YASKAWA

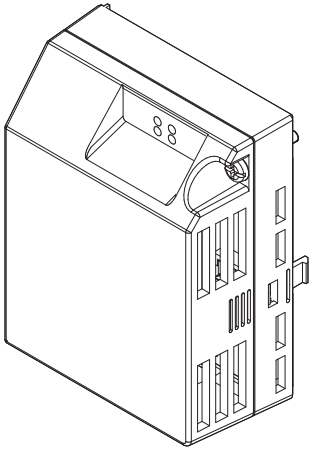
YASKAWA AC Drive V1000 Option

Modbus TCP/IP

Installation Manual

Type: SI-EM3D/V

To properly use the product, read this manual thoroughly and retain for easy reference, inspection, and maintenance. Ensure the end user receives this manual.



MANUAL NO. TOEP YAICOM 17B

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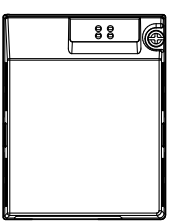
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1 Preface and Safety

Yaskawa manufactures products used as components in a wide variety of industrial systems and equipment. The selection and application of Yaskawa products remain the responsibility of the equipment manufacturer or end user. Yaskawa accepts no responsibility for the way its products are incorporated into the final system design. Under no circumstances should any Yaskawa product be incorporated into any product or design as the exclusive or sole safety control. Without exception, all controls should be designed to detect faults dynamically and fail safely under all circumstances. All systems or equipment designed to incorporate a product manufactured by Yaskawa must be supplied to the end user with appropriate warnings and instructions as to the safe use and operation of that part. Any warnings provided by Yaskawa must be promptly provided to the end user. Yaskawa offers an express warranty only as to the quality of its products in conforming to standards and specifications published in the Yaskawa manual. NO OTHER WARRANTY, EXPRESS OR IMPLIED, IS OFFERED. Yaskawa assumes no liability for any personal injury, property damage, losses, or claims arising from misapplication of its products.

◆ Applicable Documentation

The following manuals are available for the SI-EM3D/V option:

	Yaskawa AC Drive V1000 Option SI-EM3D/V Dual-Port Modbus TCP/IP Installation Manual (TOEPYAICOM17)
	The Installation Manual contains information required to install the option and set up related drive parameters.
	Yaskawa AC Drive V1000 Option SI-EM3D/V Dual-Port Modbus TCP/IP Technical Manual (SIEPYAICOM17)
	The Technical Manual contains detailed information about the option. In the U.S., access http://www.yaskawa.com to obtain the Technical Manual. Customers in other areas should contact a Yaskawa representative.

	V1000 Series AC Drive Quick Start Guide
	This guide contains basic information required to install and wire the drive. It also gives an overview of fault diagnostics, maintenance, and parameter settings. The purpose of this guide is to prepare the drive for a trial run with an application and for basic operation. This manual is available for download on our documentation website, www.yaskawa.com.
	V1000 Series AC Drive Technical Manual
	This manual provides detailed information on parameter settings, drive functions, and MEMOBUS/Modbus specifications. Use this manual to expand drive functionality and to take advantage of higher performance features. This manual is available for download on our documentation website, www.yaskawa.com.

Terms

Note: Indicates supplemental information that is not related to safety messages.

Drive: Yaskawa V1000 Series AC Drive

Option: Yaskawa AC Drive V1000 SI-EM3D/V Dual-Port Modbus TCP/IP Option

Registered Trademarks

- Modbus TCP/IP is a trademark of Modbus-IDA.
- All trademarks are the property of their respective owners.

Supplemental Safety Information

Read and understand this manual before installing, operating, or servicing this option. The option must be installed according to this manual and local codes.

The following conventions are used to indicate safety messages in this manual. Failure to heed these messages could result in serious or possibly even fatal injury or damage to the products or to related equipment and systems.

DANGER

Indicates a hazardous situation, which, if not avoided, will result in death or serious injury.

WARNING

Indicates a hazardous situation, which, if not avoided, could result in death or serious injury.

WARNING! *may also be indicated by a bold key word embedded in the text followed by an italicized safety message.*

CAUTION

Indicates a hazardous situation, which, if not avoided, could result in minor or moderate injury.

CAUTION! *may also be indicated by a bold key word embedded in the text followed by an italicized safety message.*

NOTICE

Indicates a property damage message.

NOTICE: *may also be indicated by a bold key word embedded in the text followed by an italicized safety message.*

■ General Safety

General Precautions
• The diagrams in this manual may be indicated without covers or safety shields to show details. Replace the covers or shields before operating the drive and run the drive according to the instructions described in this manual.
• Any illustrations, photographs, or examples used in this manual are provided as examples only and may not apply to all products to which this manual is applicable.
• The products and specifications described in this manual or the content and presentation of the manual may be changed without notice to improve the product and/or the manual.
• When ordering a new copy of the manual due to damage or loss, contact your Yaskawa representative or the nearest Yaskawa sales office and provide the manual number shown on the front cover.
• If nameplate becomes worn or damaged, order a replacement from your Yaskawa representative or the nearest Yaskawa sales office.

⚠ DANGER

Heed the safety messages in this manual.

Failure to comply will result in death or serious injury.

The operating company is responsible for any injuries or equipment damage resulting from failure to heed the warnings in this manual.

Electrical Shock Hazard

Do not connect or disconnect wiring while the power is on.

Failure to comply will result in death or serious injury.

Failure to comply will result in death or serious injury. Before servicing, disconnect all power to the equipment. The internal capacitor remains charged even after the power supply is turned off. The charge indicator LED will extinguish when the DC bus voltage is below 50 Vdc. To prevent electric shock, wait for at least the time specified on the warning label once all indicators are OFF, and then measure the DC bus voltage level to confirm it has reached a safe level.

NOTICE

Observe proper electrostatic discharge procedures (ESD) when handling the drive and circuit boards.

Failure to comply may result in ESD damage to the drive circuitry.

Do not perform a withstand voltage test on any part of the drive.

Failure to comply could result in damage to the sensitive devices within the drive.

Do not operate damaged equipment.

Failure to comply could result in further damage to the equipment.

Do not connect or operate any equipment with visible damage or missing parts.

Do not expose the drive to halogen group disinfectants.

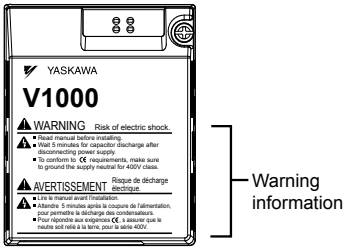
Failure to comply may cause damage to the electrical components in the drive.

Do not pack the drive in wooden materials that have been fumigated or sterilized.

Do not sterilize the entire package after the product is packed.

■ Option Unit Warning Labels

Warning information is displayed on the option unit as shown in the figure below. Follow all warnings and safety instructions when using the product.



■ Warning Contents



2 Product Overview

About this Product

This option provides a communications connection between the drive and a Modbus TCP/IP network. The option connects the drive to a Modbus TCP/IP network and facilitates the exchange of data.

This manual explains the handling, installation and specifications of this product.

The option is a communications link to connect industrial devices (such as smart motor controllers, operator interfaces, and variable frequency drives) as well as control devices (such as programmable controllers and computers) to a network. The option is a simple, networking solution that reduces the cost and time to wire and install factory automation devices, while providing interchangeability of like components from multiple vendors.

By installing the option to a drive, it is possible to do the following from a Modbus TCP/IP master device:

- Operate the drive
- Monitor drive status
- Change drive parameter settings.

Applicable Models

The option can be used with the drive models in ***Table 1***.

Table 1 Applicable Models

Drive Series	Drive Model Number	Software Version <1>
V1000	CIMR-V□□A□□□□	1012 and later

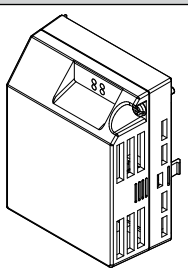
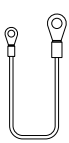
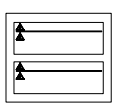
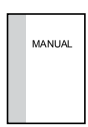
<1> See “PRG” on the drive nameplate for the software version number.

3 Receiving

Please perform the following tasks upon receipt of the option:

- Inspect the option for damage. Contact the shipper immediately if the option appears damaged upon receipt.
- Verify receipt of the correct model by checking the model number printed on the name plate of the option package.
- Contact your supplier if you have received the wrong model or the option does not function properly.

◆ Option Package Contents

Description	Option Unit	Ground Wire	Warning Labels	Installation Manual
–				
Quantity	1	4	1	1

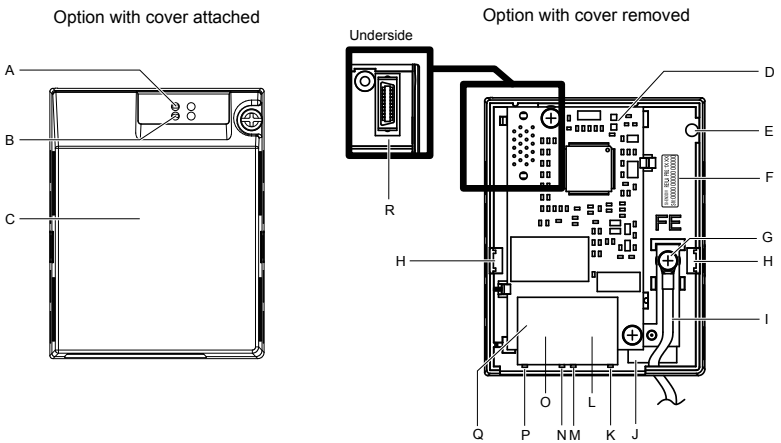
◆ Tools Required for Installation

A Phillips screwdriver (M3, M3.5 to M6 metric or #1, #2 U.S. standard) is required to install the option. Screw sizes vary by drive capacity. Select a screwdriver appropriate for the drive capacity.

Note: Tools required to prepare the option cables for wiring are not listed in this manual.

4 Option Components

◆ SI-EM3D/V Dual-Port Modbus TCP/IP Option Unit



A – LED (MS) <2>
B – LED (NS) <2>
C – Option cover
D – Modbus TCP/IP PCB
E – Attachment screw hole for option cover
F – Nameplate
G – Functional earth cable connection (FE)
H – Mounting tab
I – Ground wire <1>
J – Pass-through hole for ground wire
K – Port 2 LED (10/100) <2>
L – Port 2
M – Port 2 LED (LINK/ACT) <2>
N – Port 1 LED (10/100) <2>
O – Port 1
P – Port 1 LED (LINK/ACT) <2>
Q – Modbus TCP/IP cable connector
R – Option connector

Figure 1 Option Unit Components

<1> A selection of ground wires are packaged loose in the option shipping package. Connect the appropriate ground wire based on drive model during installation.

<2> *Refer to Option LED Display on page 14* for details on the LEDs.

◆ Dimensions

The installed option adds 27 mm (1.06 in.) to the total depth of the drive.

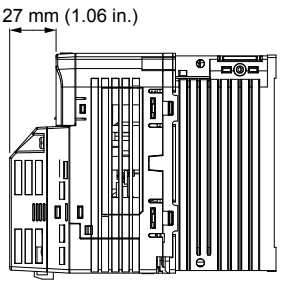


Figure 2 Dimensions

◆ Communication Connector CN1

Communication Connector CN1 is a modular RJ45 female connector and the connection point for a customer-supplied male Modbus network communication cable.

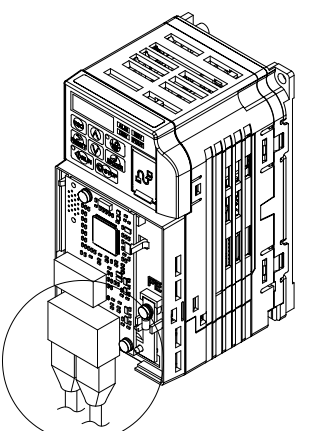
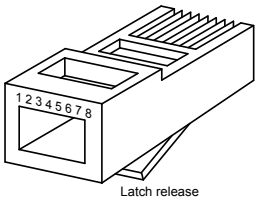


Figure 3 Communication Connector CN1 (RJ45)

Table 2 Male, 8-Way Modular Connector (Customer-Supplied)

Male 8-Way Modular Connector	Pin	Description
	1 (Pair 2)	Transmit data (TXD) +
	2 (Pair 2)	Transmit data (TXD) -
	3 (Pair 3)	Receive data (RXD) +
	4 (Pair 1)	Not used <1>
	5 (Pair 1)	Not used <1>
	6 (Pair 3)	Receive data (RXD) -
	7 (Pair 4)	Not used <1>
	8 (Pair 4)	Not used <1>

<1> Not used for 10 Mbps and 100 Mbps networks.

◆ Option LED Display

The option has four LEDs.

Bi-color Status LEDs:

- Module status (MS) red/green
- Network status (NS) red/green

Ethernet LEDs:

- Network speed - 10/100 (MS) green
- Link status and network activity - LINK/ACT (NS) red/green

The operational states of the option LEDs after completion of the power-up diagnostic LED sequence are described in ***Table 3***. Wait at least 2 seconds for the power-up diagnostic process to complete before verifying LED states.

Table 3 Option LED States

Name	Display		Operating Status	Remarks
	Color	Status		
MS	–	OFF	Power supply OFF	Power is not being supplied to the drive.
	Green	ON	Normal operation	The option is operating normally and initialization is complete.
	Green	Flashing	Standby/Initializing	The option is in process of configuring or waiting for configuration information.
	Red	Flashing	Non-fatal error occurred	The option has detected a recoverable minor fault such as incomplete configuration.
	Red	ON	Fatal error occurred	The option has detected an unrecoverable major fault.
NS	–	OFF	Power supply OFF or no network connection established.	–
	Green	ON	Online communications established	The option is online and has established connections.
	Green	Flashing	Control communications established	The option is online with a control connection.
	Red	ON	Major fault	The option detected a duplicate IP address or the control connection timed out.

Name	Display		Operating Status	Remarks
	Color	Status		
10/100 <1>	Green	OFF	10 Mbps is established	–
	Green	ON	100 Mbps is established	
LINK/ACT <1>	Green	OFF	LINK is not established	
	Green	ON	LINK is established	
	Green	Flashing	LINK is established and there is network activity.	

<1> Remove the cover to check the status of the LED. Be careful not to touch the main circuit terminals or the control board in the drive.

5 Installation Procedure

◆ Section Safety

⚠ DANGER

Electrical Shock Hazard

Do not connect or disconnect wiring while the power is on.

Failure to comply will result in death or serious injury.

Disconnect all power to the drive and wait at least the amount of time specified on the drive front cover safety label. After all indicators are off, measure the DC bus voltage to confirm safe level, and check for unsafe voltages before servicing. The internal capacitor remains charged after the power supply is turned off.

⚠ WARNING

Electrical Shock Hazard

Do not remove the option unit cover while the power is on.

Failure to comply could result in death or serious injury.

The diagrams in this section may include options and drives without covers or safety shields to show details. Be sure to reinstall covers or shields before operating any devices. The option should be used according to the instructions described in this manual.

Do not allow unqualified personnel to use equipment.

Failure to comply could result in death or serious injury.

Maintenance, inspection, and replacement of parts must be performed only by authorized personnel familiar with installation, adjustment, and maintenance of this product.

Do not use damaged wires, stress the wiring, or damage the wire insulation.

Failure to comply could result in death or serious injury.

Do not use damaged wires, place excessive stress on wiring, or damage the wire insulation.

Failure to comply could result in death or serious injury.

⚠ WARNING

Fire Hazard

Tighten all terminal screws to the specified tightening torque.

Loose electrical connections could result in death or serious injury by fire due to overheating of electrical connections.

NOTICE

Observe proper electrostatic discharge procedures (ESD) when handling the drive and circuit boards.

Failure to comply may result in ESD damage to the drive circuitry.

Never shut the power off while the drive is outputting voltage.

Failure to comply may cause the application to operate incorrectly or damage the drive.

Do not operate damaged equipment.

Failure to comply may cause further damage to the equipment.

Do not connect or operate any equipment with visible damage or missing parts.

Do not use unshielded cable for control wiring.

Failure to comply may cause electrical interference resulting in poor system performance.

Use shielded twisted-pair wires and ground the shield to the ground terminal of the drive.

Properly connect all pins and connectors.

Failure to comply may prevent proper operation and possibly damage equipment.

Check wiring to ensure that all connections are correct after installing the option and connecting any other devices.

Failure to comply could result in damage to the option.

◆ Prior to Installing the Option

Prior to installing the option, wire the drive, make necessary connections to the drive terminals, and verify that the drive functions normally without the option installed. Refer to the drive Quick Start Guide for information on wiring and connecting the drive.

◆ Installing the Option

DANGER! *DANGER! Electrical Shock Hazard. Do not connect or disconnect wiring while the power is on. Failure to comply could result in death or serious injury. Before installing the option, disconnect all power to the drive and wait at least the amount of time specified on the drive front cover safety label. After all indicators are off, measure the DC bus voltage to confirm safe level, and check for unsafe voltages before servicing. The internal capacitor remains charged after the power supply is turned off.*

1. Shut off power to the drive, wait at least five minutes after confirming the DC bus voltage is safe, then loosen the screw that fastens the front cover in place and remove the front cover. This drive front cover will be replaced by the option cover. Cover removal varies depending on drive size.

   NOTICE: *Damage to Equipment. Observe proper electrostatic discharge procedures (ESD) when handling the option, drive, and circuit boards. Failure to comply may result in ESD damage to circuitry.*

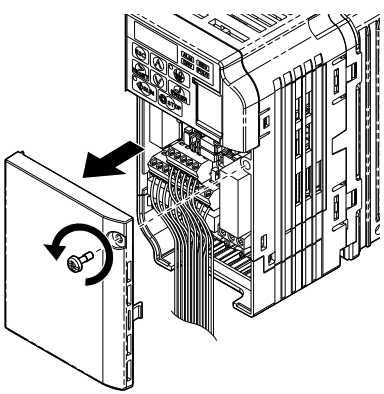


Figure 4 Remove the Front Cover

2. The remaining installation steps differ based on drive model. Find the drive model number on the drive nameplate and refer to the step indicated in ***Table 4*** based on your model number

Table 4 Installation Steps Based on Drive Model

Enclosure Type	Drive Model	Proceed to Step	Page
IP20/Open-Chassis	CIMR-V□□A□□□□B	3	*19*
IP20/NEMA Type 1<1>	CIMR-V□□A□□□□F	6	*20*

<1> Installing the option on an IP20/NEMA Type 1 enclosure drive voids NEMA Type 1 protection while maintaining IP20 conformity.

3. For IP20/Open-Chassis models CIMR-V□□A□□□□B, remove the bottom cover of the drive by applying pressure to the tabs on each side of the bottom cover. Pull the bottom cover away from the drive while pushing in on the tabs to release the cover from the drive. Refer to ***Figure 5*** for details.

Refer to ***Figure 6*** for drive models BA0006B to BA0018B, 2A0008B to 2A0069B, and 4A0001B to 4A0038B, which require removing the terminal cover prior to removing the bottom cover.

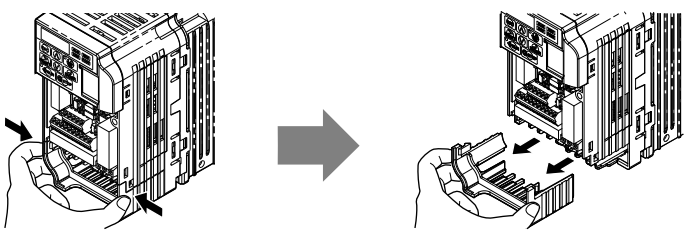


Figure 5 Remove the Bottom Cover on an IP20/Open-Chassis Drive (Models BA0001B to BA0003B and 2A0001B to 2A0006B)

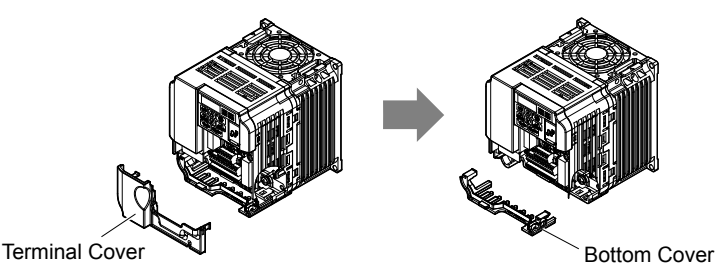


Figure 6 Remove the Terminal Cover and Bottom Cover on an IP20/Open-Chassis Drive (Models BA0006B to BA0018B; 2A0008B to 2A0069B; 4A0001B to 4A0038B)

4. On IP20/Open-Chassis models, connect the drive side of the ground wire to the drive ground terminal.

Note: The different ground wires packaged with the option connect the option to different drive models. Select the proper ground wire depending on drive size. Refer to ***Table 5*** for ground wire selection by drive model.

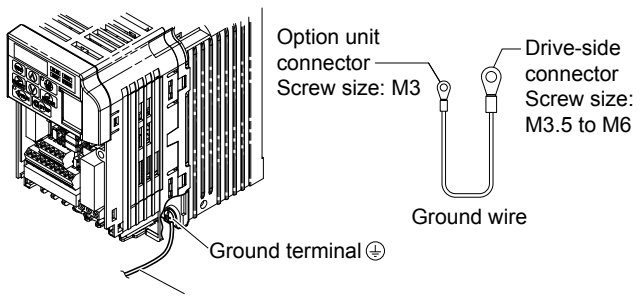


Figure 7 Connect the Ground Wire on an IP20/Open-Chassis Drive

Table 5 Ground Wire Selection

Ground Wire Length (mm/in)	Drive Model		
	Single-Phase 200 V Class	Three-Phase 200 V Class	Three-Phase 400 V Class
150/5.9	BA0001 BA0002 BA0003	2A0001 2A0002 2A0004 2A0006	–
200/7.9	BA0006 BA0010 BA0012 BA0018	2A0010 2A0012 2A0020	4A0001 4A0002 4A0004 4A0005 4A0007 4A0009 4A0011
250/9.8	–	2A0030 2A0040	4A0018 4A0023
400/15.7	–	2A0056 2A0069	4A0031 4A0038

5. For IP20/Open-Chassis models, go to Step 9. on page 36.

6. For IP20/NEMA Type 1 enclosure models CIMR-V□□A□□□□F, loosen the screw on the front of the NEMA Type 1 terminal cover and remove it from the drive. Refer to ***Figure 8*** for details.

Refer to ***Figure 9*** for drive models BA0006F to BA0018F, 2A0010F to 2A0069F, and 4A0001F to 4A0038F, which require removing the plastic terminal cover prior to removing the NEMA Type 1 terminal cover.

Note: Installing the option on an IP20/NEMA Type 1 enclosure drive voids NEMA Type 1 protection while maintaining IP20 conformity.

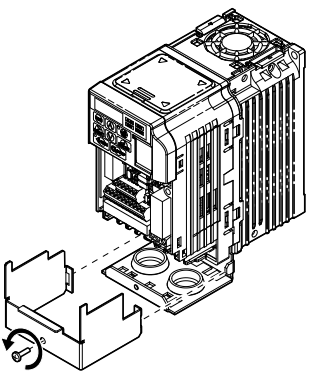


Figure 8 Remove the NEMA Type 1 Terminal Cover
(Models BA0001F to BA0003F and 2A0001F to 2A0006F)

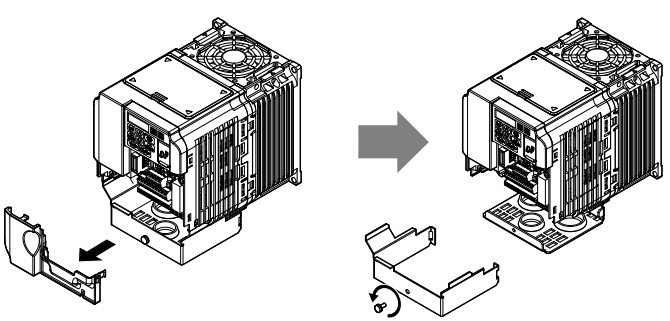


Figure 9 Remove the Terminal Cover on an IP20/NEMA Type 1 Drive
(Models BA0006F to BA0018F; 2A0008F to 2A0069F; 4A0001F to 4A0038F)

7. For models BA0001F to BA0003F and 2A0001F to 2A0006F, loosen the screws attaching the NEMA Type 1 conduit bracket to the drive to remove the NEMA Type 1 conduit bracket.

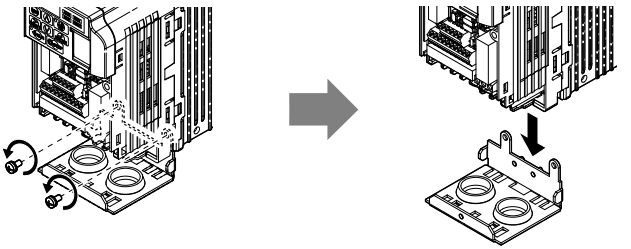


Figure 10 Remove the NEMA Type 1 Conduit Bracket (Models BA0001F to BA0003F and 2A0001F to 2A0006F)

8. On models (BA0001F to BA0003F and 2A0001F to 2A0006F), the screw for the drive ground terminal also acts as one of the screws that attaches the NEMA Type 1 conduit bracket to the drive. Reattach the NEMA Type 1 conduit bracket according to Figure 27 and connect the drive-side of the ground wire to the drive ground terminal.

Note: The different ground wires packaged with the option connect the option to different drive models. Select the proper ground wire depending on drive size. Refer to ***Table 5*** on page ***20*** for ground wire selection by drive model.

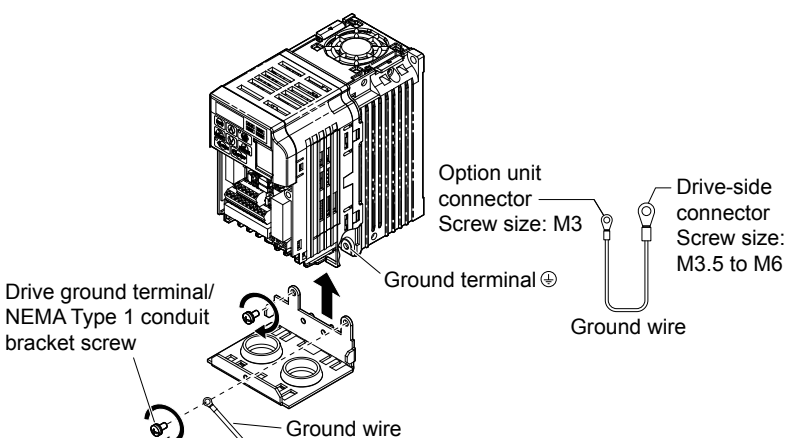
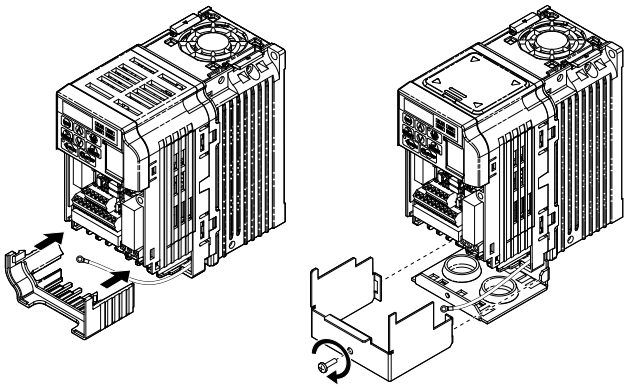


Figure 11 Reattach the NEMA Type 1 Conduit Bracket and Connect the Ground Wire (Models BA0001F to BA0003F and 2A0001F to 2A0006F)

9. Reattach the bottom cover. Keep the ground wire inside of the bottom cover when reattaching.



IP20/Open-Chassis IP20/NEMA Type 1 Enclosure

Figure 12 Reattach the Bottom Cover

10. On models BA0006 to BA0018, 2A0008 to 2A0069, and 4A0001 to 4A0038, reattach the terminal cover.

Refer to ***Figure 13*** and ***Figure 14*** for drive models BA0006 to BA0018, 2A0008 to 2A0020, and 4A0001 to 4A0011, which require routing the ground wire through the provided notch when reinstalling the terminal cover.

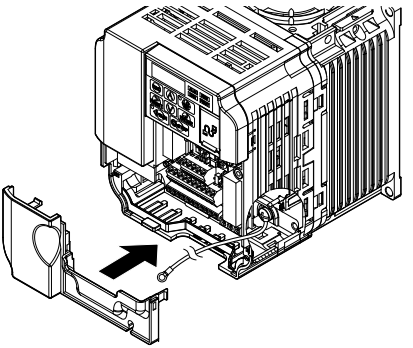


Figure 13 Reattach the Terminal Cover
(Models BA0006 to BA0018; 2A0008 to 2A0069; 4A0001 to 4A0038)

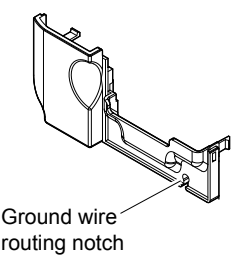


Figure 14 Terminal Cover Ground Wire Notch
(Models BA0006 to BA0018; 2A0008 to 2A0020; 4A0001 to 4A0011)

11. Remove the option cover and pass the ground wire through the inside of the drive bottom cover and into the through-hole for the ground wire at the front of the option.

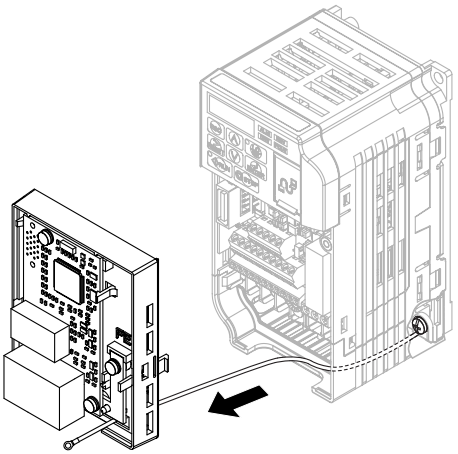


Figure 15 Ground Wire Routing

12. Attach the option to the drive. Properly seat the tabs on the left and right sides of the option to the drive case.

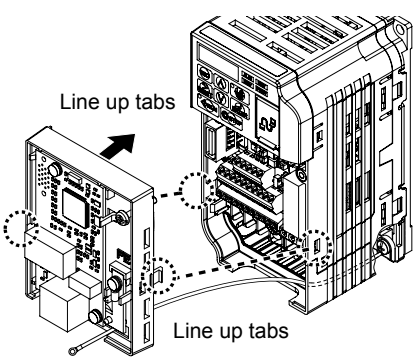


Figure 16 Connect the Option

13. Connect the ground wire at the option ground terminal. Tighten the screw to 0.5 to 0.6 N • m or (4.4 to 5.3 in lbs) using an M3 Phillips screwdriver.

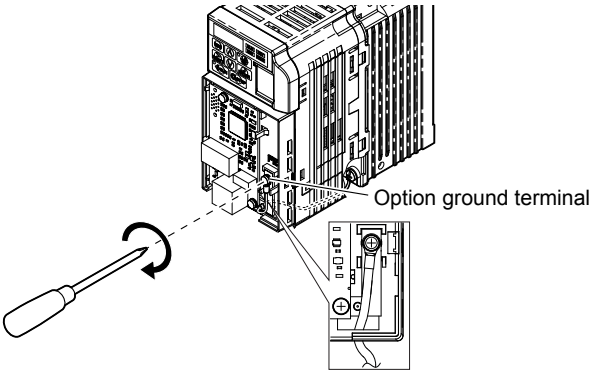


Figure 17 Connect the Ground Wire to the Option

14. Connect the communication cable to the option modular connector (CN1) port 1.

To connect the option to a network, firmly connect RJ45 8-pin shielded twisted pair Cat5e cable(s) into the modular connector ports (see ***Figure 18***).

Communication Cable Specifications

Only use cable recommended for Modbus TCP/IP. Using a cable not specifically recommended may cause the option or drive to malfunction.

The dual RJ45 network ports on the option board act as a switch to allow for flexibility in cabling topology. For example, a traditional star network topology may be employed by using a single port on the option board. Alternatively, a daisy-chained approach may be employed by using both RJ45 ports. The daisy-chained approach reduces the requirements of central switch ports. A ring topology is also possible. When implementing a ring topology, Rapid Spanning Tree Protocol (RSTP) must be enabled to function correctly.

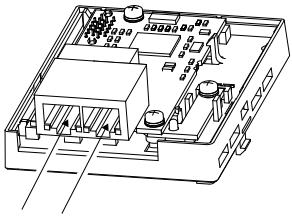


Figure 18 Communication Cable Ports

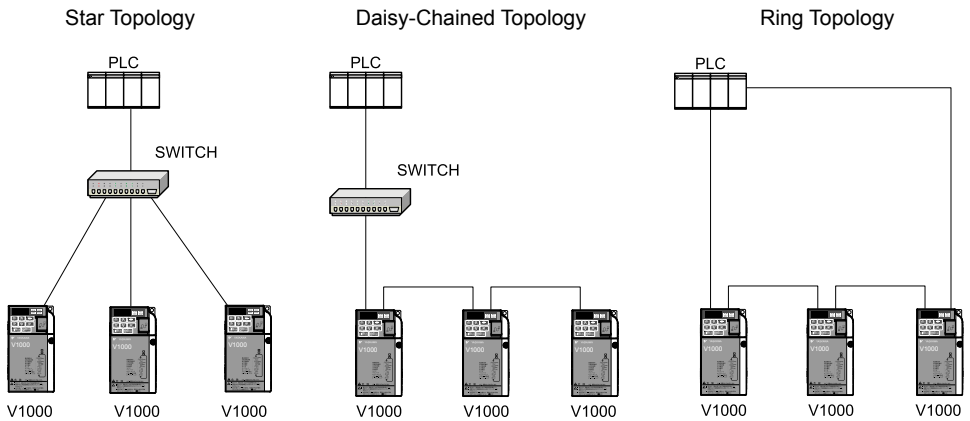


Figure 19 Topology Options

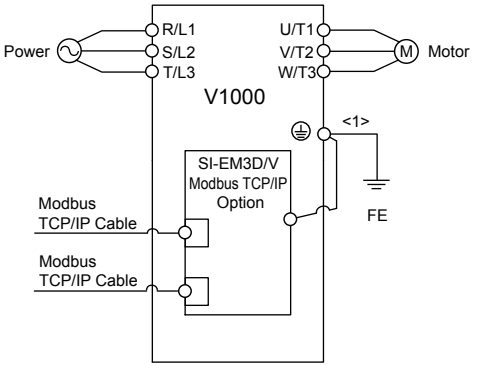


Figure 20 Option Connection Diagram

15. Use the second communication cable port to daisy chain a series of drives where applicable.

16. Attach the option cover by aligning the tabs with the mounting holes, seat the front cover into place, and tighten the screw on the front.

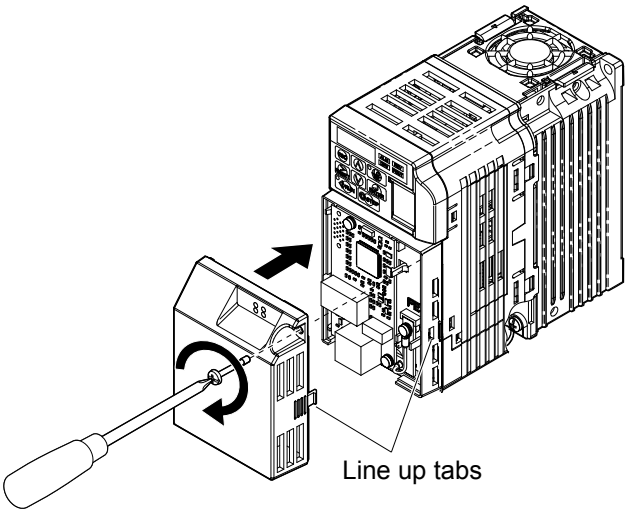


Figure 21 Attach the Option Cover

Note: Take proper precautions when wiring the option so that the front covers will easily fit back onto the drive. Make sure no cables are pinched between the front covers and the drive when replacing the covers.

17. Set drive parameters in ***Table 6*** for proper option performance.

6 Related Drive Parameters

The following parameters are used to set up the drive for operation with the option. Parameter setting instructions can be found in the drive manual.

Confirm proper setting of the parameters in ***Table 6*** before starting network communications. After changing parameter settings, cycle power to the drive for the new settings to take effect.

Table 6 Related Parameters

No. (Addr. Hex)	Name	Description	Values
b1-01 (0180) *<1>*	Frequency Reference Selection 1	0: Digital operator 1: Analog input terminals 2: MEMOBUS/Modbus communications 3: Option PCB 4: Pulse input (terminal RP)	Default: 1 Range: 0 to 4
b1-02 (0181) *<1>*	Run Command Selection 1	0: Digital operator 1: Digital input terminals 2: MEMOBUS/Modbus communications 3: Option PCB	Default: 1 Range: 0 to 3
F6-01 (03A2)	Communications Error Operation Selection	0: Ramp to stop. Decelerate to stop using the deceleration time in C1-02. 1: Coast to stop 2: Fast Stop. Decelerate to stop using the deceleration time in C1-09. 3: Alarm only *<2>* 4: Alarm (d1-04) *<3>* 5: Alarm Ramp to Stop *<3>*	Default: 1 Range: 0 to 5
F6-02 (03A3)	External Fault from Comm. Option Detection Selection	1: Detection during run only	Default: 0 Range: 0, 1
F6-03 (03A4)	External Fault from Comm. Option Operation Selection	0: Ramp to stop. Decelerate to stop using the deceleration time in C1-02. 1: Coast to stop 2: Fast Stop. Decelerate to stop using the deceleration time in C1-09. 3: Alarm only *<2>*	Default: 1 Range: 0 to 3
F6-07 (03A8)	Multi-Step Speed Enable/Disable Selection when NefRef/ ComRef is Selected	0: Multi-step reference disabled (same as F7) 1: Multi-step reference enabled (same as V7)	Default: 1 Range: 0, 1
F6-08 (036A) *<4>*	Reset Communication Parameters	0: Communication-related parameters (F6-☐☐/F7-☐☐) are not reset when the drive is initialized using A1-03. 1: Reset all communication-related parameters (F6-☐☐/F7-☐☐) when the drive is initialized using A1-03.	Default: 0 Range: 0, 1
F6-14 (03BB)	bUS Error Auto Reset	0: Disabled 1: Enabled	Default: 0 Range: 0, 1

No. (Addr. Hex)	Name	Description	Values
F7-01 (03E5) <5>	IP Address 1	Sets the most significant octet of network static IP address.	Default: 192 Range: 0 to 255
F7-02 (03E6) <5>	IP Address 2	Sets the second most significant octet of network static IP address.	Default: 168 Range: 0 to 255
F7-03 (03E7) <5>	IP Address 3	Sets the third most significant octet of network static IP address.	Default: 1 Range: 0 to 255
F7-04 (03E8) <5>	IP Address 4	Sets the fourth most significant octet of network static IP address.	Default: 20 Range: 0 to 255
F7-05 (03E9)	Subnet Mask 1	Sets the most significant octet of network static Subnet Mask.	Default: 255 Range: 0 to 255
F7-06 (03EA)	Subnet Mask 2	Sets the second most significant octet of network static Subnet Mask.	Default: 255 Range: 0 to 255
F7-07 (03EB)	Subnet Mask 3	Sets the third most significant octet of network static Subnet Mask.	Default: 255 Range: 0 to 255
F7-08 (03EC)	Subnet Mask 4	Sets the fourth most significant octet of network static Subnet Mask.	Default: 0 Range: 0 to 255
F7-09 (03ED)	Gateway Address 1	Sets the most significant octet of network Gateway address.	Default: 192 Range: 0 to 255
F7-10 (03EE)	Gateway Address 2	Sets the second most significant octet of network Gateway address.	Default: 168 Range: 0 to 255
F7-11 (03EF)	Gateway Address 3	Sets the third most significant octet of network Gateway address.	Default: 1 Range: 0 to 255
F7-12 (03E0)	Gateway Address 4	Sets the fourth most significant octet of network Gateway address.	Default: 1 Range: 0 to 255
F7-13 (03F1)	Address Mode at Startup	Select the option address setting method 0: Static <6> 1: BOOTP 2: DHCP	Default: 2 Range: 0 to 2
F7-14 (03F2)	Duplex Mode Selection	Selects duplex mode setting. 0: Half duplex forced (both ports) <7> 1: Auto-negotiate duplex mode and communication speed (both ports) 2: Full duplex forced (both ports) <7> 3: Half (port 1)/Auto (port 2) 4: Half (Port 1)/Full (port 2) 5: Auto (port 1)/Half (port 2) 6: Auto (port 1)/Full (port 2) 7: Full (port 1)/Half (port 2) 8: Full (port 1)/Auto (port 2)	Default: <8> Range: 0 to 8 <9>

No. (Addr. Hex)	Name	Description	Values
F7-15 (03F3)	Communication Speed Selection	Sets the communication speed 0: 10 Mbps 10: 10 Mbps 100: 100 Mbps 101: 10 (Port 1)/100 Mbps (port 2) 102: 100 (Port 1)/10 Mbps (port 2)	Default: 10 *<10>* Range: 10; 100 to 102 *<10>*
F7-16 (03F4)	Communication Loss Timeout	Sets the timeout value for communication loss detection in tenths of a second. A value of 0 disables the connection timeout. Example: An entered value of 100 represents 10.0 seconds.	Default: 0.0 Min.: 0.0 Max.: 30.0
H5-11 (043C)	Communications ENTER Function Selection	Selects the function for the ENTER command that saves parameter data to the drive. 0: Parameter changes are activated when ENTER command is written 1: Parameter changes are activated immediately without use of ENTER command	Default: 1 Range: 0, 1

<1> To start and stop the drive with the master device using serial communications, set b1-02 to 3. To control the drive frequency reference of the drive via the master device, set b1-01 to 3.

<2> When set to 3, 4, or 5, the drive will continue to operate when a fault is detected. Take safety measures, such as installing an emergency stop switch.

<3> Available in drive software versions PRG: 1024 and later.

<4> Parameter setting value is not reset to the default value when the drive is initialized.

<5> Cycle power for setting changes to take effect.

<6> When F7-13 is set to 0, parameters F7-01 to F7-12 must be set, and all IP Addresses (as defined with parameters F7-01 to F7-04) must be unique.

<7> When F7-14 is set to 0 or 2, parameter F7-15 must be set.

<8> Default setting differs depending on drive software version. PRG: 1012 to 1015: 0
PRG: 1016 and later: 1

<9> Setting range differs depending on drive software version. PRG: 1012 to 1023, Range: 0 to 2
PRG: 1024 and later, Range: 0 to 8

<10> Setting values differ depending on drive software version. PRG: 1012 to 1015, Default: 0; Range: 0, 10, 100
PRG: 1016 to 1023, Default: 10; Range: 10, 100
PRG: 1024 and later, Default: 10; Range: 10; 100 to 102

Table 7 Option Monitors

No.	Name	Description	Value Range
U6-80 to U6-83	Online IP Address	IP Address currently available; U6-80 is the most significant octet	0 to 255
U6-84 to U6-87	Online Subnet	Subnet currently available; U6-84 is the most significant octet	0 to 255

No.	Name	Description	Value Range
U6-88 to U6-91	Online Gateway	Gateway currently available; U6-88 is the most significant octet	0 to 255
U6-92	Online Speed	Link Speed	10: 10 Mbps 100: 100 Mbps
U6-93	Online Duplex	Duplex Setting	0: Half, 1: Full
U6-94	Port 2 Speed	Port 2 Link Speed	0: Half, 1: Full
U6-95	Port 2 Duplex	Port 2 Duplex Setting	10: 10 Mbps 100: 100 Mbps
U6-96	RSTP	RSTP Role and State	0000 to 9292
U6-98	First Fault	First Option Fault	–
U6-99	Current Fault	Current Option Fault	–

7 Modbus TCP/IP Messaging

◆ Modbus TCP/IP Overview

The Modbus TCP/IP protocol is essentially the Modbus protocol over an Modbus TCP/IP network. A master controller (typically a PLC) sends commands to slave devices, which then perform the specified functions and send a response to the master. The drive using the option has slave functionality.

■ Supported Modbus TCP/IP Commands

Table 8 Supported Modbus TCP/IP Commands

Function Code	Function Name
03H	Read Multiple Registers
06H	Write Single Register
10H	Write Multiple Registers
17H	Read/Write Multiple Registers

■ Drive Modbus TCP/IP Option Registers

All of the command registers, monitor registers, and parameters documented in the drive Technical Manual are accessible via the option.

■ High Speed Access Drive Modbus TCP/IP Option Registers

Many of the registers required for control have been specially mapped to provide higher speed access to increase network performance. Use these registers for the best response times.

All drive command registers have been mapped to this high speed access area (Modbus TCP/IP registers 01H to 01FH) as shown in ***Table 9***. In addition, the monitors shown in ***Table 10*** are mapped for high speed access.

It is possible to both read and write command data.

Note: Bits that are not used should be set to 0. Refrain from writing to reserved registers.

Table 9 Command Register Data

Register No.	Contents	
0000H	Reserved	
0001H	Operation Signals and Multi-function Inputs	
	bit 0	H5-12 = 0: Forward Run Command (0 = Stop, 1 = Forward Run) H5-12 = 1: Run Command (0 = Stop, 1 = Run)
	bit 1	H5-12 = 0: Reverse Run Command (0 = Stop, 1 = Reverse Run) H5-12 = 1: Forward/Reverse (0 = Forward, 1 = Reverse)
	bit 2	External Fault (EF0)
	bit 3	Fault Reset
	bit 4	Multi-Function Input 1 Function is ComRef when H1-01 = 40 (Forward/Stop). **Note:** When the bit at ComRef is turned on, commands from MEMOBUS/Modbus communications take control of the frequency. When a communications option card is connected, that option card is given priority.
	bit 5	Multi-Function Input 2 Function is ComCtrl when H1-02 = 41 (Reverse/Stop).
	bit 6	Multi-Function Input 3
	bit 7	Multi-Function Input 4
	bit 8	Multi-Function Input 5
	bit 9	Multi-Function Input 6
	bit A	Multi-Function Input 7
	bit B to F	Reserved
0002H	Frequency Reference	Units are determined by parameter o1-03
0003H	Output Voltage Gain	Set in units of 1 (0.1%) with a setting range of 20 to 2000 (2.0% to 200.0%) **Note:** Initial value at power up: 1000 (100.0%)
0004H-0005H	Reserved	
0006H	PID Target, 0.01% units, signed	
0007H	Analog Output Terminal AM Setting (10 V / 4000 H)	
0008H	Reserved	
0009H	Settings for Multi-Function Digital Outputs	
	bit 0	Contact Output (terminal MA/MB-MC)
	bit 1	Photocoupler Output 1 (terminal P1-PC)
	bit 2	Photocoupler Output 2 (terminal P2-PC)
	bit 3 to F	Reserved
000AH	Pulse Output Terminal MP Setting, 1 Hz units, Setting Range: 0 to 32000	
000BH-000EH	Reserved	

Register No.	Contents	
000FH	Control Selection Setting	
	bit 0	Reserved
	bit 1	PID Target Input
	bit 2 to B	Reserved
	bit C	Enable Terminal S5 Input for Broadcast Data
	bit D	Enable Terminal S6 Input for Broadcast Data
	bit E	Enable Terminal S7 Input for Broadcast Data
	bit F	Reserved

Table 10 High Speed Registers

Address (hex)	Drive Register (hex)	Description	Bit	Description
2000	4B	Status Word (U1-12)	0	During Run
			1	During Zero Speed
			2	During Reverse Direction
			3	During Fault Reset Signal Input
			4	During Speed Agree
			5	Drive Ready
			6	Alarm
			7	Fault
			8	During Operation Error (oPE□□)
			9	During Momentary Power Loss
			A	Motor 2 Selected
			B	Reserved
			C	Reserved
			D	Reserved
			E	ComRef Status, NetRef Status
			F	ComCtrl Status, NetCtrl Status
2001	44	Motor Speed Monitor (U1-05)		
2002	48	Torque Reference Monitor (U1-09)		
2003	F0	PG Count Channel 1		
2004	40	Frequency Reference Monitor (U1-01)		
2005	41	Output Frequency Monitor (U1-02)		
2006	26	Output Current (U1-03) 0.1 A		
2007	4F	Terminal A2 Input Level Monitor (U1-14)		

Address (hex)	Drive Register (hex)	Description	Bit	Description
2008	46	DC Bus Voltage Monitor (U1-07)		
2009	C0	Error Signal 1	0	Reserved
			1	Undervoltage (Uv1)
			2	Control Power Supply Undervoltage (Uv2)
			3	Soft Charge Circuit Fault (Uv3)
			4	Reserved
			5	Ground Fault (GF)
			6	Overcurrent (oC)
			7	Overvoltage (ov)
			8	Heatsink Overheat (oH)
			9	Heatsink Overheat (oH1)
			A	Motor Overload (oL1)
			B	Drive Overload (oL2)
			C	Overtorque Detection 1 (oL3)
			D	Overtorque Detection 2 (oL4)
			E	Dynamic Braking Transistor Fault (rr)
			F	Braking Resister Overheat (rH)

Address (hex)	Drive Register (hex)	Description	Bit	Description
200A	C1	Error Signal 2	0	External Fault at input terminal S3 (EF3)
			1	External Fault at input terminal S4 (EF4)
			2	External Fault at input terminal S5 (EF5)
			3	External Fault at input terminal S6 (EF6)
			4	External Fault at input terminal S7 (EF7)
			5	External Fault at input terminal S8 (EF8)
			6	Cooling fan Error (FAn)
			5	Reserved
			6	Reserved
			7	Overspeed (os)
			8	Excessive Speed Deviation (dEv)
			9	PG Disconnected (PGo)
			A	Input Phase Loss (PF)
			B	Output Phase Loss (LF)
			C	Motor Overheat (PTC input) (oH3)
			D	Digital Operator Connection Fault (oPr)
			E	EEPROM Write Error (Err)
			F	Motor Overheat Fault (PTC input) (oH4)

Address (hex)	Drive Register (hex)	Description	Bit	Description
200B	C2	Error Signal 3	0	MEMOBUS/Modbus Communication Error (CE)
			1	Option Communication Error (bUS)
			2	Reserved
			3	Reserved
			4	Control Fault (CF)
			5	Zero Servo Fault (SvE)
			5	Reserved
			6	Option External Fault (EF0)
			7	PID Feedback Loss (FbL)
			8	Undertorque Detection 1 (UL3)
			9	UL4 Undertorque Detection 2 (UL4)
			A	High Slip Braking Overload (oL7)
			B	Reserved
			C	Reserved
			D	Reserved
			E	Reserved
			F	Hardware Fault (includes oFo)
200C	4E	Terminal A1 Input Level Monitor (U1-13)		
200D	49	Digital Input Terminal Status (U1-10)		
200E	50	Terminal A3 Input Level Monitor (U1-15)		
200F	F1	PG Count Channel 2		
2010	4D	Drive Software Number (Flash) (U1-25)		

◆ Enter Command Types

The drive supports two types of Enter commands as shown in *Table 11*. An Enter command is enabled by writing 0 to register number 0900H or 0910H. These registers can be written to only. An error will occur if the user attempts to read from these registers.

Table 11 Enter Command Types

Register No.	Description
0900H	Writes data into the EEPROM (non-volatile memory) of the drive and enables the data in RAM at the same time. Parameter changes remain even if the power supply is cycled.
0910H	Writes data in the RAM only. Parameter changes are lost when the drive is shut off.

Note:

1. Because the EEPROM can be written to a maximum of 100,000 times, refrain from writing to the EEPROM too often. The Enter command registers are write-only. Consequently, if these registers are read, then the register address will be invalid (Error code: 02H). An Enter command is not required if reference or broadcast data are sent to the drive.
2. Parameter data cannot be written to EEPROM during undervoltage, even using 0900H.
3. If undervoltage occurs when a making several parameter changes issued with a single ENTER command, the writing process may be aborted before all of the new changes have been written. Because all of the data has not yet been written, the EEPROM data error "CPF06" will be displayed the next time power to the drive is cycled. To prevent this problem, wait approximately 5 seconds after issuing the ENTER command before shutting off drive power.

◆ Enter Command Settings when Upgrading the Drive

When replacing earlier Yaskawa drive models with a V1000 and keeping the MEMOBUS/Modbus communications settings, parameter H5-11 needs to be set in accordance with how the Enter command functions in the older drive. H5-11 determines if an Enter command is needed to activate parameter changes in the drive.

- Set H5-11 to 0 when upgrading from a G7 or F7 series drive to V1000 series drive.
- Set H5-11 to 1 when upgrading from a V7 series drive to V1000 series drive.

■ H5-11 and the Enter Command

H5-11 Settings	H5-11 = 0	H5-11 = 1
Drive being replaced	G7, F7	V7
How parameter settings are enabled	When the Enter command is received from the master.	As soon as the value is changed.
Upper/lower limit check	Upper/lower limit check takes the settings of related parameters into account.	The upper/lower limit of the changed parameter is checked only.
Default value of related parameters	Not affected. The settings of related parameters remain unchanged. They must be changed manually if needed.	The default settings of related parameters are changed automatically.
Error handling when setting multiple parameters	Data is accepted even if one setting is invalid. The invalid setting will be discarded. No error message occurs.	Error occurs if only one setting is invalid. All data sent are discarded.

8 Web Interface

The option contains a series of web pages that allow for viewing of status and diagnostic information through a standard web browser.

The web page is accessed through a self-contained web server at port 80. Access the home page by typing the IP address of the option in a web browser. Example: "http://192.168.1.20"

The IP address of the option can be read using monitors U6-80 to U6-83 on the digital operator if it is unknown. *Refer to Option Monitors on page 32* for details.

The home page is an HTML-based page providing basic drive and option data and a link to an enhanced web page requiring a Java© enabled web browser.

Enhanced Web Page Notes:

- The Enhanced Web Pages use a series of Java© applets.
- PCs must have Java SE 6 Update 14 or later installed to view the enhanced web pages.
- The Java© applets require an internet connection to check the revocation status.
- When no internet connection is available, disable the revocation check by changing a Java setting in the PC: All Programs / Java / Configure Java / Advanced Tab. Set "Perform certificate checks on" to "Do not check".

Enhanced Web Page Tab	Page
Main Tab	*44*
Drive Status Tab	*45*
Network Tab	Refer to the option Technical Manual for details on this tab.
Email Alerts Tab	Refer to the option Technical Manual for details on this tab.
Parameter Access Tab <1>	Refer to the option Technical Manual for details on this tab.
Configuration Tab <1>	Refer to the option Technical Manual for details on this tab.
Custom Tab	*46*

<1> Accessible after entering a valid password.

◆ HTML Home Page

The main HTML home page provides basic drive and option data and a link to an enhanced web page. The RSTP enabled home page provides Rapid Spanning Tree Protocol data. *Refer to Rapid Spanning Tree Protocol on page 47* for details on RSTP.

■ Main HTML Home Page

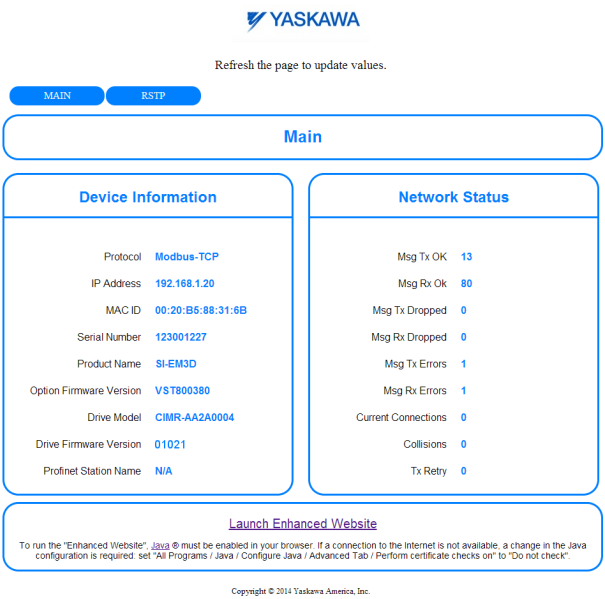


Figure 22 Main HTML Home Page

■ RSTP Enabled HTML Home Page

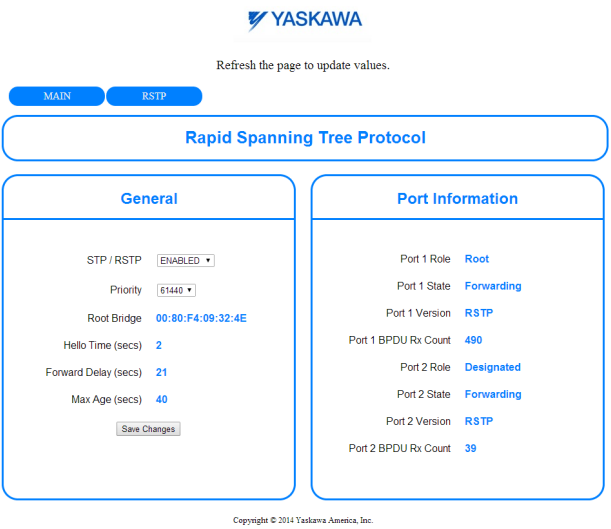


Figure 23 RSTP Enabled HTML Home Page

◆ Main Tab

The Main tab shows basic option information such as IP address, MAC address, and firmware version.

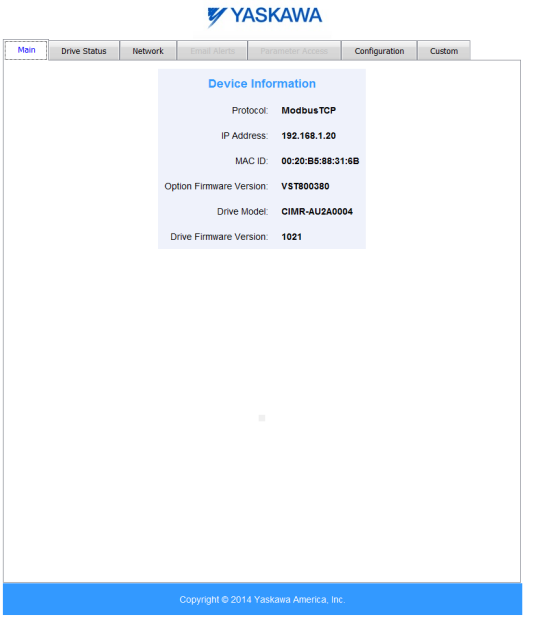


Figure 24 Main Tab View

◆ Drive Status Tab

The Drive Status tab shows basic I/O information and drive state information.

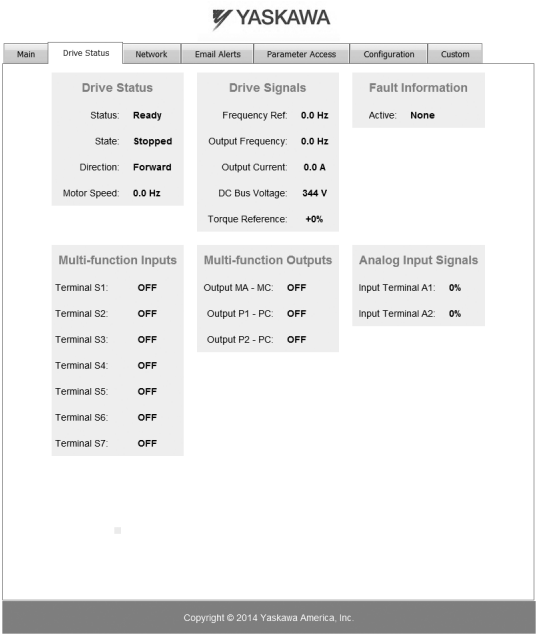


Figure 25 Drive Status Tab View

◆ Custom Tab

The Custom tab displays a selection of quick setting parameters.

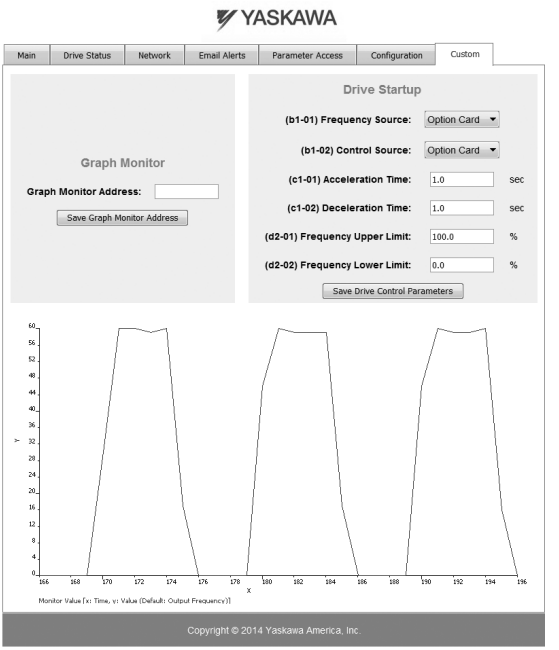


Figure 26 Custom Tab View

9 Rapid Spanning Tree Protocol

Rapid Spanning Tree Protocol (RSTP) is a mechanism that allows an Ethernet network to be configured as a ring or other topology that may have more than one pathway to each node. The RSTP protocol automatically determines the most efficient pathway to each node and disables any redundant pathways.

Refer to the option Technical Manual for a full description of RSTP features and functions.

10 Troubleshooting

◆ Drive-Side Error Codes

Drive-side error codes appear on the drive digital operator. Causes of the errors and corrective actions are listed below. Refer to the drive manual for additional error codes that may appear on the drive digital operator.

■ Faults

Both bUS (Option Communication Error) and EF0 (Option Card External Fault) can appear as an alarm or as a fault. When a fault occurs, the digital operator ALM LED remains lit. When an alarm occurs, the ALM LED flashes.

If communication stops while the drive is running, use the following questions as a guide to help remedy the fault:

- Is the option properly installed?
- Are the communication lines properly connected to the option? Are the wires loose?
- Is the controller program working? Has the controller/PLC CPU stopped?
- Did a momentary power loss interrupt communications?

Digital Operator Display		Fault Name
bUS	bUS	Option Communication Error
		• The connection was lost after establishing initial communication. • Only detected when the Run command or frequency reference is assigned to the option (b1-01 = 3 or b1-02 = 3).
Cause		**Possible Solution**
Master controller (PLC) has stopped communicating		• Check that power is supplied to the PLC • Check that PLC is not in program mode
Communication cable is not connected properly		• Check for faulty wiring • Correct any wiring problems
A data error occurred due to noise		• Check the various options available to minimize the effects of noise • Counteract noise in the control circuit, main circuit, and ground wiring • If a magnetic contactor is identified as a source of noise, install a surge absorber to the contactor coil • Make sure the cable used meets requirements • Make sure the option ground wire is connected between option FE terminal and the drive ground terminal connected to earth ground • If available, use IG5 to connect to network common.
Option is damaged		If there are no problems with the wiring and the error continues to occur, replace the option.

Digital Operator Display		Fault Name
EF0	EF0	Option Card External Fault
		The alarm function for an external device has been triggered.
Cause		**Possible Solutions**
An external fault was received from the PLC and F6-03 is set to a value other than 3.		• Remove the cause of the external fault. • Remove the external fault input from the PLC.
Problem with the PLC program		Check the PLC program and correct problems.

Digital Operator Display		Fault Name
oFA00	oFA00	Option Card Connection Error at Option Port CN5.
		The option card is incompatible with the drive.
Cause		**Possible Solution**

Digital Operator Display		Fault Name
oFA01	oFA01	Option Card Fault
		Option not properly connected
Cause		**Possible Solution**
The option card connection is faulty		• Turn off the power and reconnect the option card. • Check if the option card is properly plugged into the option port. Make sure the card is fixed properly.

Digital Operator Display		Fault Name
oFA03	oFA03	Option Card Fault
		Option card self-diagnostic error
oFA04	oFA04	Option Card Fault
		An error occurred attempting to write to the option card memory.
oFA30 to oFA43	oFA30 to oFA43	Option Card Fault
		Communication ID error
Cause		**Possible Solution**
Option card or hardware is damaged.		Replace the option card. Contact Yaskawa for consultation.

■ Minor Faults and Alarms

Digital Operator Display		Minor Fault Name	
CALL	CALL	Serial Communication Transmission Error	
		Communication has not yet been established.	
Cause		**Possible Solutions**	**Minor Fault (H2-□□ = 10)**
Communications wiring is faulty, there is a short circuit, the wiring is incorrect, or the connections are poor.		• Check for wiring errors. • Correct the wiring. • Check for disconnected cables and short circuits. Repair as needed.	YES
Programming error on the master side.		Check communications at start-up and correct programming errors.	
Communications circuitry is damaged.		• Perform a self-diagnostics check. • If the problem continues, replace the control board or the entire drive. Contact Yaskawa for instructions on replacing the control board.	

■ bUS Fault Tolerance

bUS Fault Auto-Restart

Parameter F6-14, bUS Fault Auto Reset Select, will appear when the option is installed.

Setting F6-14 = 0 (Disabled) or F6-01 = 3 or greater (Alarm only) will not affect standard default drive behavior.

Setting F6-14 = 1 (Enabled) AND F6-01 < 3 (Fault) will cause the following operation: The bUS fault occurs after the F7-16 delay and the Run command is removed from the drive. Then the option throws a bUS fault to the drive. When the condition is removed, the option commands a fault reset and returns control of the drive to the Modbus TCP/IP network.

Note: The option will only read parameter F6-01 and F6-14 from the drive during power-up.

bUS Fault Delay

Parameter F7-16, Communications Loss Detection Time Delay, will appear when the option is installed.

The setting value of F7-16 is the length of time that the option will delay sending the bUS fault to the drive.

The status LEDs on the option are not affected by the delay time set in F7-16; the LEDs will indicate the bUS condition immediately.

Note: The option will only read parameter F7-16 from the drive during power-up.

◆ Option Error Codes

■ Option Fault Monitors U6-98 and U6-99

The option can declare error/warning conditions via drive monitor parameters on the drive digital operator as shown in ***Table 12***.

Table 12 Option Fault Monitor Descriptions

Fault Condition	Fault Declared	Status Value (U6-98/U6-99)	Description
No Fault	n/a	0	No faults
Force Fault	EF0	3	Network sent a message to force this node to the fault state.
Connection Timeout	BUS ERROR	1101	The control connection timed out.
Duplicate IP Address	BUS ERROR	1102	This node and at least one other node have the same IP Address.
Default MAC Address	None	1103	Factory default MAC Address programmed into the option. Return for reprogramming.
Network Link Down	BUS ERROR	1104	No network link to option.
Hardware Error	BUS ERROR	1105	Option card hardware has stopped functioning. Cycle power to the drive.

Two drive monitor parameters, U6-98 and U6-99 assist the user in network troubleshooting.

- U6-98 displays the first declared fault since the last power cycle. U6-98 is only cleared upon drive power-up.
- U6-99 displays the present option status. U6-99 is cleared upon a network-issued fault reset and upon power-up.

If another fault occurs while the original fault is still active, parameter U6-98 retains the original fault value and U6-99 stores the new fault status value.

11 Specifications

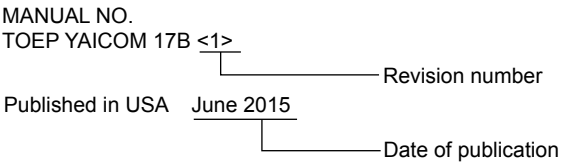
Table 13 Option Specifications

Item	Specification
Model	SI-EM3D/V
Supported Messages	• Read Multiple Registers (03H) • Write Single Register (06H) • Write Multiple Registers (10H) • Read and Write Registers (17H) Commands that support multiple registers have a maximum Read and Write size of 16 registers.
Option Conformance	Modbus-IDA Passed
Connector Type	RJ45 8-pin Shielded Twisted Pair Cat5e cable
Physical Layer Type	Isolated Physical Layer
IP Address Setting	Programmable from drive keypad or network
Communication Speed	Programmable from drive keypad or network: 10/100 Mbps, auto-negotiate
Number of Connections	Modbus TCP/IP: 10 Web Page Access: 2
Duplex Mode	Half-forced, Auto-negotiate, Full-forced
Address Startup Mode	Static, BOOTP, DHCP
Ambient Temperature	-10 °C to +50 °C (14 °F to 122 °F)
Humidity	95% RH or lower with no condensation
Storage Temperature	-20 °C to +60 °C (-4 °F to +140 °F) allowed for short-term transport of the product
Area of Use	Indoor (free of corrosive gas, airborne particles, etc.)
Altitude	1000 m (3280 ft.) or lower

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Revision History

The revision dates and the numbers of the revised manuals appear on the bottom of the back cover.



Date of Publication	Revision Number	Section	Revised Content
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		Modbus TCP/IP Messaging	Addition: Command register data
		Web Interface	Revision: Corrected unresolved cross-reference
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YASKAWA AC Drive V1000 Option

MODBUS TCP/IP

Installation Manual

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