Fuji Electric OPC-LM1-PR Encoder Interface Card Inverter Instruction Manual

Fuji Electric OPC-LM1-PR Encoder Interface Card Inverter

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.

Contents

Preface

Thank you for purchasing our OPC-LM1-PR 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 statistic 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 reducer 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 fo r 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 c hanging 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).

5. Discard

CAUTION

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

General Information

Introduction to OPC-LM1-PR

This product is an encoder interface card to be installed in the Fuji inverter FRENIC-Lift. It enables vector control according to feedback signals from the HEIDENHAIN rotary encoder (ERN1387).

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.

1. The option card is contained in the package.
2. The option card is not damaged during transportation–no defective electronic devices, dents or warps.
3. The model name “OPC-LM1-PR” is printed on the option card. (See Figure 1.1.)

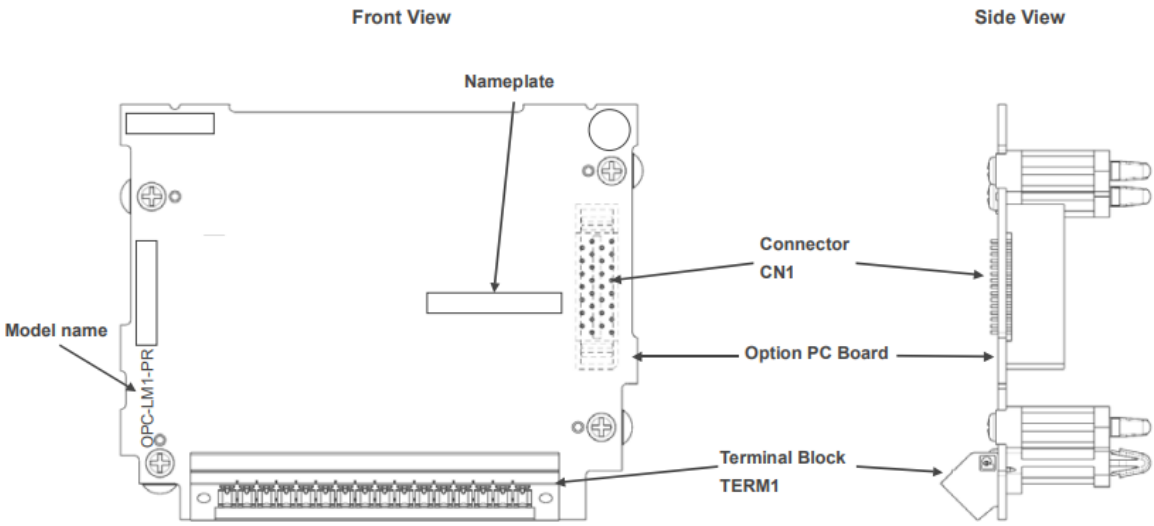


Figure 1.1 Product Appearance.

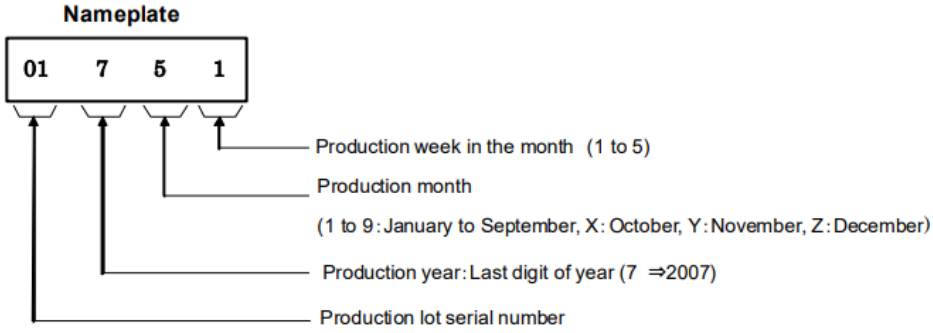


Figure 1.2 Nameplate

Accessories

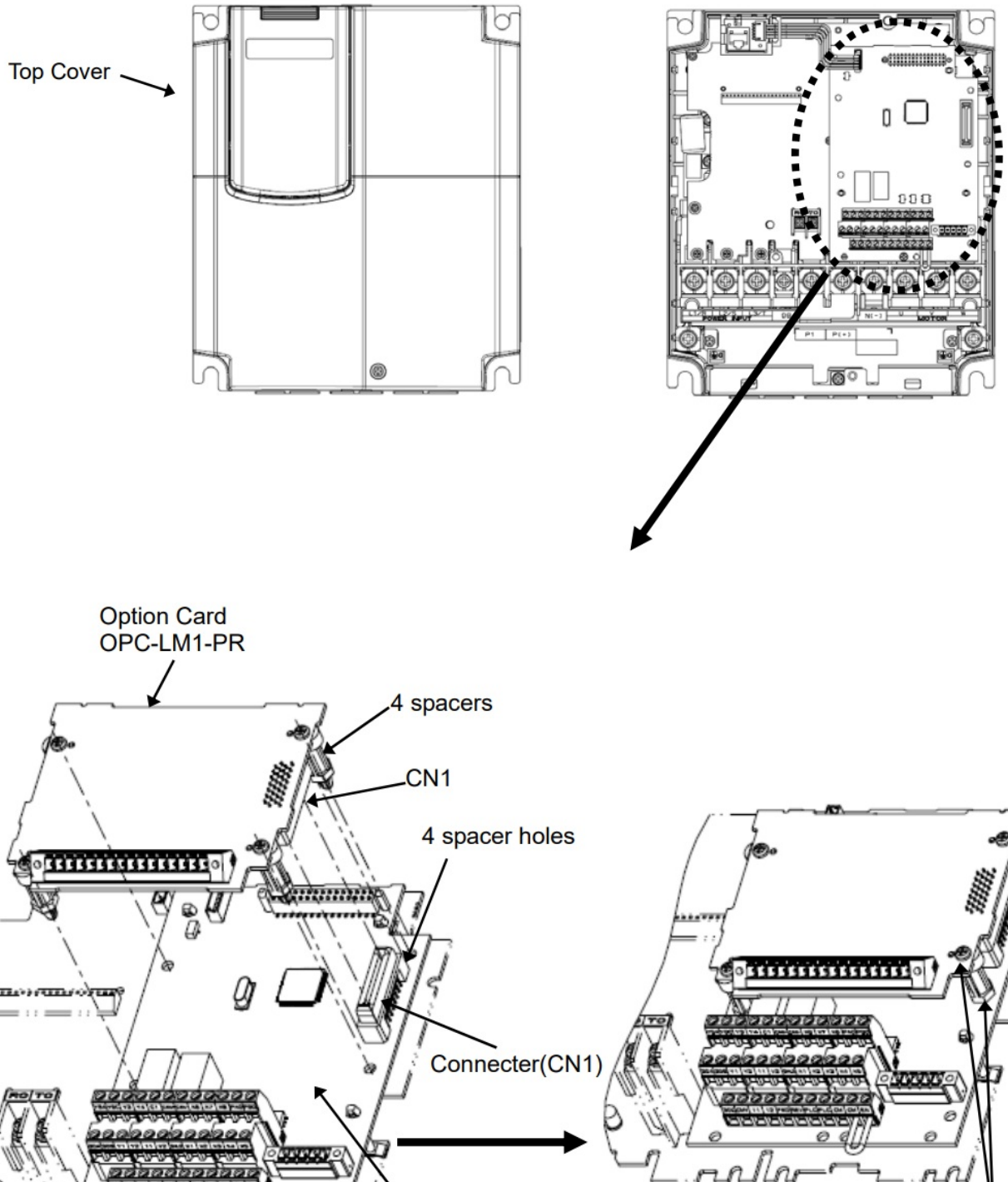
Confirm that the following accessories are included in the package:

1. Instruction Manual 1
2. Accessories 1) Plug for TERM1 1

Installation Procedure

WARNING

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


Top Cover
Option Card
OPC-LM1-PR
4 spacers
CN1
4 spacer holes
Connecter(CN1)
Control circuit board

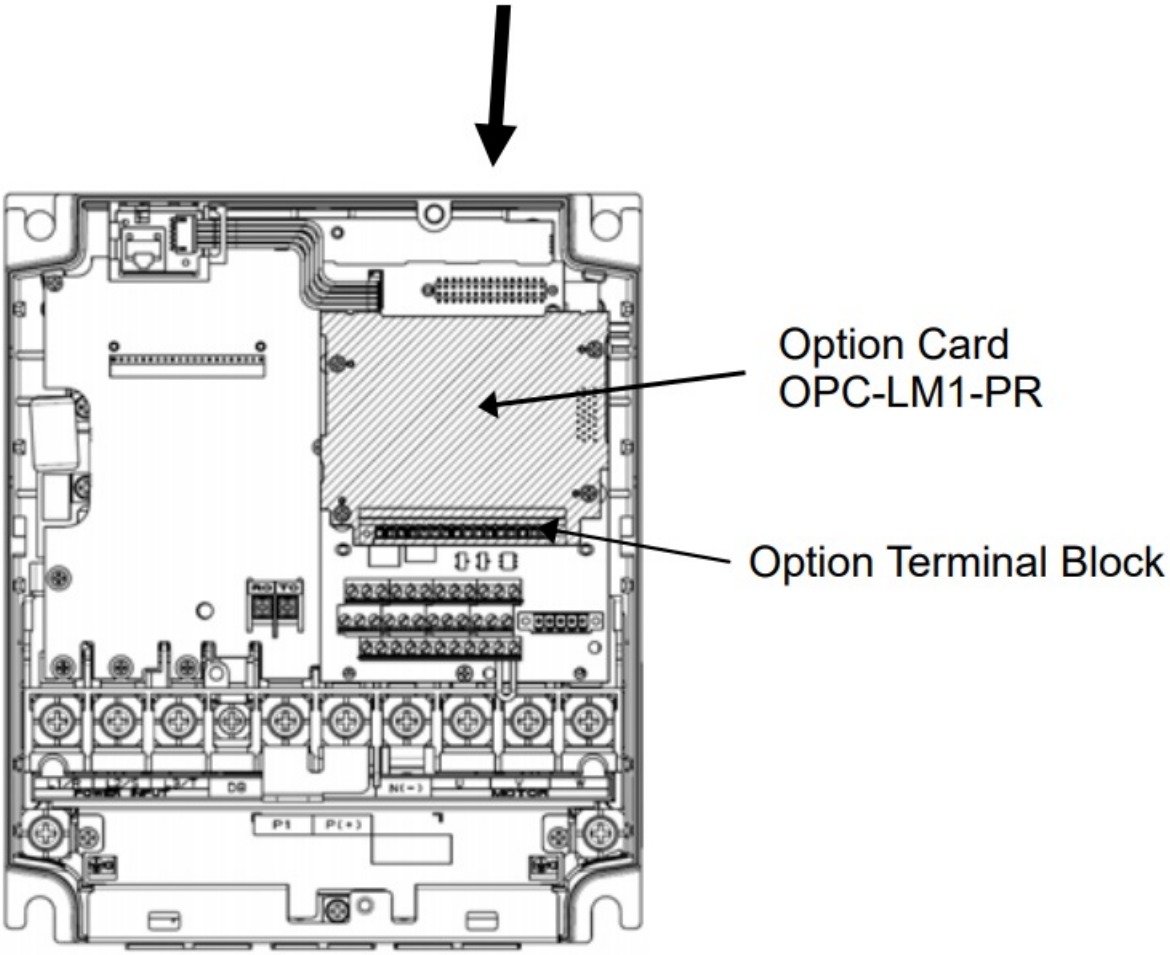


Figure 1.3 Installation Drawing

CAUTION
Make sure there is no idle gap between the spacers and the printed circuit board and OPC-LM1-PR card. (Altog ether 8 places) There is a risk of damage.

STEP1 Remove the top-cover from the inverter.
STEP2 Insert the four spacers and CN1 on the back of the OPC-LM1-PR into the spacer holes and connector (CN1) on the control circuit board in the inverter. Visually check that the spacers and CN1 are firmly inserted.
STEP3 Wire on OPC-LM1-PR.
STEP4 Put the top-cover back to the inverter.

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.

1. The cause includes incorrect usage or inappropriate repair or modification.
2. The product is used outside the standard specified range.

3. The failure is caused by dropping, damage or breakage during transportation after the purchase.
4. The cause is earthquake, fire, storm or flood, lightening, excessive voltage, or other types of disaster or secondary disasters.

Specifications

Storage Environment

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

1. Do not leave the inverter directly on the floor.
2. If the environment does not satisfy the specified requirements, wrap the option card in an airtight vinyl sheet or the like for storage.
3. 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).

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.

1. The storage site must satisfy the requirements specified for temporary storage.

2. 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%.
3. 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.

Operating Environment

Install the inverter in an environment that satisfies the requirements listed in Table 2.2.

Table 2.2 Environment Requirements

Item	Specifications
Location	Indoors
Ambient temperature	-10 to 45°C
Relative humidity	5 to 95% (No condensation)
Atmosphere	The option card must not be exposed to dust, direct sunlight, corrosive gases, flammable gas, oil mist, vapor or water drops. The atmosphere must contain only a low level of salt. (0.01 mg/cm^2 or less per year) The inverter must not be subjected to sudden changes in temperature that will cause condensation to form.
Altitude	1,000 m max. (Note)
Vibration	3 mm (Max. amplitude) 2 to 9 Hz, 9.8 m/s^2 9 to 20 Hz, 2 m/s^2 20 to 55 Hz 1 m/s^2 55 to 200 Hz

(Note) If you use the inverter in an altitude above 1000 m, you should apply an output current derating factor as listed in Table 2.3.

Table 2.3 Output Current Derating Factor in Relation to Altitude

Altitude	Output current derating factor
1000 m or lower	1.00
1000 to 1500 m	0.97
1500 to 2000 m	0.95
2000 to 2500 m	0.91
2500 to 3000 m	0.88

Terminal Arrangement

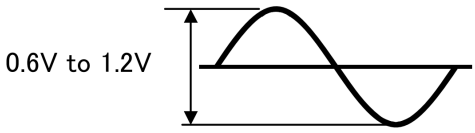
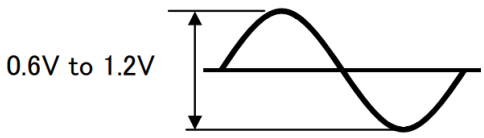
PO	PO	CM	CM	CM	PA+	PA-	PB+	PB-	PC+	PC-	PD+	PD-	FPA	FPB	CM

TERM1

Figure 2.1 Terminal Arrangement

Terminal Function and Specifications

Table 2.4 Terminal Function and Electrical Specifications of OPC-LM1-PR

<table>
<tr><th>Abbreviation</th><th>Terminal name</th><th>Terminal function</th><th>Electric specifications</th></tr>
<tr><td>PO</td><td>Power supply for encoder</td><td rowspan="2">Terminal which supplies power for encoder</td><td rowspan="2">• 5 VDC±5%, Max. 300 mA
• 5 VDC±5% Allowable wiring length. 0 to 10 m One wire each for PO and CM line 0 to 20 m Two wire each for PO and CM line</td></tr>
<tr><td>CM</td><td>Common terminal of power supply</td></tr>
<tr><td>PA+</td><td>The A phase input terminal (non-inverting)</td><td rowspan="2">The A phase input the amplitude and the frequency change depending on the speed of
the motor.</td><td rowspan="4">• Input frequency Max. 50 kHz
• Differential input signal PA(+) – PA(-), PB(+) – PB(-) 0.6V to 1.2V
  </td></tr>
<tr><td>PA-</td><td>The A phase input terminal (inverting)</td></tr>
<tr><td>PB+</td><td>The B phase input terminal (non-inverting)</td><td rowspan="2">The B phase input the amplitude and the frequency change depending on the speed of
the motor.</td></tr>
<tr><td>PB-</td><td>The B phase input terminal (inverting)</td></tr>
<tr><td>PC+</td><td>The C phase input terminal (non-inverting)</td><td rowspan="2">The C phase input the amplitude and the frequency change depending on the speed of
the motor.</td><td rowspan="4">• Input frequency Max. 24.4 Hz
• Differential input signal PC(+) – PC(-), PD(+) – PD(-) 0.6V to 1.2V
  </td></tr>
<tr><td>PC-</td><td>The C phase input terminal(inverting)</td></tr>
<tr><td>PD+</td><td>The D phase input terminal (non-inverting)</td><td rowspan="2">The D phase input the amplitude and the frequency change depending on the speed of
the motor.</td></tr>
<tr><td>PD-</td><td>The D phase input terminal(inverting)</td></tr>
<tr><td>FPA</td><td>The A phase pulse output</td><td>The pulses with same frequency as the A phase input are output.</td><td rowspan="2">• Transistor output (Open collector)
• Operation voltage of OFF level : Max. 27 V
• Operation voltage of ON level : Max. 2.0 V
• Load current at ON : Max. 50 mA
• Leakage current at OFF : Max. 200mA</td></tr>
<tr><td>FPB</td><td>The B phase pulse output</td><td>The pulses with same frequency as the B phase input are output</td></tr>
</table>

(Note) It is recommended that terminals FPA and FPB are pulled up with lowest value of resistor with the sink current not exceeding 50 mA when terminals FPA and FPB are used.

Applicable Encoder

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

Specifications of Applicable Encoder

Table 3.1 Specifications of Applicable Encoder

Item		Specifications
Application encoder	Incremental signals	2 sinusoidal signals A and B as sine and cosine with 2048 periods per re volution
	Rotor Position Detectio n	2 sinusoidal signals C and D as sine and cosine with one period per revolution
	Encoder power supply	+5 VDC (5 VDC ±5%/300 mA)
	Encoder model	HEIDENHAIN ERN1387 or its equivalent

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 the encoder is installed to the motor in opposite side of load and the inverter and the motor are wired with UVW order, in the case of JEC standard motor, the rotation is same as shown in Figure 3.1. However in the case of IEC standard motor, the rotation direction becomes opposite. In the case of IEC standard motor, interchange V with W of inverter output and make the motor and encoder rotation direction as shown in Figure 3.1.

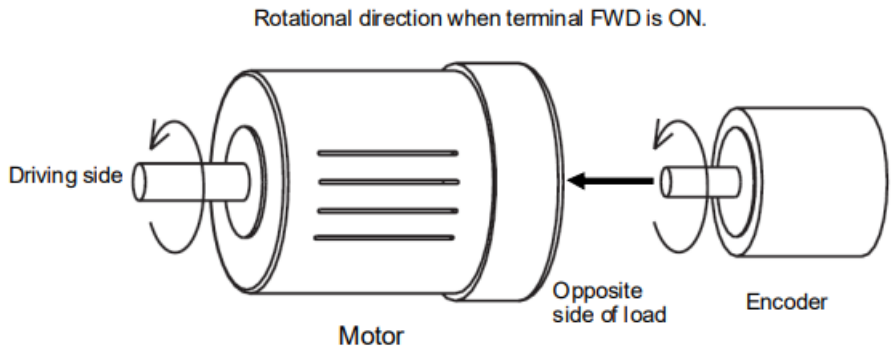


Figure 3.1 Motor and Encoder Rotational Direction when Terminal FWD is ON

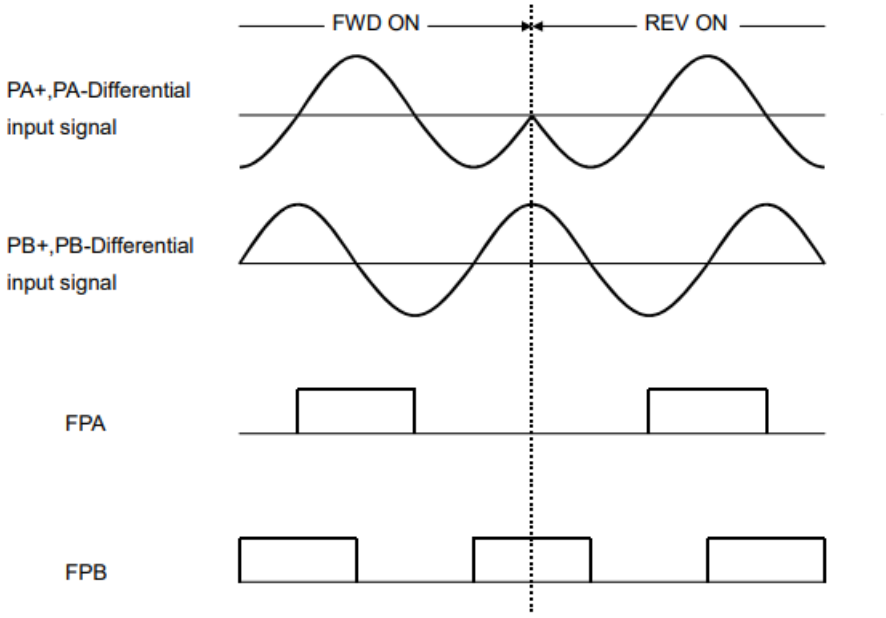


Figure 3.2 Definition of Terminal FWD ON/REV ON

Wiring

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.

Wiring Length and Cable Size

Table 4.1 Maximum Wiring Length

Item	Specifications
Maximum wiring length between option card and encoder	20 m*
Maximum wiring length between option card (terminals FPA and FPB) and user controller	5 m

*If the wiring length is 10m or more, connect 5V sensor and 0V sensor.

Wiring for the encoder option card and encoder

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

Table 4.2 Terminal Wiring of OPC-LM1-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-	

Wiring of the option card and the encoder

- The wiring of the option card and encoder must use the shield wire. Moreover, the cable length is 20 m or less.

- Connect shield of the wire to terminal CM of this option card.
- 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.

Plug

Applicable terminal plugs
The terminal block for encoder connection is removable type.
The plug (electric wire connection side) is provided as an accessory of the option card.

Table 4.3 Applicable Plug Model

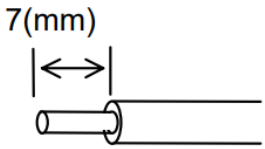
Terminal Block	Terminal Plugs Type	Manufacturer
TERM1	MC1.5/16-STF-3.81	Phoenix Contact

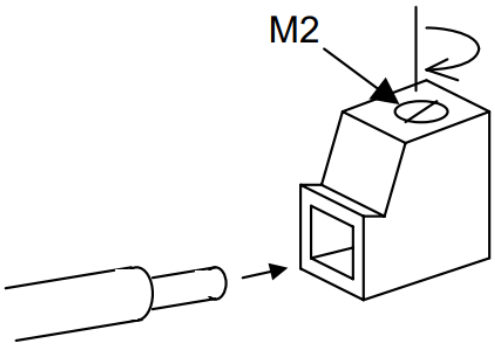
Plug specifications

Table 4.4 Plug Specifications

Item	Specifications
Tightening torque	0.22 to 0.25 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.





Connection of Wiring on Option Terminal Side.

Basic Wiring Diagram

CAUTION
• Keep the power supply voltage of encoder in the specification voltage of encoder. There is a risk of failure.

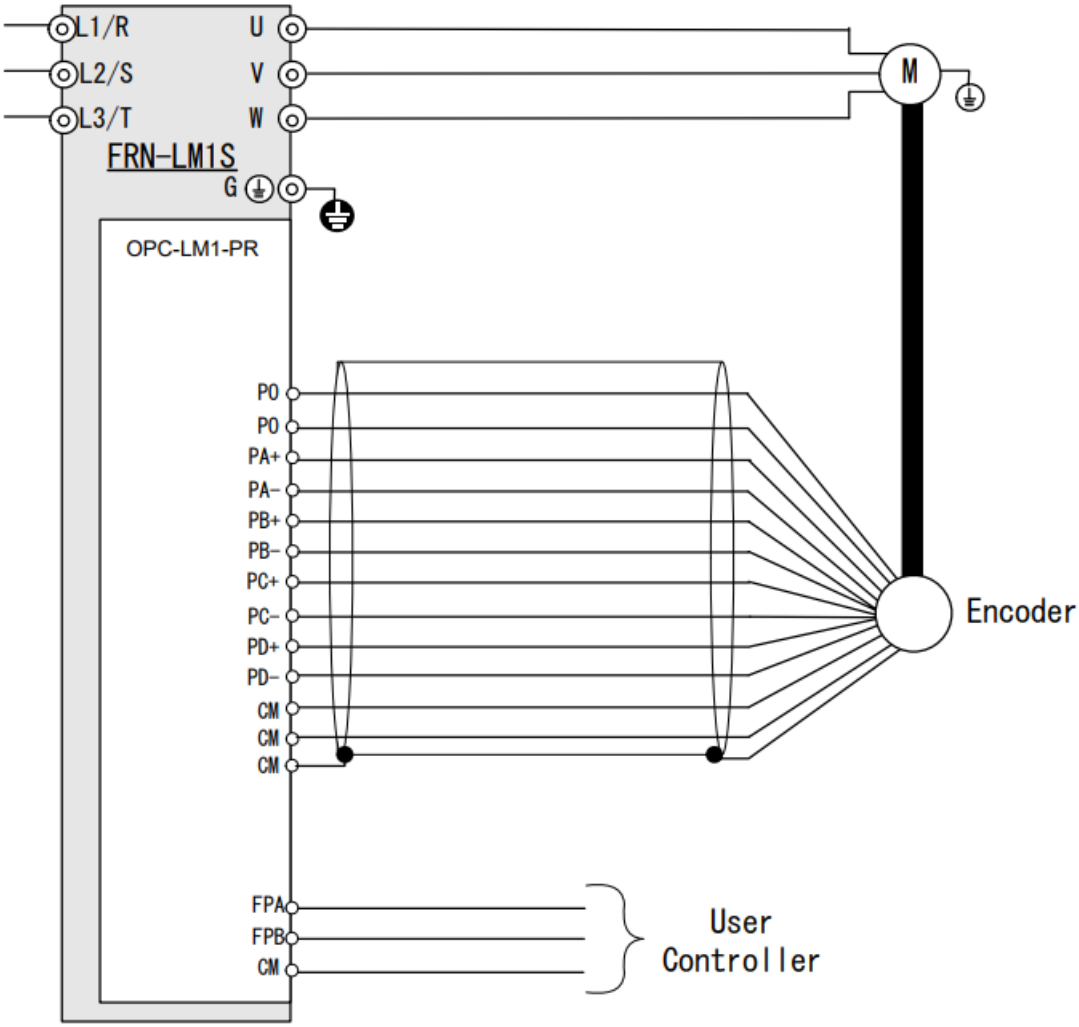


Figure 4.1 Basic Wiring Diagram

Function

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
F03	Maximum Speed	Depends on the motor
L31	Elevator Parameter – Speed	Depends on the elevator
P02	Motor – Rated capacity	Depends on the motor

Code	Name	Data Setting
F04	Rated Speed	Depends on the motor
F05	Rated Voltage at Rated Speed	Depends on the motor
F42	Control Mode	1 (PM motor – Vector control with encoder)
P03	Motor – Rated current	Depends on the motor
P07	Motor – %R1	Set %R of the motor.(Set 5% when %R is an uncertainty.)
L01	Pulse encoder – System	5
L02	Pulse encoder – Resolution	Depends on the encoder
L36	ASR – P – Constant at high speed	2.0 (It is necessary to adjust)
L38	ASR – P – Constant at low speed	2.0 (It is necessary to adjust)

Procedure of Magnetic Pole Position Offset Tuning

You have to execute the tuning as follows before driving motor.
Please inquire of the maker if tuning is impossible normally.

Tuning Mode (Function code L03)
Tuning mode is selected by function code L03 as follows. Usually, it is selected according to the tuning procedure.

1 : Tuning operation
2 : do not use this.
3 : Tuning operation with checking accuracy (Er7 occurs if tuning accuracy is not good.)
4 : Reserved for particular manufactures (Do not access this function code.)
5 : Tuning operation with motor rotation.

Tuning Condition
The recommended condition is following.

1. The rotor is fixed by engaging the mechanical brake. (In the case of L03=1 or L03=3.)
   If it is impossible to fix the rotor, it is acceptable even if the rotor is free. (In this case, if the torque bias has been set, cancel it.)
2. Encoder abnormality detection is effective. (It is effective in the initial condition as follows. L90=1, L91=10%, L92=0.5)
3. Only in case that the brake can be released, the motor is fixed and the load is removed from the motor, L03=5 is allowed to execute.

Tuning procedure
L03=3 is recommended. The tuning procedure is as follows.

1. Apply the brakes, and fix the rotor. It is acceptable without the brake in the case of the tuning at the motor unit.
2. Confirm the motor is connected with the inverter. Turn on MC during the tuning if there is MC between the inverter
   and the motor. Turn on EN terminal.
3. If you use Multi Function Key Pad (MFKP), we recommend local mode. Keep pushing the “REM/LOC” key of MFKP until the indicator “REM” change into “LOC”.
4. Execute the tuning with the function code L03=3. Select “1 DATA SET” in the program mode of MFKP, and change the function code L03 to “3” and set with the
   “FUNC/DATA” key. When the “FWD” key is pushed, the tuning is begun. “EXECUTING” is displayed in the monitor of MFKP during the tuning.
   When “EXECUTING” disappeared, it is the end of tuning. L03 automatically returns to “0”. The tuning result is stored in function code L04. Please confirm it and write down the value. Rarely there is a motor that cannot use the tuning of L03=3. Execute the tuning of L03=1 or L03=5 if the tuning error occurs during the tuning of L03=3.
5. Drive in the normal mode. The recommended procedure is as follows.
   1) Set the reference speed to around 10% of motor rated speed, and push the “FWD” key.
   2) Make the motor rotate more than one rotation, and push the “STOP” key.
   3) After the motor stops, push the “REV” key.
   4) Make the motor rotate more than one rotation.
   5) Push the “STOP” key. After the motor stopped, the reference speed returns to 0.

If the motor has not been rotated, execute the following contents.

1) Confirm whether the function code is correctly set.

2) Confirm the wiring between an encoder and option card.

3) Match the instructed rotation of the motor and the encoder.(Confirm whether the encoder and the motor are in

the state of “3.2 Encoder Installation and Signal”.)

If there is a cause in 1) to 3), after correcting them, execute the tuning again from the start of the procedure.

If you cannot find the cause, replace the wiring “V” and “W” of the inverter output. After that execute the tuning from the start of the procedure.

6. Turn off the power supply and turn on again. Confirm it is possible to drive normally.
   If it is possible to drive, the tuning is completed.
   If the motor has not rotated normally, it has miss wiring in the wiring for the magnetic pole position detection signal of encoder(C and D).
   Try to wire correctly, and execute the tuning again from the beginning.

In the case of L03=5

1. Make the motor a stand alone and release the mechanical brake. (Refer to (3) of 2.tuning condition.)
2. Confirm the motor is connected with the inverter. Turn on MC during the tuning if there is MC between the inverter and the motor. Turn on EN terminal.
3. If you use Multi Function Key Pad (MFKP), we recommend local mode. Keep pushing the “REM/LOC” key of MFKP until the indicator “REM” change into “LOC”.
4. Execute the tuning with the function code L03=5
   Select “1 DATA SET” in the program mode of MFKP, and change the function code L03 to “5” and set with the “FUNC/DATA” key. When the “FWD” key is pushed, the tuning is begun. “EXECUTING” is displayed in the monitor of MFKP during the tuning.
   At first the motor drives for about 30 seconds in a positive direction, after that it drives for about 30 seconds in the opposite direction.
   When “EXECUTING” disappeared, it is the end of tuning. L03 automatically returns to “0”. The tuning result is stored in function code L04. Please confirm it and write down the value.
   The procedure of (5) and (6) is the same as L03=3.

Documents / Resources

	**Fuji Electric OPC-LM1-PR Encoder Interface Card Inverter** [pdf] Instruction Manual OPC-LM1-PR, OPC-LM1-PR Encoder Interface Card Inverter, Encoder Interface Card Inverter, Interface Card Inverter, Inverter

References

- MH **Search - Manual-Hub.com**