Oriental motor

HP-7420-4

Compact & Lightweight Stepping Motor and Driver Package

PMC Series

Standard Type

MG Geared Type

Harmonic Geared Type

OPERATING MANUAL

Table of Contents

Thank you for purchasing an Oriental Motor product.

This Operating Manual describes product handling procedures and safety precautions.

- Please read it thoroughly to ensure safe operation.
- Always keep the manual where it is readily available.

Safety precautions

Only qualified personnel should work with the product.
Use the product correctly after thoroughly reading the section “Safety precautions.”
The precautions described below are intended to prevent danger or injury to the user and other personnel through safe, correct use of the product. Use the product only after carefully reading and fully understanding these instructions.

⚠Warning

Handling the product without observing the instructions that accompany a “Warning” symbol may result in serious injury or death.

⚠Caution

Handling the product without observing the instructions that accompany a “Caution” symbol may result in injury or property damage.

Note

The items under this heading contain important handling instructions that the user should observe to ensure safe use of the product.

⚠Warning

General

- Do not use the product in explosive or corrosive environments, in the presence of flammable gases, locations subjected to splashing water, or near combustibles. Doing so may result in fire or injury.
- Assign qualified personnel the task of installing, wiring, operating/controlling, inspecting and troubleshooting the product. Failure to do so may result in fire or injury.

Installation

- Install the motor and driver in their enclosures in order to prevent injury.

Connection

- Keep the driver’s input-power voltage within the specified range to avoid fire.
- The driver power supply to be used should be a DC power supply where the primary and secondary sides are provided with reinforced insulation. Otherwise, an electric shock may occur.
- Connect the cables securely according to the wiring diagram in order to prevent fire.
- Do not forcibly bend, pull or pinch the cable. Doing so may fire.

Operation

- Turn off the driver power in the event of a power failure, or the motor may suddenly start when the power is restored and may cause injury or damage to equipment.
- When you want to use the motor in a vertical application, take position holding measures. When the power is turned off, the motor will lose the holding brake force. The movable part will drop and possibly cause injury to personal and damage to the equipment.
- Do not turn the output current off input to “ON” while the motor is operating. The motor will stop and lose its holding ability, which may result in injury or damage to equipment.

Repair, disassembly and modification

- Do not disassemble or modify the motor or driver. This may cause injury. Refer all such internal inspections and repairs to the branch or sales office from which you purchased the product.

⚠Caution

General

- Do not use the motor and driver beyond their specifications, or injury or damage to equipment may result.
- Do not touch the motor or driver during operation or immediately after stopping. The surfaces are hot and may cause a burn.

Transportation

- Do not hold the motor output shaft or motor cable. This may cause injury.

Installation

- Keep the area around the motor and driver free of combustible materials in order to prevent fire or a burn.
- To prevent the risk of damage to equipment, leave nothing around the motor and driver that would obstruct ventilation.
- The motor and driver should be firmly secured on the metallic plate in order to prevent personal injury or equipment damage.
- Provide a cover over the rotating parts (output shaft) of the motor to prevent injury.

Operation

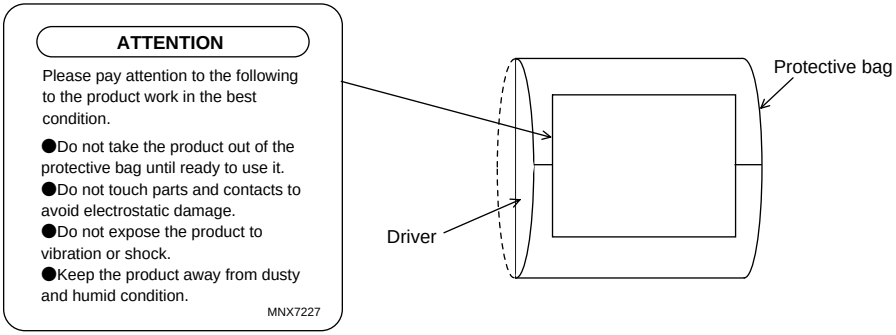
- Use a motor and driver only in the specified combination. An incorrect combination may cause a fire.
- To avoid injury, remain alert during operation so that the motor can be stopped immediately in an emergency.
- Before supplying power to the driver, turn all control inputs to the driver to "OFF." Otherwise, the motor may start suddenly and cause injury or damage to equipment.
- Make sure that the output power off input of the driver is turned on if you want to move the motor shaft directly (e.g. for manual positioning). This caution is to prevent personal injury.
- When an abnormality is noted, stop the operation immediately, or fire or injury may occur.

Disposal

- When disposing of the motor or driver, treat them as ordinary industrial waste.

Note

Before using the product, read the content of the label carefully.
The content and stick position of the label are as follows.



Product verification

Equipment checklist

- Motor 1
- Driver 1
- M2.5 Cross recessed head machine screws with washer for mounting the motor (for only **MG** geared type) 4
- Connector for signals 6-173977-4 (AMP), 6-173977-8 (AMP) 2
- Connector for power supply 6-173977-3 (AMP) 1
- Connector for motor connection 6-173977-5 (AMP) 1
- Operating manual 1

Note

Do not take the product out of the protective bag until ready to use it. Otherwise, the driver may be damage.

Model numbers and motor/driver combinations

The **PMC** series is a combined package which includes a stepping motor and driver. This operating manual is designated for the following products.

Package model number	Motor model number	Driver model number
PMC33A3	PMM33A2	PMD03CA
PMC33B3	PMM33B2	
PMC35A3	PMM35A2	
PMC35B3	PMM35B2	
PMC33A1-MG□$*^1$	PMM33A-MG□$*^1$	
PMC33B1-MG□$*^1$	PMM33B-MG□$*^1$	
PMC33A1-HG□$*^2$	PMM33A-HG□$*^2$	
PMC33B1-HG□$*^2$	PMM33B-HG□$*^2$	

The box (□$*^1$) represents the desired gear ratio (3.6, 7.2, 10, 20, 30, 50).
The box (□$*^2$) represents the desired gear ratio (50, 100).

Note

The motor and the driver are precision equipment and should not be dropped or subject to any physical shocks.

Interpreting the model number

P M C 3 3 A 3

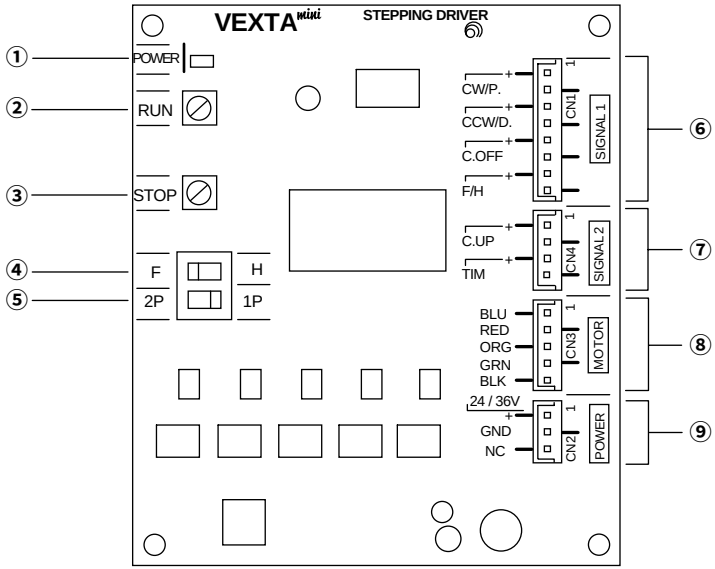
- Reference number
- Shaft type
  - **A** : Single shaft
  - **B** : Double shaft
- Motor case length
  - **3** : 31mm (1.22in.)
  - **5** : 50.5mm (1.99in.)
- Motor frame size
  - **3** : 28mm (1.1in.) sq.
- Compact & lightweight stepping motor and driver package
  PMC series

P M C 3 3 A 1 - M G 3.6

- Gear ratio
  - **MG** geared type
    - **3.6**: 3.6:1 **20**: 20:1
    - **7.2**: 7.2:1 **30**: 30:1
    - **10** : 10:1 **50**: 50:1
  - Harmonic geared type
    - **50** : 50:1 **100**: 100:1
- Geared type
  - **MG** : **MG** gear
  - **HG** : Harmonic gear
- Reference number
- Shaft type
  - **A** : Single shaft
  - **B** : Double shaft
- Motor case length
- Motor frame size
  - **3** : 28mm (1.1in.) sq.
- Compact & lightweight stepping motor and driver package
  PMC series

Names and functions of driver parts

Illustration shows the view from the connector side.



LED indications

Indication	LED name	Color	Conditions when LED ON
① POWER	Power input LED	Green	Lights when the power is input.

Potentiometers and switches

Indication	Name	Factory setting	Function	Page reference
② RUN	Run potentiometer	0.35A/phase	Current adjustment potentiometer used when motor is running.	Page25
③ STOP	Stop potentiometer	0.175A/phase	Motor standstill current adjustment potentiometer used when current has been cut back by the automatic current cutback function when there is no pulse input (motor standstill).	Page25, 26
④ F/H	Step angle switch	F	The motor step angle can be set to full step or half step with this switch.	Page15
⑤ 2P/1P	Pulse input mode switch	1P	The pulse signal input mode can be set to 1-pulse input mode or 2-pulse input mode this switch.	Page15

Terminals

Indication	Pin No.	Terminal name	Function	Page reference
⑥ SIGNAL 1 6-173977-8 (AMP) ∗1 The selection of the pulse signal input mode can be set with the pulse input mode switch. ∗2 In this table, the rotation direction shows that of motor output shaft. For harmonic geared type and gear ratio 10:1 of **MG** geared type, the motor rotation direction is opposite to the output shaft rotation direction.	1	CW/P.+ (Pulse/CW Pulse Signal Input Terminal)	The pulse mode signal is input to this terminal. The direction of the motor's rotation is determined by the following rotation direction input terminal. (When in 2-pulse input mode the CW direction command pulse signal is input to this terminal.)	Page16, 17
	2	CW/P.– (Pulse/CW Pulse Signal Input Terminal)		
	3	CCW/D.+ (Rotation Direction/ CCW Pulse Signal Input Terminal)	The rotation direction signal is input to this terminal. When a signal is input to the terminal the motor output shaft will rotate the counterclockwise direction. (When in 2-pulse input mode the CCW direction command pulse signal is input to this terminal.)	Page16, 17
	4	CCW/D.– (Rotation Direction/ CCW Pulse Signal Input Terminal)		
	5	C.OFF+ (All Windings Off Signal Input Terminal)	The all windings off signal is input to this terminal. When a signal is input to the terminal the driver will cut the power supply to the motor. The motor torque will then be reduced to zero and the motor shaft can be rotated freely for adjustment. This function is used when manual positioning etc. is required.	Page18, 19
	6	C.OFF– (All Windings Off Signal Input Terminal)		
	7	F/H+ (Step Angle Signal Input Terminal)	The motor step angle is input to this terminal.	Page19
	8	F/H– (Step Angle Signal Input Terminal)		
⑦ SIGNAL 2 6-173977-4 (AMP)	1	C.UP+ (Automatic Current Cutback Release Signal Input Terminal)	The automatic current cutback release signal is input to this terminal. Signal for deactivating the automatic current cutback function, which cuts back the output current to the motor when it is standstill.	Page20
	2	C.UP– (Automatic Current Cutback Release Signal Input Terminal)		
	3	TIM+ (Excitation Timing Signal Output Terminal)	Signal indicating that the motor excitation sequence is at step "0".	Page21
	4	TIM– (Excitation Timing Signal Output Terminal)		
⑧ MOTOR 6-173977-5 (AMP)	1	Motor Connection Terminal	Connect this terminal to the blue lead wire.	Page22, 23
	2		Connect this terminal to the red lead wire.	Page22, 23
	3		Connect this terminal to the orange lead wire.	Page22, 23
	4		Connect this terminal to the green lead wire.	Page22, 23
	5		Connect this terminal to the black lead wire.	Page22, 23
⑨ POWER 6-173977-3 (AMP)	1	24/36V (Power Supply Connection Terminal)	Connect this terminal to a "+" side of DC24V or DC36V and GND.	Page22
	2	GND (Power Supply Connection Terminal)		
	3	NC ———	No connection.	———

Installation

Motor installation

■Motor installation location

To prevent motor damage, install in a location with the following conditions.

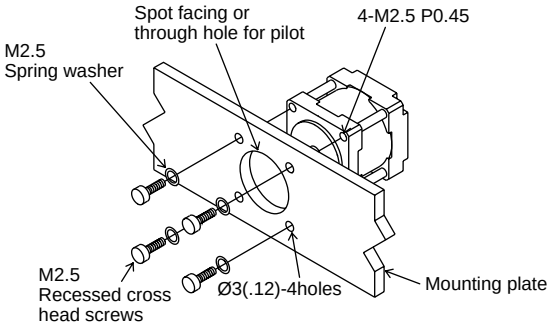
- Indoors (The motor is designed and manufactured to be used as an internal component within other equipment.)
- Ambient temperature range −10°C~+50°C (+14°F~+122°F) (non-freezing)
  For harmonic geared type: 0°C~+40°C (+32°F~+104°F) (non-freezing)
- Ambient humidity below 85% (non-condensing)
- No explosive, combustible, or corrosive gases
- No direct sunlight
- No dust or conductive particles (i.e. metal chips or shavings, pins, or wire fragments etc.)
- No water, oil, or other fluids
- Where the motor is able to dissipate heat easily
- No continuous vibration or sudden shocks
- No nearby radiation, magnetic field, or air vacuum environment

■How to install the motor

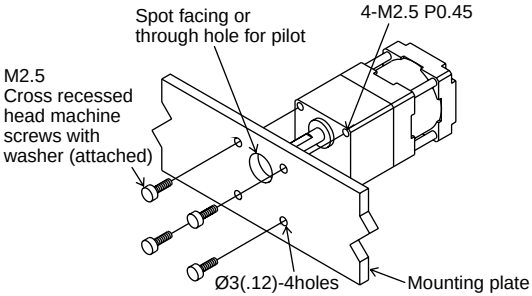
To allow for heat dissipation and to prevent vibration, be sure to securely attach the motor to solid metal surface.

The motor flange incorporates a pilot diameter. Use this pilot diameter as a guide for alignment when mounting the motor.

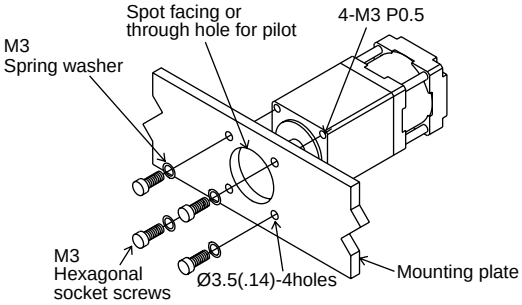
PMC3□A(B)3



PMC33A(B)1-MG□



PMC33A(B)1-HG□



The following hardware (not supplied) is needed to mount the motor.
For the installation of the **MG** geared type, use the supplied screws.

PMC3□A(B)3	• M2.5 Recessed cross head screws : 4 • M2.5 Spring washers : 4
PMC33A(B)1-HG□	• M3 Hexagonal socket screws : 4 • M3 Spring washers : 4

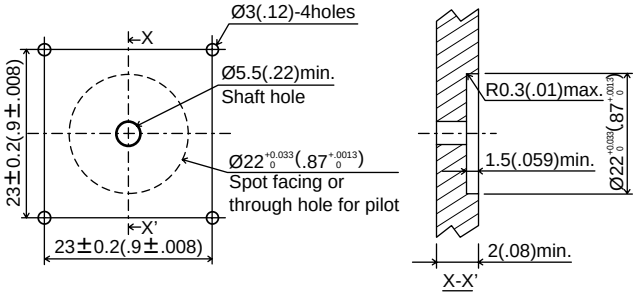
Select screws with a length appropriate for the thickness of the mounting plate.
(Refer to the below table.)

Model	Length of the screws [Unit: mm (inch)]
PMC33A(B)3 **PMC35A(B)3**	thickness of the mounting plate +2.5 (0.1)
PMC33A(B)1-MG□	thickness of the mounting plate +3.5 (0.14)
PMC33A(B)1-HG□	thickness of the mounting plate +5 (0.2)

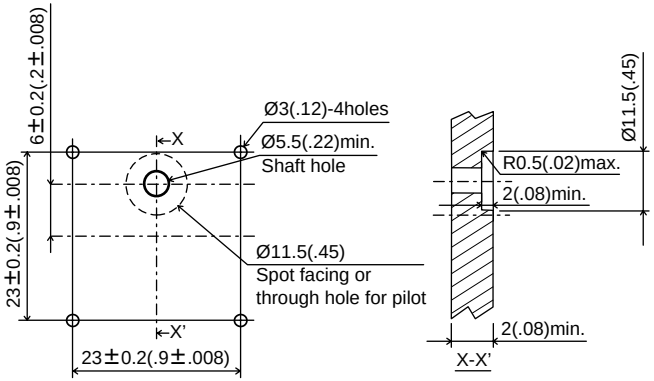
■Motor mounting plate dimensions

[unit: mm (inch)]

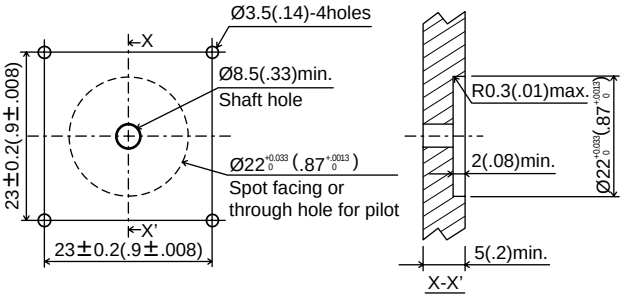
PMC3□A(B)3



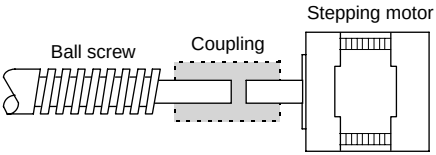
PMC33A(B)1-MG□



PMC33A(B)1-HG□



■Connecting the motor to the drive mechanism (Load)



Proper alignment is necessary when connecting the drive mechanism (load) to the motor shaft. Use a flexible coupling.

Note

- Inadequate alignment may reduce the life span of the motor bearings or damage the motor shaft.
- Exceeding the permissible overhung load or permissible thrust load will damage or shorten the life span of the bearings and motor shaft.
  Do not exceed the permissible overhung load and thrust load as indicated in the following chart.
- For geared motor, do not separate the motor and the gearhead.

Permissible overhung load [Unit: N (lb.)]

Distance from the end of the shaft [mm (inch)]	0	5 (0.2)	10 (0.39)	15 (0.59)
PMC3□A(B)3	25 (5.51)	34 (7.49)	52 (11.4)	———
PMC33A(B)1-MG□∗1	9.2 (2.02)	11.4 (2.51)	15 (3.3)	21.9 (4.82)
PMC33A(B)1-HG□∗2	140 (30.8)	160 (35.2)	200 (44.1)	240 (52.8)

Permissible thrust load [Unit: N (lb.)]

PMC33A(B)3	1 (0.22)
PMC35A(B)3	1.7 (0.374)
PMC33A(B)1-MG□∗1	10 (2.2)
PMC33A(B)1-HG□∗2	100 (22)

The box (□∗1) represents the desired gear ratio (3.6, 7.2, 10, 20, 30, 50).
The box (□∗2) represents the desired gear ratio (50, 100).

Driver installation

■Driver installation location

To prevent driver damage, install in a location with the following conditions.

- Indoors (The driver is designed and manufactured to be used as an internal component within other equipment.)
  Ambient temperature range 0°C~+40°C (+32°F~+104°F) (non-freezing).
  Install a forced-air cooling fan if ambient temperatures exceed +40°C (+104°F).
- Ambient humidity below 85%(non-condensing)
- No explosive, combustible, on corrosive gases
- No direct sunlight
- No dust or conductive particles (i.e. metal chips or shavings, pins, or wire fragments etc.)
- No water, oil, or other fluids
- Where the driver is able to dissipate heat easily
- No continuous vibration or sudden shocks
- No nearby radiation, magnetic field, or air vacuum environment
- If the driver is installed in a switch box or other enclosed area, and near a heat source, be sure to establish ventilation holes. The heat generated by the driver will cause the ambient temperature to rise which could consequently damage the driver.
- If the driver is installed near a source of vibration, and this vibration is transmitted to the driver, attach a shock absorber to prevent driver damage.
- If the driver is installed near a source of noise interference (i.e. high frequency welding machine, electromagnetic switch, etc.) install a noise filter, or connect it to a separate power source to reduce the effect of the interference, otherwise the motor may not operate correctly.
- Leave a space of at least 25mm (1in.). If using more than one driver, leave a space of at least 20mm (0.8in.) between each driver. Driver heat generation will cause the ambient temperature to rise, and if the permissible ambient operating temperature is exceeded, driver damage may result.

■How to install the driver

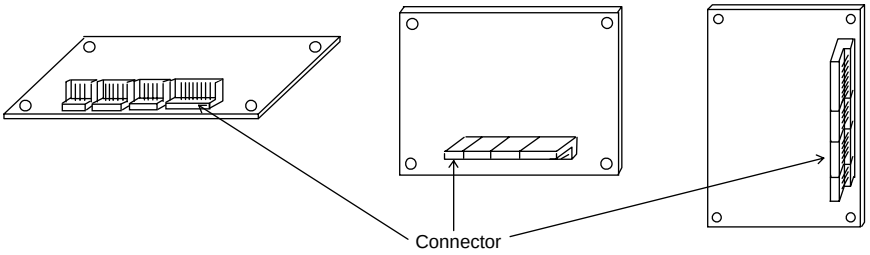
The driver is designed to cool naturally by convection.
Secure the driver to a metal plate made of steel, aluminium or other material having good thermal conductivity.

The following hardware (not supplied) is needed to mount the driver.

- M3 Screws : 4
- M3 Spring washers : 4
- Insulation type spacers : 4
- M3 Nuts : 4

■Driver mounting plate dimensions

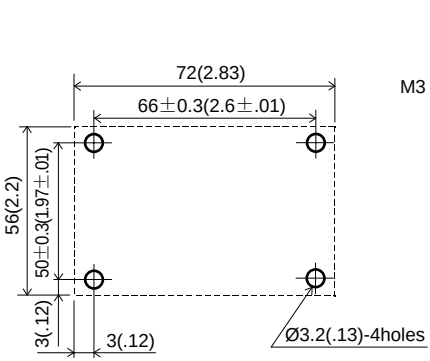
Horizontal mounting Vertical mounting

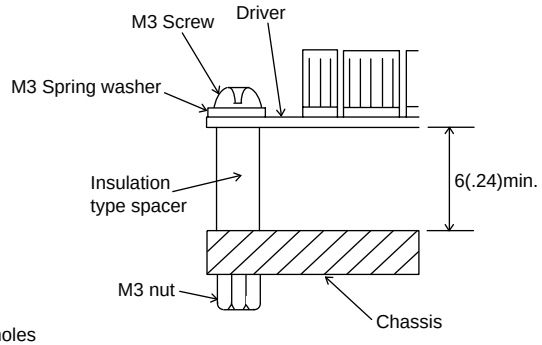


Securing the driver

1. Insert spring washers and M3 screws from the surface of the connector side of the circuit board.
2. Insert the spacer between the driver and the mounting plate, and secure by using M3 nuts.
   - Spacer size: Ø9mm (0.35in.) max. 6mm (0.24in.) min. long
   - Screw tightening torque: 0.5N·m (71oz-in)

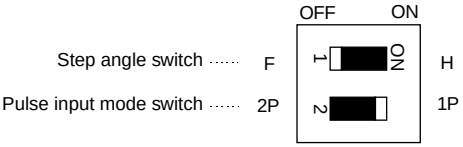
[Unit: mm (inch)]





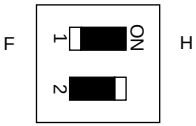
Driver function switches

The driver has various operation functions which are set with the function switches.



∗The white square section of the function switch represents the switch lever.

Step angle switch (Factory setting : F)



When the switch is set to:

"F" (Full step)

Standard type: 1step = 0.72° (1 rotation = 500 pulses)

Geared type: 1step= $0.72° \times \frac{1}{\text{gear ratio}}$

(1 rotation = 500×gear ratio pulses)

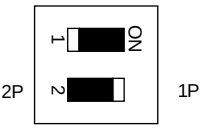
"H" (Half step)

Standard type: 1step = 0.36° (1 rotation = 1000 pulses)

Geared type: 1step = $0.36° \times \frac{1}{\text{gear ratio}}$

(1 rotation =1000×gear ratio pulses)

Pulse input mode switch (Factory setting : 1P)



Select the appropriate pulse input mode to correspond to your controller with this switch.

When the switch is set to the 1P position, 1-pulse input mode is established and motor rotation is controlled by pulse signals and rotation direction signals.

When the pulse input mode switch is set to the 2P position, 2-pulse input mode is established and motor rotation is controlled by CW and CCW pulse signals.

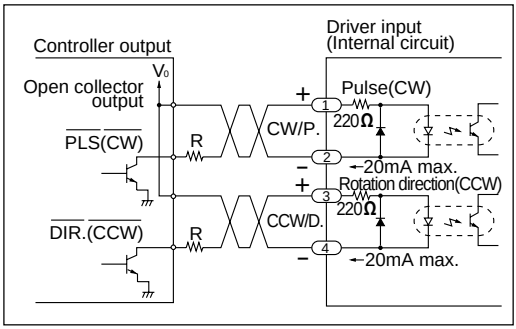
Input/output signals

Input signals

The input signals to the driver and their functions are specified below.

■ Pulse/CW pulse signals
Rotation direction/CCW pulse signals

The diagram below shows the input circuits and an example connection to a controller.



The number within ⬭ refers to the pin number of driver connector SIGNAL 1.

The information in the brackets ( ) refers to signals when in 2-pulse input mode.

Keep the voltage between DC5V and DC24V. When voltage is equal to DC5V, external resistance R is not necessary.
When voltage is above DC5V, connect external resistance R and keep the input current below 20mA.

1-Pulse input mode

Pulse signal

When the photocoupler state changes from “ON” to “OFF”, the motor rotates one step. The direction of rotation is determined by the following rotation direction signals.

Rotation direction signal

The rotation direction signal is input to rotation direction/CCW pulse signal input terminal.
An input signal at “photocoupler ON” commands a clockwise direction rotation.
(For harmonic geared type and gear ratio 10:1 of **MG** geared type: counterclockwise)
An input signal at “photocoupler OFF” commands a counterclockwise direction rotation.
(For harmonic geared type and gear ratio 10:1 of **MG** geared type: clockwise)

2-Pulse input mode

CW∗ pulse signal

When the photocoupler state changes from “ON” to “OFF”, the motor rotates one step in the clockwise direction.
(For harmonic geared type and gear ratio 10:1 of **MG** geared type: counterclockwise)

CCW∗ pulse signal

When the photocoupler state changes from “ON” to “OFF”, the motor rotates one step in the counterclockwise direction.
(For harmonic geared type and gear ratio 10:1 of **MG** geared type: clockwise)

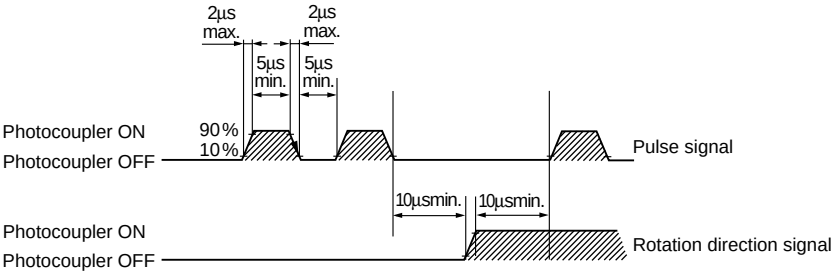
∗ CW and CCW refer to clockwise and counterclockwise directions respectively, from a reference point of facing the motor output shaft.

Relation to the pulse input mode switch

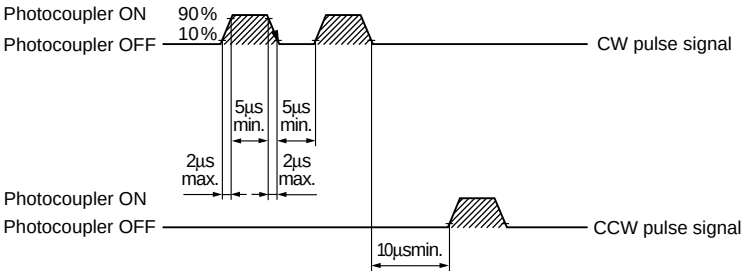
When the switch is set to the 1P position, motor rotation is controlled by pulse signals and rotation direction signals.
When the switch is set to the 2P position, motor rotation is controlled by CW pulse signals and CCW pulse signals.

Pulse waveform characteristics

1-Pulse input mode



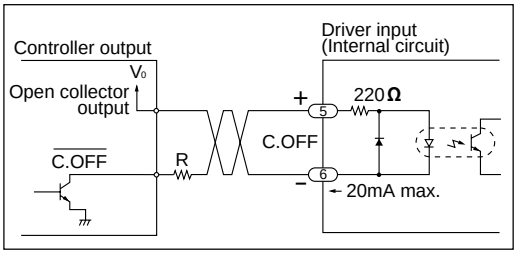
2-Pulse input mode



- The shaded area indicates when the photocoupler diode is ON. The motor moves when the photocoupler states changes from ON to OFF as indicated by the arrow.
- The pulse voltage is 4~5V in the “photocoupler ON” state, and 0~0.5V in the “photocoupler OFF” state.
- Input pulse signals should have a pulse width over 5μs, pulse rise/fall below 2μs, and a pulse duty below 50%.
- Keep the pulse signal in the “photocoupler OFF” state when no pulse is being input.
- The minimum interval time when changing rotation directions is 10μs.
- In 1-pulse input mode, leave the pulse signal at rest “photocoupler OFF” when changing rotation directions.
- In 2-pulse input mode, do not input CW and CCW pulse signals at the same time. Inputting a pulse signal while the other pulse signal is already in the “photocoupler ON” state will result in erratic motor rotation.

■All windings off signal

The diagram below shows the input circuit and an example connection to a controller.



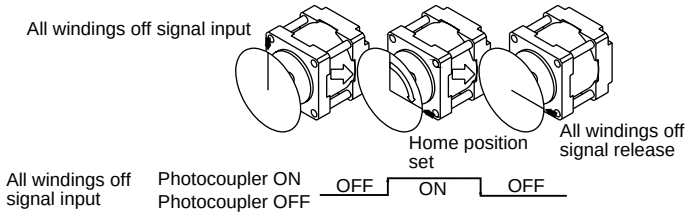
The number within ⬭ refers to the pin number of driver connector SIGNAL 1.

Keep the voltage between DC5V and DC24V. When voltage is equal to DC5V, external resistance R is not necessary.
When voltage is above DC5V, connect external resistance R, and keep the input current below 20mA.

When the all windings off signal is in the “photocoupler ON” state, the current to the motor is cut off and motor torque is reduced to zero. The motor output shaft can then be rotated freely by hand.
When the all windings off signal is in the “photocoupler OFF” state, the motor holding torque is proportional to the current set by the current adjustment rotary switches. During motor operation be sure to keep the signal in the “photocoupler OFF” state.
This signal is used when moving the motor by external force or manual home positioning etc. is desired. If this function is not needed, it is not necessary to connect this terminal.
Switching the all windings off signal from “photocoupler ON” to “photocoupler OFF” does not alter the excitation sequence.
When the motor shaft is manually adjusted with the all windings off signal input, the shaft will shift up to ±3.6°
(geared type: ±3.6°/gear ratio) from the position set after the all windings off signal is released.

Manual detection of the home position

Input the all windings off signal, set the motor to the desired position, then release the all windings off signal.



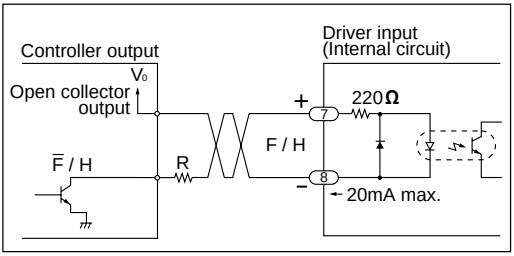
Note

For geared type, do not do manual detection of the home position. It may cause damage the gearhead and may cause the following problems.

- The motor makes a strange noise.
- The motor does not rotates correctly.

■Step angle signal

The diagram below shows the input circuit and an example connection to a controller.



The number within ⬭ refers to the pin number of driver connector SIGNAL 1.

Keep the voltage between DC5V and DC24V. When voltage is equal to DC5V, external resistance R is not necessary. When voltage is above DC5V, connect external resistance R, and keep the input current below 20mA.

Half Step

Standard type:

When the step angle signal is in the "photocoupler ON" state, it is set to half-step mode (0.36°/step, 1 rotation 1000 pulses)

Geared type:

When the step angle signal is in the "photocoupler ON" state, it is set to half-step mode

$$(0.36° \times \frac{1}{\text{gear ratio}} \text{ / step,}$$

1 rotation 1000×gear ratio pulses)

Full Step

Standard type:

When the step angle signal is in the "photocoupler OFF" state, it is set to full-step mode (0.72°/step, 1 rotation 500 pulses)

Geared type:

When the step angle signal is in the "photocoupler OFF" state, it is set to full-step mode

$$(0.72° \times \frac{1}{\text{gear ratio}} \text{ / step,}$$

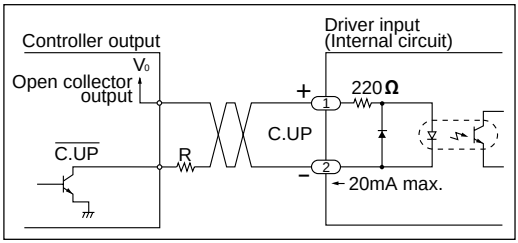
1 rotation 500×gear ratio pulses)

Note

When the step angle signal is used, the switch must be set to the F position.

■Automatic current cutback release signal

The diagram below shows the input circuit and an example connection to a controller.



The number within ⬭ refers to the pin number of driver connector SIGNAL 2.

Keep the voltage between DC5V and DC24V. When voltage is equal to DC5V, external resistance R is not necessary.
When voltage is above DC5V, connect external resistance R, and keep the input current below 20mA.

- When the automatic current cutback release signal is in the “photocoupler OFF” state, the automatic current cutback function is activated; 0.1s. after the pulse is stopped the motor output current is automatically cut back, reducing motor and driver heat.
  (The factory setting for the current cutback is 50%. In order to change this, refer to the instructions for adjusting the current at motor standstill on pages 25, 26)
- When the maximum holding torque is needed, input “photocoupler ON” signal. The automatic current cutback function is deactivated.
- When the automatic current cutback release signal is in the “photocoupler ON” state, the automatic current cutback function is deactivated.
- Because the motor’s holding power is proportional to the motor output current, the motor’s holding power is reduced when the current is cut back. (The motor has holding power proportional to the current at motor standstill, which is set with the STOP potentiometer. Refer to page 24.)

Note

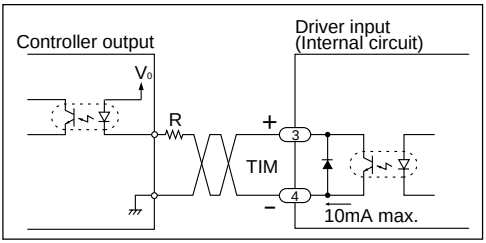
Generally, automatic current cutback release signal should be set to “photocoupler OFF” to suppress heat generation in the motor and driver.

Output signals

The output signals from the driver and their functions are specified below.

■Excitation timing signal

The diagram below shows the output circuit and an example connection to a controller.



The number within ⬭ refers to the pin number of driver connector SIGNAL 2.

Keep the voltage between DC5V and DC24V.
Keep the current below 10mA.
If the current exceeds 10mA, connect external resistance R.

The excitation timing signal is output to indicate when the motor excitation (current flowing through the winding) is in the initial stage (step “0” at power up).
The excitation timing signal can be used to increase the accuracy of home position detection by setting mechanical home position of your equipment (photo-sensor etc.) to coincide with the excitation sequence initial stage (step “0”).
When connected as shown in the example connection, the signal will be “photocoupler ON” at step “0”.

The excitation timing signal is output simultaneously with a pulse input each time the excitation sequence returns to step “0”.
The excitation sequence will complete one cycle for every 7.2° rotation of the motor output shaft.
When the power is turned ON, the excitation sequence is reset to step “0”.

Relation to the step angle switch

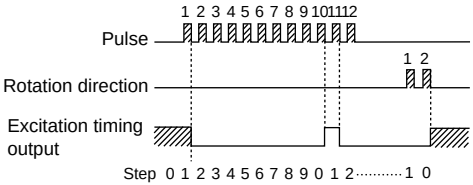
When the switch is set to the F position:

Full step: signal is output once every 10 pulses
(Standard type: 0.72°/step, Geared type: $0.72° \times \frac{1}{\text{gear ratio}}$ / step)

When the switch is set to the H position:

Half step: signal is output once every 20 pulses
(Standard type: 0.36°/step, Geared type: $0.36° \times \frac{1}{\text{gear ratio}}$ / step)

Timing chart when in full step mode



Connections

Connecting the motor, driver and power supply

- For signal lines, use twisted pair wire of AWG28 (0.08mm^2) or greater, and 1m (39.4in.) or less in length.
- For power lines and when extending the motor lead wires use wires of AWG26 (0.14mm^2) or greater.
- Separate the signal lines from the power lines and motor lead wires by at least 30cm (11.8in.). Do not band place the signal lines in the same duct as, or bind them together with, power lines, as this makes it easier for noise to enter the signal line, which can cause operating errors.
- Use an open collector transistor (sink type) for the controller signal output.
- If electrical noise generated by the motor lead wires or other equipment causes operational errors, shield the signal lines with conductive tape or wire mesh etc. (not supplied).

Pressure welding of the connectors

- The suitable wire size of AWG28 (0.08mm^2) to AWG26 (0.14mm^2) with a sheathing having an outside diameter of 0.85mm (0.03in.)~1.05mm (0.04in.).
  Use a wire rated at AWG26 (0.14mm^2) for the power line.
- Use the tool specified by the connector manufacturer (AMP 911790-1) for pressure welding of the terminals.

Note

When pulling and inserting the connector to the driver, hold the connector itself. Otherwise, the motor and the driver may be damaged.

Driver power supply

The input power voltage should come from a DC24V or DC36V power supply which is reinforced insulation.

The input current of the power supply is 0.7A or less.
Use a power supply which will supply sufficient input current.
(The current value for input power is a maximum value when connecting the drive mechanism (load) to the motor shaft.)

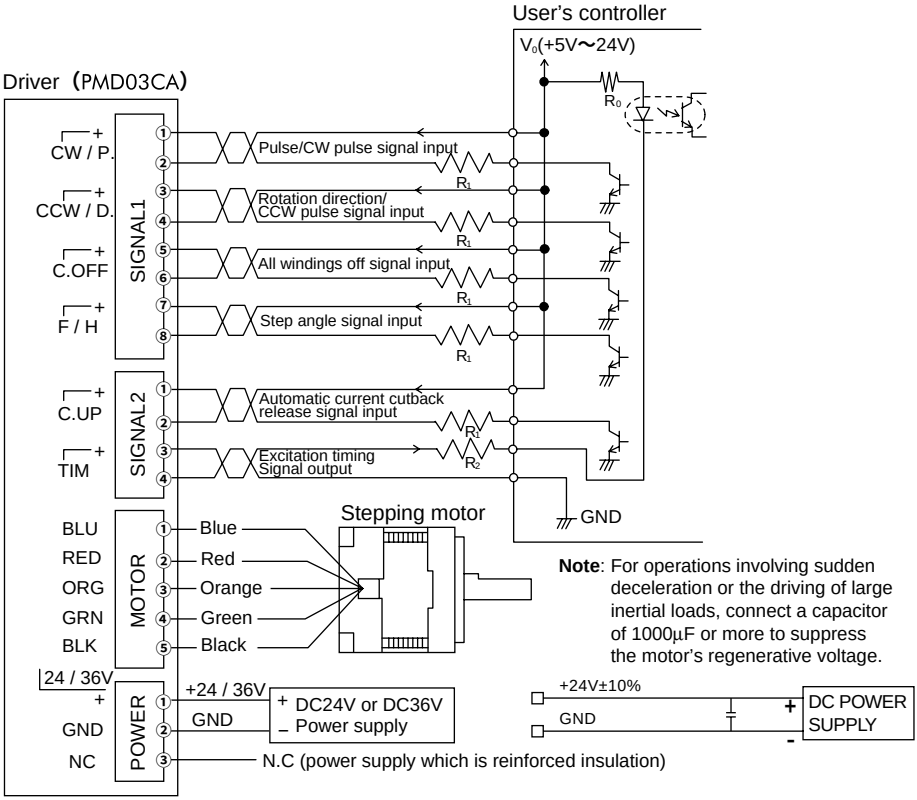
Note

If the current from the power supply is insufficient the motor torque will be reduced and the transformer may be damaged. The following abnormalities may also occur.

- Erratic motor rotation during high speeds
- Delayed motor start-up and stopping

Example connections

■Connection to user's controller



Input signal connections

Keep the voltage between DC5V and DC24V.
When voltage is equal to DC5V, external resistance R_1 is not necessary.
When voltage is above DC5V, connect external resistance R_1 and keep the input current below 20mA.

Output signal connections

Keep the voltage between DC5V and DC24V.
Keep the current below 10mA.
If the current exceeds 10mA, connect external resistance R_2.

Turning on the power

Before turning the power ON, be sure that the signal lines, motor lead wires, power line, and earth line are all properly connected.
The power LED lights when turning on the power (The power LED keeps lighting during turning on the power.).

Motor current adjustment

The **PMC** driver is shipped with the motor rated current set to 0.35A/phase (and the standstill current reduction (current cutback) ratio set to approximately 50%).
It is not necessary to adjust the current under normal operating conditions. However, readjust the current setting in the following cases.

To reduce motor vibration → Reduce the motor running current
To reduce temperature rise of the motor and driver → Reduce the motor running current and the motor
To increase the motor's standstill holding torque → Raise the motor's standstill current

Holding torque can be calculated using the following formulas
(Holding torque is proportional to output current.)

$$\text{Current cutback ratio (\%)} = \frac{\text{Standstill current setting}}{\text{Running current setting}} \times 100$$

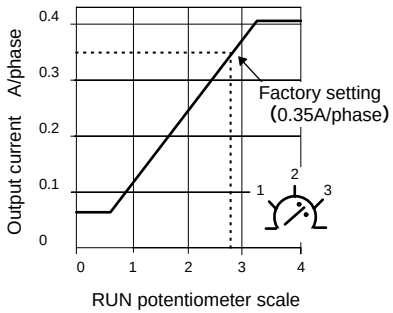
$$\text{Holding torque [N·m (oz-in)]} = \frac{\text{Maximum holding torque [N·m (oz-in)]} \times \text{Current cutback ratio (\%)}}{100}$$

Relationship between the potentiometers and the current

The relationship between the potentiometers and the current is shown below.

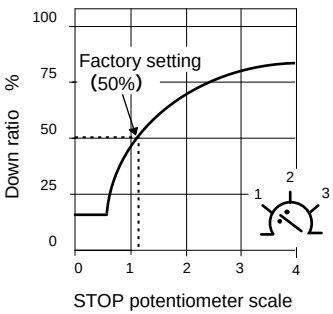
Motor running current

(Representative values)



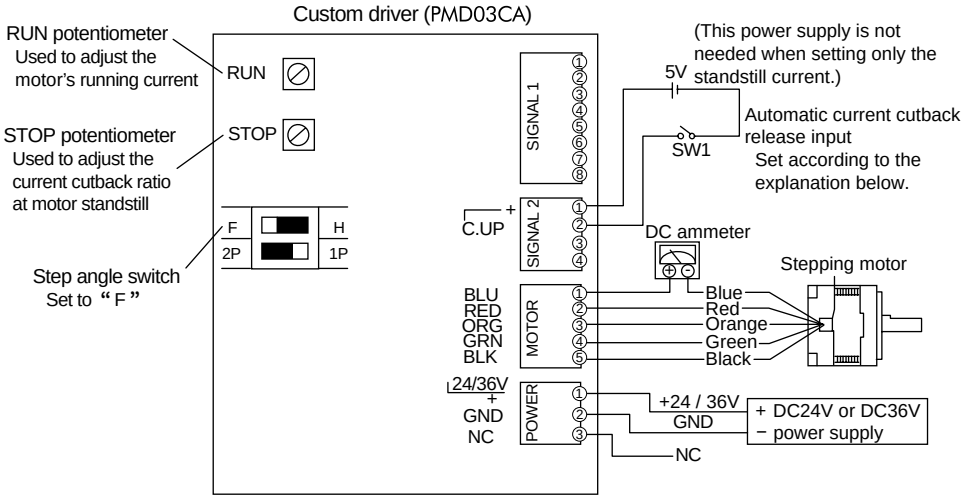
Motor standstill current

(Representative values)



Adjusting the current using an ammeter

When more precise current adjustment are necessary, make them by connecting an ammeter between the driver and motor, as shown below.



Note

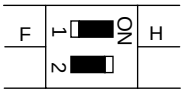
With the connections shown here, the current flowing to the ammeter is twice that of a single phase.

Therefore, the current setting (per single phase) is equivalent to half the value indicated on the ammeter.

For example, when the ammeter indicates 0.5A, the setting is 0.25A/phase.

■Setting the motor running current

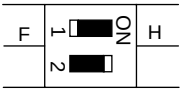
1. Confirm that the step angle switch set to F.



2. Turn on SW1 for the C.UP automatic current cutback release input. (Do not input any other signals)
3. After connecting the motor and DC ammeter, turn the power on.
4. Set the current using the RUN potentiometer.
   ∗Set the value indicated on the ammeter to twice the desired current setting (per phase).
5. Turn the power off.
6. Turn off SW1 for the C.UP automatic current cutback release input.

■Setting the motor standstill current

1. Confirm that the step angle switch set to F.



2. Check that nothing is connected or input to the C.UP terminal, and that the SW1 switch is turned off when using the connection shown above.
3. After connecting the motor and DC ammeter, turn the power on.
4. Set using the STOP potentiometer.
   ∗Set the value indicated on the ammeter to twice the desired current setting (per phase).
5. Turn the power off.

Troubleshooting

Consult the following chart if the motor is not functioning properly. If the motor is still not functioning properly after confirming the checkpoints below, contact your nearest sales office as listed at the back of this manual.

Problem	Check points	Measures
No excitation in the motor. (The motor has no holding torque and the shaft can be turned freely by hand.)	1. Is the driver POWER LED On? (If On, condition is normal)	If the POWER LED is not On, check if the power supply is properly connected.
	2. Is the all windings off signal being input to the driver?	When the all windings off signal is input the motor will lose all excitation (no holding torque). Return the all windings off signal to "photocoupler OFF".
	3. Are the driver and motor correctly connected?	Check the wiring configuration and continuity of the connector pressure weld. If the lead wires have been extended, check the extension connection.
	4. Are the current adjustment potentiometers (RUN or STOP) set too low?	These potentiometers control the output current to the motor (refer to pages 24, 25, 26). If they are set too low return them to the factory set positions.
	Note: If the motor still has no torque after checking the above conditions, the driver is probably defective. After reconfirming that the current voltage and connections are correct, contact your nearest sales office for service.	
The motor does not rotate.	First check the 4 items above.	
The motor does not rotate when a pulse signal is input.	5. In 2-pulse input mode (pulse input mode switch in the 2P position) is either the pulse/CW pulse or rotation direction/CCW pulse signal input terminal already in the "photocoupler ON" state?	The motor will not rotate if a pulse signal is input when the other pulse signal input terminal is already in the "photocoupler ON" state. Be sure to keep the pulse signal in the "photocoupler OFF" state.
	6. In 1-pulse input mode (pulse input mode switch in the 1P position) is the pulse signal connected to the rotation direction/ CCW pulse signal input terminal?	Connect the pulse signal to the pulse/CW pulse signal input terminal.

Problem	Check points	Measures
The motor rotates in the wrong direction.	7. In 2-pulse input mode (pulse input mode switch in the 2P position) are the CW and CCW pulse signal lines connected backwards?	Connect the CW pulse signal line to the pulse/CW pulse signal input terminal, and connect the CCW pulse signal line to the rotation direction/CCW pulse signal input terminal.
	8. In 1-pulse input mode (pulse input mode switch in the 1P position) leave the rotation direction/CCW pulse signal input terminal unconnected and try inputting a pulse signal to the pulse/CW pulse signal input terminal.	If the motor rotates in a counterclockwise direction the motor and driver are normal. Recheck the rotation direction signal levels. ("photocoupler ON" = clockwise, "photocoupler OFF" = counterclockwise)
	9. Is harmonic geared type or gear ratio of 10:1 of **MG** geared type used?	For harmonic geared type and 10:1 of **MG** geared type, due to the gear's construction, the direction of rotation of the output shaft is opposite to the direction of rotation of the motor itself as commanded by pulse input (Refer to page 16). Connect the CW pulse signal line to the rotation direction/CCW pulse signal input terminal, and connect the CCW pulse signal line to the pulse/CW pulse signal input terminal.
Motor rotation is erratic.	First check items 5, 6, 7 and 8.	
Motor start up is unstable.	10. While in 2-pulse input mode (pulse input mode switch in the 2P position) are the both of pulse/CW pulse and rotation direction CCW pulse signal input at the same time?	The motor will run irregularly if two pulses are input at the same time.
	11. Are the motor shaft and load properly aligned? Is the load too heavy for the motor?	Make sure the motor shaft and load are securely attached and properly aligned. Recheck the operating conditions, and if necessary lighten the load.

Problem	Check points	Measures
The motor rotates too far or not far enough.	12. Does the step angle required by your equipment match the step angle of the stepping motor?	Check the setting of the step angle switch located on the driver.
	13. Is the number of pulses set to match the amount of motor rotation?	Check the controller pulse setting.
The motor loses synchronization during acceleration or while running.	14. Is the starting pulse frequency too high?	Check this by decreasing the frequency.
	15. Is the acceleration/ deceleration time too short?	Check this by increasing the acceleration/ deceleration time.
	16. Is the motor being affected by noise interference?	Check this by running the motor while the machine suspected of producing the noise interference is off.
Motor vibration is very high.	17. Is the output torque too high?	Try reducing the motor running current with the current adjustment potentiometer “RUN”.
	18. Try changing the pulse frequency.	If the vibration decreases after the pulse frequency has been adjusted, this means the motor is resonating. Either adjust the frequency or change the step angle. Also try installing the optional (sold separately) clean damper (for double shaft model only).
Motor temperature is very high. [The temperature of the motor case should be less than 100°C (212°F). For harmonic geared type: less than 70°C (158°F).]	19. Is the motor running time too long?	Shorten the running time or increase the resting time.
	20. Is the automatic current cutback release function input?	Turn off the automatic current cutback release input.
	21. Try changing the pulse rate.	The temperature of the motor rise varies depending on the pulse rate. Refer to the speed-torque characteristics in the catalog, and operate at a lower input speed.
The automatic current cutback function does not work.	22. Is the pulse/CW pulse or rotation direction/CCW pulse signal input “photocoupler ON” after the completion of the pulse signal?	This function does not work, and the motor current is not reduced, when the pulse signal is held at “photocoupler ON”. Always return it to “photocoupler OFF”.
	23. Is automatic current cutback release function being input?	Turn off the automatic current cutback release input.

Specifications

Package Model	Single Shaft	**PMC33A3**	**PMC35A3**
	Double Shaft	**PMC33B3**	**PMC35B3**
Maximum Holding Torque	N·m (oz-in)	0.033 (4.58)	0.06 (8.33)
Rotor Inertia	kg·m^2 (oz-in^2)	9×10^{-7} (0.05)	18×10^{-7} (0.099)
Rated Current	A/phase	0.35	
Basic Step Angle		0.72°	
Shaft Runout	mm (inch)	0.05 (0.002) T.I.R. at top of output shaft	
Perpendicularity	mm (inch)	0.075 (0.003) T.I.R.	
Concentrictly	mm (inch)	0.075 (0.003) T.I.R.	
Insulation Class		Class B [130°C (266°F)]	
Power Source		DC24V±10% 0.7A or DC36V±10% 0.7A	
Output Current		0.35	
Excitation Mode		•Full step (4 phase excitation): 0.72°/step •Half step (4-5 phase excitation): 0.36°/step	
Input Signals	Input Signal	Photocoupler input, Input resistance 220Ω, Input current 20mA maximum Signal voltage Photocoupler ON: +4~+5V, Photocoupler OFF: 0~+0.5V	
	• Pulse Signal (CW Pulse Signal)	Step command pulse signal (CW step command signal at 2-pulse input mode) Pulse width: 5µs minimum, Pulse rise/fall: 2µs maximum Motor moves when the photocoupler state changes from ON to OFF.	
	• Rotation Direction Signal (CCW Pulse Signal)	Rotation direction signal Photocoupler ON: CW, Photocoupler OFF: CCW (CCW step command signal at 2-pulse input mode Pulse width: 5µs minimum, Pulse rise/fall: 2µs maximum Motor moves when the photocoupler state changes from ON to OFF.)	
	• Step Angle Signal	Full Step (0.72°) at "photocoupler OFF" Half Step (0.36°) at "photocoupler ON"	
	• All Windings Off Signal	When in the "photocoupler ON" state, the current to the motor is cut off and the motor shaft can be rotated manually. When in the "photocoupler OFF" state, the current level set by the RUN switch is supplied to the motor.	
	• Automatic Current Cutback Release Signal	When in the "photocoupler ON" state, the "Automatic Current Cutback" function at motor standstill is disabled. When in the "photocoupler OFF" state, the "Automatic Current Cutback" function at motor standstill is activated. (approximately 100ms after motor stops)	
Output Signals	Output Signal Circuit	Photocoupler, Open-Collector Output External use condition : 24VDC maximum, 10mA maximum	
	• Excitation Timing Signal	Signal is output every time the excitation sequence returns to the initial "0". (Photocoupler: ON) Full step: Signal is output every 10 pulses, Half step: Signal is output every 20 pulses	
Functions		Automatic current cutback, All windings off, Pulse input mode switch	
Indication (LED)		Power Input	
Driver Cooling Method		Natural Ventilation	
Mass	Motor kg (lb.)	0.1 (0.22)	0.17 (0.38)
	Driver kg (lb.)	0.025 (0.06)	
Insulation Resistance		100MΩ minimum under normal temperature and humidity, when measured by a DC500V megger between the motor coils and the motor casing.	
Dielectric Strength		Sufficient to withstand 0.5kV, 60Hz applied between the motor coils and casing for one minute, under normal temperature and humidity.	
Ambient Temperature Range	Motor	-10°C~+50°C (+14°F~+122°F)	
	Driver	0°C~+40°C (+32°F~+104°F)	

- Maximum holding torque refers to the holding torque at motor standstill when the rated current is supplied to the motor (5-phase excitation). Use this value to compare motor torque performance. When using the motor with the included driver, the driver's "Automatic Current Cutback" function at motor standstill reduces maximum holding torque by approximately 50%.
- The power source input current value represents the maximum current. (The input current varies according to the pulse frequency.)

Note

- Do not measure insulation resistance or perform the dielectric withstand test while the motor and driver are connected.

Package Model	Single Shaft	PMC33A1-MG3.6	PMC33A1-MG7.2	PMC33A1-MG10	PMC33A1-MG20	PMC33A1-MG30	PMC33A1-MG50
	Double Shaft	PMC33B1-MG3.6	PMC33B1-MG7.2	PMC33B1-MG10	PMC33B1-MG20	PMC33B1-MG30	PMC33B1-MG50
Maximum Holding Torque N·m (oz-in)		0.08 (11.1)	0.16 (22.2)	0.21 (29.1)	0.34 (47.2)	0.51 (70.8)	
Rotor Inertia kg·m² (oz-in²)		9×10^{-7} (0.05)					
Rated Current A/phase		0.35					
Basic Step Angle		0.2°	0.1°	0.072°	0.036°	0.024°	0.0144°
Gear Ratio		3.6:1	7.2:1	10:1	20:1	30:1	50:1
Permissible Torque N·m (oz-in)		0.08 (11.1)	0.16 (22.2)	0.21 (29.1)	0.34 (47.2)	0.51 (70.8)	
Permissible Thrust Load N (lb.)		10 (2.2)					
Permissible Overhung Load N (lb.)		15 (3.3)					
Permissible of Gear Shaft Rotation		Same as motor		Opposite to motor	Same as motor		
Permissible Speed Range (Gear Output Shaft Speed)	Full Step	0~833r/min	0~416r/min	0~300r/min	0~150r/min	0~100r/min	0~60r/min
	Half Step						
Insulation Class		Class B [130°C (266°F)]					
Power Source		DC24V±10% 0.7A or DC36V±10% 0.7A					
Output Current A/phase		0.35					
Excitation Mode	Full Step	0.2°/step	0.1°/step	0.072°/step	0.036°/step	0.024°/step	0.0144°/step
	Half Step	0.1°/step	0.05°/step	0.036°/step	0.018°/step	0.012°/step	0.0072°/step
Input Signals — Input Signal Circuit		Photocoupler input, Input resistance 220Ω, Input current 20mA maximum Signal voltage Photocoupler ON: +4~+5V, Photocoupler OFF: 0~+0.5V					
Input Signals — • Pulse Signal (CW Pulse Signal)		Step command pulse signal (CW step command signal at 2-pulse input mode) Pulse width: 5µs minimum, Pulse rise/fall: 2µs maximum Motor moves when the photocoupler state changes from ON to OFF.					
Input Signals — • Rotation Direction Signal (CCW Pulse Signal)		Rotation direction signal Photocoupler ON: CW, Photocoupler OFF: CCW (CCW step command signal at 2-pulse input mode Pulse width: 5µs minimum, Pulse rise/fall: 2µs maximum Motor moves when the photocoupler state changes from ON to OFF.)					
Input Signals — • Step Angle Signal		Full Step at "photocoupler OFF" Half Step at "photocoupler ON"					
Input Signals — • All Windings Off Signal		When in the "photocoupler ON" state, the current to the motor is cut off and the motor shaft can be rotated manually. When in the "photocoupler OFF" state, the current level set by the RUN switch is supplied to the motor.					
Input Signals — • Automatic Current Cutback Release Signal		When in the "photocoupler ON" state, the "Automatic Current Cutback" function at motor standstill is disabled. When in the "photocoupler OFF" state, the "Automatic Current Cutback" function at motor standstill is activated. (approximately 100ms after motor stops)					
Output Signals — Output Signal Circuit		Photocoupler, Open-Collector Output External use condition: 24VDC maximum, 10mA maximum					
Output Signals — • Excitation Timing Signal		Signal is output every time the excitation sequence returns to the initial "0". (Photocoupler: ON) Full step: Signal is output every 10 pulses, Half step: Signal is output every 20 pulses					
Functions		Automatic current cutback, All windings off, Pulse input mode switch					
Indication (LED)		Power Input					
Driver Cooling Method		Natural Ventilation					
Mass	Motor kg (lb.)	0.16 (0.36)					
	Driver kg (lb.)	0.025 (0.06)					
Insulation Resistance		100MΩ minimum under normal temperature and humidity, when measured by a DC500V megger between the motor coils and the motor casing.					
Dielectric Strength		Sufficient to withstand 0.5kV, 60Hz applied between the motor coils and casing for one minute, under normal temperature and humidity.					
Ambient Temperature Range	Motor	-10°C~+50°C (+14°F~+122°F)					
	Driver	0°C~+40°C (+32°F~+104°F)					

- Maximum holding torque refers to the holding torque at motor standstill when the rated current is supplied to the motor (5-phase excitation), with consideration given to the permissible strength of the gear. Use this value to compare motor torque performance. When using the motor with the dedicated driver, the driver's "Automatic current cutback" function at motor standstill reduces maximum holding torque by approximately 50%.
- The power source input current value represents the maximum current. (The input current varies according to the pulse frequency.)
- Permissible torque is the marginal value of the mechanical strength of the gear unit. Use the product with a total torque (load and acceleration) less than the permissible torque.
- Maximum overhung load indicates the value measured at 10mm (0.39in.) from the tip of the gear output shaft.

Note

- Do not measure insulation resistance or perform the dielectric withstand test while the motor and driver are connected.

Package Model	Single Shaft	PMC33A1-HG50	PMC33A1-HG100
	Double Shaft	PMC33B1-HG50	PMC33B1-HG100
Maximum Holding Torque N·m (oz-in)		1.5 (213)	2.0 (284)
Rotor Inertia kg·m² (oz-in²)		12×10^{-7} (0.066)	
Rated Current A/phase		0.35	
Basic Step Angle		0.0144°	0.0072°
Gear Ratio		50:1	100:1
Permissible Torque N·m (oz-in)		1.5 (213)	2.0 (284)
Maximum Torque N·m (oz-in)		2.0 (284)	2.8 (397)
Permissible Thrust Load N (lb.)		100 (22)	
Permissible Overhung Load N (lb.)		200 (45)	
Direction of Gear Shaft Rotation		Opposite to motor	
Permissible Speed Range (Gear Output Shaft Speed)	Full Step	0~70r/min	0~35r/min
	Half Step		
Insulation Class		Class B [130°C (266°F)]	
Power Source		DC24V±10% 0.7A or DC36V±10% 0.7A	
Output Current A/phase		0.35	
Excitation Mode	Full Step	0.0144°/step	0.0072°/step
	Half Step	0.0072°/step	0.0036°/step
Input Signals — Input Signal Circuit		Photocoupler input, Input resistance 220Ω, Input current 20mA maximum Signal voltage Photocoupler ON: +4~+5V, Photocoupler OFF: 0~+0.5V	
Input Signals — • Pulse Signal (CW Pulse Signal)		Step command pulse signal (CW step command signal at 2-pulse input mode) Pulse width: 5µs minimum, Pulse rise/fall: 2µs maximum Motor moves when the photocoupler state changes from ON to OFF.	
Input Signals — • Rotation Direction Signal (CCW Pulse Signal)		Rotation direction signal Photocoupler ON: CW, Photocoupler OFF: CCW (CCW step command signal at 2-pulse input mode Pulse width: 5µs minimum, Pulse rise/fall: 2µs maximum Motor moves when the photocoupler state changes from ON to OFF.)	
Input Signals — • Step Angle Signal		Full Step at "photocoupler OFF" Half Step at "photocoupler ON"	
Input Signals — • All Windings Off Signal		When in the "photocoupler ON" state, the current to the motor is cut off and the motor shaft can be rotated manually. When in the "photocoupler OFF" state, the current level set by the RUN switch is supplied to the motor.	
Input Signals — • Automatic Current Cutback Release Signal		When in the "photocoupler ON" state, the "Automatic Current Cutback" function at motor standstill is disabled. When in the "photocoupler OFF" state, the "Automatic Current Cutback" function at motor standstill is activated. (approximately 100ms after motor stops)	
Output Signals — Output Signal Circuit		Photocoupler, Open-Collector Output External use condition: 24VDC maximum, 10mA maximum	
Output Signals — • Excitation Timing Signal		Signal is output every time the excitation sequence returns to the initial "0". (Photocoupler: ON) Full step: Signal is output every 10 pulses, Half step: Signal is output every 20 pulses	
Functions		Automatic current cutback, All windings off, Pulse input mode switch	
Indication (LED)		Power Input	
Driver Cooling Method		Natural Ventilation	
Mass	Motor kg (lb.)	0.21 (0.47)	
	Driver kg (lb.)	0.025 (0.06)	
Insulation Resistance		100MΩ minimum under normal temperature and humidity, when measured by a DC500V megger between the motor coils and the motor casing.	
Dielectric Strength		Sufficient to withstand 0.5kV, 60Hz applied between the motor coils and casing for one minute, under normal temperature and humidity.	
Ambient Temperature Range	Motor	0°C~+40°C (+32°F~+104°F)	
	Driver	0°C~+40°C (+32°F~+104°F)	

- Maximum holding torque refers to the holding torque at motor standstill when the rated current is supplied to the motor (5-phase excitation), with consideration given to the permissible strength of the gear. Use this value to compare motor torque performance. When using the motor with the dedicated driver, the driver's "Automatic current cutback" function at motor standstill reduces maximum holding torque by approximately 50%.
- The power source input current value represents the maximum current. (The input current varies according to the pulse frequency.)
- Permissible torque is the marginal value of the mechanical strength of the gear unit. Use the product with a total torque (load and acceleration) less than the permissible torque.
- Maximum overhung load indicates the value measured at 10mm (0.39in.) from the tip of the gear output shaft.

Note

- Do not measure insulation resistance or perform the dielectric withstand test while the motor and driver are connected.

Installing and wiring in compliance with EMC directive

Introduction

■The EMC directive (89/336EEC and 92/31/EEC)

Stepping motors from ORIENTAL MOTOR are designed to be a built in component. The EMC directive requires that the customer's equipment incorporated with this product should comply with the EMC directive.
The installation and wiring method for the motor and driver are the basic methods that would effectively allow the customer's equipment to be compliant with the EMC directive. Final compliance of the equipment to the EMC directive varies according to the configuration, wiring, layout, and level of hazard of other control systems and electrical components used with the motor and driver.
This requires the customers to conduct the EMC measures of their equipment for verification.

■Applicable standards

EMI	Emission Tests	EN50081-2: 1993
	Radiated Emission Test	EN55011: 1998
EMS	Immunity Tests	EN50082-2: 1995
	Radiation Field Immunity Test	EN61000-4-3: 1996 ENV50204: 1995
	Fast Transient/Burst Immunity Test	EN61000-4-4: 1995
	Conductive Noise Immunity Test	EN61000-4-6: 1996

Installation and wiring procedures according to the EMC directive

It is essential to take effective measures against the EMI from this product to the peripheral control systems and the EMS of this product. Otherwise, a serious adverse effect may be given to the equipment functions.
The following installation and wiring procedures ensure compliance of this product to the EMC directive (applicable standards as specified on this page).

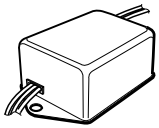
■Power supply

These products use the DC power supply input specifications.
Use the optimum DC power supply (switched power supply or the like) that conforms with the EMC directive.
Also, when using a transformer for the power supply, always connect a mains filter on the input side of the transformer.

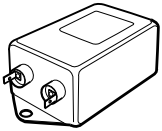
■Connection of mains filter for power line

To prevent the noise generated from the driver being transferred to the outside through the power supply transformer, connect a mains filter to the AC input line of the power supply transformer.
Use FN250-12/07 by Schaffner Electronik AG, 10ESK1 by CORCOM, ZAG2210-11S by TDK or their equivalent as the mains filter.
Install the mains filter as close as possible to the driver. Use cable clamps or similar tools to fix the input cable and output cable. The input cables and output cables to be firmly ensured that they will not be separated from the surface of the enclosure. Connect the grounding terminal of the mains filter to the grounding point in the shorter distance. Do not connect the AC input cable (AWG18: 0.75mm^2 or more) and mains filter output cables in parallel to each other. Otherwise, the noise in the enclosure may be connected directly with the power cable through the floating capacity. This may result in the effects reduced of the mains filter.

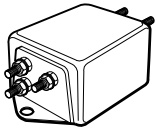
Mains filter



FN250-12/07 by Schaffer Electronik



10ESK1 by CORCOM



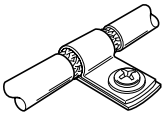
ZAG2210-11S by TDK

■Grounding method

To ensure that potential difference will not occur, connect the driver, motor and mains filter to the grounding point in the shorter distance by the use of a larger grounding cable. Use a large uniform conductive surface for the grounding point.

■Connection of signal cable

High quality braided-screen cable of AWG24 (0.2mm^2) or more should be used for signal cabling, and connect it to a controller in the shorter distance.
For some products, such braided-screen cable is available as an option. Please inquire at your nearest Oriental Motor sales office.
To earth the braided-screen, use such clamps as metallic cable clamps which can be in contact with the circumference of the braided-screen cable. Cable clamps on the braided-screen cable should be installed as close to the cable end as possible as per illustrated. On of the braided-screen cable, as illustrated. Connect the earth wire to the adequate grounding point.

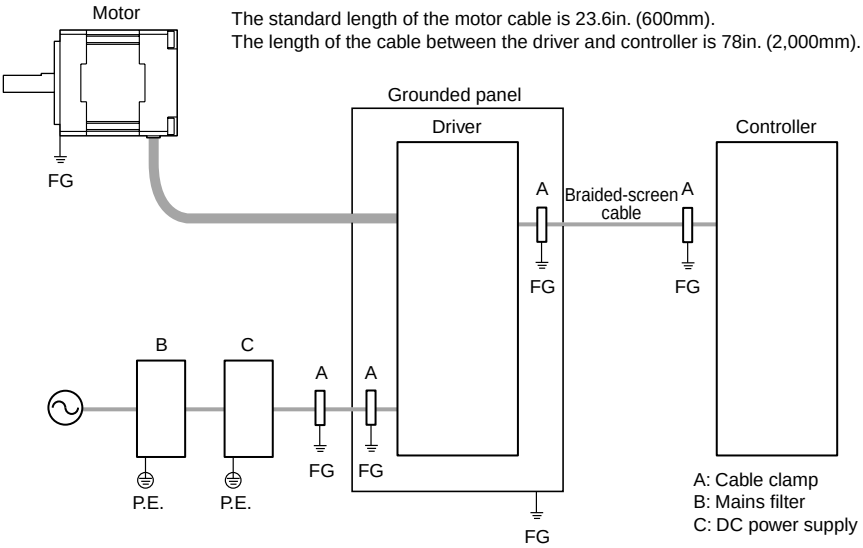


Cable clamp

■Others

- To ensure that potential difference will not occur between the motor/driver and peripheral control system equipment, earth the cable directly to the grounding point.
- When the relay and magnetic switch are used together, make sure that the surge is absorbed by the mains filter and CR circuit.
- The length of the cables should be as short as possible; do not use long cables with the excess portion wound in a bundle.
- Keep the power cables such as the motor cable and power cable away from the signal cables and connect them separately from each other as far as possible [For example, keep them 100 to 200mm (3.94 to 7.87in.) apart from each other]. Signal cables should only cross the path of motor or power cables at right angle. The AC input cable and output cable of the mains filter should be kept away from each other.

■Example of motor and driver installation and wiring



Precautions concerning static electricity

Static electricity can make the driver malfunction or destroy it. Handle the driver carefully when its power is on.

Always use an insulated screwdriver when adjusting the motor current with the driver's internal control (VR) or switch.

When using a driver mounted on the current check terminals, adjust the current in the following manner.

1. Switch off the driver power supply.
2. Insert the tester into the current check terminals.
3. Switch on the driver power supply.
4. Adjust the current by adjusting the internal control (VR) with an insulated screwdriver.
5. Switch off the driver power supply, then remove the tester.

Note: Do not approach or touch the driver with the power on.

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ORIENTAL MOTOR U.S.A. CORP.
Technical Support Line Tel:(800)468-3982
Available from 7:30 AM to 5:00 PM, P.S.T.
E-mail: techsupport@orientalmotor.com
www.orientalmotor.com

ORIENTAL MOTOR (EUROPA) GmbH
Headquarters and Düsseldorf Office
Tel:0211-5206700 Fax:0211-52067099
Munich Office
Tel:08131-59880 Fax:08131-598888
Hamburg Office
Tel:040-76910443 Fax:040-76910445

ORIENTAL MOTOR (UK) LTD.
Tel:01256-347090 Fax:01256-347099

ORIENTAL MOTOR (FRANCE) SARL
Tel:01 47 86 97 50 Fax:01 47 82 45 16

ORIENTAL MOTOR ITALIA s.r.l.
Tel:02-93906346 Fax:02-93906348

TAIWAN ORIENTAL MOTOR CO.,LTD.
Tel:(02)8228-0707 Fax:(02)8228-0708

SINGAPORE ORIENTAL MOTOR PTE LTD
Tel:(6745)7344 Fax:(6745)9405

ORIENTAL MOTOR (MALAYSIA) SDN. BHD.
Tel:(03)22875778 Fax:(03)22875528

INA ORIENTAL MOTOR CO.,LTD.
KOREA
Tel:(032)822-2042~3 Fax:(032)819-8745

ORIENTAL MOTOR CO.,LTD.
Headquarters Tokyo, Japan
Tel:(03)3835-0684 Fax:(03)3835-1890

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