Oriental motor

HP-5167

Brushless Motor

BLS Series Driver

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.

1 Introduction

■ Before using the product

Only qualified personnel of electrical and mechanical engineering should work with the product.
Use the product properly after thoroughly reading the section "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 it 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.

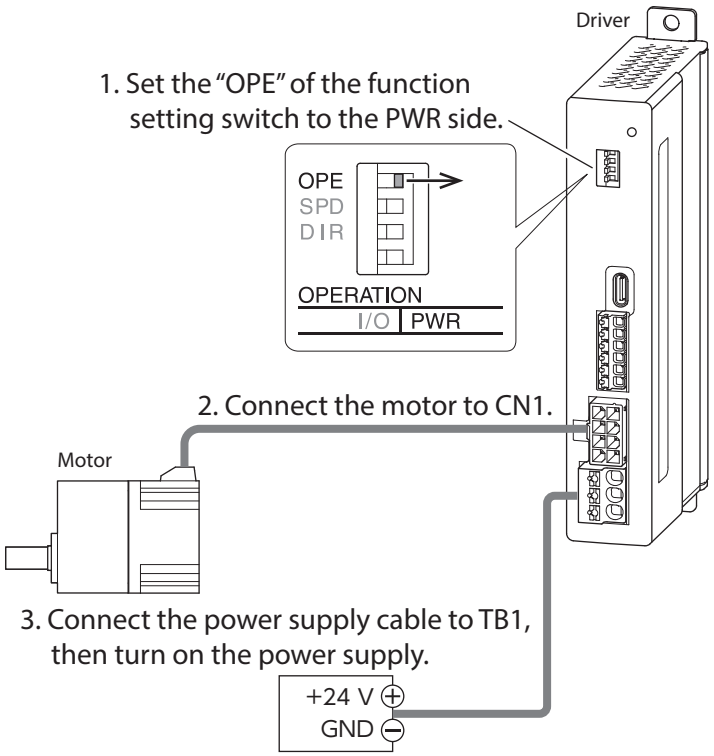
■ Operating manuals for the product

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

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

How to operate the motor easily

The motor can be operated in the following three steps.
Refer to P.12 "6 Connection" and P.20 "7 Operation" for details on how to operate the motor.



2 Safety precautions

The precautions described below are intended to ensure the safe and proper use of the product and to prevent the user and other personnel from exposure to the risk of injury. Use the product only after carefully reading and fully understanding these instructions.

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

⚠ WARNING

General

- Assign qualified personnel to the task of installing, wiring, operating/controlling, inspecting, and troubleshooting the product. Handling by unqualified personnel may result in fire, injury, or damage to equipment.
- Do not use the product in explosive or corrosive environments, in the presence of flammable gases, in areas subjected to splashing water, or near combustible materials. Doing so may result in fire 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 damage to equipment.
- If the driver protective function was activated, remove the cause before clearing the protective function. Continuing the operation without removing the cause of the problem may cause the motor to malfunction, resulting in injury or damage to equipment.
- Do not use a motor in a vertical drive such as elevating equipment. If the driver protective function is activated, the motor will stop and the moving part may fall, thereby causing injury or damage to equipment.
- Do not use a motor in a vertical drive such as elevating equipment. Since the output of the deceleration torque is limited so that the regenerative power is not returned to the power supply, the moving part will fall when the operation is performed in the downward direction. This may cause injury or damage to equipment.

Installation

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

Connection

- Always keep the power supply voltage of the driver within the specified range. Failure to do so may result in fire.
- Be sure to observe the specified cable sizes. Failure to do so may result in fire or damage to equipment.
- Make connections securely according to the connection example. Failure to do so may result in fire or damage to equipment.

Operation

- Use a motor and driver only in the specified combination. An incorrect combination may cause fire or damage to equipment.
- If the motor is operated by turning the power supply on and off, turn off the driver power in the event of a power failure.
  Otherwise, the motor may start suddenly when the power is restored, causing injury or damage to equipment.
- 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.

Maintenance and inspection

- Do not touch the motor or driver when conducting the insulation resistance measurement or dielectric strength test. Accidental contact may result in electric shock.
- Always turn off the power before performing maintenance or inspection. Failure to do so may result in electric shock.

Repair, disassembly, and modification

- Do not disassemble or modify the driver. Doing so may result in injury or damage to equipment.
  Refer all such internal inspections and repairs to the branch or sales office from which you purchased the product.

⚠ CAUTION

General

- Do not use the driver beyond its specifications. Doing so may result in fire, injury, or damage to equipment.
- Do not touch the driver while operating or immediately after stopping. The driver surface is hot, and this may cause a skin burn(s).

Installation

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

Connection

- Do not shut off the negative side of the power supply. Also, make sure that the wiring of the power supply is not disconnected. This may result in damage to equipment.
- Be sure to ground the motor and the driver to prevent damage from static electricity. Failure to do so may result in fire or damage to equipment.

Operation

- Pay enough attention to safe operation when starting and stopping the motor by turning the power supply on and off. This may cause injury or damage to equipment.
- Provide an emergency stop device or emergency stop circuit external to the equipment so that the entire equipment will operate safely in the event of a system failure or malfunction. Failure to do so may result in injury.
- If a problem occurs, immediately stop operation and turn off the driver power. Failure to do so may result in fire, electrical shock, or injury.

3 Precautions for use

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

- **Connecting a motor and a driver**

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

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

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

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

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

- **Note when using a mechanical contact to turn the power supply on and off**

  When a mechanical contact (breaker, electromagnetic switch, relay, etc.) is used to turn the power supply on and off, turn only the positive (+) side of the power supply on and off using the mechanical contact.
  If the positive (+) and the negative (-) sides of the power supply are turned on and off simultaneously using a mechanical contact, the control circuit or peripheral equipment may be damaged.
  Refer to p.13 for details.

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

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

- **Noise elimination measures**

  Refer to p.17 for noise elimination measures.

4 Preparation

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

4-1 Checking the product

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

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

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

4-2 How to identify the product model

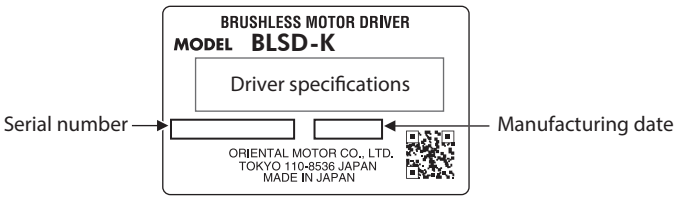
Check the model name of the product against that shown on the nameplate.

BLSD - K
1 2

1	Driver type	**BLSD**: **BLS** Series driver
2	Power supply voltage	**K**: 24 VDC

4-3 Information about nameplate

The figure shows an example.



4-4 Products that can be combined

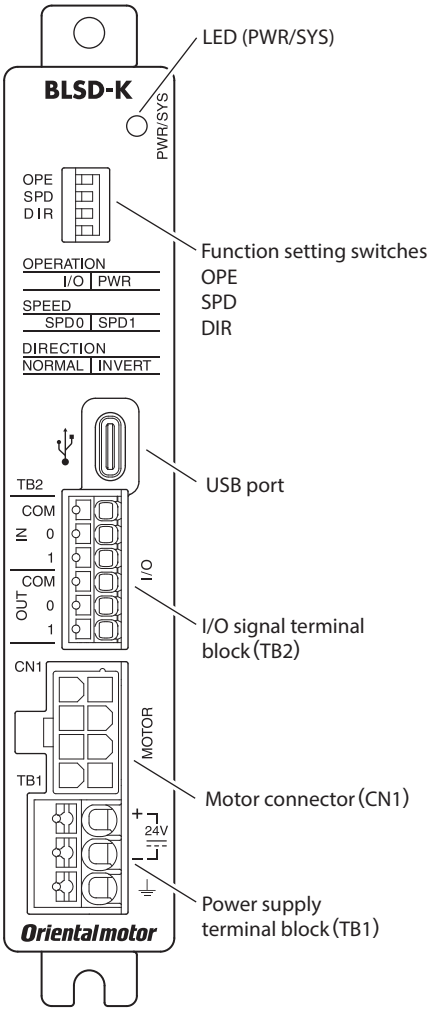
Products with which the driver can be combined are listed below. Check the model name of the product against that shown on the nameplate.
For details on the combination of a motor and a gearhead, refer to the operating manual of the motor.

Output power	Motor model	Gearhead model (**GN**, **GE**)	Driver model
25 W	**BL2M425KC-GN**	**4GN□K**	**BLSD-K**
40 W	**BL2M540KC-GN**	**5GN□K**	
90 W	**BL2M590KC-GE**	**5GE□S**	

Output power	Motor model	Gearhead model (**GF**)	Driver model
30 W	**BL2M230KCP-GF**	**GFV2G□**, **GFS2G□FR**	**BLSD-K**
	BL2M230KCP-A	–	
60 W	**BL2M460KCP-GF**	**GFV4G□**, **GFS4G□FR**	
	BL2M460KCP-A	–	
120 W	**BL2M5120KCP-GF**	**GFV5G□**, **GFS5G□FR**	
	BL2M5120KCP-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 terminal block	TB1	Connects a power supply and frame ground.
Motor connector	CN1	Connects the motor cable.
I/O signal terminal block	TB2	Connects the I/O signals.
USB port		Connects a PC in which the support software has been installed.
LED	PWR/SYS	Refer to "4-6 Indication of LED" below.
Function setting switches	–	Refer to P.20 "7-1 Function setting switches".

4-6 Indication of LED

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

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

5 Installation

5-1 Installation location

The driver is designed and manufactured to be incorporated 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 free of explosive atmosphere, toxic gas (such as sulfuric gas), or liquid
- Area not exposed to direct sun
- Area free of excessive amount of dust, iron particles or the like
- Area free of excessive salt
- Area not subject to splashing water (rain, water droplets), oil (oil droplets), or other liquids
- Area not subject to continuous vibration or excessive shocks
- Area free of excessive electromagnetic noise (from welders, power machinery, etc.)
- Area free of radioactive materials, magnetic fields, or vacuum
- Altitude Up to 1000 m (3300 ft.) above sea level

5-2 Installation method

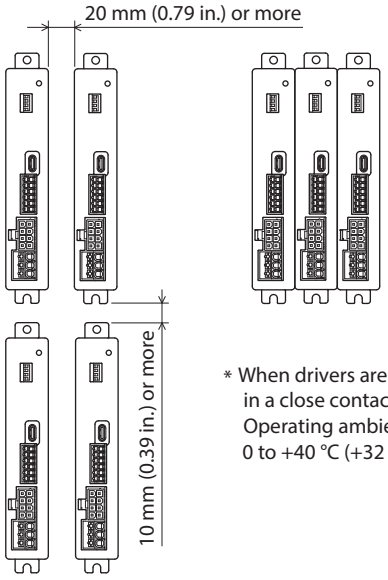
The driver is designed based on heat radiation by air convection and heat conduction to an enclosure.
When installing the driver in an enclosure, install it in a vertical direction or horizontal direction.

Note

- Do not install any equipment that generates a large amount of heat or noise near the driver.
- Do not install the driver under a host controller or other heat-sensitive equipment.
- If the ambient temperature of the driver exceeds 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.

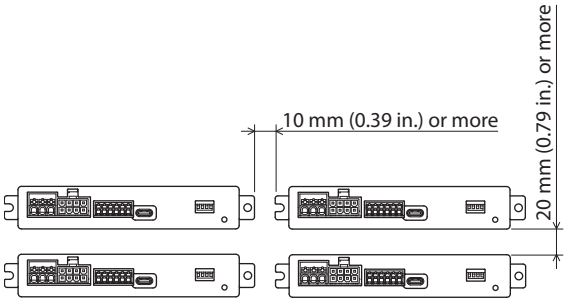
■ Installation direction

● **Vertical installation***



* When drivers are installed in a close contact state
Operating ambient temperature: 0 to +40 °C (+32 to +104 °F)

● **Horizontal installation**

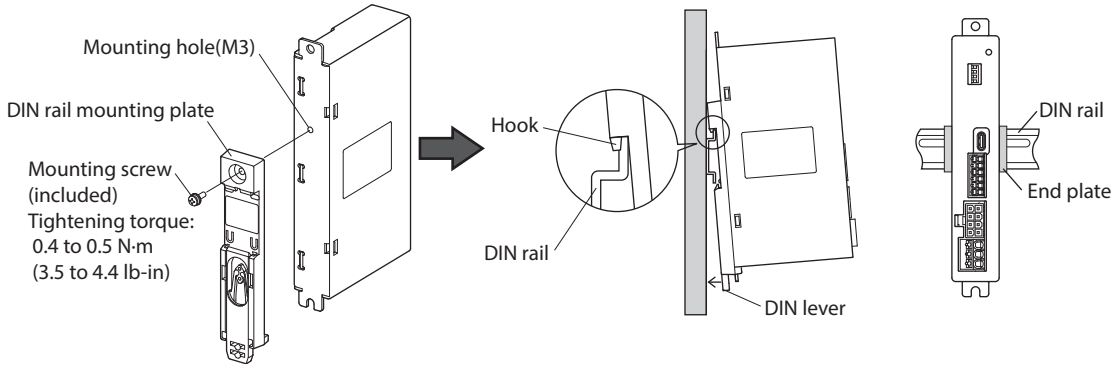


■ When a driver is installed with screws

Install the driver on an appropriate flat metal plate with excellent vibration resistance and heat conductivity.
Using the mounting holes or notches on the driver, secure it with two screws (M4: not included) so that there is no gap between the driver and the metal plate.

■ When a driver is installed on a DIN rail

Use the DIN rail mounting plate **PADP04** (sold separately) to install to a 35 mm (1.38 in.) wide DIN rail.
After installing to the DIN rail, secure the both sides of the driver with end plates that the customer provides.

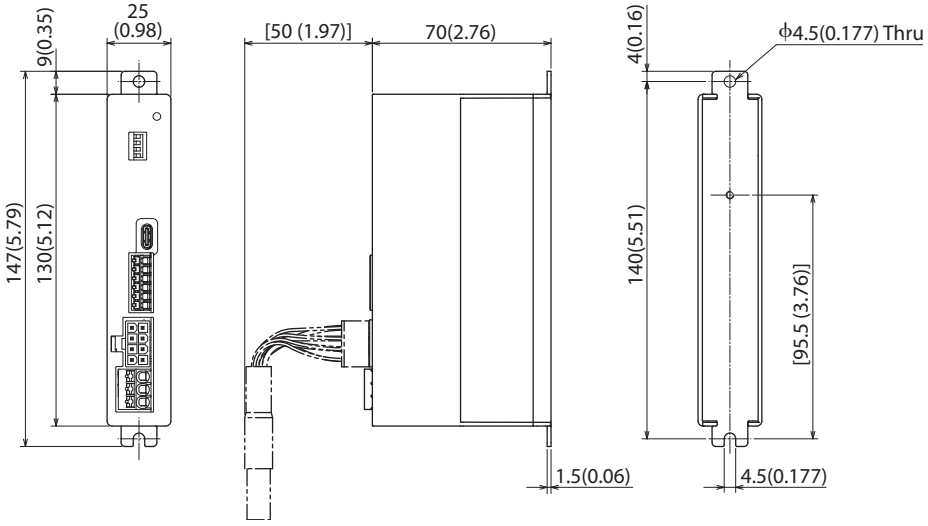


Note Be sure to use the included screws when securing the DIN rail mounting plate.

5-3 Dimensions

Mass: 0.13 kg (0.29 lb.)

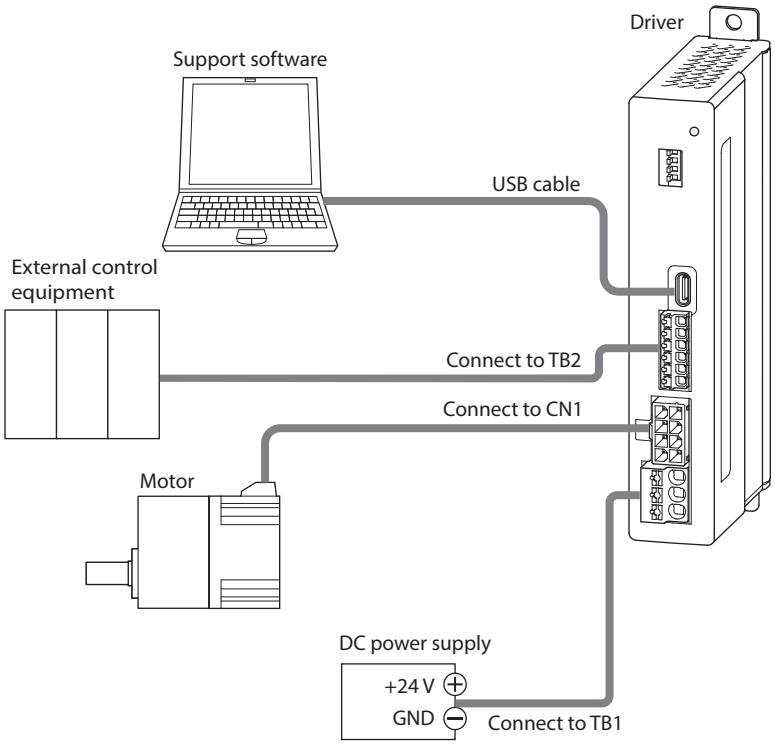
[Unit: mm (in.)]



6 Connection

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

6-1 Connection example



Note

- When connecting, pay attention to the polarity of the power supply. Connection with incorrect polarity may cause damage to the driver.
- Connect the connectors securely. Insecure connector connections may cause malfunction or damage to the driver.

memo

- When disconnecting the connector, pull out while pressing the latches on the connector with fingers.
- When turning the power off and on again or inserting/pulling out the connector, turn off the power supply and wait for the PWR/SYS LED to turn off.

6-2 Connecting the power supply (TB1)

The current capacity of the power supply varies depending on the motor connected.
Connect a power supply cable to the power supply terminal block (TB1).
Applicable lead wire size: AWG24 (0.2 mm^2) to AWG12 (3.5 mm^2)
Stripping length of wire insulation: 10 mm (0.39 in.)

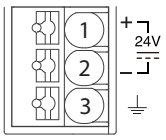
Output power	Power supply current capacity
25 W	2.2 A
40 W	4.0 A
90 W	7.1 A

Output power	Power supply current capacity
30 W	3.1 A
60 W	6.2 A
120 W	13 A

Note

- When connecting, pay attention to the polarity of the power supply. Connection with incorrect polarity may cause damage to the driver.
- The input current varies depending on the power supply voltage or the motor output power. Select a wire diameter suitable to the input current.
- Do not wire the power supply cable of the driver in the same cable duct with other power lines or motor cable.
- When connecting the power supply, use the thickest cable possible and keep the distance as short as possible. If a thin cable is used or the wiring distance is long, the voltage drop will increase.

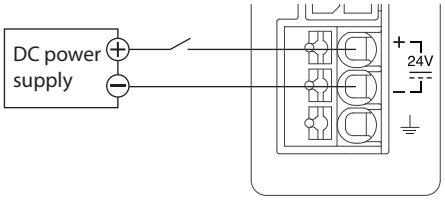
TB1 pin assignments



Pin number	Description
1	Power supply input (24 VDC)
2	Power supply ground
3	Frame ground

Note on power supply ON-OFF control using a mechanical contact

- When a mechanical contact (breaker, electromagnetic switch, relay, etc.) is used to turn the power supply on and off, turn only the positive (+) side of the power supply on and off using the mechanical contact.



Do not turn on or off the positive side (+) and the negative side (-) of the power supply simultaneously or shut off only the negative side (-) of the power supply.
The main circuit and the control circuit (USB port) in the driver are connected to the same ground. Therefore, when the power supply is turned on or off, the input current of the main circuit will flow into the control circuit, causing damage to the control circuit or peripheral equipment.

6-3 Connecting the motor and driver (CN1)

Insert the motor cable connector into the motor connector (CN1) 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 10.5 m (34.4 ft.).

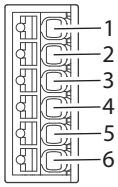
Note

- Connect the connector securely. Insecure connector connection may cause malfunction or damage to the driver.
- 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 damage the connector and driver.

6-4 Connecting the I/O signals (TB2)

Connect the I/O signal cable to the I/O signal terminal block (TB2).
Lead wire size: AWG24 (0.2 mm^2) to AWG16 (1.25 mm^2)
Stripping length of wire insulation: 8 mm (0.31 in.)

TB2 pin assignments



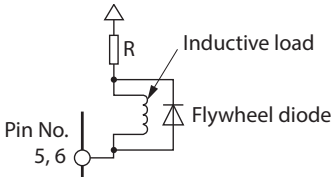
Pin number	Terminal name	Description
1	IN-COM	Common for IN0 and IN1 inputs
2	IN0	Control input 0 (FW-SPD-DIPSW)
3	IN1	Control input 1 (RV-SPD-DIPSW)
4	OUT-COM	Common for OUT0 and OUT1 outputs
5	OUT0	Control output 0 (ALM-B)
6	OUT1	Control output 1 (MOVE)

Values in parentheses ( ) are the defsult settings.

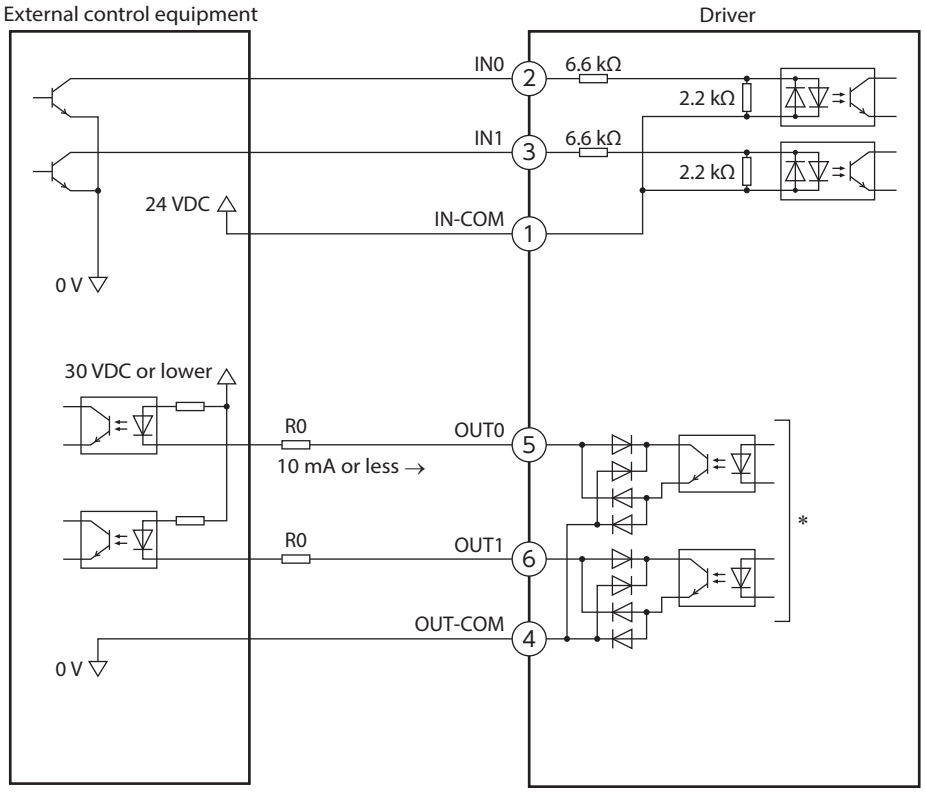
6-5 Driver I/O circuit

Note

- Use input signals at 24 VDC (−15 to +20%).
- Use output signals at 4.5 to 30 VDC, 10 mA or less. If the current exceeds 10 mA, connect an external resistor R0 to keep the current to 10 mA or less.
- When a relay (inductive load) is connected, 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.

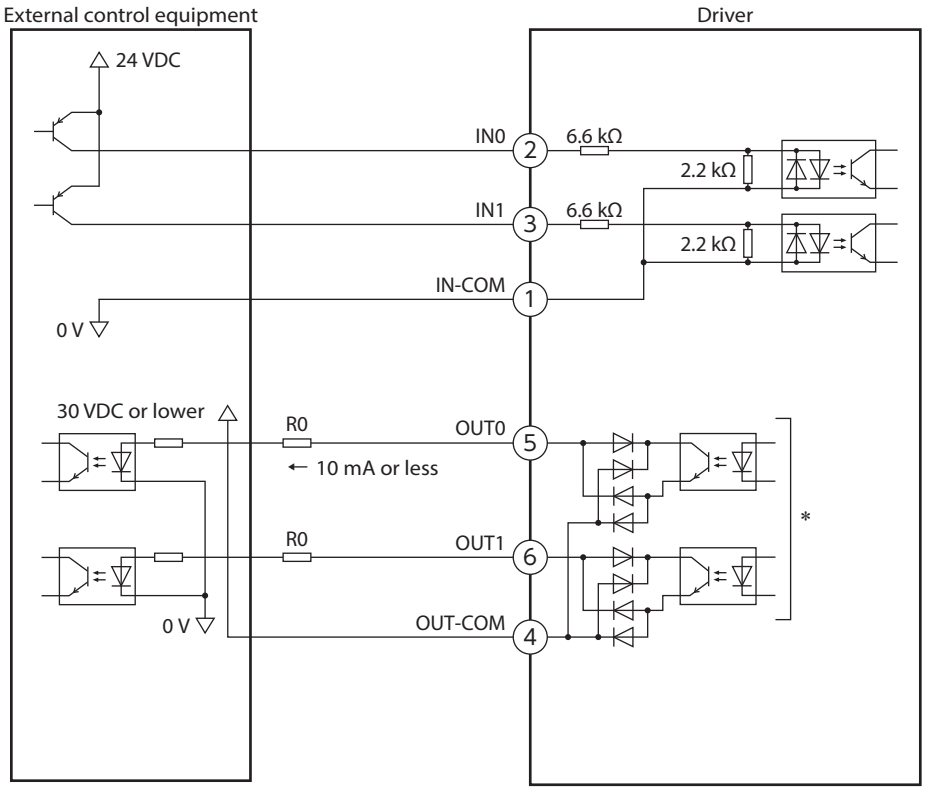


■ Connection example with a current sink output circuit



*Output saturation voltage: 1.2 VDC maximum

■ Connection example with a current source output circuit



*Output saturation voltage: 1.2 VDC maximum

6-6 Connecting the USB cable

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

Specifications of USB cable

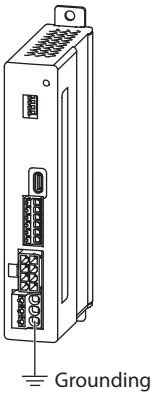
Specifications	USB 2.0 (Full speed)
Cable	Length: 3 m (9.8 ft.) or less Shape: Type-C

Note

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

6-7 Grounding

Use the thickest possible wire and the shortest distance to ground the driver to the grounding point.



Note Static electricity may damage the product if it is not grounded.

6-8 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 necessary to take appropriate measures because the 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

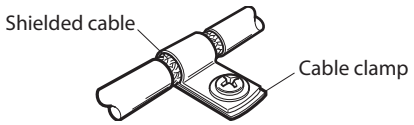
There are the following three methods mainly to take measures against the electrical noise.

● 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

- Keep power lines, such as motor and power supply cables, at least 100 mm (3.94 in.) away from signal lines, and do not bundle or parallel them. If power and signal cables must cross, cross them at right angles.
- Use a cable of AWG24 (0.2 mm^2) or thicker for the signal cable of the driver, and keep the wiring distance of 3 m (9.8 ft.) or less.
- For more effective elimination of noise, use shielded cables for a power supply cable and I/O signal cable, or install ferrite cores if unshielded 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 close to the product as possible.



- Grounding multiple points will increase the effectiveness of blocking electrical noise because the impedance at the grounding points will be reduced.
  However, ground them so that a potential difference does not occur among the grounding points.

● Suppression of effect by noise propagation

- Wrap the noise propagating cable around a ferrite core. This will prevent the propagated noise from entering into the driver or from being emitted from the driver. The frequency band in which an effect of the ferrite core can be seen is generally 1 MHz or more. Check the frequency characteristics of the ferrite core used. To increase the noise attenuation effect of the ferrite core, wrap the cable several more times.

6-9 Compliance with EMC Directive/Regulations

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, to prevent the occurrence of serious malfunctions in the functions of the mechanical device. 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 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 that the machine complies with EMC based on the installation and wiring described 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 (switched-mode power supply, etc.) that complies with the EMC Directive/Regulations.

■ 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 10.5 m (34.4 ft.).

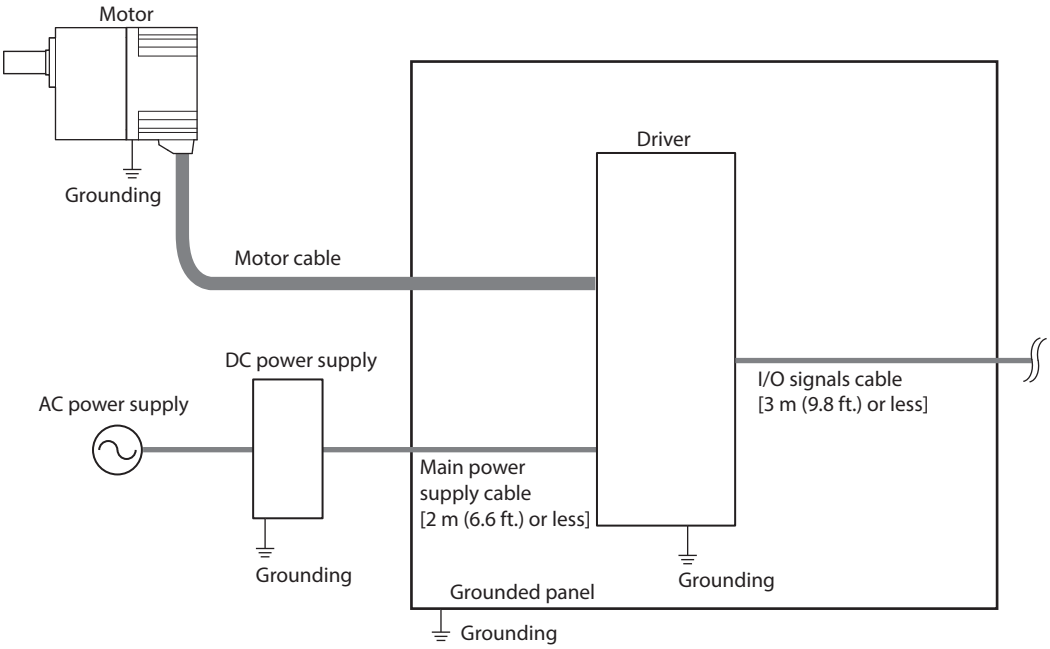
■ Notes on installation and wiring

- 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 signal cable as short as possible without coiling and bundling extra lengths.
- Separate power lines, such as motor and power supply cables, from signal lines and keep them as far apart as possible [example: about 100 to 200 mm (3.94 to 7.87 inches)]. If the power lines must cross over the signal lines, wire them at right angles.

■ How to ground

- Use the thickest possible wires and the shortest distance to ground the motor and driver so that there is no potential difference between the grounding points.
- Install the motor to a grounded metal plate.

■ Example of installation and wiring



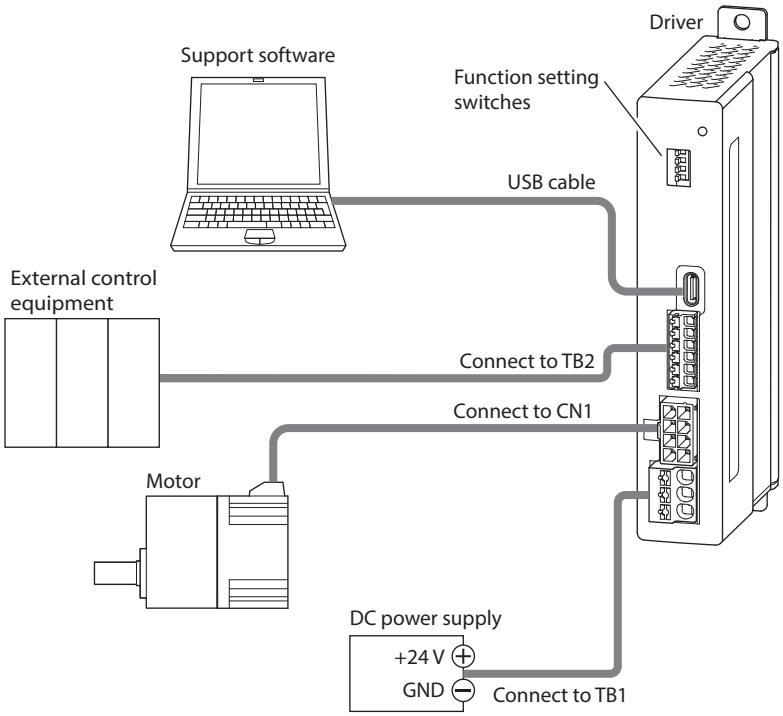
■ Precautions about static electricity

Note Do not approach or touch the driver while the power is supplied.

7 Operation

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

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

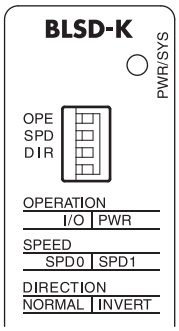


Note Note that the motor starts automatically operating when the power supply is turned on in a state where the "function setting switch: OPE (OPERATION)" is set to the "PWR" side. This may cause injury or damage to equipment. (Default: "I/O" side)

memo After the power supply is turned on, the driver automatically recognizes the motor output power.

7-1 Function setting switches

Function setting switches necessary for operation are provided on the surface of the driver. Refer to the table below for the default switch settings.

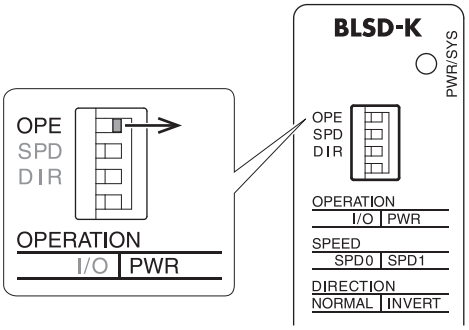


Switch name	Function	Setting		Description
		Default	–	
OPE (OPERATION)	Operating method	I/O	PWR	Selects how to operate the motor.
SPD (SPEED)	Rotation speed	SPD0	SPD1	Selects the motor rotation speed.
DIR (DIRECTION)	Rotation direction	NORMAL	INVERT	Selects the motor rotation direction.

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

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

This is a method to operate the motor only by turning the power supply on and off. (PWR operating)

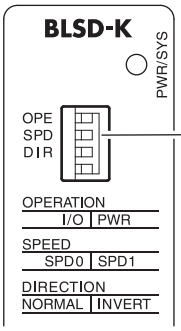


1. Set the "function setting switch: OPE (OPERATION)" to the "PWR" side. (Default: "I/O" side)
2. Turn on the power supply to operate the motor.
3. Turn off the power supply to stop the motor.

■ Operating conditions

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

● Rotation speed

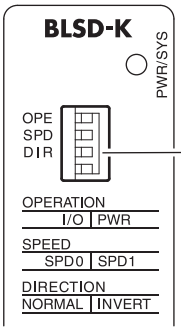


Function setting switches SPD

Function setting switch: SPD (SPEED)			
SPD0		SPD1	
OPE SPD DIR	1500 r/min*	1800 r/min*	OPE SPD DIR

* The values are the default settings. The rotation speed can be changed using the support software.

● Rotation direction



Function setting switches DIR

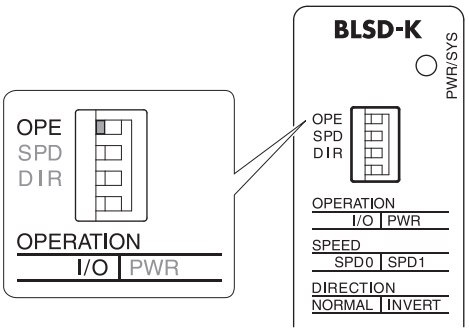
Function setting switch: DIR (DIRECTION)			
NORMAL		INVERT	
OPE SPD DIR	Rotates in the forward direction (Default)	Rotates in the reverse direction (Inverts the rotation direction)	OPE SPD DIR

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

memo
- The settings of the rotation speed, acceleration time, and torque limiting can be changed with the support software. (p.23)
- The motor coasts to a stop when the power supply is turned off during operation. The deceleration time cannot be set.
- If the motor stops due to an alarm generation or the FREE input, it can be restarted by turning the power supply off and on again.

7-3 Operation by input signals

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

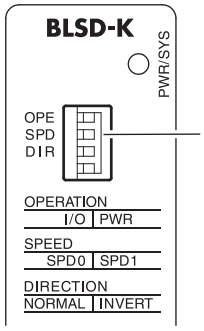


1. Set the "function setting switch: OPE (OPERATION)" to the "I/O" side. (Default: "I/O" side)
2. Turning the FW input ON causes the motor to rotate in the forward direction. Turning it OFF causes the motor to decelerate to a stop.
   Turning the RV input ON causes to rotate the motor in the reverse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

■ Operating conditions

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

● Rotation speed

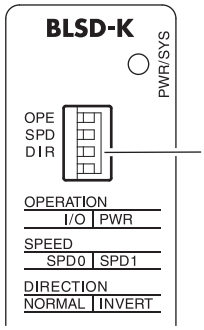


Function setting switches SPD

Function setting switch: SPD (SPEED)			
SPD0		SPD1	
OPE SPD DIR	1500 r/min*	1800 r/min*	OPE SPD DIR

* The values are the default settings. The setting value of the rotation speed can be changed by the support software.

● Rotation direction



Function setting switches DIR

Function setting switch: DIR (DIRECTION)			
NORMAL		INVERT	
OPE SPD DIR	FW input: Forward direction RV input: Reverse direction (Default)	FW input: Reverse direction RV input: Forward direction (Inverts the rotation direction)	OPE SPD DIR

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

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

7-4 Setting the rotation speed

Using the support software, a desired speed can be set for "SPD0" and "SPD1," which are selected by the "function setting switch: SPD (SPEED)." The speed control range varies depending on a motor combined.

Applicable motors		Speed control range	Default
Output power	Motor model		
25 W	**BL2M425KC-GN**	100 to 2000 r/min	SPD0: 1500 r/min SPD1: 1800 r/min
40 W	**BL2M540KC-GN**		
90 W	**BL2M590KC-GE**		

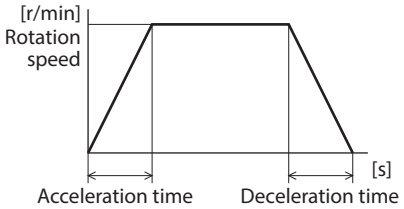
Applicable motors		Speed control range	Default
Output power	Motor model		
30 W	**BL2M230KCP-GF** **BL2M230KCP-A**	100 to 4000 r/min	SPD0: 1500 r/min SPD1: 1800 r/min
60 W	**BL2M460KCP-GF** **BL2M460KCP-A**		
120 W	**BL2M5120KCP-GF** **BL2M5120KCP-A**		

7-5 Setting the acceleration time and deceleration time

The acceleration time and the deceleration time can be set by the support software so that an impact is not applied to a load when the motor starts or stops.

The acceleration time and the deceleration time are as follows.

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



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

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

7-6 Torque limiting function

The maximum output torque of the motor can be limited. Set when limiting the motor output torque according to a load. The torque limiting value can be set by the support software based on the rated torque being 100%.
Setting range: 0.0 to 1000.0% (default: 1000.0%)

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

Name	Description
Torque limiting value	Torque limiting setting value
ATL function torque limiting	Torque limiting by the ATL function (default: enable)
Alarm torque limiting	Torque limiting when an alarm is generated (Approximately 100%)
Output power limiting	The maximum value varies depending on the motor. 25 W: 108.0%, 40 W: 117.6%, 90 W: 107.3% 30 W: 200.0%, 60 W: 200.0%, 120 W: 200.0%

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

7-7 ATL function

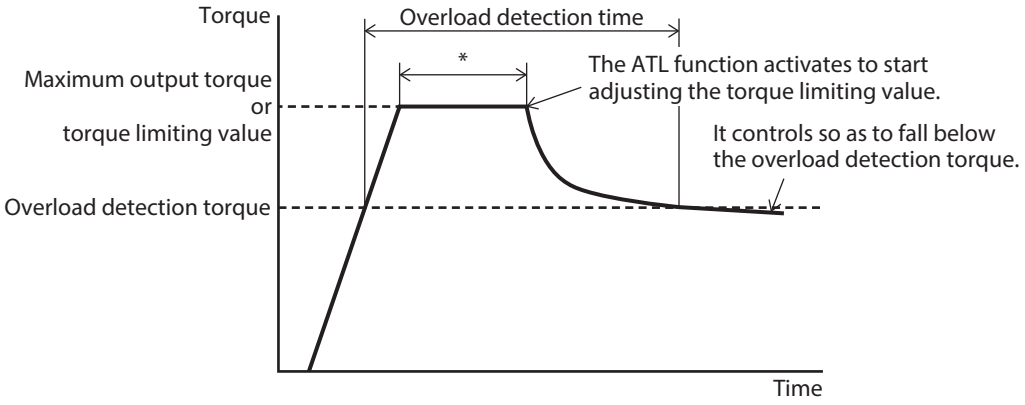
The ATL function is a function that prevents the overload alarm by automatically adjusting the torque limiting value when the output torque increases to near the overload alarm level.
The ATL function can be enabled or disabled using the support software. (Default: Enable)

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

memo The ATL function is not activated when a 25W, 40W, or 90W motor is used because the overload alarm is not generated.

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

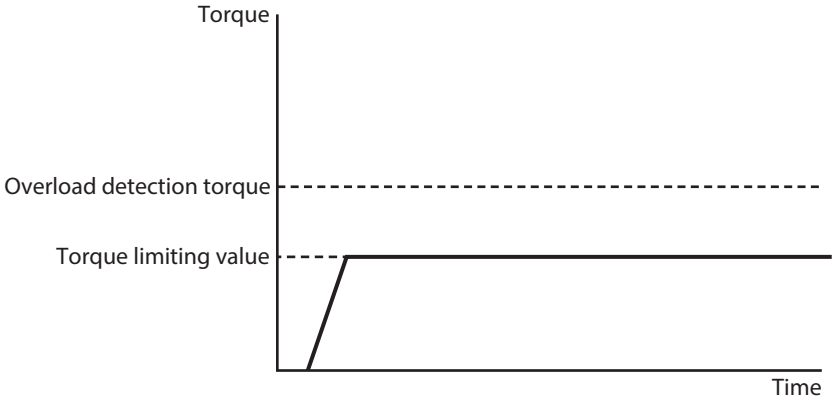
The ATL function is activated when all of the following conditions are met.
- The output torque of the motor exceeded the overload detection torque.
- The driver was estimated to exceed the overload detection time based on the output torque of the motor.



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

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

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



7-8 I/O signals

: These are the default signal assignments. They can be changed by the support software.

■ Input signals

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

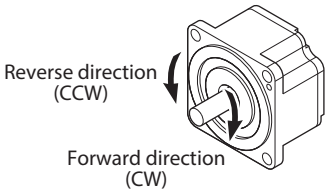
■ Output signals

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

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

7-9 Motor rotation direction

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



The rotation direction can be changed using the "function setting switch: DIR (DIRECTION)" of the driver.

Function setting switch: DIR (DIRECTION)			
NORMAL		INVERT	
	Operation by ON-OFF control of the power supply		
	Rotates in the forward direction (Default)	Rotates in the reverse direction (Inverts the rotation direction)	
	Operation by I/O		
	FW input: Forward direction RV input: Reverse direction (Default)	FW input: Reverse direction RV input: Forward direction (Inverts the rotation direction)	

Rotation direction of the gearhead output shaft

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

8 Inspection and maintenance

8-1 Inspection

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

Note

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

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

8-2 Warranty

Check on the Oriental Motor Website for the product warranty.

8-3 Disposal

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

9 Troubleshooting

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

Note Refer to P.29 "10 Alarms" when an alarm is generated.

The motor does not rotate.	● The power supply is not connected correctly or it is improper connection. ▷ Check the connection of the power supply.
	● The operation input signal is not turned ON. ▷ Check the connection.
	● The setting of the "function setting switch: OPE (OPERATION)" is wrong. ▷ Set it to the "PWR" side when operating the motor by turning the power supply on and off.
	● An alarm is present. ▷ Check to see if an alarm is generated. The PWR/SYS LED blinks red while an alarm is generated. Check the alarm contents with P.29 "10 Alarms".
	● Information of Start operation error is generated. ▷ Check to see if information is generated. The PWR/SYS LED blinks blue when information is generated. Refer to P.32 "11 Information".

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

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

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

The PWR/SYS LED blinks blue.	● Information is generated. ▷ Refer to P.32 "11 Information".

The motor rotates in the opposite direction to the specified one.	● The setting is wrong. ▷ Check the setting of the "function setting switch: DIR (DIRECTION)".
	● The gearhead with a gear ratio in which the rotation direction is opposite to that of the motor output shaft is used. ▷ Check the operating manual of the motor for the rotation direction of the gearhead output shaft.
	● A hollow shaft flat gearhead is used. ▷ The hollow shaft flat gearhead rotates in the opposite direction to the motor when viewed from the front of the gearhead and in the same direction as themotor when viewed from the rear (motor mounting side).

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

10 Alarms

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

10-1 Alarm reset

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

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

Note

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

10-2 Alarm history

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

10-3 Alarm list

Alarm code	Number of LED blinks	Alarm name	Cause	Remedial action	Reset using the ALM-RST input	Motor excitation*
20h	Nine times	Overcurrent	The motor, the cable, and the driver output circuit were short-circuited.	Turn off the power supply and check that the motor, cable, and driver are not damaged before turning the power on again. If the alarm has still not reset, the motor, cable, or driver may be damaged. Contact your nearest Oriental Motor sales office.	Not possible	Non-excitation
21h	Seven times	Main circuit overheat	The internal temperature of the driver exceeded 95 °C (203 °F).	• Reconsider the ambient temperature. • Reconsider the ventilation condition. • Reconsider the operating condition.	Possible	Non-excitation after deceleration
22h	Five times	Overvoltage	The internal voltage of the driver exceeded 44 VDC.	• Check the power supply voltage. • If the motor is rotated by an external force, reconsider the use or the environment.		Non-excitation
25h	Five times	Undervoltage	The internal voltage of the driver dropped below 18 VDC.	• Check the power supply voltage. • Check the wiring of the power supply cable.		Non-excitation after deceleration
28h	Twice	Sensor error	• An error of the sensor was detected during operation. • The sensor line in the motor cable was disconnected during operation. Or the motor cable was come off.	Check the connection between the driver and the motor.	Not possible	Non-excitation
29h	Nine times	Internal circuit error	The CPU peripheral circuit is damaged.	Turn the power off and on again. If the alarm has still not reset, the driver may be damaged. Contact your nearest Oriental Motor sales office.	Not possible	Non-excitation
2Dh	Twice	Motor connection error	An abnormality was detected in the motor power line.	• Check the connection between the driver and the motor. • If the motor is rotated by an external force, reconsider the use or the environment.		
30h	Seven times	Overload	A load exceeding the rated torque was applied for five seconds or more.	• Reduce the load. • Reconsider operating conditions such as the acceleration time and deceleration time. • If the alarm is generated at a low temperature, warm up.	Possible	Non-excitation after deceleration

* The motor excitation state when an alarm is generated is as follows.
Non-excitation: If an alarm is generated, the motor current will be cut off.
Non-excitation after deceleration: If an alarm is generated, the motor will decelerates to a stop. After deceleration to a stop, the motor current will be cut off.

Alarm code	Number of LED blinks	Alarm name	Cause	Remedial action	Reset using the ALM-RST input	Motor excitation*
31h	Seven times	Overspeed	• The motor rotation speed exceeded approximately 2800 r/min. (25 W, 40 W, 90 W) • The motor rotation speed was exceeded 4700 r/min. (30 W, 60 W, 120 W) • The power supply voltage was dropped.	• Reduce the load. • Reconsider operating conditions such as the acceleration time and deceleration time. • If the motor is rotated by an external force, reconsider how to use it or the environment. • Check the power supply voltage.	Possible	Non-excitation
41h	Nine times	EEPROM error	The data stored in the driver was damaged.	Initialize all parameters, and then turn the power supply off and on again. If the alarm has still not reset, the driver may be damaged. Contact your nearest Oriental Motor sales office.	Not possible	
42h	Twice	Sensor error at power-on	• An error of the sensor was detected when the power supply was turned on. • The sensor wire in the motor cable was disconnected when the power supply was turned on. Or the motor cable was come off.	Check the connection between the driver and the motor.		
45h	Twice	Motor combination error	A motor that is not compatible with the driver was connected.	Check the motor model and the driver model, and connect them in the correct combination.		
6Eh	Once	User alarm	The USR-ALM input was turned ON.	Turn the USR-ALM input OFF.	Possible	Non-excitation after deceleration
70h	Six times	Abnormal operation data	The motor was operated at the rotation speed exceeding the specification value.	Check the setting of the rotation speed.		
F0h	Light	CPU error	CPU malfunctioned.	Turn the power off and on again. If the alarm has still not reset, the driver may be damaged. Contact your nearest Oriental Motor sales office.	Not possible	Non-excitation

* The motor excitation state when an alarm is generated is as follows.
Non-excitation: If an alarm is generated, the motor current will be cut off.
Non-excitation after deceleration: If an alarm is generated, the motor will decelerates to a stop. After deceleration to a stop, the motor current will be cut off.

11 Information

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

■ Status when information is generated

● LED status

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

● Operation of motor

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

■ Clearing information

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

■ Information history

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

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

■ Information list

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

12 Specifications

12-1 Specifications

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

■ Applicable motor: 25 W, 40 W, 90 W

Model	Driver	BLSD-K		
	Motor	BL2M425KC-GN	BL2M540KC-GN	BL2M590KC-GE
Rated output power (Continuous)		25 W	40 W	90 W
Power supply input	Rated voltage	24 VDC		
	Permissible voltage range	−10 to +10%		
	Rated input current	1.6 A	2.4 A	5.3 A
	Maximum input current*	1.8 A (2.2 A)	3.2 A (4.0 A)	6.1 A (7.1 A)
Rated torque		0.199 N·m [28 oz-in]	0.319 N·m [45 oz-in]	0.717 N·m [101 oz-in]
Rated speed		1200 r/min		
Speed control range		100 to 2000 r/min		

* The values in parentheses ( ) are when the distance between the motor and the driver is 10.5 m (34.4 ft.).

■ Applicable motor: 30 W, 60 W, 120 W

Model	Driver	BLSD-K		
	Motor	BL2M230KCP-GF BL2M230KCP-A	BL2M460KCP-GF BL2M460KCP-A	BL2M5120KCP-GF BL2M5120KCP-A
Rated output power (Continuous)		30 W	60 W	120 W
Power supply input	Rated voltage	24 VDC		
	Permissible voltage range	−10 to +10%		
	Rated input current	1.9 A	3.3 A	6.3 A
	Maximum input current*	2.8 A (3.1 A)	5.0 A (6.2 A)	9.8 A (13.0 A)
Rated torque		0.096 N·m [13.6 oz-in]	0.191 N·m [27 oz-in]	0.382 N·m [54 oz-in]
Peak torque		0.191 N·m [27 oz-in]	0.382 N·m [54 oz-in]	0.764 N·m [108 oz-in]
Rated speed		3000 r/min		
Speed control range		100 to 4000 r/min		

* The values in parentheses ( ) are when the distance between the motor and the driver is 10.5 m (34.4 ft.).

12-2 General specifications

Operating environment	Ambient temperature	0 to +50 °C (+32 to +122 °F) (non-freezing)
	Ambient humidity	85% or less (non-condensing)
	Altitude	Up to 1000 m (3300 ft.) above sea level
	Surrounding atmosphere	No corrosive gas or dust. No water or oil. Cannot be used in radioactive materials, magnetic field, vacuum or other special environments. (For details on installation locations, refer to p.10.)
	Vibration	Not subject to continuous vibration or excessive impact. In conformance with JIS C 60068-2-6 "Sine-wave vibration test method" Frequency range: 10 to 55 Hz Pulsating amplitude: 0.15 mm (0.006 in.) Sweep direction: 3 directions (X, Y, Z) Number of sweeps: 20 times
Storage environment Shipping environment	Ambient temperature	Driver: –25 to +70 °C (–13 to +158 °F) (non-freezing)
	Ambient humidity	85% or less (non-condensing)
	Altitude	Up to 3000 m (10000 ft.) above sea level
	Surrounding atmosphere	No corrosive gas or dust. No water or oil. Cannot be used in radioactive materials, magnetic field, vacuum or other special environments.
Degree of protection		IP20

13 Regulations and standards

13-1 CE Marking / UKCA Marking

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

■ EU EMC Directive / UK EMC Regulations

This product does not contain the substances exceeding the restriction values.
Refer to P.18 "6-9 Compliance with EMC Directive/Regulations" for details on compliance.

■ EU RoHS Directive / UK RoHS Regulations

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

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