is an illegal setting value in the PDO mapping.	• The PDO mapping or Sync-Manager settings are incorrect.			√			

A-5-2　Error Descriptions

Controller Error Descriptions

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

Event name	Gives the name of the error.		Event code	Gives the code of the error.	
Meaning	Gives a short description of the error.				
Source	Gives the source of the error.		**Source details**	Gives details on the source of the error.	**Detection timing**	Tells when the error is detected.
Error attributes	**Level**	Tells the level of influence on control.[1]	**Recovery**	Gives the recovery method.[2]	**Log category**	Tells which log the error is saved in.[3]
Effects	**User program**	Tells what will happen to execution of the user program.[4]	**Operation**	Provides special information on the operation that results from the error.	
Indicators	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.				
System-defined variables	**Variable**		**Data type**		**Name**
	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.				
Cause and correction	**Assumed cause**		**Correction**		**Prevention**
	Lists the possible causes, corrections, and preventive measures for the error.				
Attached information	This is the attached information that is displayed by the Sysmac Studio or an NS-series PT.				
Precautions/ Remarks	Provides precautions, restrictions, and supplemental information.				

[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	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	Minor fault	Recovery	Error reset (after cycling slave power)	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.					

Event name	Connection Error between Inverter and Communications Unit		Event code	04BA0000 hex	
Meaning	An error occurred in the connection between the Inverter and the EtherCAT Communications Unit for the Inverter.				
Source	EtherCAT Master Function Module	Source details	Slave	Detection timing	Continuously
Error attributes	Level	Minor fault	Recovery	Error reset (after cycling slave power)	Log category	System
Effects	User program	Continues.	Operation	Inverter communications will not operate.	
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	
	Contact failure between the Inverter and the EtherCAT Communications Unit for the Inverter.		Securely install the EtherCAT Communications Unit for the Inverter.		Securely install the EtherCAT Communications Unit for the Inverter.	
	Inverter trip was reset.		Turn ON the Inverter's power supply again.		None	
	The Inverter was initialized or the mode was changed.					
	The EtherCAT Communications Unit for the Inverter failed.		Replace the EtherCAT Communications Unit for the Inverter.		None	
Attached information	None					
Precautions/ Remarks	None					

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Event name	Inverter Warning			Event code	04BB0000 hex
Meaning	An Inverter warning was detected.				
Source	EtherCAT Master Function Module		Source details	Slave	Detection timing	Continuously
Error attributes	Level	Minor fault	Recovery	Error reset (after resetting slave errors)	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	
	An Inverter warning was detected.		Read the value in slave object 3000 hex sub-index 4F hex and check the warning details. Remove the cause of the warning accordingly. Then execute an error reset with slave object 5000 hex or a fault reset with 6040 hex.		Depends on the nature of the error.	
Attached information	None					
Precautions/ Remarks	None					

Event name	Inverter Trip			Event code	04BC0000 hex
Meaning	An Inverter trip was detected.				
Source	EtherCAT Master Function Module		Source details	Slave	Detection timing	Continuously
Error attributes	Level	Minor fault	Recovery	Error reset (after resetting slave errors)	Log category	System
Effects	User program	Continues.	Operation	Motor stops.		
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	
	An Inverter trip was detected.		Read slave object 3000 hex sub-index 13 hex (cause) and 3000 hex sub-index 14 hex (inverter status) values and check the details. Remove the cause of the trip accordingly. Then execute an error reset with slave object 5000 hex or a fault reset with 6040 hex.		Depends on the nature of the error.	
Attached information	None					
Precautions/ Remarks	None					

Event name	PDO Setting Error			Event code	34F00000 hex
Meaning	There is an illegal setting value in the PDO mapping.				
Source	EtherCAT Master Function Module	Source details	Slave	Detection timing	At transfer of EtherCAT Config-uration Setup
Error attributes	Level	Minor fault	Recovery	Error reset (after resetting slave errors)	Log category	System
Effects	User program	Continues.	Operation	The slave can enter the Pre-operational state.		
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 PDO mapping or SyncManager settings are incorrect.		Read and check the ALStatus code and the value in 5200 hex. Correct the settings.		Check that there are no mistakes in settings for the PDO mapping and SyncManager.	
Attached information	None					
Precautions/ Remarks	None					

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