Oriental motor

Brushless Motor and Driver Package

BLV Series

Standard Type, Electromagnetic Brake Type

USER MANUAL (Basic Function)

KC CE

Thank you for purchasing an Oriental Motor product.
This Manual describes product handling procedures and safety precautions.
• Please read it thoroughly to ensure safe operation.
• Always keep the manual where it is readily available.

Table of contents

1 Introduction

■ Before using the product

Only qualified personnel of electrical and mechanical engineering should work with the product.
Use the product correctly after thoroughly reading the section "2 Safety precautions" on p.4. In addition, be sure to observe the contents described in warning, caution, and note in this manual.
The product described in this document has been designed and manufactured to be incorporated in general industrial equipment. Do not use for any other purpose. For the power supply, use a DC power supply with reinforced insulation on its primary and secondary sides. Oriental Motor Co., Ltd. is not responsible for any compensation for damage caused through failure to observe this warning.

■ Overview of the product

The **BLV** Series is a motor and driver package combining a slim, high-power brushless motor and a high-performance box-type driver of DC power input. Using the support software **MEXE02** or data setter **OPX-2A** (sold separately) can increase the performance, enabling setting of operation data and parameters, and motor operations easily.

■ Operating manuals for BLV Series

For operating manuals not included with the product, contact your nearest Oriental Motor sales office or download from Oriental Motor Website Download Page.

Operating manual name	Manual number	Included or not included with product
OPERATING MANUAL	HM-5112	Included
USER MANUAL (Basic Function)	HM-5113	Not included
USER MANUAL (RS-485 Communication Mode)	HM-5114	Not included
Data setter **OPX-2A**	HP-5049	Not included
Network Converter Slave Edition	HP-5065	Not included

■ CE Marking

This product is affixed the CE Marking (EMC Directive) based on the EN Standard. The input power supply voltage of this product is 24 VDC/48 VDC. Therefore this product is not subject to the Low Voltage Directive, but install and connect it as follows.

● Installation conditions

To be incorporated in equipment
Overvoltage category: I
Pollution degree: 2

● EMC Directive

This product has received EMC compliance under the conditions specified in "Example of installation and wiring" on p.22. The final level of conformance of your mechanical equipment to the EMC Directive will vary depending on such factors as the control system equipment used with the motor and driver, configuration of electrical parts, wiring, layout and hazard level. It therefore must be verified through conducting EMC measures on your mechanical equipment.

Applicable standards

EMI	Emission Tests	EN 55011 group1 class A, EN 61000-6-4
EMS	Immunity Tests	EN 61000-6-2

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.

■ Republic of Korea, Radio Waves Act

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

■ RoHS Directive

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

2 Safety precautions

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

⚠ WARNING	Handling the product without observing the instructions that accompany a "WARNING" symbol may result in serious injury or death.
⚠ CAUTION	Handling the product without observing the instructions that accompany a "CAUTION" symbol may result in injury or property damage.
(Note)	The items under this heading contain important handling instructions that the user should observe to ensure safe use of the product.

Explanation of graphic symbols

⊘ : Indicates "prohibited" actions that must not be performed.

❗ : Indicates "compulsory" actions that must be performed.

⚠ WARNING	
⊘	• Do not use the product in explosive or corrosive environments, in the presence of flammable gases, locations subjected to splashing water, or near combustibles. Doing so may result in fire, 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. Electric shock or damage to equipment may result. • Do not use a motor without electromagnetic brake in a vertical application. If the driver protective function is activated, the motor will stop and the moving part of the equipment may fall, thereby causing 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, electric shock, or damage to equipment. • Do not machine or modify the motor cable or connection cable. Doing so may result in fire, electric 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 motor, gearhead and 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.
❗	• 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. • When the protective function of the driver is activated, remove the cause before clearing the protective function. Continuing the operation without removing the cause of the problem may result in malfunction of the motor and driver, leading to injury or damage to equipment. • Install the motor, gearhead and driver in an enclosure. Failure to do so may result in electric shock or injury. • Always keep the power supply voltage of the driver within the specified range. Failure to do so may result in fire or electric shock. • For the 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. • Securely connect the wirings in accordance with the connection examples. Failure to do so may result in fire or electric shock. • Be sure to observe the specified cable sizes. Failure to do so may result in fire or electric shock. • Observe the specified screw tightening torque for the connector. Failure to do so may result in fire or damage to equipment. • Use a motor, gearhead, and driver only in the specified combination. An incorrect combination may cause fire, electric shock, or damage to equipment. • When the electromagnetic brake motor is used in an application of vertical drive such as elevating equipment, operate it after checking the condition of a load sufficiently so that a load in excess of the rated torque is not applied or a small value is not set in the torque limiting value. Failure to do so may result in injury or damage to equipment. • Always turn off the power before performing maintenance/inspection. Failure to do so may cause injury. • Regularly check the openings in the driver for accumulated dust. Failure to do so may result in fire.

⚠CAUTION

| | • Do not use the motor, gearhead and driver beyond the specifications. Doing so may result in electric shock, injury or equipment damage.
• Keep your fingers and objects out of the openings in the driver. Failure to do so may result in fire, electric shock or injury.
• Do not touch the motor, gearhead or driver while operating or immediately after stopping. The surface of the motor, gearhead or driver may be hot and cause a skin burn(s).
• Do not leave anything around the motor and driver that would obstruct ventilation. Doing so may result in damage to equipment.
• Do not move the product by holding the output shaft of the motor or the gearhead, or the motor cable. Doing so may result in injury.
• Do not touch the motor output shaft (key slot or pinion) with bare hands. Doing so may result in injury.
• When assembling the motor with the gearhead, exercise caution not to pinch your fingers or other parts of your body between the motor and gearhead. Injury may result.
• When installing the motor or gearhead in the equipment, exercise caution not to pinch your fingers or other parts of your body between the equipment and motor or gearhead. Injury may result.
• Do not shut off the negative side of the power supply during operation. Also, make sure that the wiring for the power supply does not disconnect. This may result in damage to equipment.
• Do not touch the rotating part (output shaft) while operating the motor. Doing so may cause injury. |
| | • Securely install the motor, gearhead and driver to their respective mounting plates. Inappropriate installation may cause the motor, gearhead or driver to detach and fall, resulting in injury or equipment damage.
• Provide a cover over the rotating part (output shaft) of the motor or gearhead. Failure to do so may result in injury.
• Securely install a load on the output shaft of the motor or gearhead. Inappropriate installation may result in injury.
• 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 cause injury.
• Immediately when a problem occurred, stop operation and turn off the driver power. Failure to do so may result in fire, electric shock or injury.
• The motor surface temperature may exceed 70℃ (158°F) even under normal operating conditions. If the operator is allowed to approach the motor in operation, attach a warning label in a conspicuous position as shown in the figure. Failure to do so may result in a skin burn(s). Warning label |

3 Precautions for use

This section covers restrictions and requirements the user should consider when using the **BLV** Series.

- **Regeneration energy**

  When the motor is used in operation such as vertical drive (gravitational operation) or sudden accelerating/decelerating of an inertia body, 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.
  Also, use an electromagnetic brake type motor because there is a risk of falling the moving part in vertical drive such as elevating equipment.
  If the protective function for the power supply or driver is activated, contact your nearest Oriental Motor sales office.

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

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

- **Do not use a solid-state relay (SSR) to turn on or off the power supply.**

  A circuit that turns on or off the power supply via a solid-state relay (SSR) may damage the motor and driver.

- **Notes for power ON/OFF using a mechanical contact**

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

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

  The main power supply input terminal (CN1), I/O signal connector (CN4), communication connectors (CN5/CN6/CN7), and control power supply input terminal (TB1) of the driver are 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.

- **Grease measures**

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

- **Note on using in low temperature environment**

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

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

  When using a hollow shaft flat gearhead, apply grease (molybdenum disulfide grease, etc.) on the surface of the load shaft and inner walls of the hollow output shaft to prevent seizure.

- **The driver uses semiconductor components. So be extremely careful when handling it.**

  The driver uses components that are sensitive to electrostatic charge. Before touching the driver, turn off the power to prevent electrostatic charge from generating. If an electrostatic charge is impressed on the driver, the driver may be damaged.

- **Use a connection cable (included) when extending the wiring distance between the motor and driver.**

- **Sliding noise of electromagnetic brake**

  The electromagnetic brake motor may cause sliding noise of the brake disk during operation.
  There is no functional problem.

■ Noise elimination measures

The electrical noise is of two types: 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.
Refer to p.21 for "Installing and wiring in compliance with EMC Directive."

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 the connection cable for the exclusive use of the **BLV** series when extending the wiring distance between the motor and 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**

- Separate power lines such as motor cable and power supply cable from signal lines for a distance of 100 mm (3.94 in.) or more, and also do not bundle them or wire them in parallel. If the power lines must cross over the signal lines, wire them at right angles.
- For more effective elimination of noise, use a shielded I/O signal cable or attach ferrite cores if a non-shielded cable is 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.

Shielded cable   Cable clamp
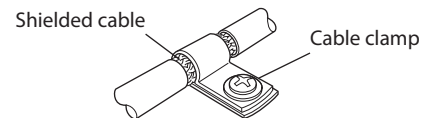
- Grounding multiple points will increase effect to block electrical noise because impedance on the grounding points is decreased. However, ground them so that a potential difference does not occur among the grounding points.

● **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.

4 System configuration

An example of system configuration using the **BLV** Series electromagnetic brake type is shown below.

RS-485 communication

External control equipment
Connect I/O signals.

Data setter **OPX-2A**
(sold separately)

Or

PC in which the support software **MEXE02** has been installed

Driver

External potentiometer
(sold separately)
Connect this potentiometer to set the motor speed externally.

Or

External DC voltage
Connect an appropriate power supply to set the motor speed using DC voltage.

Motor

The PC must be supplied by the user. Use the sold separately communication cable for the support software when connecting the PC and driver.

Connection cable (included)

Motor signal connector

Electromagnetic brake connector

Motor power connector

Power supply
Make sure power supply voltage does not exceed the rated voltage.

SW2
SW3
CN4 I/O
CN5
CN6
CN7
CN8
POWER
ALARM
VR1
VR2
CN3 HALL-S
CN2 MOTOR
TB1
CN1
24V
Orientalmotor

5 Preparation

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

5.1 Checking the product

Verify that the items listed below are included. Report any missing or damaged items to the branch or sales office from which you purchased the product.
Verify the model number of the purchased product against the number shown on the package label.
Check the model number of the motor and driver against the number shown on the nameplate.
Refer to "5.2 Combinations of motors and drivers" for the motor and driver package names and corresponding motor and driver combinations.

- Motor.. 1 unit (with a gearhead, only for combination type)
- Driver.. 1 unit
- Connection cable.. 1 pc
- CN1 connector .... 1 pc
- Operating Manual....................................... 1 copy

Included with combination type-parallel shaft gearhead

- Mounting screw set.................................... 1 set
  (hexagonal socket head screw, plain washer, spring washer, nut   each 4 pcs.)
- Parallel key... 1 pc
  (The parallel key is fixed to the gearhead output shaft.)

Included with combination type-hollow shaft flat gearhead

- Mounting screw set.................................... 1 set
  (hexagonal socket head screw, plain washer, spring washer   each 4 pcs.)
- Parallel key... 1 pc
- Safety cover.. 1 pc
- Safety cover mounting screw .... 2 pcs.

5.2 Combinations of motors and drivers

- The box (□) in the model name indicates a number representing the gear ratio.
- The box (■) in the model name indicates a number representing the length of an connection cable.
- The combination types come with the motor and gearhead pre-assembled.

■ Standard type

- **Combination type-parallel shaft gearhead**

Output power	Model	Motor model	Gearhead model	Driver model
200 W	**BLV620K□S-■**	BLVM620K-GFS	GFS6G□	BLVD20KM
400 W	**BLV640N□S-■**	BLVM640N-GFS		BLVD40NM

- **Combination type-hollow shaft flat gearhead**

Output power	Model	Motor model	Gearhead model	Driver model
200 W	**BLV620K□F-■**	BLVM620K-GFS	GFS6G□FR	BLVD20KM
400 W	**BLV640N□F-■**	BLVM640N-GFS		BLVD40NM

- **Round shaft type**

Output power	Model	Motor model	Driver model
200 W	**BLV620KA-■**	BLVM620K-A	BLVD20KM
400 W	**BLV640NA-■**	BLVM640N-A	BLVD40NM

■ **Electromagnetic brake type**

● **Combination type-parallel shaft gearhead**

Output power	Model	Motor model	Gearhead model	Driver model
200 W	**BLV620KM□S-■**	BLVM620KM-GFS	GFS6G□	BLVD20KM
400 W	**BLV640NM□S-■**	BLVM640NM-GFS		BLVD40NM

● **Combination type-hollow shaft flat gearhead**

Output power	Model	Motor model	Gearhead model	Driver model
200 W	**BLV620KM□F-■**	BLVM620KM-GFS	GFS6G□FR	BLVD20KM
400 W	**BLV640NM□F-■**	BLVM640NM-GFS		BLVD40NM

● **Round shaft type**

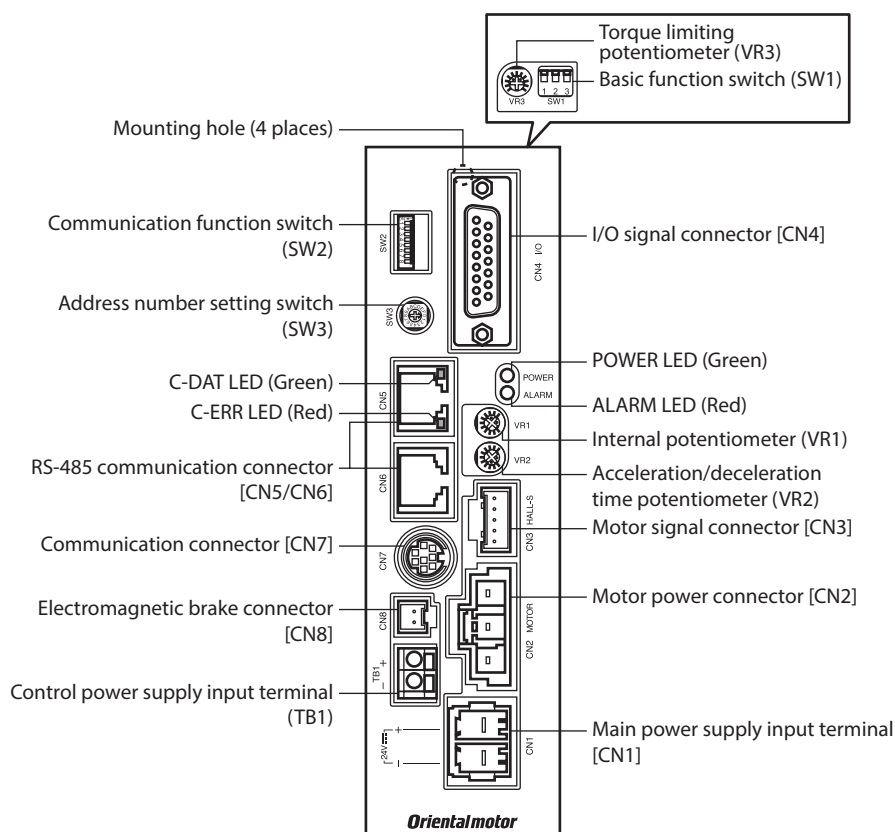| Output power	Model	Motor model	Driver model
200 W	**BLV620KMA-■**	BLVM620KM-A	BLVD20KM
400 W	**BLV640NMA-■**	BLVM640NM-A	BLVD40NM

5.3 Names and functions of parts

■ **Motor**

The figure shows the electromagnetic brake type motor of 200 W.
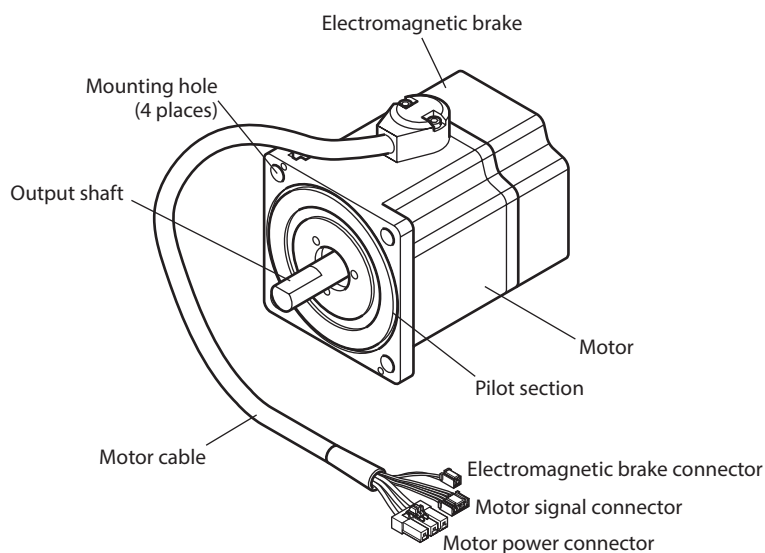
■ **Driver**

Name	Description	Ref.
POWER LED (Green)	This LED is lit while the main power or control power is input.	–
ALARM LED (Red)	This LED will blink if an alarm generates (a protective function is triggered). The alarm type can be checked by counting the number of times the LED blinks.	P.64
Internal potentiometer (VR1)	Sets the motor rotation speed.	P.32
Acceleration/deceleration time potentiometer (VR2)	The acceleration time and deceleration time for starting and stopping can be set.	P.34
Torque limiting potentiometer (VR3)	Sets the torque limiting value of the motor.	P.36
Main power supply input terminal [CN1]	Connects the main power supply. **BLV620**: +24 V **BLV640**: +48 V	P.24
Motor power connector [CN2]	Connects the motor power connector.	P.25
Motor signal connector [CN3]	Connects the motor signal connector.	P.25
Electromagnetic brake connector [CN8]	Connects the electromagnetic brake connector of the motor (electromagnetic brake type only).	
I/O signal connector [CN4]	Uses this connector when using an external control device (programmable controller) or inputting an operation command.	P.26
Basic function switch (SW1)	Selects the setting of the speed response, external DC voltage and sink logic/source logic.	P.32, P.35, P.37
Communication connector [CN7]	Connects a PC in which the **MEXE02** has been installed, or the **OPX-2A**.	P.29
Control power supply input terminal∗ (TB1)	Connects the control power supply of the driver.	Refer to the USER MANUAL (RS-485 Communication Mode).
RS-485 communication connector∗ [CN5/CN6]	Connects the RS-485 communication cable.	
C-DAT LED (Green)∗	This LED is lit when the driver communicates with the master station properly via RS-485 communication.	
C-ERR LED (Red)∗	This LED is lit when a RS-485 communication error occurs with the master station.	
Communication function switch∗ (SW2)	Sets the transmission rate, communication protocol and termination resistor of RS-485 communication.	
Address number setting switch∗ (SW3)	Sets the address number (slave address) of RS-485 communication.	
Mounting hole (4 places)	4 places on the back surface and side surface	P.19

∗ Uses when controlling the system via RS-485 communication.

6 Installation

This chapter explains the installation location, installation methods of the motor and driver, and how to install a load and an external potentiometer. The installation and wiring methods in compliance with the EMC Directive are also explained.

6.1 Installation location

The motor and 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 not exposed to direct sun
- Area free of excessive amount of dust, iron particles or the like
- Area free of excessive salt
- Area that is free of explosive atmosphere or toxic gas (such as sulfuric gas) or liquid
- 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

6.2 Installing the motor

■ Combination type-parallel shaft gearhead

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

Mounting screw set (included)

Screw size	Tightening torque [N·m (lb-in)]	Maximum applicable plate thickness [mm (in.)]∗
M8	15.5 (137)	12 (0.47)

∗ When the included mounting screw set is used.

Mounting hole dimensions [Unit: mm (in.)]

Model	ØA	ØB∗	C	ØD
BLV620 **BLV640**	120 (4.72)	42 (1.65)	20 (0.79)	8.5 (0.335)

∗ ØB indicates the external dimension of the product. Provide a hole with a diameter of "ØB +1 mm (0.04 in.) or more."
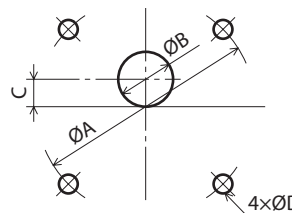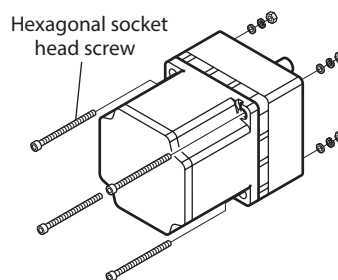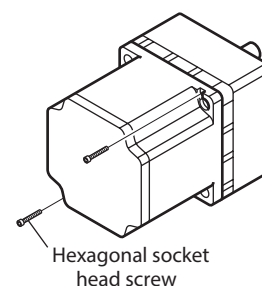
● Removing and assembling the gearhead

See the following steps to replace the gearhead or to change the cable outlet position.

Removing the gearhead from the motor

Remove the hexagonal socket head screws (2 places) assembling the motor and gearhead, and detach the gearhead from the motor.

Assembling the gearhead to the motor

1. Keep the pilot sections of the motor and gearhead in parallel, and assemble the gearhead with the motor while slowly rotating it clockwise/counterclockwise.
   At this time, note so that the pinion of the motor output shaft does not hit the side panel or gears of the gearhead strongly.

2. Check no gaps remain between the motor and gearhead, and tighten them with hexagonal socket head screws (2 pieces).

Screw size	Tightening torque [N·m (lb-in)]
M3	0.6 (5.3)
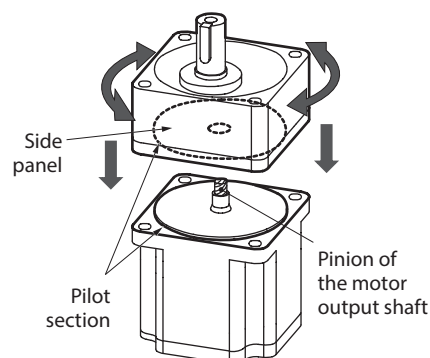
Assemble the gearhead to the motor in a condition where the motor output shaft is in an upward direction.

Note
- Do not forcibly assemble the motor and gearhead. Also, do not let metal objects or other foreign matters enter the gearhead. The pinion of the motor output shaft or gear may be damaged, resulting in noise or shorter service life.
- Do not allow dust to attach to the pilot sections of the motor and gearhead. Also, assemble the motor and gearhead carefully by not pinching the O-ring at the motor pilot section. If the O-ring is crushed or severed, grease may leak from the gearhead.
- The hexagonal socket head screws assembling the motor and gearhead are used to attach the motor and gearhead temporarily. When installing the product, be sure to use the included hexagonal socket head screws (4 pieces).

■ Combination type-hollow shaft flat gearhead

A combination type-hollow shaft flat gearhead can be installed by using either its front or rear side as the mounting surface.
Secure with the included mounting screw set through the four mounting holes so that no gaps remain between the product and mounting plate.
Also, attach the included safety cover to the hollow output shaft on the end opposite from the one where the load shaft is installed.
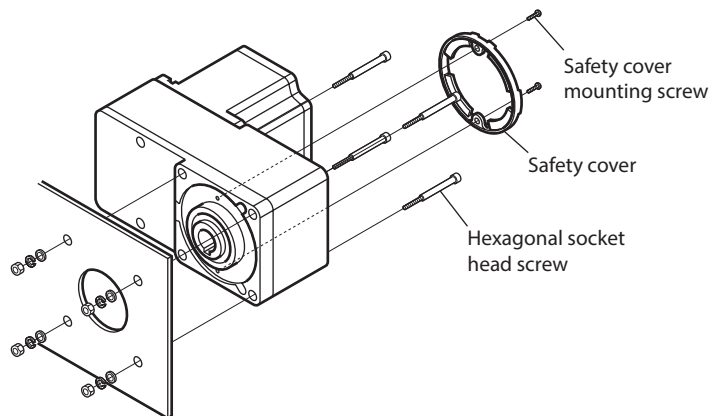[Tightening torque: 0.45 N·m (3.9 lb-in)]
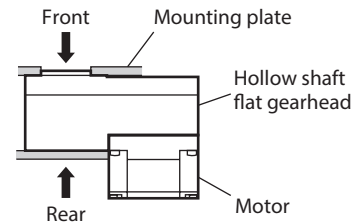
Mounting screw set (included)

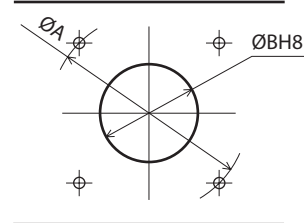| Screw size	Tightening torque [N·m (lb-in)]	Maximum applicable plate thickness [mm (in.)]∗
M8	15.5 (137)	12 (0.47)

∗ When the included mounting screw set is used.
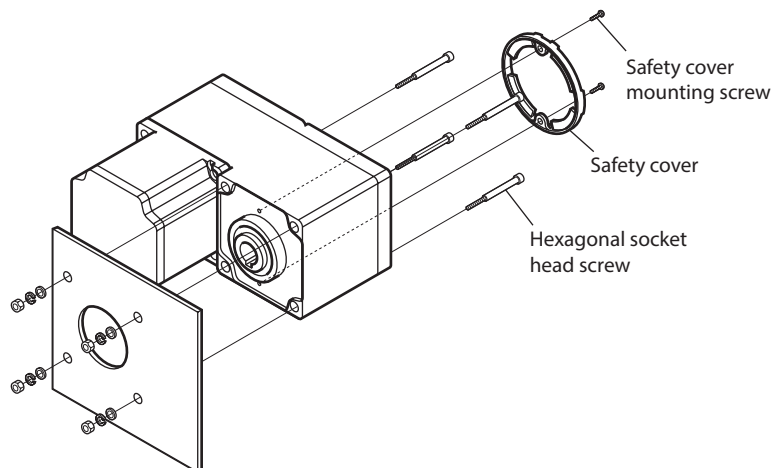
● Using the front side as the mounting surface

When the gearhead is installed by using its front side as the mounting surface, use the boss of the output shaft to align the center.
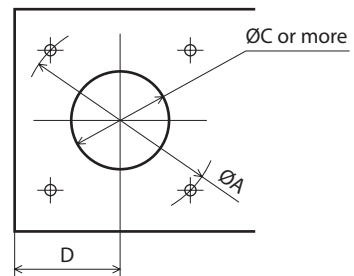

Safety cover mounting screw
Safety cover
Hexagonal socket head screw

● Mounting hole dimension

ØA ØBH8

● Using the rear side as the mounting surface

Safety cover mounting screw
Safety cover
Hexagonal socket head screw

● Mounting hole dimension

ØC or more
ØA
D

● Mounting hole dimensions [Unit: mm (in.)]

Hexagonal nuts are not included with the product, so provide them separately or drill tapped holes in the mounting plate.

Model	ØA	ØBH8	ØC	D	Screw size
BLV620 BLV640	120 (4.72)	$58^{+0.046}_{0}$ ($2.28^{+0.0018}_{0}$)	42 (1.65)	57 (2.24)	M8

Note When installing the gearhead by using its rear side as the mounting surface, prevent contact between the mounting plate and motor by keeping dimension E below the specified value.
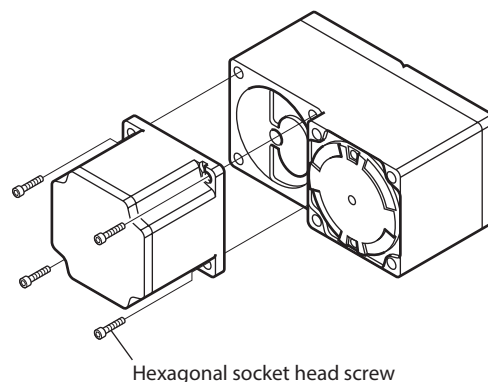
- **Removing and assembling the gearhead**

  See the following steps to replace the gearhead or to change the cable outlet position.
  Note that the motor cable cannot be positioned in the direction where it faces to the gearhead output shaft side.
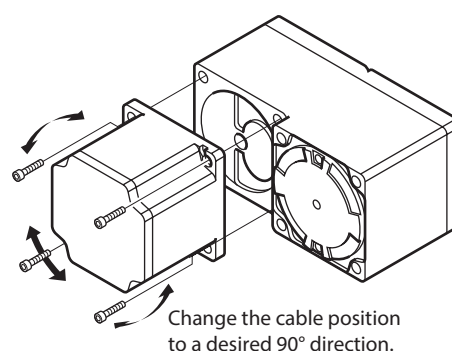
  ### Removing the gearhead from the motor

  Remove the hexagonal socket head screws (4 places) assembling the motor and gearhead, and detach the gearhead from the motor.

  Hexagonal socket head screw

  ### Assembling the gearhead to the motor

  1. Keep the pilot sections of the motor and gearhead in parallel, and assemble the gearhead with the motor while slowly rotating it clockwise/counterclockwise. At this time, note so that the pinion of the motor output shaft does not hit the side panel or gears of the gearhead strongly.

  2. Check no gaps remain between the motor and gearhead, and tighten them with hexagonal socket head screws (4 pieces).

Screw size	Tightening torque [N·m (lb-in)]
M8	15.5 (137)

  Change the cable position to a desired 90° direction.

  (Note)
  - Do not forcibly assemble the motor and gearhead. Also, do not let metal objects or other foreign matters enter the gearhead. The pinion of the motor output shaft or gear may be damaged, resulting in noise or shorter service life.
  - Do not allow dust to attach to the pilot sections of the motor and gearhead. Also, assemble the motor and gearhead carefully by not pinching the O-ring at the motor pilot section. If the O-ring is crushed or severed, grease may leak from the gearhead.
  - The motor cable position cannot be changed to the direction where the cable faces the gearhead output shaft. The gearhead case will obstruct the cable.

■ Round shaft type

Secure the product using hexagonal socket head screws through the four mounting holes.
Do not leave a gap between the product and mounting plate.
Hexagonal socket head screws are not included with the product. They must be provided by the customer.

Hexagonal socket head screw

Screw size	Tightening torque [N·m (lb-in)]
M8	15.5 (137)

Install the motor to a mounting plate of the following size or larger, so that the motor case temperature will not exceed 90 °C (194 °F).

Model	Size of mounting plate [mm (in.)]	Thickness [mm (in.)]	Material
BLV620	200×200 (7.87×7.87)	5 (0.20)	Aluminum
BLV640	250×250 (9.84×9.84)	6 (0.24)	

Mounting hole dimensions [Unit: mm (in.)]

Model	ØA	B	ØCH7∗	ØD
BLV620 **BLV640**	120 (4.72)	84.85 (3.341)	$94^{+0.035}_{0}$ ($3.7008^{+0.0014}_{0}$)	8.5 (0.335)

∗ ØC indicates the pilot diameter on the flange.

(Note) Insert the pilot located on the motor mounting surface into a pilot receiving hole in the mounting plate.
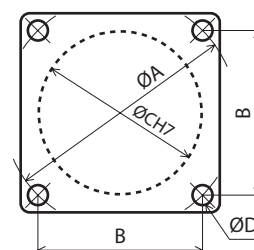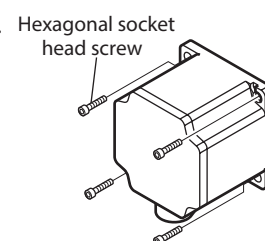
6.3   Installing a load

■ Combination type-parallel shaft gearhead, round shaft type

When installing a load on the motor or the gearhead, align the center of the motor output shaft or the gearhead output shaft with the center of the load shaft.

Note	• When coupling the motor or the gearhead with a load, pay attention to centering, belt tension, parallelism of pulleys, etc. Also, firmly secure the tightening screws of the coupling or pulleys. • When installing a load, do not damage the motor output shaft or the gearhead output shaft or bearings. Installing the load forcibly with a hammer or the like may break the bearings. Do not apply any excessive force to the output shaft. • Do not modify or machine the output shaft of the motor or gearhead. Doing so may damage the bearings, leading to damage to the motor or gearhead.

[Output shaft shape]

• **Combination type-parallel shaft gearhead**

A key slot is provided on the output shaft of gearhead. Form a key slot on the load side, and secure the load using the included parallel key. [Parallel key dimension: 6 mm (0.236 in.)]

• **Round shaft type**

A flat section is provided on the motor output shaft of each round shaft type. Apply a double-point screw, etc., at the flat section to firmly secure the load and prevent it from spinning.

[How to install a load]

• **Using a coupling**

Align the centerline of the output shaft of the motor or gearhead with the centerline of the load shaft.

• **Using a belt**

Adjust the output shaft of the motor or gearhead to lie parallel with the load shaft, and form right angles between the output shaft/load shaft and the line connecting the centers of both pulleys.

• **Using a gear drive**

Adjust the output shaft of the motor or gearhead to lie parallel with the gear shaft, and allow the output shaft to mesh correctly with the centers of the gear teeth.

• **When using the output shaft end tapped hole of a gearhead**

Use a screw hole [M6; Effective depth 12 mm (0.47 in)] provided at the end of the output shaft as an auxiliary means for preventing the transfer mechanism from disengaging.
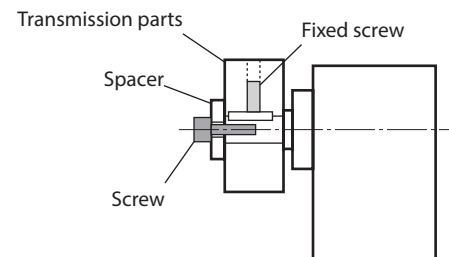
■ Combination type-hollow shaft flat gearhead

If a large impact occurs at instantaneous stop or a large radial load is applied, use a stepped load shaft.

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

Recommended load shaft installation dimensions [Unit: mm (in.)]

Model	Inner diameter of hollow shaft (H8)	Recommended diameter of load shaft (h7)	Nominal diameter of retaining ring	Applicable screw	Spacer thickness	Outer diameter of stepped shaft (ØD)
BLV620 **BLV640**	$\varnothing 25^{+0.033}_{0}$ ($\varnothing 0.9843^{+0.0013}_{0}$)	$\varnothing 25^{0}_{-0.021}$ ($\varnothing 0.9843^{0}_{-0.0008}$)	Ø25 (Ø0.98)	M8	6 (0.24) [3 (0.12)]∗	40 (1.57)

∗ The value in brackets [ ] is that when the rear side is used as the mounting surface.
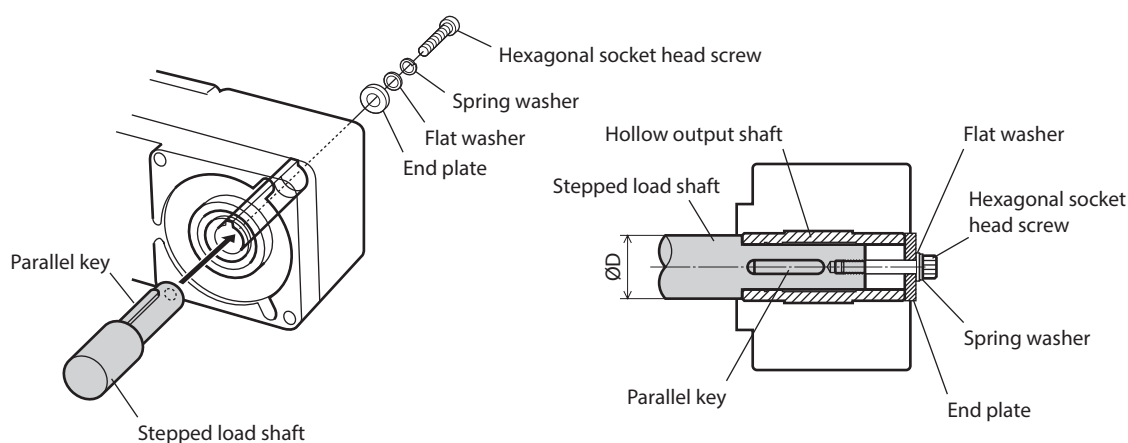
[Using a stepped load shaft]

- **Mounting method using retaining ring**

Secure the retaining ring to the load shaft by tightening the hexagonal socket head screw over a spacer, flat washer and spring washer.
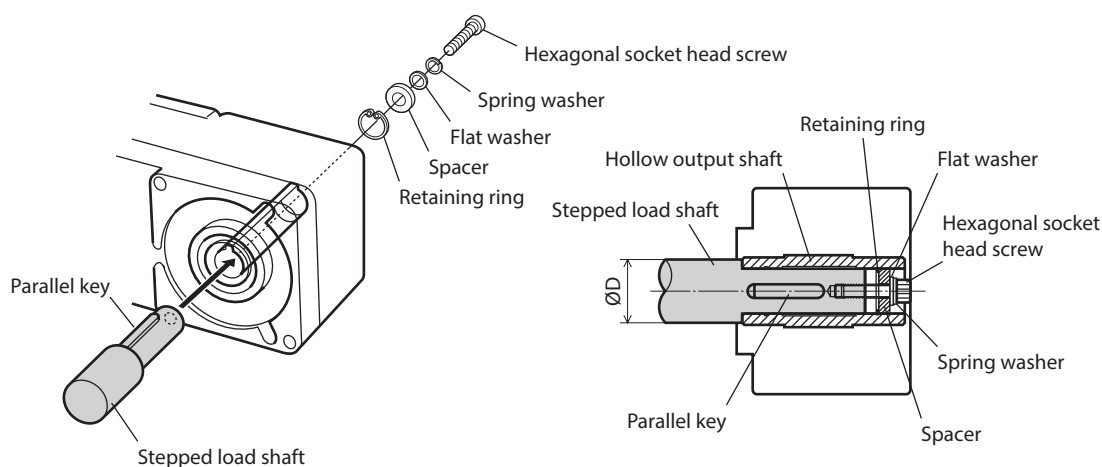

- **Mounting method using end plate**

Secure the end plate to the load shaft by tightening the hexagonal socket head screw over a flat washer and spring washer.

Note The included safety cover cannot be installed because it interferes against the hexagonal socket head screws. The customer must provide other protective measure for the rotating part.

[Using a non-stepped load shaft]

Install a spacer on the load shaft side and secure the retaining ring to the load shaft by tightening the hexagonal socket head screw over a spacer, flat washer and spring washer.
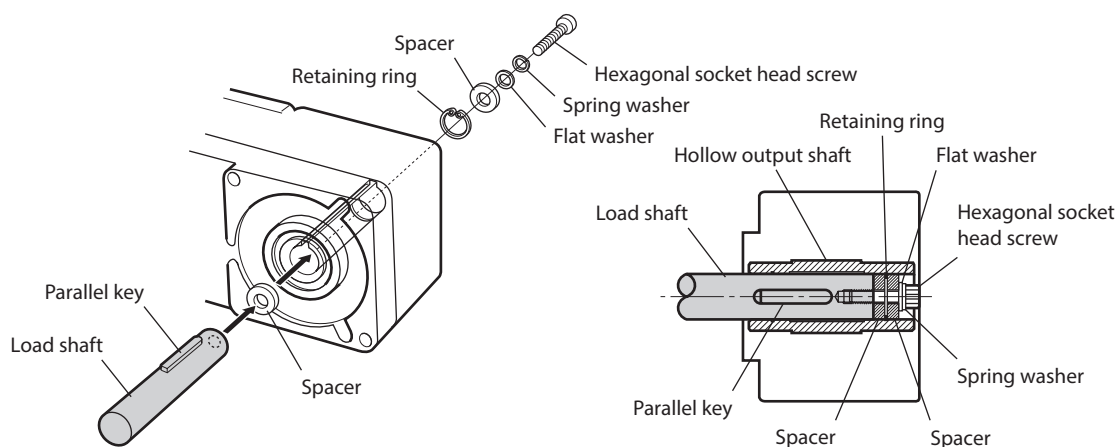
6.4 Permissible radial load and permissible axial load

Make sure the radial load and axial load received by the output shaft of the motor or gearhead will not exceed the allowable values shown in the table below.

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

● **Combination type-parallel shaft gearhead**

Model	Gear ratio	Distance from output shaft end of gearhead and permissible radial load∗ [N (lb.)]		Permissible axial load [N (lb.)]
		10 mm (0.39 in.)	20 mm (0.79 in.)	
BLV620 BLV640	5 to 20	550 (123) [500 (112)]	800 (180) [700 (157)]	200 (45)
	30, 50	1000 (220) [900 (200)]	1250 (280) [1100 (240)]	300 (67)
	100, 200	1400 (310) [1200 (270)]	1700 (380) [1400 (310)]	400 (90)

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

● **Combination type-hollow shaft flat gearhead**

Model	Gear ratio	Distance from mounting surface of hollow shaft flat gearhead and permissible radial load∗ [N (lb.)]		Permissible axial load [N (lb.)]
		10 mm (0.39 in.)	20 mm (0.79 in.)	
BLV640	5	1230 (270) [1130 (250)]	1070 (240) [990 (220)]	800 (180)
BLV620 BLV640	10			
	15, 20	1680 (370) [1550 (340)]	1470 (330) [1360 (300)]	
	30 to 100	2040 (450) [1900 (420)]	1780 (400) [1660 (370)]	

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

● **Round shaft type**

Model	Distance from output shaft end of motor and permissible radial load [N (lb.)]		Permissible axial load [N (lb.)]
	10 mm (0.39 in.)	20 mm (0.79 in.)	
BLV620 BLV640	197 (44)	221 (49)	25 (5.6)

6.5 Installing the driver

The driver is designed so that heat is dissipated via air convection and conduction through the enclosure. Install the driver to a flat metal plate offering excellent vibration resistance.
When two or more drivers are installed side by side, provide 20 mm (0.79 in.) and 25 mm (0.98 in.) clearances in the horizontal and vertical directions, respectively.
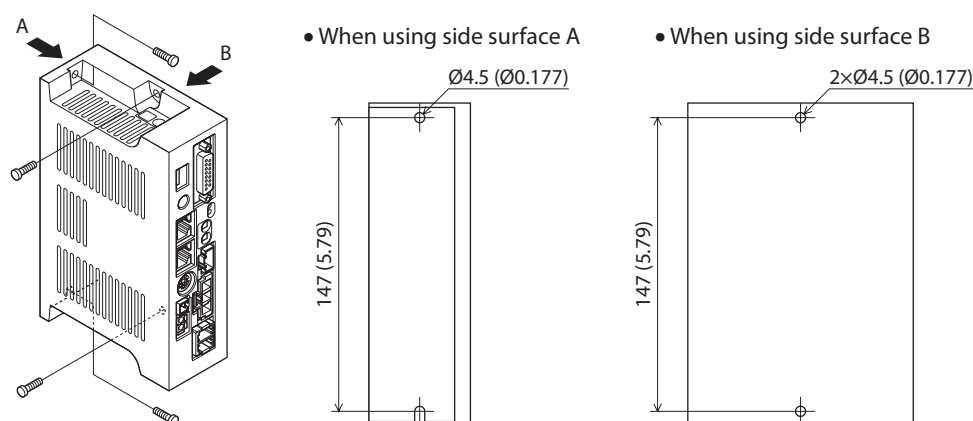
Horizontal direction
20 mm (0.79 in.) or more

Vertical direction
25 mm (0.98 in.) or more
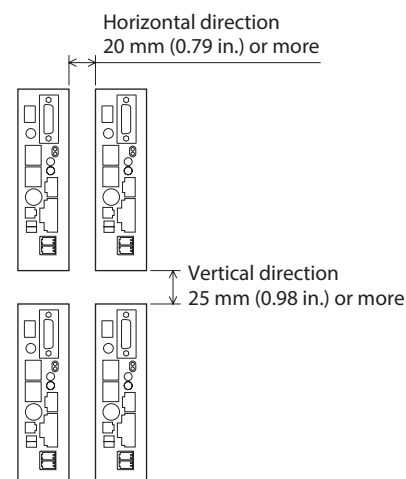
Note
- Install the driver in an enclosure whose pollution degree is 2 or better environment, or whose degree of protection is IP54 minimum.
- Do not cover the radiation vent of the driver.
- Do not install any equipment that generates a large amount of heat or noise near the driver.
- If the ambient temperature of the driver exceeds 40°C (104°F), revise the ventilation condition or force-cool the area around the driver using a fan.
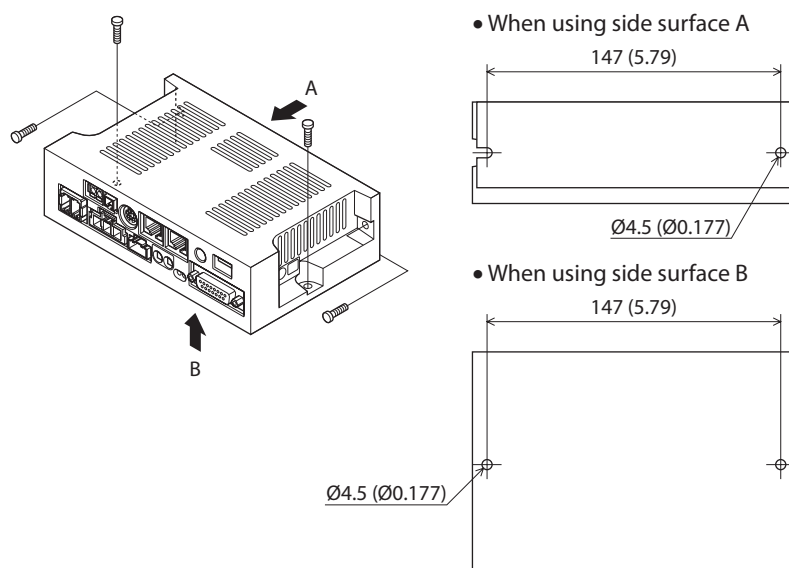
■ Installing with screws

Install the driver through the driver mounting holes using two screws (M4: not included).
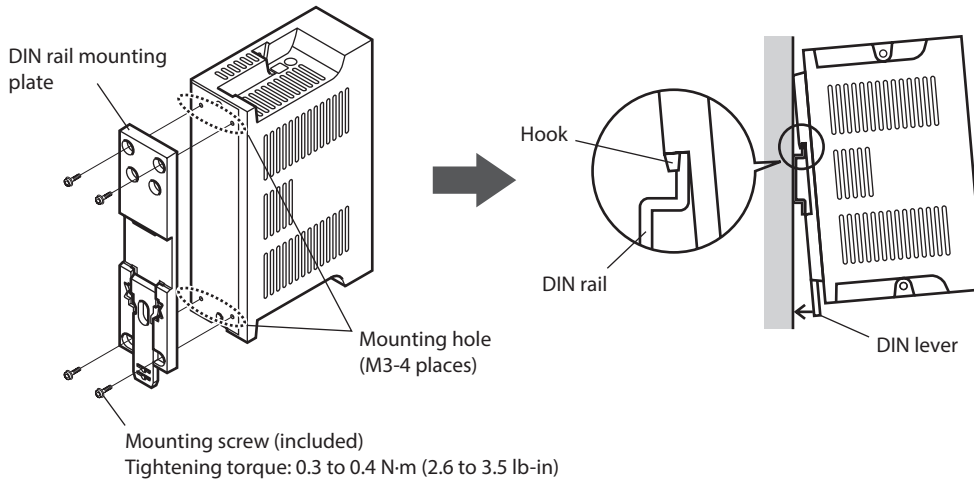
When mounting in vertical direction [Unit: mm (in.)]

- When using side surface A
  Ø4.5 (Ø0.177)
  147 (5.79)

- When using side surface B
  2×Ø4.5 (Ø0.177)
  147 (5.79)

When mounting in horizontal direction [Unit: mm (in.)]

- When using side surface A
  147 (5.79)
  Ø4.5 (Ø0.177)

- When using side surface B
 147 (5.79)
  Ø4.5 (Ø0.177)

■ Mounting to DIN rail

Use the DIN rail mounting plate **PADP03** (sold separately) and attach to a 35 mm (1.38 in.) wide DIN rail.
After installation, fix the both sides of the driver with the end plate (not included).

DIN rail mounting plate

Hook

DIN rail

DIN lever

Mounting hole (M3-4 places)

Mounting screw (included)
Tightening torque: 0.3 to 0.4 N·m (2.6 to 3.5 lb-in)

Note
- Do not use the mounting holes (M3, four places) for the DIN rail mounting plate for any purpose other than securing the DIN rail mounting plate.
- Be sure to use the included screws when securing the DIN rail mounting plate. The use of screws that would penetrate 3 mm (0.12 in.) or more through the surface of the driver may cause damage to the driver.
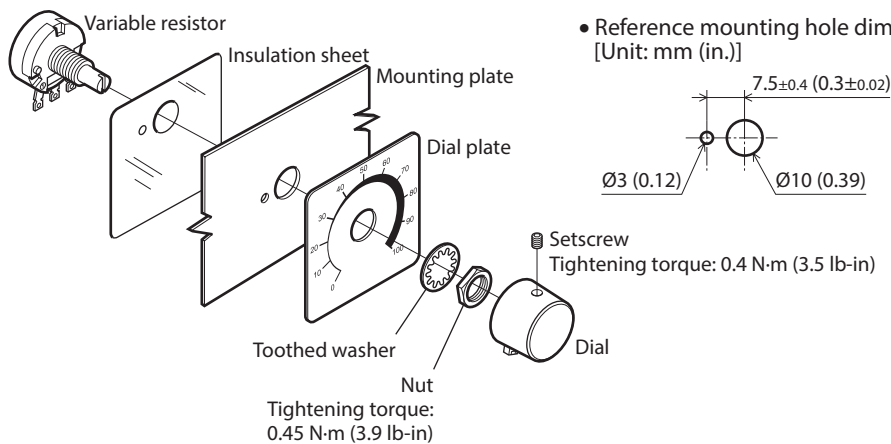
● Removing from DIN rail

Pull the DIN lever down until it locks using a flat tip screwdriver, and lift the bottom of the driver to remove it from the rail.
Use force of about 10 to 20 N (2.2 to 4.5 lb.) to pull the DIN lever to lock it. Excessive force may damage the DIN lever.

DIN lever
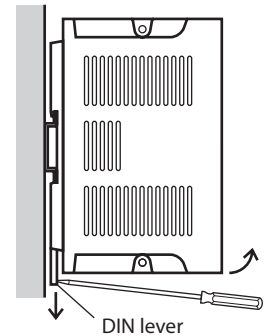
6.6 Installing an external potentiometer (sold separately)

1. Insert the variable resistor over the insulation sheet into the hole provided in the mounting plate.
2. Set the dial plate and toothed washer, and tighten with the nut.
   Tightening torque: 0.45 N·m (3.9 lb-in)
3. Install the dial and secure it with the setscrew (M4).
   Tightening torque: 0.4 N·m (3.5 lb-in)

Variable resistor

Insulation sheet

Mounting plate

Dial plate

Toothed washer

Nut
Tightening torque:
0.45 N·m (3.9 lb-in)

Dial

Setscrew
Tightening torque: 0.4 N·m (3.5 lb-in)

● Reference mounting hole dimensions
[Unit: mm (in.)]

7.5±0.4 (0.3±0.02)

Ø3 (0.12)

Ø10 (0.39)

■ **Soldering the variable resister terminals and the lead wires**

1. Guide the lead wires through the terminal hole and loop them two to three times.
2. Solder the lead wires to the terminal (Soldering condition: 235 °C (455 °F), less than 5 sec).
3. Cover a heat-shrinkable tube over the soldered part to insulate.
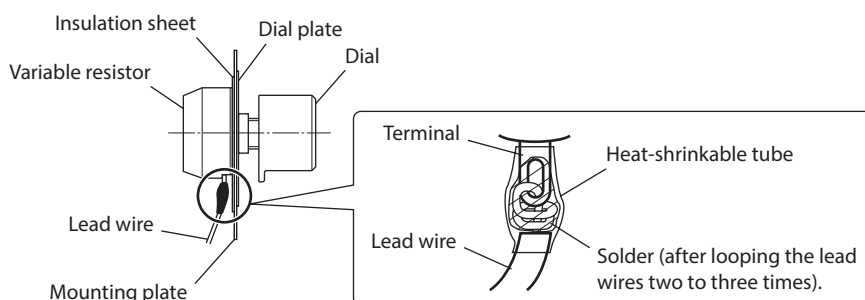
6.7 Installing and wiring in compliance with EMC Directive

The **BLV** Series has been designed and manufactured to be incorporated in equipment. The EMC Directive requires that your mechanical equipment in which the product is installed satisfies the applicable requirements.
The installation and wiring methods of the motor and driver explained here represent the basic methods that are effective in helping your mechanical equipment conform to the EMC Directive.
The final level of conformance of your mechanical equipment to the EMC Directive will vary depending on such factors as the control system equipment used with the motor and driver, configuration of electrical parts, wiring, layout and hazard level. It therefore must be verified through conducting EMC measures on your mechanical equipment.

■ **Applicable standards**

EMI	Emission Tests	EN 55011 group1 class A, EN 61000-6-4
EMS	Immunity Tests	EN 61000-6-2

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.

Effective measures must be taken against the EMI that the **BLV** Series may give to adjacent control-system equipment, as well as the EMS of the **BLV** Series itself, in order to prevent a serious functional impediment in the machinery.
The use of the following installation and wiring methods will enable the **BLV** to be compliant with the EMC Directive.
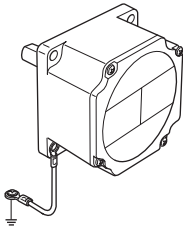
■ **Wiring the power supply cable and signal cable**

- Use a shielded cable of AWG 16 to 10 (1.25 to 6 mm^2) in diameter for the power supply cable and keep it as short as possible.
- Use a shielded cable for the I/O signals cable, and keep it as short as possible.
- Strip a part of the shielded cable and ground the stripped part using a metal cable clamp that contacts the stripped cable around its entire circumference, or use a drain wire to make the ground connection.
- Attach a cable clamp as close to the end of the cable as possible, and connect it as shown in the figure.
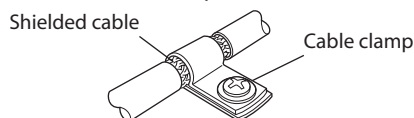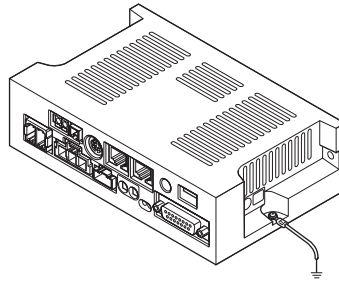
■ Grounding method

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

● **Grounding the motor**   ● **Grounding the driver**

Ground the motor and driver using any one of the mounting holes as shown in the figure.
Use shakeproof washers for grounding so that the motor and driver are electrically conducted with the grounding points, respectively.

■ Notes about installation and wiring

- Connect the motor, driver and other peripheral control equipment directly to the grounding point so that no potential difference is generated between grounds.
- When relays or electromagnetic switches are used together with the product, use CR circuits to suppress surges generated by them.
- Keep cables as short as possible without coiling and bundling extra lengths.
- Wire the power lines such as the motor cable and power cable away from the signal cables by providing a minimum clearance of 100 mm (3.94 in.) between them. If they have to cross, cross them at a right angle.
- Use the included connection cable when extending the wiring distance between the motor and driver. The EMC testing is conducted using the Oriental Motor connection cable.

■ Example of installation and wiring
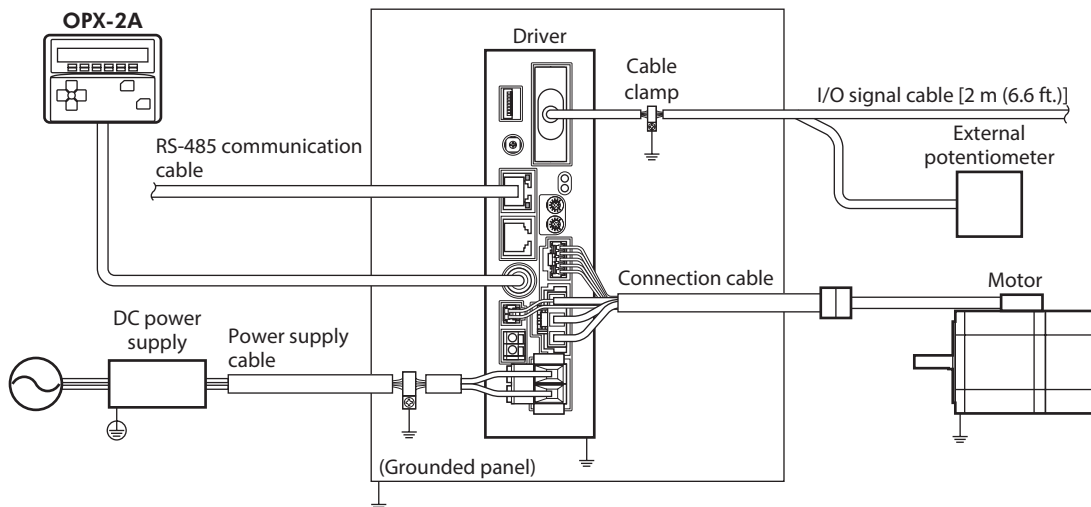
## ■ Precautions about static electricity

Static electricity may cause the driver to malfunction or suffer damage.
While the power is supplied to the driver, handle the driver with care and do not come near or touch the driver.
Always use an insulated screwdriver to adjust the driver's potentiometers or switches.

Note The driver uses parts that are sensitive to electrostatic charge. Before touching the driver, turn off the power to prevent electrostatic charge from generating. If an electrostatic charge is impressed on the driver, the driver may be damaged.

7 Connection

This chapter explains how to connect the driver with the motor, the power supply cable, and I/O signals.
Maximum extension distance between the motor and driver: 3.5 m (11.5 ft.) [including 0.5 m (1.6 ft.) of the motor cable]
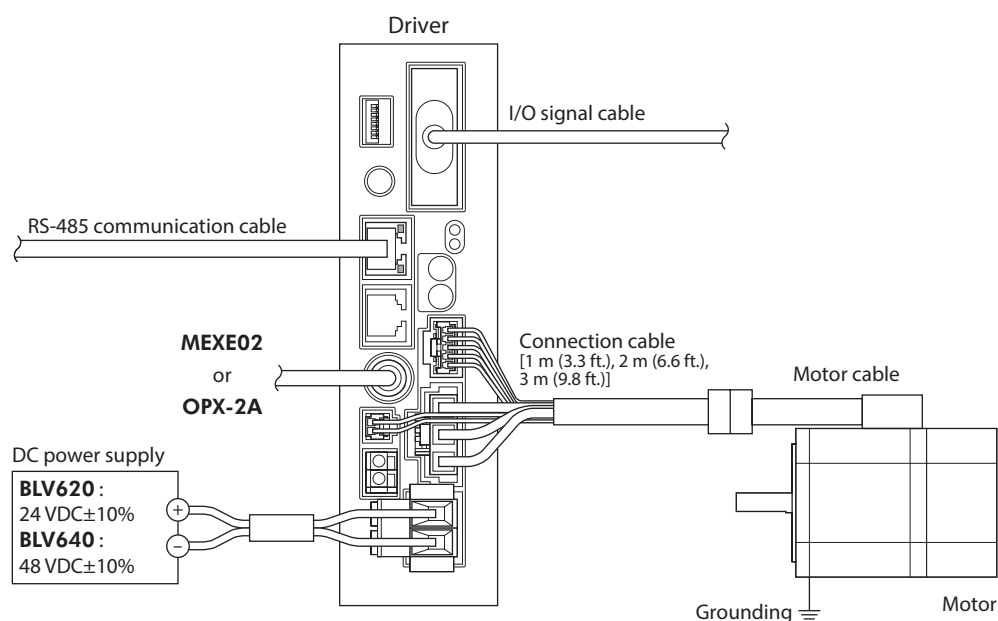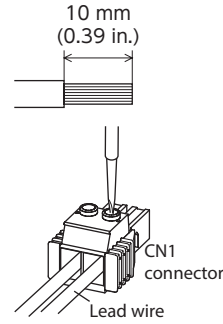

The motor cable can be connected to the driver directly.

7.1 Connecting the power supply

■ Connecting method

1. Strip the insulation of the lead wire by 10 mm (0.39 in.).
   Applicable lead wire: AWG 16 to 10 (1.25 to 6 mm^2)

   10 mm
   (0.39 in.)

2. Insert each lead wire into the CN1 connector and tighten the screw.
   Tightening torque: 0.7 to 0.8 N·m (6.1 to 7.0 lb-in)

   CN1 connector
   Lead wire

3. Insert the CN1 connector into the CN1 on the driver.
   Hold the green part of the CN1 connector, and insert it into the CN1 on the driver.
   Push the lever (orange) into the CN1 on the driver before pulling out the CN1 connector.
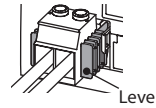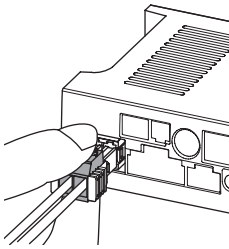
   Lever

   Supplying the power in a state where the lever (orange) is pushed in may cause damage to the driver due to connection failure.

Note
- For the power supply, use a DC power supply with reinforced insulation on its primary and secondary sides.
- When connecting, check the indication of the driver case and pay attention to the polarity of the power supply. Reverse-polarity connection may cause damage to the driver.
- Do not wire the power supply cable of the driver in the same cable duct with other power lines or motor cable. Doing so may cause malfunction due to noise.
- When turning on the power again or inserting/pulling out the connector, turn off the power and wait for the POWER LED to turn off.

Notes for power ON/OFF using a mechanical contact

- When turning on or off the power supply using a mechanical contact (breaker, electromagnetic switch, relay, etc.), do so only the positive side (+) of the power supply using the mechanical contact.

  BLV Series Driver
  CN1
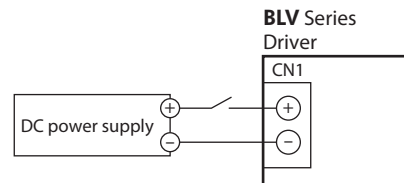
  DC power supply   (+)   (+)
                    (−)   (−)

Do not turn on or off the positive side (+) and the negative side (−) of the power supply simultaneously using a mechanical contact. Also, do not shut off only the negative side (−) of the power supply.
The main circuit and the control circuit in the driver are connected to the same ground. So the input current of the main circuit flows round into the control circuit when the power supply is turned on or off, causing damage to the control circuit or peripheral equipment.

■ **Applicable crimp terminal**

When crimp terminals are used, select the following products to use.

Manufacturer	Part number	Applicable lead wire
PHOENIX CONTACT GmbH & Co. KG	AI 1,5-10	AWG 16 (1.25 mm^2)
	AI 2,5-10	AWG 14 (2 mm^2)
	AI 4-10	AWG 12 (3.5 mm^2)

■ **Recommended power supply capacity**

Model	Input power supply voltage	Power supply capacity
BLV620	24 VDC±10%	800 W or higher
BLV640	48 VDC±10%	1 kW or higher

7.2 Connecting the motor and driver

Connect the motor power connector and the motor signal connector to the CN2 and the CN3 on the driver, respectively.
When using an electromagnetic brake type product, connect the electromagnetic brake connector to the CN8.

● Maximum extension distance between the motor and driver: 3.5 m (11.5 ft.) [including 0.5 m (1.6 ft.) of motor cable]

Motor signal connector
Connect to CN3

Motor power connector
Connect to CN2

Electromagnetic brake connector
Connect to CN8∗
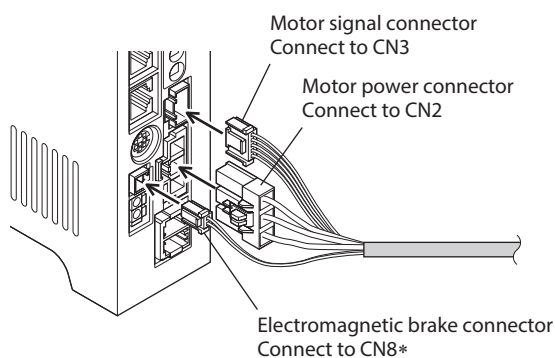
∗ Electromagnetic brake type only

Note Make sure the connector is inserted securely. Insecure connection may cause malfunction or damage to the motor or driver.

7.3 Connecting the I/O signals

Connect the I/O signals to the I/O signal connector (CN4). Keep the wiring distance as short as possible [less than 2 m (6.6 ft.)] to suppress the effect of noise.

Note
- The connector for connecting the I/O signals is not included. Provide the following products.
  · D-Sub connector (15-pin)
  · Hood (screw: No.4-40UNC)
- Wire the I/O signal cable at a distance of 100 mm (3.94 in) or more apart from the inductive load (electromagnetic relay etc.), power supply or power cable (motor cable etc.).

■ Connector function table
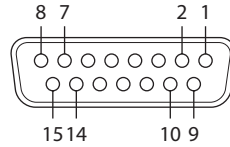
This figure is the CN4 connector viewed from the driver front side.

Pin No.	Signal type	Terminal name	Signal name	Description
1	Input	X0∗1	FWD	The motor rotates in the clockwise direction.
2		X1∗1	REV	The motor rotates in the counter clockwise direction.
3		X2∗1	STOP-MODE	This signal is used to select instantaneous stop or deceleration stop.
4		X3∗1	M0	This signal is used to select the internal potentiometer or external potentiometer (external DC voltage).
5	GND	C0	IN-COM	−
6	Output	Y2	SPEED-OUT	30 pulses are output with each revolution of the motor output shaft.
7		Y1−∗1	WNG (−)	−
8		Y0−∗1	ALARM-OUT1 (−)	−
9	Input	X4∗1	ALARM-RESET	This signal is used to reset the alarm.
10		X5∗1	MB-FREE∗2	This signal is used to select how the electromagnetic brake would operate when the motor stops.
11	Analog input	VL	VL	External speed setting input
12		VM	VM	The speed is set with the external potentiometer or external DC voltage.
13		VH	VH	
14	Output	Y1+∗1	WNG (+)	This signal is output when a warning is generated.
15		Y0+∗1	ALARM-OUT1 (+)	This signal is output when an alarm is generated (normally closed).

∗1 The assignments of I/O signals can be changed using the **MEXE02** or **OPX-2A**.
∗2 For electromagnetic brake type

■ Input signals circuit

All input signals of the driver are photocoupler inputs.
When an external power supply is used:
24 VDC −15 to +20%, 100 mA or more
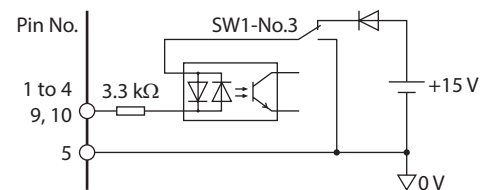
■ Output signals circuit

All output signals of the driver are photocoupler/open-collector outputs.
The ON voltage of the output circuit is maximum 1.5 V (0.5 V for SPEED-OUT output). When driving each element using the output signal circuit, give consideration to this ON voltage.

BLV620: 30 VDC or less and 100 mA or less
BLV640: 53 VDC or less and 100 mA or less
(The current of the SPEED-OUT output should be maximum 10 mA)
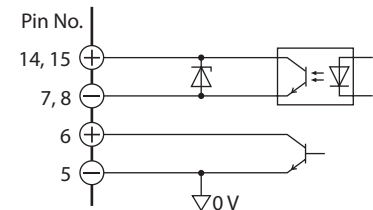
Note
- Always connect a current-limiting resistor. If the power supply voltage is connected to the output circuit directly without connecting a current-limiting resistor in between, the driver will be damaged.
- When connecting a relay (inductive load), etc., to detect alarm outputs, provide a fly-back voltage control measure based on diode, etc., for the inductive load. Or use a relay with built-in flywheel diode.
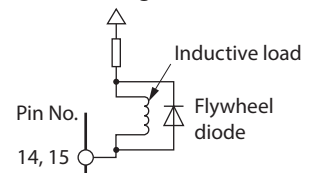
■ Input signals

The signal state represents "ON: Carrying current state" or "OFF: Not carrying current state" of the internal photocoupler rather than the voltage level of the signal.

● FWD input and REV input

When the FWD input is turned ON, the motor rotates in the clockwise direction according to the time set with the acceleration/deceleration time potentiometer. The motor stops when the signal is turned OFF.
When the REV input is turned ON, the motor rotates in the counterclockwise direction according to the time set with the acceleration/deceleration time potentiometer. The motor stops when the signal is turned OFF.
If both the FWD input and REV input are turned ON, the motor stops instantaneously.
The rotation direction of the motor can be changed using the "Motor rotation direction selection" parameter of the **MEXE02** or **OPX-2A**.
"Motor rotation direction selection" parameter ⇒ p.57

● STOP-MODE input

This signal is used to select how the motor should stop when the FWD input or REV input is turned OFF.
When the STOP-MODE input is ON, the motor stops according to the time set with the acceleration/deceleration time potentiometer.
When the STOP-MODE input is OFF, the motor stops instantaneously.

> **Note** When the electromagnetic brake type motor is used in vertical drive such as elevating equipment, be sure to turn the STOP-MODE input ON before stopping the motor. Stopping the motor while the STOP-MODE input remains OFF may cause the moving part to fall.

● M0 input

This signal is used to select how the motor speed is set.
When the M0 input is ON, the motor rotates at the speed set with the external potentiometer or external DC voltage.
When the M0 input is OFF, the motor rotates at the speed set with the internal potentiometer.
By switching the M0 input, the motor can be operated at two speeds through use of both the external potentiometer and internal potentiometer.
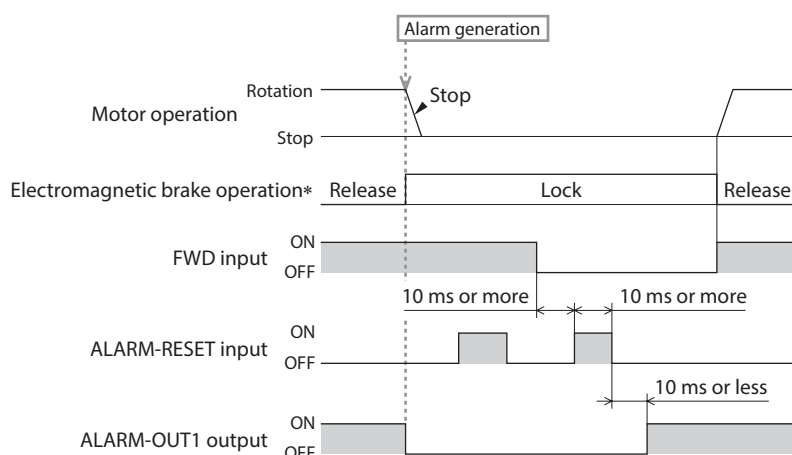Refer to p.35 for details.
Up to eight speeds can be set by assigning the M0 to M2 inputs using the **MEXE02** or **OPX-2A**.

● ALARM-RESET input

This signal is used to reset the present alarm that the protective function of the driver was activated. Be sure to remove the cause of the alarm before turning the ALARM-RESET input ON.
To reset an alarm, turn both the FWD input and REV input OFF, and remove the cause of the alarm before turning the ALARM-RESET input ON (keep it ON for 10 ms or more) and then OFF. The ALARM-RESET input is disabled while the FWD input or REV input is being ON.
If the alarm cannot be reset with the ALARM-RESET input, turn off the main power supply and turn on it again. If the control power supply is used, also turn on the control power supply again.

* The electromagnetic brake holds the position at the same time when an alarm is generated. If the **MEXE02** or **OPX-2A** is used, the electromagnetic brake can be set to hold the position after the motor coasts to a stop.

> **Note** ● Continuing the operation without removing the cause of the alarm may result in damage to equipment.
> ● Alarms of overcurrent, EEPROM error, and communication switch setting error cannot be reset with the ALARM-RESET input.

● **MB-FREE input**

This input signal is used for the electromagnetic brake type products. It is used to select how the electromagnetic brake would operate when the motor stops.
When the MB-FREE input is ON, the electromagnetic brake is released.
When the MB-FREE input is OFF, the electromagnetic brake is activated to hold the shaft in position.

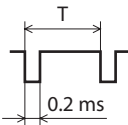**(Note)** The MB-FREE input is disabled while an alarm is present.

■ Output signals

The signal state represents "ON: Carrying current state" or "OFF: Not carrying current state" of the internal photocoupler rather than the voltage level of the signal.

● **SPEED-OUT output**

30 pulses are output with each revolution of the motor output shaft in synchronization with the motor operation. The pulse width of output pulse signals is 0.2 ms. The motor rotation speed can be calculated using the SPEED-OUT output.

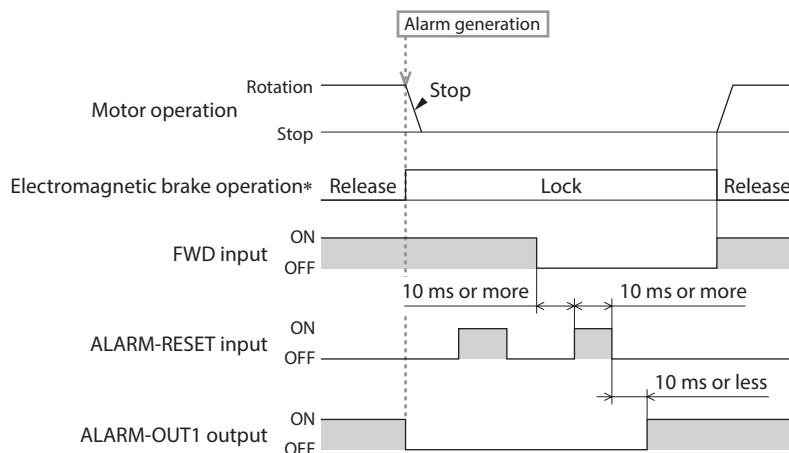$$\text{SPEED-OUT output frequency (Hz)} = \frac{1}{T}$$

$$\text{Motor shaft speed (r/min)} = \frac{\text{SPEED-OUT output frequency}}{30} \times 60$$

● **ALARM-OUT1 output**

When the protective function of the driver is activated, the ALARM-OUT1 output is turned OFF and the ALARM LED blinks (normally closed). The motor coasts to a stop in the case of the standard type. In the case of the electromagnetic brake type motor, on the other hand, the electromagnetic brake is activated to hold the shaft in position (the motor stops immediately).
To reset an alarm, turn both the FWD input and REV input OFF, and remove the cause of the alarm before turning the ALARM-RESET input ON (keep it ON for 10 ms or more) and then OFF. The ALARM-RESET input is disabled while the FWD input or REV input is being ON.
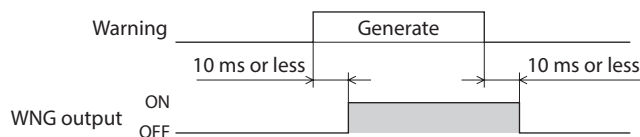If the alarm cannot be reset with the ALARM-RESET input, turn off the main power supply and turn on it again. If the control power supply is used, also turn on the control power supply again.

∗ The electromagnetic brake holds the position at the same time when an alarm is generated. If the **MEXE02** or **OPX-2A** is used, the electromagnetic brake can be set to hold the position after the motor coasts to a stop.

● **WNG output**

When a warning is generated, the WNG output is turned ON. The motor will continue to operate.
The WNG output will be turned OFF automatically once the cause of the warning is removed.

Warning list

Warning type	Cause	Remedial action
Main circuit overheat	The temperature inside the driver exceeded the overheat warning level.	Reconsider the ventilation condition in the enclosure.
Undervoltage ∗	The main power supply voltage dropped by approximately 10% or more from the rated voltage.	● Check the input voltage of the main power supply. ● Check the wiring of the power supply cable.
Overload ∗	The load torque of the motor exceeded the overload warning level.	● Decrease the load. ● Reconsider the operating condition such as acceleration time and deceleration time.
Operation prohibited	● When moved from the test mode to other mode using the **MEXE02** or **OPX-2A**, the FWD input or REV input was being ON. ● When the assignment of the input terminal was changed using the **MEXE02** or **OPX-2A**, the assigned terminal was ON.	Turn the input signal OFF.

∗ The detection level can be changed using the **MEXE02** or **OPX-2A**.

■ **Using a controller with a built-in clamp diode**

If a controller with a built-in clamp diode is used, a leakage path may form and cause the motor to operate even when the controller power is off, as long as the driver power is on. Since the power capacity of the controller is different from that of the driver, the motor may operate when the controller and driver powers are turned on or off simultaneously.
When powering down, turn off the driver power first, followed by the controller power, and when powering up, turn on the controller power first, followed by the driver power.
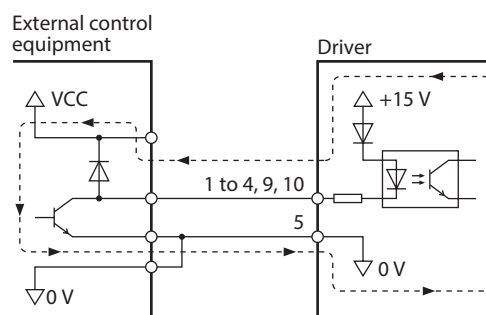
7.4 Connecting the communication cable

Connect a cable of the **MEXE02** or **OPX-2A** to the communication connector (CN7).
Refer to the USER MANUAL (RS-485 Communication Mode) for connection of RS-485 communication.

MEXE02 or **OPX-2A** cable
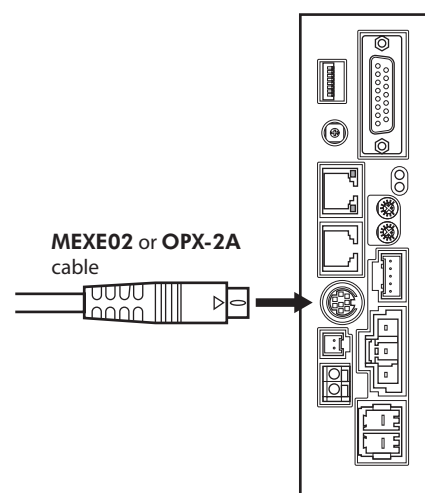
7.5 Connection diagram (example)

Each connection diagram (example) is for the electromagnetic brake type product.
In the case of the standard type product, there are no connection for the electromagnetic brake and no connection/input for the MB-FREE input signal.
Refer to p.37 for switching between sink logic and source logic.

■ Sink logic

In the connection example given below, the motor is operated with relays, switches and other contact switches.
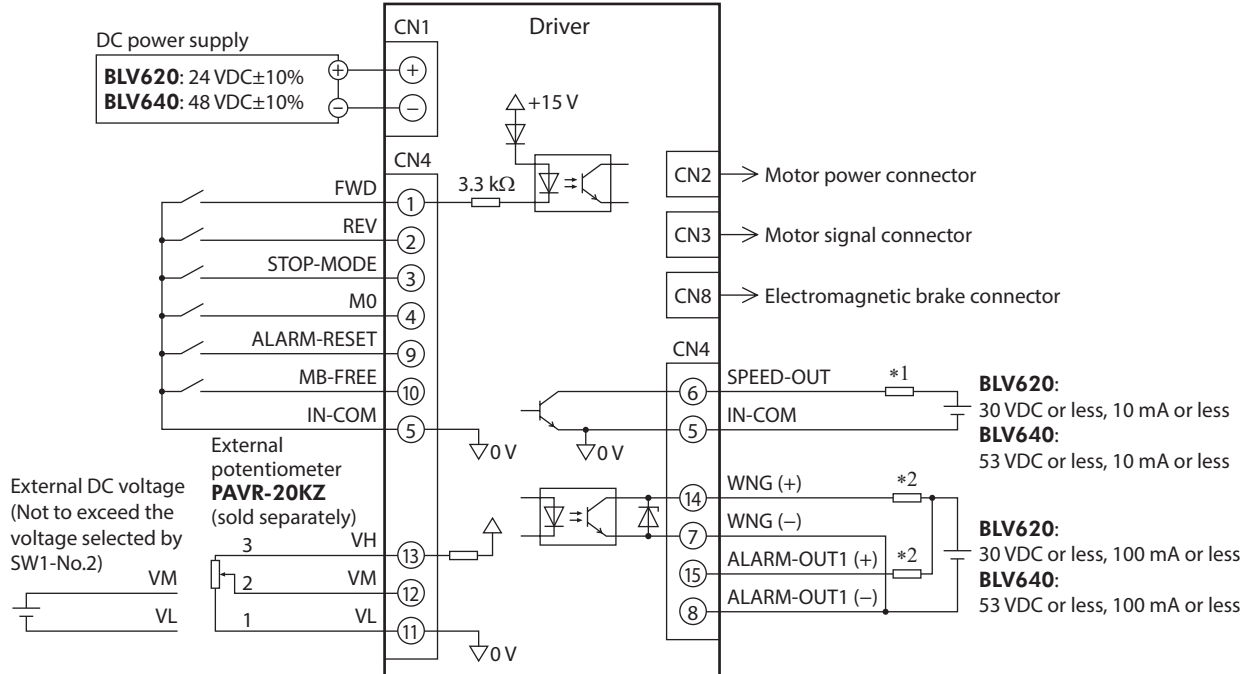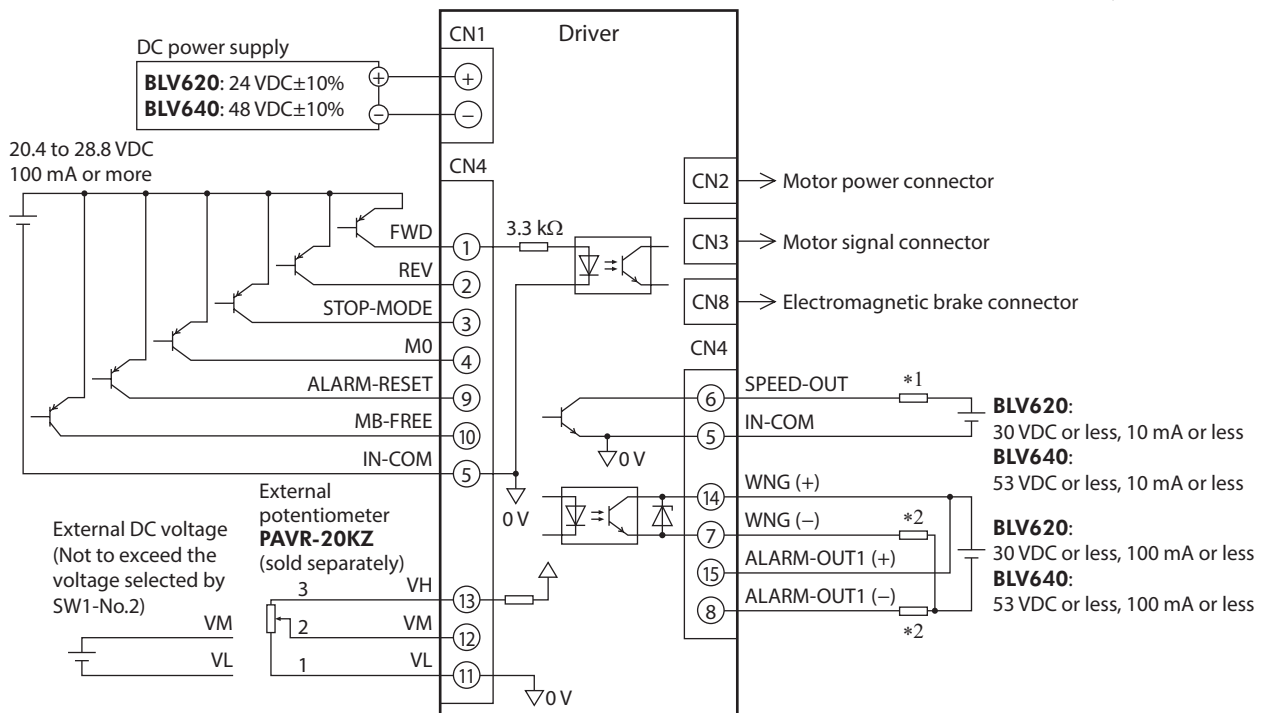

*1 Be sure to suppress the current value to 10 mA or less. Connect a current-limiting resistor if the current exceeds this specified value.
*2 Be sure to suppress the current value to 100 mA or less. Connect a current-limiting resistor if the current exceeds this specified value.

■ Source logic

In the connection example given below, the motor is operated with sequence connection of transistor type.

*1 Be sure to suppress the current value to 10 mA or less. Connect a current-limiting resistor if the current exceeds this specified value.
*2 Be sure to suppress the current value to 100 mA or less. Connect a current-limiting resistor if the current exceeds this specified value.

8 Operation

This chapter explains the operations that can be performed with the **BLV** Series.

8.1 Operation overview

With the **BLV** Series, in addition to the basic operation, the extended operation using the **MEXE02**, **OPX-2A**, or RS-485 communication can be performed.
The table below shows the details of each operation and the reference pages.

| Operation types	What you can do		Description	Ref.
Basic operation	Speed setting	Internal potentiometer	Sets the speed using the internal potentiometer.	P.32
		External potentiometer	Sets the speed using the external potentiometer.	
		External DC voltage	Sets the speed using an external DC voltage.	
	Operation and stop		Operates or stops the motor.	P.33
	Setting the acceleration time and deceleration time		The acceleration time and deceleration time for starting and stopping can be set.	P.34
	Two-speed operation		Operation can be performed at two speeds through use of both the external potentiometer (external DC voltage) and internal potentiometer.	P.35
	Examples of operating patterns		Examples of operation and stop are explained using timing charts.	P.36
	Multi-motor control		A single external potentiometer (external DC voltage) can be used to set the same speed for multiple motors.	P.39
	Function	Speed response selection	Selects the motor response in reaction to the command speed.	P.35
		Torque limiting function	The output torque of the motor can be limited.	P.36
		Sink logic/Source logic selection	Switches the input circuit between sink logic and source logic.	P.37
Extended operation	Using the support software **MEXE02** or the data setter **OPX-2A** (sold separately) can extend functions such as the digital setting of the rotation speed and torque limiting value, the setting of parameters, and various monitors.			P.40
Control via RS-485 communication	Modbus protocol can be used in RS-485 communication. Refer to the USER MANUAL (RS-485 Communication Mode) for details.			–
Control via CC-Link communication	Using the network converter **NETC01-CC**, operation via CC-Link communication can be performed. Refer to the operating manual of the network converter for details.			–
Control via MECHATROLINK communications	Using the network converter **NETC01-M2** or **NETC01-M3**, operation via MECHATROLINK communications can be performed. Refer to the operating manual of the network converter for details.			–
Control via EtherCAT communication	Using the network converter **NETC01-ECT**, operation via EtherCAT communication can be performed. Refer to the operating manual of the network converter for details.			–

8.2   Basic operation

■ Speed setting
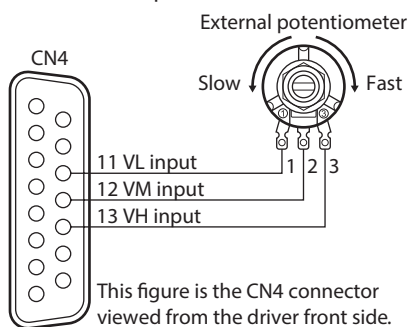
Setting range: 0, 100 to 4000 r/min

● Setting by internal potentiometer

Use an insulation screwdriver to turn the internal potentiometer (VR1).
Turn the potentiometer clockwise to increase the speed.
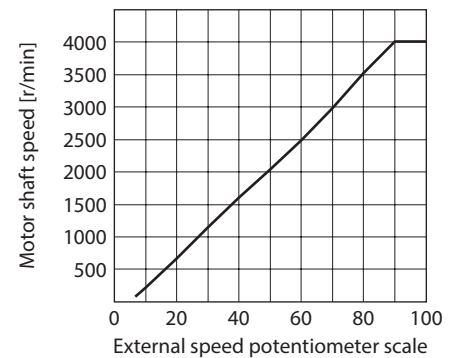Factory setting: 0 r/min
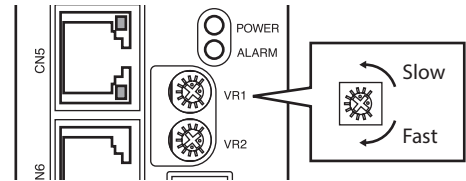
● Setting by external potentiometer (sold separately)

Connect the external potentiometer (sold separately) to the I/O
signal connector (CN4) of the driver.
If the M0 input is turned ON, the external potentiometer is enabled.
Turning the external potentiometer in the clockwise direction
increases the speed.

External potentiometer vs. speed
characteristics (representative values)

CN4

11 VL input
12 VM input
13 VH input

This figure is the CN4 connector
viewed from the driver front side.

Note When using the external potentiometer, turn the basic function switch (SW1-No.2) OFF.
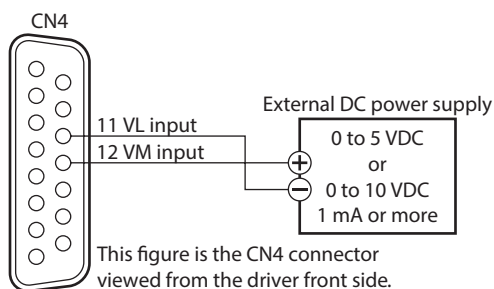
● Setting by external DC voltage

The speed can be set using 0 to 5 VDC or 0 to 10 VDC of external
DC voltage.
Select the basic function switch (SW1-No.2) to set which voltage
to be used. 0 to 5 VDC is set when the switch is set to the OFF
position, and 0 to 10 VDC is set when set to the ON position.
Factory setting: 5 VDC (OFF)

For the external voltage, use a DC power supply (0 to 5 VDC or 0
to 10 VDC) with reinforced insulation on both the primary side
and secondary side, and connect it to the I/O signal connector
(CN4).

Basic function switch
SW1-No.2
ON: 0 to 10 VDC
OFF: 0 to 5 VDC
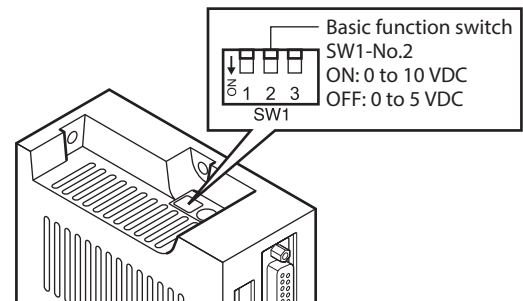
The input impedance between the VM input and VL input is
approximately 14 kΩ when the basic function switch (SW1-No.2) is
ON, and approximately 47 kΩ when OFF. The VL input is connected
to IN-COM inside the driver.

CN4

11 VL input
12 VM input

External DC power supply

0 to 5 VDC
or
0 to 10 VDC
1 mA or more

This figure is the CN4 connector
viewed from the driver front side.

External DC voltage vs. speed characteristics
(representative values)
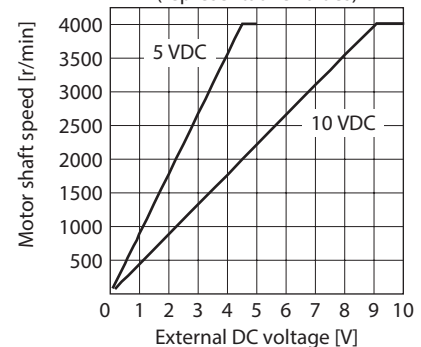
Note Be sure to use the external DC voltage at 5 VDC or less or 10 VDC or less. When connecting the external DC
power supply, make sure the polarities are correct. If the polarities are reversed, the driver may be damaged.

■ Operation and stop of motor

Inputting signals to control operation can start and stop the motor.

● Operation

When the FWD input is turned ON, the motor rotates in the clockwise direction according to the time set with the acceleration/deceleration time potentiometer. The motor stops when the signal is turned OFF.
When the REV input is turned ON, the motor rotates in the counterclockwise direction according to the time set with the acceleration/deceleration time potentiometer. The motor stops when the signal is turned OFF.
If the FWD input and REV input are turned ON simultaneously, the motor stops instantaneously.
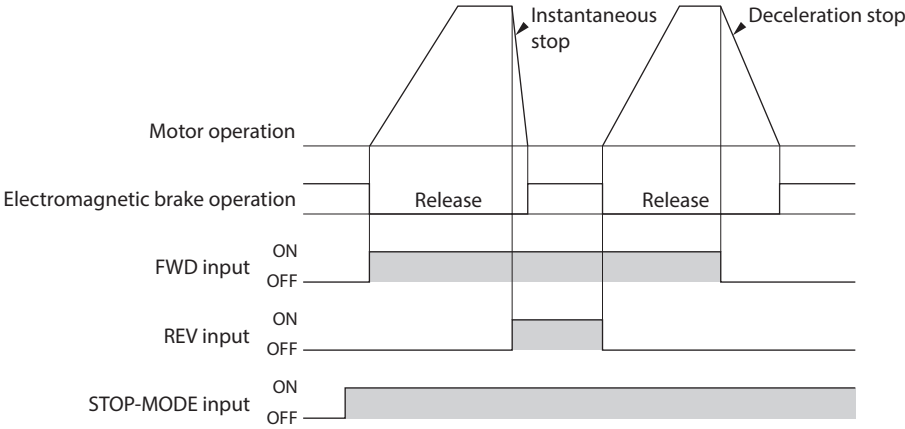
Note If the motor is used in vertical drive such as elevating equipment, operating based on the following settings may cause the shaft to reverse momentarily at starting or stopping depending on the load conditions (approximately one-fourth revolutions at the motor output shaft)
· When the set rotation speed is low
· When the acceleration time and deceleration time is long

● Stop

Select how the motor should stop when the FWD input or REV input is turned OFF.
When the STOP-MODE input is ON, the motor stops according to the time set with the acceleration/deceleration time potentiometer.
When the STOP-MODE input is OFF, the motor stops instantaneously.

FWD input	REV input	STOP-MODE input	Motor status
ON	OFF	–	Clockwise rotation
OFF	ON	–	Counterclockwise rotation
ON	ON	–	Instantaneous stop
–	–	OFF	Instantaneous stop
–	–	ON	Deceleration stop

Note When the electromagnetic brake type motor is used in vertical drive such as elevating equipment, be sure to turn the STOP-MODE input ON before stopping the motor. Stopping the motor while the STOP-MODE input remains OFF may cause the moving part to fall.
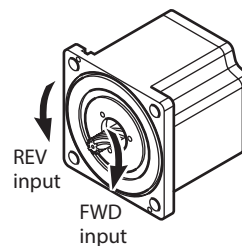
■ Rotation direction of the motor output shaft

The rotation direction of the motor output shaft represents the direction when viewed from the motor output shaft. The rotation direction of the motor can be changed using the "Motor rotation direction selection" parameter of the **MEXE02** or **OPX-2A**.
"Motor rotation direction selection" parameter ⇒ p.57

● Combination type-parallel shaft gearhead

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

| Gear ratio	Rotation direction of the gearhead output shaft
5, 10, 15, 20, 100, 200	Same as the motor output shaft
30, 50	Opposite to the motor output shaft

REV input

FWD input

● Combination type-hollow shaft flat gearhead

For all gear ratios, the output shaft of the gearhead rotates in the opposite direction to that of the motor.
The direction is different depending on whether the pre-assembled motor/gearhead is viewed from the front side or rear side.

● Viewed from Front　　● Viewed from Rear

FWD input　REV input　　REV input　FWD input
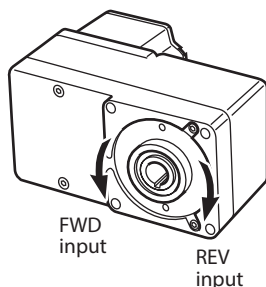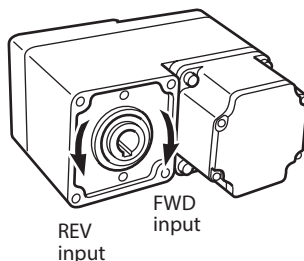
8.3　Setting the acceleration time and deceleration time

The acceleration time and deceleration time when starting and stopping the motor can be set. The acceleration time and deceleration time are effective for all speed setting devices. The acceleration time and deceleration time are the same value. They cannot be set individually.
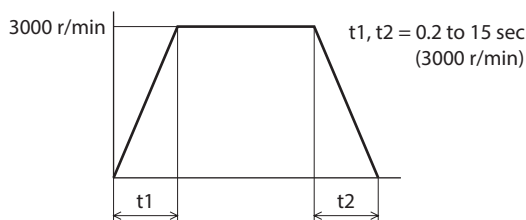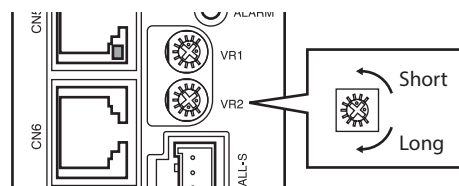The acceleration time and deceleration time can be set using the acceleration/deceleration time potentiometer (VR2). Turning the potentiometer clockwise increases the time.
The acceleration time refers to the time needed for the motor to reach the rated speed (3000 r/min) from the standstill state.
The deceleration time refers to the time needed for the motor to stop from the rated speed (3000 r/min).

Setting range: 0.2 to 15 seconds
Factory setting: 0.2 seconds

The actual acceleration time and deceleration time vary depending on the conditions of use, load inertia, load torque, etc.
If smooth acceleration operation or deceleration operation cannot be performed, increase the acceleration time and deceleration time.

8.4 Speed response selection

Select the motor response in reaction to the command speed using the basic function switch (SW1-No.1).
Setting to the high response mode (ON) can achieve quick motor response.
Setting to the regenerative power suppression mode (OFF) can slow the motor response and suppress the occurrence of the regenerative power.

Setting range: OFF (Regenerative power suppression mode)
　　　　　　　　ON (High response mode)
Factory setting: OFF (Regenerative power suppression mode)
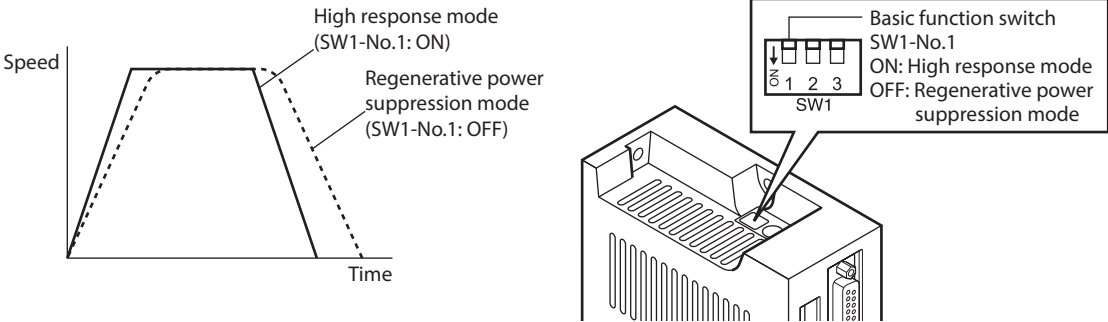
| Note	• Turn on the main power supply again after switching the basic function switch (SW1-No.1). If the control power supply is connected, also turn on the control power supply again.
	• When using the electromagnetic brake type motor in vertical drive such as elevating equipment, set the basic function switch to the high response mode (ON).

8.5 Two-speed operation

Operation can be performed at two speeds through use of both the internal potentiometer and external potentiometer (external DC voltage).
When the M0 input is ON, the motor rotates at the speed set with the external potentiometer or external DC voltage.
When the M0 input is OFF, the motor rotates at the speed set with the internal potentiometer.
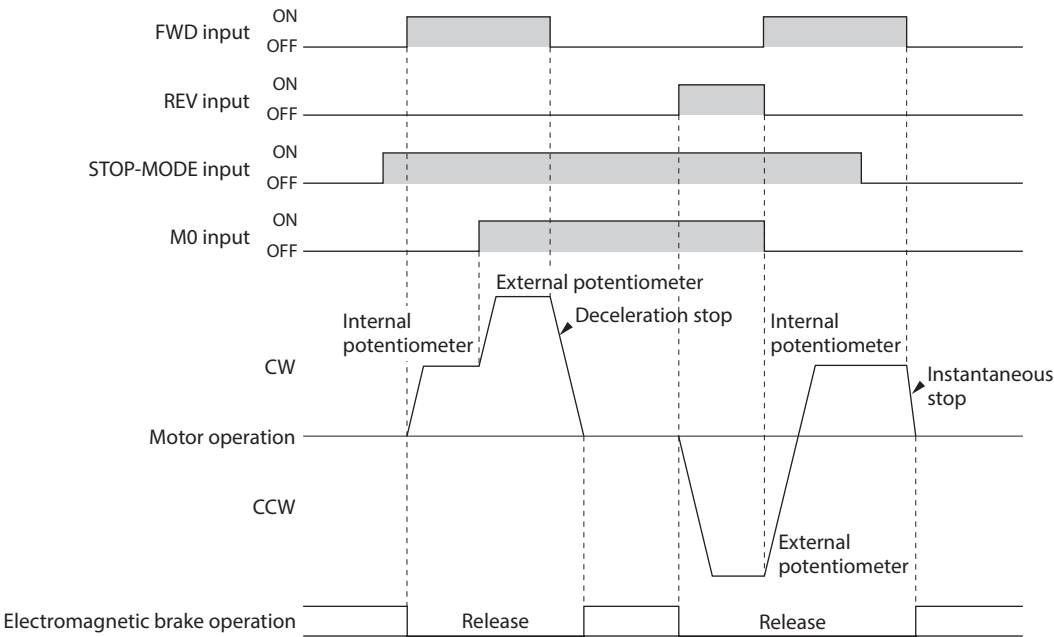
8.6　Examples of operation patterns

The charts below are examples of setting the internal potentiometer to 3000 r/min and the external potentiometer to 1000 r/min and switching the speed between these two levels.
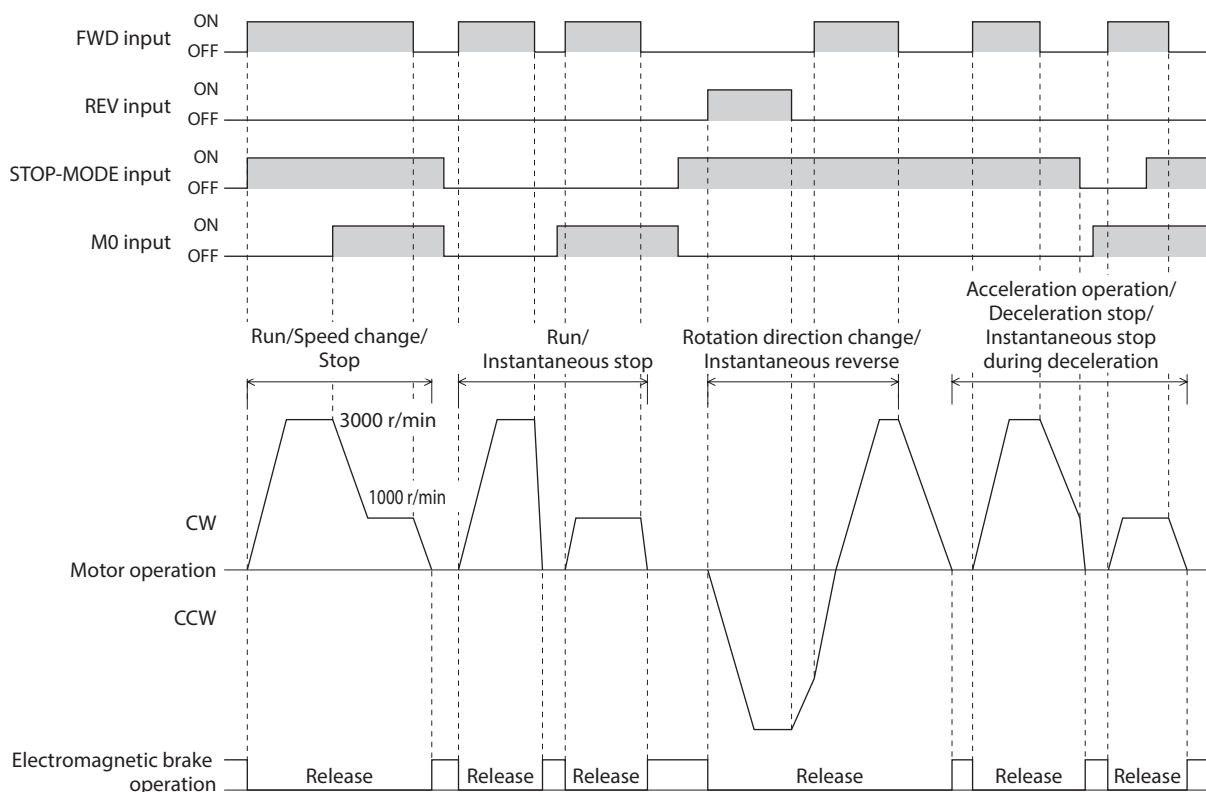
| Note | • To surely recognize the input signal, ensure the ON time and OFF time of each input signal for at least 10 ms.
• When switching between the FWD input and the REV input, provide an interval of at least 10 ms. |

If the FWD input and the REV input are turned ON at the same time, the motor stops instantaneously regardless of the status of the STOP-MODE input.
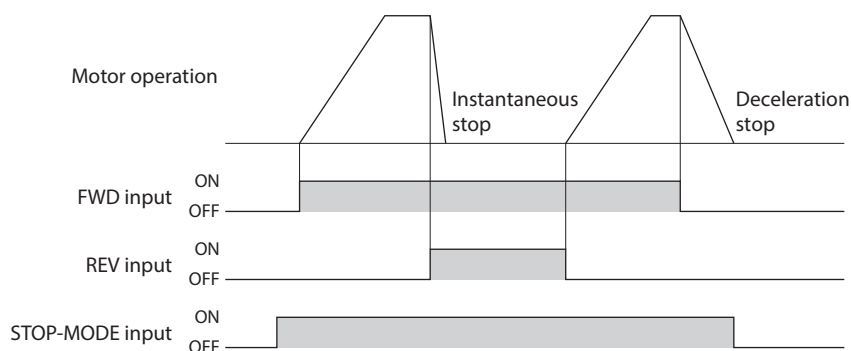
8.7　Torque limiting function

The torque limiting value of the motor is set using the torque limiting potentiometer (VR3). A desired torque limiting value can be set as a percentage (%) of the motor rated torque of 100%.
When performing the torque limiting operation continuously such as push-motion operation or winding-control operation, set the torque limiting value at 100% or less.

Setting range: 0 to 200%
Factory setting: 200%
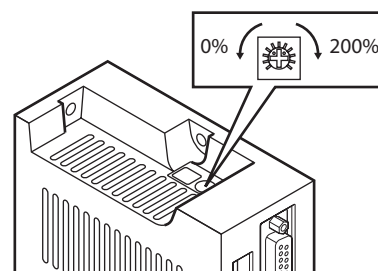
8.8   Sink logic/Source logic selection

With the basic function switch (SW1-No.3), the input circuit of the driver can be switched between sink logic and source logic.
The output circuit of the driver can be switched between sink logic and source logic by changing the wiring connection.

In the sink logic input circuit, a signal will be turned ON when the current flows out of the input terminal.
In the source logic input circuit, a signal will be turned ON when the current flows into the input terminal.
This switch is set to sink logic (OFF) at the time of shipment.
Set to sink logic or source logic based on the output circuit of the external control device (programmable controller).

Basic function switch
SW1-No.3
ON: Source logic
OFF: Sink logic
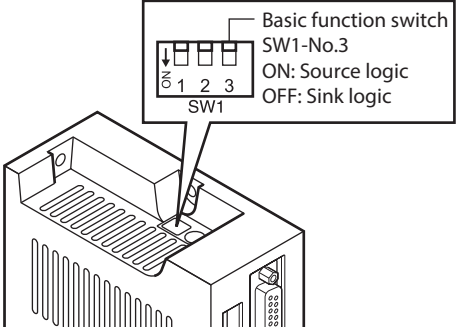
■ Example of connection with I/O signal circuit

● **Sink logic circuit**
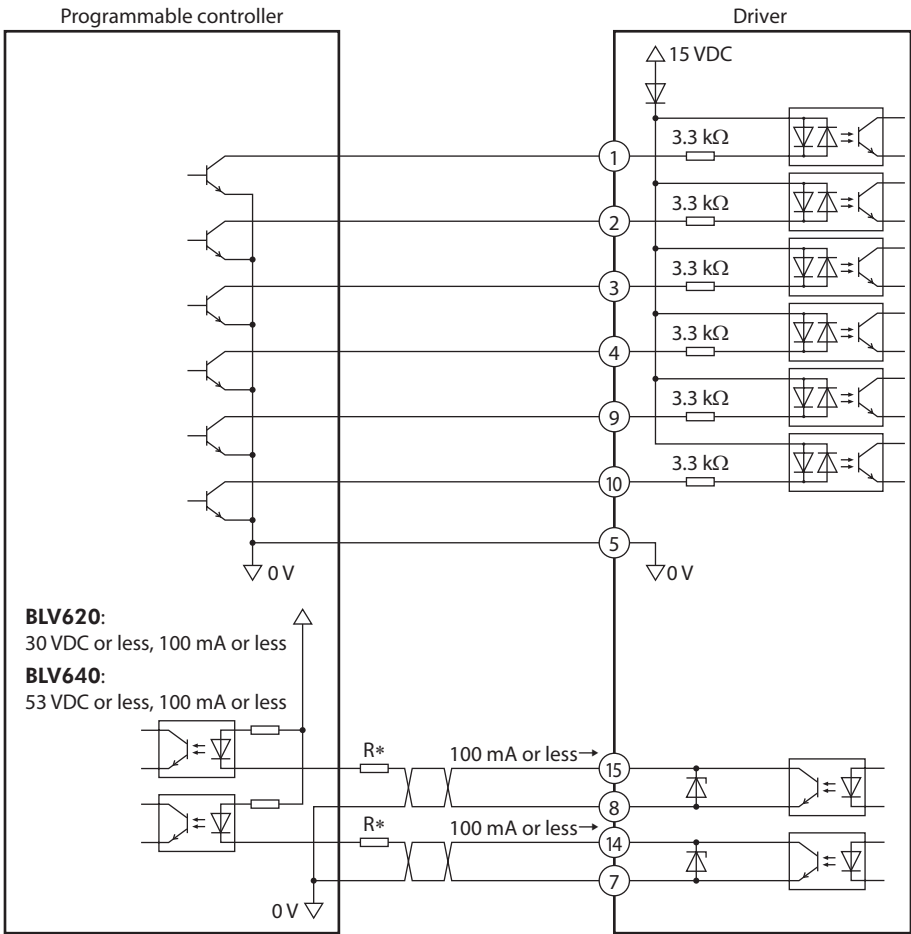
∗   Be sure to suppress the current value to 100 mA or less. Connect a current-limiting resistor if the current exceeds this specified value.

● **Source logic circuit**
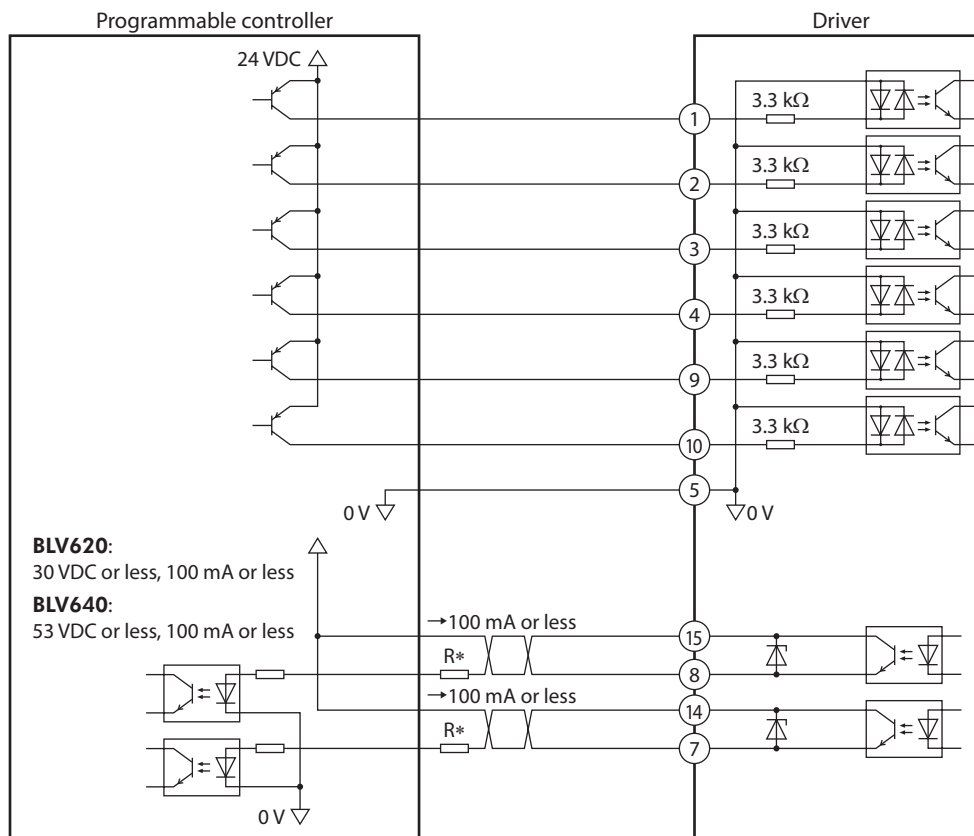
Programmable controller   Driver

24 VDC

3.3 kΩ — 1
3.3 kΩ — 2
3.3 kΩ — 3
3.3 kΩ — 4
3.3 kΩ — 9
3.3 kΩ — 10

0 V   5   0 V

BLV620:
30 VDC or less, 100 mA or less

BLV640:
53 VDC or less, 100 mA or less

→100 mA or less   15
R∗   8
→100 mA or less   14
R∗   7

0 V

∗ Be sure to suppress the current value to 100 mA or less. Connect a current-limiting resistor if the current exceeds this specified value.

8.9 Multi-motor control

To operate two or more motors at the same speed using a single external potentiometer (external DC voltage) is called multi-motor control.
Multi-motor control is achieved by allowing multiple drivers to share the power line and speed setting line.
- To perform multi-motor control using the external potentiometer, set the basic function switch (SW1-No.2) to OFF.
- Set the basic function switch (SW1-No.2) to the same setting for all drivers.

■ Using an external potentiometer

Connect the drivers as shown below.
When performing multi-motor control using the external potentiometer, the number of drivers should not exceed 20 units.
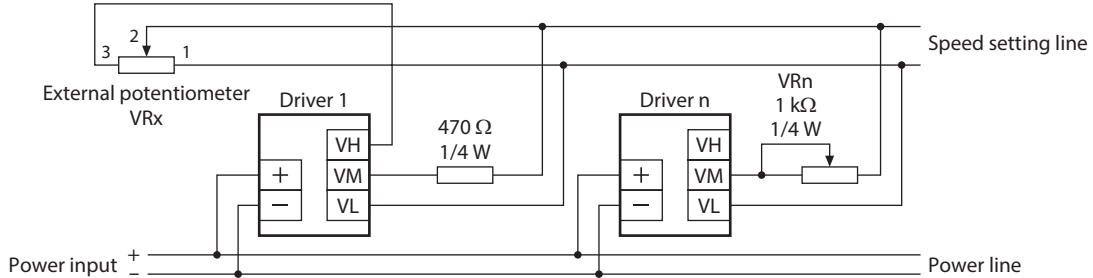
Resistance (VRx) when the number of drivers is n:

Resistance (VRx) = 20/n (kΩ), n/4 (W)

Example: If two drivers are used

Resistance (VRx) = 20/2 (kΩ), 2/4 (W), resistance (VRx) is calculated as 10 kΩ, 1/2 W.
(Use a resistor of the calculated wattage or more.)
If the speed will vary among the respective motors, make adjustments by connecting a resistor of 470 Ω, 1/4 W to the VM terminal on driver 1 and connecting a variable resistor VRn of 1 kΩ, 1/4 W to driver 2 and subsequent drivers.

■ Using external DC voltage

Connect the drivers as shown below.
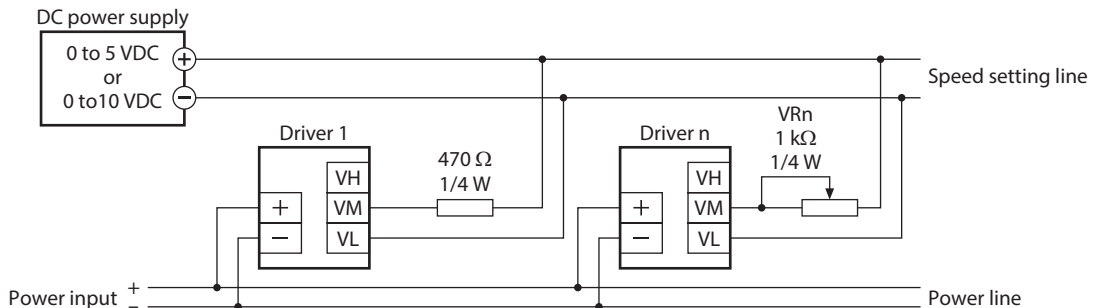
Calculation method of current capacity (I) of external DC power supply when the number of drivers is n:

Current capacity (I) = 1 × n (mA)

Example: If two drivers are used

Current capacity (I) = 1 × 2 (mA), current capacity (I) is calculated as 2 mA or more.
If the speed will vary among the respective motors, make adjustments by connecting a resistor of 470 Ω, 1/4 W to the VM terminal on driver 1 and connecting a variable resistor VRn of 1 kΩ, 1/4 W to driver 2 and subsequent drivers.

9 Extended function

Using the support software **MEXE02**, the data setter **OPX-2A** (sold separately), or RS-485 communication can extend the specifications and functions, achieving various operations.
Refer to the **OPX-2A** OPERATING MANUAL for details of setting contents and operations using the **OPX-2A**.
Refer to the USER MANUAL (RS-485 Communication Mode) for details of setting contents and operations using RS-485 communication.

9.1 Extended items

■ Operation data

Item	Standard specifications	Extended specifications
Speed setting range	0, 100 to 4000 r/min	0, 80 to 4000 r/min
Speed setting method	Internal potentiometer (VR1) External potentiometer, external DC voltage	Digital setting (Set digitally in 1 r/min increments)
Acceleration time	The time needed for the motor to reach the rated rotation speed (3000 r/min) from the standstill state	The time to reach the target speed from the present speed (Only when the acceleration time and deceleration time is set digitally)
Deceleration time	The time needed for the motor to stop from the rated speed (3000 r/min)	
Torque limiting setting method	Torque limiting potentiometer (VR3)	Digital setting (Set digitally in 1% increments)

● Up to eight operation data can be set by the extended function.

■ Function

Function	Description	Ref.
Various displays	● Rotation speed ● Transfer speed ● I/O signals status ● Load factor ● Alarm code ● Warning code ● Operation data number ● Waveform monitor (**MEXE02** only)	How to use **MEXE02** ⇒ p.41
Test function	● I/O test ● Test operation	
Various functions	● Speed reduction ratio ● Speed increasing ratio ● Conveyor speed reduction ratio ● Conveyor speed increasing ratio ● Rotation speed attainment band ● Motor rotation direction selection ● Operation input mode selection	Setting contents of **MEXE02** ⇒ p.53
Change of I/O signal assignments	I/O signal assignments can be changed.	
Alarm setting	● Enable/disable of alarm ● Action when an alarm is generated	
Warning setting	● Enable/disable of warning ● Generation level of warning	
Digital/Analog input switching	The functions assigned to the potentiometers of the driver can be changed, and also the setting method of the operation data can be switched between analog setting and digital setting (p.61).	

10   How to use MEXE02

The **MEXE02** is a software program that lets you set data required for motor operation from a PC.
Refer to the operating manual of the **MEXE02** for how to use such as data editing method and others.

10.1   Starting MEXE02

1. Connect a driver with a PC in which the **MEXE02** has been installed.
2. Set the communication port.
3. Select the product.

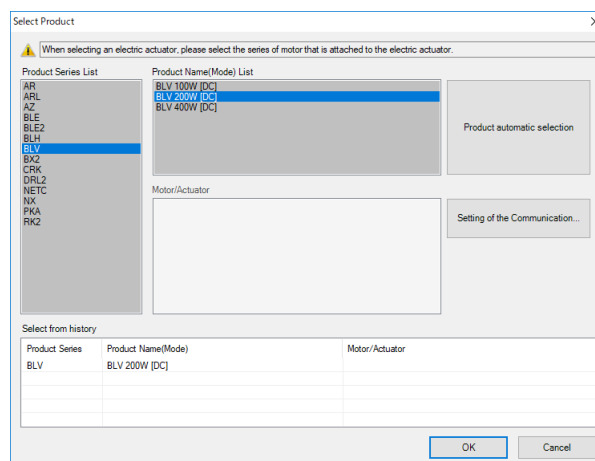   Select the following.
    Product Series List: **BLV**
    Product Name (Mode) List: **BLV 200W [DC]**
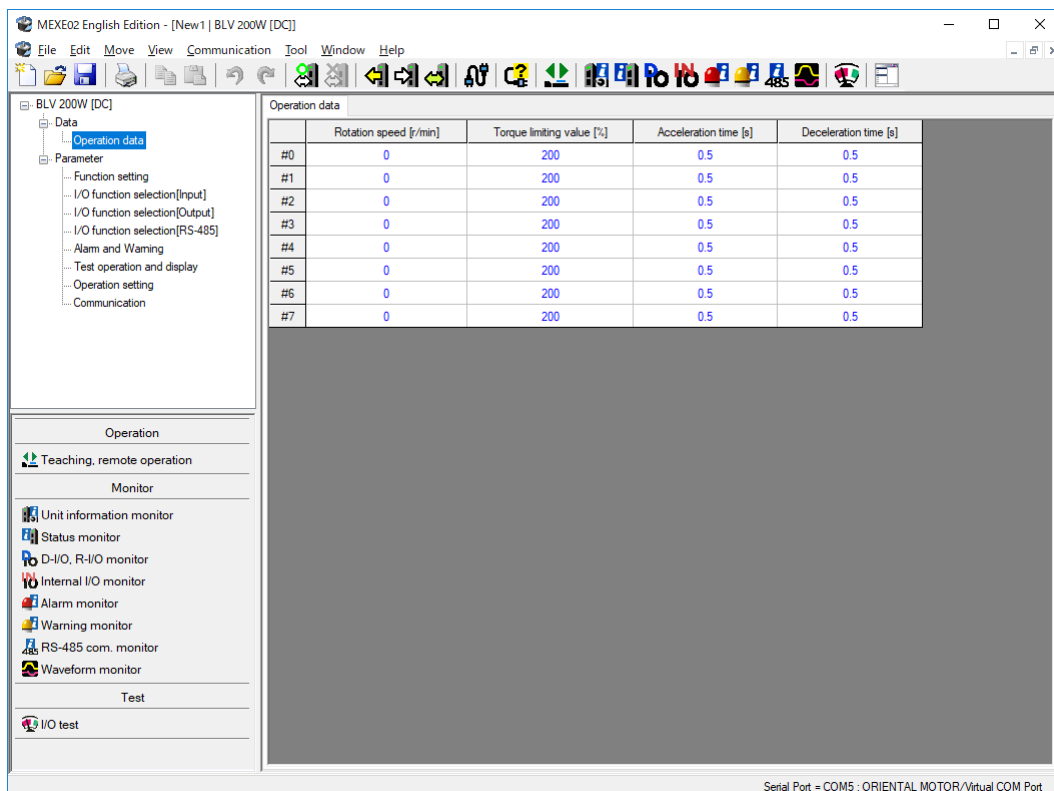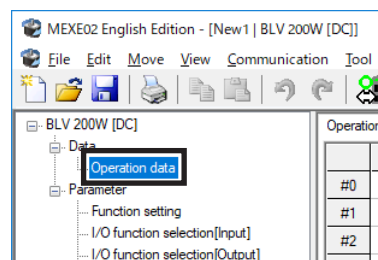   or
                                        BLV 400W [DC]

> **Note**   If a different product from the product used is selected, the data cannot be written or read, and an error message is shown.

10.2   Setting the operation data

Click "Operation data" in TreeView.
The operation data edit window appears.

■ Data entry

The background color of a cell is initially white. When the value in the cell is changed, the color of the cell changes to yellow.
The color of characters in the cell is initially blue. When the value in the cell is changed, the color of characters changes to black.

- **Entering a numeric value**

  Click a desired cell, and enter a value using the keyboard.

- **Selecting a value from a pull-down menu**

  Double-clicking a desired cell displays a pull-down menu. Select a desired value from the pull-down menu.
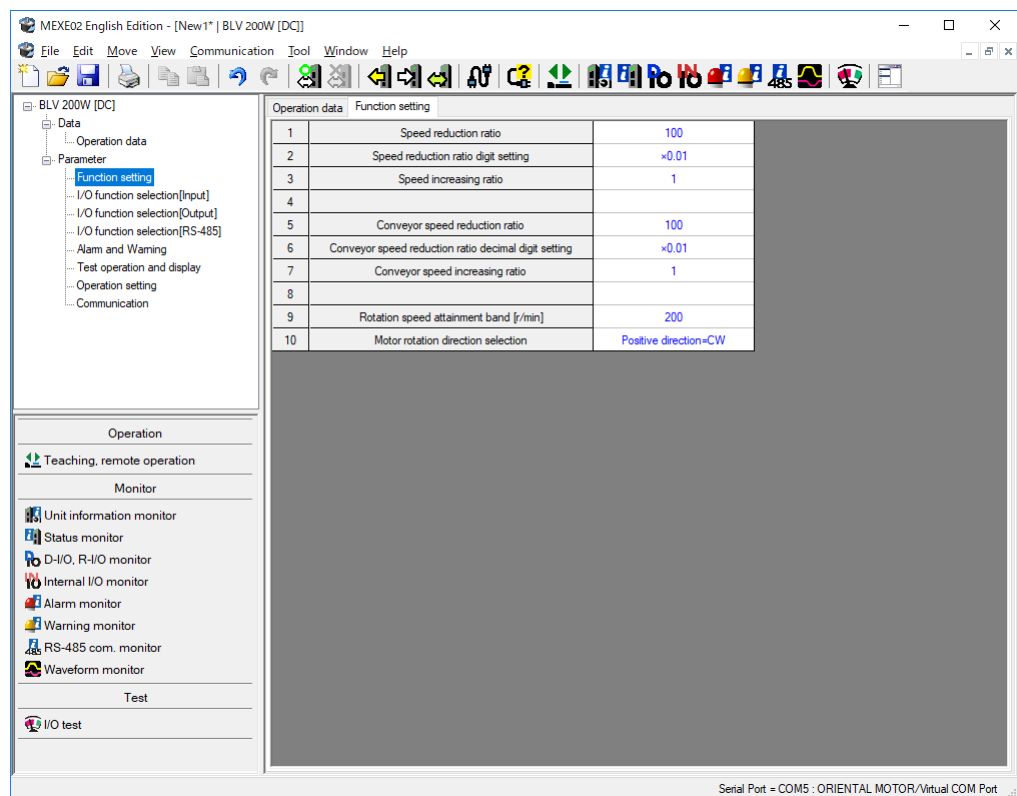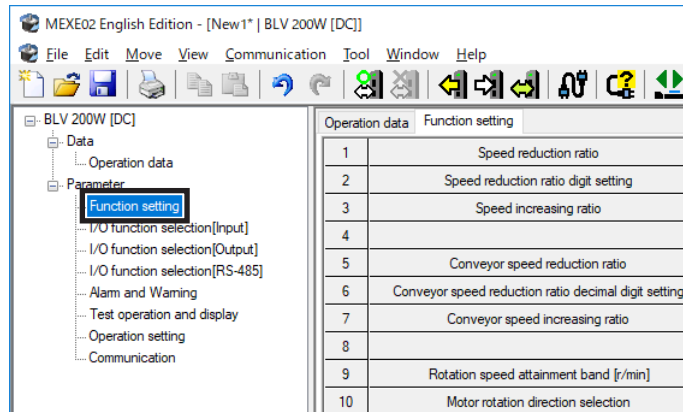

memo   Moving a cursor over a cell to be input the data can check the description, the setting range, and the update timing.

10.3 Setting of parameters

1. Click the parameter group to be edited in TreeView.
   The parameter edit window appears.

2. Write the data to the driver after editing.
   Click "Data writing" in the toolbar.

10.4 Monitor

■ Unit information monitor

The unit information monitor is provided in the **MEXE02**.
Using this monitor function can check the product information such as the number of times and the elapsed time that the main power supply is turned on and the setting status of the driver switches (SW1, SW2, SW3). The set values of parameters related to operation and communication can also be checked.

1. Start "Unit information monitor."
2. Click "Start the Unit information monitor."
   The unit information monitor starts.

The switch setting status is shown as follows.
   ON (green)
   OFF (white)
   Switches not possible to monitor (gray)

3. To exit the unit information monitor, unselect "Start the Unit information monitor."

● How to view the unit information monitor window

The status when the unit information monitor is started is displayed.

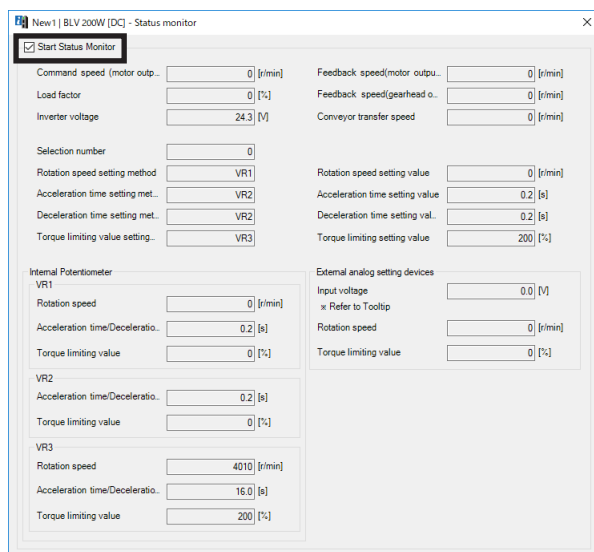| Area	Item	Description
① Product information area	Ver.	Monitors the software version used.
	Main power supply count	Monitors the number of times that the main power supply of the driver is turned on.
	Main power supply time	Monitors the integrated value of the main power supply time of the driver.
② Driver setting value area	Speed response selection *1	Monitors the speed response mode presently set.
	Motor rotation direction selection *2	Monitors the setting of the "Motor rotation direction selection" parameter presently set.
	Operation input mode selection *2	Monitors the setting of the "Operation input mode selection" parameter presently set.
③ Switch setting area	Basic setting (SW1)	Monitors the ON-OFF status of the basic function switch (SW1).
	Communication setting (SW2)	Monitors the ON-OFF status of the communication function switch (SW2).
	Address number setting (SW3)	Monitors the setting status of the address number setting switch (SW3).
④ Communication setting area *1	Protocol	Monitors the communication protocol presently set.
	Address number	Monitors the address number presently set.
	Transmission rate	Monitors the transmission rate presently set.
	Communication parity	Monitors the communication parity (for Modbus) presently set.
	Communication stop bit	Monitors the communication stop bit (for Modbus) presently set.
	Transmission waiting time	Monitors the transmission waiting time (for Modbus) presently set.

*1 To update the setting having changed to the driver, it is required to turn on the power supply again.
*2 To update the setting having changed to the driver, it is required to execute Configuration or to turn on the power supply again.

■ **Status monitor**

The present motor status such as the motor feedback speed or load factor, the setting method of operation data, and the present status of the setting value can be checked with the monitor.

1. Start the "Status monitor."
2. Click "Start Status Monitor."
   Status monitor starts.

3. To exit the status monitor, unselect "Start Status Monitor."

● **How to view the status monitor window**

Item	Description
Command speed (motor output shaft)	Monitors the command speed of the motor.
Load factor	Monitors the motor output torque as a load factor (The load factor is a value when the rated torque is being 100%).
Inverter voltage	Monitors the present voltage value inside the driver.
Feedback speed (motor output shaft)	Monitors the feedback speed of the motor.
Feedback speed (gearhead output shaft)	Monitors the feedback speed converted by the set speed reduction ratio.
Conveyor transfer speed	Monitors the conveyor transfer speed.
Selection number	Monitors the operation data number presently selected.
Rotation speed setting method	Monitors the setting method of the rotation speed presently set.
Acceleration time setting method	Monitors the setting method of the acceleration time presently set.
Deceleration time setting method	Monitors the setting method of the deceleration time presently set.
Torque limiting value setting method	Monitors the setting method of the torque limiting value presently set.
Rotation speed setting value	Monitors the rotation speed presently set.
Acceleration time setting value	Monitors the acceleration time presently set.
Deceleration time setting value	Monitors the deceleration time presently set.
Torque limiting setting value	Monitors the torque limiting value presently set.
Rotation speed	Monitors the value obtained by converting the setting values of the internal potentiometer (VR1, VR2, VR3) and the external analog setting device to the rotation speed, acceleration time/deceleration time, and torque limiting value.
Acceleration time/Deceleration time	
Torque limiting value	
Input voltage∗	Monitors the voltage of the external analog setting device presently input.

∗ If the basic function switch (SW1-No.2) is set to ON (0 to 10 VDC), half the voltage is monitored.

■ D-I/O, R-I/O monitor

D-I/O represents direct I/O and R-I/O represents remote I/O.

1. Start the D-I/O, R-I/O monitor.

2. Click "Start the D-I/O, R-I/O monitor."
   The D-I/O, R-I/O monitor starts.
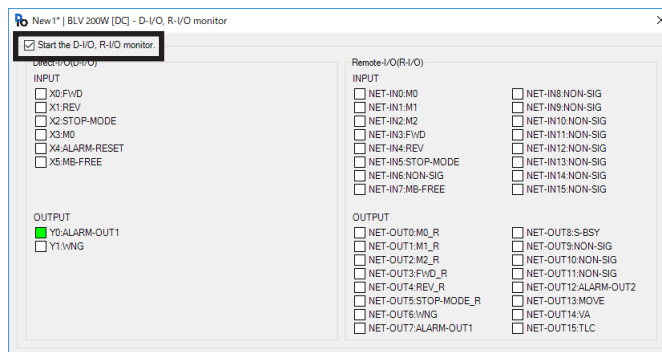
The ON-OFF status of D-I/O is indicated as follows.

Indication	Energized state
ON (green)	Conductive state
OFF (white)	Non-conductive state

The ON-OFF status of R-I/O is indicated as follows.

Indication	Communication data
ON (green)	1
OFF (white)	0

3. To exit the D-I/O, R-I/O monitor, unselect "Start the D-I/O, R-I/O monitor."

● **How to view the D-I/O, R-I/O monitor window**

| Monitored items	Description
INPUT	Monitors the assigned input signals and each ON-OFF status.
OUTPUT∗	Monitors the assigned output signals and each ON-OFF status.

∗ The Y2 (SPEED-OUT) output signal cannot be monitored.

■ Internal I/O monitor

All I/O signals of the driver and the hall sensor signal detected in the driver can be monitored.
Signals that are not assigned to I/O can also be checked. The SPEED-OUT output signal cannot be monitored.

1. Start the "Internal I/O monitor."

2. Click "Start the Internal I/O monitor."
   The internal I/O monitor starts.
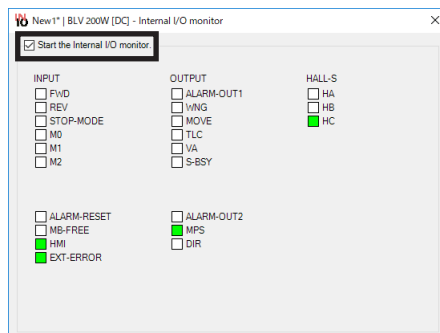
The ON-OFF status of the I/O signals is shown as follows.

Indication	Internal signal status
ON (green)	Active state
OFF (white)	Non-active state

3. To exit the internal I/O monitor, unselect "Start the Internal I/O monitor."

■ **Alarm monitor**

Checking the alarm history of the driver, resetting the alarms, and clearing the alarm history can be performed.
Up to 10 generated alarms in order of the latest to oldest can be checked.

1. Start the "Alarm monitor."

2. Click "Start the alarm monitor."
   The alarm monitor starts.

Items that can be checked in the alarm history

Item	Description
Code (Hex)	This is a code to represent the content of the generated alarm.
Alarm message	This is the content of the generated alarm.

3. To exit the alarm monitor, unselect "Start the alarm monitor."

■ **Warning monitor**

The warning generated condition and history of the driver can be checked.

1. Start the "Warning monitor."

2. Click "Start the warning monitor."
   The warning monitor starts.

3. To exit the warning monitor, unselect "Start the warning monitor."

■ RS-485 communication monitor

The received data and generated error via RS-485 communication can be checked.

1. Start the "RS-485 com. monitor."

2. Click "Start the RS-485 communication monitor."
   The RS-485 communication monitor starts.
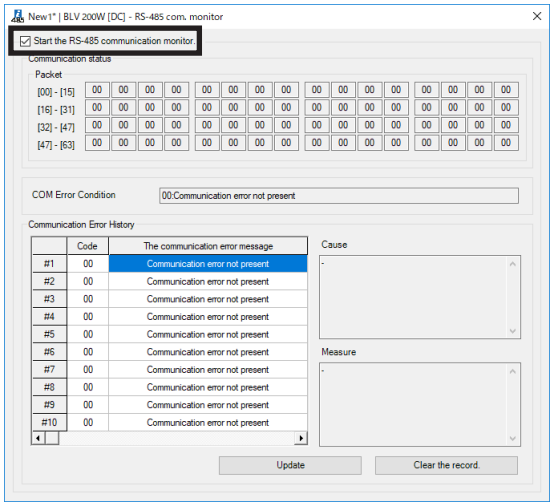
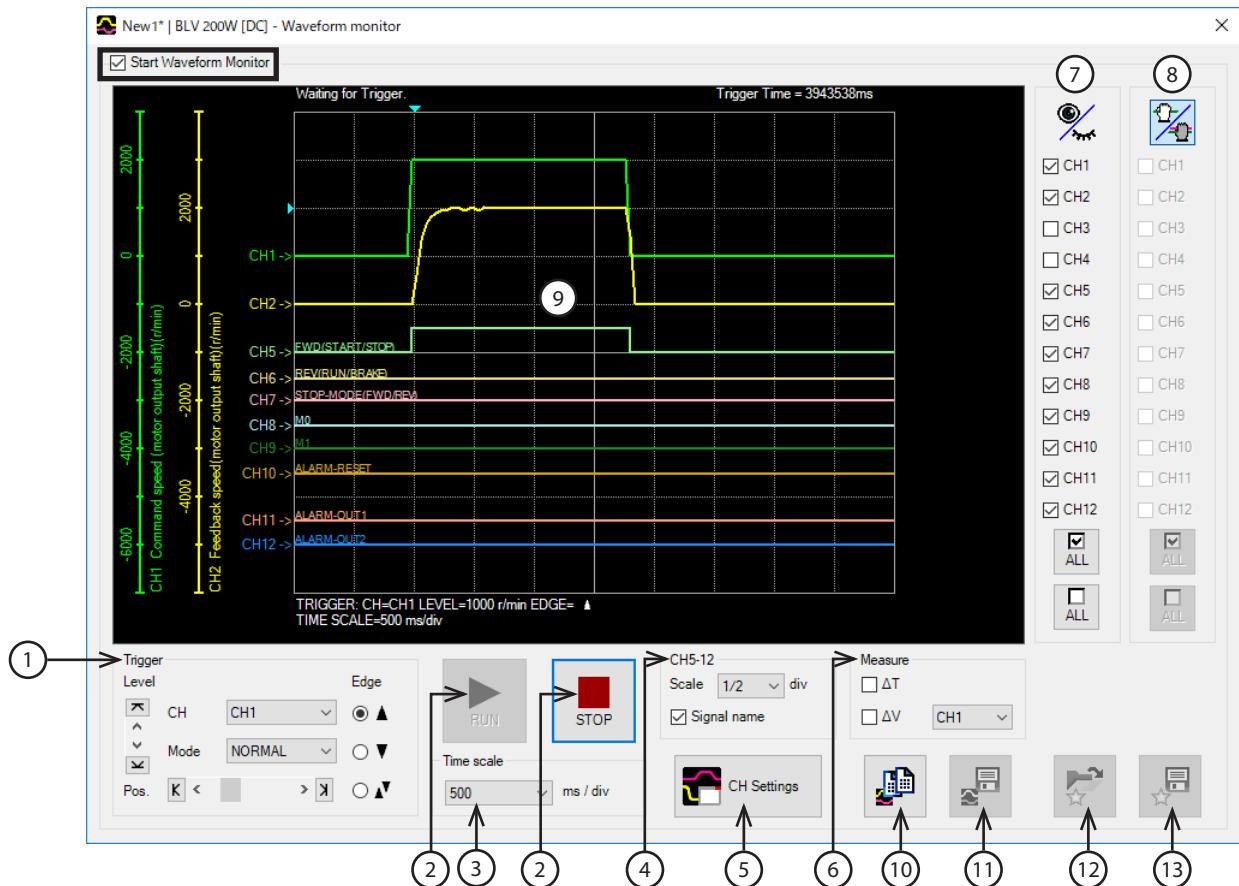3. To exit the RS-485 communication monitor, unselect "Start the RS-485 communication monitor."

■ **Waveform monitor**

The motor rotation speed or the status of I/O signals can be checked in a waveform format.

1. Start the "Waveform monitor."
2. Click "Start Waveform Monitor."
   The buttons on the window are enabled, allowing you to prepare for measurement of the waveform monitor.

1	Sets the Pos (trigger position), Level, CH, Mode, and Edge (detection condition) that are used when a waveform is measured. For "CH," only those CHs displayed on ⑨ can be used.
2	RUN: This button is used to start measurement. STOP: This button is used to stop measurement.
3	Sets the measurement time range (width).
4	Sets the display method for CH5 to CH12. Scale: Selects the display size from 1/1 (100%), 1/2 (50%), or 1/4 (25%). Signal name: Shows or hides the signal name.
5	Shows the CH setting window.
6	Shows or hides measures for measurement. Also, selects the CH to be measured.
7	Shows or hides each CH.
8	When the display position of the waveform drawn on the window is moved, the CH items selected here can be moved all together.
9	Measurement results are drawn in this area.
10	Copies the waveform presently shown to the clipboard.
11	Saves the waveform presently shown to an external file.
12	Reads the setting for measurement from "Favorites."
13	The setting for measurement can be saved as "Favorites."

3. Click the "CH Settings."
   The CH setting window is shown. Set the measurement condition for each CH.

1	Moves the display position of the waveform up and down.
2	Inverts the display of measured signal.

3	Selects the signal to be measured.
	The CH1 to CH4 are items for the command speed, load factor, or others. The following types are available.
	  Command speed (motor output shaft), feedback speed (motor output shaft), inverter voltage, load factor, selection number
	The CH5 to CH12 are items for I/O signals. The following types are available.
	  ALARM-OUT1, ALARM-OUT2, ALARM-RESET, DIR, EXT-ERROR, FWD(START/STOP), HMI, M0, M1, M2, MB-FREE, MOVE, MPS, NET-IN0 to NET-IN15, NET-OUT0 to NET-OUT15, REV(RUN/BRAKE), STOP-MODE(FWD/REV), S-BSY, TLC, VA, WNG, X0 to X5, Y0, Y1

4	Selects a display scale for signals (CH1 to CH4 only). Using this in combination with ⑤ can zoom in on signals.
5	Adds the set offset value to the signal display (CH1 to CH4 only). Using this in combination with ④ can zoom in on signals.

4. Click "RUN."
   Waveform measurement starts.

5. During measurement, click "STOP" to exit the waveform measurement.
   If "SINGLE" is selected for Mode in Trigger, measurement automatically ends when the waveform drawing ends.

6. To end the waveform measurement, unselect "Start Waveform Monitor."

10.5 Test operation

■ Teaching/remote operation

A motor can be operated using the **MEXE02**. The motor operation can be checked before connecting to a programmable controller.
Also, the teaching function of the operation data can be performed.

Note
- Teaching/remote operation and I/O test cannot be executed at the same time.
- While teaching/remote operation is performed, the motor is operated based on the data set in the teaching data.
  If the motor is used in a state where the motor output torque is limited, check the setting of the teaching data before performing teaching/remote operation.

1. Start the "Teaching, remote operation."
2. Click "Start the teaching remote operation."
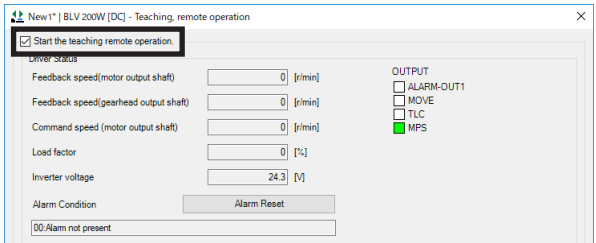
3. Click "Yes."
    Teaching/remote operation is enabled.

    Teaching/remote operation requires synchronization of the data under editing and the data of an applicable product. When the data is not synchronized, the following window appears. Select a synchronization method, and click "OK."

Note When the above window appears, all the communications in progress will be OFF.
All the other monitors in progress in other windows are also stopped. Resume monitor after synchronization is completed.

4. Execute teaching/remote operation using buttons in the window.
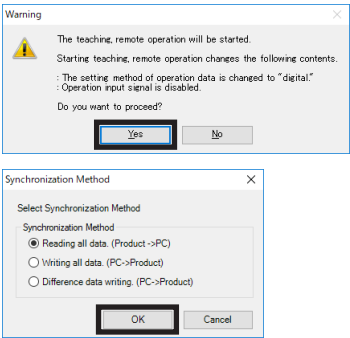
1	This is used to select the operation data number.
2	The motor rotates in the reverse direction.
3	The motor rotates in the forward direction.
4	This button is used to decelerate the rotating motor to a stop.
5	This button is used to accelerate the motor rotation speed.
6	This button is used to decelerate the motor rotation speed.
7	This is used to set the changed value in the rotation speed when pressing 5 or 6 once.
8	This is the operation data to be changed with the teaching function. The value can be changed directly.
9	This is the operation data presently written in the driver.
10*	This is used to apply the data set with the teaching function as the digital setting value of the driver.
11	This button is used to stop the rotating motor instantaneously.
12	This is used to operate whether to release or hold the electromagnetic brake at motor standstill. This is disabled while an alarm is present.

* When applying the data set with the teaching function as the digital setting value of the driver, execute while the motor is in a standstill state.

5. To exit the teaching/remote operation, unselect "Start the teaching remote operation."
    If "Start the teaching remote operation" is unselected while the motor rotates, the following window appears. Clicking "Yes" causes the motor to stop instantaneously.
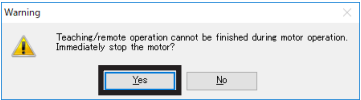
Note If the communication is disconnected while the motor rotates, the motor stops instantaneously.

■ I/O test

I/O signals can be tested.
Input signals can be monitored, and output signals can forcibly be turned ON or OFF to check the connection with a programmable controller.
Also, setting values of operation data converted from the input values from the internal potentiometer and external setting device are shown. Even if the motor is not rotated actually, the setting values (rotation speed, torque limiting value, acceleration time, deceleration time) over the input values can be checked.
Refer to the operating manual of the **MEXE02** for the operating method and others.

Note
- Output signals can forcibly be turned ON or OFF with I/O test. Therefore, other devices connected to the applicable product may operate. Before operation, check the condition of the surrounding area to ensure safety.
- Teaching/remote operation and I/O test cannot be executed at the same time.
- The Y2 (SPEED-OUT) output signal cannot be tested.

11 Setting contents of MEXE02

Functions of the product can be extended by setting the operation data and parameters using the **MEXE02**.

[MEXE02 Operation data setting window]
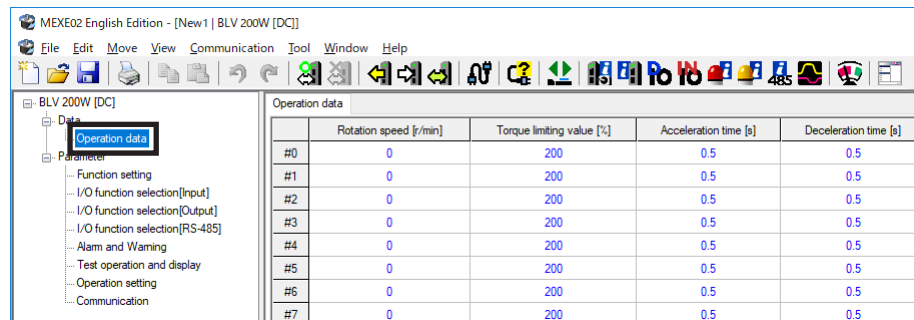
[MEXE02 Parameter setting window]
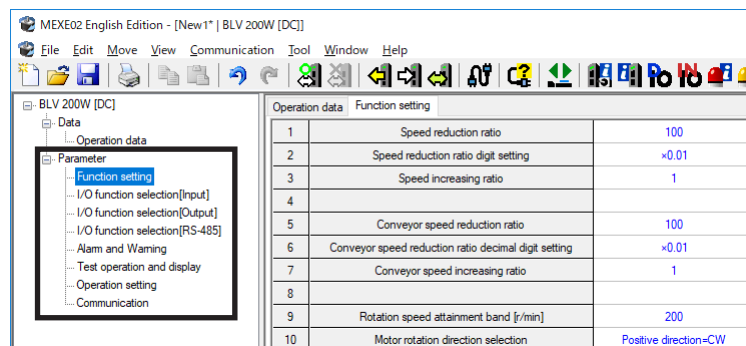
11.1 Timing to update data when the setting is changed

When parameters are written to the driver, they are saved in the non-volatile memory. The parameters saved in the non-volatile memory are stored even after the power supply is turned off. When a parameter is changed, the timing to update the changed value varies depending on the parameter. See the following four types.

- Update immediately ....Recalculation and setup are immediately executed when the parameter is written.
- Update after operation stop ....Recalculation and setup are executed when the operation is stopped.
- Update after executing configuration............Recalculation and setup are executed after configuration is executed. Configuration is executed using the **MEXE02** or communication.
- Update after turning on the power again.....Recalculation and setup are executed after the power is turned on again.

■ Notation rules

In this chapter, each update timing is represented in an alphabet.
A: Update immediately
B: Update after operation stop
C: Update after executing configuration or turning the power again
D: Update after turning on the power again

11.2 Parameter list

	Parameter name	Setting range	Factory setting	Update	Ref.
Operation data	Rotation speed	0, 80 to 4000 [r/min]	0	A	–
	Torque limiting value	0 to 200 [%]	200		
	Acceleration time	0.2 to 15.0 [s]	0.5		
	Deceleration time	0.2 to 15.0 [s]	0.5		
Function setting	Speed reduction ratio	100 to 9999	100	A	P.56
	Speed reduction ratio digit setting	×1, ×0.1, ×0.01	×0.01		
	Speed increasing ratio	1 to 5	1		
	Conveyor speed reduction ratio	100 to 9999	100		
	Conveyor speed reduction ratio decimal digit setting	×1, ×0.1, ×0.01	×0.01		
	Conveyor speed increasing ratio	1 to 5	1		
	Rotation speed attainment band	0 to 400 [r/min]	200		
	Motor rotation direction selection	Positive direction=CCW Positive direction=CW	Positive direction=CW	C	
I/O function selection	X0	Not used FWD (START/STOP)* REV (RUN/BRAKE)* STOP-MODE (FWD/REV)* MB-FREE, EXT-ERROR ALARM-RESET HMI, M0, M1, M2	FWD (START/STOP) *	B	
	X1		REV (RUN/BRAKE) *		
	X2		STOP-MODE (FWD/REV) *		
	X3		M0		
	X4		ALARM-RESET		
	X5		MB-FREE		
	Y0	Not used ALARM-OUT1, WNG, MOVE TLC, VA, ALARM-OUT2, DIR	ALARM-OUT1	A	
	Y1		WNG		
	NET-IN0 input function selection	Not used FWD (START/STOP)* REV (RUN/BRAKE)* STOP-MODE (FWD/REV)* MB-FREE, HMI, M0, M1, M2	M0	C	P.58
	NET-IN1 input function selection		M1		
	NET-IN2 input function selection		M2		
	NET-IN3 input function selection		FWD (START/STOP) *		
	NET-IN4 input function selection		REV (RUN/BRAKE) *		
	NET-IN5 input function selection		STOP-MODE (FWD/REV) *		
	NET-IN6 input function selection		Not used		
	NET-IN7 input function selection		MB-FREE		
	NET-IN8 input function selection		Not used		
	NET-IN9 input function selection		Not used		
	NET-IN10 input function selection		Not used		
	NET-IN11 input function selection		Not used		
	NET-IN12 input function selection		Not used		
	NET-IN13 input function selection		Not used		
	NET-IN14 input function selection		Not used		
	NET-IN15 input function selection		Not used		

* If the 3-wire mode is selected with the "Operation input mode selection" parameter, the signal in the parentheses ( ) will be applied.

Parameter name		Setting range	Factory setting	Update	Ref.
I/O function selection	NET-OUT0 output function selection	Not used FWD_R (START/STOP_R)∗ REV_R (RUN/BRAKE_R)∗ STOP-MODE_R (FWD/REV_R)∗ MB-FREE_R, HMI_R, M0_R, M1_R M2_R, ALARM-OUT1, WNG MOVE, TLC, VA, S-BSY ALARM-OUT2, MPS, DIR	M0_R	C	P.58
	NET-OUT1 output function selection		M1_R		
	NET-OUT2 output function selection		M2_R		
	NET-OUT3 output function selection		FWD_R (START/STOP_R)∗		
	NET-OUT4 output function selection		REV_R (RUN/BRAKE_R)∗		
	NET-OUT5 output function selection		STOP-MODE_R (FWD/REV_R)∗		
	NET-OUT6 output function selection		WNG		
	NET-OUT7 output function selection		ALARM-OUT1		
	NET-OUT8 output function selection		S-BSY		
	NET-OUT9 output function selection		Not used		
	NET-OUT10 output function selection		Not used		
	NET-OUT11 output function selection		Not used		
	NET-OUT12 output function selection		ALARM-OUT2		
	NET-OUT13 output function selection		MOVE		
	NET-OUT14 output function selection		VA		
	NET-OUT15 output function selection		TLC		
Alarm and warning	Undervoltage alarm latch	Disable, Enable	Disable	C	P.60
	Undervoltage warning level	0.0 to 48.0 [VDC]	24 VDC type: 21.6 48 VDC type: 43.2	A	
	Undervoltage warning function	Disable, Enable	Enable		
	Overload warning level	50 to 100 [%]	100		
	Overload warning function	Disable, Enable	Enable		
Test operation and display	JOG operation speed	0, 80 to 1000 [r/min]	300	A	P.60
	JOG operation torque	0 to 200 [%]	200		
	Data setter speed display	Signed, Absolute value	Signed		
	Data setter edit	Disable, Enable	Enable	D	
Operation setting	Data setter initial display	Operating speed, Conveyor transfer speed, Load factor, Operation data number, Top screen of monitor mode	Operating speed	D	P.60
	Analog input signal selection	Mode 0 to 5	Mode 0	C	
	Prevention of operation at power-on alarm	Disable, Enable	Disable		
	Electromagnetic brake action at alarm	Hold after coasting stop Hold immediately	Hold immediately		
	Operation input mode selection	2-Wire mode, 3-Wire mode	2-Wire mode		
Communication	Communication timeout	0 to 10000 [ms] (0: Not monitored)	0	A	P.62
	Communication error alarm	1 to 10 [times]	3		
	Communication parity	None, Even number, Odd number	Even number	D	
	Communication stop bit	1 bit, 2 bits	1 bit		
	Transmission waiting time	0.0 to 1000.0 [ms]	10.0		

∗ If the 3-wire mode is selected with the "Operation input mode selection" parameter, the signal in the parentheses ( ) will be applied.

11.3 Function setting

A: Update immediately, C: Update after executing configuration

Parameter name	Description	Setting range	Factory setting	Update
Speed reduction ratio	Sets the speed reduction ratio when the rotation speed of the gearhead output shaft is monitored. The speed reduction ratio is calculated by multiplying a value in the "Speed reduction ratio" parameter by that in the "Speed reduction ratio digit setting" parameter. The rotation speed of the gearhead output shaft can be checked on the monitor of the **MEXE02**, **OPX-2A**, or RS-485 communication.	100 to 9999	100	A
Speed reduction ratio digit setting		×1 ×0.1 ×0.01	×0.01	
Speed increasing ratio	Sets the speed increasing ratio when the increased rotation speed is monitored. If the speed increasing ratio is set to other than 1, the speed increasing ratio is prioritized. The rotation speed of the gearhead output shaft is shown on the monitor of the **MEXE02**, **OPX-2A**, or RS-485 communication as a value calculated by multiplying a value in the "Speed increasing ratio" parameter by a rotation speed.	1 to 5	1	
Conveyor speed reduction ratio	Sets the conveyor speed reduction ratio when the conveyor transfer speed is monitored. The conveyor speed reduction ratio is calculated by multiplying a value in the "Conveyor speed reduction ratio" parameter by that in the "Conveyor speed reduction ratio decimal digit setting" parameter. The conveyor transfer speed can be checked on the monitor of the **MEXE02**, **OPX-2A**, or RS-485 communication.	100 to 9999	100	
Conveyor speed reduction ratio decimal digit setting		×1 ×0.1 ×0.01	×0.01	
Conveyor speed increasing ratio	Sets the conveyor speed increasing ratio when the increased conveyor transfer speed is monitored. If the conveyor speed increasing ratio is set to other than 1, the conveyor speed increasing ratio is prioritized. The conveyor transfer speed is shown on the monitor of the **MEXE02**, **OPX-2A**, or RS-485 communication as a value calculated by multiplying a value in the "Conveyor speed increasing ratio" parameter by a rotation speed.	1 to 5	1	
Rotation speed attainment band	Sets the band within which the motor rotation speed is deemed to have reached the set value.	0 to 400 [r/min]	200	
Motor rotation direction selection	Sets the motor rotation direction. (Sets the rotation direction when turning the FWD input ON if the "2-wire mode" is selected with the "Operation input mode selection" parameter. Sets the rotation direction when turning the FWD/REV input OFF if the "3-wire mode" is selected.)	Positive direction =CCW Positive direction =CW	Positive direction =CW	C

■ Calculation method for speed reduction ratio

To display the rotation speed of the gearhead output shaft on the MEXE02

Set using the "Speed reduction ratio" parameter and "Speed reduction ratio digit setting" parameter.

Example) When the speed reduction ratio 15 is set

Set 150 to the "Speed reduction ratio" parameter and ×0.1 to the "Speed reduction ratio digit setting" parameter.
15 that was calculated by the formula "150 x 0.1" was set.
At this time, one-fifteenth speed of the motor rotation speed is displayed.

Rotation speed

**To display the conveyor transfer speed on the MEXE02**

Set using the "Conveyor speed reduction ratio" parameter and "Conveyor speed reduction ratio decimal digit setting" parameter.
To display the conveyor transfer speed, calculate the conveyor speed reduction ratio using the formula below and set the value in the "Conveyor speed reduction ratio" parameter.

Conveyor transfer speed
Pulley diameter

$$\text{Conveyor speed reduction ratio} = \frac{1}{\text{Feed rate per motor revolution}} = \frac{\text{Gearhead gear ratio}}{\text{Pulley diameter [m]} \times \pi}$$

If the calculated conveyor speed reduction ratio is used, the conveyor transfer speed is converted as follows.

$$\text{Conveyor transfer speed [m/min]} = \frac{\text{Motor output shaft rotation speed [r/min]}}{\text{Conveyor speed reduction ratio}}$$
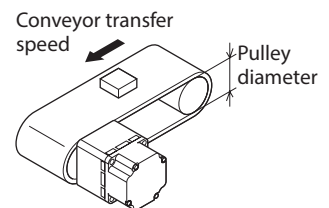
Example) **When the pulley diameter is 0.1 m and the gear ratio of the gearhead is 20**

$$\text{Conveyor speed reduction ratio} = \frac{\text{Gearhead gear ratio}}{\text{Pulley diameter [m]} \times \pi} = \frac{20}{0.1\,[\text{m}] \times \pi} \cong 63.7$$

From the conversion formula, the conveyor speed reduction ratio is calculated as 63.7 in this example.
If the conveyor speed reduction ratio is 63.7 and the rotation speed of the motor is 1300 r/min, the conveyor transfer speed is converted as follows:
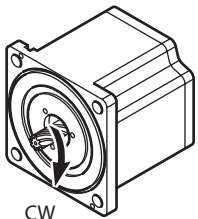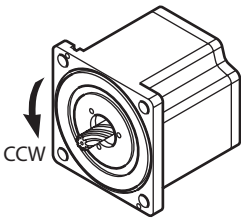
$$\text{Conveyor transfer speed [m/min]} = \frac{1300}{63.7} \cong 20.4$$

[MEXE02 Status monitor window]
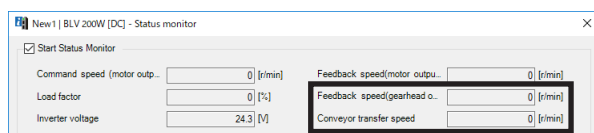
■ "Motor rotation direction selection" parameter
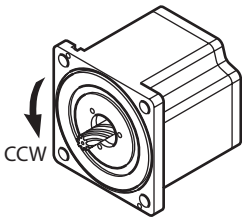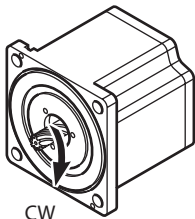
Even when a gearhead with a reduction ratio which rotation direction is opposite to the motor output shaft is used, the rotation direction of the gearhead output shaft when the input signal is turned ON can be set to the same as that of the motor.
Rotation direction of the motor output shaft ⇒ p.34

● 2-Wire mode

Input signal	Rotation direction when the input signal is turned ON	
	"Motor rotation direction selection" parameter	
	Positive direction=CW	Positive direction=CCW
FWD	CW	CCW

● 3-Wire mode

Input signal	Rotation direction when the input signal is turned ON	
	"Motor rotation direction selection" parameter	
	Positive direction=CW	Positive direction=CCW
FWD/REV	CCW	CW

11.4 I/O function selection

A: Update immediately, B: Update after operation stop, C: Update after executing configuration

Parameter name	Description	Setting range	Factory setting	Update
X0	Selects the functions to assign to the X0 to X5.	Not used FWD (START/STOP)* REV (RUN/BRAKE)* STOP-MODE (FWD/REV)* MB-FREE, EXT-ERROR ALARM-RESET HMI, M0, M1, M2	FWD (START/STOP) *	B
X1			REV (RUN/BRAKE) *	
X2			STOP-MODE (FWD/REV) *	
X3			M0	
X4			ALARM-RESET	
X5			MB-FREE	
Y0	Selects the functions to assign to the Y0 and Y1.	Not used ALARM-OUT1, WNG, MOVE TLC, VA, ALARM-OUT2, DIR	ALARM-OUT1	A
Y1			WNG	
NET-IN0 input function selection	Selects the functions to assign to the remote I/O input signals (NET-IN0 to NET-IN15). Refer to the USER MANUAL (RS-485 Communication Mode) for remote I/O.	Not used FWD (START/STOP)* REV (RUN/BRAKE)* STOP-MODE (FWD/REV)* MB-FREE, HMI, M0, M1, M2	M0	C
NET-IN1 input function selection			M1	
NET-IN2 input function selection			M2	
NET-IN3 input function selection			FWD (START/STOP) *	
NET-IN4 input function selection			REV (RUN/BRAKE) *	
NET-IN5 input function selection			STOP-MODE (FWD/REV) *	
NET-IN6 input function selection			Not used	
NET-IN7 input function selection			MB-FREE	
NET-IN8 input function selection			Not used	
NET-IN9 input function selection			Not used	
NET-IN10 input function selection			Not used	
NET-IN11 input function selection			Not used	
NET-IN12 input function selection			Not used	
NET-IN13 input function selection			Not used	
NET-IN14 input function selection			Not used	
NET-IN15 input function selection			Not used	
NET-OUT0 output function selection	Selects the functions to assign to the remote I/O output signals (NET-OUT0 to NET-OUT15). Refer to the USER MANUAL (RS-485 Communication Mode) for remote I/O.	Not used FWD_R (START/STOP_R)* REV_R (RUN/BRAKE_R)* STOP-MODE_R (FWD/REV_R)* MB-FREE_R, HMI_R, M0_R M1_R, M2_R, ALARM-OUT1 WNG, MOVE, TLC, VA, S-BSY ALARM-OUT2, MPS, DIR	M0_R	
NET-OUT1 output function selection			M1_R	
NET-OUT2 output function selection			M2_R	
NET-OUT3 output function selection			FWD_R (START/STOP_R)*	
NET-OUT4 output function selection			REV_R (RUN/BRAKE_R)*	
NET-OUT5 output function selection			STOP-MODE_R (FWD/REV_R)*	
NET-OUT6 output function selection			WNG	
NET-OUT7 output function selection			ALARM-OUT1	
NET-OUT8 output function selection			S-BSY	
NET-OUT9 output function selection			Not used	
NET-OUT10 output function selection			Not used	
NET-OUT11 output function selection			Not used	
NET-OUT12 output function selection			ALARM-OUT2	
NET-OUT13 output function selection			MOVE	
NET-OUT14 output function selection			VA	
NET-OUT15 output function selection			TLC	

* If the 3-wire mode is selected with the "Operation input mode selection" parameter, the signal in the parentheses ( ) will be applied.

■ **Input signals list**

Signal name	Description	
Not used	Set when the input signal is not used.	
FWD	When setting to 2-wire mode	When this signal is turned ON, the motor rotates in the clockwise direction. The rotation direction can be changed using the "Motor rotation direction selection" parameter.
REV		When this signal is turned ON, the motor rotates in the counterclockwise direction. The rotation direction can be changed using the "Motor rotation direction selection" parameter.
STOP-MODE		Select how to stop the motor. The motor decelerates to a stop when this signal is turned ON, and it stops instantaneously when turned OFF.
START/STOP	When setting to 3-wire mode	When this signal is turned ON, the motor rotates. The motor decelerates to a stop when it is turned OFF.
RUN/BRAKE		When this signal is turned ON, the motor rotates. The motor stops instantaneously when turned OFF.
FWD/REV		This signal is used to change the motor rotation direction. The motor rotates in the counterclockwise direction when the signal is turned ON, and it rotates in the clockwise direction when turned OFF. The rotation direction can be changed using the "Motor rotation direction selection" parameter.
MB-FREE	This signal is used to select how the electromagnetic brake would operate when the motor stops. If this signal is turned ON, the electromagnetic brake is released.	
EXT-ERROR	If this signal is turned OFF, the external stop alarm is generated to stop the motor.	
ALARM-RESET	This signal is used to reset the alarm.	
HMI	When the HMI input is turned ON, the function limitation of the MEXE02 and OPX-2A is released. When the HMI input is turned OFF, the function limitation is imposed. [Functions to be limited] ● Writing operation data and parameters ● I/O test ● Teaching, remote operation ● Clearing of history and others ● Configuration ● Initialization (Restores to factory settings)	
M0 to M2	Select the set operation data by a combination of ON-OFF status of M0, M1 and M2 inputs.	

■ **Output signals list**

Signal name	Description	
Not used	Set when the output terminal is not used.	
FWD_R	When setting to 2-wire mode	Output in response to the FWD input.
REV_R		Output in response to the REV input.
STOP-MODE_R		Output in response to the STOP-MODE input.
START/STOP_R	When setting to 3-wire mode	Output in response to the START/STOP input.
RUN/BRAKE_R		Output in response to the RUN/BRAKE input.
FWD/REV_R		Output in response to the FWD/REV input.
MB-FREE_R	Output in response to the MB-FREE input.	
M0_R to M2_R	Output in response to the M0 to M2.	
ALARM-OUT1	This signal is output when an alarm is generated.	
WNG	This signal is output when a warning is generated.	
MOVE	Output while the motor operates.	
TLC	This signal is output when the motor output torque reaches the value set in the torque limiting value.	
VA	This signal is output when the speed difference between the set rotation speed and actual motor rotation speed becomes equal to or less than the value set with the "Rotation speed attainment band" parameter.	
S-BSY	This signal is turned ON at the following conditions. ● When the maintenance command is being executed via RS-485 communication. ● When Configuration, teaching/remote operation, or I/O test is being executed with the **MEXE02**. ● When operation data or a parameter is being written with the **MEXE02** or the **OPX-2A**. While this signal is being ON, operation data cannot be rewritten or the maintenance command cannot be executed.	
ALARM-OUT2	This signal is output when a load applied to the motor exceeds the overload warning level.	
MPS	The MPS output is turned ON when the main power supply is turned on.	
DIR	Output a state of the rotation direction of the motor shaft. The rotation direction represents the forward direction if this signal is ON, and the reverse direction if this signal is OFF.	

11.5 Alarm and warning

A: Update immediately, C: Update after executing configuration

Parameter name	Description	Setting range	Factory setting	Update
Undervoltage alarm latch	Switches whether to enable or disable the retaining state of the undervoltage alarm function. If it is set to "Disable," the undervoltage alarm will automatically be cleared when the main power supply voltage returns to the undervoltage detection level or more.	Disable Enable	Disable	C
Undervoltage warning level	Sets the warning level for the undervoltage of the main power supply.	0.0 to 48.0 [VDC]	24 VDC type: 21.6 48 VDC type: 43.2	
Undervoltage warning function	Switches whether to enable or disable the undervoltage warning function.	Disable Enable	Enable	A
Overload warning level	Sets the warning level for the load torque of the motor.	50 to 100 [%]	100	
Overload warning function	Switches whether to enable or disable the overload warning function.	Disable Enable	Enable	

11.6 Test operation and display

A: Update immediately, D: Update after turning on the power again

Parameter name	Description	Setting range	Factory setting	Update
JOG operation speed	Sets the rotation speed of JOG operation for the data setter **OPX-2A**.	0, 80 to 1000 [r/min]	300	
JOG operation torque	Sets the torque limiting value of JOG operation for the data setter **OPX-2A**.	0 to 200 [%]	200	A
Data setter speed display	Sets the display method of operating speed in the monitor mode. If it is set to "Signed," "-" is displayed when the motor rotates in the reverse input direction.	Signed Absolute value	Signed	
Data setter edit	Switches whether to enable or disable the following editing functions. • Clear of the alarm and warning histories in the monitor mode • Change of the setting value in the data mode and parameter mode • All operation in the copy mode	Disable Enable	Enable	D

11.7 Operation setting

C: Update after executing configuration, D: Update after turning on the power again

Parameter name	Description	Setting range	Factory setting	Update
Data setter initial display	Selects the initial screen when the driver power is turned on.	Operating speed Conveyor transfer speed Load factor Operation data number Top screen of monitor mode	Operating speed	D
Analog input signal selection	The setting method of operation data can be changed.	Mode 0 to 5	Mode 0	
Prevention of operation at power-on alarm function	Switches whether to enable or disable the prevention of operation at power-on alarm.	Disable Enable	Disable	
Electromagnetic brake action at alarm	Sets the timing to activate the electromagnetic brake when an alarm is generated. When setting to "Hold after coasting to a stop," the electromagnetic brake will activate and hold the position after the motor coasts to a stop.	Hold after coasting to a stop Hold immediately	Hold immediately	C
Operation input mode selection	Switches operation signals of external input between the 2-wire mode and 3-wire mode.	2-Wire mode 3-Wire mode	2-Wire mode	

■ Setting of operation data using "Analog input signal selection" parameter

The setting method of operation data can be changed using the "Analog input signal selection" parameter. Combinations of the mode number and analog setting/digital setting are shown in the table below. Others except the following combinations are not available to set.

Mode No.	Operation data No.	VR1	VR2	VR3	External potentiometer	Digital setting
Mode 0 (initial setting)	0	Rotation speed	Acceleration/ Deceleration time	Torque limiting value	–	–
	1	–	Acceleration/ Deceleration time	Torque limiting value	Rotation speed	–
	2 - 7	–	–	–	–	Rotation speed Acceleration time Deceleration time Torque limiting value
Mode 1	0 - 7	–	–	–	–	Rotation speed Acceleration time Deceleration time Torque limiting value
Mode 2	0 - 7	–	–	–	Torque limiting value	Rotation speed Acceleration time Deceleration time
Mode 3	0	Acceleration time	Deceleration time	Rotation speed	–	Torque limiting value
	1	Acceleration time	Deceleration time	–	Rotation speed	Torque limiting value
	2 - 7	–	–	–	–	Rotation speed Acceleration time Deceleration time Torque limiting value
Mode 4	0	Rotation speed	Torque limiting value	Acceleration/ Deceleration time	–	–
	1	–	Torque limiting value	Acceleration/ Deceleration time	Rotation speed	–
	2 - 7	–	–	–	–	Rotation speed Acceleration time Deceleration time Torque limiting value
Mode 5	0	Torque limiting value	Acceleration/ Deceleration time	Rotation speed	–	–
	1	Torque limiting value	Acceleration/ Deceleration time	–	Rotation speed	–
	2 - 7	–	–	–	–	Rotation speed Acceleration time Deceleration time Torque limiting value

Note The torque limiting potentiometer (VR3) is set to the maximum value at the time of shipment. When selecting the mode Nos. 3 to 5, check the setting value before operating a motor because the rotation speed and acceleration/deceleration time are set to the maximum value initially.

■ "Operation input mode selection" parameter

Input of operation signal can be switched between 2-wire mode and 3-wire mode.
The operation input mode is a method to select the motor rotation direction and operation signal. The motor is operated using the FWD input and REV input in 2-wire mode. In 3-wire mode, the motor is operated using the START/STOP input, RUN/BRAKE input, and the FWD/REV input.
In each operation input mode, signal functions will be changed as follows.

2-Wire mode	3-Wire mode
FWD input	START/STOP input (ON: Operation, OFF: Deceleration stop)
REV input	RUN/BRAKE input (ON: Operation, OFF: Instantaneous stop)
STOP-MODE input	FWD/REV input (OFF: Rotates in clockwise direction, ON: Rotates in counterclockwise direction)

Note When the electromagnetic brake type motor is used in vertical drive such as elevating equipment, set the operation input mode to 2-wire mode. If the RUN/BRAKE input is turned OFF or the FWD/REV input is switched in the 3-wire mode, the moving part may fall. Also, use the motor in a state where the STOP-MODE input is being ON. If the STOP-MODE input is in an OFF state, the moving part may fall when the motor stops.
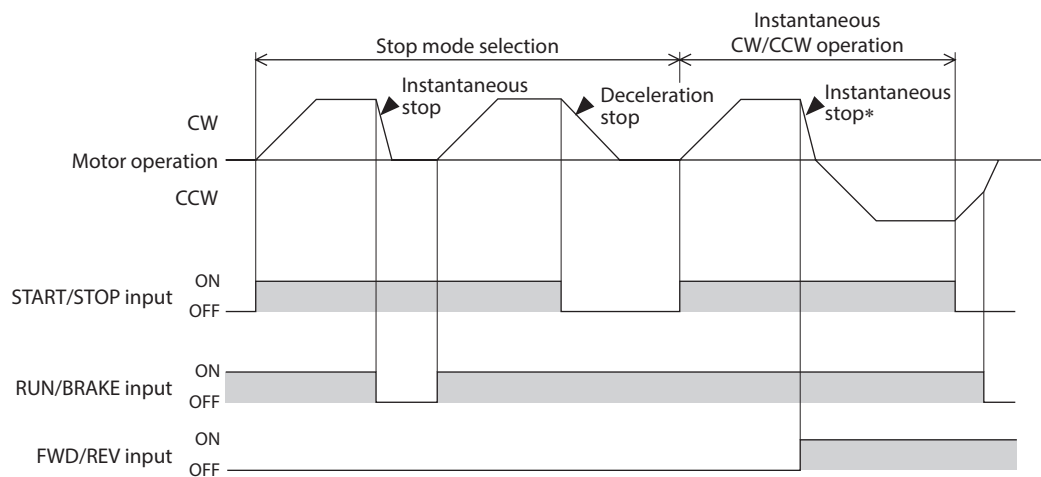
- **Timing chart in the 2-wire mode**
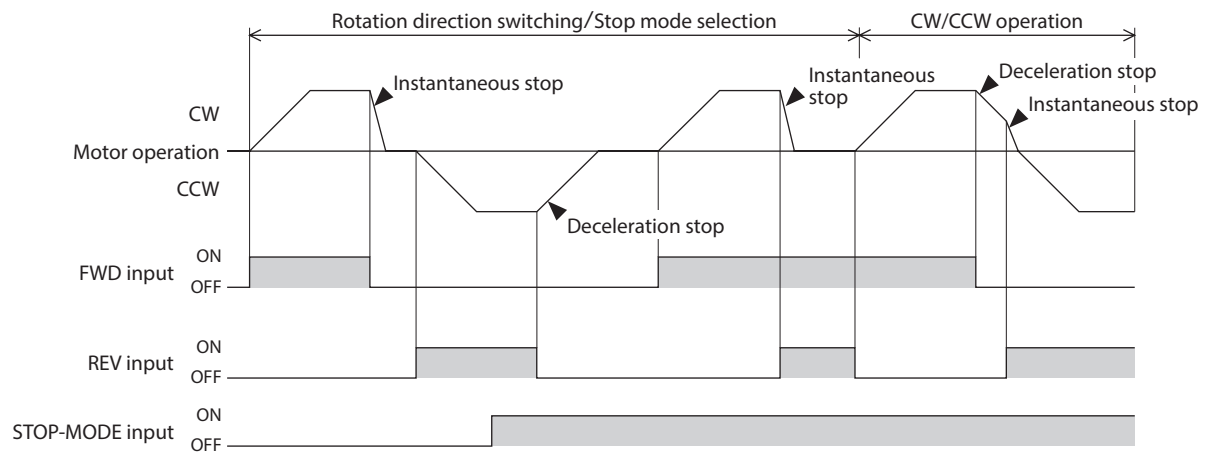
> **(Note)**
> - To surely recognize the input signal, ensure the ON time and OFF time of each input signal for at least 10 ms.
> - When switching the FWD input and REV input, provide an interval of at least 10 ms.

- **Timing chart in the 3-wire mode**

∗ If the rotation direction is changed during operation, the rotation direction will be changed after instantaneous stop.

> **(Note)** To surely recognize the input signal, ensure the ON time and OFF time of each input signal for at least 10 ms.

11.8 Communication

A: Update immediately, D: Update after turning on the power again

Parameter name	Description	Setting range	Factory setting	Update
Communication timeout	Sets the condition in which a communication timeout occurs in RS-485 communication.	0 to 10000 [ms] (0: Not monitored)	0	A
Communication error alarm	Sets the condition in which a RS-485 communication error alarm is generated. A communication error alarm will be generated after a RS-485 communication error has occurred by the number of times set here.	1 to 10 [times]	3	
Communication parity	Sets the parity of RS-485 communication (Modbus protocol).	None Even number Odd number	Even number	D
Communication stop bit	Sets the stop bit for RS-485 communication (Modbus protocol).	1 bit 2 bits	1 bit	
Transmission waiting time	Sets the transmission waiting time of RS-485 communication (Modbus protocol).	0.0 to 1000.0 [ms]	10.0	

12   Inspection and maintenance

12.1   Inspection

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

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

■ Inspection item
- Check if any of the mounting screws for the motor and gearhead is loose.
- Check if the bearing part (ball bearings) of the motor generates unusual noises.
- Check if the bearing part (ball bearings) or gear meshing part of the gearhead generates unusual noises.
- Check if the output shaft of the motor and gearhead and a load shaft are out of alignment.
- Check if a damage or stress is applied on the cable or the connection part between the cable and driver is loose.
- Check if the openings in the driver are clogged.
- Check if any of the driver mounting screws or the screws of the main power supply input terminal is loose.
- Check if there is any abnormality or unusual smell inside the driver.

12.2   Warranty

Check on the Oriental Motor Website for the product warranty.

12.3   Disposal

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

13 Protective functions

When the driver protective function is activated to generate an alarm, the ALARM-OUT1 output is turned OFF. In the case of the standard type product, the motor coasts to a stop, and the motor output shaft is in a free-run state (a state of rotating manually). In the case of the electromagnetic brake type product, on the other hand, the motor stops instantaneously and the electromagnetic brake activates to hold the shaft in position.
At the same time, the ALARM LED will start blinking. The alarm type can be checked by counting the number of times the ALARM LED blinks.

Blinking pattern example: Sensor error (number of blinks: 3)
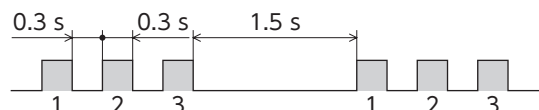
To reset an alarm, be sure to remove the cause of the alarm before performing one of the following operations:
- Turn the ALARM-RESET input ON (keep it ON for 10 ms or more) and then OFF. (Refer to p.27 for details.)
- Turn on the main power supply again.
  Turn on the control power supply again when connecting it.

Note
- An alarm cannot be reset if the FWD input or REV input is being ON. Be sure to stop the motor before resetting any alarm.
- Alarms caused by damage to the motor or driver itself cannot be reset using the method explained above. Contact your nearest Oriental Motor sales office.
- Make sure the ALARM-RESET input remains ON for at least 10 ms. If the ON period is too short, the alarm may not be reset.
- The undervoltage alarm is released automatically when the driver main power supply voltage exceeds the undervoltage detection level. If the FWD input or REV input is being ON, the motor will rotate concurrently with releasing the alarm.
- If an external stop alarm is generated, the motor stops instantaneously.

■ Alarm lists

Number of ALARM LED blinks	Alarm type	Cause	Remedial action	Reset using the ALARM-RESET input
2	Overload	A load exceeding the rated torque was applied to the motor for 5 seconds or more.	• Decrease a load. • Reconsider the operating conditions such as acceleration/deceleration time.	Possible
3	Sensor error	The motor sensor signal line was disconnected or the motor signal connector came off during operation.	Check the connection between the driver and motor.	
	Sensor error at power-on	The motor sensor signal line was disconnected or the motor signal connector came off before the main power supply was turned on.		
4	Overvoltage	• The main power supply voltage exceeded the overvoltage detection level. [Detection level] **BLV620**: Approximately 40 VDC **BLV640**: Approximately 72 VDC • Sudden starting/stopping of a large inertia load was performed.	• Check the voltage of the main power supply. • If the alarm is generated during operation, decrease a load or increase the acceleration time and deceleration time. • If the alarm is generated in acceleration, set the speed response to the regenerative power suppression mode. (p.35) • If the alarm is generated when the motor stops, set the STOP-MODE to instantaneous stop.	

Number of ALARM LED blinks	Alarm type	Cause	Remedial action	Reset using the ALARM-RESET input
5	Undervoltage	The main power supply voltage dropped below the undervoltage detection level. [Detection level] **BLV620**: Approximately 10 VDC **BLV640**: Approximately 20 VDC	• Check the voltage of the main power supply. • Check the wiring of the power supply cable.	Possible
6	Overspeed	The rotation speed of the motor output shaft exceeded approximately 4800 r/min.	• Decrease the load. • Reconsider the operating conditions such as acceleration/deceleration time.	
7	Overcurrent	Excessive current was flown through the driver due to ground fault, etc.	Check that no damage is given to the wiring between the driver and motor, and turn on the power again.	Not possible
8	EEPROM error	• Stored data was damaged. • Data became no longer writable or readable.	Initialize the parameters using the **MEXE02**, **OPX-2A**, or communication, and then turn on the power supply again.	
9	Main circuit overheat	The temperature inside the driver exceeded the main circuit overheat level.	Reconsider the ventilation condition in the enclosure.	
10	External stop *1	The EXT-ERROR input was turned OFF.	Check the EXT-ERROR input.	
11	Prevention of operation at power-on *2	The main power supply was turned on when the FWD input or REV input was being ON. ※ When the "3-wire mode" is set with the "Operation input mode selection" parameter, the main power supply was turned on again in a state where the START/STOP input and the RUN/BRAKE input were being ON.	Turn the FWD input and REV input OFF, and then turn on the main power supply again. ※ When the "3-wire mode" was set with the "Operation input mode selection" parameter, turn either the START/STOP input or the RUN/BRAKE input OFF before turning on the main power supply again.	Possible
12	Communication switch setting error	The communication function switch (SW2-No.4) was turned ON.	Turn the communication function switch (SW2-No.4) OFF, and turn on the power again. When using RS-485 communication function, refer to the USER MANUAL (RS-485 Communication Mode).	Not possible
14	Main circuit output error *3	• The motor power line was disconnected or the motor power connector came off. • When the operation input signal was switched instantaneously, the motor could not follow and continued a state of not rotating.	• Check the connection between the driver and motor. • Check the motor has rotated before switching the operation command.	Possible

*1 Only when EXT-ERROR is assigned using **MEXE02**, **OPX-2A**, or communication.
*2 When "Prevention of operation at power-on" function is enabled using **MEXE02**, **OPX-2A**, or communication.
*3 This alarm is not generated when the torque limiting value is set to less than 200%.

Note Turn off and on the power supply again to reset alarms of the overcurrent and EEPROM error, and communication switch setting error. If the product does not operate properly after the power is turned on again, the internal circuit may be damaged. Contact your nearest Oriental Motor sales office.

14 Troubleshooting and remedial actions

During motor operation, the motor or driver may fail to function properly due to an improper speed setting or wiring. When the motor cannot be operated properly, refer to the contents provided in this chapter and take appropriate action. If the problem persists, contact your nearest Oriental Motor sales office.

Phenomenon	Possible cause	Remedial action
The motor does not rotate.	The power supply is not connected properly.	Check the connection between the driver and power supply.
	Both the FWD input and REV input are being OFF.	Turn either FWD input or REV input ON.
	Both the FWD input and REV input are ON.	Turn either FWD input or REV input ON.
	The internal potentiometer is not adjusted.	The factory setting of the internal potentiometer is 0 r/min. Turn the internal potentiometer clockwise to set the speed.
	The potentiometer is not selected correctly.	Turn the M0 input OFF when using the internal potentiometer. Turn the M0 input ON when using the external potentiometer.
	The external potentiometer or external DC voltage is not connected correctly.	Check the connection of the external potentiometer or external DC voltage.
	The ALARM LED (red) is blinking.	An alarm generated due to a protective function being triggered. Refer to p.64, to reset the alarm.
The motor rotates in the opposite direction against the specified direction.	The FWD input and REV input are connected wrongly or otherwise not connected correctly.	Check the connection of the FWD input and REV input. The motor rotates in the clockwise direction when the FWD input is ON, and in the counterclockwise direction when the REV input is ON.
	The gear ratio that the gearhead output shaft rotates in the opposite direction against the motor rotation direction is used. (Refer to p.34 for the rotation direction of the gearhead output shaft.)	Reverse the FWD input and REV input operations.
	A combination type-hollow shaft flat gearhead is used.	• With the combination type-hollow shaft flat gearhead, the rotation direction of the gear output shaft is opposite of the motor output shaft. Accordingly, reverse the FWD input and REV input operations. • Is the gearhead viewed in the correct direction? With a combination type-hollow shaft flat gearhead, the rotating direction of the gearhead changes according to the direction in which the gearhead is viewed.
• Motor operation is unstable. • Motor vibration is too large.	The motor and gearhead output shaft is misaligned with a load shaft.	Check the coupling condition of the motor and gearhead output shaft and the load shaft.
	Effect of electrical noise.	Check the operation only with the motor, driver and other external equipment required for operation. If an effect of noise has been confirmed, implement the following countermeasures: · Keep away from the noise sources. · Reconsider the wiring. · Change the signal cable to a shielded cable. · Install ferrite cores.
The motor does not stop instantaneously.	The STOP-MODE input is being ON.	To cause the motor to stop instantaneously, turn the STOP-MODE input OFF.
	The load inertia is large.	Reduce the load inertia.
The electromagnetic brake does not hold the load in position.	The MB-FREE input is being ON.	Turn the MB-FREE input OFF.

15 Specifications

15.1 Specifications

The value in a state where the gearhead is not combined is described in each specification for the rated torque, the maximum instantaneous torque, the rated rotation speed, and the speed control range.
- The box (□) in the model name indicates a number representing the gear ratio.
- The box (■) in the model name indicates a number representing the length of an connection cable.

Model	Combination type-parallel shaft gearhead	BLV620K□S-■ BLV620KM□S-■	BLV640N□S-■ BLV640NM□S-■
	Combination type-hollow shaft flat gearhead	BLV620K□F-■ BLV620KM□F-■	BLV640N□F-■ BLV640NM□F-■
	Round shaft type	BLV620KA-■ BLV620KMA-■	BLV640NA-■ BLV640NMA-■
Rated output power (Continuous)		200 W	400 W
Power supply input	Rated voltage	24 VDC	48 VDC
	Permissible voltage range	±10%	
	Rated input current	13 A	11 A
	Maximum input current	25 A	18 A
Rated torque		0.65 N·m (92 oz-in)	1.3 N·m (184 oz-in)
Peak torque*1		1.15 N·m(163 oz-in)	1.8 N·m (250 oz-in)
Rated rotation speed		3000 r/min	
Speed control range		100 to 4000 r/min (analog setting) 80 to 4000 r/min (digital setting)*2	

*1 The peak torque can be used for about five seconds maximum.
*2 The specification is applied when setting with the OPX-2A, MEXE02, or communication.

15.2 General specifications

		Motor	Driver
Operating environment	Ambient temperature	0 to +40 °C [+32 to +104 °F] (non-freezing)	
	Ambient humidity	85% or less (non-condensing)	
	Altitude	1000 m (3300 ft.) or lower above sea level	
	Surrounding atmosphere	No corrosive gas or dust. Cannot be used in radioactive materials, magnetic field, vacuum or other special environment. (For details about installation locations, refer to p.12.)	
	Vibration	Not subject to continuous vibrations or excessive impact. In conformance with JIS C 60068-2-6 "Sine-wave vibration test method" Frequency range: 10 to 55 Hz Pulsating amplitude: 0.15 mm (0.006 in.) Sweep direction: 3 directions (X, Y, Z) Number of sweeps: 20 times	
Storage environment Shipping environment	Ambient temperature	−25 to +70 °C [−13 to +158 °F] (non-freezing)	
	Ambient humidity	85% or less (non-condensing)	
	Altitude	3000 m (10000 ft.) or lower above sea level	
	Surrounding atmosphere	No corrosive gas, dust, water or oil. Cannot be used in radioactive materials, magnetic field, vacuum or other special environment.	
Degree of protection		IP40	IP20

15.3 Dimensions

Mass: 0.6kg (1.32 lb.)

[Unit: mm (in.)]

5 (0.20)

5 (0.20)

22.5 (0.89)

φ4.5 (φ0.177) Thru

6.5 (0.26)

14 (0.55)

147 (5.79)

134 (5.28)

4×M3

8 (0.39)

25 (0.98)

100 (3.94)

50 (1.97)

25 (0.98) max.

160 (6.30)

147 (5.79)

2×φ4.5 (φ0.177) Thru

45 (1.77)

5 (0.20) Pitch

7.62 (0.30) Pitch
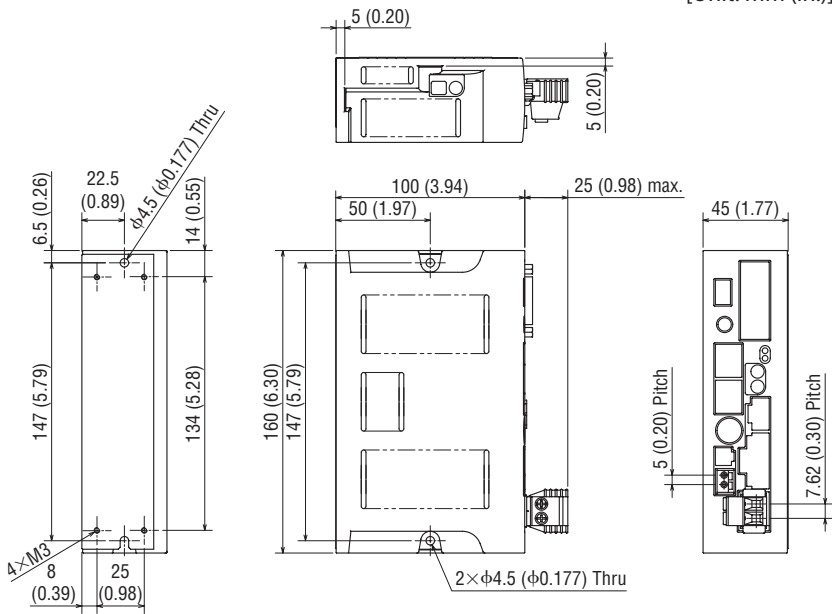
15.4 Pin assignment

Connector pin assignments of the connection cable and the motor cable are shown below. The following figures represent as the view from the direction of the lead wires side of the cable.
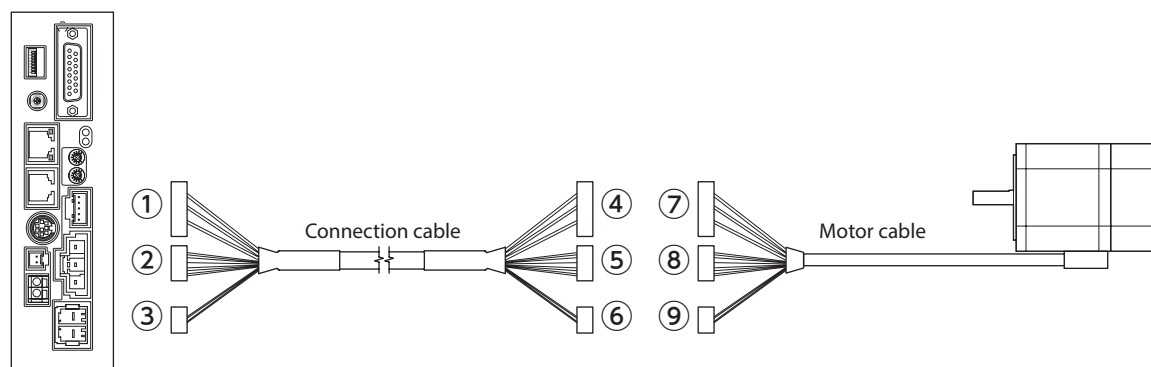
① , ⑦
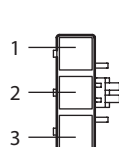
Pin No.	Lead wire color	Lead wire size
1	Blue	AWG 14 (2.0 mm²)
2	Purple	
3	Gray	

Housing: DF22CR-3S-7.92C (Hirose Electric Co., Ltd.)
Terminal: DF22-1416SCFA (Hirose Electric Co., Ltd.)

④
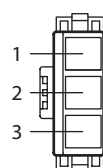
Pin No.	Lead wire color	Lead wire size
1	Blue	AWG 14 (2.0 mm²)
2	Purple	
3	Gray	

Housing: DF22R-3EP-7.92C (Hirose Electric Co., Ltd.)
Terminal: DF22-1416PCFA (Hirose Electric Co., Ltd.)

② , ⑧
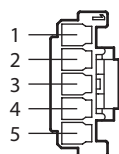
Pin No.	Lead wire color	Lead wire size
1	Yellow	AWG 24 (0.2 mm²)
2	Green	
3	Orange	
4	Red	
5	Brown	

Housing: 51103-0500 (molex)
Terminal: 50351-8000 (molex)

⑤
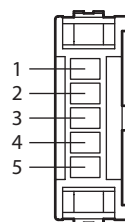
Pin No.	Lead wire color	Lead wire size
1	Yellow	AWG 24 (0.2 mm²)
2	Green	
3	Orange	
4	Red	
5	Brown	

Housing: 51198-0500 (molex)
Terminal: 50837-8000 (molex)

③ , ⑨
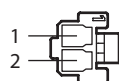
Pin No.	Lead wire color	Lead wire size
1	Black	AWG 24 (0.2 mm²)
2	White	

Housing: 51103-0200 (molex)
Terminal: 50351-8000 (molex)

⑥
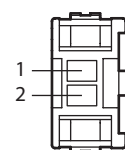
Pin No.	Lead wire color	Lead wire size
1	Black	AWG 24 (0.2 mm²)
2	White	

Housing: 51198-0200 (molex)
Terminal: 50837-8000 (molex)

16 Peripheral equipment (sold separately)

■ Data setter

The data setter lets you set data and parameters with ease and also functions as a monitor.

Model: **OPX-2A**

■ Communication cable for support software

Be sure to purchase this cable when connecting a driver to the PC in which the support software **MEXE02** has been installed.
This is a set of a PC interface cable and USB cable. The cable is connected to the USB port on the PC.

Model: **CC05IF-USB** [5 m (16.4 ft.)]

The **MEXE02** can be downloaded from Oriental Motor Website Download Page for free.

■ DIN rail mounting plate

When mounting the driver to a DIN rail, use a DIN rail mounting plate.
Use a DIN rail 35 mm (1.38 in.) wide.

Model: **PADP03**

■ External potentiometer

The motor speed can be set externally.

Model: **PAVR-20KZ**

17 Related products (sold separately)

■ **Network converter**
CC-Link compatible NETC01-CC
MECHATROLINK-Ⅱ compatible NETC01-M2
MECHATROLINK-Ⅲ compatible NETC01-M3
EtherCAT compatible NETC01-ECT

If the **BLV** Series is connected via the network converter when the **BLV** Series is used in a CC-Link system, MECHATROLINK system, or EtherCAT system, data can be sent to the driver by converting from each communication protocol to the RS-485 communication protocol. Alarms and other data output from the driver can also be sent to the master station by converting from the RS-485 communication protocol to each communication protocol.

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