Oriental motor

HP-5171-3

Brushless Motors

BLS Series Driver

AC Input

OPERATING MANUAL

Introduction

Safety precautions

Precautions for use

Preparation

Installation

Connection

Operation

Inspection and maintenance

Troubleshooting

Alarms

Information

Specifications

Regulations and standards

Thank you for purchasing an Oriental Motor product.

This operating manual describes product handling procedures and safety precautions.

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

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1 Introduction

■ Before using the product

Only qualified personnel of electrical and mechanical engineering should work with the product.
Use the product properly 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 is designed and manufactured to be incorporated into general industrial equipment. Do not use it for any other purpose.

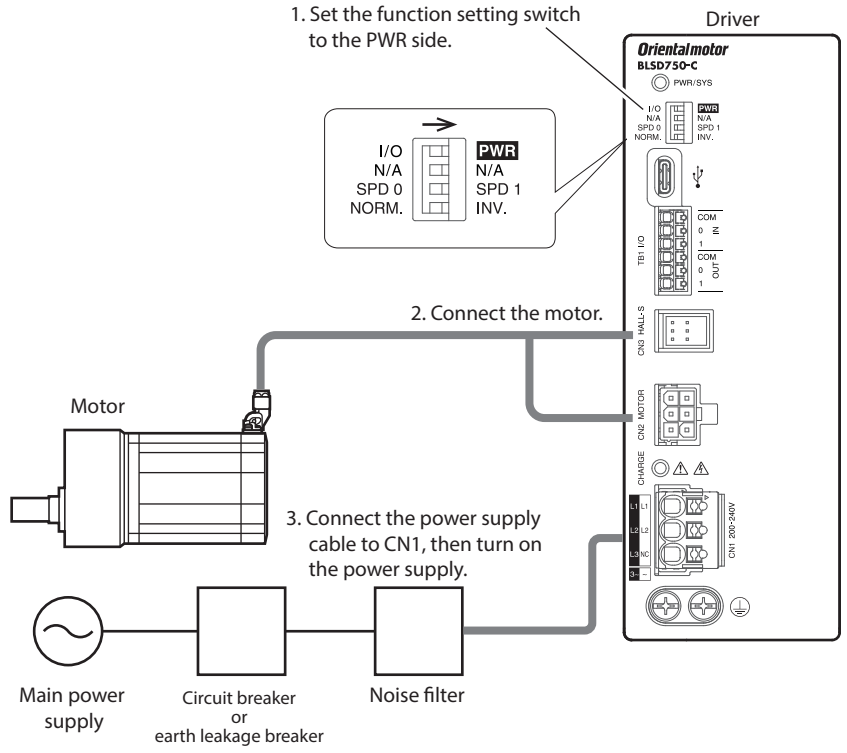
■ Operating Manuals for the product

For operating manuals, download from Oriental Motor Website Download Page or contact your nearest Oriental Motor sales office.
Also read the operating manual of the motor used in combination with a driver.

- **BLS** Series Driver AC Input OPERATING MANUAL (this document)
- **BLS** Series Motor AC Input OPERATING MANUAL

How to operate the motor with ease

The motor can be operated in the following three steps.
Refer to "6 Connection" on p.13 and "7 Operation" on p.20 for details on how to operate the motor.



2 Safety precautions

The precautions described below are intended to ensure the safe and proper use of the product and to prevent the user and other personnel from exposure to the risk of injury. 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.
memo	The items under this heading contain related information and contents to gain a further understanding of the text in this manual.

⚠ WARNING

General

- Assign qualified personnel to the task of installing, wiring, operating/controlling, inspecting, and troubleshooting the product. Handling by unqualified personnel may result in fire, electric shock, injury, or damage to equipment.
- Do not use the product in explosive or corrosive environments, in the presence of flammable gases, in areas subjected to splashing water, or near combustible materials. Doing so may result in fire, electric shock, or injury.
- Do not transport, install, connect, or inspect the product while the power is supplied. Always turn off the power before carrying out these operations. This may result in electric shock or damage to equipment.
- Do not use a motor in a vertical drive such as elevating equipment. If the driver protective function is activated, the motor will stop and the moving part may fall, thereby causing injury or damage to equipment.
- Do not insert an object into the openings in the driver. Doing so may result in fire, electric shock, injury, or damage to equipment.

Installation

- Install the driver in an enclosure. Failure to do so may result in electric shock or injury.

Connection

- Be sure to ground the driver as it is Class Ⅰ equipment. Failure to do so may result in electric shock.
- Always keep the power supply voltage of the driver within the specified range. Failure to do so may result in fire or electric shock.
- Be sure to observe the specified size of the lead wires. Failure to do so may result in fire, electric shock, or damage to equipment.
- Make connections securely according to the connection example. Failure to do so may result in fire, electric shock, or damage to equipment.

Operation

- Use a motor and driver only in the specified combination. Failure to do so may result in fire, electric shock, or damage to equipment.
- Do not use the driver beyond its specifications. Doing so may result in fire, electric shock, injury, or damage to equipment.
- The terminals marked with ⚠ ⚠ symbol on the front panel of the driver indicate the presence of high voltage. Do not touch them while the power is on. Doing so may result in fire or electric shock.
- If a problem occurs, immediately stop operation and turn off the driver power. Failure to do so may result in fire, electrical shock, or injury.
- Do not touch the connection terminals on the driver immediately after turning off the power supply (until the CHARGE LED goes out). Doing so may result in electric shock.

Maintenance and inspection

- Do not touch the motor and driver when conducting the insulation resistance measurement or dielectric strength test. Accidental contact may result in electric shock.
- Always turn off the power supply before performing maintenance or inspection. Failure to do so may result in electric shock.
- Regularly check the openings in the driver for accumulated dust. Accumulated dust may cause fire.

Repair, disassembly, and modification

- Do not disassemble or modify the driver. Doing so may result in injury or damage to equipment.

⚠ CAUTION

General

- If the driver protective function has been activated, remove the cause before resetting the protective function. Continuing the operation without removing the cause of the problem may cause the motor to malfunction, resulting in injury or damage to equipment.
- Do not touch the driver while operating or immediately after stopping. The driver surface is hot and this may cause a skin burn(s).

Installation

- Install the driver securely to the mounting plate. Incorrect installation may cause the driver to come off and fall, resulting in injury or damage to equipment.
- Keep the area around the driver free of combustible materials. Failure to do so may result in fire or a skin burn(s).
- Do not leave anything around the driver that would obstruct ventilation. Doing so may result in damage to equipment.

Connection

- Be sure to ground the motor and the driver to prevent damage from static electricity. Failure to do so may result in fire or damage to equipment.

Operation

- Before turning on the power to the driver, make sure to turn OFF all input signals to the driver. Otherwise, the motor may start suddenly when the power is turned on, causing injury or damage to equipment.
- Pay enough attention to safe operation when starting and stopping the motor by switching the power supply on and off. This may cause injury or damage to equipment.
- If the motor is operated by turning the power supply on and off, turn off the driver power in the event of a power failure. Otherwise, the motor may start suddenly when the power is restored, causing injury or damage to equipment.
- 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.
- Take safety measures to protect against momentary voltage drops. The motor will come to a stop, or the rotational torque and/or the rotation speed will be reduced. This may cause injury or damage to equipment.

2-1 Graphical symbols on the driver's front panel

⏚	⚠ WARNING	This is the Protective Earth Terminal. Be sure to ground because improper grounding may result in electric shock.
⚠ ⚡	⚠ WARNING	A high voltage is applied to the main power supply input terminals (CN1), the motor connector (CN2) and the sensor connector (CN3). Do not touch them while the power is on. Doing so may result in fire or electric shock.

2-2 Warning indication

A warning about handling precautions is described on the driver.
Be sure to observe the description contents when handling the product.

Electrical hazard warning label



3 Precautions for use

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

Connect a protective device to the power line

Connect a circuit breaker or earth leakage breaker to the driver power line to protect the primary circuit.
When installing an earth leakage breaker, use a product with measures to suppress high-frequency current.

Preventing leakage current

Stray capacitance exists between the driver's power line and other power lines, the earth and the motor, respectively. A high-frequency current may leak through this capacitance and cause damage to surrounding equipment. The actual leakage current depends on the switching frequency of the driver, the length of the wiring between the driver and the motor, etc. When connecting an earth leakage breaker, use the following product with measures to suppress high-frequency current.
[Mitsubishi Electric Corporation: NV series]

Connecting a motor and a driver

To connect a motor and a driver, always use the dedicated connection cable (sold separately). Limit the number of times so that the connection/disconnection between the connection cable and the motor or driver does not exceed 100 times.

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

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

Note when connecting a power supply whose positive terminal is grounded

The USB port on the driver is not electrically insulated. When grounding the positive terminal of the power supply, do not connect any equipment (PC, etc.) whose negative terminal is grounded. Doing so may cause the driver and this equipment to short, damaging both.
When connecting, do not ground equipment.

Notes when saving the data to non-volatile memory

Do not turn off the power supply while writing the data to non-volatile memory, and also do not turn off for five seconds after writing is completed. Doing so may abort writing the data and cause an alarm of EEPROM error to generate.
Non-volatile memory can be rewritten approximately 100,000 times.

Noise elimination measures

Refer to p.18 for noise elimination measures.

Static electricity measures for the driver

The driver uses parts that are sensitive to electrostatic charge. Take measures against static electricity since static electricity may cause the driver to malfunction or suffer damage.
Do not approach or touch the driver with the power on, except when operating the setting device or switches on the front of the driver.
Always use an insulated screwdriver to adjust the driver's potentiometers.

4 Preparation

This chapter explains the items you should check and the name and function of each part.

4-1 Checking the product

Verify that the items listed below are included.

Report any missing or damaged items to the sales office from which you purchased the product.

☐ Driver ..... 1 unit

☐ CN1 connector (3 pins) ..... 1 piece

☐ Instructions and Precautions for Safe Use ..... 1 copy

Note When taking out the driver from the electrostatic discharge (ESD) protection bag, make sure your hands are not charged with static electricity.
Static electricity may cause damage to the driver.

4-2 How to identify the product model

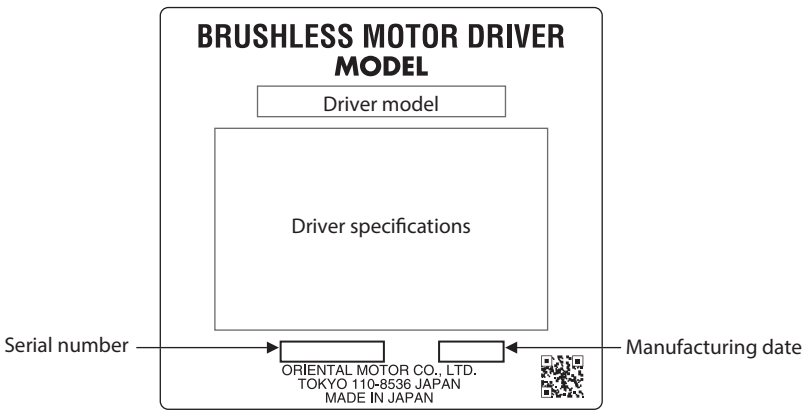
Check the model name of the product against that shown on the nameplate.

BLSD 750 - C
1 2 3

1	Driver type	**BLSD**: **BLS** Series driver
2	Output power	**750**: 750 W
3	Power supply voltage	C: Single-phase, three-phase 200-240 VAC

4-3 Information about nameplate

The figure shows an example.



4-4 Products that can be combined

Products with which the driver can be combined are listed below. Check the model name of the product against that shown on the nameplate.
For details on the combination of a motor and a gearhead, refer to the operating manual of the motor.
The box (□) in the model name indicates a number representing the gear ratio.

■ Combination type - parallel shaft gearhead

Combination type motor			Driver model
Model name	Motor model	Gearhead model	
BL2M6750CHP-□S	BL2M6750CHP-GR	6GR□S2	**BLSD750-C**

■ Combination type - hollow shaft flat gearhead

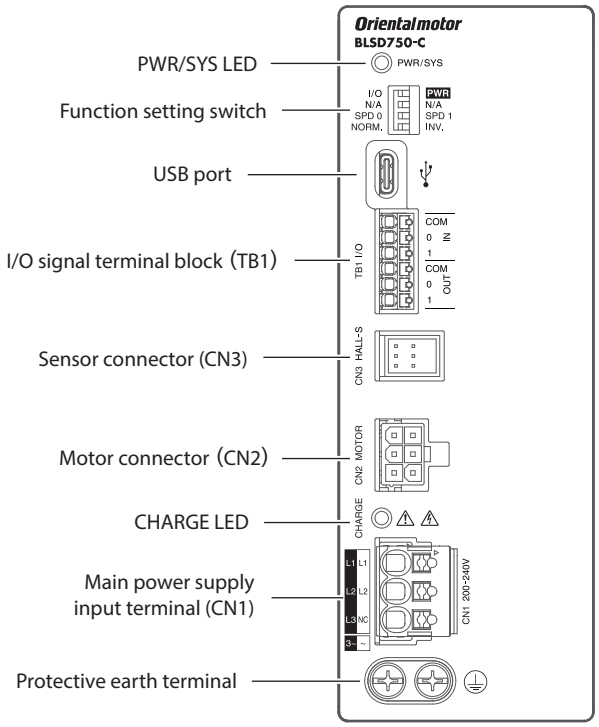
Combination type motor			Driver model
Model name	Motor model	Gearhead model	
BL2M6750CHP-□FRS	BL2M6750CHP-GR	6GR□FRS2	**BLSD750-C**

■ Round shaft type

Motor model	Driver model
BL2M6750CHP-AS **BL2M6750CHP-KS**	**BLSD750-C**

4-5 Names and functions of parts

This section explains the name and function for each part of the driver.



Name	Sign	Description
Main power supply input terminal (CN1)	–	Connects a main power supply.
	L1, L2, NC	Single-phase 200-240 VAC: Connects a single-phase 200-240 VAC power supply to L1 and L2. NC is not used.
	L1, L2, L3	Three-phase 200-240 VAC: Connects a three-phase 200-240 VAC power supply to L1, L2, and L3.
Motor connector (CN2)	MOTOR	Connects the power connector (white) of the connection cable.
Sensor connector (CN3)	HALL-S	Connects the sensor connector (black) of the connection cable.
I/O signal terminal block (TB1)	I/O	Connects the I/O signals.
USB port		Connects to a PC where the **MEXE02** has been installed.
PWR/SYS LED	PWR/SYS	Refer to "4-6 Indication of LED" on p.10.
CHARGE LED	CHARGE	This LED is lit in red while the main power is input. After the main power supply is turned off, the LED is turned off once the residual voltage in the driver drops to a safe level.
Function setting switches	–	Refer to "7-1 Function setting switches" on p.20.
Protective Earth Terminals	⏚	Connects the ground terminal of the connection cable and the grounding wire.

4-6 Indication of LED

The status of the driver can be checked using the indication of LED.

LED status	Description
No light	The power supply is not turned on.
White light	The power supply is on.
Blinking red	An alarm is being generated. The alarm item generated can be checked by counting the number of times the LED blinks. The LED will be lit in white when the alarm is reset.
Blinking blue	Information is being generated. The LED will be lit in white when the information is cleared.

5 Installation

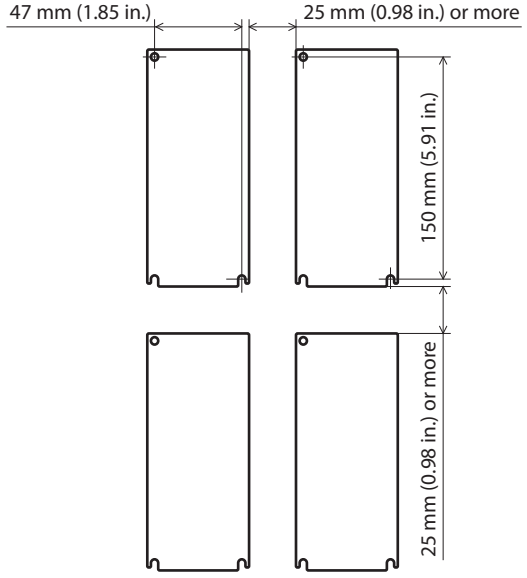
5-1 Installation location

The driver is designed and manufactured to be incorporated into equipment.
Install it in a well-ventilated location that provides easy access for inspection. The location must also satisfy the following conditions:

- Inside an enclosure installed indoors (provide ventilation holes)
- Operating ambient temperature: 0 to +50 °C [+32 to 122 °F] (non-freezing)
- Operating ambient humidity: 85 % or less (non-condensing)
- Area free of explosive atmosphere, 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 splashing water (rain, water droplets), oil (oil droplets), or other liquids
- 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

5-2 Installing the driver

The driver is designed so that heat is dissipated via air convection and conduction through the enclosure. Install the driver on a flat, highly heat conductive metal plate [material: aluminum, 300×300×2 mm (11.81×11.81×0.08 in.) or equivalent]. When installing the driver, allow at least 25 mm (0.98 in.) of horizontal and vertical clearance between the driver and the enclosure or other equipment inside the enclosure.
When installing the driver, use three screws (M4, not included) to secure the mounting hole and the cutouts.



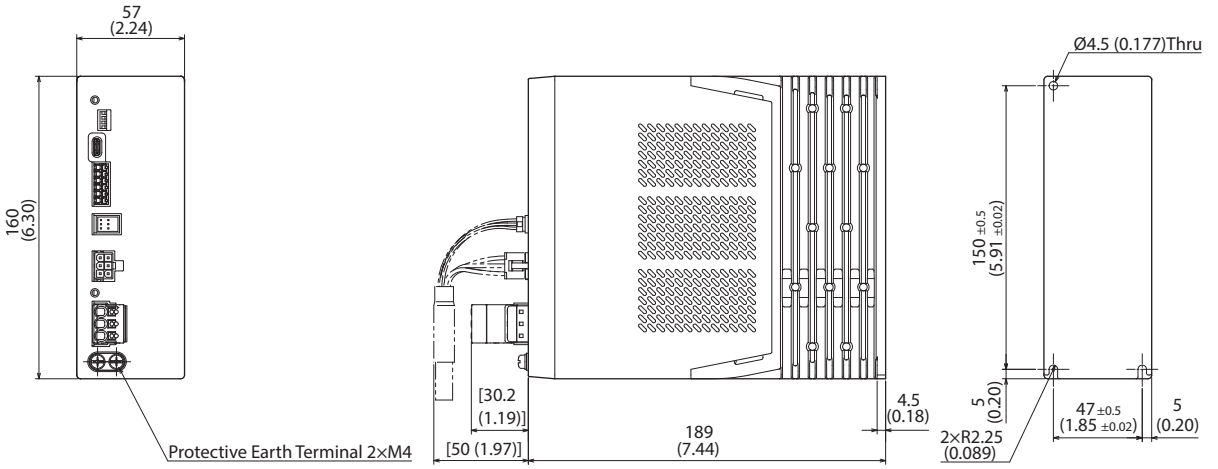
Note

- Install the driver in an enclosure whose pollution degree is 2 or better environment, or whose degree of protection is IP54 minimum.
- Do not install any equipment that generates a large amount of heat or noise near the driver.
- Do not install the driver under a host controller or other heat-sensitive equipment.
- If the ambient temperature of the driver exceeds 50 °C (122 °F), reconsider the ventilation condition such as providing forced cooling by using fans or creating spaces between the drivers.
- Be sure to install the driver vertically (in vertical position).

5-3 Dimensions

Mass: 1.4 kg (3.09 lbs.)

[Unit: mm (in.)]



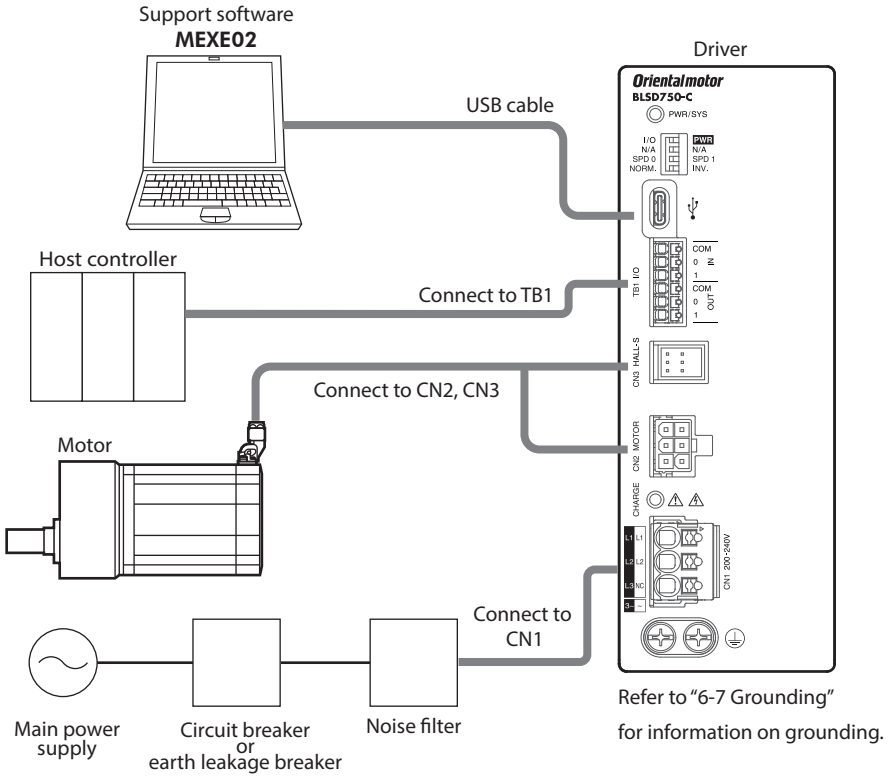
6 Connection

This chapter explains how to connect the driver to the motor, power supply, and I/O signals.

⚠ WARNING

- For protection against electric shock, do not turn on the power supply until the wiring is completed.
- A high voltage is applied to the main power supply input terminals (CN1), the motor connector (CN2) and the sensor connector (CN3). Do not touch them while the power is on. Doing so may result in fire or electric shock.

6-1 Connection example



Note

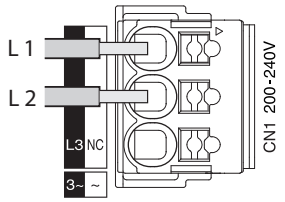
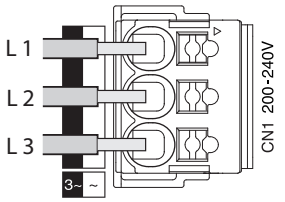
- Connect the connectors securely. Insecure connector connection may cause malfunction or damage to the driver.
- Be sure to use the dedicated connection cable (sold separately) to connect the motor.
- Before connecting or disconnecting a connector, turn off the power supply and check that the CHARGE LED is off. Residual voltage may cause electric shock.
- Do not wire the power supply cable of the driver in the same cable duct with other power lines or the motor cable. Doing so may cause malfunction due to noise.
- Maintain 20.5 m (67.3 ft.) or less for wiring distance between a motor and driver. Extending the wiring distance to more than 20.5 m (67.3 ft.) may result in heat generation from the driver or an increase in the electrical noise emitted from the product.

memo

- When disconnecting the connector, pull out while pressing the latches on the connector with fingers.

6-2 Connecting the power supply (CN1)

Connect a power supply cable to the main power supply input terminals (CN1).
A power supply cable is not included with the product. Provide a power supply cable separately.

Single-phase 200-240 VAC 50/60 Hz	Three-phase 200-240 VAC 50/60 Hz
	
Connect to L1 and L2	Connect to L1, L2, L3

■ Applicable lead wire

- Lead wire size: AWG18 to AWG14 (0.75 to 2.0 mm^2)
- Lead wire strip length: 10 mm (0.39 in.)
- Conductive material: Use only copper wires.

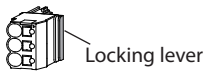
■ Circuit breaker

Be sure to connect a circuit breaker to the power line of the driver to protect the primary circuit.

- Rated current of protective device: 15 A for single-phase input driver, 10 A for three-phase input driver
- Recommended circuit breaker: Mitsubishi Electric Corporation NF30

Note

Pull out the power connector while pressing the locking lever.

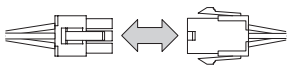


6-3 Connecting the motor and driver

Connect the connection cable (sold separately) to the motor and driver. The connection cables are provided up to 20 m (65.6 ft.).
For information on how to connect the motor and the connection cable, refer to the operating manual of the motor.

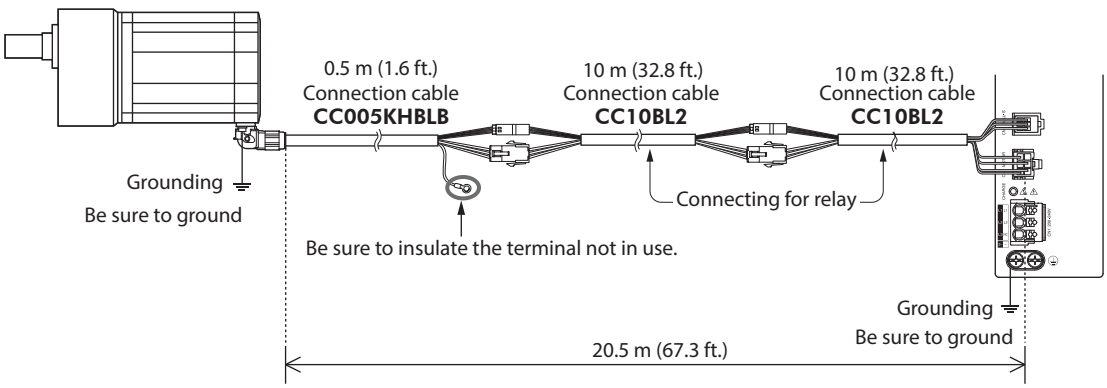
Note

- Fix all connector parts so that they are not subjected to stress.
  If they are not fixed, the cable may be damaged by stress.
- Be sure to insert the connector securely. Insecure connections may cause malfunction or damage to the motor or driver.



● Extending the wiring distance between a motor and a driver

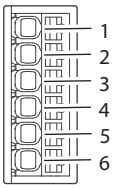
Use the connection cable for extension (sold separately) when extending the wiring distance between the motor and driver.
Up to two connection cables for extension can be added for use. The wiring distance between the motor and driver can be extended to a maximum of 20.5 m (67.3 ft.).



6-4 Connecting the I/O signals (TB1)

Connect the I/O signal cable to the I/O signal terminal block (TB1).

■ TB1 pin assignments



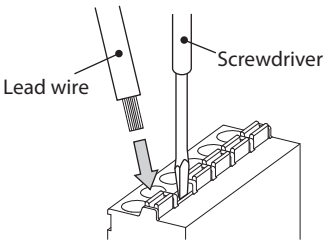
Pin number	Terminal name	Description
1	IN-COM	Common for IN0 and IN1 inputs
2	IN0	Control input 0 (FW-SPD-DIPSW)
3	IN1	Control input 1 (RV-SPD-DIPSW)
4	OUT-COM	Common for OUT0 and OUT1 outputs
5	OUT0	Control output 0 (ALM-B)
6	OUT1	Control output 1 (MOVE)

Values in parentheses ( ) are initial values.

■ Wiring method of TB1 connector

- Lead wire size: AWG24 (0.2 mm^2) to AWG16 (1.25 mm^2)
- Lead wire strip length: 8 mm (0.31 in.)

1. Strip the insulation of the lead wires.
2. Insert the lead wire while pushing the button of the orange color with a screwdriver.
3. After having inserted, release the button to secure the lead wire.



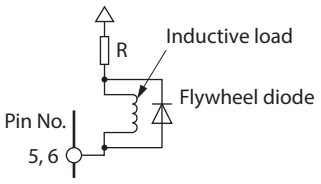
Note When inserting a lead wire, make sure that the strand does not come into contact with the adjacent lead wire and terminal. This may cause a short circuit between the strand and the lead wire or between the strand and the terminal, damaging the motor, the driver, or user's power supply equipment.

memo Keep the wiring distance as short as possible [less than 3 m (9.8 ft.)] to suppress the effect of noise.

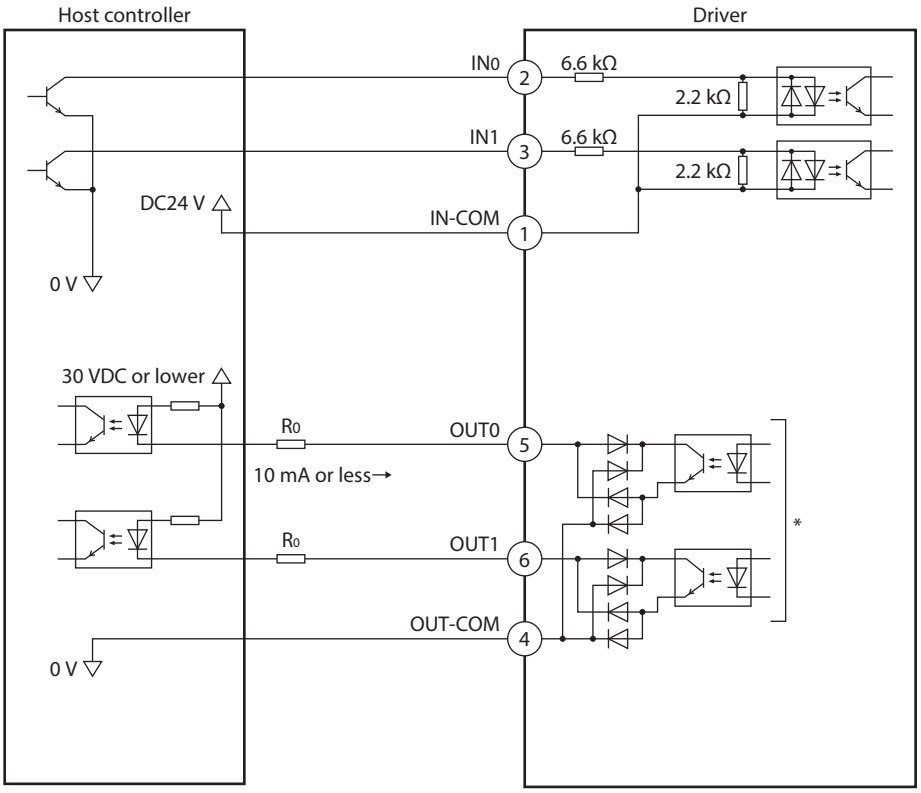
6-5 Driver I/O circuit

Note

- Use input signals at 24 VDC (–15 to +20 %).
- Use output signals at 4.5 to 30 VDC, 10 mA or less. If the current exceeds 10 mA, connect an external resistor R0 to keep the current to 10 mA or less.
- When a relay (inductive load) is connected, it is necessary to take a control measure for the fly-back voltage against the relay by connecting a diode. Or use a relay with built-in flywheel diode.

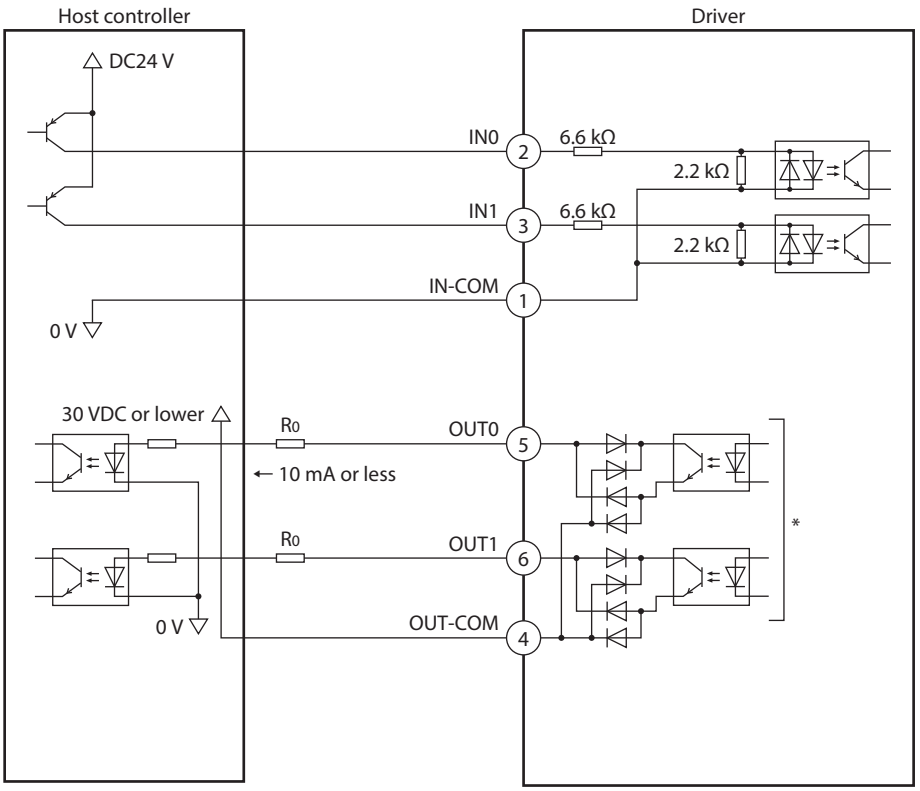


■ Connection example with a current sink output circuit



* Output saturation voltage: 1.2 VDC maximum

■ Connection example with a current source output circuit



* Output saturation voltage: 1.2 VDC maximum

6-6 Connecting the USB cable

Connect the USB cable to the USB port when using the **MEXE02**.

Specifications of USB cable

Specifications	USB 2.0 (Full speed)
Cable	Length: 3 m (9.8 ft.) or less Shape: Type-C

Note

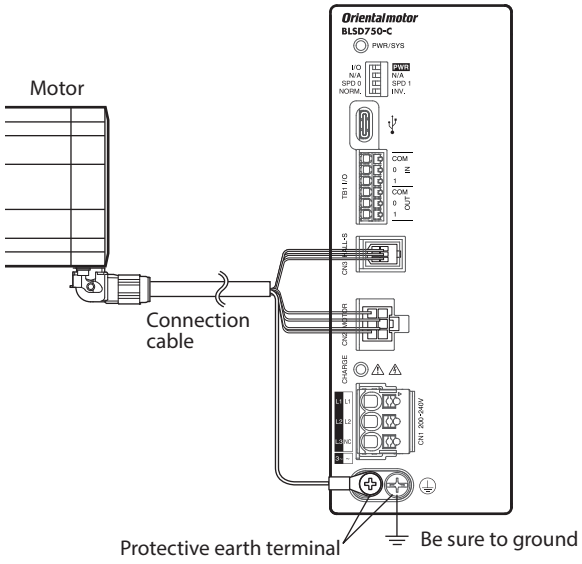
- Connect the driver and PC directly with the USB cable without using a hub or an extension cable.
- In large electrically noisy environments, use the USB cable with a ferrite core or install a ferrite core on the USB cable.
- The USB port on the driver is not electrically insulated. When grounding the positive terminal of the power supply, do not connect any equipment (PC, etc.) whose negative terminal is grounded. Doing so may cause the driver and these equipment to short, damaging both.

6-7 Grounding

Use the Protective Earth Terminals ⏚ of the motor and driver and the ground terminal of the connection cable to ground.

Note Be sure to ground the product. Failure to do so may result in electric shock or damage to the product.
If not grounded, static electricity may damage the product.

Two Protective Earth Terminals ⏚ are provided on the driver. Be sure to ground one of the protective earth terminals.
Do not share the grounding wire with a welder or any other power equipment. Use the other terminal to connect the ground terminal of the connection cable.
The grounding resistance specified in the standards applied to the equipment may not be satisfied depending on the type or length of the connection cable.
In this case, ground near the motor using the Protective Earth Terminal ⏚ of the motor.
When the ground terminal of the connection cable is not used, be sure to insulate it.

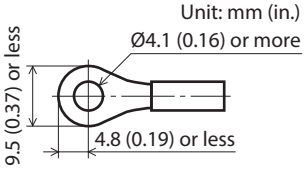


Reference
Protective earth wire of the connection cable
Conductor size: AWG18 (0.75 mm^2)
Maximum conductor resistance: 25.0 Ω/km

Ground terminal

- Applicable crimp terminal: Ring crimp terminal with insulation cover
- Terminal screw size: M4
- Tightening torque: 1.2 N·m (10.6 lb-in)
- Applicable lead wire: AWG18 to AWG14 (0.75 to 2.0 mm^2)

Unit: mm (in.)



Note Static electricity may cause the driver to malfunction or be damaged.
Be sure to ground the motor and the driver to prevent damage from static electricity.

6-8 Noise elimination measures

There are two types of electrical noise: One is noise that enters the driver from the outside and causes it to malfunction, and the other is noise that is emitted from the driver and causes peripheral equipment to malfunction.
For noise entering the driver from the outside, take measures to prevent the driver from malfunctioning. It is necessary to take appropriate measures because the signal lines are very likely to be affected by the noise.
For the noise that is emitted by the driver, take measures to suppress it.

■ Measures to eliminate electrical noise

- Install the driver inside a metal enclosure.
- When relays or electromagnetic switches are used, use noise filters or CR circuits to suppress the surge generated by these devices.
- Connect noise filters to the power lines.
- Keep the cables as short as possible.
- Use shielded twisted pair cables for power lines and signal lines.
- Keep power lines, such as motor and power supply cables, at least 100 mm (3.94 in.) away from signal lines. Also, do not bundle the cables or wire them in parallel. If the power cables and signal cables must cross, cross them at right angles.
- Wrap the cable around a ferrite core. This prevents the propagated noise from entering the driver or from being emitted from the driver. To increase the effect of noise attenuation by the ferrite core, wrap the cable several more turns.
- To ground a shielded cable, use a conductive cable clamp that ensures contact with the entire circumference of the shielded cable, and ground it as close to the equipment as possible.
- Use the shortest, thickest grounding wire possible.
- Choose a large and uniformly conductive surface for the grounding point.
- Ground the motor, driver and other peripheral control equipment so that a potential difference does not occur among the grounds.

■ Noise suppression product

● Noise Filter

- In order to prevent propagated noise through the power line, connect the following noise filter (or equivalent) to the driver power line. Keep the wiring distance between the noise filter and driver as short as possible. Use the AWG16 (1.25 mm^2) or thicker wire for the input and output cables of the noise filter.

Manufacturer	Single-phase 200-240 VAC	Three-phase 200-240 VAC
SOSHIN ELECTRIC CO., LTD.	HF2010A-UPF	HF3010C-SZA
Schaffner EMC	FN2070-10-06	FN3025HP-10-71

memo Leakage current may increase depending on the type and number of noise filters or grounding conditions.
When selecting an earth leakage breaker, make sure to sufficiently consider the magnitude of the leakage current.

- Keep an appropriate distance between the input cable and output cable of the noise filter. Also do not wire them in parallel.
- Keep the input cable of the noise filter in an enclosure as short as possible.

■ Oriental Motor noise suppression products

● Surge suppressors

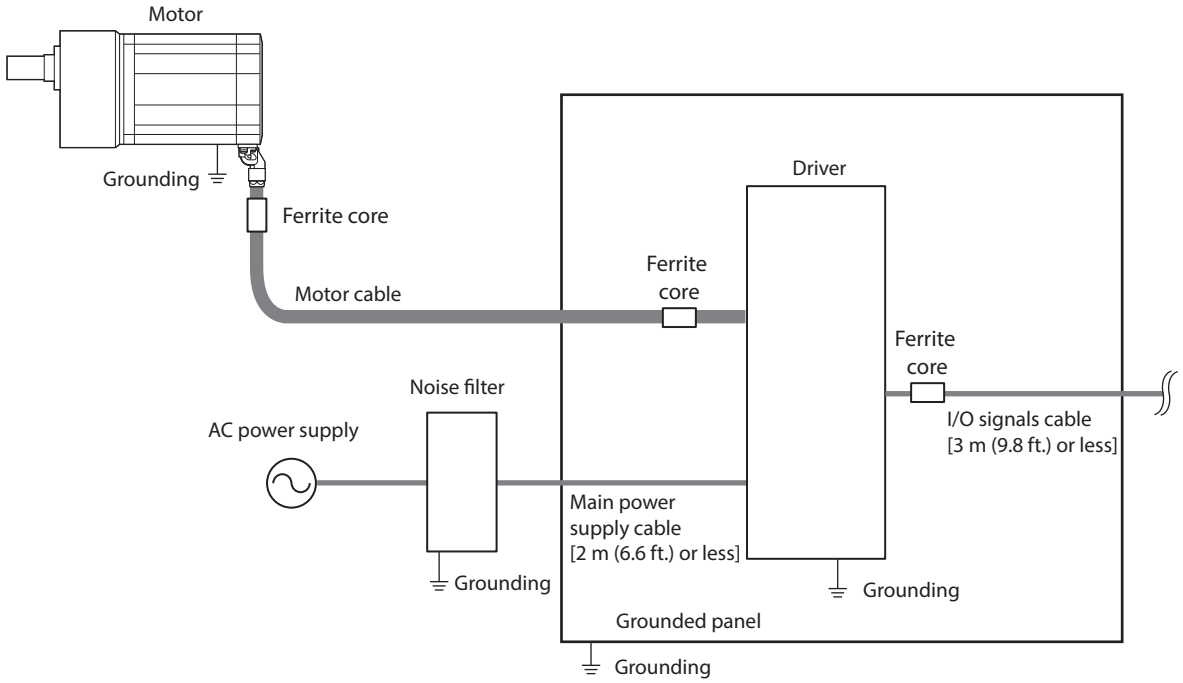
This product is effective in suppressing the surge that occurs in a contact part of the relay or electromagnetic switch. Connect it when using a relay or electromagnetic switch. Check on the Oriental Motor Website for the model of the CR circuit for surge suppression.

6-9 Compliance with the EMC Directive / Regulations

Oriental Motor products are compliant with the EMC Directive / Regulations in accordance with the contents of "6-8 Noise elimination measures" on p.18 under the terms of "Example of installation and wiring". The results of EMC testing of the equipment will vary depending on the type, layout, wiring method, etc. of the parts and components used. Verify compliance with the EMC Directive / Regulations in a condition where all parts and components, including Oriental Motor products, are assembled into the equipment.

⚠ CAUTION This equipment is not intended for use in residential environments nor for use on a low-voltage public network supplied in residential premises, and it may not provide adequate protection to radio reception interference in such environments.

■ Example of installation and wiring



□ is a ferrite core. [Model: ZCAT3035-1330 (TDK Corporation)]

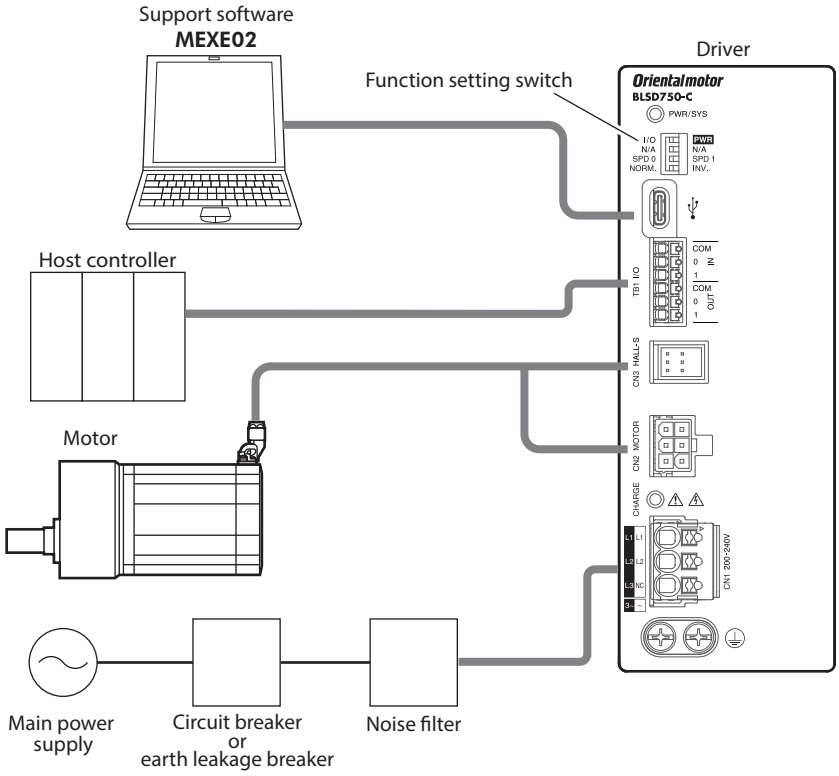
● Example of ferrite core installation

Cable length	Mounting location/Number of pieces		
	Motor cable		I/O signal cable
	Driver side	Motor side	
0.5/1 m (1.6/3.3 ft.)	1 piece	3 pieces	1 piece(2 turn)
1.5 m to 20 m (4.5 to 65.6 ft.)	–	1 piece	–

7 Operation

The motor can be operated in two ways as shown below.

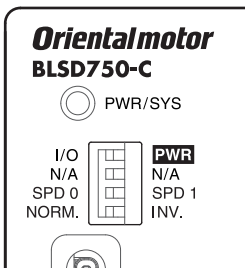
1. Operation by ON-OFF control of the power supply
2. Operation by input signals



Note Note that the motor automatically starts operating when the power supply is turned on in a state where the function setting switch is set to the "PWR" side. This may cause injury or damage to equipment. (Factory setting: "I/O" side)

7-1 Function setting switches

Function setting switches necessary for operation are provided on the front of the driver. Refer to the table below for the default switch settings.
"N/A" stands for "not available for use."

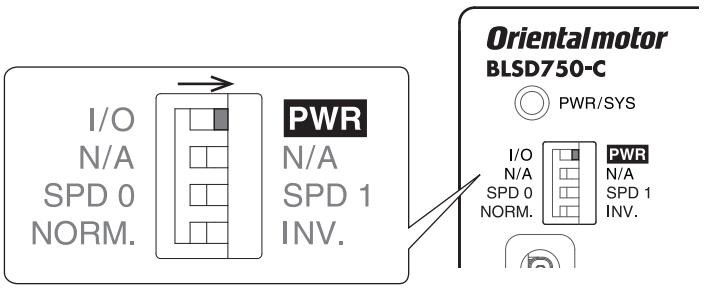


Setting		Function	Description
Default	–		
I/O	PWR	Operating method	Selects the motor operating method.
SPD0	SPD1	Rotation speed	Selects the motor rotation speed.
NORM.	INV.	Rotation direction	Selects the motor rotation direction.

Note Change the setting of the function setting switches before turning on the power supply. The setting of the function setting switches is enabled when the driver power supply is turned on. Do not operate the function setting switches while the power is supplied.

7-2 Operation by ON-OFF control of the power supply

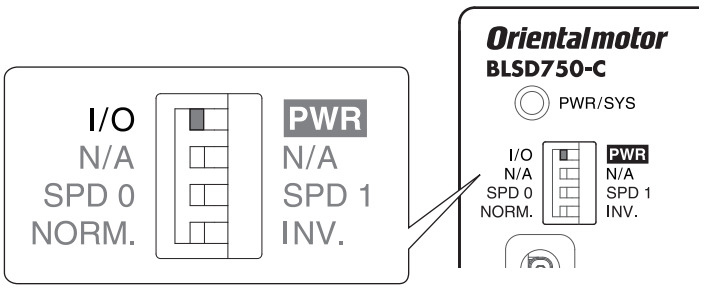
This is a method of operating the motor by turning the power supply on and off. (Operation by ON-OFF of power supply)



1. Set the function setting switch to the "PWR" side. (Factory setting: "I/O" side)
2. Turn on the power supply to operate the motor.
3. Turn off the power supply to stop the motor.

7-3 Operation by input signals

This is a method of operating the motor by turning the input signal ON and OFF. (Operation by I/O)

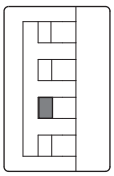
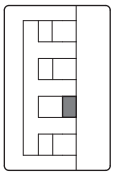


1. Set the function setting switch to the "I/O" side. (Factory setting: "I/O" side)
2. Turning the FW input ON causes the motor to rotate in a clockwise direction. Turning it OFF causes the motor to decelerate to a stop.
   Turning the RV input ON causes the motor to rotate in a counterclockwise direction. Turning it OFF causes the motor to decelerate to a stop.
   If both the FW and RV inputs are turned ON, the motor decelerates to a stop.

7-4 Operating conditions

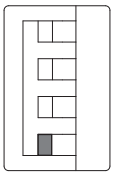
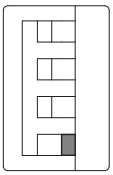
The operating conditions can be selected by the function setting switches.

■ Rotation speed

SPD0	SPD1
I/O N/A **SPD 0** NORM.  **PWR** N/A SPD 1 INV. 1500 r/min*	I/O N/A SPD 0 NORM.  **PWR** N/A **SPD 1** INV. 1800 r/min*

* It is an initial value. The rotation speed can be changed using the **MEXE02**.

■ Rotation direction

NORM.	INV.
I/O N/A SPD 0 **NORM.**  **PWR** N/A SPD 1 INV. FW input: Clockwise rotation RV input: Counterclockwise rotation (Factory setting)	I/O N/A SPD 0 NORM.  **PWR** N/A SPD 1 **INV.** FW input: Counterclockwise rotation RV input: Clockwise rotation (Reversing the rotation direction)

Note The setting of the function setting switches is enabled when the driver power supply is turned on. Do not operate the function setting switches while the power is supplied.

memo
- The settings of the rotation speed, acceleration time, and torque limiting value can be changed with the **MEXE02**. (⇒ p.23)
- If the deceleration time is set shorter than the coasting stop time of the motor, the motor will not stop at the specified time.
- If the function setting switch is set to the "PWR" side, the FW input will be always ON inside the driver.

7-5 Setting the rotation speed

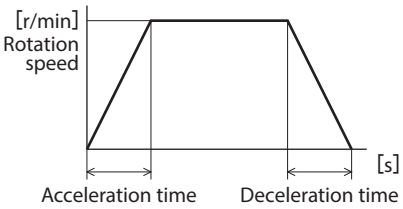
Using the **MEXE02**, a desired speed can be set for "SPD0" and "SPD1," which are selected by the function setting switch.

Speed control range	Initial value
100 to 4000 r/min	SPD0: 1500 r/min SPD1: 1800 r/min

7-6 Setting the acceleration time and deceleration time

The acceleration time and the deceleration time can be set by the **MEXE02** so that no shock is applied to a load when the motor starts or stops.

The actual acceleration time and deceleration time vary depending on the conditions of use, load inertia, load torque, etc.



Setting	Product specification range	Initial value
Acceleration time	100 to 30000 ms	1000 ms
Deceleration time	100 to 30000 ms	1000 ms

memo
- If the deceleration time is set shorter than the coasting stop time of the motor, the motor will not stop at the specified time.
- The motor coasts to a stop when the power supply is turned off during operation. The deceleration time cannot be set.

7-7 Torque limiting function

The maximum output torque of the motor can be limited. Set when limiting the motor output torque according to a load.

The torque limiting value can be set by the **MEXE02** based on the rated torque being 100 %.

Setting range: 0.0 to 1000.0 % (Initial value: 1000.0 %)

The motor operates at the lowest torque limiting value among the following conditions.

Name	Description
Torque limiting value	Torque limiting setting value
ATL function torque limiting	Torque limiting by the ATL function (Default: Enable)
Alarm torque limiting	Torque limiting when an alarm is generated (Approximately 100 %)
Output power limiting	Maximum value: 200 %

Note If the limit is increased significantly during the torque limiting process, a large impact torque may be generated, causing damage to the motor or equipment. Be careful when changing the torque limiting value.

7-8 ATL function

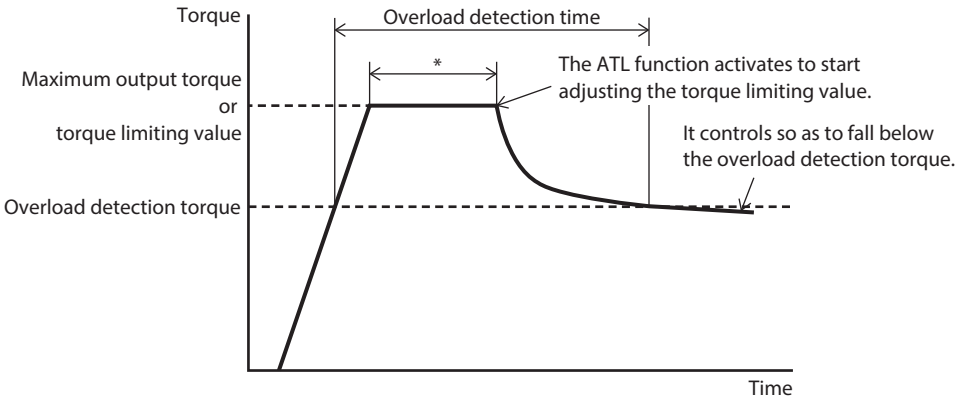
The ATL function is a function that prevents the overload alarm by automatically adjusting the torque limiting value when the output torque increases to near the overload alarm level.
The ATL function can be enabled or disabled using the **MEXE02**. (Default: Enable)

Note When the ATL function is activated, the output torque is automatically limited.
Be sure to check beforehand that it will not cause any problems with the operation of the equipment.

■ When the torque limiting value larger than the overload detection torque is set

The ATL function is activated when all of the following conditions are met.

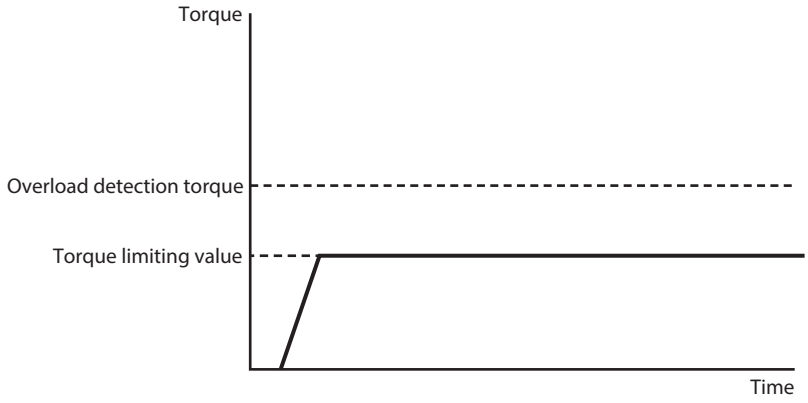
- The output torque of the motor exceeded the overload detection torque.
- The driver was estimated to exceed the overload detection time based on the output torque of the motor.



* The time varies depending on the operating condition or a load.

■ When the torque limiting value smaller than the overload detection torque is set

The ATL function is not activated because the motor output torque is smaller than the overload detection torque.



7-9 I/O signals

: These are the default signal assignments. They can be changed by the **MEXE02**.

■ Input signals

Terminal name	Signal name	Function
IN0	FW-SPD-DIPSW	Turning the FW input ON causes the motor to rotate in a clockwise direction. Turning it OFF causes the motor to decelerate to a stop. Turning the RV input ON causes the motor to rotate in a counterclockwise direction. Turning it OFF causes the motor to decelerate to a stop. If both the FW and RV inputs are turned ON, the motor decelerates to a stop.
IN1	RV-SPD-DIPSW	
Signal that can change the assignment	FREE	Turning the FREE input ON shuts off the motor current to put the motor in a non-excitation state. (The motor coasts to a stop.)
	ALM-RST	Turning the ALM-RST input ON resets the alarm presently being generated. (It is enabled at the ON edge.)
	USR-ALM	Turning the USR-ALM input ON generates the user alarm.

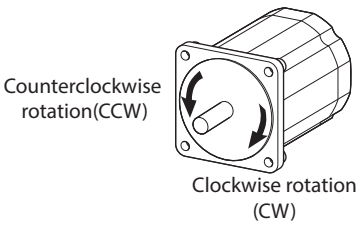
■ Output signals

Terminal name	Signal name	Function
OUT0	ALM-B	Output the alarm status of the driver. (Normally closed) Alarm not generated: ON Alarm is being generated: OFF
OUT1	MOVE	Output while the motor operates. During operation: ON During stop: OFF

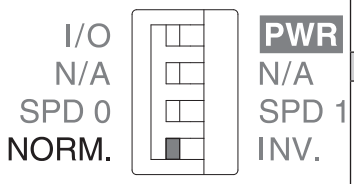
memo
- I/O signals are enabled even when the function setting switch is set to the "PWR" side.
- If the function setting switch is set to the "PWR" side, the FW input will be always ON inside the driver.

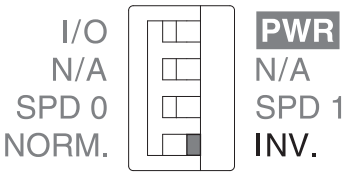
7-10 Motor rotation direction

The rotation direction of the motor output shaft is the direction as viewed from the motor output shaft side.



The rotation direction can be changed using the function setting switch of the driver.

NORM.		INV.
	Operation by ON-OFF control of the power supply	
	Clockwise rotation (Factory setting)	Counterclockwise rotation (Reversing the rotation direction)
	Operation by I/O	
	FW input: Clockwise rotation RV input: Counterclockwise rotation (Factory setting)	FW input: Counterclockwise rotation RV input: Clockwise rotation (Reversing the rotation direction)



Rotation direction of the gearhead output shaft

The rotation direction of the gearhead output shaft varies depending on the type or the gear ratio of the gearhead.
Check the operating manual of the motor for the rotation direction of the gearhead output shaft.

8 Inspection and maintenance

8-1 Inspection

Check the following items regularly.
If any abnormality occurs, stop using the product and contact your nearest Oriental Motor sales office.

Note

- Do not conduct the insulation resistance measurement or dielectric strength test with the motor and driver connected.
  Doing so may result in damage to the product.
- The driver uses semiconductor elements, so be extremely careful when handling them.
  Static electricity may damage the driver.

■ Inspection items

- Check to see if any of the mounting screws secured the driver are loose.
- Check to see if the connection of the terminal block and the connection of the connector are loose.
- Check to see if there is no dust on the driver.
- Check to see if the driver has an abnormal odor or has defects in its appearance.

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 Troubleshooting

The motor or driver may not operate properly if the rotation speed is set incorrectly or the connection is incorrect.
If the motor cannot operate properly, refer to the contents of this chapter and take appropriate action.
If the problem persists, contact your nearest Oriental Motor sales office.

Note Refer to "10 Alarms" on p.28 when an alarm is generated.

The motor does not rotate.	● The power supply is not connected correctly or the connection is poor. ▷ Check the connection of the power supply.
	● The operation input signal is not turned ON. ▷ Check the connection.
	● The setting of the function setting switch is incorrect. ▷ Set it to the "PWR" side when operating the motor by turning the power supply on and off.
	● An alarm is present. ▷ Check to see if an alarm is generated. The PWR/SYS LED blinks in red while an alarm is generated. Check the alarm contents with "10 Alarms" on p.28.
	● Information of Start operation error is generated. ▷ Check to see if information is generated. The PWR/SYS LED blinks in blue when information is generated. Refer to "11 Information" on p.31.

The rotation speed is not increased.	● The power supply voltage is dropping. ▷ Check the power supply voltage.

● The time to stop the motor is long. **● The time to stop the motor is incorrect.**	● Load inertia is too large. ▷ Check it by increasing the friction load or reducing the load inertia.

Torque limiting value is not increased.	● The ATL function is activated. ▷ Refer to "7-8 ATL function" on p.24.

The PWR/SYS LED blinks in blue.	● Information is generated. ▷ Refer to "11 Information" on p.31.

The motor rotates in the opposite direction to the specified one.	● The setting is incorrect. ▷ Refer to "7-10 Motor rotation direction" on p.25.
	● The gearhead with a gear ratio in which the rotation direction is opposite to that of the motor output shaft is used. ▷ Check the operating manual of the motor for the rotation direction of the gearhead output shaft.
	● A hollow shaft flat gearhead is used. ▷ The output shaft of the hollow shaft flat gearhead rotates in the opposite direction to the motor when viewed from the front of the gearhead, and in the same direction as the motor when viewed from the rear (motor mounting side).

● The motor movement is not stable. **● Motor vibration is too large.**	● The motor and gearhead output shaft and a load shaft are out of alignment. ▷ Check the coupling condition of the motor and gearhead output shaft and the load shaft.
	● The product is affected by electrical noise. ▷ Check operation only with the motor, driver, and minimum external equipment required for operation. If a noise effect has been confirmed, take the following countermeasures: [Keep away from the noise sources.] [Reconsider the wiring.]

10 Alarms

This driver is equipped with the alarm function to protect against temperature rise, poor connection, operation error, and the like. If an alarm is generated, the ALM-B output will be turned OFF, and simultaneously the motor will stop and the PWR/SYS LED will blink in red.
The alarm item generated can be checked by counting the number of times the LED blinks or by using the **MEXE02**.

10-1 Alarm reset

Before resetting an alarm by one of the following methods, be sure to remove the cause of the alarm and ensure safety.

- Turn the ALM-RST input ON. (It is enabled at the ON edge.)
- Execute the alarm reset using the **MEXE02**.
- Turn the power supply off and on again.

Note

- If an alarm is generated during operation by turning the power supply on and off, turn the power supply off and on again.
- Some alarms can only be reset by turning the power supply off and on again. Refer to "10-3 Alarm list" below.

10-2 Alarm history

Up to 16 generated alarms are stored in non-volatile memory in order from most recent to oldest.
The stored alarm history can be read and cleared using the **MEXE02**.

10-3 Alarm list

Alarm code	Number of LED blinks	Alarm name	Cause	Remedial action	Reset using the ALM-RST input	Motor excitation*
20h	Nine times	Overcurrent	The motor, the cable, and the driver output circuit were short-circuited.	Turn off the power supply and make sure the motor, cable, and driver are not damaged before turning on the power again. If the alarm has still not reset, the motor, cable, or driver may be damaged. Contact your nearest Oriental Motor sales office.	Not possible	Non-excitation
21h	Seven times	Main circuit overheat	The internal temperature of the driver exceeded 85 °C (203 °F).	• Reconsider the ambient temperature. • Reconsider the ventilation condition. • Reconsider the operating condition.	Possible	Non-excitation after deceleration
22h	Five times	Overvoltage	• The power supply voltage exceeded approximately 120 % of the rated voltage. • The internal voltage of the driver exceeded 420 VAC.	• Check the power supply voltage. • If the motor is rotated by an external force, reconsider the use or the environment.		Non-excitation
25h	Five times	Undervoltage	• The power supply voltage dropped below approximately 60 % of the rated voltage. • The internal voltage of the driver dropped below 150 VAC.	• Check the power supply voltage. • Check the wiring of the power supply cable.		Non-excitation after deceleration
28h	Twice	Sensor error	• An error of the sensor was detected during operation. • The sensor line in the motor cable was disconnected during operation. Or the motor cable was come off.	Check the connection between the driver and the motor.	Not possible	Non-excitation

Alarm code	Number of LED blinks	Alarm name	Cause	Remedial action	Reset using the ALM-RST input	Motor excitation*
29h	Nine times	Internal circuit error	The CPU peripheral circuit is damaged.	Turn the power off and on again. If the alarm has still not reset, the driver may be damaged. Contact your nearest Oriental Motor sales office.	Not possible	Non-excitation
2Dh	Twice	Motor connection error	An abnormality was detected in the motor power line.	• Check the connection between the driver and the motor. • If the motor is rotated by an external force, reconsider the use or the environment.		
30h	Seven times	Overload	A load exceeding the rated torque was applied for five seconds or more. Check the specified time refer to p.30	• Reduce the load. • Reconsider operating conditions such as the acceleration time and deceleration time. • If the alarm is generated at a low temperature, warm up.	Possible	Non-excitation after deceleration
31h	Seven times	Overspeed	• The motor rotation speed was exceeded approximately 4800 r/min. • The power supply voltage was dropped.	• Reduce the load. • Reconsider operating conditions such as the acceleration time and deceleration time. • If the motor is rotated by an external force, reconsider the use or the environment. • Check the power supply voltage.		Non-excitation
41h	Nine times	EEPROM error	The data stored in the driver was damaged.	Initialize all parameters, and then turn the power supply off and on again. If the alarm has still not reset, the driver may be damaged. Contact your nearest Oriental Motor sales office.	Not possible	
42h	Twice	Sensor error at power-on	• An error of the sensor was detected when the power supply was turned on. • The sensor wire in the motor cable was disconnected when the power supply was turned on. Or the motor cable was come off.	Check the connection between the driver and the motor.		
45h	Twice	Motor combination error	A motor that is not compatible with the driver was connected.	Check the motor model and the driver model, and connect them in the correct combination.		
6Eh	Once	User alarm	The USR-ALM input was turned ON.	Turn the USR-ALM input OFF.	Possible	Non-excitation after deceleration
70h	Six times	Abnormal operation data	The motor was operated at the rotation speed exceeding the specification value.	Check the setting of the rotation speed.		
F0h	Light	CPU error	CPU malfunctioned.	Turn the power off and on again. If the alarm has still not reset, the driver may be damaged. Contact your nearest Oriental Motor sales office.	Not possible	Non-excitation

* The motor excitation state when an alarm is generated is as follows.

Non-excitation: If an alarm is generated, the motor current will be cut off.

Non-excitation after deceleration: If an alarm is generated, the motor will decelerate to a stop. After deceleration to a stop, the motor current will be cut off.

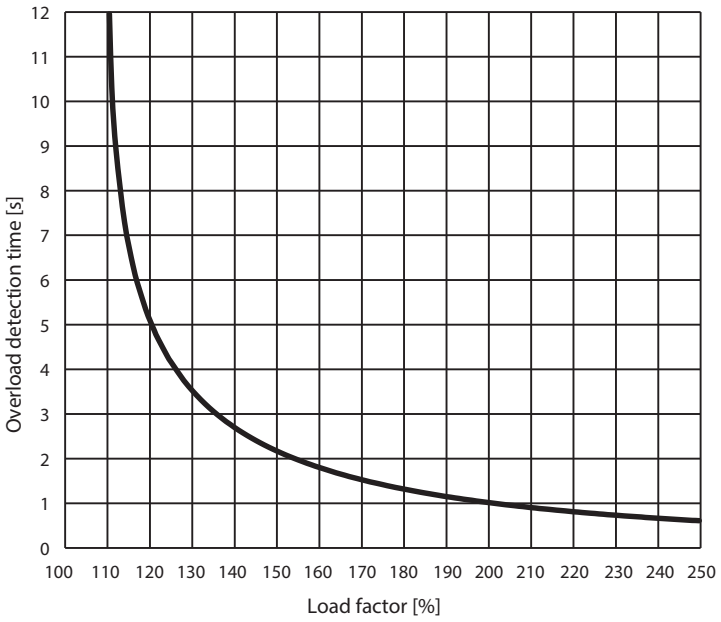
■ Characteristics of overload alarm

The time when the overload alarm is detected varies according to the load factor of the motor.
The load factor of the motor is the percentage of the maximum torque in the continuous duty region taken as 100 %.

● 750 W type motor

Overload detection time (reference)

Load factor	Overload detection time (reference)
105 %	Not detected
110 %	About 13 seconds
130 %	About 3.5 seconds
150 %	About 2.1 seconds
170 %	About 1.5 seconds
200 %	About 1.0 seconds



11 Information

The driver is equipped with a function to generate information output before an alarm is generated.

■ Status when information is generated

● LED status

If information is generated, the PWR/SYS LED will blink in blue.

● Operation of motor

The motor continues to operate during information unlike in the case of an alarm.

■ Clearing information

The generated information will automatically be cleared if the condition to clear information is met.

■ Information history

Up to 16 generated information items are stored in RAM in order from most recent to oldest.
The information stored as the information history is the information code, the time of generation, and the information content.
The stored information history can be checked using the **MEXE02**.

Note The information history will be cleared if the power supply of the driver is turned OFF.

■ Information list

Description	Cause	Condition to clear
Start operation restricted mode	• "Remote operation" was executed with the **MEXE02**. • Configuration was executed. • Data was written to the driver from the **MEXE02**. • "Reset" was executed with the **MEXE02**.	• Remote operation was canceled. • Configuration was completed. • Writing data was completed. • Data was restored to the factory setting.
I/O test mode	• "I/O test" was executed with the **MEXE02**. • Configuration was executed.	• The I/O test mode was canceled. • Configuration was completed.
Configuration request	The parameter that required executing Configuration was changed.	Configuration was executed.
Reboot request	A parameter that requires the power supply to be turned on again was changed.	The power supply was turned on again.
I/O operation disabled	An operation start signal is being ON when "I/O test" or "remote operation" of the **MEXE02** has been completed.	All operation start signal were turned OFF.
Start operation error	• An attempt has been made to start the motor while an alarm is generated or the FREE input is input. • The power supply was turned on while an operation input signal was ON. (During operation by I/O)	Operation was started properly.

12 Specifications

12-1 Specifications

The values for the rated torque, peak torque, rated speed, and speed control range are those when the gearhead is not combined. Check on the Oriental Motor Website for the product specifications.

Model name	Driver	**BLSD750-C**
	Motor	**BL2M6750**
Rated output power (Continuous)		750 W
Power supply input	Rated voltage	Single-phase 200-240 VAC Three-phase 200-240 VAC
	Permissible voltage range	–15 to +10 %
	Rated input current	Single-phase: 8.4 A Three phase: 4.5 A
	Maximum input current	Single-phase: 14.0 A Three phase: 7.2 A
Rated torque		2.39 N·m
Peak torque		4.78 N·m
Rated speed		3000 r/min
Speed control range*		100 to 4000 r/min

* The rotation speed is 1500 r/min at the time of shipment. The settings of the rotation speed can be changed with the **MEXE02**.

12-2 General specifications

Operating environment	Ambient temperature	Driver: 0 to +50 °C (+32 to +122 °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. No water or oil. Cannot be used in radioactive materials, magnetic field, vacuum or other special environments. (For details on installation locations, refer to p.11.)
	Vibration	Not subject to continuous vibration or excessive impact. In conformance with JIS C 60068-2-6 "Sine-wave 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 Shipping environment	Ambient temperature	Driver: –25 to +70 °C (–13 to +158 °F) (non-freezing)
	Ambient humidity	85 % or less (non-condensing)
	Altitude	Up to 3000 m (10000 ft.) above sea level
	Surrounding atmosphere	No corrosive gas or dust. No water or oil. Cannot be used in radioactive materials, magnetic field, vacuum or other special environments.
Degree of protection		IP20

13 Regulations and standards

13-1 UL Standards, CSA Standards

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

13-2 CE Marking

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

■ EU Low Voltage Directive / UK Electrical Equipment (Safety) Regulations

Installation conditions

Overvoltage category	Ⅱ
Pollution degree	2
Degree of protection	IP20
Protection against electric shock	Class Ⅰ equipment

- This product cannot be used in IT power distribution systems.
- Isolate the motor cable, power supply cable and other drive cables from the encoder cable and signal cables by means of double insulation.
- Use a circuit breaker conforming to EN or IEC Standards.
- The driver is not provided with the motor overtemperature protection specified in EN Standards.
- The driver is provided with the electronic motor overload protection specified in EN Standards.
  Refer to p.30 for detection of the overload alarm.

memo The driver is provided with the electronic motor overload protection, but is not provided with the thermal retention function and the speed sensitive function.

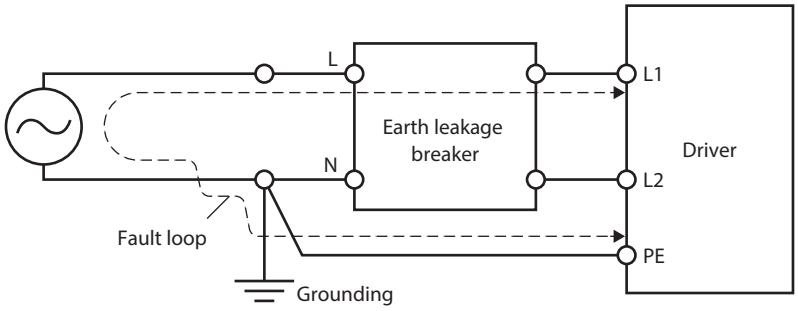
- The driver is not provided with the ground fault protection. Wire the product in accordance with "Wiring example having considered ground fault protection." Also observe the followings.
- Earth leakage breaker: Rated current 15 A, rated sensitivity current 30 mA
- When connecting to a power supply of Overvoltage category III, use an insulation transformer to ground its secondary side (N for single-phase, Neutral point for three-phase).
- Fault loop impedance

Driver power supply specifications	Fault loop impedance
Single-phase 200-240 V	1000 Ω
Three-phase 200-240 VAC (Delta connection)	
Three-phase 200-240 VAC (Star connection)	577 Ω

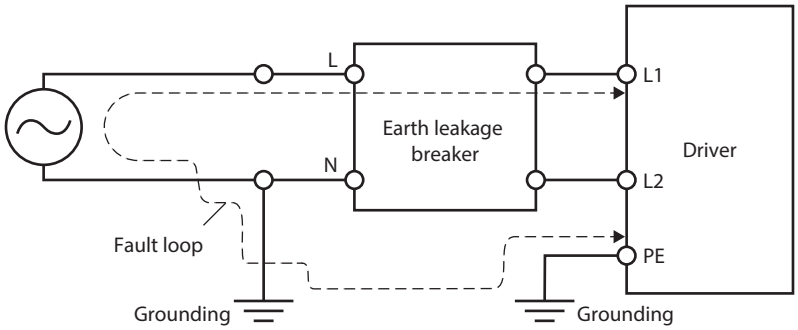
● Wiring example having considered ground fault protection

Single-phase 200-240 VAC

• TN power distribution systems

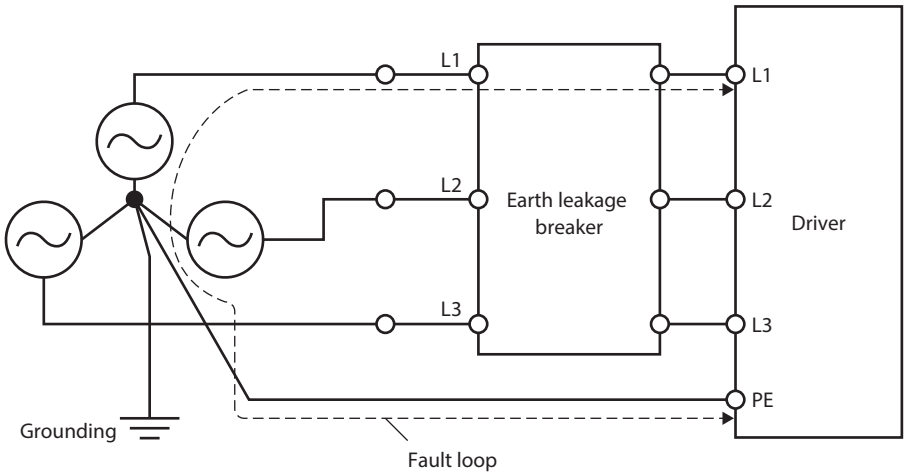


• TT power distribution systems

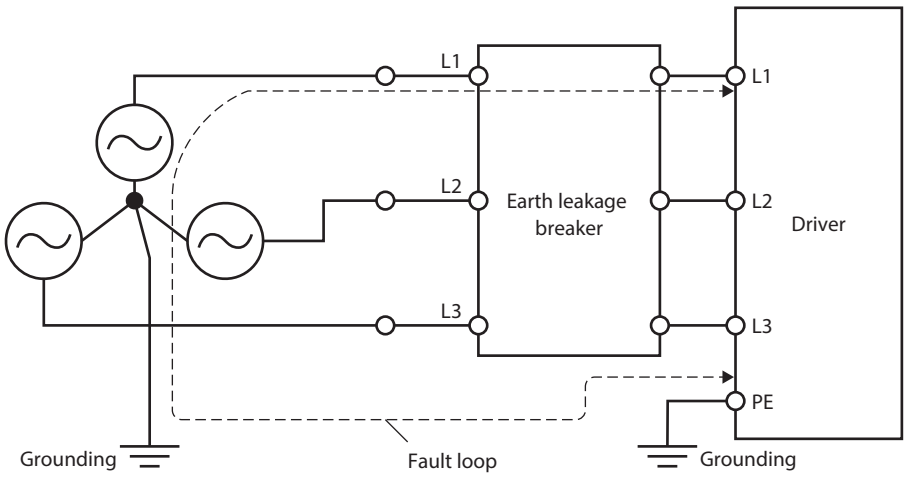


Three-phase 200-240 V

• TN power distribution systems



• TT power distribution systems



■ EU EMC Directive / UK EMC Regulation

Refer to "6-9 Compliance with the EMC Directive / Regulations" on p.19 for details about conformity.

■ EU RoHS Directive / UK RoHS Regulations

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

ORIENTAL MOTOR U.S.A. CORP.
Technical Support Tel:800-468-3982
8:30am EST to 5:00pm PST (M-F)

ORIENTAL MOTOR (EUROPA) GmbH
Schiessstraße 44, 40549 Düsseldorf, Germany
Technical Support Tel:00 800/22 55 66 22

ORIENTAL MOTOR (UK) LTD.
Blythe Valley Business Park,
Central Blvd Blythe Valley Park,
Solihull B90 8AG, United Kingdom
Tel:+44-1926-671220

ORIENTAL MOTOR (FRANCE) SARL
Tel:+33-1 47 86 97 50

ORIENTAL MOTOR ITALIA s.r.l.
Tel:+39-02-93906347

ORIENTAL MOTOR ASIA PACIFIC PTE. LTD.
Singapore
Tel:1800-842-0280

ORIENTAL MOTOR (MALAYSIA) SDN. BHD.
Tel:1800-806-161

ORIENTAL MOTOR (THAILAND) CO., LTD.
Tel:1800-888-881

ORIENTAL MOTOR (INDIA) PVT. LTD.
Tel:1800-120-1995 (For English)
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TAIWAN ORIENTAL MOTOR CO., LTD.
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SHANGHAI ORIENTAL MOTOR CO., LTD.
Tel:400-820-6516

INA ORIENTAL MOTOR CO., LTD.
Korea
Tel:080-777-2042

ORIENTAL MOTOR CO., LTD.
4-8-1 Higashiueno, Taito-ku, Tokyo
110-8536 Japan
Tel:+81-3-6744-0361
www.orientalmotor.co.jp/ja