The following procedure is a supplement to other documentation supplied with the SI-EN3 option card. This document will cover installation, drive setup, diagnostics, related drive parameters, configuring messages and error codes.

The option provides a communications connection between the drive and an ODVA EtherNet/IP network. The option connects the drive to an EtherNet/IP network and facilitates the exchange of data. EtherNet/IP 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.

Please read this cheat sheet and other documentation provided with the SI-EN3 option card thoroughly before attempting any installation.

Step 1 — Option Card Information

Applicable Models

The option can be used with the following drive models:

Drive Series	Drive Model	Software Version
A1000	CIMR-A*2A****	1010 or later
	CIMR-A*4A0002* to 4A0675*	1010 or later
	CIMR-A*4A0930* to 4A1200*	3010 or later
	CIMR-A*5A***	1017 or later / 5040 or later
P1000	CIMR-P*2A****	8500 or later
	CIMR-P*4A0002* to 4A0675*	8500 or later
	CIMR-P*5A***	8500 or later
iQpump1000	CIMR-PW2A****	8550 or later
	CIMR-PW4A0002* to 4A0675*	8550 or later
	CIMR-PW5A***	8550 or later

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.
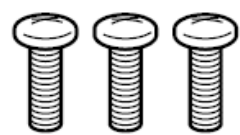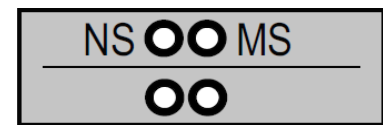
Option Package Contents
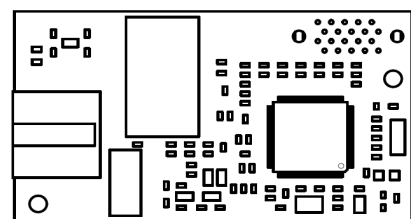
- Option PCB – 1x
- Ground Wire – 1x
- Screws (M3) – 3x
- NS ○○ MS ○○ LED Label – 1x
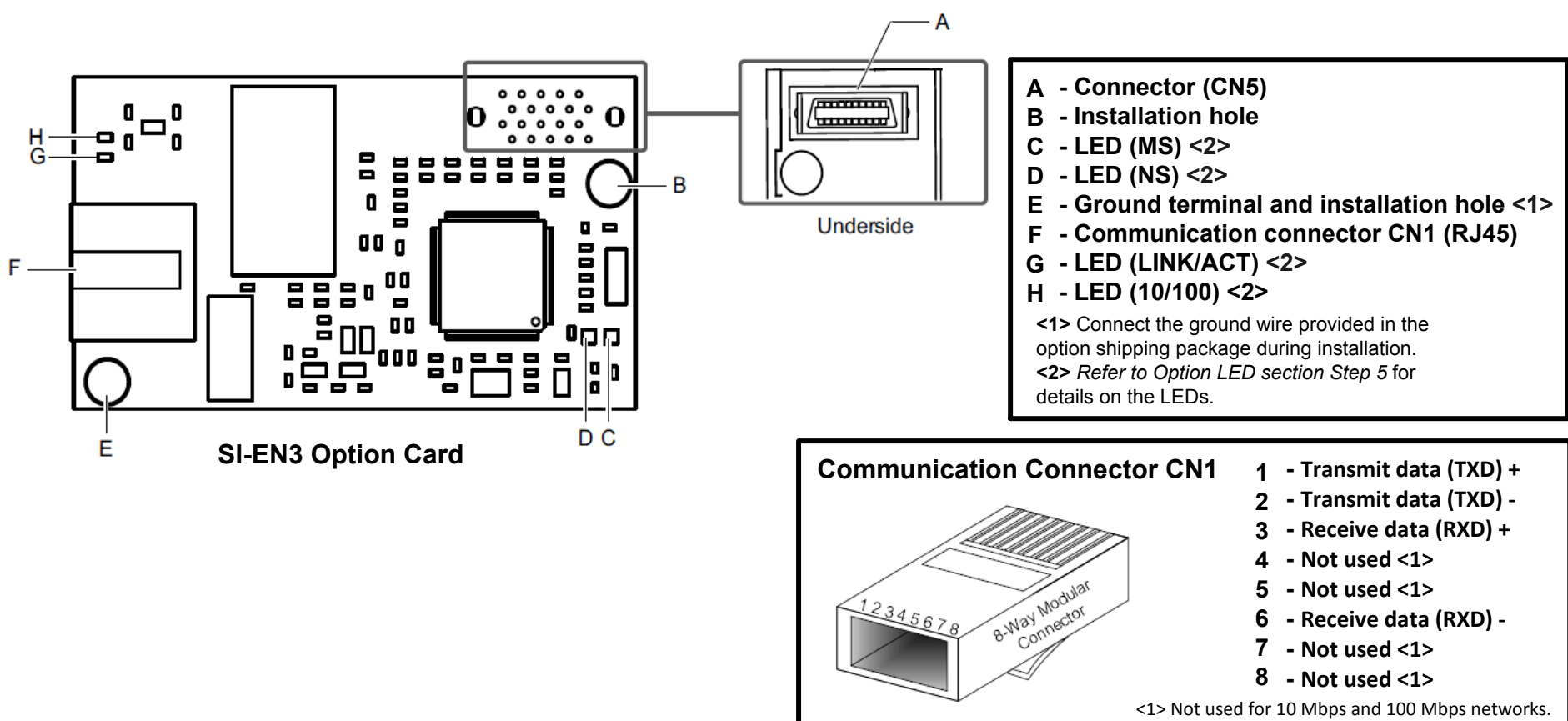
Tools required for installation

- A Phillips screwdriver (M3 metric/#1, #2 U.S. standard size) 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)
- A straight-edge screwdriver (blade depth: 0.4 mm, width: 2.5 mm) is required to wire the option terminal block.

Step 2 — Installing the SI-EN3 Option Card

In this step the SI-EN3 option card is installed. ***WITH POWER OFF*** install the SI-EN3 card as shown below. ***Make sure to follow good wiring practices and all applicable codes. Ensure that the option card is grounded properly as shown in item ④ below.***

This option card can be inserted into the CN5-A connector located on the drive's control board.

A - Connector (CN5)
B - Installation hole
C - LED (MS) <2>
D - LED (NS) <2>
E - Ground terminal and installation hole <1>
F - Communication connector CN1 (RJ45)
G - LED (LINK/ACT) <2>
H - LED (10/100) <2>

<1> Connect the ground wire provided in the option shipping package during installation.
<2> Refer to Option LED section Step 5 for details on the LEDs.

SI-EN3 Option Card

Communication Connector CN1

1 - Transmit data (TXD) +
2 - Transmit data (TXD) -
3 - Receive data (RXD) +
4 - Not used <1>
5 - Not used <1>
6 - Receive data (RXD) -
7 - Not used <1>
8 - Not used <1>

8-Way Modular Connector
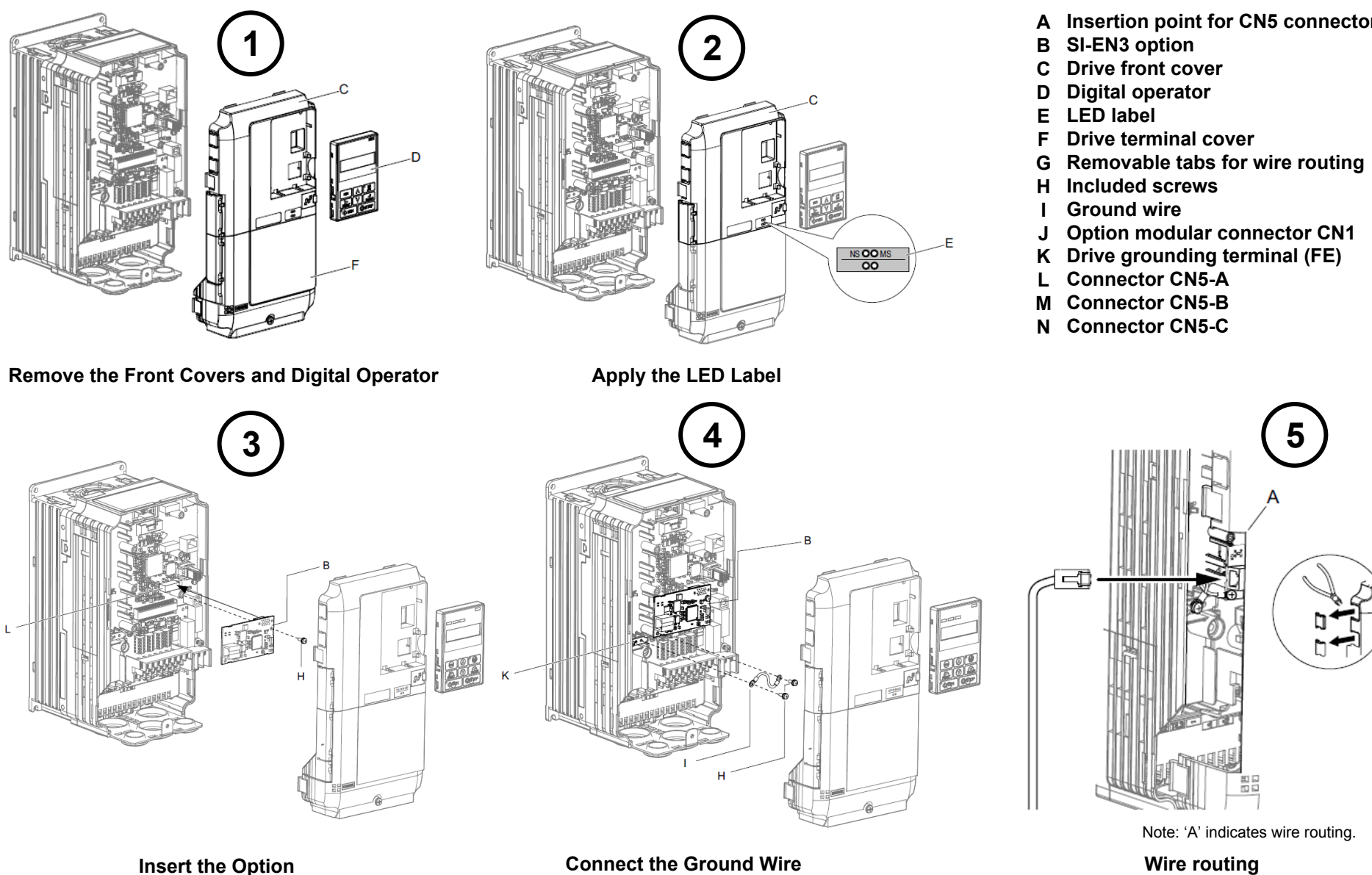
<1> Not used for 10 Mbps and 100 Mbps networks.

Option Card Installation

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 Quick Start Guide packaged with the drive for information on wiring and connecting the drive. Shut off power to the drive, wait the appropriate amount of time for voltage to dissipate, then remove the digital operator (D) and front covers (C, F). Front cover removal varies by model.

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.*

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.*

A Insertion point for CN5 connector
B SI-EN3 option
C Drive front cover
D Digital operator
E LED label
F Drive terminal cover
G Removable tabs for wire routing
H Included screws
I Ground wire
J Option modular connector CN1
K Drive grounding terminal (FE)
L Connector CN5-A
M Connector CN5-B
N Connector CN5-C

Remove the Front Covers and Digital Operator
Apply the LED Label
Insert the Option
Connect the Ground Wire
Wire routing

Note: 'A' indicates wire routing.

Wiring the Option

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. In these cases, using diagonal cutting pliers, cut out the perforated openings on the left side of the drive front cover. Sharp edges along the cut out should be smoothed down with a file or sand paper to prevent any damage to the wires. Route the communication wiring inside the enclosure for drives that do not require routing through the front cover.

Step 3 — Option LED Display and Power-Up Diagnostics

Option LED Display

The Ethernet/IP option has four LEDs.
Bi-color Status LEDs:
- Module status (MS) red/green
- Network status (NS) red/green
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 the power-up diagnostic LED sequence is completed are described in the table below. Wait at least 2 seconds for the power-up diagnostic process to complete before verifying the states of the LEDs.

Name	Display Color	Display Status	Operating Status	Remarks
MS	–	OFF	Power supply OFF	Power is not being supplied to the drive
	Green	ON	Option operating	The option is operating normally
	Green	Flashing	Option initializing	The option is configuring an IP address
	Red	ON	Fatal error occurred	The option has detected a fatal (unrecoverable) error
	Red	Flashing	Non-fatal error occurred	The option has detected a non-fatal (recoverable) error
	Green/Red	Flashing	Option self-test	The option is in self-test mode
NS	–	OFF	Offline or Power supply OFF	–
	Green	ON	Online communications established	The option is online and has established connections
	Green	Flashing	Online communications not established	The option is online without an established connection
	Red	ON	Communications error (fatal)	The option detected a duplicate IP address
	Red	Flashing	Communications time-out (non-fatal)	A communications time-out occurred
	Green/Red	Flashing	Option self-test	The option is in self-test mode
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	

Power-Up Diagnostics

An LED test is performed each time the drive is powered up. The initial boot sequence may take several seconds. After the LEDs have completed the diagnostic LED sequence, the option is successfully initialized. The LEDs then assume operational conditions as shown in the table below.

Sequence	Module Status (MS)	Network Status (NS)	Time (ms)
1	Green	OFF	250
2	Red	OFF	250
3	Green	OFF	–
4	Green	Green	250
5	Green	Red	250
6	Green	OFF	–

Step 4 — EDS File, Related Drive Parameters and Monitors

Step 5 — Configuring Messaging / Polled Assemblies / Input and Output Assemblies

Step 6 — Error Codes

EDS File

For easy network implementation of drives equipped with this option, an EDS file can be obtained from:
U.S.: http://www.yaskawa.com
Europe: http://www.yaskawa.eu.com
Japan: http://www.e-mechatronics.com
Other areas: Contact a Yaskawa representative.
ODVA: http://www.odva.org

Note: Download the EDS file for SI-EN3 option. The SI-EN3 may not function as a slave in the network without the appropriate EDS file.

Related Drive Parameters and Monitors

The following parameters are used to set up the drive for operation with the option. Parameter setting instructions can be found in the drive Quick Start Guide or Technical Manual.
Confirm proper setting of the all parameters in the table below, before starting network communications.
After changing parameter settings, cycle power to the drive for the new settings to take effect.

No.	Name	Description	Values
b1-01 <1>	Frequency Reference Selection	0: Operator 1: Terminals - A1 or A2 2: MEMOBUS/Modbus 3: Option PCB 4: Pulse Input	Default: 1 Range: 0 to 4 (Set to 3 for E/IP)
b1-02	Run Command Selection	0: Digital Operator 1: Digital input terminals 2: MEMOBUS/Modbus 3: Option PCB	Default: 1 Range: 0 to 3 (Set to 3 for E/IP)
F6-01	Operation Selection after Communications Error	0: Ramp to Stop 1: Coast to Stop 2: Fast-Stop 3: Alarm Only <2>	Default: 1 Range: 0 to 3
F6-02	External Fault Detection Conditions EF0	0: Always detected 1: Detected during operation	Default: 0 Range: 0, 1
F6-03	Stopping Method for Ext. Flt from the Com. Option	0: Ramp to Stop 1: Coast to Stop 2: Fast-Stop 3: Alarm Only <2>	Default: 1 Range: 0 to 3
F6-06 <3>	Torque Ref./ Torque Limit via Comm. Opt.	0: Disabled. 1: Enabled. <4>	Default: 0 Range: 0, 1
F6-07 <3>	Net/Com Ref Selection Func.	0: Disabled, 1: Multi-step speed ref. allowed	Default: 0 Range: 0, 1
F6-08 <3>	Reset Comm. Related Parameters	0: Do not reset parameters 1: Reset parameters	Default: 0 <7> Range: 0, 1
F7-01 <5><6> <7>	IP Address 1	Sets the static/fixed IP address. Parameter F7-01 sets the most significant octet.	Default: 192 Range: 0 to 255
F7-02 <5><6> <7>	IP Address 2	Sets the static/fixed IP address. Parameter F7-02 sets the second most significant octet.	Default: 168 Range: 0 to 255
F7-03 <5><6> <7>	IP Address 3	Sets the static/fixed IP address. Parameter F7-03 sets the third most significant octet.	Default: 1 Range: 0 to 255
F7-04 <5><6> <7>	IP Address 4	Sets the static/fixed IP address. Parameter F7-04 sets the fourth most significant octet.	Default: 20 Range: 0 to 255
F7-05 <7>	Subnet Mask 1	Sets the static/fixed Subnet Mask. Parameter F7-05 sets the most significant octet.	Default: 255 Range: 0 to 255
F7-06 <7>	Subnet Mask 2	Sets the static/fixed Subnet Mask. Parameter F7-06 sets the 2nd most significant octet.	Default: 255 Range: 0 to 255
F7-07 <7>	Subnet Mask 3	Sets the static/fixed Subnet Mask. Parameter F7-07 sets the 3rd most significant octet.	Default: 255 Range: 0 to 255
F7-08 <7>	Subnet Mask 4	Sets the static/fixed Subnet Mask. Parameter F7-08 sets the 4th most significant octet.	Default: 0 Range: 0 to 255
F7-09 <7>	Gateway Address 1	Sets the static/fixed Gateway address. Parameter F7-09 sets the most significant octet.	Default: 192 Range: 0 to 255
F7-10 <7>	Gateway Address 2	Sets the static/fixed Gateway address. Parameter F7-10 sets the 2nd most significant octet.	Default: 168 Range: 0 to 255

No.	Name	Description	Values
F7-11 <7>	Gateway Address 3	Sets the static/fixed Gateway address. Parameter F7-11 sets the 3rd most significant octet.	Default: 1 Range: 0 to 255
F7-12 <7>	Gateway Address 4	Sets the static/fixed Gateway address. Parameter F7-12 sets the 4th most significant octet.	Default: 1 Range: 0 to 255
F7-13	Address Mode at Startup	0: Static <6> 1: BOOTP 2: DHCP	Default: 2 Range: 0 to 2
F7-14	Duplex Mode Selection	0: Half duplex forced 1: Auto-negotiate 2: Full duplex forced	Default: 1 Range: 0 to 2
F7-15 <8>	Comm. Speed Selection	10: 10 Mbps 100: 100 Mbps	Default: 10 Range: 10, 100
F7-17	EtherNet/IP Speed Scaling Factor	Sets the scaling factor for the speed monitor in EtherNet/IP Class ID 2AH Object.	Default: 0 Min.: -15 Max.: 15
F7-18	EtherNet/IP Current Scaling Factor	Sets the scaling factor for the output current monitor in EtherNet/IP Class ID 2AH Object.	Default: 0 Min.: -15 Max.: 15
F7-19	EtherNet/IP Torque Scaling Factor	Sets the scaling factor for the torque monitor in EtherNet/IP Class ID 2AH Object.	Default: 0 Min.: -15 Max.: 15
F7-20	EtherNet/IP Power Scaling Factor	Sets the scaling factor for the power monitor in EtherNet/IP Class ID 2AH Object.	Default: 0 Min.: -15 Max.: 15
F7-21	EtherNet/IP Voltage Scaling Factor	Sets the scaling factor for the voltage monitor in EtherNet/IP Class ID 2AH Object.	Default: 0 Min.: -15 Max.: 15
F7-22	EtherNet/IP Time Scaling	Sets the scaling factor for the time monitor in EtherNet/IP Class ID 2AH Object.	Default: 0 Min.: -15 Max.: 15
F7-23 to F7-32	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	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. Refer to Input Assemblies (Drive Produces) for definitions of the default MEMOBUS/Modbus registers.	Default: 0

Monitor	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
U6-98	First Fault	First Option Fault	–
U6-99	Current Fault	Current Option Fault	–

<1> To start and stop the drive with the EtherNet/IP master device using serial communications, set b1-02 to 3 or set the "Net Control" bit in the assemblies or Control Supervisor Object. To control the drive frequency reference of the drive via the master device, set b1-01 to 3 or set the Net Reference bit in the assemblies or AC/DC Object.
<2> If F6-01 is set to 3, the drive will continue to operate when a fault is detected. Take safety measures, such as installing an emergency stop switch.
<3> 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.
<4> 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.
<5> Cycle power for setting changes to take effect.
<6> If F7-13 is set to 0, then all IP Addresses (F7-01 to F7-04) must be unique.
<7> Set F7-01 to F7-12 when F7-13 is set to 0.
<8> Set F7-15 when F7-14 is set to 0 or 2.

Polled Assemblies

Assembly Number (Hex)	Description	Type	Bytes
20(14)	Basic Speed Control Output	Output	4
21(15)	Extended Speed Control Output	Output	4
22(16)	Speed and Torque Control Output	Output	6
23(17)	Extended Speed and Torque Control Output	Output	6
70(46)	Basic Speed Control Input	Input	4
71(47)	Extended Speed Control Input	Input	4
72(48)	Speed and Torque Control Input	Input	6
73(49)	Extended Speed and Torque Control Input	Input	6
100(64)	(Vendor Specific Yaskawa Electric (YE) Assy)-MEMOBUS/Modbus Message Output	Output	5
101(65)	(Vendor Specific Yaskawa Electric (YE) Assy)-Speed/Torque Control Output	Output	8
116(74)	(Vendor Specific Yaskawa Electric (YE) Assy)-High Speed/Torque Control Output	Output	44
150(96)	(Vendor Specific Yaskawa Electric (YE) Assy)-MEMOBUS/Modbus Message Input	Input	5
151(97)	(Vendor Specific Yaskawa Electric (YE) Assy)-Speed/Torque Status Input	Input	8
166(A6)	(Vendor Specific Yaskawa Electric (YE) Assy)-High Speed/Torque Status Input	Input	44

This section provides information on methods used to control the drive with the option installed.

NOTE: It is beyond the scope of this document using the SI-EN3 option with the vendor specific assemblies (Output 100, 101 and 116, Input 150, 151 and 156). Please refer to the SIEP C730600 58A 1000-Series Option SI-EN3 Technical Manual for information on how to use these assemblies.

Output Assemblies (Drive Consumes)

The convention in this cheat sheet is from the PLC perspective. As such, an assembly is called an "Output Assembly" when outputted from the PLC and received by this node. This section details "Output Assemblies" that are "Consumed" by this drive.

Basic Speed Control Output - 20 (0x14)

Output Instance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
20	0	–	–	–	–	–	Fault Reset	–	Run Fwd
	1	–							
	2	Speed Reference (Low Byte)							
	3	Speed Reference (High Byte)							

Extended Speed Control Output - 21 (0x15)

Output Instance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
21	0	–	NetRef	NetCtrl	–	–	Fault Reset	Run Rev	Run Fwd
	1	–							
	2	Speed Reference (Low Byte)							
	3	Speed Reference (High Byte)							

Speed and Torque Control Output - 22 (0x16)

Output Instance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
22	0	–	–	–	–	–	Fault Reset	–	Run Fwd
	1	–							
	2	Speed Reference (Low Byte)							
	3	Speed Reference (High Byte)							
	4	Torque Reference/Torque Limit (Low Byte)							
	5	Torque Reference/Torque Limit (High Byte)							

Extended Speed and Torque Control Output - 23 (0x17)

Output Instance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
23	0	–	NetRef	NetCtrl	–	–	Fault Reset	Run Rev	Run Fwd
	1	–							
	2	Speed Reference (Low Byte)							
	3	Speed Reference (High Byte)							
	4	Torque Reference/Torque Limit (Low Byte)							
	5	Torque Reference/Torque Limit (High Byte)							

Output Assembly Data Info

Name	Description
Run Fwd	Forward Run Command 0: Stop 1: Forward Run
Run Rev	Reverse Run Command 0: Stop 1: Reverse Run
Fault Reset	Fault Reset (0 to 1 transition: Fault Reset)
NetCtrl	Run command from Network 0: Depends on b1-02 1: Enables the run command from network
NetRef	Speed reference from Network 0: Depends on b1-01 1: Enables the speed reference from network
Speed Reference	Speed Command Sets drive speed reference. Speed reference data: Frequency reference/2SS (SS: Speed scale) Setting range: 0 to 0xFFFF For example, when setting a reference of 4096 with a speed scale of 2: Speed reference data = 4096/22 = 1024 = 0x0400 Unit depends on o1-03.
Torque Reference / Torque Limit	Torque Reference/Torque Limit Sets the Torque Reference/Torque Limit in units of 0.1%. Sets the Torque Reference when using Torque Control (d5-01 = 1). Sets the Torque Limit when using Speed Control (d5-01 = 0). The Torque Reference and Torque Limit are disabled with F6-06 = 0.

Input Assemblies (Drive Produces)

The convention in this cheat sheet is from the PLC perspective. An "Input Assembly" is outputted from this node and read by the PLC. This section details "Input Assemblies" that are "Produced" by this drive.

Basic Speed Control Input - 70 (0x46)

Input Instance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
70	0	–	–	–	–	–	Running 1 (FWD)	–	Faulted
	1	–							
	2	Speed Actual (Low Byte)							
	3	Speed Actual (High Byte)							

Extended Speed Control Input - 71 (0x47)

Input Instance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
71	0	At Speed	Ref from Net	Ctrl from Net	Ready	Running 2 (REV)	Running 1 (FWD)	Warning	Faulted
	1	Drive State							
	2	Speed Actual (Low Byte)							
	3	Speed Actual (High Byte)							

Speed and Torque Control Input - 72 (0x48)

Input Instance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
72	0	–	–	–	–	–	Running 1 (FWD)	–	Faulted
	1	–							
	2	Speed Actual (Low Byte)							
	3	Speed Actual (High Byte)							
	4	Torque Actual (Low Byte)							
	5	Torque Actual (High Byte)							

Extended Speed and Torque Control Input - 73 (0x49)

Input Instance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
73	0	At Speed	Ref from Net	Ctrl from Net	Ready	Running 2 (REV)	Running 1 (FWD)	Warning	Faulted
	1	Drive State							
	2	Speed Actual (Low Byte)							
	3	Speed Actual (High Byte)							
	4	Torque Actual (Low Byte)							
	5	Torque Actual (High Byte)							

Input Assembly Data Info

Name	Description
Faulted	Faulted 0: No Faults Occurred 1: Fault Occurred
Warning	Warning 0: No Warning Occurred 1: Warning Occurred
Running 1 (FWD)	Forward Running 0: Stop or Reverse Running 1: Forward Running
Running 2 (REV)	Reverse Running 0: Stop or Forward Running 1: Reverse Running
Ready	Drive Ready 0: Not Ready 1: Ready
Ctrl from Net	Status of Run command from Network 0: Run command is not from network 1: Run command is from network
Ref from Net	Status of Speed reference from Network 0: Speed reference is not from network 1: Speed reference is from network
At Speed	Speed Agree 0: No Speed Agree 1: Speed actual at speed reference
Drive State	Contains the value from the Control Supervisor (Class 0x29) Instance 1 Attribute 6.
Speed Actual	Actual Drive Speed Monitors drive output frequency. Speed actual data: Output frequency x 2SS (SS: Speed scale) Range: 0 to 0xFFFF For example, when output frequency of 1024 with a speed scale of 2: Speed actual data = 1024 x 22 = 4096 = 0x1000 Unit depends on o1-03.
Torque Actual	Output Torque Shows the Torque Reference. Value displays in 0.1% units.

Error Codes

Display	Description
bUS	Option Communication Error.
	• 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) .
EFO	Option Card External Fault.
	The alarm function for an external device has been triggered.
oFA00	Option Card Connection Error at Option Port CN5-A.
	Option is not properly connected.
oFA01	Option Card Fault (CN5-A).
	Option is not properly connected.
oFA03	Option Card Error (CN5-A).
	Option self-diagnostics error.
oFA04	Option Card Error (CN5-A).
	Option flash write mode.
oFA30 to oFA43	Communication Option Card Connection Error (CN5-A).
	Communication ID error.
CALL	Serial communication transmission error .
	Communication is not established.