Oriental motor

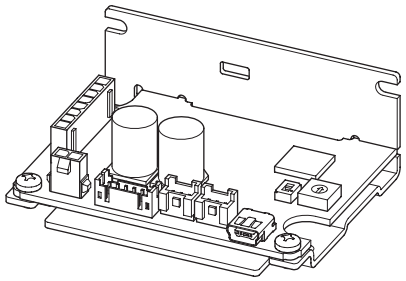
HP-5111

Brushless Motor

BLH Series

RS-485 communication type

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.

Table of contents

1 Introduction

■ 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 "2 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. For the power supply, use a DC power supply with reinforced insulation on its primary and secondary sides. Oriental Motor Co., Ltd. is not responsible for any damage caused through failure to observe this warning.

■ Operating manuals for the product

Operating manuals for the **BLH** Series RS-485 communication type are listed below.
For operating manuals not included with the product, contact your nearest Oriental Motor sales office or download from Oriental Motor Website Download Page.

	Operating manual name	Manual number	Included or not included with product
Motor	**BLHM** Motor OPERATING MANUAL	HM-5238	Included
	BLHM Electromagnetic Brake Motor OPERATING MANUAL	HM-5258	Included
Driver	BLH Series RS-485 communication type OPERATING MANUAL	HP-5111	Included
	BLH Series RS-485 communication type USER MANUAL	HP-5113	Not included

Refer to the USER MANUAL for details on settings of RS-485 communication, driver functions, and parameters.

2 Safety precautions

The precautions described below are intended to ensure the safe and correct 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.

Explanation of graphic symbols

Indicates "prohibited" actions that must not be performed.

Indicates "compulsory" actions that must be performed.

⚠WARNING

- Do not use the product in explosive or corrosive environments, in the presence of flammable gases, locations subjected to splashing water, or near combustibles. Doing so may result in fire or injury.
- Do not forcibly bend, pull, or pinch the cable. Doing so may result in fire.
- Do not use in vertical drive such as elevating equipment. When the driver protective function is activated, the motor will stop operating. The moving part may fall, leading to injury or damage to equipment.
- Do not disassemble or modify the motor, gearhead or driver. Doing so may cause injury. Refer all such internal inspections and repairs to the branch or sales office from which you purchased the product.

- 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, injury or damage to equipment.
- If the driver protective function was activated, remove the cause before canceling the alarm. Continuing the operation without removing the cause of the problem may cause malfunction of the motor, leading to injury or damage to equipment.
- Install the motor, gearhead and driver in an enclosure. Failure to do so may result in injury.
- Always keep the power supply voltage of the driver within the specified range. Failure to do so may result in fire.
- Connect the cables securely according to the wiring example. Failure to do so may result in fire.
- For the driver power supply, use a DC power supply with reinforced insulation on its primary and secondary sides. Failure to do so may result in electric shock.
- If the motor is operated by turning on and off the power supply, turn off the driver power in the event of a power failure. Otherwise, the motor may suddenly start when the power is restored, causing injury or damage to equipment.

⚠CAUTION

- Do not use the motor, gearhead, and driver beyond the specifications. Doing so may result in injury or damage to equipment.
- Do not touch the motor and driver during operation or immediately after stopping. The surface is hot, and this may cause a skin burn(s).
- Do not lift up the motor by holding the output shaft of the motor or the gearhead, or the motor cable. Doing so may cause the product to fall, leading to injury.
- Keep the area around the motor and driver free of combustible materials. Failure to do so may result in fire or a skin burn(s).
- Do not leave anything around the motor and driver that would obstruct ventilation. Doing so may result in damage to equipment.
- Do not shut off the negative side of the power supply. Also, make sure that the wiring for the power supply does not disconnect. This may result in damage to equipment.
- Do not touch the rotating part (output shaft) while operating the motor. Doing so may cause injury.
- Pay enough attention to safe operation when starting and stopping the motor by switching ON-OFF of the power supply. Failure to do so may result in injury or damage to equipment.

- Provide a cover over the rotating part (output shaft) of the motor and gearhead. Failure to do so may result in injury.
- Use a motor and driver only in the specified combination. An incorrect combination may cause a fire.
- Provide an emergency stop device or emergency stop circuit external to the equipment so that the entire equipment will operate safely in the event of a system failure or malfunction. Failure to do so may result in injury.
- Immediately when trouble has occurred, stop operation and turn off the driver power. Failure to do so may result in fire, electrical shock or injury.
- 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).

Warning label

3 Precautions for use

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

Be sure to match the output power of the driver with that of the motor when using.

- **Notes for continuous regeneration operation**

  When regeneration operation is continuously performed, check the following conditions are satisfied before use.
  - Set the value of the "Deceleration mode selection" parameter to "Deceleration stop 3."
  - Use a power supply that can sufficiently allow the regenerative power.

Note Do not perform gravitational operation (vertical drive) because a load may fall.

- **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 on power ON/OFF using a mechanical contact**

  When turning on or off the power supply using a mechanical contact (breaker, electromagnetic switch, relay, etc.), do so only the positive side (+) of the power supply using the mechanical contact.
  Turning on or off the positive side (+) and the negative side (–) of the power supply simultaneously using a mechanical contact may cause damage to the control circuit or peripheral equipment.
  Refer to the USER MANUAL for details.

- **Note on connecting a power supply whose positive terminal is grounded**

  The driver's USB connector 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.

- **Noise elimination measures**

  Refer to p.14 for the noise elimination measures.

- **Notes when saving the data to the non-volatile memory**

  Do not turn off the power supply while writing the data to the non-volatile memory, and also do not turn off for 5 seconds after the completion of writing the data. Doing so may abort writing the data and cause an EEPROM error alarm to generate.
  The non-volatile memory can be rewritten approximately 100,000 times.

- **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.

- **Apply grease to the hollow output shaft of a hollow shaft flat gearhead.**

  Apply grease (molybdenum disulfide grease, etc.) on the surface of the load shaft and the inner walls of the hollow output shaft to prevent seizure.

- **Sliding noise of electromagnetic brake**

  Sliding noise of the brake disk for the electromagnetic brake motor may be generated during operation.
  It is no functional problem.

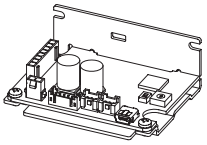
4 Preparation

This chapter explains the items you should check, as well as 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 branch or sales office from which you purchased the product.
Refer to "4.4 Products possible to combine" for combinations of the driver and motor.

☐ Driver ..... 1 unit ☐ OPERATING MANUAL ..... 1 copy

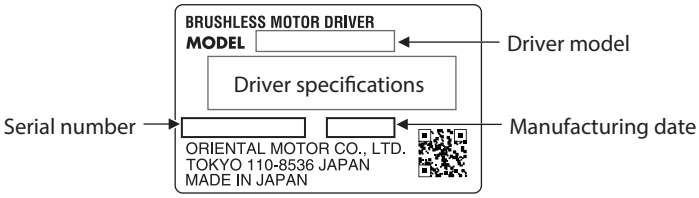


4.2 How to identify the product model

BLH2D 30 - K R
① ② ③ ④

①	Driver type	**BLH2D**: **BLH** Series driver
②	Output power	**15**: 15 W **30**: 30 W **50**: 50 W
③	Power supply voltage	**K**: 24 VDC
④	**R**: RS-485 communication type **D**: Digital setting type Blank: Analog setting type	

4.3 Information about nameplate



4.4 Products possible to combine

Products with which the drivers can be combined are listed below.
Verify the driver model and the motor model against the model name described on the nameplate of the product.
The box (☐) in the motor model name indicates a code or a number representing the gear ratio, the shaft type, or the gearhead type.
For details about the motor, refer to the operating manual included with the motor.

Output power	Motor model	Driver model	Cable set model
15 W	**BLHM015K-☐☐**	**BLH2D15-KR**	**LHS003CC** or **LHS010CC**
30 W	**BLHM230KC-☐☐*** **BLHM230KCM-☐☐**	**BLH2D30-KR**	
50 W	**BLHM450KC-☐☐*** **BLHM450KCM-☐☐**	**BLH2D50-KR**	

* For the lead wire type, "**KC**" of the motor model are replaced by "**K**".

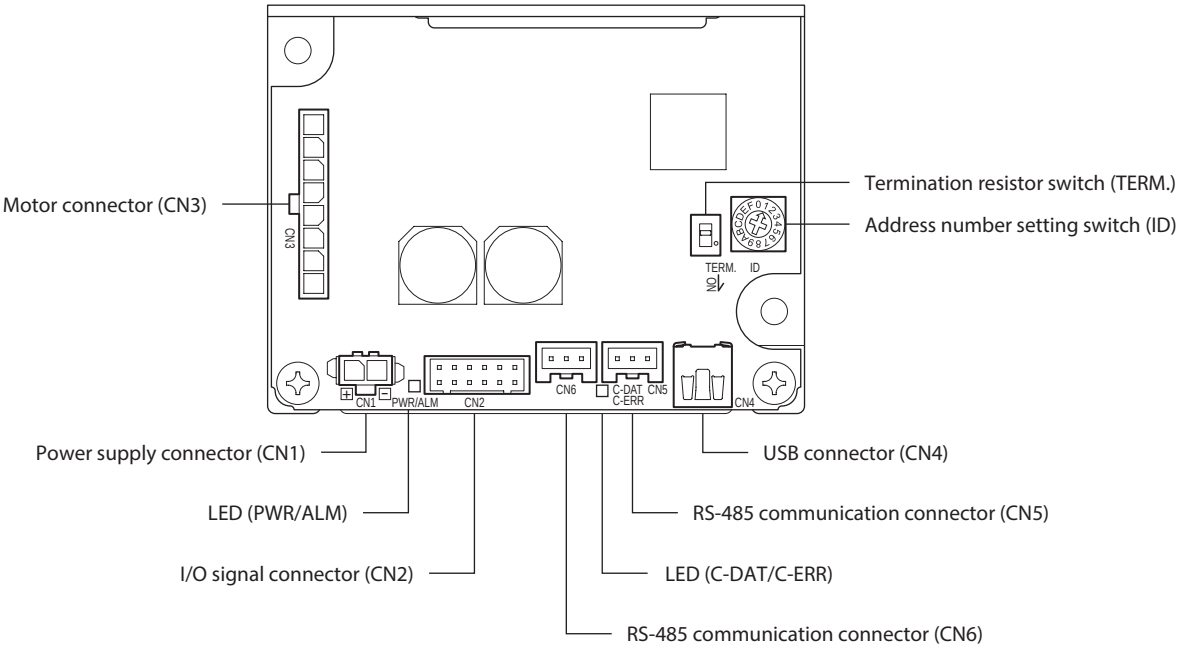
● **Cable set** (Each cable can be purchased separately.)

• I/O signal cable ..... 1 pc • Power supply cable ..... 1 pc

Length	Cable set model	I/O signal cable	Power supply cable
300 mm (11.8 in.)	**LHS003CC**	LH003C3	LH003C1
1000 mm (39.4 in.)	**LHS010CC**	LH010C3	LH010C1

4.5 Names and functions of parts

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



Name	Sign	Description
Power supply connector	CN1	Connects the power supply cable.
I/O signal connector	CN2	Connects the I/O signal cable to connect with an external control device.
Motor connector	CN3	Connects the motor cable.
USB connector	CN4	Connects a PC in which the **MEXE02** has been installed.
RS-485 communication connector	CN5	Connects a communication cable to connect with an external control device. Or connect to a different driver with a daisy chain.
	CN6	
LED	PWR/ALM	This LED is lit in green while the power is supplied. If an alarm is generated, this LED will blink in red. If information is generated, it will blink in orange.
	C-DAT C-ERR	This LED is lit in green when the driver communicates with the master station properly via RS-485 communication. This LED is lit in red when an error occurs in communication with the master station via RS-485 communication.
Address number setting switch	ID	Sets the address number when used via RS-485 communication. Factory setting: 1 (0 to F)
Termination resistor switch	TERM.	Sets the termination resistor (120 Ω) of RS-485 communication. Factory setting: OFF (OFF: Disabled, ON: Enabled)

5 Installation

5.1 Installation location

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

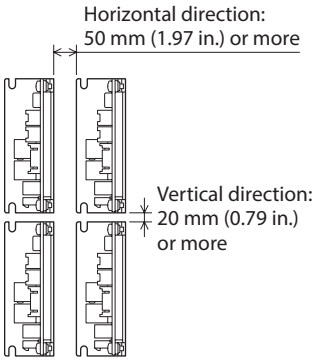
- Inside an enclosure that is installed indoors (provide vent holes)
- Operating ambient temperature: 0 to +50°C [+32 to 122 °F] (non-freezing)
- Operating ambient humidity: 85% or less (non-condensing)
- Area that is free of explosive atmosphere or toxic gas (such as sulfuric gas) or liquid
- Area not 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 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

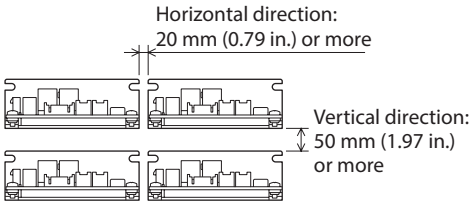
■ Installation direction

The driver is designed on the basis of heat radiation by air convection and heat conduction to an enclosure.
When installing the driver in an enclosure, be sure to use the mounting holes on the driver, and install it in a vertical direction or horizontal direction.

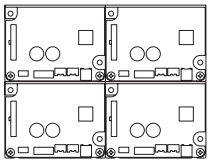
● Vertical installation



● Horizontal installation



- Drivers can be installed as shown in the figure below.
  When using the USB cable for communication, install them with taking the cable outlet position into account.



Both the vertical installation and the horizontal installation are available.

■ Installation method

Install the driver onto an appropriate flat metal plate having excellent vibration resistance and heat conductivity.
Using the mounting holes or notches of the driver, secure it with two screws (M3: not included) so that there is no gap between the driver and metal plate.

Note

- Do not install any equipment that generates a large amount of heat or noise near the driver.
- If the ambient temperature of the driver exceeds the upper limit of the operating ambient temperature, reconsider the ventilation condition or forcibly cool the area around the driver using a fan in order to keep within the operating ambient temperature.

6 Connection

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

6.1 Connecting the motor and driver (CN3)

Insert the motor cable connector into the motor connector (CN3) on the driver.

When extending the motor cable, use a connection cable (sold separately).
The maximum extension distance including the cable length of the motor itself should be 2 m (6.6 ft.).

Note

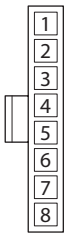
- Firmly insert the connector in position. Insecure connector connection may cause malfunction or damage to the motor or driver.
- Be sure to insert and pull out the connector while holding the connectors part. Do not apply any force in a direction other than the direction of inserting and pulling out the connector. Applying improper force may cause damage to the connector and driver.

CN3 pin assignment

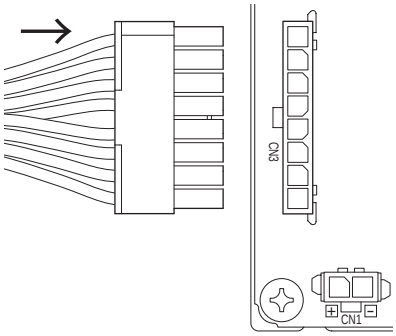
Pin No.	Lead wire color*	Lead wire size
1	Gray (Black)	AWG22
2	Purple	
3	Blue	
4	Yellow	AWG26
5	Green	
6	Orange	
7	Red	
8	Brown (White)	

* The color in parentheses ( ) indicates the 15 W type.

Viewed from the direction of an arrow in the right figure



- Housing 43645-0800 (molex)
- Terminal AWG22, 24: 43030-0001 (molex)
  AWG26: 43030-0004 (molex)



For lead wire type, all lead wire sizes are AWG22 (15W: AWG24).

6.2 Connecting the power supply (CN1)

Insert the power supply cable connector into the power supply connector (CN1) on the driver.
Lead wire size: AWG22 (0.3 mm^2)

Note

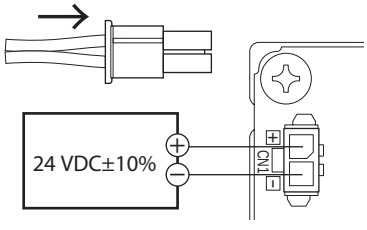
- When connecting, pay attention to the polarity of the power supply. Connection with incorrect polarity may cause damage to the driver.
- When turning on or off the power supply using a mechanical contact (breaker, electromagnetic switch, relay, etc.), do so only the positive side (+) of the power supply using the mechanical contact.
  Turning on or off the positive side (+) and the negative side (–) of the power supply simultaneously using a mechanical contact may cause damage to the control circuit or peripheral equipment.
- Do not wire the power supply cable of the driver in the same cable duct with other power lines or motor cables.
- When turning on the power again or inserting/pulling out the motor cable connector, turn off the power and wait for at least 5 seconds before doing so.

CN1 pin assignment

Pin No.	Lead wire color	Lead wire size
1	Red	AWG22
2	Black	

Viewed from the direction of an arrow in the right figure

Housing: 43645-0200 (molex)
Terminal: 43030-0001 (molex)

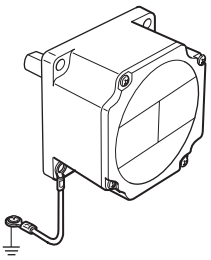


6.3 Grounding

The wire used to ground the motor and driver must be as thick and short to the grounding point as possible so that no potential difference is generated. Choose a large, thick and uniformly conductive surface for the grounding point.

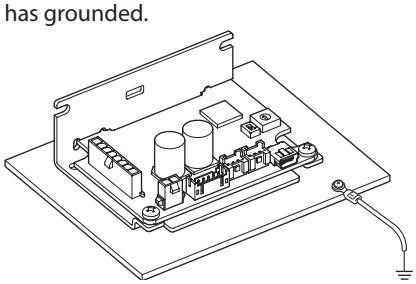
● Grounding the motor

Connect the grounding wire along with a set screw to the grounding point, using a shakeproof washer.
For the 15 W type motor, remove the paint from the mounting surface of the geared motor, and install it to a metal surface that has grounded.



● Grounding the driver

Install the driver to a metal surface that has grounded.

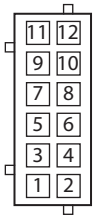


6.4 Connecting the I/O signals (CN2)

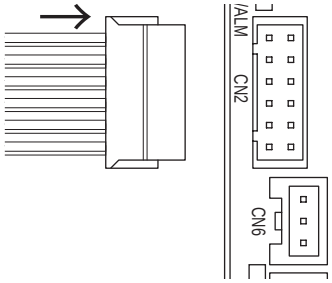
Insert the connector of the I/O signal cable into the I/O signal connector (CN2) on the driver.
Lead wire size: AWG26 (0.14 mm^2)

CN2 pin assignment

Viewed from the direction of an arrow in the right figure



Housing: PHDR-12VS (JST)
Terminal: SPHD-001T-P0.5 (JST)



Pin No.	Lead wire color	Terminal name	Initial assignment signal ∗1	Description
12	–	–	–	Not connected.
11	Black	D-IN0	START/STOP	These signals are used to operate the motor. The motor rotates according to the acceleration time when both the START/STOP input and RUN/BRAKE input are turned ON. If the START/STOP input is turned OFF, the motor stops according to the deceleration time. If the RUN/BRAKE input is turned OFF, the motor stops instantaneously.
10	White	D-IN1	RUN/BRAKE	
9	Gray	D-IN2	FWD/REV	This signal is used to change the motor rotation direction. The motor rotates in the forward direction when the signal is turned ON. ∗2
8	Light blue	D-IN3	M0	This signal is used to select the operation data number.
7	Purple	D-IN4	ALM-RST	This signal is used to reset the alarm. (The alarm will be reset at the ON edge of the input.)
6	Blue	VH	External analog setting device ∗3	These signals are used when the rotation speed is externally set using an external analog setting device (external potentiometer or external DC voltage).
5	Green	VM		
4	Yellow	VL		
3	Orange	GND	GND	I/O signals common
2	Red	D-OUT0	SPEED-OUT	30 pulses are output while the motor output shaft makes one revolution.
1	Brown	D-OUT1	ALM-B	This is a signal to output an alarm status. It is turned OFF when an alarm is generated. (Normally closed)

∗1 These signals are assigned at the time of shipment. Functions for the pin Nos. 1, 2, and 7 to 11 can be changed using the **MEXE02** or RS-485 communication.

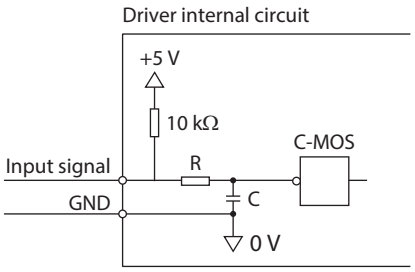
∗2 The rotation direction of the output shaft varies depending on the gear ratio of the gearhead.
The rotation direction can be changed by setting of the "Motor rotation direction" parameter.

∗3 If the "External setting method" parameter is changed, the rotation speed and torque limiting value can be set with the PWM signal input.

6.5 Driver I/O circuit

■ Input signals circuit

Input signals of the driver are C-MOS inputs.
The signal state represents "ON: 0 to 0.5 V (L level)" and "OFF: 4 to 5 V (H level)".

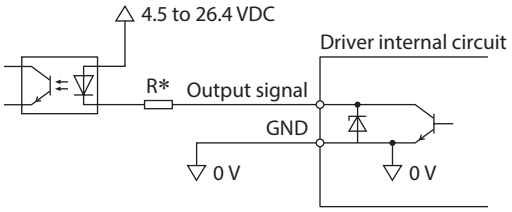


● Changing the logic level setting of input signals

The logic level setting for input terminals D-IN0 to D-IN4 can be changed using the **MEXE02** or RS-485 communication.
Refer to the USER MANUAL for details.

■ Output signals circuit

Output signals of the driver are transistor open-collector outputs. The signal state represents a state of "ON: Carrying current" or "OFF: Not carrying current" for the internal transistor rather than the voltage level of the signal.
ON voltage: 0.5 VDC maximum
External power supply: 4.5 to 26.4 VDC, 10 mA or less



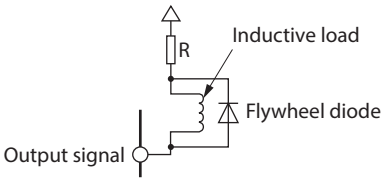
∗ Recommended resistance value when a current limiting resistor R is connected:
For 24 VDC: 2.7 kΩ to 4.7 kΩ (1 W)
For 5 VDC: 560 Ω to 820 Ω (0.25 W)

● Changing the logic level setting of output signals

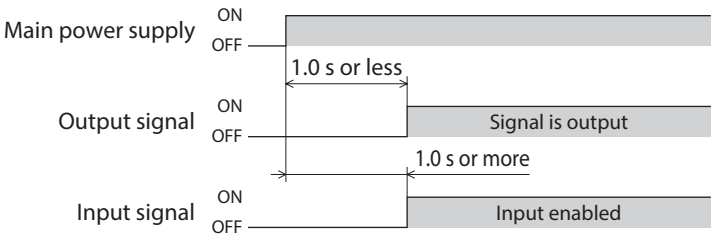
The logic level setting for output terminals D-OUT0 and D-OUT1 can be changed using the **MEXE02** or RS-485 communication.
However, if the SPEED-OUT output is assigned, it cannot be changed.
Refer to the USER MANUAL for details.

Note

- Be sure to suppress a current flowing to the output circuit to 10 mA or less.
  Connect a current limiting resistor R externally if the current exceeds this specified value.
  If the driver is used without connecting a current-limiting resistor, it will be damaged.
- When a relay (inductive load) is connected, provide a control measure for the fly-back voltage against the relay by connecting a diode. Or use a relay with built-in flywheel diode.



■ Timing chart when power is input



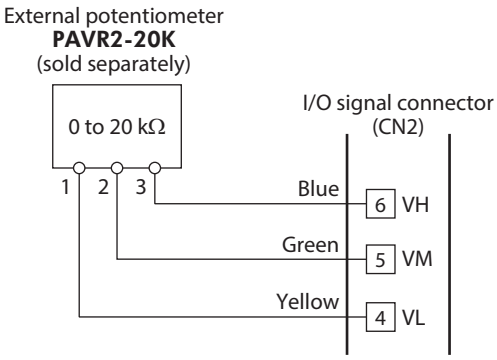
6.6 Connecting external analog setting devices

Using an external potentiometer (sold separately), external DC voltage, or PWM signal input, the rotation speed or the torque limiting value can be set.

■ Using an external potentiometer

Connect to the pin Nos. 4 to 6 of the CN2.

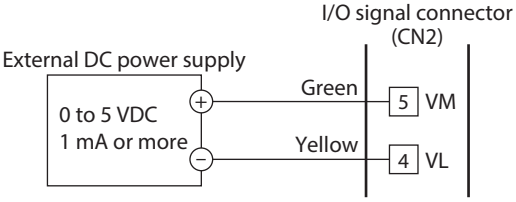
memo When the **PAVR2-20K** is used, use the ferrule (rod terminal).
Manufacturer: PHOENIX CONTACT GmbH & Co. KG
Model: AI 0,14-8 [AWG26 (0.14mm^2)]



Note When a shielded cable is used for connection with the external potentiometer, connect shields to VL of the pin No.4 from near the I/O signal connector (CN2).

■ Using external DC voltage

For external DC voltage, use a DC power supply (0 to 5 VDC) with reinforced insulation on its primary and secondary sides, and connect to the pin Nos. 4 and 5 of the CN2.
The input impedance between the VM input and the VL input is approximately 47 kΩ.
The VL input is connected to GND inside the driver.

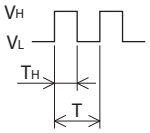


Note
- Be sure to use the voltage of an external control device at 5 VDC or lower.
  When connecting an external control device, make sure the polarities are correct. If the polarities are reversed, the driver may be damaged.
- When a shielded cable is used for connection with the external control device, connect shields to VL of the pin No.4 from near the I/O signal connector (CN2).

■ Using PWM signal input

When the operation data is set using the PWM signal input, connect the PWM signal lines to the pin Nos. 4 and 5 of the CN2.

- Input signal specifications

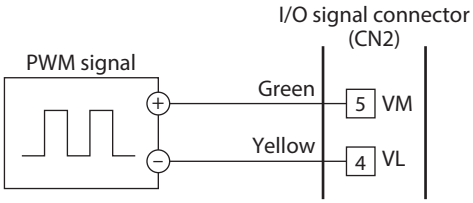


$$\text{PWM duty cycle (\%)} = \frac{T_H}{T} \times 100$$

$$\text{PWM frequency}* \text{ (kHz)} = \frac{1}{T}$$

V_H = 4.5 to 5.0 V V_L = 0 to 0.5 V

∗ Available for 1 kHz to 25 kHz



Note
- Be sure to use the voltage of an external control device at 5 VDC or lower.
  When connecting an external control device, make sure the polarities are correct. If the polarities are reversed, the driver may be damaged.
- When a shielded cable is used for connection with the external control device, connect shields to VL of the pin No.4 from near the I/O signal connector (CN2).

6.7 Connecting the USB cable (CN4)

When the **MEXE02** is used, connect the USB cable to the USB connector.

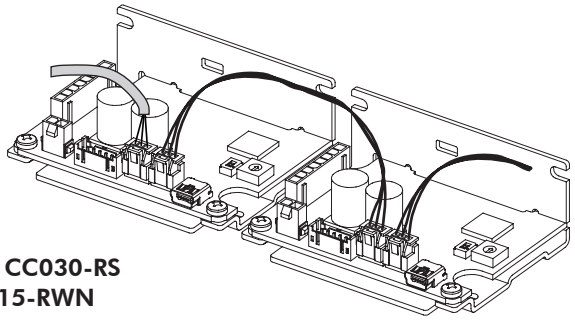
Specifications of USB cable

Specification	USB2.0 (full speed)
Cable	Length: 3 m (9.8 ft.) or less Shape: A to mini B

Note
- Connect the driver and PC directly with the USB cable without using a hub or extension cable.
- In large electrically noisy environments, use the USB cable with a ferrite core or install a ferrite core to the USB cable.

6.8 Connecting the RS-485 communication cable (CN5, CN6)

Connect this cable when controlling the driver via RS-485 communication.
Connect the RS-485 communication cable to the CN5 connector or the CN6 connector on the driver. The vacant connector can be used to connect a different driver.
RS-485 communication cables for connection (sold separately) are available.

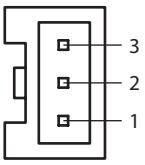


- **Model**

Cable for connecting between driver and controlle 3 m (9.8 ft.): **CC030-RS**
Cable for connecting between drivers 150 mm (5.91 in.): **LH0015-RWN**

■ Pin assignments

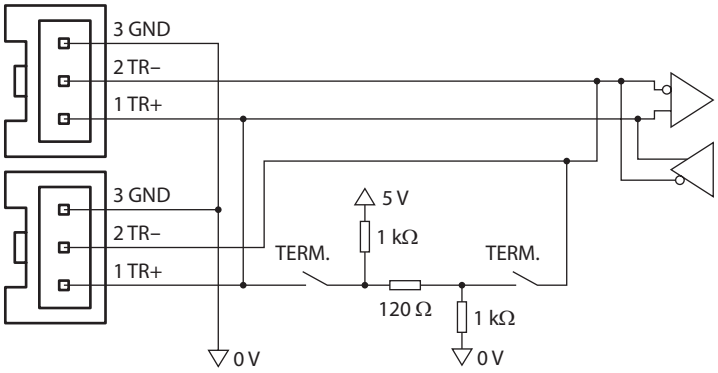
Pin No.	Signal name	Description	**CC030-RS** wire color
1	TR+	RS-485 communication signal (+)	White
2	TR–	RS-485 communication signal (–)	Gray
3	GND	GND	Orange



Housing: PAP-03V-S (JST)
Terminal: SPHD-001T-P0.5 (JST)
SPHD-002T-P0.5 (JST)

Applicable lead wire
- SPHD-001T-P0.5 AWG26 to 22 (0.13 to 0.33 mm^2)
- SPHD-002T-P0.5 AWG28 to 24 (0.08 to 0.21 mm^2)

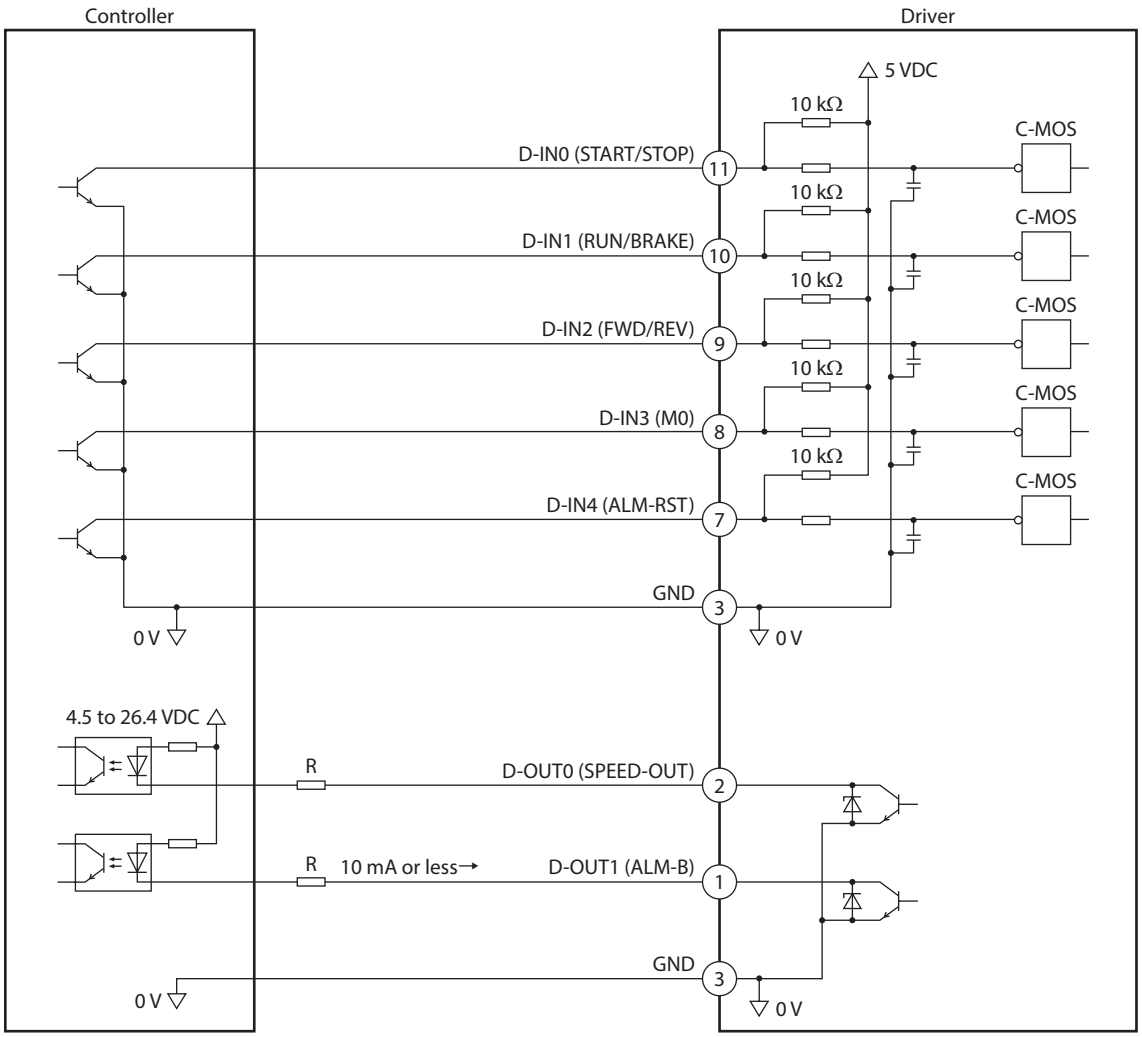
■ Internal input circuit



Note
- Keep 10 m (32.8 ft.) or less for the total extension distance of the RS-485 communication cable.
- Use a twisted-pair cable when using a communication cable other than the **CC030-RS**.
- Keep 15 units or less for the number of drivers connected.

6.9 Connection diagram

A connection example of I/O signals with a programmable controller are as shown below.
The I/O signals circuit of the **BLH** Series RS-485 communication type are configured with current SINK logic. (Current SOURCE logic is not supported.)



Note

- Insulate unused lead wires which are on the opposite side to the connector of the I/O signal cable to prevent them from contacting other devices, or connect them to 5 VDC or the signal ground (GND) of your external control device according to usage of signals.
- When extending the I/O signal cable, keep the length of 3 m (9.8 ft.) or less and wire in order to suppress noise effects.
- Be sure to suppress the current value of output signals to 10 mA or less. Connect a current limiting resistor R externally if the current exceeds this specified value.

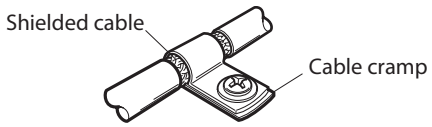
6.10 Noise elimination measures

There are two types of electrical noises: One is a noise to invade into the driver from the outside and cause the driver malfunction, and the other is a noise to emit from the driver and cause peripheral equipments malfunction.
For the noise that is invaded from the outside, take measures to prevent the driver malfunction. It is needed to take adequate measures because signal lines are very likely to be affected by the noise.
For the noise that is emitted from the driver, take measures to suppress it.

Measures against electrical noise

There are the following three methods mainly to take measures against the electrical noise.

- **Noise suppression**
  - When relays or electromagnetic switches are used, use noise filters or CR circuits to suppress surge generated by them.
  - Use a connection cable (sold separately) when extending the wiring distance between the motor and the driver. This is effective in suppressing the electrical noise emitted from the motor.
  - Cover the driver by a metal plate such as aluminum. This is effective in shielding the electrical noise emitted from the driver.
- **Prevention of noise propagation**
  - Place the power lines such as the motor and power supply cables, keeping a distance of 100 mm (3.94 in.) or more from the signal lines such as I/O signal cable and RS-485 communication cable, and also do not bundle them or wire them in parallel. If a power cable and a signal cable have to cross, cross them at a right angle.
  - Use a cable of AWG26 (0.14 mm^2) or thicker for the I/O signal cable.
  - Use a cable of AWG28 (0.08 mm^2) or thicker for the RS-485 communication cable.
  - For more effective elimination of noise, use shielded cables for a power supply cable and a signal cable or attach ferrite cores if non-shielded cables are used.
  - Keep cables as short as possible without coiling and bundling extra lengths.
  - To ground a shielded cable, use a metal cable clamp that can maintain contact with the entire circumference of the shielded cable, and ground as near the product as possible.



  - Grounding multiple points will increase effect to block electrical noise because impedance on the grounding points is decreased. However, ground them so that a potential difference does not occur among the grounding points.
- **Suppression of effect by noise propagation**
  - Loop the noise propagated cable around a ferrite core. Doing so will prevent the propagated noise invades into the driver or emits from the driver. The frequency band in which an effect by the ferrite core can be seen is generally 1 MHz or more. Check the frequency characteristics of the ferrite core used. When increasing the effect of noise attenuation by the ferrite core, loop the cable a lot.

6.11 Conformity to the EMC Directive

Effective measures must be taken against the EMI that the motor and driver may give to adjacent control-system equipment, as well as the EMS of the motor and driver itself, in order to prevent a serious functional impediment in the machinery. The use of the following installation and wiring methods will enable the motor and driver to be compliant with the EMC Directive. Refer to p.22 for the applicable standards.
Oriental Motor conducts EMC measurements on its motors and drivers in accordance with "Example of installation and wiring" shown on the next page.
The user is responsible for ensuring the machine's compliance with the EMC Directive, based on the installation and wiring explained below.

■ About power supply

The **BLH** Series is a product of DC power supply input. Use a DC power supply (such as a switching power supply) that optimally conforms to the EMC Directive.

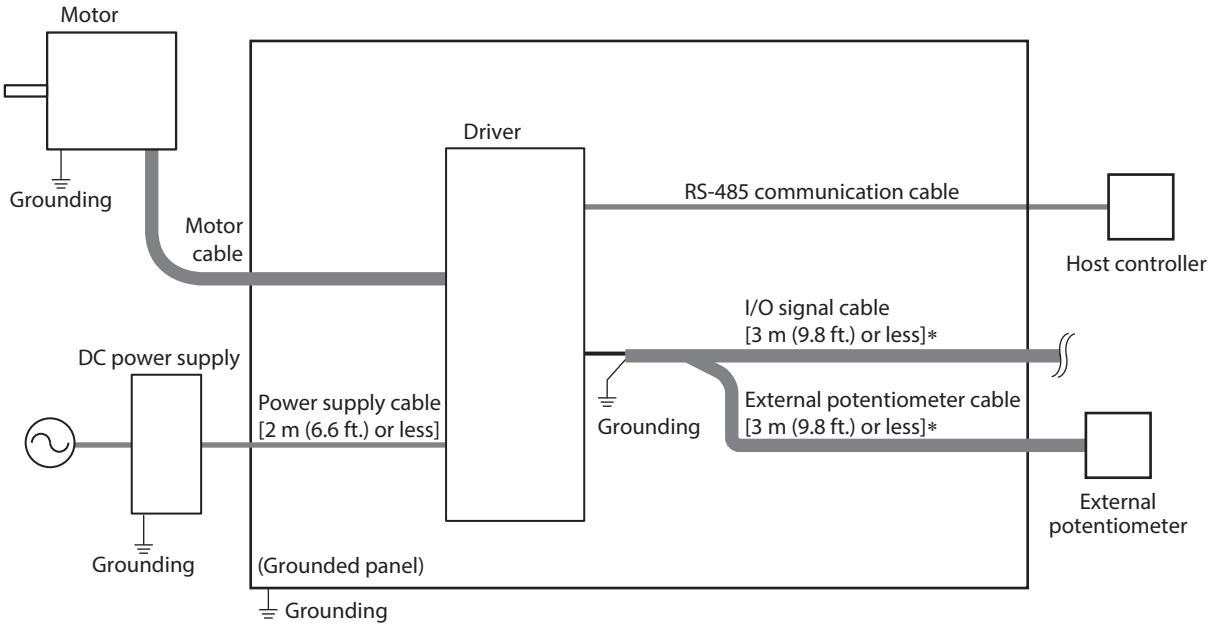
■ Connecting the motor cable

When extending the motor cable, use a connection cable (sold separately). The maximum extension distance including the cable length of the motor itself should be 2 m (6.6 ft.).

■ Notes about installation and wiring

- Connect the motor, driver and other peripheral control equipment directly to the grounding point so as to prevent a potential difference from developing between grounds.
- When relays or electromagnetic switches are used together with the system, use noise filters and CR circuits to suppress surges generated by them.
- Keep a power supply cable and a signal cable as short as possible without coiling and bundling extra lengths.
- Separate power lines such as the motor cable and the power supply cable from signal lines, and wire them apart as much as possible [example: about 100 to 200 mm (3.94 to 7.87 in.)]. If the power lines must cross over the signal lines, wire them at right angles.

■ Example of installation and wiring



* Shielded cable

■ Precautions about static electricity

Static electricity may cause the driver to malfunction or suffer damage. Be careful of handling the driver while the power is supplied.

Note

- Do not approach or touch the driver while the power is supplied.
- Always use an insulated screwdriver to set the address number setting switch and the termination resistor switch of the driver.

7 Guidance

If you are new to this product, read this chapter to understand the operating methods along with the operation flow. This is an example how to set operation data and parameters to the driver and operate the motor using a host controller. Refer to the USER MANUAL for details.

Note

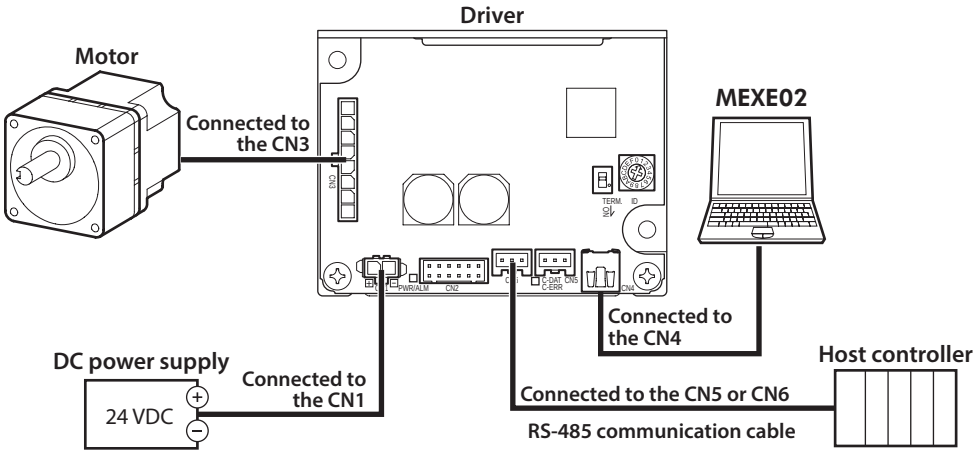
- Before operating the motor, check the surrounding conditions to ensure safety.
- After changing a parameter, it may be required to perform Configuration or turn on the driver power again in order to update the new setting.
  Refer to the USER MANUAL. for details about the update timing.

STEP1	Checking the installation and connection
⬇	
STEP2	Setting switches
⬇	
STEP3	Setting the communication parameters
⬇	
STEP4	Turning on the power supply again
⬇	
STEP5	Operating the motor
⬇	
STEP6	Checking the operation

This operation is performed under the following conditions.
- Number of drivers connected: 1 unit
- Address number: 1 (set by the switch)
- Transmission rate: 115,200 bps
- Termination resistor: Set to be enable

STEP1 Checking the installation and connection

Connection diagram



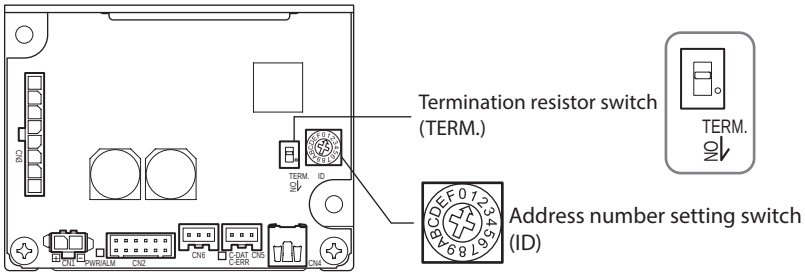
■ CN5/CN6 pin assignment

Pin No.	Signal name	Description
1	TR+	RS-485 communication signal (+)
2	TR–	RS-485 communication signal (–)
3	GND	GND

STEP2 Setting switches

Set the termination resistor and the address number with the switches.

Note Turn off the driver power before setting the switches. If the switches are set while the power is still on, the new switch settings will not be enabled.



- **Setting the address number setting switch**

Set the address number (slave address) using the address number setting switch. Make sure each address number (slave address) you set for each driver is unique.
Address number (slave address) 0 is reserved for broadcasting, so do not use this address.

ID switch	Address number
0	Not used.
1	1 (factory setting)
2	2
3	3
4	4
5	5
6	6
7	7

ID switch	Address number
8	8
9	9
A	10
B	11
C	12
D	13
E	14
F	15

memo The address number can also be set with the "communication ID" parameter. If the address number is set using the parameter in a state where communication is not established, connect the **MEXE02** to set.

- **Setting the termination resistor**

Set the termination resistor (120 Ω) of RS-485 communication to the driver located the farthest away (positioned at the end) from the host controller.
Set the termination resistor switch to enable the termination resistor. (OFF ⇒ ON)
Factory setting: OFF (termination resistor disabled)

STEP3 Setting the communication parameters

Turn on the driver power supply and check the communication parameters listed below using the **MEXE02**.
If communication is not established, reconsider the communication parameters of the driver.

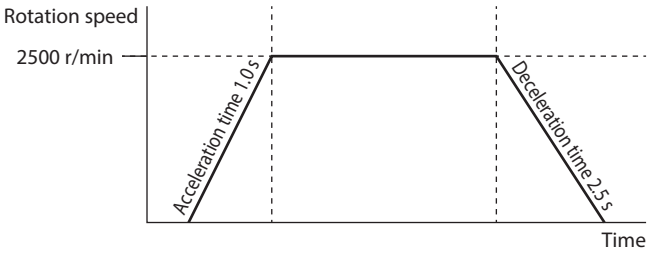
Parameter name	Factory setting
Communication ID	−1: The switch setting of the driver is followed
Baudrate	4: 115,200 bps
Communication order	0: Even Address-High Word & Big-Endian
Communication parity	1: Even parity
Communication stop bit	0: 1 bit
Transmission waiting time	30 (3.0 ms)
Silent interval	0.0: Set automatically

STEP4 Turning on the power supply again

The address number setting switch and the communication parameters of the driver will be updated after turning on the power supply again.

STEP5 Operating the motor

Send a message to operate the motor. As an example, this section explains how to perform the following operation.



1. Send the following query to set the operation data.

Communication data (HEX)	Description
01 10 07 80 00 02 04 00 00 00 00 DD FF	Sets the operation data No.0 rotation speed setting method to "0: Digital setting." (Factory setting)
01 10 09 00 00 02 04 00 00 00 00 99 FF	Sets the operation data No.0 torque limiting value setting method to "0: Digital setting." (Initial value)
01 10 04 80 00 02 04 00 00 09 C4 CE CC	Sets the setting value of the operation data No.0 rotation speed to "2500 r/min."
01 10 07 00 00 02 04 00 00 00 64 D4 74	Sets the setting value of the operation data No.0 torque limiting value to "100%."
01 10 06 00 00 02 04 00 00 00 0A 58 08	Sets the setting value of the operation data No.0 acceleration time to "1.0 s."
01 10 06 80 00 02 04 00 00 00 19 11 A5	Sets the setting value of the operation data No.0 deceleration time to "2.5 s."

* If the indirect reference function is used, each operation data item of the operation data No.0 can be set with consecutive addresses.

Note Set the transmission interval of frames sent from the master should be longer than the silent interval (C3.5) after receiving the response. It should be 2.5 ms or more when the transmission rate is 115,200 bps. Refer to the USER MANUAL for details.

2. Send the following query to perform operation.

Communication data (HEX)	Description
01 10 00 7C 00 02 04 00 00 00 18 F4 D4	Turns the START/STOP and RUN/BRAKE inputs ON (operation start of operation data No.0)
01 10 00 7C 00 02 04 00 00 00 10 F5 12	Turns the START/STOP input OFF

3. Check the motor rotates without any problem.

STEP6 Checking the operation

If the motor does not operate, check the following points.

- Is any alarm present?
- Are the power supply, the motor, and the RS-485 communication cable connected securely?
- Are the slave address, the transmission rate, and the termination resistor set correctly?
- Is the C-DAT/C-ERR LED unlit? Or is it lit in red? (A communication error is generated)

8 Maintenance and inspection

8.1 Inspection

It is recommended that periodic inspections are 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.

Note

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

■ Inspection item

- Check if any of the mounting screws of the motor and gearhead is 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.
- Check if dust is deposited on the driver.

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

The value in a state where the gearhead is not combined is described in each specification for the "rated torque," "peak torque," "rated rotation speed" and "speed control range." Refer to "4.4 Products possible to combine" (p.5) for the motor model name.
For the lead wire type, "**KC**" of the motor model are replaced by "**K**".

Model				
	Motor	**BLHM015K-□□**	**BLHM230KC-□□** **BLHM230KCM-□□**	**BLHM450KC-□□** **BLHM450KCM-□□**
	Driver	**BLH2D15-KR**	**BLH2D30-KR**	**BLH2D50-KR**
Rated output power (Continuous)		15 W	30 W	50 W
Power supply input	Rated voltage	24 VDC		
	Permissible voltage range	−10 to +10%		
	Rated input current	0.93 A	1.9 A	2.9 A
	Maximum input current	2.3 A	4.1 A	5.4 A
Rated torque		0.048 N·m (6.8 oz-in)	0.115 N·m (16.3 oz-in)	0.191 N·m (27 oz-in)
Peak torque		0.072 N·m (10.2 oz-in)	0.173 N·m (24 oz-in)	0.287 N·m (40 oz-in)
Rated rotation speed		3000 r/min	2500 r/min	
Speed control range		(80∗) 100 to 3000 r/min		

∗ Digital setting

Check on the Oriental Motor Website for the product specifications.

9.2 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, dust. Cannot be used in radioactive materials, magnetic field, vacuum or other special environment. (For details about installation locations, refer to p.7.)
	Vibration	Not subject to continuous vibrations 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, dust, water or oil. Cannot be used in radioactive materials, magnetic field, vacuum or other special environment.
Degree of protection		IP00

9.3 Communications specifications

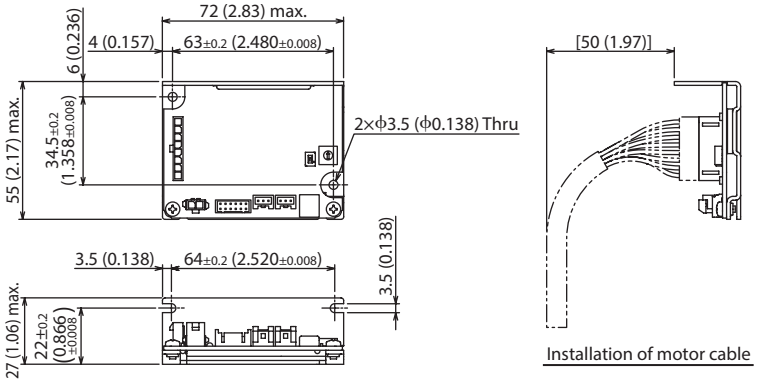
Electrical characteristics	In conformance with EIA-485 Use a twisted pair cable and keep the total extension distance of the communication cable up to 10 m (32.8 ft.). ∗
Communication mode	Half duplex Asynchronous mode (data: 8 bits, stop bit: 1 bit/2 bits, parity: none/even number/odd number)
Transmission rate	Selectable from 9,600 bps, 19,200 bps, 38,400 bps, 57,600 bps, 115,200 bps, and 230,400 bps.
Protocol	Modbus RTU mode
Type of Connection	Up to 15 drivers can be connected to one programmable controller (master device).

∗ If the motor cable or the power supply cable generates an undesirable amount of noise depending on the wiring or configuration, shield the cable or install a ferrite core.

9.4 Dimensions

Mass: 46 g (1.62 oz.)

[Unit: mm (in.)]



10 Regulations and standards

10.1 UL Standards, CSA Standards

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

Applicable Standards	Certification body/Standards File No.
UL 62368-1 CSA C22.2 No.62368-1	UL/E208200

10.2 EU Directives

■ CE Marking

This product is affixed the CE Marking under the EMC Directive.

- **Low Voltage Directives**
  - This product is not subject to the coverage of the Low Voltage Directive because the input power supply voltage is 24 VDC.
  - When conforming the equipment incorporating this product to the Low Voltage Directive, connect the driver power supply input to the DC power supply where the primary and secondary sides are provided with reinforced insulation.
  - Install this product inside an enclosure because it is designed and manufactured to be incorporated in equipment.
  - Degree of protection for driver: IP00

- **EMC Directive**

This product has received EMC compliance under the conditions specified in "Example of installation and wiring" on p.15. The final level of conformance of your mechanical equipment to the EMC Directive will vary depending on such factors as the control system equipment used with the motor and driver, configuration of electrical parts, wiring, layout, and hazard level. It therefore must be verified through conducting EMC measures on your mechanical equipment.

Applicable standards

EMI	EN 55011 Group 1 Class A EN 61000-6-4
EMS	EN 61000-6-2

Caution: This equipment is not intended for use in residential environments nor for use on a lowvoltage public network supplied in residential premises, and it may not provide adequate protection to radio reception interference in such environments.

10.3 Republic of Korea, Radio Waves Act

KC Mark is affixed to this product under the Radio Waves Act, the republic of Korea.

10.4 RoHS Directive

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

Published in January 2020

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

ORIENTAL MOTOR U.S.A. CORP.
Technical Support Tel:(800)468-3982
8:30 A.M. to 5:00 P.M., P.S.T. (M-F)
7:30 A.M. to 5:00 P.M., C.S.T. (M-F)
www.orientalmotor.com

ORIENTAL MOTOR DO BRASIL LTDA.
Tel:+55-11-3266-6018
www.orientalmotor.com.br

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

ORIENTAL MOTOR (UK) LTD.
Tel:01256-347090
www.oriental-motor.co.uk

ORIENTAL MOTOR (FRANCE) SARL
Tel:01 47 86 97 50
www.orientalmotor.fr

ORIENTAL MOTOR ITALIA s.r.l.
Tel:02-93906346
www.orientalmotor.it

ORIENTAL MOTOR ASIA PACIFIC PTE. LTD.
Singapore
Tel:1800-8420280
www.orientalmotor.com.sg

ORIENTAL MOTOR (MALAYSIA) SDN. BHD.
Tel:1800-806161
www.orientalmotor.com.my

ORIENTAL MOTOR (THAILAND) CO., LTD.
Tel:1800-888-881
www.orientalmotor.co.th

ORIENTAL MOTOR (INDIA) PVT. LTD.
Tel:+91-80-41125586
www.orientalmotor.co.in

TAIWAN ORIENTAL MOTOR CO., LTD.
Tel:0800-060708
www.orientalmotor.com.tw

SHANGHAI ORIENTAL MOTOR CO., LTD.
Tel:400-820-6516
www.orientalmotor.com.cn

INA ORIENTAL MOTOR CO., LTD.
Korea
Tel:080-777-2042
www.inaom.co.kr

ORIENTAL MOTOR CO., LTD.
Hong Kong Branch
Tel:+852-2427-9800

ORIENTAL MOTOR CO., LTD.
4-8-1 Higashiueno, Taito-ku, Tokyo
110-8536 Japan
Tel:03-6744-0361
www.orientalmotor.co.jp