

## Brushless Motor

# BLM Motor Connector Type Watertight, Dust-Resistant

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## OPERATING MANUAL

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.

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# 1 Introduction

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## ■ Before using the product

Only qualified personnel of electrical and mechanical engineering should work with the product. Use the product correctly after thoroughly reading the section "Safety precautions." In addition, be sure to observe the contents described in warning, caution, and note in this manual.

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.

## ■ Related operating manuals

Operating manuals are not included with the product. Download from Oriental Motor Website Download Page or contact your nearest Oriental Motor sales office.

	Operating manual name
Motor	<b>BLM</b> Motor Connector Type Watertight, Dust-Resistant OPERATING MANUAL (this document)
Driver	<b>BMU</b> Series OPERATING MANUAL
	<b>BLE2</b> Series OPERATING MANUAL

Refer to the operating manuals of the speed controller for details about connections and operations. Search for an operating manual by the model name shown on the nameplate.

## 2 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.

Please read and understand these precautions thoroughly before using the product.

 <b>WARNING</b>	Handling the product without observing the instructions that accompany a "WARNING" symbol may result in serious injury or death.
 <b>CAUTION</b>	Handling the product without observing the instructions that accompany a "CAUTION" symbol may result in injury or property damage.
	The items under this heading contain important handling instructions that the user should observe to ensure safe use of the product.
	The items under this heading contain related information and contents to gain a further understanding of the text in this manual.

### Description of graphic symbols

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

 <b>WARNING</b>	
	<ul style="list-style-type: none"> <li>• Do not use the product in explosive or corrosive environments, in the presence of flammable gases, in water, or near combustibles. Doing so may result in fire, electric shock, or injury.</li> <li>• Do not transport, install, connect or inspect the product while the power is supplied. Always turn off the power before carrying out these operations. Electric shock or damage to equipment may result.</li> <li>• Do not use a motor in a vertical application. If the driver's protection function is activated, the motor will stop and the moving part of the equipment will drop, thereby causing injury or equipment damage.</li> <li>• Do not machine or modify the cable. Doing so may result in fire, electric shock, or damage to equipment.</li> <li>• Do not apply any excessive force to the motor connector. Doing so may result in fire, electric shock, or damage to equipment.</li> <li>• Do not forcibly bend, pull or pinch the cable. Doing so may result in fire, electric shock, or damage to equipment.</li> <li>• Do not remove the connector cap until the connection cable is connected so that the O-ring of the connector for cable connection on the motor is not damaged. Doing so may result in fire, electric shock, or damage to equipment.</li> <li>• Do not touch the motor or driver when conducting the insulation resistance measurement or dielectric strength test. Accidental contact may result in electric shock.</li> <li>• Do not disassemble or modify the motor. Doing so may result in electric shock, injury or damage to equipment. Refer all such internal inspections and repairs to the branch or sales office from which you purchased the product.</li> </ul>
	<ul style="list-style-type: none"> <li>• Only qualified and educated personnel should be allowed to perform installation, connection, operation and inspection/troubleshooting of the product. Handling by unqualified and uneducated personnel may result in fire, electric shock, injury, or damage to equipment.</li> <li>• Be sure to ground the motor as it is Class I equipment. Failure to do so may result in electric shock.</li> <li>• Use a motor and driver only in the specified combination. Failure to do so may result in fire, electric shock, or damage to equipment.</li> <li>• Always turn off the power before performing maintenance or inspection. Failure to do so may result in electric shock.</li> </ul>

 <b>CAUTION</b>	
	<ul style="list-style-type: none"> <li>• Do not use the motor beyond the specifications. Doing so may result in fire, electric shock, injury or damage to equipment.</li> <li>• Do not touch the motor while operating or immediately after stopping. The surface of the motor is hot and it may cause a skin burn(s).</li> <li>• Do not leave anything around the motor that would obstruct ventilation. Doing so may result in damage to equipment.</li> <li>• Do not lift up the product by holding the output shaft or cable. Doing so may result in injury.</li> <li>• Do not touch the motor output shaft (end or pinion) with bare hands. Doing so may cause injury.</li> <li>• When assembling the motor with the gearhead, exercise caution not to pinch your fingers or other parts of your body between the motor and gearhead. Injury may result.</li> <li>• When installing the motor in equipment, exercise caution not to pinch your fingers or other parts of your body between the product and equipment. Injury may result.</li> <li>• Do not touch the rotating part (output shaft) while operating the motor. Doing so may cause injury.</li> </ul>
	<ul style="list-style-type: none"> <li>• Securely install the motor to the mounting plate. Inappropriate installation may cause the motor to detach and fall, resulting in injury or damage to equipment.</li> <li>• Provide a cover over the rotating part (output shaft). Failure to do so may result in injury.</li> <li>• Securely install a load on the output shaft. Inappropriate installation may result in injury.</li> <li>• Be sure to ground the motor and driver to prevent them from being damaged by static electricity. Failure to do so may result in fire or damage to equipment.</li> <li>• The motor surface temperature may exceed 70°C (158°F) even under normal operating conditions. If the operator is allowed to approach the motor in operation, attach a warning label in a conspicuous position as shown in the figure. Failure to do so may result in a skin burn(s).</li> </ul> <div style="text-align: right; margin-top: 10px;">                       Warning label                 </div>

# 3 Precautions for use

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This chapter covers restrictions and requirements the user should consider when using the product.

## **Be sure to match the motor output power with the driver output power.**

### ■ Wiring

#### ● Connecting the motor and driver

To connect the motor and driver, always use the dedicated connection cable (sold separately). Limit the number of times so that attaching/detaching between the connection cable and the motor or driver will not exceed 100 times. Before removing the connection cable, wipe off moisture and dirt attached to the motor.

#### ● Make sure to prevent water from splashing on the end part of the driver side including the connector for driver connection of the connection cable

Splashing water on it may cause water to ingress into the inside of the motor through the lead wires, resulting in damage to the motor. Refer to "6.4 Caution about wirings" on p.15 for details.

### ■ Installation circumstances

#### ● Grease measures

On rare occasions, grease may ooze out from the gearhead. If there is concern over possible environmental contamination resulting from the leakage of grease, check for grease stains during regular inspections. Alternatively, install an oil pan or other device to prevent damage resulting from contamination.

Grease leakage may lead to problems in the user's equipment or products.

#### ● Note when using in low temperature environment

When an ambient temperature is low, since the load torque may increase by the oil seal or viscosity increment of grease used in the gearhead, the output torque may decrease or the overload alarm may be generated. However, as time passes, the oil seal or grease is warmed up, and the motor can be driven without generating an overload alarm.

### ■ Operations

#### ● Rotation direction of the gearhead output shaft

The rotation direction of the gearhead output shaft may vary with that of the motor output shaft depending on the gear ratio of the gearhead.

Gear ratio	Rotation direction of the gearhead output shaft
5, 10, 15, 20, 100	Same direction as the motor output shaft
30, 50	Opposite direction to the motor output shaft

### ■ Insulation resistance measurement and dielectric strength test

#### ● Do not conduct the insulation resistance measurement or dielectric strength test with the motor and driver connected

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

## About watertight performance

The motor conforms to IP67 rating for degree of protection in a state where the connection cable is attached. (Except for the end part of the driver side including the connector for driver connection of the connection cable) Use the motor after thoroughly reading the following if the motor is washed with water or used in an environment where water is splashed.

- **Degree of protection IP67**

The degree of protection for ingress against water of the motor is evaluated under the following conditions according to IEC 60529 and IEC 60034-5.

Test condition: Usable after immersion in water to a depth of 1 m for 30 minutes.

- **Do not use the motor in water**

- **Do not splash hot water or apply hot air to the motor.**

The watertight performance of the motor is assumed that fresh water or tap water at normal temperature [+ 5 to +35 °C (+41 to +95 °F)] is used.

- **Do not wash the motor with high-pressure water**

Washing with high-pressure water may cause the painting to peel off.

- **Do not use a metal brush or similar hard brushes**

Washing using a metal brush or similar hard brushes may cause the painting to peel off.

# 4 Checking the product

## 4.1 Package contents

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.

Verify the model number of the purchased product against the number shown on the nameplate.

### ■ Motor

- Motor..... 1 unit
- Instructions and Precautions for Safe Use..... 1 copy

### ■ Gearhead (sold separately)

- Gearhead..... 1 unit
- Mounting screw..... 1 set  
Hexagonal socket head screw, plain washer, spring washer: 4 pieces each
- Parallel key..... 1 piece (fixed to the gearhead output shaft)
- Screw for motor assembly ..... 1 set  
Hexagonal socket head screw: 4 pieces

## 4.2 Combination tables

Products with which the motors can be combined are listed below.

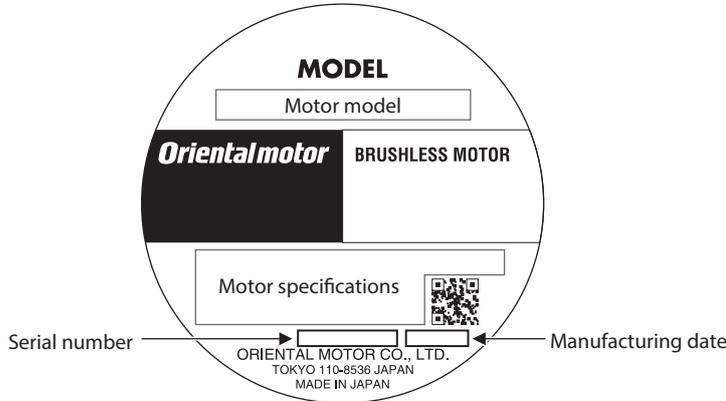
Output power	Motor model	Applicable gearhead model		Applicable driver model		
		Model	<input type="checkbox"/> Gear ratio	Single-phase 100-120 VAC	Single-phase 200-240 VAC	Three-phase 200-240 VAC
200 W	<b>BLM7200HW-GFV</b>	<b>GFV7G□SW</b>	<b>5, 10, 15, 20, 30, 50, 100</b>	<b>BMUD200-A BLE2D200-A</b>	<b>BMUD200-C BLE2D200-C</b>	
300 W	<b>BLM7300HW-GFV</b>		<b>5, 10, 15, 20, 30, 50, 100</b>	–	<b>BMUD300-C BLE2D300-C</b>	
400 W	<b>BLM7400HW-GFV</b>		<b>5, 10, 15, 20, 30, 50</b>	–	<b>BMUD400-C BLE2D400-C</b>	<b>BMUD400-S BLE2D400-S</b>

### 4.3 Information about nameplate

The figure shows an example.

**memo** The position describing the information may vary depending on the product.

#### Motor



#### Gearhead



### 4.4 Connection cable/flexible connection cable (sold separately)

To connect the motor and driver, the dedicated connection cable (sold separately) is needed.

The connection cables are provided up to 20 m (65.6 ft.). The cable length that can be connected varies depending on the driver used. Check the operating manual of the driver.

#### Product number code

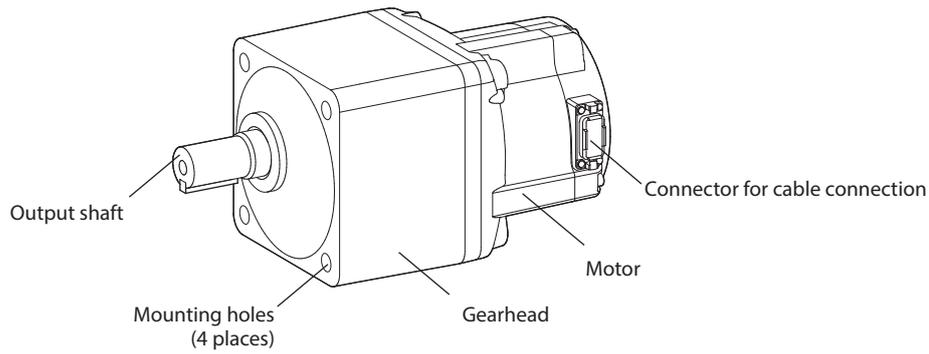
**CC 010 KH BL R F**  
 1      2      3      4      5      6

1	Cable type	<b>CC:</b> Connection cable					
2	Cable length*	<b>005:</b> 0.5 m (1.6 ft.)	<b>010:</b> 1 m (3.3 ft.)	<b>015:</b> 1.5 m (4.9 ft.)	<b>020:</b> 2 m (6.6 ft.)	<b>025:</b> 2.5 m (8.2 ft.)	<b>030:</b> 3 m (9.8 ft.)
		<b>040:</b> 4 m (13.1 ft.)	<b>050:</b> 5 m (16.4 ft.)	<b>070:</b> 7 m (23.0 ft.)	<b>100:</b> 10 m (32.8 ft.)	<b>150:</b> 15 m (49.2 ft.)	<b>200:</b> 20 m (65.6 ft.)
3	Motor connection method	<b>KH:</b> Metal connector					
4	Applicable model	<b>BL:</b> Brushless motor					
5	Blank: Connection cable	<b>R:</b> Flexible connection cable					
6	Cable outlet direction	<b>F:</b> Output shaft direction	<b>B:</b> Opposite to output shaft direction		<b>V:</b> Vertical direction		

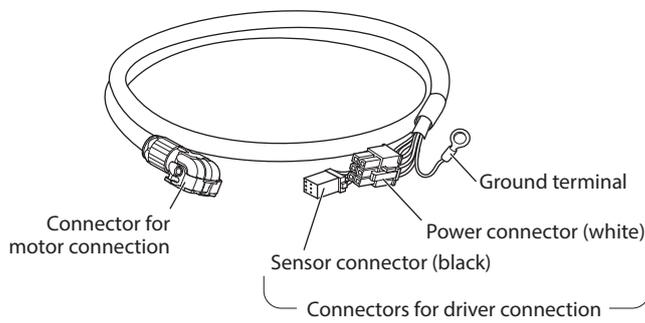
\* Cable length 0.5 m (1.6 ft.) is connection cable only

## 4.5 Names of parts

The figure shows the gearhead pre-assembled.



### ■ Connection cable/flexible connection cable (sold separately)



# 5 Installation

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This section explains the installation method of a load in addition to the installation location and installation method of the product.

## 5.1 Installation location

Install the product in a well-ventilated location that provides easy access for inspection. The location must also satisfy the following conditions:

- Indoors
- 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 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
- Altitude Up to 1000 m (3300 ft.) above sea level
- Area not subject to oil (oil droplets) or chemicals

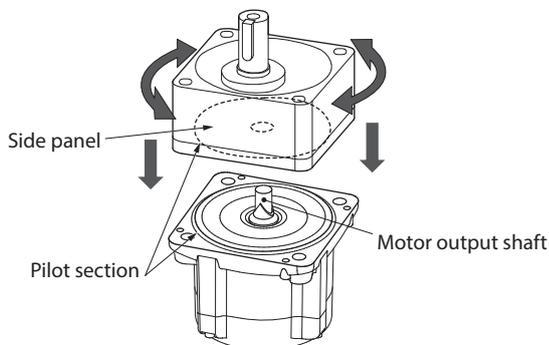
The motor can be used in an environment where it is splashed with water (excluding the part of the connectors for driver connection). However, do not use it under water or in high water pressure.

## 5.2 Installation method

### ■ Assembling the gearhead to the motor

1. Keep the pilot sections of the motor and gearhead in parallel, and assemble the gearhead with the motor while slowly rotating it clockwise/counterclockwise.

At this time, note so that the motor output shaft does not hit the side panel or gears of the gearhead strongly.



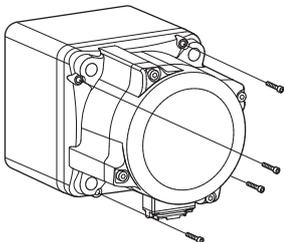
Assemble the gearhead to the motor in a condition where the motor output shaft is in an upward direction.

#### Note

- Do not forcibly assemble the motor and gearhead. Also, prevent metal objects or foreign substances from entering in the gearhead. The pinion of the motor output shaft or gear may be damaged, resulting in noise or shorter service life.
- Do not allow dust to attach to the pilot sections of the motor and gearhead. Also, assemble the motor and gearhead carefully by not pinching the O-ring at the motor pilot section. If the O-ring is crushed or severed, grease may leak from the gearhead, or water may penetrate into the inside of the motor, resulting in electric shock or damage to the product.

2. Check that there is no gap between the motor and gearhead, and secure them with hexagonal socket head screws for assembling (4 places).

Tightening torque: 0.6 N·m (5.3 lb-in)

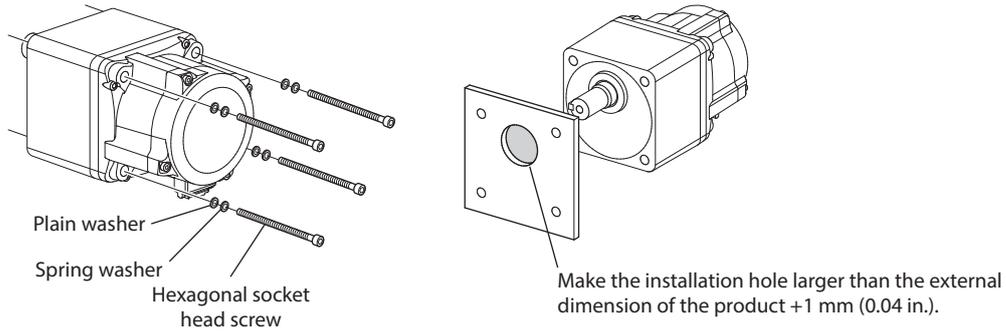


#### Note

Be sure to secure four places with the assembly screws, and surely tighten them with the recommended tightening torque. Failure to do so may cause water to penetrate into the inside of the motor, resulting in electric shock or damage to the product. Also, grease may leak from the gearhead.

## ■ Installation method

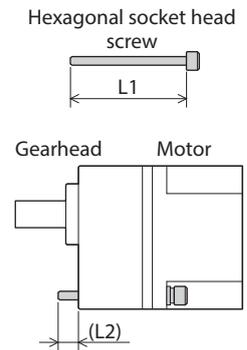
Secure the motor through four mounting holes using the gearhead included mounting screw set. Do not leave a gap between the motor and mounting plate.



### Mounting screw

Gearhead model	□: Gear ratio	Hexagonal socket head screw			Tightening torque [N·m (lb-in)]
		Screw size	L1 [mm (in.)]	L2 [mm (in.)]	
GFV7G□SW	5 to 20	M8	95 (3.74)	13 (0.51)	12.0 (106)
	30 to 50		110 (4.33)	16 (0.63)	
	100		120 (4.72)	12 (0.47)	

\* The gear ratio of the 400 W is 5:1 to 50:1.



## ■ Installing a load

When installing a load, pay attention to the following points.

- Align the centerline of the output shaft with that of the load.
- A key slot is provided on the gearhead output shaft. Form a key slot on the load side and secure the load using the parallel key.

### Note

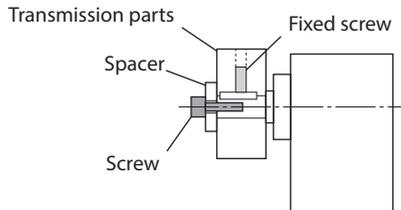
- When coupling with a load, pay attention to centering, belt tension, parallelism of pulleys, etc. Also, firmly secure the tightening screws of the coupling or pulleys.
- When installing a load, do not damage the output shaft or bearing. Forcing in the load by driving it with a hammer, etc., may break the bearing. Do not apply any excessive force to the output shaft.
- Do not modify or machine the output shaft. This may damage the bearing, resulting in damage to the motor and gearhead.

### When using the output shaft end tapped hole of a gearhead

Use a tapped hole provided at the end of the output shaft as an auxiliary means for preventing the transfer mechanism from disengaging.

Screw size: M6

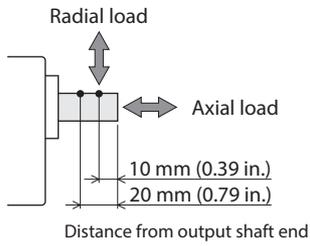
Effective depth of screw: 12 mm (0.47 in.)



### 5.3 Permissible radial load and permissible axial load

Make sure a radial load and axial load applied to the output shaft will not exceed the permissible values shown in the table below.

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



Gearhead model	□: Gear ratio*1	Permissible radial load [N (lb.))*2 Distance from output shaft end of the gearhead		Permissible axial load [N (lb.)]
		10 mm (0.39 in.)	20 mm (0.79 in.)	
<b>GFV7G□SW</b>	<b>5 to 20</b>	550 (123) [500 (112)]	800 (180) [700 (157)]	200 (45)
	<b>30 to 50</b>	1000 (220) [900 (200)]	1250 (280) [1100 (240)]	300 (67)
	<b>100</b>	1400 (310) [1200 (270)]	1700 (380) [1400 (310)]	400 (90)

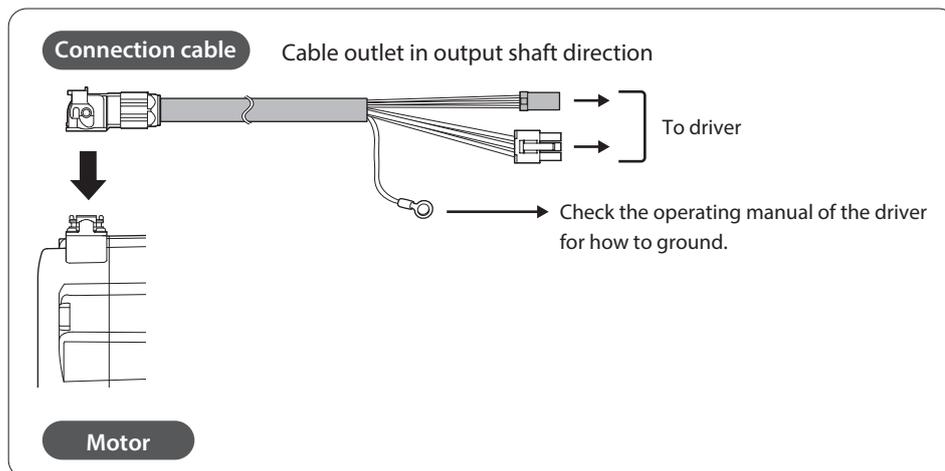
\*1 The gear ratio of the 400 W is 5:1 to 50:1.

\*2 The values assume a rated speed of 3000 r/min or below. The values in brackets [ ] are based on a rated speed of 4000 r/min.

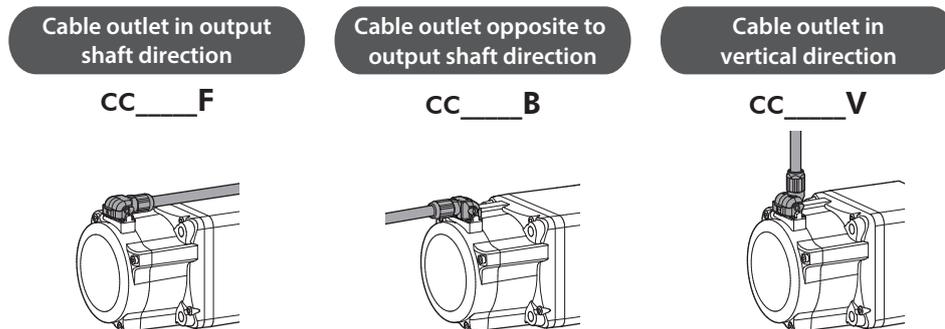
# 6 Connection

## 6.1 Connecting the motor and driver

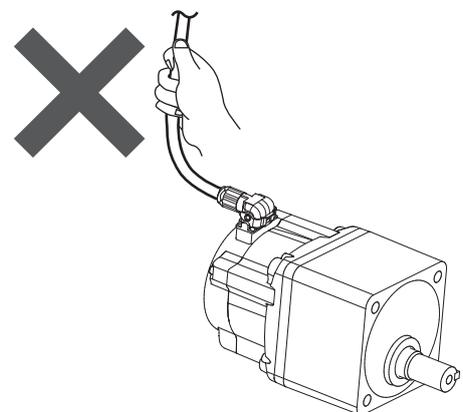
Connect the motor and driver using the connection cable (sold separately).  
 There are three types of connection cables which cable outlet directions are different.  
 Up to two pieces of the connection cables for relay can be connected.  
 Check the operating of the driver.



[Cable outlet direction]



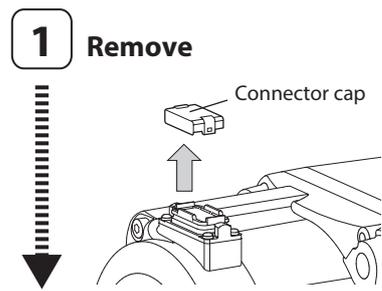
**Note** Do not lift up the product by holding the connection cable. Doing so may cause damage to the product.



## 6.2 Connection procedures of the motor and connection cable

The following example explains using the connection cable of "cable outlet in output shaft direction."

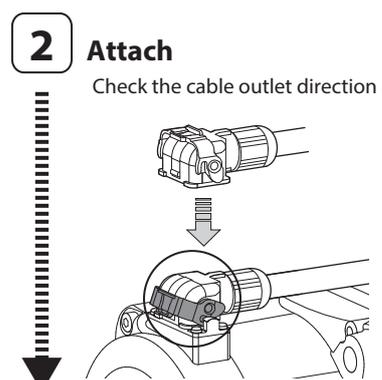
**1 Remove**



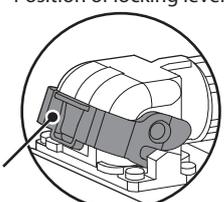
Connector cap

**2 Attach**

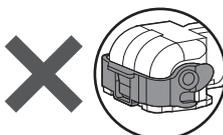
Check the cable outlet direction and insert the connector securely.



Position of locking lever



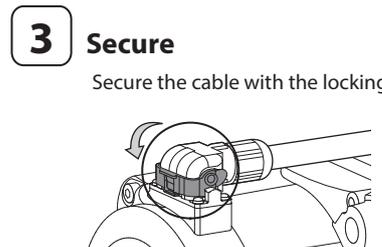
Locking lever



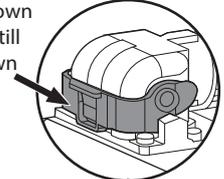
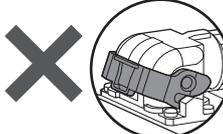
The connector cannot be inserted if the locking lever is turned down.

**3 Secure**

Secure the cable with the locking lever so that the cable does not come off.



Be sure to turn down the locking lever till the position shown in the figure.

Secure the connector by turning down the locking lever completely.

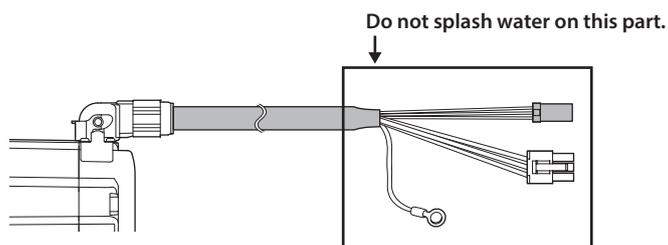
## 6.3 Detaching the connection cable

If the locking lever is turned up, the cable can be detached.

**Note** Before removing the connection cable, wipe off moisture and dirt attached to the motor. Entering foreign particles into the connector for cable connection on the motor may result in electric shock or damage to the product.

## 6.4 Caution about wirings

Make sure to prevent water from splashing on the end part of the driver side of the connection cable because water-resistant measures are not provided on it. Splashing water may cause water to penetrate into the inside of the motor through the lead wires, resulting in damage to the motor.



Also, when using the connection cable for extension, be sure to prevent water from splashing on the end part of the connection cable.

# 7 Grounding

Ground using the Protective Earth Terminals ⊕ of the driver, as well as the ground terminal of the connection cable.

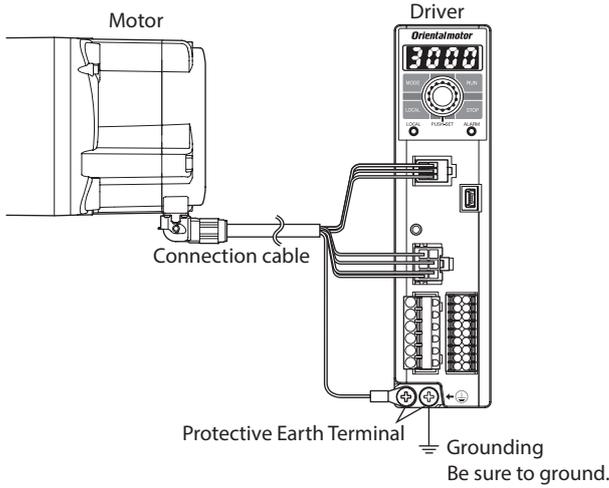
**Note** Be sure to ground the motor and driver. Failure to do so may result in electric shock or damage to the product. Static electricity may cause damage to the product if the Protective Earth Terminals are not grounded.

Two Protective Earth Terminals (screw size: M4) are provided on the driver.

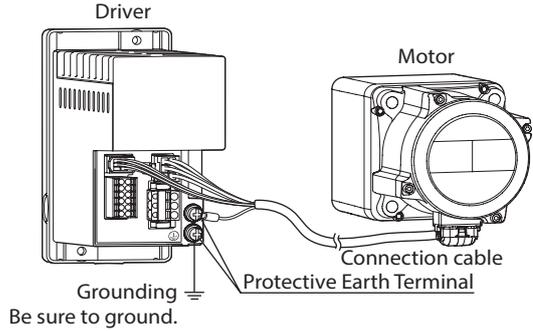
Be sure to ground one of the Protective Earth Terminals. Either of the two Protective Earth Terminals can be used for grounding the driver.

Be sure to connect the protective earth wire of the connection cable to the other protective earth terminal.

## ■ BLE2 series



## ■ BMU series



**memo** Do not share the grounding wire with a welder or any other power equipment.

The grounding resistance value provided in the standards applied to the equipment may not be satisfied depending on the length of the connection cable. In this case, use a connection cable which length satisfies the grounding resistance.

Use to add a connection cable for extension when the extension distance between the motor and the driver is not enough.

For details, please refer to the instruction manual of the operating of the driver.

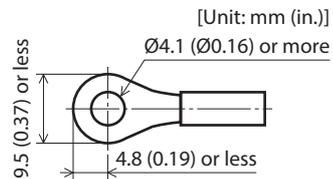
Reference: Protective earth wire of the connection cable

Conductor size: AWG18 (0.75 mm<sup>2</sup>)

Maximum conductor resistance: 25.0 Ω/km

## ■ Ground terminal

- Applicable crimp terminal: Round crimp terminal with insulation cover
- Terminal screw size: M4
- Tightening torque: 1.2 N·m (10.6 lb-in)
- Applicable lead wire: AWG18 to 14 (0.75 to 2.0 mm<sup>2</sup>)



## ■ Precautions about static electricity

Static electricity may cause the driver to malfunction or suffer damage. Be sure to ground the motor and driver to prevent them from being damaged by static electricity.

# 8 Inspection and maintenance

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## 8.1 Inspection

It is recommended that periodic inspections would 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.



Do not conduct the insulation resistance measurement or dielectric strength test with the motor and speed controller connected. Doing so may cause damage to the product.

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### ■ Inspection item

- Check if any of the mounting screws of the motor and gearhead are loose.
- Check if the bearing part (ball bearings) of the motor generates unusual noises.
- Check if the bearing part (ball bearings) or gear meshing part of the gearhead generates unusual noises.
- Check if the output shaft of the motor and gearhead and a load shaft are out of alignment.
- Check if a damage or stress is applied on the cable or the connection part between the cable and driver is loose.

## 8.2 Warranty

Check on the Oriental Motor Website for the product warranty.

## 8.3 Disposal

Dispose the product correctly in accordance with laws and regulations, or instructions of local governments.

# 9 Specifications

## 9.1 Specifications

Check on the Oriental Motor Website for the product specifications.

## 9.2 General specifications

Operation environment	Ambient temperature	0 to +40 °C [+32 to +104 °F] (non-freezing)
	Ambient Humidity	85% or less (non-condensing)
	Altitude	Up to 1000 m (3300 ft.) above sea level
	Surrounding atmosphere	No corrosive gas or dust. Cannot be used in radioactive materials, magnetic field, vacuum or other special environment. Details about the installation location are described on p.10.
	Vibration	Not subject to continuous vibrations or excessive impact. In conformance with JIS C 60068-2-6 "Sinewave vibration test method" Frequency range: 10 to 55 Hz Pulsating amplitude: 0.15 mm (0.006 in.) Sweep direction: 3 directions (X, Y, Z) Number of sweeps: 20 times
Storage environment	Ambient temperature	-20 to +70 °C [-4 to +158 °F] (non-freezing)
	Ambient Humidity	85% or less (non-condensing)
Shipping environment	Altitude	Up to 1000 m (3300 ft.) above sea level
	Surrounding atmosphere	No corrosive gas, dust, water or oil. Cannot be used in radioactive materials, magnetic field, vacuum or other special environment.
Degree of protection		IP67 (When the connection cable is installed to the motor. Excluding the part of the connectors for driver connection.)

# 10 Regulations and standards

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Check on the Oriental Motor Website for the regulations and standards.

## ■ UL Standards, CSA Standards

This product is recognized by UL under the UL and CSA Standards.

## ■ CE Marking

This product is affixed with the marks under the following directives.

### ● Low Voltage Directive

#### Installation conditions

- For incorporating in equipment
- Overvoltage category: II
- Pollution degree: 3
- Protection against electric shock: Class I

### ● RoHS Directive

This product does not contain the substances exceeding the restriction values.

## ■ The motor temperature rise tests

The temperature rise tests stipulated in the above standards are conducted in a state where a motor is mounted on a heat radiation plate instead of attaching a gearhead. The size, thickness and material of the heatsink plates are as follows.

Motor model	Size [mm (in.)]	Thickness [mm (in.)]	Material
<b>BLM7200</b>	200×200 (7.87×7.87)	5 (0.20)	Aluminum alloy
<b>BLM7300</b> <b>BLM7400</b>	250×250 (9.84×9.84)	6 (0.24)	

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- Please contact your nearest Oriental Motor office for further information.

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