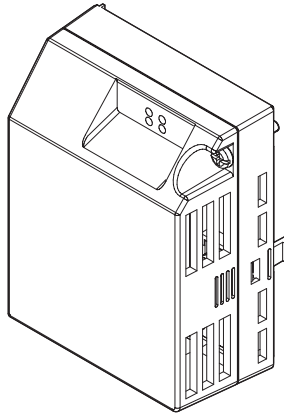




YASKAWA AC Drive-V1000 Option **Modbus TCP/IP** **Installation Manual**

Type SI-EM3/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.



Copyright © 2008 YASKAWA ELECTRIC AMERICA, INC.

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, mechanical, electronic, photocopying, recording, or otherwise, without the prior written permission of Yaskawa. No patent liability is assumed with respect to the use of the information contained herein. Moreover, because Yaskawa is constantly striving to improve its high-quality products, the information contained in this manual is subject to change without notice. Every precaution has been taken in the preparation of this manual. Yaskawa assumes no responsibility for errors or omissions. Neither is any liability assumed for damages resulting from the use of the information contained in this publication.



Table of Contents

1 PREFACE AND SAFETY	4
2 PRODUCT OVERVIEW	9
3 RECEIVING	10
4 OPTION COMPONENTS	11
5 INSTALLATION PROCEDURE	15
6 WEB INTERFACE	23
7 OPTION DRIVE PARAMETERS	27
8 MODBUS TCP/IP MESSAGING	29
9 TROUBLESHOOTING	34
10 SPECIFICATIONS	38


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, EXPRESSED 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 option and drive:

Option

	Yaskawa AC Drive -V1000 Option Modbus TCP/IP Installation Manual Manual No: TOEP YEACOM 02□
	Read this manual first. The installation manual is packaged with the Modbus TCP/IP Option and contains a basic overview of wiring, settings, functions, and fault diagnoses.
	Yaskawa AC Drive -V1000 Option Modbus TCP/IP Technical Manual Manual No: SIEP YEACOM 02□
	The technical manual contains detailed information and command registers. To obtain the technical manual access these sites: U.S.: http://www.yaskawa.com Other areas: contact a Yaskawa representative.

Yaskawa Drive

	Yaskawa AC Drive-V1000 Quick Start Guide Manual No: TOEP C710606 14□	To obtain instruction manuals for Yaskawa products access these sites: U.S.: http://www.yaskawa.com Europe: http://www.yaskawa.eu.com Japan: http://www.e-mechatronics.com Other areas: contact a Yaskawa representative.
	Yaskawa AC Drive-V1000 Technical Manual Manual No: SIEP C710606 18□	

◆ Terms

Note: Indicates a supplement or precaution that does not cause drive damage.

Drive:	Yaskawa AC Drive-V1000 Series.
Modbus TCP/IP Option:	Yaskawa AC Drive-V1000 Option Modbus TCP/IP SI-EM3/V.
≥ 1012:	Indicates a drive feature or function that is only available in drive software version 1012 or greater.
H (Example: 900H)	Indicates an engineering unit for hexadecimal number format.

1 Preface and Safety

◆ Registered Trademarks

- Modbus TCP/IP is a trademark of the 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 unit. The option unit 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.

CAUTION

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

NOTICE

Indicates an equipment damage message.

■ General Safety

General Precautions

- The diagrams in this section may include option units and drives without covers or safety shields to illustrate 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.
- 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.

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.

NOTICE

Do not expose the drive to halogen group disinfectants.

Failure to comply may cause damage to the electrical components in the option unit.

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.

Do not modify the drive circuitry.

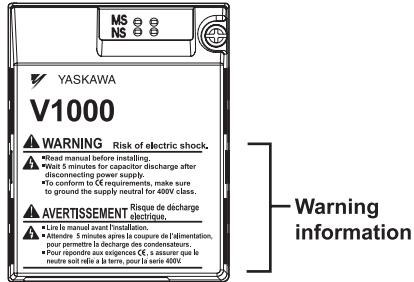
Failure to comply could result in damage to the drive and will void warranty.

Yaskawa is not responsible for any modification of the product made by the user. This product must not be modified.

1 Preface and Safety

■ 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

⚠ WARNING Risk of electric shock.

- **⚡** Read manual before installing.
- Wait 5 minutes for capacitor discharge after disconnecting power supply.
- To conform to **CE** requirements, make sure to ground the supply neutral for 400V class.

⚠ AVERTISSEMENT Risque de décharge électrique.

- **⚡** Lire le manuel avant l'installation.
- Attendre 5 minutes après la coupure de l'alimentation, pour permettre la décharge des condensateurs.
- Pour répondre aux exigences **CE**, s'assurer que le neutre soit relié à la terre, pour la série 400V.

2 Product Overview

◆ About This Product

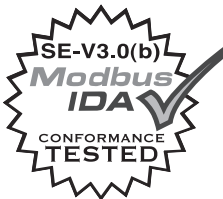
This option provides a communications connection between the drive and a Modbus TCP/IP network. The option connects the drive to a Modbus TCP/IP network and facilitates the exchange of data.

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 the operation status of the drive
- change parameter settings.



◆ Applicable Models

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

Table 1 Applicable Models

Drive	Software Version <I>
CIMR-VU□A□□□□□A□	≥ 1012

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

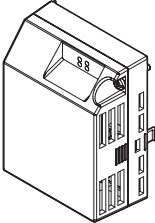
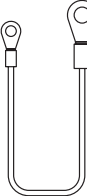
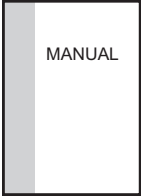
3 Receiving

Please perform the following tasks after receiving the option.

- Inspect the option for damage. If the option appears damaged upon receipt, contact the shipper immediately.
- Verify receipt of the correct model by checking the information on the nameplate (see *Figure 1*).
- If you have received the wrong model or the option does not function properly, contact your supplier.

◆ Contents and Packaging

Table 2 Option Package Contents

Description:	Option Unit	Ground Wires	Installation Manual
—			
Quantity:	1	4	1

◆ Tool Requirements

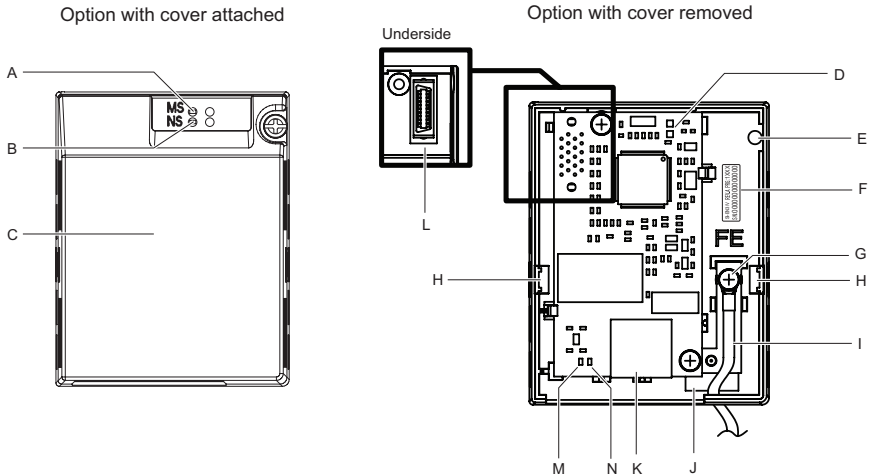
A Phillips screwdriver (M3, M3.5 to M6 metric or #1, #2 U.S. standard </>) is required to install the option.

<1> Screw sizes vary by drive capacity. Select a screwdriver that matches the drive capacity.

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

4 Option Components

◆ Option



- | | |
|---|---|
| A – LED (MS) | H – Mounting tabs |
| B – LED (NS) | I – Ground wire <1> |
| C – Option cover | J – Pass-through hole for wire |
| D – Modbus TCP/IP PCB | K – Modbus TCP/IP cable connection |
| E – Screw hole (attaching option cover) | L – Option connector |
| F – Nameplate | M – LED (10/100) |
| G – Functional Earth cable connection (FE) | N – LED (LINK/ACT) |

<1> Ground wires are packaged loose inside the option packaging and must be connected during installation.

Figure 1 Option Unit

Note: For details on the LEDs, *Refer to Option LEDs on page 14.*

4 Option Components

◆ Dimensions

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

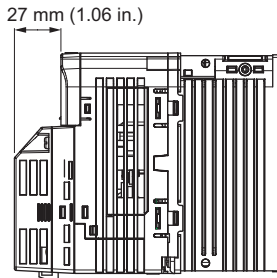


Figure 2 Dimensions

◆ Terminal

The communication connector is a RJ45 modular jack. This RJ45 modular jack is the connection point of the Modbus TCP/IP network communication cable to the option.

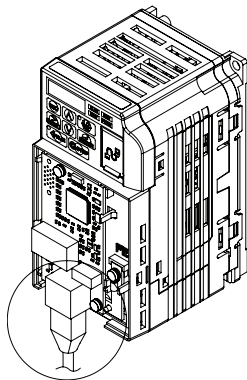
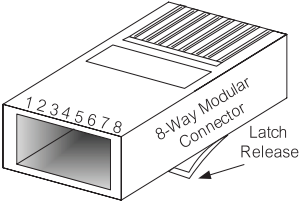


Figure 3 RJ45 Modular Jack

Table 3 Wiring for 8-way Option Modular Connectors

SI-EM3/V Ethernet 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 <I>
	5 (Pair 1)	Not used <I>
	6 (Pair 3)	Receive data (RXD) -
	7 (Pair 4)	Not used <I>
	8 (Pair 4)	Not used <I>

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

4 Option Components

◆ Option LEDs

The option has two bi-color, red/green LEDs: one for Module Status (MS) and one for Network Status (NS) and two green Ethernet LEDs: one to indicate network speed (10/100) and one to indicate the link status and network activity (LINK/ACT).

The operational states of the option LEDs are described in *Table 4*.

Table 4 Option LED States

Name	Indication		Operating Status	Remarks
	Color	Status		
MS	–	OFF	Power supply OFF.	Power is not supplied to the drive.
	Green	ON	Option operating.	Option is operating normally.
	Green	Flashing	Option initializing.	Option is configuring an IP address.
	Red	ON	Fatal error occurred.	Option detected a fatal (unrecoverable) error.
	Red	Flashing	Non-fatal error occurred.	Option detected a non-fatal (recoverable) error. Example: A loss of link fault.
NS	–	OFF	Offline or power supply OFF.	Possible causes include: <ul style="list-style-type: none"> the device is powered off option is not configured with an IP address and therefore cannot communicate on the network loss of link no active connections.
	Green	ON	Online communications established.	Option is online and established one or more connections.
	Green	Flashing	Control connection active.	A control connection is established and is active.
	Red	ON	Communications error (fatal).	Possible causes include: <ul style="list-style-type: none"> option detected a duplicate IP address on the network a connection timeout fault is detected. To clear the duplicate IP address fault, the IP address conflict must be resolved and the drive power must be cycled.
10/100	Green	OFF	10 Mbps is established.	–
	Green	ON	100 Mbps is established.	
LINK/ACT	Green	OFF	Link is not established.	
	Green	ON	Link is established.	
	Green	Flashing	Link is established and there is network activity.	

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, wait at least five minutes after all indicators are off, measure the DC bus voltage to confirm safe level, and check for unsafe voltages before servicing to prevent electric shock. 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.

WARNING

Electrical Shock Hazard

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

Failure to comply could result in death or serious injury.

The diagrams in this section may include option units and drives without covers or safety shields to show details. Be sure to reinstall covers or shields before operating any devices. The option board 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 remove option cover while the power to the drive is on.

Failure to comply could result in death or serious injury.

5 Installation Procedure

WARNING

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

Damage to Equipment

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

Failure to comply may result in ESD damage to 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

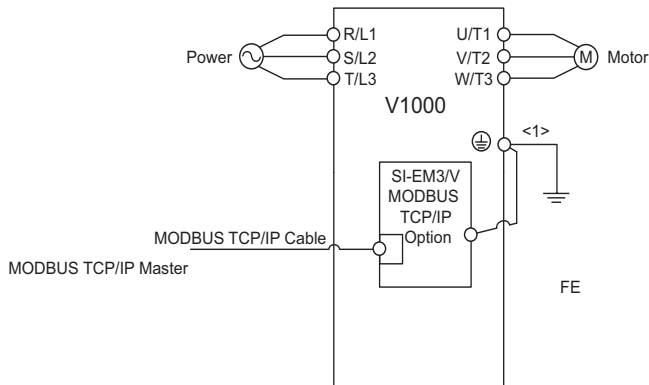
Properly connect all pins and connectors.

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

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

Failure to comply may result in damage to the option unit.

◆ Wiring Diagram



<1> The FE terminal on the option is supplied with a ground wire that should be connected to the ground terminal on the drive.

Figure 4 Wiring Diagram

◆ Prior to Installing the Option Unit

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

5 Installation Procedure

◆ Installing the Option Unit

Remove the front cover of the drive before installing the option. Follow the directions below for proper installation.

1. Switch off the power supply to the drive.

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. Before installing the option, disconnect all power to the drive. 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 at least five minutes after all indicators are off and measure the DC bus voltage level to confirm safe level.

2. Remove the front cover. The original drive front cover may be discarded because it will be replaced by the option cover in step 8.

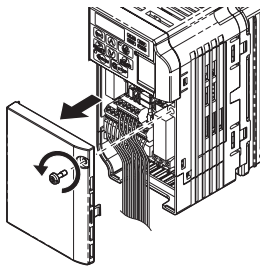


Figure 5 Remove Front Cover

3. Remove the bottom cover and connect the option ground wire to the ground terminal.

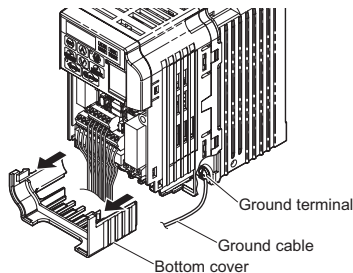
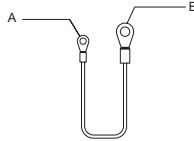


Figure 6 Connect Ground Wire

Note: The four different ground wires packaged with the option connect the option to different drive models. Select the proper ground wire from the option kit depending on drive size. Refer to *Table 5*.



- A** – Option unit connection: screw size = M3
B – Drive-side connection: screw size = M3.5 to M6

Figure 7 Ground Wire

Table 5 Ground Wire Selection

Ground Wire Length (mm/in)	Drive Model CIMR-VU		
	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 Installation Procedure

Note: Cover removal steps for larger models of V1000 with a Terminal Cover:

-Single-Phase 200 V Class: CIMR-VUBA0006 to BA0018

-Three-Phase 200 V Class: CIMR-VU2A0008 to 2A0069

-Three-Phase 400 V Class: All models

Remove the terminal cover before removing the bottom cover to install the option. Replace the terminal cover after wiring the option.

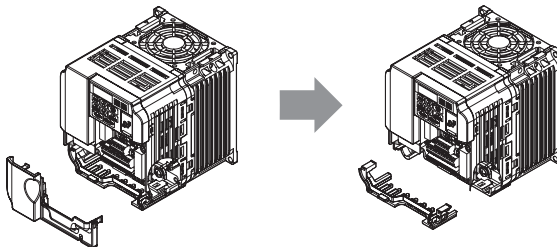


Figure 8 Models with Terminal Cover

4. Reattach the bottom cover.
5. Connect the option to the drive. Properly secure the tabs on the left and right sides of the option to the drive case.

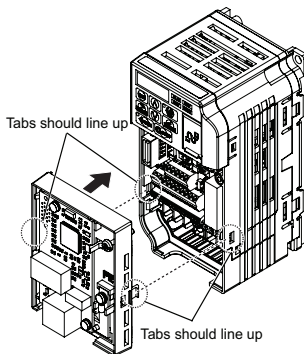


Figure 9 Attach Option

6. Connect the ground wire between the drive ground terminal and the option ground. When wiring the option, pass the ground wire through the inside of the drive bottom cover, then pass the ground wire into the through-hole for the ground wire at the front of the option.

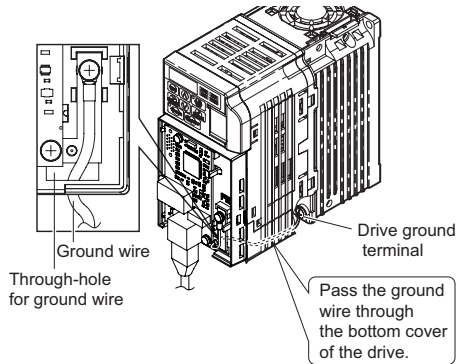


Figure 10 Ground Wire Connection

7. Connect the communication wire to the option modular connector. Refer to Procedure on page 22.
8. Attach the option cover to the front of the option.

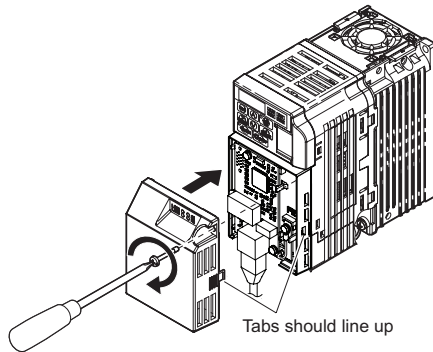


Figure 11 Attach Cover

5 Installation Procedure

◆ Communication Cable Wiring

■ Procedure

To connect the option to a network, insert a RJ45 8-pin Shielded Twisted Pair Cat 5e cable into the modular connector port. Ensure the cable end is firmly connected.

Note: Only use specified cable for Modbus TCP/IP™. Using an unspecified cable may cause the option or drive to malfunction.

Note: Replace the option cover after all wiring is completed.

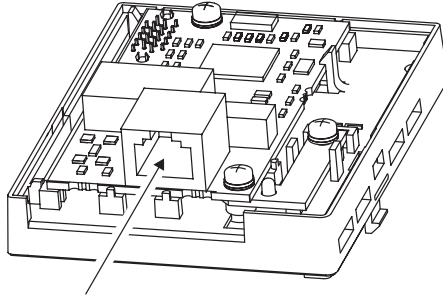


Figure 12 Communication Cable Port

◆ Communication Cable Specification

The use of CAT 5e or better Shielded Twisted Pair (STP) cable is recommended.

6 Web Interface

The web server interface to the drive option allows management of diagnostic information through a standard web browser. The embedded web pages include:

- Main Page
- Drive Status Page
- Network Monitor Page
- Documentation Page

◆ Main Page

The embedded main page shows basic option information such as IP address, MAC address, and firmware version. This page also shows the status of the option, and provides links to the other embedded web pages.

YASKAWA
The Drive for Quality™

Information	
Protocol	Modbus/TCP
IP Address:	192.168.1.20
MAC ID:	00:20:B5:24:22:6D
Product Name	SI-EM3
Option Firmware Version:	VST800240
Drive Firmware Version:	1012


Main Status

[Information](#)

Main Menu


Welcome to the Yaskawa Modbus/TCP Web Interface

Please choose from the following options:




Status & Monitor

Monitor Drive Signals



Network

Network Status Monitor



Information

View Drive and Option Documentation

www.yaskawa.com



Figure 13 Main Page View

6 Web Interface

◆ Drive Status Page

The embedded drive status page shows basic I/O information and drive state information.



**Status, Monitor and Fault History**

Drive Signals

Stopped	On	Forward	On	Alarm	Off
Running	Off	Reverse	Off	Fault	Off

Drive Signals		Multi-function Inputs		Multi-function Outputs	
Frequency Ref.	0.00 Hz	Terminal S1	Off	Output MA/MB-MC	Off
Output Frequency	0.00 Hz	Terminal S2	Off	Output P1 - PC	Off
Output Current	0.0	A. Terminal S3	Off	Output P2 - PC	Off
DC Bus Voltage	333	VDC Terminal S4	Off		
		Terminal S5	Off		
		Terminal S6	Off		
		Terminal S7	Off		

Analog Input Signals

Input Terminal A1	0.0	%
-------------------	------------	---

Fault Information

Active: None

Copyright © 2008 Yaskawa Electric America

Figure 14 Drive Status Page View

◆ Network Monitor Page

The embedded network monitor page shows the status of the option network traffic and the status of open I/O connections.



Network Monitor	
Diagnostics	
Msg. TX OK	389
Msg. Rx OK	475
Current Connections	0
Control Connection Delta Time	N/A

Figure 15 Network Monitor Page View

Table 6 Network Monitor Explanations



Network Monitor	Explanation
Msg Tx OK	Cumulative number of messages transmit successfully from SI-EM3/V.
Msg Rx OK	Cumulative number of messages received successfully to SI-EM3/V.
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.
Note: Cumulative counters are reset when the power supply is cycled.	



6 Web Interface

◆ Documentation Page

The embedded documentation page contains links to the option documentation on the Yaskawa website.



 **Documentation** 

Document	Description	
Installation Manual	V1000 Option EtherNet Modbus TCP/IP Installation Manual	
Technical Manual	V1000 Option EtherNet Modbus TCP/IP Technical Manual	

NOTE: INTERNET CONNECTION IS REQUIRED TO VIEW/OPEN DOCUMENTS.

Copyright © 2008 Yaskawa Electric America

Figure 16 Documentation Page View

7 Option Drive Parameters

Before starting network communications, verify proper setting of drive parameters in **Table 7** using the drive digital operator.

Table 7 Parameter Settings

No.	Name	Description	Default
b1-01 <1>	Frequency Reference Selection	Selects the frequency reference input source. 0: Operator - Digital preset speed d1-01 to d1-17 1: Terminals - Analog input terminal A1 or A2 2: MEMOBUS/Modbus communications 3: Option PCB 4: Pulse Input (Terminal RP)	1 (Set to 3 for Modbus TCP/IP)
b1-02 <1>	Run Command Selection	Selects the run command input source. 0: Digital Operator - RUN and STOP keys 1: Digital input terminals S1 to S7 2: MEMOBUS/Modbus communications 3: Option PCB	1 (Set to 3 for Modbus TCP/IP)
F6-01	Operation Selection after Communications Error	Determines drive response when a bUS error is detected during communications with the option. 0: Ramp to Stop 1: Coast to Stop 2: Fast-Stop 3: Alarm Only <2>	1
F6-02	External Fault Detection Conditions (EF0)	Sets the condition for external fault detection (EF0). 0: Always detected 1: Detected only during operation	0
F6-03	Stopping Method for External Fault from Communication Option Board	Determines drive response for external fault input (EF0) detection during communication. 0: Ramp to Stop 1: Coast to Stop 2: Fast-Stop 3: Alarm Only <2>	1
F6-07 <3>	NetRef/ComRef Selection Function	0: Multi-step speed reference disabled 1: Multi-step speed reference allowed	1
F6-08 <3>	Reset Communication Related Parameters	Determines if communication-related parameters F6-□□ and F7-□□ are set back to original default values when the drive is initialized using parameter A1-03. 0: Do not reset F6-□□ and F7-□□ parameters 1: Reset F6-□□ and F7-□□ parameters Note: Setting this parameter does not affect communication-related parameters.	0
F7-01 to F7-04	IP Address	Sets static IP address of network connection. Note: Parameter F7-01 sets the most significant octet.	192 168 1 20

7 Option Drive Parameters

No.	Name	Description	Default
F7-05 to F7-08	Subnet Mask	Sets static Subnet Mask of network connection. Note: Parameter F7-05 sets the most significant octet.	255 255 255 0
F7-09 to F7-12	Gateway Address	Sets static Gateway address of network connection. Note: Parameter F7-09 sets the most significant octet.	192 168 1 1
F7-13	Address Mode at Startup	Selects how the option address is set. 0: Static 1: BOOTP 2: DHCP	2
F7-14	Duplex Mode Selection	Selects duplex mode setting. 0: Half duplex forced 1: Auto-negotiate duplex mode and communication speed 2: Full duplex forced	0
F7-15	Communication Speed Selection	Sets the communication speed. 10: 10 Mbps 100: 100 Mbps	10
F7-16	Communication Loss Time-out	Control connection time-out value for detection of communication loss. The value is in tenths of a second (i.e. an entered value of 100 represents 10.0 seconds). A value of 0 disables the connection time-out.	0
H5-11	Communications ENTER Function Selection	Select 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	1

- <1> To start and stop the drive with the option master device using serial communications, set b1-02 to "3". To control the drive frequency reference via the master device, set b1-01 to "3".
- <2> If F6-01 is set to 3, then the drive will continue to operate when a BUS error or an EF0 fault is detected. Take proper safety measures, such as installing an emergency stop switch.
- <3> Software versions 1012 and later have F6-07 and F6-08 both set to 1.

Table 8 Option Monitors

No.	Name	Description	Value Range
U6-80 to U6-83	Online IP Address	IP Address, U6-80 is the most significant octet.	0 to 255
U6-84 to U6-87	Online Subnet	Subnet, U6-94 is the most significant octet.	0 to 255
U6-88 to U6-91	Online Gateway	Gateway, U6-88 is the most significant octet.	0 to 255
U6-92	Online Speed	Link Speed	10, 100
U6-93	Online Duplex	Duplex Setting	0: Half, 1: Full
U6-98	First Fault	First Option Board Fault	-
U6-99	Current Fault	Current Option Board Fault	-

8 Modbus TCP/IP Messaging

◆ Modbus TCP/IP Overview

The Modbus TCP/IP protocol is basically the Modbus protocol over an Ethernet TCP/IP network. As such, a master controller sends commands to slave devices. The slave, in turn, will perform the specified function and then send a response back to the master. Masters are typically a PLC. The drive using the SI-EM3/V option has slave functionality.

■ Supported Modbus Commands

Table 9 Supported Modbus 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 Registers

All of the command registers, monitors registers and parameters documented in the V1000 Drive Technical Manual are accessible via the SI-EM3/V 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, which will increase network performance. It is recommended that these registers be used for best response times.

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

8 Modbus TCP/IP Messaging

Table 10 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 (0.01 A units for drives set to 11 kW in Heavy or Normal Duty and 0.1 A units for drives set to 15 kW and above.)		
2007	4F	Terminal A2 Input Level Monitor (U1-14)		
2008	46	DC Bus Voltage Monitor (U1-07)		

8 Modbus TCP/IP Messaging

Address (hex)	Drive Register (hex)	Description	Bit	Description
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)
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	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)

8 Modbus TCP/IP Messaging

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	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 OFX)			
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 the table below. An Enter Command is enabled by writing 0 to register number 0900H or 0910H.

■ Enter Commands

Table 11 Enter Command Types

Register Number	Description
0900H	Writes data into the EEPROM (non-volatile memory) of the drive and enables the data to 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: Because the EEPROM can be written to a maximum of 100,000 times, refrain from frequently writing to the EEPROM. An Enter Command is not required if reference or broadcast data are sent to the drive.

◆ Enter Command Settings when Upgrading the Drive

When replacing earlier Yaskawa drive models with 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 or not in order to activate parameter changes in the drive.

- If upgrading from a G7 or F7 series drive to V1000, set parameter H5-11 to 0.
- If upgrading from a V7 series drive to V1000, set parameter H5-11 to 1.

■ Enter Commands

Table 12 Enter Command Types

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 is performed taking 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. Parameters 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.

9 Troubleshooting

◆ Drive-Side Error Codes

Drive-side error codes appear on the drive digital operator. Causes of the errors and corrective actions are listed in **Table 13**. For additional error codes that may appear on the drive digital operator, refer to the drive technical manual.

■ Faults

Both bUS (Option Communication Error) and EF0 (External Fault Input from the option) 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?
- Is the communication line properly connected to the option? Is it loose?
- Is the controller program working? Has the controller/PLC CPU stopped?
- Did a momentary power loss interrupt communications?

Table 13 Fault Display and Possible Solutions

LED Operator Display		Fault Name
<i>bUS</i>	bUS	Option Communication Error.
		<ul style="list-style-type: none"> • After establishing initial communication, the connection was lost • 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
Option is damaged.		If there are no problems with the wiring and the error continues to occur, replace the option.
Control Connection Time-out.		<ul style="list-style-type: none"> • Option did not receive a command (write to Modbus Address 01H) within the time-out period specified in parameter F7-16 • Check value programmed in F7-16 • Check if PLC program stopped running
Duplicate IP Address.		The option shares IP Address with at least one other node.

LED Operator Display		Fault Name
EFO	EF0	External Fault Input from the option. The alarm function for an external device is triggered.
Cause		Corrective Action
An external fault is being sent from the upper controller (PLC).		<ul style="list-style-type: none"> • Remove the cause of the external fault • Reset the external fault input from the PLC device
Problem with the PLC program.		Check the program used by the PLC and make the appropriate corrections.

LED Operator Display		Fault Name
oFA00	oFA00	Option Fault. Option is not properly connected.
Cause		Possible Solution
Non-compatible option connected to the drive.		Connect an option that is compatible with the drive.

LED Operator Display		Fault Name
oFA01	oFA01	Option Fault. Option is not properly connected.
Cause		Possible Solution
Problem with the connectors between the drive and option.		Turn the power off and check the connectors between the drive and option.

LED Operator Display		Fault Name
oFA03	oFA03	Option Fault. Option self-diagnostics error.
Cause		Possible Solution
Option hardware fault.		Replace the option.

LED Operator Display		Fault Name
oFA04	oFA04	Option Fault. Option Flash write mode.
Cause		Possible Solution
Option hardware fault.		Replace the option.

9 Troubleshooting

LED Operator Display		Fault Name
oFA30	oFA30 to oFA43	Option Fault (Port A).
oFA43		Communication ID error.
Cause		Possible Solution
Option hardware fault.		Replace the option.

■ Minor Faults and Alarms

LED Operator Display		Minor Fault Name	
CALL	CALL	Serial Communication Transmission Error.	
		Communication is not established.	
Cause		Possible Solution	Minor Fault (H2-□□ = 10)
Communication wiring is faulty, there is a short circuit, or improper connection.		<ul style="list-style-type: none"> • Check for wiring errors • Correct the wiring • Remove ground shorts and reconnect loose wires 	YES
Programming error on the master side.		Check communications at start-up and correct programming errors.	
Communication circuitry is damaged.		<ul style="list-style-type: none"> • Perform a self-diagnostics check • Replace the drive if the fault continues to occur 	

◆ 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 14*.

Table 14 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.
Network Link Down	BUS ERROR	1200	No network link to option board.
Control Connection Time-out	BUS ERROR	1201	The control connection timer (F7-16) timed out.
Duplicate IP Address	BUS ERROR	1202	This node and at least one other node have the same IP Address.
Default MAC Address	None	1203	Factory default MAC Address programmed into the option. Return for reprogramming.

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 SI-EM3/V 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.

10 Specifications

◆ Specifications

Table 15 Option Specifications

Item	Specification
Model	SI-EM3/V (PCB model: UTC000310)
SI-EM3/V 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	Passed
Connector Type	RJ45 8-pin Shielded Twisted Pair Cat 5e cable
Physical Layer Type	<ul style="list-style-type: none"> • Isolated Physical Layer • TCP Protocol Transformer Isolated
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	<ul style="list-style-type: none"> • 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
Humidity	Up to 95% RH (no condensation)
Storage Temperature	-20 °C to +60 °C (allowed for short-term transport of the product)
Area of Use	Indoor (free of corrosive gas, airborne particles, etc.)
Altitude	Up to 1000 m

YASKAWA AC Drive-V1000 Option

Modbus TCP/IP

Installation Manual

YASKAWA ELECTRIC AMERICA, INC.

2121 Norman Drive South, Waukegan, IL 60085, U.S.A.
Phone: 1-847-887-7000 or (800)YASKAWA (800-927-5292) Fax: 1-847-887-7370
Internet: <http://www.yaskawa.com>

YASKAWA ELETRICO DO BRASIL LTDA.

Avenida Fagundes Filho, 620 Sao Paulo-SP CEP 04304-000, Brazil
Phone 55-11-3585-1100 Fax 55-11-5581-8795
Internet: <http://www.yaskawa.com.br>



YASKAWA ELECTRIC AMERICA INC.

YASKAWA

In the event that the end user of this product is to be the military and said product is to be employed in any weapons systems or the manufacture thereof, the export will fall under the relevant regulations as stipulated in the Foreign Exchange and Foreign Trade Regulations. Therefore, be sure to follow all procedures and submit all relevant documentation according to any and all rules, regulations and laws that may apply. Specifications are subject to change without notice for ongoing product modifications and improvements.
© 2008 YASKAWA ELECTRIC AMERICA INC. All rights reserved.

MANUAL NO. TOEP YEACOM 02A
Published in U.S.A December 2008 08-12