

**OPC-PR
OPC-PS
OPC-PSH**

Option Card for SinCos and Serial Communication Encoder

CAUTION

- Deliver this instruction manual without fail to those who actually operate the equipment.
- Read this instruction manual and understand the description before installing, connecting (wiring), operating or performing maintenance and inspection of the option.
- Keep this instruction manual in a safe place until the option is discarded.
- The product is subject to change without prior notice.

Fuji Electric Co., Ltd. INR-SI47-1891aE

1.5 Product Guarantee

The product guarantee term is one year after installation or two years after manufacturing on the nameplate, whichever expires first.
However, the guarantee will not apply in the following cases, even if the guarantee term has not expired.

- The cause includes incorrect usage or inappropriate repair or modification.
- The product is used outside the standard specified range.
- The failure is caused by dropping, damage or breakage during transportation after the purchase.
- The cause is earthquake, fire, storm or flood, lightning, excessive voltage, or other types of disaster or secondary disasters.

2 Specifications

2.1 Storage Environment

2.1.1 Temporary Storage

Store the option card in an environment that satisfies the requirements listed in Table 2.1.

Table 2.1 Environmental Requirements for Storage and Transportation

Item	Requirements
Storage Temperature ¹⁾	-25 to 70°C Location where the option card is not subject to abrupt changes in temperature that would result in the formation of condensation or ice.
Relative humidity	5 to 95% ²⁾
Atmosphere	The inverter must not be exposed to dust, direct sunlight, corrosive or flammable gases, oil mist, vapor, water drops or vibration. The atmosphere must contain only a low level of salt. (0.01 mg/cm ² or less per year)
Atmospheric pressure	86 to 106 kPa (in storage) 70 to 106 kPa (during transportation)

¹⁾ Assuming a comparatively short storage period (e.g., during transportation or the like)

²⁾ Even if the humidity is within the specified requirements, avoid such places where the option card will be subjected to sudden changes in temperature that will cause condensation to form.

Precautions for temporary storage

- Do not leave the inverter directly on the floor.
- If the environment does not satisfy the specified requirements, wrap the option card in an airtight vinyl sheet or the like for storage.
- If the option card is to be stored in an environment with a high level of humidity, put a drying agent (such as silica gel) in the airtight package described in item (2).

2.1.2 Long-term Storage

The long-term storage methods for the inverter vary largely according to the environment of the storage site. General storage methods are described below.

- The storage site must satisfy the requirements specified for temporary storage.
- The inverter must be stored in a package that is airtight to protect it from moisture. Include a drying agent inside the package to maintain the relative humidity inside the package to within 70%.
- If the option card has been installed in the equipment or control board at a construction site where it may be subjected to humidity, dust or dirt, then remove the option card and store it in a suitable environment specified in Table 2.1.

Preface

Thank you for purchasing our OPC-PR/PS/PSH inverter option card. Before using the option card, read this manual carefully to understand how to use the option card correctly. Improper handling blocks correct operation or causes a short life or breakdown. This manual does not describe how to use the inverter. Refer to the FRENIC-Lift Instruction Manual for details about the inverter. Keep this manual on hand for reference when using the option card.

Safely Precautions

Note the following items when using the option card. Improper use may result in unexpected failure, electric shock, or possible injury.

(1) Application

WARNING

- This product must not be used for any life support system or other purpose directly related to human safety.
- Although this product is manufactured under strict quality control, be sure to install appropriate safety devices for applications where drive failure could result in serious accident or material loss.
An accident could occur.

(2) Installation and Wiring

WARNING

- Wait at least five minutes after turning off the power before installing or wiring the option card. Use a circuit tester or similar instrument to check the voltage before performing installation or wiring. (Check whether the charge lamp goes off.) **Otherwise, electric shock may occur.**
- Discharge static electricity from your body before handling the option card. Never touch the option card with wet hands. **Otherwise, accident or electric shock may occur.**
- No foreign matter such as screws, metal patches, lint, chips, and dust in the option card.
There is risk of fire or accident.
- Do not damage or stress the wiring. **Otherwise, accident or electric shock may occur.**
- Do not connect the red lead between the motor and the encoder.
There is a risk of accident.

CAUTION

- Do not install or operate a damaged option card or one that is lacking parts. **Otherwise, an injury may occur.**
- Since noise is generated by the inverter, motor, and wiring, carefully monitor surrounding sensors and devices for abnormal operation. **There is a risk of accident.**

(3) Operation

WARNING

- Check and adjust parameters before operation. Improper parameters may cause an unexpected action for some machines. **There is a risk of accident.**

CAUTION

- High-speed operation can be set easily for the inverter. Fully check motor or device performance before changing the setup. **Otherwise, accident may occur.**

(4) Maintenance and Inspection, and Parts Replacement

WARNING

- Wait at least five minutes after turning off the power before inspecting the option card. (Check whether the charge lamp goes off.) **There is a risk of electric shock.** Only authorized personnel are allowed to maintain and inspect the option card and replace parts. **Otherwise, electric shock or injury may occur.**
- Never modify the option card. **Otherwise, electric shock or injury may occur.**

CAUTION

- Do not execute a megger test (insulation resistance measurement).

2.2 Encoder Installation and Signal

The encoder shall rotate in the direction shown in Figure 3.1 when terminal FWD is ON.

Encoder output pulse is shown in Figure 3.2. Connect the encoder directly to the motor using a coupling.

- If rotation direction is reversed when terminal FWD is ON, setting value of H190 set to 0.

Rotational direction when terminal FWD is ON.

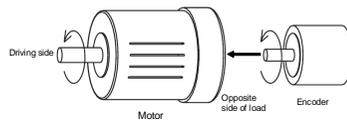


Figure 2.1 Motor and Encoder Rotational Direction when Terminal FWD is ON

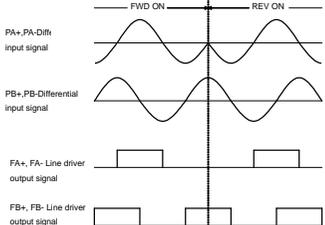


Figure 2.2 Definition of Terminal FWD ON/REV ON

2.3 Plug

Plug specifications

Table 2.1 Plug Specifications

Item	Specifications
Maximum tightening torque	0.339 N · m
Screw size	M2
Bared wire length	7 mm
Maximum wire size	AWG16

(Note) Insert the wire into the upper side of the metal bracket on the terminal block, and tighten the screw.

(5) Discard

CAUTION

- Since the option card uses soldering lead, treat it as an industrial waste when discarding it.

1 General Information

1.1 Introduction to OPC-PR/PS/PSH

This product is an encoder interface card to be installed in the Fuji inverter FRN-LM2. It enables vector control according to feedback signals from the rotary encoder.

1.2 Before Using the Option Card

Check the following items when you receive this product. Also check whether this product has been damaged during transport. If anything is amiss, contact your distributor or your nearest branch office.

- The option card is contained in the package.
- The option card is not damaged during transportation—no defective electronic devices, dents or warps.
- The model name "OPC-PR" or "OPC-PS" or "OPC-PSH" is printed on the option card. (See Figure 1.1.)

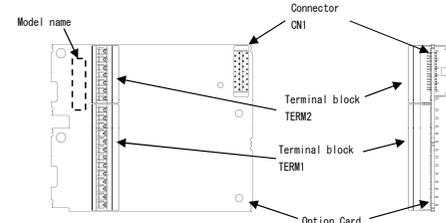


Figure 1.1 Product Appearance.

1.3 Accessories

Confirm that the following accessories are included in the package:

- Instruction Manual 1
- Accessories 1) screw 4

3 Function

3.1 Function Code Setting

CAUTION

- Set the function code in the following order at first.
(1) C21 (2) P01 (3) F03 (4) L31 (5) P02
Because when you change them, some other function codes synchronize and change.
There is a risk of accident or injury.

Set the function code as follows before beginning magnetic pole position offset tuning. (Set in order of the list.)

Code	Name	Data Setting
C21	Unit for Speed Command	Your easy-to-use setting
P01	Motor - Number of poles	Depends on the motor specification
F03	Maximum Speed	Depends on the motor specification
L31	Elevator Parameter - Speed	Depends on the elevator specification
P02	Motor - Rated capacity	Depends on the motor specification

Code	Name	Data Setting			
F04	Rated Speed	Depends on the motor specification			
F05	Rated Voltage at Rated Speed	Depends on the motor specification			
F42	Control Mode	0 (Induction motor - Vector control with encoder) 1 (PM motor - Vector control with encoder)			
L01	Pulse encoder - System	Setting value	OPC-PR	OPC-PS	OPC-PSH
		4 (EnDat)	N/A	A	A
		5 (SinCos)	A	N/A	N/A
		6 (BiSS-C)	N/A	A	A
		7 (SSI)	N/A	A	A
8 (HiPerface)	N/A	N/A	A		
L02	Pulse encoder - Resolution	Depends on the encoder specification			

Code	Name	Data Setting
L201	AB pulse output rate	Specifies pulse amount per 1 mechanical rotation. (1 pulse = 4 counts)
L202	AB pulse output mode	0 same phase output 1 opposite phase output
L203	Z pulse output enable	0 (Disable) 1 (Enable)
L204	Reserved for particular manufacturer	Do not change from default value.
L205	AB pulse output hysteresis enable	0 (Disable) 1 (Enable)
L207 - L208	Reserved for particular manufacturer	Do not change from default value.
L209	Encoder Serial communication (number of ST bits)	Depends on the encoder specification. (OPC-PS/PSH)
L210 - L219	Reserved for particular manufacturer	Do not change from default value.

1.4 Installation Procedure

WARNING

- Turn off the power and wait for at least five minutes before starting installation. Further, check that the LED monitor is unlit and check that the DC link bus voltage between the P (+) and N (-) terminals is lower than 25 VDC.
Otherwise, electric shock could occur.

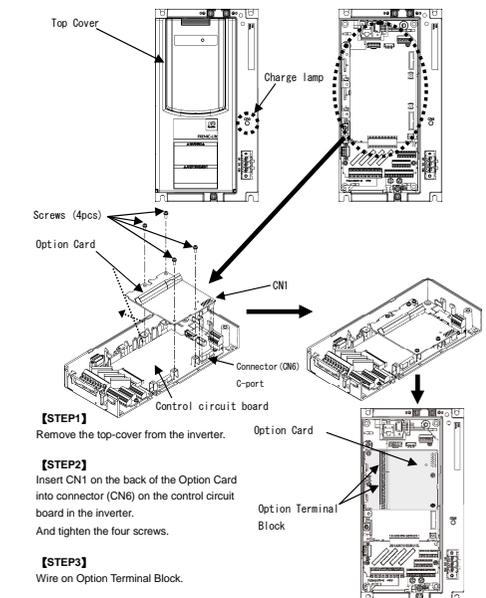


Figure 1.2 Installation Drawing

4 Specification For OPC-PR

4.1 Applicable Encoder For OPC-PR

CAUTION

Check the encoder specification again before operating the inverter. Improper encoder specification may cause unexpected inverter operation or device operation.
There is a risk of accident or injury.

4.1.1 Specifications of Applicable Encoder

Item	Specifications	
	Table 4.1	Table 4.2
Application encoder	Incremental signals	2 sinusoidal signals A and B as sine and cosine - Signal level : 0.6Vpp to 1.2Vpp - Phase angle : 90 degree ±10 degree
	Rotor Position Detection	2 sinusoidal signals C and D as sine and cosine with one period per revolution - Signal level : 0.6Vpp to 1.2Vpp - Phase angle : 90 degree ±10 degree
Encoder power supply	+5 VDC (5 VDC ±5%/200 mA)	
Encoder model	HEIDENHAIN ERN1387 or its equivalent	

4.1.2 Terminal Function and Specifications For OPC-PR

Abbreviation	Terminal name	Terminal function	Electric specifications
SD	Shield	Shield of encoder cable	Connect shield cable
PO	Power supply for encoder	Terminal which supplies power for encoder	- 5 VDC±5%, Max. 200 mA - Allowable wiring length: 0 to 10 m. One wire each for PO and CM line
CM	Common terminal of power supply		0 to 20 m. Two wire each for PO and CM line
PA+	The A phase input terminal (non-inverting)	The A phase input the amplitude and the frequency change depending on the speed of the motor.	Input frequency Max. 50 kHz Differential input signal : PA(+) - PA(-), PB(+), PB(-)
PA-	The A phase input terminal (inverting)		
PB+	The B phase input terminal (non-inverting)	The B phase input the amplitude and the frequency change depending on the speed of the motor.	0.6V to 1.2V
PB-	The B phase input terminal (inverting)		
PC+	The C phase input terminal (non-inverting)	The C phase input the amplitude and the frequency change depending on the speed of the motor.	Input frequency Max. 1k Hz Differential input signal : PC(+) - PC(-), PD(+), PD(-)
PC-	The C phase input terminal (inverting)		
PD+	The D phase input terminal (non-inverting)	The D phase input the amplitude and the frequency change depending on the speed of the motor.	0.6V to 1.2V
PD-	The D phase input terminal (inverting)		
FA+	The A phase pulse output	The pulses with same frequency as the A phase input are output.	- line driver output - Output voltage : Max. 5.25 V - Maximum frequency: 10kHz Set data value of L201 to output 10kHz or less. If it is set over 10kHz, it may output incorrect pulse. Output frequency is calculated from the following equation. $motor\ rotation\ speed(r/min) \times data\ value\ of\ L201 / 60$
FB+	The B phase pulse output	The pulses with same frequency as the B phase input are output.	
FZ+	The Z phase pulse output	The pulses with same frequency as the Z phase input are output.	

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4.1.3 Terminal Arrangement For OPC-PR

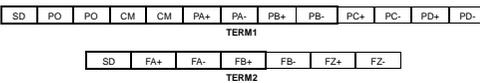


Figure 4.1 Terminal Arrangement of OPC-PR

4.2 Wiring For OPC-PR

CAUTION

Check the wiring again before operating the inverter. Improper wiring may cause unexpected inverter operation or device operation.
There is a risk of accident or injury.

4.2.1 Wiring Length and Cable Size For OPC-PR

Table 4.3 Maximum Wiring Length

Item	Specifications
Maximum wiring length between option card and encoder	20 m*
Maximum wiring length between option card (terminals FA+, FB+, and FZ+) and user controller	5 m

*If the wiring length is 10m or more, connect 5V sensor and 0V sensor.
*The wiring of the option card and encoder must use the shield wire.
Connect shield of the wire to terminal CM of this option card.

Wiring for the encoder option card and encoder
The encoder connection cable must use cable made by HEIDENHAIN 17 pin (4 x 0.14) + (2 x 0.14) + (4 x 0.5) mm.
Connect 0.5 mm² with PO and terminal CM of the option card.

Table 4.4 Terminal Wiring of OPC-PR

Terminal name	Wiring color	Encoder side symbol	Note
PO	blown / green	5V Up	
	blue	5V sensor	Connect when the wiring length is 10 m or more.
CM	white / green	0V Un	
	white	0V sensor	Connect when the wiring length is 10 m or more.
PA+	green / black	A+	
PA-	yellow / black	A-	
PB+	blue / black	B+	
PB-	red / black	B-	
PC+	gray	C+	
PC-	pink	C-	
PD+	yellow	D+	
PD-	purple	D-	

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4.3 Basic Wiring Diagram For OPC-PR

CAUTION

Keep the power supply voltage of encoder in the specification voltage of encoder.
There is a risk of failure.
Separate the wiring of the option card and the wiring of other power lines to prevent the malfunction by the noise.
Never put them in the same duct.
There is a risk of accident.

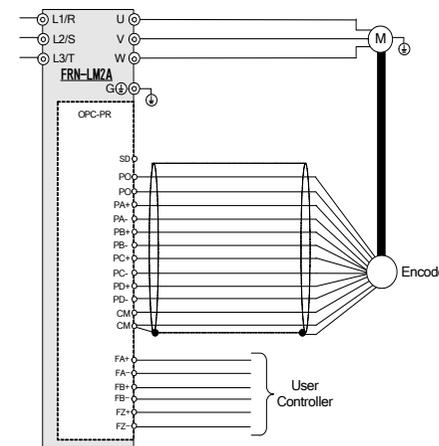


Figure 4.2 Basic Wiring Diagram

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5 Specification For OPC-PS and OPC-PSH

5.1 Applicable Encoder For OPC-PS and OPS-PSH

CAUTION

Check the encoder specification again before operating the inverter. Improper encoder specification may cause unexpected inverter operation or device operation.
There is a risk of accident or injury.

Table 5.1 Applicable encoder for OPC-PS and OPC-PSH

Application encoder	Data interface of encoder			
	Endat2.1	SSI	BiSS-C	Hiperface*1
OPC-PS	Applicable	Applicable	Applicable	Not applicable
OPC-PSH	Applicable	Applicable	Applicable	Applicable

*1 If encoder of Hiperface use, switch SW1 located on OPC-PSH to 8V.

5.1.1 Specifications of Applicable Encoder Endat2.1

This card is only for the absolute encoder with serial interface Endat2.1.

Table 5.2 specification of applicable encoder Endat2.1

Item	Specification
Data interface	Endat2.1
Encoder power supply	+5Vdc (5Vdc±5%/200mA)
Code signal	Differential line driver/receiver
Encoder model	E.g. HEIDENHAIN ECN1313

5.1.2 Specifications of Applicable Encoder SSI

This card is only for the absolute encoder with serial interface SSI.

Table 5.3 specification of applicable encoder SSI

Item	Specification
Data interface	SSI
Encoder power supply	+5Vdc (5Vdc±5%/200mA)
Code signal	Differential line driver/receiver
Encoder model	E.g. HEIDENHAIN ECN1313

5.1.3 Specifications of Applicable Encoder BiSS-C

This card is only for the absolute encoder with serial interface BiSS-C.

Table 5.4 specification of applicable encoder BiSS-C

Item	Specification
Data interface	BiSS-C
Encoder power supply	+5Vdc (5Vdc±5%/200mA)
Code signal	Differential line driver/receiver
Encoder model	E.g. Kubler SineX 5873

5.1.4 Specifications of Applicable Encoder Hiperface

This card is only for the absolute encoder with serial interface Hiperface.

Table 5.5 specification of applicable encoder Hiperface

Item	Specification
Data interface	Hiperface
Encoder power supply	+8Vdc (8Vdc±5%/200mA)
Code signal	Differential line driver/receiver
Encoder model	E.g. SICK SR550

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5.1.5 Terminal Function and Specifications For OPC-PS and OPC-PSH

Table 5.6 Terminal Function and Electrical Specifications of OPC-PS and OPC-PSH

Abbreviation	Terminal name	Terminal function	Electric specifications
SD	Shield	Shield of encoder cable	Connect shield cable
PO	Power supply for encoder	Terminal which supplies power for encoder	- In case of OPC-PS 5 VDC±5%, Max. 200 mA - In case of OPC-PSH 5 VDC±5% or 8VDC±5%, Max. 200 mA - Allowable wiring length for Endat2.1 and SSI: 0 to 10 m. One wire each for PO and CM line - Allowable wiring length for BiSS-C and Hiperface is 20m.
CM	Common terminal of power supply		0 to 20 m. Two wire each for PO and CM line
PA+	The A phase input terminal (non-inverting)	The A phase input the amplitude and the frequency change depending on the speed of the motor.	Input frequency Max. 50 kHz Differential input signal : PA(+) - PA(-), PB(+), PB(-)
PA-	The A phase input terminal (inverting)		
PB+	The B phase input terminal (non-inverting)	The B phase input the amplitude and the frequency change depending on the speed of the motor.	0.6V to 1.2V
PB-	The B phase input terminal (inverting)		
CK+	Communication clock (non-inverting)	Clock transmission	
CK-	Communication clock (inverting)		RS485 conforming
DT+	Communication data (non-inverting)	Data sending and receiving	
DT-	Communication data (inverting)		
FA+	The A phase pulse output	The pulses with same frequency as the A phase input are output.	- line driver output - Output voltage : Max. 5.25 V - Maximum frequency: 10kHz
FB+	The B phase pulse output	The pulses with same frequency as the B phase input are output.	Set data value of L201 to output 10kHz or less. If it is set over 10kHz, it may output incorrect pulse. Output frequency is calculated from the following equation. $motor\ rotation\ speed(r/min) \times data\ value\ of\ L201 / 60$
FZ+	The Z phase pulse output	The pulses with same frequency as the Z phase input are output.	

5.1.6 Terminal Arrangement For OPC-PS and OPC-PSH

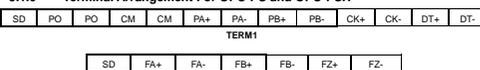


Figure 5.1 Terminal Arrangement of OPC-PS and OPC-PSH

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5.2 Wiring For OPC-PS and OPC-PSH

CAUTION

Check the wiring again before operating the inverter. Improper wiring may cause unexpected inverter operation or device operation.
There is a risk of accident or injury.

5.2.1 Wiring Length and Cable Size For OPC-PS and OPC-PSH

Table 5.7 Maximum Wiring Length

Item	Specifications
Maximum wiring length between option card and encoder	20 m*
Maximum wiring length between option card (terminals FA+, FB+, and FZ+) and user controller	5 m

*If the wiring length is 10m or more, connect 5V sensor and 0V sensor.
*The wiring of the option card and encoder must use the shield wire.
Connect shield of the wire to terminal CM of this option card.

Wiring for the encoder option card and encoder
The encoder connection cable must use cable made by HEIDENHAIN 17 pin (4 x 0.14) + (2 x 0.14) + (4 x 0.5) mm.
Connect 0.5 mm² with PO and terminal CM of the option card.

Table 5.8 Terminal Wiring of each encoder

Terminal name	Endat2.1 and SSI		BiSS-C		Hiperface	
	Wiring color	Encoder side symbol	Wiring color	Encoder side symbol	Wiring color	Encoder side symbol
PO	brown / green	5V Up	brown	+V	red	U
CM	blue	5V sensor*	-	-	-	-
	white / green	0V Un	white	0V	blue	GND
PA+	green / black	A+	black	A	pink	+COS
	yellow / black	A-	purple	A-	black	RECCOS
PB+	blue / black	B+	gray / pink	B	white	+SIN
	red / black	B-	red / blue	B-	brown	RESIN
CK+	purple	CLOCK	green	C+	-	-
CK-	yellow	CLOCK	yellow	C-	-	-
DT+	gray	DATA	gray	D+	gray or yellow	Data+
DT-	pink	DATA	pink	D-	green or purple	Data-

*Connect when the wiring length is 10 m or more.

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5.3 Basic Wiring Diagram For OPC-PS and OPC-PSH

CAUTION

Keep the power supply voltage of encoder in the specification voltage of encoder.
There is a risk of failure.
Separate the wiring of the option card and the wiring of other power lines to prevent the malfunction by the noise.
Never put them in the same duct.
There is a risk of accident.

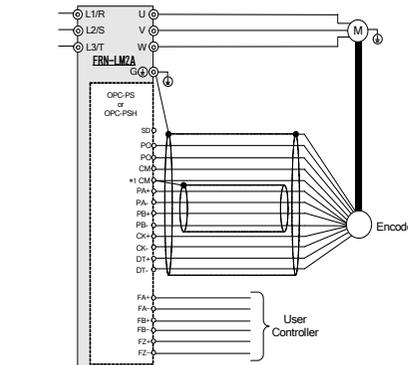


Figure 5.2 Wiring Diagram for OPC-PS and OPC-PSH

*1 If encoder is Endat2.1 or SSI, use double shield cable and connect shield to CM.



Figure 5.3 Connecting shield cable to ground

Connect shield to point where it is shown in Figure 5.3.

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5.4 Setting up the slide switch For OPC-PSH

WARNING

Wait at least five minutes after turning off the power before changing the switch.
Use a circuit tester or similar instrument to check the voltage before changing the switch.
(Check whether the charge lamp goes off.) Otherwise, electric shock may occur.

Switching the slide switch located on OPC-PSH allows you to switch the power supply of encoder to 5V or 8V. The location of this switch is shown in Figure 5.4. To access the slide switch, remove the front cover so that you can see OPC-PSH.

Table 5.9 list the function of slide switch.

Slide Switch	Function
SW1	Switch the power supply of encoder to 5V or 8V. This power supply is outputted from PO terminal. Factory default : 5V

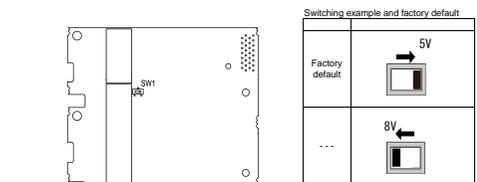


Figure 5.4 Location of the Slide Switch on OPC-PSH

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