



OPC-LM1-PP

Option Card for Permanent
Magnet Synchronous Motor
Drive

CAUTION

- Deliver this instruction manual without fail to those who actually operate the equipment.
- Read this operation 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.

Preface

Thank you for purchasing our OPC-LM1-PP 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 lifesupport 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 multimeter 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 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 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).

(5) Discard

CAUTION

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

Contents

	Page
1. General Information	3
1.1. Introduction to OPC-LM1-PP	3
1.2. Before Using the Option Card	3
1.3. Accessories	3
1.4. Installation Procedure	4
1.5. Product Guarantee	5
2. Specifications	5
2.1. Storage Environment	5
2.1.1. Temporary Storage	5
2.1.2. Long-term Storage	5
2.2. Operating Environment	6
2.3. Terminal Arrangement	6
2.4. Terminal function and Specifications	7
2.5. Output signals of Dividing Frequency	9
3. Applicable Encoder	10
3.1. Specifications of Applicable Encoder	10
3.2. Encoder Installation and Signal	11
4. Wiring	12
4.1. Wiring Length and Cable Size	12
4.2. Plug	12
4.3. Basic Wiring Diagram	13
5. function	14
5.1. Function Code Setting	14
5.2. Procedure of Pole Position Tuning	14
6. Appendix	14
6.1. Specification of Encoder	16
6.2. Wiring for Encoder	16
6.3. Encoder installation and Signal	16
6.4. Inverter output wiring	16
6.5. Function setting	17

If anything is unclear about the option card or there is something doubtful about its condition,
contact your distributor or our nearest branch office.

1.General Information

1.1.Introduction to OPC-LM1-PP

The high performance vector control of permanent magnet synchronous motor (PMSM) can be achieved by using this product. The feature of this product is as follows:

- (1)Output signals of dividing feedback pulses from encoder is installed.
- (2)Disconnection detection of the encoder is installed.
- (3)UVW 3bit code and 4bit gray code are available.

1.2.Before Using the Option Card

Check the items described below when you receive this product. Also check whether this product has been damaged during transport. If anything is amiss, contact your distributor or our 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-PP" is printed on the option card. (See Figure 1.1)

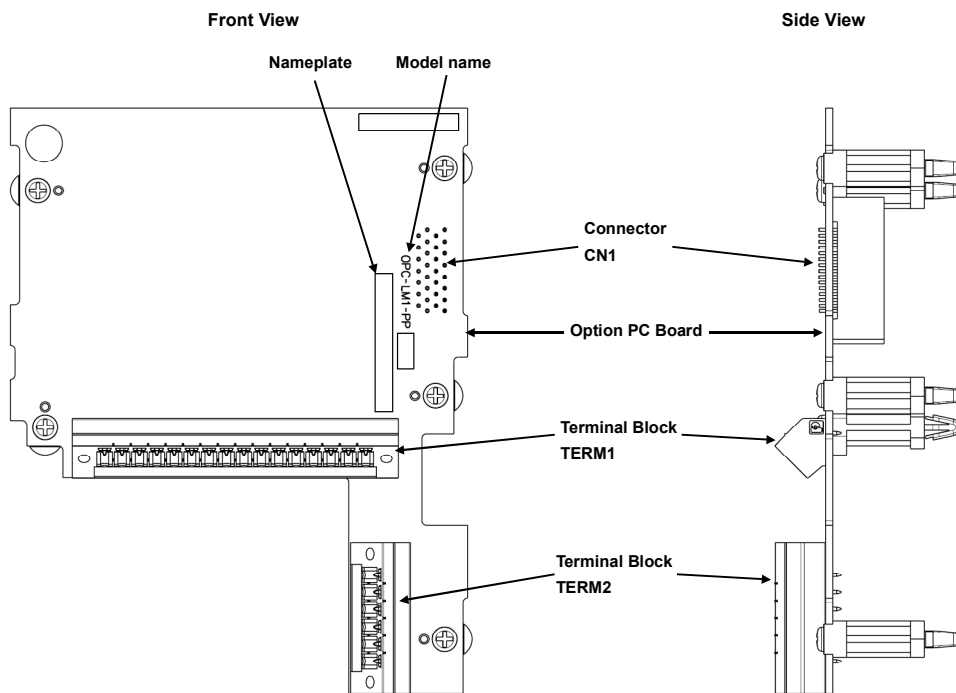


Figure1.1 Product Appearance.

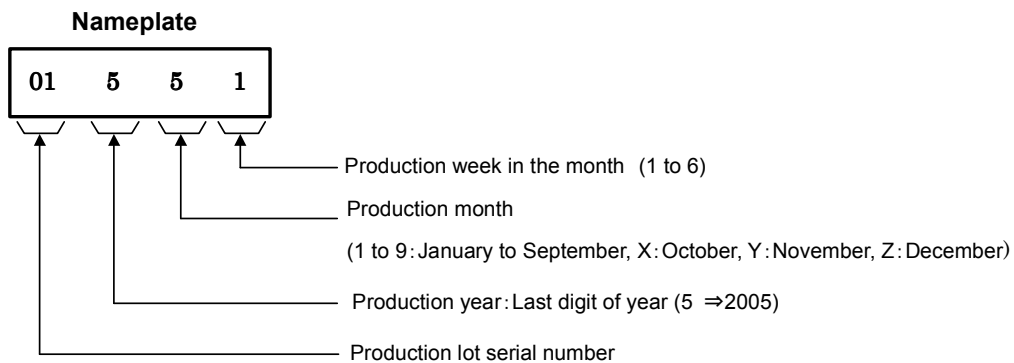


Figure1.2 Nameplate.

1.3.Accessories

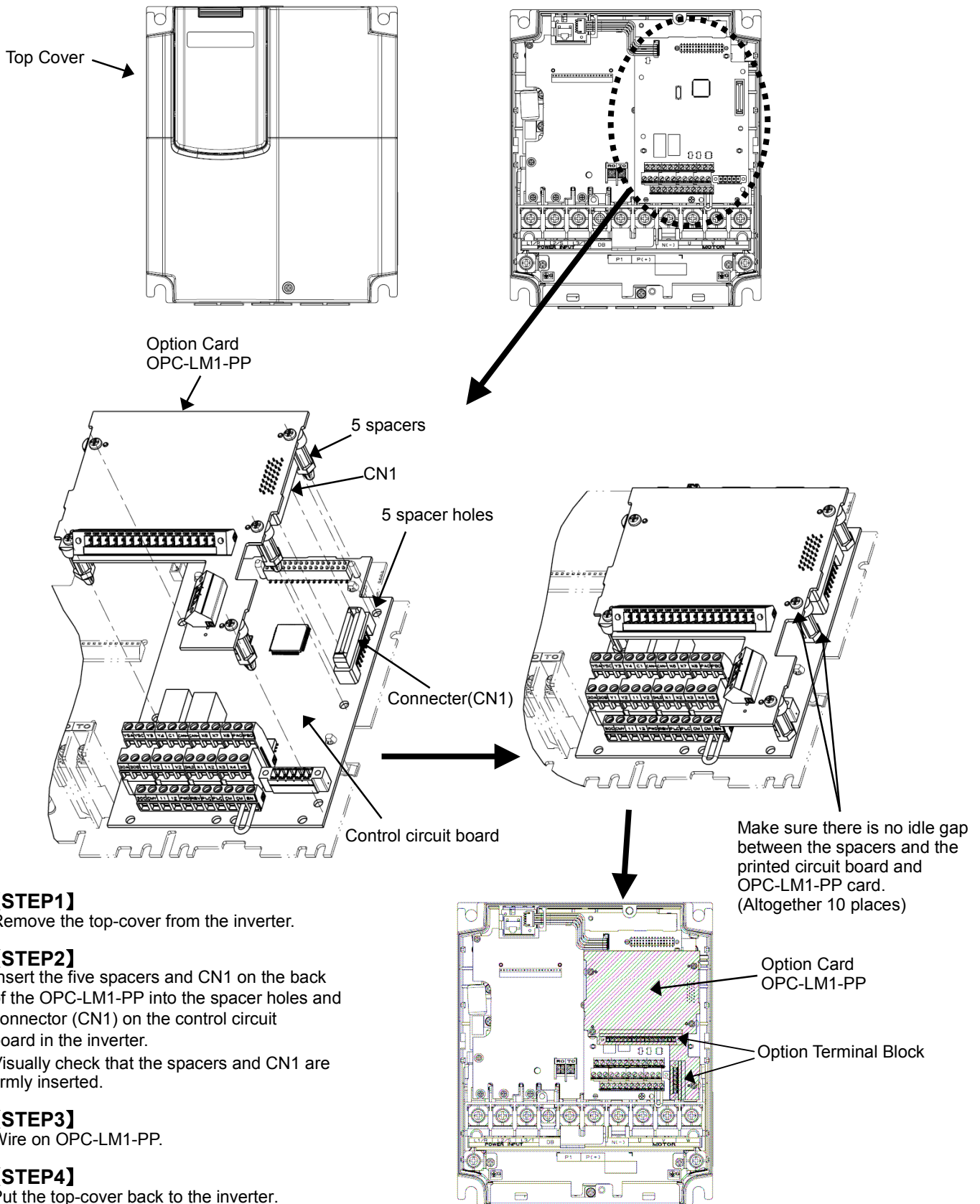
Confirm that the following accessories are included in the package:

- | | | |
|-----------------------|-------------------|---------|
| 1. Instruction Manual | | 1 |
| 2. Accessories | 1) Plug for TERM1 | 1 |
| | 2) Plug for TERM2 | 1 |

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 the DC link circuit voltage between the P (+) and N (-) terminals to be lower than 25 VDC. **Otherwise, electric shock could occur.**



[STEP1]

Remove the top-cover from the inverter.

[STEP2]

Insert the five spacers and CN1 on the back of the OPC-LM1-PP 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-PP.

[STEP4]

Put the top-cover back to the inverter.

Figure1.3 Installation drawing

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.

- (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.

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 strage)	
	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).

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.

- (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.

2.2.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 1)
Vibration	3mm(Max. amplitude):2Hz to 9Hz、9.8m/s ² :9Hz to 20Hz、2m/s ² :20Hz to 55Hz 1m/s ² :55Hz to 200Hz

(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

2.3.Terminal Arrangement

PO	PO	CM	CM	PA+	PA-	PB+	PB-	F0+	F0-	F1+	F1-	F2+	F2-	F3+	F3-
----	----	----	----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

TERM1

FA
FB
CM

TERM2

Figure.2.1 Terminal arrangement

2.4. Terminal function and Specifications

UVW 3bit code

The terminal specifications for the UVW 3bit are given in the following table 2.4

Table 2.4 UVW 3bit code Terminal Specifications

Terminal Symbol	Contents	Specifications	
TERM1	PO	Power supply for encoder	DC5V ± 5%, max.300mA
	CM	Common terminal of power supply	DC0V (GND for power supply)
	PA+	Pulse input terminal A(+)	• Line driver input (RS422) • Input frequency max.100kHz
	PA-	Pulse input terminal A(-)	
	PB+	Pulse input terminal B(+)	Encoder Accuracy : refer to *A
	PB-	Pulse input terminal B(-)	
	F0+	Pulse input terminal U(+)	• Line driver input (RS422) • Input frequency max.100kHz
	F0-	Pulse input terminal U(-)	
	F1+	Pulse input terminal V(+)	
	F1-	Pulse input terminal V(-)	
	F2+	Pulse input terminal W(+)	Encoder Accuracy : refer to *B
	F2-	Pulse input terminal W(-)	
	F3+	Not connect	—
	F3-	Not connect	
TERM2	FA	Pulse output terminal FA Dividing frequency of pulse A(+)	• Transistor output (Open collector) • Max.DC27V, 50mA • $V_{OL} \leq 2.0V (I_{OL}=50mA)$ • $I_{OH} \leq 200 \mu A (V_{OH}=27V)$ • Ratio of dividing frequency setting 1/1, 1/2, 1/4, 1/8, 1/16, 1/32, 1/64 Wavy accuracy : refer to *D
	FB	Pulse output terminal FB Dividing frequency of pulse B(+)	
	CM	FA,FB common terminal	

4bit gray code (F0,F1,F2,F3)

The terminal specifications for the 4bit are given in the following table 2.5

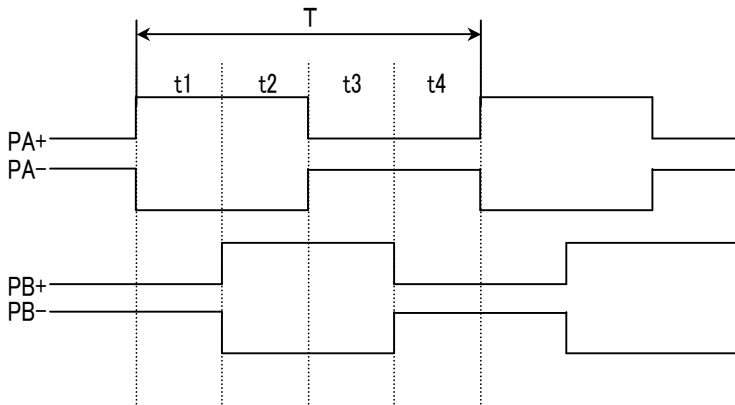
Table 2.5 4bit gray code Terminal Specifications

Terminal Symbol	Contents	Specifications	
TERM1	PO	Power supply for encoder	DC5V ± 5%, 300mA max
	CM	Common terminal of power supply	DC0V (GND for power supply)
	PA+	Pulse input terminal A(+)	• Line driver input (RS422) • Input frequency Max.100kHz
	PA-	Pulse input terminal A(-)	
	PB+	Pulse input terminal B(+)	Encoder Accuracy : refer to *A
	PB-	Pulse input terminal B(-)	
	F0+	Pulse input terminal F0(+)	• Line driver input (RS422) • Input frequency Max.100kHz
	F0-	Pulse input terminal F0(-)	
	F1+	Pulse input terminal F1(+)	
	F1-	Pulse input terminal F1(-)	
	F2+	Pulse input terminal F2(+)	Encoder Accuracy : refer to *C
	F2-	Pulse input terminal F2(-)	
	F3+	Pulse input terminal F3(+)	
	F3-	Pulse input terminal F3(-)	
TERM2	FA	Pulse output terminal FA Dividing frequency of pulse A(+)	• Transistor output (Open collector) • Max.DC27V, 50mA • $V_{OL} \leq 2.0V (I_{OL}=50mA)$ • $I_{OH} \leq 200 \mu A (V_{OH}=27V)$ • Ratio of dividing frequency setting 1/1, 1/2, 1/4, 1/8, 1/16, 1/32, 1/64 Wavy accuracy : refer to *D
	FB	Pulse output terminal FB Dividing frequency of pulse B(+)	
	CM	FA,FB common terminal	

***A (The accuracy of input terminal PA+, PA-, PB+, PB-)**

The following accuracy is needed at 100kHz inputs.

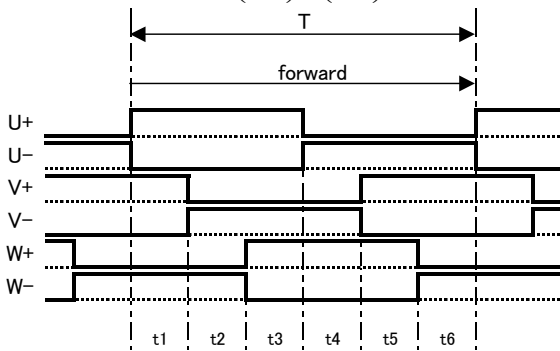
$$t1, t2, t3, t4 = \left(\frac{1}{4}T\right) \pm \left(\frac{1}{8}T\right)$$



***B (The accuracy of input terminal U+,U-,V+,V-,W+,W-)**

The following accuracy is needed at 100kHz inputs.

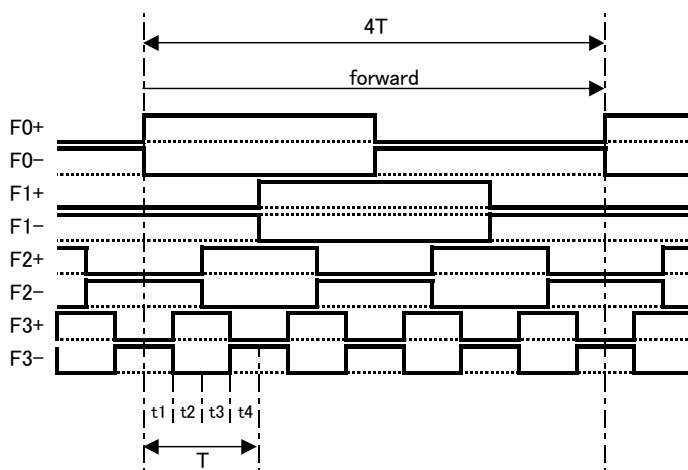
$$t1, t2, t3, t4, t5, t6 = \left(\frac{1}{6}T\right) \pm \left(\frac{1}{8}T\right)$$



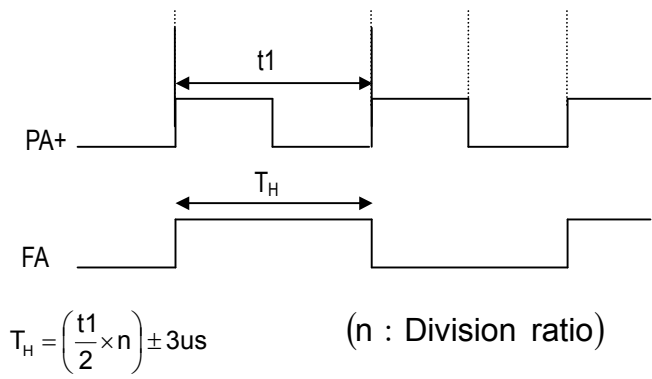
***C (The accuracy of input terminal F0+,F0-,F1+,F1-,F2+,F2-,F3+,F3-)**

The following accuracy is needed at 100kHz inputs.

$$t1, t2, t3, t4 = \left(\frac{1}{4}T\right) \pm \left(\frac{1}{8}T\right)$$



***D (The accuracy of output terminal FA, FB)**



2.5. Output signals of Dividing Frequency

The input pulse from encoder is divided, and it is possible to output. The division ratio 「n」 is set with dip switch SW1 on the option card. Figure 2.2 shows externals of the ratio of dividing frequency set switch of the pulse output. Table 2.6 shows the method of setting SW1.

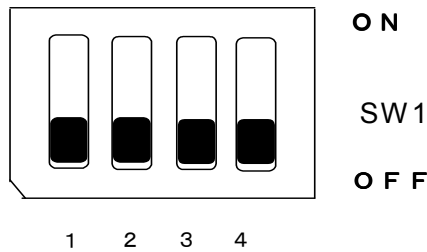


Figure 2.2 Ratio of dividing frequency set switch.

Table 2.6 Division ratio setting

SW1				n : Division ratio
1	2	3	4	
OFF	OFF	OFF	Invalidity	1 (Factory setting)
ON	OFF	OFF		2
OFF	ON	OFF		4
ON	ON	OFF		8
OFF	OFF	ON		16
ON	OFF	ON		32
OFF	ON	ON		64
ON	ON	ON		Set prohibition (Low output)

The dividing frequency circuit diagram is as follows. If the control relay is inserted, the diode is connected to both of the excitation coil for the surge absorption.

(Note) It is recommended that terminal FA,FB are pulled up with lowest value of resistor with the sink current not exceeding 50mA when terminal FA,FB are used.

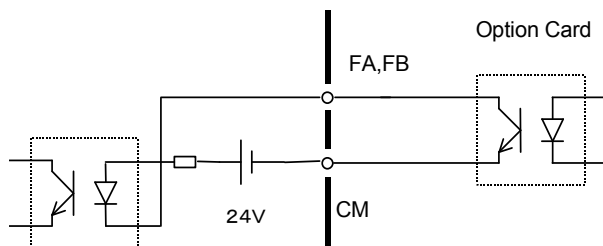


Figure 2.3 The dividing frequency circuit diagram

3.Applicable Encoder

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.

3.1.Specifications of Applicable Encoder

Table 3.1 Specifications of Applicable encoder.

Item		Specifications
Applicable Encoder	Pulse encoder frequency	100kHz max,15kp/s or more at the maximum motor speed *1
	Encoder power supply	+5Vdc±10% / 300mA *2
	Pulse output system	Line driver (AM26LS31)
	Magnetic pole position detection method	UVW 3bit code *3 4 bit gray code(F0,F1,F2,F3) *4

- *1 The setting range is between 360 to 60000 P/R, however the encoder is selected to given the pulse 15kp/s or more at maximum motor speed. In case of the low pulse is given, the performance will be fault.
 e.g.) 1500r/min : 600P/R or more 200r/min : 4500P/R or more
 In case of the high frequency pulse is given, it is never exceeded the pulse frequency 100kp/s at maximum speed.
- *2 Encoder current consumption (Non Load) = max.240mA , Load current =max .60mA.
- *3 Refer to the Figure 3.1
- *4 Refer to the Figure 3.2

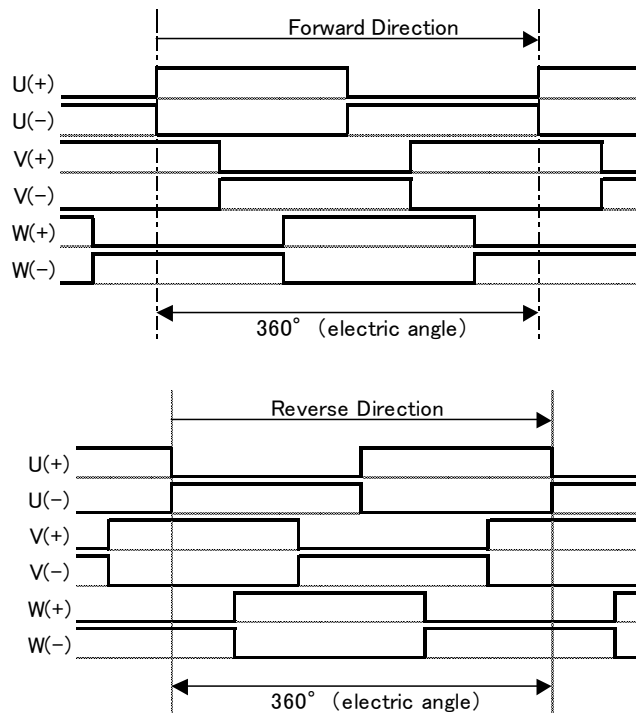


Figure 3.1 UVW 3 bit code

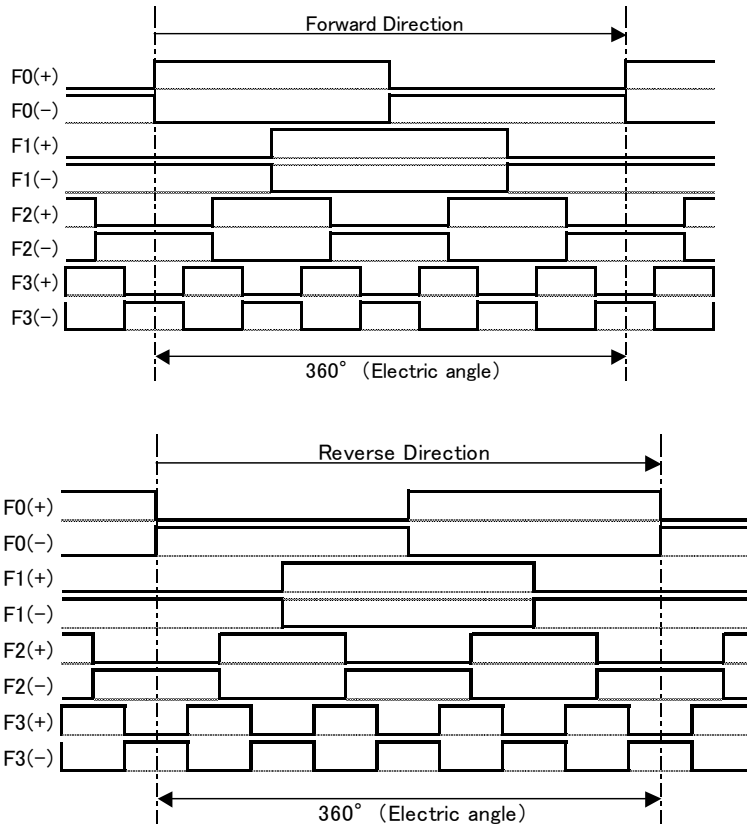


Figure 3.2 4 bit gray code

3.2.Encoder Installation and Signal

The encoder shall rotate in the direction of Figure 3.3, when terminal FWD is ON. Encoder output pulse is shown the Figure3.4. Connect the encoder directly to the motor using a coupling. If encoder rotation is different from Figure 3.3, interchange V with W of inverter output. The rotational direction of IEC standard motors is opposite to Figure 3.3.

Rotational direction when terminal FWD is ON.

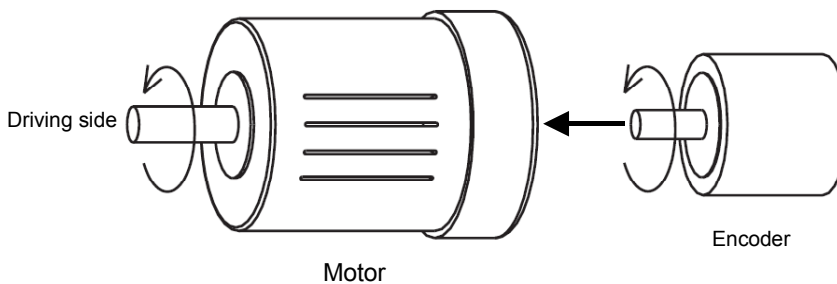


Figure 3.3 Motor and encoder rotational direction when terminal FWD is ON

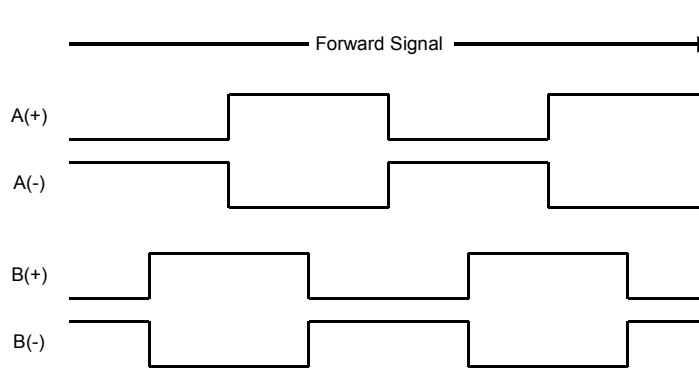


Figure 3.4 Encoder signals

4.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.

4.1.Wiring Length and Cable Size

Table 4.1 Maximum wiring length

Item	Specification
TERM1 (option card)	20m
TERM2 (option card)	5m

Table 4.2 Relation between wire size and wiring length

Encoder specification	Wire length			
	Up to 5m	Up to 10m	Up to 15m	Up to 20m
5V±10%、300mA	0.128mm ² (AWG26)	0.259mm ² (AWG23)	0.412mm ² (AWG21)	0.519mm ² (AWG20)
5V±5%、300mA	0.259mm ² (AWG23)	0.657mm ² (AWG19)	0.811mm ² (AWG18)	1.318mm ² (AWG17)

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 20m 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. Moreover, never put in the same duct.

4.2.Plug

Applicable terminal plugs

The terminal block for encoder connection is removable type.
 The plug (electric wire connection side) is accessories of option card.

Table 4.3 Applicable plug model

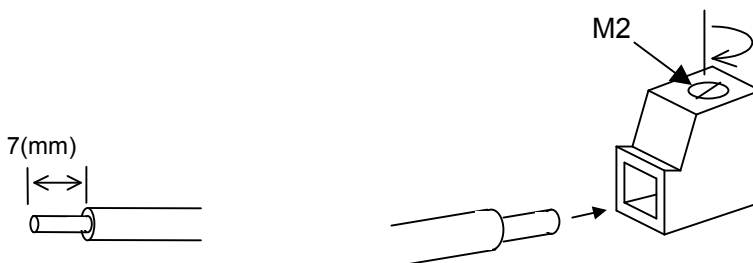
Terminal Block	Terminal Plugs Type	Company
TERM1	MC1.5/16-STF-3.81	Phoenix Contact
TERM2	MC1.5/3-STF-3.81	

Specification of plug

Table 4.4 Specification of plug

Item	Specification
Tightening torque	0.22 to 0.25 N·m
Size of screw	M2
Bared wire length	7mm
The applicable 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.

4.3. Basic Wiring Diagram

CAUTION

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

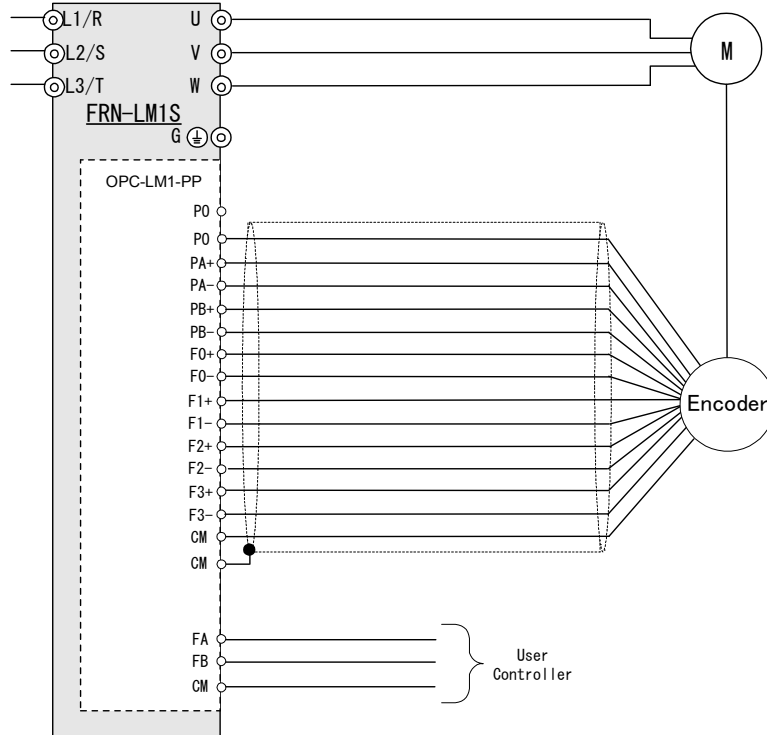


Figure 4.1 Basic Wiring Diagram.

* The shielded wires should be connected to CM terminal.

However, when the wires are influenced by induction noise from external devices, you had better connect the shield wires of the encoder side and ground.

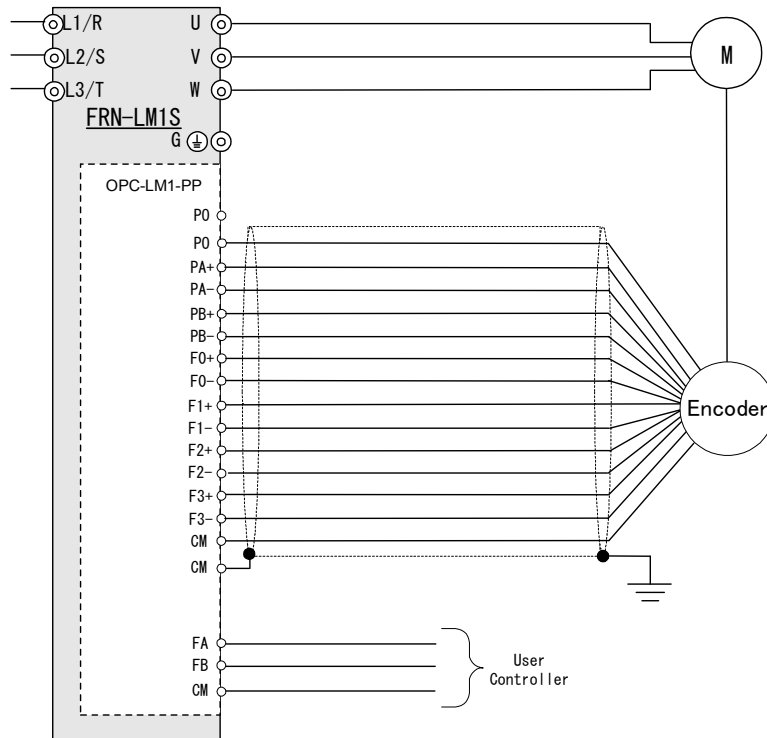


Figure 4.2

(Note) In the case of an encoder that connected shield wire and a frame of an encoder, the shield wire should be earthed via the encoder and motor directly.

5.Function

5.1.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.

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	5.0 (%)
P08	Motor - %X	10.0 (%)
L01	Pulse encoder - System	2 : 3bit code (Signal : U,V,W) 3 : 4bit gray code (Signal : F0,F1,F2,F3)
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)

5.2.Procedure of Magnetic Pole Position Offset Tuning

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

1. 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 : Tuning operation with miss wiring detection (Er7 occurs if miss wiring is detected)
- 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)

2. Tuning Condition

The recommended condition is following.

- (1) The rotor is fixed.
 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. Tuning procedure

- (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.
- (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=2 (*1). This work is used to detect the miss wiring.
However, in the case of Surface Permanent Magnet motor (SPM motor), this work cannot detect the miss wiring. In this case, Skip to procedure 3-(5).

In the case of finishing tuning normally, Skip to procedure 3-(5).

If tuning error (Er7) occurs, it might be a miss wiring. Reset the error display and execute the procedure as follows.

After turning off the power supply, replace V and W of the wiring for inverter drive, and execute the tuning again afterwards.

(In the case of the rotor free, if tuning error (Er7) occurs similarly even if V and W are replaced, it might be disconnection or miss wiring of the encoder. Please try to wire correctly, and execute again from the beginning.)

- (5) Execute the tuning with the function code L03=3 (*1).
- (6) Make the motor rotate more than one rotation at the low frequency about 1 Hz. (In the case of MFKP local mode, Execute the annotation (*2))

Function code L04 is corrected automatically when the encoder zero point is detected. (When the power supply is turned on, the encoder zero point has error. When the encoder passes zero point and detects it, it is corrected. At that time L04 changes into a true value. It changes plus or minus 30 deg or less in the case of UVW 3 bit code, and it changes plus or minus 11.25 deg or less in the case of 4 bit gray code.)

In the case of confirming driving normally, Skip to procedure 3-(7) after confirming L04 corrected.

If it is impossible to be rotated normally, it has miss wiring in the encoder wiring. Please replace the wiring for A and B after turning off the power supply, and execute again from the beginning.

- (7) Turn off the power supply and turn on again. Confirm it is possible to drive normally.

If not normally rotating, it has miss wiring in the wiring for the magnetic pole position detection signal of encoder. Try to wire correctly, and execute again from the beginning. (Change V and W of the encoder wiring for UVW 3bit code. In the case of 4bit gray code, wire to make the signal which is described specifications.)

*1 : Tuning executing procedure after reactivates

(1) In the case of local mode

Select "1 DATA SET" in the program mode of MFKP, and change the function code L03 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.

(2) In the case of remote mode

Set the function code L03. When the drive instruction is set, the tuning is begun.

In the case of tuning mode L03=1 or 3, it takes 4 second for tuning. In the case of tuning mode L03=2, it takes 12 second for tuning.

Release the drive instruction after regulated time passed. Then L03 returns to "0". The tuning result is stored in function code L04. Please confirm it and write down the value.

*2 : Make the motor rotate at the low frequency by MFKP local mode

Push the "FWD" key, and set the reference speed to about 1Hz, and make the motor rotate more than one rotation. Push the "STOP" key, and return to 0 the reference speed after the motor stopped.

6. Appendix

It explains the connection example when encoder TS5200N series made in TAMAGAWA SEIKI CO.,LTD is used.

6.1. Specification of Encoder

Table 5.1 Specification of TS5200N series

Item	Specifications
Encoder Power Supply	+5Vdc (+5Vdc±5% / 200mA (Non Load))
Pulse Output System	Line driver (AM26LS31)
Magnetic pole position detection method	UVW 3bit code

6.2. Wiring for Encoder

Table 5.2 Terminal wiring of OPC-LM1-PP

Terminal name	Wiring color	Encoder side symbol	Note
PO	RED	DC+5V	
CM	BLACK	GND	
PA+	BLUE	A	
PA-	BLUE / BLACK	\bar{A}	
PB+	GREEN	B	
PB-	GREEN / BLACK	\bar{B}	
F0+	BROWN	U	
F0-	BROWN / BLACK	\bar{U}	
F1+	GRAY	V	
F1-	GRAY / BLACK	\bar{V}	
F2+	WHITE	W	
F2-	WHITE / BLACK	\bar{W}	
F3+	-	-	Not connect
F3-	-	-	Not connect

6.3. Encoder installation and Signal

Encoder installation and rotating direction

Figure 5.1 and Figure 5.2 show the installing direction and the rotating direction. The encoder shall rotate in the direction of Figure 5.1 and 5.2, when terminal FWD is ON.

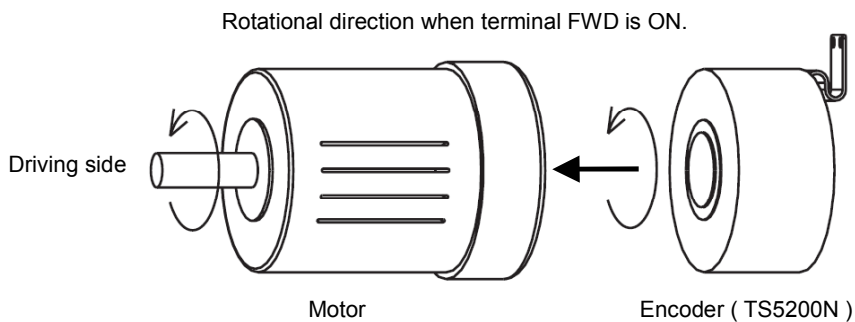


Figure 5.1 One case of installing motor and encode

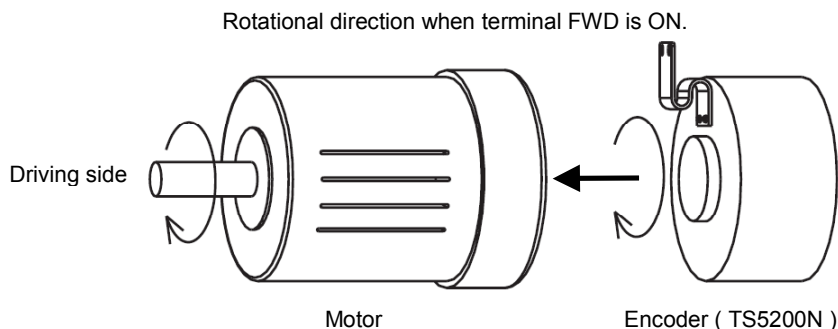


Figure 5.2 Another case of installing motor and encode

Encoder signal

Encoder output pulse is shown the Figure5.3, when terminal FWD is ON.

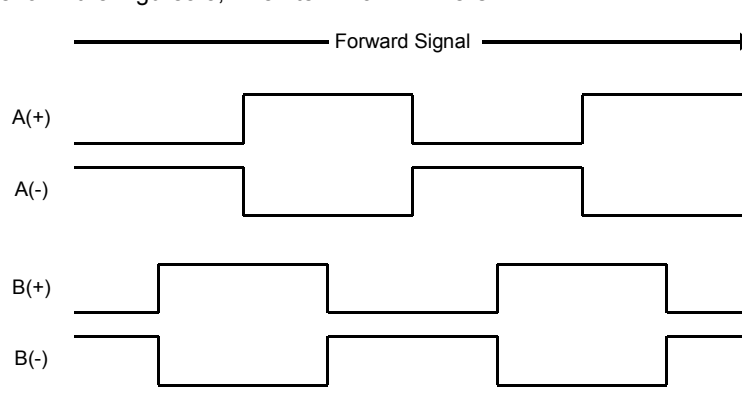


Figure 5.3 Encoder signals

6.4. Inverter output wiring

Connect Inverter output terminals U,V,W and motor as follows, and rotating direction is as follows.

Installed direction of encoder and rotating direction	Regulated rotating direction of motor	Inverter output terminals	Motor input terminals
According to Figure 5.1	According to IEC standard	U	U
		V	W
		W	V
	Opposite to IEC standard	U	U
		V	V
		W	W
According to Figure 5.2	According to IEC standard	U	U
		V	V
		W	W
	Opposite to IEC standard	U	U
		V	W
		W	V

6.5. Function setting

Please set the function according to 5.function.