Oriental motor

HM-60244-3

OPERATING MANUAL

Closed Loop Stepping Motor and Driver Package
αSTEP
AZ Series Motor

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.

Introduction

■ Before use

Only qualified personnel should work with the product.
Use the product correctly after thoroughly reading the "Safety precautions."
The product described in this manual has been designed and manufactured to be incorporated in general industrial equipment. Do not use for any other purpose. Oriental Motor Co., Ltd. is not responsible for any damage caused through failure to observe this warning.

■ Operating Manuals for the AZ Series

Operating manuals for the **AZ** Series are listed below.
Always keep the manual where it is readily available.

- **AZ** Series Motor OPERATING MANUAL (this document)
- **AZ** Series Driver OPERATING MANUAL (Supplied with driver)
- **AZ** Series OPERATING MANUAL Function Edition

The "OPERATING MANUAL Function Edition" does not come with the product. For details, contact your nearest Oriental Motor sales office or download from Oriental Motor Website Download Page.

- APPENDIX UL Standards for **AZ** Series AC power input type (Supplied with product)

■ Hazardous substances

The products do not contain the substances exceeding the restriction values of RoHS Directive (2011/65/EU).

CE Marking

The motor being combined with the **AZ** Series AC power input type driver is affixed the CE Marking under the Low Voltage Directive.

● Low Voltage Directive

- This product is designed and manufactured to be incorporated in equipment.
- This product cannot be used with cables normally used for IT equipment.
- Install the product within the enclosure in order to avoid contact with hands.
- When a product can be touched with hands, be sure to ground. When installing the motor and driver, securely connect their Protective Earth Terminals.
- To protect against electric shock using an earth leakage breaker (RCD), connect a type B earth leakage breaker to the primary side of the driver.
- When using a circuit breaker (MCCB), use a unit conforming to the EN or IEC standard.
- Isolate the motor cable, power-supply cable and other drive cables from the signal cables by means of double insulation.
- The temperature of the driver's heat sink may exceed 90 °C (194 °F) depending on the driving conditions. Accordingly, take heed of the following items:
  - Do not touch the driver.
  - Do not use the driver near flammable objects.
  - Always conduct a trial operation to check the driver temperature.

- Applicable Standards

EN 60034-1, EN 60034-5, EN 60664-1

- Installation condition (EN Standards)

- To be incorporated in equipment
- Overvoltage category: II
- Pollution degree: 3
- Degree of protection: IP65
- Protection against electric shock: Class I

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.

Description of signs

⚠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.

Description of graphic symbols

	Indicates "prohibited" actions that must not be performed.
	Indicates "compulsory" actions that must be performed.

⚠Warning	
	Do not use the product in explosive or corrosive environments, in the presence of flammable gases, locations subjected to splashing water, or near combustibles. This may cause fire, electric shock or injury.
	Do not transport, install the product, perform connections or inspections when the power is on. This may cause electric shock.
	Do not forcibly bend, pull or pinch the cable. This may cause fire or electric shock.
	Do not disassemble or modify the product. This may cause injury or damage to equipment.

⚠Warning	
	Assign qualified personnel the task of installing, wiring, operating/controlling, inspecting and troubleshooting the product. Failure to do so may result in fire, electric shock, injury or damage to equipment.
	If this product is used in an vertical application, be sure to provide a measure for the position retention of moving parts. Failure to do so may result in injury or damage to equipment.
	Do not use the brake mechanism of an electromagnetic brake motor as a deceleration/safety brake. This may cause injury or damage to equipment.
	When the driver generates an alarm (any of the driver's protective functions is triggered), take measures to hold the moving part in place since the motor stops and loses its holding torque. Failure to do so may result in injury or damage to equipment.
	Install the product in an enclosure. Failure to do so may result in electric shock or injury.
	The motor and driver are designed with Class I equipment basic insulation. When installing the motor, do not touch the product or be sure to ground them. Failure to do so may result in electric shock.

⚠Caution	
	Do not use the product beyond its specifications. This may cause electric shock, injury or damage to equipment.
	Keep your fingers and objects out of the openings in the product. Failure to do so may result in fire, electric shock or injury.
	Do not touch the product while operating or immediately after stopping. This may cause a skin burn(s).
	Do not carry the motor by holding the motor output shaft or motor cable. Doing so may cause injury.
	Keep the area around the product free of combustible materials. Failure to do so may result in fire or a skin burn(s).
	Leave nothing around the product that would obstruct ventilation. Failure to do so may result in damage to equipment.
	Do not touch the rotating part (output shaft) during operation. Doing so may cause injury.
	Do not touch the terminals while performing the insulation resistance test or dielectric strength test. This may cause electric shock.

⚠Caution	
	Provide a cover over the rotating part (output shaft) of the motor. Failure to do so may result in injury.
	Use a motor and driver only in the specified combination. Failure to do so may result in fire.
	Provide an emergency stop device or emergency stop circuit external to the equipment so that the entire equipment will operate safely in the event of a system failure or malfunction. Failure to do so may result in injury.
	To dispose of the product, disassemble it into parts and components as much as possible and dispose of individual parts/components as industrial waste.
	The motor surface temperature may exceed 70 °C (158 °F) even under normal operating conditions. If the operator is allowed to approach the running motor, attach a warning label as shown below in a conspicuous position. Failure to do so may result in a skin burn(s).  Warning label

Precautions for use

This section covers limitations and requirements the user should consider when using the product.

- Always use the cable (supplied or accessory) to connect the motor and driver.

Be sure to use the cable (supplied or accessory) to connect the motor and driver. In the following condition, an appropriate accessory cable must be purchased separately.

- If a flexible cable is to be used.
- If a cable of 3 m (9.8 ft.) or longer is to be used.
- If a motor and driver package without a cable was purchased.

- Conduct the insulation resistance test or dielectric strength test separately on the motor and the driver.

Conducting the insulation resistance test or dielectric strength test with the motor and driver connected may result in damage to the product.

- Do not make a strong impact on the motor output shaft or encoder

- Making a strong impact on an encoder may cause the motor malfunction or damage to the encoder.
- When transporting the motor or installing a load, handle the motor carefully not to make a strong impact on the motor output shaft.

- Do not apply an radial load and axial load in excess of the specified permissible limit

Operating the motor under an excessive radial load or axial load may damage the motor bearings (ball bearings). Be sure to operate the motor within the specified permissible limit of radial load and axial load.

- Use the motor in conditions where its surface temperature will not exceed 80 °C (212 °F).

The surface temperature on the motor case may exceed 80 °C (212 °F) depending on operating conditions such as ambient temperature, operating speed, duty cycle and others. In order to protect the encoder, use the motor so that the surface temperature on the motor case does not exceed 80 °C (212 °F).
If the encoder temperature reaches the upper limit, the motor overheat protection alarm will generate.
Use the geared type motor in a condition where the gear case temperature does not exceed 70 °C (158 °F), in order to prevent deterioration of grease and parts in the gear case.
If the motor is to be operated continuously, install the motor in a location where heat dissipation capacity equivalent to a level achieved with a heat sink [made of aluminum, 250×250×6 mm (9.84×9.84×0.24 in.)] is ensured.

- Holding torque at standstill

The motor holding torque is reduced by the current cutback function of the driver at motor standstill. When operating the motor, take account of the motor torque drop at the time of stopping.

- Do not use the electromagnetic brake to reduce speed or as a safety brake.

Do not use the electromagnetic brake as a means to decelerate and stop the motor. The brake hub of the electromagnetic brake will wear significantly and the braking force will drop. Since the power off activated type electromagnetic brake is equipped, it helps maintain the position of the load when the power is cut off, but this brake cannot securely hold the load in place. Accordingly, do not use the electromagnetic brake as a safety brake. To use the electromagnetic brake to hold the load in place, do so after the motor has stopped.

- Grease of geared motor

On rare occasions, a small amount of grease may ooze out from the geared motor. If there is concern over possible environmental damage resulting from the leakage of grease, check for grease stains during regular inspections.Alternatively, install an oil pan or other device to prevent leakage from causing further damage. Oil leakage may lead to problems in the customer's equipment or products.

- Peak torque of geared type motor

Always operate the geared type motor under a load not exceeding the peak torque. If the load exceeds the peak torque, the gear will be damaged.

- Rotation direction of the gear output shaft

The relationship between the rotation direction of the motor shaft and that of the gear output shaft changes as follows, depending on the gear type and gear ratio.

Type of gear	Gear ratio	Rotation direction (relative to the motor rotation direction)
TS geared	3.6, 7.2, 10	Same direction
	20, 30	Opposite direction
PS geared **HPG** geared	All gear ratios	Same direction
Harmonic geared	All gear ratios	Opposite direction

- Do not perform push-motion operation with geared types.

Doing so may cause damage to the motor or gear part.

General specifications

Degree of protection	IP65 (Excluding the mounting surface and connectors)	
Operation environment	Ambient temperature	0 to +40 °C (+32 to +104 °F) (non-freezing)
	Humidity	85% or less (non-condensing)
	Altitude	Up to 1000 m (3300 ft.) above sea level
	Surrounding atmosphere	No corrosive gas, dust, water or oil
Storage environment Shipping environment	Ambient temperature	−20 to +60 °C (−4 to +140 °F) (non-freezing)
	Humidity	85% or less (non-condensing)
	Altitude	Up to 3000 m (10000 ft.) above sea level
	Surrounding atmosphere	No corrosive gas, dust, water or oil
Insulation resistance	100 MΩ or more when 500 VDC megger is applied between the following places: • Case - Motor windings • Case - Electromagnetic brake windings	
Dielectric strength	Sufficient to withstand the following for 1 minute: • Case - Motor windings 1.5 kVAC 50/60 Hz • Case - Electromagnetic brake windings 1.5 kVAC 50/60 Hz	

Preparation

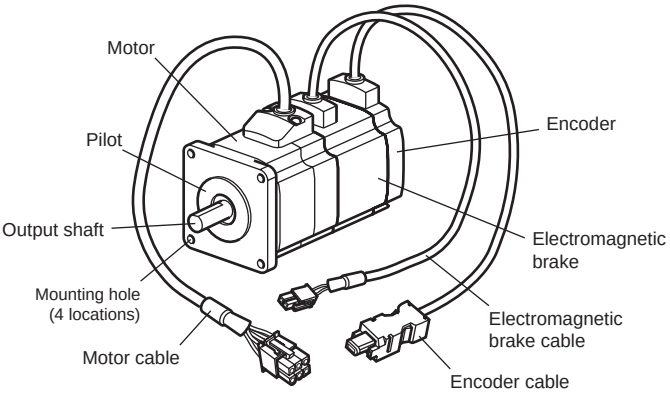
■ Checking the product

Verify that the items listed below are included. Report any missing or damaged items to the branch or sales office from which you purchased the product.

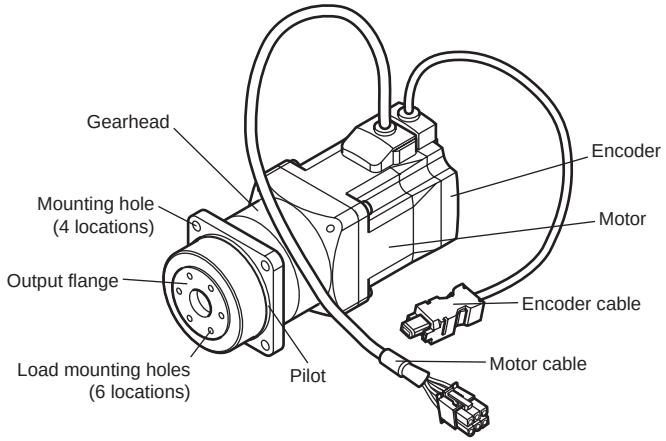
- Motor .....1 unit
- Parallel key .....1 pc.
  [Supplied with geared types; except for the AZM46-TS geared type and the **HPG** geared flange output type]
- Motor mounting screw (M4) .....4 pcs.
  [Supplied with AZM66-TS geared type]
- OPERATING MANUAL Motor .....1 copy (this document)

■ Names of parts

● Standard type with electromagnetic brake (Example: AZM66MC)



● **HPG geared flange output type**
(Example: AZM66AC-HP5F**)**



Installation

■ Location for installation

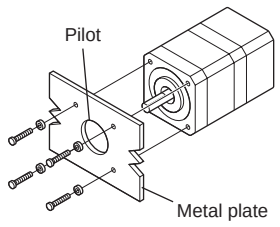
The motor has been designed and manufactured to be incorporated in equipment. Install them in a well-ventilated location that provides easy access for inspection.
The location must also satisfy the following conditions:

- Inside an enclosure that is installed indoors (provide vent holes)
- Operating ambient temperature: 0 to +40 °C (+32 to +104 °F) (non-freezing)
- Operating ambient humidity 85% or less (non-condensing)
- Area that is free of explosive atmosphere or toxic gas (such as sulfuric gas) or liquid
- Area not exposed to direct sun
- Area free of excessive amount of dust, iron particles or the like
- Area not subject to splashing water (rain, water droplets), oil (oil droplets) or other liquids
- Area free of excessive salt
- Area not subject to continuous vibration or excessive shocks
- Area free of excessive electromagnetic noise (from welders, power machinery, etc.)
- Area free of radioactive materials, magnetic fields or vacuum
- 1000 m (3300 ft.) or lower above sea level

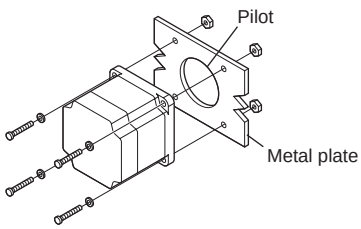
■ Installation method

The motor can be installed in any direction. To allow for heat dissipation and prevent vibration, install the motor on a metal surface of sufficient strength.

- Installation method A



- Installation method B



● **Nominal size, tightening torque and installation method**

- Standard type

Motor model	Nominal size	Tightening torque [N·m (oz-in)]	Effective depth of bolt [mm (in.)]	Installation method
AZM46	M3	1 (142)	4.5 (0.177)	A
AZM66 AZM69	M4	2 (280)	–	B

- **TS** geared type

Motor model	Nominal size	Tightening torque [N·m (oz-in)]	Effective depth of bolt [mm (in.)]	Installation method
AZM46	M4	2 (280)	8 (0.315)	A
AZM66			–	B

- **PS** geared type

Motor model	Nominal size	Tightening torque [N·m (oz-in)]	Effective depth of bolt [mm (in.)]	Installation method
AZM46	M4	2 (280)	8 (0.315)	A
AZM66	M5	2.5 (350)	10 (0.394)	

- **HPG** geared type

Motor model	Nominal size	Tightening torque [N·m (oz-in)]	Effective depth of bolt [mm (in.)]	Installation method
AZM46	M3	1.4 (198)	–	B
AZM66	M5	6.3 (890)		

- Harmonic geared type

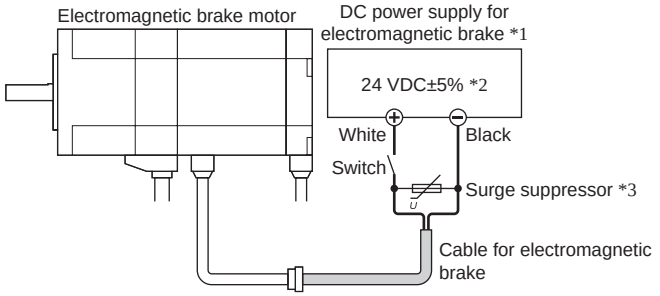
Motor model	Nominal size	Tightening torque [N·m (oz-in)]	Effective depth of bolt [mm (in.)]	Installation method
AZM46	M4	2 (280)	8 (0.315)	A
AZM66	M5	2.5 (350)	10 (0.394)	

■ Installing a load

When connecting a load to the motor, align the centers of the motor output shaft and load shaft. Be careful not to damage the output shaft or bearings when installing a coupling or pulley to the motor output shaft.

● Electromagnetic brake motor

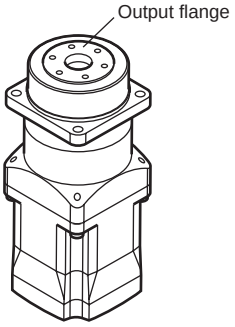
To release the electromagnetic brake and install the load, a DC power supply is needed to power the electromagnetic brake.
Connect the DC power supply (24 VDC±5%) to the motor using the "cable for electromagnetic brake." When purchasing the electromagnetic brake type motor and driver package with cables, the "cable for electromagnetic brake" is supplied with the product.



*1 The power supply current capacities are as follows.
AZM46: 0.08 A or more
AZM66, AZM69: 0.25 A or more
*2 If the distance between the motor and driver is extended to 20 m (65.6 ft.) or longer, use a power supply of 24 VDC±4%.
*3 To protect the switch contacts and prevent generation of noise, it is recommended that a surge suppressor be used.
[Recommended surge suppressor: Z15D121 (SEMITEC Corporation)].

● HPG geared flange output type

When installing a load to the **HPG** geared flange output type, use the load mounting holes on the output flange.



Load mounting hole

Motor model	Number of screw holes	Nominal size	Tightening torque [N·m (oz-in)]	Effective depth of bolt [mm (in.)]
AZM46	3 locations	M4	4.5 (630)	6 (0.236)
AZM66	6 locations			7 (0.276)

Note Since the tightening torque for the load mounting screw is large, using a mechanically weak load or screws may cause damage. Satisfy the following conditions for the load and mounting screws. Also, be sure to tighten with the specified torque.
Material of load: Steel
Mounting screw: Use a Bolt which tensile strength rank is 12.9 or higher

■ Permissible radial load, permissible axial load and permissible moment load

Note Failure due to fatigue may occur when the motor bearings and output shaft are subject to repeated loading by an radial or axial load that is in excess of the permissible limit.

● Permissible radial load

- Standard type

Motor model	Permissible radial load [N (lb.)]				
	Distance from the tip of motor output shaft [mm (in.)]				
	0 (0)	5 (0.2)	10 (0.39)	15 (0.59)	20 (0.79)
AZM46	35 (7.8)	44 (9.9)	58 (13)	85 (19.1)	–
AZM66	90 (20)	100 (22)	130 (29)	180 (40)	270 (60)
AZM69					

- **TS** geared type

Motor model	Gear ratio	Permissible radial load [N (lb.)]				
		Distance from the tip of motor output shaft [mm (in.)]				
		0 (0)	5 (0.2)	10 (0.39)	15 (0.59)	20 (0.79)
AZM46	3.6, 7.2, 10	20 (4.5)	30 (6.7)	40 (9)	50 (11.2)	–
	20, 30	40 (9)	50 (11.2)	60 (13.5)	70 (15.7)	–
AZM66	3.6, 7.2, 10	120 (27)	135 (30)	150 (33)	165 (37)	180 (40)
	20, 30	170 (38)	185 (41)	200 (45)	215 (48)	230 (51)

- **PS** geared type

Motor model	Gear ratio	Permissible radial load [N (lb.)]				
		Distance from the tip of motor output shaft [mm (in.)]				
		0 (0)	5 (0.2)	10 (0.39)	15 (0.59)	20 (0.79)
AZM46	5, 7.2, 10	73 (16.4)	84 (18.9)	100 (22)	123 (27)	–
	25, 36, 50	109 (24)	127 (28)	150 (33)	184 (41)	–
AZM66	5	200 (45)	220 (49)	250 (56)	280 (63)	320 (72)
	7.2, 10	250 (56)	270 (60)	300 (67)	340 (76)	390 (87)
	25, 36, 50	330 (74)	360 (81)	400 (90)	450 (101)	520 (117)

- **HPG** geared shaft output type

Motor model	Gear ratio	Permissible radial load [N (lb.)]				
		Distance from the tip of motor output shaft [mm (in.)]				
		0 (0)	5 (0.2)	10 (0.39)	15 (0.59)	20 (0.79)
AZM46	5	130 (29)	150 (33)	170 (38)	200 (45)	230 (51)
	9	160 (36)	180 (40)	210 (47)	240 (54)	290 (65)
AZM66	5	210 (47)	230 (51)	250 (56)	280 (63)	310 (69)
	15	290 (65)	310 (69)	340 (76)	370 (83)	400 (90)

• Harmonic geared type

Motor model	Gear ratio	Permissible radial load [N (lb.)] Distance from the tip of motor output shaft [mm (in.)]				
		0 (0)	5 (0.2)	10 (0.39)	15 (0.59)	20 (0.79)
AZM46	50, 100	180 (40)	220 (49)	270 (60)	360 (81)	510 (114)
AZM66		320 (72)	370 (83)	440 (99)	550 (123)	720 (162)

● Permissible axial load

Type	Motor model	Gear ratio	Permissible axial load [N (lb.)]
Standard	AZM46	–	4.3 (0.96) {6.0 (1.35)} ∗
	AZM66		8.9 (2) {12.7 (2.8)} ∗
	AZM69		14 (3.1) {17.6 (3.9)} ∗
TS geared	AZM46	3.6, 7.2, 10, 20, 30	15 (3.3)
	AZM66	3.6, 7.2, 10, 20, 30	40 (9)
PS geared	AZM46	5, 7.2, 10, 25, 36, 50	50 (11.2)
	AZM66	5, 7.2, 10, 25, 36, 50	100 (22)
HPG geared	AZM46	5, 9	150 (33)
	AZM66	5	300 (67)
		15	500 (112)
Harmonic geared	AZM46	50, 100	220 (49)
	AZM66		450 (101)

∗ The brackets { } indicate the value for the electromagnetic brake type.

■ Permissible moment load

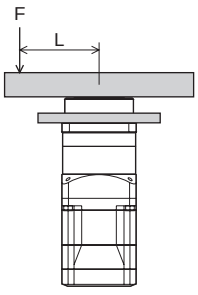
When installing an arm or table on the flange surface, calculate the moment load using the formula below if the flange surface receives any eccentric load. The moment load should not exceed the permissible value specified in the table.

● HPG geared flange output type

Motor model	Gear ratio	Permissible moment load [N·m (oz-in)]
AZM46	5	1.9 (260)
	9	2.3 (320)
AZM66	5	5.2 (730)
	15	7 (990)

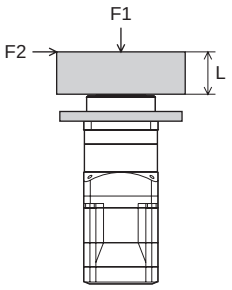
Example 1;
When an external force F is applied on the position of distance L from the center of the output flange

Moment load :M [N·m (oz-in)] = F × L



Example 2;
When external forces F1 and F2 are applied on the position of distance L from the mounting face of the output flange

Moment load :M [N·m (oz-in)] = F2 × (L + coefficient "a")

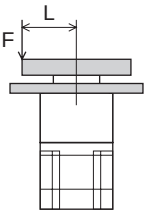


Motor model	coefficient "a"
AZM46	0.006
AZM66	0.011

● Harmonic geared type

Motor model	Permissible moment load [N·m (oz-in)]
AZM46	5.6 (790)
AZM66	11.6 (1640)

Moment load :M [N·m (oz-in)] = F × L

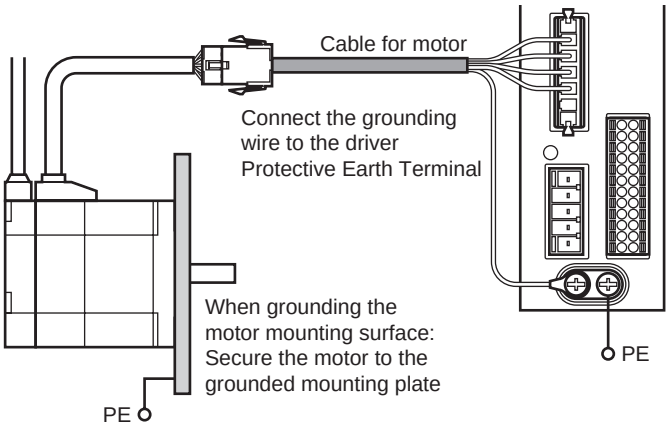


Grounding the motor

■ AC power input type

Connect the grounding wire of the "cable for motor" to the driver Protective Earth Terminal.
However, the grounding resistance value provided in the standards in which the user applies to the equipment may not be satisfied depending on the type or length of the "cable for motor." In this case, also ground the motor mounting surface.

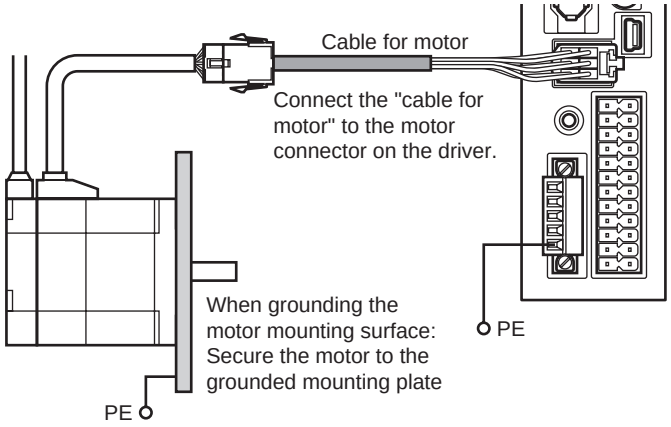
1. Connect the grounding wire of the "cable for motor" to the driver Protective Earth Terminal.
2. Ground the driver Protective Earth Terminal.
   Refer to the Driver OPERATING MANUAL for how to ground the driver.
3. When grounding the motor mounting surface, secure it to the grounded mounting plate.
   Install the motor so that the following conditions are satisfied.
   • The motor mounting surface and mounting plate are closely attached.
   • The motor mounting surface and mounting plate are electrically conducted.
   • The contact resistance between the motor mounting surface and mounting plate is minimized.



■ DC power input type

Since a grounding wire is included in the "cable for motor," you can ground it only to connect with a driver.
However, the grounding resistance value provided in the standards in which the user applies to the equipment may not be satisfied depending on the type or length of the "cable for motor." In this case, also ground the motor mounting surface.

1. Connect the "cable for motor" to the motor connector on the driver.
2. Ground the driver Protective Earth Terminal.
   Refer to the Driver OPERATING MANUAL for how to ground.
3. When grounding the motor mounting surface, secure it to the grounded mounting plate.
   Install the motor so that the following conditions are satisfied.
   • The motor mounting surface and mounting plate are closely attached.
   • The motor mounting surface and mounting plate are electrically conducted.
   • The contact resistance between the motor mounting surface and mounting plate is minimized.



● Reference: Grounding wire of the "cable for motor"

- Conductor size: AWG18 (0.75 mm^2)
- Maximum conductor resistance: 21.8 Ω/km (25.6 Ω/km for flexible cable)

Inspection

It is recommended that periodic inspections be conducted for the items listed below after each operation of the motor. If an abnormal condition is noted, discontinue any use and contact your nearest Oriental Motor sales office.

During inspection

- Are any of motor mounting screws loose?
- Are there any abnormal noises in the motor bearings (ball bearings) or other moving parts?
- Are there any scratches, signs of stress or loose driver connection in the motor cable?
- Are the motor’s output shaft and load shaft out of alignment?

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