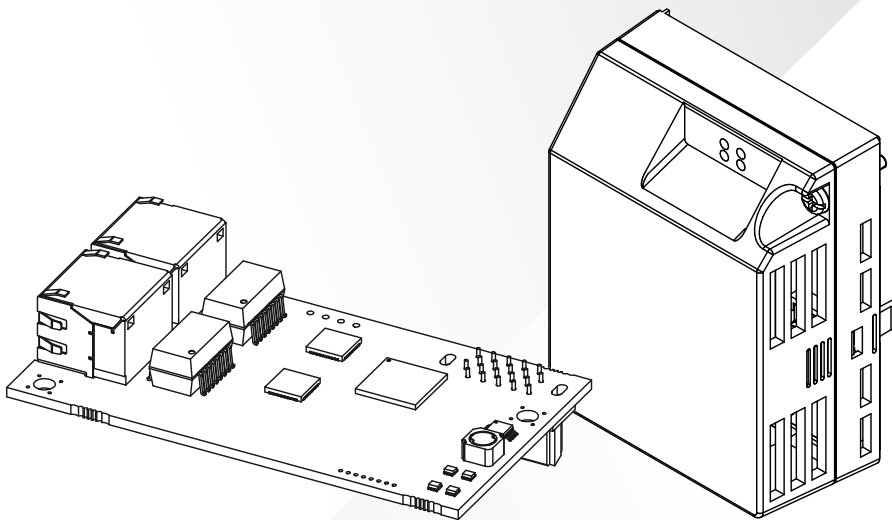# EtherCAT Option

Options Card for AC Drives and Regenerative Units
Technical Manual

Type: SI-ES3
SI-ES3/V

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Table of Contents

1 Preface and General Precautions

This chapter describes important safety precautions regarding the use of this product. Failure to follow these precautions may result in serious injury or death, and may lead to damage to this product or related devices and systems. Yaskawa shall not be held responsible for any injury or equipment damage as a result of failure to observe the precautions and instructions contained in this manual.

◆ Safety Information

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

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

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

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

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

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

NOTICE *Identifies a property damage message.*

■ General Safety Instructions

Yaskawa Electric manufactures and supplies electronic components for a variety of industrial applications. The selection and application of Yaskawa products is the responsibility of the designer of the equipment or the customer that assembles the final product. Yaskawa is not responsible for how our products are incorporated into the final system design. In all cases, Yaskawa products should not be incorporated into a product or design as the exclusive or sole safety control function. All control functions are designed to dynamically detect failures and operate safely without exception. All products that are designed to incorporate parts manufactured by Yaskawa must be provided to the end user and include proper warnings and instructions regarding their safe use and operation. All warnings from Yaskawa must be promptly issued to the end user. Yaskawa offers warranties only for the quality of our products, in compliance with standards and specifications that are described in the manual. Yaskawa does not offer other warranties, either explicit or implied. Injuries, property damage, and lost business opportunities caused by improper storage or handling and negligence oversight on the part of your company or your customers will void Yaskawa's warranty for the product.

Note:

Failure to obey the safety messages in the manual can cause serious injury or death. Yaskawa is not responsible for injuries or damage to equipment caused by ignoring the safety messages.

•Read this manual carefully when mounting, operating, and repairing AC drives.

•Obey all warnings, cautions, and notices.

•Approved personnel must perform all work.

•Install the drive in an area with these conditions.

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

⚠ WARNING *Fire Hazard. Do not connect power supply wiring to drive output terminals U/T1, V/T2, and W/T3. Connect power supply wiring to main circuit input terminals R/L1, S/L2, and T/L3. Failure to obey can cause death or serious injury.*

⚠ WARNING *Crush Hazard. Only approved personnel can operate a crane or hoist to move the drive. Failure to obey can cause death or serious injury from falling equipment.*

⚠ WARNING *Electrical Shock Hazard. Do not make changes to the drive body or drive circuitry. Failure to obey can cause death or serious injury and will void warranty. Yaskawa is not responsible for changes to the product made by the user.*

⚠ WARNING *Electrical Shock Hazard. Only let authorized persons install, wire, maintain, examine, replace parts, and repair the drive. Failure to obey can cause death or serious injury.*

⚠ WARNING *Electrical Shock Hazard. Always ground the motor-side grounding terminal. Contacting the motor case can cause death or serious injury from incorrect equipment grounding.*

⚠ WARNING *Electrical Shock Hazard. Do not work on the drive or around the drive while wearing loose clothing or jewelry. Tighten loose clothing and remove all metal objects such as watches or rings. Failure to obey can cause death or serious injury.*

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

⚠ WARNING *Sudden Movement Hazard. Remove all persons and objects from the area around the drive, motor, and load before starting Auto-Tuning. The drive and motor can start suddenly during Auto-Tuning and cause death or serious injury.*

⚠ WARNING *Sudden Movement Hazard. Remove all persons and objects from the area around the drive, motor, and machine area and attach covers, couplings, shaft keys, and machine loads before energizing the drive. Failure to obey can cause death or serious injury.*

⚠ WARNING *Fire Hazard. Do not use the main circuit power supply (Overcurrent Category III) at incorrect voltages. Make sure that the drive rated voltage aligns with the power supply voltage before energizing the drive. Failure to obey can cause death or serious injury.*

⚠ WARNING *Fire Hazard. Do not put flammable or combustible materials on top of the drive and do not install the drive near flammable or combustible materials. Attach the drive to metal or other noncombustible material. Failure to obey can cause death or serious injury.*

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

⚠ WARNING *Fire Hazard. Tighten screws against the bit at an angle in the specified range described in this manual. Tightening screws at an angle outside of the specified range can cause damage the terminal block or start a fire if the connection is loose.*

⚠ WARNING *Crush Hazard. Use a lifting mechanism made to move large drives when necessary. Failure to obey can cause death or serious injury from falling equipment.*

⚠ WARNING *Electrical Shock Hazard. Do not cause a short circuit on the drive output circuit. Failure to obey can cause death or serious injury.*

⚠ WARNING *Electrical Shock Hazard. Always use a type B Residual Current Monitor/Residual Current Device (RCM/RCD) where a residual current operated protective or monitoring device protects against direct or indirect contact as specified by IEC/EN 60755 The drive can cause a residual current with a DC component in the protective earthing conductor. Failure to obey can cause death or serious injury.*

⚠ WARNING *Electrical Shock Hazard. Ground the neutral point on the power supply of drive models 2xxxB/C and 4xxxA/B/C to comply with the EMC Directive before turning on the EMC filter or if there is high resistance grounding. If the EMC filter is switched ON without the neutral point being grounded or if there is high resistance grounding, it can cause death or serious injury.*

Test

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

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

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

⚠ CAUTION *Burn Hazard. Do not touch a hot drive heatsink. De-energize the drive, wait 15 minutes minimum, and make sure that the heatsink is cool to replace the cooling fans. Failure to obey can cause minor to moderate injury.*

NOTICE *Observe correct electrostatic discharge (ESD) procedures when touching the drive and circuit boards. Failure to obey can cause ESD damage to the drive circuitry.*

NOTICE *Do not connect or disconnect the motor from the drive while the drive is supplying voltage. Incorrect equipment sequencing can cause damage to the drive.*

NOTICE *Do not do a withstand voltage test or Megger test on the drive. Failure to obey can cause damage to the drive.*

NOTICE *Do not connect or operate damaged equipment or equipment with missing parts. Failure to obey can cause damage to the drive and connected equipment.*

NOTICE *Install fuses and an RCM/RCD. Failure to obey can cause damage to the drive.*

NOTICE *Do not use unshielded wire for control wiring. Use shielded, twisted-pair wires and ground the shield to the ground terminal of the drive. Failure to obey can cause electrical interference and unsatisfactory system performance.*

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

NOTICE *Make sure that all connections are correct after you install the drive and connecting peripheral devices. Failure to obey can cause damage to the drive.*

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

■ Intended Use

This communication option card is electrical equipment intended to enable Yaskawa drives to communicate with an additional fieldbus system for commercial use. Do not use this product for any other purpose.

1. Read and understand all safety precautions.
2. Wire and ground the drive and communication option card in accordance with all applicable standards and safety precautions.
3. Firmly attach all parts and protective covers.
4. Always use the product in the proper environmental conditions as specified in this manual.

DANGER *Electrical Shock Hazard. Make sure that all electrical connections are correct and install all drive covers before energizing the drive. Use terminals for their intended function only. Incorrect wiring or ground connections, and incorrect repair of protective covers can cause death or serious injury.*

WARNING *Electrical Shock Hazard. Do not make changes to the drive body or drive circuitry. Failure to obey can cause death or serious injury and will void warranty. Yaskawa is not responsible for changes to the product made by the user.*

◆ Legal Information

■ Exclusion of Liability

This product is not designed and manufactured for use in life-support machines or systems.

Contact a Yaskawa representative or your Yaskawa sales representative if you are considering the application of this product for special purposes, such as machines or systems used for passenger cars, medicine, airplanes and aerospace, nuclear power, electric power, or undersea relaying.

WARNING *Injury to Personnel. Yaskawa manufactured this product with strict quality-control guidelines. Install applicable safety devices to minimize the risk of accidents when installing the product where its failure could cause a life-or-death situation, loss of human life, or a serious accident or physical injury.*

■ About Registered Trademarks

- EtherCAT® is a registered trademark of Beckhoff Automation GmbH.
- Other company names and product names that appear in this document are trademarks or registered trademarks of the respective companies.

2 Product Overview

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◆ About This Product

The EtherCAT Communication Option (Models: SI-ES3 and SI-ES3/V) is an option card designed to connect the YASKAWA AC drives or regenerative units to an EtherCAT network. Using this option card and an EtherCAT master you can:

- Operate the AC drive or regenerative unit
- Monitor the AC drive or regenerative unit operation status
- Read or modify AC drive or regenerative unit parameters.

The option contains support for the Velocity mode according the CANopen Device Profile and Motion Control (DSP402) profile. It also contains YASKAWA vendor specific CANopen objects based on the present CANopen option board specification.

The EtherCAT Option supports the following communication profiles:

- DS 301 Ver. 4.02
- DSP 402 Ver. 3.0 Velocity Mode (not available for D1000 and R1000)

◆ Applicable Models

The option can be used with these drive series:

Table 2.1 Applicable Models

Drive Series	Software Version		Drive Series	Software Version
Option Card Model: SI-ES3			GA700	VSAA1010 and higher
A1000	For models up to 630 kW: VSA901017 and higher For models more than 630 kW: VSA903015 and higher		GA500	VSVA01010 and higher
			Q2A	VSAA923010 and higher
D1000	For models up to 630 kW: VSD902006 and higher For models more than 630 kW: VSD903014 and higher		Q2V	VSVA22010 and higher
			CR700	VSRA01013 and higher
R1000	VSD902102 and higher		**Option Card Model: SI-ES3/V**	
U1000	VSU901010 and higher		V1000	VSV901020 and higher
GA800	VSAA09010 and higher			

For software version, see "PRG" on the nameplate of the drive or regenerative unit.

3   Receiving

Please perform the following tasks after receiving the Communication Option card:

- Inspect the Communication Option card for damage. If the Communication Option card appears damaged upon receipt, contact the shipping company immediately.
- Verify receipt of the correct model by checking the information:
  For V1000: Find the information on the mounting frame label of the option card.
  For other units: Find the information on the PCB.
- If you have received the wrong option card model or the Communication Option card does not function properly, contact your supplier.

◆ Packaging Content

Table 3.1 Option Package Contents for SI-ES3 (AC Drives and Regenerative Units)
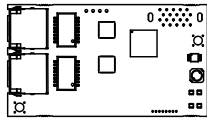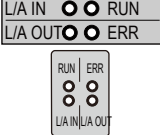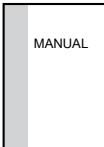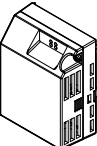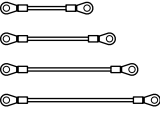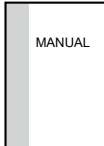
Description	Option Card	Ground Cables	Screws (M3)	LED Label	Installation Manual
Illustration					MANUAL
Quantity	1	1	3	2	1

Table 3.2 Option Package Contents for SI-ES3/V (V1000 AC Drive)

Description	Option Card	Ground Cables	Installation Manual
Illustration			MANUAL
Quantity	1	4; of different length	1

◆ Labels to be Attached to the Product

Attach the following labels to the end product to make sure the product remains CE compliant.

Note:

If the end product shall comply with UL directives, do not attach the stickers to the product.

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Label	Description
	Read the manual. Obey the safety messages in the manual to prevent any kind of damage to humans, or to the equipment.
	Electrical Shock Hazard. Correctly ground the drive before you turn on the EMC filter switch. If you touch electrical equipment that is not grounded, it can cause serious injury or death.
5 min	Electrical Shock Hazard. De-energize the drive and wait 5 minutes minimum until the Charge LED turns off. Remove the front cover and terminal cover to do work on wiring, circuit boards, and other parts. Use terminals for their correct function only. Incorrect wiring, incorrect ground connections, and incorrect repair of protective covers can cause death or serious injury.

4   EtherCAT Option Components

◆ EtherCAT Option SI-ES3

Looking from the connector
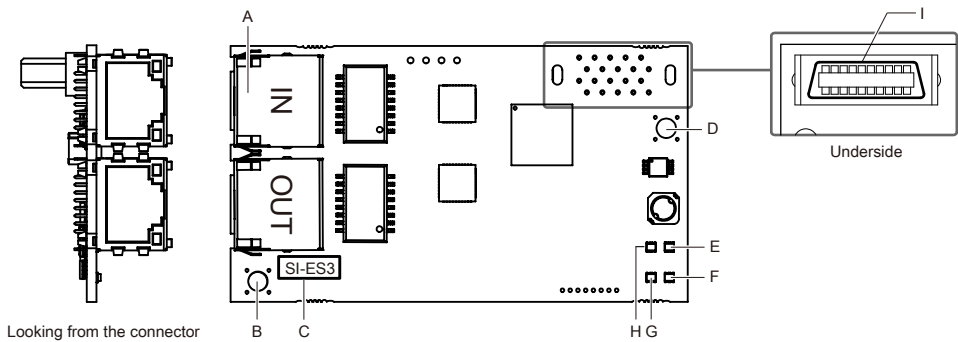
A - **Communication cable connector (RJ45)**
B - **Ground terminal (installation hole)**
C - **Model number**
D - **Installation hole**
E - **LED (RUN)**

F - **LED (ERR)**
G - **LED (L/A OUT)**
H - **LED (L/A IN)**
I - **Connector (CN5)**

Figure 4.1 Option Card

◆ EtherCAT Option SI-ES3/V for V1000

EtherCAT with cover attached

Underside

EtherCAT with cover removed

A - LED (ERR)
B - LED (RUN)
C - LED (L/A IN)
D - LED (L/A OUT)
E - Option Cover
F - Communication cable connector (RJ45)
G - Mounting clip
H - Connector (CN5)

I - Option Card PCB
J - Attachment screw hole for option cover
K - Nameplate
L - Ground terminal (FE)
M - Mounting clip
N - Wire
O - Through-hole for wire
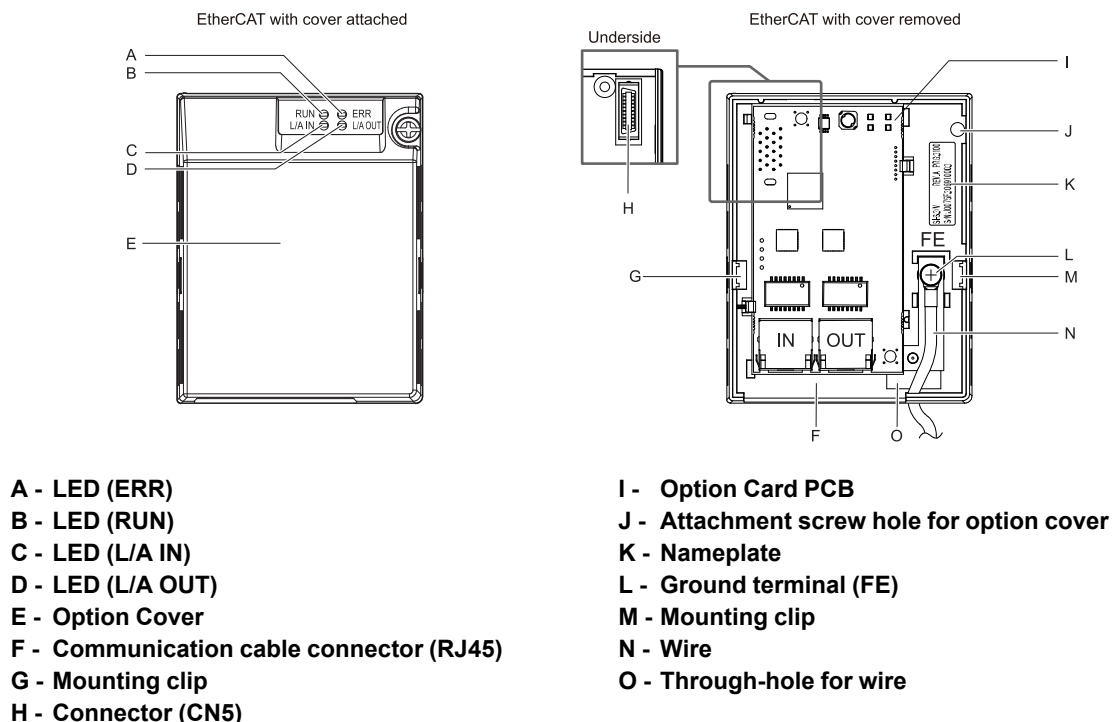
Figure 4.2 Option Card for V1000

◆ EtherCAT Option Status LEDs

The EtherCAT Option has four LEDs that indicate the communication status. The indications conform with DS303, Part 3: Indicator Specification.

■ LEDs L/A OUT and L/A IN: Ethernet Link/Activity Output and Input

The Link/Activity indicators show the status of the physical link and show activity on the link period.

LED	Color	Display	Meaning
Link Activity OUT Link Activity IN	–	Off	No link. The communication cable is not physically connected. The communication controller is not started up.
	Green	On	The module is connected to Ethernet. A communication cable is physically connected, but no data is being exchanged.
	Green	Flickering	There is traffic on Ethernet, data is being exchanged.

■ RUN LED

A green lit RUN LED indicates the status of the communication network state machine.
A red lit RUN LED is only used by the NOID firmware loader.

LED	Color	Display	Meaning
RUN	–	Off	The device is in Init state.
	Green	Blinking	The device is in Pre-Operational State.
	Green	Single flash	The device is in Safe-Operational State.
	Green	On	The device is in Operational State.
	Red	Blinking (1 Hz or 6 Hz)	The Option BOOT or APP firmware is executing the NOID firmware loader. 1 Hz: Firmware loader protocol in IDLE state (waiting for commands from the drive) 6 Hz: Firmware loader protocol is processing commands

■ ERR LED

The red error LED indicates the presence of any errors.

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LED	Color	Display	Meaning
ERR	–	Off	No link. The communication option card is in working condition.
	Red	Blinking	General configuration error.
		Single flash	The slave device application has changed the communication state autonomously: The parameter "Change" in the AL status register is set to 01 (Hex): change/error.
		Double flash	The sync manager watchdog time out has occurred.
		On	Possible causes: 1: A Process Data Interface error has occurred, the NOID application interface has failed. 2: An option card FATAL event has occurred (system has stalled execution, see object 4000 (Hex) for the cause).
		Blinking (1 Hz or 6 Hz)	The option BOOT or APP firmware is executing the NOID firmware loader. 1 Hz: Firmware loader protocol in IDLE state (waiting for commands from drive) 6 Hz: Firmware loader protocol is processing commands

◼ Indicator Flash Rates
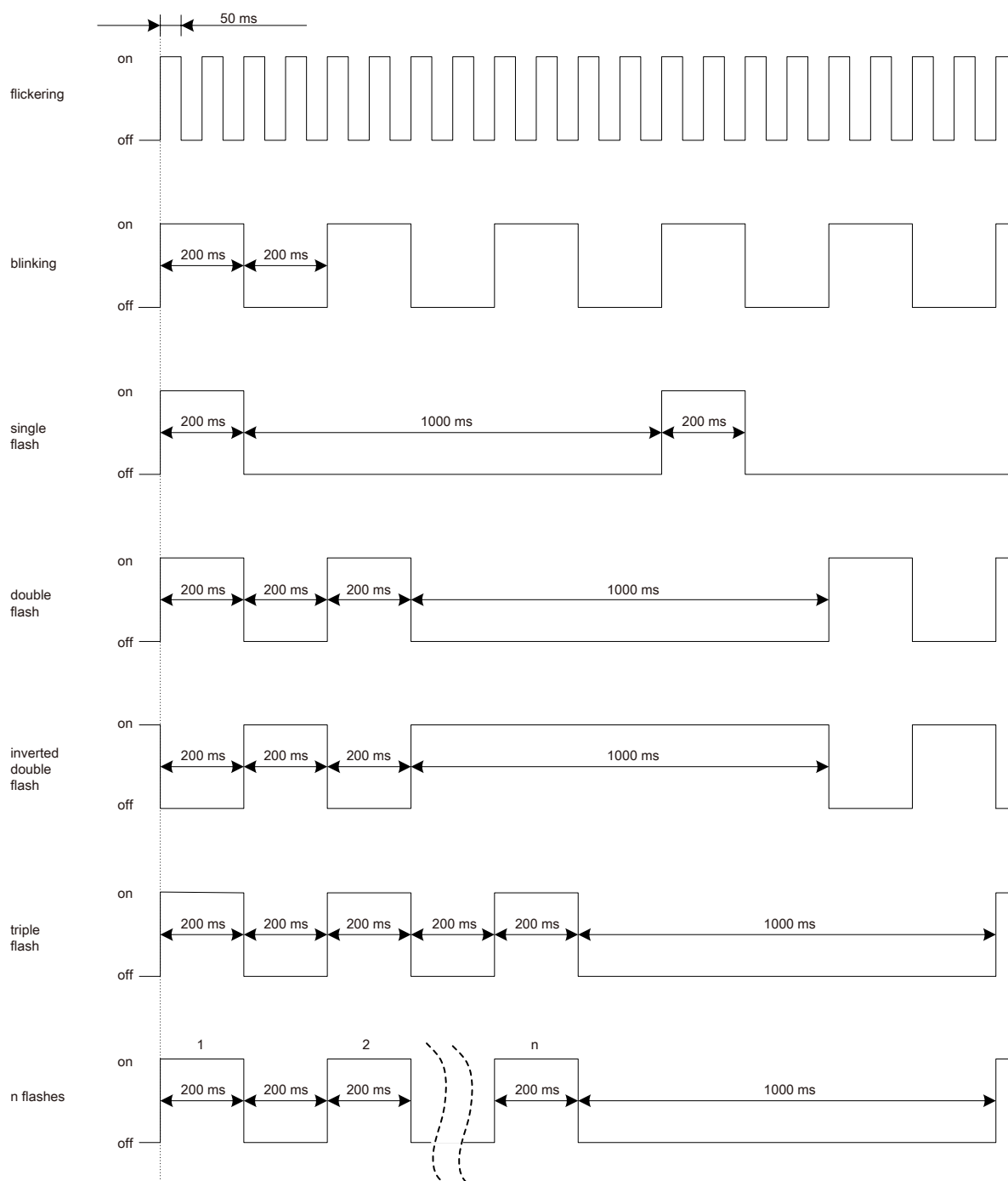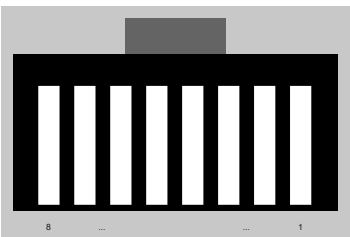
Figure 4.3 Meaning of LED Flash Rates

◆ Connecting the Option Card

■ Communication Connector

The Communication Option card is connected to the network using a RJ45 connector.

Table 4.1 Pin Assignment of RJ45 Communication Connector

Connector	Pin	Signal	Description
	1	TD+	Send data
	2	TD-	Send data
	3	RD+	Receive data
	4	–	N.C. (Pins denoted as N.C. do not connect to any signal)
	5	–	N.C. (Pins denoted as N.C. do not connect to any signal)
	6	RD-	Receive data
	7	–	N.C. (Pins denoted as N.C. do not connect to any signal)
	8	–	N.C. (Pins denoted as N.C. do not connect to any signal)
	Housing	–	Shield

■ Communication Cable

YASKAWA recommends using EtherCAT® dedicated Cat5e or better communication cables.

■ Network Termination

If the drive is the last node in the network, network termination is automatically realized by the ASIC of the Communication Option card.

5　Mechanical & Electrical Installation

◆ Safety Precautions

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

⚠ WARNING *Electrical Shock Hazard. Do not operate equipment when covers are missing. Some figures in this section include drives without covers or safety shields to more clearly show the inside of the drive. Replace covers and shields before operation. Use drives only as specified by the instructions. Failure to obey can cause death or serious injury.*

⚠ WARNING *Electrical Shock Hazard. Do not work on the drive or around the drive while wearing loose clothing or jewelry. Tighten loose clothing and remove all metal objects such as watches or rings. Failure to obey can cause death or serious injury.*

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

⚠ WARNING *Electrical Shock Hazard. Only let authorized persons install, wire, maintain, examine, replace parts, and repair the drive. Failure to obey can cause death or serious injury.*

⚠ WARNING *Electrical Shock Hazard. Do not make changes to the drive body or drive circuitry. Failure to obey can cause death or serious injury and will void warranty. Yaskawa is not responsible for changes to the product made by the user.*

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

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

NOTICE *Observe correct electrostatic discharge (ESD) procedures when touching the drive. Failure to obey can cause ESD damage to the drive circuitry.*

NOTICE *Do not lift the drive with the cover removed. Failure to obey can cause damage to the drive board and terminal block.*

NOTICE *Do not use unshielded wire for control wiring. Use shielded, twisted-pair wires and ground the shield to the ground terminal of the drive. Failure to obey can cause electrical interference and unsatisfactory system performance.*

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> **NOTICE**   *Do not change the drive circuitry. Failure to obey can cause damage to the drive and will void warranty. Yaskawa is not responsible for modifications of the product made by the user.*

> **NOTICE**   *Make sure that all connections are correct after you install the drive and connecting peripheral devices. Failure to obey can cause damage to the drive.*

◆ Preconditions for Installing the Option Card

Prior to installing the Communication Option Card, wire the AC drive or regenerative unit and connect to the drive terminals. For more information on wiring and connecting the inverter drive or regenerative unit, refer to the manual packaged with the AC drive or regenerative unit.

Verify that the AC drive or regenerative unit runs normally without the option installed.

■ Tools Required

A Phillips screwdriver PH1(#1) or PH2(#2) is required to install the Communication Option card.

Note:

Tools required to prepare communication network cables for wiring are not listed in this manual.

◆ Installing the Option on a A1000, D1000, R1000, or U1000

1. Turn off the power. Wait until the CHARGE LED turns off and then remove the cover. Refer to the drive manual for direction on removing the front cover.

2. Plug the option card (E) to the CN5-A connector (C).

    Fieldbus option cards must always be plugged into CN5-A connector.

3. Connect the ground wire (F) to option card and fix with screw (1).

    Select shortest possible cable for ground connection.

4. Fix option card to the drive with screw (2) additionally. Connect the ground wire (F) to drive ground terminal (D).

Note:
There are only two screw holes on the drive for ground terminals. If three different option cards are connected, two of the ground wires will need to share the same ground terminal.
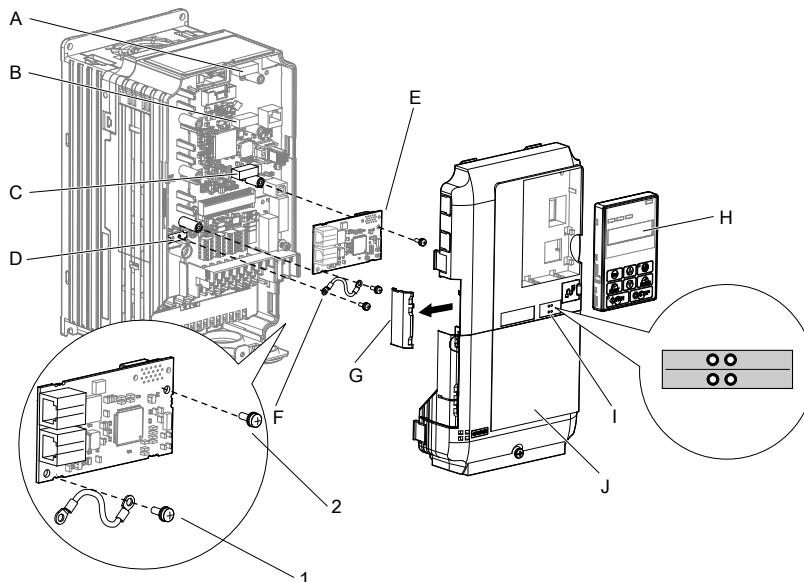
A - Connector CN5-C
B - Connector CN5-B
C - Connector CN5-A
D - Drive grounding terminal (FE)
E - Option cards

F - Ground wire
G - Opening for cable lines (use cutter to create the opening)
H - Operator
I - LED labels
J - Front cover

Figure 5.1 Installing the Option Card on a A1000, D1000, R1000 or U1000

5. Prepare the RJ45 network cable connectors.

    For drives CIMR-Ax2A0004 to 2A0040 and 4A0002 to 4A0023: the network cable should be routed to the outside through the openings at the left side (G) of the front cover. Make sure no sharp edges remain.

    For drives 2A0056 to 2A0211, and 4A0031 to 0165: enough space to keep all wiring inside the unit is available.
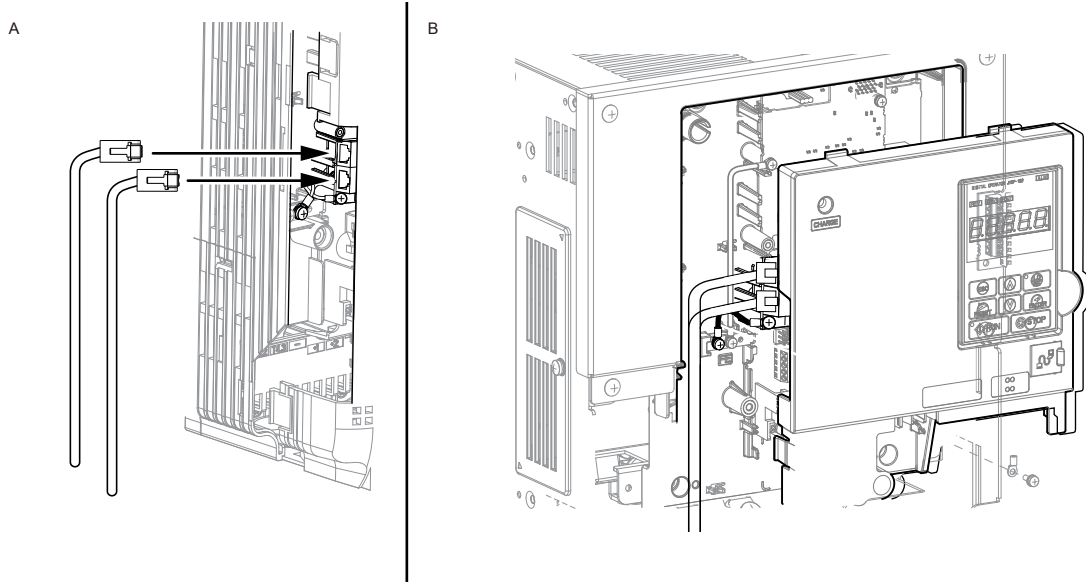
A - **Opening for network cables (CIMR-Ax2A0004 to**   B - **Space for wiring (CIMR-Ax2A0056 to 2A0211,**
    2A0040, 4A0002 to 4A0023)   **4A0031 to 4A0165)**

Figure 5.2 Network Cable Routing

6. Plug in the RJ45 network cable connector to the option.

7. Reinstall the front cover back onto the drive as it was before.

8. Attach the LED label (I) as shown in Figure 5.1.

9. Switch on the drive power supply.

◆ Installing the Option on a V1000

1. Turn off the power. Wait until the CHARGE LED turns off and then remove the cover.

2. Remove the front cover. Refer to the drive manual for direction on removing the front cover.

Note:

The original front cover may be discarded because it will be replaced by the cover of the Communication Option card.

3. Remove the bottom cover and connect the Communication Option ground wire to the ground terminal.
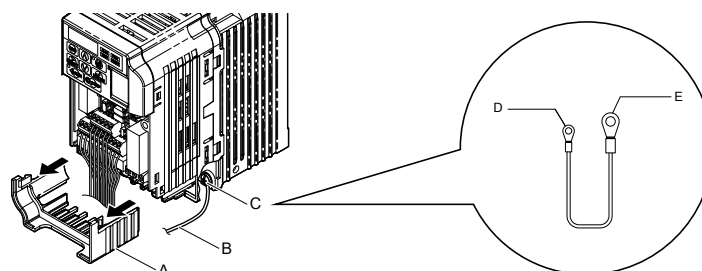
A - **Bottom Cover**   D - **Communication Option card connection (screw**
B - **Ground Cable**   **size: M3)**
C - **Wire**   E - **Drive-side connection (screw size: M3.5 to M6)**

Figure 5.3 Connect Ground Wire

Select shortest possible cable for ground connection.

4. Re-attach the bottom cover.

5. Connect the Communication Option card to the drive. Properly secure the tabs on the left and right side of the Communication Option card to the drive case.
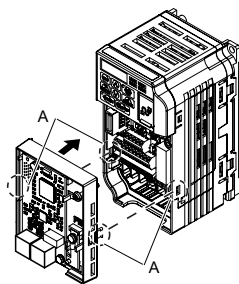
A - Tabs should line up

Figure 5.4 Attach Communication Option Card

6. Connect the ground wire to the Communication Option card.

   When wiring the Communication Option card, pass the ground wire through the inside of the drive bottom cover, then pass the ground wire into the through-hole for the ground wire at the front of the Communication Option card.
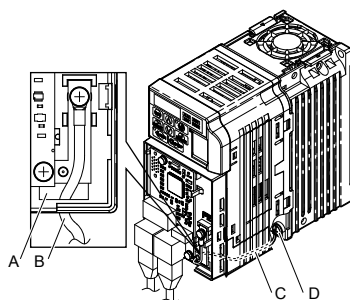
A - Through-hole for ground wire
B - Ground wire

C - Pass ground wire through the bottom cover of the drive
D - Drive ground terminal

Figure 5.5 Connect Ground Wire

7. Connect the communication wire to the Communication Option card modular connector.

8. Attach the cover to the front of the Communication Option card.

9. Switch on the drive power supply.

◆ Installing the Option on a GA800, or GA700
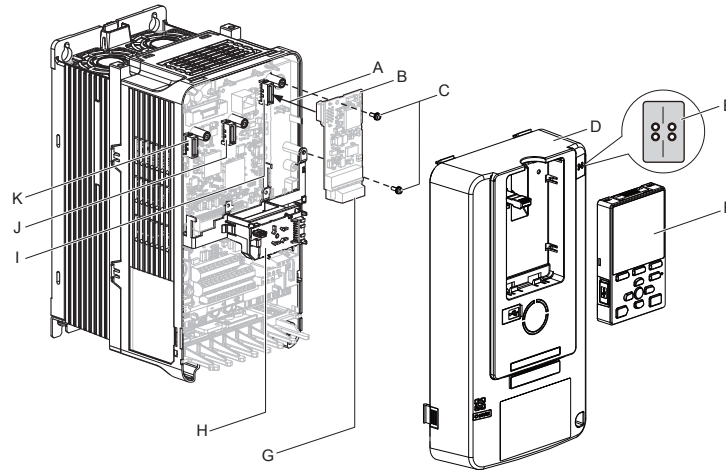
A - Insertion for CN5 connector
B - Option card
C - Screws (included)
D - Drive front cover
E - LED label
F - Keypad

G - Option terminal block (CN1)
H - LED Status Ring board
I - Connector CN5-A
J - Connector CN5-B (Not for communication option installation)
K - Connector CN5-C (Not for communication option installation)

Figure 5.6 Drive Components with Option Card

The procedures for removing and re-attaching the front cover of the drives, and for removing the LED Status Ring board, differ by model. For detailed information please refer to the Technical Manual of the inverter drive. Communication option cards can only be inserted into the **CN5-A** connector located on the drive control board.

1. Affix the LED label (E) in the appropriate position on the drive front cover (D).
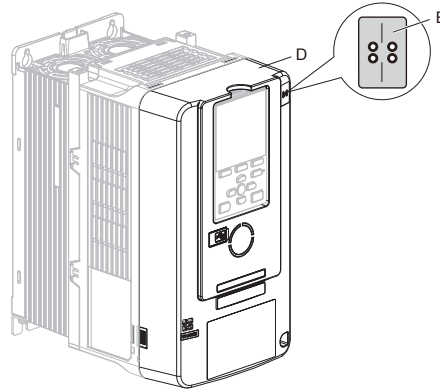
Figure 5.7 Affix the LED Label

2. Turn off the power. Wait until the CHARGE LED turns off and then remove the cover. Refer to the drive manual for direction on removing the front cover.

3. Move the keypad connector to the holder on the drive after removing the keypad and before removing the front cover. Insert the keypad connector tab into the holder when installing the keypad connector to the holder.
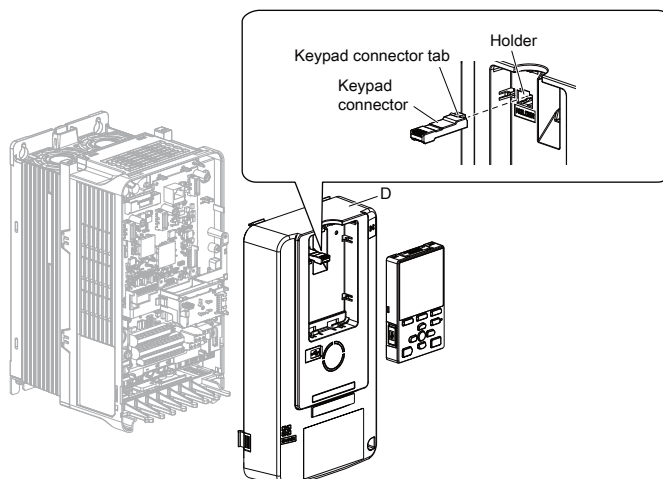
Figure 5.8 Remove the Front Cover and Keypad

4. Carefully remove the LED Status Ring board (H) and place it on the right side of the drive using the temporary placement holes. Do not remove the LED Status Ring board cable connector.
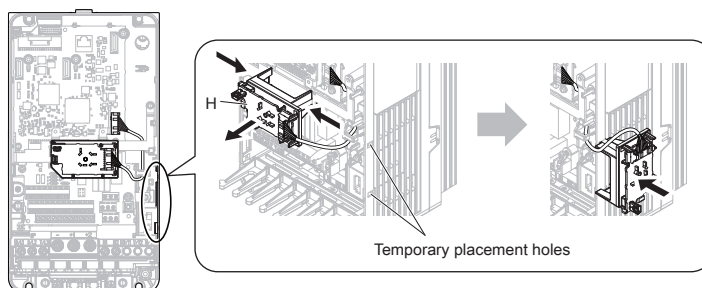
Figure 5.9 Remove the LED Status Ring Board

5. Insert the option card (B) into the CN5-A connector (I) on the drive and fasten it into place using the included screws (C). Tighten both screws to 0.5 to 0.6 Nm (4.4 to 5.3 in. lbs).

Note:
Installing the option card on a drive requires only two screws and does not require a ground wire. The option package ships with three screws and a ground wire for installation on other drive series. Do not use the ground wire or the extra screw.
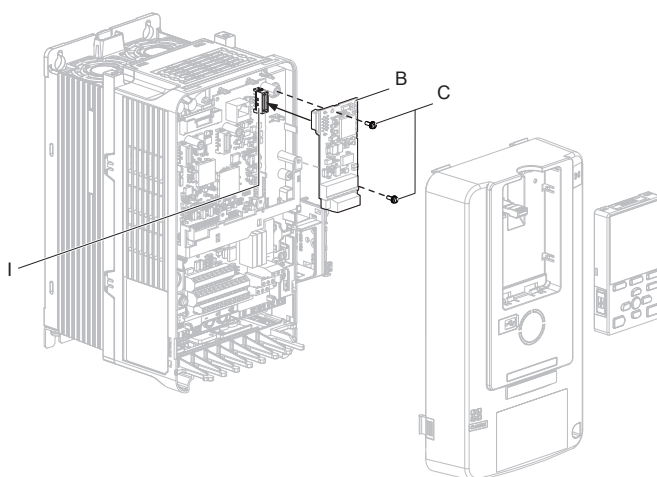
Figure 5.10 Insert the Option Card

6. Firmly connect the communication cable to option terminal block. Install communications cables apart from main-circuit wiring and other electrical and power lines. Ensure the cable end is firmly connected.

7. Reattach and secure the LED Status Ring board (H). Use the open space provided inside the LED Status Ring board to route option wiring. Do not pinch cables between the front cover or the LED Status Ring board and the drive.

8. Install the keypad to the drive after replacing the keypad connector and then the keypad connector. At that time, insert the keypad connector tab into the drive.

9. Reattach and secure the front cover of the drive (D) including the keypad (F).
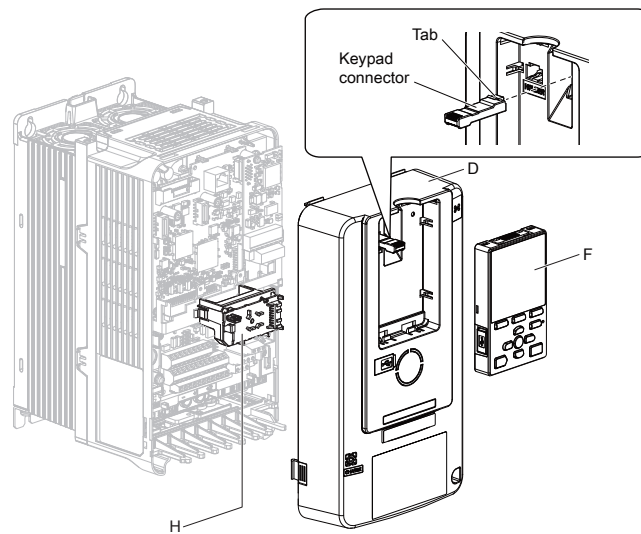
Figure 5.11 Reinstall the Front Cover and Keypad

10. Switch on the drive power supply.

◆ Installing the Option on a GA500

If you want to install the option card on a GA500 AC drive, you must use the Option Card Mounting Kit (Model: JOHB-GA500). The installation procedure is described in the manual that is shipped with that option.

Communication option cards can only be inserted into the **CN5-A** connector located on the drive control board.

◆ Installing the Option on a Q2A
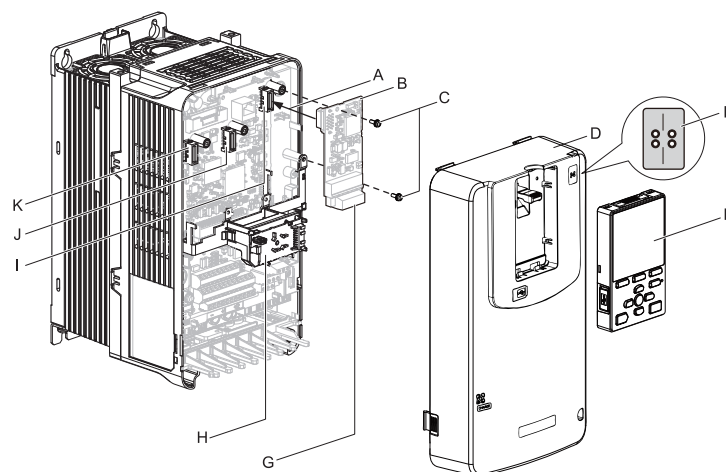
- **A - Insertion for CN5 connector**
- **B - Option card**
- **C - Screws (included)**
- **D - Drive front cover**
- **E - LED label**
- **F - Keypad**
- **G - Option terminal block (CN1)**
- **H - USB port board**
- **I - Connector CN5-A**
- **J - Connector CN5-B (Not for communication option installation)**
- **K - Connector CN5-C (Not for communication option installation)**

Figure 5.12 Q2A Components with Option Card

The procedures for removing and re-attaching the front cover of the inverter drives, and for removing the USB port board, differ by model. For detailed information please refer to the Technical Manual of the inverter drive. Communication option cards can only be inserted into the **CN5-A** connector located on the drive control board.

1. Affix the LED label (E) in the appropriate position on the drive front cover (D).
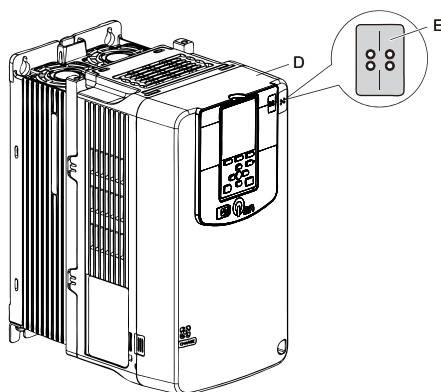
Figure 5.13 Affix the LED Label

2. Turn off the power. Wait until the CHARGE LED turns off and then remove the cover. Refer to the drive manual for direction on removing the front cover.

3. Move the keypad connector to the holder on the drive after removing the keypad and before removing the front cover. Insert the keypad connector tab into the holder when installing the keypad connector to the holder.
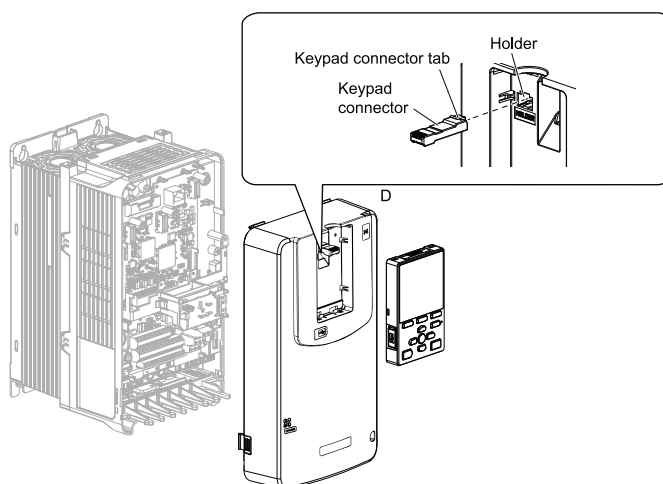
Figure 5.14 Remove the Front Cover and Keypad

4. Carefully remove the USB port board (H) and place it on the right side of the drive using the temporary placement holes. Do not remove the USB port board cable connector.
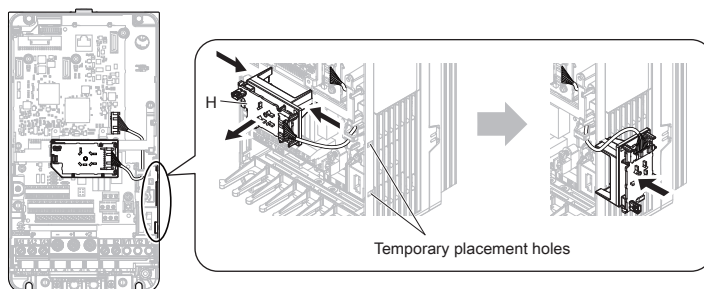
Figure 5.15 Remove the USB Port Board

5. Insert the option card (B) into the CN5-A connector (I) on the drive and fasten it into place using the included screws (C). Tighten both screws to 0.5 to 0.6 Nm (4.4 to 5.3 in. lbs).

Note:
Installing the option card on a Q2A drive requires only two screws and does not require a ground wire. The option package ships with three screws and a ground wire for installation on other drive series. Do not use the ground wire or the extra screw.
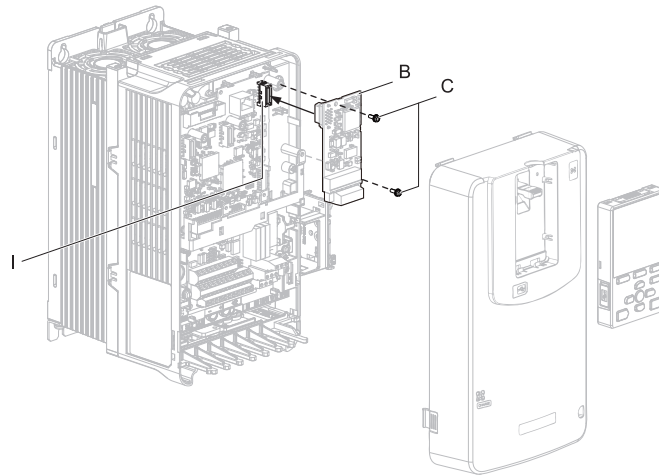
Figure 5.16 Insert the Option Card

6. Firmly connect the communication cable to option terminal block. Install communications cables apart from main-circuit wiring and other electrical and power lines. Ensure the cable end is firmly connected.

7. Reattach and secure the USB port board (H). Use the open space provided inside the USB port board to route option wiring. Do not pinch cables between the front cover or the USB port board and the drive.

8. Install the keypad to the drive after replacing the keypad connector and then the keypad connector. At that time, insert the keypad connector tab into the drive.

9. Reattach and secure the front cover of the drive (D) including the keypad (F).
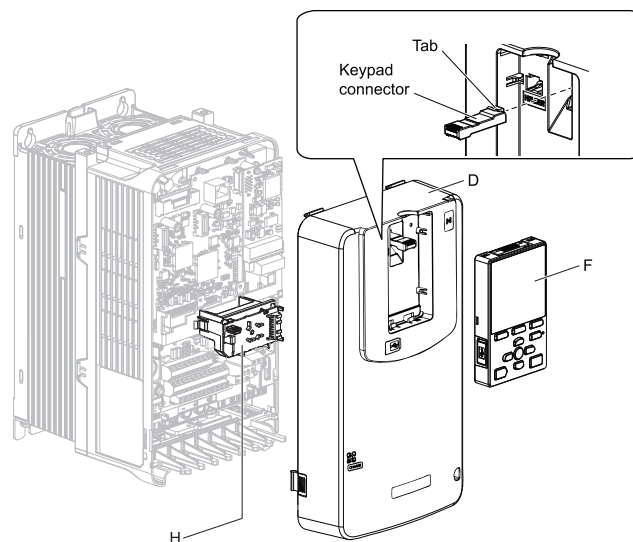
Figure 5.17 Reinstall the Front Cover and Keypad

10. Switch on the drive power supply.

◆ Installing the Option on a Q2V

If you want to install the option card on a Q2V AC drive, you must use the Option Card Mounting Kit (Model: JOHB-Q2V). The installation procedure is described in the manual that is shipped with that option.

Communication option cards can only be inserted into the **CN5-A** connector located on the drive control board.

◆ ESI File

For easy network implementation of drives equipped with a Communication Option card, the ESI file can be obtained from these sources:

- Europe:
  http://www.yaskawa.eu.com
- Japan:
  http://www.e-mechatronics.com

- USA:
  http://www.yaskawa.com

For other areas, and when using Q2A or Q2V AC drives, contact your sales representative.

6 EtherCAT Option Related Drive Parameters

The drive parameters listed in Table 9.3 have influence on some functions of the communication option card.

◆ Parameters for A1000, D1000, R1000, U1000, GA800, GA700, GA500, CR700, V1000

Some drive parameters have influence on some functions of the communication option card. Check these parameters before starting network communications.

Table 6.1 Parameter Settings

No.	Name	Description	Default
b1-01 *1	Frequency Reference Selection	Selects the frequency reference input source 0: Operator - Digital preset speed d1-01 to d1-17 1: Terminals - Analog input terminals 2: MEMOBUS/Modbus communications 3: Option card 4: Pulse Input (Terminal RP)	*6
b1-02 *1	Run Command Selection	Selects the run command input source 0: Digital Operator - RUN and STOP keys 1: Digital input terminals Sx 2: MEMOBUS/Modbus communications 3: Option card	1
E2-04, E4-04, E5-04, E9-09 *2	Motor Poles	Set the number of motor poles described on the motor nameplate. Relevant for DSP402. 2 to 48	4
F6-01	Operation Selection after Communications Error	Determines drive response when a bUS error is detected during communications with the EtherCAT Option 0: Ramp to Stop 1: Coast to Stop 2: Fast-Stop 3: Alarm Only *3	1
F6-02	External Fault Detection Conditions (EF0)	Sets the condition for external fault detection (EF0) 0: Always detected 1: Detected only during operation	0
F6-03	Stopping Method for External Fault from Communication Option Board	Determines drive response for external fault input (EF0) detection during EtherCAT communication 0: Ramp to Stop 1: Coast to Stop 2: Fast-Stop 3: Alarm Only	1
F6-06 *4	Torque Reference/Torque Limit selection from Communications Option	0: Torque reference/torque limit via network communications are disabled. 1: Torque reference/torque limit via network communications are enabled. *5	0
F6-07	NetRef/ComRef Selection Function	0: Multi-step speed reference disabled 1: Multi-step speed reference allowed	0
F6-08	Reset Communication Related Parameters	Determines if communication-related parameters are set back to their original default values when the drive is initialized. 0: Do not reset F6-xx and F7-xx parameters when the drive is initialized using parameter A1-03. 1: Reset F6-xx and F7-xx parameters when the drive is initialized using parameter A1-03. **Note:** Setting this parameter does not affect communication-related parameters. Setting this parameter only determines if communication-related parameters (F6-xx and F7-xx) are also reset when A1-03 is used to initialize the drive.	0
o1-03 *7	Digital Operator Display Selection	Sets the units to display the frequency reference and output frequency. 0: 0.01 Hz 1: 0.01% (100% = E1-04) 2: r/min (enter the number of motor poles to E2-04/E4-04/E5-04). Relevant for DSP402. 3: User defined by parameters o1-10 and o1-11	*6

*1 To start and stop the drive from an EtherCAT® master device using serial communications, set b1-02 to 3. To control the frequency reference of the drive via the master device, set b1-01 to 3.
*2 It's necessary to set up the number of motor poles when the Drive Profile DSP402 objects are used. Also refer to *7
*3 If set to 3, then the drive will continue to operate when an EF0 fault is detected. Take proper safety measures, such as installing an emergency stop switch.
*4 This parameter might not appear in certain drives. Furthermore its availability is limited to depending on the control mode selection. For details refer to the technical manual for the drive the option card is used with.
*5 If the drive is set to receive the torque reference/limit from the network (F6-06 = 1) make sure the value is set appropriately by the controller. If no torque reference/limit value is entered the motor will not produce torque.
*6 The default value depends on the drive used and/or the drive software version. For details refer to the technical manual for the drive.
*7 Changing o1-03 changes the units for input object 2010 (Hex) (frequency reference), output object 2110 (Hex) (output frequency) and 2200 (Hex) (motor speed). Furthermore o1-03 must be set to 2 and the number of motor poles must be set to the correct value in order to use the Drive Profile DSP402.

◆ Parameters for Q2A, Q2V

Some drive parameters have influence on some functions of the communication option card. Check these parameters before starting network communications.

Table 6.2 Parameter Settings

No.	Name	Description	Default
b1-01 *1	Freq. Ref. Sel. 1	Sets the input method for the frequency reference. 0: Keypad 1: Analog Input 2: Modbus 3: Option PCB 4: Pulse Train Input	*6
b1-02 *1	Run Comm. Sel 1	Sets the input method for the Run command. 0: Keypad 1: Analog Input 2: Modbus 3: Option PCB	1
E2-04, E4-04, E5-04, E9-09 *2	Motor Pole Count	Sets the number of motor poles. 2 to 48	4
F6-01	Comm.Error Selection	Sets the method to stop the motor or let the motor continue operating when the drive detects a *bUS [Option Communication Error]*. 0: Ramp->Stop 1: Coast->Stop 2: Fast-Stop (C1-09) 3: Alarm Only *3 4: AL-Run at d1-04 5: AL-Ramp Stop	1
F6-02	Comm Ext Flt Detect (EF0)	Sets when the drive will detect *EF0 [Option Card External Fault]* is detected. 0: Always Detected 1: Detect@RUN Only	0
F6-03	Comm Ext Flt Select (EF0)	Determines drive response for external fault input (EF0) detection during EtherCAT communication 0: Ramp->Stop 1: Coast->Stop 2: Fast-Stop (C1-09) 3: Alarm Only	1
F6-06 *4	Trq Ref/Lim Comms	Sets the function that enables and disables the torque reference and torque limit received from the communication option. 0: Disabled. 1: Enabled. *5	0
F6-07	Multi-Ref@NetRef/ComRef	Sets the function that enables and disables the multi-step speed reference when the frequency reference source is NetRef or ComRef (communication option card or Modbus communications). 0: Disable MultiStep References 1: Enable MultiStep References	0

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No.	Name	Description	Default
F6-08	Comm Par RST@Initialize	Sets the function to initialize *F6-xx and F7-xx parameters* when the drive is initialized with *A1-03 [Init Parameters]*. 0: Retain Pars - No Reset 1: Factory Default - Reset	0
o1-03 *7	FrqDisplay Unit Selection	Sets the display units for the frequency reference and output frequency. 0: 0.01 Hz 1: 0.01% (100% = E1-04) 2: rpm (Enter the number of motor poles to E2-04/E4-04/E5-04). Relevant for DSP402. 3: User-selected units	*6

*1   To start and stop the drive from an EtherCAT® master device using serial communications, set b1-02 to 3. To control the frequency reference of the drive via the master device, set b1-01 to 3.

*2   E2-04 is necessary to set up when the Drive Profile DSP402 objects are used. Also refer to *7

*3   If set to 3, then the drive will continue to operate when an EF0 fault is detected. Take proper safety measures, such as installing an emergency stop switch.

*4   This parameter might not appear in certain drives. Furthermore its availability is limited to depending on the control mode selection. For details refer to the technical manual for the drive the option card is used with.

*5   If the drive is set to receive the torque reference/limit from the network (F6-06 = 1) make sure the value is set appropriately by the controller. If no torque reference/limit value is entered the motor will not produce torque.

*6   The default value depends on the drive used and/or the drive software version. For details refer to the technical manual for the drive.

*7   Changing o1-03 changes the units for input object 2010 (Hex) (frequency reference), output object 2110 (Hex) (output frequency) and 2200 (Hex) (motor speed). Furthermore o1-03 must be set to 2 and E2-04 must be set to the correct value in order to use the Drive Profile DSP402.

7 Supported Modes of Operation

The option contains support for the Velocity mode according the CANopen Device Profile and Motion Control (DSP402) profile. It also contains YASKAWA vendor specific CANopen objects based on the present CANopen option board specification.

The EtherCAT Option supports the following communication profiles:

• DS 301 Ver. 4.02

• DSP 402 Ver. 3.0 Velocity Mode (not available for D1000 and R1000)

To reset a mode, a power cycle is necessary.

Note:

If an object of the range 6xxx is used, the DSP402 mode is used.

8 Object Dictionary

◆ CANopen DSP402 Controlword/Statusword

This section describes how to control the drive via controlword/statusword and how to access drive parameters.

■ CANopen DSP402 Controlword

Table 8.1 Controlword

Bit Number	Controlword	Application Reference/CPI Function Calls	Reference
0	Switch on	This bit controls the DS402 state machine.	28
1	Enable voltage	This bit controls the DS402 state machine.	28
2	Quick stop	This bit controls the DS402 state machine.	28
3	Enable operation	This bit controls the DS402 state machine.	28
4	Operation mode specific		27
5	Operation mode specific		27
6	Operation mode specific		27
7	Fault Reset	This bit controls the DS402 state machine.	28
8	Operation mode specific	Not implemented	
9	Reserved		27
10	Manufacturer specific	Not used	
11	Manufacturer specific	N/A	

Bit Number	Controlword	Application Reference/CPI Function Calls	Reference
12	Manufacturer specific	N/A	
13	Manufacturer specific	N/A	
14	Manufacturer specific	N/A	
15	Manufacturer specific	N/A	

■ CANopen DSP402 Statusword

Table 8.2 Statusword

Bit Number	Statusword	Application Reference/CPI Function Calls	Reference
0	Ready to switch on	This bit controls the DS402 state machine.	28
1	Switched on	This bit controls the DS402 state machine.	28
2	Operation enabled	This bit controls the DS402 state machine.	28
3	Fault	This bit controls the DS402 state machine.	28
4	Voltage enabled	This bit controls the DS402 state machine.	28
5	Quick stop	This bit controls the DS402 state machine.	28
6	Switch on disabled	This bit controls the DS402 state machine.	28
7	Warning	1: INVR: 00FC (Hex) & 0040 (Hex) 2: !(INVR: 00FC (Hex) & 0040 (Hex))	
8	Manufacturer specific	N/A	
9	Remote	1: Online-DRV:INVSTS2 & 0003 (Hex) != 0 (INV uses NET cmd or ref) 0: Online-DRV:INVSTS2 & 0003 (Hex) = 0 (INV does not use NET cmd or ref)	
10	Target reached (Op mode spec)		27
11	Internal limit active	0: Always, not implemented	
12	Operation mode specific		27
13	Operation mode specific		27
14	Manufacturer specific	N/A	
15	Manufacturer specific	N/A	

■ Controlword Operation Mode Specific Bits in Velocity Mode

Table 8.3 Controlword Operation Mode Specific Bits in Velocity Mode

Bit Number	Controlword	Application Reference/CPI Function Calls
4	rfg enable	0: Online-DRV:OPTSTS2#0002 (Hex) = 0 (Clear NetRef bit) 1: Online-DRV:OPTSTS2#0002 (Hex) = 1 (Set NetRef bit)
5	rfg unlock	0: Discard any new NET set-point 1: Use NET set-point
6	rfg use ref	0: Force NET set-point to zero 1: Use NET set-point
9	Not implemented	Not implemented

■ Statusword Operation Mode Specific Bits in Velocity Mode

Table 8.4 Statusword Operation Mode Specific Bits in Velocity Mode

Bit Number	Control Word	Application Reference/CPI Function Calls
(10)	Target reached	0: !(INVR:00FC (Hex) & 0010 (Hex)) 1: INVR:00FC (Hex) & 0010 (Hex)
12	Reserved	0: Always, not applicable in velocity mode
13	Reserved	0: Always, not applicable in velocity mode

EN

■ CANopen DSP402 Controlword State Transition Bits

Table 8.5 Controlword State Transitions

DSP402 Command	Control Word Bits					Transitions
	Bit 7	Bit 3	Bit 2	Bit 1	Bit 0	
0: Shutdown	0	X	1	1	0	2,6,8
1: Switch on	0	0	1	1	1	3
2: Switch on + enable operation	0	1	1	1	1	3 + 4 *1
3: Disable voltage	0	X	X	0	X	7,9,10,12
4: Quick stop	0	X	0	1	X	7,10,11
5: Disable operation	0	0	1	1	1	5
6: Enable operation	0	1	1	1	1	4,16
7: Fault reset	0 -> 1	X	X	X	X	15

*1   Automatic transition to Enable operation state after executing SWITCHED ON state functionality.
*2   If the option does not have the NetCtrl command (Online-DRV#INVSTS2&0002 (Hex)) it will not process any command orders against the drive.

■ CANopen DSP402 Statusword State Transition Bits

After a change in the control word (remote control) according to Table 8.4 the node state will change and the state result will be indicated in the status word according to Table 8.5.

Table 8.6 Statusword State Transitions

DSP402 Command	Status Word Bits					
	Bit 6	Bit 5	Bit 3	Bit 2	Bit 1	Bit 0
1: Not ready to switch on	0	X	0	0	0	0
2: Switch on disabled	1	X	0	0	0	0
3: Ready to switch on	0	1	0	0	0	1
4: Switched on	0	1	0	0	1	1
5: Operation enabled	0	1	0	1	1	1
6: Quick stop active	0	0	0	1	1	1
7: Fault reaction active	0	X	1	1	1	1
8: Fault	0	X	1	0	0	0

■ CANopen DSP402 State Transition Definition

The YASKAWA EtherCAT® option has the following state transitions and states. The module must be in the state Operation Enable in order to accept frequency and operation commands. In Table 8.6 the events needed to change between different states are described. Some events are internally triggered, but most of the events are triggered from the control word received from the bus.

■ CANopen DSP402 State Diagram

At any time the EtherCAT® option card will be in one of the following states. The events that are able to trigger a transition between the states are either sent with the control word or triggered by an internal action. All the possible events and the corresponding transition number are listed in Table 8.7.
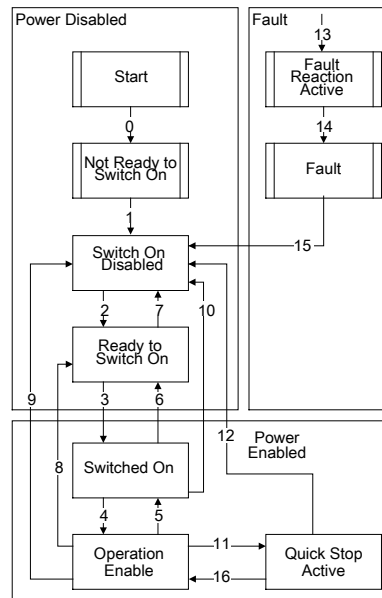
Transition 16 is only available while the drive is performing the Quick Stop action. When completed, transition will automatically be processed.

Figure 8.1 DSP402 State Diagram

■ **CANopen DSP402 Event Description**

The following state transitions are available in the CANopen DSP402 drive profile. Transition 0 and 1 are triggered at start-up and when all start-up tests are performed the module will be in state 3. Some commands like fault reset can be triggered from more then one place. For example, the reset command can be triggered both from the bus with the control word, or from the application drive.

Table 8.7 Event Description

State Transition Number	Transition Name	DSP402 Event
0	Startup => Not Ready To Switch On	Reset
1	Not ready to switch on => Switch on disabled	Self test and init successful
2	Switch on disabled => Ready to switch on	Shutdown command received
3	Ready to switch on => Switched on disabled	Switch on command received
4	Switched on => Operation enabled	Enable operation command received
5	Operation enabled => Switched on	Disable operation command received
6	Switched on => Ready to switch on	Shutdown command received
7	Ready to switch on => Switch on disabled	Quickstop command received
8	Operation enabled => Ready to switch on	Shutdown command received
9	Operation enabled => Switch on disabled	Disable voltage command received
10	Switched on => Switch on disable	Disable voltage or quickstop command received
11	Operation enabled => Quick stop active	Quickstop command received
12	Quick stop active => Switch on disabled	Quickstop completed or Disable voltage command received
13	All states => Fault reaction active	Fatal fault has occurred in the drive
14	Fault reaction active => Fault	The fault action is completed
15	Fault => Switch on disabled	Fault reset command received
16	Quick stop active => Operation enabled	Enable operation command received

◆ **Object Dictionary Overview**

The Object Dictionary consists of the following sections:

• Communication Profile Objects
• Manufacturer Specific Profile Objects

- Regenerative Units Specific Objects
- Drive and Motion Profile Objects

■ Communication Profile Objects (DS301)

Index (Hex)	Name	Ref.	Index (Hex)	Name	Ref.
1000	Device Type	31	1011	Restore Default Parameters	33
1001	Error Register	32	1018	Identity Object	34
1003	Pre-defined Error Field	32	1600 - 1628	Receive PDO Mapping	34
1008	Manufacturer Device Name	32	1A00 - 1A28	Transmit PDO Mapping	35
1009	Manufacturer Hardware Version	32	1C00	Sync Manager Communication Type	35
100A	Manufacturer Software Version	31	1C12	Sync Manager RxPDO assign	35
1010	Store Parameters	33	1C13	Sync Manager TxPDO assign	35

■ Manufacturer Specific Profile Object (DS301)

Table 8.8 Input Objects

Index (Hex)	Name	Ref.	Index (Hex)	Name	Ref.
2000	Operation Command	36	2080	Selectable (default: none)	40
2010	Speed Command	36	2090	Selectable (default: none)	40
2020	Torque Limit	37	20A0	Selectable (default: none)	40
2030	Torque Compensation	37	20B0	Selectable (default: none)	40
2040	MEMOBUS/Modbus Read Request	37	20C0	Selectable (default: none)	40
2050	MEMOBUS/Modbus Write Request	38	20D0	FM analog output 1	41
2051	Advanced MEMOBUS/Modbus Write Request	38	20E0	AM analog output 2	41
2060	MEMOBUS/Modbus Unlimited ENTER Command	38	20F0	Multi-function DO output	42
2061	MEMOBUS/Modbus Unlimited ENTER Command 2	39	3000	Selectable (default: none)	40
2070	MEMOBUS/Modbus Limited ENTER Command	39	3100	Selectable (default: none)	40
2071	MEMOBUS/Modbus Limited ENTER Command 2	39			

Table 8.9 Output Objects

Index (Hex)	Name	Ref.	Index (Hex)	Name	Ref.
2100	Drive Status	42	2200	Motor Speed	46
2110	Output Frequency	43	2210	DC Bus Voltage	46
2120	Output Current	43	2220	Analog input monitor A1	46
2130	Output Torque Reference	43	2240	Analog input monitor A2	47
2140	MEMOBUS/Modbus Read Response	43	2260	Analog input monitor A3	47
2150	MEMOBUS/Modbus Write Response	44	2270	Inverter DI Input	47
2151	Advanced MEMOBUS/Modbus Write Response	44	2301	Error Register	47
2155	PDO Parameter Write Response	44	2318	Drive Information	48
2160	MEMOBUS/Modbus Not Limited Enter Command Response	45	251x	Main Parameter Group A	48
2161	MEMOBUS/Modbus Not Limited Enter Command Response 2	45	252x	Main Parameter Group B	48
2180	Selectable (default: Input terminal status)	45	253x	Main Parameter Group C	49
2190	Selectable (default: Analog input 1 monitor)	45	254x	Main Parameter Group D	49
21A0	Selectable (default: none)	45	255x	Main Parameter Group E	49
21B0	Selectable (default: none)	45	256x	Main Parameter Group F	50
21C0	Selectable (default: none)	45	258x	Main Parameter Group H	50
21E0	Selectable (default: none)	45	25Cx	Main Parameter Group L	50
21F0	Selectable (default: none)	45	25Ex	Main Parameter Group N	50
			25Fx	Main Parameter Group O	51

Index (Hex)	Name	Ref.
261x	Main Parameter Group Q	51
262x	Main Parameter Group R	51
264x	Main Parameter Group T	51
265x	Main Parameter Group U	52
2E00	Gateway Mode Communication Settings	52
2E01	Gateway Slave 1 Drive Operation	52
2E02	Gateway Slave 2 Drive Operation	53
2E03	Gateway Slave 3 Drive Operation	54
2E04	Gateway Slave 4 Drive Operation	55

Index (Hex)	Name	Ref.
2F01	Gateway Slave 1Drive Status	53
2F02	Gateway Slave 2 Drive Status	54
2F03	Gateway Slave 3 Drive Status	55
2F04	Gateway Slave 4 Drive Status	56
4000	Option NVS FATAL Record	56
4001	Option Info + Status Record	56
4010	Store Parameters	57
4011	Restore Default Parameters	57

■ Regenerative Units Specific Objects

Index (Hex)	Name	Ref.
5000	Regenerated Energy	58
5001	Input Voltage	58
5002	Current Limit	58

Index (Hex)	Name	Ref.
5003	AC Power	58
5004	Consumed Energy	59
5005	DC Bus Voltage Reference	59

■ Drives and Motion Specific Profile Object (DS402)

Table 8.10 Common Entries

Index (Hex)	Name	Ref.
60FD	Digital Inputs	63
60FE	Digital Outputs	63
6502	Supported Drive Modes	64

Table 8.11 Device Control

Index (Hex)	Name	Ref.
6040	Control Word	60
6041	Status Word	60

Index (Hex)	Name	Ref.
6060	Modes of Operation	62
6061	Modes of Operation Display	62

Table 8.12 Velocity Mode

Index (Hex)	Name	Ref.
6042	vl target velocity	60
6043	vl velocity demand	60
6044	vl control effort	60
6046	vl velocity min max amount	60
6048	vl velocity acceleration	61

Index (Hex)	Name	Ref.
6049	vl velocity deceleration	61
604A	vl velocity quick stop	61
604C	vl dimension factor	62
604D	vl pole number	62

◆ Communication Profile Objects (DS301) Details

■ 1000 (Hex): Device Type

A1000   V1000   D1000   R1000   U1000   GA800   GA700   GA500   Q2A   Q2V   CR700

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value
1000	0	Device Type	RO	No	UNS32	

This object describes the type of the device and its functionality. It is composed of a 16 bit field that describes the device profile used and a second 16 bit field that gives additional information about optional functionality.

For devices using object dictionaries of A1000, V1000, U1000, GA800, GA700, GA500, Q2A, Q2V, CR700

Bit 0 - 15	Device Profile Number = 0192 (Hex) (402) (static)
Bit 16 - 23	Type = 01 (Hex)
Bit 24 - 31	Mode Bits (Vendor specific) = 00 (Hex)

For devices using object dictionaries of D1000 and R1000

Bit 0 - 15	Device Profile Number = 0000 (Hex) (402) (static)
Bit 16 - 23	Type = 00 (Hex)
Bit 24 - 31	Mode Bits (Vendor specific) = 00 (Hex)

■ 1001 (Hex): Error Register

A1000 V1000 D1000 R1000 U1000 GA800 GA700 GA500 Q2A Q2V CR700

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value (Range)
1001	0	Error Register	RO	No	UNS8	0 (0 - 1)

This register shows the fault status of the device. If any errors occurs in the device, bit 0 (generic error) is set to one.

0	No error
1	Generic error

■ 1003 (Hex): Pre-defined Error Field

A1000 V1000 D1000 R1000 U1000 GA800 GA700 GA500 Q2A Q2V CR700

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value (Range)
1003	0	Number of errors	RW	No	UNS8	00 (Hex) (00 - FF (Hex))
1003	1	Standard error field (Emergency error code)	RO	No	UNS32	0000 (Hex) (0000 - FFB8 (Hex))

Refer to *Emergency Error Codes on page 67*.

This register provides a history of errors that occurred in the drive and have been signalized via the Emergency object. Subindex 0 contains the number of errors. Subindexes 1 to FF contain a rolling list of error codes where subindex 1 always contains the last occurring error.

The number of valid logged errors in sub index is 01 - FE (Hex). Writing a 0 to subindex 0 resets the error field.

■ 1008 (Hex): Manufacturer Device Name

A1000 V1000 D1000 R1000 U1000 GA800 GA700 GA500 Q2A Q2V CR700

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value
1008	0	Manufacturer device name	RO	No	String	-

This object displays the name of the connected base unit.

■ 1009 (Hex): Manufacturer Hardware Version

A1000 V1000 D1000 R1000 U1000 GA800 GA700 GA500 Q2A Q2V CR700

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value
1009	0	Manufacturer hardware version	RO	No	String	x.y

Note:

x: Major hardware version

y: Minor hardware revision assigned during production

This object contains the option card hardware version.

■ 100A (Hex): Manufacturer Software Version

A1000 V1000 D1000 R1000 U1000 GA800 GA700 GA500 Q2A Q2V CR700

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value
100A	0	Manufacturer software version	RO	No	String	

This object contains the manufacturer software version.

Example

Software version number: VST92420123

- VST9: Option card for 1000 series and GA series
- 2: European product
- 42: Bus type "EtherCAT"
- 01: Major revision
- 23: Minor revision

■ 1010 (Hex): Store Parameters

A1000 V1000 D1000 R1000 U1000 GA800 GA700 GA500 Q2A Q2V CR700

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value
1010	0	Store parameters	RO	No	UNS8	1
1010	1	Save all parameters	RW	No	UNS32	01 (Hex) [Save on command]

By writing "save" to this object, the Communication Option settings are saved in the non-volatile memory.

Signature	MSB			LSB
ASCII	e	v	a	s
Hex	65	76	61	73

Actions: Will issue Limited Enter command. Writes data into the EEPROM of the drive and enables the data in RAM at the same time. Parameter changes remain even if the power supply is cycled.

Note:

Because the EEPROM can be written to a maximum of 100,000 times, refrain from writing to the EEPROM too often.

Table 8.13 Non-volatile Stored Parameters (NVS Parameters)

CANopen Object (Hex)	Default Value (Hex)	EEPROM Size	CANopen Object (Hex)	Default Value (Hex)	EEPROM Size
2080:2	FFFFFFFF	32 bit	2190:2	004E	16 bit
2090:2	FFFF	16 bit	21A0:2	FFFF	16 bit
20A0:2	FFFF	16 bit	21B0:2	FFFF	16 bit
20B0:2	FFFF	16 bit	21C0:2	FFFF	16 bit
20C0:2	FFFF	16 bit	21E0:2	FFFF	16 bit
3000:2	FFFF	16 bit	21F0:2	FFFFFFFF	32 bit
3100:2	FFFF	16 bit	604C:1	00000001	32 bit
2180:2	0049	16 bit	604C:2	00000001	32 bit

■ 1011 (Hex): Restore Default Parameters

A1000 V1000 D1000 R1000 U1000 GA800 GA700 GA500 Q2A Q2V CR700

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value
1011	0	Restore default parameters	RO	No	UNS8	1
1011	1	Restore all default parameters	RW	No	UNS32	01 (Hex) [Restore on command]

EN

By writing "load" to this object, the Communication Option default settings are restored.

Signature	MSB			LSB
ASCII	d	a	o	l
Hex	64	61	6F	6C

Actions: Option will write value=2220 to A1-03 (INVR:0103 (Hex)) together with an EEPROM ENTER command.

Note:

Because the EEPROM can be written to a maximum of 100,000 times, refrain from writing to the EEPROM too often.

Table 8.14 Non-volatile Stored Parameters (NVS Parameters)

CANopen Object (Hex)	Default Value (Hex)	EEPROM Size	CANopen Object (Hex)	Default Value (Hex)	EEPROM Size
2080:2	FFFFFFFF	32 bit	2190:2	004E	16 bit
2090:2	FFFF	16 bit	21A0:2	FFFF	16 bit
20A0:2	FFFF	16 bit	21B0:2	FFFF	16 bit
20B0:2	FFFF	16 bit	21C0:2	FFFF	16 bit
20C0:2	FFFF	16 bit	21E0:2	FFFF	16 bit
3000:2	FFFF	16 bit	21F0:2	FFFFFFFF	32 bit
3100:2	FFFF	16 bit	604C:1	00000001	32 bit
2180:2	0049	16 bit	604C:2	00000001	32 bit

■ 1018 (Hex): Identity Object

A1000 V1000 D1000 R1000 U1000 GA800 GA700 GA500 Q2A Q2V CR700

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value
1018	0	Number of entries	RO	No	UNS8	4
1018	1	Vendor ID	RO	No	UNS32	00000539 (Hex)
1018	2	Product code	RO	No	UNS32	Depends on base unit
1018	3	Revision number	RO	No	UNS32	
1018	4	Communication Option serial number	RO	No	UNS32	-

This object contains general information about the drive.

Vendor ID

Value: 00000539 (Hex) for "Yaskawa Electric Corporation, Japan"

Product Code

The value consists of the first three letters of the product name followed by a running number and is in ASCII format.

Example: Value 56313030 (Hex) (ASCII: V100) in case a V1000 is connected.

Revision Number

YASKAWA Communication Option software revision number.

Example

Software version number: VST92420123

- VST9: Option card for 1000 series and GA series
- 2: European product
- 42: Bus type "EtherCAT"
- 01: Major revision
- 23: Minor revision

■ 1600 (Hex) to 1628 (Hex): Receive PDO Mapping

A1000 V1000 D1000 R1000 U1000 GA800 GA700 GA500 Q2A Q2V CR700

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value (Range)
1600	0	Number of entries	RW	No	UNS8	0 (0 - 8)
1600	1	Mapped Object #1	RW	No	UNS32	-
1600	2	Mapped Object #2	RW	No	UNS32	-
1600	n	Mapped Object #n	RW	No	UNS32	-

These objects are automatically filled by the master.

■ 1A00 (Hex) to 1A28 (Hex): Transmit PDO Mapping

A1000 V1000 D1000 R1000 U1000 GA800 GA700 GA500 Q2A Q2V CR700

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value (Range)
1A00	0	Number of entries	RW	No	UNS8	0 (0 - 8)
1A00	1	Mapped Object #1	RW	No	UNS32	-
1A00	2	Mapped Object #2	RW	No	UNS32	-
1A00	n	Mapped Object #n	RW	No	UNS32	-

These objects are automatically filled by the master.

■ 1C00 (Hex): Sync Manager Communication Type

A1000 V1000 D1000 R1000 U1000 GA800 GA700 GA500 Q2A Q2V CR700

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value (Range)
1C00	0	Number of entries	RO	No	UNS8	4
1C00	1	Mailbox receive	RO	No	UNS8	1
1C00	2	Mailbox send	RO	No	UNS8	2
1C00	3	Process data output	RO	No	UNS8	3
1C00	4	Process data input	RO	No	UNS8	4

■ 1C12 (Hex): Sync Manager RxPDO Assign

A1000 V1000 D1000 R1000 U1000 GA800 GA700 GA500 Q2A Q2V CR700

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value (Range)
1C12	0	Number of entries	RW	No	UNS8	1 (0 - 4)
1C12	1	Assigned RxPDO #1	RW	No	UNS16	1600 (Hex)
1C12	2	Assigned RxPDO #1	RW	No	UNS16	-
1C12	3	Assigned RxPDO #1	RW	No	UNS16	-
1C12	4	Assigned RxPDO #1	RW	No	UNS16	-

■ 1C13 (Hex): Sync Manager TxPDO Assign

A1000 V1000 D1000 R1000 U1000 GA800 GA700 GA500 Q2A Q2V CR700

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value (Range)
1C13	0	Number of entries	RW	No	UNS8	1 (0 - 4)
1C13	1	Assigned TxPDO #1	RW	No	UNS16	1A00 (Hex)
1C13	2	Assigned TxPDO #2	RW	No	UNS16	-

EN

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value (Range)
1C13	3	Assigned TxPDO #3	RW	No	UNS16	-
1C13	4	Assigned TxPDO #4	RW	No	UNS16	-

◆ Manufacturer Specific Profile Objects (DS301) Details

The SI-ES3 option offers the manufacturer specific objects listed below. These objects are specific to Yaskawa products and are therefore not available on other EtherCAT products.

The manufacturer specific objects list consists of static objects and configurable objects. The content of configurable objects can be determined by linking these objects to drive parameters, monitors or MEMOBUS/Modbus registers.

■ 2000 (Hex): Operation Command

`A1000` `V1000` `D1000` `R1000` `U1000` `GA800` `GA700` `GA500` `Q2A` `Q2V` `CR700`

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value (Range)
2000	0	Number of entries	RO	No	UNS8	2
2000	1	Operation Command	RW	Rx/Tx	UNS16	
2000	2	MEMOBUS/Modbus address Mapped to MEMOBUS/Modbus address 0001 (Hex) [Operation command and multi-function inputs]	RO	No	UNS16	0001 (Hex)

This object is used for starting and stopping the drive, for controlling the multi-function digital input terminals, as well for triggering and resetting faults.

Bit No. (Hex)	Description A1000, D1000, R1000, U1000, GA700	Description Q2A	Description V1000	Function
0	H5-12 = 0: Forward Run Command H5-12 = 1: Run Command			0: Stop, 1: Forward run 0: Stop, 1: Run
1	H5-12 = 0: Reverse Run Command H5-12 = 1: Forward/Reverse			0: Stop, 1: Reverse run 0: Forward, 1: Reverse
2	External Fault (EF0)			1: External Fault Input (EF0)
3	Fault Reset			1: Fault reset
4	Terminal S1 Function	Terminal DI1 Function	Terminal S1 Function	Multi-function Input 1
5	Terminal S2 Function	Terminal DI2 Function	Terminal S2 Function	Multi-function Input 2
6	Terminal S3 Function	Terminal DI3 Function	Terminal S3 Function	Multi-function Input 3
7	Terminal S4 Function	Terminal DI4 Function	Terminal S4 Function	Multi-function Input 4
8	Terminal S5 Function	Terminal DI5 Function	Terminal S5 Function	Multi-function Input 5
9	Terminal S6 Function	Terminal DI6 Function	Terminal S6 Function	Multi-function Input 6
10	Terminal S7 Function	Terminal DI7 Function	Reserved	Multi-function Input 7 For V1000: Reserved
11	Terminal S8 Function	Terminal DI8 Function	Reserved	Multi-function Input 8 For V1000: Reserved
12 - 15	Reserved			Reserved

■ 2010 (Hex): Speed Reference/Speed Limit

`A1000` `V1000` `U1000` `GA800` `GA700` `GA500` `Q2A` `Q2V` `CR700`

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value
2010	0	Number of entries	RO	No	UNS8	2
2010	1	Value	RW	Rx/Tx	UNS16	0
2010	2	MEMOBUS/Modbus address Mapped to MEMOBUS/Modbus address 0002 (Hex) [Frequency reference]	RO	No	UNS16	0002 (Hex)

Sets the speed reference or speed limit. The unit of this value depends on the setting of the drive parameter *o1-03*. Refer to *EtherCAT Option Related Drive Parameters on page 24*. The value will be used as the speed reference for speed control [d5-01 = 0] or as the speed limit in torque control [d5-01 = 1].

Note:

The availability of the torque control function depends on the drive and the selected control mode. For details refer to the technical manual for the drive.

■ 2020 (Hex): Torque Reference/Torque Limit

A1000 U1000 GA800 GA700 Q2A CR700

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value (Range)
2020	0	Number of entries	RO	No	UNS8	2
2020	1	Value	RW	Rx/Tx	SINT16	0 (0 - 3000)
2020	2	MEMOBUS/Modbus address Mapped to MEMOBUS/Modbus address 0004 (Hex) [Torque ref/limit]	RO	No	UNS16	0004 (Hex)

Sets the torque reference or torque limit in units of 0.1%. In order to use this object set drive parameter *F6-06 = 1*. Refer to *EtherCAT Option Related Drive Parameters on page 24*. The value will be used as the torque reference for torque control [d5-01 = 1] or as the torque limit in speed control [d5-01 = 0].

Note:

The availability of the torque control function depends on the drive and the selected control mode. For details refer to the technical manual for the drive.

■ 2030 (Hex): Torque Compensation

A1000 U1000 GA800 GA700 Q2A CR700

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value (Range)
2030	0	Number of entries	RO	No	UNS8	2
2030	1	Torque Compensation	RW	Rx/Tx	SINT16	0 (0 - 2000)
2030	2	MEMOBUS/Modbus address Mapped to MEMOBUS/Modbus address 0005 (Hex) [Torque compensation]	RO	No	UNS16	0005 (Hex)

This object sets the torque compensation in units of 0.1%.

Note:
Only usable if Torque Control is enabled.

■ 2040 (Hex): MEMOBUS/Modbus Read Request

A1000 V1000 D1000 R1000 U1000 GA800 GA700 GA500 Q2A Q2V CR700

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value (Range)
2040	0	Number of entries	RO	No	UNS8	1
2040	1	MEMOBUS/Modbus read request	RW	Possible	UNS32	0

Objects 2040 (Hex) and 2140 (Hex) are used as a pair to read out the contents of drive's MEMOBUS/Modbus registers. Object 2040 (Hex) determines the register to be read. After sending a MEMOBUS/Modbus Read Request to the drive, the MEMOBUS/Modbus register content can be read out from object 2140 (Hex).

The address of the MEMOBUS/Modbus must be written in byte 3 and 4 of Subindex 1, bytes 1 and 2 have to be set to 0.

Signature	MSB			LSB
Byte	4	3	2	1
Hex	yy	xx	00	00

For more details on MEMOBUS/Modbus address and data, refer to the Technical Manual of the AC drive or regenerative unit.

EN

■ **2050 (Hex): MEMOBUS/Modbus Write Request**

A1000 V1000 D1000 R1000 U1000 GA800 GA700 GA500 Q2A Q2V CR700

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value (Range)
2050	0	Number of entries	RO	No	UNS8	1
2050	1	MEMOBUS/Modbus write request	RW	Possible	UNS32	0

Object 2050 (Hex) is used to write the contents of drive's MEMOBUS/Modbus registers. Writing this object automatically issues an Unlimited Enter command, which applies changes immediately. This happened regardless of the Communications ENTER Function Selection (H5-11).

The automatic ENTER command makes the writing process slower, but also makes the process of writing registers less complicated. For these reasons, Yaskawa suggests using object 2050 for most applications.

The address of the MEMOBUS/Modbus must be written in byte 3 and 4 of Subindex 1, the value must be written to bytes 1 and 2.

Signature	MSB			LSB
Byte	4	3	2	1
Hex	Address		Value	

For more details on MEMOBUS/Modbus address and data, refer to the Technical Manual of the AC drive or regenerative unit.

■ **2051 (Hex): Advanced MEMOBUS/Modbus Write Request**

A1000 V1000 D1000 R1000 U1000 GA800 GA700 GA500 Q2A Q2V CR700

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value (Range)
2051	0	Number of entries	RO	No	UNS8	1
2051	1	MEMOBUS/Modbus write request	RW	Possible	UNS32	0

Object 2051(Hex) is used to write the contents of drive's MEMOBUS/Modbus registers. Writing object 2051 (Hex) does not automatically issue an enter command. An internal automatic ENTER command can be set (H5-11=1) to apply changes to registers immediately regardless of which fieldbus object is used.

When object 2051 is used without automatic ENTER commands (H5-11=0), the writing process is faster. In order to apply changes to registers, an ENTER commands must be issued separately. Also, Yaskawa AC drives and regenerative units check for inconsistencies when an ENTER command is issued, and not before. This means that incorrect parameter settings may not be reported correctly over the fieldbus (see Object 2151 for details). For these reasons, Yaskawa suggests using the object 2051 only for applications where the writing speed is of critical importance.

The address of the MEMOBUS/Modbus must be written in byte 3 and 4 of Subindex 1, the value must be written to bytes 1 and 2.

Signature	MSB			LSB
Byte	4	3	2	1
Hex	Address		Value	

For more details on MEMOBUS/Modbus address and data, refer to the Technical Manual of the AC drive or regenerative unit.

■ **2060 (Hex): MEMOBUS/Modbus Unlimited ENTER Command**

A1000 V1000 D1000 R1000 U1000 GA800 GA700 GA500 Q2A Q2V CR700

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value (Range)
2060	0	Unlimited ENTER command Mapped to MEMOBUS/Modbus address 0910 (Hex) [Un-Memorized ENTER command]	RW	Possible	UNS32	00000001 (Hex) (00000001, 65766173 (Hex))

Object 2060 is used to issue a MEMOBUS/Modbus unlimited ENTER command. The Unlimited ENTER command activates parameters in the drive RAM only. If the drive power is cycled, parameter changes are lost. If more than one parameter has been changed, it is enough to send only one ENTER command after the last parameter change. Doing so will activate all changed parameters. This ENTER command can be used without limitations.

Note:

Both of the following settings activate automatic ENTER commands, which makes this object unneccesary.
• Activating the Communications ENTER Function (H5-11=1) .

• Using object 2050 to issue MEMOBUS write commands.

To execute this type of ENTER command, "save" (73H + 61H + 76H + 65H) has to be written in object 2060 (Hex), subindex 0.

Signature	MSB			LSB
ASCII	e	v	a	s
Hex	65	76	61	73

■ 2061 (Hex): MEMOBUS/Modbus Unlimited ENTER Command 2

A1000 V1000 D1000 R1000 U1000 GA800 GA700 GA500 Q2A Q2V CR700

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value (Range)
2061	0	MEMOBUS/Modbus Unlimited ENTER Command 2 Mapped to MEMOBUS/Modbus address 0910 (Hex) [Un-Memorized ENTER command]	RW	Possible	UNS8	0 (Hex) (0, 1 (Hex))

Object 2061 is used to issue a MEMOBUS/Modbus unlimited ENTER command. The Unlimited ENTER command activates parameters in the drive RAM only. If the drive power is cycled, parameter changes are lost. If more than one parameter has been changed, it is enough to send only one ENTER command after the last parameter change. Doing so will activate all changed parameters. This ENTER command can be used without limitations.

Note:

Both of the following settings activate automatic ENTER commands, which makes this object unneccesary.
• Activating the Communications ENTER Function (H5-11=1) .

• Using object 2050 to issue MEMOBUS write commands.

To execute this type of ENTER command, toggle subindex 0 from 0 to 1.

■ 2070 (Hex): MEMOBUS/Modbus Limited ENTER Command

A1000 V1000 D1000 R1000 U1000 GA800 GA700 GA500 Q2A Q2V CR700

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value
2070	0	Limited ENTER command Mapped to MEMOBUS/Modbus address 0900 (Hex) [Memorized ENTER command]	RW	Possible	UNS32	00000001 (Hex) (00000001, 65766173 (Hex))

Object 2070 is used to issue a MEMOBUS/Modbus limited ENTER command. The limited ENTER command activates parameters in the drive's RAM and saves them to the EEPROM. When power supply loss occurs or the power supply is cycled, the drive will operate using the saved parameters. If more than one parameter has been changed, it is sufficient to send only one ENTER command after the last parameter change. Doing so will activate all changed parameters.

Note:

This type of ENTER command can be applied approximately 100,000 times and should be used only when necessary.

To execute this type of ENTER command, "save" (73H + 61H + 76H + 65H) has to be written in object 2070 (Hex), subindex 0.

Signature	MSB			LSB
ASCII	e	v	a	s
Hex	65	76	61	73

■ 2071 (Hex): MEMOBUS/Modbus Limited ENTER Command 2

A1000   V1000   D1000   R1000   U1000   GA800   GA700   GA500   Q2A   Q2V   CR700

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value
2071	0	Limited ENTER command 2 Mapped to MEMOBUS/Modbus address 0900 (Hex) [Memorized ENTER command]	RW	Possible	UNS8	0 (Hex) (0, 1 (Hex))

Object 2070 is used to issue a MEMOBUS/Modbus limited ENTER command. The limited ENTER command activates parameters in the drive's RAM and saves them to the EEPROM. When power supply loss occurs or the power supply is cycled, the drive will operate using the saved parameters. If more than one parameter has been changed, it is sufficient to send only one ENTER command after the last parameter change. Doing so will activate all changed parameters.

Note:

This type of ENTER command can be applied approximately 100,000 times and should be used only when necessary.

To execute this type of ENTER command, toggle subindex 0 from 0 to 1.

■ 2080 (Hex) to 3100 (Hex): Freely Configurable Input Objects

A1000   V1000   D1000   R1000   U1000   GA800   GA700   GA500   Q2A   Q2V   CR700

These objects can be used to write selectable MEMOBUS content via fieldbus communication. User is free to assign any MEMOBUS address to this object. Once assigned, the content of this MEMOBUS address can be written via PDO or SDO until Power Off. Although this object can be read, please note that this is not necessarily the content of the register.

Subindex 2 is for determining the MEMOBUS address to be written.

Subindex 1 is for reading and writing the content.

For more details on MEMOBUS/Modbus address and data, refer to the Technical Manual of the AC drive or regenerative unit.

2080 (Hex): Freely Configurable Input Object

This object is intended for writing up to two registers at the same time. To write to only one register, set the other register value to FFFF (Hex).

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value (Range)
2080	0	Number of entries	RO	No	UNS8	2
2080	1	Value	RW	Possible	UNS32	-
2080	2	MEMOBUS/Modbus address of content 1 and 2	RW	Possible	UNS32	FFFF + FFFF (Hex) (00000000 - FFFFFFFF (Hex))

2090 (Hex) to 3100 (Hex): Freely Configurable Input Objects

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value (Range)
2090, 20A0, 20B0, 20C0, 3000, 3100	0	Number of entries	RO	No	UNS8	2
2090, 20A0, 20B0, 20C0, 3000, 3100	1	Value	RW	Possible	UNS16	-
2090, 20A0, 20B0, 20C0, 3000, 3100	2	MEMOBUS/Modbus address of content	RW	Possible	UNS16	FFFF (Hex) (0000 - FFFF (Hex))

Limitations of Object Content Selection

The following limitations have to be considered when setting the content of an object.

• The communication option card can not be switched to the Operational state until the content selection process is complete. Otherwise, an emergency message (code 6301 (Hex)) will be sent.

- When object content selection is ongoing, no other request or command, including Run, can be sent to the drive. Otherwise, an error message or an emergency message (code 6301 (Hex)) will be sent.
- For 4 byte input objects, MEMOBUS/Modbus register numbers up to 00FF (Hex) can be linked in any combination. If MEMOBUS/Modbus register numbers from 0100 (Hex) are linked to a 4 byte object, the MEMOBUS/Modbus register numbers must be consecutive.

Mapped Register 1	Mapped Register 2	Combination possible?
0007 (Hex)	0009 (Hex)	Possible
0201 (Hex)	0202 (Hex)	Possible
0202 (Hex)	0201 (Hex)	Not possible
0201 (Hex)	0203 (Hex)	Not possible
0202 (Hex)	0202 (Hex)	Not possible
0200 (Hex)	FFFF (Hex)	Possible
FFFF (Hex)	FFFF (Hex)	Possible

- Register numbers must not be consecutive for 4 Byte output objects.
- A MEMOBUS/Modbus register can no be mapped to two or more objects at the same time.
- MEMOBUS/Modbus registers 0001 (Hex), 0002 (Hex), 0004 (Hex), 0005 (Hex), 0007 (Hex), 0008 (Hex), 0009 (Hex), and 0014 (Hex) are already linked to not changeable input objects and can not be linked to any object with selectable content. Trying to map one of those registers to an input object will result in an error message.

Example

- In order to map the drive output power monitor (U1-08, 0047 (Hex)) to output object 21A0 (Hex), write 0047 (Hex) to subindex 2 of object 21A0 (Hex).
- In order to map the speed reference 1 (d1-01, 0280 (Hex)) to input object 2090 (Hex), write 0280 (Hex) to subindex 2 of object 2090 (Hex).
- In order to map the input terminal status (U1-10, 0049 (Hex)) and output terminal status (U1-11, 004A (Hex)) to output object 21F0 (Hex) (4 Byte), write 0049 (Hex) to the higher and 004A (Hex) to the lower word of object 2090 (Hex), subindex 2.

■ 20D0 (Hex): Analog Output Terminal FM (for V1000: AM)

A1000 V1000 D1000 R1000 U1000 GA800 GA700 GA500 Q2A Q2V CR700

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value
20D0	0	Number of entries	RO	No	UNS8	2
20D0	1	Analog Output Terminal FM For V1000: Analog Output Terminal AM For Q2A: Analog Output Terminal AO1	RW	Rx/Tx	UNS16	-
20D0	2	MEMOBUS/Modbus address Mapped to MEMOBUS/Modbus address 0007 (Hex) [AM analog output 1]	RO	No	UNS16	0007 (Hex)

This object controls the FM analog terminal output value.

For V1000: This object controls the AM analog terminal output value.

For Q2A: This object controls the AO1 analog terminal output value.

■ 20E0 (Hex): Analog Output Terminal AM

A1000 D1000 R1000 U1000 GA800 GA700 Q2A CR700

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value
20E0	0	Number of entries	RO	No	UNS8	2
20E0	1	Analog Output Terminal AM For Q2A: Analog Output Terminal AO2	RW	Rx/Tx	UNS16	-
20E0	2	MEMOBUS/Modbus address Mapped to MEMOBUS/Modbus address 0008 (Hex) [AM analog output 2]	RO	No	UNS16	0008 (Hex)

This object controls the AM analog terminal output value.

This object is not available for V1000.

For Q2A: This object controls the AO2 analog terminal output value.

EN

■ **20F0 (Hex): Multi-function DO Output**

A1000 V1000 D1000 R1000 U1000 GA800 GA700 GA500 Q2A Q2V CR700

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value
20F0	0	Number of entries	RO	No	UNS8	2
20F0	1	Multi-function DO Output	RW	Rx/Tx	UNS16	-
20F0	2	MEMOBUS/Modbus address Mapped to MEMOBUS/Modbus address 0009 (Hex) [Multi-function DO]	RO	No	UNS16	0009 (Hex)

This object controls the multi-function DO outputs.

Bit defines:

Signature	Bit (Hex)	GA700	Q2A	A1000	V1000
LSB	0	Terminals M1-M2	Terminals 2NO-2CM	Terminals M1-M2	Contact Output (terminal MA/MB-MC)
	1	Terminals M3-M4	Terminals 3NO-3CM	Terminals M3-M4	Photocoupler Output 1 (terminal P1-PC) enabled
	2	Terminals M5-M6	Terminals 4NO-4CM	Terminals M5-M6	Photocoupler Output 2 (terminal P1-PC) enabled
	3 - 5	Reserved	Reserved	Reserved	Reserved
	6	1: bit 7 function is enabled	1: bit 7 function is enabled	1: bit 7 function is enabled	Reserved
	7	Faulty Relay MA/MB-MC	Faulty Relay 1NO/1NC-1CM	Faulty Relay MA/MB-MC	Reserved
MSB	8 - F	Reserved	Reserved	Reserved	Reserved

Value	Description
1	On
0	Off

■ **2100 (Hex): Drive Status**

A1000 V1000 D1000 R1000 U1000 GA800 GA700 GA500 Q2A Q2V CR700

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value (Range)
2100	0	Number of entries	RO	No	UNS8	2
2100	1	Drive Status	RO	Tx	UNS16	-
2100	2	MEMOBUS/Modbus address Mapped to MEMOBUS/Modbus address 00FC (Hex) [Drive Status]	RO	No	UNS16	00FC (Hex) (0 - FFFF (Hex))

These objects can be used to monitor the drive status. The value in object 2100 (Hex) is not filtered.

Bit No. (Hex)	Function	Description
0	During Run	1: During Run 0: During Stop
1	During Zero Speed	1: During Zero Speed
2	Reverse Running	1: During Reverse Running 0: During Forward Running
3	During Fault Reset Signal Input	1: During Fault Reset Signal Input
4	During Speed Agree	1: During Speed Agree
5	During Drive Ready	1: During Drive Ready 0: Not Ready
6	During Alarm	1: During Alarm
7	During Fault	1: During Fault
8	During Operation Error	1: During Operation Error
9	During Momentary Power Loss	1: During Momentary Power Loss 0: During Power Loss
A	NetCtrl Status	1: NetCtrl
B	Digital Output 1 Status (function set in drive parameter H2-01)	1: ON 0: OFF
C	Digital Output 2 Status (function set in drive parameter H2-02)	1: ON 0: OFF

Bit No. (Hex)	Function	Description
D	Digital Output 3 Status (function set in drive parameter H2-03)	1: ON 0: OFF
E	Motor 2 Selected	1: Motor 2 Selected (not available for D1000 and R1000)
F	Zero-Servo End	1: Zero-Servo End (not available for D1000 and R1000)

■ 2110 (Hex): Output Frequency

A1000 V1000 U1000 GA800 GA700 GA500 Q2A Q2V CR700

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value (Range)
2110	0	Number of entries	RO	No	UNS8	2
2110	1	Output Frequency	RO	Tx	UNS16	0 (0 - FFFF (Hex))
2110	2	MEMOBUS/Modbus address Mapped to MEMOBUS/Modbus address 0041 (Hex) [Output frequency]	RO	No	UNS16	0041 (Hex)

This object can be used to monitor the drive output frequency. The unit of the monitor value is determined by drive parameter o1-03.

o1-03 = 0: Hz

o1-03 = 1: %

100% equal *E1-04 [Maximum Output Frequency]*.

o1-03 = 2: r/min

Enter the number of motor poles into E2-04/E4-04/E5-04.

o1-03 = 3: User defined by parameters o1-10 and o1-11

■ 2120 (Hex): Output Current

A1000 V1000 U1000 GA800 GA700 GA500 Q2A Q2V CR700

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value (Range)
2120	0	Number of entries	RO	No	UNS8	2
2120	1	Output Current	RO	Tx	UNS16	0 (0 - FFFF)
2120	2	MEMOBUS/Modbus address Mapped to MEMOBUS/Modbus address 00FB (Hex) [Output current]	RO	No	UNS16	00FB (Hex)

This object can be used to monitor the drive output current in units of Ampere. The current value resolution is the same as in drive monitor U1-03 [Output Current]. For details refer to the technical manual of the drive.

■ 2130 (Hex): Output Torque Reference

A1000 V1000 U1000 GA800 GA700 GA500 Q2A Q2V CR700

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value
2130	0	Number of entries	RO	No	UNS8	2
2130	1	Output Torque Reference	RO	Tx	SINT16	-
2130	2	MEMOBUS/Modbus address Mapped to MEMOBUS/Modbus address 0048 (Hex) [Output torque reference]	RO	No	UNS16	0048 (Hex)

This object can be used to monitor the drive internal calculated torque reference. To set the torque reference from the PLC, use object 2020 (Hex).

The availability of this object content depends on the drive control mode. If the selected control mode does not support this monitor (equal to drive monitor U1-09 [Torque Reference]), the torque reference monitor value will be 0. For details refer to the technical manual of the drive.

■ 2140 (Hex): MEMOBUS/Modbus Read Response

A1000 V1000 U1000 GA800 GA700 GA500 Q2A Q2V CR700

EN

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value (Range)
2140	0	Number of entries	RO	No	UNS8	1
2140	1	MEMOBUS/Modbus read response	RO	Tx	UNS32	0 (00000000 - FFFFFFFF (Hex))

This object contains the data of the drive MEMOBUS/Modbus register content specified in object 2040 (Hex). Bytes 1 and 2 of subindex 1 will contain the data, bytes 3 and 4 will contain the MEMOBUS/Modbus Address read.

Signature	MSB			LSB
Byte	4	3	2	1
Hex	AA		BB	
Content	MEMOBUS/Modbus address		Data	

■ 2150 (Hex): MEMOBUS/Modbus Write Response

A1000 V1000 U1000 GA800 GA700 GA500 Q2A Q2V CR700

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value (Range)
2150	0	Number of entries	RO	No	UNS8	1
2150	1	MEMOBUS/Modbus write response	RO	Tx	UNS32	0 (0 - FFFFFFFF (Hex))

Bytes 1 and 2 of subindex 1 will contain the data, bytes 3 and 4 will contain the MEMOBUS/Modbus Address written.

Signature	MSB			LSB
Byte	4	3	2	1
Hex	AA		BB	
Content	MEMOBUS/Modbus address		Data	

■ 2151 (Hex): Advanced MEMOBUS/Modbus Write Response

A1000 V1000 U1000 GA800 GA700 GA500 Q2A Q2V CR700

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value (Range)
2151	0	Number of entries	RO	No	UNS8	1
2151	1	MEMOBUS/Modbus write response	RO	Tx	UNS32	0 (0 - FFFFFFFF (Hex))

Object 2151 is used to confirm register changes made by object 2051. Bytes 1 and 2 of subindex 1 will contain the data that were written, bytes 3 and 4 will contain the MEMOBUS/Modbus Address that was written to.

Signature	MSB			LSB
Byte	4	3	2	1
Hex	AA		BB	
Content	MEMOBUS/Modbus address		Data	

■ 2155 (Hex): PDO Parameter Write Response

A1000 V1000 U1000 GA800 GA700 GA500 Q2A Q2V CR700

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value
2155	0	PDO Parameter Write Response	RO	Tx	3 bytes	-

Object 2155 displays the RxPDO number and number of errors that has occurred when writing an RxPDO, if any.

This object contains the response from the drive when writing a drive parameter directly using a RxPDO. Byte 1 and 2 contain the last RxPDO number that caused the error. Byte 3 contains the number of errors. The error counter is increased when a control data write is flagged as invalid by the drive (INVSTS2: Bit6, Control command error or local option RxPDO error).

Signature	MSB		LSB
Byte	3	2	1
Content	8 bit error counter	Last RxPDO number that caused the error	

■ 2160 (Hex): MEMOBUS/Modbus Unlimited Enter Command Response

A1000　V1000　U1000　GA800　GA700　GA500　Q2A　Q2V　CR700

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value (Range)
2160	0	MEMOBUS/Modbus Not Limited Enter Command Response	RO	Tx	UNS32	0

Object 2160 (Hex) contains the response from the drive when writing an Enter command using object 2060 (Hex). Response values:

OK	65766173 (Hex)
ERR	MEMOBUS error code or SDO abort code if SDO request

■ 2161 (Hex): MEMOBUS/Modbus Unlimited Enter Command Response 2

A1000　V1000　U1000　GA800　GA700　GA500　Q2A　Q2V　CR700

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value (Range)
2161	0	MEMOBUS/Modbus Not Limited Enter Command Response	RO	Tx	UNS32	0

Object 2161 (Hex) contains the response from the drive when writing an Enter command using object 2061 (Hex). Response values:

OK	00000001 (Hex)
ERR	MEMOBUS error code or SDO abort code if SDO request

■ 2180 (Hex) to 21F0 (Hex): Freely Configurable Output Objects

A1000　V1000　D1000　R1000　U1000　GA800　GA700　GA500　Q2A　Q2V　CR700

These objects can be used to read selectable MEMOBUS content via fieldbus communication. User is free to assign any MEMOBUS address to this object. Once assigned, the content of this MEMOBUS address can be read via PDO or SDO until Power Off.

Subindex 2 is for determining the MEMOBUS address to be read. Subindex 1 is for reading the content.

The content of these objects can be selected by linking them to drive MEMOBUS/Modbus registers.

2180 (Hex) to 21E0 (Hex): Freely Configurable Output Objects

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value (Range)
2180, 2190, 21A0, 21B0, 21C0, 21E0	0	Number of entries	RO	No	UNS8	2
2180, 2190, 21A0, 21B0, 21C0, 21E0	1	Freely Configurable Output Object	RW	Possible	UNS16	0 (0 - FFFF (Hex))

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value (Range)
2180	2	MEMOBUS/Modbus address of content 1 and 2	RW	Possible	UNS16	0049 (Hex)
2190	2					004E (Hex)
21A0, 21B0, 21C0, 21E0	2					FFFF (Hex)

21F0 (Hex): Freely Configurable Output Object

This object is intended for reading up to two registers at the same time. To read to only one register, set the other register value to FFFF (Hex).

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value (Range)
21F0	0	Number of entries	RO	No	UNS8	2
21F0	1	Freely Configurable Output Object	RW	Possible	UNS32	0 (0 - FFFF (Hex))
21F0	2	MEMOBUS/Modbus address of content 1 and 2	RW	Possible	UNS32	FFFF + FFFF (Hex)

■ 2200 (Hex): Motor Speed

`A1000` `V1000` `U1000` `GA800` `GA700` `GA500` `Q2A` `Q2V` `CR700`

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value
2200	0	Number of entries	RO	No	UNS8	0
2200	1	Motor speed	RO	Tx	UNS16	0
2200	2	MEMOBUS/Modbus write response	RO	No	UNS16	0044 (Hex)

This object can be used to monitor the motor speed (drive parameter U1-05). The value in object 2200 (Hex) is not filtered. Setting units are determined by o1-03.

The availability of the object content depends on the drive control mode. For details refer to the drive technical manual.

■ 2210 (Hex): DC-Bus Voltage (for U1000: Control Circuit Voltage)

`A1000` `V1000` `D1000` `R1000` `U1000` `GA800` `GA700` `GA500` `Q2A` `Q2V` `CR700`

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value (Range)
2210	0	Number of entries	RO	No	UNS8	2
2210	1	DC-Bus Voltage (for U1000: Control Circuit Voltage)	RO	Tx	UNS16	0
2210	2	MEMOBUS/Modbus address Mapped to MEMOBUS/Modbus address 0046 (Hex) [DC bus voltage] For D1000 and R1000: 1081 (Hex) [DC bus voltage]	RO	No	UNS16	0046 (Hex) or 1081 (Hex)

This object can be used to monitor the DC BUS voltage.

■ 2220 (Hex): Analog Input Monitor A1

`A1000` `V1000` `D1000` `R1000` `U1000` `GA800` `GA700` `GA500` `Q2A` `Q2V` `CR700`

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value (Range)
2220	0	Number of entries	RO	No	UNS8	2
2220	1	Analog Input Monitor A1	RO	Tx	UNS16	0 (0.0 - 100.0)
2220	2	MEMOBUS/Modbus address Mapped to MEMOBUS/Modbus address 004E (Hex) [Terminal A1 Input Level]	RO	No	UNS16	004E (Hex)

This object can be used to display the analog input terminal A1 level: 100% when input is 10 V.

■ 2240 (Hex): Analog Input Monitor A2

`A1000` `V1000` `D1000` `R1000` `U1000` `GA800` `GA700` `GA500` `Q2A` `Q2V` `CR700`

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value (Range)
2240	0	Number of entries	RO	No	UNS8	2
2240	1	Analog Input Monitor A2	RO	Tx	UNS16	0 (0.0 - 100.0)
2240	2	MEMOBUS/Modbus address Mapped to MEMOBUS/Modbus address 004F (Hex) [Terminal A2 Input Level]	RO	No	UNS16	004F (Hex)

This object can be used to display the analog input terminal A2 level: 100% when input is 10 V.

■ 2260 (Hex): Analog Input Monitor A3

`A1000` `D1000` `R1000` `U1000` `GA800` `GA700` `Q2A` `CR700`

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value (Range)
2260	0	Number of entries	RO	No	UNS8	2
2260	1	Analog Input Monitor A3	RO	Tx	UNS16	0 (0.0 - 100.0)
2260	2	MEMOBUS/Modbus address Mapped to MEMOBUS/Modbus address 0050 (Hex) [Terminal A3 Input Level]	RO	No	UNS16	0050 (Hex)

This object can be used to display the analog input terminal A3 level: 100% when input is 10 V.

■ 2270 (Hex): Drive DI Input

`A1000` `V1000` `D1000` `R1000` `U1000` `GA800` `GA700` `GA500` `Q2A` `Q2V` `CR700`

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value (Range)
2270	0	Number of entries	RO	No	UNS8	2
2270	1	Drive DI Input	RO	Tx	UNS16	0
2270	2	MEMOBUS/Modbus address Mapped to MEMOBUS/Modbus address 0049 (Hex) [Input Terminal Status]	RO	No	UNS16	0049 (Hex)

This object can be used to display the input terminal status.

Bit defines:

Signature	Bit (Hex)	GA700	Q2A	A1000	V1000
LSB	0	Terminal S1 (MFDI 1)	Terminal DI1 (MFDI 1)	Terminal S1 (MFDI 1)	Terminal S1 (MFDI 1)
	1	Terminal S2 (MFDI 2)	Terminal DI2 (MFDI 2)	Terminal S2 (MFDI 2)	Terminal S2 (MFDI 2)
	2	Terminal S3 (MFDI 3)	Terminal DI3 (MFDI 3)	Terminal S3 (MFDI 3)	Terminal S3 (MFDI 3)
	3	Terminal S4 (MFDI 4)	Terminal DI4 (MFDI 4)	Terminal S4 (MFDI 4)	Terminal S4 (MFDI 4)
	4	Terminal S5 (MFDI 5)	Terminal DI5 (MFDI 5)	Terminal S5 (MFDI 5)	Terminal S5 (MFDI 5)
	5	Terminal S6 (MFDI 6)	Terminal DI6 (MFDI 6)	Terminal S6 (MFDI 6)	Terminal S6 (MFDI 6)
	6	Terminal S7 (MFDI 7)	Terminal DI7 (MFDI 7)	Terminal S7 (MFDI 7)	(not used)
MSB	7	Terminal S8 (MFDI 8)	Terminal DI8 (MFDI 8)	Terminal S8 (MFDI 8)	not used)

■ 2301 (Hex): Error Register

`A1000` `V1000` `D1000` `R1000` `U1000` `GA800` `GA700` `GA500` `Q2A` `Q2V` `CR700`

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value (Range)
2301	0	Error register	RO	No	UNS8	0 (0 - 1)

This register shows the fault status of the device. If any errors occurs in the device, bit 0 (generic error) is set to one.

Values:

- 00 (Hex) = No error
- 01 (Hex) = Generic error

■ 2318 (Hex): Drive Information

`A1000` `V1000` `D1000` `R1000` `U1000` `GA800` `GA700` `GA500` `Q2A` `Q2V` `CR700`

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value (Range)
2318	0	Number of entries	RO	No	UNS8	2
2318	1	Power Rating	RO	No	UNS16	0508 (Hex)
2318	2	Drive Model Code	RO	No	String	

This object contains information read from the device.

Power Rating

This object shows the drive power rating read from inverter parameter o2-04. Default value: 0508 (Hex).

Drive Model Code

This object entry shows the drive model code.

Values:

- 1000 series: COSMOS
- xx700 series: String concatenated from values read from the following inverter registers. Value: 15F3 (Hex) - 15F9 (Hex).
- Q2A series: Q2A
- Q2V series: Q2V

■ 251x (Hex): Main Parameter Group A

`GA800` `GA700` `GA500` `Q2A` `Q2V` `CR700`

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type
251x	0	Number of entries	RO	No	UNS8
251x	1 - FF	Parameter Ax-yy	RW	No	UNS16

To write a value into a parameter of the AC drive, you must write the value to the corresponding sub-index of this object.

x: Defines the parameter sub-group

yy: Defines the parameter number

> **Note:**
>
> If parameter number is *00*, then the value for *yy* must be set to *FF*.
>
> For a detailed description of the parameters, refer to the Technical Manual of the AC drive used.

To write a value into a parameter A1-02 of the AC drive, you must write this value to object 2511, sub-index 02.

■ 252x (Hex): Main Parameter Group B

`GA800` `GA700` `GA500` `Q2A` `Q2V` `CR700`

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type
252x	0	Number of entries	RO	No	UNS8
252x	1 - FF	Parameter Bx-yy	RW	No	UNS16

To write a value into a parameter of the AC drive, you must write the value to the corresponding sub-index of this object.

x: Defines the parameter sub-group

yy: Defines the parameter number

Note:

If parameter number is *00*, then the value for *yy* must be set to *FF*.

For a detailed description of the parameters, refer to the Technical Manual of the AC drive used.

To write a value into a parameter B1-02 of the AC drive, you must write this value to object 2521, sub-index 02.

■ **253x (Hex): Main Parameter Group C**

`GA800` `GA700` `GA500` `Q2A` `Q2V` `CR700`

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type
253x	0	Number of entries	RO	No	UNS8
253x	1 - FF	Parameter Cx-yy	RW	No	UNS16

To write a value into a parameter of the AC drive, you must write the value to the corresponding sub-index of this object.

x: Defines the parameter sub-group

yy: Defines the parameter number

Note:

If parameter number is *00*, then the value for *yy* must be set to *FF*.

For a detailed description of the parameters, refer to the Technical Manual of the AC drive used.

To write a value into a parameter C1-02 of the AC drive, you must write this value to object 2531, sub-index 02.

■ **254x (Hex): Main Parameter Group D**

`GA800` `GA700` `GA500` `Q2A` `Q2V` `CR700`

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type
254x	0	Number of entries	RO	No	UNS8
254x	1 - FF	Parameter Dx-yy	RW	No	UNS16

To write a value into a parameter of the AC drive, you must write the value to the corresponding sub-index of this object.

x: Defines the parameter sub-group

yy: Defines the parameter number

Note:

If parameter number is *00*, then the value for *yy* must be set to *FF*.

For a detailed description of the parameters, refer to the Technical Manual of the AC drive used.

To write a value into a parameter D1-02 of the AC drive, you must write this value to object 2541, sub-index 02.

■ **255x (Hex): Main Parameter Group E**

`GA800` `GA700` `GA500` `Q2A` `Q2V` `CR700`

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type
255x	0	Number of entries	RO	No	UNS8
255x	1 - FF	Parameter Ex-yy	RW	No	UNS16

To write a value into a parameter of the AC drive, you must write the value to the corresponding sub-index of this object.

x: Defines the parameter sub-group

yy: Defines the parameter number

Note:

If parameter number is *00*, then the value for *yy* must be set to *FF*.

For a detailed description of the parameters, refer to the Technical Manual of the AC drive used.

To write a value into a parameter E1-02 of the AC drive, you must write this value to object 2551, sub-index 02.

■ 256x (Hex): Main Parameter Group F

`GA800` `GA700` `GA500` `Q2A` `Q2V` `CR700`

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type
256x	0	Number of entries	RO	No	UNS8
256x	1 - FF	Parameter Fx-yy	RW	No	UNS16

To write a value into a parameter of the AC drive, you must write the value to the corresponding sub-index of this object.

x: Defines the parameter sub-group

yy: Defines the parameter number

Note:

If parameter number is *00*, then the value for *yy* must be set to *FF*.

For a detailed description of the parameters, refer to the Technical Manual of the AC drive used.

To write a value into a parameter F1-02 of the AC drive, you must write this value to object 2561, sub-index 02.

■ 258x (Hex): Main Parameter Group H

`GA800` `GA700` `GA500` `Q2A` `Q2V` `CR700`

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type
258x	0	Number of entries	RO	No	UNS8
258x	1 - FF	Parameter Hx-yy	RW	No	UNS16

To write a value into a parameter of the AC drive, you must write the value to the corresponding sub-index of this object.

x: Defines the parameter sub-group

yy: Defines the parameter number

Note:

If parameter number is *00*, then the value for *yy* must be set to *FF*.

For a detailed description of the parameters, refer to the Technical Manual of the AC drive used.

To write a value into a parameter H1-02 of the AC drive, you must write this value to object 2581, sub-index 02.

■ 25Cx (Hex): Main Parameter Group L

`GA800` `GA700` `GA500` `Q2A` `Q2V` `CR700`

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type
25Cx	0	Number of entries	RO	No	UNS8
25Cx	1 - FF	Parameter Lx-yy	RW	No	UNS16

To write a value into a parameter of the AC drive, you must write the value to the corresponding sub-index of this object.

x: Defines the parameter sub-group

yy: Defines the parameter number

Note:

If parameter number is *00*, then the value for *yy* must be set to *FF*.

For a detailed description of the parameters, refer to the Technical Manual of the AC drive used.

To write a value into a parameter L1-02 of the AC drive, you must write this value to object 25C1, sub-index 02.

■ 25Ex (Hex): Main Parameter Group N

`GA800` `GA700` `GA500` `Q2A` `Q2V` `CR700`

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type
25Ex	0	Number of entries	RO	No	UNS8
25Ex	1 - FF	Parameter Nx-yy	RW	No	UNS16

To write a value into a parameter of the AC drive, you must write the value to the corresponding sub-index of this object.

x: Defines the parameter sub-group

yy: Defines the parameter number

Note:

If parameter number is *00*, then the value for *yy* must be set to *FF*.

For a detailed description of the parameters, refer to the Technical Manual of the AC drive used.

To write a value into a parameter N1-02 of the AC drive, you must write this value to object 25E1, sub-index 02.

■ 25Fx (Hex): Main Parameter Group O

GA800 GA700 GA500 Q2A Q2V CR700

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type
25Fx	0	Number of entries	RO	No	UNS8
25Fx	1 - FF	Parameter Ox-yy	RW	No	UNS16

To write a value into a parameter of the AC drive, you must write the value to the corresponding sub-index of this object.

x: Defines the parameter sub-group

yy: Defines the parameter number

Note:

If parameter number is *00*, then the value for *yy* must be set to *FF*.

For a detailed description of the parameters, refer to the Technical Manual of the AC drive used.

To write a value into a parameter O1-02 of the AC drive, you must write this value to object 25F1, sub-index 02.

■ 261x (Hex): Main Parameter Group Q

GA800 GA700 GA500 Q2A Q2V CR700

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type
261x	0	Number of entries	RO	No	UNS8
261x	1 - FF	Parameter Qx-yy	RW	No	UNS16

To write a value into a parameter of the AC drive, you must write the value to the corresponding sub-index of this object.

x: Defines the parameter sub-group

yy: Defines the parameter number

Note:

If parameter number is *00*, then the value for *yy* must be set to *FF*.

For a detailed description of the parameters, refer to the Technical Manual of the AC drive used.

To write a value into a parameter Q1-02 of the AC drive, you must write this value to object 2611, sub-index 02.

■ 262x (Hex): Main Parameter Group R

GA800 GA700 GA500 Q2A Q2V CR700

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type
262x	0	Number of entries	RO	No	UNS8
262x	1 - FF	Parameter Rx-yy	RW	No	UNS16

To write a value into a parameter of the AC drive, you must write the value to the corresponding sub-index of this object.

EN

x: Defines the parameter sub-group

yy: Defines the parameter number

Note:

If parameter number is *00*, then the value for *yy* must be set to *FF*.

For a detailed description of the parameters, refer to the Technical Manual of the AC drive used.

To write a value into a parameter R1-02 of the AC drive, you must write this value to object 2621, sub-index 02.

■ 264x (Hex): Main Parameter Group T

`GA800` `GA700` `GA500` `Q2A` `Q2V` `CR700`

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type
264x	0	Number of entries	RO	No	UNS8
264x	1 - FF	Parameter Tx-yy	RW	No	UNS16

To write a value into a parameter of the AC drive, you must write the value to the corresponding sub-index of this object.

x: Defines the parameter sub-group

yy: Defines the parameter number

Note:

If parameter number is *00*, then the value for *yy* must be set to *FF*.

For a detailed description of the parameters, refer to the Technical Manual of the AC drive used.

To write a value into a parameter T1-02 of the AC drive, you must write this value to object 2641, sub-index 02.

■ 265x (Hex): Main Parameter Group U

`GA800` `GA700` `GA500` `Q2A` `Q2V` `CR700`

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type
265x	0	Number of entries	RO	No	UNS8
265x	1 - FF	Parameter Ux-yy	RO	No	UNS16

To read a value from a parameter of the AC drive, you must write the value to the corresponding sub-index of this object.

x: Defines the parameter sub-group

yy: Defines the parameter number

Note:

If parameter number is *00*, then the value for *yy* must be set to *FF*.

For a detailed description of the parameters, refer to the Technical Manual of the AC drive used.

To read a value from a parameter U1-02 of the AC drive, you must write this value to object 2651, sub-index 02.

■ 2E00 (Hex): Gateway mode communication settings

`GA800` `GA700` `GA500` `Q2A` `Q2V` `CR700`

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type
2E00	0	Gateway mode communication settings	RW	Tx/Rx	UNS16

This object maps to the Command source update register used for the gateway mode.

- **Bit 0:** Drive 1 Update Command Enabled
- **Bit 1:** Drive 2 Update Command Enabled
- **Bit 2:** Drive 3 Update Command Enabled
- **Bit 3:** Drive 4 Update Command Enabled
- **Bit 4 - 15:** Reserved

■ 2E01 (Hex): Gateway slave 1 drive operation

`GA800` `GA700` `GA500` `Q2A` `Q2V` `CR700`

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type
2E01	0	Number of entries.	RO	No	UNS8
2E01	1	Slave 1 operation command	RW	Tx/Rx	UNS16
2E01	2	Slave 1 speed reference/limit	RW	Tx/Rx	UNS16

Slave 1 operation command

This object entry maps to the gateway mode Run Command (Drive 1) register.

- **Bit 0:** Fwd/Stop if H5-12 = 0, else Run/Stop
- **Bit 1:** Rev/Stop if H5-12 = 0, else Rev/Fwd
- **Bit 2:** External fault
- **Bit 3:** Fault reset
- **Bit 4:** ComRef
- **Bit 5:** ComCtrl
- **Bit 6 - 15:** Reserved

Slave 1 speed reference/limit

This object entry maps to the gateway mode Frequency Reference (Drive 1) register.

■ 2F01 (Hex): Gateway slave 1 drive status

GA800 GA700 GA500 Q2A Q2V CR700

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type
2F01	0	Number of entries.	RO	No	UNS8
2F01	1	Slave 1 drive status	RO	Tx	UNS16
2F01	2	Slave 1 output frequency	RO	Tx	UNS16

Slave 1 drive status

This object entry maps to the gateway mode Drive Status (Drive 1) register.

- **Bit 0:** During run
- **Bit 1:** During reverse run
- **Bit 2:** Drive ready
- **Bit 3:** Fault
- **Bit 4:** Frequency command setting fault
- **Bit 5:** No response from slave
- **Bit 6:** Communication error
- **Bit 7:** No response from slave 10 consecutive attempts
- **Bit 8:** Communication fault has occurred 10 consecutive times
- **Bit 9:** Receive broadcast command while drive is running
- **Bit 10:** Communication error with master drive
- **Bit 11 - 13:** Reserved
- **Bit 14:** ComRef status
- **Bit 15:** ComCtrl status

Slave 1 output frequency

This object entry maps to the gateway mode Output frequency or frequency reference (Drive Status Bit 4: ON) (Drive 1) register.

■ 2E02 (Hex): Gateway slave 2 drive operation

GA800 GA700 GA500 Q2A Q2V CR700

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type
2E02	0	Number of entries.	RO	No	UNS8
2E02	1	Slave 2 operation command	RW	Tx/Rx	UNS16
2E02	2	Slave 2 speed reference/limit	RW	Tx/Rx	UNS16

Slave 2 operation command

This object entry maps to the gateway mode Run Command (Drive 2) register.

- **Bit 0:** Fwd/Stop if H5-12 = 0, else Run/Stop
- **Bit 1:** Rev/Stop if H5-12 = 0, else Rev/Fwd
- **Bit 2:** External fault
- **Bit 3:** Fault reset
- **Bit 4:** ComRef
- **Bit 5:** ComCtrl
- **Bit 6 - 15:** Reserved

Slave 2 speed reference/limit

This object entry maps to the gateway mode Frequency Reference (Drive 2) register.

◼ 2F02 (Hex): Gateway slave 2 drive status

`GA800` `GA700` `GA500` `Q2A` `Q2V` `CR700`

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type
2F02	0	Number of entries.	RO	No	UNS8
2F02	1	Slave 2 drive status	RO	Tx	UNS16
2F02	2	Slave 2 output frequency	RO	Tx	UNS16

Slave 2 drive status

This object entry maps to the gateway mode Drive Status (Drive 2) register.

- **Bit 0:** During run
- **Bit 1:** During reverse run
- **Bit 2:** Drive ready
- **Bit 3:** Fault
- **Bit 4:** Frequency command setting fault
- **Bit 5:** No response from slave
- **Bit 6:** Communication error
- **Bit 7:** No response from slave 10 consecutive attempts
- **Bit 8:** Communication fault has occurred 10 consecutive times
- **Bit 9:** Receive broadcast command while drive is running
- **Bit 10:** Communication error with master drive
- **Bit 11 - 13:** Reserved
- **Bit 14:** ComRef status
- **Bit 15:** ComCtrl status

Slave 2 output frequency

This object entry maps to the gateway mode Output frequency or frequency reference (Drive Status Bit 4: ON) (Drive 2) register.

◼ 2E03 (Hex): Gateway slave 3 drive operation

`GA800` `GA700` `GA500` `Q2A` `Q2V` `CR700`

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type
2E03	0	Number of entries.	RO	No	UNS8
2E03	1	Slave 3 operation command	RW	Tx/Rx	UNS16
2E03	2	Slave 3 speed reference/limit	RW	Tx/Rx	UNS16

Slave 3 operation command

This object entry maps to the gateway mode Run Command (Drive 3) register.

- **Bit 0:** Fwd/Stop if H5-12 = 0, else Run/Stop
- **Bit 1:** Rev/Stop if H5-12 = 0, else Rev/Fwd
- **Bit 2:** External fault

- **Bit 3:** Fault reset
- **Bit 4:** ComRef
- **Bit 5:** ComCtrl
- **Bit 6 - 15:** Reserved

Slave 3 speed reference/limit

This object entry maps to the gateway mode Frequency Reference (Drive 3) register.

■ 2F03 (Hex): Gateway slave 3 drive status

GA800 GA700 GA500 Q2A Q2V CR700

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type
2F03	0	Number of entries.	RO	No	UNS8
2F03	1	Slave 3 drive status	RO	Tx	UNS16
2F03	2	Slave 3 output frequency	RO	Tx	UNS16

Slave 3 drive status

This object entry maps to the gateway mode Drive Status (Drive 3) register.

- **Bit 0:** During run
- **Bit 1:** During reverse run
- **Bit 2:** Drive ready
- **Bit 3:** Fault
- **Bit 4:** Frequency command setting fault
- **Bit 5:** No response from slave
- **Bit 6:** Communication error
- **Bit 7:** No response from slave 10 consecutive attempts
- **Bit 8:** Communication fault has occurred 10 consecutive times
- **Bit 9:** Receive broadcast command while drive is running
- **Bit 10:** Communication error with master drive
- **Bit 11 - 13:** Reserved
- **Bit 14:** ComRef status
- **Bit 15:** ComCtrl status

Slave 3 output frequency

This object entry maps to the gateway mode Output frequency or frequency reference (Drive Status Bit 4: ON) (Drive 3) register.

■ 2E04 (Hex): Gateway slave 4 drive operation

GA800 GA700 GA500 Q2A Q2V CR700

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type
2E04	0	Number of entries.	RO	No	UNS8
2E04	1	Slave 4 operation command	RW	Tx/Rx	UNS16
2E04	2	Slave 4 speed reference/limit	RW	Tx/Rx	UNS16

Slave 4 operation command

This object entry maps to the gateway mode Run Command (Drive 4) register.

- **Bit 0:** Fwd/Stop if H5-12 = 0, else Run/Stop
- **Bit 1:** Rev/Stop if H5-12 = 0, else Rev/Fwd
- **Bit 2:** External fault
- **Bit 3:** Fault reset
- **Bit 4:** ComRef
- **Bit 5:** ComCtrl
- **Bit 6 - 15:** Reserved

Slave 4 speed reference/limit

This object entry maps to the gateway mode Frequency Reference (Drive 4) register.

■ 2F04 (Hex): Gateway slave 4 drive status

`GA800` `GA700` `GA500` `Q2A` `Q2V` `CR700`

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type
2F04	0	Number of entries.	RO	No	UNS8
2F04	1	Slave 4 drive status	RO	Tx	UNS16
2F04	2	Slave 4 output frequency	RO	Tx	UNS16

Slave 4 drive status

This object entry maps to the gateway mode Drive Status (Drive 4) register.

- **Bit 0:** During run
- **Bit 1:** During reverse run
- **Bit 2:** Drive ready
- **Bit 3:** Fault
- **Bit 4:** Frequency command setting fault
- **Bit 5:** No response from slave
- **Bit 6:** Communication error
- **Bit 7:** No response from slave 10 consecutive attempts
- **Bit 8:** Communication fault has occurred 10 consecutive times
- **Bit 9:** Receive broadcast command while drive is running
- **Bit 10:** Communication error with master drive
- **Bit 11 - 13:** Reserved
- **Bit 14:** ComRef status
- **Bit 15:** ComCtrl status

Slave 4 output frequency

This object entry maps to the gateway mode Output frequency or frequency reference (Drive Status Bit 4: ON) (Drive 4) register.

■ 4000 (Hex): Option NVS FATAL Record

`A1000` `V1000` `D1000` `R1000` `U1000` `GA800` `GA700` `GA500` `Q2A` `Q2V` `CR700`

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value (Range)
4000	0	Option NVS (Non-volatile Storage) FATAL Record	RW	No	UNS8	14
4000	1	Number of FATALs	RO	No	UNS16	0 (0 - FFFF (Hex))

Information regarding a system failure/crash is stored in this object and can be read out for on-site troubleshooting.

Writing FB (Hex) to sub-index 0 will clear the record in NVS memory.

■ 4001 (Hex): Option Info + Status Record

`A1000` `V1000` `D1000` `R1000` `U1000` `GA800` `GA700` `GA500` `Q2A` `Q2V` `CR700`

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value (Range)
4001	0	Number of entries	RO	No	UNS8	5
4001	1	OptBootFwRev	RO	No	UNS32	00AABBCC
4001	2	OptAppFwRev	RO	No	UNS32	00AABBCC
4001	3	OptRunTimeMS	RO	No	UNS32	0 (0 - FFFFFFFF (Hex))

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value (Range)
4001	4	NOISystem: iSysErrorBits	RO	No	UNS16	0 (0 - FFFF (Hex))
4001	5	NOISystem: iSysErrorBitsLatched	RO	No	UNS16	0 (0 - FFFF (Hex))

This object provides general information of option system firmware parts and internal system states.

OptBootFwRev

This object entry shows the drive model code.

Value:

- AA = Major revision
- BB = Minor revision
- CC = Build

OptAppFwRev

Application firmware revision in flash.

Value:

- AA = Major revision
- BB = Minor revision
- CC = Build

OptRunTimeMS

Total running time in milliseconds of option system since power-up.

NOISystem: iSysErrorBits

NOI System active error bits.

NOISystem: iSysErrorBitsLatched

NOI System latched (All errors that have occurred since start-up) error bits.

■ 4010 (Hex): Store Parameters

`A1000` `V1000` `D1000` `R1000` `U1000` `GA800` `GA700` `GA500` `Q2A` `Q2V` `CR700`

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value
4010	0	Store parameters	RW	No	UNS32	01 (Hex) (Save on command)

By writing "save" to this object, the Communication Option settings are saved in the non-volatile memory.

Signature	MSB			LSB
ASCII	e	v	a	s
Hex	65	76	61	73

Actions: Will issue Limited Enter command. Writes data into the EEPROM of the drive and enables the data in RAM at the same time. Parameter changes remain even if the power supply is cycled.

Note:

Because the EEPROM can be written to a maximum of 100,000 times, refrain from writing to the EEPROM too often.

■ 4011 (Hex): Restore Default Parameters

`A1000` `V1000` `D1000` `R1000` `U1000` `GA800` `GA700` `GA500` `Q2A` `Q2V` `CR700`

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value
4011	0	Restore default parameters	RW	No	UNS32	01 (Hex) (Restore on command)

By writing "load" to this object, the Communication Option default settings are restored.

EN

Signature	MSB			LSB
ASCII	d	a	o	l
Hex	64	61	6F	6C

Actions: Option will write value=2220 to A1-03 (INVR:0103 (Hex)) together with an EEPROM ENTER command.

Note:

Because the EEPROM can be written to a maximum of 100,000 times, refrain from writing to the EEPROM too often.

◆ Regenerative Units Specific Objects Details

These objects are used for devices capable of regeneration.

■ 5000 (Hex): Regenerated Energy

`D1000` `R1000` `U1000`

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value (Range)
5000	0	Number of entries	RW	No	UNS8	3 (0, 3)
5000	1	Regenerated energy GWh Mapped to MEMOBUS/Modbus address 0823 (Hex) [Regenerated energy GWh]	RO	Tx	UNS16	0 (0 - FFFF (Hex))
5000	2	Regenerated energy MWh Mapped to MEMOBUS/Modbus address 0824 (Hex) [Regenerated energy MWh]	RO	Tx	UNS16	0 (0 - FFFF (Hex))
5000	3	Regenerated energy kWh Mapped to MEMOBUS/Modbus address 0825 (Hex) [Regenerated energy kWh]	RO	Tx	UNS16	0 (0 - FFFF (Hex))

Energy regenerated by the regenerative unit.

0: Regenerated Energy

Write 0 to sub-index 0 to clear this object as well as object 5004 (Hex) [Consumed Energy].

■ 5001 (Hex): Input Voltage

`D1000` `R1000` `U1000`

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value (Range)
5001	-	Input voltage Mapped to MEMOBUS/Modbus address 1083 (Hex) [Power Supply Voltage]	RW	Tx	UNS16	0 (0 - FFFF (Hex))

This object determines the input voltage of the regenerative unit.

■ 5002 (Hex): Current Limit

`D1000` `R1000`

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value (Range)
5002	0	Number of entries	RO	No	UNS8	2
5002	1	Positive current limit Mapped to MEMOBUS/Modbus address 0004 (Hex) [Active Current Limit (Positive)]	RW	Rx/Tx	UNS16	0 (0.0 - 100.0)
5002	2	Negative current limit Mapped to MEMOBUS/Modbus address 000E (Hex) [Active Current Limit (Negative)]	RW	Rx/Tx	UNS16	0 (0.0 - 100.0)

This object can be used to set and read out the positive and negative current limit.

Current Limit value is determined in units of 0.1% of rated current.

Positive current: motoring current.

Negative current: regenerative current.

■ 5003 (Hex): AC Power

`D1000` `R1000`

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value (Range)
5003	-	AC Power Mapped to MEMOBUS/Modbus address 1086 (Hex) [Power Supply Side Power]	RO	Tx	UNS16	0 (0 - FFFF (Hex))

This object can be used to read out the AC power from the device.

■ 5004 (Hex): Consumed Energy

`D1000` `U1000`

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value (Range)
5004	0	Number of entries	RW	No	UNS8	3 (0, 3)
5004	1	Consumed energy GWh Mapped to MEMOBUS/Modbus address 0820 (Hex) [Regenerated energy GWh]	RO	Tx	UNS16	0 (0 - FFFF (Hex))
5004	2	Consumed energy MWh Mapped to MEMOBUS/Modbus address 0821 (Hex) [Regenerated energy MWh]	RO	Tx	UNS16	0 (0 - FFFF (Hex))
5004	3	Consumed energy kWh Mapped to MEMOBUS/Modbus address 0822 (Hex) [Regenerated energy kWh]	RO	Tx	UNS16	0 (0 - FFFF (Hex))

Energy consumed by the regenerative unit.

0: Consumed Energy

Write 0 to sub-index 0 to clear this object as well as object 5000 (Hex) [Regenerated Energy].

■ 5005 (Hex): DC Bus Voltage Reference

`D1000` `R1000`

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value (Range)
5005	-	DC bus voltage reference Mapped to MEMOBUS/Modbus address 000D (Hex) [DC Bus Voltage Reference]	RW	Rx/Tx	UNS16	0 (0 - FFFF (Hex))

This object can be used to read out the DC bus voltage reference.

◆ Drives and Motion Profile Objects (DS402) Details

The drive supports the Drive and Motion Profile DSP 402 Velocity Mode. Before using the Velocity Mode, set parameter o1-03 = 2.

Figure 8.2 Velocity mode with all objects

■ 6040 (Hex): Controlword

`A1000` `V1000` `U1000` `GA800` `GA700` `GA500` `Q2A` `Q2V` `CR700`

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value (Range)
6040	0	Controlword	RW	Rx/Tx	UNS16	-

This object sets the device to different states.

■ 6041 (Hex): Statusword

`A1000` `V1000` `U1000` `GA800` `GA700` `GA500` `Q2A` `Q2V` `CR700`

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value (Range)
6041	0	Statusword	RW	Rx/Tx	UNS16	-

This object shows different states of the device.

■ 6042 (Hex): vl Target Velocity

`A1000` `V1000` `U1000` `GA800` `GA700` `GA500` `Q2A` `Q2V` `CR700`

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value (Range)
6042	0	vl Target Velocity Mapped to MEMOBUS/Modbus address 0010 (Hex) [Reference frequency in rpm]	RW	Rx/Tx	SINT16	0 (-32768 - 32767)

This object sets the drive internal speed reference. It is internally multiplied with the 604C (Hex) vl dimension factor. The AC drive works internally with absolute values only. Negative values written to this object set the internal reverse run command.

■ 6043 (Hex): vl Velocity Demand

`A1000` `V1000` `U1000` `GA800` `GA700` `GA500` `Q2A` `Q2V` `CR700`

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value (Range)
6043	0	vl Velocity Demand Mapped to MEMOBUS/Modbus address 003E (Hex) [Output frequency in rpm]	RO	Tx	SINT16	0 (-32768 - 32767)

This object shows the output frequency (rpm) of the drive to the motor. The AC drive works internally with absolute values only. Negative values read from this object depend upon internal reverse run command.

■ 6044 (Hex): vl Velocity Control Effort/Actual Value

`A1000` `V1000` `U1000` `GA800` `GA700` `GA500` `Q2A` `Q2V` `CR700`

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value (Range)
6044	0	vl Velocity Control Effort/Actual Value Mapped to: - If A1-02 = (0 or 5), MEMOBUS/Modbus address 003E (Hex) [Output frequency in rpm] - Else MEMOBUS/Modbus address 00AC (Hex) [Motor speed in rpm]	RO	Tx	SINT16	0 (-32768 - 32767)

This object shows the measured/calculated motor speed. The AC drive works internally with absolute values only. Negative values read from this object depend upon internal reverse run command.

■ 6046 (Hex): vl Velocity Min Max Amount

`A1000` `V1000` `U1000` `GA800` `GA700` `GA500` `Q2A` `Q2V` `CR700`

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value (Range)
6046	1	vl Velocity Min Amount; in rpm Mapped to MEMOBUS/Modbus address 028A (Hex) (*d2-02 [Frequency reference lower limit]*)	RO	Rx/Tx	UNS32	0 $(0 - 2^{32}-1)$
6046	2	vl Velocity Max Amount; in rpm Mapped to MEMOBUS/Modbus address 0289 (Hex) (*d2-01 [Frequency reference upper limit]*)	RO	Rx/Tx	UNS32	0 $(0 - 2^{32}-1)$

Object 6046 (Hex) sets the minimum and maximum allowable speed of the AC drive. The indices 1 & 2 are mapped to AC drive parameters *d2-02 [Frequency reference lower limit]* and *d2-01 [Frequency reference upper limit]* respectively. Internal calculation is performed on the value entered into this object.

If this object is PDO-mapped and the values of this object are changed constantly, then SDO traffic may be blocked. If your application requires sending SDOs and PDOs simultaneously, then wait a minimum of 10 ms between changes of this object.

Note:

When switching between motor 1 and motor 2 or switching control modes, the calculation will use old internal values until the object content is changed. The changing of object content triggers the use of the appropriate internal values.

■ 6048 (Hex): vl Velocity Acceleration

`A1000` `V1000` `U1000` `GA800` `GA700` `GA500` `Q2A` `Q2V` `CR700`

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value (Range)
6048	1	Acceleration Delta Speed; in rpm	RO	Rx/Tx	UNS32	(0 - 2^{32}-1)
6048	2	Acceleration Delta Time; in sec	RO	Rx/Tx	UNS16	(0 - 65535)

Object 6048 (Hex) sets the acceleration ramp of the AC drive. The indices 1 & 2 are mapped to AC drive parameter *C1-01 [Acceleration time 1]*. Internal calculation is performed on the value entered into this object.

If this object is PDO-mapped and the values of this object are changed constantly, then SDO traffic may be blocked. If your application requires sending SDOs and PDOs simultaneously, then wait a minimum of 10 ms between changes of this object.

Note:

When switching between motor 1 and motor 2 or switching control modes, the calculation will use old internal values until the object content is changed. The changing of object content triggers the use of the appropriate internal values.

■ 6049 (Hex): vl Velocity Deceleration

`A1000` `V1000` `U1000` `GA800` `GA700` `GA500` `Q2A` `Q2V` `CR700`

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value (Range)
6049	1	Acceleration Delta Speed; in rpm	RO	Rx/Tx	UNS32	(0 - 2^{32}-1)
6049	2	Acceleration Delta Time; in sec	RO	Rx/Tx	UNS16	(0 - 65535)

Object 6049 (Hex) sets the deceleration ramp of the AC drive. The indices 1 & 2 are mapped to AC drive parameter *C1-02 [Deceleration time 1]*. Internal calculation is performed on the value entered into this object.

If this object is PDO-mapped and the values of this object are changed constantly, then SDO traffic may be blocked. If your application requires sending SDOs and PDOs simultaneously, then wait a minimum of 10 ms between changes of this object.

Note:

When switching between motor 1 and motor 2 or switching control modes, the calculation will use old internal values until the object content is changed. The changing of object content triggers the use of the appropriate internal values.

■ 604A (Hex): vl Velocity Quick Stop

`A1000` `V1000` `U1000` `GA800` `GA700` `GA500` `Q2A` `Q2V` `CR700`

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value (Range)
604A	1	Quick Stop Delta Speed; in rpm	RW	Rx/Tx	UNS32	(0 - 2^{32}-1)
604A	2	Quick Stop Delta Time; in sec	RW	Rx/Tx	UNS16	(0 - 65535)

Object 604A (Hex) sets the Fast-Stop deceleration ramp of the AC drive. The indices 1 & 2 are mapped to AC drive parameter *C1-09 [Fast-Stop Time]*. Internal calculation is performed on the value entered into this object.

If this object is PDO-mapped and the values of this object are changed constantly, then SDO traffic may be blocked. If your application requires sending SDOs and PDOs simultaneously, then wait a minimum of 10 ms between changes of this object.

Note:

When switching between motor 1 and motor 2 or switching control modes, the calculation will use old internal values until the object content is changed. The changing of object content triggers the use of the appropriate internal values.

■ 604C (Hex): vl Dimension Factor

A1000 V1000 U1000 GA800 GA700 GA500 Q2A Q2V CR700

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value (Range)
604C	1	vl Dimensions Factor numerator	RW	Rx/Tx	SINT32	1 $(-2^{31} - 2^{32}-1)$
604C	2	vl Dimensions Factor denominator	RW	Rx/Tx	SINT32	1 $(-2^{31} - 2^{32}-1)$

The vl dimension factor is multiplied with the target velocity. The quotient of the subindexes vl dimension factor numerator and vl dimension factor denominator determines the vl dimension factor.

The following objects are multiplied by the dimension factor and are always used in a product (multiplication):

Object (Hex)	Object name	Reference	Object (Hex)	Object name	Reference
6042	vl_target_velocity	60	6048	vl_velocity_acceleration	61
6043	vl_velocity_demand	60	6049	vl_velocity_deceleration	61
6044	vl-control_effort	60	604A	vl_velocity_quick_stop	61
6046	vl_velocity_min_max_amount	60			

■ 604D (Hex): vl Pole Number

A1000 V1000 U1000 GA800 GA700 GA500 Q2A Q2V CR700

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value (Range)
604D	0	vl Pole Number Internal Register depends on control mode and motor selected.	RW	Tx	UNS8	4 (2 - 254)

This object sets the number of motor poles and is used to calculate all speed related values in r/min. This value corresponds to the number of motor poles setting in the drive.

■ 6060 (Hex): Modes of Operation

A1000 V1000 U1000 GA800 GA700 GA500 Q2A Q2V CR700

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value
6060	0	Modes of Operation	RW	Rx/Tx	SINT8	2

This object sets the mode of the device. The object supports 2 (Velocity Mode) only. Refer to *Supported Modes of Operation on page 26*.

Supported modes:

Value	Description
2	Velocity mode

■ 6061 (Hex): Modes of Operation Display

A1000 V1000 U1000 GA800 GA700 GA500 Q2A Q2V CR700

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value (Range)
6061	0	Modes of Operation	RW	Tx	SINT8	- (-2, 2)

This object shows the mode of the device. Refer to *Supported Modes of Operation on page 26*.

Supported modes:

Value	Description
2	Velocity mode
-2	Vendor control mode

■ 60FD (Hex): Digital Inputs

A1000 V1000 U1000 GA800 GA700 GA500 Q2A Q2V CR700

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value (Range)
60FD	0	Drive digital input status	RO	Tx	UNS32	- (0 - 2^{32}-1)

This object contains the drive digital output status (seen as input to the network). The content of this object is equal to drive MEMOBUS/Modbus register 004A (Hex) (*U1-11 [Drive Output Terminal Status]*). For details on the content of this register refer to the technical manual for the drive.

Bit defines:

Signature	Bit (Hex)	GA700	Q2A	A1000	V1000
LSB	0 - F	0 (reserved)	0 (reserved)	0 (reserved)	0 (reserved)
	10	Terminals M1-M2	Terminals 2NO-2CM	Terminals M1-M2	Multi-Function Digital Output (fault) (terminal MA/MB-MC)
	11	Terminals M3-M4	Terminals 3NO-3CM	Terminals M3-M4	Multi-Function Digital Output 1 (terminal P1) enabled
	12	Terminals M5-M6	Terminals 4NO-4CM	Terminals M5-M6	Multi-Function Digital Output 2 (terminal P2) enabled
	13	0 (not used)	0 (not used)	0 (not used)	0 (not used)
	14	0 (not used)	0 (not used)	0 (not used)	0 (not used)
	15	0 (not used)	0 (not used)	0 (not used)	0 (not used)
	16	0 (not used)	0 (not used)	0 (not used)	0 (not used)
	17	Faulty Relay MA/MB-MC	Faulty Relay 1NO/1NC-1CM	Faulty Relay MA/MB-MC	0 (not used)
	18	0 (not used)	0 (not used)	0 (not used)	0 (not used)
	19	0 (not used)	0 (not used)	0 (not used)	0 (not used)
	1A	0 (not used)	0 (not used)	0 (not used)	0 (not used)
	1B	0 (not used)	0 (not used)	0 (not used)	0 (not used)
	1C	0 (not used)	0 (not used)	0 (not used)	0 (not used)
	1D	0 (not used)	0 (not used)	0 (not used)	0 (not used)
	1E	0 (not used)	0 (not used)	0 (not used)	0 (not used)
MSB	1F	0 (not used)	0 (not used)	0 (not used)	0 (not used)

Value	Description
1	On
0	Off

■ 60FE (Hex): Digital Outputs

A1000 V1000 U1000 GA800 GA700 GA500 Q2A Q2V CR700

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value (Range)
60FE	0	Number of elements	RO	-	UNS8	1
60FE	1	Physical outputs	RW	Rx/Tx	UNS32	- (0 - 2^{32}-1)

This object is used to set drive digital inputs (seen as output from the network).

Bit defines:

Signature	Bit (Hex)	GA700	Q2A	A1000	V1000
LSB	0 - F	0 (reserved)	0 (reserved)	0 (reserved)	0 (reserved)
	10	When H5-12 = 0, Forward run/stop 1: Forward run, 0: Stop When H5-12 = 1, run/stop 1: Run, 0: Stop	When H5-12 = 0, Forward run/stop 1: Forward run, 0: Stop When H5-12 = 1, run/stop 1: Run, 0: Stop	Terminal S1 Function	Terminal S1 Function
	11	When H5-12 = 0, Forward run/stop 1: Forward run, 0: Stop When H5-12 = 1, run/stop 1: Run, 0: Stop	When H5-12 = 0, Forward run/stop 1: Forward run, 0: Stop When H5-12 = 1, run/stop 1: Run, 0: Stop	Terminal S2 Function	Terminal S2 Function
	12	External Fault (EF0)	External Fault (EF0)	Terminal S3 Function	Terminal S3 Function
	13	Fault Reset	Fault Reset	Terminal S4 Function	Terminal S4 Function
	14	Multi-function input command 1	Multi-function input command 1	Terminal S5 Function	Terminal S5 Function
	15	Multi-function input command 2	Multi-function input command 2	Terminal S6 Function	Terminal S6 Function
	16	Multi-function input command 3	Multi-function input command 3	Terminal S7 Function	0 (reserved)
	17	Multi-function input command 4	Multi-function input command 4	Terminal S8 Function	0 (reserved)
	18	Multi-function input command 5	Multi-function input command 5	External Fault (EF0)	External Fault (EF0)
	19	Multi-function input command 6	Multi-function input command 6	Fault Reset	Fault Reset
	1A	Multi-function input command 7	Multi-function input command 7	0 (reserved)	0 (reserved)
	1B	Multi-function input command 8	Multi-function input command 8	0 (reserved)	0 (reserved)
	1C	0 (reserved)	0 (reserved)	0 (reserved)	0 (reserved)
	1D	0 (reserved)	0 (reserved)	0 (reserved)	0 (reserved)
	1E	0 (reserved)	0 (reserved)	0 (reserved)	0 (reserved)
MSB	1F	0 (reserved)	0 (reserved)	0 (reserved)	0 (reserved)

Value	Description
1	On
0	Off

■ 6502 (Hex): Supported Drive Modes

A1000   V1000   U1000   GA800   GA700   GA500   Q2A   Q2V   CR700

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value
6502	-	Supported Drive Modes Mapped to: MEMOBUS/Modbus address 00020002 (Hex) [vl velocity mode and vendor specific]	RO	Tx	UNS32	00020002 (Hex)

This object displays the supported drive modes.

9   Process Data Objects (PDO)

◆ PDOs and Default PDO Setup

PDOs (Process Data Object) will be used for I/O exchange. PDOs are mapped to objects during configuration (PRE-OPERATIONAL state). TxPDOs are used to transfer data from the option card and RxPDOs are used to transfer data to the option card.

The Communication Option card supports at least 8 parameters mapped to RxPDO and 8 parameters mapped to TxPDO.

The drive supports 15 Receive and 16 Transmit PDOs. The following tables show available PDOs, their default settings and the objects required to set up when changing the PDO configuration or the PDO mapping.

◆ Transmit PDOs (TxPDO)

The Transmit PDOs have a default mapping according to the table below. The transmit PDOs can be re-mapped by the end user by writing to map objects 1A00 (Hex) - 1A28 (Hex). Refer to *Communication Profile Objects (DS301) on page 30*.

Table 9.1 Transmit PDO Mapping

PDO Number	Mapped Objects (Hex)	Index (Hex)
1	Sub-index 1: 6041:0, 2-bytes [DSP402 status word]	1A00
2	Sub-index 1: 6041:0, 2-bytes [DSP402 status word] Sub-index 2: 6061:0, 2-bytes [DSP402 Modes of operation display]	1A01
6	Sub-index 1: 6041:0, 2-bytes [DSP402 status word] Sub-index 2: 6044:0, 2-bytes [vl control effort]	1A05
7	Sub-index 1: 6041:0, 2-bytes [DSP402 status word] Sub-index 2: 60FD:0, 4-bytes [Digital inputs]	1A06
21	Sub-index 1: 6042:0, 2-bytes [vl target velocity]	1A14
22	Sub-index 1: 6043:0, 2-bytes [vl velocity demand]	1A15
23	Sub-index 1: 6048:1, 4-bytes [vl Accel delta speed] Sub-index 2: 6048:2, 2-bytes [vl Accel delta time]	1A16
24	Sub-index 1: 6049:1, 4-bytes [vl Decel delta speed] Sub-index 2: 6049:2, 2-bytes [vl Decel delta time]	1A17
25	Sub-index 1: 604A:1, 4-bytes [vl quick-stop delta speed] Sub-index 2: 604A:2, 2-bytes [vl quick-stop delta time]	1A18
26	Sub-index 1: 604C:1, 4-bytes [vl Dimension factor] Sub-index 2: 604C:2, 4-bytes [vl Dimension factor]	1A19
36	Sub-index 1: 2100:1, 2-bytes [Drive status]	1A23
37	Sub-index 1: 2110:1, 2-bytes [Output frequency]	1A24
38	Sub-index 1: 2120:1, 2-bytes [Output current]	1A25
39	Sub-index 1: 2130:1, 2-bytes [Output torque reference]	1A26
40	Sub-index 1: 2140:1, 2-bytes [MEMOBUS/Modbus read response]	1A27
41	Sub-index 1: 2150:1, 2-bytes [MEMOBUS/Modbus write response]	1A28
42	Sub-index 1: 6041:0, 2-bytes [DSP402 status word] Sub-index 2: 6061:0, 1-byte [DSP402 Modes of operation display] Sub-index 3: 6044:0, 2-bytes [DSP402 vl velocity actual value] Sub-index 4: 60FD:0, 4-bytes [DSP402 Digital inputs] Sub-index 5: 6042:0, 2-bytes [DSP402 vl target velocity] Sub-index 6: 6043:0, 2-bytes [DSP402 vl velocity demand]	1A29
81	Sub-index 1: 2100:1, 2-bytes [Drive status] Sub-index 2: 5001:0, 2-bytes [Input voltage] Sub-index 3: 5003:0, 2-bytes [AC power] Sub-index 4: 2210:1, 2-bytes [DC bus voltage]	1A50

◆ Receive PDOs (RxPDO)

The Receive PDOs have a default mapping according to the table below. The end user can re-map Receive PDOs by writing to the map objects 1600 (Hex) - 1628 (Hex). Refer to *Communication Profile Objects (DS301) on page 30*.

Table 9.2 Receive PDO Mapping

PDO Number	Mapped Objects (Hex)	Index (Hex)
1	Sub-index 1: 6040:0, 2-bytes [DSP402 control word]	1600
2	Sub-index 1: 6040:0, 2-bytes [DSP402 control word] Sub-index 2: 6060:0, 1-bytes, [DSP402 Modes of operation]	1601
6	Sub-index 1: 6040:0, 2-bytes [DSP402 control word] Sub-index 2: 6042:0, 2-bytes, [Vl target velocity]	1605
7	Sub-index 1: 6040:0, 2-bytes [DSP402 control word] Sub-index 2: 60FE:1, 4-bytes, [Physical digital outputs]	1606
8	Sub-index 1: 6040:0, 2-bytes [DSP402 control word] Sub-index 2: 6060:0, 1-bytes, [DSP402 Modes of operation]	1607

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PDO Number	Mapped Objects (Hex)	Index (Hex)
21	Sub-index 1: 6048:1, 4-bytes [Vl Accel delta speed] Sub-index 2: 6048:2, 2-bytes, [Vl Accel delta time]	1614
22	Sub-index 1: 6049:1, 4-bytes [Vl Decel delta speed] Sub-index 2: 6049:2, 2-bytes, [Vl Decel delta time]	1615
23	Sub-index 1: 604A:1, 4-bytes [Vl quick-stop delta speed] Sub-index 2: 604A:2, 2-bytes, [Vl quick-stop delta time]	1616
24	Sub-index 1: 604C:1, 4-bytes [Vl Dimension factor] Sub-index 2: 604C:2, 4-bytes, [Vl Dimension factor]	1617
36	Sub-index 1: 2000:1, 2-bytes [Operation command]	1623
37	Sub-index 1: 2010:1, 2-bytes [Speed reference/limit]	1624
38	Sub-index 1: 2020:1, 2-bytes [Torque reference/limit]	1625
39	Sub-index 1: 2030:1, 2-bytes [Torque compensation]	1626
40	Sub-index 1: 2040:1, 4-bytes [MEMOBUS read request]	1627
41	Sub-index 1: 2050:1, 4-bytes [MEMOBUS write request]	1628
42	Sub-index 1: 6040:0, 2-bytes [DSP402 control word] Sub-index 2: 6042:0, 2-bytes [DSP402 vl target velocity] Sub-index 3: 6048:1, 4-bytes [DSP402 vl velocity acceleration delta speed] Sub-index 4: 6048:2, 2-bytes [DSP402 vl velocity acceleration delta time] Sub-index 5: 6049:1, 4-bytes [DSP402 vl velocity deceleration delta speed] Sub-index 6: 6049:2, 2-bytes [DSP402 vl velocity deceleration delta time] Sub-index 7: 6046:1, 4-bytes [vl velocity min amount] Sub-index 8: 6046:2, 4-bytes [vl velocity max amount]	1629
81	Sub-index 1: 2000:1, 2-bytes [Operation command]	1650

◆ RxPDO Mapped Drive Registers Above 0100 (Hex) Range

Drive registers up to 00FF (Hex) can be configured as process data exchanged on each I/F scan cycle. Drive registers from 0100 (Hex) cannot be exchanged on each I/F scan cycle.

To be able to RxPDO map those objects on EtherCAT a "slow" IO channel has been realized inside the option system firmware. This slow IO channel is using the overlaid MEMOBUS/Modbus channel in I/F to write the drive registers required.

When the RxPDO mapping is performed on any drive register and the address is larger than 0100 (Hex) it will be added to the slow IO control set. ENTER command management for slow IO channel control sets:

- New value only written against drive if it changes from the previously written value.
- If a value update is detected the write will be scheduled directly after the RxPDO EtherCAT process data cycle is complete.
- If the written value via MEMOBUS/Modbus failed for some reason, i.e. Parameter cannot be written when the drive is running, a new retry will be triggered after 8 ms.
- If a RAM ENTER command is required for the written value to be used by the drive, the ENTER command will be written when the last register that should be updated in an slow IO data scan set update is triggered.
  - I.e mapped drive registers: A: 0200 (Hex), B: 0201 (Hex), C: 0203 (Hex)
    - ♦ All three registers changes at the same time: RAM ENTER command executed with C.
    - ♦ Only register 0200 (Hex) changes: RAM ENTER command executed with A.

Table 9.3 Objects Managed in the Slow IO Channel

CoE Object (Hex)	Linked INV Register	Information
2080, 2090, 20A0, 20B0, 20C0, 3000, 3100	If sub-index 2 MEMOBUS address is > 0100 (Hex) that address is linked.	Configurable input objects
2040, 2140	Register address in MEMOBUS read payload	Overlaid MEMOBUS read channel, request and response CoE objects
2050, 2150	Register address in MEMOBUS write payload	Overlaid MEMOBUS write channel, request and response CoE objects **Note:** No ENTER command is executed for this request. It has to be manually managed with object 2060 (Hex).
2051, 2151	Register address in MEMOBUS write payload	Overlaid advanced MEMOBUS write channel, request and response CoE objects **Note:** No ENTER command is executed for this request. It has to be manually managed with object 2060 (Hex).

CoE Object (Hex)	Linked INV Register	Information
2060, 2061, 2160, 2161	0910 (Hex) [RAM Enter]	MEMOBUS RAM (un-memorized) Enter command
6046:1	028A (Hex) / d2-02 [Frequency Reference Lower Limit]	AC drive frequency reference lower limit
6046:2	0289 (Hex) / d2-01 [Frequency Reference Upper Limit]	AC drive frequency reference upper limit
6048:1, 6048:2	0200 (Hex) / C1-01 [Acceleration Time 1]	vl velocity acceleration #1 = delta speed #2 = delta time
6049:1, 6049:2	0201 (Hex) / C1-02 [Deceleration Time 1]	vl velocity deceleration #1 = delta speed #2 = delta time
604A:1, 604A:2	0208 (Hex) / C1-09 [Fast Stop Time]	vl velocity quick stop #1 = delta speed #2 = delta time

10 Troubleshooting

◆ Communication Option Card Error Codes

If a fault or alarm occurs in the inverter drive or regenerative unit, the fault or alarm will be stored in consecutive sub-indices of object 1003. Additionally an emergency telegram will be sent once.

Index (Hex)	Sub	Content	Acc.	PDO Map.	Data Type	Value (Range)
1003	0	Number of errors	RW	No	UNS8	00 (Hex) (00 - FF (Hex))
1003	1	Standard error field (Emergency error code)	RO	No	UNS32	0000 (Hex) (0000 - FFB8 (Hex))

Table 10.1 Emergency Telegram Specification

Byte	0	1	2	3	4	5	6	7
Content	Emergency Error Code			Error register object 1001 (Hex) = 1	Manufacturer specific error info. Not used. Set to zero.			

◆ Emergency Error Codes

Error Code (Hex)	Meaning	Drive Display	Value of MEMOBUS/ Modbus Address 0080 (Hex)
0000	No error	No error	00
5450	DC Fuse Blowout	FUd	01
3220	DC bus undervoltage	Uv1	02
5200	Ctrl Power Supply Voltage Fault	Uv2	03
3221	SoftCharge Bypass Circuit Fault	Uv3	04
2340	Out Short Circuit or IGBT Fault	SC	05
2330	Ground Fault	GF	06
2220	Overcurrent	oC	07
3210	DC Bus Overvoltage	ov	08
4280	Heatsink Overheat	oH	09
4210	Heatsink Overheat	oH1	0A
2310	Motor Overload	oL1	0B
2221	Drive Overloaded	oL2	0C
2311	Overtorque Detection 1	oL3	0D
2312	Overtorque Detection 2	oL4	0E
5420	Dynamic Braking Transistor	rr	0F
4410	Braking Resistor Overheat	rH	10

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Error Code (Hex)	Meaning	Drive Display	Value of MEMOBUS/ Modbus Address 0080 (Hex)
5441	External Fault (terminal S3)	EF3	11
5442	External Fault (terminal S4)	EF4	12
5443	External Fault (terminal S5)	EF5	13
5444	External Fault (terminal S6)	EF6	14
5445	External Fault (terminal S7)	EF7	15
5480	External Fault (terminal S8)	EF8	16
FF01	Internal Fan Fault	FAn	17
7180	Overspeed	oS	18
8321	Speed Deviation	dEv	19
7305	PG Disconnect	PGo	1A
3130	Input Phase Loss	PF	1B
3300	Output Phase Loss	LF	1C
FF02	Motor Overheat Alarm (PTC Input)	oH3	1D
5300	Keypad Connection Fault	oPr	1E
5530	EEPROM Write Error	Err	1F
4310	Motor Overheat Fault (PTC Input)	oH4	20
FF03	MEMOBUS/Modbus Communication Fault	CE	21
FF04	Option Communication Error	bUS	22
FF05	Control Fault	CF	25
8313	Zero Servo Fault	SvE	26
5481	Option Card External Fault	EF0	27
FF06	PID Feedback Loss	FbL	28
FF07	Undertorque Detection 1	UL3	29
FF08	Undertorque Detection 2	UL4	2A
FF09	High Slip Braking oL	oL7	2B
FF0A	External Fault 9	EF9	2C
FF0B	External Fault 10	EF10	2D
FF0C	External Fault 11	EF11	2E
FF0D	External Fault 12	EF12	2F
6000	Hardware Fault	oFx	30
FF0E	Z Pulse Fault	dv1	32
FF0F	Z Pulse Noise Fault Detection	dv2	33
FF10	Inversion Detection	dv3	34
FF11	Inversion Prevention Detection	dv4	35
FF12	Output Current Imbalance	LF2	36
FF13	Pull-Out Detection	STPo	37
FF14	PG Hardware Fault	PGoH	38
FF15	MECHATROLINK Watchdog Timer Err	E5	39
FF16	Too Many Speed Search Restarts	SEr	3B
FF17	Reserved	CASEFAL1	3C
FF18	Reserved	CASEFAL2	3D
FF19	Reserved	CASEFAL3	3E
FF1A	Reserved	CASEFAL4	3F
FF1B	Reserved	CASEFAL5	40
FF1C	Excessive PID Feedback	FbH	41

Error Code (Hex)	Meaning	Drive Display	Value of MEMOBUS/ Modbus Address 0080 (Hex)
FF1D	External Fault (terminal S1)	EF1	42
FF1E	External Fault (terminal S2)	EF2	43
FF1F	Mechanical Weakening Detection 1	oL5	44
FF20	Mechanical Weakening Detection 2	UL5	45
FF21	Current Offset Fault	CoF	46
FF22	PLC Detection Error 1	PE1	47
FF23	PLC Detection Error 2	PE2	48
FF24	DriveWorksEZ Fault	dWFL	49
6301	Error during object content selection	-	-
FF25	EEPROM Memory DWEZ Data Error	dWF1	4A
FF26	DriveWorksEZ Fault 2	dWF2	4B
FF27	DriveWorksEZ Fault 3	dWF3	4C
FF28	Output Voltage Detection Fault	voF	4D
FF29	Braking Resistor Fault	rF	4E
FF2A	BrakingTransistor Overload Fault	boL	4F
FF2B	Motor Overheat (NTC Input)	oH5	50
FF2C	LSo Fault	LSo	51
FF2D	Node Setup Error	nSE	52
FF2E	Thermistor Disconnect	THo	53
FF2F	Overacceleration Detection	dv6	54
FF30	Motor Contactor Response Error	SE1	55
FF31	Starting Current Error	SE2	56
FF32	Output Current Error	SE3	57
FF33	Brake Response Error	SE4	58
FF34	Speed Reference Missing	FrL	59
FF35	Polarity Judge Timeout	dV7	5B
FF36	Ground Fault	GF	5C
FF37	Output Phase Loss 3	LF3	5F
FF38	Current Imbalance	UnbC	60
FF39	Gate Drive Board Power Supply Voltage Low	Uv4	61
FF3A	Power Supply Undervoltage	Auv	66
FF3B	Power Supply Overvoltage	Aov	67
FF3C	Power Supply Frequency Fault	Fdv	68
FF3D	Phase Order Detection Fault	SrC	69
FF3E	Power Supply Undervoltage Pre-Alarm	PAUv	6B
FF3F	AC Fuse Blowout	FUA	70
FF40	Resonance Detection	vrE	71
FF41	Control Circuit Error	CPF00	81
FF42	Control Circuit Error	CPF01	82
FF43	A/D Conversion Failure	CPF02	83
FF44	PWM Motor Failure	CPF03	84
FF45	Control Circuit Error	CPF06	87
FF46	Terminal Board Connection Error	CPF07	88
FF47	EEPROM Serial Communications Error	CPF08	89
FF48	RAM Fault	CPF11	8C

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Error Code (Hex)	Meaning	Drive Display	Value of MEMOBUS/ Modbus Address 0080 (Hex)
FF49	FLASH Memory Fault	CPF12	8D
FF4A	Watchdog Circuit Exception	CPF13	8E
FF4B	Control Circuit Fault	CPF14	8F
FF4C	Clock Fault	CPF16	91
FF4D	Timing Fault	CPF17	92
FF4E	Control Circuit Fault	CPF18	93
FF4F	Control Circuit Fault	CPF19	94
FF50	Hardware Fault (at power ON)	CPF20	95
FF51	Hardware Fault (after communication start up)	CPF21	96
FF52	A/D Conversion Failure	CPF22	97
FF53	PWM Feedback Fault	CPF23	98
FF54	Drive Capacity Signal Fault	CPF24	99
FF55	Terminal Board not Connected	CPF25	9A
FF56	ASIC BB Circuit Error	CPF26	9B
FF57	ASIC PWM Setting Register Error	CPF27	9C
FF58	ASIC PWM Pattern Error	CPF28	9D
FF59	ASIC On-delay Error	CPF29	9E
FF5A	ASIC BB ON Error	CPF30	9F
FF5B	ASIC Code Error	CPF31	A0
FF5C	ASIC Start-up Error	CPF32	A1
FF5D	Watchdog Circuit Exception Circuit Fault	CPF33	A2
FF5E	ASIC Power, Clock Error	CPF34	A3
FF5F	External A/D Conversion Failure	CPF35	A4
FF60	ASIC Reception Error	CPF36	A5
FF61	ASIC Reception Error	CPF37	A6
FF62	EEPROM Motor Failure	CPF38	A7
FF63	Control Circuit Error	CPF40	A9
FF64	Control Circuit Error	CPF41	AA
FF65	Control Circuit Error	CPF42	AB
FF66	Control Circuit Error	CPF43	AC
FF67	Control Circuit Error	CPF44	AD
FF68	Control Circuit Error	CPF45	AE
FF69	Option Card Connection Error at Option Port CN5-A	oFA00	101
FF6A	Option Card Fault at Option Port CN5-A	oFA01	102
FF6B	Option Card Fault at Option Port CN5-A	oFA02	103
FF6C	Option Card Error Occurred at Option Port CN5-A	oFA03	104
FF6D	Option Card Error Occurred at Option Port CN5-A	oFA04	105
FF6E	Option Card Error Occurred at Option Port CN5-A	oFA05	106
FF6F	Option Card Error Occurred at Option Port CN5-A	oFA06	107
FF70	Option Card Error Occurred at Option Port CN5-A	oFA10	111
FF71	Option Card Error Occurred at Option Port CN5-A	oFA11	112
FF72	Option Card Error Occurred at Option Port CN5-A	oFA12	113
FF73	Option Card Error Occurred at Option Port CN5-A	oFA13	114
FF74	Option Card Error Occurred at Option Port CN5-A	oFA14	115
FF75	Option Card Error Occurred at Option Port CN5-A	oFA15	116

Error Code (Hex)	Meaning	Drive Display	Value of MEMOBUS/ Modbus Address 0080 (Hex)
FF76	Option Card Error Occurred at Option Port CN5-A	oFA16	117
FF77	Option Card Error Occurred at Option Port CN5-A	oFA17	118
FF78	Comm. ID Error	oFA30	131
FF79	Model Code Error	oFA31	132
FF7A	Checksum Error	oFA32	133
FF7B	Comm. option timeout waiting for response	oFA33	134
FF7C	MEMOBUS/Modbus communications timeout	oFA34	135
FF7D	Drive timeout waiting for response	oFA35	136
FF7E	CI Check Error	oFA36	137
FF7F	Drive timeout waiting for response	oFA37	138
FF80	Control Command Selection Error	oFA38	139
FF81	Drive timeout waiting for response	oFA39	13A
FF82	Control Response Selection 1 Error	oFA40	13B
FF83	Drive timeout waiting for response	oFA41	13C
FF84	Control Response Selection 2 Error	oFA42	13D
FF85	Drive timeout waiting for response	oFA43	13E
FF86	Option Card Fault at Option Port CN5-B	oFb00	201
FF87	Option Card Fault at Option Port CN5-B	oFb01	202
FF88	Option Card Fault at Option Port CN5-B	oFb02	203
FF89	Option Card Fault at Option Port CN5-B	oFb05	206
FF8A	Option Card Fault at Option Port CN5-B	oFb06	207
FF8B	Option Card Fault at Option Port CN5-B	oFb10	211
FF8C	Option Card Error Occurred at Option Port CN5-B	oFb11	212
FF8D	Option Card Error Occurred at Option Port CN5-B	oFb12	213
FF8E	Option Card Error Occurred at Option Port CN5-B	oFb13	214
FF8F	Option Card Error Occurred at Option Port CN5-B	oFb14	215
FF90	Option Card Error Occurred at Option Port CN5-B	oFb15	216
FF91	Option Card Error Occurred at Option Port CN5-B	oFb16	217
FF92	Option Card Error Occurred at Option Port CN5-B	oFb17	218
FF93	Comm. ID Error	oFb30	231
FF94	Model Code Error	oFb31	232
FF95	Checksum Error	oFb32	233
FF96	Comm. option timeout waiting for response	oFb33	234
FF97	MEMOBUS/Modbus communications timeout	oFb34	235
FF98	Drive timeout waiting for response	oFb35	236
FF99	CI Check Error	oFb36	237
FF9A	Drive timeout waiting for response	oFb37	238
FF9B	Control Command Selection Error	oFb38	239
FF9C	Drive timeout waiting for response	oFb39	23A
FF9D	Control Response Selection 1 Error	oFb40	23B
FF9E	Drive timeout waiting for response	oFb41	23C
FF9F	Control Response Selection 2 Error	oFb42	23D
FFA0	Drive timeout waiting for response	oFb43	23E
FFA1	Option Card Connection Error at Option Port CN5-C	oFC00	301
FFA2	Option Card Fault at Option Port CN5-C	oFC01	302

EN

Error Code (Hex)	Meaning	Drive Display	Value of MEMOBUS/ Modbus Address 0080 (Hex)
FFA3	Option Card Fault at Option Port CN5-C	oFC02	303
FFA4	A/D Conversion Error	oFC05	306
FFA5	Option Response Error	oFC06	307
FFA6	RAM Fault	oFC10	311
FFA7	Option Card Error Occurred at Option Port CN5-C	oFC11	312
FFA8	Option Card Error Occurred at Option Port CN5-C	oFC12	313
FFA9	Option Card Error Occurred at Option Port CN5-C	oFC13	314
FFAA	Option Card Error Occurred at Option Port CN5-C	oFC14	315
FFAB	Option Card Error Occurred at Option Port CN5-C	oFC15	316
FFAC	Option Card Error Occurred at Option Port CN5-C	oFC16	317
FFAD	Option Card Error Occurred at Option Port CN5-C	oFC17	318
FFAE	Option Card Error Occurred at Option Port	oFC50	351
FFAF	Option Card Error Occurred at Option Port	oFC51	352
FFB0	Option Card Error Occurred at Option Port	oFC52	353
FFB1	Option Card Error Occurred at Option Port	oFC53	354
FFB2	Option Card Error Occurred at Option Port	oFC54	355
FFB3	Option Card Error Occurred at Option Port	oFC55	356
FFB4	Damping Resistor Overheat	doH	408
FFB5	Snubber Discharge Resistor Overheat	SoH	409
FFB6	Internal Resistance Fault	Srr	40A
FFB7	Safety Circuit Fault	SCF	40F
FFB8	Drive Cooling Fan Failure	FAn1	413
FFC0	Comparator 1 Limit Error	CP1	414
FFC1	Comparator 2 Limit Error	CP2	415
FFC2	Bluetooth Communication Fault	bCE	416
FFC3	Communication Error 1	dCE1	41A
FFC4	Communication Error 2	dCE2	41B
FFC5	Overcurrent 2	oC2	45F

◆ Yaskawa-specific SDO Abort Codes

SDO abort codes are supported as specified in DS301. Additionally the abort codes listed below are implemented.

SDO Abort Code (Hex)	Description
0602 0010	Consecutive MEMOBUS/Modbus Read/Write/Enter commands are send but the wait time between messages is too short.
	A MEMOBUS/Modbus Read or Write Response (2140 (Hex) and 2150 (Hex)) was attempted but no or an incorrect MEMOBUS/Modbus address has been written to object 2040 (Hex) or 2050 (Hex) before.
	A MEMOBUS/Modbus write request has been sent during DC bus under voltage.
0602 0022	Drive Profile DSP402 is used and a value is written to object 6042 (Hex) (vl Target Velocity) while the drive status is not "Operation Enable".
	Object 2155 (Hex) is tried to be read while the SI-ES3 option is not in "Operational" state.
	A MEMOBUS/Modbus Read or Write command (2040 (Hex) and 2050 (Hex)) was performed with an invalid MEMOBUS/Modbus address.

◆ Fault

This section gives information about some of the causes and possible solutions of faults. You must use the Fault Reset operation to remove the fault before you can operate the drive. Use the information in this table to remove the cause of the fault.

Code	Name	Causes	Possible Solutions
bUS	Option Communication Error	The drive did not receive a signal from the controller.	Correct wiring errors.
		The communications cable wiring is incorrect.	
		There is a short-circuit in the communications cable or the communications cable is not connected.	• Repair short circuits and connect cables. • Replace the defective communications cable.
		Electrical interference caused a communication data error.	• Examine the control circuit lines, main circuit lines, and ground wiring, and decrease the effects of electrical interference. • Make sure that a magnetic contactor is not the source of the electrical interference, then use a Surge Protective Device if necessary. • Use only the recommended cables or other shielded line. Ground the shield on the controller side or the drive input power side. • Separate the communication wiring from drive power lines, and install a noise filter to the input side of the power supply for communication. • Decrease the effects of electrical interference from the controller.
		The option is incorrectly installed to the drive.	Correctly install the option to the drive.
		The option is damaged.	If the fault continues and the wiring is correct, replace the option.
EF0	Option Card External Fault	The communication option received an external fault from the controller.	1. Find the device that caused the external fault and remove the cause. 2. Clear the external fault input from the controller.
		A programming error occurred on the controller side.	Examine the operation of the controller program.
oFA00	Option Not Compatible with Port	The option connected to connector CN5-A is not compatible.	Connect the option to the correct connector. **Note:** Encoder options are not compatible with connector CN5-A.
oFA01	Option Fault/Connection Error	The option card connected to connector CN5-A is not compatible.	1. De-energize the drive. 2. Refer to the option card manual and correctly connect the option card to the connector on the drive.
oFA30 to oFA43	Communication Option Card Connection Error (CN5-A)	A fault occurred in the option card.	1. De-energize the drive. 2. Make sure that the option card is correctly connected to the connector. 3. If the problem continues, replace the option card.
oFb00	Option Not Compatible with Port	The option connected to connector CN5-B is not compatible.	Connect the option to the correct connector. **Note:** DO-A3, AO-A3, PG-B3, and PG-X3 options can connect to connector CN5-B. To connect only one PG option card, use the CN5-C connector.
oFb02	Duplicate Options	The same option cards or the same type of option cards are connected to connectors CN5-A, B, and C.	Connect the option card to the correct connector.
oFC00	Option Not Compatible with Port	The option connected to connector CN5-C is not compatible.	Connect the option to the correct connector. **Note:** AI-A3, DI-A3, and communication options cannot be connected to the CN5-C connector.
oFC02	Duplicate Options	The same option cards or the same type of option cards are connected to connectors CN5-A, B, and C.	Connect the option card to the correct connector.

◆ Option Board Error Management

This section describes the errors managed by the option board and the linked actions taken.

Option Error	Description	Error Indication	Possible Solution
OP > SAFEOP/PREOP when Drive running	When an EtherCAT state transition from OP > SAFEOP/PREOP was made when the drive was in OPERATION enabled.	BUS Error is triggered in drive. Error against drive will be cleared when the next lower to higher EtherCAT state transition is made.	• Check and correct state machine transitions in control word.

Option Error	Description	Error Indication	Possible Solution
OP > SAFEOP 1. EtherCAT WD time out	If the EtherCAT watchdog time out is enabled (Default in native XML description file) and output data from PLC to the drive isn't updated in time an error will be triggered	BUS Error is triggered in drive. Error against drive will be cleared when the next lower to higher EtherCAT state transition is made.	• Check network connection (e.g. if cables plugged in at each node). • Check telegram timing. Are telegrams sent to the slave the error occurred on?

Option Error	Description	Error Indication	Possible Solution
OP > SAFE_OP 1. Drive FCS error 2. Drive COMID error	1. Drive has detected a Sum check error. 2. Drive has detected a Communication Option ID error. Possible cause: 1. Option card system is overloaded. 2. Option card is not properly processing the state.	1. Drive fault: OFx32 2. Drive fault: OFx30	1+2 actions: • Disable process data OUT sync manager channel. • Force EtherCAT state change to SAFE_OP.

Option Error	Description	Error Indication	Possible Solution
OP > SAFE_OP 1. Option card FCS error 2. Option card COMID error	1. Option card has detected a Sum check error. 2. Option card has detected a Communication Option ID error. Possible cause: 1. Drive system is overloaded. 2. Drive is not properly processing the state.	1. Drive fault: OFx32 2. Drive fault: OFx30	1+2 actions: • Disable process data IN sync manager channel. • Force EtherCAT state change to SAFE_OP.

Option Error	Description	Error Indication	Possible Solution
Initial power-up sequence not completed within 10 seconds.	Possible cause: • Drive is not processing the internal interface protocol. • Drive does not support this communication option card.	Drive fault: OFx00 Option will log FATAL event record in NVS memory and set ERR LED: solid RED.	Actions: • Check drive firmware version. • If drive firmware version is correct, replace option card. • Replace the drive.

Option Error	Description	Error Indication	Possible Solution
I/F proc time out	Option card has not processed any drive system frames in 1000 ms. Possible cause: • Drive has stopped serving the internal interface to option card or HW failure.	Drive fault: OFx00 Option will log FATAL event record in NVS memory and set ERR LED: solid RED.	• Force communication state to INIT.

Option Error	Description	Error Indication	Possible Solution
Option ID Error: Power-up sequence copyright string mismatch.	Drive reported invalid copyright string in power-up process.	Drive fault: OFx00 Option will log FATAL event record in NVS memory and set ERR LED: solid RED.	• Replace option card.

◆ Minor Faults/Alarms

This section gives information about the causes and possible solutions when a minor fault or alarm occurs. Use the information in this table to remove the cause of the minor fault or alarm.

Code	Name	Causes	Possible Solutions
CALL	Serial Comm Transmission Error	The communications cable wiring is incorrect.	Correct any wiring errors.
		There is a short circuit or the communications cable is not connected.	• Repair short circuits and connect cables. • Replace the defective communications cable.
		There was a programming error on the controller side.	Examine communications at start-up and correct programming errors.
		The communications circuitry is damaged.	• Do a self-diagnostics check. • If the problem continues, replace the control board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.
		The termination resistor setting for MEMOBUS/Modbus communications is incorrect.	On the last drive in a MEMOBUS/Modbus network, set DIP switch S2 to the ON position to enable the termination resistor.
EEP	EEPROM Checksum Error	Communication wiring is faulty, there is a short circuit, or something is not connected properly.	Correct any wiring errors.
		EEPROM checksum error.	• If these errors occur, the object dictionary will be reset to its default values. After the object dictionary has been changed and object dictionary contents are then changed, execute a Store Parameter command (Index = 1010 (Hex)). • If the object dictionary has not been changed, execute a Restore Parameter command (Index = 1011 (Hex)).
		Programming error occurred on the controller side.	Check communications at start-up and correct programming errors.
		Communications circuitry is damaged.	• Perform a self-diagnostics check. • If the problem continues, replace either the control board or the entire drive. For instructions on replacing the control board, contact Yaskawa or your nearest sales representative.
		Termination resistor setting for MEMOBUS/Modbus communications is incorrect.	Enable the termination resistor in the last drive in a MEMOBUS/Modbus network by setting DIP switch S2 to the ON position.

11 Specifications

Item	Specification
Model	SI-ES3 For V1000: SI-ES3/V
Communication Profile	DSP 301 Ver. 4.02 DSP 402 Ver. 1.1 Velocity Mode
Connector	RJ45 connector
Communication Speed	10/100 Mbps
Ambient Temperature	-10 °C to +50 °C
Humidity	up to 95% RH (non-condensing)
Storage Temperature	-20 °C to +60 °C (allowed for short-term transport of the product)
Area of Use	Indoor (free of corrosive gas, airborne particles, etc.)
Altitude	Up to 1000 m

12 Examples

◆ How to Use The Gateway Mode

This function can be used with: GA800 GA700 GA500 .

With the Gateway Mode function, it is possible to do simple control of up to four slave drives through a master drive connected via Modbus. That includes these functions:

- Give a Run command to the slave drive via a register in the master drive
- Give a Frequency command to the slave drive via a register in the master drive
- Read the status and frequency output of the slave drive
- Read and write parameters and registers of the slave drive via the master drive, using a Memobus read and write function

A - Fieldbus communication
B - Master (drive with fieldbus communication option card)
C - Slave (drive) - up to 4 slave drives can be used
D - RS-485 communication
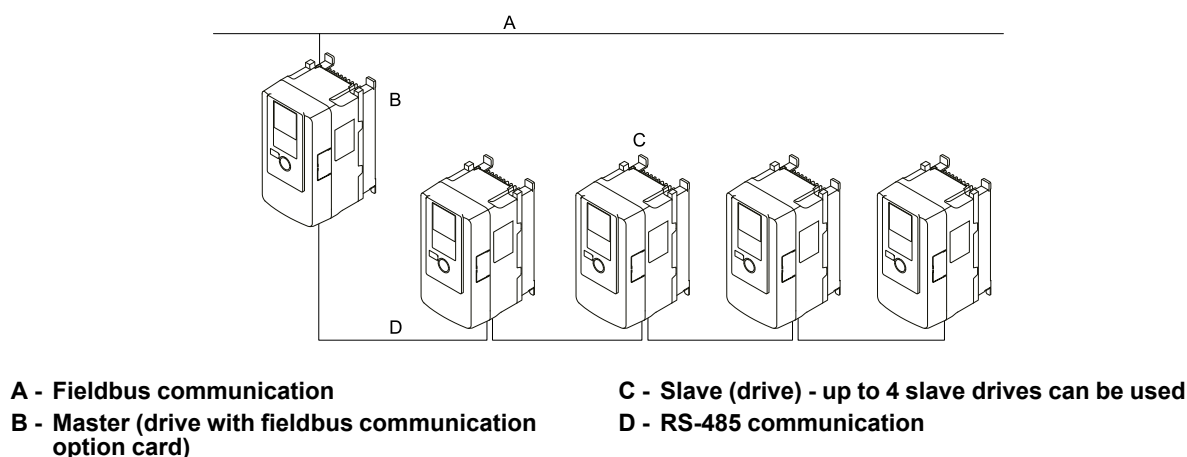
Figure 12.1 PLC and Drive Connection Example

These functions are useful when drives must be able to communicate with the upper level controller through a certain fieldbus protocol (i.e. EtherCAT), but the option card cost for each individual drive is prohibitive.

■ Simple Slave Control

This example shows communication with just one slave drive.

To use this function the following parameters have to be set:

Table 12.1 Required Parameter Settings When Using One Slave Drive

Master Drive:	Slave 1 Drive:
F6-16 = 1 H5-01 = 1F b1-01 = 3 b1-02 = 3	F6-16 = 0 (Default) H5-01 = 01 H5-09 = 0.9 b1-01 = 2 b1-02 = 2

The master drive uses these objects for communication with the slave drive:

1. Gateway Mode Communication Settings (Object 2E00 (Hex))

Object	Sub	Description		
2E00	0	Gateway Mode Communication Settings		This flag enables command updates.
		bit 0	Drive 1 Update Command Enabled	To input the Run command and frequency reference at the same time, change the bit value from 0 to 1 after you write all commands.
		bit 1	Drive 2 Update Command Enabled	
		bit 2	Drive 3 Update Command Enabled	
		bit 3	Drive 4 Update Command Enabled	
		bit 4	Update Register Access Command Enabled	
		bit 5 - 15	Reserved	

This object will enable communication to the slave drive. In this example with 1 slave drive, set bit 0 to "TRUE" to enable communication to the slave drive.
When using more than one slave drive, this register can also be used to update the commands for all slave drives at the same time, thereby allowing nearly simultaneous start of frequency reference changes.

2. Gateway Slave 1 Drive Operation (Object 2E01 (Hex))

Object	Sub	Description		
2E01	1	Slave 1 Operation Command		
		bit 0	Fwd/Stop if H5-12 = 0, else Run/Stop	
		bit 1	Rev/Stop if H5-12 = 0, else Rev/Fwd	
		bit 2	External fault	
		bit 3	Fault reset	
		bit 4	ComRef	
		bit 5	ComCtrl	
		bit 6 - 15	Reserved	
	2	Slave 1 Speed Reference/Limit		
		bit 0 - 15	Speed reference/limit	The unit of measure changes when o1-03 changes.

With the bits of subindex 1 of object you can give run and stop commands or activate the fault or reset the fault for slave drive 1. With subindex 2 you can give a frequency reference/limit.

3. Gateway Slave 1 Drive Status (Object 2F01 (Hex))

Object	Sub	Description		
2F01	1	Command source update (15C6h)		
		bit 0	During Run	
		bit 1	During Reverse Run	
		bit 2	Drive Ready	
		bit 3	Fault	
		bit 4	Frequency Command Setting Fault	
		bit 5	No response from slave	
		bit 6	Communication Error	
		bit 7	No response from slave 10 consecutive attempts.	
		bit 8	Communication fault has occurred 10 consecutive times.	
		bit 9	Receive broadcast command while drive is running.	
		bit 10	Communication error with master drive	
		bit 11 - 13	Reserved	
		bit 14	ComRef status	
		bit 15	ComCtrl status	
	2	Slave 1 output frequency		
		bit 0 - 15	Output frequency or frequency reference (Drive status bit 4: ON) Drive status bit 4 = 0 [Output Frequency] Drive status bit 4 = 1 [Frequency Reference]	The unit of measure changes when o1-03 changes.

■ Memobus Read and Write

The Memobus Read and Write function to the slave drives is demonstrated below with one slave.

To use this function the same parameters as in section "Simple Slave Control" must be set again on the master and slave drive.

To enable the Memobus Read and Write function with the slaves, set bit 4 in object 2E00 (Hex) to "TRUE".

Object	Sub	Description		
2E00	0	Gateway Mode Communication Settings		This flag enables command updates.
		bit 0	Drive 1 Update Command Enabled	To input the Run command and frequency reference at the same time, change the bit value from 0 to 1 after you write all commands.
		bit 1	Drive 2 Update Command Enabled	
		bit 2	Drive 3 Update Command Enabled	
		bit 3	Drive 4 Update Command Enabled	
		bit 4	**Update Register Access Command Enabled**	
		bit 5 - 15	Reserved	

The master drive uses these objects for Memobus Read and Write function with the slave drive:

1. Gateway Memobus Read or Write Request (Object 2EFF (Hex))

Object	Sub	Description		
2EFF	1	Slave Address for Reg. Access + Read/Write		
		bit 0 - 3	0: Broadcast Messages (Memobus) 1: Drive 1 2: Drive 2 3: Drive 3 4: Drive 4 5: Run command and frequency reference broadcast message	When bit 0 to 3 = 0, access is enabled for broadcast messages only. When bit 0 to 3 = 5, access is enabled for Run command and frequency reference broadcast messages only. Drive 0 is excluded.
		bit 4	0: Read 1: Write	
		bit 5 - 15	Reserved	
	2	Register number		
		bit 0 - 15		
	3	Data (Write register)		
		bit 0 - 15		

To choose slave drive 1 for the read/write command, set object 2EFF (Hex) subindex 1 bit 0 to "TRUE", and set bit 4 to select the read or write command.
Enter the register number that you want to read or write using object 2EFF (Hex) subindex 2.
Enter the data you want to write into the register using object 2Eff (Hex) subindex 3. This function is available only if a write command is selected.

2. Gateway Memobus Read or Write Response (Object 2FFF (Hex))

Object	Sub	Description		
2FFF	1	Slave Address for Reg. Access + Read/Write		
		bit 0 - 7	00: Memobus communication complete 02: Register number not registered 21: Upper/Lower limit reached 22: Write mode error 23: Write performed during occurrence of Uv 24: Write performed while writing parameter settings FF: Memobus communication ongoing	
		bit 8 - 10	0: Memobus command ignored 1: Drive 1 2: Drive 2 3: Drive 3 4: Drive 4	
		bit 11 - 15	Reserved	
	2	Register number		
		bit 0 - 15		
	3	Data		
		bit 0 - 15		

If a read/write command was sent to the slave, the answer will be stored in object 2FFF (Hex).

- Object 2FFF (Hex) subindex 1 bit 0 - bit 7 show the status of the Memobus read/write to the slave.
- Object 2FFF (Hex) subindex 1 bit 8 - bit 10 show the slave drive number the read/write command was sent to.
- Object 2FFF (Hex) subindex 2 show the register which was read or written.
- Object 2FFF (Hex) subindex 3 show the data which was read or written.

■ **Communication Specification**

Table 12.2 MEMOBUS/Modbus Specifications

Item	Specification
Interface	RS-485
Synchronization method	Asynchronous (start-stop synchronization)

Item	Specification
Communication parameter	Communications speed:1.2, 2.4, 4.8, 9.6, 19.2, 38.4, 57.6, 76.8, 115.2 kbps
	Data length: 8 bit (fixed)
	Parity: even, odd, none
	Stop bit 1 bit (fixed)
Communication protocol	MEMOBUS/Modbus standard (RTU mode only)
Number of possible units to connect	Maximum: 31 units

■ Set the Termination Resistor

You must enable the termination resistor on the slave terminal of the drive to use MEMOBUS/Modbus communications. Use DIP switch S2 on the terminal block to enable and disable the built-in termination resistor. Use the tip of a tweezers or a jig with a tip width of 0.8 mm (0.03 in.) to set the DIP switch. When you install the drive in the terminal of the communication line, set DIP switch S2 to ON. Set DIP switch S2 to OFF on all other drives.
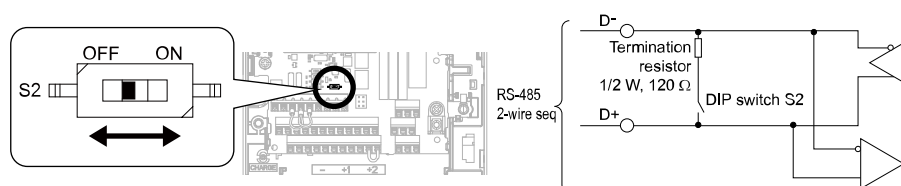
Figure 12.2 MEMOBUS/Modbus Communication Terminal and DIP Switch S2

■ Wiring Diagram for More than One Drive

This figure shows how to wire more than one connected drive with using MEMOBUS/Modbus communications.
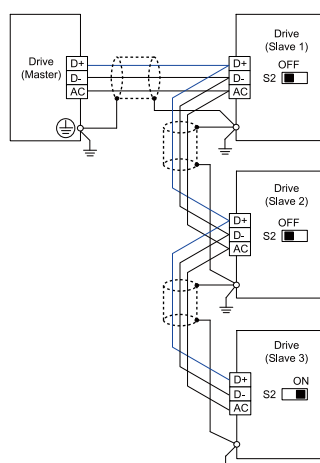
Figure 12.3 Wiring Diagram for More than One Drive (Example using three slave drives)

Note:

Set DIP switch S2 to the ON position on the last drive of the MEMOBUS/Modbus communication network to enable the termination resistor.

◆ Example Project with SPEED7 Studio

The following example shows how to make the YASKAWA EtherCAT communication option card available in a SPEED7 Studio project.

Note:

The graphics were created using SPEED7 Studio version of August 2016. In later versions, the software user interface may vary.

■ Procedure

1. Click **Extra > Install device description file (EtherCAT ESI)** to import the device description file for the communication option card.
2. In the projecting view, right-click the EC-Mastersystem and select **Add new device...**.

EN
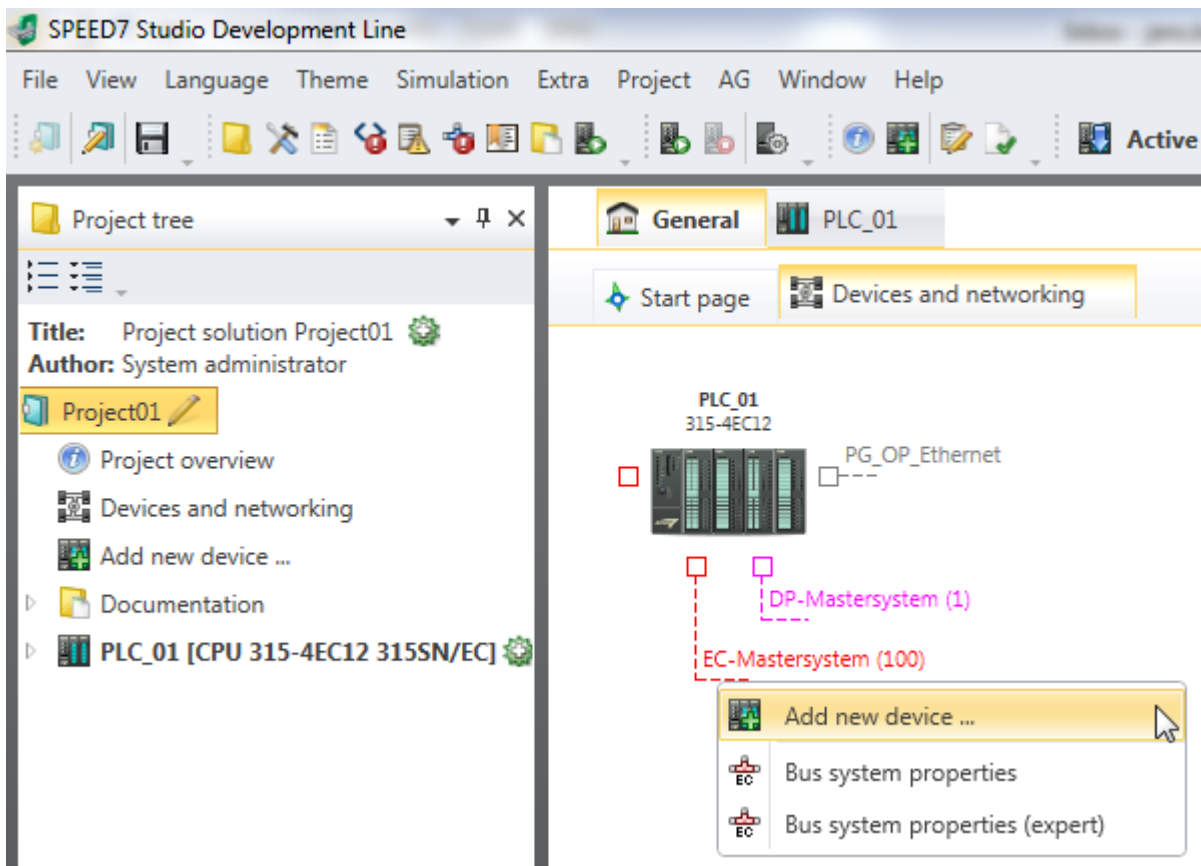
3. In the dialog box, select **ESI** on the left pane.
4. Navigate to **Manufacturer > Yaskawa Electric Corporation > Drives** and select your inverter drive. Confirm with **OK**.
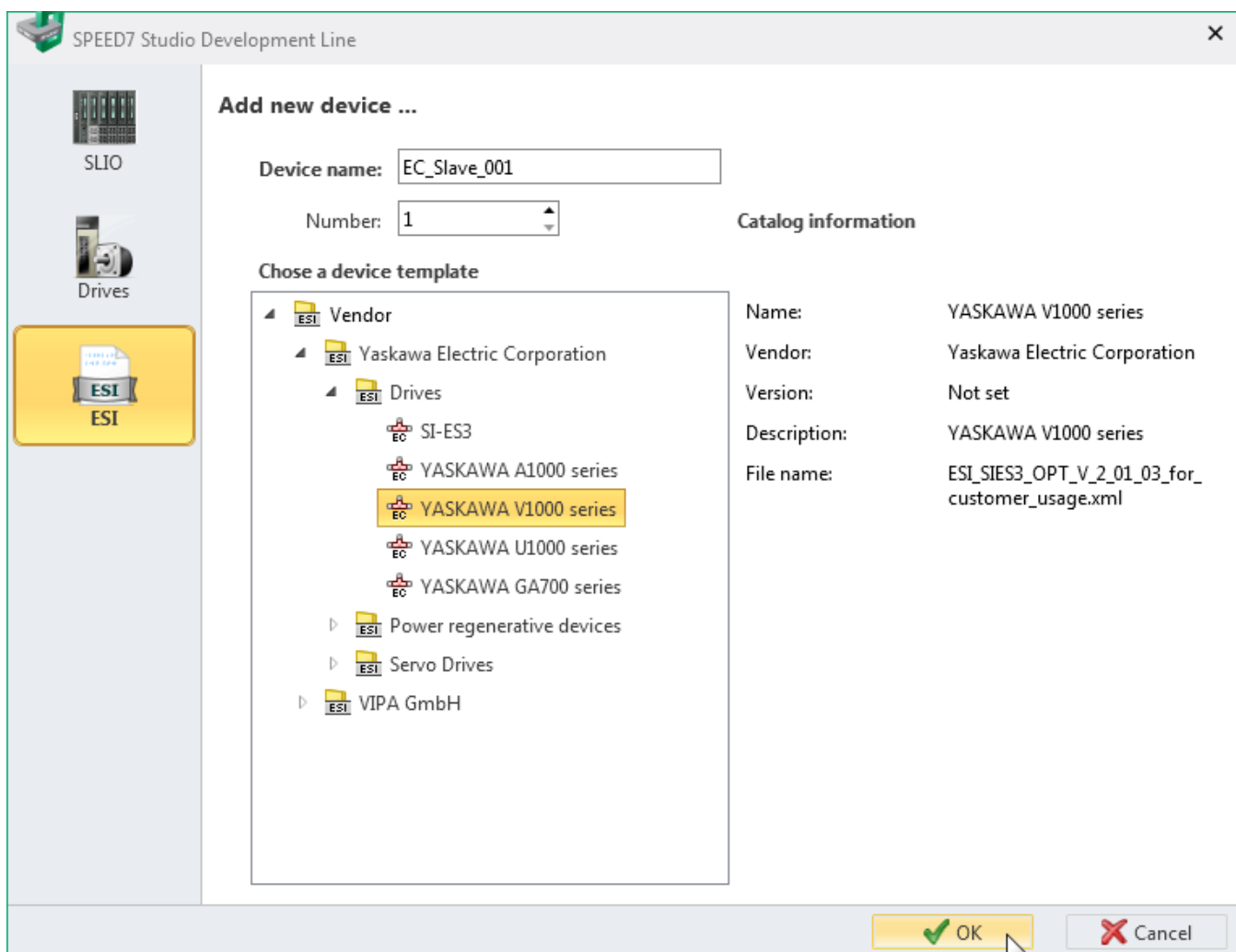
■ Result

After following the procedure, the YASKAWA inverter drive is ready for further use.
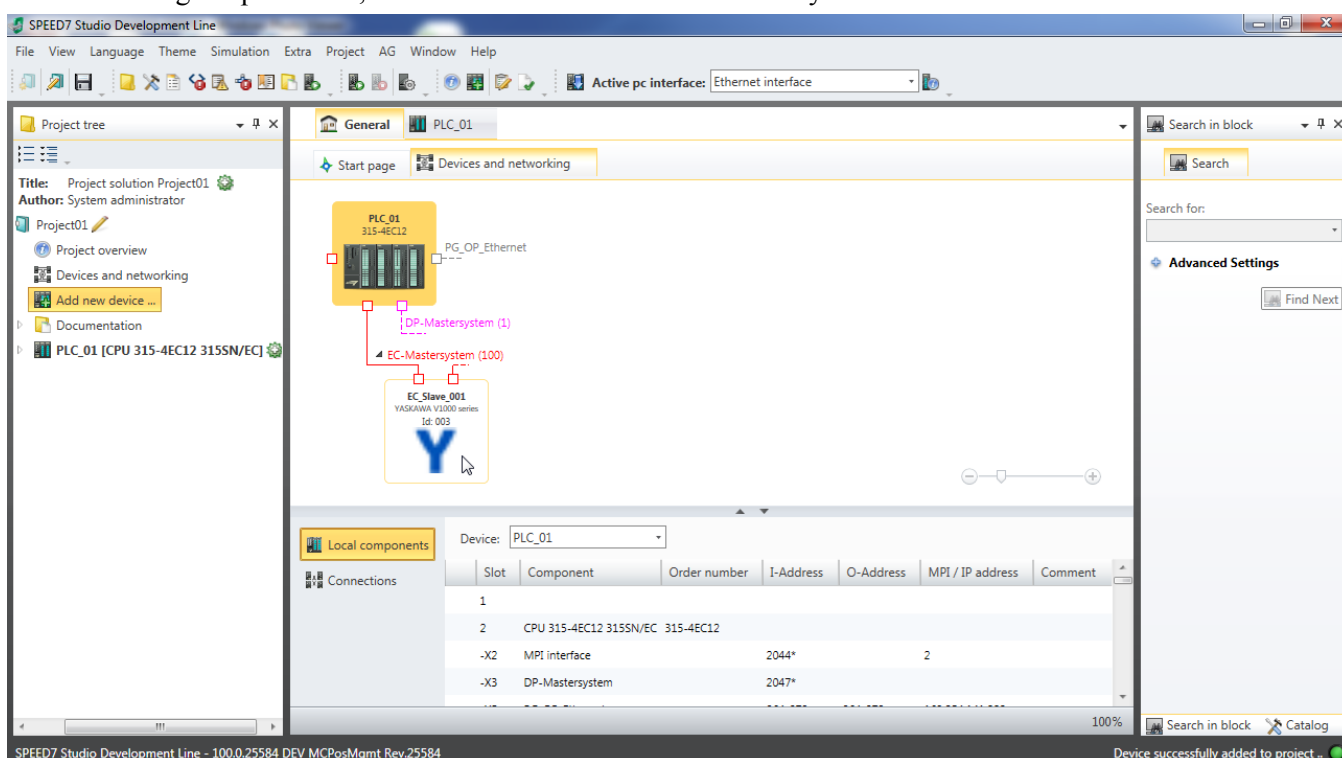
◆ **Example Project with TwinCAT System Manager**

The following example shows how to make the YASKAWA EtherCAT communication option card available in a Beckhoff TwinCAT System Manager.

Note:

The graphics were created using TwinCAT System Manager version 2.11. In other versions, the software user interface may vary.

■ **Procedure**

1. Click **Action > Import XML Description...** to import the device description file for the communication option card.
2. In the project tree, right-click **I/O Devices** in the **I/O Configuration** node and select **Scan Devices...**.
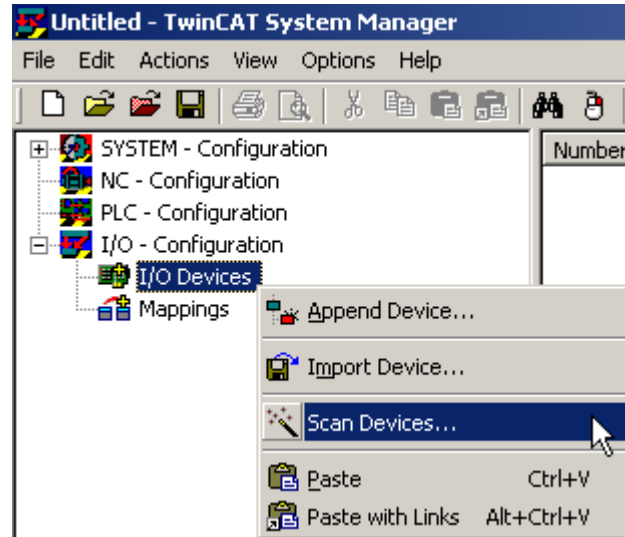
3. Make sure the EtherCAT device (line two in the graphic) is selected and confirm with **OK**.
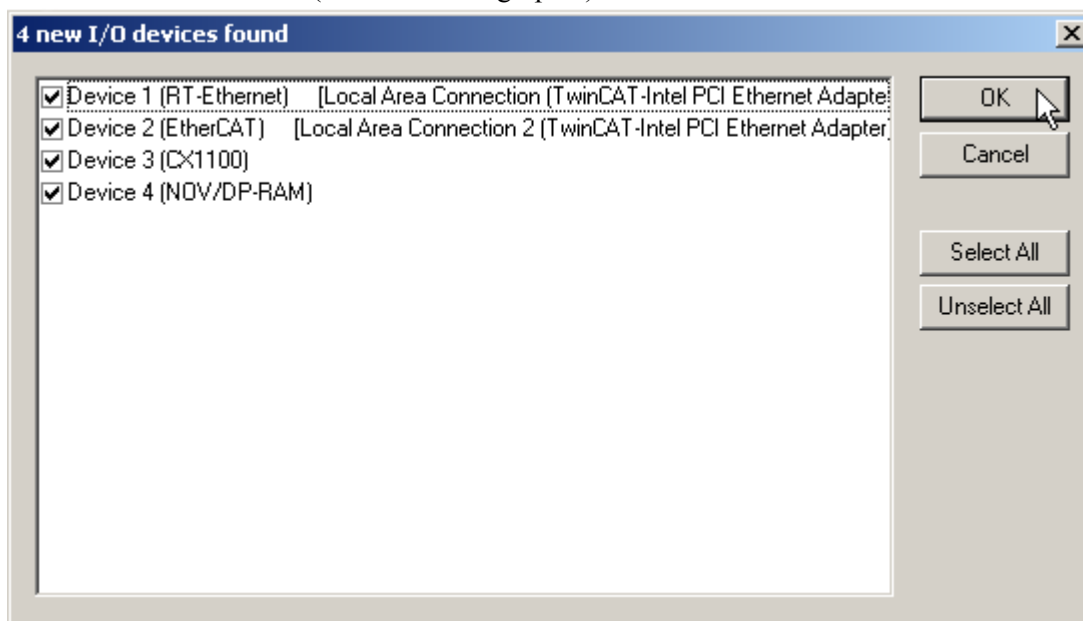
4. TwinCAT System Manager will ask you to scan for boxes. Select **Yes**.

■ **Result**

After following the procedure, the YASKAWA inverter drive is ready for further use.

Revision History

Date of Publication	Revision Number	Section	Revised Content
September 2011	–	–	First Edition
September 2016	B	All	Updated with new supported inverter drives and regenerative unit. Updated software versions. Updated descriptions and procedures.
July 2018	C	All	Updated with new supported AC drives. Updated descriptions and procedures.
October 2018	D	8	Added objects 251x to 265x.
May 2020	E	2, 8, 12	Updated compatibility information Added example "How to Use The Gateway Mode"
		3	Added "Labels to be Attached to the Product"

EtherCAT Option
Technical Manual

In the event that the end user of this product is to be the military and said product is to be employed in any weapons systems or the manufacture thereof, the export will fall under the relevant regulations as stipulated in the Foreign Exchange and Foreign Trade Regulations. Therefore, be sure to follow all procedures and submit all relevant documentation according to any and all rules, regulations and laws that may apply.
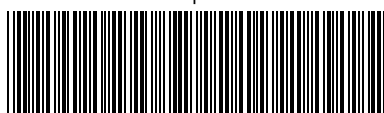Specifications are subject to change without notice for ongoing product modifications and improvements.

CE

Original instructions

YASKAWA Europe GmbH

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