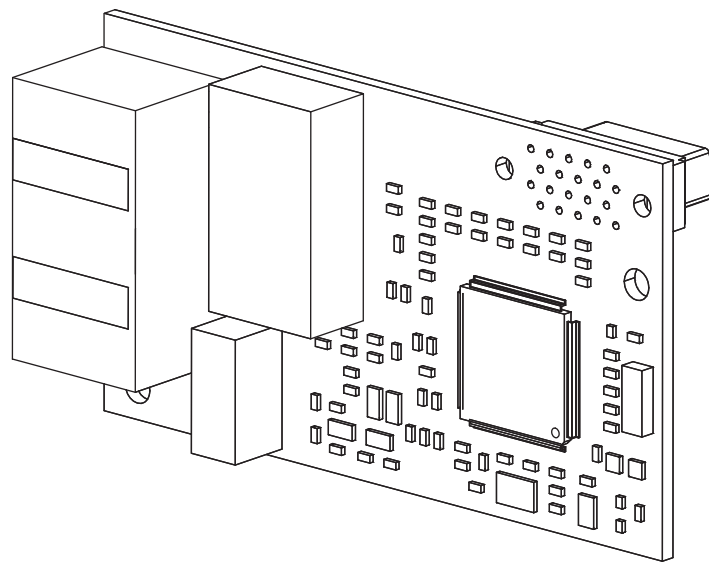


YASKAWA AC Drive 1000-Series Option Modbus TCP/IP Technical Manual

Type: SI-EM3D

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



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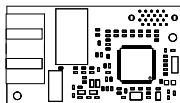
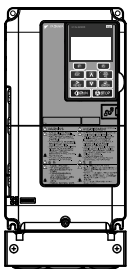
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1 Preface and Safety

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 option:

	Yaskawa AC Drive 1000-Series Option SI-EM3D Dual-Port Modbus TCP/IP Installation Manual (TOEPYAICOM18)
	The Installation Manual contains information required to install the option and set up related drive parameters.
	Yaskawa AC Drive 1000-Series Option SI-EM3D Dual-Port Modbus TCP/IP Technical Manual (SIEPYAICOM18)
	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.
	1000-Series AC Drive Safety Precautions
	Read this manual first. This manual contains essential safety information and simplified information for the drive. This document also provides basic instructions on mechanical installation, a connection diagram, main circuit and control circuit connections, switch and jumper configuration, basic troubleshooting, standards compliance and fusing, drive specifications, and an abbreviated parameter list.
	1000-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 .
	1000-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 1000-Series AC Drive

Option: Yaskawa AC Drive 1000-Series SI-EM3D 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.

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	Model Number	Software Version <1>
A1000	CIMR-A□2A□□□□	1010 and later
	CIMR-A□4A0002□ to 4A0675□	
	CIMR-A□4A0930 and 4A1200	301□
	CIMR-A□5A□□□□	504□; 1017 and later
D1000	CIMR-D□2A0005□ to 4A0370□	2600 and later
	CIMR-D□4A0630□	301□ and later
R1000	CIMR-R□2A03P5□ to 4A0300□	2102 and later

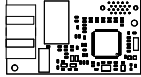


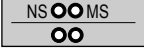
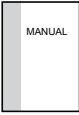
<1> See “PRG” on the drive nameplate for the software version number.

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	Ground Wire	Screws (M3)	LED Label	Installation Manual
—					
Quantity	1	1	3	1	1

◆ Tools Required for Installation

- A Phillips screwdriver (M3 metric or #1, #2 U.S. standard) is required to install the option and remove drive front covers. Screw sizes vary by drive capacity. Select a screwdriver appropriate for the drive capacity.
- Diagonal cutting pliers. (required for some drive models)
- A small file or medium grit sandpaper. (required for some drive models)

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

4 Option Components

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

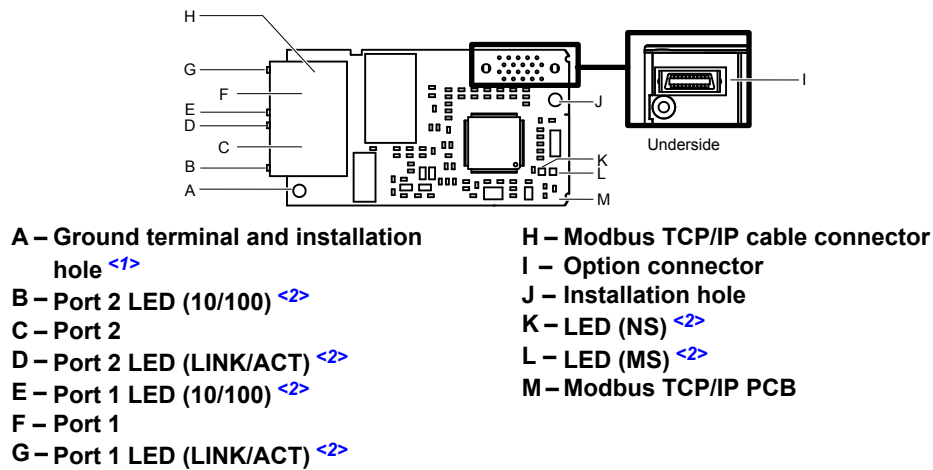


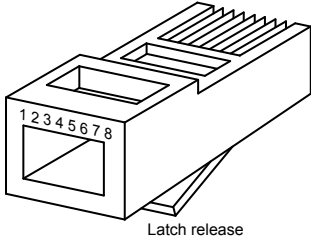
Figure 1 Option Components

- <1> The ground wire is packaged loose in the option shipping package. Connect this ground wire during installation.
 <2> Refer to [Option LED Display on page 10](#) for details on the LEDs.

◆ Communication Connector CN1

The communication connector on the option is a modular RJ45 female connector designated CN1. CN1 is the connection point for a customer-supplied male Modbus network communication cable.

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.
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 front covers of the drive 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 touch circuit boards while the power is on.

Failure to comply could result in death or serious injury.

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.

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.

NOTICE

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.

Figure 2 shows an exploded view of the drive with the option and related components for reference.

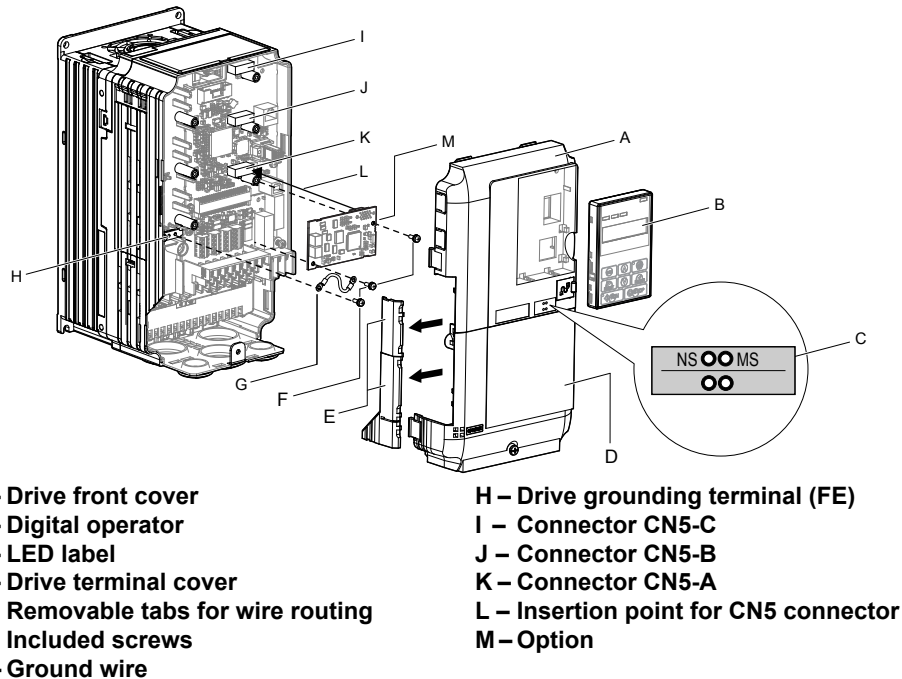


Figure 2 Drive Components with Option

◆ Installing the Option

Remove the front covers of the drive before installing the option. Refer to the drive Quick Start Guide for directions on removing the front covers. Cover removal varies depending on drive size. This option can only be inserted into the **CN5-A** connector located on the drive control board.

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 the appropriate amount of time for voltage to dissipate, then remove the digital operator (B) and front covers (A, D). Front cover removal varies by model.

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.

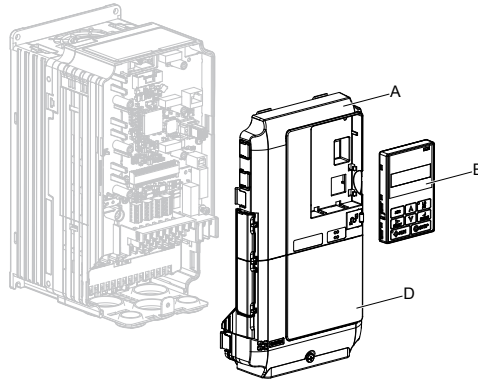


Figure 3 Remove the Front Covers and Digital Operator

2. With the front covers and digital operator removed, apply the LED label (C) in the appropriate position on the drive top front cover (A).

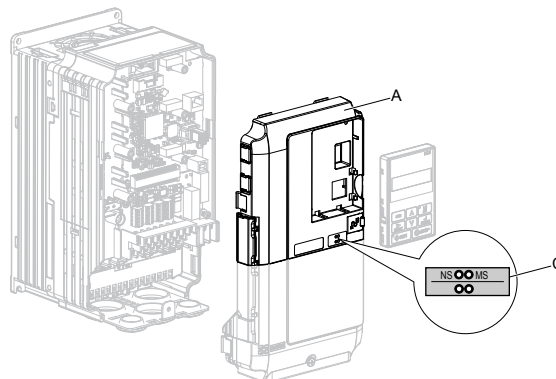


Figure 4 Apply the LED Label

3. Make sure the screws on the left and right sides of the option terminal block (J) are tightened with a tightening torque of 0.5 to 0.6 Nm (4.4 to 5.3 in lbs), then insert the option (B) into the **CN5-A** connector (L) located on the drive and fasten it using one of the included screws (H).

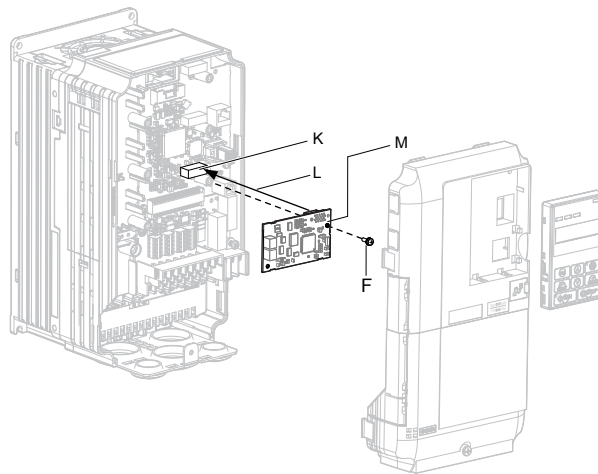


Figure 5 Insert the Option

4. Connect the ground wire (I) to the ground terminal (K) using one of the remaining provided screws (H). Connect the other end of the ground wire (I) to the remaining ground terminal and installation hole on the option (B) using the last remaining provided screw (H) and tighten both screws to 0.5 to 0.6 N·m (4.4 to 5.3 in lbs).

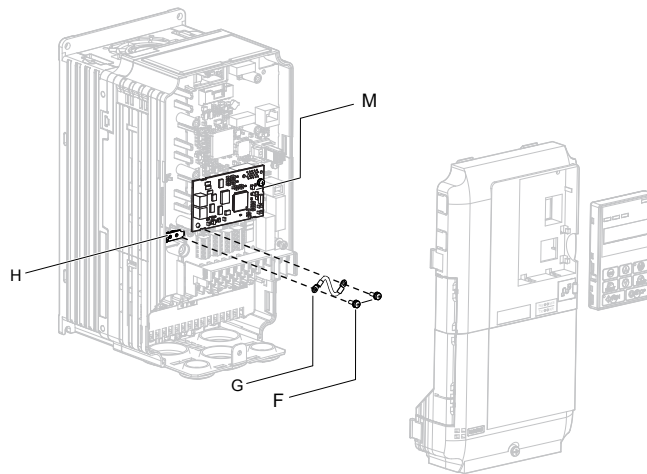


Figure 6 Connect the Ground Wire

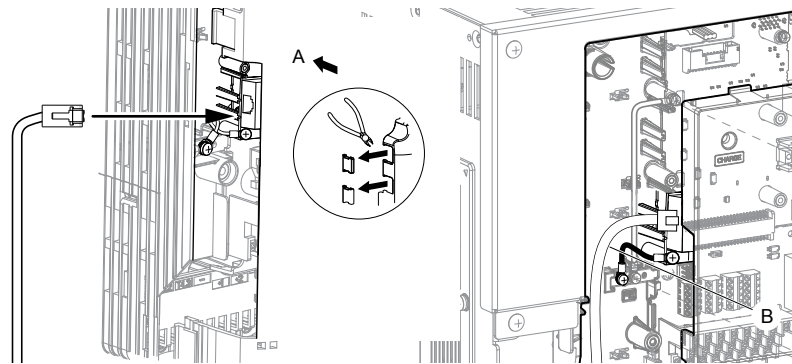
Note: There are two screw holes on the drive for use as ground terminals. When connecting three options, two ground wires will need to share the same drive ground terminal.

5. Route the option wiring.

Depending on the drive model, some drives may require routing the wiring through the side of the front cover to the outside to provide adequate space for the wiring. Refer to the Peripheral Devices & Options section of the drive Quick Start Guide or Technical Manual for more information on wire routing of specific models.

Route the wiring through the side of the front cover to the outside. In these cases, using diagonal cutting pliers, cut out the perforated openings on the left side of the drive front cover as shown in [Figure 7-A](#). Use a file or sandpaper to make the sharp edges along the cutout smoother to prevent any damage to the wires. Route the wiring inside the enclosure as shown in [Figure 7-B](#) for drives that do not require routing through the front cover.

Note: Separate communication cables from main circuit wiring and other electrical lines.



A – Route wires through the openings provided on the left side of the front cover. <1>

B – Use the open space provided inside the drive to route option wiring.

Figure 7 Wire Routing Examples

<1> The drive will not meet NEMA Type 1 requirements if wiring is exposed outside the enclosure.

6. 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 7](#)).

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.

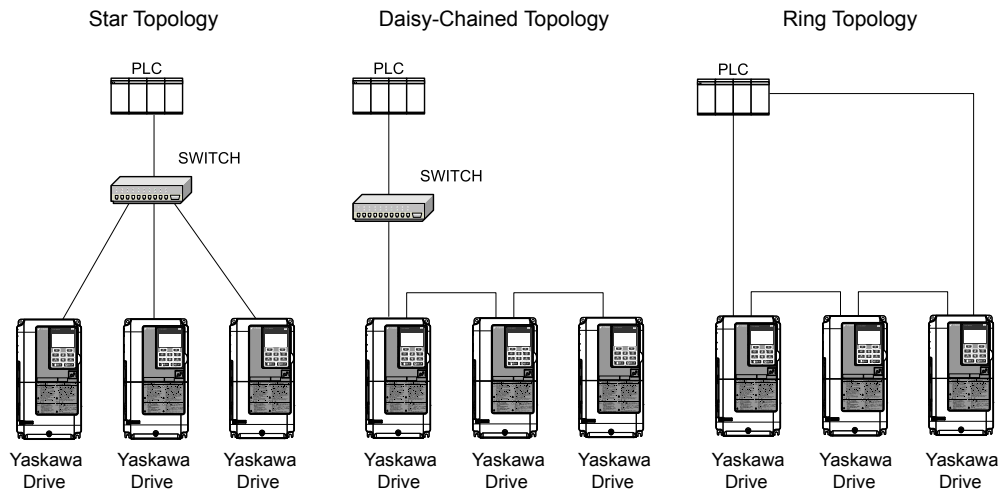


Figure 8 Topology Options

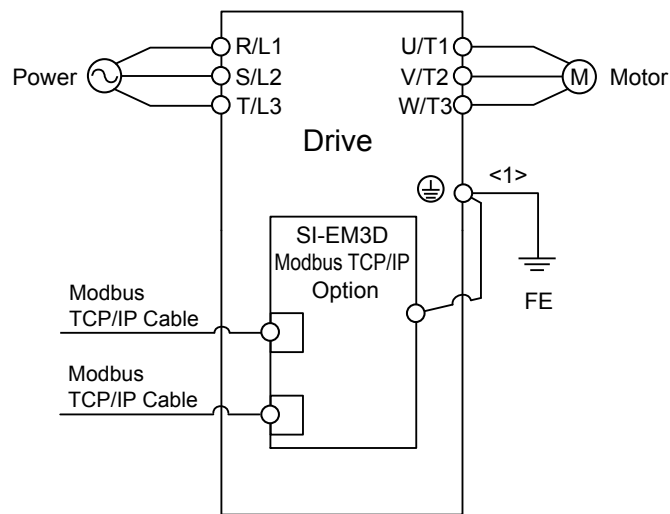


Figure 9 Option Connection Diagram

7. Use the second communication cable port to daisy chain a series of drives where applicable.
8. Replace and secure the front covers of the drive (A, D) and replace the digital operator (B).

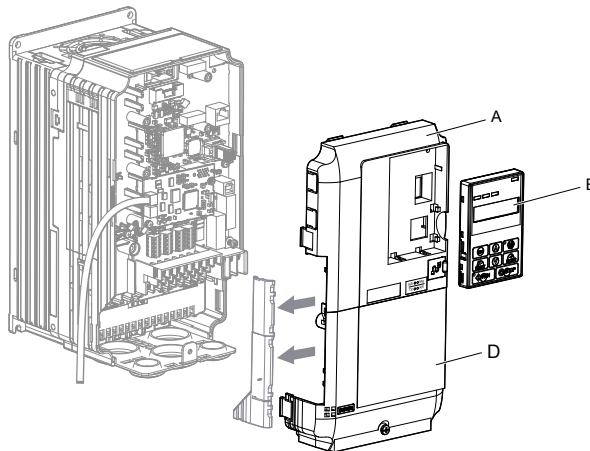


Figure 10 Replace the Front Covers and Digital Operator

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.

9. Set drive parameters in [Table 4](#) 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 4](#) before starting network communications. After changing parameter settings, cycle power to the drive for the new settings to take effect.

Table 4 Related Parameters

No. (Addr. Hex)	Name	Description	Values
b1-01 (0180) </>	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) </>	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 </> 4: Alarm (d1-04) </> 5: Alarm Ramp to Stop </>	Default: 1 Range: 0 to 3
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 </>	Default: 1 Range: 0 to 3
F6-06 (03A7) </>	Torque Reference/Torque Limit Selection from Comm. Option	0: Disabled. Torque reference/limit from option board disabled. 1: Enabled. Torque reference/limit from option board enabled. </>	Default: 0 Range: 0, 1
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: 0 Range: 0, 1
F6-08 (036A) </>	Reset Communication Parameters	0: Communication-related parameters (F6-□□/□□) are not reset when the drive is initialized using A1-03. 1: Reset all communication-related parameters (F6-□□/□□) 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
F7-01 (03E5) </>	IP Address 1	Sets the most significant octet of network static IP address.	Default: 192 Range: 0 to 255
F7-02 (03E6) </>	IP Address 2	Sets the second most significant octet of network static IP address.	Default: 168 Range: 0 to 255
F7-03 (03E7) </>	IP Address 3	Sets the third most significant octet of network static IP address.	Default: 1 Range: 0 to 255
F7-04 (03E8) </>	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

6 Related Drive Parameters

No. (Addr. Hex)	Name	Description	Values
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 <8> 1: BOOTP 2: DHCP	Default: 2 Range: 0 to 2
F7-14 (03F2)	Duplex Mode Selection	Selects duplex mode setting. 0: Half duplex forced <9> 1: Auto-negotiate duplex mode and communication speed 2: Full duplex forced <9> 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: 1 Range: 0 to 8 <10>
F7-15 (03F3)	Communication Speed Selection	Sets the communication speed 10: 10 Mbps 100: 100 Mbps 101: 10 (Port 1)/100 Mbps (port 2) 102: 100 (Port 1)/10 Mbps (port 2)	Default: 10 Range: 10; 100 to 102 <11>
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
F7-23 to F7-32 (03FB to 0374)	Dynamic Output Assembly Parameters	Parameters used in Output Assembly 116. Each parameter contains a MEMOBUS/Modbus address. The value received for Output Assembly 116 will be written to this corresponding MEMOBUS/Modbus address. A MEMOBUS/Modbus address value of 0 means that the value received for Output Assembly 116 will not be written to any MEMOBUS/Modbus register.	Default: 0
F7-33 to F7-42 (0375 to 037E)	Dynamic Input Assembly Parameters	Parameters used in Input Assembly 166. Each parameter contains a MEMOBUS/Modbus address. The value sent for Input Assembly 166 will be read from this corresponding MEMOBUS/Modbus address. A MEMOBUS/Modbus address value of 0 means that the value sent for Input Assembly 166 is not defined by the user, therefore the option default register value will be returned.	Default: 0
H5-11 (043C)	Communications ENTER Function Selection	Select the function for the ENTER command that saves parameter data to the drive. 0: Drive requires an Enter command before accepting any changes to parameter settings. 1: Parameter changes are activated immediately without the Enter command.	Default: 0 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: 1021 and later.
- <4> Enabled in CLV, AOLV/PM, and CLV/PM control modes (A1-02 = 3, 6, or 7). When enabled, d5-01 determines whether the value is read as the Torque Limit value (d5-01 = 0) or read as the Torque Reference value (d5-01 = 1). In CLV/PM, this value is read as the Torque Limit.
- <5> The setting specifies that the Torque Reference or Torque Limit is to be provided via network communications (F6-06 = 1). The motor may rotate if no torque reference or Torque Limit is supplied from the PLC.
- <6> Parameter setting value is not reset to the default value when the drive is initialized.
- <7> Cycle power for setting changes to take effect.
- <8> 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.
- <9> When F7-14 is set to 0 or 2, parameter F7-15 must be set.
- <10> Setting range differs depending on drive software version. PRG: 1020 and earlier, Range: 0 to 2

PRG: 1021 and later, Range: 0 to 8

<11> Setting range differs depending on drive software version. PRG: 1020 and earlier, Range: 10, 100

PRG: 1021 and later, Range: 10; 100 to 102

Table 5 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
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 6 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 7](#). In addition, the monitors shown in [Table 8](#) 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 7 Command Register Data

Register No.	Contents	
0000H	Reserved	
0001H	Operation Commands 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 ComCtrl is turned on, commands from MEMOBUS/Modbus communications take control of the operation. However, 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	Multi-Function Input 8
	bit C to F	Reserved
0002H	Frequency Reference	Units are determined by parameter o1-03.

Register No.	Contents	
0003H	Output voltage gain Unit: 0.1% Range: 20 (2.0%) to 2000 (200.0%), Default when power on: 1000 (100.0%)	
0004H	Torque Reference/Torque Limit, 0.1% units, signed (Usable only if Torque Control is enabled)	
0005H	Torque Compensation, 0.1% units, signed (Usable only if Torque Control is enabled)	
0006H	PID Target, 0.01% units, signed	
0007H	Analog Output Terminal FM Setting (10 V / 4000 H)	
0008H	Analog Output Terminal AM Setting (10 V / 4000 H)	
0009H	Settings for Multi-Function Digital Outputs	
	bit 0	Multi-Function Contact Output 1 (terminal M1-M2)
	bit 1	Multi-Function Contact Output 2 (terminal M3-M4)
	bit 2	Multi-Function Contact Output 3 (terminal M5-M6)
	bit 3 to 5	Reserved
	bit 6	Enables the function in bit 7
	bit 7	Fault Contact Output (terminal MA/MB-MC)
bit 8 to F	Reserved	
000AH	Pulse Output Terminal MP Setting, 1 Hz units, Setting Range: 0 to 32000	
000BH to 000EH	Reserved	
000FH	Control Selection Setting	
	bit 0	Reserved
	bit 1	PID Setpoint Input
	bit 2	Torque reference / torque limit input (enables the setting from MEMOBUS/Modbus)
	bit 3	Torque compensation input (enables the setting from MEMOBUS/Modbus)
	bit 4 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	Enable Terminal S8 Input for Broadcast Data	
0010H to 001AH	Reserved	
001BH	Analog Monitor Option AO-A3 Analog Output 1 (10 V/4000 H)	
001CH	Analog Monitor Option AO-A3 Analog Output 2 (10 V/4000 H)	
001DH	Digital Output Option DO-A3 Output (Binary)	
001EH to 001FH	Reserved	

Table 8 Drive 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)		
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)			
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 9](#). 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 9 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 1000-series drive 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 parameter H5-11 to 0 when upgrading from a G7 or F7 series drive to 1000-series drive.
- Set parameter H5-11 to 1 when upgrading from a V7 series drive to 1000-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.

◆ Message Content

The data section of the Modbus packet contains the Modbus message. In this data section, the master sends commands to the slave, and the slave responds. The message format is configured for both sending and receiving as shown below, and the length of data packets depends on the command (function) content.

SLAVE ADDRESS
FUNCTION CODE
DATA
ERROR CHECK

■ Unit Identifier

This field is used for intra-system routing purposes. It is typically used to communicate to a Modbus+ or a Modbus serial line slave through a gateway between an Modbus TCP/IP network and a Modbus serial line. This field is set by the Modbus master in the command and must be returned with the same value in the response by the slave. This is sometimes referred to as the Unit ID. A drive using the option has no gateway functionality.

■ Function Code

When sent by the master, this field identifies the command to be undertaken by the slave. It also identifies the format for the DATA section of the message. The slave normally echoes this command back to the master in its response message. When the most significant bit of this field is set in the response message, it signals an error condition has occurred.

■ Data

This field contains multiple bytes of varying length based upon the Function Code for commands and based upon the results of the command in the response. When sent by the master, this field contains details of the command that the slave will require to carry out the function. When sent by the slave, this field contains details of the response and sometimes error information.

◆ Modbus TCP/IP Option Function Details

■ Read Multiple Registers 03 (03 H)

This function code is used to read the contents of a contiguous block of registers. The command specifies the starting register and the number of registers. The normal response packs two bytes per register. For each register in the response, the first byte contains the most significant bits and the second byte contains the least significant bits.

Table 10 Read Multiple Registers Command

Description	Byte	Data (Hex)
Slave Address	1	00 to FF
Function Code	1	03
Starting Register	2	0000 to FFFF
Quantity of Registers	2	N <1>

<1> N = Quantity of Registers (range is 1 - 16)

Table 11 Read Multiple Registers Response

Description	Byte	Data (Hex)
Slave Address	1	00 to FF
Function Code	1	03
Number of Data Bytes	1	2 x N <1>
Register Values	N <1> x 2	Values contained in slave registers.

<1> N = Quantity of Registers

Table 12 Read Multiple Registers Error Response

Description	Byte	Data (Hex)
Slave Address	1	00 to FF
Error Code	1	83
Exception Code	1	<i>Refer to Modbus TCP/IP Exception Codes on page 30 for details.</i>

Examples of Fault Response, Read Response, and Read Multiple Registers Command

Note: In option software version VST800380, any invalid register in the range will return an error response. In option versions VST800381 and later, invalid registers in the range will not return an error response provided at least 1 register is valid. Invalid registers will be set to 0 in the response.

Table 13 lists command examples to read register contents (register addresses 0020H to 0023H) from a drive with the slave address (unit identifier) 02H.

Table 14 shows examples of responses indicating that multiple registers have been read successfully. The contents read from 0020H are 1770H, 1770H, 0109H, and 0000H.

Table 15 shows examples of an error response when reading multiple registers. The exception code is 02H (indicating a register number error).

Table 13 Example Read Multiple Registers Command

Description		Data (Hex)
Slave Address		02
Function Code		03
Starting Register	Upper	00
	Lower	20
Quantity of Registers	Upper	00
	Lower	04

Table 14 Example Read Multiple Registers Response

Description	Data (Hex)
Slave Address	02
Function Code	03
Number of Data Bytes	08

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Description		Data (Hex)
Starting Register	Upper	17
	Lower	70
Next Register	Upper	17
	Lower	70
Next Register	Upper	01
	Lower	09
Last Register	Upper	00
	Lower	00

Table 15 Example Read Multiple Registers Error Response

Description	Data (Hex)
Slave Address	02
Error Code	83
Exception Code	02

■ Write Single Register 06 (06 H)

This function code is used to write to a single register in the drive. The command specifies the address of the register to be written and the value to write. The normal response is an echo of the request, returned after the register contents have been written.

Table 16 Table 19 Write Single Register Command

Description	Byte	Data (Hex)
Slave Address	1	00 to FF
Function Code	1	06
Register Address	2	0000 to FFFF
Register Value	2	0000 to FFFF

Table 17 Write Single Register Response

Description	Byte	Data (Hex)
Slave Address	1	00 to FF
Function Code	1	06
Register Address	2	0000 to FFFF
Register Value	2	0000 to FFFF

Table 18 Write Single Register Error Response

Description	Byte	Data (Hex)
Slave Address	1	00 to FF
Error Code	1	86
Exception Code	1	<i>Refer to Modbus TCP/IP Exception Codes on page 30 for details.</i>

Examples of Register Write Command

Table 19 lists command examples when writing register value 0003H to register address 0001H in a drive with the slave address (unit identifier) 01H.

Table 20 shows examples of responses indicating that the write command has been executed successfully. The command specifies the value and the register address to write to.

Table 21 shows examples of an error response when writing to a register. The exception code is 21H (indicating an invalid value).

Table 19 Example Write Single Registers Command

Description	Data (Hex)
Slave Address	01
Function Code	03

Description		Data (Hex)
Register Address	Upper	00
	Lower	01
Register Value	Upper	00
	Lower	03

Table 20 Example Write Single Register Response

Description		Data (Hex)
Slave Address		01
Function Code		06
Register Address	Upper	00
	Lower	01
Register Value	Upper	00
	Lower	03

Table 21 Example Write Single Register Error Response

Description	Data (Hex)
Slave Address	01
Error Code	86
Exception Code	21

Write Multiple Registers 16 (10 H)

This function code is used to write to a contiguous block of registers in the drive. The command specifies the starting register address, the number of registers and the values to be written. The command packs two bytes per register. For each register in the command the first byte contains the most significant bits and the second byte contains the least significant bits. The normal response returns the function code, starting address and quantity of registers written.

Table 22 Write Multiple Registers Command

Description	Byte	Data (Hex)
Slave Address	1	00 to FF
Function Code	1	10
Starting Register	2	0000 to FFFF
Quantity of Registers	2	N </>
Number of Data Bytes	1	N </> x 2
Register Values	N </> x 2	0000 to FFFF

<1> N = Quantity of Registers (range is 1 - 16)

Table 23 Write Multiple Registers Response

Description	Byte	Data (Hex)
Slave Address	1	00 to FF
Function Code	1	10
Starting Register	2	0000 to FFFF
Quantity of Registers	2	N </>

<1> N = Quantity of Registers

Table 24 Write Multiple Registers Error Response

Description	Byte	Data (Hex)
Slave Address	1	01
Error Code	1	90
Exception Code	1	<i>Refer to Modbus TCP/IP Exception Codes on page 30 for details.</i>

Examples of Multiple Registers Write Command

Table 25 lists command examples when writing register values 0001H and 0258H to register addresses 0001H and 0002H in a drive with the slave address (unit identifier) 01H.

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Table 26 shows examples of responses indicating that the write command has been executed successfully. The command specifies the beginning of the register address and the number of registers.

Table 27 shows examples of an error response when writing to a register. The exception code is 02H (indicating a register number error).

Table 25 Example Write Multiple Registers Command

Description		Data (Hex)
Slave Address		01
Function Code		10
Starting Register	Upper	00
	Lower	01
Quantity of Registers	Upper	00
	Lower	02
Number of Data Bytes		04
First Register Data	Upper	00
	Lower	01
Next Register Data	Upper	02
	Lower	58

Table 26 Example Write Multiple Registers Response

Description		Data (Hex)
Slave Address		01
Function Code		10
Starting Register	Upper	00
	Lower	01
Quantity of Registers	Upper	00
	Lower	02

Table 27 Example Write Multiple Registers Error Response

Description	Data (Hex)
Slave Address	01
Error Code	90
Exception Code	02

■ Read/Write Multiple Registers 23 (17 H)

This function code performs a combination of one read operation and one write operation in a single Modbus TCP/IP transaction. The write operation is performed before the read. The command specifies the starting read address, quantity of contiguous registers to read, starting write address, quantity of contiguous registers to write and the values to be written. The normal response contains the values of the registers that were read.

For both the address and the values, the first byte contains the most significant bits and the second byte contains the least significant bits.

Note: In option software version VST800380, any invalid register in the range will return an error response. In option versions VST800381 and later, invalid registers in the range will not return an error response provided at least 1 register is valid. Invalid registers will be set to 0 in the response.

Table 28 Read/Write Multiple Registers Command

Description	Byte	Data (Hex)
Slave Address	1	00 to FF
Function Code	1	17
Read Starting Register	2	0000 to FFFF
Quantity of Registers to Read	2	M <?>
Write Starting Register	2	0000 to FFFF
Quantity of Registers to Write	2	N <?>
Write Byte Count	1	N <?> X 2
Write Register Values	N <?> X 2	0000 to FFFF

- <1> M = Quantity of Registers to Read (range is 1 - 16)
- <2> N = Quantity of Registers to Write (range is 1 - 16)

Table 29 Read/Write Multiple Registers Response

Description	Byte	Data (Hex)
Slave Address	1	00 to FF
Function Code	1	17
Number of Data Bytes	1	M <1> x 2
Read Register Values	2	Values contained in slave registers

<1> M = Quantity of Registers

Table 30 Read/Write Multiple Registers Error Response

Description	Byte	Data (Hex)
Slave Address	1	00 to FF
Error Code	1	97
Exception Code	1	<i>Refer to Modbus TCP/IP Exception Codes on page 30 for details.</i>

Read/Write Multiple Registers

Table 31 lists command examples when reading registers 0001H and 0002H and then writing register values 0103H and 0258H to register addresses 0102H and 0103H in a drive with the slave address (unit identifier) 01H.

Table 32 shows examples of responses indicating that the read/write multiple registers command has been executed successfully. Read data 1 contains the value of register address 0001H (0001H). Read data 2 contains the value of the register address 0002H (0002H).

Table 33 shows examples of an error response when the command to read and write to multiple registers has failed. The exception code is 02H (indicating a register number error).

Table 31 Example Read/Write Multiple Registers Command

Description		Data (Hex)
Slave Address		01
Function Code		17
Read Starting Register	Upper	00
	Lower	01
Quantity of Registers to Read	Upper	00
	Lower	02
Write Starting Register	Upper	01
	Lower	02
Quantity of Registers to Write	Upper	00
	Lower	02
Number of Data Bytes		04
First Write Register Data	Upper	01
	Lower	03
Next Write Register Data	Upper	02
	Lower	58

Table 32 Example Read/Write Multiple Registers Response

Description		Data (Hex)
Slave Address		01
Function Code		17
Number of Data Bytes		04
Read Data 1	Upper	00
	Lower	01
Read Data 2	Upper	00
	Lower	02

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Table 33 Example Read/Write Multiple Registers Error Response

Description	Data (Hex)
Slave Address	01
Error Code	97
Exception Code	02

◆ Modbus TCP/IP Exception Codes

When an error occurs, remove the cause and restart communications.

Error Code	Error Name
	Cause
01H	Function Code Error
	<ul style="list-style-type: none">Attempted to set a function code from a PLC other than 03H, 06H, 10H, and 17H.
02H	Register Number Error
	<ul style="list-style-type: none">A register number specified in the command message does not exist.Attempted to send a broadcast message using other register numbers than 0001H or 0002H.
03H	Byte Count Error
	<ul style="list-style-type: none">Read data or write data is greater than 16 bytes. Invalid command message quantity.In a write message, the “Number of Data Items” contained within the message does not equal twice the amount of data words (i.e., the total of Data 1+ Data 2, etc.).
21H	Data Setting Error
	<ul style="list-style-type: none">Control data or parameter write data is outside the allowable setting range.Attempted to write a contradictory parameter setting.
22H	Write Mode Error
	<ul style="list-style-type: none">Attempted to write while the drive was operating to a parameter that cannot be written to during run.During an EEPROM data error (CPF06), the master attempted to write to a parameter other than A1-00 to -05, E1-03, or o2-04.Attempted to write to read-only data.
	DC Bus Undervoltage Write Error
23H	<ul style="list-style-type: none">Attempted to write from the master during an undervoltage fault (Uv1).Attempted to execute and Enter command during Uv1.
	Write Error During Parameter Process
24H	<ul style="list-style-type: none">Master attempted writing to the drive while the drive was processing parameter data.

◆ Control Connection Timeout

The option has a safety feature that declares a fault if communications between the master and drive is lost after the master commanded the drive to run.

A controlled connection is defined as one in which a master commands the drive by writing to register 01H. After this write, the option will begin a timer. The timer will be reset upon subsequent writes to register 01H. If the timer exceeds the value programmed in drive parameter F7-16, the option will declare a BUS ERROR if the option card has an active run command to the drive. A value of 0 in F7-16 means that the timeout is disabled.

The drive reaction to a BUS ERROR is programmable through drive parameter F6-01.

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 19](#)* 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	33
Drive Status Tab	33
Network Tab	34
Email Alerts Tab	35
Parameter Access Tab </>	36
Configuration Tab </>	37
Custom Tab	38

[<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 39* for details on RSTP.

■ Main HTML Home Page

The screenshot shows the 'Main' page of the Yaskawa web interface. At the top, there is a YASKAWA logo and a refresh button. Below the logo, there are two tabs: 'MAIN' (selected) and 'RSTP'. The main content area is titled 'Main' and contains two columns of data:

Device Information	Network Status
Protocol: Modbus-TCP	Msg Tx OK: 13
IP Address: 192.168.1.20	Msg Rx Ok: 80
MAC ID: 00:20:B5:88:31:6B	Msg Tx Dropped: 0
Serial Number: 123001227	Msg Rx Dropped: 0
Product Name: SI-EM3D	Msg Tx Errors: 1
Option Firmware Version: VST800380	Msg Rx Errors: 1
Drive Model: CIMR-AA2A0004	Current Connections: 0
Drive Firmware Version: 01021	Collisions: 0
Profinet Station Name: N/A	Tx Retry: 0

Below the data, there is a link to 'Launch Enhanced Website' and a note: 'To run the "Enhanced Website", Java ® must be enabled in your browser. If a connection to the internet is not available, a change in the Java configuration is required. set "All Programs / Java / Configure Java / Advanced Tab / Perform certificate checks on" to "Do not check"'. At the bottom, there is a copyright notice: 'Copyright © 2014 Yaskawa America, Inc.'.

Figure 11 Main HTML Home Page

■ RSTP Enabled HTML Home Page

The screenshot shows the 'RSTP Enabled HTML Home Page' of the Yaskawa web interface. At the top, there is a YASKAWA logo and a refresh button. Below the logo, there are two tabs: 'MAIN' and 'RSTP' (selected). The main content area is titled 'Rapid Spanning Tree Protocol' and contains two columns of data:

General	Port Information
STP / RSTP: ENABLED	Port 1 Role: Root
Priority: 61440	Port 1 State: Forwarding
Root Bridge: 00:80:F4:09:32:4E	Port 1 Version: RSTP
Hello Time (secs): 2	Port 1 BPDU Rx Count: 490
Forward Delay (secs): 21	Port 2 Role: Designated
Max Age (secs): 40	Port 2 State: Forwarding
Save Changes	Port 2 Version: RSTP
	Port 2 BPDU Rx Count: 39

At the bottom, there is a copyright notice: 'Copyright © 2014 Yaskawa America, Inc.'.

Figure 12 RSTP Enabled HTML Home Page

◆ Main Tab

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

The screenshot displays the YASKAWA web interface with the 'Main' tab selected. The 'Device Information' section is highlighted, showing the following details:

Device Information	
Protocol:	ModbusTCP
IP Address:	192.168.1.20
MAC ID:	00:20:B5:88:31:8B
Option Firmware Version:	VST800380
Drive Model:	CIMR-AU2A0004
Drive Firmware Version:	1021

The interface also includes a navigation menu at the top with tabs for Main, Drive Status, Network, Email Alerts, Parameter Access, Configuration, and Custom. A copyright notice at the bottom reads 'Copyright © 2014 Yaskawa America, Inc.'

Figure 13 Main Tab View

◆ Drive Status Tab

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

The screenshot displays the YASKAWA web interface with the 'Drive Status' tab selected. The interface is divided into several sections:

Drive Status		
Status:	Ready	
State:	Stopped	
Direction:	Forward	
Motor Speed:	0.0 Hz	

Drive Signals	
Frequency Ref:	0.0 Hz
Output Frequency:	0.0 Hz
Output Current:	0.0 A
DC Bus Voltage:	344 V
Torque Reference:	+0%

Fault Information	
Active:	None

Multi-function Inputs	
Terminal S1:	OFF
Terminal S2:	OFF
Terminal S3:	OFF
Terminal S4:	OFF
Terminal S5:	OFF
Terminal S6:	OFF
Terminal S7:	OFF

Multi-function Outputs	
Output MA - MC:	OFF
Output P1 - PC:	OFF
Output P2 - PC:	OFF

Analog Input Signals	
Input Terminal A1:	0%
Input Terminal A2:	0%

The interface includes a navigation menu at the top with tabs for Main, Drive Status, Network, Email Alerts, Parameter Access, Configuration, and Custom. A copyright notice at the bottom reads 'Copyright © 2014 Yaskawa America, Inc.'

Figure 14 Drive Status Tab View

◆ Network Tab

The Network tab shows the status of the option network traffic and the status of open I/O connections.

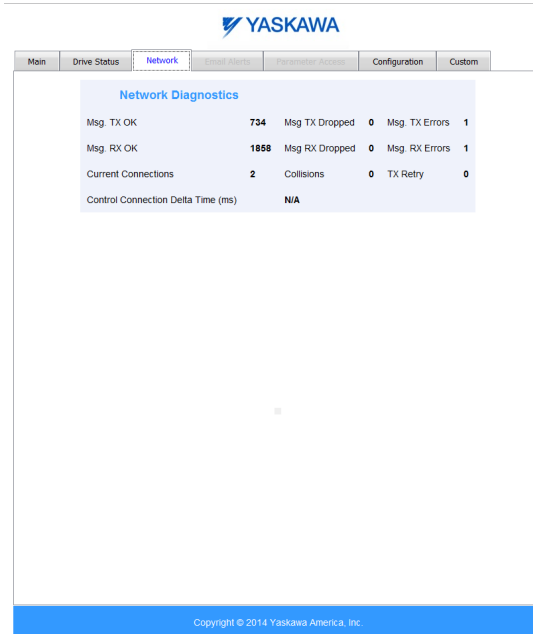


Figure 15 Network Tab View

Table 34 Network Monitor Descriptions

Network Monitor	Explanation
Msg Tx OK	Cumulative number of messages transmitted successfully from the option.
Msg Rx OK	Cumulative number of messages received successfully to the option.
Current Connections	Current number of open connections.
Control Connection Delta Time	The time between the last two writes to the Control register, MEMOBUS/Modbus address 0001H.
Msg Tx Dropped	Cumulative number of messages dropped due to output network buffer being full and unable to hold the new message.
Msg Rx Dropped	Cumulative number of messages dropped due to input network buffer being full and unable to hold the new message.
Collisions	Cumulative number of collisions (half duplex only) reported by the MAC/PHY (Media Access Control/Physical Connection).
Msg Tx Errors	Cumulative number of transmit underruns and transmit stops reported by the MAC/PHY.
Msg Rx Errors	Cumulative number of receive overruns, receive stops, and receive error frames reported by the MAC/PHY.
Tx Retry	Cumulative number of transmits in which the 1st attempt was delayed due to busy medium reported by the MAC/PHY.

◆ Email Alerts Tab

The Email Alerts tab allows the user to configure four Email Fault/Alarm conditions. When the condition is true, one email will be sent to the provided email address. Another email will not be sent until the condition becomes false and then true again. A 30-second timer prevents emails from being sent when conditions reoccur immediately after being removed. The timer helps limit the amount of emails sent regarding the same intermittent condition and helps to reduce network traffic by reducing emails about reoccurring errors.

Figure 16 Email Alerts Tab View

■ Conditional Email Set-up

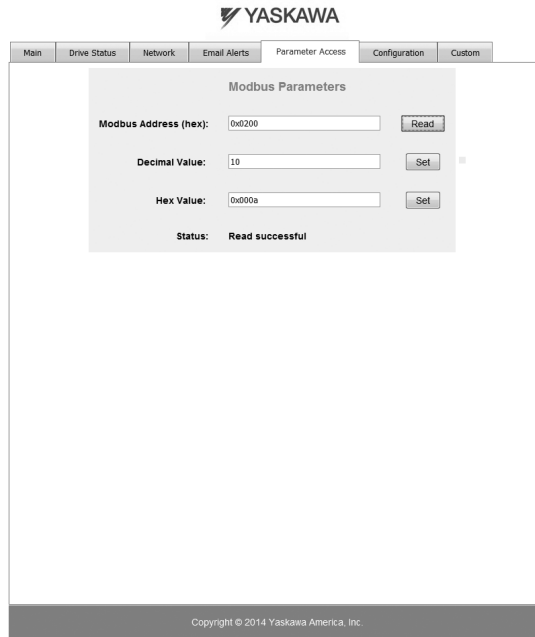
1. Define the condition that will trigger the email by selecting a monitor parameter, a comparator, and a value. Set up comparator values for the range of values to check in the chosen condition. If choosing only one condition and no OR or AND are needed, set the “OR/AND” drop-down selection to “NotUsed”.
2. Enter the email address where the alert will be sent.
3. Enter the message that will appear in the email contents.
4. Enter the email subject.
5. Click the “Email Active” check box to enable the alert.

Clicking “Save to device” will save the entered information into the option memory.

Clicking “Cancel and reload” will cancel any pending edits and display the most recently saved settings from the option board.

◆ Parameter Access Tab

The Parameter Access tab allows the user to read and write parameters from the drive. Write access is restricted until a valid password is entered.



The screenshot displays the YASKAWA web interface for the Parameter Access tab. At the top, there is a navigation menu with tabs: Main, Drive Status, Network, Email Alerts, Parameter Access (selected), Configuration, and Custom. Below the menu is a central panel titled "Modbus Parameters". This panel contains three input fields: "Modbus Address (hex):" with the value "0x0200" and a "Read" button; "Decimal Value:" with the value "10" and a "Set" button; and "Hex Value:" with the value "0x000a" and a "Set" button. Below these fields, the "Status:" is displayed as "Read successful". At the bottom of the interface, a footer indicates "Copyright © 2014 Yaskawa America, Inc."

Figure 17 Parameter Access Tab View

The MEMOBUS/Modbus address for the drive parameter being accessed must be entered in hexadecimal. The number must begin with “0x” to signify hexadecimal. Clicking “Read” will load and display the current value of the given MEMOBUS/Modbus Address.

Clicking “Set” will save the given value to the given MEMOBUS/Modbus address.

After a “Read” or “Set” command is given, Status will display “Waiting” while the action is being carried out, then “Complete” is displayed when finished.

◆ Configuration Tab

The Configuration tab sets web page behavior parameters. Access is restricted unless a valid password is entered.

Figure 18 Configuration Tab View

■ Security Login

Enter a valid password and click “Log in”. The button text changes to “Log out” and the status changes to “Logged in”.

Note: The default security password is “yaskawa”.

This password can be changed in the “Change Password” section of the tab. Entering a valid password allows access to the settings in the Configuration tab, Email Alerts tab, and the Parameter Access tab.

■ Change Password

To change the password, enter the new password in the “New Password:” and “Confirm Password:” text boxes then click “Change password”. The Status display will change to “Idle” then “Changing Password” then “Password Changed”. If the passwords in the two text boxes do not match, the Status will display “Passwords don’t match”.

■ Option Card

The values displayed in the various tabs are refreshed at the rate defined in the “Applet Refresh Rate (ms)” text box. Enter values in the range of 1000 ms to 65.535 seconds.

Parameter Security can be enabled or disabled by clicking one of the radio buttons. When “Disabled” is selected, no password is necessary and all functions in the web pages will be available. When “Enabled” is selected, a valid password must be entered to edit email settings and to write parameters.

■ Email Settings

The “Email Server IP” text box must contain the IP address of the email server. The subnet address is configured in drive parameters F7-05 through F7-08. The configured email alerts will use the server at this address when sending emails.

Enter the email server port in the “Email Port” text box.

The value in the “From Email Address” text box identifies the origin of the email alerts to the recipient.

Click “Submit Email Parameters” to save the email settings to the option.

Click “Save Configuration Parameters to Flash” to save the entered values from this tab into non-volatile memory. These values will then be remembered after cycling power.

■ General Settings

Click “Save Options Card Parameters” to save the Applet Refresh Rate and the Parameter Security settings to the option.

◆ Custom Tab

The Custom tab displays a selection of quick setting parameters.

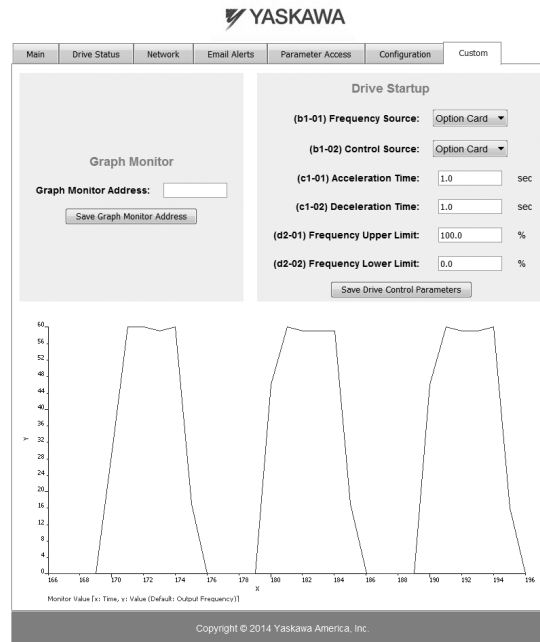


Figure 19 Custom Tab View

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.

If one path fails, RSTP activates another pathway to keep the network traffic flowing. After restoring the failed path, RSTP disables any redundant paths without disrupting network traffic.

◆ Convergence Time

Convergence is the process that RSTP performs to identify the root node and which pathways to disable. Convergence occurs on power up and when the network changes (e.g., path failures and restorations).

Take special care when using parameter F7-16, Communication Timeout Loss, and be sure to give RSTP enough time for convergence. When F7-16 is set too short, convergence will not be able to complete before it expires. The complexity of the network and the number of drives on the network will both factor into the value of the timeout.

RSTP is unnecessary and should be disabled when using star or line topology network configurations (RSTP is disabled by default).

◆ Topology

The option is ideal for use in ring topologies. With RSTP enabled, a ring topology provides redundancy to the network. RSTP determines the fastest paths to each node on the network and virtually splits the ring by disabling one port on one node to prevent data from being transmitted endlessly around the ring. If a path on the ring fails, RSTP re-enables the disabled port and reconnects the split. All nodes on the network remain accessible without any interruptions.

RSTP is unnecessary and should be disabled when using star or line topology network configurations (RSTP is disabled by default).

◆ Enabling RSTP

RSTP is enabled from the webpage on the option.

The IP address of the option card is necessary to access the webpage. Use the operator to read the IP address values from monitors U6-80, U6-81, U6-82, and U6-83.

These monitors display the IP address whether the card is configured to receive its IP address from a master controller (BOOTP or DHCP) or if it is configured statically.

Refer to [Table 35](#) for example values of the monitors for an option IP address of 192.168.1.20.

Table 35 Example IP Address Monitor Values

Monitor	Value
U6-80	192
U6-81	168
U6-82	1
U6-83	20

Enter the IP address to address bar of your web browser (Ex. <http://192.168.1.20>) and hit enter to load the main page for the option. Refer to [Figure 11](#) for an example of the main page.

At the top of the page, click the RSTP button. The RSTP webpage will be displayed with “N/A” values.



Refresh the page to update values.

MAIN
RSTP

Rapid Spanning Tree Protocol

General

STP / RSTP DISABLED

Priority 61440

Root Bridge N/A

Hello Time (secs) N/A

Forward Delay (secs) N/A

Max Age (secs) N/A

Port Information

Port 1 Role N/A

Port 1 State N/A

Port 1 Version N/A

Port 1 BPDU Rx Count N/A

Port 2 Role N/A

Port 2 State N/A

Port 2 Version N/A

Port 2 BPDU Rx Count N/A

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Figure 20 RSTP Page Initial View

Change the select box labeled “STP / RSTP” from “DISABLED” to “ENABLED” then click “Save Changes”. The webpage will automatically refresh and enable RSTP. Refer to [Figure 12](#) for an example of an RSTP enabled home page.

◆ Rapid Spanning Tree Protocol Webpage

There are two groups of data displayed on the RSTP webpage: General and Port Information.

■ General

STP / RSTP Enable

To enable RSTP, Change this setting to “ENABLED” and click “Save Changes” to enable RSTP.

Priority

The RSTP Priority controls which bridge in the network becomes the root bridge. For most installations, the PLC or controller should be configured as the root bridge. A lower value in the “Priority” field indicates a higher priority. The priority ranges from 0 to 61440 in increments of 4096. The option defaults to the lowest priority, 61440. [Table 36](#) lists the possible priorities.

Table 36 Priority Values

0	16384	32678	49152
4096	20480	36864	53248
8192	24576	40960	57344
12288	28672	45056	61440

To change the priority, select the desired priority from the list and click “Save Changes”.

Root Bridge

This field displays the MAC address of the root bridge on the network.

Hello Time (secs)

The Hello Time is displayed in seconds. This value is set by the root bridge and indicates how often bridge packets will be sent out.

Forward Delay (secs)

The Forward Delay is displayed in seconds. This value is set by the root bridge. When the port is using STP and not RSTP, the Forward Delay is the length of time the bridge will wait before transitioning between states.

Max Age (secs)

The Max Age is displayed in seconds. This value is set by the root bridge and indicates how long a message can be passed along before being discarded.

■ Port Information**Port Role**

The Port Role identifies how the port is being used. The seven possible values for Port Role are described in [Table 37](#).

Table 37 Port Role Values

Port Role	Description
Unknown	An unknown error has occurred within RSTP.
Root	This port leads to the root bridge.
Designated	This port leads away from the root bridge.
Alternate	This port is an alternate path to the root bridge.
Backup	This port is an alternate path away from the root bridge.
Disabled	This port does not have an active link.
N/A	RSTP is disabled.

Port State

The Port State indicates if the port is accepting and sending messages. The four possible values for Port State and the features of each state are shown in [Table 38](#).

Table 38 Port State Values

Port State	Accept Packets	Forward Packets	Learn MAC Addresses
Discarding	NO	NO	NO
Learning	NO	NO	YES
Forwarding	YES	YES	YES
N/A	RSTP is disabled.		

Port Version

RSTP can operate in normal RSTP mode or support STP mode. When an STP-only node is detected on the network, this port operates in STP mode and displays “STP”. “RSTP” will be displayed in all other cases.

Port BPDU Rx Count

The Port BPDU Rx Count shows the number of BPDU packets received on that port. In general, root ports receive far more BPDU packets than designated ports.

◆ RSTP Monitor U6-96

Monitor U6-96 is dedicated to RSTP. U6-96 shows the role and state for each port.

The displayed value has four digits. The first two digits belong to port 1 and the last two digits belong to port 2. The first and third digits represent port role while the second and fourth digits represent port state.

The possible port role and state values are shown in [Figure 21](#).

3
2
2
2

Port 1 Role		Port 1 State		Port 2 Role		Port 2 State	
0	Unknown	0	Discarding	0	Unknown	0	Discarding
2	Root	1	Learning	2	Root	1	Learning
3	Designated	2	Forwarding	3	Designated	2	Forwarding
4	Alternate			4	Alternate		
5	Backup			5	Backup		
6	Disabled			6	Disabled		
9	RSTP Disabled			9	RSTP Disabled		

Figure 21 U6-96 Monitor Values

Refer to [Table 37](#) for descriptions of the port role values.

Refer to [Table 38](#) for descriptions of the port state values.

Below are a few examples:

- 9292 = RSTP is disabled and both ports are forwarding.
- 3222 = Port 1 is forwarding and is the designated port. Port 2 is forwarding and is the root port.
- 2232 = Port 1 is forwarding and is the root port. Port 2 is forwarding and is the designated port.
- 3232 = Both ports are forwarding and are designated ports. This only occurs when the option is the root bridge.
- 4022 = Port 1 is discarding and is the alternate port. Port 2 is forwarding and is the root port.
- 2260 = Port 1 is forwarding and is the root port. Port 2 is discarding and is the disabled port.

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
<i>bUS</i>	bUS	Option Communication Error
		<ul style="list-style-type: none"> • 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		<ul style="list-style-type: none"> • Check that power is supplied to the PLC • Check that PLC is not in program mode
Communication cable is not connected properly		<ul style="list-style-type: none"> • Check for faulty wiring • Correct any wiring problems
A data error occurred due to noise		<ul style="list-style-type: none"> • 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
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
<i>EF0</i>	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.		<ul style="list-style-type: none"> • 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
<i>oFAD0</i>	oFA00	Option Card Connection Error at Option Port CN5-A
		Option compatibility error
Cause		Possible Solution

Digital Operator Display		Fault Name
<i>oFAD1</i>	oFA01	Option Card Fault at Option Port CN5-A
		Option not properly connected
Cause		Possible Solution
The option card connection to port CN5-A is faulty		<ul style="list-style-type: none"> • 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. • If the option is not a communication option card, try to use the card in a different option port. If the option card works properly in a different option port, CN5-A is damaged, and the drive requires replacement. If the error persists (oFb01 or oFC01 occur), replace the option card.

10 Troubleshooting

Digital Operator Display		Fault Name
oFA03 to oFA06	oFA03 to oFA06	Option Card Error Occurred at Option Port CN5-A
oFA10, oFA11	oFA10, oFA11	
oFA12 to oFA17	oFA12 to oFA17	Option Card Connection Error (CN5-A)
oFA30 to oFA43	oFA30 to oFA43	Communication Option Card Connection Error (CN5-A)
Cause		Possible Solution
Option card or hardware is damaged		<ul style="list-style-type: none"> • Cycle power to the drive. • If the problem continues, replace the control board or the entire drive. Contact Yaskawa or a Yaskawa representative for instructions on replacing the control board.

Digital Operator Display		Fault Name
oFb00	oFb00	Option Card Fault at Option Port CN5-B
		Option compatibility error
Cause		Possible Solution
The option card installed into port CN5-B is incompatible with the drive		Confirm that the drive supports the option card to be installed. Refer to Option Compatibility on page 46 for details. Contact Yaskawa for assistance.
A communication option card has been installed in option port CN5-B		Communication option cards are only supported by option port CN5-A. It is not possible to install more than one communication option.

Digital Operator Display		Fault Name
oFb02	oFb02	Option Card Fault at Option Port CN5-B
		Same type of option card is currently connected
Cause		Possible Solution
An option card of the same type is already installed in option port CN5-A		Except for PG options, only one of each option card type can only be installed simultaneously. Make sure only one type of option card is connected. Refer to Option Compatibility on page 46 for details. Contact Yaskawa for assistance.
An input option card is already installed in option port CN5-A		Install a communication option, a digital input option, or an analog input option. More than one of the same type of card cannot be installed simultaneously.

Digital Operator Display		Fault Name
oFC00	oFC00	Option Card Connection Error at Option Port CN5-C
		Option compatibility error
Cause		Possible Solution
The option card installed into port CN5-C is incompatible with the drive		Confirm that the drive supports the option card to be installed. Refer to Option Compatibility on page 46 for details. Contact Yaskawa for assistance.
A communication option card has been installed in option port CN5-C		Communication option cards are only supported by option port CN5-A. It is not possible to install more than one communication option.

Digital Operator Display		Fault Name
oFC02	oFC02	Option Card Fault at Option Port CN5-C
		Same type of option card is currently connected
Cause		Possible Solution
An option card of the same type is already installed in option port CN5-A or CN5-B.		Except for PG options, only one of each option card type can only be installed simultaneously. Make sure only one type of option card is connected.
An input option card is already installed in option port CN5-A or CN5-B.		Install a communication option, a digital input option, or an analog input option. More than one of the same type of card cannot be installed simultaneously.

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.		<ul style="list-style-type: none"> 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.		<ul style="list-style-type: none"> 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. 	
Termination resistor setting is incorrect.		Install a termination resistor at both ends of a communication line. Set the internal termination resistor switch correctly on slave drives. Place DIP switch S1 to the ON position.	

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 39](#).

Table 39 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.

10 Troubleshooting

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.

◆ Option Compatibility

A limited number of options may be simultaneously connected to the drive depending on the type of option.

Table 40 below lists the number of options that can be connected to the drive and the drive ports for connecting those options.

Table 40 Option Installation

Option	Port/Connector	Number of Options Possible
PG-B3, PG-X3	CN5-C	2 <1>
PG-F3 <2> <3>, PG-RT3 <2> <3>	CN5-C	1
AO-A3, DO-A3	CN5-A, B, C	1
SI-B3 <3>, SI-C3, SI-EN3 <3>, SI-EN3D, SI-EM3 <3>, SI-EM3D, SI-EP3 <3>, SI-ES3 <3>, SI-ET3 <3>, SI-N3, SI-P3, SI-S3, SI-T3, SI-W3 <3>, AI-A3 <4>, DI-A3 <4>	CN5-A	1

<1> When connecting two PG option cards, use both CN5-B and CN5-C. When connecting only one PG option card, use the CN5-C connector.

<2> Not available for the application with Motor 2 Selection.

<3> Not available with models 4A0930 and 4A1200.

<4> When using AI-A3 and DI-A3 as monitors, the card can be connected to any of CN5-A, CN5-B or CN5-C. The input status of AI-A3 can then be viewed using U1-21, U1-22, and U1-23, and the input status of DI-A3 can then be viewed using U1-17.

11 Specifications

Table 41 Option Specifications

Item	Specification
Model	SI-EM3D
Supported Messages	<ul style="list-style-type: none"> • 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

Revision History

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

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Date of Publication	Revision Number	Section	Revised Content
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		Back Cover	Revision: Format
July 2014	-	-	First Edition

YASKAWA AC Drive 1000-Series Option Modbus TCP/IP Technical Manual

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