Oriental motor

HP-5163-3

Brushless Motor

BLV Series R Type Driver
BLVD-KBRD

OPERATING MANUAL

Installation and Connection Edition

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.

Original instructions

1 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 is 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 compensation for damage caused through failure to observe this warning.

■ Overview of the product

● Compatible with battery drive

This product is compatible with the allowable operating voltage of 15 VDC to 40 VDC, taking into account voltage fluctuations.

● Stability at low speeds

Excellent stability at low speeds is obtained in comparison with conventional brushless motors. Using this product can achieve smooth starting and stopping of equipment.

● Equipped with the power removal function

The power removal function is a function that stops supplying the power to the motor by the hardware. The power removal function is assumed to be used to prevent unexpected starting of the moving parts of equipment when an operator works inside the operating range of the moving parts.

● Compatible with network communications

Parameters can be set and operation can be executed or stopped via communications of RS-485 (Modbus RTU) or CAN (CANopen).
Parameters can also be set using the support software.

■ Related operating manuals

Operating manuals are not included with the product. Download them from Oriental Motor Website Download Page or contact your nearest Oriental Motor sales office. To use the product, read this manual together with the **BLV** Series **R** Type OPERATING MANUAL Function Edition.

Operating manual name
BLV Series **R** Type Driver: **BLVD-KBRD** OPERATING MANUAL Installation and Connection Edition (this document)
BLV Series **R** Type OPERATING MANUAL Function Edition
BLV Series **R** Type Driver CANopen Communication Profile
BLV Series **R** Type Motor OPERATING MANUAL

Search for an operating manual by the model name shown on the nameplate.

2 Safety precautions

The precautions described below are intended to ensure the safe and correct use of the product, and to prevent the customer and others from exposure to the risk of injury. Use the product only after carefully reading and fully understanding these instructions.

Description of signs

⚠WARNING	Handling the product without observing the instructions that accompany a "WARNING" symbol may result in serious injury or death.
⚠CAUTION	Handling the product without observing the instructions that accompany a "CAUTION" symbol may result in injury or property damage.
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.

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, in places subjected to splashing water, or near combustibles. 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 touch the driver while the power is on. Doing so may result in fire or electric shock. • Do not use a motor without an electromagnetic brake in an application of vertical drive such as elevating equipment. If the alarm function (protective function) of the driver is activated, the motor will stop operating. This may cause the moving part to fall, resulting in injury or damage to equipment. • Do not use the brake mechanism of the electromagnetic brake motor as a safety brake. It is intended to hold the moving part and motor positions. Using it as a safety brake may result in injury or damage to equipment. • Do not forcibly bend, pull, or pinch the cable. Doing so may result in fire, electrical shock, or damage to equipment. • Do not touch the motor or driver when conducting the insulation resistance measurement or dielectric strength test. Accidental contact may result in electric shock. • Do not disassemble or modify the driver. Doing so may result in electric shock, injury, or damage to equipment. Refer all such internal inspections and repairs to the branch or sales office from which you purchased the product.
	• Only qualified and educated personnel should be allowed to perform installation, connection, operation and inspection/troubleshooting of the product. Handling by unqualified and uneducated personnel may result in fire, electric shock, injury, or damage to equipment. • Use a motor and a driver only in the specified combination. An incorrect combination may cause fire, electric shock, or damage to equipment. • If the alarm function (protective function) of the driver is activated, remove the cause before resetting the alarm. Continuing the operation without removing the cause of the problem may result in malfunction of the motor, leading to injury or damage to equipment. • Install the driver in an enclosure. Inappropriate installation may result in injury.

⚠WARNING	
	• Always keep the power supply voltage of the driver within the specified range. Failure to do so may result in fire, electric shock, or damage to equipment. • Connect the cables securely according to the wiring example. Failure to do so may result in fire, electric shock, or damage to equipment. • For a main power supply for communication, use a battery or a DC power supply with reinforced insulation on its primary and secondary sides. Failure to do so may result in electric shock. • Turn off the main power supply in the event of a power failure. Otherwise, the motor may suddenly start when the power is restored, causing injury or damage to equipment. • Always turn off the power before performing maintenance or inspection. Failure to do so may result in electric shock.

⚠CAUTION	
	• Do not use the driver beyond its specifications. Doing so may result in fire, electric shock, injury, or damage to equipment. • Do not touch the driver while operating or immediately after stopping. The surface is hot, and this may cause a skin burn(s). • 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.
	• Securely install the driver to the mounting plate. Inappropriate installation may cause the motor or driver to detach and fall, resulting in injury or damage to equipment. • Make sure the wiring for the power supply does not disconnect. This may result in damage to equipment. • When moving the moving part by hands, put the motor into a non-excitation state. Operating in a state where the motor is excited 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. • Be sure to ground the driver to prevent them from being damaged by static electricity. Failure to do so may result in fire 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. • Immediately when a problem occurred, stop operation and turn off the main power supply. Failure to do so may result in fire, electrical shock, or injury.

3 Precautions for use

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

■ Wiring

● Connecting a motor and a driver

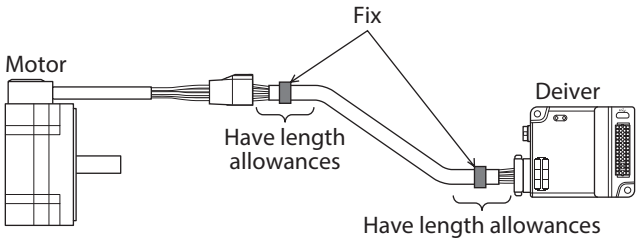
Use the dedicated connection cable (sold separately) when extending the wiring distance between the motor and the driver.

● Notes when the cable is used

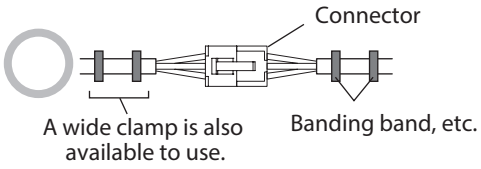
Note the following points when the cable is used.

How to fix the cable

Fix the cable at the positions near the connector so that no stress due to the bending or self-weight of the cable is applied on the connector.
Also, do not excessively bend the cable near the connection part of the connector. Applying stress on the cable may cause poor contact or disconnection, leading to malfunction or heat generation.

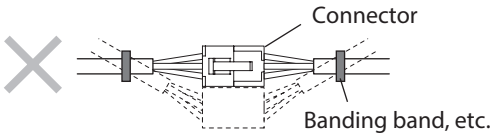


• Fixing at two places on each side



Fix using two cable ties or a wide clamp.

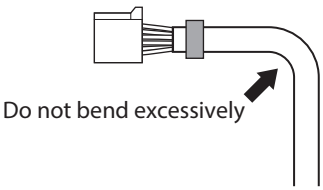
• Fixing at one place on each side



When the cable is moved, it causes the connectors to move, causing stress to apply on the connector part.

When bending the cable

Do not excessively bend the cable.
Applying stress on the cable may cause poor contact or disconnection, leading to malfunction or heat generation.



● Note when connecting a power supply whose positive terminal is grounded

The USB connector 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.

● Noise elimination measures

Refer to p.23 for noise elimination measures.

■ Insulation resistance measurement and dielectric strength test

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

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

■ Operations

● Regeneration energy

When the motor is used in operation such as rapid acceleration/deceleration of an inertia body or vertical drive (elevating equipment), regeneration energy may generate. Since the driver has no function to consume regeneration energy, if the output capacity or overvoltage allowance of the DC power supply is small, the protective function for the power supply or driver may be activated to stop the motor. When performing these operations, use a DC power supply or battery that has a large output capacity or overvoltage allowance.
If the protective function for the power supply or driver is activated, contact your nearest Oriental Motor sales office.

■ Power removal function

- **When the power removal function is used, be sure to conduct a risk assessment of equipment in advance and check that the safety requirements of the safety-related parts of a control system are satisfied.**
- **The design of the safety-related parts of a control system using the power removal function should be performed by qualified personnel who are trained in the relevant safety standards and understand the contents of this chapter.**
- **If the power removal function is activated, the motor output shaft may be rotated by external forces (gravity on a vertical axis, etc.). To hold the motor output shaft in position, install an external brake mechanism or equivalent. The brake mechanism of the electromagnetic brake motor is used for the purpose to hold the position. Do not use the brake mechanism of the electromagnetic brake motor for braking the motor rotation. This may result in injury or damage to equipment.**
- **If the power removal function is activated, the driver stops supplying the power to the motor. However, the power supplying to the driver is not shut off, and the driver is not electrically insulated either. Before performing maintenance or inspection, always turn off the driver power, and check the PWR/SYS LED is turned off. Failure to do so may result in electric shock.**
- **If the inverter circuit is failed, the motor output shaft may rotate up to 180 degrees in an electrical angle (36 degrees in a mechanical angle) even when the power removal function is activated. Make sure this movement does not cause hazardous situations. Failure to do so may result in injury or damage to equipment.**
- **Connect the I/O signals related to the power removal function to an external device which conforms to the safety standard.**
- **Be sure to perform the verification testing of the power removal function when starting up or maintaining the equipment, or when replacing the driver. Failure to do so may result in injury or damage to equipment. If the power removal function is used in an incorrect state such as incorrect wiring of I/O signals, the power removal function may not be activated properly, causing hazardous situations.**

■ Saving the data

● 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 five seconds after the completion of writing the data. Doing so may abort writing the data and cause an alarm of EEPROM error to generate.
The non-volatile memory can be rewritten approximately 100,000 times.

4 Checking the product

4-1 Package contents

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

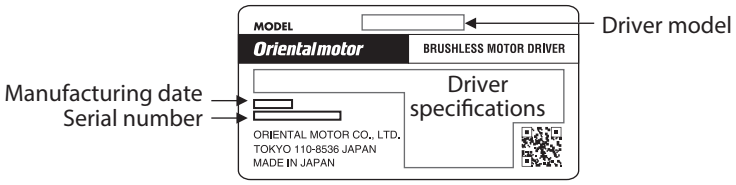
☐Driver ..... 1 unit
☐Instructions and Precautions for Safe Use ..... 1 copy

4-2 Product model

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

Driver model: **BLVD-KBRD**

4-3 Information about nameplate



4-4 Products possible to combine

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

- The box (□) in the model name indicates a number representing the gear ratio.
- The box (◆) in the model name indicates **F** or **B** representing the cable outlet direction.

■ Pinion shaft type/parallel shaft gearhead

Output power	Driver model	Applicable motor model	Applicable gearhead model
400 W	**BLVD-KBRD**	**BLMR6400SK-GFV-◆**	**GFV6G□**

■ Pinion shaft type/hollow shaft flat gearhead

Output power	Driver model	Applicable motor model	Applicable gearhead model
400 W	**BLVD-KBRD**	**BLMR6400SK-GFV-◆**	**GFS6G□FR**

■ Round shaft type

Output power	Driver model	Applicable motor model
400 W	**BLVD-KBRD**	**BLMR5400K-A-◆**

■ Electromagnetic brake type Pinion shaft type/parallel shaft gearhead

Output power	Driver model	Applicable motor model	Applicable gearhead model
400 W	**BLVD-KBRD**	**BLMR6400SKM-GFV-◆**	**GFV6G□**

■ Electromagnetic brake type Pinion shaft type/hollow shaft flat gearhead

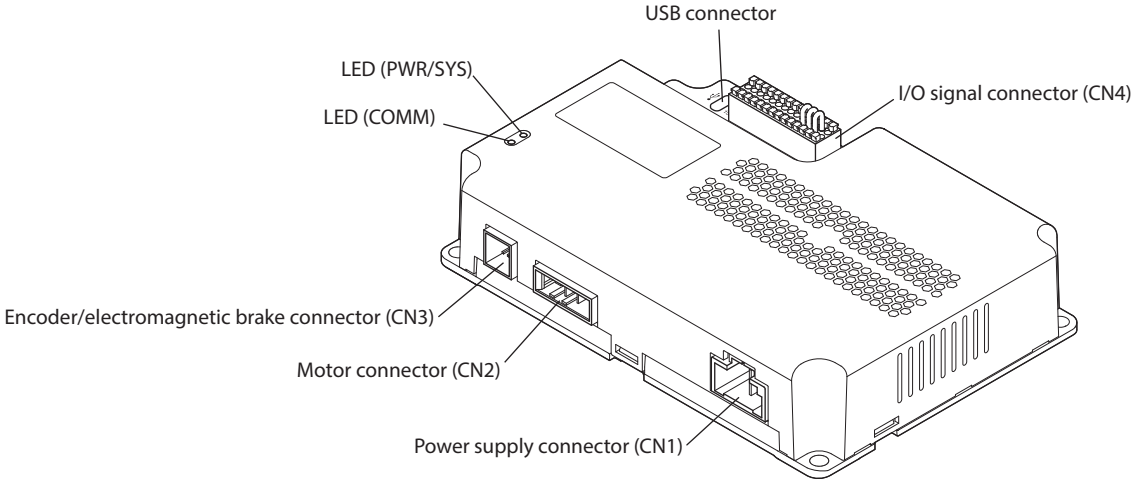
Output power	Driver model	Applicable motor model	Applicable gearhead model
400 W	**BLVD-KBRD**	**BLMR6400SKM-GFV-◆**	**GFS6G□FR**

■ Electromagnetic brake type Round shaft type

Output power	Driver model	Applicable motor model
400 W	**BLVD-KBRD**	**BLMR5400KM-A-◆**

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.
Motor connector	CN2	Connects the motor connector.
Encoder/electromagnetic brake connector	CN3 ENC/MB	Connects the encoder/electromagnetic brake connector.
I/O signal connector	CN4 I/O	Connects with external equipment.
USB connector		Connects a PC in which the support software has been installed.
LED	PWR/SYS	Refer to "4-6 Indication of LEDs."
	COMM	

4-6 Indication of LEDs

The driver status and the communication status via RS-485 or CAN can be checked using the indication of LEDs.

■ PWR/SYS LED

The status of the driver can be checked.

LED status	Description
No light	The main power is not supplied.
White light	The main power is supplied. (PWR)
Blinking red	An alarm is being generated. The alarm type 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 white	The power removal function has been activated. The LED will be lit in white when the power removal function and the ETO status is released.
Blinking blue	Information is being generated. The LED will be lit in white when the information is cleared.
Repeating "Green → Red → Simultaneously lit (yellow) → No light"	This is the driver simulation mode.

■ COMM LED

The communication status can be checked. It is unlit in the initial state.
When each communication is started, the COMM LED is lit or blinks depending on the communication status.

memo If communications of CAN and RS-485 were used simultaneously, CAN communication is prioritized.

● When using via RS-485 communication

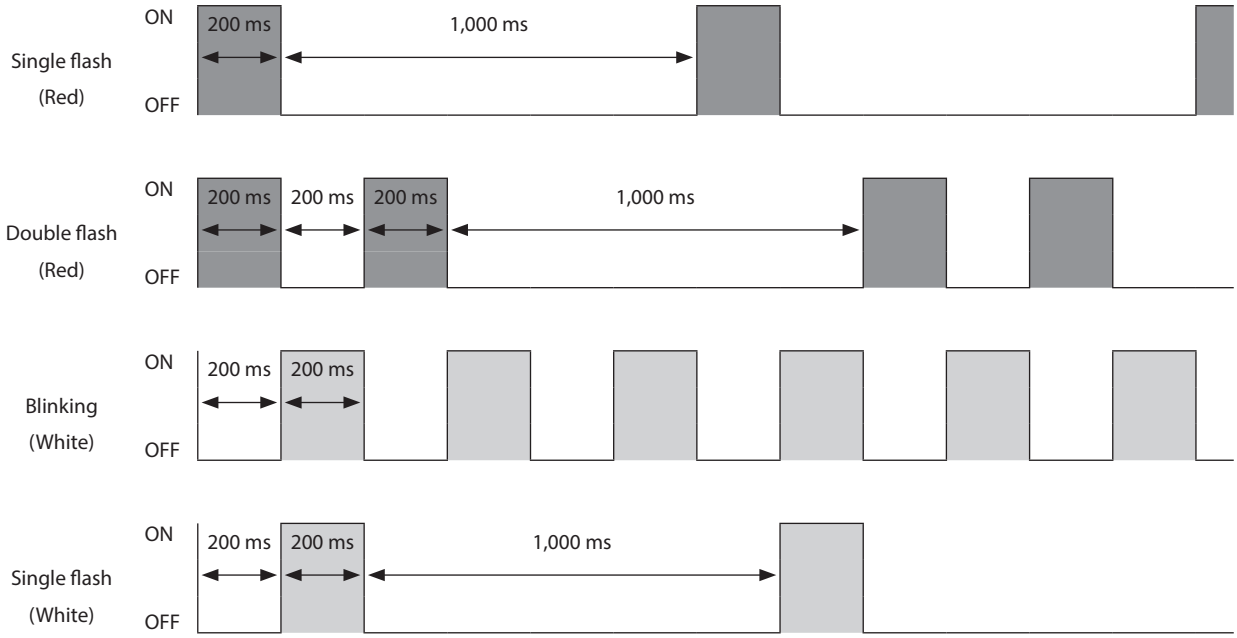
LED status	Description
White light or blinking white	The driver communicates with the master station properly via RS-485 communication. (C-DAT)
Red light	An error occurs in communication with the master station via RS-485 communication. The LED will be lit or blink in white when the communication status returns to the normal state. (C-ERR)

● When using via CAN communication

With the COMM LED, the red LED (Error LED) and the white LED (Run LED) are indicated independently for each function.
Red LED (Error LED): Indicates the status of CAN communication and the error in CAN messages.
White LED (Run LED): Indicates the status of CANopen network state machine.

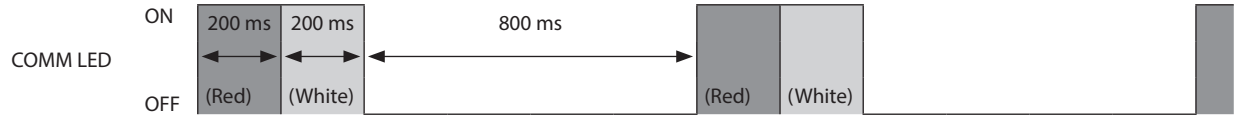
LED status		Description
Red LED (Error LED)	No light	The driver is in a state of normal operation.
	Single flash	The error counter of the CAN controller reached the warning level.
	Double flash	Guarding event or Heartbeat event has occurred.
	Lighting	The driver is in a state of Bus off.
White LED (Run LED)	Blinking	The driver is in a state of PRE-OPERATIONAL.
	Single flash	The driver is in a state of STOPPED.
	Lighting	The driver is in a state of OPERATIONAL.

Blinking state of LED



memo An example when the red LED (Error LED) and the white LED (Run LED) blink simultaneously is shown below.

Example: When the red LED is "Single flash" and the white LED is "Single flash"



The red LED is prioritized in a state where the red LED and the white LED blink simultaneously.

5 Installation

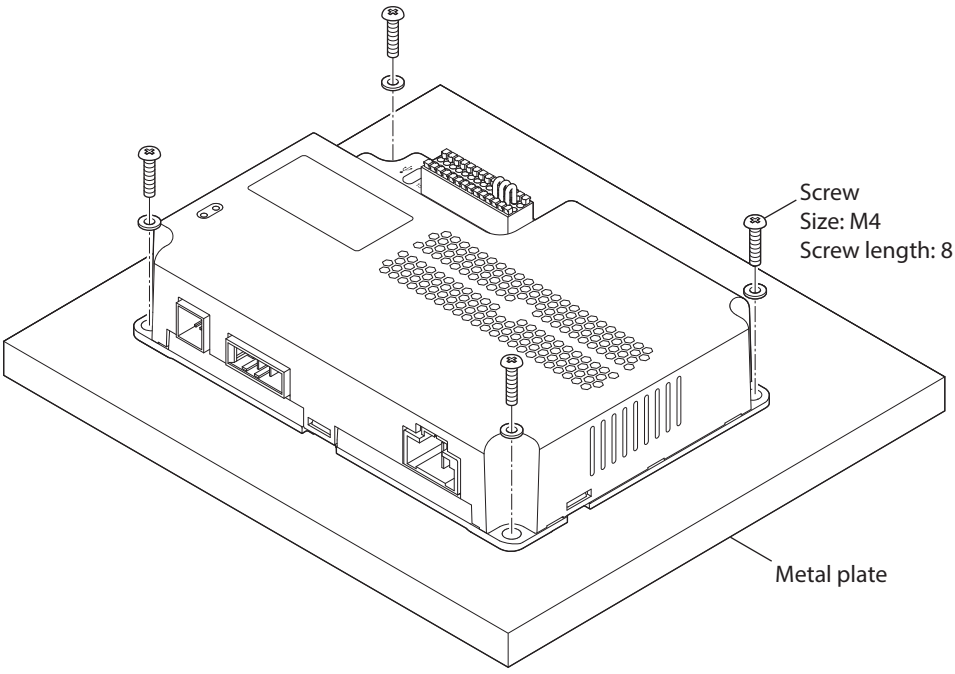
5-1 Installation location

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

- Inside an enclosure that is installed indoors (provide vent holes)
- Operating ambient temperature: 0 to +40 °C [+32 to +104 °F] (non-freezing)
- Operating ambient humidity: 85% or less (non-condensing)
- Area 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 not subject to splashing water (rain, water droplets), oil (oil droplets) or other liquids
- Area free of excessive salt
- Area not subject to continuous vibration or excessive shocks
- Area free of excessive electromagnetic noise (from welders, power machinery, etc.)
- Area free of radioactive materials, magnetic fields or vacuum
- Up to 1000 m (3300 ft.) above sea level

5-2 How to install

The driver can be installed in any direction.
Install the driver to a flat metal plate* offering high heat conductivity.
When installing the driver, use the mounting holes and secure to the metal plate with four screws (M4: not included).
* Material: Aluminum, size: 350×350×2 mm (13.8×13.8×0.08 in.) or equivalent



Note

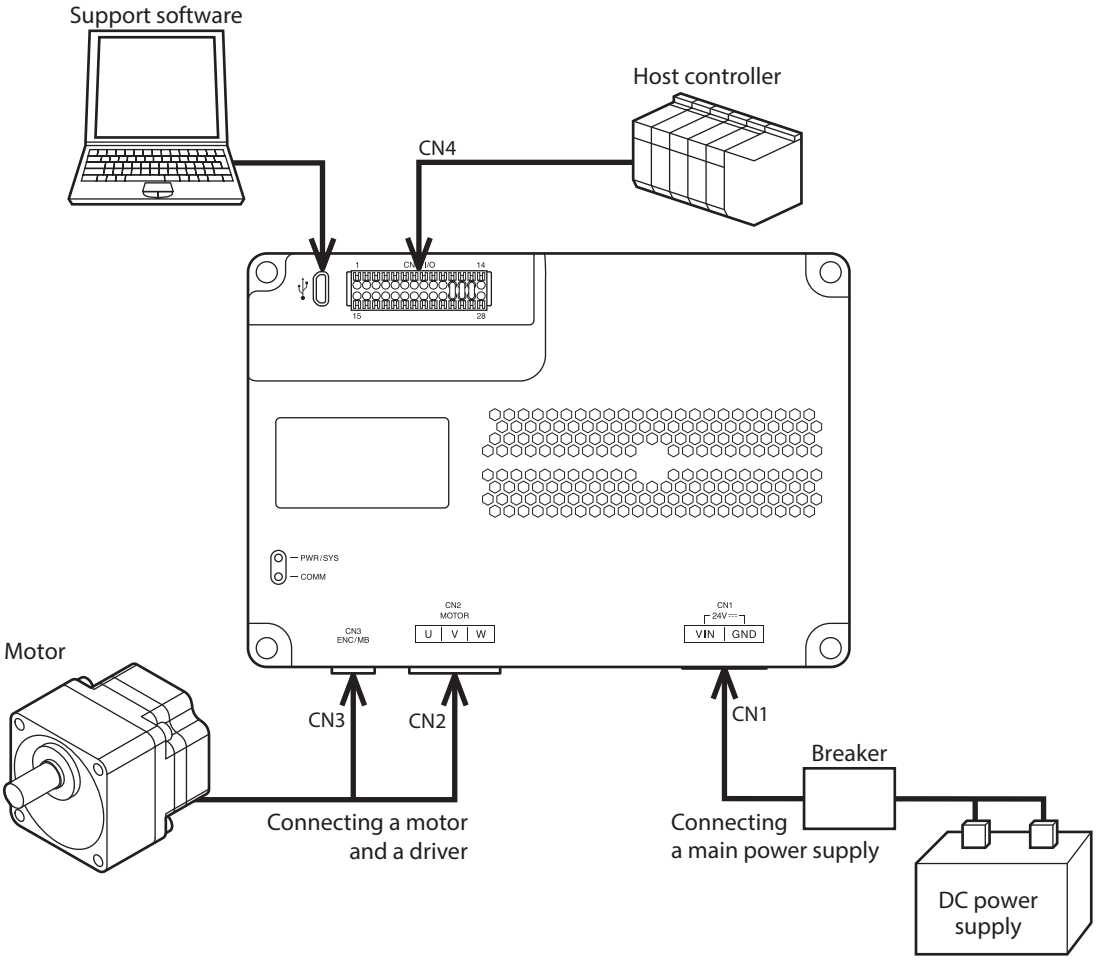
- Install the driver in an enclosure.
- Do not install any equipment that generates a large amount of heat or noise near the driver.
- Do not install the driver underneath a host controller or other equipment vulnerable to heat.
- If the ambient temperature of the driver exceeds the upper limit of the 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 supplies, and I/O signals.

6-1 System configuration

⚠WARNING For protection against electric shock, do not turn on the power supply until the wiring is completed.



Note

- Connect the connectors securely. Insecure connector connections may cause malfunction or damage to the product.
- Keep 3.5 m (11.5 ft.) or less for the wiring distance between a motor and a driver. Extending the wiring distance to 3.5 m (11.5 ft.) or more may result in heat generation from the driver or increase of the electrical noise emitted from the products including the motor and the cable.

memo

- Before connecting or disconnecting a connector, turn off the main power supply for communication, and check the PWR/SYS LED has been turned off.
- When wiring the I/O signal cable, provide a clearance at least 100 mm (3.94 in.) from inductive loads such as electromagnetic relay, and do not parallel to the power supply cable and connection cable.
- Do not wire the power supply cable in the same cable duct with other power line or motor cable.

6-2 Connecting the main power supply (CN1)

The power supply current capacity varies depending on the motor connected.
Insert the connector of the power supply cable into the main power supply connector (CN1) on the driver.
The power supply cable **LC02D06B** (sold separately) is provided.

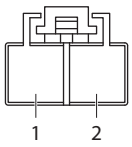
Motor	Input power supply voltage	Power supply current capacity
400 W	24 VDC	31 A or more

Note

- To connect the power supply, use as thick a cable as possible and wire over the shortest possible distance. If a thin cable is used or the wiring distance is long, the voltage drop is increased.
- Do not wire the power supply cable in the same cable duct with other power line or motor cable.

■ Pin assignment

Pin No.	Name	Description
1	VIN	Main power supply input (24 VDC)
2	GND	Ground for main power supply

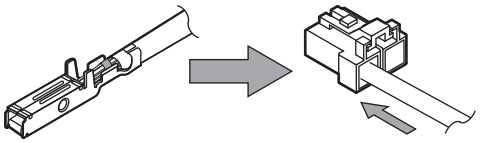


Connector: DF60A-2S-10.16C
(Hirose Electric Co., Ltd.)
Contact: DF60-1012SCFA
(Hirose Electric Co., Ltd.)
Designated crimp tool: HT306/DF60-1012
(Hirose Electric Co., Ltd.)

■ How to wire the connector

- Applicable lead wire: AWG12 to AWG10 (3.5 to 5.5 mm^2)

1. Strip the insulation of the lead wires.
2. Crimp the lead wires and contacts using the designated crimp tool.
3. Insert the lead wires that have crimped contacts into the connector for CN1.



6-3 Connecting the motor and the driver (CN2, CN3)

Insert the connectors of the motor cable or connection cable into the motor connector (CN2) and the encoder/electromagnetic brake connector (CN3) on the driver.
Use the dedicated connection cable (sold separately) when extending the wiring distance between the motor and the driver.
The maximum extension distance including the cable length of the motor itself should be 3.5 m [11.5 ft.].

Note

- Connect the connectors securely. Insecure connector connections may cause malfunction or damage to the product.
- Be sure to insert and pull out the connector while holding the connector 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 product.
- Do not lift up the product by holding the motor cable. Doing so may result in damage to the product.

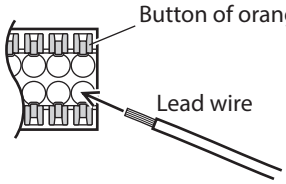
6-4 Connecting the I/O signals (CN4)

Connect the I/O signal cable for communication, RS-485 communication cable, or CAN communication cable to CN4 according to your method for using.

■ How to wire the CN4 connector

- Applicable lead wire: AWG26 to 20 (0.14 to 0.5 mm^2)
- Lead wire strip length: 7 mm (0.28 in.)

1. Strip the insulation of the lead wire.
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.



Connector: DFMC0,5/14-ST-2,54
(PHOENIX CONTACT GmbH & Co. KG)

memo Be certain the I/O signal cable is as short as possible.

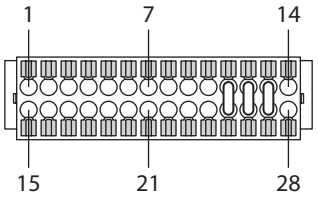
■ Pin assignments list

memo

- All input signals of the driver are photocoupler inputs.
- The status of signals is shown as follows.
  I/O signals for normally open: "ON: Current-carrying" "OFF: Not current-carrying"
  I/O signals for normally closed: "ON: Not current-carrying" "OFF: Current-carrying"

Pin No.	Signal name	Description*
1	OUT0+	Control output 0 (COMM-PWR)
2	OUT0–	
3	OUT1+	Control output 1 (ALM-B)
4	OUT1–	
5	CAN_L	CAN Low
6	CAN_H	CAN High
7	CAN_GND	Ground for CAN communication
8	485GND	Ground for RS-485 communication
9	TR+	Positive side of signal for RS-485 communication
10	TR–	Negative side of signal for RS-485 communication
11	HWTO1+	Positive side of power removal input 1
12	HWTO1–	Negative side of power removal input 1
13	0V	0 V for internal connection
14	EDM–	Negative side of power removal failure monitoring output

* Values in parentheses ( ) are initial values.



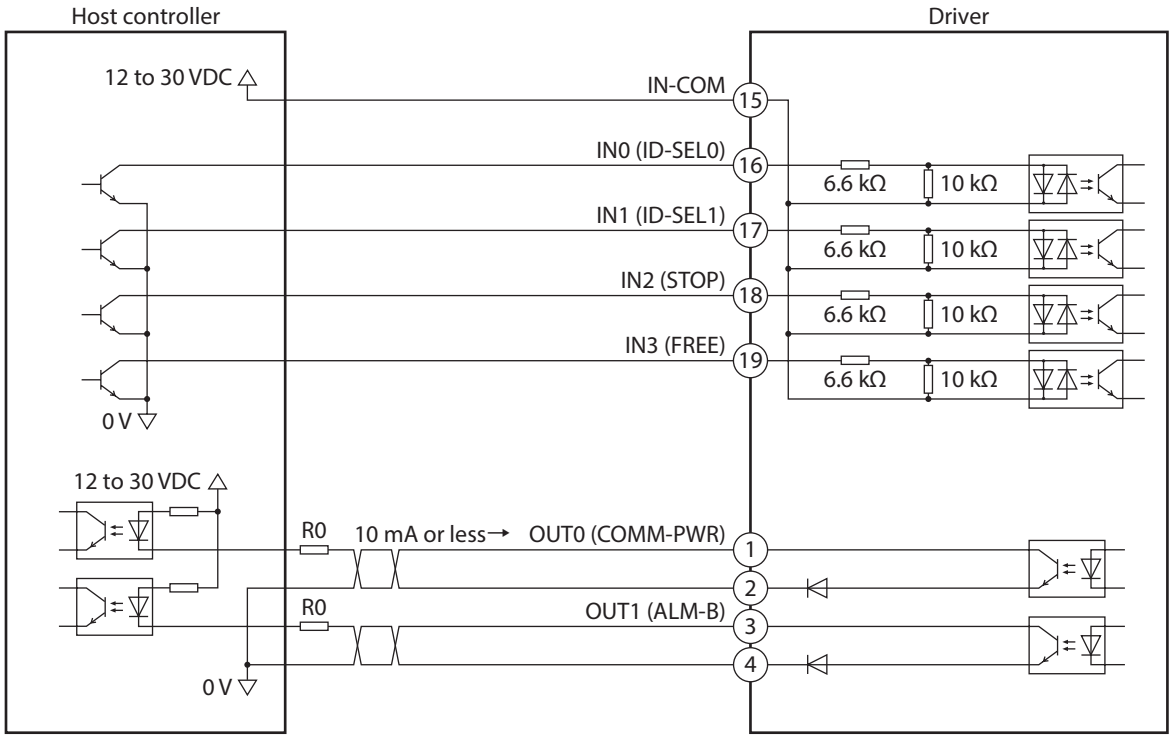
Pin No.	Signal name	Description*
15	IN-COM	Common for IN0 to IN3 inputs
16	IN0	Control input 0 (ID-SEL0)
17	IN1	Control input 1 (ID-SEL1)
18	IN2	Control input 2 (STOP)
19	IN3	Control input 3 (FREE)
20	NC	Non Connection
21	NC	Non Connection
22	485GND	Ground for RS-485 communication
23	TR+	Positive side of signal for RS-485 communication
24	TR–	Negative side of signal for RS-485 communication
25	+V	Positive side for internal connection
26	HWTO2+	Positive side of power removal input 2
27	HWTO2–	Negative side of power removal input 2
28	EDM+	Positive side of power removal failure monitoring output

* Values in parentheses ( ) are initial values.

Note

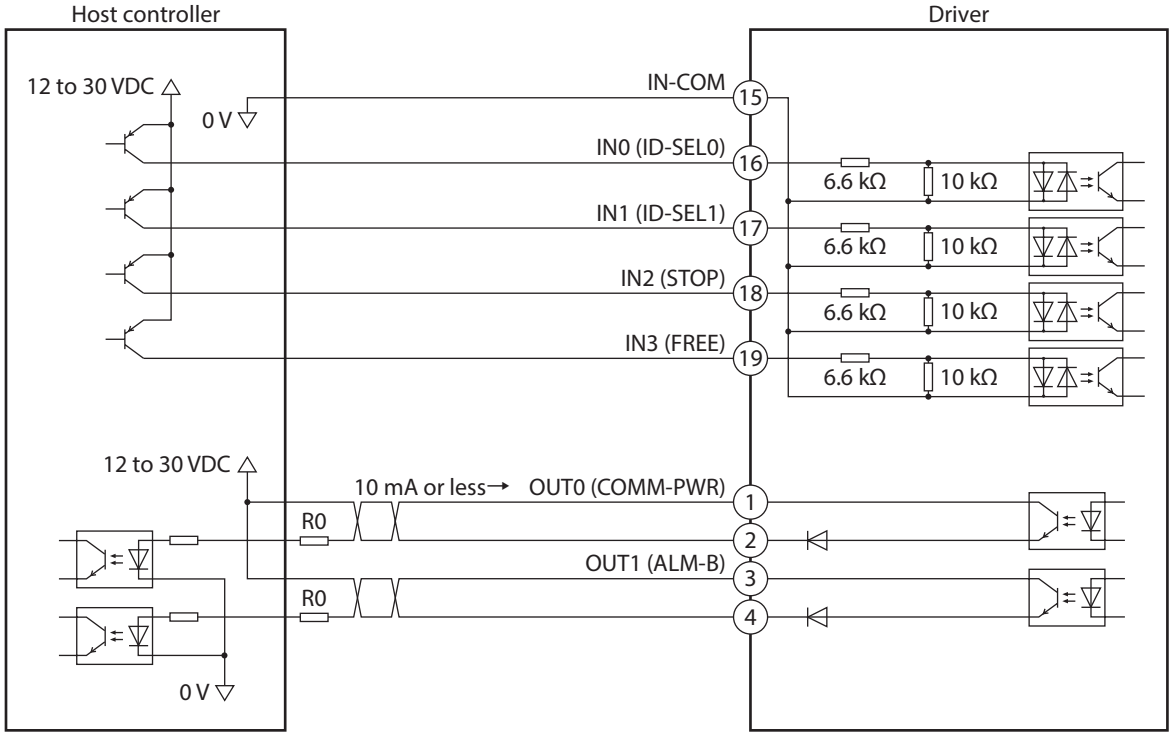
- "No.7: CAN_GND," "No.8: 485GND," and "No.22: 485GND" are connected to a signal ground (SG). The SG is insulated from "No.13: 0 V" and "Ground for main power supply."
- If the power removal function is not used, connect a jumper wire (included) between the terminals as shown in the figure.

■ Connection example with a current sink output circuit



* Values in parentheses ( ) are initial values.

■ Connection example with a current source output circuit

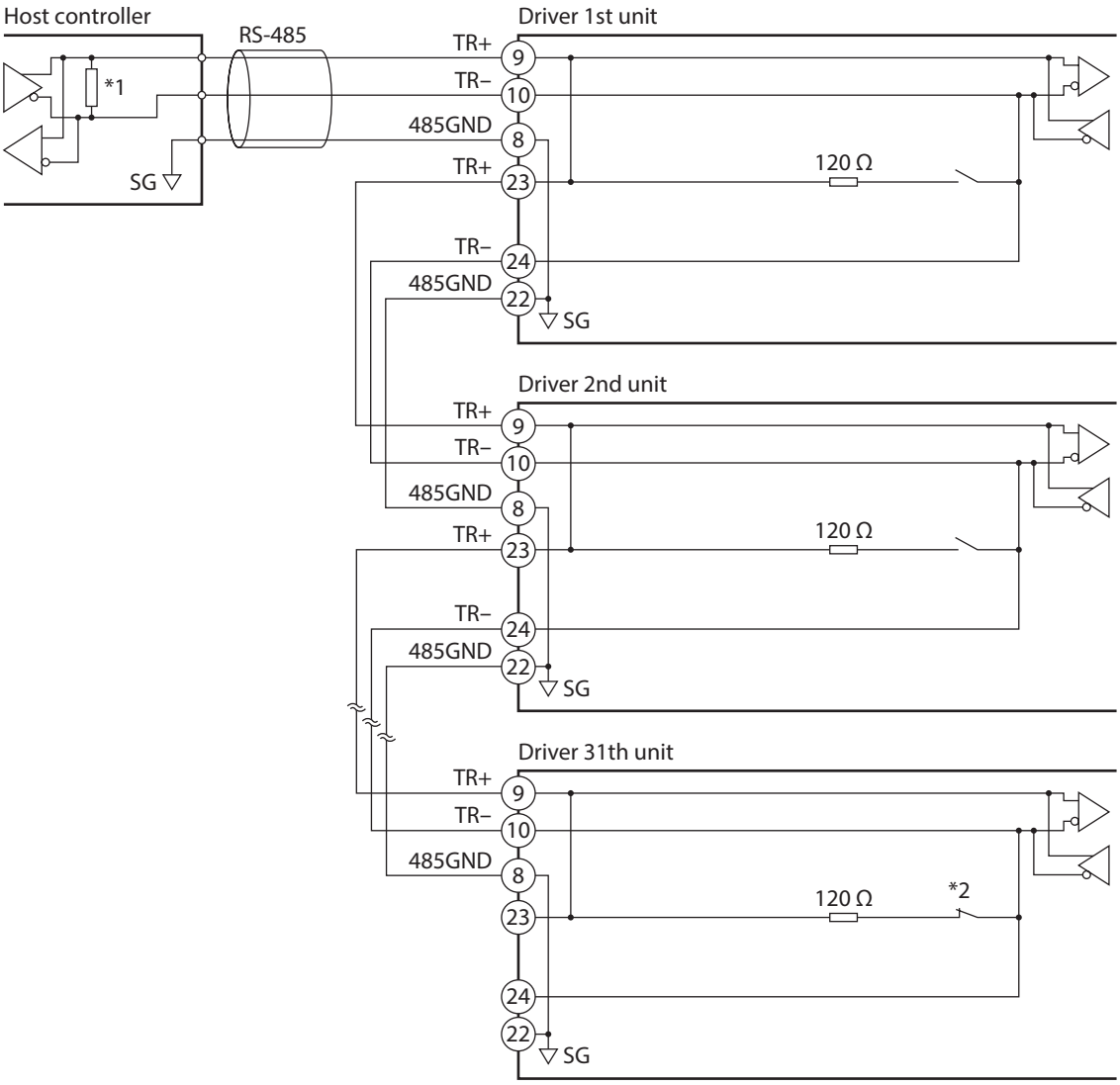


* Values in parentheses ( ) are initial values.

Note

- Use input signals at 12 to 30 VDC.
- Use output signals at 12 to 30 VDC, 10 mA or less. If the current exceeds 10 mA, connect an external resistor R0 so that the current becomes 10 mA or less.
- The saturated voltage of output signals is 2.0 VDC maximum.

■ Connection example with a host controller (RS-485 communication)



*1 Termination resistor 120 Ω

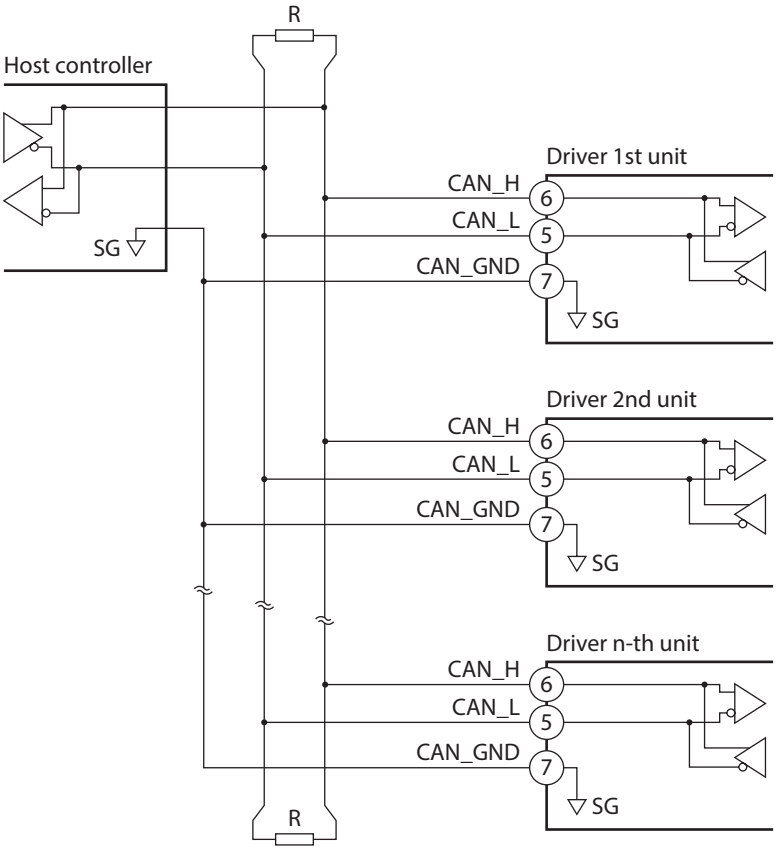
*2 Set the "RS-485 communication termination resistor" parameter to "Enable" with the support software.

Note

- Use twisted-pair wires for the communication cable and keep the total extension distance up to 10 m (32.8 ft.).
- Keep 31 units or less for the number of drivers connected.
- The SG is insulated from the ground for main power supply.

memo Refer to p.34 for the communication specifications.

■ Connection example with a host controller (CAN communication)



R: Termination resistor
Connect the termination resistors (120 Ω, 1/4 W or more) on both ends of a bus. Termination resistors are not included with the product.

Note

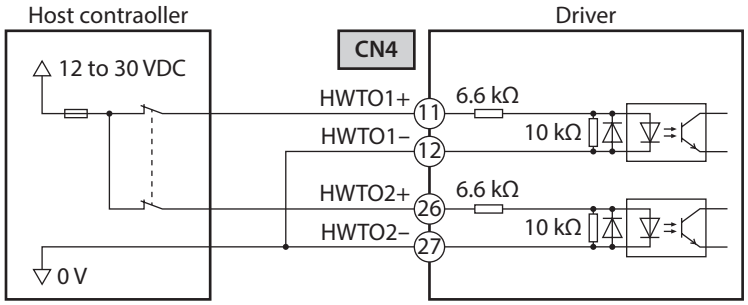
- Use the CAN-Bus cable for the communication cable.
- The SG is insulated from the ground for main power supply.

memo Refer to p.35 for the communication specifications.

■ Connection example with a host controller (power removal function)

● Input signal

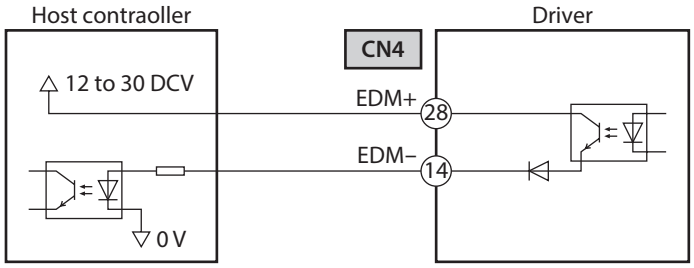
Signal name	Specifications
HWTO1+ input HWTO1– input	Input voltage: 12 to 30 VDC
HWTO2+ input HWTO2– input	



Note Provide individual contacts for operating the HWTO1 input and the HWTO2 input.

● Output signal

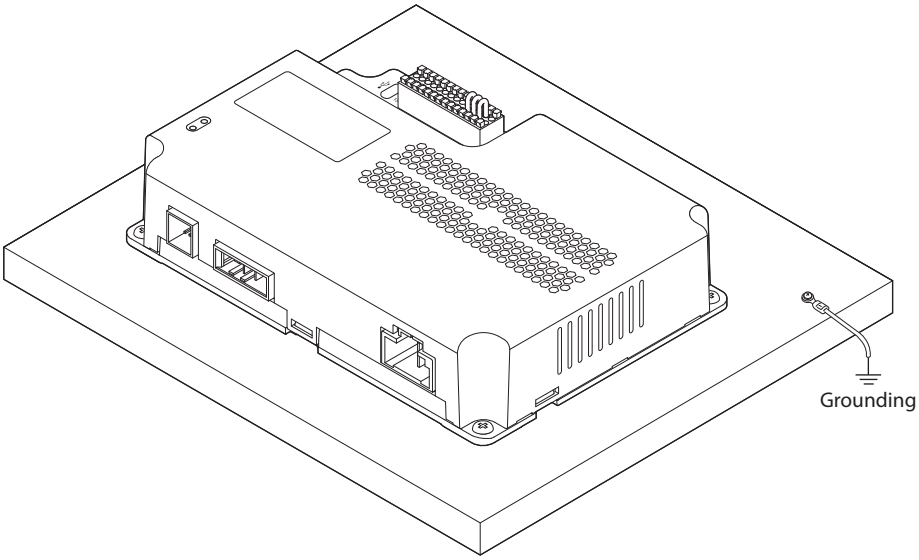
Signal name	Specifications
EDM+ output EDM– output	Voltage: 12 to 30 VDC Current: 10 mA or less Output saturated voltage: 2.0 V maximum



Note The EDM output is not an output signal to ensure the safety. Do not use the EDM output for any other purpose except for monitoring a failure.

6-5 Grounding

Install the driver to a metal surface that has grounded.



Note Static electricity may cause damage to the products if they are not grounded.

6-6 Connecting the USB cable

Connect the USB cable to the USB connector when using the support software.

Specifications of USB cable

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

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 to the USB cable.
- 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.

6-7 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 equipment 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

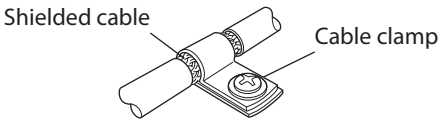
There are the following three methods mainly to take measures against the electrical noise.

● 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 AWG 26 (0.14 mm^2) or thicker for the I/O signal cable.
- Use a cable of AWG 26 (0.14 mm^2) or thicker for the RS-485 communication cable.
- Use the CAN-Bus cable for the CAN communication cable.
- For more effective elimination of noise, use shielded cables for a power supply cable and a signal cable or install 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.

6-8 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.
Oriental Motor conducts EMC testing on its motors and drivers in accordance with "Example of installation and wiring."
The user is responsible for ensuring the machine's compliance with the EMC Directive, based on the installation and wiring explained below.

⚠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.

■ About power supply

The driver is a product of DC power input. Use a DC power supply compliant with 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 3.5 m [11.5 ft.] (3 m [9.8 ft.] for the connector type).

■ Notes about installation and wiring

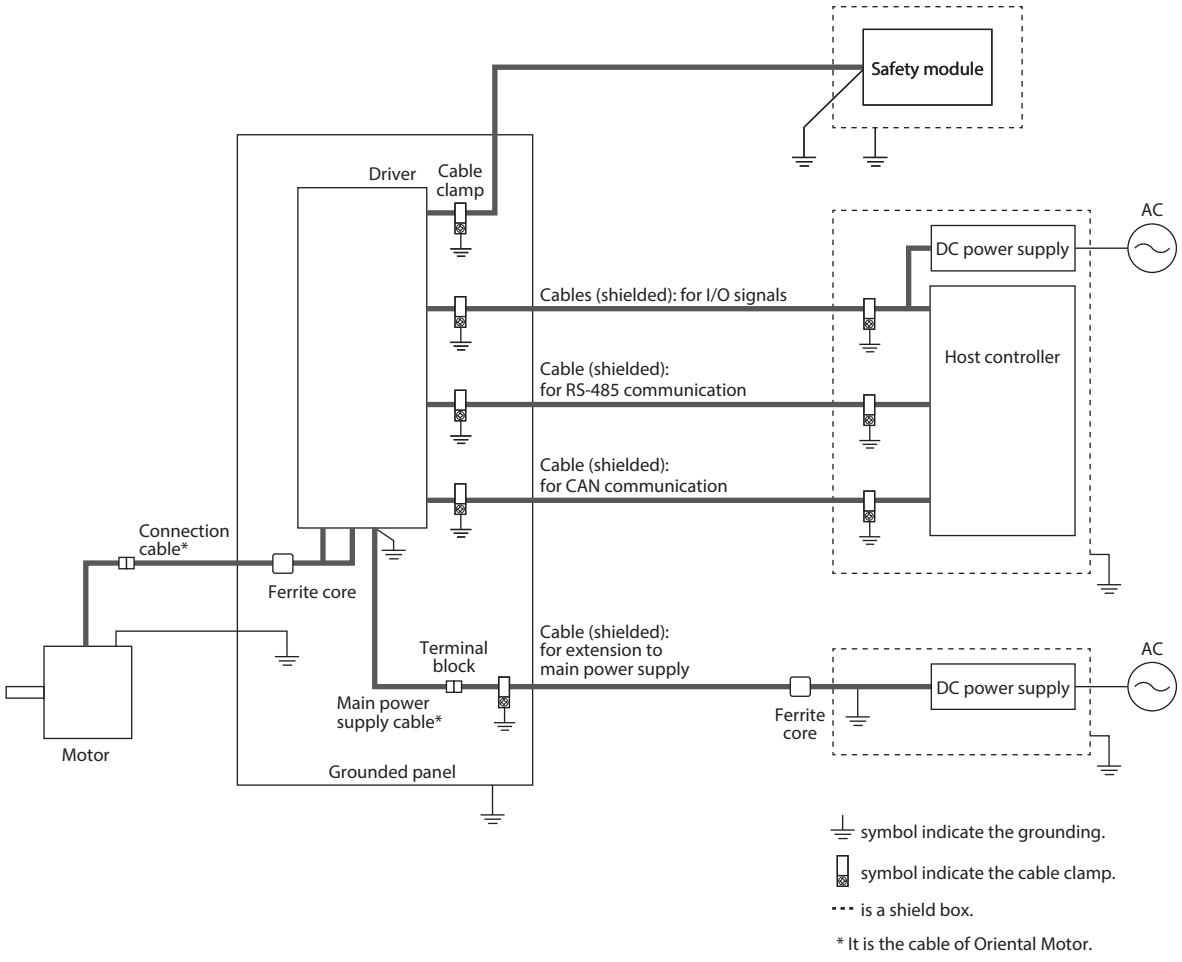
- Ground the motor, driver and other peripheral control equipment directly to the grounding point so that a potential difference does not occur among the grounds.
- When relays or electromagnetic switches are used together with the system, use noise filters and CR circuits to suppress surges generated 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.

■ Grounding method

- Wires used to ground the motor and the driver must be as thick and short as possible so that no potential difference is generated between the grounding points.
- Choose a large, thick and uniformly conductive surface for the grounding point.
- Install the motor to a grounded metal plate.

■ Example of installation and wiring

Note 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.



Note
- The termination resistors are connected on both ends of the CAN communication cable to conduct the testing.
- The CAN-Bus cable is used for the CAN communication cable.

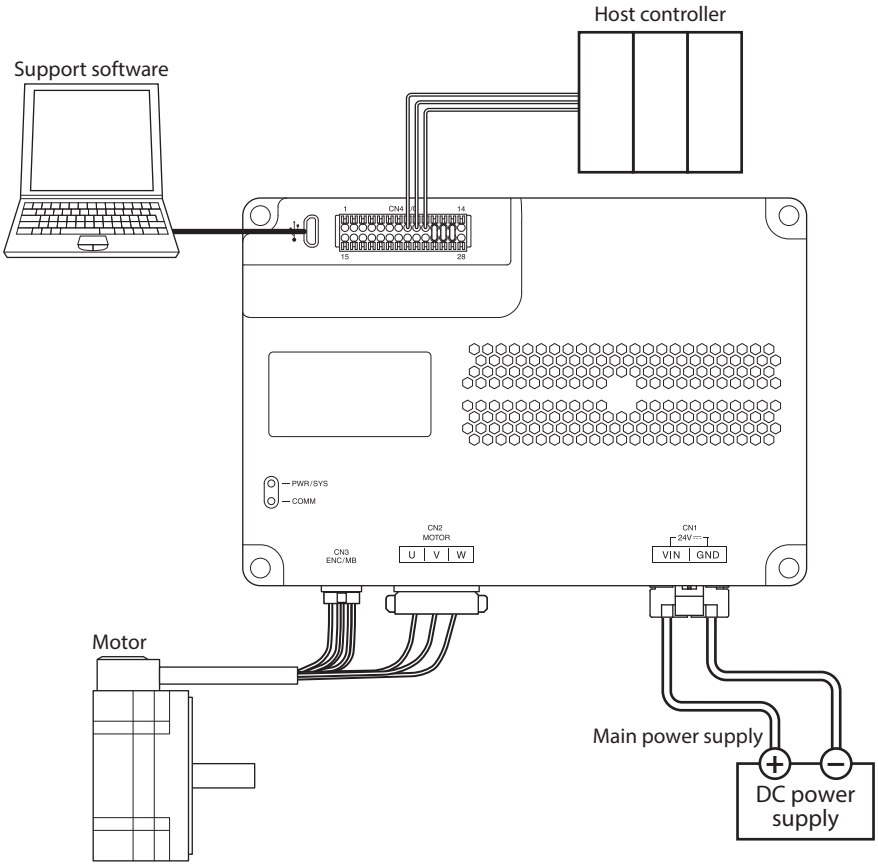
7 Guidance

If you are new to this product, read this section to understand the setting flow of the communication parameters.

STEP1	Check of installation and connection	
↓		
STEP2	Connection of termination resistor	Check the connection of the termination resistor.
↓		
STEP3	Power activation	Turn on the main power supply.
↓		
STEP4	Check of communication parameters	Use the support software to check the communication parameters.

7-1 Setting of RS-485 communication

STEP 1 Check of installation and connection



STEP 2 Connection of termination resistor

Connect a termination resistor for a driver located the farthest away (positioned at the end) from the host controller.
There are the following two methods for how to connect a termination resistor.

● When a termination resistor inside the driver is used

Change the "RS-485 communication termination resistor" parameter to "Enable" with the support software.

Name	Setting
RS-485 communication termination resistor	Enable

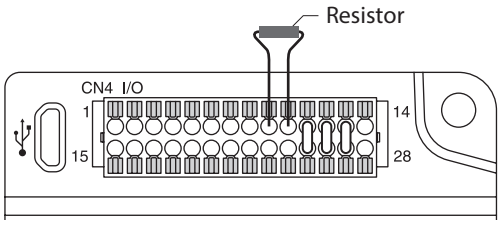
Note The termination resistor is turned ON only when the main power is supplied to the driver since it is turned ON or OFF inside the driver.

memo The termination resistor inside the driver is set based on the address number (slave address).
The terminating resistor is enabled when the slave address 4 is set (initial value).
When the slave address 4 is used, check the connection of termination resistor.
Refer to the OPERATING MANUAL Function Edition for how to set the address number.

● When a resistor (120 Ω) is connected between the TR+ and TR- terminals of the CN4 connector

Connecting method

1. Connect lead wires to a resistor.
2. Connect the lead wires between the TR+ and TR– terminals of CN4.



Note
- Be sure to connect a resistor between the TR+ and TR– terminals. Incorrect connection may cause damage to the resistor.
- When connecting a resistor, set the "RS-485 communication termination resistor" parameter to "Disable."

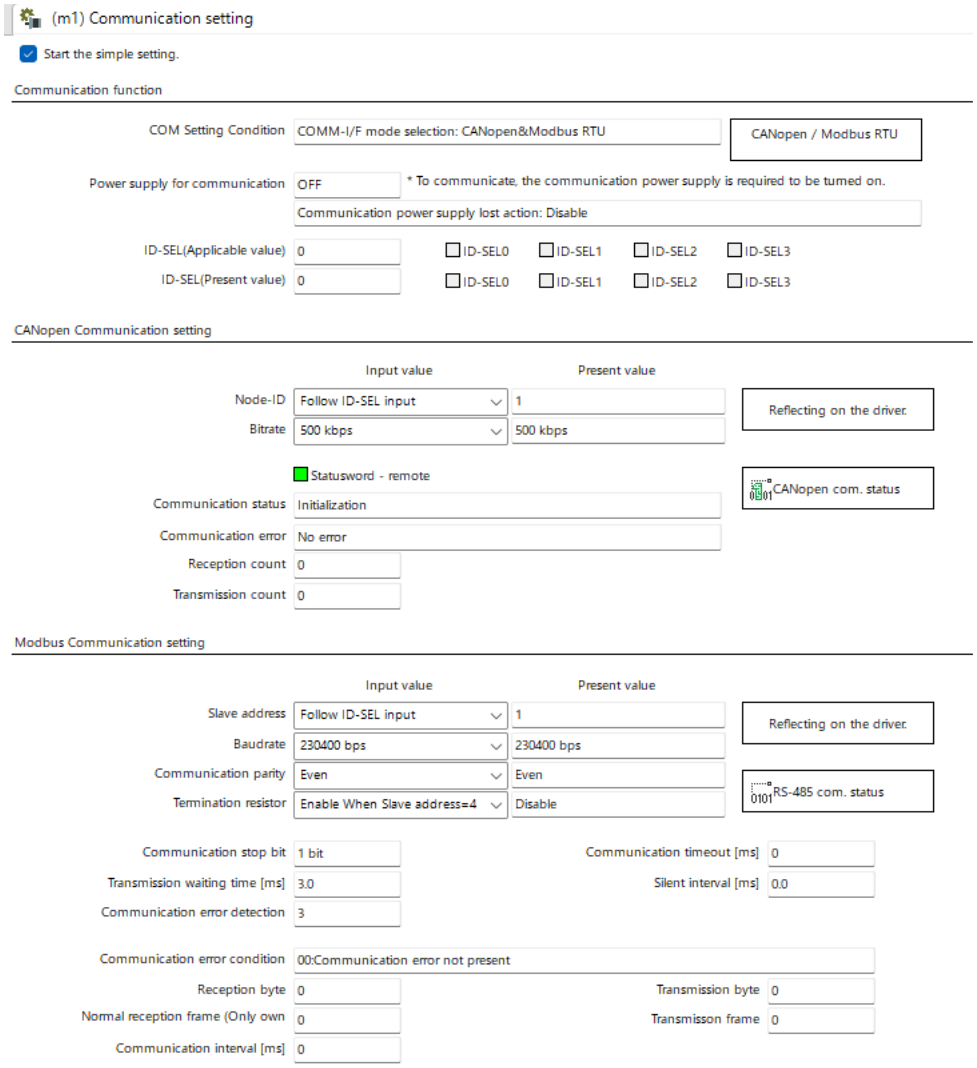
memo For a resistor, use a metal film resistor of 120 Ω, 1/2 W or more.

STEP 3 Power activation

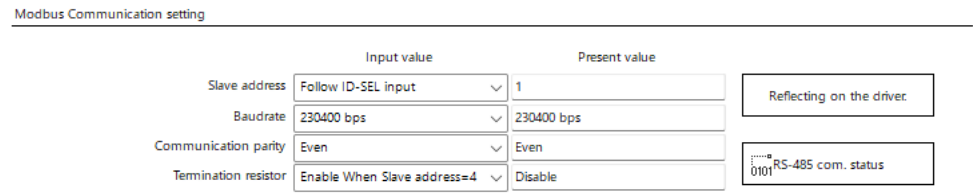
Turn on the main power supply.
Start the support software.
Execute "Communication port" to check the setting of the communication port.
Execute "Data reading" to read the driver data.

STEP 4 Check of communication parameters

Start "Starts the simple setting." of the support software.



Set the following communication parameters according to the communication parameters of the host controller.



If the values are different, change the value of the "Input value" and execute "Reflecting on the driver."

If the following communication parameters are different from those of the host controller, execute "Detailed setting..." to change the parameters.

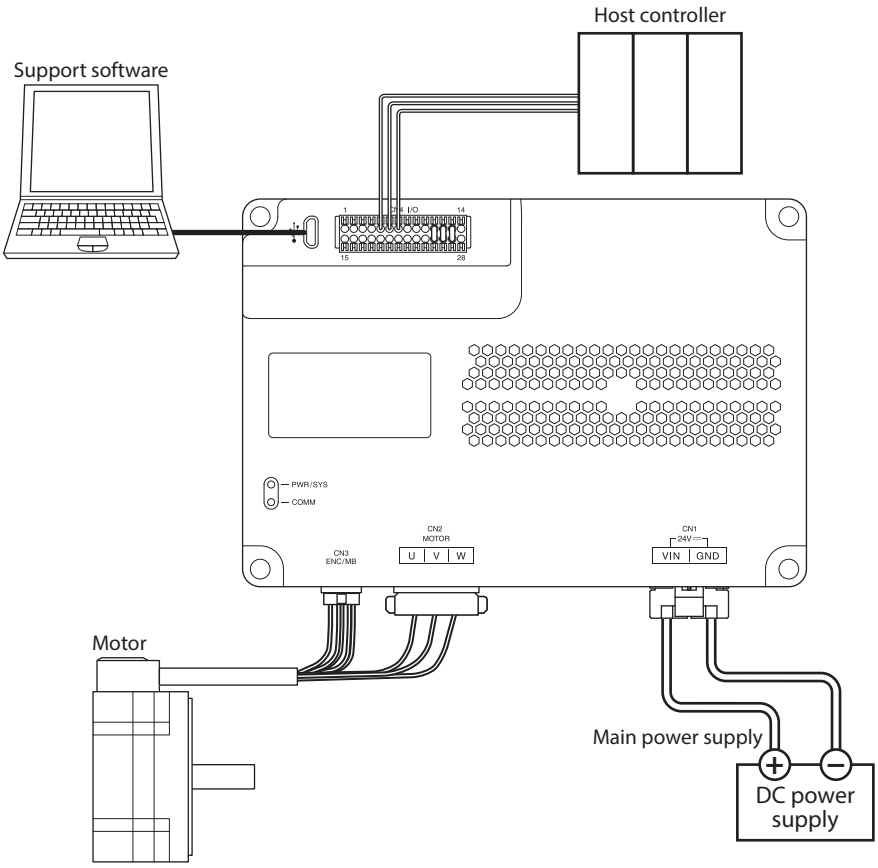
Parameter name	Initial value
Byte & word order (Modbus)	Even Address-High Word & Big-Endian
Communication stop bit (Modbus)	1 bit

memo

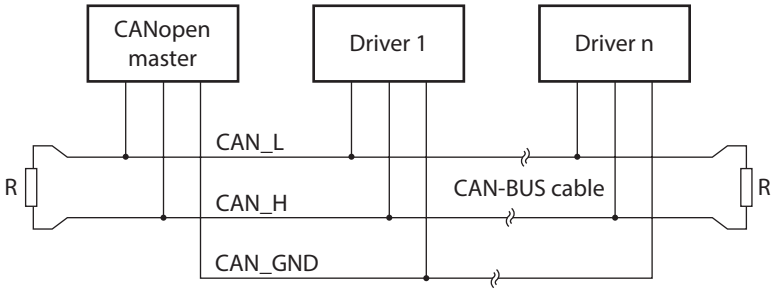
- The "Slave address" can be changed by the ID-SEL0 and ID-SEL1 inputs.
- For **BLVD-KBRD**, it is not necessary to connect a power supply for communication. Turning on the main power supply will automatically set to ON.

7-2 Setting of CAN communication

STEP 1 Check of installation and connection



STEP 2 Connection of termination resistor



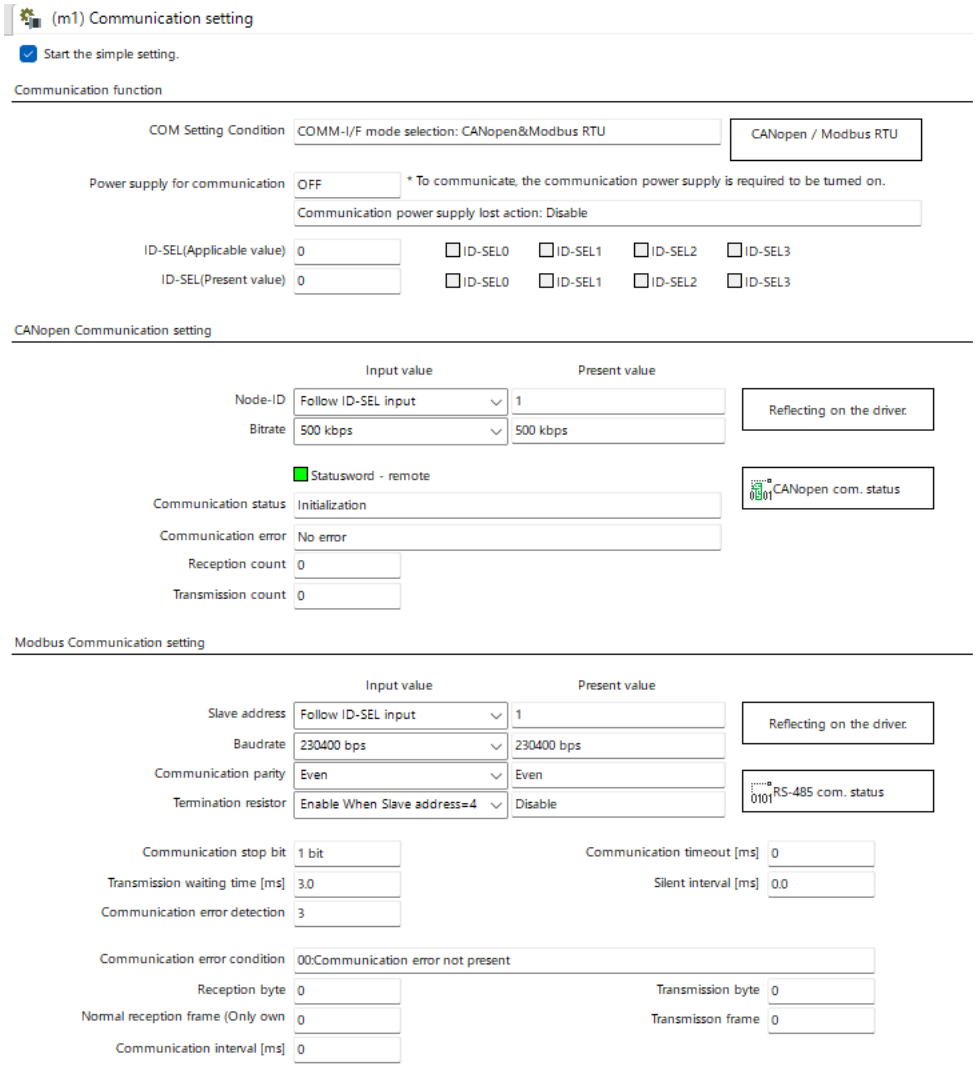
R: Termination resistor
Connect the termination resistor (120 Ω, 1/4 W or more) on both ends of a bus. Termination resistors are not included with the product.

STEP 3 Power activation

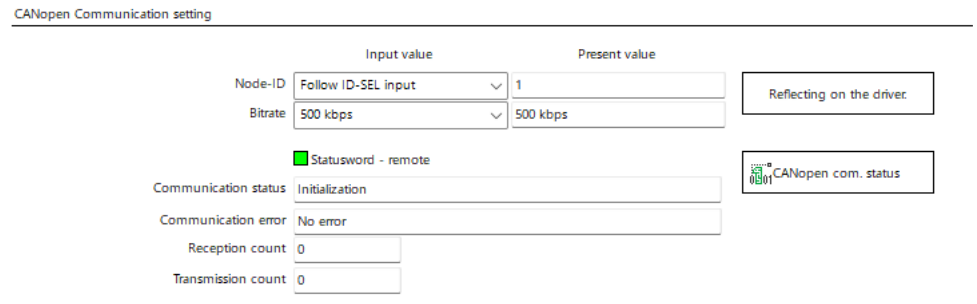
Turn on the main power supply.
Start the support software.
Execute "Communication port" to check the setting of the communication port.
Execute "Data reading" to read the driver data.

STEP 4 Check of communication parameters

Start "Starts the simple setting." of the support software.



Set the following communication parameters according to the communication parameters of the host controller.



If the values are different, change the value of the "Input value" and execute "Reflecting on the driver."

memo

- The "Node-ID" can be changed by the ID-SEL0 and ID-SEL1 inputs.
- For **BLVD-KBRD**, it is not necessary to connect a power supply for communication. Turning on the main power supply will automatically set to ON.

8 Inspection and maintenance

8-1 Inspection

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

■ Inspection item

- Check if any of the mounting screws secured the driver is loose.
- Check if the connection part with the connector is loose.
- Check if dust is deposited on the driver.
- Check if the driver has unusual smells or appearance defects.

Note The driver uses semiconductor components. Static electricity may damage the semiconductor components of the driver, so be extremely careful when handling them.

8-2 Warranty

■ Product warranty

Check on the Oriental Motor Website for the product warranty.

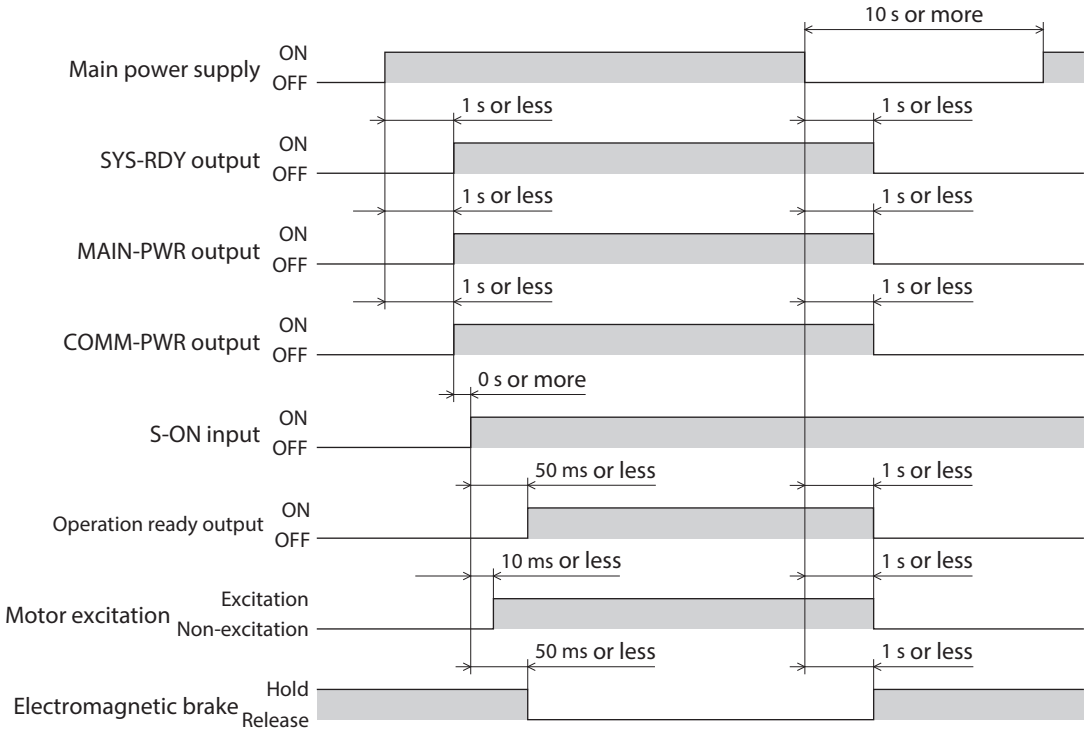
8-3 Disposal

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

9 Appendix

9-1 Timing chart

■ Power activation



9-2 Alarm list

Alarm code	Number of LED blinks	Alarm type	Reset using the ALM-RST input	Motor excitation*1
10h	7	Position deviation	Possible	Non-excitation after deceleration
20h	9	Overcurrent	Not possible	Non-excitation
21h	7	Main circuit overheat	Possible	Non-excitation after deceleration
22h	5	Overvoltage		Non-excitation
25h		Undervoltage		Non-excitation after deceleration
26h	7	Motor overheat		
28h	2	Encoder error	Not possible	Non-excitation
29h	9	Internal circuit error		
2Ah	2	Encoder communication error		
2Dh	2	Motor connection error*2		

Alarm code	Number of LED blinks	Alarm type	Reset using the ALM-RST input	Motor excitation*1
30h	7	Overload	Possible	Non-excitation after deceleration
31h		Overspeed		Non-excitation
41h	9	EEPROM error	Not possible	
42h	2	Initial encoder error		
44h	9	Encoder EEPROM error		
45h	2	Motor combination error		
4Ah	7	Return-to-home incomplete	Possible	Excitation
50h	9	Electromagnetic brake overcurrent	Not possible	Non-excitation
53h	3	HWTO input circuit error		
55h	2	Electromagnetic brake connection error		
60h	3	±LS both sides active	Possible	Excitation
61h		Reverse ±LS connection		
62h	4	Return-to-home operation error		
63h		No HOMES		
64h		Z, SLIT signal error		
66h		Hardware overtravel		
67h	6	Software overtravel		
68h	1	HWTO input detection		Non-excitation
6Ah	6	Return-to-home additional operation error		Excitation
6Eh	1	User alarm*2		Non-excitation after deceleration*3
70h	6	Operation data error		Excitation
71h		Unit setting error	Not possible	Non-excitation
81h	8	Network bus error	Possible	Excitation
84h		RS-485 communication error		
85h		RS-485 communication timeout		
8Ch		Outside setting range	Not possible	Non-excitation
F0h	Lighting	CPU error		
F3h	6	CPU overload		

*1 An excitation state of the motor when an alarm is generated is as follows.
Non-excitation: If an alarm is generated, the motor current is cut off and the motor holding force is lost.
When an electromagnetic brake motor is used, the electromagnetic brake automatically actuates to hold the motor shaft.
Non-excitation after deceleration: If an alarm is generated, the motor decelerates to a stop.
After decelerating to a stop, the motor current is cut off and the motor holding force is lost.
When an electromagnetic brake motor is used, the electromagnetic brake automatically actuates to hold the motor shaft.
Excitation: If an alarm is generated, the motor will decelerates to a stop.
After decelerating to a stop, the motor current is not shut off and the motor excitation state is continued.

*2 It is effective for the driver version 3.00 or later.

*3 This is the initial setting. The motor excitation state after stop can be set with the "User alarm action" parameter.

9-3 Specifications

■ Specifications

Motor models in the table below describe a part of the entire name of models. Refer to p.9 for models in details.

Model	Driver	**BLVD-KBRD**
	Motor	**BLMR5400K** **BLMR6400SK**
Rated output power		400 W
Power supply input	Rated voltage	24 VDC
	Allowable operating voltage	15 to 40 VDC
	Rated current	20 A
	Maximum input current	31 A
I/O signals	Input signal	12 to 30 VDC
	Output signals	12 to 30 VDC Current 10 mA or less
Rated torque		1.27 N·m (11.2 lb-in)
Peak torque		2.54 N·m (22 lb-in) [200%]
Rated speed		3000 r/min
Speed control range		1 to 4000 r/min (Speed ratio 1:4000)

■ General specifications

Degree of protection		IP20
Operating environment	Ambient temperature	0 to +40 °C (+32 to +104 °F) (non-freezing)
	Humidity	85% or less (non-condensing)
	Altitude	Up to 1000 m (3300 ft.) above sea level
	Surrounding atmosphere	No corrosive gas, dust, water or oil. Cannot be used in radioactive materials, magnetic field, vacuum or other special environments.
	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 Hz 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	−25 to +70 °C [−13 to +158 °F] (non-freezing)
	Humidity	85% or less (non-condensing)
	Altitude	Up to 3000 m (10000 ft.) above sea level
	Surrounding atmosphere	No corrosive gas, dust, water or oil. Cannot be used in radioactive materials, magnetic field, vacuum or other special environments.

■ RS-485 communication specifications

Electrical characteristics	In conformance with EIA-485 Use twisted-pair wires and keep the total extension distance 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 (initial value).
Protocol	Modbus RTU mode
Type of Connection	Up to 31 drivers can be connected to one host controller.

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

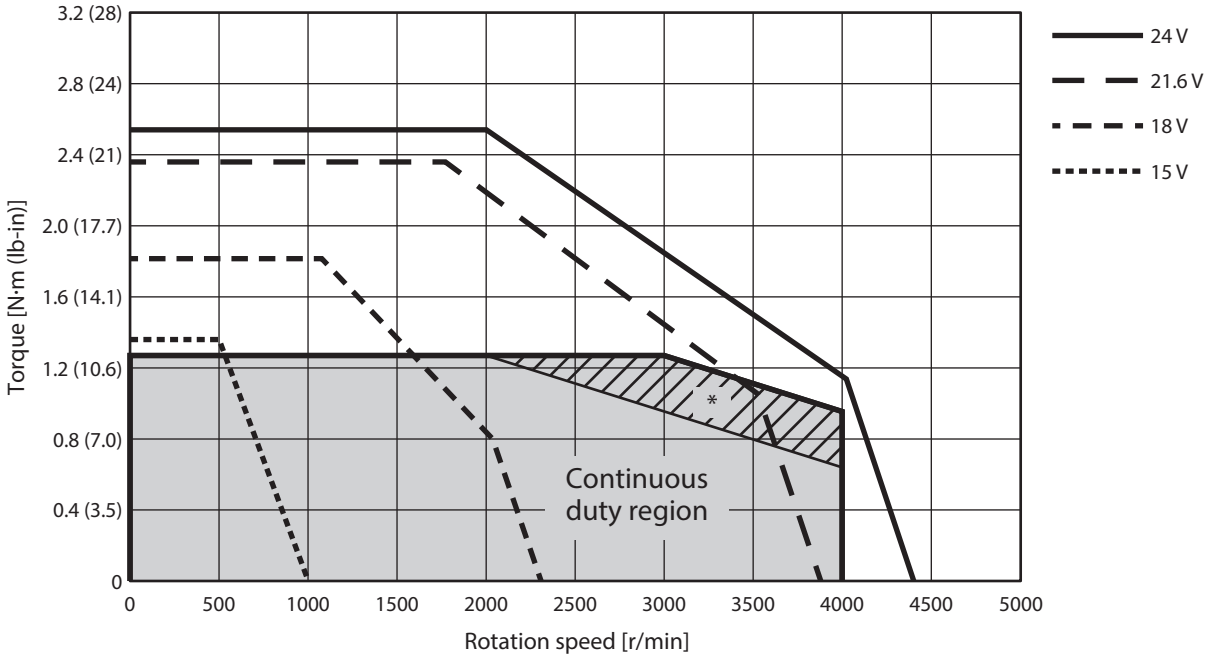
■ CAN communication specifications

Electrical characteristics	In conformance with ISO 11898 Use the CAN-Bus cable.
Communication protocol	CANopen
Communication profile	In conformance with CiA DS301 Version 4.2.0
Device profile	In conformance with CiA DSP402 Version 4.0.0
Node ID	1 to 127
Bit rate	Selectable from 1 Mbps, 800 kbps, 500 kbps (initial value), 250 kbps, 125 kbps, 50 kbps, 20 kbps, 10 kbps
Maximum bus length	25 m (82 ft.) [maximum bus length at 1 Mbps]
Communication objects	NMT (Network Management) SDO (Service Data Object: 1 SDO server) PDO (Process Data Object: 4 Receive-PDO, 4 Transmit-PDO) EMCY (Emergency Object) SYNC (Synchronization Object)
Operation modes	Profile velocity mode (pv) Profile position mode (pp) Homing mode (hm)

■ Main power supply input voltage and output torque

If the input voltage to the main power supply is dropped, the output torque is limited.

● **400 W type motor**

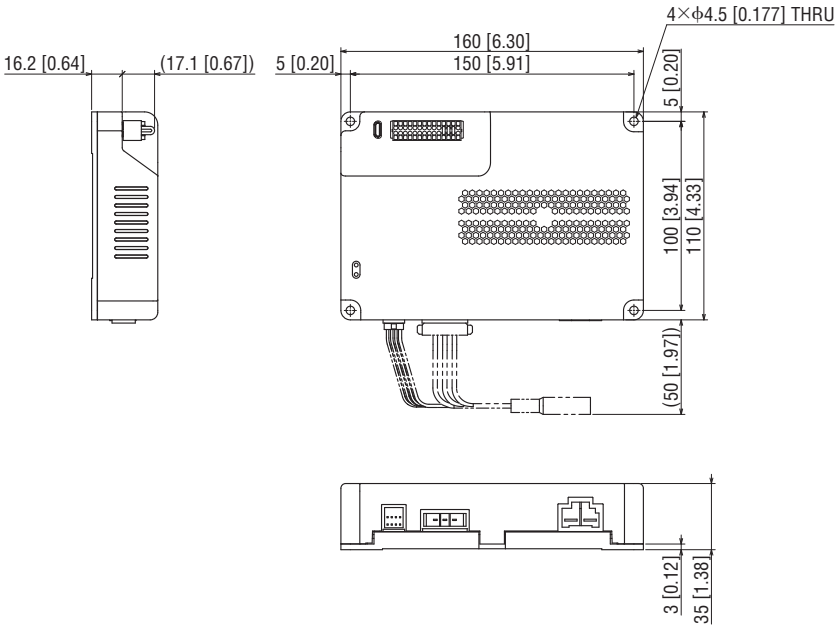


* The shaded area indicates the time rating of 30 minutes.

■ Dimensions

Mass: 0.46 kg (1.01 lb.)

[Unit: mm (in.)]



9-4 Regulations and standards

■ UL Standards, CSA Standards

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

■ CE Marking/UKCA Marking

This product is affixed with the marks under the following directives/regulations.
Declaration of Conformity can be downloaded from Download Page of the product in Oriental Motor Website (https://www.orientalmotor.eu/).

● **EU EMC Directive/UK EMC Regulation**

Refer to "6-8 Conformity to the EMC Directive" on p.24 for details about conformity.

● **EU Machinery Directive /UK Machinery Regulation**

Applicable standards: EN ISO 12100, EN 61800-5-2, EN ISO 13849-1:2023

■ EU RoHS Directive/UK RoHS Regulation

This products do not contain the substances exceeding the restriction values.

■ Functional safety

This product is certified by TÜV SÜD Product Service GmbH under the following standards and affixed with the TÜV SÜD Mark. It is not a certified product if the TÜV SÜD Mark is not affixed.

Applicable standards	Functional safety		IEC 61800-5-2, EN 61800-5-2 IEC 61508-1, EN 61508-1 IEC 61508-2, EN 61508-2 ISO 13849-1:2023, EN ISO 13849-1:2023
		Electrical safety	EN 61800-5-1
		EMC	IEC 61000-6-7, EN 61000-6-7
Safety function			STO (Safe Torque Off)

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 "Function Edition" for detection of the overload alarm.

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

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