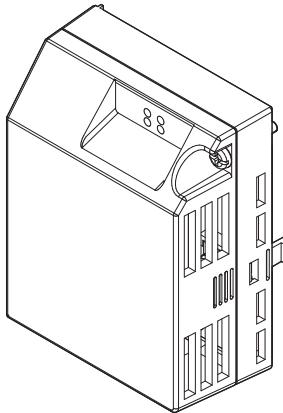


## Inverter HF-520 Option **PROFIBUS-DP** Installation Manual

Type: SI-P3/V-H

### NOTICE

1. Make sure that this installation manual is delivered to the end user of inverter unit.
2. Read this manual before installing or operating the inverter unit, and store it in a safe place for reference.



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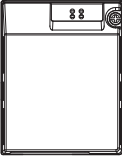
# 1 Preface and Safety

Sumitomo manufactures products used as components in a wide variety of industrial systems and equipment. The selection and application of Sumitomo products remain the responsibility of the equipment manufacturer or end user. Sumitomo accepts no responsibility for the way its products are incorporated into the final system design. Under no circumstances should any Sumitomo 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 Sumitomo 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 Sumitomo must be promptly provided to the end user. Sumitomo offers an express warranty only as to the quality of its products in conforming to standards and specifications published in the Sumitomo manual. **NO OTHER WARRANTY, EXPRESSED OR IMPLIED, IS OFFERED.** Sumitomo 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 PROFIBUS-DP Option:

### Option Unit

	<b>Inverter HF-520 Series Option PROFIBUS-DP Installation Manual Manual No.: DM2309E (this book)</b>	Read this manual first. The installation manual is packaged with the PROFIBUS-DP Option and contains a basic overview of wiring, settings, functions, and fault diagnoses.
	<b>Inverter HF-520 Series Option PROFIBUS-DP Technical Manual Manual No.: DM2310E</b>	The technical manual contains detailed information and command registers. To obtain the technical manual access these sites: Japan: <a href="http://www.shi.co.jp/ptc/">http://www.shi.co.jp/ptc/</a>

# 1 Preface and Safety

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## Inverter

	<b>HF-520 Technical Manual</b> <b>Manual No. : DM2302E</b>
	This manual describes installation, wiring, operation procedures, functions, troubleshooting, maintenance, and inspections to perform before operation. To obtain instruction manuals for Sumitomo products access the site below: <a href="http://www.shi.co.jp/ptc/">http://www.shi.co.jp/ptc/</a>
	<b>HF-520 Operating and Maintenance Manual</b> <b>Manual No. : DM2301E</b>
	This guide is packaged together with the product. It contains basic information required to install and wire the drive. This guide provides basic programming and simple set-up and adjustment.

---

## ◆ Terms

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

**Drive:** HF-520 Series

**PROFIBUS-DP Option:** HF-520 Series Option PROFIBUS-DP (SI-P3/V-H)

## ◆ Registered Trademarks

- PROFIBUS-DP is a registered trademark of PROFIBUS International.
- Other company names and product names listed in this manual are registered trademarks of those companies.

## ◆ Supplemental Safety Information

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

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

### **DANGER**

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

### **WARNING**

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

### **CAUTION**

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

### **NOTICE**

Indicates an equipment damage message.

# 1 Preface and Safety

---

## ■ General Safety

### General Precautions

- The diagrams in this section may include option units and drives without covers or safety shields to illustrate details. Be sure to reinstall covers or shields before operating any devices. The option board should be used according to the instructions described in this manual.
- Any illustrations, photographs, or examples used in this manual are provided as examples only and may not apply to all products to which this manual is applicable.
- The products and specifications described in this manual or the content and presentation of the manual may be changed without notice to improve the product and/or the manual.

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

#### **Do not expose the drive to halogen group disinfectants.**

Failure to comply may cause damage to the electrical components in the option unit.  
Do not pack the drive in wooden materials that have been fumigated or sterilized.  
Do not sterilize the entire package after the product is packed.



## ■ Option Unit Label Warnings

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

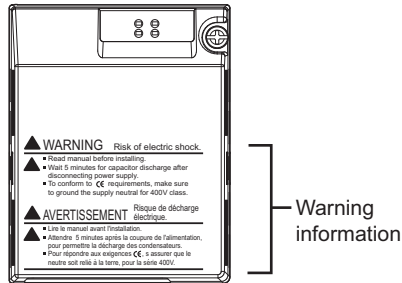


Figure 1 Warning Labels

## ■ Warning Contents

### **▲ WARNING** Risk of electric shock.

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

### **▲ AVERTISSEMENT** Risque de décharge électrique.

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

# 2 Product Overview

### ◆ About This Product

PROFIBUS is an open digital communication system supporting a wide range of fast, time-critical applications.

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

By installing the PROFIBUS-DP Option to a drive, it is possible to do the following from a PROFIBUS-DP master device:

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

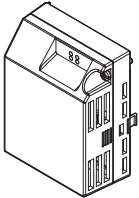
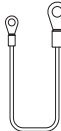

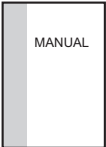
## 3 Receiving

Please perform the following tasks after receiving the PROFIBUS-DP Option:

- Inspect the PROFIBUS-DP Option for damage.
- Verify receipt of the correct model by checking the information on the nameplate (see [Figure 2](#)).
- If you receive the wrong model or the PROFIBUS-DP Option does not function properly, contact your supplier.

### ◆ Contents and Packaging

Table 1 Contents of Package

Description:	Option Unit	Ground Cables	Warning Labels	Installation Manual (This book)
				
<b>Quantity:</b>	1	4	1	1

### ◆ Tool Requirements

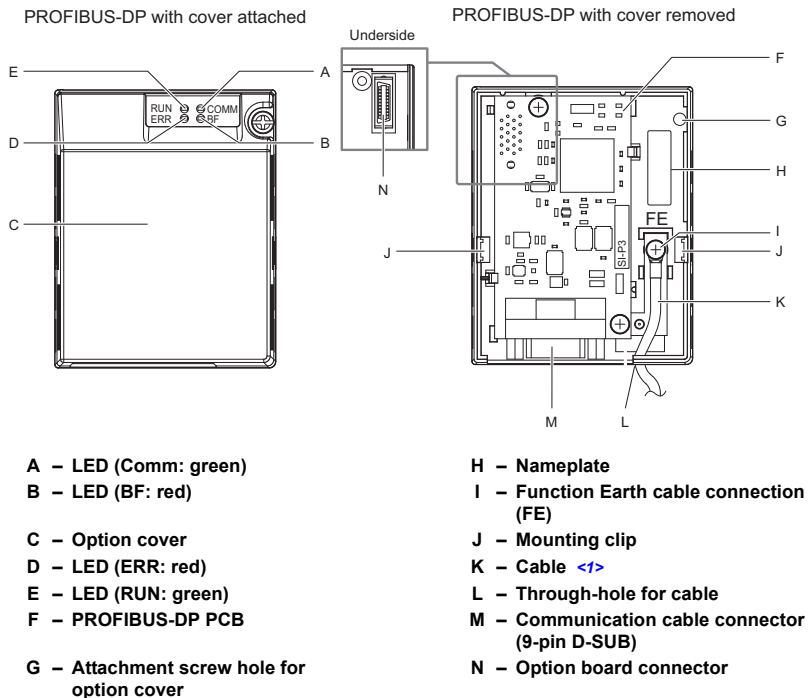
A Phillips screwdriver (M3, M3.5 to M6 <1> metric or (#1, #2 <1>) U.S. standard size) is required to install the PROFIBUS-DP Option.

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

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

# 4 PROFIBUS-DP Option Components

### ◆ PROFIBUS-DP Option



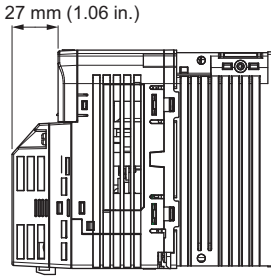
<1> Cables are not connected to the PROFIBUS-DP Option and are packaged separately in the box.

**Figure 2 Option Unit**

**Note:** For details on the LEDs, [Refer to PROFIBUS-DP Option LED Display on page 15.](#)

### ◆ Dimensions

The installed PROFIBUS-DP Option adds 27 mm (1.06 in.) to the total depth of the drive. (*Figure 3*)



**Figure 3 Dimensions**

## 4 PROFIBUS-DP Option Components

### ◆ Communication connector

The drive has a 9 pin D-sub connector for installing the option card. Once installed, the drive can connect to a PROFIBUS network.

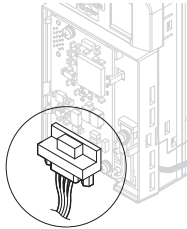
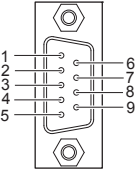


Figure 4 Communication connector location

Table 2 Communication connector (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	–	–

### ◆ PROFIBUS-DP Option LED Display

**Table 3 LED Display**

LED	Display		Communication Status	Meaning
	Color	Status		
RUN (Power)	Green	ON	Power is on	Power is being properly supplied to PROFIBUS-DP Option, and PROFIBUS-DP Option has completed its hardware self-diagnostics check
		OFF	Power is off	<ul style="list-style-type: none"> <li>• The drive has no power supply</li> <li>• PROFIBUS-DP Option and drive are not connected properly and/or there is no power supplied to the PROFIBUS-DP Option</li> <li>• An internal, self-diagnostic error occurred in the PROFIBUS-DP Option</li> </ul>
ERR (Option Error)	Red	ON	PROFIBUS-DP Option error	Self-diagnostics error occurred in the PROFIBUS-DP Option
		Flashing	Drive connection error	Connection error between PROFIBUS-DP Option and drive. This includes node address setting errors to parameter F6-30 on the drive side
		OFF	Normal operation	Drive and PROFIBUS-DP Option are properly connected
COMM (Communication Status)	Green	ON	Communication connected	Normal send/receive between PROFIBUS-DP Option and PROFIBUS-DP master
		OFF	No data exchange	There is a problem establishing communication between PROFIBUS-DP Option and the PROFIBUS-DP master
BF (PROFIBUS-DP Error)	Red	ON	Waiting for communication procedure setting	Communication-related parameters are being set or initialized by the PROFIBUS-DP master.
		Flashing	Communication setting error	Communication parameter error from PROFIBUS-DP master
		OFF	Normal operation	LED is off once the PROFIBUS-DP master is finished setting communication-related parameters

**Table 4 Understanding LED Display**

LED				Communication Status	Possible Cause	Solution
RUN	ERR	COMM	BF			
×	×	×	×	No power	The drive has no power	<ul style="list-style-type: none"> <li>• Shut the drive off and check that the PROFIBUS-DP Option is properly connected</li> <li>• Turn the power back on again</li> </ul>
					PROFIBUS-DP Option is not properly connected to the drive, and therefore is not receiving enough power	

## 4 PROFIBUS-DP Option Components

LED				Communication Status	Possible Cause	Solution
RUN	ERR	COMM	BF			
○	×	×	×	<ul style="list-style-type: none"> <li>Checking connection with the drive</li> <li>Waiting for data from the master</li> </ul>	<ul style="list-style-type: none"> <li>PROFIBUS-DP Option is reading the node address or parameter configuration</li> <li>Waiting for initial input data from master device</li> </ul>	–
×	○	×	×	PROFIBUS-DP Option Self-diagnostics error	The PROFIBUS-DP Option is damaged	Cycle power to the drive. If the LED status does not change, replace the PROFIBUS-DP Option
×	□	×	×	Problem connecting to the drive	<ul style="list-style-type: none"> <li>Problem initializing the drive and PROFIBUS-DP Option</li> <li>Incorrect node address</li> </ul>	<ul style="list-style-type: none"> <li>Cycle power to the drive. If the LED status does not change, replace the PROFIBUS-DP Option</li> <li>Check the node address setting in the drive (parameter F6-10)</li> </ul>
○	×	×	○	Waiting for data from the master device	Waiting for data from the master device (Set_Parm_Message or Chk_Cfg_Message)	<ul style="list-style-type: none"> <li>Check the network settings in the master</li> <li>Make sure the master device is operating normally</li> <li>Check the terminal resistance settings on the data line</li> <li>Look for any problems with the data line, or if the connector</li> <li>Check that the data lines are properly connected to the drive</li> </ul>
○	×	×	□	Data is incorrect or PROFIBUS-DP Option timed out waiting for data	The communication procedure in the master is set incorrectly	<ul style="list-style-type: none"> <li>Check the communication procedure settings in the master</li> </ul>
○	×	○	×	Sending or receiving data	–	–

○: On / □: Flashing / ×: Off

### ◆ Setting Node Address

Set drive parameter F6-30 to a unique node address (Range 0 to 125) on the network.



## 5 Installation Procedure

### ◆ Section Safety

#### DANGER

##### **Electrical Shock Hazard**

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

Failure to comply will result in death or serious injury.

Disconnect all power to the drive, wait at least five minutes after all indicators are off, measure the DC bus voltage to confirm safe level, and check for unsafe voltages before servicing to prevent electric shock. The internal capacitor remains charged even after the power supply is turned off. The charge indicator LED will extinguish when the DC bus voltage is below 50 Vdc.

#### WARNING

##### **Electrical Shock Hazard**

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

Failure to comply could result in death or serious injury.

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

**Do not allow unqualified personnel to use equipment.**

Failure to comply could result in death or serious injury.

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

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

Failure to comply could result in death or serious injury.

### NOTICE

#### **Damage to Equipment**

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

Failure to comply may result in ESD damage to circuitry.

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

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

**Do not operate damaged equipment.**

Failure to comply may cause further damage to the equipment.

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

**Do not use unshielded cable for control wiring.**

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

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

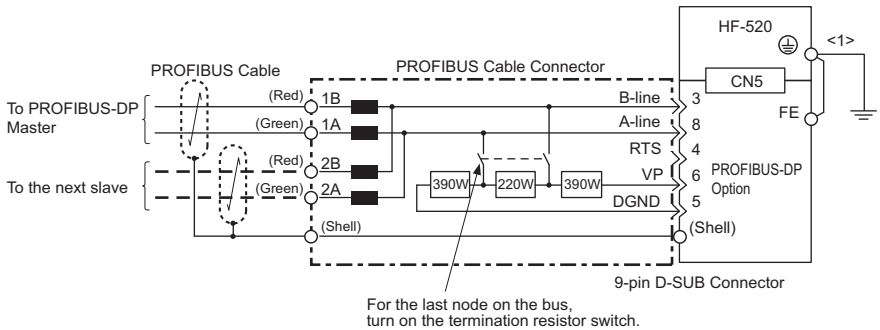
**Properly connect all pins and connectors.**

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

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

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

## ◆ Connection Diagram



<1> The FE terminal on the PROFIBUS-DP Option is fitted with a ground cable that should be connected to the ground terminal on the drive.

**Figure 5 Connection Diagram**

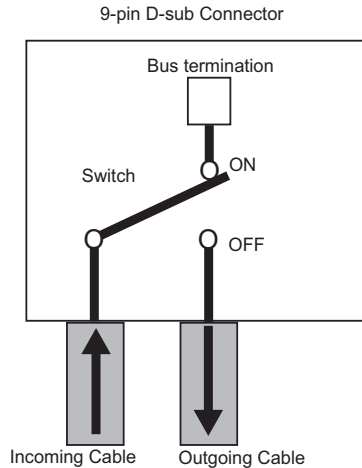
## ■ PROFIBUS-DP Termination

Because the PROFIBUS-DP Option does not have a termination resistor, a termination resistance must be set using a switch on the 9 pin D-sub connector. Make sure that only the D-sub connector for the last or end drive in the network has a terminating resistor. If any other drive on the network has a terminating resistor, communication problems may occur.

Most 9 pin D-sub connectors have a function for disconnecting the output side of the cable. Use only the input side cable entry when connecting both ends of the network. If the connector is reversed, then communication will not be possible between devices. Most connectors have arrows indicating the input and output sides.

Terminating resistors as shown in [Figure 6](#) can only be used for baud rates below 1.5 Mbps. 1.5 Mbps and higher baud rates require termination with resistors as shown in [Figure 7](#).

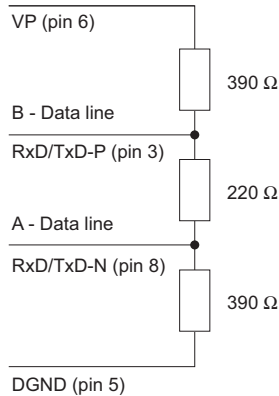
## 5 Installation Procedure



**Figure 6 PROFIBUS Cable Connection with Termination Resistors**

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

**Bus termination OFF** = incoming and outgoing cables connected.



**Figure 7 Cable Termination of the PROFIBUS-DP Option Cable to EN50170 (pin numbers for a 9-pin D-sub connector)**

### ◆ Prior to Installing the Option Unit

Prior to installing the PROFIBUS-DP Option, wire the drive and make necessary connections to the drive terminals. Refer to the HF-520 manual for information on wiring and connecting the drive. Verify that the drive operates normally without the option installed.

---

### ◆ Installing the Option Unit

Remove the front cover of the drive before installing the PROFIBUS-DP Option. Follow the directions below for proper installation.

1. Switch off the power supply to the drive.

**DANGER! Electrical Shock Hazard** - Do not connect or disconnect wiring while the power is on. Failure to comply will result in death or serious injury. Before installing the PROFIBUS-DP Option, disconnect all power to the drive. The internal capacitor remains charged even after the power supply is turned off. The charge indicator LED will extinguish when the DC bus voltage is below 50 Vdc. To prevent electric shock, wait at least five minutes after all indicators are off and measure the DC bus voltage level to confirm safe level.

2. Remove the front cover. The original drive front cover may be discarded because it will be replaced by the PROFIBUS-DP Option cover in step 7.

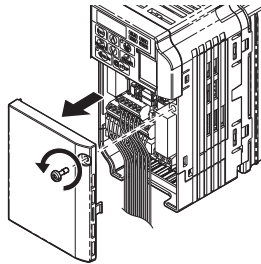
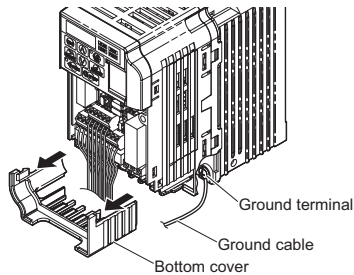


Figure 8 Remove Front Cover

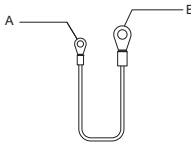
## 5 Installation Procedure

3. Remove the bottom cover and connect the PROFIBUS-DP Option ground cable to the ground terminal.



**Figure 9 Connect Ground Cable**

**Note:** The four different ground cables packaged with the PROFIBUS-DP Option connect to different models. Select the proper ground cable from the PROFIBUS-DP Option kit depending on drive size.



**A – Option unit connection: screw size = M3**

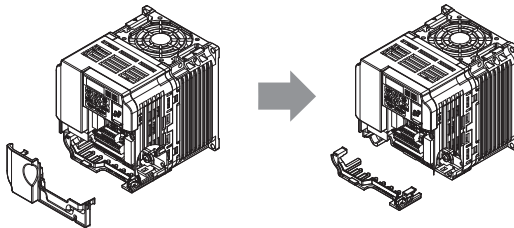
**B – Drive-side connection: screw size = M3.5 to M6**

**Figure 10 Ground Cable**

**Note:** Cover removal for certain larger models with a Terminal Cover:

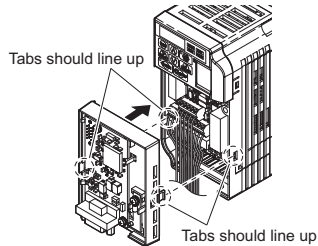
- Single-Phase 200 V Class: HF520S-A75 to 2A2
- Three-Phase 200 V Class: HF5202-1A5 to 7A5
- Three-Phase 400 V Class: All models

Remove the terminal cover before removing the bottom cover to install the PROFIBUS-DP Option. Replace the terminal cover after wiring the PROFIBUS-DP Option.



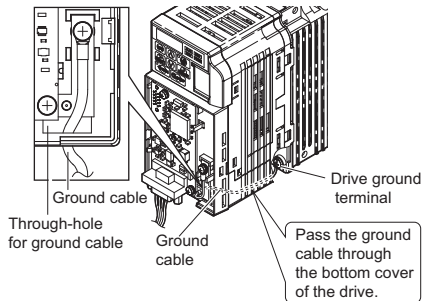
**Figure 11 Models with Terminal Cover**

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



**Figure 12 Attach PROFIBUS-DP Option**

6. Connect the ground cable from the drive ground terminal to the PROFIBUS-DP Option ground. When wiring the PROFIBUS-DP Option, pass the ground cable through the inside of the drive bottom cover. then pass the ground cable into the through-hole at the front of the PROFIBUS-DP Option.



**Figure 13 Ground Cable Connection**

## 5 Installation Procedure

7. Attach the PROFIBUS-DP Option cover to the front of the PROFIBUS-DP Option.

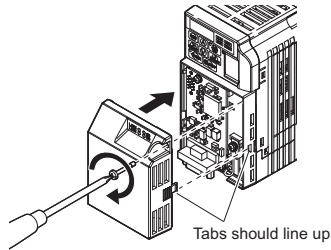


Figure 14 Attach Cover

### ◆ Communication Cable Specifications

To ensure proper performance, SUMITOMO recommends using PROFIBUS-DP-dedicated cables that fulfill the specifications in [Table 5](#). For more information on cables, refer to the PROFIBUS-DP website at <http://www.profibus.com>.

### ■ Cable Requirements

Table 5 Communication Cable Requirements

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



### ■ Cable Length

Communication speed determines maximum permissible cable length. *Table 6* shows the specifications for Type A bus cables.

**Table 6 Cable Length**

Communication speed (kbps)	Distance per segment (m)	Communication speed (kbps)	Distance per segment (m)
9.6	1200	500	400
19.2	1200	1500	200
45.45	1200	3000	100
93.75	1200	6000	100
187.5	1000	12000	100

---

### ◆ GSD Files

For easy network implementation of drives equipped with a PROFIBUS-DP Option, a GSD file can be obtained from:

Japan: <http://www.shi.co.jp/ptc/>

# 6 PROFIBUS-DP Option Drive Parameters

Confirm the proper setting of all parameters in [Table 7](#) before starting network parameters.

**Table 7 Parameter Settings**

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

## 6 PROFIBUS-DP Option Drive Parameters

No.	Name	Description	Values
F6-30 <3> <4>	Node Address	Select the node address of a PROFIBUS-DP Option.	Default: 0 Min: 0 Max: 125
F6-31	Clear Mode Selection	Selects the action to take when a "Clear Mode" command is received 0: Resets back to 0 1: Maintains the previous value	Default: 0 Range: 0, 1
F6-32	PROFIBUS Map Selection	0: PPO Type	Default: 0 Range: 0

- <1> To start and stop the drive through the PROFIBUS-DP network, set b1-02 to "3". To control the frequency reference of the drive via the PROFIBUS-DP network, set b1-01 to "3".
- <2> If F6-03 is set to 3, then the drive will continue to operate when an EF0 fault is detected. Take proper safety measures, such as installing an emergency stop switch.
- <3> All node addresses must be unique. Node addresses 0, 1, and 2 are typically reserved for control, maintenance, and diagnostic equipment. The ERR light will illuminate when 0 or greater than 125 is entered.
- <4> Power must be cycled in order for any setting changes to take affect.

# 7 PROFIBUS-DP Option Data and I/O Maps

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

### ■ High-Speed I/O Data

High-speed I/O data is directly transferred to or from the drive and can control the drive. For example, when the drive is set for PROFIBUS-DP communications, the drive Run/Stop and Frequency Reference commands are typically transferred to the drive within 2 ms after being received by the option.

### ■ MEMOBUS/Modbus Message

MEMOBUS/Modbus message data is transferred to the drive using MEMOBUS/Modbus messages. All drive parameters and data can be accessed through MEMOBUS/Modbus. Because the data in this message type is transferred to the drive after the PROFIBUS-DP Option receives and edits it, more time is required to return the data to the master. The master must synchronize the timing of sending and receiving the data by handshaking.

### ■ Memory Maps

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

### ■ Basic and Extended Register Maps

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

## 7 PROFIBUS-DP Option Data and I/O Maps

**Table 8 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) <1>
3	Frequency Reference (Low Byte)	3	Motor Speed (Low Byte) <1>
4	Reserved	4	Output Current (High Byte) <2>
5		5	Output Current (Low Byte) <2>

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

<2> Data is displayed in units of 0.01 A.

**Table 9 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) <3>
3	Frequency Reference (Low Byte)	3	Motor Speed (Low Byte) <3>
4	Reserved	4	Torque Reference Monitor (High Byte) <4>
5		5	Torque Reference Monitor (Low Byte) <4>
6		6	Reserved
7		7	Reserved
8		8	Frequency Reference (High Byte)
9		9	Frequency Reference (Low Byte)
10		Analog Output Channel 1 (High Byte) <1>	10
11	Analog Output Channel 1 (Low Byte) <1>	11	Output Frequency (Low Byte)
12	Reserved	12	Output Current (High Byte) <5>
13		13	Output Current (Low Byte) <5>
14	Digital Output (High Byte) <2>	14	Analog Input Channel 1 (High Byte)
15	Digital Output (Low Byte) <2>	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)

## 7 PROFIBUS-DP Option Data and I/O Maps

Output (Master Device to Drive)		Input (Drive to Master Device)	
Byte	Description	Byte	Description
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			
30			
31	Handshaking Register	31	Handshaking Register

- <1> To select drive analog output channel for communications, set H4-01 (Multi-Function Analog Output Terminal AM) to 000 (through-mode).
- <2> Drive digital output ON/OFF during communications, set H2-01 (Terminal MA, MB 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).
- <3> 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.
- <4> Cannot be used when setting A1-02 (Control Method Selection) to 0 (V/f Control without PG).
- <5> Data is displayed in units of 0.01 A.

## 7 PROFIBUS-DP Option Data and I/O Maps

**Table 10 Extended Data 2 Register Map**

Output (Master Device – Drive)		Input (Drive – 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) <I>
3	Frequency Reference (Low Byte)	3	Motor Speed (Low Byte) <I>
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

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

## 7 PROFIBUS-DP Option Data and I/O Maps

### ◆ Supported Parameter Process Data Object (PPO) Type Formats

Set drive parameter F6-32 = “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. Refer to the PROFIBUS specification for more information on PPO types 1~5.

PROFIBUS-DP 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			PZD																						
PKE	IND	PWE	PZD1 STW ZSW	PZD2 HSW HIW	PZD3	PZD4	PZD5	PZD6	PZD7	PZD8	PZD9	PZD10													
PPO TYPE 1: Octet-String 12																									
PPO TYPE 2: Octet-String 20																									
PPO TYPE 3: Octet-String 4																									
PPO TYPE 4: Octet-String 12																									
PPO TYPE 5: Octet-String 28																									

- 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



## 8 Troubleshooting

### ◆ Drive-Side Error Codes

Drive-side error codes appear on the drive LED operator. Causes of the errors and corrective actions are listed in [Table 11](#). For additional error codes that may appear on the LED operator screen, refer to the technical manual for the drive.

#### ■ Faults

bUS (PROFIBUS-DP Option Communication Error) and EF0 (External Fault Input from the PROFIBUS-DP Option) may appear as an alarm or a fault. When a fault occurs, the digital operator LEDs remain lit. When an alarm occurs, the digital operator LEDs flash and the “ALM” light illuminates

If communication stops while the drive is running, check the following items to resolve the fault:

- Is the PROFIBUS-DP Option properly installed?
- Is the communication line properly connected to the PROFIBUS-DP Option? Is it loose?
- Is the controller program working? Has the controller CPU stopped?
- Did a momentary power loss interrupt communications?

**Table 11 Fault Display and Possible Solutions**

LED Operator Display		Fault Name
<i>bUS</i>	bUS	PROFIBUS-DP Option Communication Error
		<ul style="list-style-type: none"> <li>• After establishing initial communication, the connection was lost</li> <li>• Only detected when the run command or frequency reference is assigned to the option (b1-03 = 3 or b1-02 = 3)</li> </ul>
Cause		Possible Solution
Master controller (PLC) has stopped communicating.		Check for faulty wiring.
Communication cable is not connected properly		Correct any wiring problems
A data error occurred due to noise		Check the various options available to minimize the effects of noise. <ul style="list-style-type: none"> <li>• Take steps to counteract noise in the control circuit wiring, main circuit lines, and ground wiring.</li> <li>• If a magnetic contactor is identified as a source of noise, install a surge absorber to the contactor coil</li> </ul> Ground the shield on the controller side and on the PROFIBUS-DP Option side
PROFIBUS-DP Option is damaged.		If there are no problems with the wiring and the error continues to occur, replace the PROFIBUS-DP Option

## 8 Troubleshooting

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

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

LED Operator Display		Fault Name
oFA01	oFA01	PROFIBUS-DP Option Fault (Port A)
		PROFIBUS-DP Option is not properly connected
Cause		Possible Solution
Problem with the connectors between the drive and PROFIBUS-DP Option.		Turn the power off and check the connectors between the drive and PROFIBUS-DP Option.

LED Operator Display		Fault Name
oFA03	oFA03	PROFIBUS-DP Option Fault (Port A)
		PROFIBUS-DP Option self-diagnostics error
Cause		Possible Solution
PROFIBUS-DP Option hardware fault.		Replace the PROFIBUS-DP Option.

LED Operator Display		Fault Name
oFA04	oFA04	PROFIBUS-DP Option Fault (Port A)
		PROFIBUS-DP Option Flash write mode
Cause		Possible Solution
PROFIBUS-DP Option hardware fault.		Replace the PROFIBUS-DP Option.

LED Operator Display		Fault Name
oFA30 to oFA43	oFA30 to oFA43	PROFIBUS-DP Option Fault (port A)
		Communication ID error
Cause		Possible Solution
PROFIBUS-DP Option hardware fault		⇒ Replace the PROFIBUS-DP Option.

### ■ Minor Faults and Alarms

**Table 12 Alarm Display**

LED 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" will be displayed on the operator when the drive is set for control by PROFIBUS-DP and: <ul style="list-style-type: none"> <li>• a conventional data format is used and the operation command bit F is set to 1</li> <li>• a PPO type data format is used the the control word (STW) bit 3 is set to 0</li> </ul>		Set either of the bits depending on which data format is used	No output

LED 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 is faulty, there is a short circuit, or something is not connected properly		Check for wiring errors ⇒ Correct the wiring ⇒ Remove and ground shorts and reconnect loose wires	YES
Programming error on the master side		⇒ Check communications at start-up and correct programming errors	
Communication circuitry is damaged		Perform a self-diagnostics check ⇒ Replace the drive if the fault continues to occur	

# 9 Specifications

### ◆ Specifications

**Table 13 Option Unit Specifications**

Items	Specifications
Model	SI-P3/V-H (PCB model: SI-P3)
PROFIBUS-DP Data	<ul style="list-style-type: none"> <li>• PROFIBUS DP-V0, V1</li> <li>• PPO TYPE: 1~5 (No. 3.072, Profile for Variable Speed Drives)</li> <li>• Extended data 1 High-speed I/O data (inputs: 16 bytes, outputs: 16 bytes) MEMOBUS/Modbus message (inputs: 16 bytes, outputs: 16 bytes)</li> <li>• Extended data 2 High-speed I/O data (inputs: 4 bytes, outputs: 4 bytes) MEMOBUS/Modbus message (inputs: 8 bytes, outputs: 8 bytes)</li> <li>• Basic data High-speed I/O data (inputs: 6 bytes, outputs: 6 bytes)</li> </ul>
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
Humidity	Up to 95% RH (no condensation)
Storage Temperature	-20 °C to +60 °C (allowed for short-term transport of the product)
Area of Use	Indoor (free of corrosive gas, airborne particles, etc.)
Altitude	Up to 1000 m

## 10 Warranty

### ◆ Warranty policy on inverter

Warranty period	The warranty period is 18 months from date of shipment or 12 months after initial operation, whichever comes first.
Warranty condition	<p>In the event that any problem or damage to the Product arises during the "Warranty Period" from defects in the Product whenever the Product is properly installed and combined with the Buyer's equipment or machines maintained as specified in the maintenance manual, and properly operated under the conditions described in the catalog or as otherwise agreed upon in writing between the Seller and Buyer or its customers; the Seller will provide, at its sole discretion, appropriate repair or replacement of the Product without charge at a designated facility, except as stipulated in the "Warranty Exclusions" as described below.</p> <p>However, if the Product is installed or integrated into the Buyer's equipment or machines, the Seller shall not reimburse the cost of: removal or re-installation of the Product or other incidental costs related thereto, any lost opportunity, any profit loss or other incidental or consequential losses or damages incurred by the Buyer or its customers.</p>
Warranty exclusion	<p>Notwithstanding the above warranty, the warranty as set forth herein shall not apply to any problem or damage to the Product that is caused by:</p> <ol style="list-style-type: none"> <li>1. Installation, connection, combination or integration of the Product in or to the other equipment or machine that rendered by any person or entity other than the Seller.</li> <li>2. Insufficient maintenance or improper operation by the Buyer or its customers such that the Product is not maintained in accordance with the maintenance manual provided or designated by the Seller;</li> <li>3. Improper use or operation of the Product by the Buyer or its customers that is not informed to the Seller, including, without limitation, the Buyer's or its customers' operation of the Product not in conformity with the specifications;</li> <li>4. Any problem or damage on any equipment or machine to which the Product is installed, connected or combined or any specifications particular to the buyer or its customers;</li> <li>5. Any changes, modifications, improvements or alterations to the Product or those functions that are rendered on the Product by any person or entity other than the Seller;</li> <li>6. Any parts in the Product that are supplied or designated by the Buyer or its customers;</li> <li>7. Earthquake, fire, flood, salt air, gas, lightning, acts of God or any other reasons beyond the control of the Seller;</li> <li>8. Normal wear and tear, or deterioration of the Product's parts, such as the cooling fan bearings;</li> <li>9. Any other troubles, problems or damage to the Product that are not attributable to the Seller.</li> </ol>
Others	The Seller will not be responsibility for the installation and removal of the inverter. Any inverter transportation cost shall be born by both Seller and Buyer.

# Worldwide Locations

## U.S.A

**Sumitomo Machinery Corporation of America (SMA)**  
4200 Holland Blvd., Chesapeake, VA 23323, U.S.A.  
TEL (1)757-485-3355 FAX (1)757-485-7490

## Canada

**SM Cyclo of Canada, Ltd. (SMC)**  
1453 Cornwall Road, Oakville, Canada ON L6J 7T5  
TEL (1)905-469-1050 FAX (1)905-469-1055

## Mexico

**SM Cyclo de Mexico, S.A. de C.V. (SMME)**  
Av. Desarrollo 541, Col. Finsa, Guadalupe,  
Nuevo León, Mexico, CP67132  
TEL (52)81-8144-5130 FAX (52)81-8144-5130

## Brazil

**Sumitomo Industrias Pesadas do Brasil Ltda. (SHPB)**  
Rodovia do Acucar (SP-075) Km 26  
Itu, Sao Paulo, Brasil  
TEL (55)11-4886-1000 FAX (55)11-4886-1000

## Chile

**SM Cyclo de Chile, Ltda. (SMCH)**  
San Pablo 3507, Quinta Normal, Santiago, Chile  
TEL (56)2-892-7000 FAX (56)2-892-7001

## Argentina

**SM Cyclo de Argentina S.A. (SMAR)**  
Ing. Delapini, 2236 Area de Promocion el Triangulo,  
Paridito Mahinas Argentinas Grand Bourg,  
Buenos Aires, Argentina B1615KGB  
TEL (54)3327-45-4095 FAX (54)3327-45-4099

## Guatemala

**SM Cyclo de Guatemala Ensambladora, Ltda. (SMGT)**  
Parque Industrial Unisor, 0 Calle B 19-50 Zona 3,  
Bodega D-1 Delta Balcenas en Villa Nueva, Guatemala  
TEL (502)6648-0500 FAX (502)6631-9171

## Colombia

**SM Cyclo Colombia, S.A.S.**  
Carrera 11, No.93A-53, Office 203, Bogotá, Colombia  
TEL (57)1-3000673

## Germany

**Sumitomo (SHI) Cyclo Drive Germany GmbH (SCG)**  
Cyclodstraße 92, 85229 Markt Indersdorf, Germany  
TEL (49)8136-66-0 FAX (49)8136-5771

## Austria

**Sumitomo (SHI) Cyclo Drive Germany GmbH (SCG)**  
SCG Branch Austria Office  
Gruentalerstraße 30A, 4020 Linz, Austria  
TEL (43)732-330958 FAX (43)732-331978

## Belgium

**Sumitomo (SHI) Cyclo Drive Germany GmbH (SCG)**  
SCG Branch Benelux Office  
Heikneuterlaan 23, 3010 Kessel-Lo, Leuven, Belgium  
TEL (32)16-60-83-11 FAX (32)16-60-16-39

## France

**SM-Cyclo France SAS (SMFR)**  
8 Avenue Christian Doppler, 77700 Serris, France  
TEL (33)164171717 FAX (33)164171718

## Italy

**SM-Cyclo Italy Srl (SMIT)**  
Via de' Artigianato 23, 20010 Cornaredo (MI), Italy  
TEL (39)293-481101 FAX (39)293-481103

## Spain

**SM-Cyclo Iberia, S.L.U. (SMIB)**  
C/Landabari No. 3, 6° B, 48940 Leioa, Vizcaya, Spain  
TEL (34)9448-05389 FAX (34)9448-01550

## Sweden

**SM-Cyclo Scandinavia AB (SMSC)**  
Industrigatan 21B, 234 35 Lomma, Sweden  
TEL (46)40220030

## United Kingdom

**SM-Cyclo UK Ltd. (SMUK)**  
Unit 29, Bergen Way, Sutton Fields Industrial Estate,  
Kingston upon Hull, HU7 0YQ, East Yorkshire,  
United Kingdom  
TEL (44)1482-790340 FAX (44)1482-790321

## Turkey

**SM-Cyclo Turkey Güç Aktarım Sis. Tic. Ltd. Sti. (SMTR)**  
Büyükdere Çayırbaşı Cd. Dede Yusuf Sk. No:11,  
34453 Sarıyer İstanbul, Turkey  
TEL (90)216-384-4482 FAX (90)216-384-4482

## China

**Sumitomo (SHI) Cyclo Drive China, Ltd. (SCK)**  
11F, SMEG Plaza, No.1386 Hongqiao Road,  
Changning District, Shanghai, China (P.C.200336)  
TEL (86)21-3462-7877 FAX (86)21-3462-7922

## Hong Kong

**SM-Cyclo of Hong Kong Co.,Ltd. (SMHK)**  
Rm 1301, CEO Tower, 77 Wing Hong Street,  
Cheung Sha Wan, Kowloon, Hong Kong  
TEL (852)2460-1881 FAX (852)2460-1882

## Korea

**Sumitomo (SHI) Cyclo Drive Korea, Ltd. (SCK)**  
Royal Bldg. 9F Rm.913, 5 Danju-Dong, Chongro-Ku,  
Seoul, Korea 110-721  
TEL (82)2-730-0151 FAX (82)2-730-0156

## Taiwan

**Tatung SM-Cyclo Co., Ltd. (TSC)**  
22 Chungshan N. Road 3rd., Sec. Taipei, Taiwan 104,  
R.O.C.  
TEL (886)2-2595-7275 FAX (886)2-2595-5594

## Singapore

**Sumitomo (SHI) Cyclo Drive Asia Pacific Pte. Ltd. (SCA)**  
15 Kwong Min Road, Singapore 628718  
TEL (65)6591-7800 FAX (65)6863-4238

## Philippines

**Sumitomo (SHI) Cyclo Drive Asia Pacific Pte. Ltd. (SCA)**  
Philippines Branch Office  
828 Granville Industrial Complex, Carmona, Cavite,  
Philippines  
TEL (63)2-584-4921 FAX (63)2-584-4922  
TEL (63)46-430-3591  
TEL (63)46-482-0580  
TEL (63)46-482-0581

## Vietnam

**SM-Cyclo (Vietnam) Co., Ltd.**  
Factory 2B, Lot K1-2-5, Road No. 2-3-5A,  
Le Minh Xuan Industrial Park, Binh Chanh Dist.,  
HCMC, Vietnam.  
TEL (84)8-37-663-709 FAX (84)8-37-663-710

## Malaysia

**SM-Cyclo of Malaysia Sdn. Bhd. (SMMA)**  
No.7C, Jalan Anggerik Mokara 31/56, Kota Kemuning,  
Seksyen 31, 40460 Shah Alam, Selangor D.E., Malaysia  
TEL (60)3-51210455 FAX (60)3-51210578

## Indonesia

**PT. SM-Cyclo Indonesia**  
Kawasan Industri Lippo Cikarang Jalan Sungkai Blok F 25  
No.09 K Delta Silicon 5 Lippo Cikarang, Bekasi, Indonesia  
TEL (62)21-2961-2100 FAX (62)21-2961-2211

## Thailand

**SM-Cyclo (Thailand) Co., Ltd.**  
195 Empire Tower, 21st Fl., Unit 2103-4, South Sathorn  
Rd.,  
Yannawa Sathorn, Bangkok 10120, Thailand  
TEL (66)2-670-0998 FAX (66)2-670-0999

## Australia

**Sumitomo (SHI) Hansen Australia Pty. Ltd. (SHAU)**  
181 Power Street Glendenning NSW 2761, Australia  
TEL (61)2-9208-3000 FAX (61)2-9208-3050

## India

**Sumi-Cyclo Drive India Pvt. Ltd. (SMIN)**  
Survey No.130, Hissa No.02, Jeevan Nagar, Off Mumbai-  
Bangalore bypass, Tathawade, Pune-411 033, India  
TEL (91)20-6674-2900 FAX (91)20-6674-2901

## Japan

**Sumitomo Heavy Industries, Ltd.**  
ThinkPark Tower, 1-1 Osaki 2-chome, Shinagawa-ku,  
Tokyo 141-6025, Japan  
TEL (81)3-6737-2511 FAX (81)3-6866-5160

Specifications, dimensions, and other items are subject to change without prior notice.

 **Sumitomo Heavy Industries, Ltd.**

**Power Transmission & Controls Group**

Headquarter ThinkPark Tower, 1-1 Osaki 2-chome, Shinagawa-ku, Tokyo 141-6025, Japan

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