YASKAWA

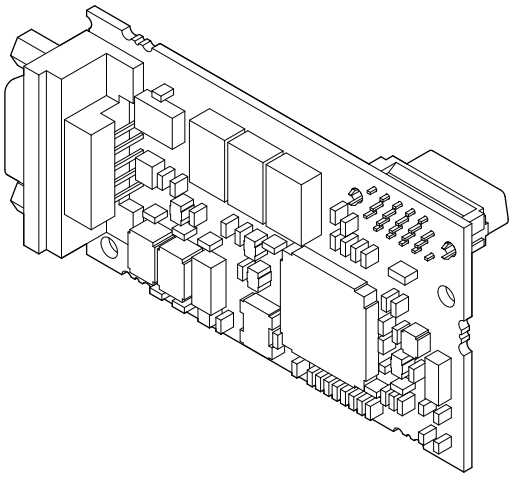
YASKAWA AC Drive 1000-Series Option

PROFIBUS-DP

Technical Manual

Type SI-P3

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



MANUAL NO. SIEP C730600 42B

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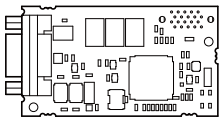
1 Preface and Safety

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.

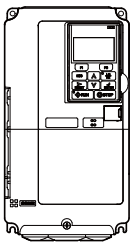
◆ Applicable Documentation

The following manuals are available for the option:

PROFIBUS-DP SI-P3 Option

	**Yaskawa AC Drive 1000-Series Option PROFIBUS-DP Installation Manual Manual No: TOBPC73060042**	Read this manual first. The installation manual is packaged with the option and contains information required to install the option and set up related drive parameters.
	Yaskawa AC Drive 1000-Series Option PROFIBUS-DP Technical Manual Manual No: SIEPC73060042	The technical manual contains detailed information about the option. Access the following sites to obtain the technical manual: U.S.: http://www.yaskawa.com Europe: http://www.yaskawa.eu.com Japan: http://www.e-mechatronics.com For questions, contact your local Yaskawa sales office or the nearest Yaskawa representative.

Yaskawa Drive

	**Yaskawa AC Drive 1000-Series Quick Start Guide**	The drive manuals cover basic installation, wiring, operation procedures, functions, troubleshooting, and maintenance information. The manuals also include important information about parameter settings and drive tuning. Access these sites to obtain Yaskawa instruction manuals: 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 1000-Series Technical Manual	

◆ Terms and Abbreviations

Note:	Indicates a supplement or precaution that does not cause drive damage.
Drive:	Yaskawa AC Drive 1000-Series
Option:	Yaskawa AC Drive 1000-Series SI-P3 PROFIBUS-DP Option
V/f:	V/f Control
CLV:	Closed Loop Vector Control
OLV/PM:	Open Loop Vector Control for PM
AOLV/PM:	Advanced Open Loop Vector Control for PM
CLV/PM:	Closed Loop Vector Control for PM

◆ Registered Trademarks

- PROFIBUS-DP is a registered trademark of PROFIBUS International.
- Trademarks are the property of their respective owners.

◆ Supplemental Safety Information

Read and understand this manual before installing, operating, or servicing this option. Install the option according to this manual and local codes.

The following conventions indicate safety messages in this manual. Failure to heed these messages could cause fatal injury or damage products and 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 book may include options and drives without covers or safety shields to illustrate details. Be sure to reinstall covers or shields before operating any devices. Use the option 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 new copies of the manual, contact a 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 modify the drive or option circuitry.

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

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

Do not expose the drive or option to halogen group disinfectants.

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

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

The SI-P3 PROFIBUS-DP Option is an open digital communication system supporting a wide range of fast, time-critical applications.

PROFIBUS Decentral Periphery (PROFIBUS-DP) is one of the three PROFIBUS variants. DP is dedicated to fast data communication between systems and peripherals at a field level. This option connects a Yaskawa drive to a field network using the PROFIBUS-DP protocol.

PROFIBUS-DP is included into the European Fieldbus Standard EN 50170.

The network is primarily used in process and factory automation.

Installing the option to a Yaskawa drive allows a PROFIBUS-DP master device to:

- operate the drive
- monitor the operation status of the drive
- change parameter settings.

◆ Applicable Models

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

Table 1 Applicable Models

Drive Series	Drive Model Number
A1000	All models

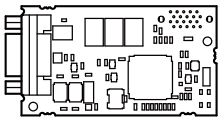
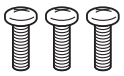
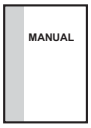
3 Receiving

Please perform the following tasks upon receiving 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 option nameplate (Refer to ***Figure 1*** on page ***8***).
- Contact your supplier if you have received the wrong model or the option does not function properly.

◆ Contents and Packaging

Table 2 Contents of Package

Description:	Option	Ground Wire	Screws (M3)	LED Label	Installation Manual
-					
Quantity:	1	1	3	1	1

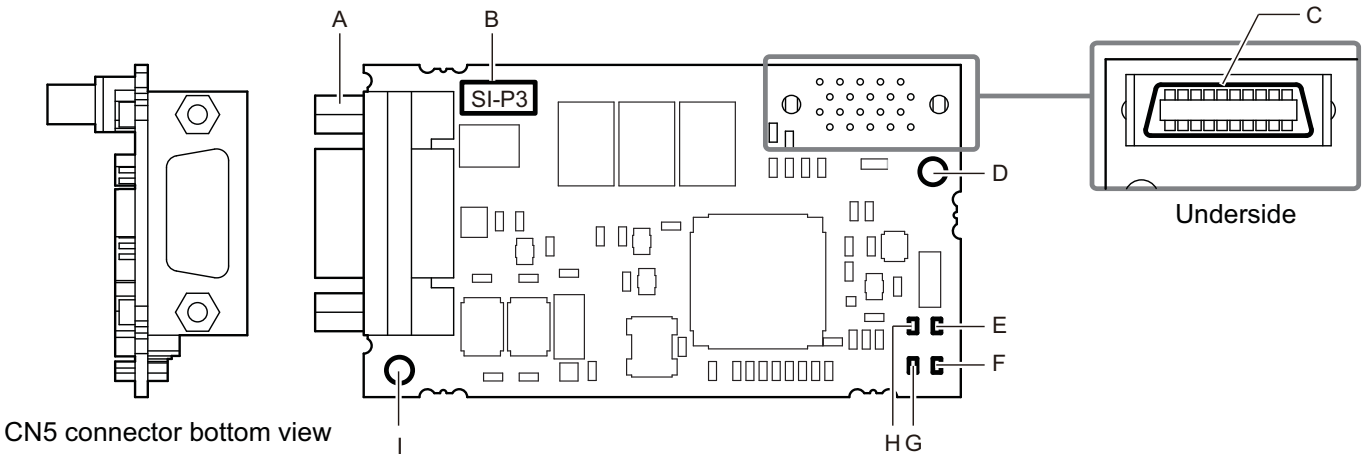
◆ Tools Required for Installation

- A Phillips screwdriver (M3 metric / #1, #2 U.S. standard size) is required to install the option.
- A pair of diagonal cutting pliers.
- A small file or medium-grit sandpaper.

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

4 Option Components

◆ PROFIBUS-DP SI-P3 Option



A – Communication cable connector
B – Model number
C – Connector (CN5)
D – Installation hole
E – LED (RUN) *<1>*
F – LED (COMM) *<1>*
G – LED (BF) *<1>*
H – LED (ERR) *<1>*
I – Ground terminal and installation hole *<2>*

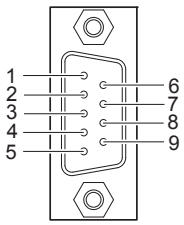
<1> *Refer to Option LED Display on page 9* for details on the LEDs.
<2> The ground wire provided in the option shipping package must be connected during installation.

Figure 1 PROFIBUS-DP Option Components

◆ Communication Connector CN5

The drive has a 9-pin D-sub connector to connect to a PROFIBUS network.

Table 3 Communication Connector Description (9-pin D-sub)

PROFIBUS Connector	Pin	Signal	Description
Bottom View 	1	Shield	Connected to the metal-shell (no direct FG-connection)
	2	–	–
	3	RxD/TxD-P	Receive/Transmit data; line B (red)
	4	CNTR-P	Control signal for repeaters (direction control)
	5	DGND	Data ground (reference voltage to VP)
	6	VP	Power supply output for bus termination (for termination resistor)
	7	–	–
	8	RxD/TxD-N	Receive/Transmit data; line A (green)
	9	–	–

◆ Option LED Display

The option has four bicolor, red/green LEDs to relay information about power, communication status, and errors. The operational states of the LEDs after completion of the power-up diagnostic process are described in *Table 5*. Wait at least 2 seconds for the power-up diagnostic process to complete before verifying the states of the LEDs.

Table 4 Option LED States

LED	Display		Operating Status	Remarks
	Color	Status		
RUN (Power)	Green	ON	Power supply ON	Power is supplied to the option, and the option hardware self-diagnostics check is complete.
		OFF	Power supply OFF	• The drive has no power supply. • Option and drive are not connected properly and/or no power is supplied to the option. • An internal, self-diagnostic error occurred in the option.
ERR (Option Error)	Red	ON	Option error	Self-diagnostic error occurred in the option.
		Flashing	Drive connection error	Connection error between option and drive. This includes node address setting errors to parameter F6-30 on the drive side.
		OFF	Normal operation	Drive and option are properly connected.
COMM (Communication Status)	Green	ON	Communication connected	Normal send/receive between the option and the PROFIBUS-DP master.
		OFF	No data exchange	There is a problem establishing communication between the option and the PROFIBUS-DP master.
BF (PROFIBUS-DP Error)	Red	ON	Waiting for communication procedure setting	Communication-related parameters are in the process of being set or initialized by the PROFIBUS-DP master.
		Flashing	Communication setting error	Communication parameter error from PROFIBUS-DP master.
		OFF	Normal operation	LED shuts off when the PROFIBUS-DP master is finished setting communication-related parameters.

Table 5 LED Operation After Power-up Diagnostic

LED				Communication Status	Possible Cause	Solution
RUN	ERR	COMM	BF			
×	×	×	×	No power	Drive has no power.	Check all wiring to the drive, then turn on the power.
					Option is not properly connected to the drive or is not receiving enough power.	Shut off the drive and make sure the option is connected properly. Turn the power back on.
○	×	×	×	• Checking connection with the drive • Waiting for data from the master	• Option is reading the node address or parameter configuration. • Waiting for initial input data from master device.	–
×	○	×	×	Option self-diagnostics error	The option is damaged.	Cycle power to the drive. If the LED status does not change, replace the option.
×	□	×	×	Problem connecting to the drive	• Problem initializing the drive and the option. • Incorrect node address.	• Cycle power to the drive. If the LED status does not change, replace the option. • Check the node address setting in the drive (F6-10)
○	×	×	○	Waiting for data from the master device	Waiting for data from the master device. (Set_Parm_Message or Chk_Cfg_Message)	• Check master network settings. • Make sure the master device is operating normally. • Check terminal resistance settings on the data line. • Check for problems with the data line and connector. • Check if the data line is connected properly to communication connector CN5.
○	×	×	□	Incorrect data or option time out waiting for data	The communication settings in the master are set incorrectly.	Check the communication settings in the master.
○	×	○	×	Sending or receiving data	–	–

○: On / □: Flashing / ×: Off

5 Installation Procedure

◆ Section Safety

⚠ DANGER

Electric 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. Use the option 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 to the drive 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.

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, drive, and circuit boards.

Failure to comply may result in ESD damage to circuitry.

Never shut the power off while the drive is running or 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.

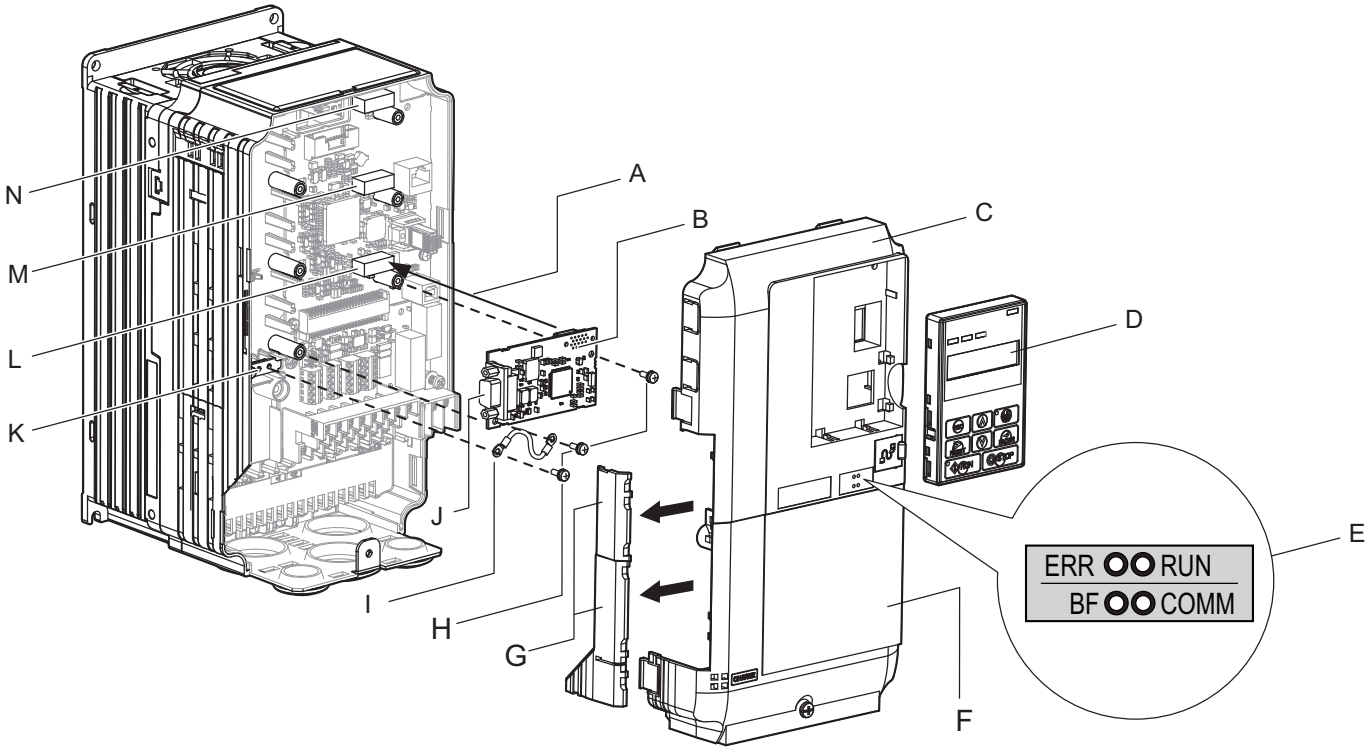
Check wiring to ensure that all connections are correct after installing the option and connecting any other devices.

Failure to comply may result in damage to the option.

◆ Prior to Installing the Option

Prior to installing the option, wire the drive, make the necessary connections to the drive terminals, and verify that the drive functions normally. Refer to the Quick Start Guide packaged with the drive 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.



A – Insertion point for CN5
B – Option card
C – Front cover
D – Digital operator
E – LED label
F – Terminal cover
G – Removable tabs for wire routing
H – Included screws
I – Ground wire
J – CN5 communication connector
K – Drive grounding terminal (FE)
L – Connector CN5-A
M – Connector CN5-B
N – Connector CN5-C

Figure 2 Drive Components with Option

◆ Installing the Option

Refer to the instructions below to install the option.

1. 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). Refer to the Quick Start Guide packaged with the drive for directions on removing the front covers. Cover removal varies depending on drive size.

DANGER! *Electrical Shock Hazard. 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 to prevent electric shock. The internal capacitor remains charged even after the power supply is turned off.*

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.*

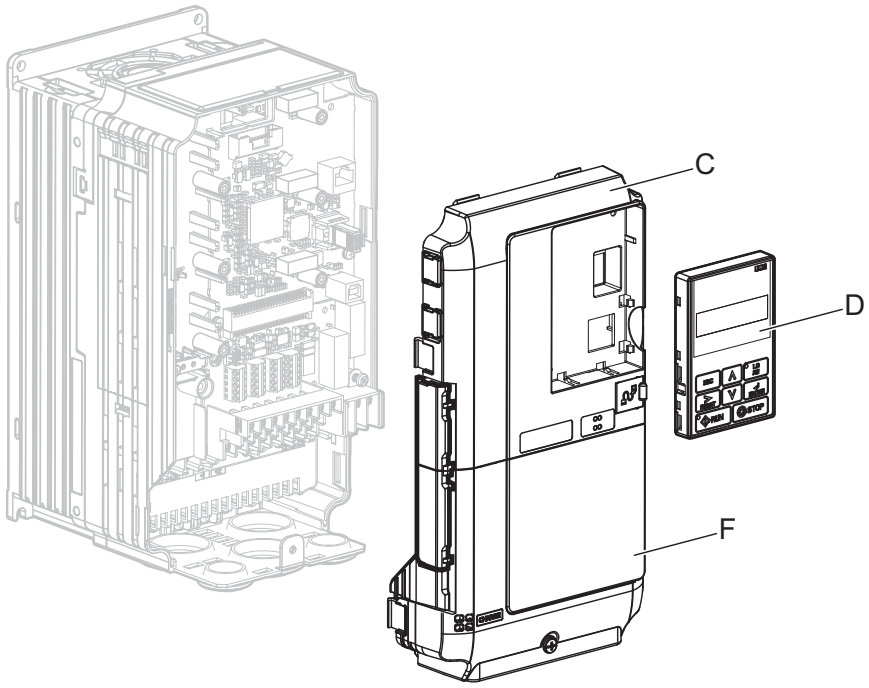


Figure 3 Remove the Front Covers and Digital Operator

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

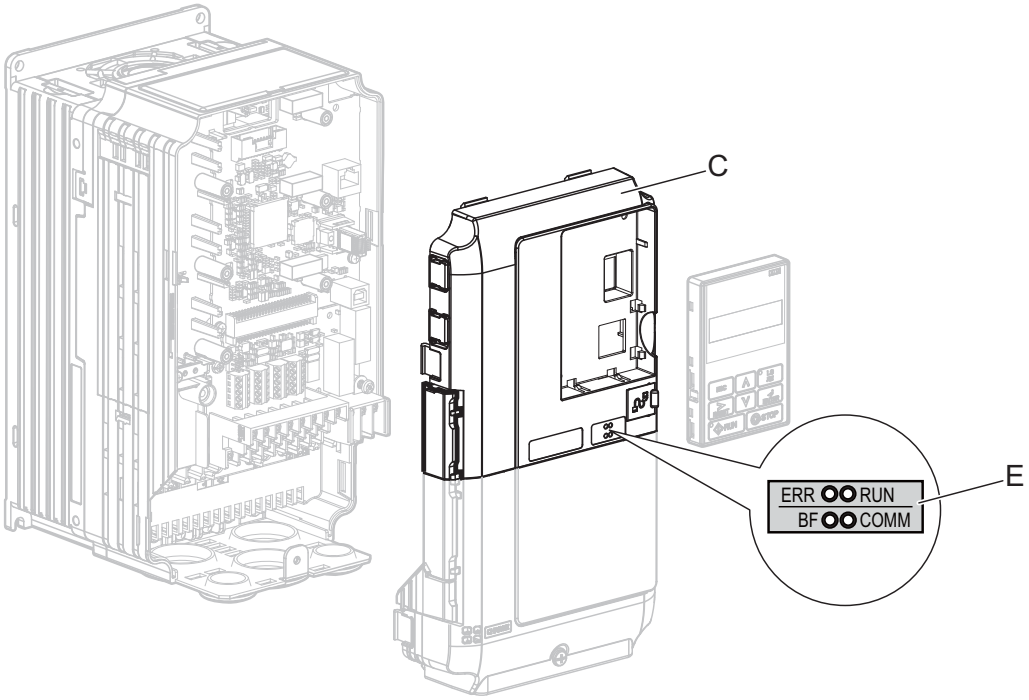


Figure 4 Apply the LED Label

3. Insert the option card (B) into the CN5-A connector (L) located on the drive and fasten it using one of the included screws (H).

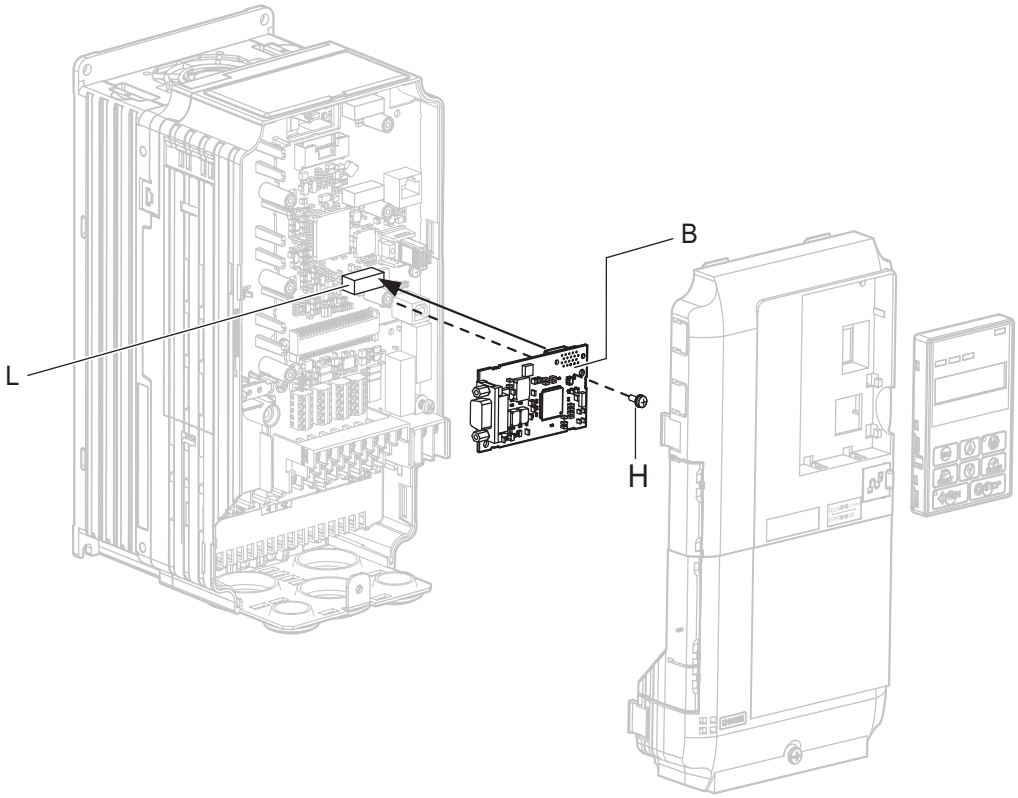


Figure 5 Insert the Option Card

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 using the last remaining provided screw (H).

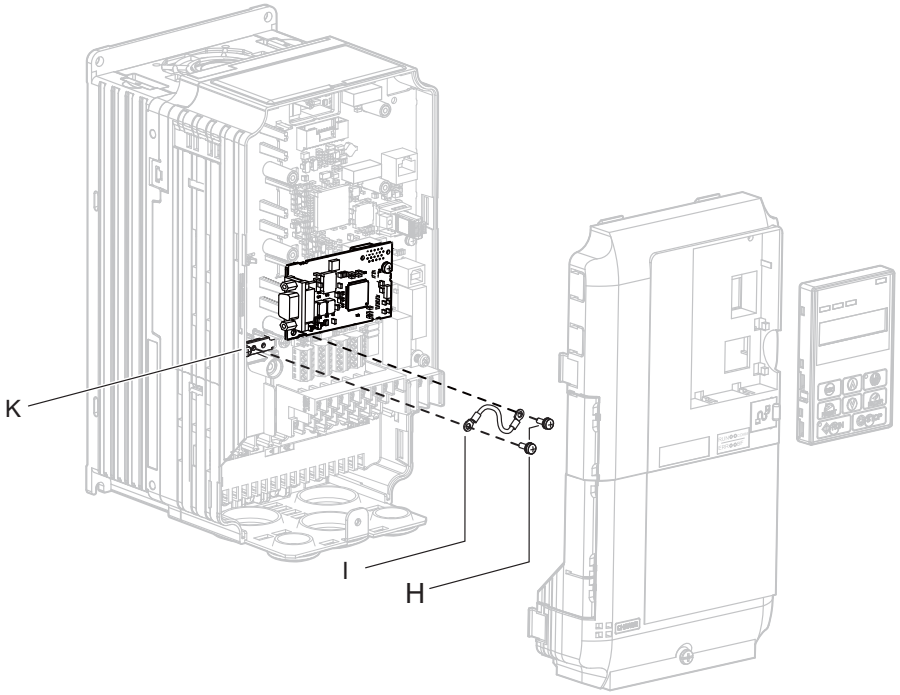


Figure 6 Connect the Ground Wire

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

5. Select the proper type of 9-pin D-sub CN5 connector and network cable.
Refer to on page 41 for details on cable selections and cable lengths.
Refer to the PROFIBUS-DP website at www.profibus.com for more information on cables and connectors.

6. Connect the option to the network using a 9 pin D-sub connector as shown in ***Figure 7***.

Connection Diagram

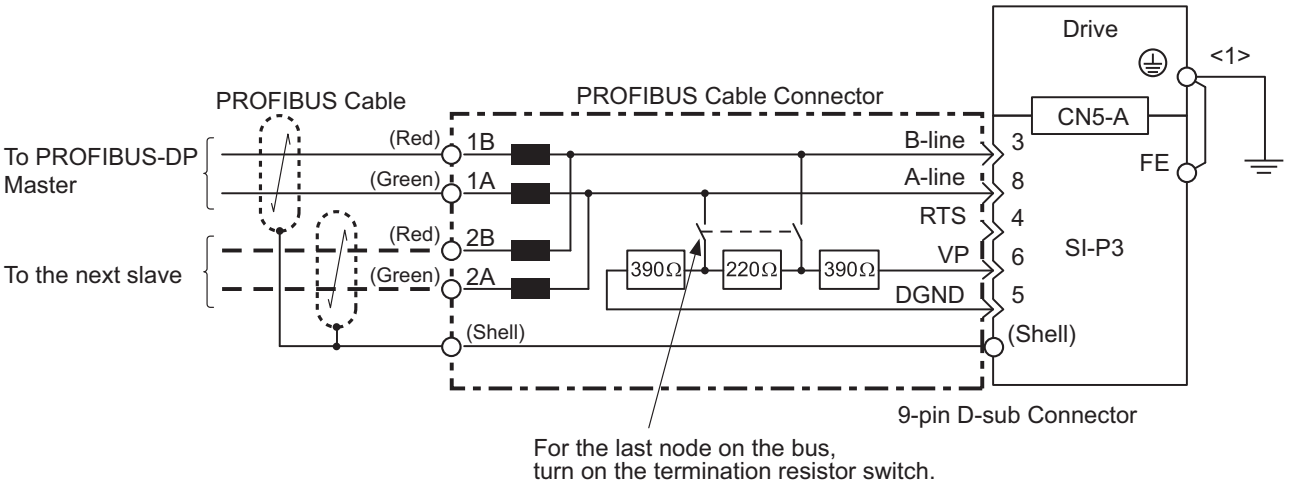


Figure 7 Option Connection Diagram

<1> The ground wire provided in the option shipping package must be connected during installation.

PROFIBUS-DP Termination

The option does not have a termination resistor. The termination resistance must be set on the final drive in the network using a switch on the 9-pin D-sub connector. Make sure that only the connector for the final drive in the network has a termination resistor; communication problems may arise if any other network drive has a termination resistor.

Use only the input side cable entry as shown in ***Figure 8*** when connecting both ends of the network. Most 9-pin D-sub connectors have a function for disconnecting the output side of the cable. Communication will not be possible between devices if the connector is reversed. Most connectors have arrows indicating the input and output sides.

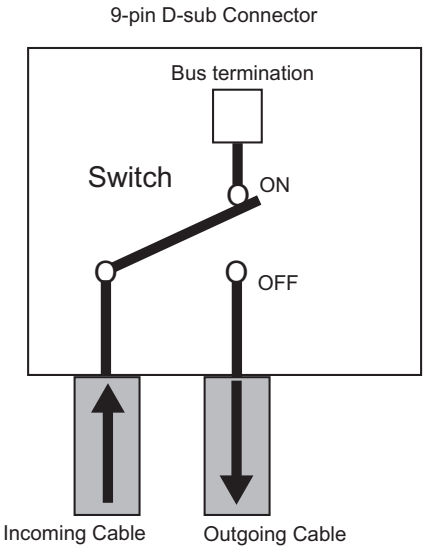


Figure 8 PROFIBUS Cable Connection with Termination Resistors

Bus termination ON = incoming and outgoing cables not connected.
Bus termination OFF = incoming and outgoing cables connected.

Termination resistors without inductors as shown in ***Figure 9*** can only be used for baud rates below 1.5 Mbps. Baud rates 1.5 Mbps and higher require termination with resistors and inductors as shown in ***Figure 7***.

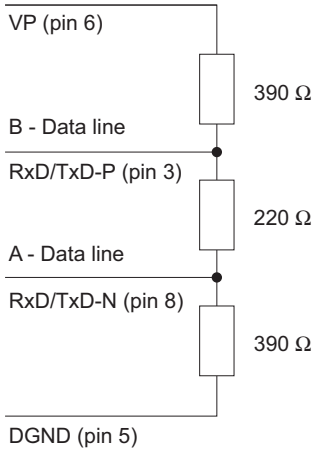
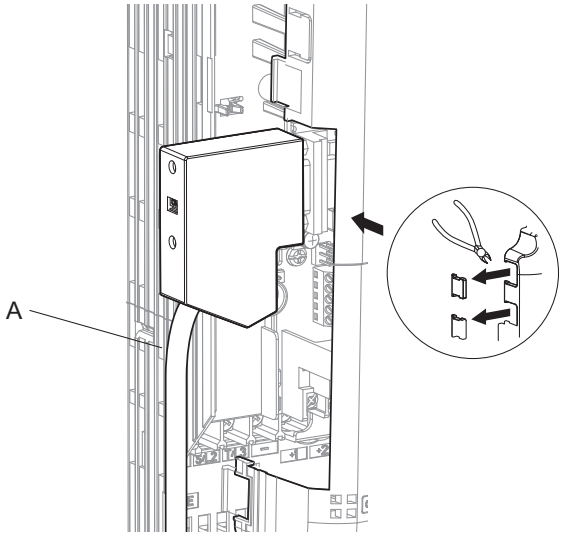


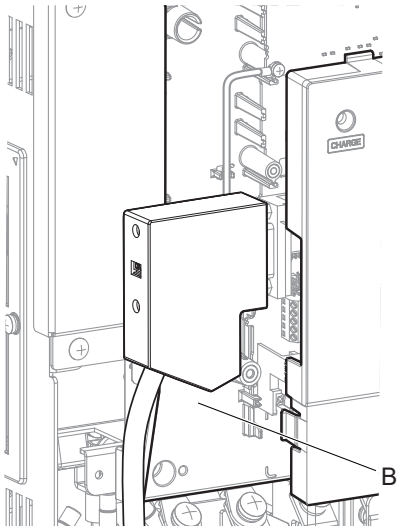
Figure 9 Cable Termination of the Option Cable to EN50170 (Pin Numbers for a 9-pin D-sub Connector)

7. 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. In these cases, use diagonal cutters to cut out the perforated openings in the left side of the drive front cover as shown in ***Figure 10-A*** and leave no sharp edges to damage wiring.

Route the wiring inside the enclosure as shown in ***Figure 10-B*** for drives that do not require routing through the front cover. Refer to the Peripheral Devices & Options section of the drive Technical Manual for more information.



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.

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

Figure 10 Wire Routing Examples

8. After connecting the prepared cable for the 9-pin D-sub communication connector CN5, recheck the option wire routing performed in step **6**.

9. Replace and secure the front covers of the drive (C, F) and replace the digital operator (D).

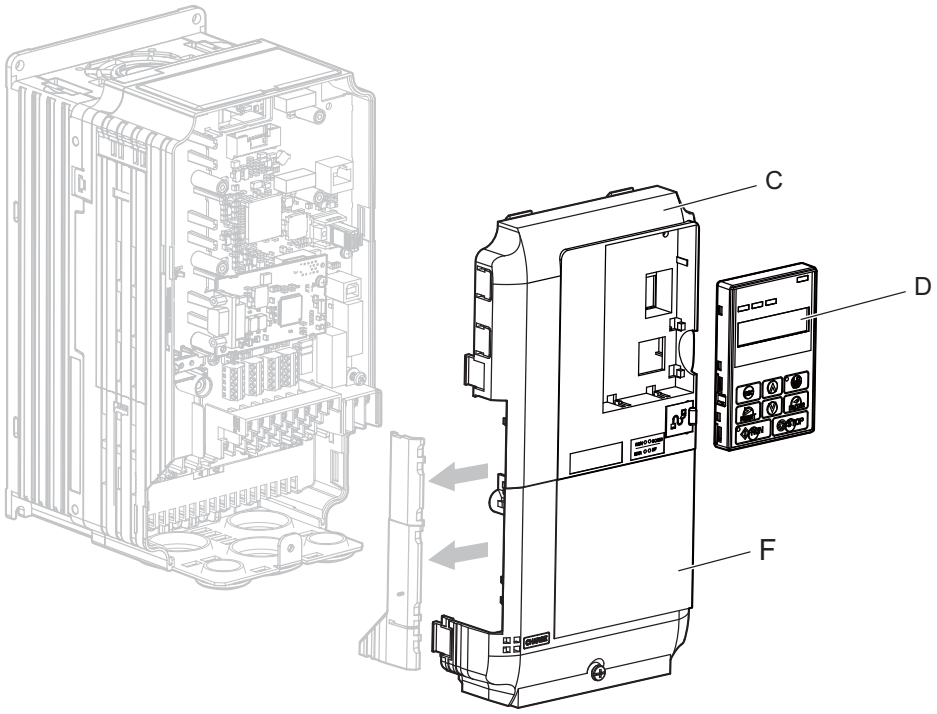


Figure 11 Replace the Front Covers and Digital Operator

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.

10. Set drive parameters in ***Table 8*** for proper option performance. Be sure to set parameter F6-30 to a node address unique to the network.

◆ Communication Cable Specifications

To ensure proper performance, Yaskawa recommends using PROFIBUS-DP-dedicated cables that fulfill the specifications in *Table 6*. Refer to the PROFIBUS-DP website at www.profibus.com for more information on cables.

■ Cable Requirements

Table 6 Communication Cable Requirements

Condition	Specifications
Impedance	135 to 165 Ω at a frequency of (3 to 20 MHz)
Capacity	30 pF/m maximum
Loop Resistance	110 Ω/km maximum
Core Cross-Section	0.34 mm^2 minimum
Core Diameter	0.64 mm minimum

■ Cable Length

Communication speed determines maximum permissible cable length. *Table 7* shows the specifications for Type A bus cables.

Table 7 Communication Cable Length

Communication Speed (kbps)	Distance per Segment
9.6	1200 m (3937 ft.)
19.2	1200 m (3937 ft.)
45.45	1200 m (3937 ft.)
93.75	1200 m (3937 ft.)
187.5	1000 m (3280 ft.)
500	400 m (1312 ft.)
1500	200 m (656 ft.)
3000	100 m (328 ft.)
6000	100 m (328 ft.)
12000	100 m (328 ft.)

◆ GSD Files

To facilitate network implementation, obtain a GSD file from one of the following websites depending on your region:
US: http://www.yaskawa.com
Europe: http://www.yaskawa.eu.com
Japan: http://e-mechatronics.com
Other areas: Contact your Yaskawa representative

6 Related Parameters

The following parameters are used to set up the drive for operation with the option.

Confirm proper setting of all parameters in *Table 8* before starting network communications.

Table 8 Parameter Settings

No. (Addr. Hex)	Name	Description	Values
b1-01 (180) <1>	Frequency Reference Selection 1	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 4: Pulse Input (Terminal RP)	Default: 1 Range: 0 to 4 (Set to 3 for SI-P3)
b1-02 (181) <1>	Run Command Selection 1	Selects the run command input source 0: Digital Operator - RUN and STOP keys 1: Digital input terminals S☐ 2: MEMOBUS/Modbus communications 3: Option	Default: 1 Range: 0 to 3 (Set to 3 for SI-P3)
F6-01 (3A2)	Communications Error Operation Selection	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>	Default: 1 Range: 0 to 3
F6-02 (3A3)	External Fault from Comm. Option Detection Selection	Sets the condition for external fault detection (EF0) 0: Always detected 1: Detected only during operation	Default: 0 Range: 0, 1
F6-03 (3A4)	External Fault from Comm. Option Operation Selection0	Determines drive response for external fault input (EF0) detection during PROFIBUS communication 0: Ramp to Stop 1: Coast to Stop 2: Fast-Stop 3: Alarm Only <2>	Default: 1 Range: 0 to 3
F6-06 (3A7) <3>	Torque Reference/Torque Limit Selection from Comm. Option	0: Torque reference/torque limit via network communications are disabled. 1: Torque reference/torque limit via network communications are enabled. <4>	Default: 0 Range: 0, 1
F6-07 (3A8)	Multi-Step Speed Enable/ Disable Selection when NefRef/ComRef is Selected	0: Multi-step speed reference disabled (F7 functionality) 1: Multi-step speed reference allowed (V7 functionality)	Default: 0 Range: 0, 1
F6-08 (36A)	Reset Communication Parameters	Determines which F6-☐☐ and F7-☐☐ parameters are reset to default values when initializing the drive using A1-03. 0: Do not reset parameters 1: Reset parameters **Note:** Setting this parameter does not affect communication-related parameters. Setting this parameter only determines if communication-related parameters (F6-☐☐ and F7-☐☐) are also reset when initializing with A1-03.	Default: 0 Range: 0, 1
F6-30 (3CB) <5> <6>	PROFIBUS-DP Node Address	0 to 125	Default: 0 Min: 0 Max: 125
F6-31 (3CC)	PROFIBUS-DP Clear Mode Selection	Selects the action to take when a “Clear Mode” command is received 0: Resets to 0 1: Maintains the previous value	Default: 0 Range: 0, 1
F6-32 (3CD) <6>	PROFIBUS-DP Data Format Selection	0: PPO Type 1: Conventional	Default: 0 Range: 0, 1
F6-33 <6>	IND Data Size Selection	0: Word 1: Byte	Default: 0 Range: 0, 1

<1> Set b1-02 to 3 to start and stop the drive through the PROFIBUS-DP network. Set b1-01 to 3 to control the frequency reference of the drive via the PROFIBUS-DP network.

<2> Take proper safety measures, such as installing an emergency stop switch, when setting F6-03 to 3, as the drive will continue operation when detecting an EF0 fault.
<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 as the torque reference value (d5-01 = 1). In CLV/PM, this value is read as the torque limit.
<4> Default setting specifies that the torque reference or torque limit is to be provided via network communications (F6-06 = 1). The motor may not rotate if no torque reference or torque limit is supplied from the PLC.
<5> All node addresses must be unique. Node addresses 0, 1, and 2 are typically reserved for control, maintenance, and diagnostic equipment. The "Err" LED will illuminate when a value of 0 or a value greater than 125 is entered.
<6> Cycle power for setting changes to take effect.

7 Option Data and I/O Maps

◆ Conventional Formats

The configuration tool of PROFIBUS-DP master sets the input and output data length of SI-P3 from Extended Data 1 (32 bytes), Extended Data 2 (12 bytes), and Basic Data (6 bytes).

Conventional formats have two message types: High-speed I/O Data and MEMOBUS/Modbus message. Set parameter F6-32 to 1 to use conventional formats.

■ High-Speed I/O Data

High-speed I/O data is directly transferred between the drive and controller or PLC. When the drive is set for PROFIBUS-DP communications, the drive Run/Stop and Frequency Reference commands are transferred within 2 ms after being received by the option.

■ MEMOBUS/Modbus Message

MEMOBUS/Modbus message data is transferred between the drive and controller or PLC using MEMOBUS/Modbus messages. All drive parameters and data can be accessed through MEMOBUS/Modbus. The data in this message type is transferred to the drive after being received and edited by the option and more time is required to return the data to the master. The master must synchronize the timing of sending and receiving the data by a process called handshaking. *Refer to Handshaking Register on page 25* for more information.

◆ Memory Maps

The following memory maps show the I/O data bytes.

■ Basic and Extended Register Maps

	Basic Data (6 bytes)	Extended Data 1 (32 bytes)	Extended Data 2 (12 bytes)
High-speed I/O Data	Bytes 0 to 5	Bytes 0 to 15	Bytes 0 to 3
MEMOBUS/Modbus Data	–	Bytes 16 to 31	Bytes 4 to 11

Table 9 Basic Data Register Map Detail

Output (Master Device to Drive)		Input (Drive to Master Device)	
Byte	**Description**	**Byte**	**Description**
0	Operation Command High Byte	0	Drive Status High Byte
1	Operation Command Low Byte	1	Drive Status Low Byte
2	Frequency Reference High Byte	2	Motor Speed High Byte <3>
3	Frequency Reference Low Byte	3	Motor Speed Low Byte <3>
4	Torque Reference/Torque Limit High Byte <1> <2>	4	Output Current High Byte <4>
5	Torque Reference/Torque Limit Low Byte <1> <2>	5	Output Current High Byte <4>

<1> Enabled in CLV, AOLV/PM, and CLV/PM control modes (A1-02 = 3, 6, or 7).
<2> Set when network communication is designated as the source of the torque limit and torque reference (F6-06 = 1). When enabled, d5-01 determines whether the value is read as the torque limit value (d5-01 = 0) or as the torque reference value (d5-01 = 1). In CLV/PM, this value is read as the torque limit.
<3> Unit depends on the setting of o1-03 (Digital Operator Display Scaling). When the drive is operating in V/f Control or OLV/PM, the drive output frequency becomes the input data.
<4> Data is displayed in units of 0.01 A for drives 7.5 kW and smaller, and in units of 0.1 A for drives 11 kW and larger. This convention is the same regardless of drive duty mode selection.

Table 10 Extended Data 1 Register Map

Output (Master Device to Drive)		Input (Drive to Master Device)	
Byte	**Description**	**Byte**	**Description**
0	Operation Command High Byte	0	Drive Status High Byte
1	Operation Command Low Byte	1	Drive Status Low Byte
2	Frequency Reference High Byte	2	Motor Speed High Byte <5>
3	Frequency Reference Low Byte	3	Motor Speed Low Byte <5>
4	Torque Reference High Byte <1> <2>	4	Torque Reference Monitor High Byte <6>

Output (Master Device to Drive)		Input (Drive to Master Device)	
Byte	Description	Byte	Description
5	Torque Reference Low Byte <1> <2>	5	Torque Reference Monitor Low Byte <6>
6	Torque Compensation High Byte <1>	6	Speed Detection PG Pulse Count 1 High Byte
7	Torque Compensation Low Byte <1>	7	Speed Detection PG Pulse Count 1 Low Byte
8	Reserved	8	Frequency Reference High Byte
9		9	Frequency Reference Low Byte
10	Analog Output Channel 1 High Byte <3>	10	Output Frequency High Byte
11	Analog Output Channel 1 Low Byte <3>	11	Output Frequency Low Byte
12	Analog Output Channel 2 High Byte <3>	12	Output Current High Byte <7>
13	Analog Output Channel 2 Low Byte <3>	13	Output Current Low Byte <7>
14	Digital Output High Byte <4>	14	Analog Input Channel 1 High Byte
15	Digital Output Low Byte <4>	15	Analog Input Channel 1 Low Byte
16	MEMOBUS/Modbus Function Code	16	MEMOBUS/Modbus Function Code
17	MEMOBUS/Modbus Starting Register Address High Byte	17	MEMOBUS/Modbus Starting Register Address High Byte
18	MEMOBUS/Modbus Starting Register Address Low Byte	18	MEMOBUS/Modbus Starting Register Address Low Byte
19	MEMOBUS/Modbus Number of Data	19	MEMOBUS/Modbus Number of Data
20	MEMOBUS/Modbus Data 1 High Byte	20	MEMOBUS/Modbus Data 1 High Byte
21	MEMOBUS/Modbus Data 1 Low Byte	21	MEMOBUS/Modbus Data 1 Low Byte
22	MEMOBUS/Modbus Data 2 High Byte	22	MEMOBUS/Modbus Data 2 High Byte
23	MEMOBUS/Modbus Data 2 Low Byte	23	MEMOBUS/Modbus Data 2 Low Byte
24	MEMOBUS/Modbus Data 3 High Byte	24	MEMOBUS/Modbus Data 3 High Byte
25	MEMOBUS/Modbus Data 3 Low Byte	25	MEMOBUS/Modbus Data 3 Low Byte
26	MEMOBUS/Modbus Data 4 High Byte	26	MEMOBUS/Modbus Data 4 High Byte
27	MEMOBUS/Modbus Data 4 Low Byte	27	MEMOBUS/Modbus Data 4 Low Byte
28	Reserved	28	Reserved
29		29	
30		30	
31	Handshaking Register	31	Handshaking Register

<1> Enabled in CLV, AOLV/PM, and CLV/PM control modes (A1-02 = 3, 6, or 7).
<2> Set when network communication is designated as the source of the torque limit and torque reference (F6-06 = 1).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.
<3> To select drive analog output channel for communications, set H4-01 (Multi-Function Analog Output Terminal FM) and H4-04 (Multi-Function Analog Output Terminal AM) to 000 (through-mode).
<4> Drive digital output ON/OFF during communications, set H2-01 (Terminal M1, M2 and MC Function Selection (relay)), H2-02 (Terminal P1 Function Selection (open-collector)), and H2-03 (Terminal P2 Function Selection (open-collector)) to F (through-mode).
<5> Unit depends on the setting of o1-03 (Digital Operator Display Scaling). Input data is 0 when the drive is set for V/f Control or OLV/PM.
<6> Not possible when using V/f control, V/f with PG, or OLV/PM (A1-02 = 0, 1, or 5).
<7> Data is displayed in units of 0.01 A for drives 7.5 kW and smaller, and in units of 0.1 A for drives 11 kW and larger. This convention is the same regardless of drive duty mode selection.

Table 11 Operation Command

Command Signal	Description
0	H5-12 = 0: Forward Run/Stop, 1: FRUN H5-12 = 1: Run/Stop, 1: RUN
1	H5-12 = 0: Reverse Run/Stop, 1: RRUN H5-12 = 1: Forward/Reverse, 1: REV
2	Multi-function digital input command 3
3	Multi-function digital input command 4
4	Multi-function digital input command 5
5	Multi-function digital input command 6
6	Multi-function digital input command 7
7	Multi-function digital input command 8
8	External Fault, 1: Fault (EF0)
9	Fault Reset, 1: Fault Reset

Command Signal	Description
A	Reserved
B	
C	
D	
E	Fault Trace and Fault History Reset 1: Fault information is reset by the rising edge of this bit.
F	Baseblock command 1: Ext Baseblock

Table 12 Drive Status: U1-12

Drive Status	Description
0	1: During run
1	1: During zero speed
2	1: During reverse run
3	1: During fault reset signal input
4	1: During speed agree
5	1: Drive ready
6	1: Alarm
7	1: Fault
8	1: During operation error (oPE□□)
9	1: During momentary power loss
A	1: NetCtrl status
B	1: M1-M2 relay closed
C	1: Photocoupler output 1 closed
D	1: Photocoupler output 2 closed
E	1: Motor 2 selected
F	1: Zero Servo Complete

Table 13 Extended Data 2 Register Map

Output (Master Device to Drive)		Input (Drive to Master Device)	
Byte	Description	Byte	Description
0	Operation Command High Byte	0	Drive Status High Byte
1	Operation Command Low Byte	1	Drive Status Low Byte
2	Frequency Reference High Byte	2	Motor Speed High Byte <1>
3	Frequency Reference Low Byte	3	Motor Speed Low Byte <1>
4	MEMOBUS/Modbus Function Code	4	MEMOBUS/Modbus Function Code
5	MEMOBUS/Modbus Starting Register Address High Byte	5	MEMOBUS/Modbus Starting Register Address High Byte
6	MEMOBUS/Modbus Starting Register Address Low Byte	6	MEMOBUS/Modbus Starting Register Address Low Byte
7	MEMOBUS/Modbus Data Length	7	MEMOBUS/Modbus Data Length
8	MEMOBUS/Modbus Data 1 High Byte	8	MEMOBUS/Modbus Data 1 High Byte
9	MEMOBUS/Modbus Data 1 Low Byte	9	MEMOBUS/Modbus Data 1 Low Byte
10	Reserved	10	Reserved
11	Handshaking Register	11	Handshaking Register

<1> Unit depends on the setting of o1-03 (Digital Operator Display Scaling). When the drive is operating in V/f Control or OLV/PM, the drive output frequency becomes the input data.

◆ MEMOBUS/Modbus Message Area

In the MEMOBUS/Modbus message area, MEMOBUS/Modbus messages are transferred to the option, and the parameters in the drive can be set, read, and monitored. Up to four data items can be written or read at one time.

The option edits the MEMOBUS/Modbus message internally and transfers the message to the drive after receiving the message; more time is required to return the message. Use the handshaking register to synchronize sending or receiving of the data between the PROFIBUS-DP master and the option. *Refer to Handshaking Register on page 25* for details.

Execute an Enter command to validate the written data and write a parameter to the drive. Refer to the MEMOBUS/Modbus Communications chapter of the drive Technical Manual for details on the Enter command and for a list of monitor data using the MEMOBUS/Modbus message area.

■ Configuration of MEMOBUS/Modbus Command Message

Table 14 shows the configuration of MEMOBUS/Modbus command messages when the Extended Data 1 is selected.

Table 14 MEMOBUS/Modbus Command Message

Byte	Name	Function	
16	Function code	MEMOBUS/Modbus command code: 03H: Read command (reading Drive internal data) 08H: Loop back 10H: Write command (writing data into the drive) Other codes: Not supported.	
17	Starting Resistor No.	Starting resistor No.	High Byte
18			Low Byte
19	Number of Data Items	Sets the number of bytes to read or write (only 2, 4, 6, or 8 allowed)	
20	Data 1 <1>	Data word 1	High Byte
21			Low Byte
22	Data 2 <1>	Data word 2	High Byte
23			Low Byte
24	Data 3 <1>	Data word 3	High Byte
25			Low Byte
26	Data 4 <1>	Data word 4	High Byte
27			Low Byte
28	Reserved	Reserved	
29			
30			
31	Handshaking Register	*Refer to Handshaking Register on page 25* for details.	

<1> Setting is needed only for the write command. Select 00H for the read command.

■ Configuration of MEMOBUS/Modbus Response Messages

Table 15 shows the configuration of MEMOBUS/Modbus response messages when the Extended Data 1 is selected.

Table 15 MEMOBUS/Modbus Response Messages

Byte	Name	Function	
16	Function code	MEMOBUS/Modbus response codes 00H: Waiting for response from drive 03H: Response to read operation 10H: Response to write operation 83H: Read command error 90H: Write command error Other codes: Not supported.	
17	Starting resistor No.	Starting resistor No.	High Byte
18			Low Byte
19	Number of data items	Write: Set double number of written data items Read: Set double number of read data items	
20	Data 1 <1>	Data word 1	High Byte
21			Low Byte

Byte	Name	Function	
22	Data 2 <1>	Data word 2	High Byte
23			Low Byte
24	Data 3 <1>	Data word 3	High Byte
25			Low Byte
26	Data 4 <1>	Data word 4	High Byte
27			Low Byte
28	Reserved		
29			
30			
31	Handshaking register	*Refer to Handshaking Register on page 25* for details.	

<1> Data is returned only for the read command.

If an error occurs, the option sets the Most Significant Bit (MSB) in the MEMOBUS/Modbus response code to 1 and returns the error response. The number of data items is set to 02H and an error code is written into the Low Byte of Data Refer to the MEMOBUS/Modbus Communications chapter in the drive Technical Manual for the details on MEMOBUS/Modbus error codes.

■ Parameter Settings Using MEMOBUS/Modbus Commands

The written or read data of each parameter is transferred in a hexadecimal value.

Negative values are expressed as a two complement.

Example 1: The frequency reference is 30Hz.

30 Hz/0.01 Hz = 3000 → BB8H

Example 2:–5% is assigned as the bias for terminal FM of multi-function analog output 1.

5/0.1 = 50 → 32H

Converted into a two complement → FFCEH

Example 3:60.00 Hz is assigned for d1-01 (register No.: 0280H).

60.00 Hz/0.01 Hz = 6000 → 1770H

Table 16 Parameter Settings Using MEMOBUS/Modbus Commands

Byte	Name		Data		
			Command Message	Response Message	Response Message (at Fault) <2>
16	Function code		10H	10H	90H
17	Starting Register No.	High Byte	02H	02H	00H
18		Low Byte	80H	80H	00H
19	Number of Data Items		02H	02H	02H
20	Data 1	High Byte	17H	00H	00H
21		Low Byte	70H	00H	02H
22	Data 2	High Byte	00H	00H	00H
23		Low Byte	00H	00H	00H
24	Data 3	High Byte	00H	00H	00H
25		Low Byte	00H	00H	00H
26	Data 4	High Byte	00H	00H	00H
27		Low Byte	00H	00H	00H
28	Reserved		00H	00H	00H
29			00H	00H	00H
30			00H	00H	00H
31	Handshaking Register <1>		80H	80H	80H

<1> Depends on the status of the previous data.
<2> Depends on the status of the fault.

■ Handshaking Register

Handshaking synchronizes the timing of the sending or receiving of MEMOBUS/Modbus message data between the option and the PROFIBUS-DP master.

When the master toggles bit 7 of the handshaking register in the output data, the option starts to process the data in the MEMOBUS/Modbus registers. Ensure that the data in the MEMOBUS/Modbus registers is valid before toggling bit 7.

When the option toggles bit 7 of the handshaking register in the input data to the same value as handshaking register bit 7 in the output data, the content of the input data MEMOBUS/Modbus registers is valid.

Handshaking Output Register

PROFIBUS-DP Master to option

Bit 7	6	5	4	3	2	1	0
HS	–	–	–	–	–	–	INIT

Bit	Name	Function
7	HS	Handshaking bit. Synchronizes send and receive timing. Changes status when sending new command messages. This bit is reset to 0 at power up or by setting the handshaking output register bit INIT to 1.
1 to 6	–	Not used.
0	INIT	Clears the handshaking bit to 0.

Handshaking Input Register

Option to PROFIBUS-DP Master

Bit 7	6	5	4	3	2	1	0
HS	STATUS			WD			–

Bit	Name	Function
7	HS	Handshaking bit. Synchronizes send and receive timing. Changes status when sending new command messages. This bit is reset to 0 at power up or by initializing the handshaking output register bit INIT back to 0.
5 to 6	STATUS <1>	Status of the data exchange between the PROFIBUS-DP master and the drive. 00H: Idle 01H: SI-P3 sends a MEMOBUS/Modbus command to the drives 10H: SI-P3 waits for a MEMOBUS/Modbus response from the drives 11H: SI-P3 receives a MEMOBUS/Modbus response from the drives
1 to 4	WD <1>	Counter increases every 64 ms
0	–	Not used

<1> STATUS and WD are for reference.

■ Example of Handshaking

Clear the handshaking register HS bit (bit 7) to 0 for the PLC program after turning on the power supply or after re-initializing. ***Figure 12*** describes the handshaking function. The arrows indicate whether the PROFIBUS-DP master or the option has the control for the protocol.

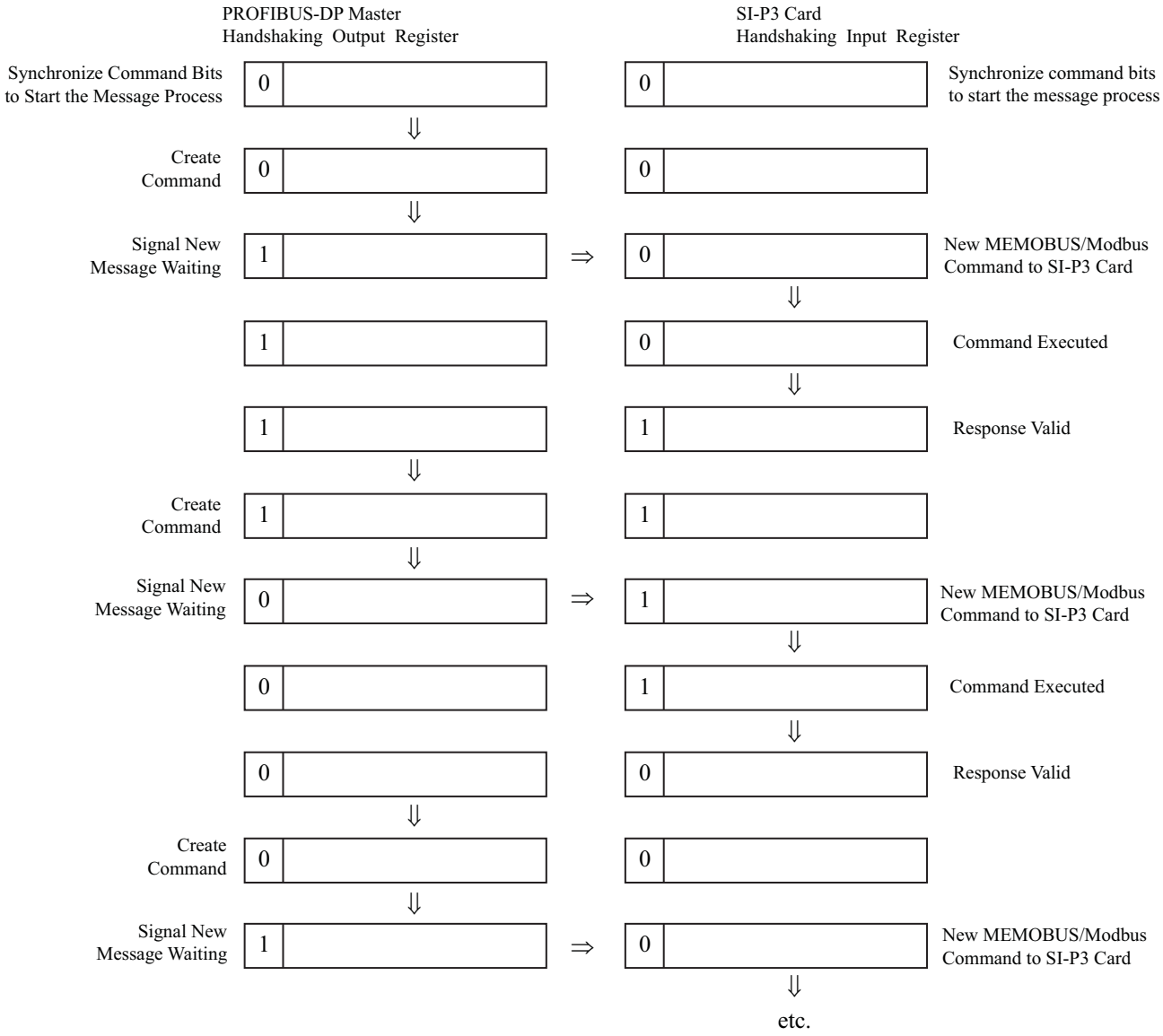


Figure 12 Example of Handshaking

■ Flowchart

Figure 13 illustrates the handshaking function when using a MEMOBUS/Modbus message.

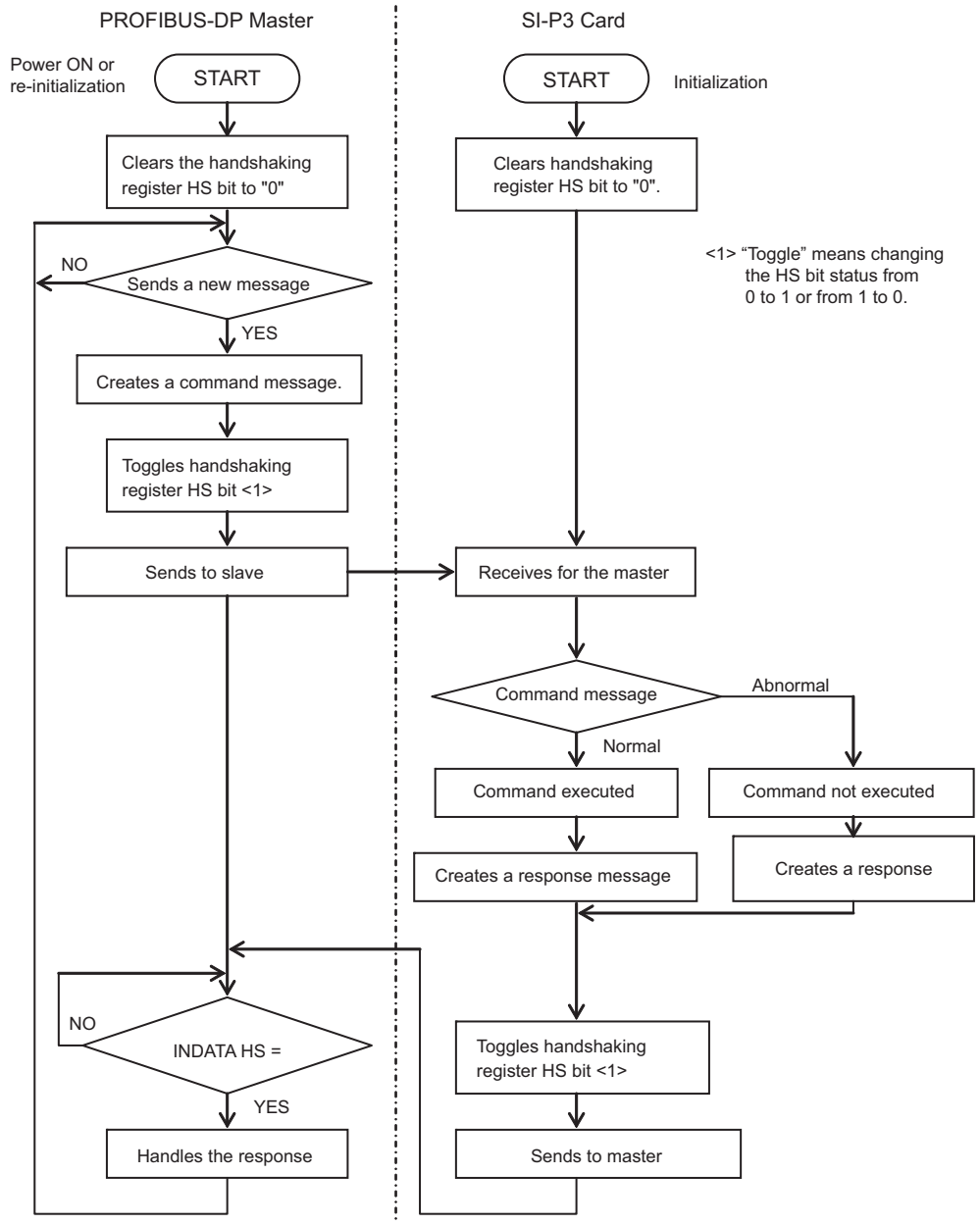


Figure 13 MEMOBUS/Modbus Message Flowchart

8 Parameter Process Data Object Formats

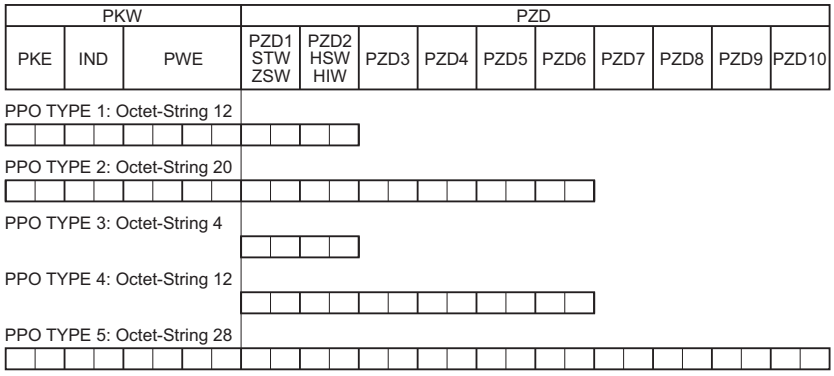
◆ Supported Parameter Process Data Object (PPO) Type Formats

Set drive parameter F6-32 to 0 to use PPO type formats. The PPO is defined for cyclic data transfer, allowing the master and the slave to exchange process data (PZD) and parameters. Refer to the PROFIBUS specification for more information on PPO types 1~5.

The option supports five possible PPO type formats:

- PPO type 1 (8 octets PKW + 4 octets PZD)
- PPO type 2 (8 octets PKW + 12 octets PZD)
- PPO type 3 (4 octets PZD)
- PPO type 4 (12 octets PZD)
- PPO type 5 (8 octets PKW + 20 octets PZD)

All PPO Types have the registers STW, ZSW, HSW, and HIW. These registers are not mapped directly to drive registers.



PKW: Parameter ID/value
PZD: Process Data, cyclically transferred
PKE: Parameter ID (1st and 2nd octet)
IND: Sub-index (3rd octet), 4th octet is reserved
PWE: Parameter value (5th until 8th octet)
STW: Control word
HSW: Main setpoint
ZSW: Status word
HIW: Main actual value

◆ Configuration of Registers

■ PKE

Bit	PPO Write	PPO Read
0	PNU number (*Refer to Supported PNU on page 33* for details)	
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11	SPM always 0	SPM always 0
12	See Task ID	See Response ID When Response ID is 7, see PWE error code
13		
14		
15		

■ IND

Bit	PPO Write	PPO Read
0	Sub-Index for parameter number (F6-33 = 0)	Sub-Index for parameter number (F6-33 = 0)
1		
2		
3		
4		
5		
6		
7		
8	Sub-Index for parameter number (F6-33 = 1)	Sub-Index for parameter number (F6-33 = 1)
9		
10		
11		
12		
13		
14		
15		

■ PWE

Bit	PPO Write	PPO Read
0 to 31	Setting Data	Error code when Response ID is 7 0: Incorrect PNU number 1: Write mode error 2: Lower or upper limit violated 3: Disabled IND is set 17: Write mode error during Uv condition or Write mode error during parameter processing

■ STW/ZSW

Bit	PPO Write	PPO Read
0	OFF1: reserved	Ready to switch on: always 1
1	OFF2: reserved	Ready: always 1
2	OFF3: reserved	0: Not ready 1: Drive ready
3	Enable to RUN 0: Baseblock + Stop 1: Not Baseblock	0: No fault condition 1: Fault condition
4	0: STOP 1: RUN	Always 1
5	Ramp function generation enable: reserved	Always 1
6	Enable ramp function generator set-point: reserved	Switch-on inhibit: always 0
7	1: Fault Reset	0: No alarm condition 1: Alarm condition
8	0: Stop 1: JOG RUN forward (Fmax/10 speed)	0: No speed agree 1: Speed agree condition
9	0: Stop 1: JOG RUN reverse (Fmax/10 speed)	0: Local control 1: Control from PROFIBUS
10	0: Local control 1: Control from PROFIBUS	Always 0
11	Reserved	
12		
13		
14		
15		

■ HSW/HIW

Bit	PPO Write	PPO Read
0 to 15	Setting Frequency (±10000/100%)	Output Frequency or Motor speed (with PG) (±10000/100%)

■ Task ID

ID	Description
0	No action
1	Request parameter value
2	Change parameter value (word)
3	Change parameter value (double word)
6	Request parameter value from array
7	Change parameter value in array (word)
8	Change parameter value in array (double word)
9	Request number of array elements

■ Response ID

ID	Description
0	No action
1	Transfer parameter value (word)
2	Transfer parameter value (double word)
4	Transfer parameter value (array word)
5	Transfer parameter value (array double word)
6	Transfer number of array element
7	Task cannot be executed (with error number)

◆ SI-P3 Device Data

Parameter	Setting Value	Note
GSD_Revision	3	GSD file revision 3.0.
Vendor_Name	“YASKAWA ELECTRIC”	
Model_Name	“PROFIBUS-DP INTERFACE CARD SI-P3”	
Ident_Number	0x0ACF	
FMS_supp	0	PROFIBUS-FMS not supported
Protocol_Ident	0	PROFIBUS-DP supported
Station_Type	0	DP-Slave.
Slave_Family	3	
Revision	“V1.0”	Device revision 1.0
Hardware_Release	“V1.0”	Hardware revision 1.0
Software_Release	“V1.0”	Software revision 1.0
Implementation_type	“DPC31”	DP protocol
Redundancy	0	Redundancy NOT supported
Repeater_Ctrl_Sig	2	Supported, TTL level
24V_Pins	0	No external 24 Volt input
Set_Slave_Add_supp = 1	1	Station address is set remotely
Auto_Baud_supp	1	Automatic baud rate select
9.6_supp	1	9600 Baud
19.2_supp	1	19.2 kBaud
45.45_supp	1	45.45 kBaud
93.75_supp	1	93.75 kBaud
187.5_supp	1	187.5 kBaud
500_supp	1	500 kBaud
1.5M_supp	1	1.5 MBaud
3M_supp	1	3 MBaud
6M_supp	1	6 MBaud
12M_supp	1	12 MBaud

Parameter	Setting Value	Note
MaxTsdr_9.6	60	60 Tbit = 6.25 msec
MaxTsdr_19.2	60	60 Tbit = 3.125 msec
MaxTsdr_45.45	60	60 Tbit = 1.32 msec
MaxTsdr_93.75	60	60 Tbit = 640 usec
MaxTsdr_187.5	60	60 Tbit = 320 usec
MaxTsdr_500	100	100 Tbit = 200 usec
MaxTsdr_1.5M	150	150 Tbit = 100 usec
MaxTsdr_3M	250	250 Tbit = 83 usec
MaxTsdr_6M	450	450 Tbit = 75 usec
MaxTsdr_12M	800	800 Tbit = 67 usec
Min_Slave_Interval	5	Minimum slave interval=0.5 ms
Freeze_Mode_supp	1	Freeze mode not supported
Sync_Mode_supp	1	Sync mode not supported
Fail_Safe	1	Fail safe supported
DPV1_Slave	1	
DPV1_Data_Types	1	
C1_Read_Write_supp	0	
C2_Read_Write_supp	1	
C2_Max_Data_Len	240	
C2_Response_Timeout	100	
C2_Read_Write_required	0	
C2_Max_Count_Channels	1	
Max_Initiate_PDU_Length	52	
Modular_Station	1	Modular station.
Max_Module	1	Maximum # of modules: 1
Max_Input_Len	32	Maximum # of input bytes
Max_Output_Len	32	Maximum # of output bytes
Max_Data_Len	64	Maximum # of data bytes
Max_User_Prm_Data_Len	4	
Ext_User_Prm_Data_Const(0)	0x40,0x01,0x00,0x01	
Ext_User_Prm_Data_Ref(0)	1	
Ext_User_Prm_Data_Ref(0)	2	
Max_Diag_Data_Len	11	Maximum diagnostic length
Unit_Diag_Bit(0024)	“Undervoltage Condition”	
Unit_Diag_Bit(0025)	“Inverter Communications Error”	
Unit_Diag_Bit(0026)	“PNU915: Illegal PNU configured”	
Unit_Diag_Bit(0027)	“PNU916: Illegal PNU configured”	

Module = “Basic data” 0x72 1 EndModule
Module = “Extended Data 1” 0x5F, 0x6F 2 EndModule
Module = “Extended Data 2” 0x55, 0x65 3 EndModule
Module = “PPO Type 1” 0xF3, 0xF1 4 EndModule
Module = “PPO Type 2” 0xF3, 0xF5 5 EndModule
Module = “PPO Type 3” 0xF1 6 EndModule
Module = “PPO Type 4” 0xF5 7 EndModule
Module = “PPO Type 5" 0xF3, 0xF9 8 EndModule
Module = “PPO Type 1 (No Cons.)” 0x73, 0x71 9 EndModule
Module = “PPO Type 2 (No Cons.)” 0x73, 0x75 10 EndModule
Module = “PPO Type 3 (No Cons.)” 0x71 11 EndModule
Module = “PPO Type 4 (No Cons.)” 0x75 12 EndModule
Module = “PPO Type 5 (No Cons.)” 0x73, 0x79 13 EndModule

◆ Supported PNU

Supported PNU No.	Data type	Write	Read	Description
900	Octet String 12		O	Type 1 PPO-Write
901	Octet String 20		O	Type 2 PPO-Write
902	Octet String 4		O	Type 3 PPO-Write (DP-V1only)
903	Octet String 12		O	Type 4 PPO-Write (DP-V1only)
904	Unsigned 16		O	Current PPO-Write
905	Octet String 28		O	Type 5 PPO-Write
907	Octet String 12		O	Type 1 PPO-Read
908	Octet String 20		O	Type 2 PPO-Read
909	Octet String 4		O	Type 3 PPO-Read (DP-V1only)
910	Octet String 12		O	Type 4 PPO-Read (DP-V1only)
911	Unsigned 16		O	Current PPO-Read
912	Octet String 28		O	Type 5 PPO-Read
915	Array[10] Unsigned 16	O	O	Assign MEMOBUS/Modbus Write Command to PZD in PPO-Write
916	Array[10] Unsigned 16	O	O	Assign MEMOBUS/Modbus response to PZD in PPO-Read
918	Unsigned 16		O	Node address
947	Array[10] Unsigned 16		O	Fault number
948	Array[10] Unsigned 16		O	Fault time (Elapsed time between fault occurrence)
963	Unsigned 16		O	Current baud rate
964	Unsigned 16		O	Device identification (*Refer to PNU964 on page 35* for details)
965	Octet String 2		O	Profile code: 0x0302
967	V2	O	O	Read or Write Control word
968	V2		O	Read Status word
971	Unsigned 16	O		Start Store in non-volatile memory (Enter code with EEPROM)

■ Example: To read the Drive Command (STW) using PNU900

Command setting

Data type	Settings	Description
PKE	6384H	6: Request parameter value from array
		384H=900 dec (PNU 900)
IND	5	5th Word data of PPO type 1
PWE	0	N/A
STW	–	up to Master command
HSW	–	up to Master command

Response

Data type	Settings	Description
PKE	4384H	4: Transfer parameter value (array word)
		384H=900 dec (PNU 900)
IND	5	5th Word data of PPO type 1
PWE	(STW)	STW data
ZSW	–	up to drive status
HIW	–	up to drive status

■ Example: To read the Drive Status (ZSW) using PNU907

Command setting

Data type	Settings	Description
PKE	638BH	6: Request parameter value from array
		38BH=907 dec (PNU 907)
IND	5	5th Word data of PPO type 1

Data type	Settings	Description
PWE	0	N/A
STW	–	up to Master command
HSW	–	up to Master command

Response

Data type	Settings	Description
PKE	438BH	4: Transfer parameter value (array word)
		38BH=907 dec (PNU 907)
IND	5	5th Word data of PPO type 1
PWE	(ZSW)	ZSW data
ZSW	–	up to drive status
HIW	–	up to drive status

■ Example: To read the data Type 1 PPO-Write 1st word

Command setting

Data type	Settings	Description
PKE	6384H	6: Request parameter value from array
		384H=900 dec (PNU 900)
IND	1	First Word data of PPO type 1
PWE	0	N/A
STW	–	up to Master command
HSW	–	up to Master command

Response

Data type	Settings	Description
PKE	4384H	4: Transfer parameter value (array word)
		384H=900 dec (PNU 900)
IND	1	First Word data of PPO type 1
PWE	6384H	PPO-Write 1st Word data
ZSW	–	up to drive status
HIW	–	up to drive status

■ Example: To read current PPO-Write

Command setting

Data type	Settings	Description
PKE	1388H	1: Request parameter value
		388H=904 dec (PNU 904)
IND	0	Not array type
PWE	0	N/A
STW	–	up to Master command
HSW	–	up to Master command

Response

Data type	Settings	Description
PKE	1388H	1: Transfer parameter value (word)
		388H=904 dec (PNU 904)
IND	0	Not array type
PWE	1	1: Type 1 PPO-Write 2: Type 2 PPO-Write 3: Type 3 PPO-Write 4: Type 4 PPO-Write 5: Type 5 PPO-Write
ZSW	–	up to drive status
HIW	–	up to drive status

■ How to use PNU 915 (Assignment, PZD in PPO-Write)

PZD #	PNU	INDX	Assigned PNU	Description
PZD1	915	1	P0.1	Operation command
PZD2	915	2	P0.2	Frequency Reference
PZD3	915	3	P0.6	PID set point
PZD4	915	4	P0.7	Analog Output
PZD5	915	5	P0.9	Digital Output
PZD6	915	6	P0.15	PID set point enable
PZD7	915	7		
PZD8	915	8		
PZD9	915	9		
PZD10	915	10		

■ How to use PNU 916 (Assignment, PZD in PPO-Read)

PZD #	PNU	INDX	Assigned PNU	Description
PZD1	916	1	P0.32	Drive Status
PZD2	916	2	P0.2	Frequency Reference
PZD3	916	3	P0.36	Output Frequency
PZD4	916	4	P0.38	Output Current
PZD5	916	5	P0.68	Motor Speed
PZD6	916	6	P0.69	Output Voltage
PZD7	916	7	P0.70	Bus Voltage
PZD8	916	8	P0.72	Torque Monitor
PZD9	916	9	P0.71	Output Power
PZD10	916	10	P0.73	Input terminal status

■ PNU963

Value	Baud rate (kbit/s)
0	9.6
1	19.2
2	93.75
3	187.5
4	500
6	1500
7	3000
8	6000
9	12000

■ PNU964

Sub-Index	Description	Settings
1	Manufacturer Coding	273 dec
2	Device type	1
3	Software version	0
4	Firmware Data (year)	2007 dec
5	Firmware Data (month/day)	0220 dec
6	DO	1

◆ PNU Numbers for Drive Parameters

DPV0 PNU Number (Dec)	Description	INDEX (Dec)
11	A1 Function Group	00–99
12	A2 Function Group	00–99
21	b1 Function Group	00–99
22	b2 Function Group	00–99
23	b3 Function Group	00–99
24	b4 Function Group	00–99
25	b5 Function Group	00–99
26	b6 Function Group	00–99
27	b7 Function Group	00–99
28	b8 Function Group	00–99
29	b9 Function Group	00–99
31	C1 Function Group	00–99
32	C2 Function Group	00–99
33	C3 Function Group	00–99
34	C4 Function Group	00–99
35	C5 Function Group	00–99
36	C6 Function Group	00–99
41	d1 Function Group	00–99
42	d2 Function Group	00–99
43	d3 Function Group	00–99
44	d4 Function Group	00–99
45	d5 Function Group	00–99
46	d6 Function Group	00–99
47	d7 Function Group	00–99
51	E1 Function Group	00–99
52	E2 Function Group	00–99
53	E3 Function Group	00–99
54	E4 Function Group	00–99
55	E5 Function Group	00–99
61	F1 Function Group	00–99
62	F2 Function Group	00–99
63	F3 Function Group	00–99
64	F4 Function Group	00–99
65	F5 Function Group	00–99
66	F6 Function Group	00–99
67	F7 Function Group	00–99
81	H1 Function Group	00–99
82	H2 Function Group	00–99
83	H3 Function Group	00–99
84	H4 Function Group	00–99
85	H5 Function Group	00–99
86	H6 Function Group	00–99
121	L1 Function Group	00–99
122	L2 Function Group	00–99
123	L3 Function Group	00–99
124	L4 Function Group	00–99
125	L5 Function Group	00–99
126	L6 Function Group	00–99
127	L7 Function Group	00–99
128	L8 Function Group	00–99
141	n1 Function Group	00–99
142	n2 Function Group	00–99

DPV0 PNU Number (Dec)	Description	INDEX (Dec)
143	n3 Function Group	00–99
145	n5 Function Group	00–99
146	n6 Function Group	00–99
148	n8 Function Group	00–99
151	o1 Function Group	00–99
152	o2 Function Group	00–99
153	o3 Function Group	00–99
154	o4 Function Group	00–99
171	q1 Function Group	00–99
181	r1 Function Group	00–99
201	T1 Function Group	00-99
202	T2 Function Group	00–99
203	T3 Function Group	00–99
211	U1 Function Group	00–99
212	U2 Function Group	00–99
213	U3 Function Group	00–99
214	U4 Function Group	00–99
215	U5 Function Group	00–99
216	U6 Function Group	00–99
217	U7 Function Group	00–99
218	U8 Function Group	00–99
300	RAM Enter Command	0
301	ROM Enter Command	0

■ PNU Numbering for MEMOBUS/Modbus registers

DPV0 PNU Number	Description	INDEX
	Command	
0	0001H MEMOBUS/Modbus #	1
0	0002H MEMOBUS/Modbus #	2
0	0003H MEMOBUS #	3
0	0004H MEMOBUS #	4
0	0005H MEMOBUS #	5
0	0006H MEMOBUS #	6
0	0007H MEMOBUS/Modbus #	7
0	0008H MEMOBUS #	8
0	0009H MEMOBUS/Modbus #	9
0	000AH MEMOBUS/Modbus #	10
0	000FH MEMOBUS/Modbus #	15
0	0010H MEMOBUS/Modbus #	16
0	0011H MEMOBUS/Modbus #	17
0	001BH MEMOBUS #	27
0	001CH MEMOBUS #	28
0	001DH MEMOBUS #	29
	Monitor	
0	0020H MEMOBUS/Modbus #	32
0	0021H MEMOBUS/Modbus #	33
0	0022H MEMOBUS/Modbus #	34
0	0023H MEMOBUS/Modbus #	35
0	0024H MEMOBUS/Modbus #	36
0	0025H MEMOBUS/Modbus #	37
0	0026H MEMOBUS/Modbus #	38
0	0027H MEMOBUS/Modbus #	39
0	0028H MEMOBUS/Modbus #	40
0	0029H MEMOBUS/Modbus #	41

DPV0 PNU Number	Description	INDEX
0	002AH MEMOBUS/Modbus #	42
0	002BH MEMOBUS/Modbus #	43
0	002CH MEMOBUS/Modbus #	44
0	002DH MEMOBUS/Modbus #	45
0	002EH MEMOBUS/Modbus #	46
0	002FH MEMOBUS/Modbus #	47
0	0030H MEMOBUS/Modbus #	48
0	0031H MEMOBUS/Modbus #	49
0	0032H MEMOBUS/Modbus #	50
0	0033H MEMOBUS/Modbus #	51
0	0034H MEMOBUS/Modbus #	52
0	…	…
0	00FFH MEMOBUS/Modbus #	255

Note: When PNU is set to 0 and INDEX is set to MEMOBUS/Modbus register number, parameter values can be read and written instead of using PNU number.

Note: MEMOBUS/Modbus register C1-01 is 200Hex
When PNU is 0 and INDEX is 200H(512 dec), C1-01 setting value can be read and written instead of using PNU 31 (dec) and INDEX 01.

■ Example: Writing to C1-01

Command setting

Data type	Settings	Description
PKE	701FH	7: Change parameter value in array (word)
		1FH = 31 (C1 parameter)
IND	1	C1-01
PWE	10	Assign 10
STW	–	up to Master command
HSW	–	up to Master command

Response

Data type	Settings	Description
PKE	401FH	4: Transfer parameter value (array word)
		1FH = 31 (C1 parameter)
IND	1	C1-01
PWE	0	N/A
STW	–	up to drive status
HSW	–	up to drive status

■ Example: Reading to d1-17

Command setting

Data type	Settings	Description
PKE	6029H	6: Request parameter value from array
		29H = 41 (d1 parameter)
IND	11H	11H = 17 (d1-17)
PWE	0	N/A
STW	–	up to Master command
HSW	–	up to Master command

Response

Data type	Settings	Description
PKE	4029H	4: Transfer parameter value (array word)
		29H = 41 (d1 parameter)
IND	11H	d1-17
PWE	258H	d1-17 value

Data type	Settings	Description
STW	–	up to drive status
HSW	–	up to drive status

■ Example: Writing to RAM with the Enter command

Command setting

Data type	Settings	Description
PKE	212CH	2: Change parameter value (word)
		12CH = 300
IND	0	N/A
PWE	0	N/A
STW	–	up to Master command
HSW	–	up to Master command

Response

Data type	Settings	Description
PKE	112CH	1: Transfer parameter value (word)
		12CH = 300
IND	0	N/A
PWE	0	N/A
STW	–	up to drive status
HSW	–	up to drive status

9 Troubleshooting

◆ Drive-Side Error Codes

Table 17 lists the various fault codes related to the option. Further details on various faults can be found in the drive Technical Manual.

■ Faults

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

Check the following items first when an error code occurs on the drive:

- Communication cable connections
- Make sure the option is properly installed to the drive
- Operation status of the controller program and controller CPU
- Did a momentary power loss interrupt communications?

Table 17 Fault Displays, Causes, and Possible Solutions

Digital Operator Display		Fault Name
bUS	bUS	Option Communication Error
		The connection was lost after establishing initial communication. Only detected when the run command frequency reference is assigned to the option (bl-01 = 3 or bl-02 = 3).
Cause		**Possible Solution**
Master controller (PLC) has stopped communicating.		Check for faulty wiring. Correct any wiring problems.
Communication cable is not connected properly.		
A data error occurred due to noise.		• Counteract noise in control circuit wiring, main circuit lines, and ground wiring. • If a magnetic contactor is the noise source, install a surge absorber to the contactor coil. • Use cables recommended by Yaskawa or another type of shielded line. Ground the shield on the controller side and on the option side.
Option is damaged.		If there are no wiring problems and the error continues to occur, replace the option.
Digital Operator Display		**Fault Name**
EF0	EF0	External Fault Input from the option
		The alarm function for an external device has been triggered.
Cause		**Possible Solution**
An external fault is being sent from the main controller (PLC).		• 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.
Digital Operator Display		**Fault Name**
oFA00	oFA00	Non-Compatible Option connected to drive port CN5-A
		Option is not properly connected.
Cause		**Possible Solution**
Non-compatible option connected to drive port CN5-A.		Use only compatible options. Connect the SI-P3 to CN5-A. For other option connections, refer to the Installation Manual for those options.
Digital Operator Display		**Fault Name**
oFA01	oFA01	Option Fault (CN5-A)
		Option is not properly connected.
Cause		**Possible Solution**
Problem with the connector between the drive and option.		Turn the power off and check the connectors between the drive and option.
Digital Operator Display		**Fault Name**
oFA30 to oFA43	oFA30 to oFA43	Option Fault (CN5-A)
		Communication ID error.
Cause		**Possible Solution**
Option hardware fault.		Replace the option. Contact Yaskawa for assistance.

Digital Operator Display		Fault Name
oFb00	oFb00	Non-Compatible Option connected to drive port CN5-B
		Non-compatible option is connected.
Cause		**Possible Solution**
Non-compatible option connected to drive port CN5-B.		Use only compatible options. Connect the SI-P3 to CN5-A. For other option connections, refer to the Installation Manual for those options.
Digital Operator Display		**Fault Name**
oFb02	oFb02	Option Fault (CN5-B)
		Two of the same option are connected simultaneously.
Cause		**Possible Solution**
Options AI-A3 or D1-A3 connected to the CN5-B port while an option was connected to CN5-A.		Only one of these options, AI-A3, DI-A3 or SI-□□ option can be connected to the drive at the same time. The SI-N3 must be connected to CN5-A.
Digital Operator Display		**Fault Name**
oFc00	oFc00	Non-Compatible Option connected to drive port CN5-C
		Non-compatible option is connected.
Cause		**Possible Solution**
Non-compatible option connected to drive port CN5-C.		Use only compatible options. Connect the SI-P3 to CN5-A. For other option connections, refer to the Installation Manual for those options.
Digital Operator Display		**Fault Name**
oFc02	oFc02	Option Fault (CN5-C)
		Two of the same options are connected simultaneously.
Cause		**Possible Solution**
Options AI-A3 or D1-A3 connected to the CN5-C port while an option was connected to CN5-A.		Only one of these options, AI-A3, DI-A3 or SI-□□ option can be connected to the drive at the same time. The SI-N3 must be connected to CN5-A.

■ Minor Faults and Alarms

Digital Operator Display		Minor Fault Name	
bb	bb	Baseblock	
		Data format and setting contents do not match.	
Cause		**Possible Solution**	**Minor Fault (H2-□□ = 10)**
The drive output is disabled. "bb" is displayed on the operator when the drive is set for control by PROFIBUS-DP, and a conventional data format is used, and the operation command bit F is set to 1, or a PPO type data format is used, and the control word (STW) bit 3 is set to 0.		Set either of the bits depending on the data format used.	No output
Digital Operator Display		**Minor Fault Name**	
CALL	CALL	Serial Communication Transmission Error	
		Communication has not yet been established.	
Cause		**Possible Solution**	**Minor Fault (H2-□□ = 10)**
Communication wiring or terminal resistor connection is faulty. There is a short circuit, or an option component is not connected properly.		Check for wiring errors and correct the wiring. Remove any ground shorts and reconnect loose wires.	Yes
Master-side programming error.		Check communications at start-up and correct programming errors.	
Damaged communication circuitry.		Perform a self-diagnostics check and replace the drive if the fault continues to occur.	

10 Specifications

Table 18 Option Specifications

Items	Specifications
Model	SI-P3
PROFIBUS-DP Data	• PROFIBUS-DP V0, V1 • PPO-TYPE: 1~5 (No. 3.072, Profile for Variable Speed Drives) • Extended data 1 High-speed I/O data (inputs: 16 bytes, outputs: 16 bytes) MEMOBUS/Modbus message (inputs: 16 byes, outputs: 16 bytes) • Extended data 2 High-speed I/O data (inputs: 4 bytes, outputs: 4 bytes) MEMOBUS/Modbus message (inputs: 8 bytes, outputs: 8 bytes) • Basic data High-speed I/O data (inputs: 6 bytes, outputs: 6 bytes)
Connector	9-pin D-sub connector (#4/40 UNC thread)
Communications Speed	9.6 kbps to 12 Mbps
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

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YASKAWA AC Drive 1000-Series Option

PROFIBUS-DP
Technical Manual

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