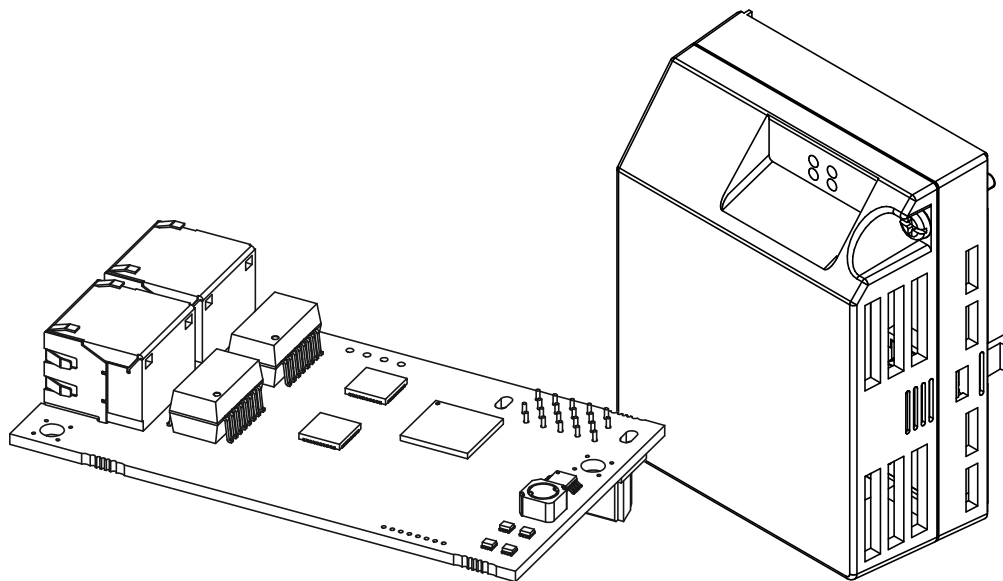


## YASKAWA EtherCAT Communication Option

Communication Options Card for Inverter  
Drives and Regenerative Units

### Installation Manual

Type: SI-ES3  
SI-ES3/V



---

**This Page Intentionally Blank**

# Table of Contents

1. Preface and General Precautions . . . . .	5
Receiving . . . . .	5
About Terms and Abbreviations in This Document . . . . .	5
About Registered Trademarks . . . . .	5
Safety . . . . .	5
Explanation of Signal Words . . . . .	5
General Safety Instructions . . . . .	5
Intended Use . . . . .	7
Warranty and Exclusion of Liability . . . . .	7
2. Product Overview . . . . .	7
About This Product . . . . .	7
Applicable Models . . . . .	8
3. Receiving . . . . .	8
Receiving the Option Card . . . . .	8
Content and Packaging . . . . .	9
Tools Required . . . . .	9
4. EtherCAT Option Components . . . . .	9
EtherCAT Option SI-ES3 . . . . .	9
EtherCAT Option SI-ES3/V for V1000 . . . . .	10
EtherCAT Option Status LEDs . . . . .	10
LEDs L/A OUT and L/A IN: Ethernet Link/Activity 1 and 2 . . . . .	10
RUN LED . . . . .	10
ERR LED . . . . .	11
Indicator Flash Rates . . . . .	12
Communication Connector . . . . .	12
Communication Cable . . . . .	13
Network Termination . . . . .	13
5. Mechanical & Electrical Installation . . . . .	13
Safety Precautions . . . . .	13
Before Installing the Option Card . . . . .	14
Installing the Option on a A1000, D1000, R1000 or U1000 . . . . .	14
Installing the Option on a V1000 . . . . .	15
Installing the Option on a GA700 . . . . .	17
ESI File . . . . .	19
6. EtherCAT Option Related Drive Parameters . . . . .	19
7. Troubleshooting . . . . .	20

---

Communication Option Card Error Codes . . . . .	20
Yaskawa-specific SDO Abort Codes . . . . .	21
Fault . . . . .	21
Minor Faults/Alarms . . . . .	22
8. Specifications . . . . .	23
Index . . . . .	24
Revision History . . . . .	25

# 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.

## ◆ Receiving

This instruction manual contains the information necessary to use the product correctly. Thoroughly read this manual before installing, wiring, operating, or performing maintenance and inspections. Make sure to read and understand the safety information and precautions before using the product.

## ■ About Terms and Abbreviations in This Document

Representations Used in This Manual	Description
EtherCAT® Option	Yaskawa EtherCAT® communication option card
EtherCAT®	Ethernet for Control Automation Technology, an open Ethernet-based network
Online-DRV	NOID processing mode, process (ctrl/resp) data is active
Online-DRVMB	NOID processing mode, process resp data is active, ctrl data is on hold (Until MEMOBUS process is complete)
Online-PRG	NOID processing mode, NO process (ctrl/resp) data is active
Host	YASKAWA inverter drive or regenerative unit
LED	Light Emitting Diode
OPT, Option	The unit described in this document
INV, Inverter	Inverter drive or regenerative unit
PCB	Printed Circuit Board
FCS	Frame Check Sequence
INVR	MEMOBUS register number
ESI	EtherCAT® Slave Information file

## ■ 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.

## ◆ Safety

Read the safety guidelines carefully before installing, wiring, or operating this product.

### ■ Explanation of Signal Words

- ⚠ DANGER** Indicates a hazardous situation, which, if not avoided, will cause death or serious injury.
- ⚠ WARNING** Indicates a hazardous situation, which, if not avoided, could cause death or serious injury.
- ⚠ CAUTION** Indicates a hazardous situation, which, if not avoided, could cause minor or moderate injury.
- NOTICE** Indicates 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. Yaskawa assumes no responsibility for personal injury, property damage or loss, or compensation for damage caused by the incorrect application of our products.

**Note:**

Be aware that serious injury or death may result if the warnings described in this manual are not observed. Yaskawa assumes no responsibility for injuries or equipment damage to your company or customers that are caused by a failure to observe the information contained in this manual.

- Read this manual carefully when mounting, operating, and repairing AC drives and Communication options.
- Follow all warnings, cautions, and instructions.
- All work should be carried out by qualified personnel.
- Ensure the drive is installed to an area that matches the following 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. To prevent electric shock, always wait for at least the amount of time indicated on the warning labels. 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** *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.*

**⚠ WARNING** *Electrical Shock Hazard. The leakage current of drive models 4389A to 4675A, 2xxxB/C and 4xxxB/C is more than 3.5 mA. The IEC/EN 61800-5-1: 2007 standard specifies that users must wire the power supply to automatically turn off when the protective ground wire disconnects. Users can also connect a protective ground wire that has a minimum cross-sectional area of 10 mm<sup>2</sup> (copper wire) or 16 mm<sup>2</sup> (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** *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. Use a type B Residual Current Monitor/Residual Current Device (RCM/RCD) for protection against contact when using a residual current operated protective device or monitoring device 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. Failure to obey can cause death or serious injury.*

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

## ■ 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.*

## ◆ Warranty and Exclusion of Liability

This product is not designed nor manufactured for use in life-support machines or systems.

Contact your 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.*

## 2 Product Overview

### ◆ About This Product

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

- Operate the inverter drive or regenerative unit
- Monitor the inverter drive or regenerative unit operation status

- Read or modify inverter drive or regenerative unit parameters.

The option contains support for the Velocity mode according to 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 the drive models in [Table 2.1](#):

**Table 2.1 Applicable Models**

Option Card Model	Drive Series	Software Version
SI-ES3	A1000	For models up to 630 kW: VSA901017 and higher For models more than 630 kW: VSA903015 and higher
	D1000	For models up to 630 kW: VSD902006 and higher For models more than 630 kW: VSD903014 and higher
	R1000	VSD902102 and higher
	U1000	VSU901010 and higher
	GA700	VSAA0010 and higher
SI-ES3/V	V1000	VSV901020 and higher

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

## 3 Receiving

This instruction manual contains the information necessary to use the product correctly. Thoroughly read this manual before installing, wiring, operating, or performing maintenance and inspections. Make sure to read and understand the safety information and precautions before using the product.

---

#### ◆ Receiving the Option Card

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 shipper 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.



## ◆ Content and Packaging

Table 3.1 Option Package Contents for SI-ES3 (Inverter Drives and Regenerative Units)

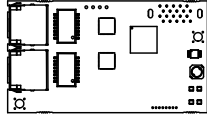


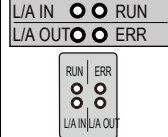
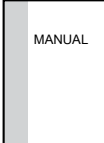
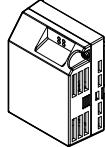

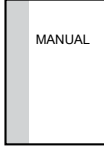
Description	Option Card	Ground Cables	Screws (M3)	LED Label	Installation Manual
Illustration					
Quantity	1	1	3	2	1

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

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

## ◆ Tools Required

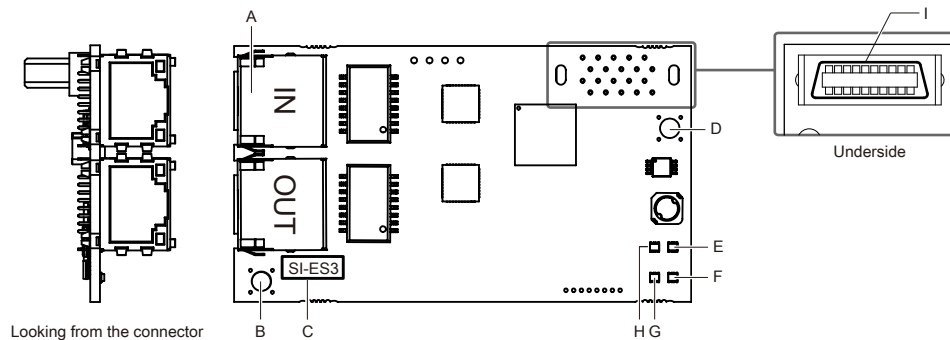
A Phillips screwdriver PH1(#1) or PH2(#2) is required to install the Communication Option card.

**Note:**

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

# 4 EtherCAT Option Components

## ◆ EtherCAT Option SI-ES3



- 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

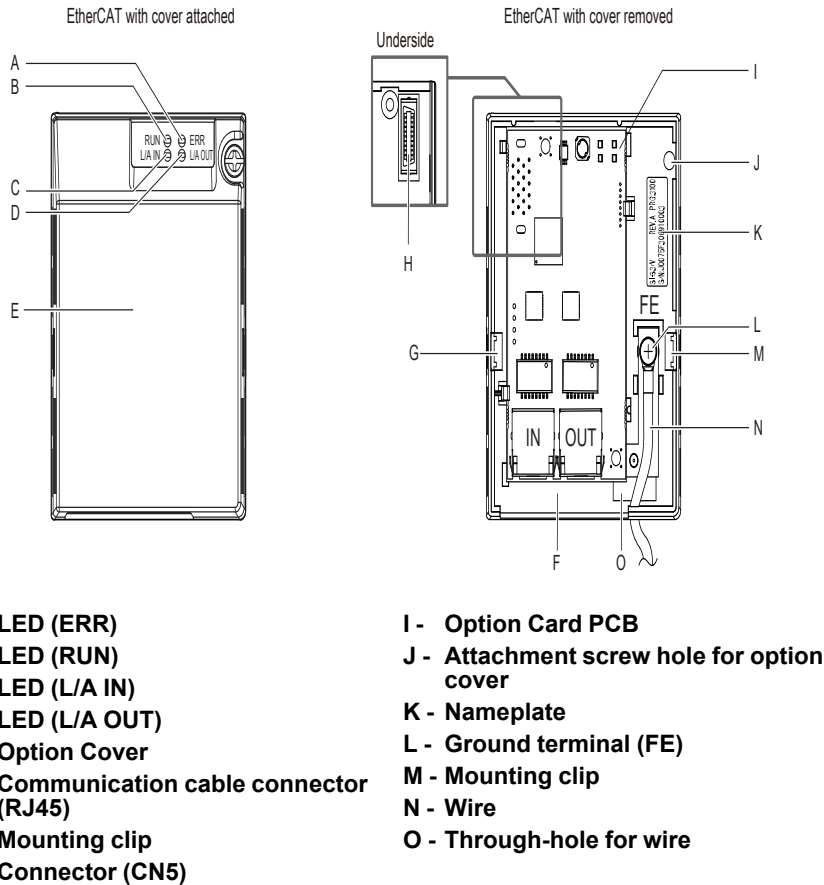


Figure 4.2 Option Card for V1000

◆ 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 1 and 2

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

LED	Color	Display	Meaning
Link Activity 1/2	–	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.

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

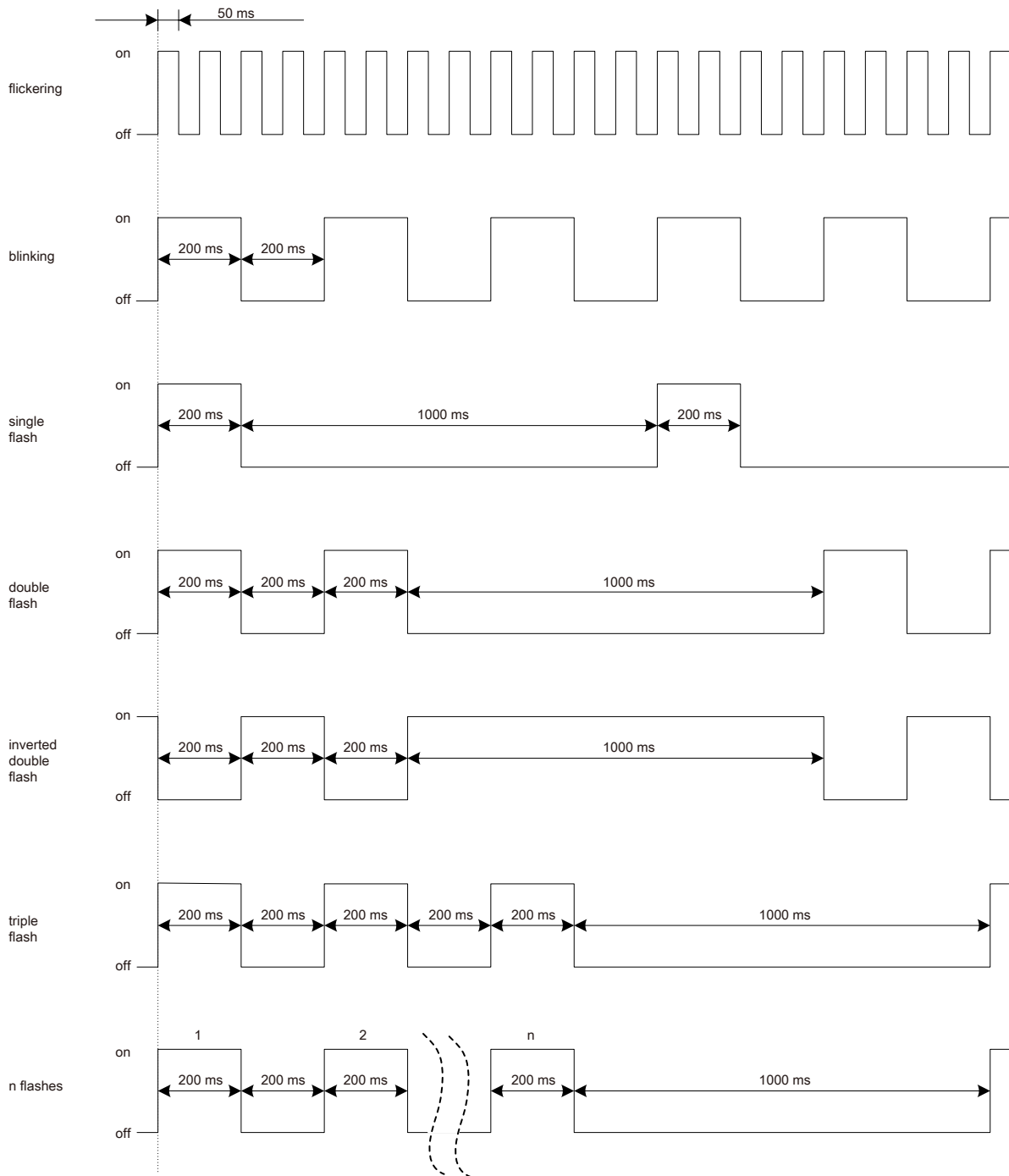
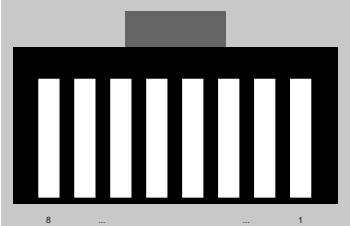


Figure 4.3 Meaning of LED Flash Rates

◆ 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. To prevent electric shock, always wait for at least the amount of time indicated on the warning labels. 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 with covers removed. The diagrams in this section may include drives without covers or safety shields to illustrate details. Be sure to reinstall covers or shields before operating the drives and run the drives according to the instructions described in this manual. 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 the circuit boards while the power is on. Failure to comply could 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 handling the drive. Failure to obey can cause ESD damage to the drive circuitry.*

**NOTICE** *Do not lift the drive when it has its cover removed. The drive board and terminal block may be damaged.*

**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 modify the drive circuitry. Failure to comply could cause damage to the drive and will void warranty. Yaskawa is not responsible for any modification of the product made by the user.*

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

### ◆ Before Installing the Option Card

Prior to installing the Communication Option Card, wire the inverter 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 inverter drive or regenerative unit.

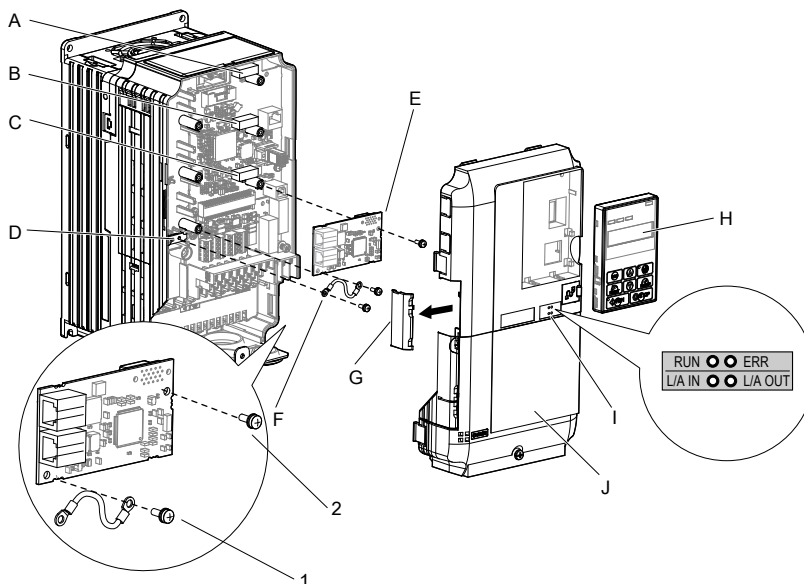
Verify that the inverter drive or regenerative unit runs normally without the option installed.

### ◆ 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 inverter with screw (2) additionally. Connect the ground wire (F) to inverter 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               | F - Ground wire   |
| B - Connector CN5-B               | G - Opening for cable lines (use<br>cutter to create the opening) |
| C - Connector CN5-A               | H - Operator  |
| D - Drive grounding terminal (FE) | I - LED labels  |
| E - Option cards                  | 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 inverter drives CIMR-Ax2A0004 to 0040 and 4A0002 to 0023: 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 Inverter drives 2A0056 to 0211, and 4A0031 to 0165: enough space to keep all wiring inside the unit is available.

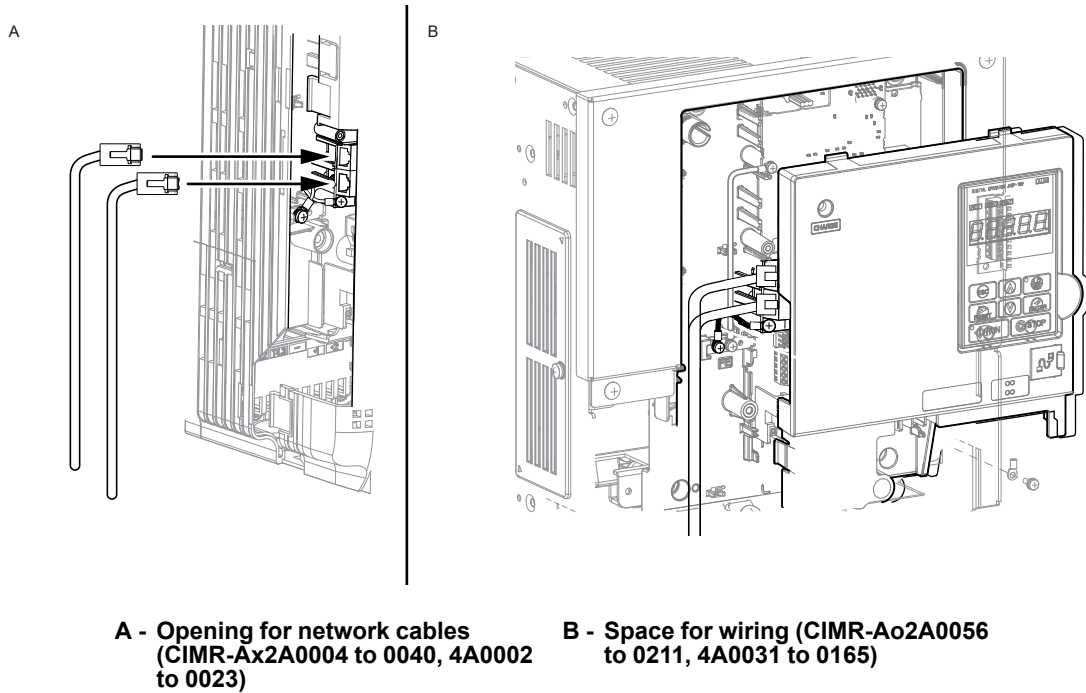


Figure 5.2 Network Cable Routing

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.

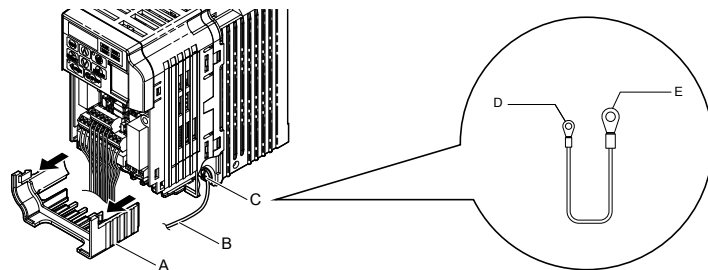
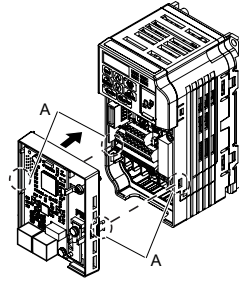


Figure 5.3 Connect Ground Wire

Select shortest possible cable for ground connection.

4. Re-attach the bottom cover.

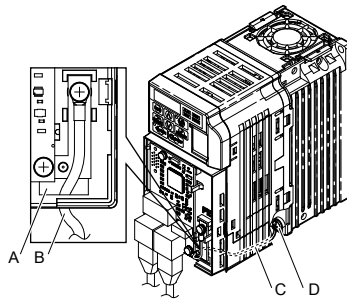
5. Connect the Communication Option card to the drive. Properly secure the tabs on the left and right side of the Communication Option card to the drive case.



**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**

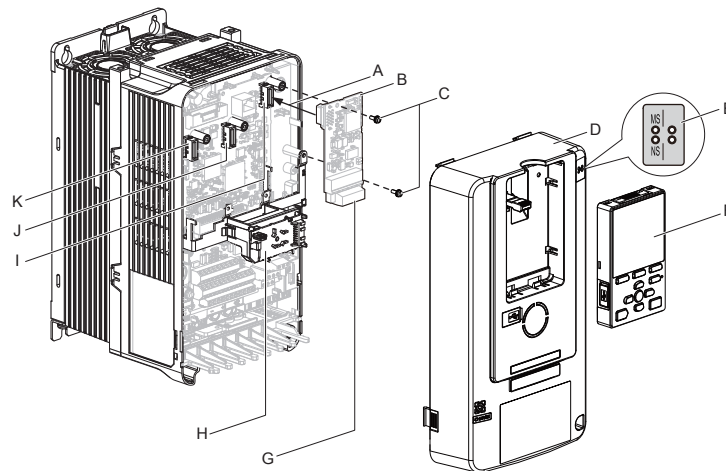
**C - Pass ground wire through the bottom cover of the drive**  
**D - Drive ground terminal**

**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 GA700

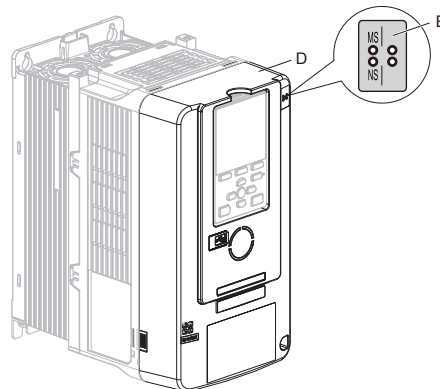


- |  |  |
|--|--|
| <b>A - Insertion for CN5 connector</b> | <b>G - Option terminal block (CN1)</b>                                 |
| <b>B - Option card</b>                 | <b>H - LED Status Ring board</b>                                       |
| <b>C - Screws (included)</b>           | <b>I - Connector CN5-A</b>   |
| <b>D - Drive front cover</b>           | <b>J - Connector CN5-B (Not for communication option installation)</b> |
| <b>E - LED label</b>                   | <b>K - Connector CN5-C (Not for communication option installation)</b> |
| <b>F - Keypad</b>                      |  |

**Figure 5.6 GA700 Components with Option Card**

The procedures for removing and re-attaching the front cover of the inverter 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.

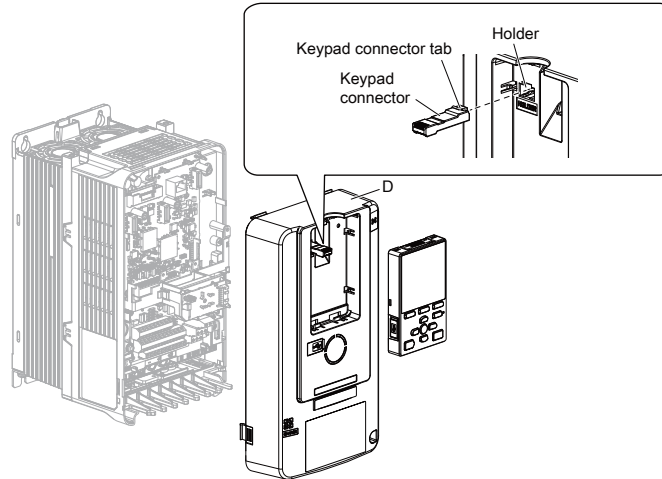
1. Affix the LED label (E) in the appropriate position on the drive front cover (D).



**Figure 5.7 Affix the LED Label**

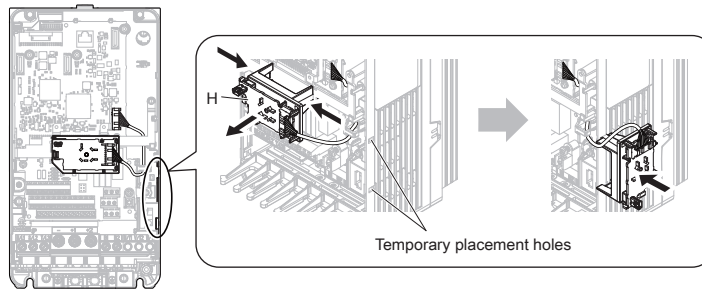
2. Turn off the power. Wait until the CHARGE LED turns off and then remove the cover. Refer to the drive manual for direction on removing the front cover.

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.

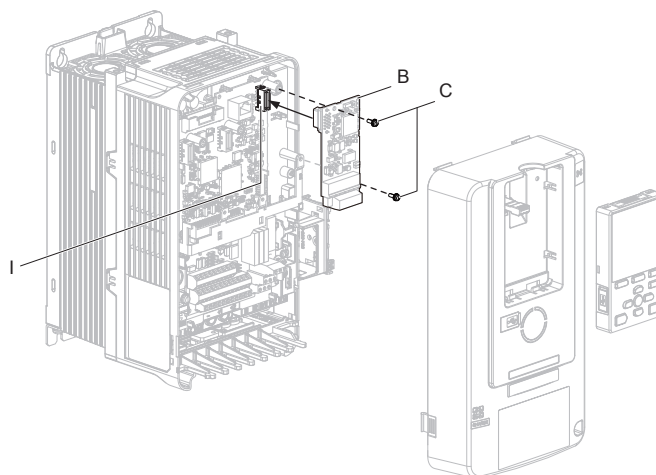


**Figure 5.9 Remove the LED Status Ring Board**

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:**

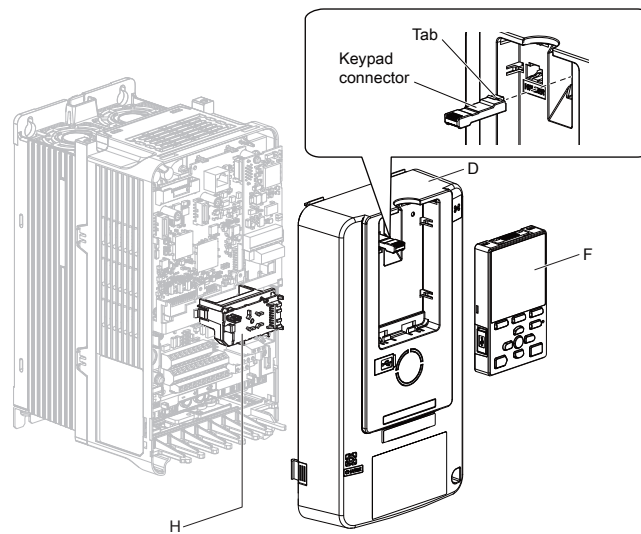
Installing the option card on a GA700 drive requires only two screws and does not require a ground wire. The option package ships with three screws and a ground wire for installation on other drive series. Do not use the ground wire or the extra screw.



**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.

## ◆ ESI File

For easy network implementation of drives equipped with a Communication Option card, the ESI file (ESI\_SI-ES3\_2\_01\_Rev\_00 or later revisions) can be obtained from these sources:

- Europe: <http://www.yaskawa.eu.com>
- Japan: <http://www.e-mechatronics.com>
- USA: <http://www.yaskawa.com>
- Other areas: contact a YASKAWA representative

## 6 EtherCAT Option Related Drive Parameters

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 */	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 */	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 *2	Motor 1 Motor Poles	Set the number of motor poles described on the motor nameplate. Relevant for DSP402. 2 to 48	4

## 7 Troubleshooting

No.	Name	Description	Default
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. <b>Note:</b> 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 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 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 7.1 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.			

### ◆ 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) (v1 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 explains the causes and possible solutions when a fault occurs. The drive will remain inoperable until the fault is cleared using the Fault Reset operation. Remove the cause of the fault referring to the following table.

Code	Name	Causes	Possible Solutions
bUS	Option Communication Error	No signal was received from the controller.	Correct any wiring errors.
		The communications cable wiring is incorrect.	
		There is a short circuit or disconnection in the communications cable.	<ul style="list-style-type: none"> <li>Repair disconnected cables and short circuits for proper wiring.</li> <li>Replace a faulty communications cable with a normal one.</li> </ul>
		Communication data error occurred due to noise.	<ul style="list-style-type: none"> <li>Check the control circuit lines, main circuit lines, and ground wiring, and minimize the effects of noise.</li> <li>Check whether an electromagnetic contactor is the noise source, and use Surge Protective Device if necessary.</li> <li>Use only recommended cables or other shielded line. Ground the shield on the controller side or the drive input power side.</li> <li>Separate all communication wiring from drive power lines, and install a noise filter to the input side of the power supply for communication.</li> <li>Minimize the effects of controller noise.</li> </ul>

Code	Name	Causes	Possible Solutions
		The option card is not properly connected to the drive.	Mount the option card to the drive correctly.
		The option card is damaged.	Replace the option card if the error continues to occur even though the wiring is correct.
EF0	Option Card External Fault	The communication option card received an external fault from the controller.	1. Identify the device that triggered the external faults and remove the cause. 2. Clear the external fault input from the controller.
		Programming error occurred on the controller side.	Check the operation of the controller program.
oFA00	Not supported	An option card that is not compatible with the CN5-A connector was connected.	Connect the option card to the correct connector. <b>Note:</b> The encoder option card could not be connected to the CN5-A connector.
oFA01	Connection Error	The option card connected to the CN5-A connector was changed during operation.	1. De-energize the drive. 2. Properly connect the option card to the connector on the drive, referring to the manual for the option card.
oFA30 to oFA43	Communication Option Card Connection Error (CN5-A)	A fault occurred in the option card.	1. De-energize the drive. 2. Check whether the option card is connected securely to the connector. 3. If the problem continues, replace the option card.
oFb00	Not supported	An option card that is not compatible with the CN5-B connector was connected.	Connect the option card to the correct connector. <b>Note:</b> The option cards that can be connected to the CN5-B connector are the DO-A3, AO-A3, PG-B3, and PG-X3. Use the CN5-C connector when mounting only one encoder option card.
oFb02	DuplicateOptions	The same option card or the same type of option card has been connected to the CN5-A, B, and C connectors.	Connect the option card to the correct connector.
oFC00	Not supported	An option card that is not compatible with the CN5-C connector was connected.	Connect the option card to the correct connector. <b>Note:</b> AI-A3, DI-D3, and communication option cards cannot be connected to the CN5-C connector.
oFC02	DuplicateOptions	The same option card or the same type of option card has been connected to the CN5-A, B, and C connectors.	Connect the option card to the correct connector.

### ◆ Minor Faults/Alarms

This section explains the causes and possible solutions when a minor fault or alarm occurs. Remove the cause of the fault referring to the following table.

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 disconnection in the communications cable.	<ul style="list-style-type: none"> <li>Repair disconnected cables and short circuits for proper wiring.</li> <li>Replace a faulty communications cable with a normal one.</li> </ul>
		Programming error occurred on the controller side.	Check communications at start-up and correct programming errors.

Code	Name	Causes	Possible Solutions
		Communications circuitry is damaged.	<ul style="list-style-type: none"> <li>Perform a self-diagnostics check.</li> <li>If the problem continues, replace the control board or the entire drive. For instructions on replacing the control board, contact Yaskawa or your nearest sales representative.</li> </ul>
		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.
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.	<ul style="list-style-type: none"> <li>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)).</li> <li>If the object dictionary has not been changed, execute a Restore Parameter command (Index = 1011 (Hex)).</li> </ul>
		Programming error occurred on the controller side.	Check communications at start-up and correct programming errors.
		Communications circuitry is damaged.	<ul style="list-style-type: none"> <li>Perform a self-diagnostics check.</li> <li>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.</li> </ul>
		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.

## 8 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

---

# Index

<b>A</b>	
Alarm .....	22
<b>B</b>	
bUS	
Fault .....	21
<b>C</b>	
CALL .....	22
<b>E</b>	
EEP .....	23
EFO	
Fault .....	22
<b>F</b>	
Fault .....	21
<b>M</b>	
Minor Fault .....	22
<b>O</b>	
oFA00 .....	22
oFA01 .....	22
oFA30 to oFA43 .....	22
oFb00 .....	22
oFb02 .....	22
oFC00 .....	22
oFC02 .....	22



---

## Revision History

Date of Publication	Revision Number	Section	Revised Content
July 2011	–	–	First Edition
September 2016	B	All	Updated with new supported inverter drives and regenerative unit. Updated descriptions and procedures.

# YASKAWA EtherCAT Communication Option

## Communication Options Card for Inverter Drives and Regenerative Units

---

### YASKAWA EUROPE GmbH

Hauptstraße 185, 65760 Eschborn, Germany

Phone: +49-6196-569-500

E-mail: [support@yaskawa.eu.com](mailto:support@yaskawa.eu.com)

<http://www.yaskawa.eu.com>

### DRIVE CENTER (INVERTER PLANT)

2-13-1, Nishimiyaichi, Yukuhashi, Fukuoka, 824-8511, Japan

Phone: +81-930-25-2548 Fax: +81-930-25-3431

<http://www.yaskawa.co.jp>

### YASKAWA AMERICA, INC.

2121, Norman Drive South, Waukegan, IL 60085, U.S.A.

Phone: +1-800-YASKAWA (927-5292) or +1-847-887-7000 Fax: +1-847-887-7310

<http://www.yaskawa.com>

---

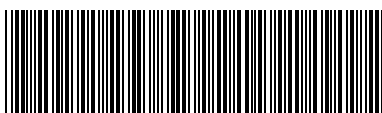
# YASKAWA

YASKAWA Europe GmbH

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.

© 2016 YASKAWA Europe GmbH



\*TOEPC71061699\*

MANUAL NO. TOEP C710616 99B <1>-0  
Published in Germany September 2016  
11-9  
Original instructions