Oriental motor

HM-5142-6

Brushless Motor and Driver Package

BXⅡ Series

USER MANUAL

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.

How to read this manual

Entry	1	This part explains the composition of the operating manuals, the product overview and safety standards as well as the name and function of each part and others.
Installation and connection	2	This part explains the installation method of the product, the mounting method of a load and the connection method as well as I/O signals.
Method to use the operation panel	3	This part explains how to set data and how to operate a motor using the operation panel on the driver.
Parameter list	4	This part explains the data and parameters that are required to operate a product.
Operation of speed control mode	5	This part explains the operation such as run/stop of a motor, change of the operation speed and others by the speed control mode.
Operation of position control mode	6	This part explains the operation such as positioning operation, return-to-home operation and others by the position control mode.
BX-compatible mode	7	The **BX** Ⅱ Series has equipped the **BX**-compatible mode so that users can operate it in almost the same condition as a traditional **BX** Series. This section explains the **BX**-compatible mode.
Inspection, troubleshooting and remedial actions	8	This part explains the periodical inspection methods as well as confirmation items and remedial actions when problems have happened.
Reference	9	This part explains the standards and CE Marking.
Appendix	10	This part explains accessories (sold separately) that are used in combination with the products.

1 Entry

2 Installation and connection

3 Method to use the operation panel

4 Parameter list

5 Operation of speed control mode

6 Operation of position control mode

7 BX-compatible mode

8 Inspection, troubleshooting and remedial action

9 Reference

10 Appendix

1 Entry

This part explains the composition of the operating manuals, the product overview and safety standards as well as the name and function of each part and others.

Table of contents

1 Operating Manuals for the BXⅡ Series

Operating manuals for the **BX**Ⅱ Series are listed below.
The USER MANUAL does not come with the product. For details, contact your nearest Oriental Motor sales office or download from Oriental Motor Website Download Page.
Always keep the manual where it is readily available.

Applicable product	Type of operating manual	Manual number	Description of operating manual
BXⅡ Series	OPERATING MANUAL (Supplied with the product)	HM-5141	This manual explains the motor and driver functions as well as installation method, and others.
	USER MANUAL (This document)	HM-5142	This manual explains the functions, installation/connection method and data setting method as well as the operating method and others for the motor and driver.
Data setting software **MEXE02**	OPERATING MANUAL	HM-60131	This manual explains how to set data using the accessory data setting software **MEXE02** (sold separately).

2 Introduction

■ Before use

Only qualified and educated personnel should work with the product.
Use the product correctly after thoroughly reading the section "3 Safety precautions" on p.10.
The product described in this manual has been designed and manufactured for use as a component to be installed in general industrial equipment. Do not use for any other purpose. Oriental Motor Co., Ltd. is not responsible for any damage caused through failure to observe this warning.

■ Overview of the product

The **BXⅡ** Series is a motor and driver package product consisting of a compact, high torque brushless motor equipped with an encoder, and a high functional driver.
This driver has two control modes of speed control and position control, and the operation panel on the driver can be used to display or set digitally.
This product is also compatible with the **BX** Series that has been conventionally used.
Operation data and parameters can be set using any of the operation panel on the driver, data setting software **MEXE02** or accessory data setter **OPX-2A** (sold separately).

3 Safety precautions

The precautions described below are intended to prevent danger or injury to the user and other personnel through safe, correct use of the product. 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.

⚠ Warning

General

- 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.
- 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 equipment damage.
- Do not transport, install, connect or inspect the product while the power is supplied. Always turn the power off before carrying out these operations. Failure to observe these instructions may result in electric shock or malfunction.
- The terminals on the driver front panel marked with ⚠ ⚠ symbol indicate the presence of high voltage. Do not touch these terminals while the power is on. Doing so may result in fire or electric shock.
- Do not use a standard type motor (not equipped an 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 drop, thereby causing injury or equipment damage.
- Do not use the brake mechanism of the electromagnetic brake motor as a safety brake. It is intended to hold the moving parts and motor position. Using it as a safety brake may result in injury or damage to equipment.
- If the driver protective function was activated, remove the cause and reset 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.

Installation

- The motor and driver are Class I equipment.
  When installing the motor and driver, ground their Protective Earth Terminals. Failure to do so may result in electric shock.
- Install the motor and driver inside an enclosure. Failure to do so may result in electric shock or injury.

Connection

- Securely connect the cables in accordance with the connection examples. Failure to do so may result in fire or electric shock.
- Do not forcibly bend, pull or pinch the cable. Doing so may result in fire or electric shock.
- Do not machine or modify the motor cable, conversion cable or connection cable. Doing so may result in electric shock or fire.
- Be sure to observe the specified cable sizes. Use of unspecified cable sizes may result in fire.

Operation

- Use a specified motor (gearhead), driver and regeneration unit combination. Failure to do so may result in fire, electric shock or equipment damage.
- Always keep the power supply voltage of the driver within the specified range. Failure to do so may result in fire or electric shock.
- Do not turn the FREE input ON when using the motor in vertical direction. Doing so may cause the motor holding power to lose, causing personal injury or damage to equipment.
- When using the electromagnetic brake motor in vertical drive (gravitational operation), be sure to operate after checking the load condition. If a load in excess of the rated torque is applied or the small torque limiting value is set, the load may fall. This may result in injury or damage to equipment.

Maintenance and inspection

- Always turn off the power before performing maintenance/inspection. Failure to do so may result in electric shock.
- Do not touch the motor or driver when conducting the insulation resistance measurement or dielectric strength test. Doing so may result in electric shock.
- Do not touch the connection terminals on the driver immediately (until the CHARGE LED turns off) after the power is turned off. Residual voltage may cause electric shock.
- Regularly check the openings in the driver for accumulated dust. Accumulated dust may cause fire.

Repair, disassembly and modification

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

⚠ Caution

General

- Do not use the product in conditions exceeding the specifications of the motor (gearhead), driver or regeneration unit. Doing so may result in fire, electric shock, injury or equipment damage.
- Do not insert an object into the openings in the driver. Doing so may result in fire, electric shock or injury.
- Do not touch the motor (gearhead), driver or regeneration unit while operating or immediately after stopping. The surface of the motor (gearhead), driver or regeneration unit may be hot, thereby causing a skin burn(s).

Installation

- Do not leave anything around the motor and driver that would obstruct ventilation. Doing so may result in damage to equipment.
- Do not carry the product by holding the motor (gearhead) output shaft or any of the cables. 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 (pinion shaft) with the gearhead, exercise caution not to pinch your fingers or other parts of your body between the motor and gearhead. Injury may result.
- 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 (gearhead). Failure to do so may result in injury.
- When installing the motor (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.
- Securely install the load on the motor (gearhead) output shaft. Inappropriate installation may result in injury.

Connection

- For the power supply of I/O signals, use a DC power supply with reinforced insulation on its primary and secondary sides. Failure to do so may result in electric shock.

Operation

- Provide an emergency stop device or emergency stop circuit external to the equipment so that the entire equipment will operate safely in the event of a system failure or malfunction. Failure to do so may result in injury.
- Immediately when trouble has occurred, stop operation and turn off the driver power. Failure to do so may result in fire, electrical shock or injury.
- Do not touch the rotating part (output shaft) while operating the motor. Doing so may result in injury.
- The motor surface temperature may exceed 70 °C (158 °F) even under normal operating conditions. If the operator is allowed to approach the running motor, attach a warning label as shown in the right in a conspicuous position. Failure to do so may result in a skin burn(s).

Warning label

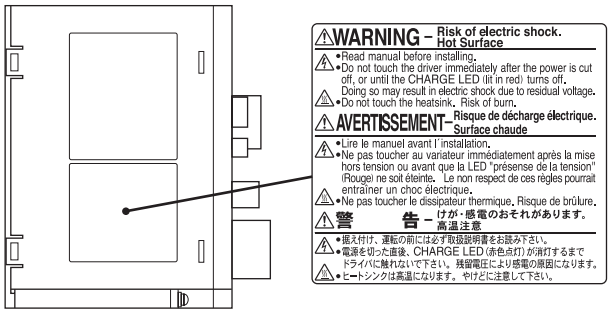
- Use an insulated screwdriver to adjust the switches in the driver. Failure to do so may result in electric shock.

Disposal

- To dispose of the motor (gearhead) and driver, disassemble it into parts and components as much as possible and dispose of individual parts/components as industrial waste.

■ Warning information

A warning label with handling instructions is attached on the driver. Be sure to observe the instructions on the label when handling the driver.



4 Precautions for use

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

- Connect protective devices to the power line

  Connect a circuit breaker or earth leakage breaker to the driver power line to protect the primary circuit. If an earth leakage breaker is to be installed, use one incorporating high-frequency noise elimination measures. For selection of the protective device, refer to the following "Preventing leakage current."

- Use an electromagnetic brake motor in an application of vertical drive such as elevating equipment

  When the motor is used in an application of vertical drive such as elevating equipment (lifting and lowering device), use an electromagnetic brake motor so that the load can be held in position.

- Do not use a solid-state relay (SSR) to turn on/off the power

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

- Conduct the insulation resistance measurement or dielectric strength test separately on the motor and the driver.

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

- Do not conduct the insulation resistance measurement or dielectric strength test on an encoder

  Doing so may damage the product.

- Grease measures

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

- Caution when using in low temperature environment

  When an ambient temperature is low, since the load torque may increase by the oil seal or viscosity increment of grease used in the gearhead, the output torque may decrease or an overload alarm may generate. 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.

- Preventing leakage current

  Stray capacitance exists between the driver's current-carrying line and other current-carrying lines, the earth and the motor, respectively. A high-frequency current may leak out through such capacitance, having a detrimental effect on the surrounding equipment. The actual leakage current depends on the driver's switching frequency, the length of wiring between the driver and motor, and so on. When connecting an earth leakage breaker, use one of the following products offering resistance against high frequency current:
  Mitsubishi Electric Corporation: NV series

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

  The data edit connector (CN6) and I/O signals connector (CN5/CN7) 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 this equipment to short, damaging both.

- The driver uses semiconductor elements, so be extremely careful when handling them.

  Static electricity may damage the driver.

- Connecting the motor and driver

  Always use the supplied conversion cable to connect the motor and driver. Also, use a connection cable (supplied or accessory) when extending the wiring distance between the motor and driver.

- When using the motor in operation such as vertical drive (gravitational operation) or a large inertial load drive, use an accessory regeneration unit (sold separately).

  The driver may be damaged if the regeneration energy generated during vertical drive (gravitational operation) or sudden starting/stopping of a large inertial load exceeds the allowable limit that can be absorbed by the driver. The accessory regeneration unit (sold separately) is designed to discharge the regenerated energy, thereby protecting the driver.

- Saving data to the non-volatile memory

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

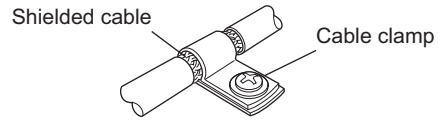
■ Noise measures

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 equipments malfunction.
For the noise that is invaded from the outside, take measures to prevent the driver malfunction. It is needed to take adequate measures because signal lines are very likely to be affected by the noise.
For the noise that is emitted from the driver, take measures to suppress it.
Refer to p.160 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.

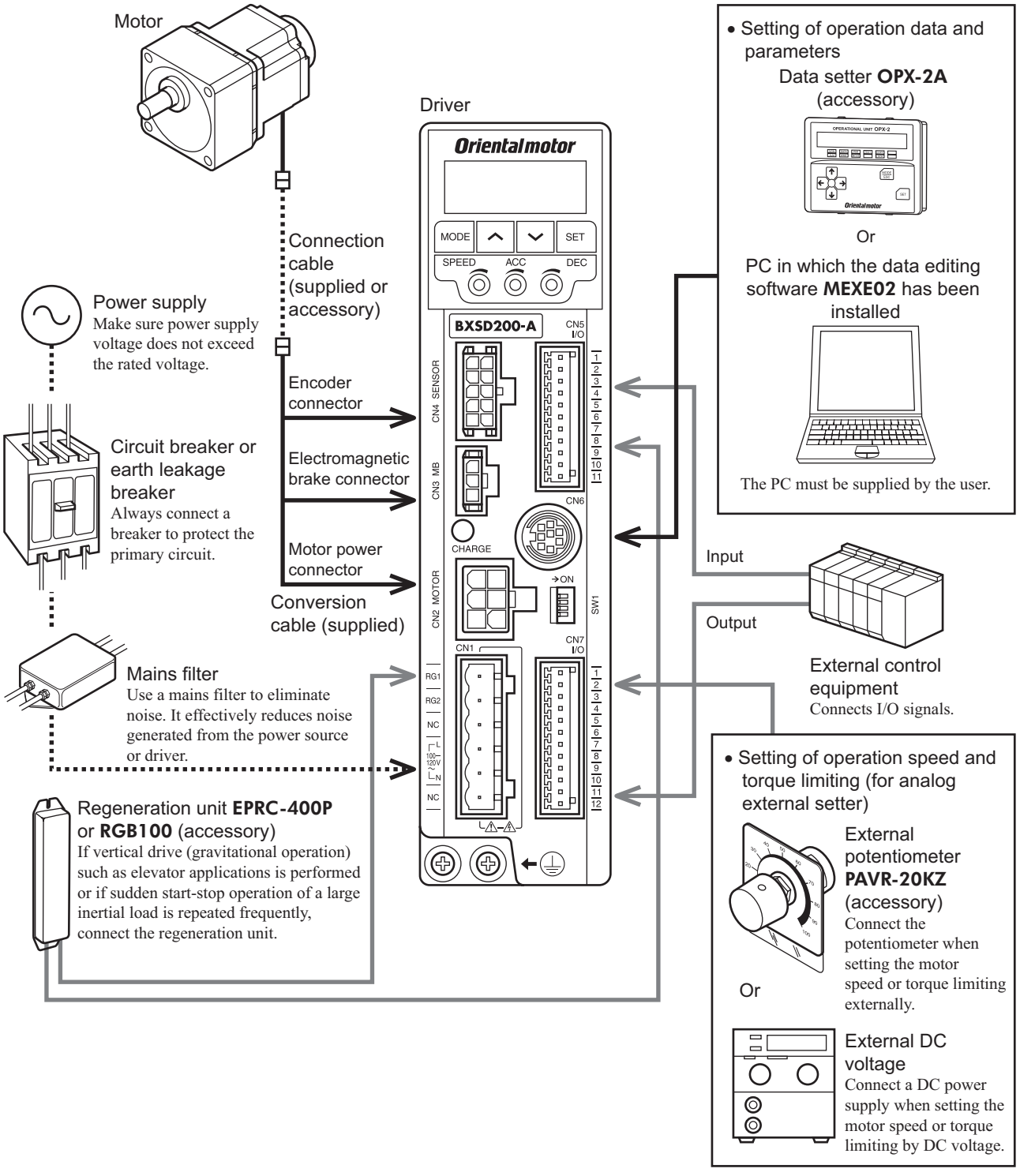
- Noise suppression
  - When relays or electromagnetic switches are used together with the system, use noise filters and CR circuits to suppress surges generated by them.
  - Use an accessory cable when extending a wiring distance between the motor and driver. This is effective in suppressing the electrical 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
  - Connect a noise filter in the power supply cable of driver.
  - Place the power lines, such as the motor and power supply cables, keeping a distance of 100 mm (3.94 in.) or more from the signal lines, and also do not bundle them or wire them in parallel. If the power cables and signal cables have to cross, cross them at a right angle.
  - 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 will maintain contact with the entire circumference of the cable. Ground the cable clamp near the product.



  - When grounding PE terminals of multiple drivers to a grounding point, it becomes more effective to block the electrical noise since impedance on the grounding point 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. To increase the effect of noise attenuation by the ferrite core, loop the cable a lot.

5 System configuration

The system configuration of the **BX Ⅱ** Series is shown below.



6 Preparation

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

6.1 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.
For the model names of motor and driver combinations, refer to "6.3 Combination tables" on p.17.

- Motor (with a gearhead, only for combination type).....1 unit
- Driver.....1 unit
- Conversion cable [0.2 m (8 in.)].....2 pcs (each 1 pc for motor and encoder)
- Connection cable.....2 pcs (each 1 pc for motor and encoder)
  (Only models with a supplied connection cable)
- CN1 connector (6 pins).....1 pc
- CN5 connector (11 pins).....1 pc
- CN7 connector (12 pins).....1 pc
- Driver mounting bracket set.....1 set
- OPERATING MANUAL.....1 copy

Accessories for combination type parallel shaft gearhead

- Hexagonal socket head screw set.....1 set
  (Hexagonal socket head screw, flat washer, spring washer and nut, 4 pcs. each)
- Parallel key.....1 pc*

* For the **BXS6200** and **BXS6400** types, the parallel key is fixed to the gearhead output shaft.

Accessories for combination type hollow shaft flat gearhead

- Hexagonal socket head screw set.....1 set
  (Hexagonal socket head screw, flat washer, spring washer and nut, 4 pcs. each)*
- Parallel key.....1 pc
- Safety cover.....1 pc
- Safety-cover mounting screws.....2 pcs

* For the **BXS6200** and **BXS6400** types, hexagonal nuts are not included.

6.2 How to identify the product model

BXS 6 200 A M - 5 S - 1

- **1**: Number: Length (m) of a supplied connection cable
  None: Without a connection cable
- **S**: Gearhead type for the combination type **S**: Parallel shaft gearhead
  FR: Hollow shaft flat gearhead
- **5**: Number: Gear ratio for the combination type
  A: Round shaft type
- **M**: **M**: Electromagnetic brake type
  None: Standard type
- **A**: Power supply voltage **A**: Single-phase 100-120 VAC
  C: Single-phase 200-240 VAC, Three-phase 200-240 VAC
- **200**: Output power **30**: 30 W **60**: 60 W **120**: 120 W
  200: 200 W **400**: 400 W
- **6**: Motor frame size **2**: 60 mm (2.36 in.) sq. **4**: 80 mm (3.15 in.) sq. **5**: 90 mm (3.54 in.) sq.
  6: 104 mm (4.09 in.) sq.
  [Gearhead frame size of combination type parallel gearhead: 110 mm (4.33 in.)]
- **BXS**: Series name **BXS**: **BXⅡ** Series

6.3 Combination tables

- ☐ in the model names indicates a number representing the gear ratio.
- When a connection cable is included, ■ in the model names indicates a number (**-1**, **-2**, **-3**) representing the cable length.
- The combination types come with the motor and gearhead pre-assembled.

■ Standard type

	Model	Motor model	Gearhead model	Driver model
Combination type parallel shaft gearhead	**BXS230A-☐S■**	BXM230-GFS	GFS2G☐	BXSD30-A
	BXS230C-☐S■			BXSD30-C
	BXS460A-☐S■	BXM460-GFS	GFS4G☐	BXSD60-A
	BXS460C-☐S■			BXSD60-C
	BXS5120A-☐S■	BXM5120-GFS	GFS5G☐	BXSD120-A
	BXS5120C-☐S■			BXSD120-C
	BXS6200A-☐S■	BXM6200-GFS	GFS6G☐	BXSD200-A
	BXS6200C-☐S■			BXSD200-C
	BXS6400C-☐S■	BXM6400-GFS		BXSD400-C
Combination type hollow shaft flat gearhead	**BXS230A-☐FR■**	BXM230-GFS	GFS2G☐FR	BXSD30-A
	BXS230C-☐FR■			BXSD30-C
	BXS460A-☐FR■	BXM460-GFS	GFS4G☐FR	BXSD60-A
	BXS460C-☐FR■			BXSD60-C
	BXS5120A-☐FR■	BXM5120-GFS	GFS5G☐FR	BXSD120-A
	BXS5120C-☐FR■			BXSD120-C
	BXS6200A-☐FR■	BXM6200-GFS	GFS6G☐FR	BXSD200-A
	BXS6200C-☐FR■			BXSD200-C
	BXS6400C-☐FR■	BXM6400-GFS		BXSD400-C
Round shaft type	**BXS230A-A■**	BXM230-A2	–	BXSD30-A
	BXS230C-A■			BXSD30-C
	BXS460A-A■	BXM460-A2		BXSD60-A
	BXS460C-A■			BXSD60-C
	BXS5120A-A■	BXM5120-A2		BXSD120-A
	BXS5120C-A■			BXSD120-C
	BXS6200A-A■	BXM6200-A		BXSD200-A
	BXS6200C-A■			BXSD200-C
	BXS6400C-A■	BXM6400-A		BXSD400-C

■ Electromagnetic brake type

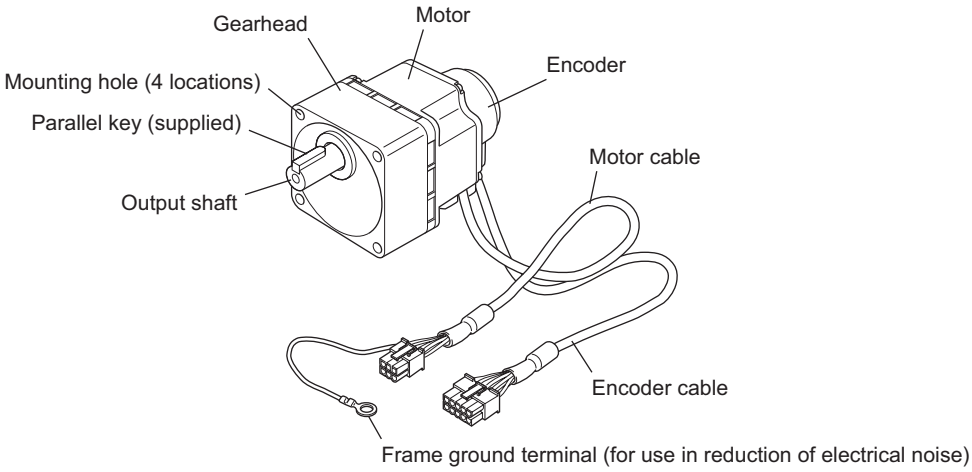
	Model	Motor model	Gearhead model	Driver model
Combination type parallel shaft gearhead	**BXS230AM-□S■**	BXM230M-GFS	GFS2G□	BXSD30-A
	BXS230CM-□S■			BXSD30-C
	BXS460AM-□S■	BXM460M-GFS	GFS4G□	BXSD60-A
	BXS460CM-□S■			BXSD60-C
	BXS5120AM-□S■	BXM5120M-GFS	GFS5G□	BXSD120-A
	BXS5120CM-□S■			BXSD120-C
	BXS6200AM-□S■	BXM6200M-GFS	GFS6G□	BXSD200-A
	BXS6200CM-□S■			BXSD200-C
	BXS6400CM-□S■	BXM6400M-GFS		BXSD400-C
Combination type hollow shaft flat gearhead	**BXS230AM-□FR■**	BXM230M-GFS	GFS2G□FR	BXSD30-A
	BXS230CM-□FR■			BXSD30-C
	BXS460AM-□FR■	BXM460M-GFS	GFS4G□FR	BXSD60-A
	BXS460CM-□FR■			BXSD60-C
	BXS5120AM-□FR■	BXM5120M-GFS	GFS5G□FR	BXSD120-A
	BXS5120CM-□FR■			BXSD120-C
	BXS6200AM-□FR■	BXM6200M-GFS	GFS6G□FR	BXSD200-A
	BXS6200CM-□FR■			BXSD200-C
	BXS6400CM-□FR■	BXM6400M-GFS		BXSD400-C
Round shaft type	**BXS230AM-A■**	BXM230M-A2	–	BXSD30-A
	BXS230CM-A■			BXSD30-C
	BXS460AM-A■	BXM460M-A2		BXSD60-A
	BXS460CM-A■			BXSD60-C
	BXS5120AM-A■	BXM5120M-A2		BXSD120-A
	BXS5120CM-A■			BXSD120-C
	BXS6200AM-A■	BXM6200M-A		BXSD200-A
	BXS6200CM-A■			BXSD200-C
	BXS6400CM-A■	BXM6400M-A		BXSD400-C

6.4 Names and functions of parts

■ Motor

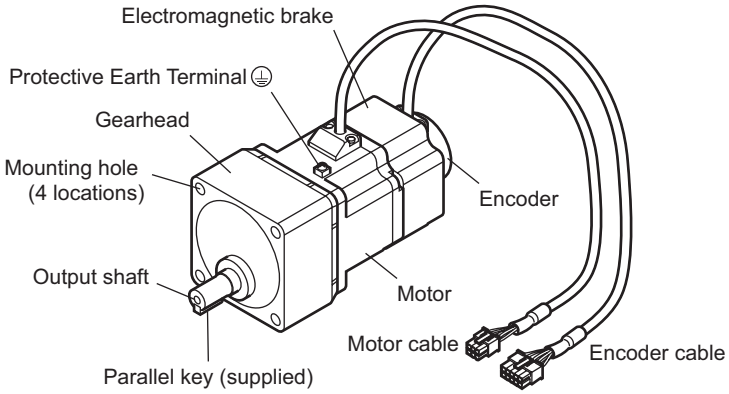
- Combination type parallel shaft gearhead
  Standard type

The illustration shows the **BXS230**, **BXS460** and **BXS5120** types.



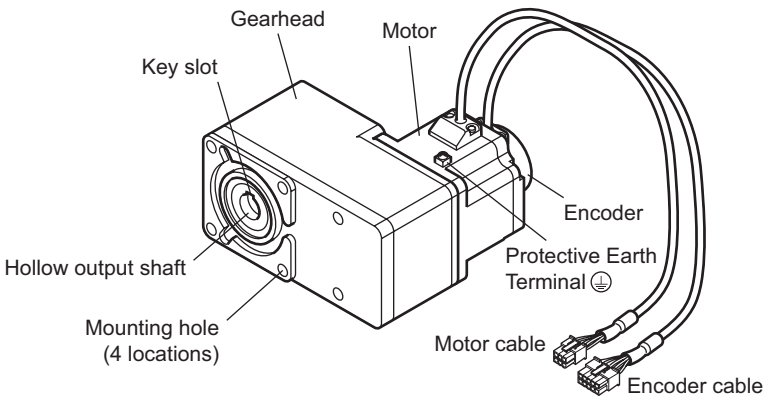
- Combination type parallel shaft gearhead
  Electromagnetic brake type

The illustration shows the **BXS6200** and **BXS6400** types.

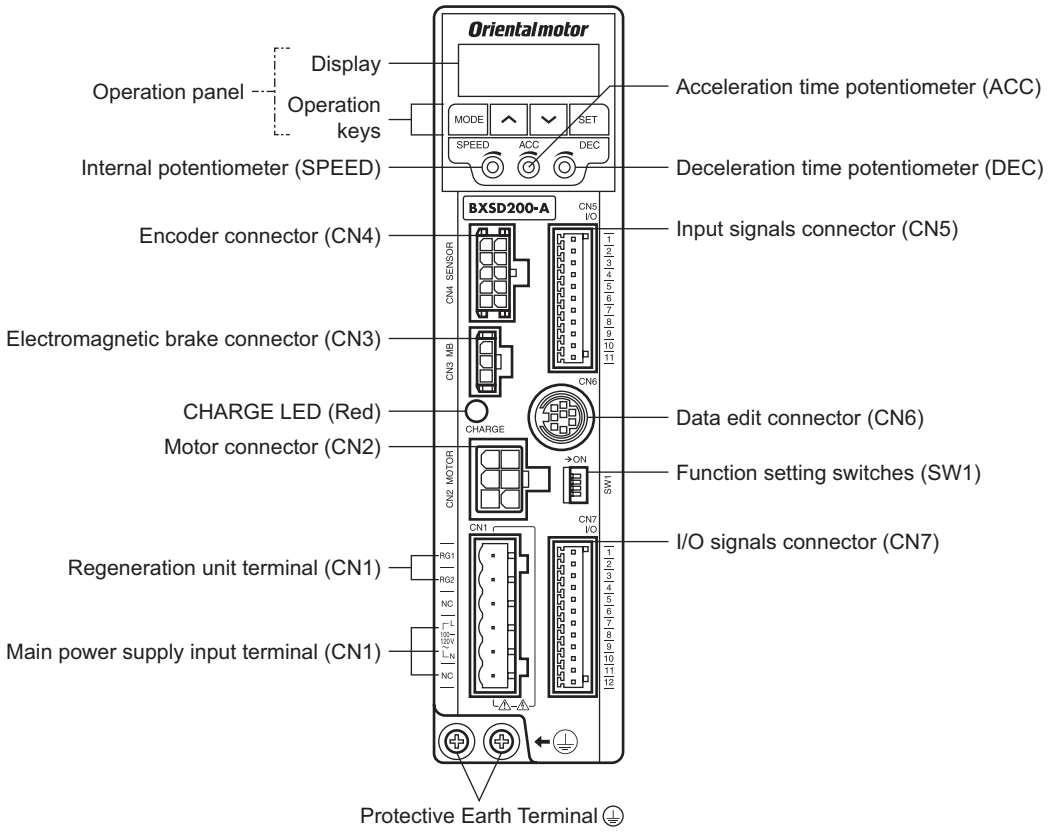


- Combination type hollow shaft flat gearhead
  Standard type

The illustration shows the **BXS6200** and **BXS6400** types.



■ Driver



Item	Description	Ref.
Operation panel	• Display: This display shows the monitor items, setting screen, alarms, etc. • Operation keys: These keys are used to switch the function mode or change parameters.	p.64
Internal potentiometer (SPEED)	This potentiometer is used to set the operation speed of the motor.	p.106
Acceleration time potentiometer (ACC)	This potentiometer is used to set the acceleration time for starting the motor.	p.107
Deceleration time potentiometer (DEC)	This potentiometer is used to set the deceleration time for stopping the motor.	
Encoder connector (CN4)	Connects the encoder connector of the conversion cable.	p.38
Electromagnetic brake connector (CN3)	Connects the electromagnetic brake connector of the conversion cable.	
CHARGE LED (Red)	This LED is lit while the main power is input. After the main power was turned off, the LED will turn off once the residual voltage in the driver drops to a safe level.	–
Motor connector (CN2)	Connects the motor power connector of the conversion cable.	p.38
Regeneration unit terminal (CN1)	Connects an accessory regeneration unit **EPRC-400P** or **RGB100** (sold separately).	p.44
Main power supply input terminal (CN1)	Connects the main power supply. • Single-phase 100-120 VAC L, N: Connects a single-phase 100-120 VAC power supply. NC: Not used. • Single-phase 200-240 VAC L1, L2: Connects a single-phase 200-240 VAC power supply. L3: Not used. • Three-phase 200-240 VAC L1, L2, L3: Connects a three-phase 200-240 VAC power supply.	p.37
Input signals connector (CN5)	Connects the input signals.	p.39
Data edit connector (CN6)	Connects a PC in which the data editing software **MEXE02** has been installed, or an accessory data setter **OPX-2A** (sold separately).	p.43

Item	Description	Ref.
Function setting switches (SW1)	• SW1-No.1: This is used to switch between the speed control mode and position control mode. [Factory setting: OFF] • SW1-No.2: This is used to set the **BX**-compatible mode. [Factory setting: OFF] • SW1-No.3: Not used. Keep this switch in the OFF position. • SW1-No.4: This switch is used to select the power supply for input signals (use the built-in power supply or external power supply). [Factory setting: OFF]	p.39 p.48
I/O signals connector (CN7)	• Connects an accessory external potentiometer **PAVR-20KZ** (sold separately) or external DC power supply. • Connects the output signals.	p.39
Protective Earth Terminal ⏚	Ground this terminal using a grounding wire of AWG18 to 14 (0.75 to 2.0 mm^2).	p.37
Mounting holes (two locations at the rear)	These mounting holes are used to install the driver with screws (M4).	p.33

2 Installation and connection

This part explains the installation method of the product, the mounting method of a load and the connection method as well as I/O signals.

Table of contents

1 Installation

This chapter explains the installation location and installation method of the motor and driver, as well as how to install a load and analog external setter. Also covered in this section are the installation and wiring methods that are in compliance with the relevant EMC Directive.

1.1 Location for installation

The motor and driver have been designed and manufactured for use as components to be installed 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 +50 °C [+32 to +122 °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
- Up to 1000 m (3300 ft.) above sea level

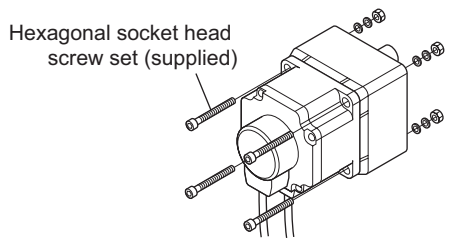
1.2 Installation overview

This section explains an overview of how to install the motor and driver. Refer to each applicable section for details.

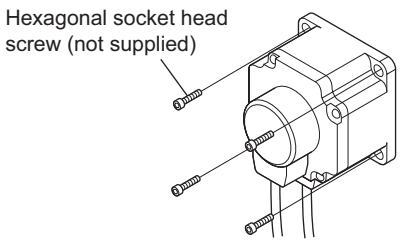
■ Installing the combination type parallel shaft gearhead or round shaft type

Secure the motor/gearhead using the hexagonal socket head screws through the four mounting holes. Tighten the nuts until no gaps remain between the motor/gearhead and mounting plate.
The combination type parallel shaft gearheads come with a set of hexagonal socket head screws. Round shaft types do not come with hexagonal socket head screws. Hexagonal socket head screws must be provided by the user if the round shaft types are used.
For machining dimension of the mounting plate or installing/removing method of the gearhead, refer to p.26 for the combination type parallel shaft gearhead and p.27 for the round shaft type.

• Combination type parallel shaft gearhead



• Round shaft type



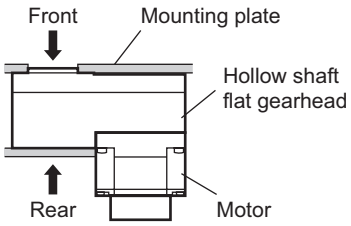
Hexagonal socket head screw set (supplied with the combination type parallel shaft gearhead)

Model	Screw size	Tightening torque	Maximum applicable plate thickness ∗
BXS230	M4	1.8 N·m (15.9 lb-in)	5 mm (0.20 in.)
BXS460	M6	6.4 N·m (56 lb-in)	8 mm (0.31 in.)
BXS5120 **BXS6200** **BXS6400**	M8	15.5 N·m (137 lb-in)	12 mm (0.47 in.)

∗ When the supplied hexagonal socket head screw set is used.

■ Installing the 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 the motor/gearhead using the hexagonal socket head screws through the four mounting holes. Tighten the nuts until no gaps remain between the motor/gearhead and mounting plate.
Attach the supplied safety cover to the hollow output shaft on the end opposite from the one where the load shaft is installed.
Refer to p.27 for the installation method and removing/installing method of the gearhead.



Hexagonal socket head screw (supplied)

Model	Screw size	Tightening torque	Maximum applicable plate thickness ∗
BXS230	M5	3.8 N·m (33 lb-in)	5 mm (0.20 in.)
BXS460	M6	6.4 N·m (56 lb-in)	8 mm (0.31 in.)
BXS5120 **BXS6200** **BXS6400**	M8	15.5 N·m (137 lb-in)	12 mm (0.47 in.)

∗ When the supplied hexagonal socket head screws are used.

■ Installing the driver

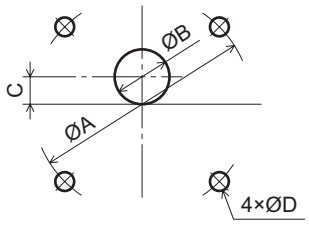
The driver can be installed in three different ways. Refer to p.33 for the specific installation methods.

- Install the driver through the mounting holes (two locations) provided at the driver rear side using screws (M4: not supplied).
- Install the driver to a DIN rail using an accessory DIN rail mounting plate (sold separately).
- Install the driver using the supplied driver mounting bracket.

1.3 Installing the combination type parallel shaft gearhead

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

Model	ØA	ØB	C	ØD
BXS230	70 (2.76)	24 (0.94)	10 (0.39)	4.5 (0.177)
BXS460	94 (3.70)	34 (1.34)	13 (0.51)	6.5 (0.256)
BXS5120	104 (4.09)	40 (1.57)	18 (0.71)	8.5 (0.335)
BXS6200 **BXS6400**	120 (4.72)	42 (1.65)	20 (0.79)	8.5 (0.335)

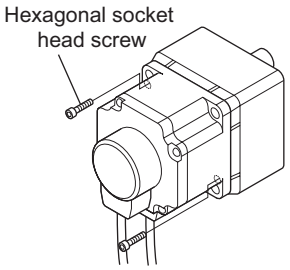


ØB indicates the external dimensions of the product.
Drill holes with a minimum diameter of ØB +1 mm (0.04 in.).

■ Removing/Installing the gearhead

To replace the gearhead or change the cable outlet direction, remove the screws assembling the gearhead.
The gearhead can be removed and the motor cable position changed to a desired 90° direction.

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

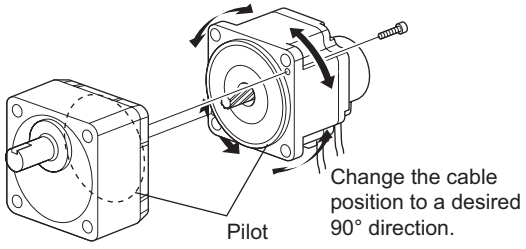


Assembly screws

Model	Screw size	Tightening torque
BXS230 **BXS460**	M2.6	0.4 N·m (3.5 lb-in)
BXS5120 **BXS6200** **BXS6400**	M3	0.6 N·m (5.3 lb-in)

2. Using the pilot sections of the motor and gearhead as guides, install the gearhead to the motor and tighten the hexagonal socket head screws.

At this time, the motor cable position can be changed to a desired 90° direction. When installing the gearhead, slowly rotate it clockwise/counterclockwise to prevent the pinion of the motor output shaft from contacting the side panel or gear of the gearhead. Also confirm that no gaps remain between the motor flange surface and the end face of the gearhead pilot section.



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 motor/gearhead assembly, be sure to use the supplied hexagonal socket head screws (4 pcs.).

1.4 Installing the round shaft type

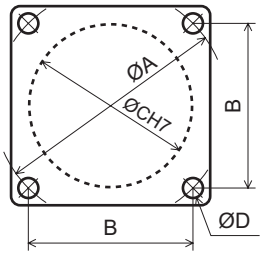
■ Mounting plate size

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	Thickness	Material
BXS230	115×115 mm (4.53×4.53 in.)	5mm (0.20 in.)	Aluminum
BXS460	135×135 mm (5.31×5.31 in.)		
BXS5120	165×165 mm (6.50×6.50 in.)		
BXS6200	200×200 mm (7.87×7.87 in.)		
BXS6400	250×250 mm (9.84×9.84 in.)	6 mm (0.24 in.)	

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

Model	ØA	B	ØCH7	ØD
BXS230	70 (2.76)	49.5 (1.949)	$54\ ^{+0.030}_{0}$ ($2.1260\ ^{+0.0012}_{0}$)	4.5 (0.177)
BXS460	94 (3.70)	66.47 (2.616)	$73\ ^{+0.030}_{0}$ ($2.8740\ ^{+0.0012}_{0}$)	6.5 (0.256)
BXS5120	104 (4.09)	73.54 (2.895)	$83\ ^{+0.035}_{0}$ ($3.2677\ ^{+0.0014}_{0}$)	8.5 (0.335)
BXS6200 **BXS6400**	120 (4.72)	84.85 (3.341)	$94\ ^{+0.035}_{0}$ ($3.7008\ ^{+0.0014}_{0}$)	8.5 (0.335)



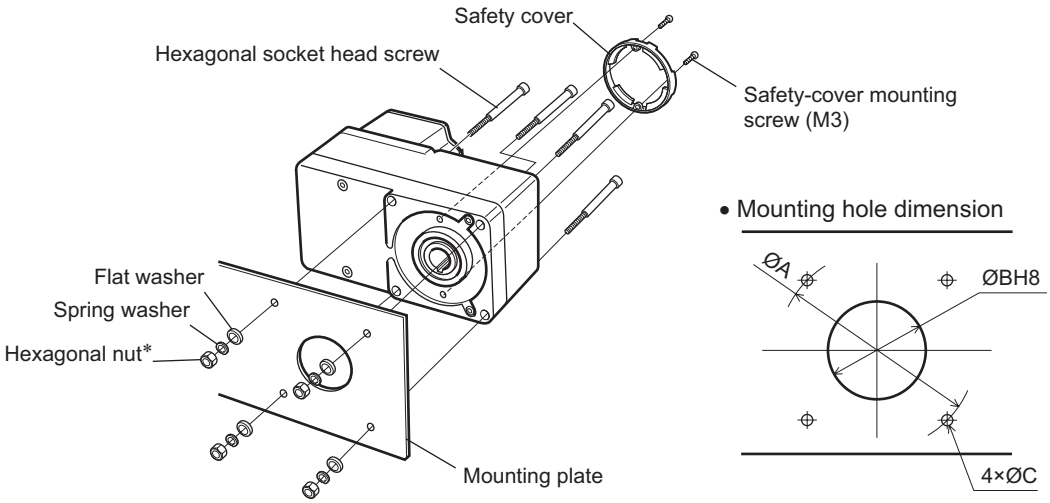
ØC indicates the pilot diameter on the flange.

Note Insert the pilot located on the motor mounting surface into a pilot receiving hole in the mounting plate.

1.5 Installing the combination type hollow shaft flat gearhead

■ 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.

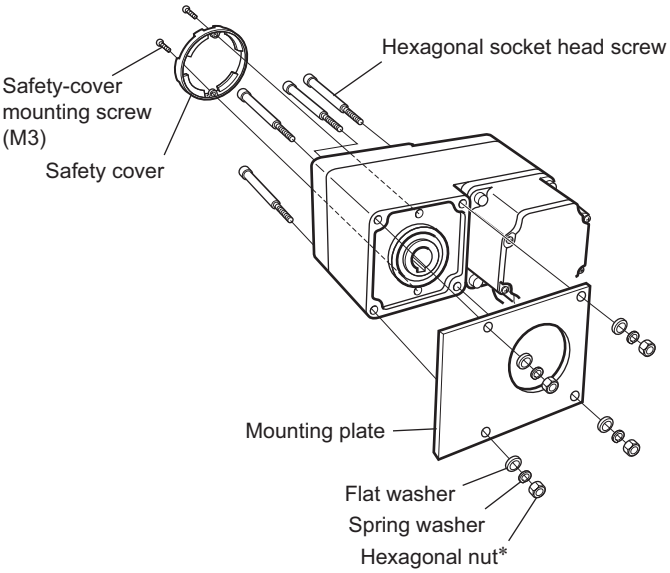


∗ The **BXS6200** and **BXS6400** do not come with hexagonal nuts. Provide hexagonal nuts separately or drill tapped holes in the mounting plate.

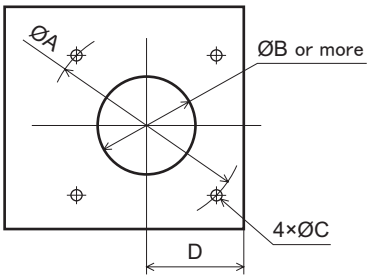
Mounting hole dimensions

Model	Screw size	Tightening torque	ØA [mm (in.)]	ØBH8 [mm (in.)]	ØC [mm (in.)]
BXS230	M5	3.8 N·m (33 lb-in)	70 (2.76)	$34\ ^{+0.039}_{0}$ ($1.34\ ^{+0.015}_{0}$)	5.5 (0.217)
BXS460	M6	6.4 N·m (56 lb-in)	94 (3.70)	$38\ ^{+0.039}_{0}$ ($1.50\ ^{+0.015}_{0}$)	6.5 (0.256)
BXS5120	M8	15.5 N·m (137 lb-in)	104 (4.09)	$50\ ^{+0.039}_{0}$ ($1.97\ ^{+0.015}_{0}$)	8.5 (0.335)
BXS6200 **BXS6400**			120 (4.72)	$58\ ^{+0.046}_{0}$ ($2.28\ ^{+0.018}_{0}$)	–

■ Using the rear side as the mounting surface



• Mounting hole dimension



* The **BXS6200** and **BXS6400** do not come with hexagonal nuts. Provide hexagonal nuts separately or drill tapped holes in the mounting plate.

Mounting hole dimensions

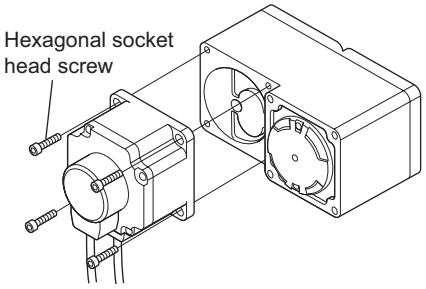
Model	Screw size	Tightening torque	ØA mm (in.)	ØB mm (in.)	ØC mm (in.)	D mm (in.)
BXS230	M5	3.8 N·m (33 lb-in)	70 (2.76)	25 (0.98)	5.5 (0.217)	29 (1.14)
BXS460	M6	6.4 N·m (56 lb-in)	94 (3.70)	30 (1.18)	6.5 (0.256)	39 (1.54)
BXS5120	M8	15.5 N·m (137 lb-in)	104 (4.09)	35 (1.38)	8.5 (0.335)	44 (1.73)
BXS6200 **BXS6400**			120 (4.72)	42 (1.65)	–	57 (2.24)

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 D below the specified value.

■ Removing/Installing the gearhead

To replace the gearhead or change the cable outlet direction, remove the screws assembling the gearhead. The gearhead can be removed and the motor cable position can be changed to one of three 90° directions. Note that the motor cable cannot be positioned in the direction where the cable faces the gearhead output shaft.

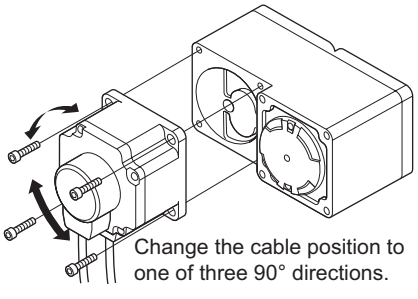
1. Remove the hexagonal socket head screws (4 pcs.) attaching the gearhead and motor and detach the motor from the gearhead.



Assembly screws

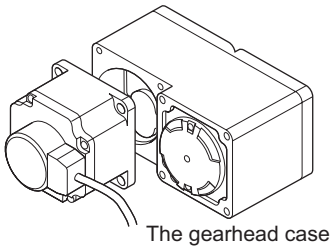
Model	Screw size	Tightening torque
BXS230	M4	1.8 N·m (15.9 lb-in)
BXS460	M6	6.4 N·m (56 lb-in)
BXS5120 **BXS6200** **BXS6400**	M8	15.5 N·m (137 lb-in)

2. Using the pilot sections of the motor and gearhead as guides, install the motor to the gearhead and tighten the hexagonal socket head screws.
   At this time, the motor cable position can be changed to one of three 90° directions. Install the motor carefully to prevent the pinion of the motor output shaft from contacting the casing or gear of the gearhead.
   Also confirm that no gaps remain between the motor flange surface and the end face of the gearhead pilot section.



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.



1.6 Installing a load to the combination type parallel gearhead or round shaft type

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

Note

- When coupling the motor (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 (gearhead output shaft) or bearing. Forcing in the load by driving it with a hammer, etc., may break the bearing. Do not apply any excessive force to the output shaft.
- Do not modify or machine the motor (gearhead) output shaft. The bearing may be damaged or motor (gearhead) may break.

■ Output shaft shape

- Combination type parallel shaft gearhead

  A key slot is provided on the output shaft of each combination type parallel shaft gearhead. Form a key slot on the load side and secure the load using the supplied parallel key.

- 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 motor (gearhead) output shaft with the centerline of the load shaft.

- Using a belt drive

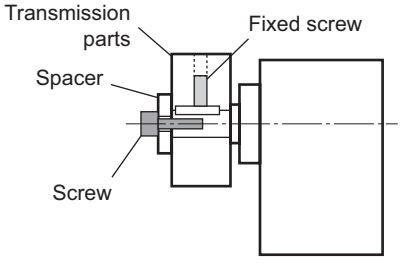
  Adjust the motor (gearhead) output shaft to lie parallel with the load shaft and form right angles between the output shaft/load shaft and the line connecting the centers of both pulleys.

- Using a gear drive

  Adjust the motor (gearhead) output shaft 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 tapped hole provided at the end of the output shaft as an auxiliary means for preventing the transfer mechanism from disengaging. (The output shaft end tapped hole is not provided for the GFS2G type gearheads.)



Gearhead model	Output shaft end tapped hole
GFS4G	M5, Effective depth 10 mm (0.39 in.)
GFS5G GFS6G	M6, Effective depth 12 mm (0.47 in.)

1.7 Installing a load to the combination type hollow shaft flat gearhead

If the motor is subject to a strong impact upon instantaneous stop or receives a large radial load, use a stepped load shaft.

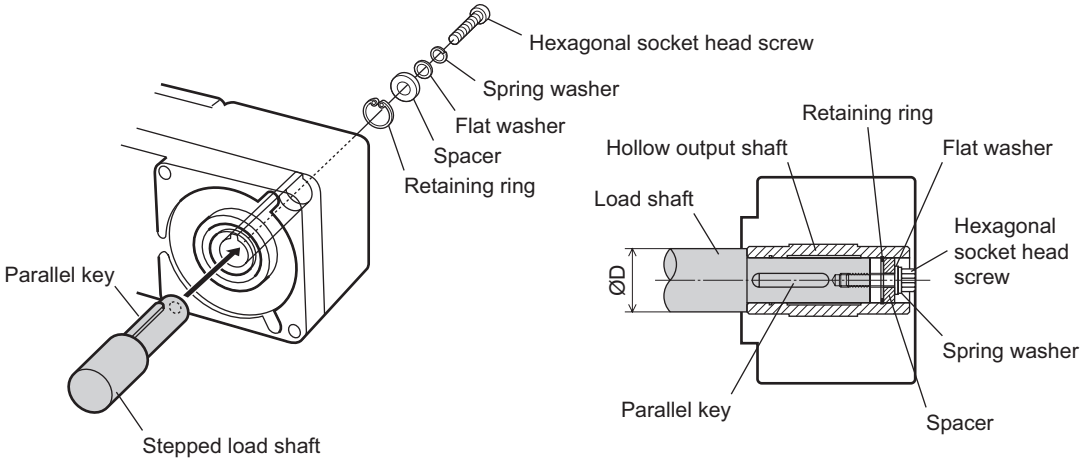
Note

- Apply grease (molybdenum disulfide grease, etc.) on the surface of the load shaft and inner walls of the hollow output shaft to prevent seizure.
- When installing a load, do not damage the hollow output shaft or bearing of the gearhead. Forcing in the load by driving it with a hammer, etc., may break the bearing. Do not apply any excessive force to the output shaft.
- Do not modify or machine the hollow output shaft of the gearhead. The bearing may be damaged or motor (gearhead) may break.

■ Stepped load shaft

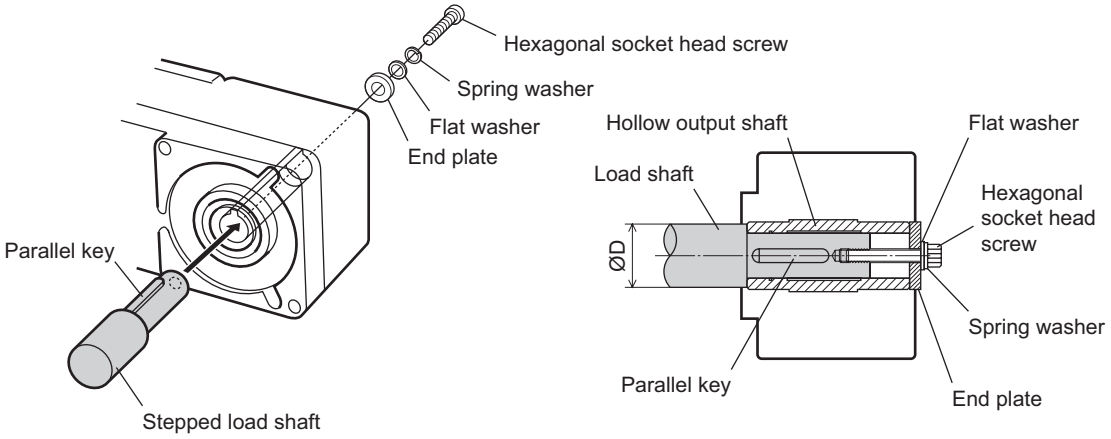
- Mounting method using retaining ring

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

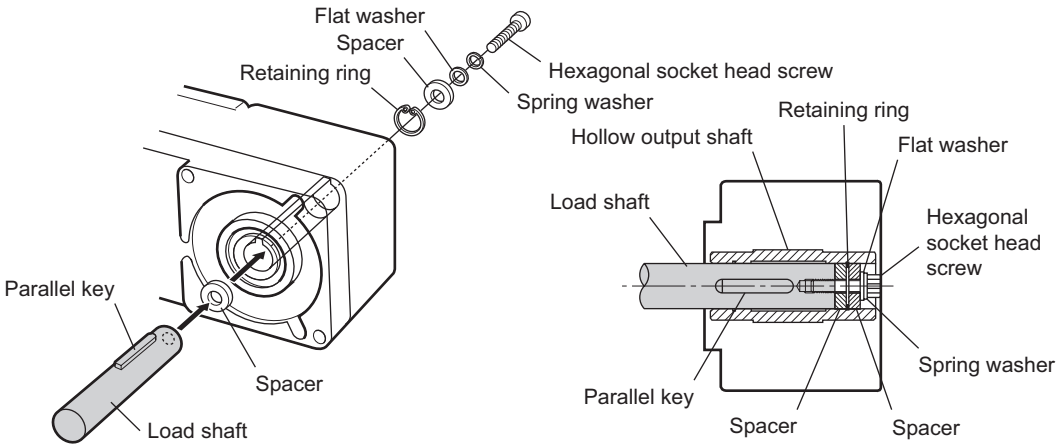
- Recommended load shaft installation dimensions [Unit: mm (in.)]

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)
BXS230	Ø12 $^{+0.027}_{0}$ (Ø0.4724 $^{+0.0011}_{0}$)	Ø12 $^{0}_{-0.018}$ (Ø0.4724 $^{0}_{-0.0007}$)	Ø12 (Ø0.47)	M4	3 (0.12)	20 (0.79)
BXS460	Ø15 $^{+0.027}_{0}$ (Ø0.5906 $^{+0.0011}_{0}$)	Ø15 $^{0}_{-0.018}$ (Ø0.5906 $^{0}_{-0.0007}$)	Ø15 (Ø0.59)	M5	4 (0.16)	25 (0.98)
BXS5120	Ø20 $^{+0.033}_{0}$ (Ø0.7874 $^{+0.0013}_{0}$)	Ø20 $^{0}_{-0.021}$ (Ø0.7874 $^{0}_{-0.0008}$)	Ø20 (Ø0.79)	M6	5 (0.20)	30 (1.18)
BXS6200 BXS6400	Ø25 $^{+0.033}_{0}$ (Ø0.9843 $^{+0.0013}_{0}$)	Ø25 $^{0}_{-0.021}$ (Ø0.9843 $^{0}_{-0.0008}$)	Ø25 (Ø0.98)	M8	6 (0.24) [3 (0.12)]∗	40 (1.57)

∗ The value in [ ] is the thickness when installing the gearhead by using its rear side as the mounting surface.

■ 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.



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
BXS230	Ø12 $^{+0.027}_{0}$ (Ø0.4724 $^{+0.0011}_{0}$)	Ø12 $^{0}_{-0.018}$ (Ø0.4724 $^{0}_{-0.0007}$)	Ø12 (Ø0.47)	M4	3 (0.12)
BXS460	Ø15 $^{+0.027}_{0}$ (Ø0.5906 $^{+0.0011}_{0}$)	Ø15 $^{0}_{-0.018}$ (Ø0.5906 $^{0}_{-0.0007}$)	Ø15 (Ø0.59)	M5	4 (0.16)
BXS5120	Ø20 $^{+0.033}_{0}$ (Ø0.7874 $^{+0.0013}_{0}$)	Ø20 $^{0}_{-0.021}$ (Ø0.7874 $^{0}_{-0.0008}$)	Ø20 (Ø0.79)	M6	5 (0.20)
BXS6200 BXS6400	Ø25 $^{+0.033}_{0}$ (Ø0.9843 $^{+0.0013}_{0}$)	Ø25 $^{0}_{-0.021}$ (Ø0.9843 $^{0}_{-0.0008}$)	Ø25 (Ø0.98)	M8	6 (0.24) [3 (0.12)]∗

∗ The value in [ ] is the thickness when installing the gearhead by using its rear side as the mounting surface.

1.8 Permissible radial load and permissible axial load

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

Note If the radial load or axial load exceeds the specified allowable value, repeated load applications may cause the bearing or output shaft of the motor (gearhead) to undergo a fatigue failure.

■ Combination type parallel shaft gearhead

Model		Distance from output shaft end of gearhead and permissible radial load [N (lb.)] ∗		Permissible axial load [N (lb.)]
	Gear ratio	10 mm (0.39 in.)	20 mm (0.79 in.)	
BXS230	5	100 (22) [90 (20)]	150 (33) [110 (24)]	40 (9)
	10 to 20	150 (33) [130 (29)]	200 (45) [170 (38)]	
	30 to 200	200 (45) [180 (40)]	300 (67) [230 (51)]	
BXS460	5	200 (45) [180 (40)]	250 (56) [220 (49)]	100 (22)
	10 to 20	300 (67) [270 (60)]	350 (78) [330 (74)]	
	30 to 200	450 (101) [420 (94)]	550 (123) [500 (112)]	
BXS5120	5	300 (67) [230 (51)]	400 (90) [300 (67)]	150 (33)
	10 to 20	400 (90) [370 (83)]	500 (112) [430 (96)]	
	30 to 200	500 (112) [450 (101)]	650 (146) [550 (123)]	
BXS6200 BXS6400	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 speed of 4000 r/min.

■ Combination type hollow shaft flat gearhead

Model		Distance from mounting surface of gearhead and permissible radial load [N (lb.)] ∗1		Permissible axial load [N (lb.)]
	Gear ratio	10 mm (0.39 in.)	20 mm (0.79 in.)	
BXS230	5, 10	450 (101) [410 (92)]	370 (83) [330 (74)]	200 (45)
	15 to 200	500 (112) [460 (103)]	400 (90) [370 (83)]	
BXS460	5, 10	800 (180) [730 (164)]	660 (148) [600 (135)]	400 (90)
	15 to 200	1200 (270) [1100 (240)]	1000 (220) [910 (200)]	
BXS5120	5, 10	900 (200) [820 (184)]	770 (173) [700 (157)]	500 (112)
	15, 20	1300 (290) [1200 (270)]	1110 (240) [1020 (220)]	
	30 to 200	1500 (330) [1400 (310)]	1280 (280) [1200 (270)]	
BXS6200 BXS6400	5 ∗2	1230 (270) [1130 (250)]	1070 (240) [990 (220)]	800 (180)
	10			
	15, 20	1680 (370) 1550 (340)]	1470 (330) [1360 (300)]	
	30 to 100	2040 (450) [1900 (420)]	1780 (400) [1660 (370)]	

∗1 The values assume a rated speed of 3000 r/min or below. The values in brackets [ ] are based on a speed of 4000 r/min.

∗2 **BXS6400** type only

■ 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.)	
BXS230	87.2 (19.6)	107 (24)	Not to exceed one-half the motor's mass ∗
BXS460	117 (26)	137 (30)	
BXS5120	156 (35)	176 (39)	
BXS6200 BXS6400	197 (44)	221 (49)	

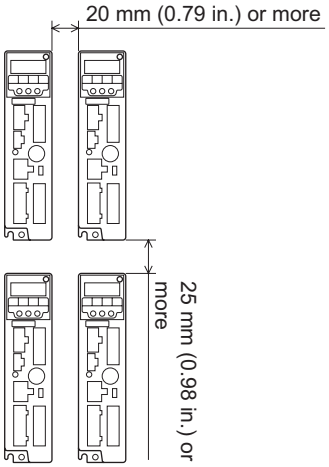
∗ Minimize an axial load as much as possible. If an axial load must be applied, do not let it exceed one-half the motor's mass.

1.9 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 high heat conductivity [corresponding to an aluminum plate of 200×200×2 mm (7.87×7.87×0.08 in.)].

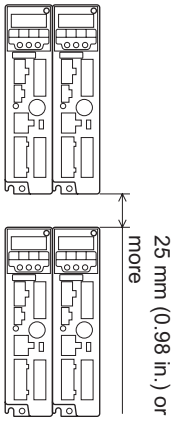
■ Installation direction

When installing drivers, provide a clearance of at least 25 mm (0.98 in.) in the horizontal and vertical directions between the driver and enclosure or other equipment within the enclosure. When two or more drivers are to be installed side by side, provide 20 mm (0.79 in.) and 25 mm (0.98 in.) clearances in the horizontal and vertical directions, respectively.



It is possible to install drivers closely in the horizontal direction. In this case, install the drivers to a heat sink [corresponding to an aluminum plate of 350×350×2 mm (13.78×13.78×0.08 in.)].
In addition, for the **BXS6200** and **BXS6400** types, satisfy the following conditions.

- Ambient temperature: 0 to +40 °C (+32 to +104 °F)
- When using the driver mounting bracket or installing to a DIN rail, use the product in the load factor of 90% maximum.



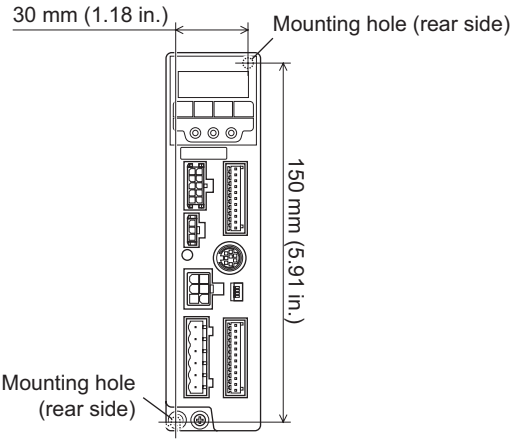
Note

- Install the driver in an enclosure whose pollution degree is 2 or better environment, or whose degree of protection is IP54 minimum.
- Do not install any equipment that generates a large amount of heat or noise near the driver.
- Do not install the driver underneath the controller or other equipment vulnerable to heat.
- Check ventilation if the ambient temperature of the driver exceeds 50 °C (122 °F).
- Be sure to install the driver vertically (in vertical position).

■ Installation method

- Installing with screws

Install the driver through the mounting holes using two screws (M4: not supplied).



- Mounting to DIN rail

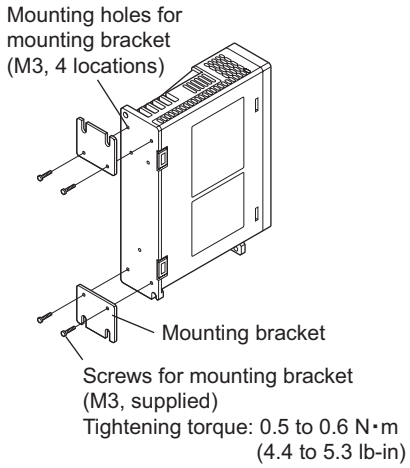
When installing the driver to a DIN-rail, use an accessory DIN rail mounting plate **MADP02** (sold separately) and mount it to a 35 mm (1.38 in.) wide DIN rail.

- Installation using the driver mounting bracket

Secure the mounting bracket to the driver rear side using the supplied mounting screws, and install the driver inside equipment.

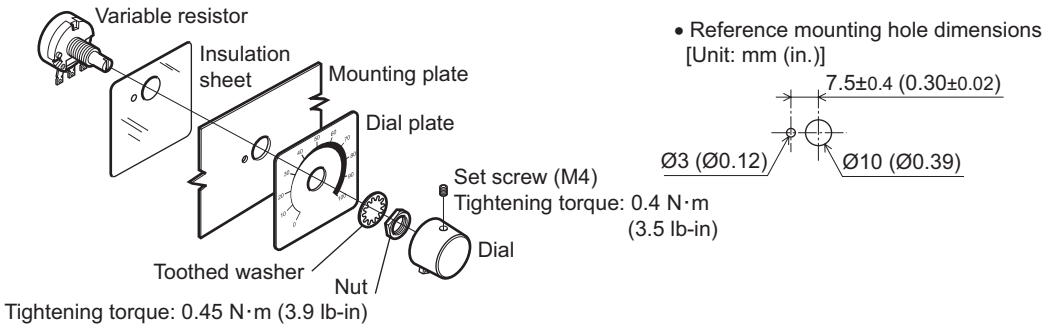
Note

- Do not use the mounting holes of the driver mounting bracket for any other purpose.
- Be sure to secure the driver mounting bracket using the supplied screws. 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.



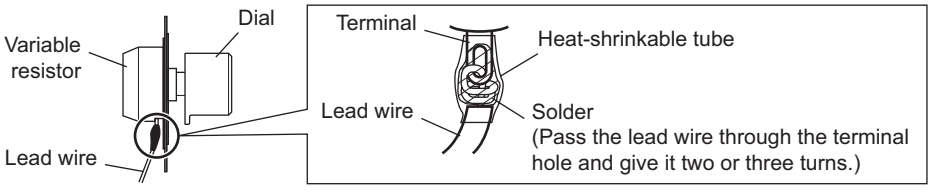
1.10 Installing the PAVR-20KZ (accessory)

Connect the **PAVR-20KZ** as shown below.



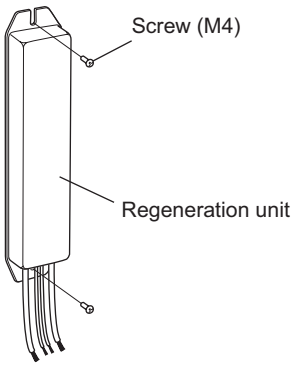
Soldering the variable resister terminals and the lead wires

Cover a heat-shrinkable tube over the soldered part to insulate.
Soldering condition: 235 °C (455 °F), less than 5 s

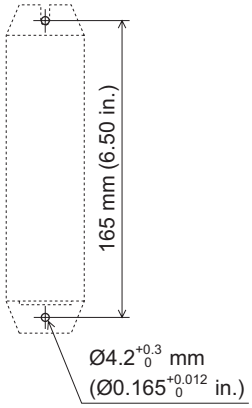


1.11 Installing the regeneration unit (accessory)

Install the regeneration unit **EPRC-400P** or **RGB100** in a location where heat dissipation capacity equivalent to a level achieved with a heat sink [corresponding to an aluminum plate of 350×350×3 mm (13.78×13.78×0.12 in.)] is ensured.
Secure the regeneration unit on a smooth metal plate offering high heat conductivity, using two screws (M4, not supplied).
The regeneration units vary depending on the motor output power. Refer to p.164 for details.



• Mounting hole dimensions

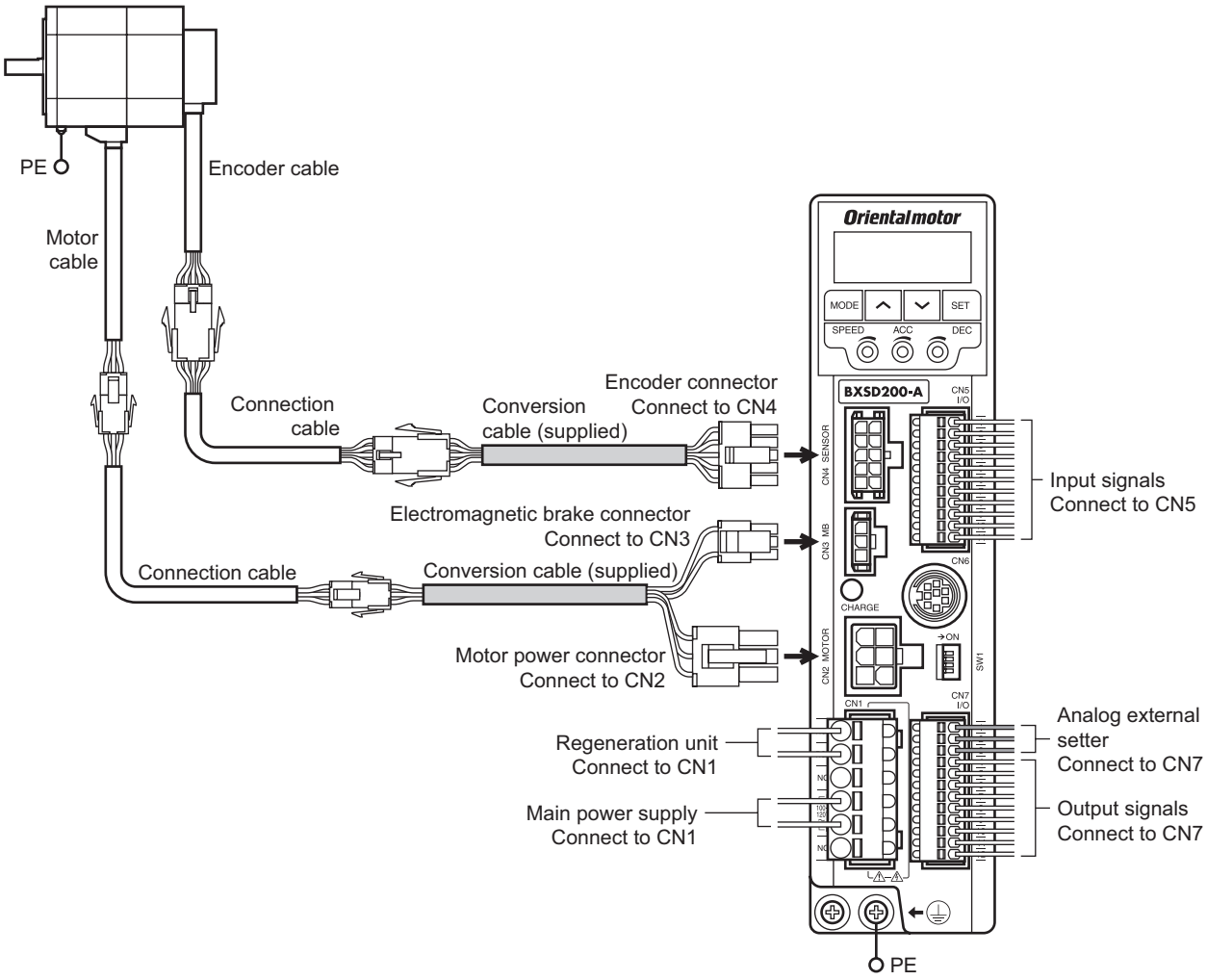


2 Connection

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

2.1 Connection example

A connection example shown below applies to the electromagnetic brake motor (**BXS6200**, **BXS6400**).



Note

- Always use the supplied conversion cable to connect the motor. Connecting the motor directly may cause malfunction.
- Regardless of whether an electromagnetic brake is equipped or not, be sure to connect the electromagnetic brake connector to the CN3.
- Have the connector plugged in securely. Insecure connections may cause malfunction or damage to the motor or driver.
- Do not wire the power supply cable of the driver in the same cable duct with other power line or motor cable. Doing so may cause malfunction due to noise.
- When cycling the power or plugging/unplugging the connector, turn off the power and wait for the CHARGE LED to turn off before doing so. Residual voltage may cause electric shock.
- When installing the motor on a moving part, use a flexible cable offering excellent flexibility. Refer to p.164 for details.

2.2 Connecting the power supply

Connects the power supply cable to the main power supply input terminal (CN1).
The power supply cable does not come with the product. Provide it by the user.

Input power supply	Connection method
Single-phase 100-120 VAC	Connect the live side to terminal L, and the neutral side to terminal N.
Single-phase 200-240 VAC	Connect the live side to terminal L1, and the neutral side to terminal L2.
Three-phase 200-240 VAC	Connect the R, S and T phase lines to the L1, L2 and L3 terminals, respectively.

■ Applicable lead wire

- Applicable lead wire: AWG18 to 14 (0.75 to 2.0 mm^2)
- Strip Length: 10 mm (0.39 in.)
- Conductive material: Use only copper wire.

■ Applicable crimp terminal

If crimp terminals are used, select the following terminals.

Manufacturer	PHOENIX CONTACT GmbH & Co. KG
Model	AI 0.75-10 [AWG18 (0.75 mm^2)] AI 1-10 [AWG18 (0.75 mm^2)] AI 1.5-10 [AWG16 (1.25 mm^2)] AI 2.5-10 [AWG14 (2.0 mm^2)]

■ Circuit breaker

Be sure to connect a circuit breaker to the power line of the driver to protect the primary circuit.
Rated current of protective device: Single-phase input 15 A, three-phase input 10 A
Circuit breaker: Mitsubishi Electric Corporation NF30

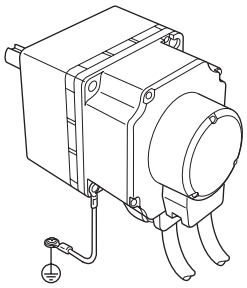
2.3 Grounding

■ How to ground the motor

Ground the Protective Earth Terminal of the motor near the motor. Wire it as short as possible. The grounding method varies depending on the motor output power.

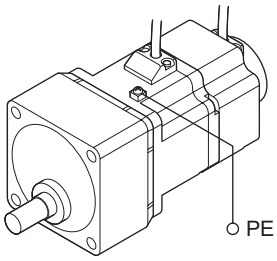
- **BXS230**, **BXS460**, **BXS5120**

Ground the motor using one of the four mounting holes on the motor frame.
At this time, insulate the frame ground terminal from the cable without grounding.



- **BXS6200**, **BXS6400**

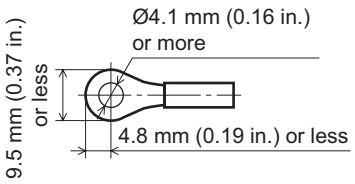
Be sure to ground the Protective Earth Terminal of the motor (screw size: M4).



- Protective Earth Terminal of the motor

Use a round terminal which is larger than the following size, and secure it with a mounting screw over a serrated-tooth lock washer.

- Applicable crimp terminal: Round crimp terminal with insulation cover
- Applicable lead wire: AWG18 to 14 (0.75 to 2.0 mm^2)
- Thread size of terminal: M4
- Tightening torque: 1.2 N·m (10.6 lb-in)



- Lead wire for Protective Earth Terminal of the motor

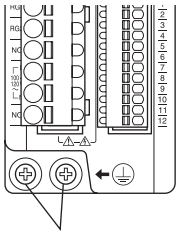
Use the lead wire of AWG18 (0.75 mm^2) or thicker for the lead wire for Protective Earth Terminal.

■ Grounding the driver

Be sure to ground the Protective Earth Terminal of the driver (screw size: M4).

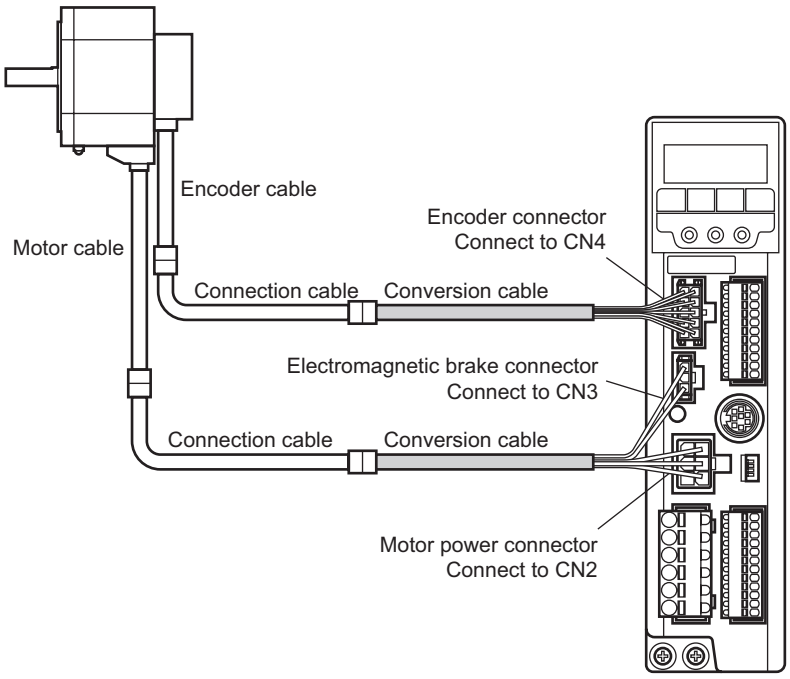
- Applicable crimp terminal: Round crimp terminal with insulation cover
- Tightening torque: 1.2 N·m (10.6 lb-in)
- Applicable lead wire: AWG18 to 14 (0.75 to 2.0 mm^2)

Either of the two Protective Earth Terminals can be used for grounding the driver. The terminal that is not grounded can be used as a spare terminal.
Use the spare terminal according to your specific need, such as connecting it to the motor in order to ground the motor.
Do not share the Protective Earth Terminal with a welder or any other power equipment.
When grounding, secure it near the driver.



2.4 Connecting the motor and driver

Connect the motor to the driver via the supplied conversion cable.
Connect the motor power connector of the conversion cable to the CN2, the electromagnetic brake connector to the CN3 and the encoder connector to the CN4.
When extending the wiring distance between the motor and driver, use the connection cable (supplied or sold separately). Connection can be extended to a maximum of 30 m (98.4 ft.).

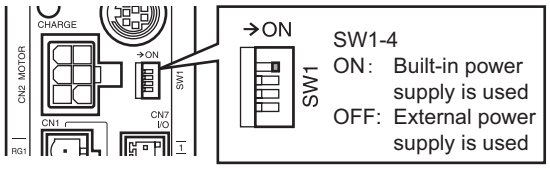


Note

- Always use the supplied conversion cable to connect the motor. Connecting the motor without using the conversion cable may cause malfunction.
- Have the connector plugged in securely. Insecure connection may cause malfunction or damage to the motor or driver.
- Do not plug or unplug the connector while the power is supplied. Doing so may cause malfunction or electric shock.

2.5 Selecting a power supply for input signals

Select the power supply for input signals (use the built-in power supply or external power supply).
To control the operation using relays and switches, set the SW1-No.4 to the ON side to select the built-in power supply.
Factory setting: OFF (an external power supply is used)

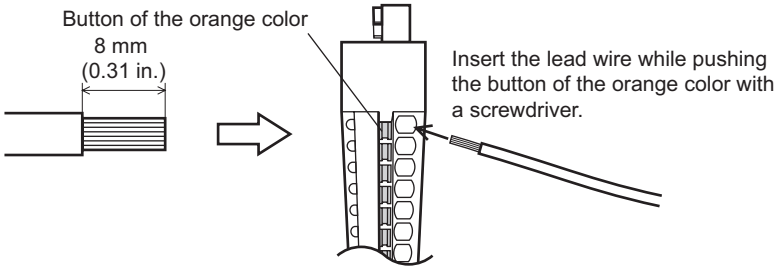


Note The built-in power supply cannot be used with the source logic. If the source logic is used, do not set the SW1-No.4 to the ON side.

2.6 Connecting the I/O signals

Connect the input signals to the CN5, and also connect the external setting input signals and output signals to the CN7.

- Applicable lead wire: AWG26 to 20 (0.14 to 0.5 mm^2)
- Strip Length: 8 mm (0.31 in.)



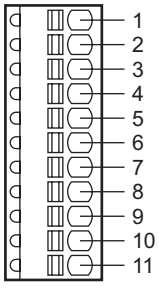
Applicable crimp terminal

If crimp terminals are used, select the following terminals.

Manufacturer	PHOENIX CONTACT GmbH & Co. KG
Model	A 0.25-7 [AWG24 (0.2 mm^2)] A 0.34-7 [AWG22 (0.3 mm^2)] A 0.5-8 [AWG20 (0.5 mm^2)]

■ CN5 pin assignment

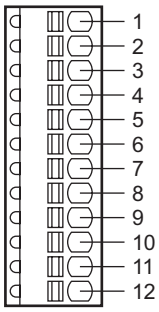
Pin No.	Signal name	Function∗
1	IN-COM0	Input signals common
2	IN0	Input terminal 0 [FWD]
3	IN1	Input terminal 1 [RVS]
4	IN2	Input terminal 2 [M0]
5	IN3	Input terminal 3 [M1]
6	IN4	Input terminal 4 [M2]
7	IN5	Input terminal 5 [FREE]
8	IN6	Input terminal 6 [STOP]
9	IN7	Input terminal 7 [ALM-RST]
10	IN8	Input terminal 8 [Not used (possible to extend)]
11	IN-COM1	Input signals common (0 V)



∗ The signal in brackets [ ] is a function that is assigned at the time of shipment (speed control mode).

■ CN7 pin assignment

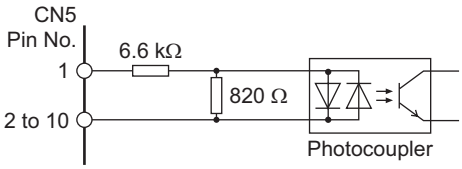
Pin No.	Signal name	Function ∗
1	VH	External setting input
2	VM	
3	VL	
4	OUT0+	Output terminal 0+ [ALM]
5	OUT0−	Output terminal 0− [ALM]
6	OUT1+	Output terminal 1+ [MOVE]
7	OUT1−	Output terminal 1− [MOVE]
8	OUT2+	Output terminal 2+ [WNG]
9	OUT2−	Output terminal 2− [WNG]
10	ASG	A-phase output
11	BSG	B-phase output
12	OUT-COM	ASG/BSG common



∗ The signal in brackets [ ] is a function that is assigned at the time of shipment (speed control mode).

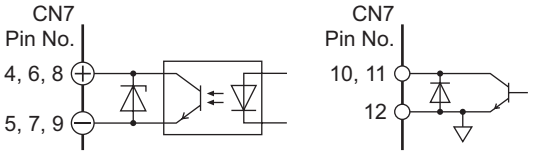
■ Input signals circuit

The following input signals of the driver are photocoupler inputs. When using an external power supply: 24 VDC −15 to +20%, 100 mA or more



■ Output signals circuit

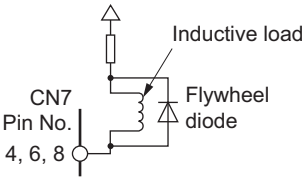
Two types of driver output signal are available: photocoupler/open-collector output and transistor/open-collector output



Pin No.	Signal name	Description
4 to 9	OUT0 to OUT2	Photocoupler/open collector output ON voltage: 1.6 VDC maximum 4.5 to 30 VDC, 100 mA or less
10, 11	ASG, BSG	Transistor/open-collector output ON voltage: 0.5 VDC maximum 4.5 to 30 VDC, 20 mA or less

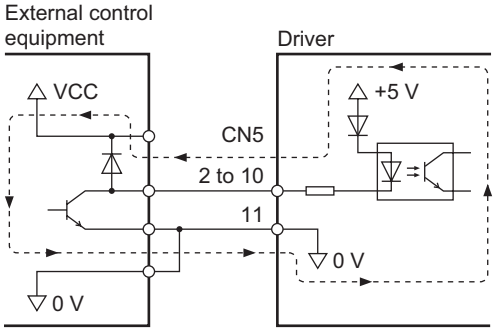
Note

- 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.



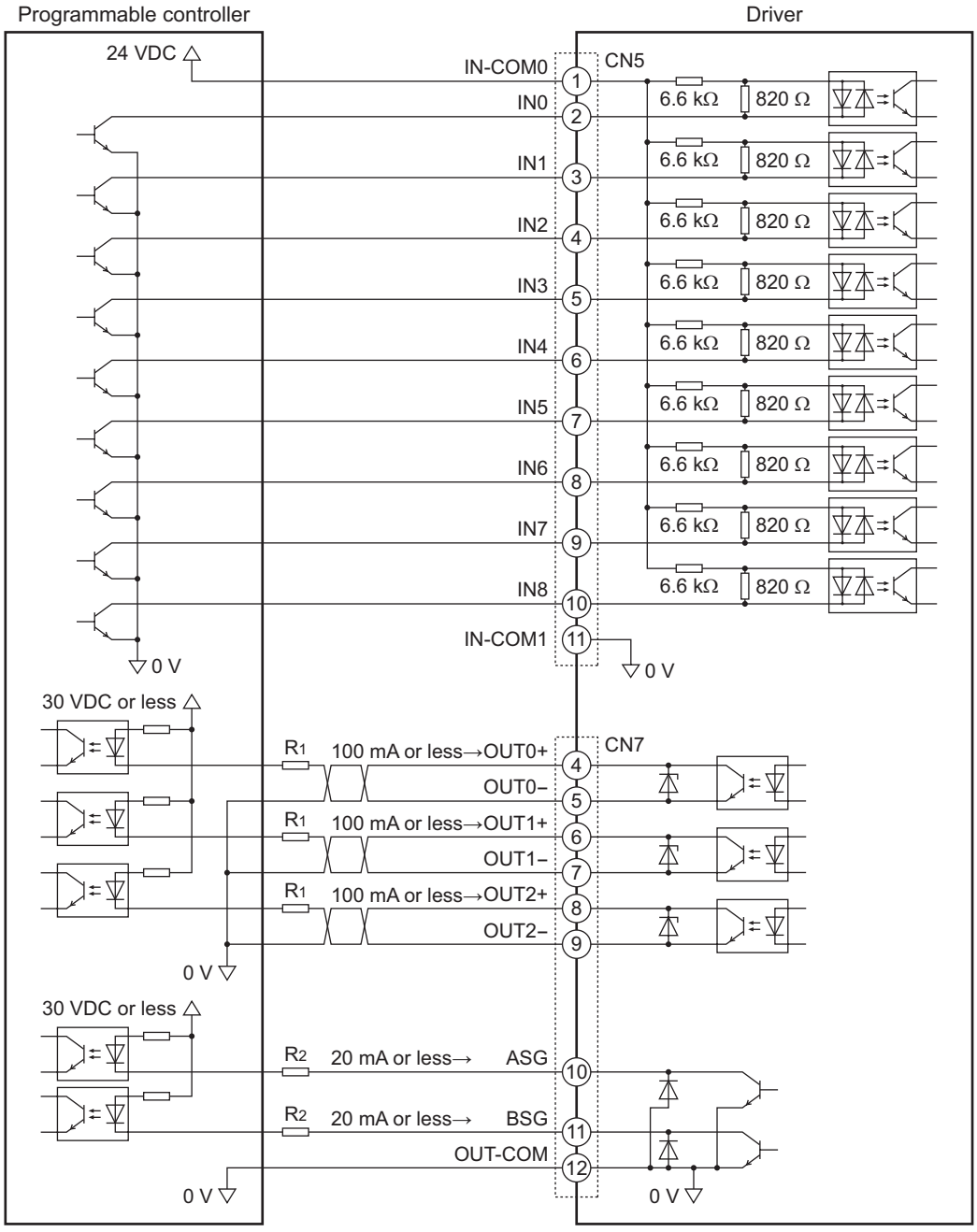
■ Using a controller with a built-in clamp diode

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.



■ Example of connection with I/O signal circuit

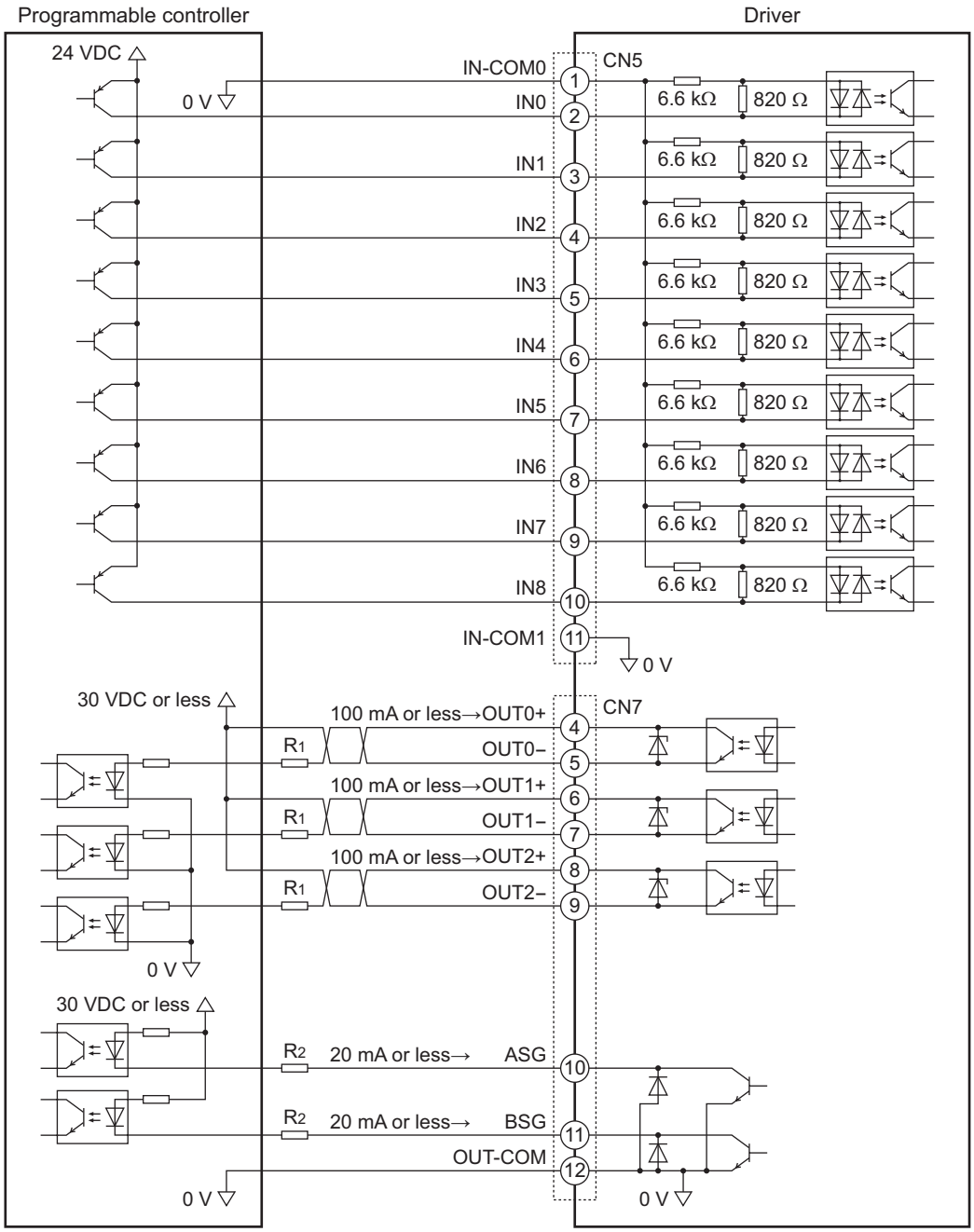
- Sink logic circuit



Note

- Use output signals at 30 VDC or less.
- Be sure to connect a current-limiting resistor R1 to the OUT0 to OUT2 signals to keep the current at 100 mA or less.
- Be sure to connect a current-limiting resistor R2 to the ASG and BSG signals to keep the current at 20 mA or less.

- Source logic circuit



Note

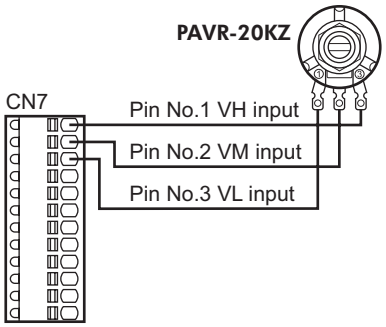
- Use output signals at 30 VDC or less.
- Be sure to connect a current-limiting resistor R1 to the OUT0 to OUT2 signals to keep the current at 100 mA or less.
- Be sure to connect a current-limiting resistor R2 to the ASG and BSG signals to keep the current at 20 mA or less. The ASG and BSG signals do not correspond to the source logic.

2.7 Connecting an analog external setter

When connecting an accessory **PAVR-20KZ** (sold separately) or external DC voltage to the CN7, the operation speed or torque limiting can be set. Refer to p.106 to p.108 for the setting method.

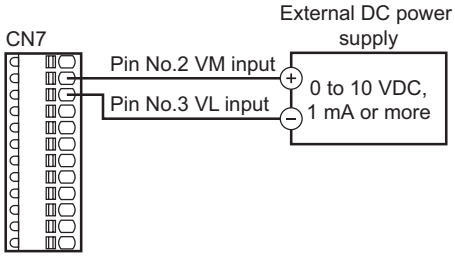
■ When using the PAVR-20KZ

Connect to the pin No.1 to No.3 of the CN7.



■ When using external DC voltage

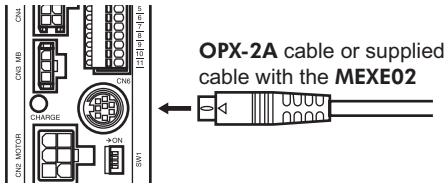
Connect the external DC voltage to the pin No.2 and No.3 of the CN7 using a DC power supply (0 to 10 VDC) with reinforced insulation on its primary and secondary sides.
The input impedance between the VM input and VL input is approximately 41.8 kΩ .
The VL input is connected to the IN-COM1 inside the driver.



Note Be sure to keep the external DC voltage to 10 VDC or lower. When connecting the external DC power supply, make sure the polarities are correct. If the polarities are reversed, the driver may be damaged.

2.8 Connecting the data setter

Connect the **OPX-2A** cable (accessory) or supplied cable with the **MEXE02** to CN6 on the driver.



⚠ Caution The data edit connector (CN6) and I/O signals connector (CN5/CN7) 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 this equipment to short, damaging both.

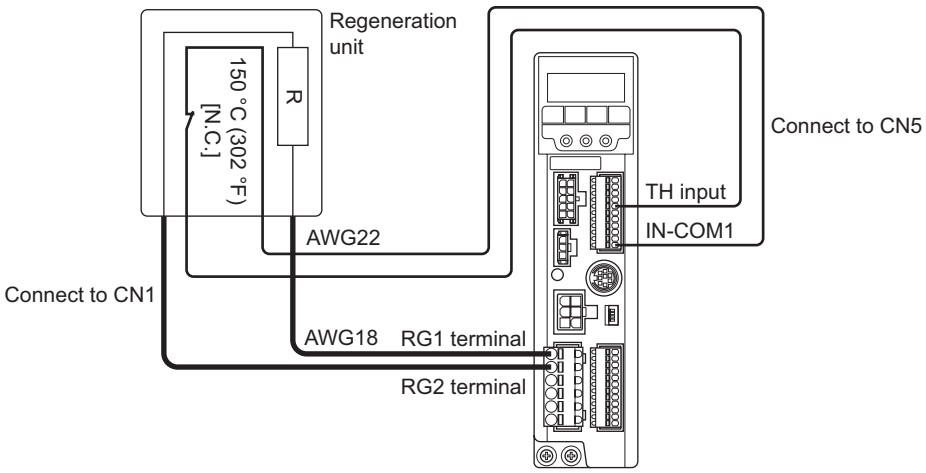
2.9 Connecting the regeneration unit

If vertical drive (gravitational operation) such as elevator applications is performed or if sudden start-stop operation of a large inertial load is repeated frequently, connect an accessory regeneration unit **EPRC-400P** or **RGB100** (sold separately). Install the regeneration unit in a location where heat dissipation capacity equivalent to a level achieved with a heat sink [made of aluminum, 350×350×3 mm (13.78×13.78×0.12 in.)] is ensured.
The regeneration units vary depending on the motor output power. Refer to p.164 for details.

■ Connection method

The connection of the regeneration unit to the I/O terminals of the driver varies depending on the connection methods. Refer to p.45 to 47 and p.51 to 53 for the connection method.

- Regenerative current flows through the two thick lead wires (AWG18: 0.75 mm^2) of the regeneration unit. Connect them to the RG1 and RG2 terminals of the CN1.
- The two thin lead wires (AWG22: 0.3 mm^2) of the regeneration unit are thermostat outputs. Connect them to the TH input and IN-COM1 that are assigned to the CN5. Refer to p.39 for the connection method.



Note

- If the current consumption of the regeneration unit exceeds the allowable level when assigning the TH input to the CN5, the thermostat will be triggered and the regeneration unit overheat alarm will generate. If the regeneration unit overheat alarm generates, turn off the power and check the content of the error.
- The TH input is not assigned to the CN5 at the time of shipment. When the regeneration unit is used, assign the TH input by the parameter. Refer to p.101 for details.
- If an external power supply is used for the power supply of input signals, turn on the external power supply before turning on the driver main power supply.

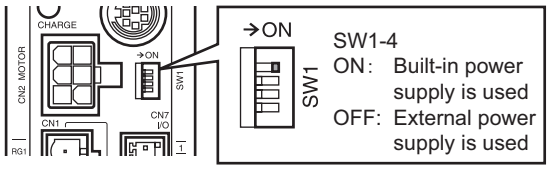
■ Regeneration unit specifications

Applicable product	**BXS230**, **BXS460**, **BXS5120**	**BXS6200**, **BXS6400**
Model	**EPRC-400P**	**RGB100**
Continuous regeneration capacity	100 W	100 W
Resistance value	400 Ω	150 Ω
Thermostat operating temperature	Operation: Open at 150±7 °C (302±13 °F) Reset: Close at 145±12 °C (293±22 °F) [Normally closed]	
Thermostat electrical rating	120 VAC 4 A, 30 VDC 4 A (Minimum current 12 VDC 5 mA)	120 VAC 4 A, 30 VDC 4 A (Minimum current 5 mA)

2.10 Connection diagram (example)

This section explains the speed control mode (factory setting) as an example.

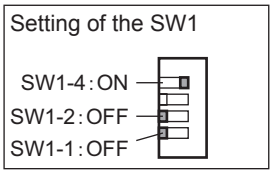
When using the built-in power supply, set the SW1-No.4 to the ON side. It is set to the OFF side (external power supply is used) at the time of shipment. When using the external power supply, use it with the factory setting.



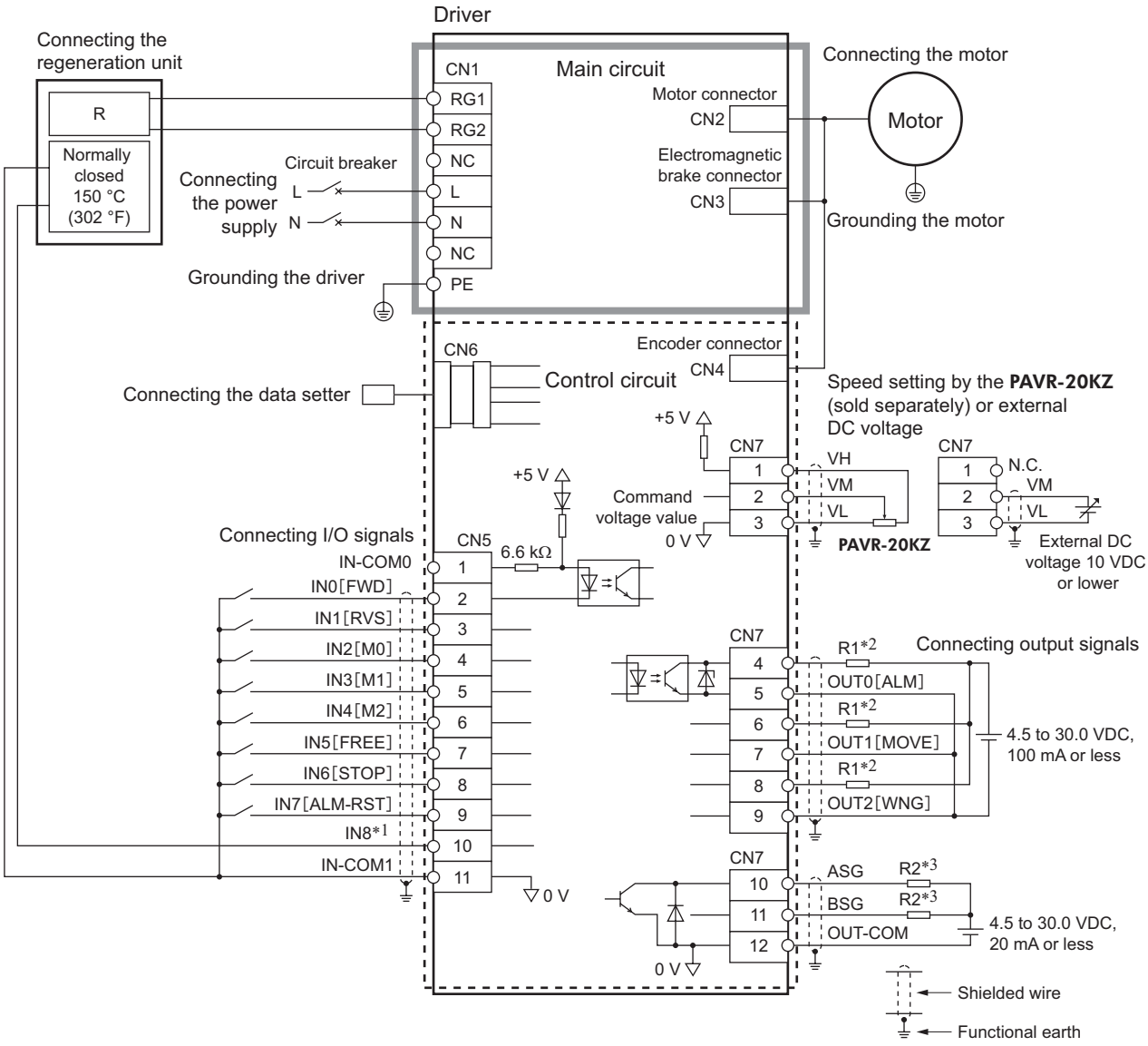
■ Sink logic

- When using the built-in power supply

This is a connection example that the power supply is single-phase 100-120 VAC, the rotation speed is set using an analog external setter (potentiometer or DC voltage) and the motor is operated with relays, switches and other contact switches. The I/O signal in brackets [ ] is the initial value. Refer to p.101 for the assignment of the I/O signals.



Speed control mode



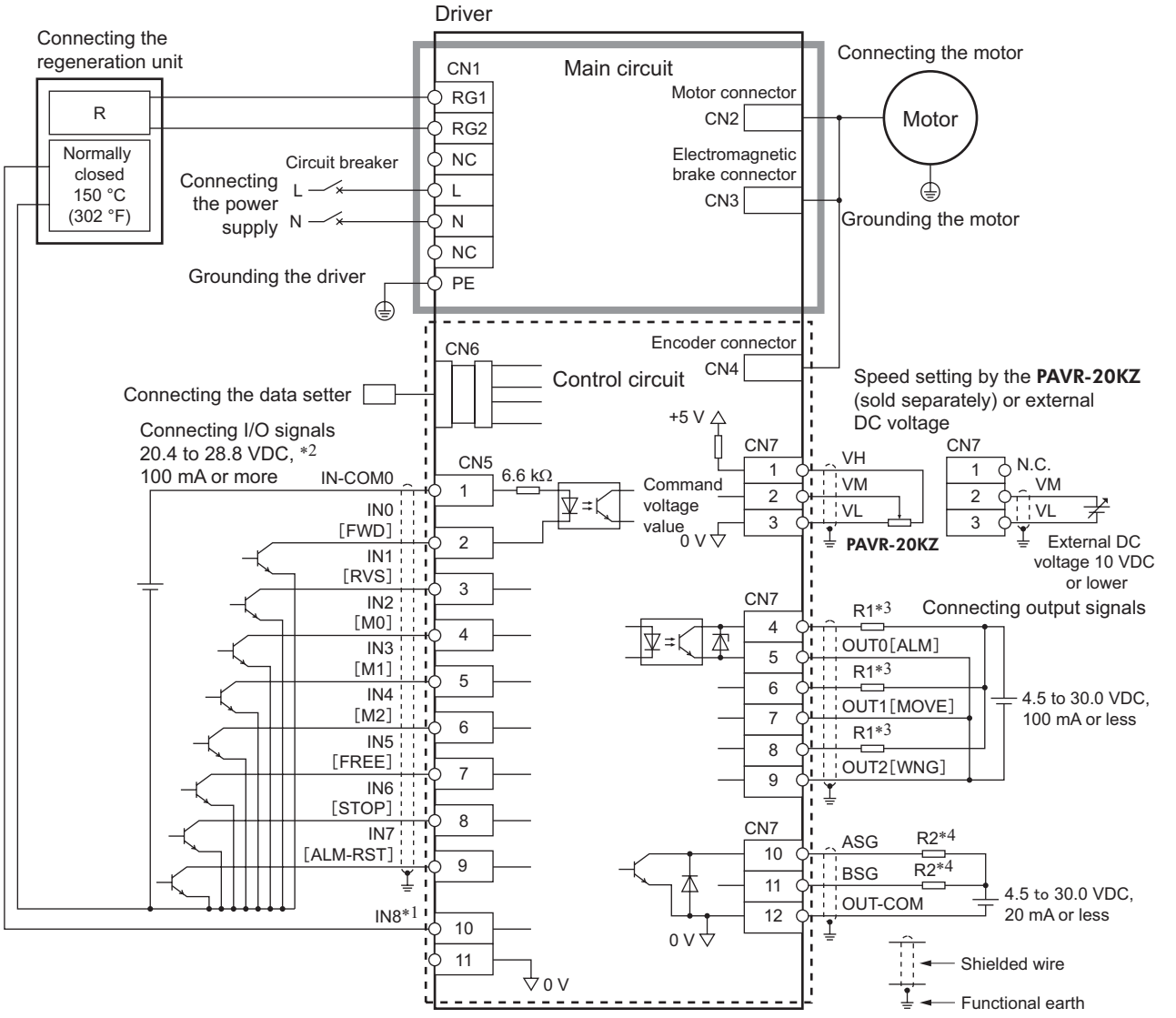
∗1 This is a connection in which the TH input is assigned to the IN8. The initial value is [Not used].
∗2 Connect a current-limiting resistor R1 according to the power supply voltage so that the current will not exceed 100 mA.
∗3 Connect a current-limiting resistor R2 according to the power supply voltage so that the current will not exceed 20 mA.

- When using the external power supply

This is a connection example that the power supply is single-phase 100-120 VAC, the rotation speed is set using an analog external setter (potentiometer or DC voltage) and the motor is operated with sequence connection of transistor type. The I/O signal in brackets [ ] is the initial value. Refer to p.101 for the assignment of the I/O signals.

Setting of the SW1

Speed control mode

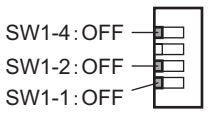


*1 This is a connection in which the TH input is assigned to the IN8. The initial value is [Not used].
*2 Turn on the external power supply before turning on the driver main power supply.
*3 Connect a current-limiting resistor R1 according to the power supply voltage so that the current will not exceed 100 mA.
*4 Connect a current-limiting resistor R2 according to the power supply voltage so that the current will not exceed 20 mA.

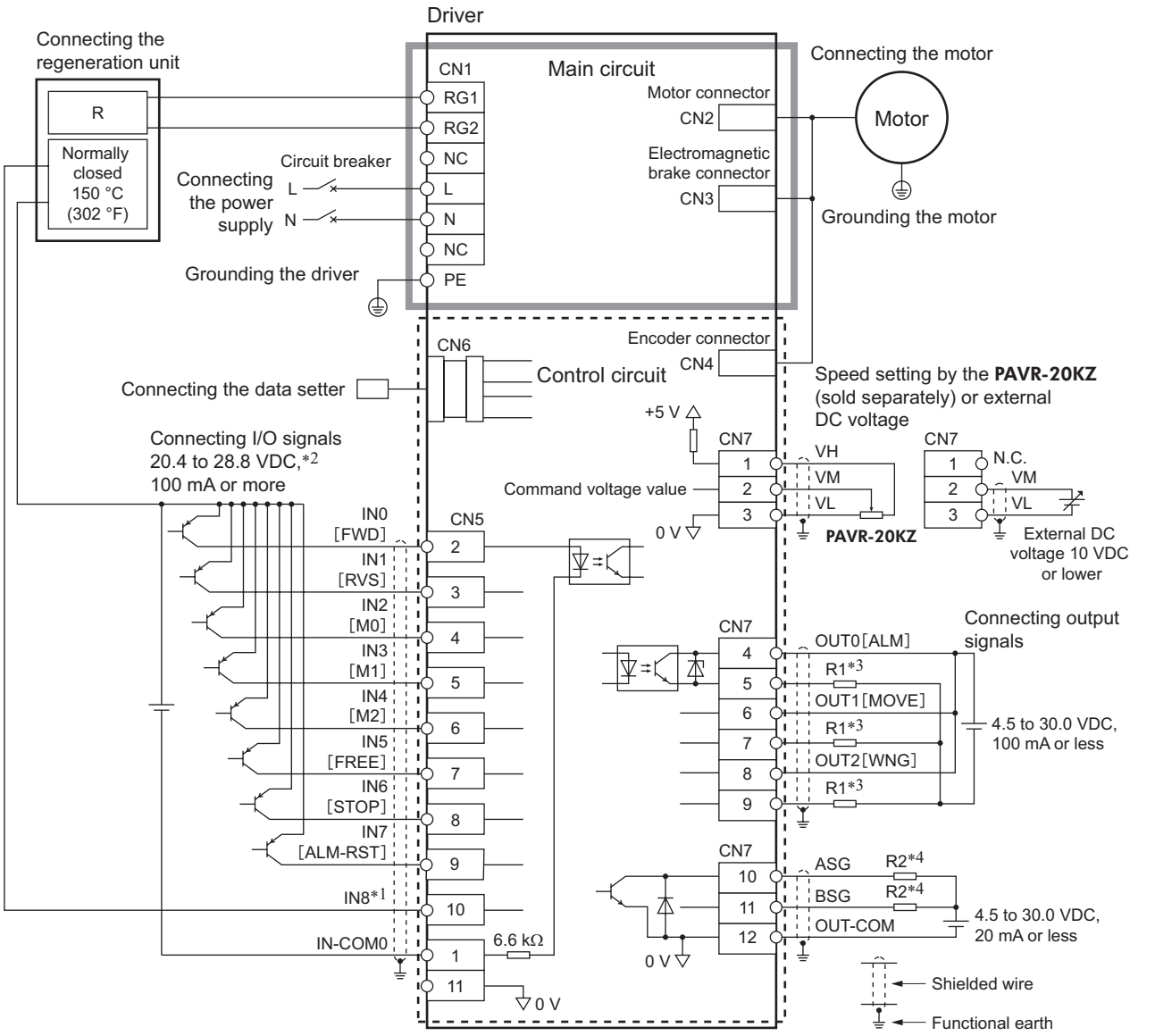
■ Source logic

This is a connection example that the power supply is single-phase 100-120 VAC, the rotation speed is set using an analog external setter (potentiometer or DC voltage) and the motor is operated with sequence connection of transistor type. The I/O signal in brackets [ ] is the initial value. Refer to p.101 for the assignment of the I/O signals.
The ASG and BSG signals do not correspond to the source logic.

Setting of the SW1



Speed control mode



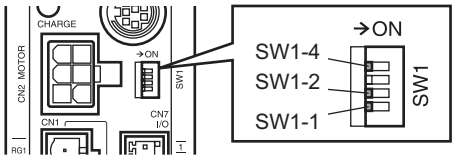
∗1 This is a connection in which the TH input is assigned to the IN8. The initial value is [Not used].
∗2 Turn on the external power supply before turning on the driver main power supply.
∗3 Connect a current-limiting resistor R1 according to the power supply voltage so that the current will not exceed 100 mA.
∗4 Connect a current-limiting resistor R2 according to the power supply voltage so that the current will not exceed 20 mA.

3 Connection method for each control mode

The four control modes are available in the **BX**Ⅱ Series. This chapter explains I/O signals assignment and connection method for each control mode.

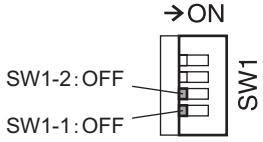
3.1 Switching the control mode

Four different control modes that are available for the **BX**Ⅱ Series can be switched based on a combination of the ON/OFF status of the SW1-No.1, SW1-No.2, and SW1-No.4.



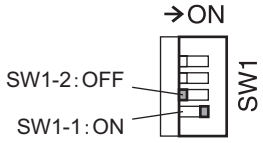
Note Switch the control mode before turning on the power. If the control mode is switched after turning on the power, the new setting will not be effective.

■ Speed control mode (Factory setting)



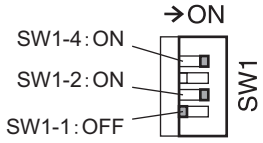
Set the SW1-No.1 and SW1-No.2 to the OFF side.
Speed control operation can be performed.
Up to 16 operation data can be set.

■ Position control mode



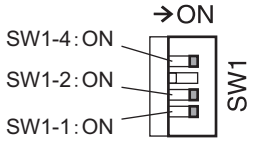
Set the SW1-No.1 and SW1-No.2 to the ON side and OFF side respectively.
Position control operation can be performed.
Up to 16 operation data can be set.

■ BX-compatible mode (Speed control)



Set the SW1-No.1 to the OFF side, and set the SW1-No.2 and SW1-No.4 to the ON side.
When the **BX** Series is used in the speed control mode, the **BX**Ⅱ Series can be used in similar I/O conditions or functions as the **BX** Series by using this control mode.

■ BX-compatible mode (Position control)



Set the SW1-No.1, SW1-No.2, and SW1-No.4 to the ON side.
When the **BX** Series is used in the position control mode, the **BX**Ⅱ Series can be used in similar I/O conditions or functions as the **BX** Series by using this control mode.

■ Referential page

For more information for how to use each control mode, refer to the following pages.

Control mode	Connection method	Operation method
Speed control mode	page 45	page 104
Position control mode	page 51	page 118
BX-compatible mode (Speed control)	page 149	page 140
BX-compatible mode (Position control)	page 150	page 140

3.2 Assignment of I/O signals for each control mode

■ Speed control mode (Factory setting)

• CN5

Pin No.	Signal name	Function
1	IN-COM0	Input signals common
2	IN0	FWD
3	IN1	RVS
4	IN2	M0
5	IN3	M1
6	IN4	M2
7	IN5	FREE
8	IN6	STOP
9	IN7	ALM-RST
10	IN8	Not used (possible to extend)
11	IN-COM1	Input signals common (0 V)

• CN7

Pin No.	Signal name	Function
1	VH	External setting input
2	VM	
3	VL	
4	OUT0+	ALM
5	OUT0−	
6	OUT1+	MOVE
7	OUT1−	
8	OUT2+	WNG
9	OUT2−	
10	ASG	A-phase output
11	BSG	B-phase output
12	OUT-COM	ASG/BSG common

■ Position control mode

• CN5

Pin No.	Signal name	Function
1	IN-COM0	Input signals common
2	IN0	HOME
3	IN1	START
4	IN2	M0
5	IN3	M1
6	IN4	M2
7	IN5	FREE
8	IN6	STOP
9	IN7	ALM-RST
10	IN8	HOMES
11	IN-COM1	Input signals common (0 V)

• CN7

Pin No.	Signal name	Function
1	VH	External setting input
2	VM	
3	VL	
4	OUT0+	ALM
5	OUT0−	
6	OUT1+	READY
7	OUT1−	
8	OUT2+	HOME-P
9	OUT2−	
10	ASG	A-phase output
11	BSG	B-phase output
12	OUT-COM	ASG/BSG common

■ BX-compatible mode (Speed control)

• CN5

Pin No.	Signal name	Function
1	IN-COM0	Input signals common
2	IN0	CW
3	IN1	CCW
4	IN2	M0
5	IN3	M1
6	IN4	M2
7	IN5	FREE
8	IN6	BRAKE/ACL ∗1
9	IN7	Not used (possible to extend)
10	IN8	
11	IN-COM1	Input signals common (0 V)

• CN7

Pin No.	Signal name	Function
1	VH	External setting input
2	VM	
3	VL	
4	OUT0+	ALM
5	OUT0−	
6	OUT1+	BUSY(TLM)/ALP ∗2
7	OUT1−	
8	OUT2+	Not used (possible to extend)
9	OUT2−	
10	ASG	A-phase output
11	BSG	B-phase output
12	OUT-COM	ASG/BSG common

∗1 This signal is used as the BRAKE input in normal condition, but it functions as the ACL input if the driver protective function is activated.

∗2 This signal is used as the BUSY output in normal condition, but it functions as the ALP output if the driver protective function is activated. Also, the BUSY output can be changed to the TLM output using the parameter.

■ BX-compatible mode (Position control)

• CN5

Pin No.	Signal name	Function
1	IN-COM0	Input signals common
2	IN0	START
3	IN1	HOME-LS
4	IN2	M0
5	IN3	M1
6	IN4	M2
7	IN5	FREE
8	IN6	BRAKE/ACL ∗1
9	IN7	Not used (possible to extend)
10	IN8	
11	IN-COM1	Input signals common (0 V)

• CN7

Pin No.	Signal name	Function
1	VH	External setting input
2	VM	
3	VL	
4	OUT0+	ALM
5	OUT0−	
6	OUT1+	BUSY(TLM)/ALP ∗2
7	OUT1−	
8	OUT2+	Not used (possible to extend)
9	OUT2−	
10	ASG	A-phase output
11	BSG	B-phase output
12	OUT-COM	ASG/BSG common

∗1 This signal is used as the BRAKE input in normal condition, but it functions as the ACL input if the driver protective function is activated.

∗2 This signal is used as the BUSY output in normal condition, but it functions as the ALP output if the driver protective function is activated. Also, the BUSY output can be changed to the TLM output using the parameter.

3.3 Connection diagram for each control mode

■ Speed control mode (Factory setting)

Refer to p.45 for details.

■ BX-compatible mode

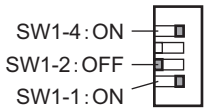
Refer to p.149 for details.

■ Position control mode

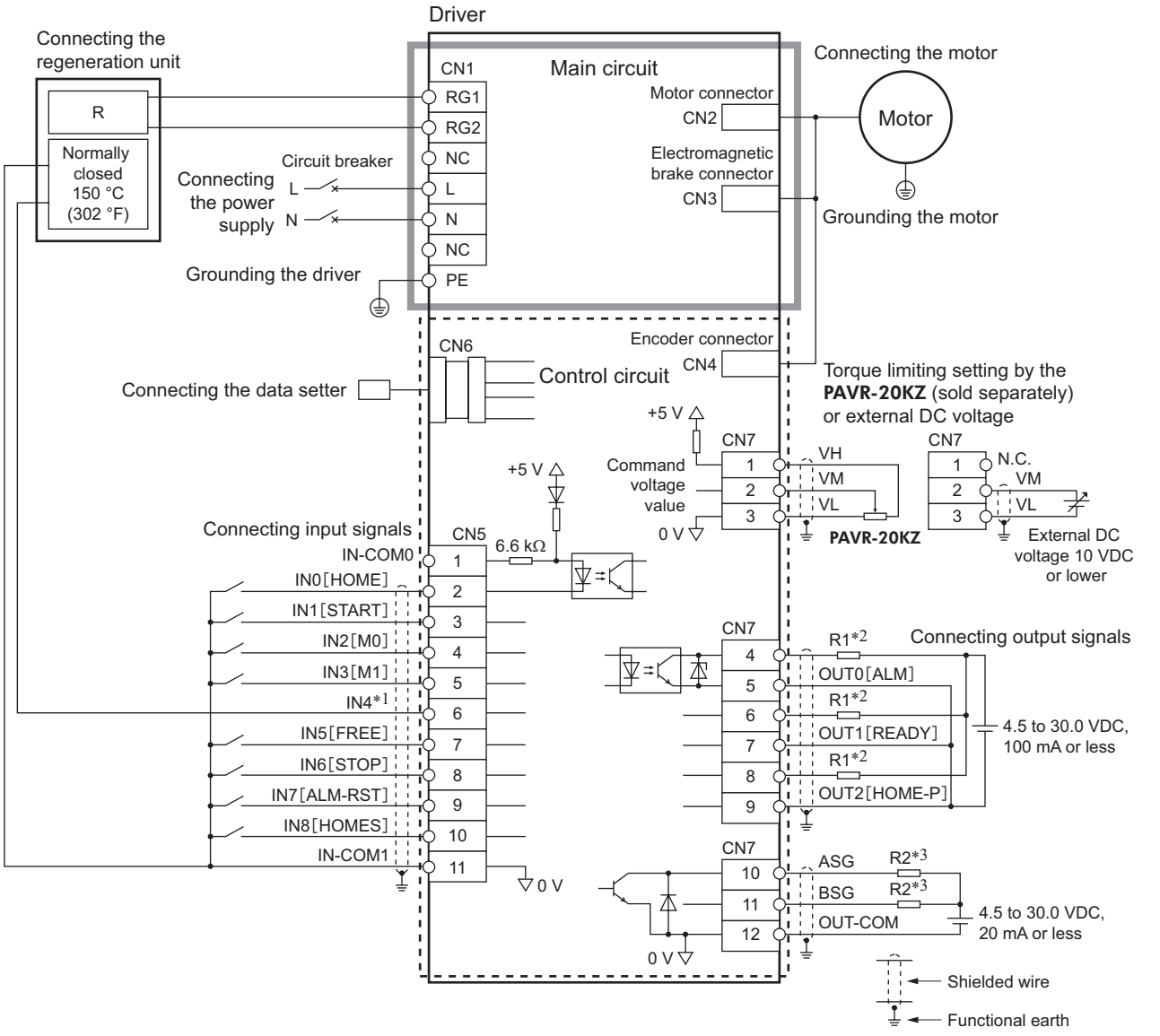
- Sink logic: When using the built-in power supply

This is a connection example that the power supply is single-phase 100-120 VAC, the torque limiting is set using an analog external setter (potentiometer or DC voltage) and the motor is operated with relays, switches and other contact switches. The I/O signal in brackets [ ] is the initial value.
Refer to p.101 for the assignment of the I/O signals.

Setting of the SW1



Position control mode

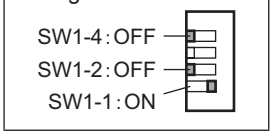


∗1 This is a connection in which the TH input is assigned to the IN4. The initial value is [M2].
∗2 Connect a current-limiting resistor R1 according to the power supply voltage so that the current will not exceed 100 mA.
∗3 Connect a current-limiting resistor R2 according to the power supply voltage so that the current will not exceed 20 mA.

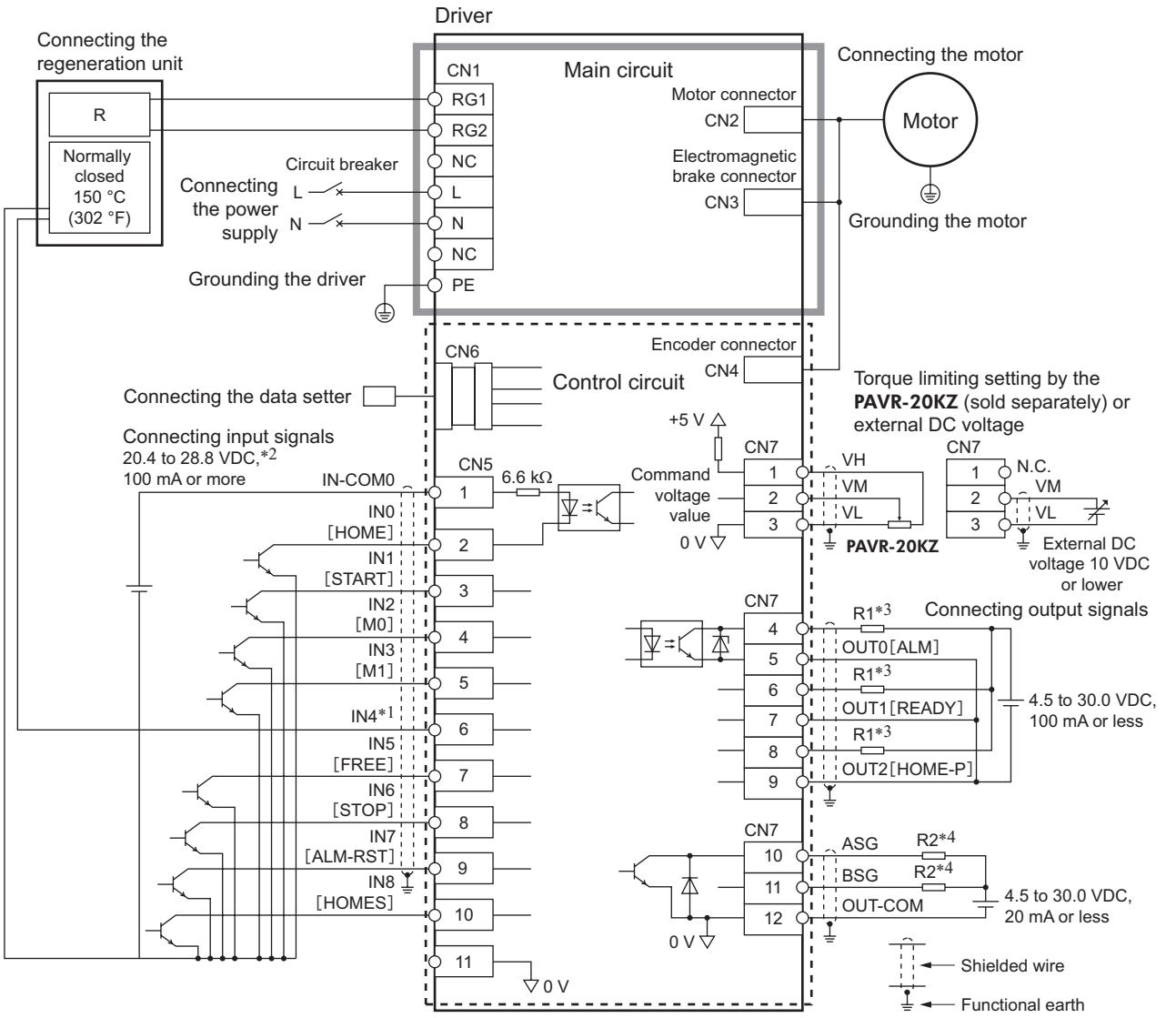
- Sink logic: When using the external power supply

This is a connection example that the power supply is single-phase 100-120 VAC, the torque limiting is set using an analog external setter (potentiometer or DC voltage) and the motor is operated with sequence connection of transistor type. The I/O signal in brackets [ ] is the initial value.
Refer to p.101 for the assignment of the I/O signals.

Setting of the SW1



Position control mode



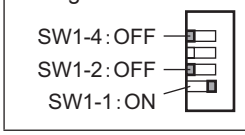
∗1 This is a connection in which the TH input is assigned to the IN4. The initial value is [M2].
∗2 Turn on the external power supply before turning on the driver main power supply.
∗3 Connect a current-limiting resistor R1 according to the power supply voltage so that the current will not exceed 100 mA.
∗4 Connect a current-limiting resistor R2 according to the power supply voltage so that the current will not exceed 20 mA.

- Source logic

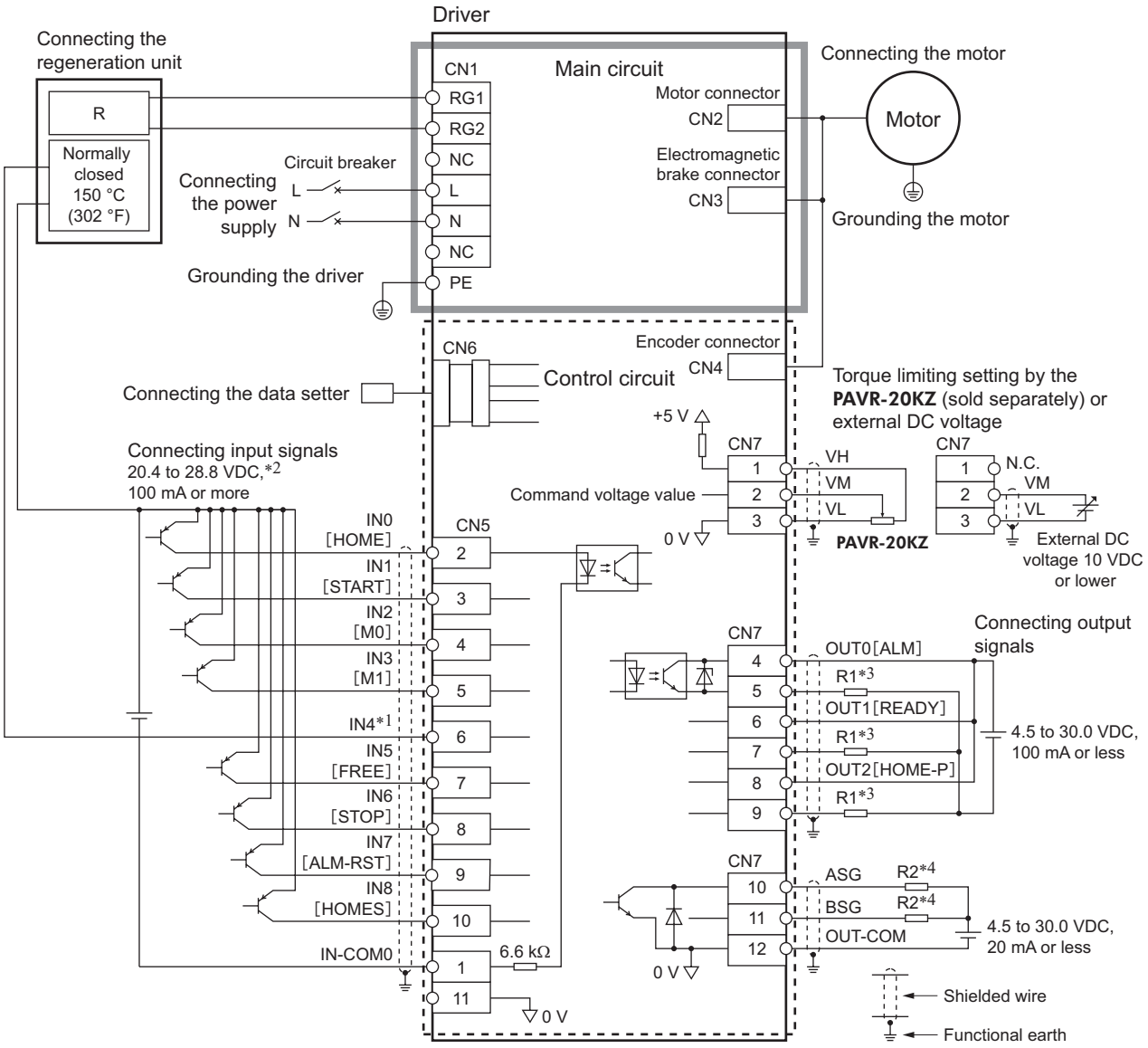
This is a connection example that the power supply is single-phase 100-120 VAC, the torque limiting is set using an analog external setter (potentiometer or DC voltage) and the motor is operated with sequence connection of transistor type. The I/O signal in brackets [ ] is the initial value.
Refer to p.101 for the assignment of the I/O signals.

The ASG and BSG signals do not correspond to the source logic.

Setting of the SW1



Position control mode



∗1 This is a connection in which the TH input is assigned to the IN4. The initial value is [M2].
∗2 Turn on the external power supply before turning on the driver main power supply.
∗3 Connect a current-limiting resistor R1 according to the power supply voltage so that the current will not exceed 100 mA.
∗4 Connect a current-limiting resistor R2 according to the power supply voltage so that the current will not exceed 20 mA.

4 Explanation of I/O signals

The data described here can be set by any of the operation panel, **MEXE02** or **OPX-2A**.

4.1 Outline of input signals

With the **BX**Ⅱ Series, signals that can be assigned are vary depending on the control mode.
Refer to the following pages for details of signals.

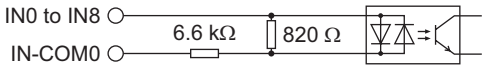
Note Make sure each input signal remains ON for at least 10 ms.

■ Input signals list

Signal name	Speed control	Position control	**BX**-compatible		Reference page
			Speed control	Position control	
FWD input	○	○	–	–	p.55
CW input	–	–	○	○	p.143
RVS input	○	○	–	–	p.55
CCW input	–	–	○	○	p.143
M0 to M3 input	○	○	○	○	p.56
FREE input	○	○	○	○	p.56
STOP input	○	○	–	–	p.57
BRAKE input	–	–	○	○	p.144
ALM-RST input	○	○	○	○	p.57
TH input	○	○	○	○	p.57
TL input	○	○	○	○	p.57
S-ON input	○	○	○	○	p.58
HMI input	○	○	○	○	p.58
START input	–	○	–	○	p.58
HOME input	–	○	–	○	p.58
HOMES input	–	○	–	–	p.59
HOME-LS input	–	–	–	○	p.143
SSTART input	–	○	–	○	p.59
MS0 to MS5 input	–	○	–	○	p.59
+JOG, −JOG input	–	○	–	○	p.59
P-PRESET input	–	○	–	○	p.59

■ Internal input circuit

All input signals of the driver are photocoupler inputs. The signal state represents the "ON: Carrying current" or "OFF: Not carrying current" state of the internal photocoupler rather than the voltage level of the signal.



■ Changing the logic level setting of input signals

The logic level setting for input terminals IN0 to IN8 can be changed using the parameter.

Related parameters

ID	Parameter name	Description	Setting range	Initial value
2192	IN0 input logic level setting	Changes the logic level setting for the input terminals IN0 to IN8.	0: Normal 1: Invert	0
2193	IN1 input logic level setting			
2194	IN2 input logic level setting			
2195	IN3 input logic level setting			
2196	IN4 input logic level setting			
2197	IN5 input logic level setting			
2198	IN6 input logic level setting			
2199	IN7 input logic level setting			
2200	IN8 input logic level setting			

4.2 Description of input signals

■ FWD input, RVS input

- Speed control mode

These are the operation signals to rotate or stop the motor.
When the operation data number is selected and the FWD input or RVS input is turned ON, the motor will rotate at the operation speed corresponding to the selected operation data number. If the operation signal being ON is turned OFF, the motor will decelerate to a stop.
The rotation direction is based on the direction set in the "motor rotation direction" parameter (ID: 450).

Related parameters

ID	Parameter name	Description	Setting range	Initial value
450	Motor rotation direction	Sets the rotation direction of the motor output shaft.	0: Positive direction=CCW 1: Positive direction=CW	1

- Position control mode

These signals are used to start continuous operation.
When the operation data number is selected and the FWD input or RVS input is turned ON, continuous operation will be stared at the operation speed corresponding to the selected operation data number. When the FWD input is turned ON, the motor rotates in the positive direction, and when the RVS input is turned ON, the motor rotates in the negative direction.
If the signal of the same direction is turned ON again while decelerating to a stop, the motor will accelerate and continue operating.
If both of the FWD and RVS inputs are turned ON or OFF simultaneously, the motor will decelerate to a stop.

■ M0 to M3 inputs

Desired operation data number can be selected by a combination of ON/OFF status of the M0 to M3 inputs.

Operation data No.	M3	M2	M1	M0
0	OFF	OFF	OFF	OFF
1	OFF	OFF	OFF	**ON**
2	OFF	OFF	**ON**	OFF
3	OFF	OFF	**ON**	**ON**
4	OFF	**ON**	OFF	OFF
5	OFF	**ON**	OFF	**ON**
6	OFF	**ON**	**ON**	OFF
7	OFF	**ON**	**ON**	**ON**
8	**ON**	OFF	OFF	OFF
9	**ON**	OFF	OFF	**ON**
10	**ON**	OFF	**ON**	OFF
11	**ON**	OFF	**ON**	**ON**
12	**ON**	**ON**	OFF	OFF
13	**ON**	**ON**	OFF	**ON**
14	**ON**	**ON**	**ON**	OFF
15	**ON**	**ON**	**ON**	**ON**

■ FREE input

- Speed control mode

When the FREE input is turned ON, the motor current will be cut off.
When the "servo lock at motor standstill" parameter (ID: 2069) is set to "1: Servo lock," the motor will be excited when it stops, and the motor holding torque will generate. At this time, since the motor holding torque is lost if the FREE input is turned ON, the motor output shaft can be rotated manually. When an electromagnetic brake motor is used, the electromagnetic brake will also be released.
If the FWD input or RVS input is turned ON while the FREE input is being ON, the motor will not rotate.

Note When driving a vertical load, do not turn the FREE input ON. Since the motor loses its holding torque, the load may drop.

Related parameters

ID	Parameter name	Description	Setting range	Initial value
2069	Servo lock at motor standstill	Uses in the speed control mode. If the holding force is required while the motor stops, set to "1" to enable the servo lock.	0: Free (disable servo lock) 1: Servo lock	0

- Position control mode

When the FREE input is turned ON, the motor current will be cut off. The motor output shaft can be rotated manually since the motor holding torque is lost. When an electromagnetic brake motor is used, the electromagnetic brake will be released.
The motor cannot operate while the FREE input is being ON.

■ STOP input

- Speed control mode

When the STOP input is turned ON, the motor stops based on the setting of the "STOP input action" parameter (ID: 256).
When the "servo lock at motor standstill" parameter (ID: 2069) is set to "0: Free," the setting range of the "STOP input action" parameter will be "0, 2: Immediate stop" or "1, 3: Deceleration stop."
If the FWD input or RVS input is turned ON while the STOP input is being ON, the motor will not rotate.

Related parameters

ID	Parameter name	Description	Setting range	Initial value
256	STOP input action	Sets how to stop the motor when the STOP input has turned ON.	0: Immediate stop 1: Deceleration stop 2: Immediate stop + current OFF 3: Deceleration stop + current OFF	0
2069	Servo lock at motor standstill	Uses in the speed control mode. If the holding force is required while the motor stops, set to "1" to enable the servo lock.	0: Free (disable servo lock) 1: Servo lock	0

- Position control mode

When the STOP input is turned ON, the motor stops based on the setting of the "STOP input action" parameter (ID: 256).
When the STOP input is turned ON while positioning operation is being performed, the balance of the travel amount will be cleared.
If the operation signal such as the FWD input or RVS input is turned ON while the STOP input is being ON, the motor will not rotate.

■ ALM-RST input

When an alarm generates, the motor will stop. If the ALM-RST input is turned from ON to OFF at this time, the alarm will be reset (The alarm will be reset at the OFF edge of the ALM-RST input).
Always reset an alarm after removing the cause of the alarm and ensuring safety.

Note Note that some alarms cannot be reset with the ALM-RST input. Refer to p.154.

■ TH input

The TH input is normally closed.
When using a regeneration unit, connect the thermostat output of the regeneration unit.
The TH input is normally in the ON state and it will be turned OFF if the thermostat of the regeneration unit is activated, thereby causing the regeneration unit overheat alarm to generate.

Note When the TH input is not assigned to the input terminal, this input will be always set to ON.
If the TH input is assigned to multiple input terminals, the function will be performed when all of the terminals are turned ON.

■ TL input

The TL input is normally closed.
When the TL input is turned ON, the torque limiting function is enabled. The motor output torque is limited based on the setting value of the "torque limiting" parameter (ID: 896 to 911). Refer to p.108 for the setting method.
If the TL input is turned OFF, the torque limiting function is disabled and the maximum output torque of the motor will be instantaneous peak torque.

Note When the TL input is not assigned to the input terminal, this input will be always set to ON. If the TL input is assigned to multiple input terminals, the function will be performed when all of the terminals are turned ON.

■ S-ON input

This signal is used to excite the motor.
It is enabled when the "servo lock at motor standstill" parameter (ID: 2069) is set to "1: Servo lock" in the speed control mode.
The S-ON input is normally closed.
The motor will be excited when the S-ON input is turned ON, while the motor will become non-excitation state when the S-ON input is turned OFF.
If an electromagnetic brake motor is used, when the S-ON input is turned ON, the electromagnetic brake will be released after the motor is excited. When the S-ON input is turned OFF, the motor will become non-excitation state after actuating the electromagnetic brake to hold the position.
The motor cannot operate while it is in a state of non-excitation.

Note When the S-ON input is not assigned to the input terminal, this input will be always set to ON. If the S-ON input is assigned to multiple input terminals, the function will be performed when all of the terminals are turned ON.

■ HMI input

The HMI input is normally closed.
When the HMI input is turned ON, the function limitation of the **MEXE02** or **OPX-2A** will be released.
When the HMI input is turned OFF, the function limitation will be imposed.
The following functions will be limited.

- I/O test
- Test operation
- Teaching function
- Writing parameters, downloading, initializing

Note When the HMI input is not assigned to the input terminal, this input will be always set to ON. If the HMI input is assigned to multiple input terminals, the function will be performed when all of the terminals are turned ON.

■ START input (For position control mode only)

This signal is used to start positioning operation.
When the operation data number is selected and the START input is turned ON, positioning operation will be started.

■ HOME input (For position control mode only)

This signal is used to start return-to-home operation.
When the HOME input is turned ON, return-to-home operation will be started.
When the return-to-home operation is completed and the motor stops, the HOME-P output turns ON.
Refer to p.129 for return-to-home operation.

Related parameters

ID	Parameter name	Description	Setting range	Initial value
353	Operating speed of home-seeking	Sets the operation speed for return-to-home operation.	0 to 4000 r/min	300
354	Acceleration/ deceleration of home-seeking	Sets the acceleration and deceleration time for return-to-home operation.	0.000 to 30.000 s	0.100
356	Position offset of home-seeking	Sets the amount of offset from home position. The motor shaft rotates 0.72° per one step.	−8,388,608 to +8,388,607 step	0
357	Starting direction of home-seeking	Sets the starting direction for home detection.	0: Negative direction 1: Positive direction	1

■ HOMES input (For position control mode only)

This is an input signal of the mechanical home sensor in return-to-home operation.

■ SSTART input (For position control mode only)

This signal is used to start sequential positioning operation.
Positioning operation based on the next operation data number will be executed every time the SSTART input turns ON. This function is useful when multiple positioning operations must be executed sequentially, because there is no need to repeatedly select each data number.
Refer to p.123 for sequential positioning operation.

■ MS0 to MS5 input (For position control mode only)

These signals are used to start direct positioning operation.
When any of the MS0 to MS5 inputs is turned ON, the positioning operation corresponding to the input data number will be executed. Since positioning operation can be executed by turning any of the MS0 to MS5 inputs ON, the steps of selecting the operation data number can be saved.
Refer to p.122 for direct positioning operation.

Related parameters

ID	Parameter name	Description	Setting range	Initial value
2048	MS0 operation No. selection	Sets the operation data number corresponding to the MS0 to MS5 inputs.	Operation data No.0 to 15	0
2049	MS1 operation No. selection			1
2050	MS2 operation No. selection			2
2051	MS3 operation No. selection			3
2052	MS4 operation No. selection			4
2053	MS5 operation No. selection			5

■ +JOG input, −JOG input (For position control mode only)

These signals are used to start JOG operation.
When the +JOG input is turned ON, JOG operation is started in the positive direction, and when the −JOG input is turned ON, JOG operation is started in the negative direction.
Refer to p.134 for JOG operation.

Related parameters

ID	Parameter name	Description	Setting range	Initial value
323	JOG operation speed	Sets the operation speed for JOG operation.	0 to 4000 r/min	300
324	Acceleration/ deceleration time of JOG operation	Sets the acceleration and deceleration time for JOG operation.	0.000 to 30.000 s	0.100
2081	JOG operation torque	Sets the torque limiting value for JOG operation. Sets the maximum torque based on the rated torque being 100%.	0 to 250%	100
2084	JOG travel amount	Sets the travel amount for JOG operation. The motor shaft rotates 0.72° per one step.	1 to 8,388,607 step	1

■ P-PRESET input (For position control mode only)

This signal is used to preset the present position.
When the P-PRESET input is turned from OFF to ON, the command position is set to the value of the "preset position" parameter (ID: 454). (This input becomes effective at the ON edge of the input.) However, the preset will not execute in the following conditions.

- While an alarm is present
- While the motor is operating

Related parameters

ID	Parameter name	Description	Setting range	Initial value
454	Preset position	Sets the preset position. The motor shaft rotates 0.72° per one step.	−8,388,608 to +8,388,607 step	0

4.3 Outline of output signals

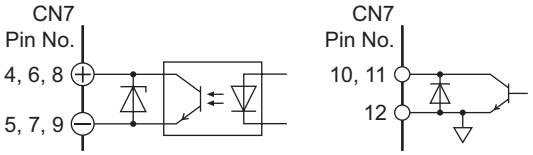
With the **BX**Ⅱ Series, signals that can be assigned are vary depending on the control mode.
Refer to the following pages for details of signals.

■ Output signals list

Signal name	Speed control	Position control	**BX**-compatible		Reference page
			Speed control	Position control	
ALM output	○	○	○	○	p.60
WNG output	○	○	○	○	p.60
MOVE output	○	○	○	○	p.61
TLC output	○	○	—	—	p.61
TLM output	—	—	○	○	p.145
VA output	○	○	○	○	p.62
READY output	—	○	—	○	p.61
HOME-P output	—	○	—	○	p.61
END output	—	○	—	○	p.61
ZSG output	○	○	○	○	p.62

■ Internal input circuit

For the output signals of the driver, the OUT0 to OUT2 are photocoupler/open-collector outputs, and the ASG and BSG are transistor/open-collector outputs.



4.4 Description of output signals

■ ALM output

When an alarm generates, the ALM output will turn OFF. The current supplied to the motor will be cut off and the motor will stop. At the same time, the alarm code will be displayed on the operation panel on the driver. Refer to p.154 for alarm codes.

Related parameters

ID	Parameter name	Description	Setting range	Initial value
385	Excessive position deviation alarm	Sets the condition that an excessive position deviation alarm generates.	0.01 to 300.00 rev	20.00
2113	Prevention of operation at power-on alarm function	Sets whether to enable or disable the prevention of operation at power-on alarm.	0: Disable 1: Enable	0

■ WNG output

When a warning generates, the WNG output will turn ON. Refer to p.155 for warnings.

Related parameters

ID	Parameter name	Description	Setting range	Initial value
419	Overvoltage warning	Sets the condition that an overvoltage warning generates.	120 to 440 V	435
421	Excessive position deviation warning	Sets the condition that an excessive position deviation warning generates.	0.01 to 300.00 rev	20.00
2129	Overload warning function	Sets whether to enable or disable the overload warning function.	0: Disable 1: Enable	0
2133	Overload warning level	Sets the condition that an overload warning generates.	50 to 100%	100

■ MOVE output

The MOVE output turns ON while the motor is operating. Even when the motor cable is unplugged, the MOVE output will turn ON.

■ READY output (For position control mode only)

When the driver becomes ready to operate, the READY output turns ON. Input the operation command to driver after the READY output turned ON.
The READY output turns ON when all of the following conditions are satisfied.

- The driver power is turned ON
- All inputs which start operation are OFF
- The FREE input and STOP input are OFF
- The S-ON input is being ON (When the S-ON input is assigned)
- An alarm is not present
- The motor is not operated
- Test function, downloading or teaching function was not performed using the **MEXE02**
- Test operation, downloading, initializing or teaching function was not performed using the **OPX-2A**

■ END output (For position control mode only)

When the motor has completed its operation, the END output will turn ON. When the motor was converged in a position of the "position completion signal range" parameter against the command position while the MOVE output is in an OFF state, the END output turns ON.

Related parameters

ID	Parameter name	Description	Setting range	Initial value
259	Positioning completion signal range	Sets an output range that the END output is turned ON. The motor shaft rotates 0.72° per one step.	1 to 100 step	1

■ HOME-P output (For position control mode only)

The HOME-P output turns ON corresponding to the setting of the "HOME-P output function selection" parameter (ID: 2054). Refer to p.136 for setting the position origin.

When "HOME-P output function selection" parameter is set to "0: Home output"

When the command position of the driver is in the home position while the MOVE output is OFF, the HOME-P output will turn ON. However, the HOME-P output remains OFF when the position origin for the driver has not been set.

When "HOME-P output function selection" parameter is set to "1: Return-to-home complete output"

Regardless of the command position by the driver, if the position origin for the driver is set, the HOME-P output will turn ON. Therefore, it turns ON after completing the return-to-home operation or preset. Once the HOME-P output turns ON, it will not turn OFF until the motor has moved from the position origin.

Related parameters

ID	Parameter name	Description	Setting range	Initial value
2054	HOME-P output function selection	Sets the timing to output the HOME-P output.	0: Home output 1: Return-to-home complete output	0

■ TLC output

When the motor torque reaches the torque limiting value, the TLC output will turn ON.

■ VA output

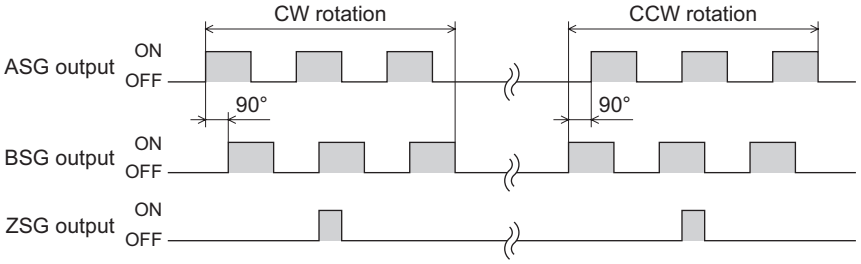
When the detection speed reaches the "command speed ± speed attainment band", the VA output will turn ON.
An output range that the VA output is turned ON can be set using "rotation speed attainment band" parameter (ID: 2215). If the parameter is set to 0, the VA output will not turn ON.

Related parameters

ID	Parameter name	Description	Setting range	Initial value
2215	Rotation speed attainment band	Sets the output range for the VA output.	0 to 400 r/min	200

■ Encoder output

Three signals of the ASG, BSG and ZSG outputs are output from the encoder.
The ZSG output cannot be checked unless it is assigned to any of the OUT0 to OUT2.
Both the ASG output and BSG output are output 500 pulses per revolution of the motor output shaft.



- ASG output

  The ASG output is pulses to output according to the motor rotation amount.

- BSG output

  The BSG output is the pulse output to determine the motor rotation direction and has a 90° phase difference with respect to the ASG output. The motor rotation direction can be determined by detecting the BSG output level at the rise of the ASG output.

- ZSG output

  The ZSG output is output once every revolution of the motor output shaft.

Note The minimal output range of the ZSG output is about 1 ms.

3 Method to use the operation panel

This part explains how to set data and how to operate a motor using the operation panel on the driver.

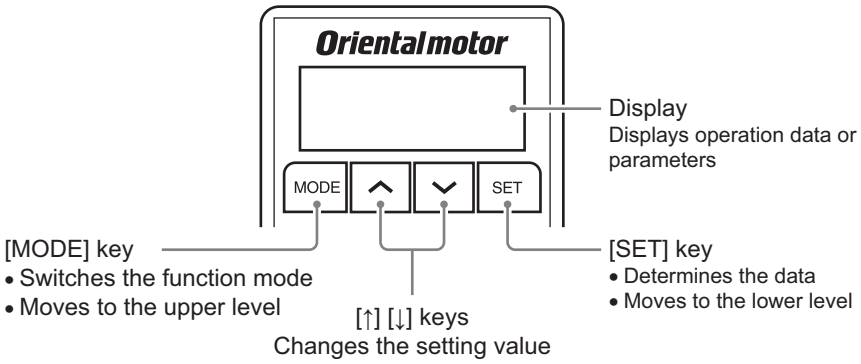
Table of contents

1 Overview of the operation panel

This chapter explains the name and function of each part of the operation panel as well as function modes.

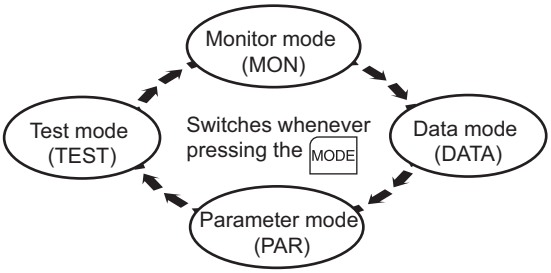
1.1 Names and functions of parts

The operation panel cannot remove from the driver.



1.2 Function mode types

Multiple function modes are available in the **BX Ⅱ** Series and the mode will switch whenever pressing the [MODE] key.
The monitor mode is always displayed when turning on the power.

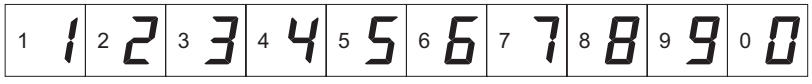


Function mode types	Description
Monitor mode	This is a mode to be displayed when turning on the power. The motor rotation speed is displayed at the factory setting. Use the monitor mode when operating the motor.
Data mode	Sets the operation data.
Parameter mode	Sets the parameter.
Test mode	The connection status of each I/O signal can be checked. Also, the operation check can be performed by connecting the motor and driver only.

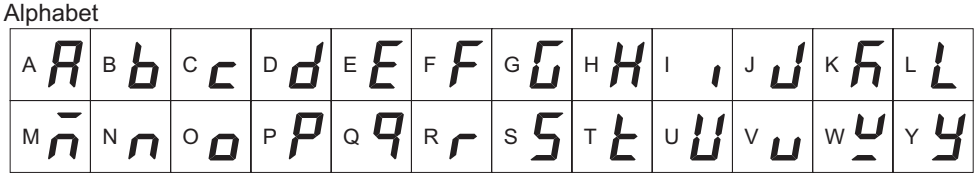
1.3 How to read the display

The display on the driver is a 7-segment LED. ("5" in Arabic numeral and "S" in the alphabet are the same indication.)

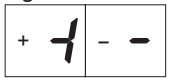
• Arabic numeral



• Alphabet



• Sign

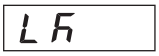


1.4 Edit lock function

This is a function to prohibit the data editing or erasing by the operation panel.
It is not allowed to change or delete data while the edit lock function is enabled.

- Setting of the edit lock function

Press the [MODE] key for minimum 5 seconds on the top screen of each mode.
The "LK" is displayed and the edit lock function will be enabled.

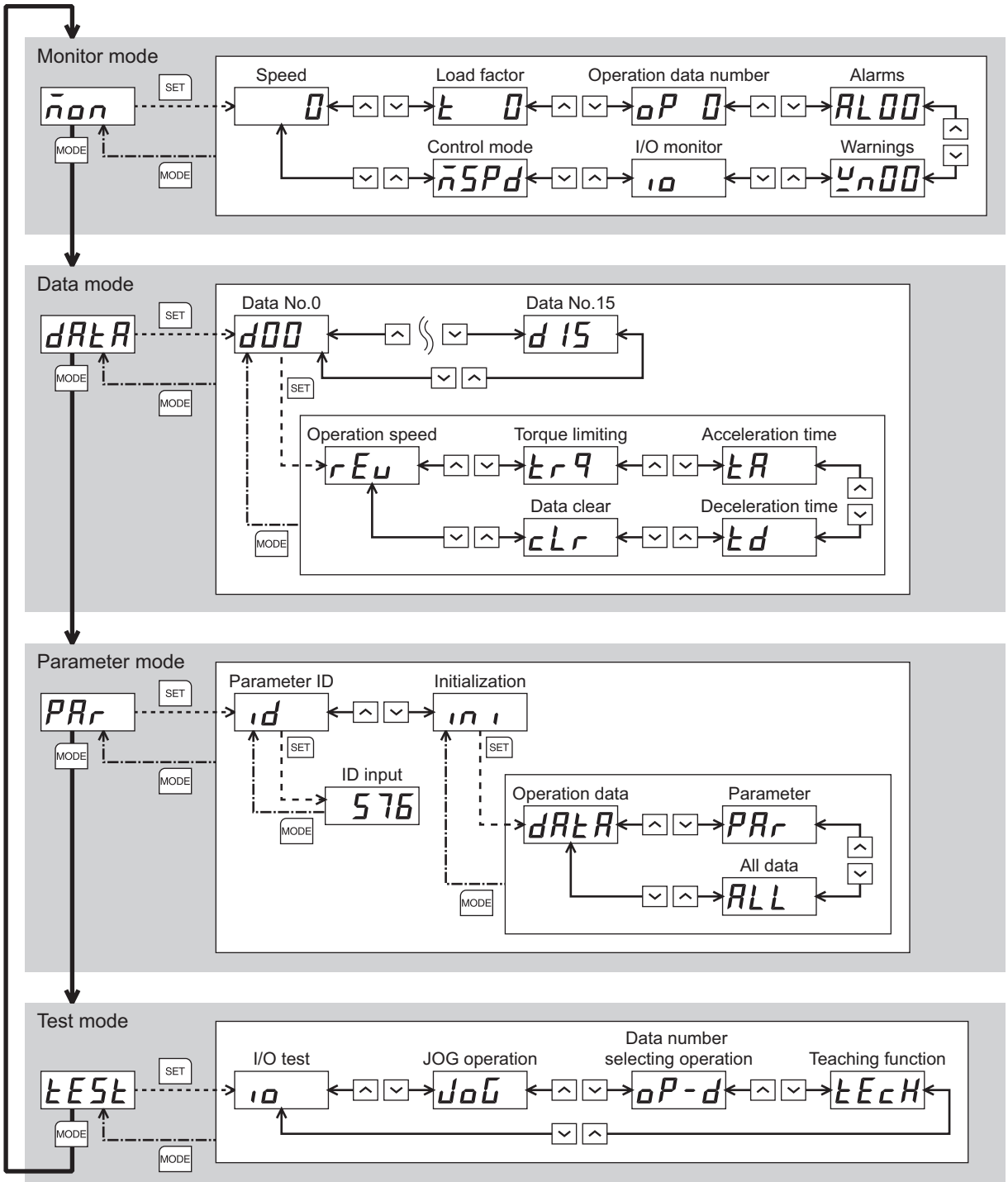


- Resetting of the edit lock function

Again, press the [MODE] key for minimum 5 seconds on the top screen.
The "UnLK" is displayed and the edit lock function will be released.

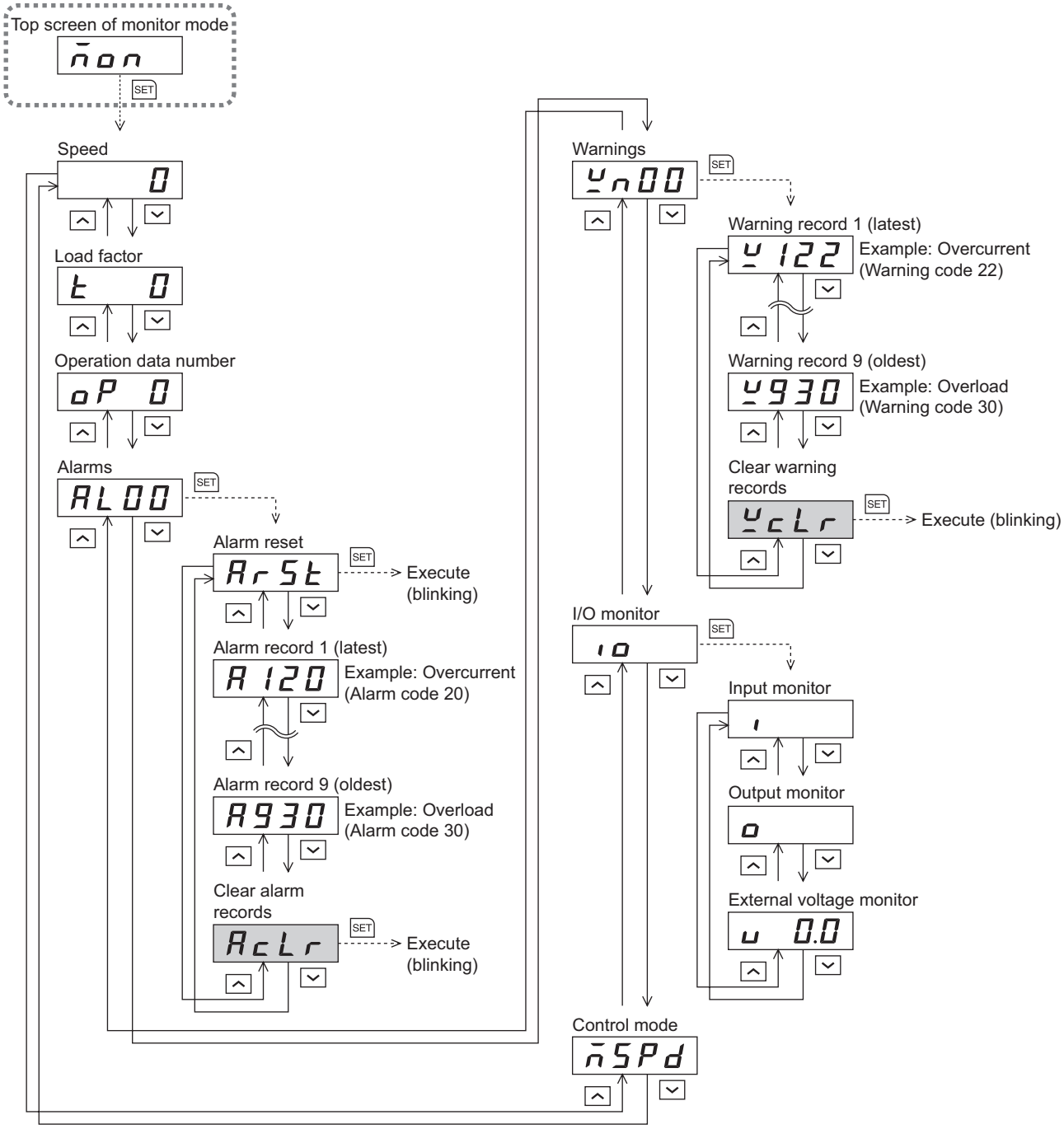
2 Explanation of the function mode (Speed control mode)

2.1 Screen transitions



2.2 Monitor mode

This is a mode to be displayed when turning on the power. The motor rotation speed is displayed at the factory setting. Use the monitor mode when operating the motor.



- In the lower level except the top screen, press the MODE key to return to the previous level.
- When operations are limited by the edit lock function, the screens in gray color are not displayed.

■ Speed

The motor operation speed can be checked.
The operation speed can be displayed as the rotation speed of the gear output shaft. To do this, set the "speed reduction ratio" parameter (ID: 2085) and "speed reduction ratio digit setting" parameter (ID: 2086).
It is also possible to increase the rotation speed and display the increased speed. Set in the "speed increasing ratio" parameter (ID: 2087).

■ Load factor

The motor generating torque can be checked. The present load factor is displayed based on the rated torque being 100%.

■ Operation data number

The operation data number corresponding to the current operation can be checked.

■ Alarms

When an alarm generates, 2-digit alarm code will be displayed.
The present alarm can be reset, and also alarm records can be checked or cleared.
Refer to p.154 for the causes or actions of the alarm.

Note When operations are limited by the edit lock function, the alarm records cannot be cleared.

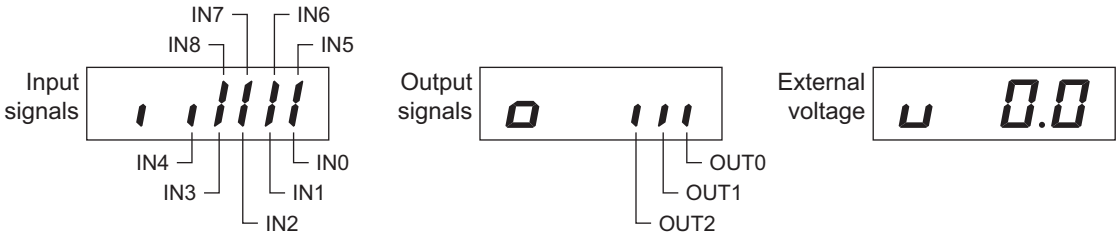
■ Warnings

When a warning generates, 2-digit warning code will be displayed.
Warning records can be checked and cleared.

Note When operations are limited by the edit lock function, the warning records cannot be cleared.

■ I/O monitor

The ON/OFF status of each I/O signal for the driver can be checked.
Each digit on the 7-segment LED display corresponds to a signal. The corresponding digit is lit when the signal is ON, and the digit is unlit when the signal is OFF.
The voltage value input by the analog external setter can also be checked.



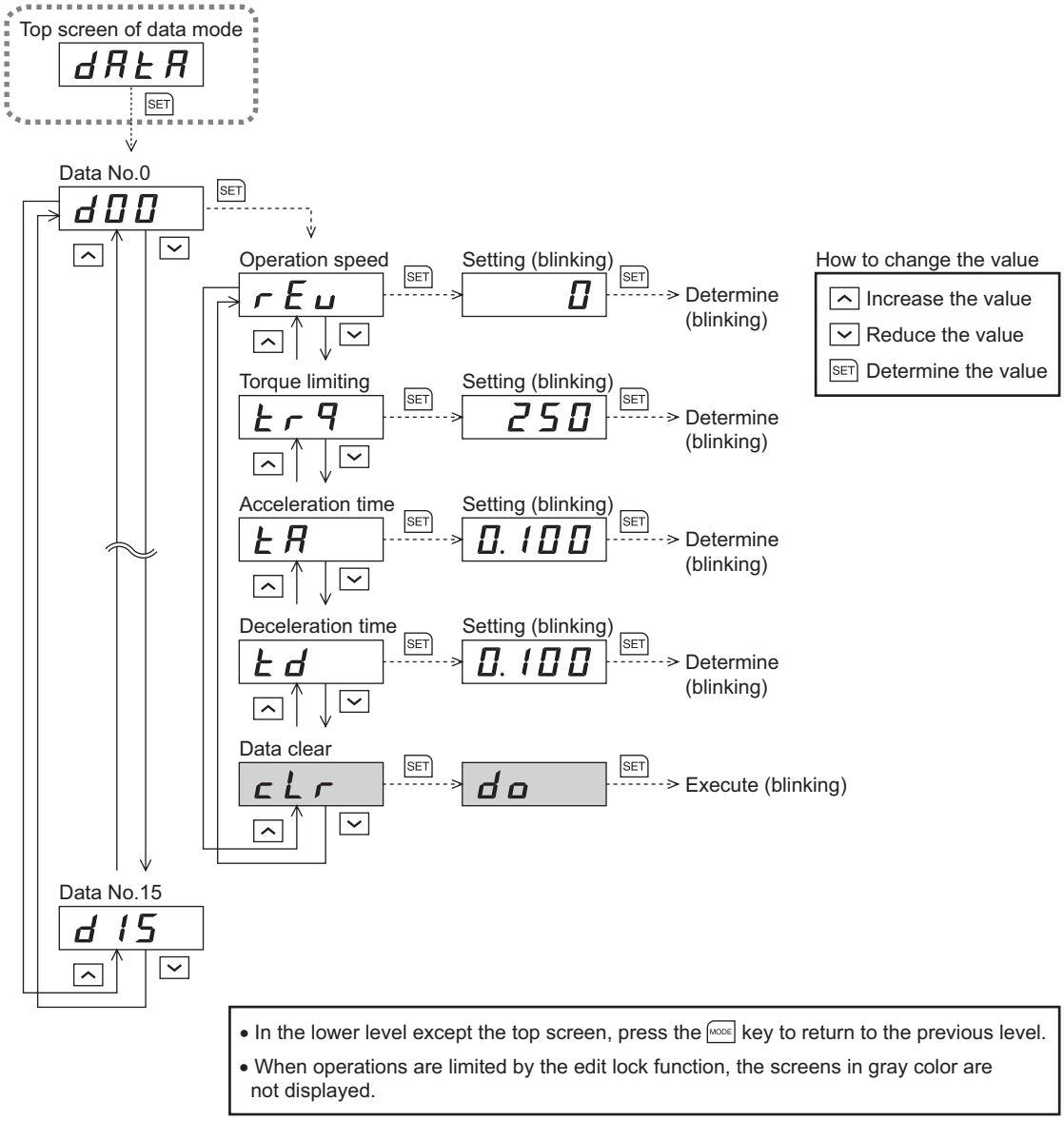
■ Control mode

The present control mode can be checked.

Speed control mode	Speed control mode (servo lock)	Position control mode
nSPd	nSPL	nPoS

2.3 Data mode

Sets the operation data.



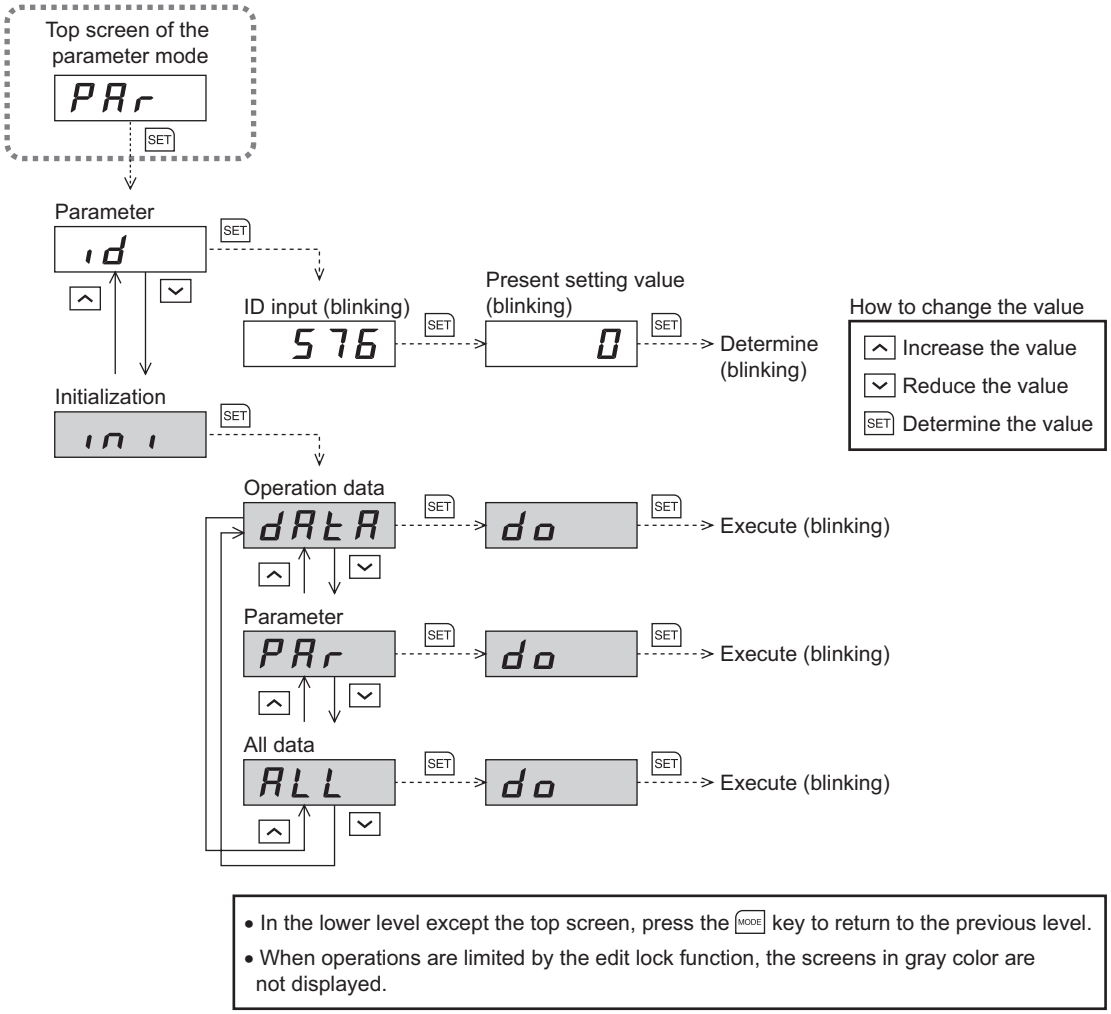
■ Setting items

Item	Description	Setting range	Initial value
Operation speed	Sets the operation speed for the speed control operation. Set as the rotation speed of the motor output shaft.	0 to 4000 r/min	0
Torque limiting	Sets when limiting the motor output torque. Set the instantaneous peak torque based on the rated torque being 100%.	0 to 250%	250
Acceleration time	The acceleration time is set as the time needed for the motor to reach the rated rotation speed (3000 r/min) from the standstill state.	0.000 to 0.999 s and 1.00 to 30.00 s	0.100
Deceleration time	The deceleration time is set as the time needed for the motor to stop from the rated rotation speed (3000 r/min).		
Data clear	Reset the operation data to the initial value.	−	−

Note When operations are limited by the edit lock function, the data clear cannot be executed.

2.4 Parameter mode

Sets the parameter.



■ Parameter ID

There is a unique ID in each parameter. Input the ID and set.
Refer to p.89 for parameter ID.

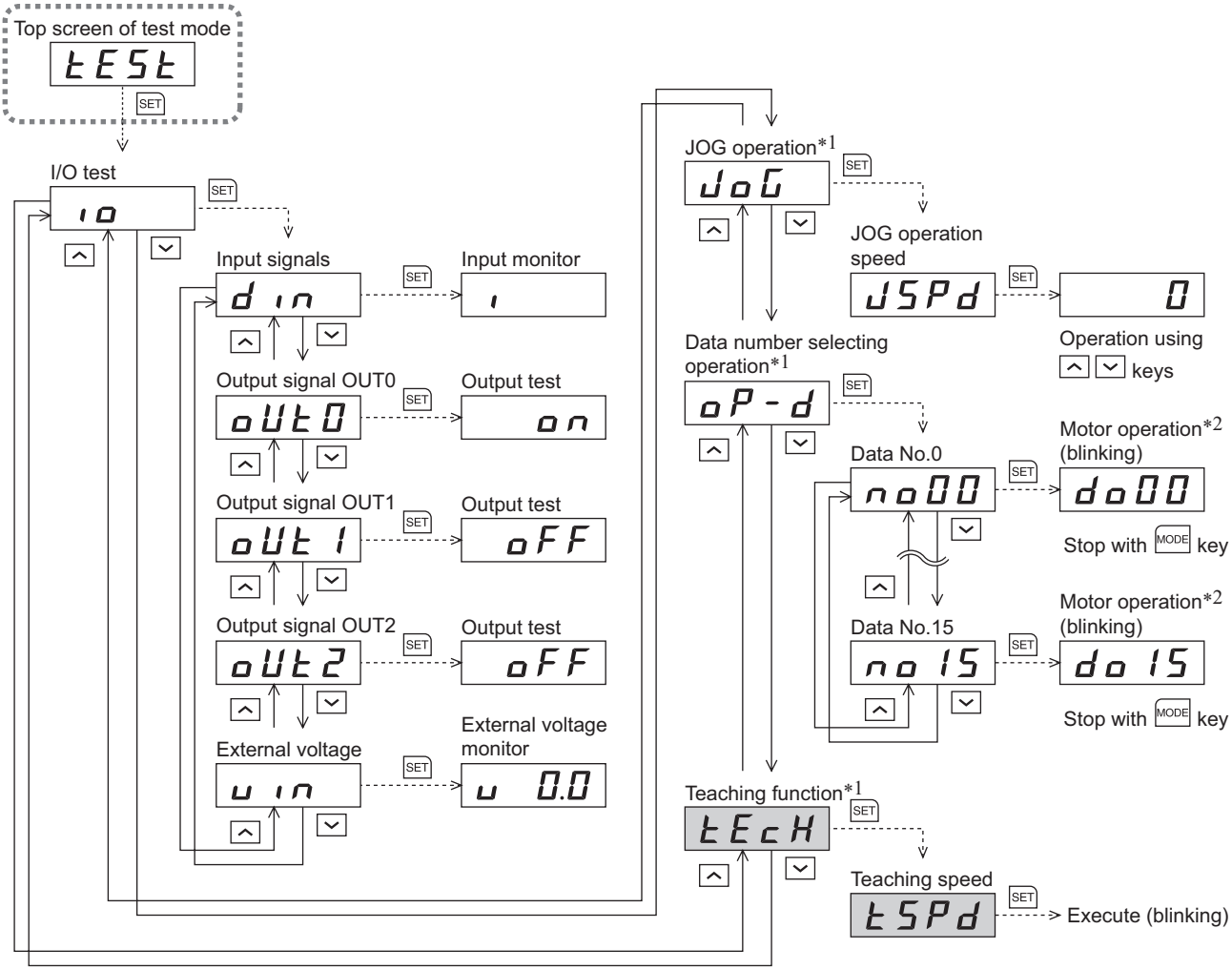
■ Initialization

Reset the data saved in the driver to the initial value. Selecting any of the "operating data only," "parameter only" or "all data," the initialization can be performed.

Note When operations are limited by the edit lock function, the initialization cannot be performed.

2.5 Test mode

The connection status of each I/O signal can be checked. Also, the operation check can be performed by connecting the motor and driver only.



- In the lower level except the top screen, press the MODE key to return to the previous level.
- When operations are limited by the edit lock function, the screens in gray color are not displayed.

∗1 These operations cannot be executed while the FREE input or STOP input is being ON. Be sure to execute after turning OFF.
∗2 When the "servo lock at motor standstill" parameter (ID: 2069) is set to "1: Servo lock," it will blink even if the rotation speed is 0 r/min.

Note In operation, the motor rotates at the set speed while pressing the operation button. Execute the test operation after confirming thoroughly that the motor rotation will not cause any dangerous situation.

When pressing the [SET] key while operating a motor

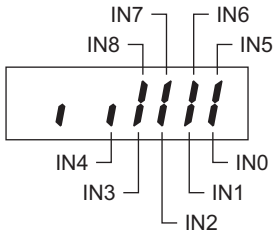
It cannot move to the setting screen of the test mode while operating.
An error will occur even when the [SET] key is pressed, and "Err" will be displayed.
Be sure to stop the motor operation before pressing the [SET] key.

■ I/O test

The ON/OFF status of each input signal can be checked and the ON/OFF status of each output signal can be switched.
The voltage value input by the analog external setter can also be checked.

- Input signals

Each digit on the 7-segment LED display corresponds to a signal.
The corresponding digit is lit when the signal is ON, and the digit is unlit when the signal is OFF.



- Output signals

The ON/OFF status of the output signal can be switched with the [↑] [↓] keys.

- External voltage

The voltage value input by the analog external setter can be checked.

■ JOG operation

The motor can be operated with the [↑] [↓] keys.
The motor rotates in the forward direction while pressing the [↑] key.
The motor rotates in the reverse direction while pressing the [↓] key.
The rotation speed is displayed while JOG operation is executed.

Set the operation data for JOG operation using the following parameters.
- JOG operation speed parameter (ID: 323)
- JOG acceleration/deceleration parameter (ID: 324)
- JOG operation torque parameter (ID: 2081)

Note JOG operation cannot be executed while the FREE input or STOP input is being ON. Be sure to execute after turning OFF.

■ Data number selecting operation

Test operation can be executed by selecting the operation data number.
The setting method of the operation speed is the value selected by the "analog speed/torque" parameter (ID: 2161).

Note The data number selecting operation cannot be executed while the FREE input or STOP input is being ON. Be sure to execute after turning OFF.

■ Teaching function

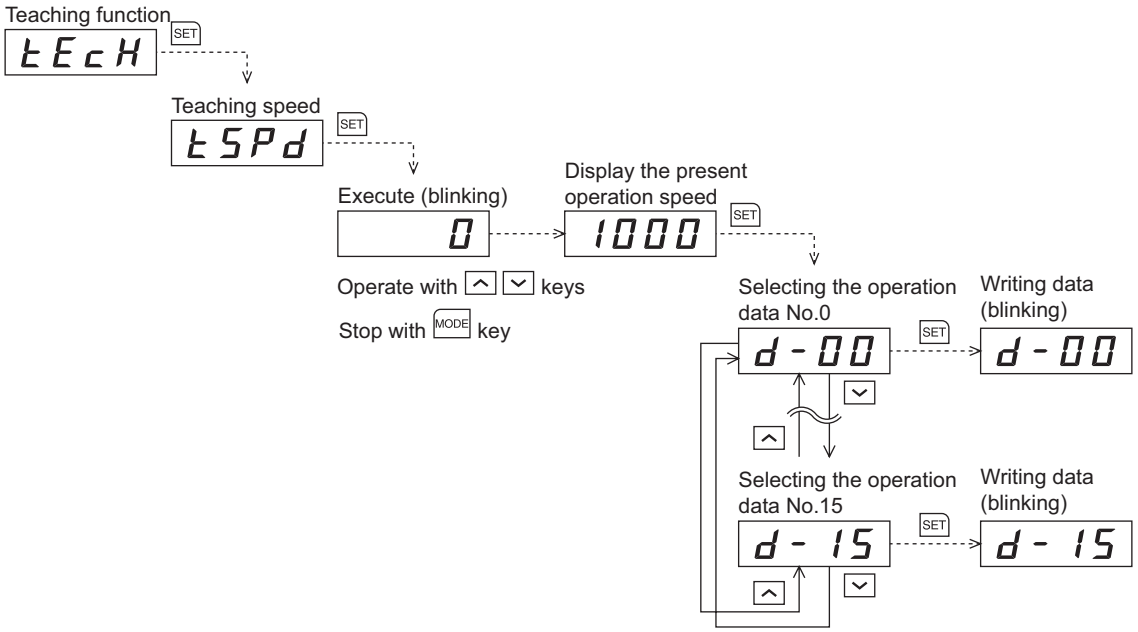
The motor operation speed can be changed with the [↑] [↓] keys and the new value can be updated to the operation data.
The speed is maintained when releasing a hand from the key.

Set the operation data for teaching function using the following parameters.
- "JOG acceleration/deceleration" parameter (ID: 324)
- "JOG operation torque" parameter (ID: 2081)

Note
- When operations are limited by the edit lock function, teaching function cannot be executed.
- Teaching operation cannot be executed while the FREE input or STOP input is being ON. Be sure to execute after turning OFF.

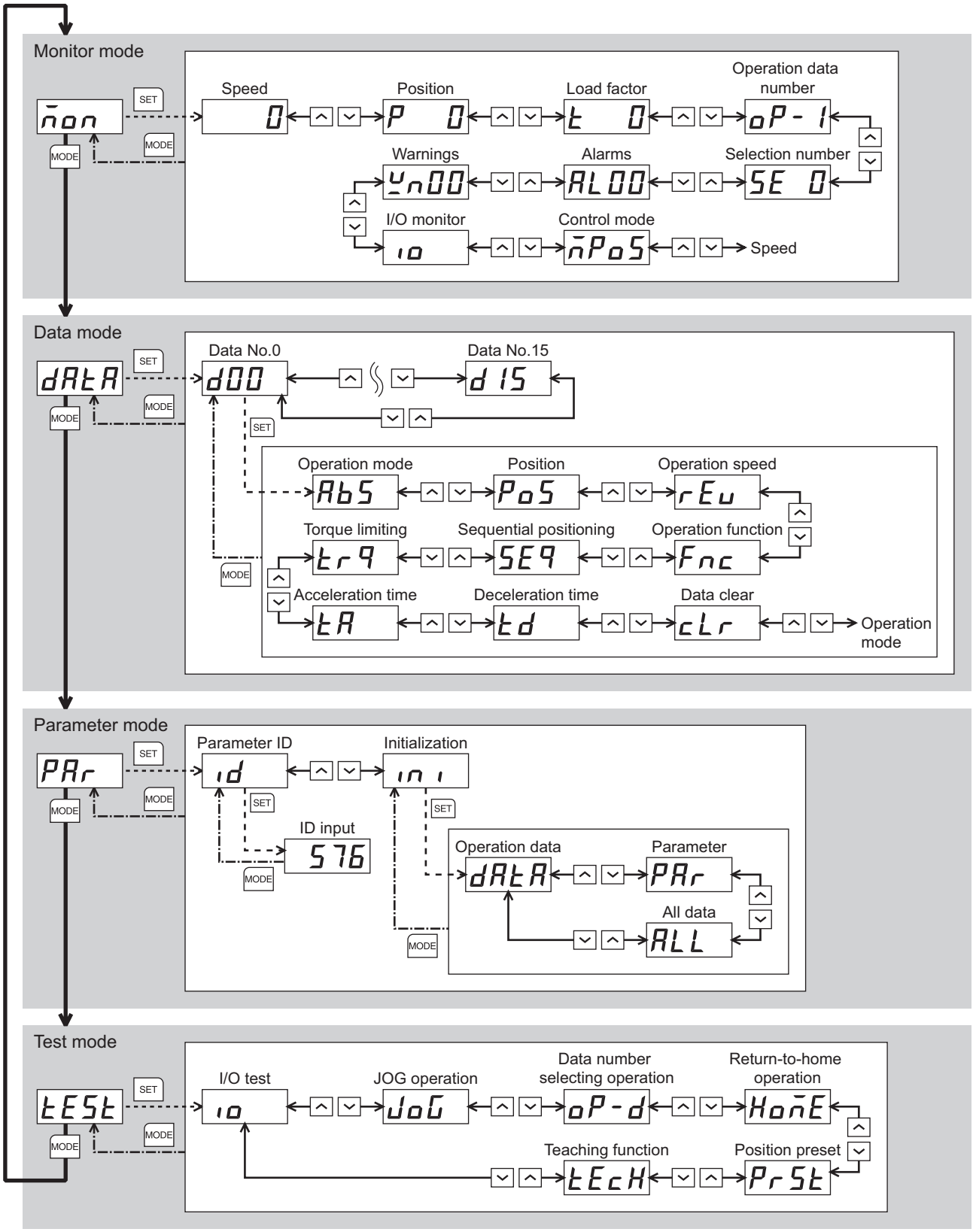
Example of teaching function

The motor rotates in the forward direction and increases the speed while pressing the [↑] key. When decelerating the speed, press the [↓] key.
If the [↓] key is pressed when the operation speed is 0 r/min, the motor rotates in the reverse direction and increases the speed. When decelerating the speed, press the [↑] key.



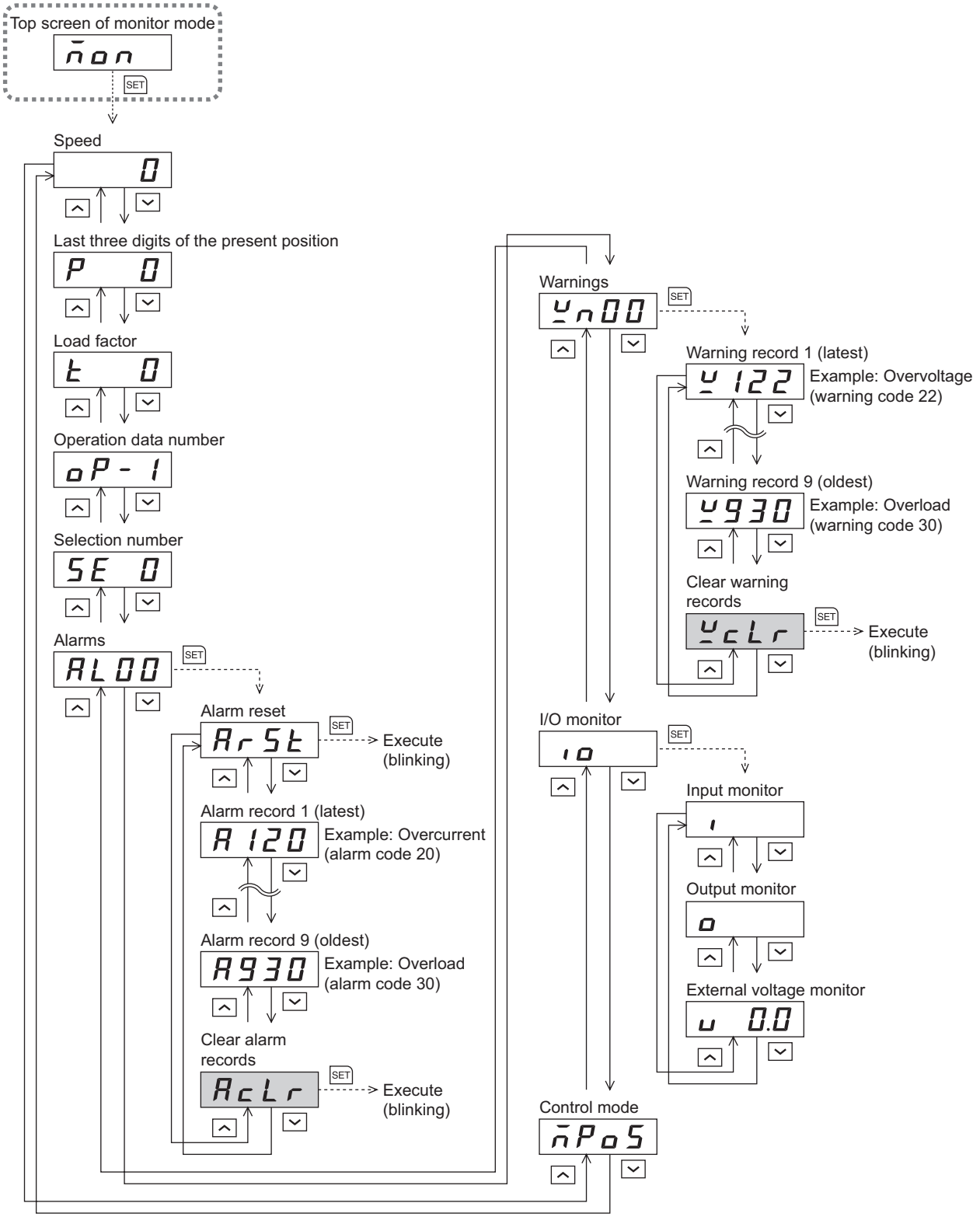
3 Explanation of the function mode (Position control mode)

3.1 Screen transitions



3.2 Monitor mode

This is a mode to be displayed when turning on the power. The motor rotation speed is displayed at the factory setting. Use the monitor mode when operating the motor.



- In the lower level except the top screen, press the MODE key to return to the previous level.
- When operations are limited by the edit lock function, the screens in gray color are not displayed.

■ Speed

The motor operation speed can be checked.
The operation speed can be displayed as the rotation speed of the gear output shaft. To do this, set the "speed reduction ratio" parameter (ID: 2085) and "speed reduction ratio digit setting" parameter (ID: 2086).
It is also possible to increase the rotation speed and display the increased speed. Set in the "speed increasing ratio" parameter (ID: 2087).

■ Last three digits of the present position

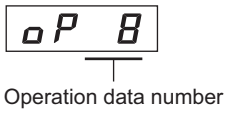
Only the last three digits are displayed among the present position of the motor with reference to the home position.
The display range is 0 to 999. When the number on the display reaches "999," the next number will bring back to "0."

■ Load factor

The motor generating torque can be checked. The present load factor is displayed based on the rated torque being 100%.

■ Operation data number

The operation data number corresponding to the present positioning operation can be checked.



When the "oP- 1" is displayed

If the operation data number is checked immediately when the power supply is input in the position control mode, the "oP- 1" will be displayed. In addition, if the operation data number is checked by executing the following operation, the "oP- 1" is displayed.

- While executing return-to-home operation, continuous operation or JOG operation
- When an alarm is generated and reset
- When the operation is stopped by the BRAKE (STOP) input
- When the motor excitation is turned OFF by the FREE input or S-ON input
- When executing the position preset

■ Selection number

The operation data number currently selected can be checked.

■ Alarms

When an alarm generates, 2-digit alarm code will be displayed.
The present alarm can be reset, and also alarm records can be checked or cleared.
Refer to p.154 for the causes or actions of the alarm.

Note When operations are limited by the edit lock function, the alarm records cannot be cleared.

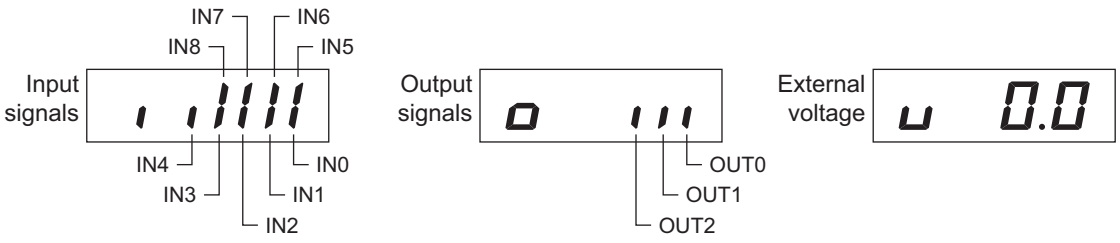
■ Warnings

When a warning generates, 2-digit warning code will be displayed.
Warning records can be checked and cleared.

Note When operations are limited by the edit lock function, the warning records cannot be cleared.

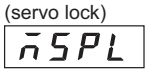
■ I/O monitor

The ON/OFF status of each I/O signal for the driver can be checked.
Each digit on the 7-segment LED display corresponds to a signal. The corresponding digit is lit when the signal is ON, and the digit is unlit when the signal is OFF.
The voltage value input by the analog external setter can also be checked.



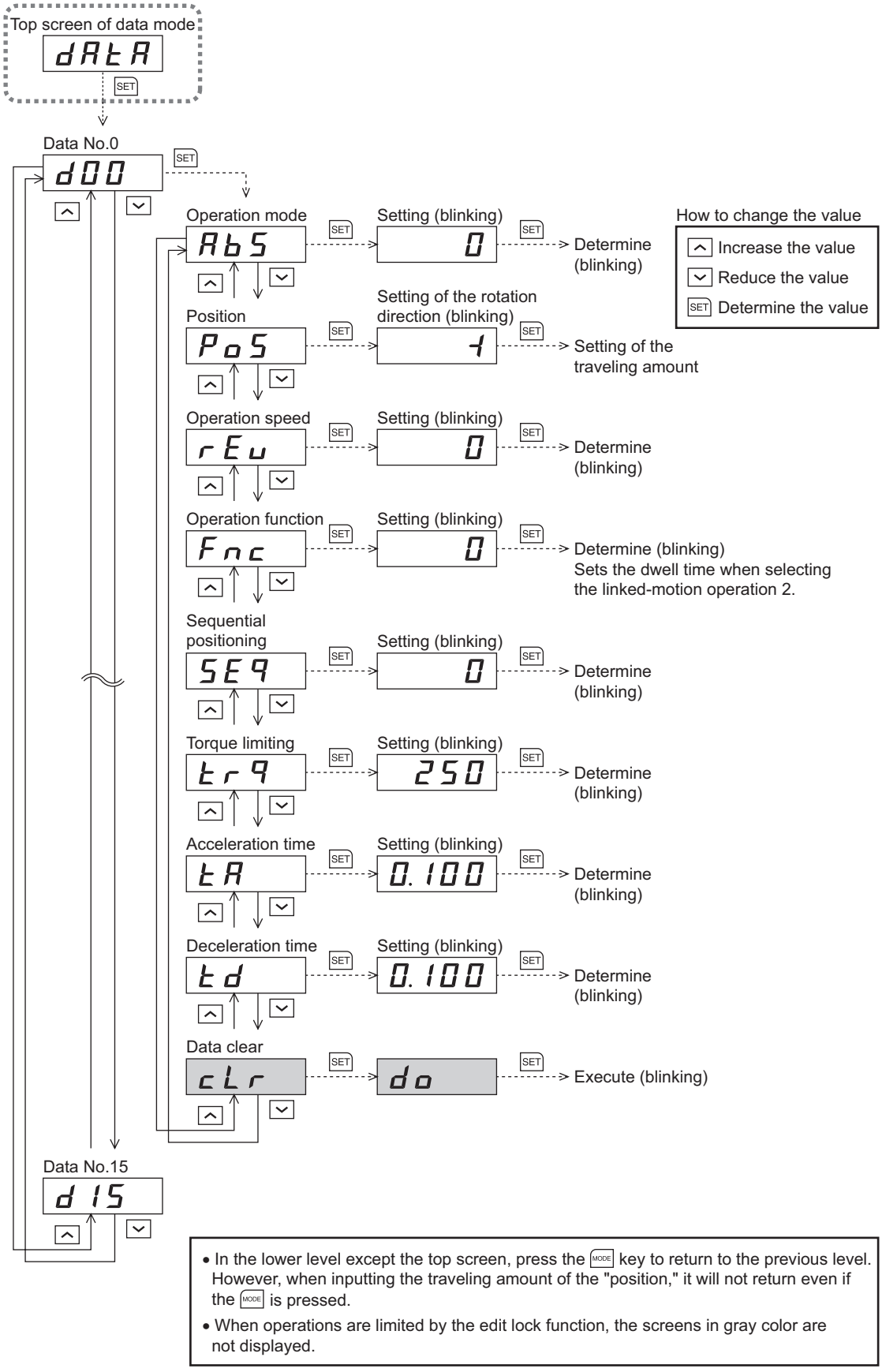
■ Control mode

The present control mode can be checked.

Position control mode	Speed control mode	Speed control mode (servo lock)
		

3.3 Data mode

Sets the operation data.



- In the lower level except the top screen, press the MODE key to return to the previous level. However, when inputting the traveling amount of the "position," it will not return even if the MODE is pressed.
- When operations are limited by the edit lock function, the screens in gray color are not displayed.

■ Setting items

In the case of the position control mode, all setting items other than the torque limiting are set by the digital setting. When the torque limiting is set by the analog setting, change the "analog speed/torque" parameter (ID: 2161) to "2: Analog torque limiting."

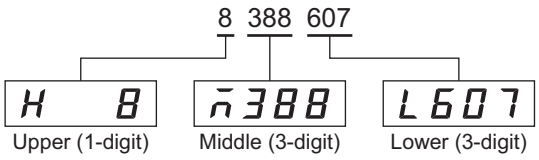
Item	Description	Setting range	Initial value
Operation mode	Selects how to specify the position (travel amount) in positioning operation (absolute mode or incremental mode).	0: Incremental mode 1: Absolute mode	0
Position	Sets the position (travel amount) for positioning operation. The motor shaft rotates 0.72° per one step.	−8,388,608 to +8,388,607 step	0
Operation speed	Sets the operation speed for positioning operation and continuous operation. Set as the rotation speed of the motor output shaft.	0 to 4000 r/min	0
Operation function	Sets to execute positioning operation as single-motion or linked-motion operation.	0: Single-motion 1: Linked-motion 2: Linked-motion2	0
Dwell time	Sets the waiting time between the first operation data and second operation data for linked-motion operation 2.	0.000 to 0.999 s and 1.00 to 50.00 s	0.000
Sequential positioning	Sets whether to enable or disable sequential positioning operation.	0: Disable 1: Enable	0
Torque limiting	Sets when limiting the motor output torque. Sets the instantaneous peak torque based on the rated torque being 100%.	0 to 250%	250
Acceleration time	Sets the acceleration time for positioning operation and continuous operation. The acceleration time is set as the time needed for the motor to reach the rated rotation speed (3000 r/min) from the standstill state.	0.000 to 0.999 s and 1.00 to 30.00 s	0.100
Deceleration time	Sets the deceleration time for positioning operation and continuous operation. The deceleration time is set as the time needed for the motor to stop from the rated rotation speed (3000 r/min).		
Data clear	Reset the operation data to the initial value.	−	−

Note When operations are limited by the edit lock function, the data clear cannot be executed.

■ Setting method of travel amount

The travel amount of "position" can be set up to 8 digits. However, up to 3 digits each can be displayed because the 4-digit LED is used on the operation panel. Therefore, input the travel amount by dividing a maximum of 8 digits into an "upper," "middle" and "lower."

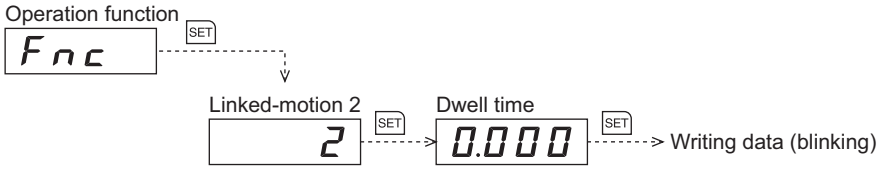
Example: When inputting 8,388,607 steps



■ Setting method of dwell time

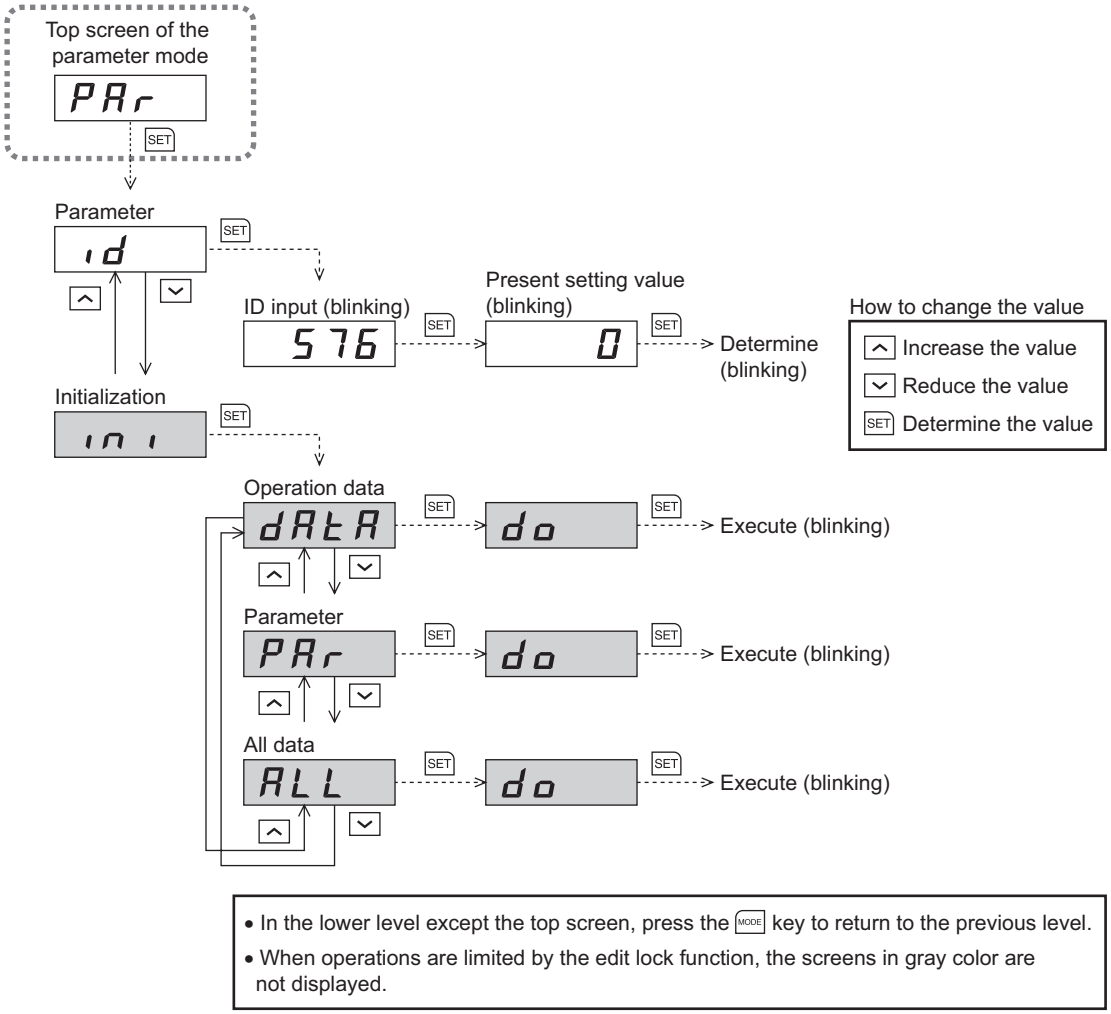
Select "Linked-motion 2" in "operation function" and press the [SET] key to display the setting screen of the dwell time.

Input the dwell time with [↑] [↓] keys and determine by pressing the [SET] key.



3.4 Parameter mode

Sets the parameter.



■ Parameter ID

There is a unique ID in each parameter. Input the ID and set.
Refer to p.89 for parameter ID.

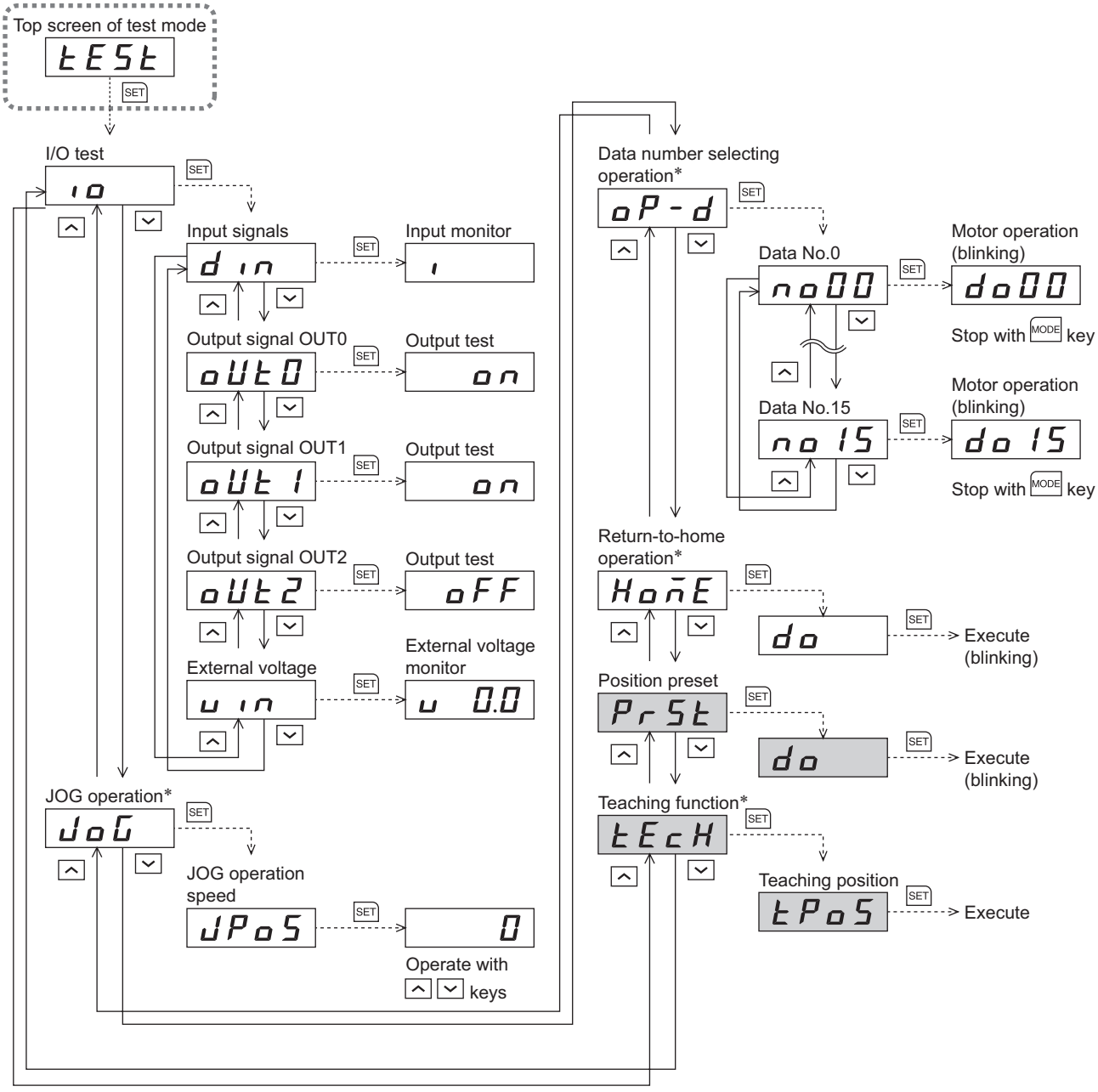
■ Initialization

Reset the data saved in the driver to the initial value. Selecting any of the "operating data only," "parameter only" or "all data," the initialization can be performed.

Note When operations are limited by the edit lock function, the initialization cannot be performed.

3.5 Test mode

The connection status of each I/O signal can be checked. Also, test operation of the motor or position preset can be performed.



- In the lower level except the top screen, press the MODE key to return to the previous level.
- When operations are limited by the edit lock function, the screens in gray color are not displayed.

* These operations cannot be executed while the FREE input, STOP input, or S-ON input is being ON. Be sure to execute after turning OFF.

Note In operation, the motor rotates at the set speed while pressing the operation button. Execute the test operation after confirming thoroughly that the motor rotation will not cause any dangerous situation.

When the [SET] key is pressed while operating a motor

It cannot move to the setting screen of the test mode while operating.
An error will occur even when the [SET] key is pressed, and "Err" will be displayed.
Be sure to stop the motor operation before pressing the [SET] key.

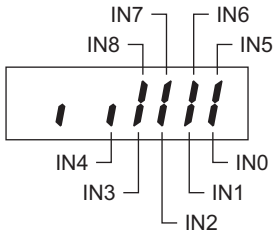
Err

■ I/O test

The ON/OFF status of each input signal can be checked and the ON/OFF status of each output signal can be switched.
The voltage value input by the analog external setter can also be checked.

- Input signals

Each digit on the 7-segment LED display corresponds to a signal.
The corresponding digit is lit when the signal is ON, and the digit is unlit when the signal is OFF.



- Output signals

The ON/OFF status of the output signal can be switched with the [↑] [↓] keys.

- External voltage

The voltage value input by the analog external setter can be checked.

■ JOG operation

The motor can be operated with the [↑] [↓] keys.
When pressing the [↑] key once, the motor rotates by one step in the forward direction. If the key is kept pressing, the motor rotates in the forward direction continuously.
When pressing the [↓] key once, the motor rotates by one step in the reverse direction. If the key is kept pressing, the motor rotates in the reverse direction continuously.
The present position is displayed while JOG operation is executed.

Set the operation data for JOG operation using the following parameters.
- JOG operation speed parameter (ID: 323)
- JOG acceleration/deceleration parameter (ID: 324)
- JOG operation torque parameter (ID: 2081)

Note JOG operation cannot be executed while the FREE input or STOP input is being ON. Be sure to execute after turning OFF.

■ Data number selecting operation

Positioning operation can be executed by selecting the operation data number.
When the operation speed of the selected operation data is 0 r/min, the operating data error alarm will generate.

Note The data number selecting operation cannot be executed while the FREE input or STOP input is being ON. Be sure to execute after turning OFF.

■ Return-to-home operation

Return-to-home operation can be executed.
The operation speed can be set using the "operating speed of home-seeking" parameter (ID: 353).

Note Return-to-home operation cannot be executed while the FREE input or STOP input is being ON. Be sure to execute after turning OFF.

■ Position preset

The position preset is used to renew the command position (present position) to the value of the "preset position" parameter (ID: 454).

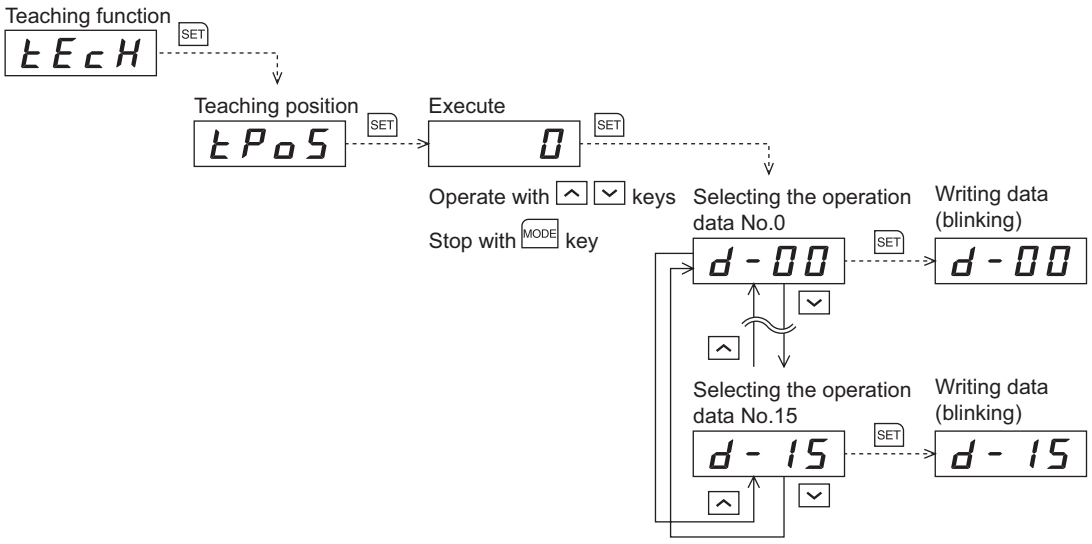
Note When operations are limited by the edit lock function, the position preset cannot be executed.

■ Teaching function

The new position can be updated in the operation data by changing the travel amount of the motor with [↑] [↓] keys.
When pressing the [↑] key once, the motor rotates by one step in the forward direction. If the key is kept pressing, the motor rotates in the forward direction continuously.
When pressing the [↓] key once, the motor rotates by one step in the reverse direction. If the key is kept pressing, the motor rotates in the reverse direction continuously.
The absolute mode will be automatically selected as the operation mode of any position data set by teaching function.

Set the operation data for teaching function using the following parameters.

- JOG operation speed parameter (ID: 323)
- JOG acceleration/deceleration parameter (ID: 324)
- JOG operation torque parameter (ID: 2081)



Note

- When operations are limited by the edit lock function, teaching function cannot be executed.
- Teaching function cannot be executed while the FREE input or STOP input is being ON. Be sure to execute after turning OFF.

4 Parameter list

This part explains the data and parameters that are required to operate a product.

Table of contents

1 Operation data

The data described here is set by any of the operation panel, **MEXE02** or **OPX-2A**.
Up to 16 operation data can be set (Data No.0 to No.15).

1.1 Speed control mode

■ Operation data types

The following operation data is required for the speed control operation.

Item	Description	Setting range	Initial value
Operation speed	Sets the operation speed for the speed control operation. Set as the rotation speed of the motor output shaft.	0 to 4000 r/min	0
Acceleration time	The acceleration time is set as the time needed for the motor to reach the rated rotation speed (3000 r/min) from the standstill state.	0.000 to 30.000 s	0.100
Deceleration time	The deceleration time is set as the time needed for the motor to stop from the rated rotation speed (3000 r/min).		
Torque limiting	Sets when limiting the motor output torque. Sets the instantaneous peak torque based on the rated torque being 100%.	0 to 250%	250

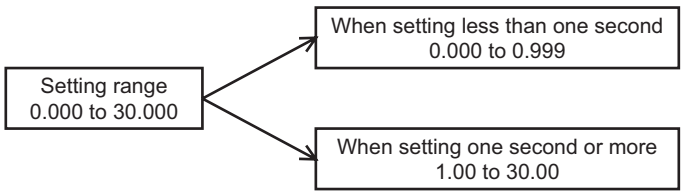
■ Operation data ID

When setting the operation data by the operation panel or the parameter mode of the **OPX-2A**, check the ID in the table below.

Operation data No.	ID			
	Operation speed	Acceleration time	Deceleration time	Torque limiting
0	576	768	832	896
1	577	769	833	897
2	578	770	834	898
3	579	771	835	899
4	580	772	836	900
5	581	773	837	901
6	582	774	838	902
7	583	775	839	903
8	584	776	840	904
9	585	777	841	905
10	586	778	842	906
11	587	779	843	907
12	588	780	844	908
13	589	781	845	909
14	590	782	846	910
15	591	783	847	911

■ Notes for inputting the value by the operation panel

Since the operation panel can display 4-digit only, set in the following range when inputting the acceleration time or deceleration time.



1.2 Position control mode

If the data has been changed while operating the motor, a recalculation and setup will be performed after the operation is stopped, and the data will be updated.

■ Operation data types

The following data is required for the positioning operation.

Item	Description	Setting range	Initial value
Position	Sets the position (travel amount) for positioning operation. The motor shaft rotates 0.72° per one step.	−8,388,608 to +8,388,607 step	0
Operation speed ∗	Sets the operation speed in positioning operation and continuous operation. Set as the rotation speed of the motor output shaft.	0 to 4000 r/min	0
Operation mode	Sets the operation mode of the position (travel amount) for positioning operation.	0: Incremental 1: Absolute	0
Operation function	Sets the operation function to execute positioning operation.	0: Single-motion 1: Linked-motion 2: Linked-motion2	0
Acceleration time ∗	Sets the acceleration time for positioning operation. The acceleration time is set as the time needed for the motor to reach the rated rotation speed (3000 r/min) from the standstill state.	0.000 to 30.000 s	0.100
Deceleration time ∗	Sets the deceleration time for positioning operation. The deceleration time is set as the time needed for the motor to stop from the rated rotation speed (3000 r/min).		
Torque limiting	Sets when limiting the motor output torque. Sets the instantaneous peak torque based on the rated torque being 100%.	0 to 250%	250
Sequential positioning	Sets whether to enable or disable sequential positioning operation.	0: Disable 1: Enable	0
Dwell time	Sets the waiting time between the first operation data and second operation data in linked-motion operation 2.	0.000 to 50.000 s	0.000

∗ These items are set by the digital setting.

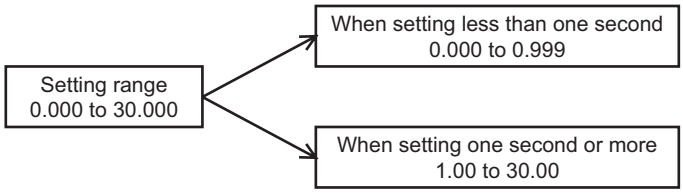
■ Operation data ID

When setting the operation data by the operation panel or the parameter mode of the **OPX-2A**, check the ID in the table below.

Operation data No.	ID								
	Position	Operation speed	Operation mode	Operation function	Acceleration time	Deceleration time	Torque limiting	Sequential positioning	Dwell time
0	512	576	640	704	768	832	896	960	1024
1	513	577	641	705	769	833	897	961	1025
2	514	578	642	706	770	834	898	962	1026
3	515	579	643	707	771	835	899	963	1027
4	516	580	644	708	772	836	900	964	1028
5	517	581	645	709	773	837	901	965	1029
6	518	582	646	710	774	838	902	966	1030
7	519	583	647	711	775	839	903	967	1031
8	520	584	648	712	776	840	904	968	1032
9	521	585	649	713	777	841	905	969	1033
10	522	586	650	714	778	842	906	970	1034
11	523	587	651	715	779	843	907	971	1035
12	524	588	652	716	780	844	908	972	1036
13	525	589	653	717	781	845	909	973	1037
14	526	590	654	718	782	846	910	974	1038
15	527	591	655	719	783	847	911	975	1039

■ Notes for inputting the value by the operation panel

Since the operation panel can display 4-digit only, set in the following range when inputting the acceleration time, deceleration time or dwell time.



2 Parameter

The parameters can be set by any of the operation panel, **MEXE02** or **OPX-2A**.

When writing parameters to the driver, they are saved in the non-volatile memory. The parameters saved in the non-volatile memory will be retained even after the power supply is turned off. When a parameter is changed, the timing to enable the new value varies depending on the parameter. See the following three types.

- Effective immediately ..... Executes the recalculation and setup immediately when writing the parameter.
- Effective after stopping the operation..... Executes the recalculation and setup after stopping the operation.
- Effective after turning on the power again.... Executes the recalculation and setup after turning on the power again.

Note The non-volatile memory can be rewritten approximately 100,000 times.

2.1 Parameter list

All parameters can be set in both the speed control mode and position control mode.
The parameters that can be used vary depending on the control mode.

ID	Parameter name	Setting range	Initial value	Reference page	Control mode ∗1	
					Speed control	Position control
256	STOP input action	0: Immediate stop 1: Deceleration stop 2: Immediate stop + current OFF 3: Deceleration stop + current OFF Speed control mode (disable servo lock) 0, 2: Immediate stop 1, 3: Deceleration stop	0	p.93	○	○
258	Overtravel action	0: Immediate stop 1: Deceleration stop	0		×	
259	Positioning completion signal range	1 to 100 step The motor shaft rotates 0.72° per one step.	1			
290	Position loop gain	1 to 100 Hz	7	p.95	○ ∗2	
291	Speed loop gain	1 to 1000 Hz	200		○	
292	Speed loop integral time constant	0 to 1000 ms	33			
293	Speed filter	0 to 200 ms	1		○ ∗2	
294	Moving average time	1 to 200 ms	1			
323	JOG operation speed	0 to 4000 r/min	300	p.94	○	
324	JOG acceleration/deceleration rate	0.000 to 30.000 s	0.100			
353	Operating speed of home-seeking	0 to 4000 r/min	300	p.97	×	○ ∗3
354	Acceleration/deceleration of home-seeking	0.000 to 30.000 s	0.100			
356	Position offset of home-seeking	−8,388,608 to +8,388,607 step The motor shaft rotates 0.72° per one step.	0			
357	Starting direction of home-seeking	0: Negative direction 1: Positive direction	1			○
385	Excessive position deviation alarm	0.01 to 300.00 rev	20.00	p.97		
419	Overvoltage warning	120 to 440 V	435		○	
421	Excessive position deviation warning	0.01 to 300.00 rev	20.00		×	
450	Motor rotation direction	0: Positive direction=CCW 1: Positive direction=CW	1	p.98	○	
451	Software overtravel	0: Disable 1: Enable	1		×	

∗1 ○: Possible to use.
×: Not possible to use.
∗2 Possible to use when setting the "servo lock at motor standstill" parameter (ID: 2069) to "1: Servo lock."
∗3 Not possible to use in the **BX**-compatible mode.

ID	Parameter name	Setting range	Initial value	Reference page	Control mode ∗1	
					Speed control	Position control
452	Positive software limit	−8,388,608 to +8,388,607 step The motor shaft rotates 0.72° per one step.	+8,388,607	p.98	×	○
453	Negative software limit		−8,388,608			
454	Preset position		0			
455	Wrap setting	0: Disable 1: Enable	0			
456	Wrap setting range	1 to 8,388,607 step The motor shaft rotates 0.72° per one step.	1000			
480	Data setter speed display	0: Plus sign 1: Absolute value 2: Minus sign	0	p.99	○	
512 to 527	Position No.0 to Position No.15	−8,388,608 to +8,388,607 step The motor shaft rotates 0.72° per one step.	0	p.87	×	
576 to 591	Operating speed No.0 to Operating speed No.15	0 to 4000 r/min	0	p.86 p.87	○	
640 to 655	Operation mode No.0 to Operation mode No.15	0: Incremental 1: Absolute	0	p.87	×	
704 to 719	Operation function No.0 to Operation function No.15	0: Single-motion 1: Linked-motion 2: Linked-motion2	0			
768 to 783	Acceleration time No.0 to Acceleration time No.15	0.000 to 30.000 s	0.100	p.86 p.87	○	
832 to 847	Deceleration time No.0 to Deceleration time No.15		0.100			
896 to 911	Torque limiting No.0 to Torque limiting No.15	0 to 250%	250			
960 to 975	Sequential positioning No.0 to Sequential positioning No.15	0: Disable 1: Enable	0	p.87	×	
1024 to 1039	Dwell time No.0 to Dwell time No.15	0.000 to 50.000 s	0.000			
2048	MS0 operation No. selection	0 to 15	0	p.93		
2049	MS1 operation No. selection		1			
2050	MS2 operation No. selection		2			
2051	MS3 operation No. selection		3			
2052	MS4 operation No. selection		4			
2053	MS5 operation No. selection		5			
2054	HOME-P output function selection	0: Home output 1: Return-to-home complete output	0			
2064	Speed filter selection	0: Without speed filter 1: Speed filter 2: Moving average	0	p.95	○ ∗2	
2069	Servo lock at motor standstill	0: Free (disable servo lock) 1: Servo lock	0	p.94	○	×
2081	JOG operation torque	0 to 250%	100			○
2084	JOG travel amount	1 to 8,388,607 step The motor shaft rotates 0.72° per one step.	1		×	
2085	Speed reduction ratio	100 to 9999	100		○	

∗1 ○: Possible to use.
×: Not possible to use.
∗2 Possible to use when setting the "servo lock at motor standstill" parameter (ID: 2069) to "1: Servo lock."

ID	Parameter name	Setting range	Initial value	Reference page	Control mode ∗1	
					Speed control	Position control
2086	Speed reduction ratio digit setting	0: ×1 1: ×0.1 2: ×0.01	2	p.94	○	○
2087	Speed increasing ratio	1 to 5	1			
2113	Prevention of operation at power-on alarm function	0: Disable 1: Enable	0	p.97		
2129	Overload warning function		0			
2133	Overload warning level	50 to 100%	100			
2160	Data setter initial display	0: Speed 1: Detected position 2: Load factor 3: Operation data number 4: Selection number 5: Top screen of monitor mode	0	p.99		
2161	Analog speed/torque	• Speed control mode 0: Digital setting 1: Analog setting 2: Analog torque limiting • Position control mode 0 or 1: Digital setting 2: Analog torque limiting	1			
2162	Analog acceleration/deceleration	0: Digital setting 1: Analog setting	1			×
2164	Panel initial view	0: Speed 1: Detected position 2: Load factor 3: Operation data number 4: Selection number 5: Top screen of monitor mode	0			○
2176	IN0 input function selection	Refer to p.101 for details.	1[3] ∗2	p.101		
2177	IN1 input function selection		2[4] ∗2			
2178	IN2 input function selection		48			
2179	IN3 input function selection		49			
2180	IN4 input function selection		50			
2181	IN5 input function selection		16			
2182	IN6 input function selection		18			
2183	IN7 input function selection		24			
2184	IN8 input function selection		0[62] ∗2			
2192	IN0 input logic level setting	0: Normal 1: Invert	0			
2193	IN1 input logic level setting					
2194	IN2 input logic level setting					
2195	IN3 input logic level setting					
2196	IN4 input logic level setting					
2197	IN5 input logic level setting					
2198	IN6 input logic level setting					
2199	IN7 input logic level setting					
2200	IN8 input logic level setting					
2208	OUT0 output function selection	Refer to p.101 for details.	65			
2209	OUT1 output function selection		68[67] ∗2			
2210	OUT2 output function selection		66[70] ∗2			
2215	Rotation speed attainment band	0 to 400 r/min	200	p.93		

∗1 ○: Possible to use.
×: Not possible to use.

∗2 This is the initial value for the speed control mode. The value in the brackets [ ] is applied for the position control mode. When using the product in the **BX**-compatible mode, refer to the part 7 "**BX**-compatible mode."

ID	Parameter name	Setting range	Initial value	Reference page	Control mode ∗1	
					Speed control	Position control
2256	Analog operation speed command gain	0 to 4000 r/min/V	850 (635) ∗2	p.98	○	×
2257	Analog operation speed command offset	−2000 to +2000 r/min	0			
2258	Analog torque limiting gain	0 to 250%/V	54			○
2259	Analog torque limiting offset	−50 to +50%	0			
2261	Analog rotation speed maximum value	0 to 4000 r/min	4000 (3150) ∗2			
2263	Analog torque limiting maximum value	0 to 250%	250			
2289	Continuous operation	0: Disable 1: Enable	0	p.94	×	○ ∗2
2290	BUSY/TLM switching	0: BUSY 1: TLM（TLC）	0	p.93	○ ∗2	

∗1 ○: Possible to use.
×: Not possible to use.
∗2 When the **BX**-compatible mode is used

2.2 I/O parameter

All parameters can be set in both the speed control mode and position control mode.
The parameters that can be used vary depending on the control mode.

ID	Parameter name	Description	Setting range	Initial value	Effective *1	Control mode *2	
						Speed control	Position control
256	STOP input action	Sets how the motor should stop when the STOP input is turned ON.	0: Immediate stop 1: Deceleration stop 2: Immediate stop + current OFF 3: Deceleration stop + current OFF Speed control mode (disable servo lock) 0, 2: Immediate stop 1, 3: Deceleration stop	0	A	○	○
258	Overtravel action	Sets how the motor should stop when an overtravel has occurred.	0: Immediate stop 1: Deceleration stop	0		×	
259	Positioning completion signal range	Sets the output range that the END output is turned ON. The motor shaft rotates 0.72° per one step.	1 to 100 step	1			
2048	MS0 operation No. selection	Sets the operation data number corresponding to the MS0 to MS5 inputs.	0 to 15	0	B		
2049	MS1 operation No. selection			1			
2050	MS2 operation No. selection			2			
2051	MS3 operation No. selection			3			
2052	MS4 operation No. selection			4			
2053	MS5 operation No. selection			5			
2054	HOME-P output function selection	Sets the timing to output the HOME-P output.	0: Home output 1: Return-to-home complete output	0	A		
2215	Rotation speed attainment band	Sets the output range for the VA output.	0 to 400 r/min	200		○	
2290	BUSY/TLM switching	Uses in the **BX**-compatible mode. Switches the BUSY output and TLM output.	0: BUSY 1: TLM（TLC）	0	C		

*1 Indicates the timing for the data to become effective. (A: Effective immediately, B: Effective after stopping the operation, C: Effective after turning on the power again)

*2 ○: Possible to use.
×: Not possible to use.

2.3 Operation parameter

All parameters can be set in both the speed control mode and position control mode.
The parameters that can be used vary depending on the control mode.

ID	Parameter name	Description	Setting range	Initial value	Effective ∗1	Control mode ∗2	
						Speed control	Position control
323	JOG operation speed	Sets the operation speed for JOG operation.	0 to 4000 r/min	300	B	○	○
324	JOG acceleration/ deceleration rate	Sets the acceleration and deceleration time for JOG operation.	0.000 to 30.000 s	0.100			
2069	Servo lock at motor standstill	Uses in the speed control mode. If the holding force is required while the motor stops, set to "1" to enable the servo lock.	0: Free (disable servo lock) 1: Servo lock	0	C		×
2081	JOG operation torque	Sets the maximum torque based on the rated torque being 100% in JOG operation.	0 to 250%	100	B		○
2084	JOG travel amount	Sets the travel amount for JOG operation. The motor shaft rotates 0.72° per one step.	1 to 8,388,607 step	1		×	
2085	Speed reduction ratio	The speed reduction ratio can be set by multiplying the value in "speed reduction ratio" parameter by the value in "speed reduction ratio digit setting" parameter. If the speed reduction ratio is set, the rotation speed that is calculated based on the actual speed of the motor will be displayed.	100 to 9999	100	A	○	
2086	Speed reduction ratio digit setting		0: ×1 1: ×0.1 2: ×0.01	2			
2087	Speed increasing ratio	If the speed increasing ratio is set, the rotation speed that is calculated based on the actual speed of the motor will be displayed.	1 to 5	1			
2289	Continuous operation	Uses in the **BX**-compatible mode (position control). Sets whether to enable or disable the continuous operation.	0: Disable 1: Enable	0	C	×	

∗1 Indicates the timing for the data to become effective. (A: Effective immediately, B: Effective after stopping the operation, C: Effective after turning on the power again)
∗2 ○: Possible to use.
×: Not possible to use.

■ How to set the speed reduction ratio

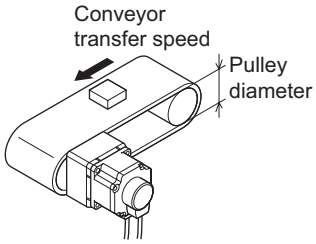
Set the speed reduction ratio as a combination of the "speed reduction ratio" parameter (ID: 2085) and "speed reduction ratio digit setting" parameter (ID: 2086).
The relationships of speed reduction ratio and decimal position are explained by the combinations shown below.

Actual speed reduction ratio	Speed reduction ratio parameter	Speed reduction ratio digit setting parameter
1.00 to 9.99	100 to 999	2
10.0 to 99.9		1
100 to 999		0
10.00 to 99.99	1000 to 9999	2
100.0 to 999.9		1
1000 to 9999		0

■ When displaying the conveyor transfer speed

To display the conveyor transfer speed, set the conveyor speed reduction ratio by using the formula below.

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



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

$$\text{Conveyor transfer speed [m/min]} = \frac{\text{Rotation speed of motor output shaft [r/min]}}{\text{Conveyor speed reduction ratio}}$$

Example:
The pulley diameter is 0.1 m and gear ratio (speed reduction ratio) of the gear head is 20

$$\text{Conveyor speed reduction ratio} = \frac{\text{Gear ratio of gearhead}}{\text{Pulley diameter [m]} \times \pi} = \frac{20}{0.1 \text{ [m]} \times \pi} \fallingdotseq 63.7$$

From the conversion formula, the conveyor speed reduction ratio is calculated as 63.7 in this example. This means that the "speed reduction ratio" parameter is 637, and the "speed reduction ratio digit setting" parameter is 1.
When the speed reduction ratio is 63.7 and the motor rotation speed is 1300 r/min, the conveyor transfer speed is converted as follows.

$$\text{Conveyor transfer speed [m/min]} = \frac{1300}{63.7} \fallingdotseq 20.4$$

"20.4" is displayed on the panel.

2.4 Motor parameter

All parameters can be set in both the speed control mode and position control mode.
The parameters that can be used vary depending on the control mode.

ID	Parameter name	Description	Setting range	Initial value	Effective *1	Control mode *2	
						Speed control	Position control
290	Position loop gain	Adjusts the motor response in reaction to the position deviation.	1 to 100 Hz	7	A	○ *3	○
291	Speed loop gain	Adjusts the motor response in reaction to the speed deviation.	1 to 1000 Hz	200		○	
292	Speed loop integral time constant	Adjusts the deviation that cannot be adjusted with the speed loop gain.	0 to 1000 ms	33			
293	Speed filter	Adjusts the motor response.	0 to 200 ms	1	B	○ *3	
294	Moving average time	Sets the time constant for the moving average filter.	1 to 200 ms	1			
2064	Speed filter selection	Sets the filter function to adjust the motor response.	0: Without speed filter 1: Speed filter 2: Moving average	0	C		

*1 Indicates the timing for the data to become effective. (A: Effective immediately, B: Effective after stopping the operation, C: Effective after turning on the power again)
*2 ○: Possible to use.
×: Not possible to use.
*3 Possible to use when the "servo lock at motor standstill" parameter (ID: 2069) is set to "1: Servo lock."

■ Position loop gain, speed loop gain, speed loop integral time constant

Vibration that occurs while the motor is accelerating/decelerating or at standstill can be adjusted to an optimal value. (The optimal value varies depending on the equipment or operating conditions.)

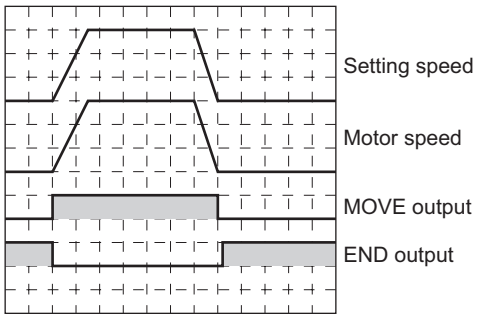
Related parameters

Position loop gain	Adjusts the motor response in reaction to the position deviation. When this value is increased, the deviation between the command position and actual position will be small. An excessively high value may increase the motor overshooting or cause motor hunting.
Speed loop gain	Adjusts the motor response in reaction to the speed deviation. When this value is increased, the deviation between the command speed and actual speed will be small. An excessively high value may increase the motor overshooting or cause motor hunting.
Speed loop integral time constant	Decreases the deviation that cannot be adjusted with the speed loop gain. An excessively long value may slow the motor response. Too short value may cause the motor to vibrate.

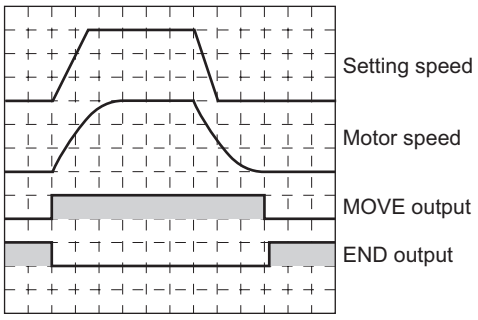
■ Speed filter

When setting the "speed filter" parameter (ID293) while the "speed filter selection" parameter (ID: 2064) is set to "1: speed filter," the command position is filtered and the motor response can be adjusted.
When the speed filter level is increased, the motor operation at starting/stopping will become smooth. Note, however, that an excessively long filter level will result in lower synchronization against the commands. Set an appropriate value according to the specific load and application.

- When the "speed filter" parameter is set to 0 ms



- When the "speed filter" parameter is set to 200 ms



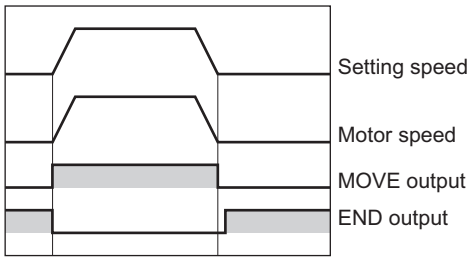
Note

- If the "speed filter" parameter (ID: 293) is set to 0, the speed filter will be disabled.
- When the "servo lock at motor standstill" parameter (ID: 2069) is set to "0: Free" in the speed control mode, the speed filter will be disabled.

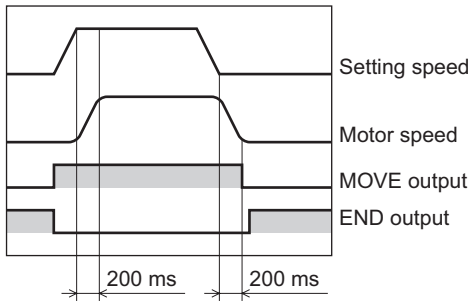
■ Moving average filter

When setting the "moving average time" parameter (ID: 2064) while the "speed filter selection" parameter (ID: 2064) is set to "2: moving average," the motor response can be adjusted. The positioning time can be shortened by suppressing the residual vibration for positioning operation.
Optimum value for the "moving average time" parameter varies depending on the load or operating condition. Set a suitable value based on the load or operating condition.

- When the "moving average filter" is not used



- When the "moving average filter" parameter is set to 200 ms



2.5 Alarm/warning parameter

All parameters can be set in both the speed control mode and position control mode.
The parameters that can be used vary depending on the control mode.

ID	Parameter name	Description	Setting range	Initial value	Effective ∗1	Control mode ∗2	
						Speed control	Position control
385	Excessive position deviation alarm	Sets the condition that an excessive position deviation alarm generates.	0.01 to 300.00 rev	20.00	A	×	○
419	Overvoltage warning	Sets the condition in which an overvoltage warning generates.	120 to 440 V	435		○	
421	Excessive position deviation warning	Sets the condition in which an excessive position deviation warning generates.	0.01 to 300.00 rev	20.00		×	
2113	Prevention of operation at power-on alarm function	Sets whether to enable or disable the "prevention of operation at power-on alarm function."	0: Disable 1: Enable	0		○	
2129	Overload warning function	Sets whether to enable or disable the overload warning function.		0			
2133	Overload warning level	Sets the condition in which the overload warning generates.	50 to 100%	100			

∗1 Indicates the timing for the data to become effective. (A: Effective immediately)
∗2 ○: Possible to use.
×: Not possible to use.

2.6 Return-to-home parameter

All parameters can be set in both the speed control mode and position control mode.
The parameters that can be used vary depending on the control mode.

ID	Parameter name	Description	Setting range	Initial value	Effective ∗1	Control mode ∗2	
						Speed control	Position control
353	Operating speed of home-seeking	Set the operation speed of return-to-home operation.	0 to 4000 r/min	300	B	×	○ ∗3
354	Acceleration/ deceleration of home-seeking	Sets the acceleration and deceleration time for return-to-home operation.	0.000 to 30.000 s	0.100			
356	Position offset of home-seeking	Sets the amount of offset from home position. The motor shaft rotates 0.72° per one step.	−8,388,608 to +8,388,607 step	0			
357	Starting direction of home-seeking	Sets the starting direction for home detection.	0: Negative direction 1: Positive direction	1			○

∗1 Indicates the timing for the data to become effective. (B: Effective after stopping the operation)
∗2 ○: Possible to use.
×: Not possible to use.
∗3 Not possible to use in the **BX**-compatible mode.

2.7 Coordination parameter

All parameters can be set in both the speed control mode and position control mode.
The parameters that can be used vary depending on the control mode.

ID	Parameter name	Description	Setting range	Initial value	Effective ∗1	Control mode ∗2	
						Speed control	Position control
450	Motor rotation direction	Sets the rotation direction of the motor output shaft.	0: Positive direction=CCW 1: Positive direction=CW	1	C	○	○
451	Software overtravel	Sets whether to enable or disable software overtravel detection using software limits.	0: Disable 1: Enable	1	A	×	
452	Positive software limit	Sets the value of software limit in positive direction. The motor shaft rotates 0.72° per one step.	−8,388,608 to +8,388,607 step	+8,388,607			
453	Negative software limit	Sets the value of software limit in negative direction. The motor shaft rotates 0.72° per one step.		−8,388,608			
454	Preset position	Sets the preset position.The motor shaft rotates 0.72° per one step.		0			
455	Wrap setting	Sets whether to enable or disable the wrap function.	0: Disable 1: Enable	0	C		
456	Wrap setting range	Sets the wrap setting range. The motor shaft rotates 0.72° per one step.	1 to 8,388,607 step	1000			

∗1 Indicates the timing for the data to become effective. (A: Effective immediately, C: Effective after turning on the power again)
∗2 ○: Possible to use.
×: Not possible to use.

2.8 Analog adjustment parameter

All parameters can be set in both the speed control mode and position control mode.
The parameters that can be used vary depending on the control mode.

ID	Parameter name	Description	Setting range	Initial value	Effective ∗1	Control mode ∗2	
						Speed control	Position control
2256	Analog operation speed command gain	Sets the speed command per 1 VDC of the input voltage by the analog external setter.	0 to 4000 r/min/V	850 (635) ∗3	A	○	×
2257	Analog operation speed command offset	Sets the offset of the speed command input by the analog external setter.	−2000 to +2000 r/min	0			
2258	Analog torque limiting gain	Sets the torque limiting per 1 VDC of the input voltage by the analog external setter.	0 to 250%/V	54			○
2259	Analog torque limiting offset	Sets the offset of the torque limiting input by the analog external setter.	−50 to +50%	0			
2261	Analog operating speed maximum value	Sets the maximum value of the rotation speed by the analog external setter.	0 to 4000 r/min	4000 (3150) ∗3			×
2263	Analog torque limiting maximum value	Sets the maximum value of the torque limiting by the analog external setter.	0 to 250%	250			○

∗1 Indicates the timing for the data to become effective. (A: Effective immediately)
∗2 ○: Possible to use.
×: Not possible to use.
∗3 When the **BX**-compatible mode is used

2.9 Common parameter

All parameters can be set in both the speed control mode and position control mode.
The parameters that can be used vary depending on the control mode.

ID	Parameter name	Description	Setting range	Initial value	Effective *1	Control mode *2	
						Speed control	Position control
480	Data setter speed display	Sets the display method of the speed monitor for the **OPX-2A**.	0: Plus sign 1: Absolute value 2: Minus sign	0	A	○	○
2160	Data setter initial display	Sets the initial screen to display on the **OPX-2A** when the driver power is turned on.	0: Speed 1: Detected position 2: Load factor 3: Operation data number 4: Selection number 5: Top screen of monitor mode	0			
2161	Analog speed/torque	Changes the setting method of operation speed and torque limiting. For details, refer to the next clause.	• Speed control mode 0: Digital setting 1: Analog setting 2: Analog torque limiting • Position control mode 0 or 1: Digital setting 2: Analog torque limiting	1	C		
2162	Analog acceleration/ deceleration	Changes the setting method of acceleration/deceleration time. Refer to the next page for details.	0: Digital setting 1: Analog setting	1			×
2164	Panel initial view	Sets the initial screen to display on the operation panel when the driver power is turned on.	0: Speed 1: Detected position 2: Load factor 3: Operation data number 4: Selection number 5: Top screen of monitor mode	0	A		○

*1 Indicates the timing for the data to become effective. (A: Effective immediately, C: Effective after turning on the power again)
*2 ○: Possible to use.
×: Not possible to use.

■ "Analog speed/torque" parameter (ID: 2161)

The setting method of operating data can be changed using "analog speed/torque" parameter (ID: 2161) and "analog acceleration/deceleration" parameter (ID: 2162).

- Analog setting .....Internal potentiometer (SPEED), **PAVR-20KZ** (accessory), external DC voltage
- Digital setting.....Operation panel, **MEXE02**, **OPX-2A** (accessory)

- Speed control mode

The setting method of operation speed and torque limiting can be changed between the analog setting and digital setting.

Operation data	When the parameter is 0		When the parameter is 1		When the parameter is 2	
	Operation speed	Torque limiting	Operation speed	Torque limiting	Operation speed	Torque limiting
No.0	Digital setting	Digital setting	Internal potentiometer	Digital setting	Digital setting	**PAVR-20KZ** External DC voltage
No.1			**PAVR-20KZ** External DC voltage			
No.2 to No.15			Digital setting			

Setting example

- When all operating data is set by the digital setting: Set the "analog speed/torque" parameter to 0.
- When the operation speed of the operating data Nos. 0 and 1 is set by the analog setting: Set the "analog speed/torque" parameter to 1.

- Position control mode

The operation speed is set by the digital setting. Note, however, that the torque limiting can also be set by the analog setting.

Operation data	When the parameter is 0		When the parameter is 1		When the parameter is 2	
	Operation speed	Torque limiting	Operation speed	Torque limiting	Operation speed	Torque limiting
No.0 to No.15	Digital setting	Digital setting	Digital setting	Digital setting	Digital setting	**PAVR-20KZ** External DC voltage

Setting example

- When all operating data is set by the digital setting: Set the "analog speed/torque" parameter to 0 or 1.
- When the torque limiting is set by the analog setting: Set the "analog speed/torque" parameter to 2.

■ "Analog acceleration/deceleration" parameter (ID: 2162)

This parameter is effective in the speed control mode.
The setting method of acceleration time and deceleration time can be changed between the analog setting and digital setting.

- Analog setting .....Acceleration time potentiometer (ACC), Deceleration time potentiometer (DEC)
- Digital setting.....Operation panel, **MEXE02**, **OPX-2A** (accessory)

Operation data	When the parameter is 0		When the parameter is 1	
	Acceleration time	Deceleration time	Acceleration time	Deceleration time
No.0 No.1	Digital setting	Digital setting	Analog setting	Analog setting
No.2 to No.15			Digital setting	Digital setting

2.10 I/O function parameter

All parameters can be set in both the speed control mode and position control mode.
The parameters that can be used vary depending on the control mode.

ID	Parameter name	Description	Setting range	Initial value	Effective ∗1	Control mode ∗2	
						Speed control	Position control
2176	IN0 input function selection	Assigns the input signals to the input terminals IN0 to IN8.	Refer to the next table.	1[3] ∗3	C	○	○
2177	IN1 input function selection			2[4] ∗3			
2178	IN2 input function selection			48			
2179	IN3 input function selection			49			
2180	IN4 input function selection			50			
2181	IN5 input function selection			16			
2182	IN6 input function selection			18			
2183	IN7 input function selection			24			
2184	IN8 input function selection			0[62] ∗3			
2192	IN0 input logic level setting	Changes the logic level setting for the input terminals IN0 to IN8.	0: Normal 1: Invert	0			
2193	IN1 input logic level setting						
2194	IN2 input logic level setting						
2195	IN3 input logic level setting						
2196	IN4 input logic level setting						
2197	IN5 input logic level setting						
2198	IN6 input logic level setting						
2199	IN7 input logic level setting						
2200	IN8 input logic level setting						
2208	OUT0 output function selection	Assigns the output signals to the output terminals OUT0 to OUT2.	Refer to the next table.	65			
2209	OUT1 output function selection			68[67] ∗3			
2210	OUT2 output function selection			66[70] ∗3			

∗1 Indicates the timing for the data to become effective. (C: Effective after turning on the power again)

∗2 ○: Possible to use.
×: Not possible to use.

∗3 This is the initial value for the speed control mode. The value in the brackets [ ] is applied for the position control mode. When using the product in the **BX**-compatible mode, refer to the part 7 "**BX**-compatible mode."

■ Setting range of the function selection parameter

- IN input function selection parameter

0:Not used	7:−JOG	16:FREE	48:M0
1:FWD ∗	8:MS0	17:S-ON	49:M1
2:RVS ∗	9:MS1	18:STOP ∗	50:M2
3:HOME	10:MS2	22:TH	51:M3
4:START	11:MS3	24:ALM-RST	54:TL
5:SSTART	12:MS4	25:P-PRESET	62:HOMES ∗
6:+JOG	13:MS5	27:HMI	

∗ For the **BX**-compatible mode, the name of each signal changes as follows.
FWD→ CW, RVS→ CCW, STOP→ BRAKE, HOMES→ HOME-LS

- OUT output function selection parameter

0:Not used	69:END
65:ALM	70:HOME-P
66:WNG	71:TLC ∗
67:READY	77:VA
68:MOVE	85:ZSG

∗ For the **BX**-compatible mode, the name of signal changes as follows.
TLC→ TLM

Note The signals that can be used vary depending on the control mode. Use signals after setting correctly.

5 Operation of speed control mode

This part explains how to operate with the speed control mode.

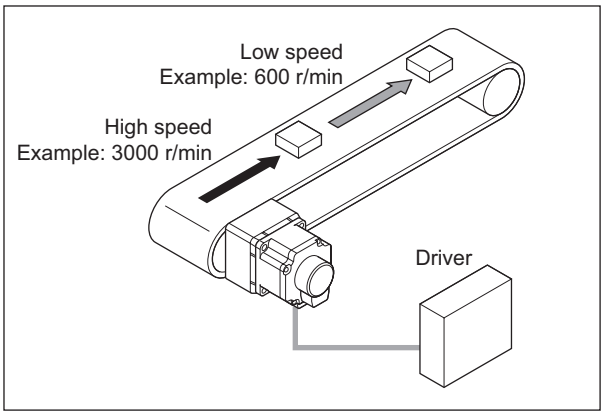
Table of contents

1 Overview of speed control mode

Operation

【Setting with operation data and parameters】

Speed control mode



Multi-speed operation

Acceleration/deceleration operation

Multi-motor control

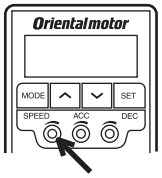
Other operations

- JOG operation
- Test operation

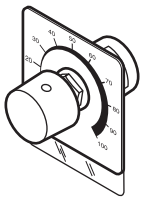
Speed setting method

【Analog setting】

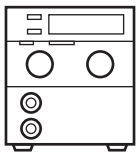
Internal potentiometer



External potentiometer **PAVR-20KZ** (accessory)

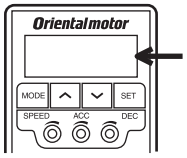


External DC voltage



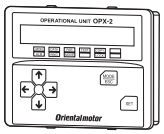
【Digital setting】

Operation panel



Data setting software **MEXE02** (accessory)

Data setter **OPX-2A** (accessory)



Function

【Setting with parameters】

- I/O
  - How to move when inputting the STOP input
- Operation function
  - JOG operation
  - Speed reduction ratio/speed increasing ratio
  - Servo lock at motor standstill
  - Motor rotation direction
- Motor function
  - Speed loop gain
  - Speed loop integral time constant
- Alarm/warning
  - Alarm detection
  - Warning detection
- Analog adjustment
  - Analog speed/torque
  - Analog acceleration/deceleration
  - Analog command gain
  - Analog command offset
- I/O function
  - Input function
  - Input logic level
  - Output function
  - Rotation speed attainment band

2 Setting the operation data

2.1 Operation data types

Operation data can be set up to 16 data (operation data No.0 to No.15), and it is set using the analog setting or digital setting.

- Analog setting .....Internal potentiometer (SPEED), **PAVR-20KZ** (accessory), external DC voltage
- Digital setting.....Operation panel, **MEXE02**, **OPX-2A** (accessory)

The following operation data is required for the speed control operation.

Item	Description	Setting method		Setting range	Initial value
Operation speed	Sets the operation speed for the speed control operation. Set as the rotation speed of the motor output shaft.	Analog	Internal potentiometer (SPEED) *, **PAVR-20KZ** (accessory), external DC voltage	0 r/min or 30 to 4000 r/min	0
		Digital	Operation panel, **MEXE02**, **OPX-2A**	0 to 4000 r/min	
Acceleration time	The acceleration time is set as the time needed for the motor to reach the rated rotation speed (3000 r/min) from the standstill state.	Analog	Acceleration time potentiometer (ACC) *	0.1 to 30.0 s	0.1
		Digital	Operation panel, **MEXE02**, **OPX-2A**	0.000 to 30.000 s	
Deceleration time	The deceleration time is set as the time needed for the motor to stop from the rated rotation speed (3000 r/min).	Analog	Deceleration time potentiometer (DEC) *	0.1 to 30.0 s	0.1
		Digital	Operation panel, **MEXE02**, **OPX-2A**	0.000 to 30.000 s	
Torque limiting	Sets when limiting the motor output torque. Sets the instantaneous peak torque based on the rated torque being 100%.	Analog	**PAVR-20KZ**, External DC voltage	0 to 250%	250
		Digital *	Operation panel, **MEXE02**, **OPX-2A**		

* This is the setting method being selected at the time of shipment.

2.2 Analog setting and digital setting

The setting method of operation data can be changed using "analog speed/torque" parameter (ID: 2161) and "analog acceleration/deceleration" parameter (ID: 2162).

■ When changing the setting method of operation speed and torque limiting

Use the "analog speed/torque" parameter (ID: 2161).

Operation data	When the parameter is 0		When the parameter is 1		When the parameter is 2	
	Operation speed	Torque limiting	Operation speed	Torque limiting	Operation speed	Torque limiting
No.0	Digital setting	Digital setting	Internal potentiometer	Digital setting	Digital setting	**PAVR-20KZ** External DC voltage
No.1			**PAVR-20KZ** External DC voltage			
No.2 to No.15			Digital setting			

Related parameters

ID	Parameter name	Description	Setting range	Initial value
2161	Analog speed/torque	Changes the setting method of operation speed and torque limiting	0: Digital setting 1: Analog speed 2: Analog torque limiting	1

■ When changing the setting method of acceleration time and deceleration time

Use the "analog acceleration/deceleration" parameter (ID: 2162).

Operation data	When the parameter is 0		When the parameter is 1	
	Acceleration time	Deceleration time	Acceleration time	Deceleration time
No.0 No.1	Digital setting	Digital setting	Analog setting	Analog setting
No.2 to No.15			Digital setting	Digital setting

Related parameters

ID	Parameter name	Description	Setting range	Initial value
2162	Analog acceleration/ deceleration	Changes the setting method of acceleration/deceleration time.	0: Digital setting 1: Analog setting	1

■ Setting example

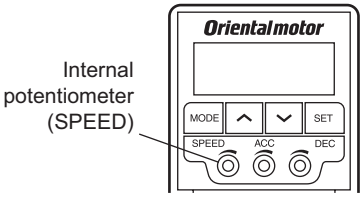
- When all operation data is set by the digital setting:
  Set the "analog speed/torque" parameter (ID: 2161) to 0.
  Set the "analog acceleration/deceleration" parameter (ID: 2162) to 0.
- When the operation speed for the operation data No.0 and No.1 is set by the analog setting, and the acceleration/ deceleration time is set by the digital setting:
  Set the "analog speed/torque" parameter (ID: 2161) to 1.
  Set the "analog acceleration/deceleration" parameter (ID: 2162) to 0.

2.3 Setting the operation speed

Setting range: Analog setting 0 r/min or 30 to 4000 r/min
Digital setting 0 to 4000 r/min

■ Setting by the internal potentiometer

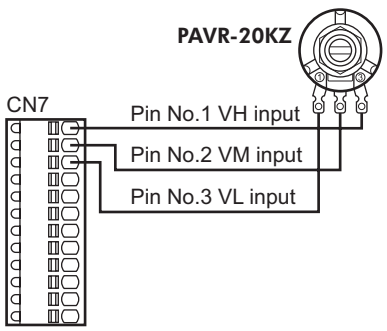
When using the internal potentiometer, set the "analog speed/torque" parameter (ID: 2161) to "1: Analog speed."
Turning the internal potentiometer (SPEED) by an insulated screwdriver in the clockwise direction will increase the speed.
Factory setting: 0 r/min



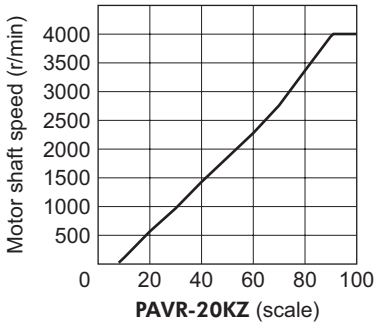
Note Be sure not to turn the internal potentiometer too much since it rotates lightly. Doing so may damage the driver.

■ Setting by the PAVR-20KZ (accessory)

When using the **PAVR-20KZ**, set the "analog speed/torque" parameter (ID: 2161) to "1: Analog speed."
Also, turn the M0 input ON.
Turning the **PAVR-20KZ** in the clockwise direction will increase the speed.

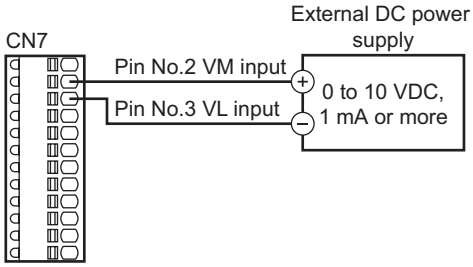


• **PAVR-20KZ** scale - Rotation speed characteristics (representative value)

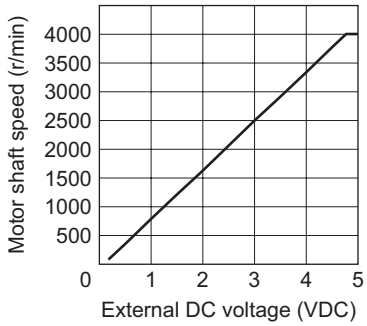


■ Setting by external DC voltage

When using external DC voltage, set the "analog speed/ torque" parameter (ID: 2161) to "1: Analog speed." Also, turn the M0 input ON.



• External DC voltage - Rotation speed characteristics (representative values)



Note Be sure to keep the external DC voltage to 10 VDC or lower. When connecting the external DC power supply, make sure the polarities are correct. If the polarities are reversed, the driver may be damaged.

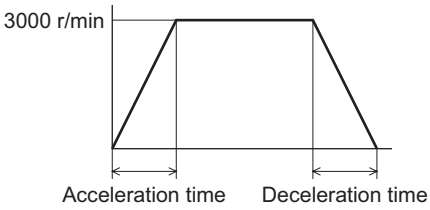
■ Digital setting by the operation panel

The operation speed of the operation data can be directly set with the operation panel. Set the "analog speed/torque" parameter (ID: 2161) to "0: Digital setting."

2.4 Setting of acceleration/deceleration time

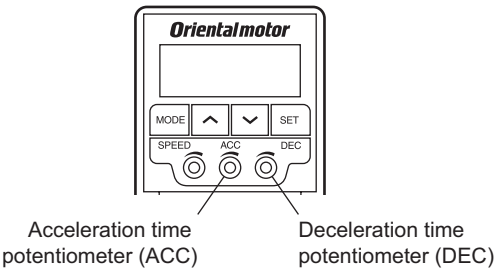
Setting range: Analog setting 0.1 to 30.0 s
Digital setting 0.000 to 30.000 s

Acceleration time refers to the time needed for the motor to reach the rated speed (3000 r/min) from the standstill status.
Deceleration time refers to the time needed for the motor to stop from the rated speed (3000 r/min).
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 is not possible, readjust the acceleration time or deceleration time.



■ Setting by acceleration time potentiometer and deceleration time potentiometer

When using these potentiometers, set the "analog acceleration/ deceleration" parameter (ID: 2162) to "1: Analog setting." Turning the potentiometer by an insulated screwdriver in the clockwise direction will increase the time.
Factory setting: 0.1 s



Note Be sure not to turn the acceleration time potentiometer and deceleration time potentiometer too much since they rotate lightly. Doing so may damage the driver.

■ Digital setting by the operation panel

The acceleration time and deceleration time of the operation data can be directly set with the operation panel. Set the "analog acceleration/deceleration" parameter (ID: 2162) to "0: Digital setting."

2.5 Setting of torque limiting

The maximum output torque of the motor can be limited. Set the torque limiting when limiting the motor torque for a safety or based on a load.
Setting range: 0 to 250%

This section explains how to set the torque limiting by external DC voltage as an example.

Note The motor may not start operating with the torque limiting value depending on variations in load torque, individual differences in motors, gearheads or drivers, as well as operating environment. Set the torque limiting value with providing a margin of 20% or more as a guide.

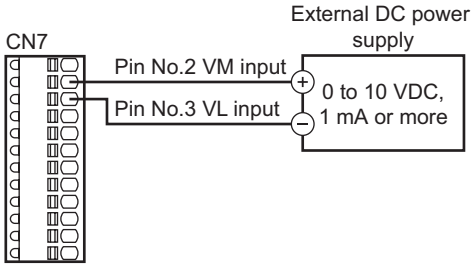
■ Assignment of the TL input

When the TL input is assigned to any of the input terminal IN0 to IN8, the torque will be limited by the ON/OFF status of the TL input.
When the TL input is being ON: The torque limiting is enabled and the maximum output torque of the motor will be limited.
When the TL input is being OFF: The torque limiting is disabled and the maximum output torque of the motor will be instantaneous peak torque.

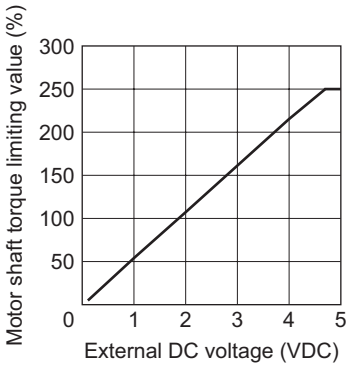
Note When the TL input is not assigned to the input terminal, this input will be always set to ON. If the TL input is assigned to multiple input terminals, the function will be performed when all of the terminals are turned ON.

■ Setting by external DC voltage

When using external DC voltage, set the "analog speed/torque" parameter (ID: 2161) to "2: Analog torque limiting."



• External DC voltage - Torque limiting characteristics (representative values)



Note Be sure to keep the external DC voltage to 10 VDC or lower. When connecting the external DC power supply, make sure the polarities are correct. If the polarities are reversed, the driver may be damaged.

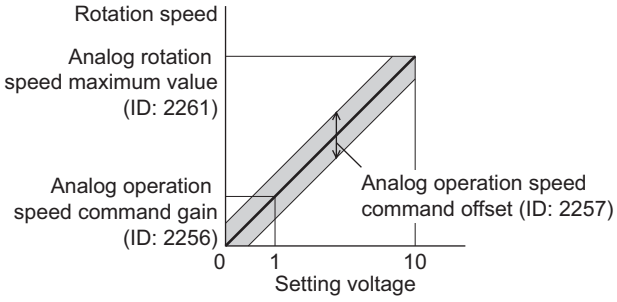
2.6 Gain adjustment and offset adjustment for external potentiometer

If the gain or offset is adjusted when setting the operation speed or torque limiting value by the analog external setter, the slope of the speed command or offset can be changed.

Note The rotation speed corresponding to the voltage value varies depending on the products.

■ Gain adjustment and offset adjustment for operation speed

Adjust using the following parameters.

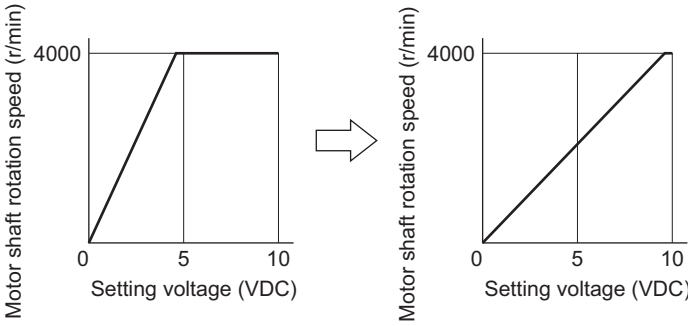


- Related parameters

ID	Parameter name	Description	Setting range	Initial value
2256	Analog operation speed command gain	Sets the speed command per 1 VDC of the input voltage by the analog external setter.	0 to 4000 r/min/V	850
2257	Analog operation speed command offset	Sets the offset of the speed command input by the analog external setter.	−2000 to +2000 r/min	0
2261	Analog operating speed maximum value	Sets the maximum value of the operation speed by the analog external setter.	0 to 4000 r/min	4000

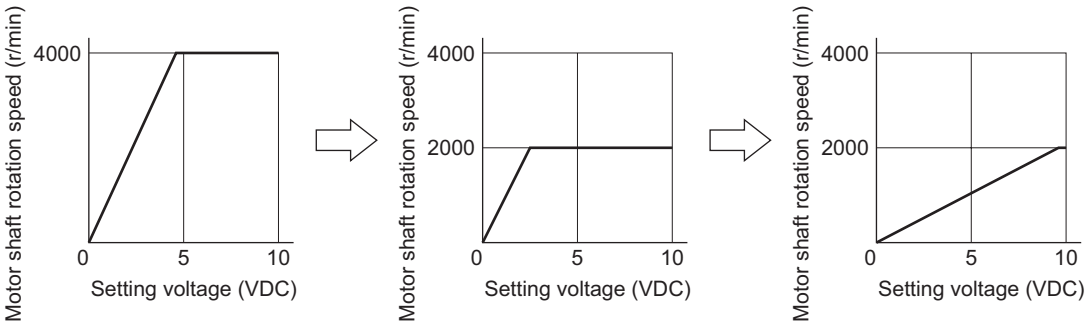
- Setting example 1:
  When setting the rotation speed of the motor output shaft up to 4000 r/min (maximum rotation speed) using the external DC voltage of 0 to 10 VDC

  Sets the "analog speed command gain" parameter (ID: 2256) to 425.



- Setting example 2:
  When setting the rotation speed of the motor output shaft up to 2000 r/min (maximum rotation speed) using the external DC voltage of 0 to 10 VDC

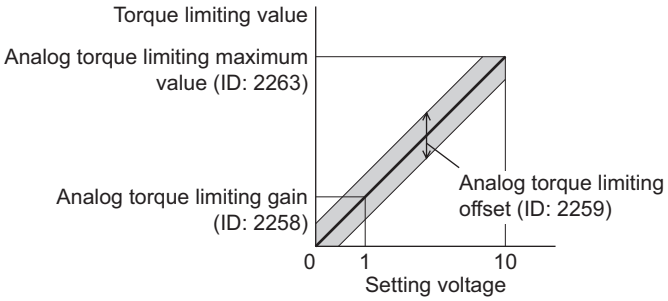
  Set the "analog rotation speed maximum value" parameter (ID: 2261) to 2000, and set the "analog rotation speed command gain" (ID: 2256) to 213.



Refer to "How to adjust the speed difference" on p.114 for how to use the "analog speed command offset" parameter (ID: 2257).

■ Gain adjustment and offset adjustment for torque limiting value

Adjust using the following parameters.

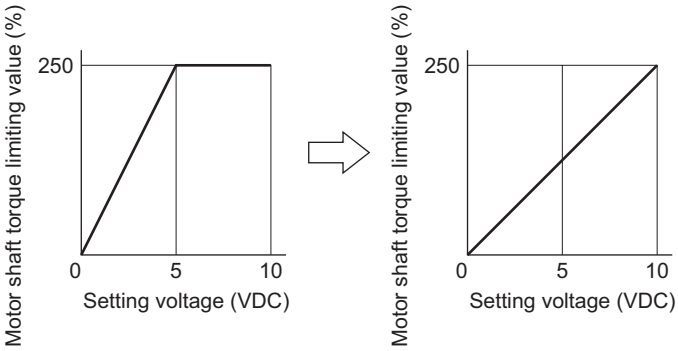


- Related parameters

ID	Parameter name	Description	Setting range	Initial value
2258	Analog torque limiting gain	Sets the torque limiting per 1 VDC of the input voltage by the analog external setter.	0 to 250%/V	54
2259	Analog torque limiting offset	Sets the offset of the torque limiting input by the analog external setter.	−50 to +50%	0
2263	Analog torque limiting maximum value	Sets the maximum value of the torque limiting by the analog external setter.	0 to 250%	250

- Setting example:
  When adjusting the torque limiting value up to 250% using the external DC voltage of 0 to 10 VDC

  Sets the "analog torque limiting gain" parameter (ID: 2258) to 27.



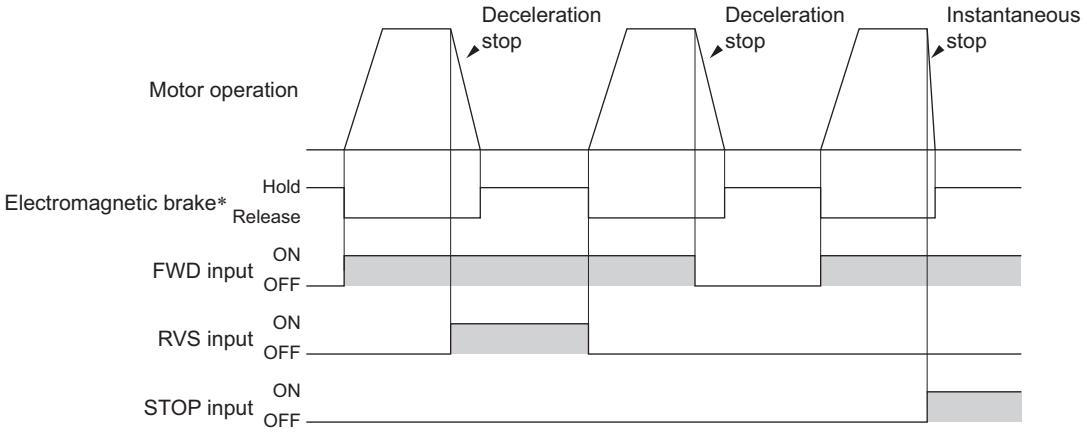
3 Operation

The motor operation can be started or stopped by inputting signals to control operation.

3.1 Start operation and stop operation

■ Start operation

When the FWD input is turned ON, the motor rotates in the forward direction. When the FWD input is turned OFF, the motor stops.
When the RVS input is turned ON, the motor rotates in the reverse direction. When the RVS input is turned OFF, the motor stops.
If the FWD and RVS inputs are turned ON simultaneously, the motor will decelerate to a stop.
If the STOP input is turned ON while operating the motor, the motor will stop instantaneously. The stopping method can be changed by the "STOP input action" parameter (ID: 256).



* When the electromagnetic brake motor is used

■ Stop operation

When the STOP input is turned ON, the motor stops based on the setting of the "STOP input action" parameter.
If the "servo lock at motor standstill" parameter (ID: 2069) is set to 0, either of "immediate stop" or "deceleration stop" can be selected.
If the "servo lock at motor standstill" parameter (ID: 2069) is set to 1, the holding force generates when the motor stops (excitation ON).

Related parameters

ID	Parameter name	Description	Setting range	Initial value
256	STOP input action	Sets how to stop the motor when the STOP input has turned ON.	0: Immediate stop 1: Deceleration stop 2: Immediate stop + current OFF 3: Deceleration stop + current OFF	0
2069	Servo lock at motor standstill	Uses in the speed control mode. If the holding force is required while the motor stops, set to "1" to enable the servo lock.	0: Free (disable servo lock) 1: Servo lock	0

Note The "servo lock at motor standstill" parameter will be enabled after the power is cycled.

3.2 Rotation direction of the motor

■ 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 can be changed by the parameter.

Related parameters

ID	Parameter name	Description	Setting range	Initial value
450	Motor rotation direction	Sets the rotation direction of the motor output shaft.	0: Positive direction=CCW 1: Positive direction=CW	1

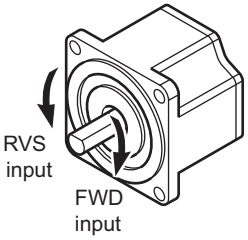
Note The "motor rotation direction" parameter will be enabled after the power is cycled.

■ Rotation direction of the gearhead output shaft

The rotation direction for the FWD input and RVS input shown here is the initial value of the "motor rotation direction" parameter.

- 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.

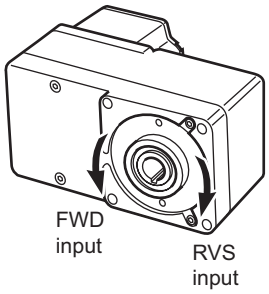


Model (short name)	Gear ratio of gearhead	Rotation direction of the gearhead output shaft
BXS230 BXS460 BXS5120	5, 10, 15, 20, 200	Same as the motor output shaft
	30, 50, 100	Opposite to the motor output shaft
BXS6200 BXS6400	5, 10, 15, 20, 100, 200	Same as the motor output shaft
	30, 50	Opposite to the motor output shaft

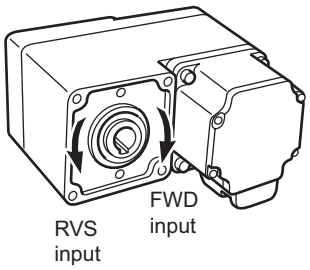
- Combination type hollow shaft flat gearhead

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

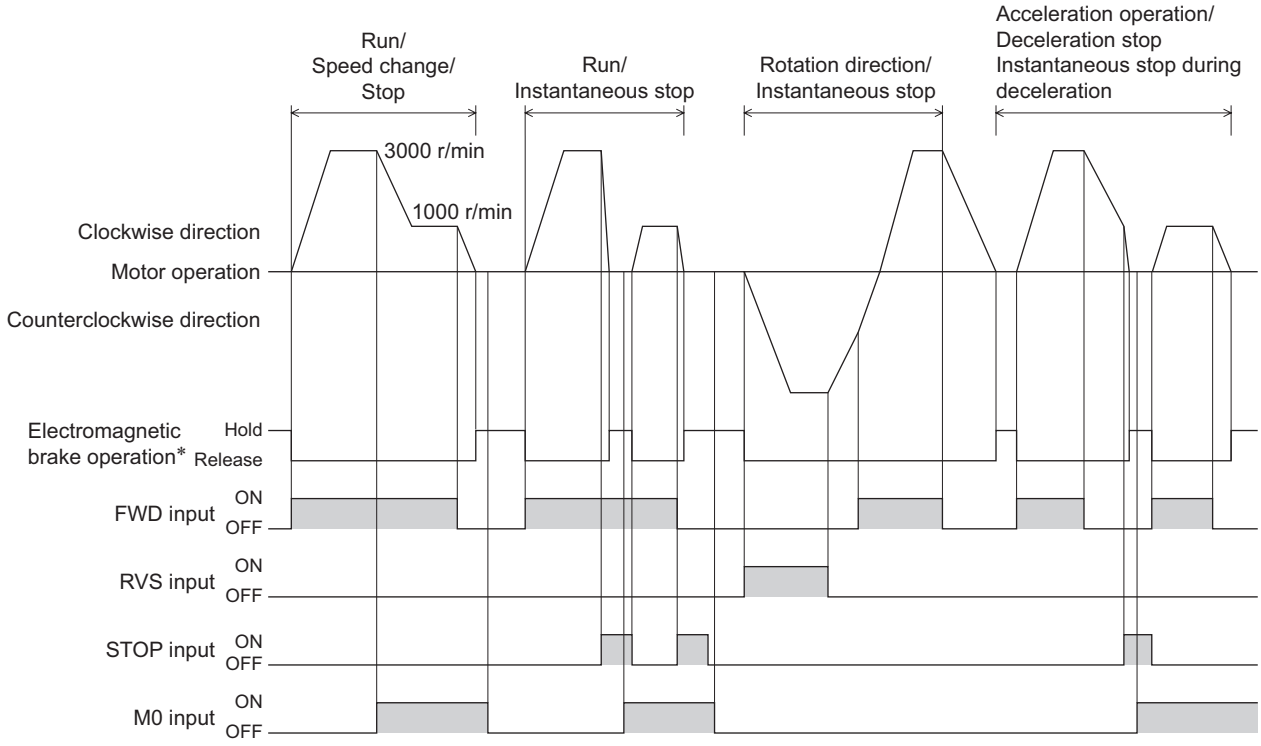


Viewed from Rear



3.3 Examples of operation patterns

The chart below are examples of setting the internal potentiometer to 3000 r/min and external DC voltage to 1000 r/min and switching the speed between these two levels.
The rotation direction for the FWD input and RVS input shown here is the initial value of the "motor rotation direction" parameter (ID: 450).



* When the electromagnetic brake motor is used

Note

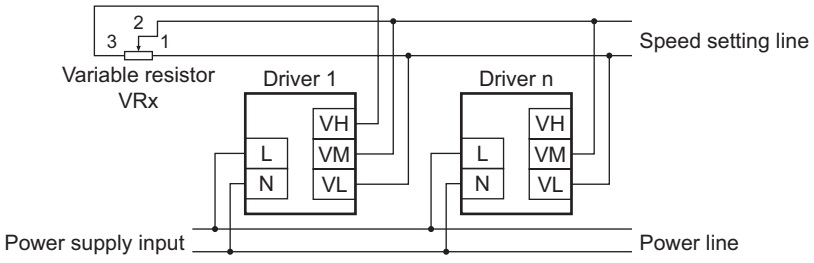
- Make sure each signal remains ON for at least 10 ms.
- When switching the FWD input and RVS input, provide an interval of at least 10 ms.

3.4 Multi-motor control

Using a single variable resistor or external DC voltage, multiple motors can be operated at the same speed.
A connection example shown below applies to the single-phase specification. For the three-phase specification, connect the power supply line to the three-phase power supply.
Connection of a motor and I/O signals is omitted in the figure.

■ When using a variable resistor

Connect the drivers as shown below. When using the variable resistor, up to 20 units can be operated.



Resistance (VRx) when the number of drivers is n:

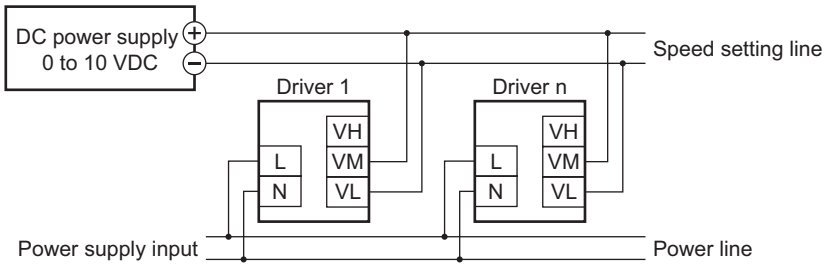
Resistance (VRx) = 20/n (kΩ), n/4 (W)

Example: If two drivers are used

Resistance (VRx) = 20/2 (kΩ), 2/4 (W), resistance (VRx) is calculated as 10 kΩ, 1/2 W.

■ When using external DC voltage

Connect the drivers as shown below.



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.

■ How to adjust the speed difference

To adjust the speed difference among the first motor and the second and subsequent motors, change the parameter or connect a resistor to adjust.

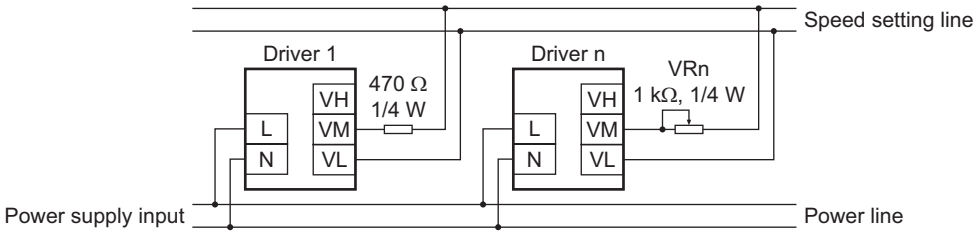
- Adjustment by the parameter

The speed difference can be adjusted by changing the "analog speed command gain" parameter (ID: 2256) and "analog speed command offset" parameter (ID: 2257) for the second and subsequent drivers. This section explains how to adjust by the "analog speed command offset" parameter. Refer to p.108 for details.

- When the speed of the second motor is slower than that of the first motor:
  Set the offset value to rotate faster (positive side) by the "analog speed command offset" parameter.
- When the speed of the second motor is faster than that of the first motor:
  Set the offset value to rotate slower (negative side) by the "analog speed command offset" parameter.

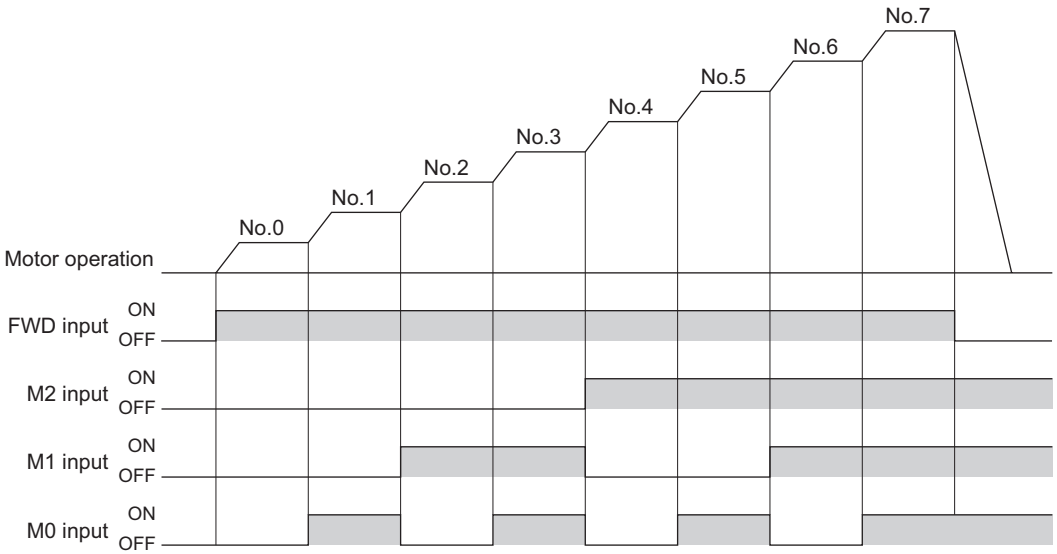
- Adjustment by a resistor

Connect a resistor of 470 Ω, 1/4 W to the terminal VM on the driver 1 and connect a variable resistor VRn of 1 kΩ, 1/4 W to the driver 2 and subsequent drivers.



3.5 Multi-speed operation

When assigning the M0 to M3 inputs to the CN5 input terminals, the multi-speed operation of the motor is possible using a maximum of 16 operation data.
This section shows an example in which multi-speed operation is performed with 8 operating data using the M0 to M2 inputs.
See the table below for a combination of the M0 to M3 inputs and how to select the operating data.



Combination of the M0 to M3 inputs and operation data

Operation data No.	M3	M2	M1	M0
0	OFF	OFF	OFF	OFF
1	OFF	OFF	OFF	ON
2	OFF	OFF	ON	OFF
3	OFF	OFF	ON	ON
4	OFF	ON	OFF	OFF
5	OFF	ON	OFF	ON
6	OFF	ON	ON	OFF
7	OFF	ON	ON	ON
8	ON	OFF	OFF	OFF
9	ON	OFF	OFF	ON
10	ON	OFF	ON	OFF
11	ON	OFF	ON	ON
12	ON	ON	OFF	OFF
13	ON	ON	OFF	ON
14	ON	ON	ON	OFF
15	ON	ON	ON	ON

6 Operation of position control mode

This part explains how to operate with the position control mode.

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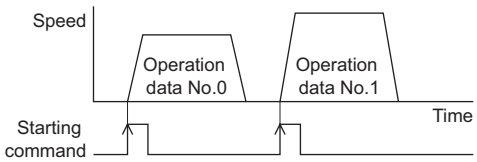
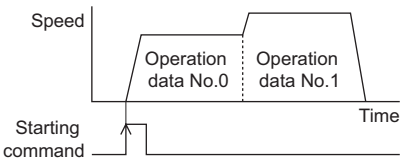


• Linked-motion operation



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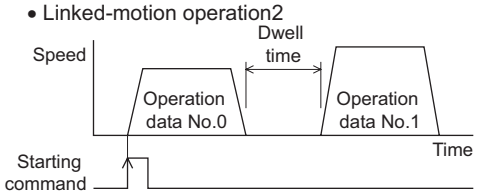

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Operation method

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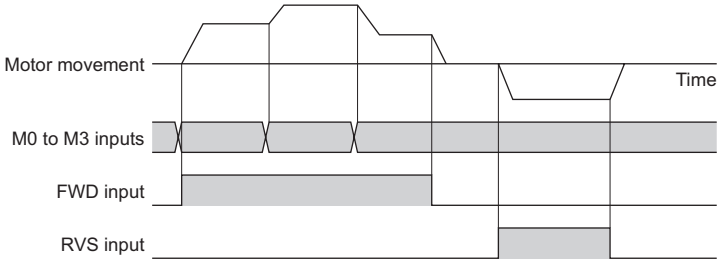

Function

【Setting with parameters】

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When the "oP-1" is displayed on the operation panel

If the operation data number is checked immediately when the power supply is input in the position control mode, the"oP-1" will be displayed. In addition, if the operation number is checked by performing the following operation, the "oP-1" will be displayed.

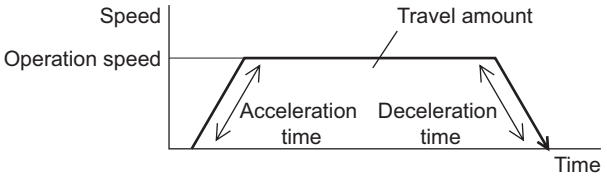
- While return-to-home operation, continuous operation or JOG operation is executed
- When an alarm is generated and reset
- When the operation is stopped by the BRAKE (STOP) input
- When the motor excitation is turned OFF by the FREE input or S-ON input
- When the position preset is executed

2 Positioning operation

This chapter explains positioning operation that is executed with setting the motor operation speed, position (travel amount), operation function and other items to operation data. When executing positioning operation, the motor starts rotating and accelerates until reaching the operation speed. Once the motor reaches the operation speed, the speed is maintained and the motor will decelerate to a stop when approaching the stop position.
The operation function refers to an executing method of the operation data for positioning operation. Positioning operation can be executed using a single operating data, and it can also be executed by linking multiple continuous operation data.

2.1 Operation data

Operation data can be set up to 16 data (operation data No.0 to No.15), and it can be set using any of the operation panel, **MEXE02** or **OPX-2A** (accessory). The following data is required for the positioning operation.



Item	Description	Setting range	Initial value
Position	Sets the position (travel amount) for positioning operation. The motor shaft rotates 0.72° per one step.	−8,388,608 to +8,388,607 step	0
Operation speed ∗1	Sets the operation speed for positioning operation. Set as the rotation speed of the motor output shaft.	0 to 4000 r/min	0
Operation mode	Sets the operation mode of the position (travel amount) for positioning operation.	0: Incremental 1: Absolute	0
Operation function	Sets the operation function for positioning operation.	0: Single-motion 1: Linked-motion 2: Linked-motion 2	0
Acceleration time ∗1	Sets the acceleration time for positioning operation. The acceleration time is set as the time needed for the motor to reach the rated rotation speed (3000 r/min) from the standstill state.	0.000 to 30.000 s	0.100
Deceleration time ∗1	Sets the deceleration time for positioning operation. The deceleration time is set as the time needed for the motor to stop from the rated rotation speed (3000 r/min).		
Torque limiting ∗2	Sets when limiting the motor output torque. Sets the instantaneous peak torque based on the rated torque being 100%.	0 to 250%	250
Sequential positioning	Sets whether to enable or disable sequential positioning operation.	0: Disable 1: Enable	0
Dwell time	Sets the waiting time between the first operation data and second operation data in linked-motion operation 2.	0.000 to 50.000 s	0.000

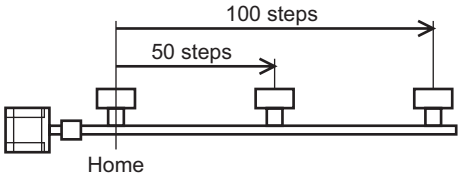
∗1 These items are set by the digital setting.
∗2 The torque limiting can be changed to the analog setting by the "analog speed/torque" parameter (ID: 2161). Refer to p.99 for details.

■ Operation mode

There are the following two types in the operation mode.

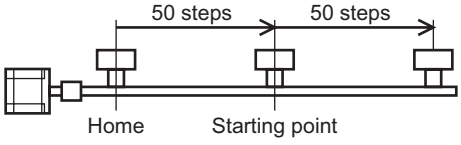
- Absolute mode (ABS)

The position (travel amount) from the home is set [Absolute positioning].



- Incremental mode (INC)

Each motor destination becomes the starting point for the next movement. This mode is suitable when the same position (travel amount) is repeatedly used [Incremental positioning].



■ Operation function, dwell time

There are the following three types in the operation function.

Item	Description	Ref.
Single-motion operation	A single operation data set is used to execute positioning operation.	p.125
Linked-motion operation	Multiple sets of operation data are linked to execute multi-speed positioning operation.	p.126
Linked-motion operation 2	Dwell time refers to a wait time at standstill between the present operation data and next operating data. Multiple operation data of different directions can be linked.	p.127

2.2 Starting method of positioning operation

There are the following three starting methods.

Item	Description
Operation data number selection mode	When the START input is turned ON while selecting the operation data number with the M0 to M3 inputs, positioning operation is executed.
Direct positioning	When any of the MS0 to MS5 inputs is turned ON, the positioning operation corresponding to the input data number is executed.
Sequential positioning	Positioning operation is executed to the next operation data number every time the SSTART input signal is input.

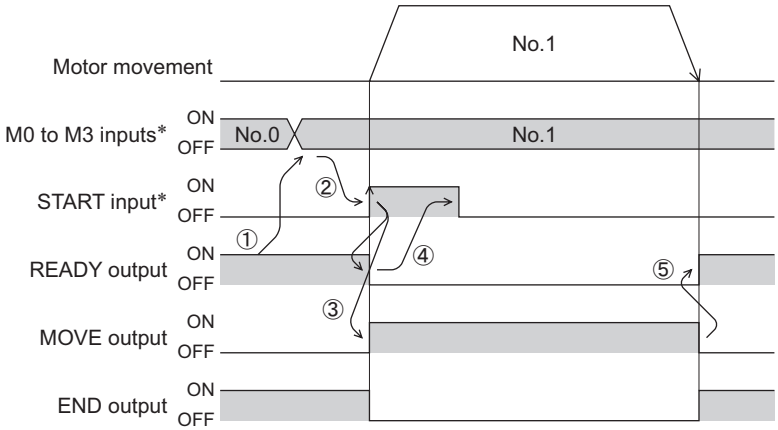
■ Operation data number selection mode

Select an operation data based on a combination of ON/OFF status of the M0 to M3 inputs. Refer to p.56 for details.

Operation data No.	M3	M2	M1	M0
0	OFF	OFF	OFF	OFF
1	OFF	OFF	OFF	**ON**
2	OFF	OFF	**ON**	OFF
.	.	.	.	.
.	.	.	.	.
.	.	.	.	.
13	**ON**	**ON**	OFF	**ON**
14	**ON**	**ON**	**ON**	OFF
15	**ON**	**ON**	**ON**	**ON**

Operation method

1）Check the READY output is being ON.
2）Select the operation data number using the M0 to M3 inputs, and turn the START input ON.
3）The motor starts positioning operation.
4）Check the READY output has been turned OFF and turn the START input OFF.
5）When the positioning operation is completed, the READY output is turned ON.



* After setting the M0 to M3 inputs, wait at least 10 ms before turning the START input ON.

■ Direct positioning

When any of the MS0 to MS5 inputs is turned ON, the positioning operation corresponding to the input operation data number will be executed. Since positioning operation can be executed by turning any of the MS0 to MS5 inputs ON, the steps of selecting the operation data number can be saved. Set the operation data assigning the MS0 to MS5 inputs with parameters.

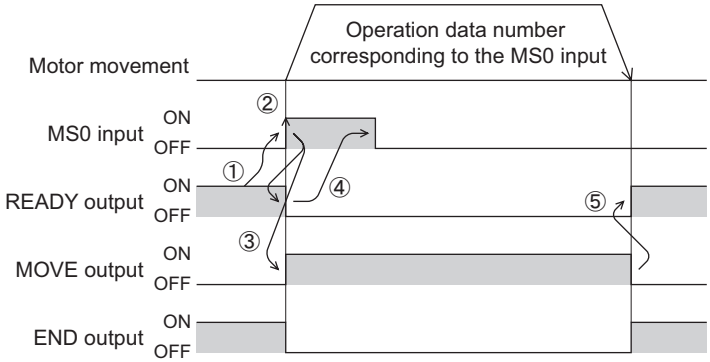
Note In the case of torque limiting, the torque limiting value in the operation data number selected by the M0 to M3 inputs will be applied.

Related parameters

ID	Item	Description	Setting range	Initial value
2048	MS0 operation No. selection	Sets the operation data number corresponding to the MS0 to MS5 inputs.	0 to 15	0
2049	MS1 operation No. selection			1
2050	MS2 operation No. selection			2
2051	MS3 operation No. selection			3
2052	MS4 operation No. selection			4
2053	MS5 operation No. selection			5

Operation method

1）Check the READY output is being ON.
2）Turn the MS0 input ON.
3）The motor starts positioning operation.
4）Check the READY output has been turned OFF and turn the MS0 input OFF.
5）When the positioning operation is completed, the READY output is turned ON.



■ Sequential positioning operation

In sequential positioning operation, positioning operation based on the next operation data number will be executed every time the SSTART input turns ON.
This function is useful when multiple positioning operations must be executed sequentially, because there is no need to repeatedly select each data number.
When the "sequential positioning" of operation data is executed up to the data number set to "disable," the operation returns to the original data number that was selected before starting the sequential operation.
If the starting point for the sequential positioning operation is changed using the M0 to M3 inputs or the MS0 to MS5 inputs, sequential positioning operation with multiple patterns can be set. This is useful when setting a different operation pattern for each load.

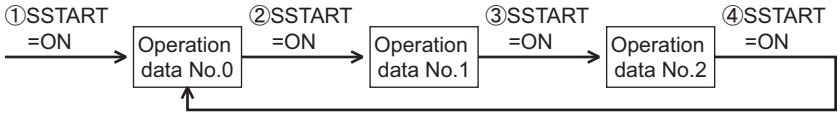
Note In the case of torque limiting, the torque limiting value in the operation data number selected by the M0 to M3 inputs will be applied.

- When the operation pattern is one type

1) Turning the SSTART input ON will execute the positioning operation of the operation data No.0.
2) After the operation 1) is completed, when turning the SSTART input ON again, positioning operation for the operation data No.1 will be executed.
3) After the operation 2) is completed, when turning the SSTART input ON again, positioning operation for the operation data No.2 will be executed.
4) After the operation 3) is completed, when turning the SSTART input ON again, positioning operation for the operation data No.0 will be executed by returning to the operation data No.0 because the sequential positioning for the operation data No.3 has been set to "Disable."

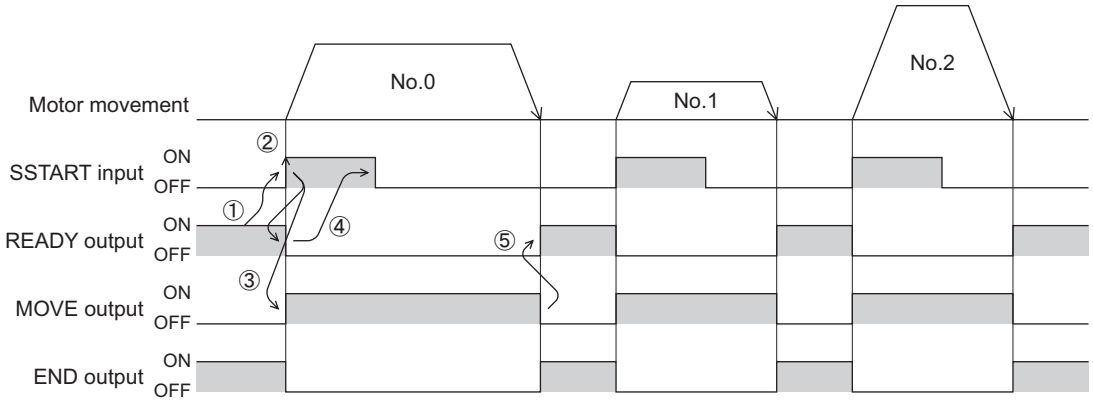
• Setting example

Operation data	Sequential positioning
No.0	Enable
No.1	
No.2	
No.3	Disable



- Operation method

1) Check the READY output is being ON.
2) Turn the SSTART input ON.
3) The motor starts positioning operation.
4) Check the READY output has been turned OFF and turn the SSTART input OFF.
5) When the positioning operation is completed, the READY output will be turned ON.
6) 1) to 5) is repeated.



- When the operation pattern is multiple types

1）Selecting the data No.3 for the starting point of sequential positioning and turning the START input ON will execute positioning operation.

2）After the operation 1) is completed, when turning the SSTART input ON again, positioning operation for the operation data No.4 will be executed.

3）After the operation 2) is completed, when turning the SSTART input ON again, positioning operation for the operation data No.5 will be executed.

4）After the operation 3) is completed, when turning the SSTART input ON again, positioning operation for the operation data No.3 will be executed by returning to the operation data No.3 because the sequential positioning for the operation data No.6 has been set to "Disable."

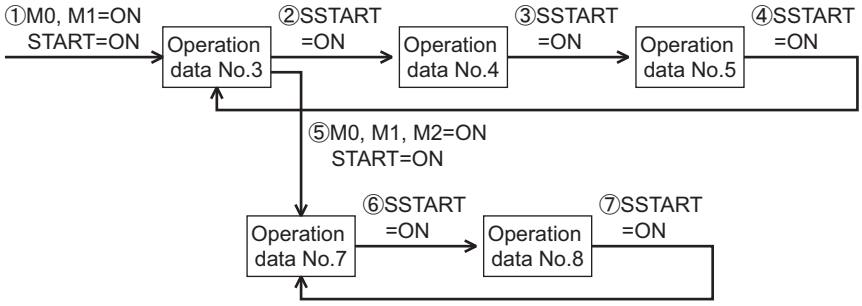
5）After the operation 4) is completed, selecting the operation data No.7 and turning the START input ON will execute positioning operation.
The operation data No.7 will become the new starting point of sequential positioning operation.

6）After the operation 5) is completed, when turning the SSTART input ON again, positioning operation for the operation data No.8 will be executed.

7）After the operation 6) is completed, when turning the SSTART input ON again, positioning operation for the operation data No.7 will be executed by returning to the operation data No.7 because the sequential positioning for the operation data No.9 has been set to "Disable."

• Setting example

Operation data	Sequential positioning
No.3	Enable
No.4	
No.5	
No.6	Disable
No.7	Enable
No.8	
No.9	Disable



- Notes about sequential positioning operation

If the following operations are performed while executing the sequential positioning operation, the starting point of the sequential positioning operation will be changed to the operation No.0.
And the present operation data number will be set to "-1."

- When the power supply was turned on
- When any of operations other than positioning operation was performed
- When an alarm was generated and reset
- When the BRAKE (STOP) input was turned ON
- When the command to turn the motor excitation OFF, such as the FREE input or AWO input, was input
- When the position preset was executed

Note When performing the sequential positioning operation for the operation data which "operation function" is set to "Linked-motion" or "Linked-motion2," set the "sequential positioning" to "Enable."

2.3 Operation function

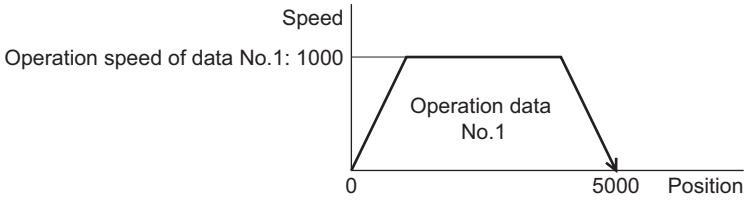
■ Single-motion operation

The positioning operation is executed only once with a single operation data set.

- Example of single-motion operation

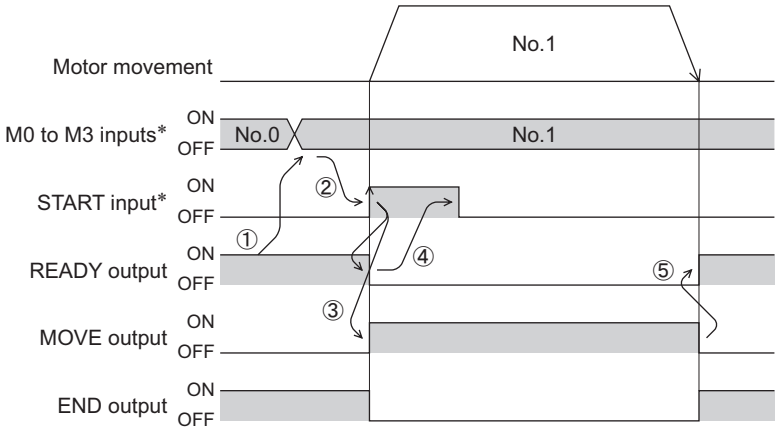
Operation data	Position	Operation speed	Operation mode	Operation function	Acceleration time	Deceleration time	Torque limiting
No.1	5000	1000	INC	Single-motion	1.000	1.000	250

Operation image



Operation method

1）Check the READY output is being ON.
2）Select the operation data No.1 by turning the M0 input ON, and turn the START input ON.
3）The motor starts positioning operation of the operation data No.1.
4）Check the READY output has been turned OFF and turn the START input OFF.
5）When the positioning operation is completed, the READY output is turned ON.



* After setting the M0 to M3 inputs, wait at least 10 ms before turning the START input ON.

■ Linked-motion operation

When the operation function of operation data is set to "Link," positioning operation based on the next data number will be executed without stopping the motor.
If operation data includes data for which "Single-motion" is set, the motor will stop after the positioning operation with respect to the "single" operation data is completed.
Note that up to four sets of operation data can be linked and only operation data of the same direction can be linked.

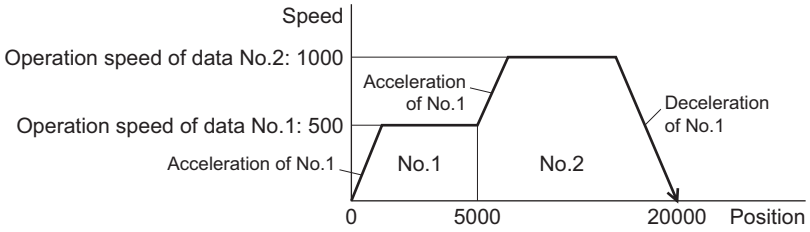
Note

- Multiple operation data of different directions cannot be linked. The operation data error alarm will generate when operating the data.
- Up to four sets of operation data can be linked. When combining the linked-motion operation and the linked-motion operation 2, make sure the total number of linked operation data sets does not exceed four sets. When the operation is performed with five or more sets of operation data linked together, the operation data error alarm will generate upon start of operation.
- Even if "Link" is set in the data No.15, No.0 will not be linked. The operation pertaining to No.15 will be processed independently.
- The acceleration/deceleration time in linked-motion operation corresponds to the acceleration/deceleration time specified for the operation data number with which the linked-motion operation is started.
- For the torque limiting of linked-motion operation, the torque limiting value in the operation data number (selecting by the M0 to M3 inputs) that the linked-motion operation was started will be applied. However, if the M0 to M3 inputs are switched while operating, the torque limiting value will be changed to the value in the operation data number that is selected by the M0 to M3 inputs.

- Example of linked-motion operation

Operation data	Position	Operation speed	Operation mode	Operation function	Acceleration time	Deceleration time
No.1	5000	500	INC	Linked-motion	1.000	1.000
No.2	20000	1000	INC	Single-motion	Not applied	Not applied

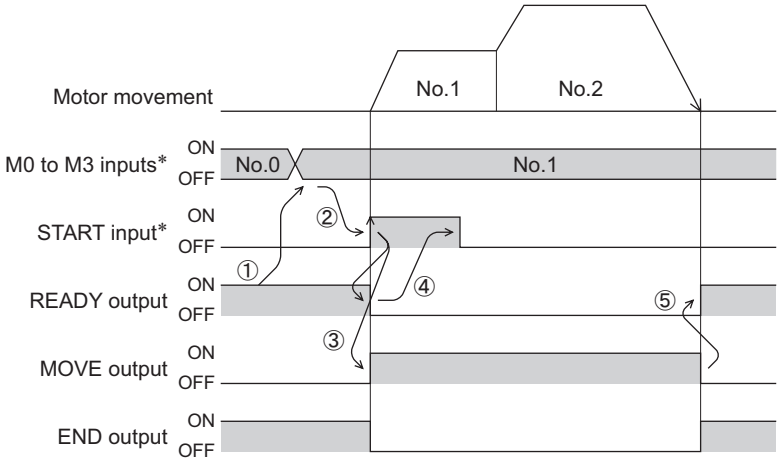
Operation image



Torque limiting
The torque limiting value in the operation data number selected by the M0 to M3 inputs will be applied.

Operation method

1）Check the READY output is being ON.
2）Select the operation data No.1 by turning the M0 input ON, and turn the START input ON.
3）The motor starts positioning operation that the operation data No.1 and No.2 are linked.
4）Check the READY output has been turned OFF and turn the START input OFF.
5）When the positioning operation is completed, the READY output will be turned ON.



∗ After setting the M0 to M3 inputs, wait at least 10 ms before turning the START input ON.

■ Linked-motion operation 2

When the operation function of operation data is set to "Link2," operation data whose rotation direction is different can be linked. In this case, the motor stops for the dwell time after completing each positioning operation, and it operates according to the next operation data. If operation data includes data for which "Single-motion" is set, the motor will stop after the positioning operation with respect to the "single" operation data is completed.

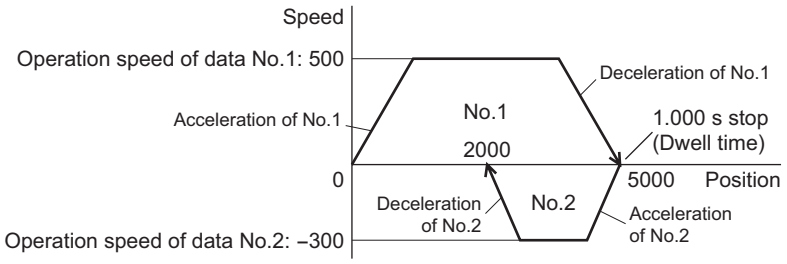
Note

- Up to four sets of operation data can be linked. When combining the linked-motion operation and the linked-motion operation 2, make sure the total number of linked operation data sets does not exceed four sets. When the operation is performed with five or more sets of operation data linked together, the operation data error alarm will generate upon start of operation.
- Even if "Link2" is set in the data No.15, No.0 will not be linked. The operation pertaining to No.15 will be processed independently.
- For the torque limiting of linked-motion operation, the torque limiting value in the operation data number (selecting by the M0 to M3 inputs) that the linked-motion operation was started will be applied. However, if the M0 to M3 inputs are switched while operating, the torque limiting value will be changed to the value in the operation data number that is selected by the M0 to M3 inputs.

- Example of linked-motion operation 2

Operation data	Position	Operation speed	Operation mode	Operation function	Acceleration time	Deceleration time	Dwell time
No.1	5000	500	INC	Linked-motion 2	1.000	1.000	1.000
No.2	−3000	300	INC	Single-motion	1.000	1.000	Not used

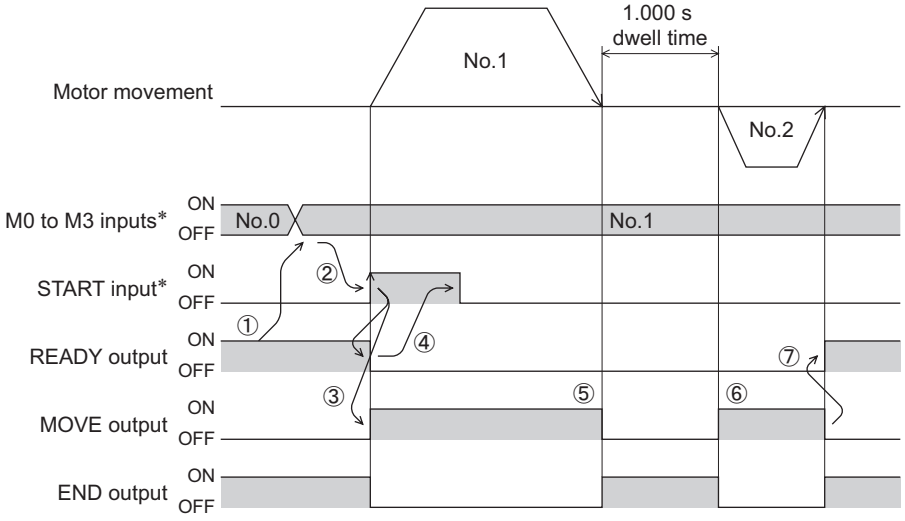
Operation image



Torque limiting
The torque limiting value in the operation data number selected by the M0 to M3 inputs will be applied.

Operation method

1）Check the READY output is being ON.
2）Select the operation data No.1 by turning the M0 input ON, and turn the START input ON.
3）The motor starts positioning operation of the operation data No.1.
4）Check the READY output has been turned OFF and turn the START input OFF.
5）When the positioning operation is completed, the MOVE output will be turned OFF.
6）When the dwell time has been passed, positioning operation of the operation data No.2 is automatically started. The MOVE output will be simultaneously turned ON.
7）When the positioning operation of the operation data No.2 is completed, the READY output will be turned ON.

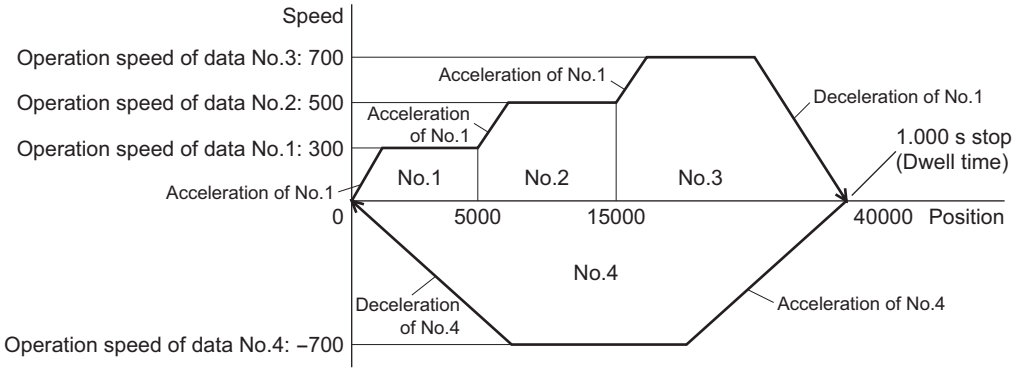


∗ After setting the M0 to M3 inputs, wait at least 10 ms before turning the START input ON.

- Example of linked-motion operation 2:
  When combining the linked-motion operation and the linked-motion operation 2

Operation data	Position	Operation speed	Operation mode	Operation function	Acceleration time	Deceleration time	Dwell time
No.1	5000	300	INC	Linked-motion	1.000	1.000	Not used
No.2	10000	500	INC	Linked-motion	Not applied	Not applied	Not used
No.3	25000	700	INC	Linked-motion2	Not applied	Not applied	1.000
No.4	0	700	ABS	Single-motion	2.000	2.000	Not used

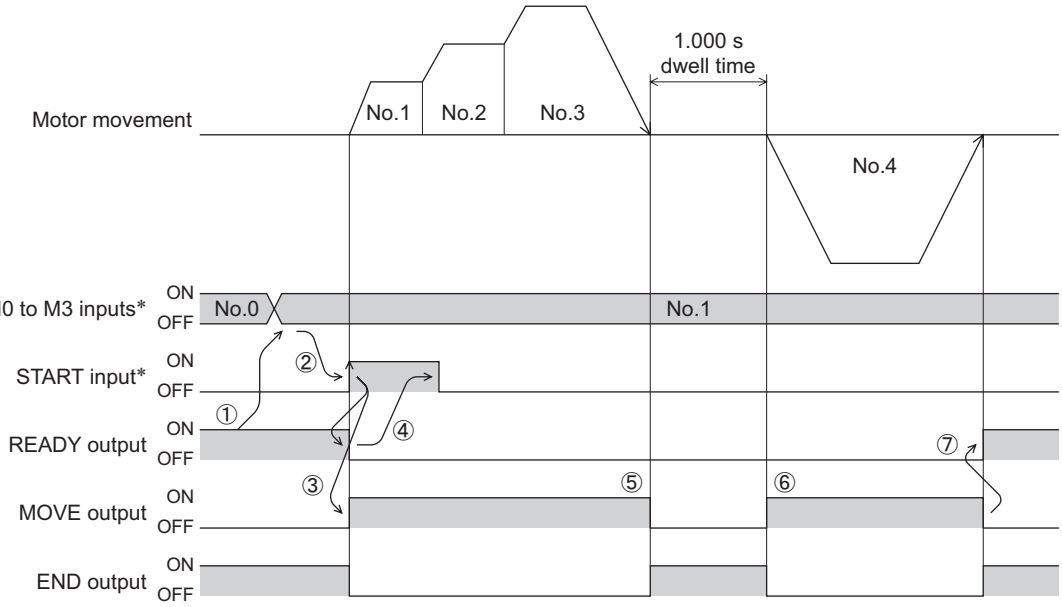
Operation image



Torque limiting
The torque limiting value in the operation data number selected by the M0 to M3 inputs will be applied.

Operation method

1）Check the READY output is being ON.
2）Select the operation data No.1 by turning the M0 input ON, and turn the START input ON.
3）The motor starts positioning operation that the operation data No.1 to No.3 is linked.
4）Check the READY output has been turned OFF and turn the START input OFF.
5）When the positioning operation is completed, the MOVE output will be turned OFF.
6）When the dwell time has been passed, positioning operation of the operation data No.4 is automatically started. The MOVE output will be simultaneously turned ON.
7）When the positioning operation of the operation data No.4 is completed, the READY output will be turned ON.



∗ After setting the M0 to M3 inputs, wait at least 10 ms before turning the START input ON.

3 Return-to-home operation

This chapter explains return-to-home operation to set the position (home position) that becomes the starting point when performing positioning operation.
Execute when returning the motor position to the home position at the time of turning on the power supply or completing positioning operation.

3.1 Return-to-home operation types

For return-to-home operation, two types such as the 1-sensor mode and position preset mode are available.

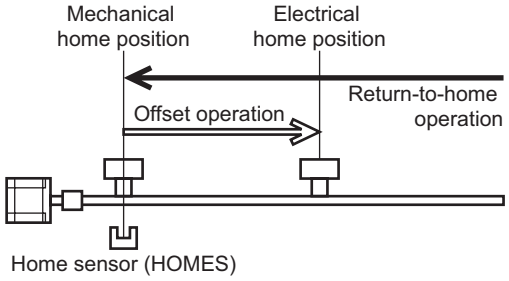
Item	Description	Features
1-sensor mode	Operates at the speed of return-to-home operation. The motor stops when the ON edge of the HOME sensor is detected and the position at which the motor stopped will become the home position.	• A sensor is required externally.
Position preset	If the position preset is executed at the position that the motor stops, the command position (present position) will be the value of the "preset position" parameter (ID: 454). The home position can be set arbitrarily.	• An external sensor is not required. • A desired position can be set to the home position.

3.2 Extended function

Item	1-sensor mode	Position preset	Related parameters
Position offset	Possible	Not possible	Position offset of home-seeking (ID: 356)
Command position after return-to-home operation	Becomes 0	Desired position	Preset position (ID: 454)

■ Position offset

This is a function that performs positioning operation of the offset value set in the parameter after return-to-home operation and sets the stopped position as the home position. The home position set by the position offset is called "electrical home position" in distinction from the normal home position. If the value of the position offset is 0, the electrical home and mechanical home will become the same position.



■ Command position after return-to-home operation

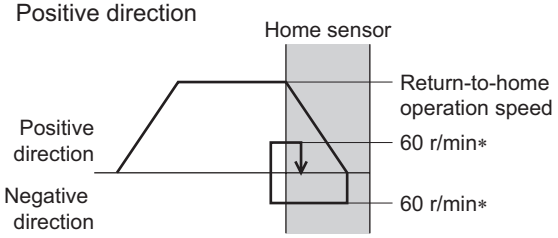
If the position preset is executed at the position that the motor stops, the command position will be the value of the "preset position" parameter (ID: 454).

3.3 Parameter for return-to-home operation

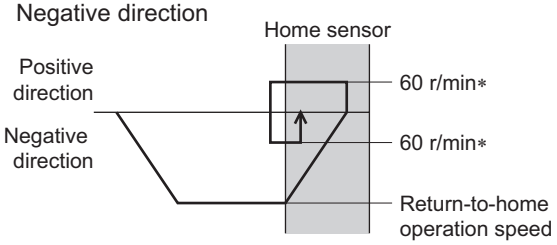
ID	Parameter name	Description	Setting range	Initial value
353	Operating speed of home-seeking	Sets the operation speed for return-to-home operation.	0 to 4000 r/min	300
354	Acceleration/ deceleration of home-seeking	Sets the acceleration and deceleration time for return-to-home operation.	0.000 to 30.000 s	0.100
356	Position offset of home-seeking	Sets the amount of offset from home position. The motor shaft rotates 0.72° per one step.	−8,388,608 to +8,388,607 step	0
357	Starting direction of home-seeking	Sets the starting direction for home detection.	0: Negative direction 1: Positive direction	1

3.4 Operation image

• Starting direction of return-to-home operation: Positive direction



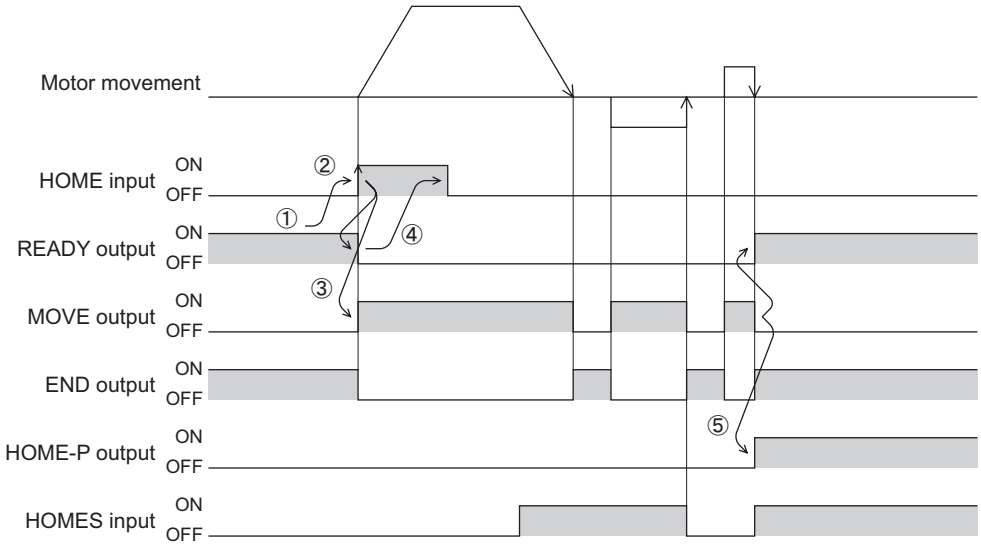
• Starting direction of return-to-home operation: Negative direction



∗ When the return-to-home operation speed is set to 60 r/min or lower, the set return-to-home operation speed will be applied.

Operation method

1）Check the READY output is being ON.
2）Turn the HOME input ON.
3）Return-to-home operation is started.
4）Check the READY output has been turned OFF and turn the HOME input OFF.
5）When the return-to-home operation is completed, the HOME-P output will be turned ON.



Note Return-to-home operation cannot be executed while the FREE input or STOP input is being ON. Be sure to execute after turning OFF.

3.5 Position preset

When the position preset is executed, the command position (present position) will be the value of the "preset position" parameter (ID: 454).
However, the preset will not be executed in the following conditions.

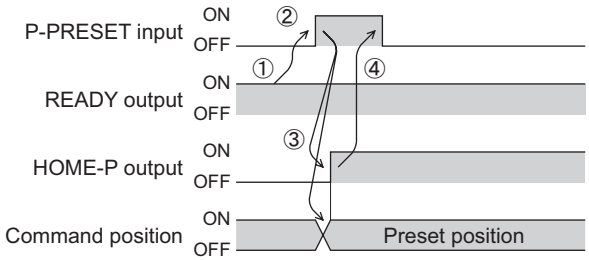
- While the motor is operating
- While an alarm is present

Related parameters

ID	Parameter name	Description	Setting range	Initial value
454	Preset position	Sets the preset position. The motor shaft rotates 0.72° per one step.	−8,388,608 to +8,388,607 step	0

Operation method

1）Check the READY output is being ON.
2）Turn the P-PRESET input ON.
3）When the internal processing in the driver is completed, the HOME-P output will be turned ON.
4）Check the HOME-P output has been turned ON and turn the P-PRESET input OFF.



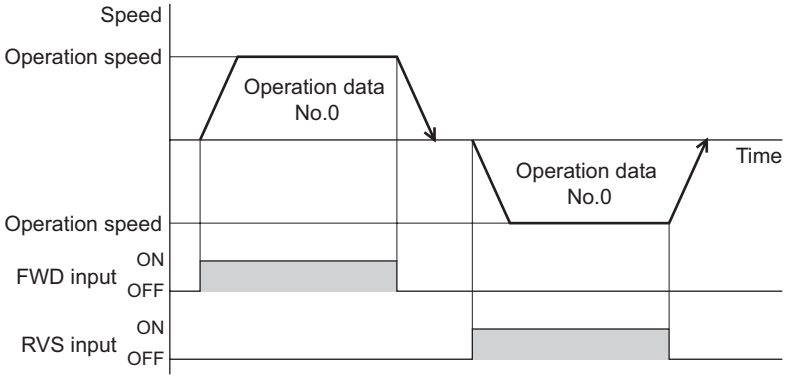
4 Continuous operation

When the FWD input or RVS input is assigned, continuous operation can be executed.
The motor operates continuously while the FWD input or RVS input is being ON.
For the operation speed of the FWD and RVS inputs, the operation speed corresponding to the selected operation data number is applied. When the operation data number is changed while executing continuous operation, the speed will be changed.
When the FWD input or RVS input is turned OFF, the motor will decelerate to a stop. If the signal of the same direction is turned ON while decelerating, the motor will accelerate again and continue continuous operation.
If the FWD and RVS inputs are turned ON simultaneously, the motor will decelerate to a stop.

4.1 Operation data

Operation data can be set up to 16 data (operation data No.0 to No.15), and it is set using any of the operation panel, **MEXE02** or **OPX-2A** (accessory).
The following operation data is required for continuous operation. Set each item by the digital setting.

Item	Description	Setting range	Initial value
Operation speed	Sets the operation speed for continuous operation. Set as the rotation speed of the motor output shaft.	0 to 4000 r/min	0
Acceleration time	Sets the acceleration time for continuous operation. The acceleration time is set as the time needed for the motor to reach the rated rotation speed (3000 r/min) from the standstill state.	0.000 to 30.000 s	0.100
Deceleration time	Sets the deceleration time for continuous operation. The deceleration time is set as the time needed for the motor to stop from the rated rotation speed (3000 r/min).		



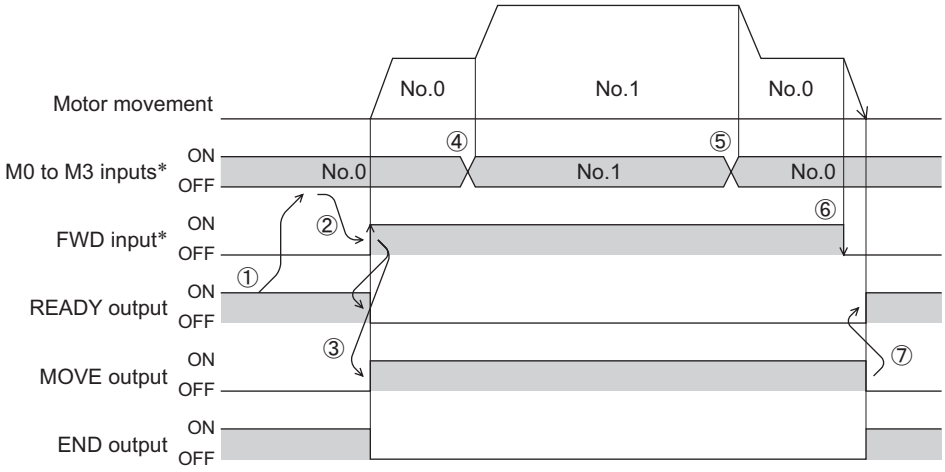
4.2 Starting method of continuous operation

When selecting the operation data number and turning the FWD input or RVS input ON, continuous operation is started.
Select an operation data based on a combination of ON/OFF status of the M0 to M3 inputs. Refer to p.56 for details.

Operation data No.	M3	M2	M1	M0
0	OFF	OFF	OFF	OFF
1	OFF	OFF	OFF	**ON**
2	OFF	OFF	**ON**	OFF
.	.	.	.	.
.	.	.	.	.
.	.	.	.	.
13	**ON**	**ON**	OFF	**ON**
14	**ON**	**ON**	**ON**	OFF
15	**ON**	**ON**	**ON**	**ON**

- Operation method

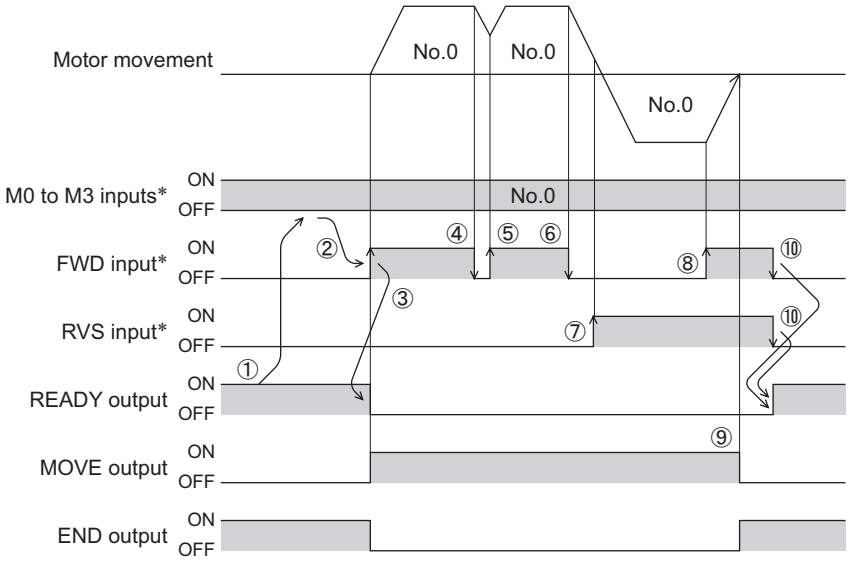
1）Check the READY output is being ON.
2）Select the operation data number using the M0 to M3 inputs, and turn the FWD input ON.
3）The motor starts continuous operation. The READY output is turned OFF.
4）Select the operation data No.1 by turning the M0 input ON. The motor accelerates to the operation speed of the operation data No.1.
5）Select the operation data No.0 by turning the M0 input OFF. The motor decelerates to the operation speed of the operation data No.0.
6）Turn the FWD input OFF.
7）The motor decelerates to a stop and the READY output is turned ON.



∗ After setting the M0 to M3 inputs, wait at least 10 ms before turning the FWD input or RVS input ON.

- Operation method: When combining the FWD and RVS inputs

1）Check the READY output is being ON.
2）Select the operation data number using the M0 to M3 inputs, and turn the FWD input ON.
3）The motor starts continuous operation. The READY output is turned OFF.
4）Turn the FWD input OFF. The motor decelerates.
5）Turn the FWD input ON while decelerating the motor. The motor accelerates again.
6）Turn the FWD input OFF. The motor decelerates.
7）Turn the RVS input ON while decelerating the motor. The motor stops once, and it rotates in the reverse direction.
8）If the FWD input is turned ON while the RVS input is being ON, the motor decelerates.
9）The motor decelerates to a stop and the MOVE output is turned OFF.
10）If both the FWD input and RVS input are turned OFF, the READY output is turned ON.



∗ After setting the M0 to M3 inputs, wait at least 10 ms before turning the FWD input or RVS input ON.

5 Other operations

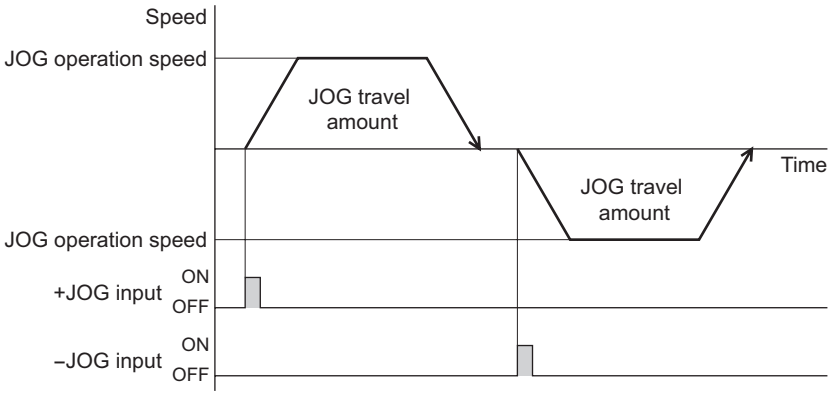
5.1 JOG operation

If +JOG input or −JOG input is assigned, JOG operation is enabled.
JOG operation is a function that executes positioning operation for the travel amount being set in the "JOG travel amount" parameter (ID: 2084).
When the +JOG input is turned ON, JOG operation is performed in the positive direction, and when the −JOG signal is turned ON, JOG operation is performed in the negative direction.
This is a convenient function when adjusting the position slightly.

Related parameters

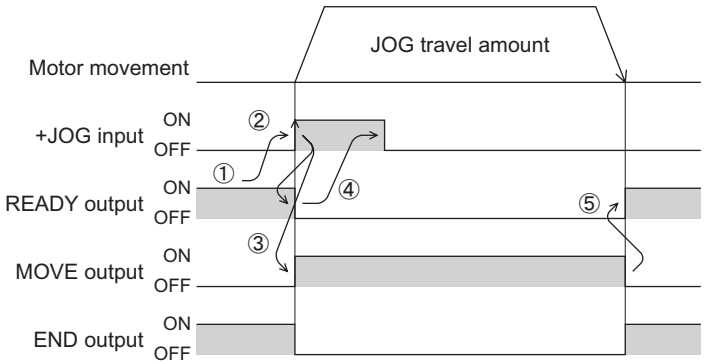
ID	Parameter name	Description	Setting range	Initial value
323	JOG operation speed	Sets the operation speed for JOG operation.	0 to 4000 r/min	300
324	JOG acceleration/ deceleration rate	Sets the acceleration and deceleration time for JOG operation.	0.000 to 30.000 s	0.100
2081	JOG operation torque	Sets the maximum torque based on the rated torque being 100% in JOG operation.	0 to 250%	100
2084	JOG travel amount	Sets the travel amount for JOG operation. The motor shaft rotates 0.72° per one step.	1 to 8,388,607 step	1

Operation image



Operation method

1）Check the READY output is being ON.
2）Turn the +JOG input ON.
3）The motor starts positioning operation.
4）Check the READY output has been turned OFF and turn the +JOG input OFF.
5）When the positioning operation is completed, the READY output will be turned ON.



Note JOG operation cannot be executed while the FREE input or STOP input is being ON. Be sure to execute after turning OFF.

5.2 Test operation

Test operation can be executed using any of the operation panel, **MEXE02** or **OPX-2A**. JOG operation or teaching function can be executed in test operation.
When executing using the operation panel, refer to p.81.
When executing using the **MEXE02**, refer to the OPERATING MANUAL of the **MEXE02**.
When executing using the **OPX-2A**, refer to the OPERATING MANUAL of the **OPX-2A**.

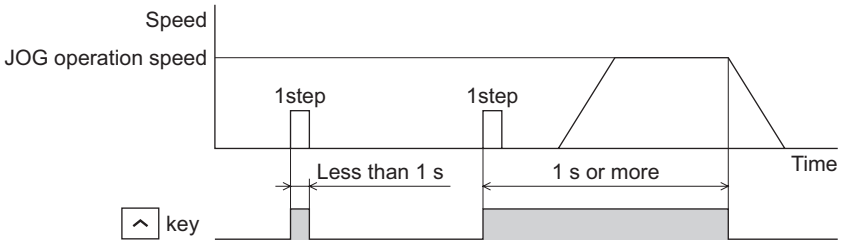
■ JOG operation

Wiring condition or operation status for the motor and driver can be checked by JOG operation.
Set the operation data for JOG operation using the following parameters.

- JOG operation speed parameter (ID: 323)
- JOG acceleration/deceleration parameter (ID: 324)
- JOG operation torque parameter (ID: 2081)

Example: When executing JOG operation by the operation panel

The motor can be operated with the [↑] [↓] keys.
When pressing the [↑] key once, the motor rotates by one step in the forward direction. If the key is kept pressing, the motor rotates in the forward direction continuously.
When pressing the [↓] key once, the motor rotates by one step in the reverse direction. If the key is kept pressing, the motor rotates in the reverse direction continuously.



Note JOG operation cannot be executed while the FREE input or STOP input is being ON. Be sure to execute after turning OFF.

■ Teaching function

This is a function that moves the motor using the operation panel, **OPX-2A** or **MEXE02** and sets the present position as the position (travel amount) of the operation data.
When the position (travel amount) is set using teaching function, the absolute mode will be automatically selected as the operation mode.

Set the operation data for teaching function using the following parameters.

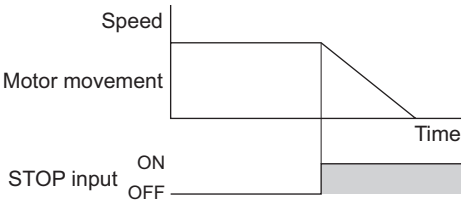
- JOG operation speed parameter (ID: 323)
- JOG acceleration/deceleration parameter (ID: 324)
- JOG operation torque parameter (ID: 2081)

Note
- Perform teaching function when the position origin is being set. Refer to p.136 for setting the position origin.
- Teaching function cannot be executed while the FREE input or STOP input is being ON. Be sure to execute after turning OFF.

5.3 Stop operation

■ STOP action

When the STOP input is turned ON while the motor is operating, the motor will stop.
The stopping method is determined by the setting of the "STOP input action" parameter (ID: 256).
For example, the operation when setting the "STOP input action" parameter (ID: 256) to "1: Deceleration stop" is shown in the figure to the right.

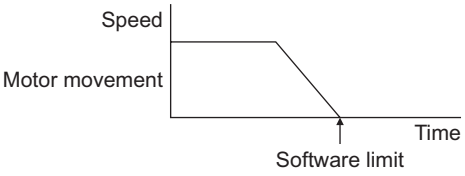


Related parameters

ID	Parameter name	Description	Setting range	Initial value
256	STOP input action	Sets how the motor should stop when the STOP input is turned ON.	0: Immediate stop 1: Deceleration stop 2: Immediate stop + current OFF 3: Deceleration stop + current OFF	0

■ Software overtravel

The software overtravel is a function that limits the range of movement being set the upper and lower limit of the moving range by the parameter.
If the "software overtravel" parameter (ID: 451) is set to "1: Enable," the motor can be decelerated to a stop by the software limit.
The operation pattern is shown to the right.



Note Software overtravel will become effective when the position origin is being set. See the following for setting the position origin.

Related parameters

ID	Parameter name	Description	Setting range	Initial value
451	Software overtravel	Sets whether to enable or disable the software overtravel detection using software limits.	0: Disable 1: Enable	1
452	Positive software limit	Sets the value of software limit in the positive direction. The motor shaft rotates 0.72° per one step.	−8,388,608 to +8,388,607 step	+8,388,607
453	Negative software limit	Sets the value of software limit in the negative direction. The motor shaft rotates 0.72° per one step.		−8,388,608

5.4 Position origin for the driver

The position origin will be set whenever one of the following operations is executed:

- Return-to-home operation is executed.
- Position preset is executed.

5.5 Wrap function

This is a function that resets the command position and multi-rotation data to 0 whenever the command position exceeds the value set in the "wrap setting range" parameter. Since the multi-rotation data is also reset to 0, the continuous rotating operation in the same direction can be performed.
The command position varies in a range of "0 to (wrap setting value−1)."

Related parameters

ID	Parameter name	Description	Setting range	Initial value
455	Wrap setting	Sets whether to enable or disable the wrap function.	0: Disable 1: Enable	0
456	Wrap setting range	Sets the wrap setting range. The motor shaft rotates 0.72° per one step.	1 to 8,388,607 step	1000

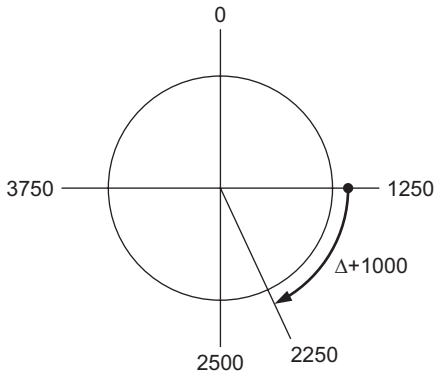
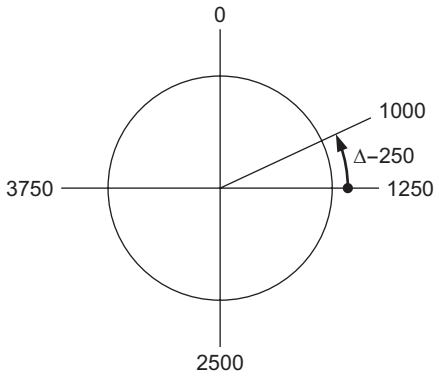
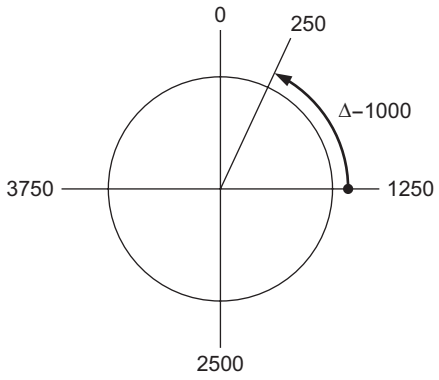
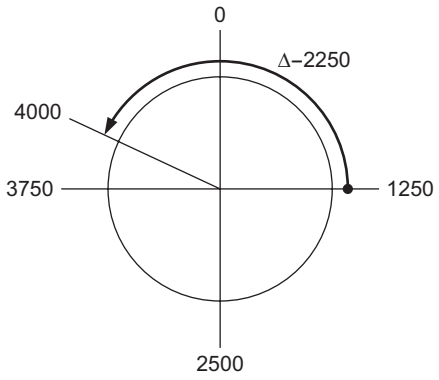
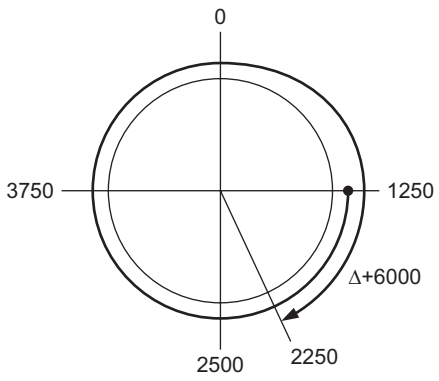
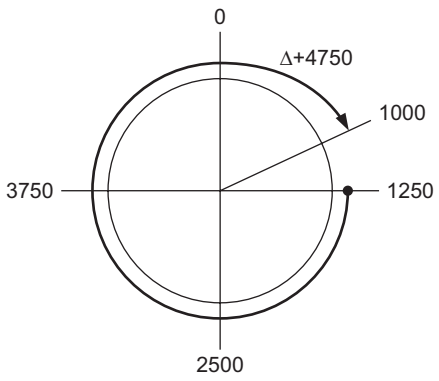
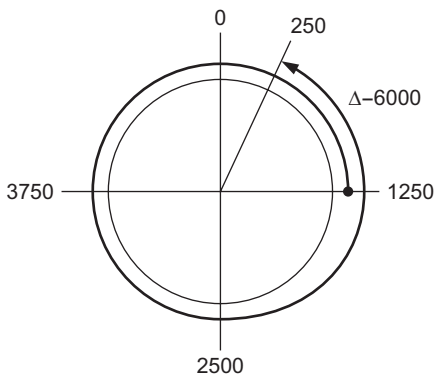
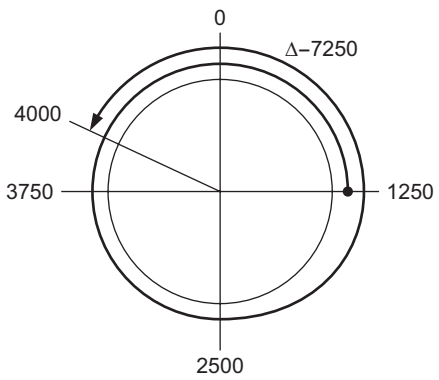
Note When setting the "wrap setting" parameter (ID: 455) to "1: Enable," the software overtravel will be disabled. It will be disabled even when setting the "software overtravel" parameter to "1: Enable (ID: 451)."

■ Example of wrap function

Operation examples when positioning operation is performed in the following conditions are shown in the next page.

- Wrap setting: 5000
- Command position: 1250
- Combination type motor/gearhead of the gear ratio 10: 1

For the combination type motor/gearhead of the gear ratio 10:1, when positioning operation is executed at the command position to be 1250 steps on the gearhead output shaft, the movement will be as follows.

Position	Operation mode: Incremental	Operation mode: Absolute
+1000		
−1000		
+6000		
−6000		

7 BX-compatible mode

The **BX**Ⅱ Series has the **BX**-compatible mode so that users can operate it in almost the same condition as a traditional **BX** Series.
This section explains the **BX**-compatible mode.

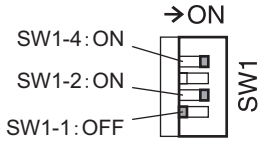
Table of contents

1 Description of the BX-compatible mode

1.1 Switching of the BX-compatible mode

Note Switch the **BX**-compatible mode before turning on the power. The new setting will not be effective by switching the **BX**-compatible mode after turning on the power.

■ BX-compatible mode (Speed control)



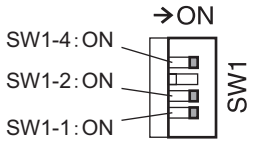
Set the SW1-No.1 to the OFF side, and set the SW1-No.2 and SW1-No.4 to the ON side.
When the **BX** Series is used in the speed control mode, the **BX Ⅱ** Series can be used in similar I/O conditions or functions as the **BX** Series by using this control mode.

If the **BX** Series is used in the position control mode (servo lock at motor standstill), set the "servo lock at motor standstill" parameter (ID: 2069) to "1: Servo lock." This generates the holding force when the motor stops.

Related parameters

ID	Parameter name	Description	Setting range	Initial value
2069	Servo lock at motor standstill	Uses in the speed control mode. If the holding force is required while the motor stops, set to "1" to enable the servo lock.	0: Free (disable servo lock) 1: Servo lock	0

■ BX-compatible mode (Position control)



Set the SW1-No.1, SW1-No.2, and SW1-No.4 to the ON side.
When the **BX** Series is used in the position control mode, the **BX Ⅱ** Series can be used in similar I/O conditions or functions as the **BX** Series by using this control mode.

1.2 Operation data

■ Operation speed

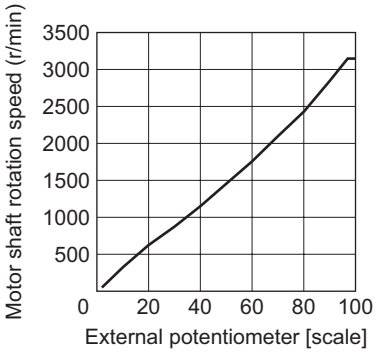
- Analog setting: 0 r/min or 30 to 3000 r/min
- Digital setting: 0 to 4000 r/min

■ Acceleration/deceleration time

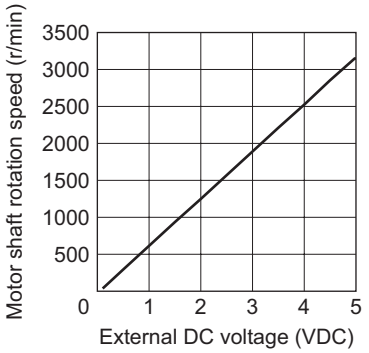
- Analog setting: 0.1 to 15 s
- Digital setting: 0.0 to 30.0 s

■ Speed characteristics
Rotation speed - Torque characteristics at analog setting

- External potentiometer scale - Rotation speed characteristics (representative values)



- External DC voltage - Rotation speed characteristics (representative values)



1.3 Assignment of I/O signals

■ BX-compatible mode (Speed control)

BXⅡ Series **BX**-compatible mode (Speed control)				**BX** Series Speed control mode		
Connector No.	Pin No.	Signal name	Function	Connector No.	Pin No.	Signal name
CN5	1	IN-COM0	Input signals common	CN4	1	CW
	2	IN0	CW		2	CCW
	3	IN1	CCW		3	M0
	4	IN2	M0		4	M1
	5	IN3	M1		5	M2
	6	IN4	M2		6	FREE
	7	IN5	FREE		7	BRAKE
	8	IN6	BRAKE/ACL ∗1		8	IN-COM
	9	IN7	Not used (possible to extend) ∗3		9	H
	10	IN8	Not used (possible to extend) ∗3		10	M
	11	IN-COM1	Input signals common（0 V）		11	L
CN7	1	VH	External speed setting input		12	ALM
	2	VM			13	BUSY
	3	VL			14	ASG
	4	OUT0+	ALM		15	BSG
	5	OUT0−			16	OUT-COM
	6	OUT1+	BUSY（TLM）/ALP ∗2			
	7	OUT1−				
	8	OUT2+	Not used (possible to extend) ∗3			
	9	OUT2−				
	10	ASG	A-phase output			
	11	BSG	B-phase output			
	12	OUT-COM	ASG/BSG common			

∗1 This signal is used as the BRAKE input in normal condition, but it functions as the ACL input if the driver protective function is activated.

∗2 This signal is used as the BUSY output in normal condition, but it functions as the ALP output if the driver protective function is activated. Also, the BUSY output can be changed to the TLM output using the parameter.

∗3 A signal can be assigned. The functions for the IN0 to IN6, OUT0, and OUT1 cannot be changed.

■ BX-compatible mode (Position control)

BXⅡ Series **BX**-compatible mode (Position control)				**BX** Series Position control mode		
Connector No.	Pin No.	Signal name	Function	Connector No.	Pin No.	Signal name
CN5	1	IN-COM0	Input signals common	CN4	1	START
	2	IN0	START		2	HOME-LS
	3	IN1	HOME-LS		3	M0
	4	IN2	M0		4	M1
	5	IN3	M1		5	M2
	6	IN4	M2		6	FREE
	7	IN5	FREE		7	BRAKE
	8	IN6	BRAKE/ACL ∗1		8	IN-COM
	9	IN7	Not used (possible to extend) ∗3		9	H
	10	IN8	Not used (possible to extend) ∗3		10	M
	11	IN-COM1	Input signals common (0 V)		11	L
CN7	1	VH	External speed setting input		12	ALM
	2	VM			13	BUSY
	3	VL			14	ASG
	4	OUT0+	ALM		15	BSG
	5	OUT0−			16	OUT-COM
	6	OUT1+	BUSY（TLM）/ALP ∗2			
	7	OUT1−				
	8	OUT2+	Not used (possible to extend) ∗3			
	9	OUT2−				
	10	ASG	A-phase output			
	11	BSG	B-phase output			
	12	OUT-COM	ASG/BSG common			

∗1 This signal is used as the BRAKE input in normal condition, but it functions as the ACL input if the driver protective function is activated.

∗2 This signal is used as the BUSY output in normal condition, but it functions as the ALP output if the driver protective function is activated. Also, the BUSY output can be changed to the TLM output using the parameter.

∗3 A signal can be assigned. The functions for the IN0 to IN6, OUT0, and OUT1 cannot be changed.

2 Explanation of I/O signals

This chapter explains the specific I/O signals in the **BX**-compatible mode.

2.1 Input signals

■ CW input, CCW input

These signals are effective in the **BX**-compatible mode (Speed control).
When selecting the operation data number and turning the CW input or CCW input ON, the motor rotates at the operation speed of the selected operation data number. If the operation signal being ON is turned OFF, the motor will decelerate to a stop.
Turning the CW input ON will rotate the motor in the CW direction, and turning the CCW input ON will rotate the motor in the CCW direction. If the CW and CCW inputs are turned ON simultaneously, the motor will decelerate to a stop.
CW (FWD) and CCW (RVS) are displayed on the **MEXE02**.

■ START input

This signal is effective in the **BX**-compatible mode (Position control).
This is a signal to start positioning operation.
When the operation data number is selected and the START input is turned ON, an operation will be started.

■ HOMES-LS input

This signal is effective in the **BX**-compatible mode (Position control). The HOMES-LS input is normally closed.
This is an input of the mechanical home sensor in return-to-mechanical home operation.
HOME-LS (HOMES) is displayed on the **MEXE02**.

■ M0 to M2 inputs

Desired operation types or operation data number can be selected by a combination of ON/OFF status of the M0 to M2 inputs.
Refer to p.146 for details.

Operation data No.	M2	M1	M0	Speed control	Position control
0	OFF	OFF	OFF	Internal potentiometer/ Digital setting 0	Positioning operation 0/ Continuous operation 0
1	OFF	OFF	**ON**	Analog external setter/ Digital setting 1	Positioning operation 1/ Continuous operation 1
2	OFF	**ON**	OFF	Digital setting 2	Positioning operation 2
3	OFF	**ON**	**ON**	Digital setting 3	Positioning operation 3
4	**ON**	OFF	OFF	Digital setting 4	Positioning operation 4
5	**ON**	OFF	**ON**	Digital setting 5	Positioning operation 5
6	**ON**	**ON**	OFF	Digital setting 6	Return-to-electrical home operation
7	**ON**	**ON**	**ON**	Digital setting 7	Return-to-mechanical home operation

■ FREE input

When the FREE input is turned ON, the motor current will be cut off. The motor output shaft can be rotated manually since the motor holding torque is lost. When an electromagnetic brake motor is used, the electromagnetic brake will be released.

Note When driving a vertical load, do not turn the FREE input ON. Since the motor loses its holding torque, the load may drop.

■ BRAKE input/ACL input

The BRAKE input/ACL input is normally closed.
This signal is used as the BRAKE input in normal condition, but it functions as the ACL input if the driver protective function is activated.
BRAKE (STOP) is displayed on the **MEXE02**.

- BRAKE input

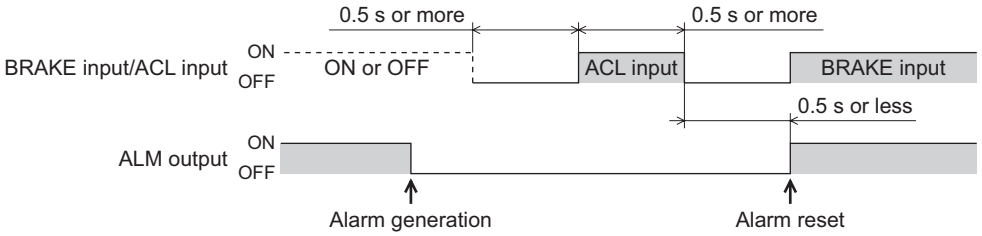
When operating the motor, turn the BRAKE input ON. If the same stop operation as the **BX** Series is required, set the "STOP input action" parameter (ID: 256) to 2 (Immediate stop + current OFF).
If the BRAKE input is turned OFF while operating the motor, the motor will stop instantaneously. When an electromagnetic brake motor is used, the electromagnetic brake will hold a load in position.

Related parameters

ID	Parameter name	Description	Setting range	Initial value
256	STOP input action	Sets how to stop the motor when the STOP input has turned ON.	0: Immediate stop 1: Deceleration stop 2: Immediate stop + current OFF 3: Deceleration stop + current OFF	0

- ACL input

If a protective function of the driver is activated and an alarm is generated, the motor will stop and the ALM output will be turned OFF.
When turning the ACL input ON (keep it ON for 0.5 seconds or more), the ALM output is turned ON and the alarm can be reset.
Always reset an alarm after removing the cause of the alarm and ensuring safety.
Refer to p.153 for alarms.



Note Some alarms cannot be reset with the ACL input. To reset these alarms, cycle the power. Refer to p.154 for details.

2.2 Output signals

■ ALM output

The ALM output is normally closed.
If a protective function of the driver is activated and an alarm is generated, the motor will stop and the ALM output will be turned OFF. At the same time, the alarm code will be displayed on the operation panel on the driver.
Check the cause of the alarm with the alarm code.

■ BUSY output/ TLM output/ ALP output

This signal is used as the BUSY output in normal condition, but it functions as the ALP output if the driver protective function is activated. Also, the BUSY output can be changed to the TLM output using the parameter.
BUSY/TLM (TLC)/ALP is displayed on the **MEXE02**.

Related parameters

ID	Parameter name	Description	Setting range	Initial value
2290	BUSY/TLM switching	Switches the BUSY output and TLM output.	0: BUSY output 1: TLM output	0

- BUSY output

The BUSY output turns ON while the motor is operating. It will be turned OFF when the operation is completed. When the motor was converged in a position of the "position completion signal range" parameter (ID: 259) against the command position, the BUSY output turns ON.

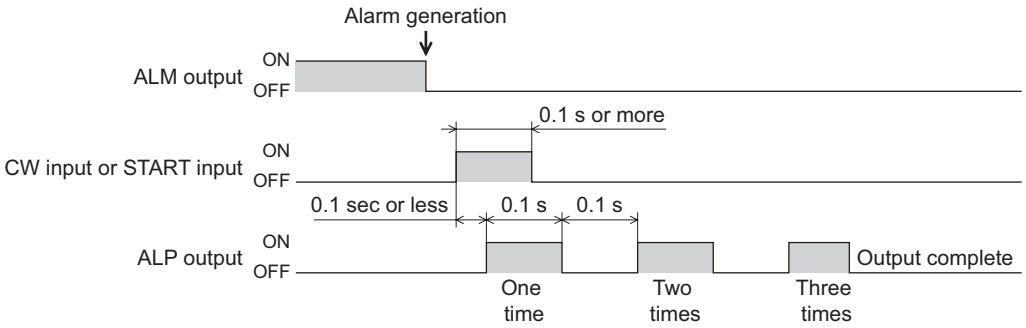
Related parameters

ID	Parameter name	Description	Setting range	Initial value
259	Positioning completion signal range	Sets the output range in which the END output turns ON. The motor shaft rotates 0.72° per one step.	1 to 100 step	1

- ALP output

When the CW input or START input is turned ON (keep it ON for 0.1 second or more) while an alarm is generating, the ALP output will be output multiple times according to the alarm content. The type of the generated alarm can be checked by counting the number of times the ALP output has output.

Example: When the overvoltage alarm was generated (3 times of ALP output)



Number of output times for the ALP output	Descriptions of alarms
2	Overload
3	Overvoltage
4	Excessive position deviation
5	Overcurrent
6	Overspeed
7	EEPROM error
8	Sensor error at power-on
9	Undervoltage
10	Other alarms than above

- TLM output

When the motor torque reaches the torque limiting value, the TLC output will turn ON.

3 Operation

This chapter explains the specific operations in the **BX**-compatible mode (position control).
Extending the operation data, return-to-electrical home operation and return-to-mechanical home operation in the **BX**-compatible mode are explained here. For other operations, refer to the next part.

- **BX**-compatible mode (Speed control)..... Part 5 "Operation of speed control mode"
- **BX**-compatible mode (Position control)..... Part 6 "Operation of position control mode"

3.1 Extending the operation data

When assigning the M3 input to the IN7 or IN8, the operation data No.8 to No. 15 can be extended.

Operation data No.	M3	M2	M1	M0	Speed control	Position control
0	OFF	OFF	OFF	OFF	Internal potentiometer/ Digital setting 0	Positioning operation 0/ Continuous operation 0
1	OFF	OFF	OFF	**ON**	Analog external setter/ Digital setting 1	Positioning operation 1/ Continuous operation 1
2	OFF	OFF	**ON**	OFF	Digital setting 2	Positioning operation 2
3	OFF	OFF	**ON**	**ON**	Digital setting 3	Positioning operation 3
4	OFF	**ON**	OFF	OFF	Digital setting 4	Positioning operation 4
5	OFF	**ON**	OFF	**ON**	Digital setting 5	Positioning operation 5
6	OFF	**ON**	**ON**	OFF	Digital setting 6	Return-to-electrical home operation
7	OFF	**ON**	**ON**	**ON**	Digital setting 7	Return-to-mechanical home operation
8	**ON**	OFF	OFF	OFF	Digital setting 8	Positioning operation 8
9	**ON**	OFF	OFF	**ON**	Digital setting 9	Positioning operation 9
10	**ON**	OFF	**ON**	OFF	Digital setting 10	Positioning operation 10
11	**ON**	OFF	**ON**	**ON**	Digital setting 11	Positioning operation 11
12	**ON**	**ON**	OFF	OFF	Digital setting 12	Positioning operation 12
13	**ON**	**ON**	OFF	**ON**	Digital setting 13	Positioning operation 13
14	**ON**	**ON**	**ON**	OFF	Digital setting 14	Positioning operation 14
15	**ON**	**ON**	**ON**	**ON**	Digital setting 15	Positioning operation 15

■ For speed control

The setting method of operation speed and torque limiting can be changed using the "analog speed/torque" parameter (ID: 2161).

- Analog setting.....Internal potentiometer (SPEED), **PAVR-20KZ** (accessory), external DC voltage
- Digital setting.....Operation panel, **MEXE02**, **OPX-2A** (accessory)

Operation data	When the parameter is 0		When the parameter is 1		When the parameter is 2	
	Operation speed	Torque limiting	Operation speed	Torque limiting	Operation speed	Torque limiting
No.0	Digital setting	Digital setting	Internal potentiometer	Digital setting	Digital setting	**PAVR-20KZ** External DC voltage
No.1			**PAVR-20KZ** External DC voltage			
No.2 to No.15			Digital setting			

- Setting example
  - When all operating data is set by the digital setting: Set the "analog speed/torque" parameter to 0.
  - When the operation speed of the operation data No.0 is set by the internal potentiometer: Select the operation data No.0 by turning all of the M0 to M2 inputs OFF, and set the "analog speed/torque" parameter to 1.
- Related parameters

ID	Parameter name	Description	Setting range	Initial value
2161	Analog speed/torque	Changes the setting method of operation speed and torque limiting	0: Digital setting 1: Analog setting 2: Analog torque limiting	1

■ For position control

The operation data No.0 and No.1 can be changed to continuous operation using the "continuous operation" parameter (ID: 2289).
And if the operation data No.6 is selected, the operation changes to return-to-electrical home operation. If the operation data No.7 is selected, the operation changes to return-to-mechanical home operation.

- Related parameters

ID	Parameter name	Description	Setting range	Initial value
2289	Continuous operation	Sets whether to enable or disable the continuous operation.	0: Disable 1: Enable	0

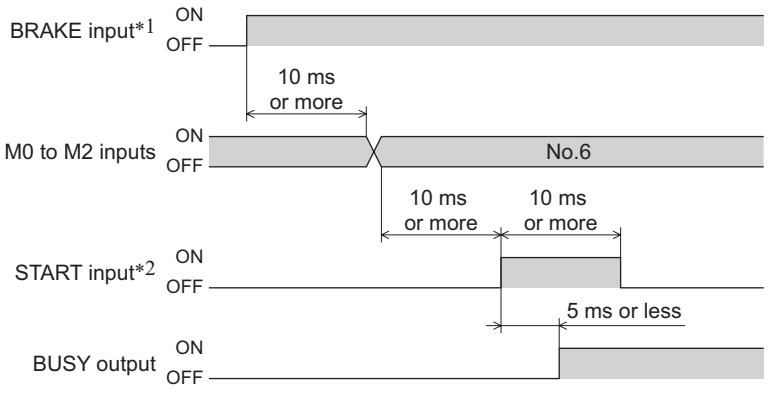
- When the "oP- 1" is displayed on the operation panel

If the operation data number is checked immediately when the power supply is input in the position control mode, the "oP- 1" will be displayed. In addition, if the operation data number is checked by executing the following operation, the "oP- 1" will be displayed.

- While return-to-home operation, continuous operation or JOG operation is executed
- When an alarm is generated and reset
- When the operation is stopped by the BRAKE (STOP) input
- When the motor excitation is turned OFF by the FREE input or S-ON input
- When the position preset was executed

3.2 Return-to-electrical home operation

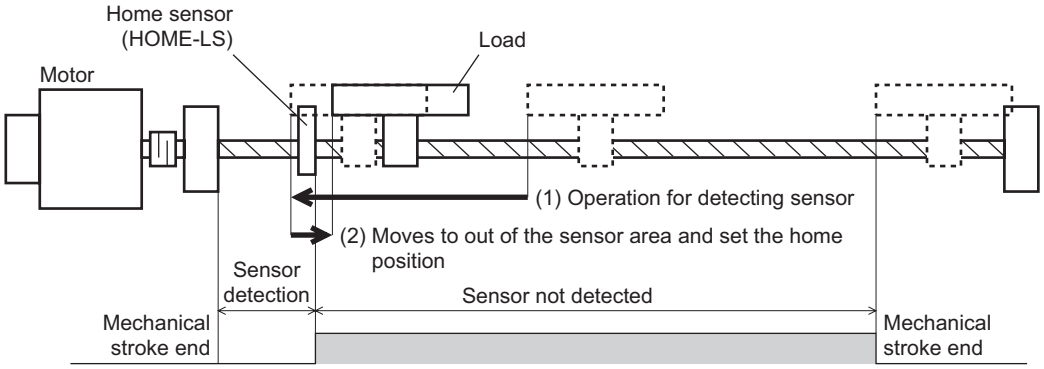
The electrical home position refers to the motor position effective when the driver power is turned on.
Select the operation data No.6 using the M0 to M2 inputs and turn the START input ON to start return-to-electrical home operation.



*1 Be sure to turn the BRAKE input ON before operating the motor.
*2 Turn the START input ON after setting the operation data with the M0 to M2 inputs.

3.3 Return-to-mechanical home operation

This is an operation in which the reference point of positioning (mechanical home position) is detected automatically. An external sensor is required.
Select the operation data No.7 using the M0 to M2 inputs and turn the START input ON to start return-to-mechanical home operation.
The motor initially rotates in the starting direction set in the "starting direction of home-seeking" parameter (ID: 357). When the home sensor is detected, the motor rotates in the backward direction and stops.



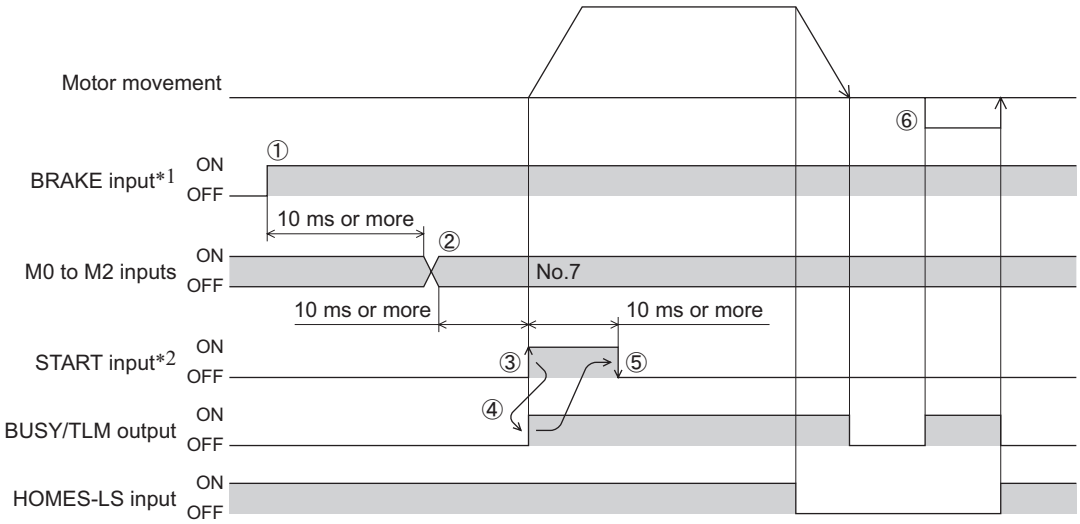
Note
- Install the home sensor just before the stroke end in the detection direction.
- Unless the operation speed is set to the operating data No.7, an operation data error alarm will generate upon start of operation.

- Related parameters

ID	Parameter name	Description	Setting range	Initial value
357	Starting direction of home-seeking	Sets the starting direction for home detection.	0: Negative direction 1: Positive direction	1

- Operation method

1）Turn the BRAKE input ON.
2）Select the operation data No.7 using the M0 to M2 inputs.
3）Turn the START input ON.
4）Return-to-home operation is started.
5）Turn the START input OFF.
6）The motor rotates in the backward direction when detecting the OFF position of the HOME-LS input and it stops when detecting the ON position of the HOME-LS input.



∗1 Be sure to turn the BRAKE input ON before operating the motor.
∗2 Turn the START input ON after setting the operation data with the M0 to M2 inputs.

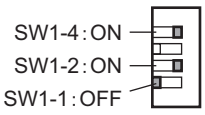
4 Connection example

This chapter explains a connection example to replace the **BX** Series with the **BX Ⅱ** Series.

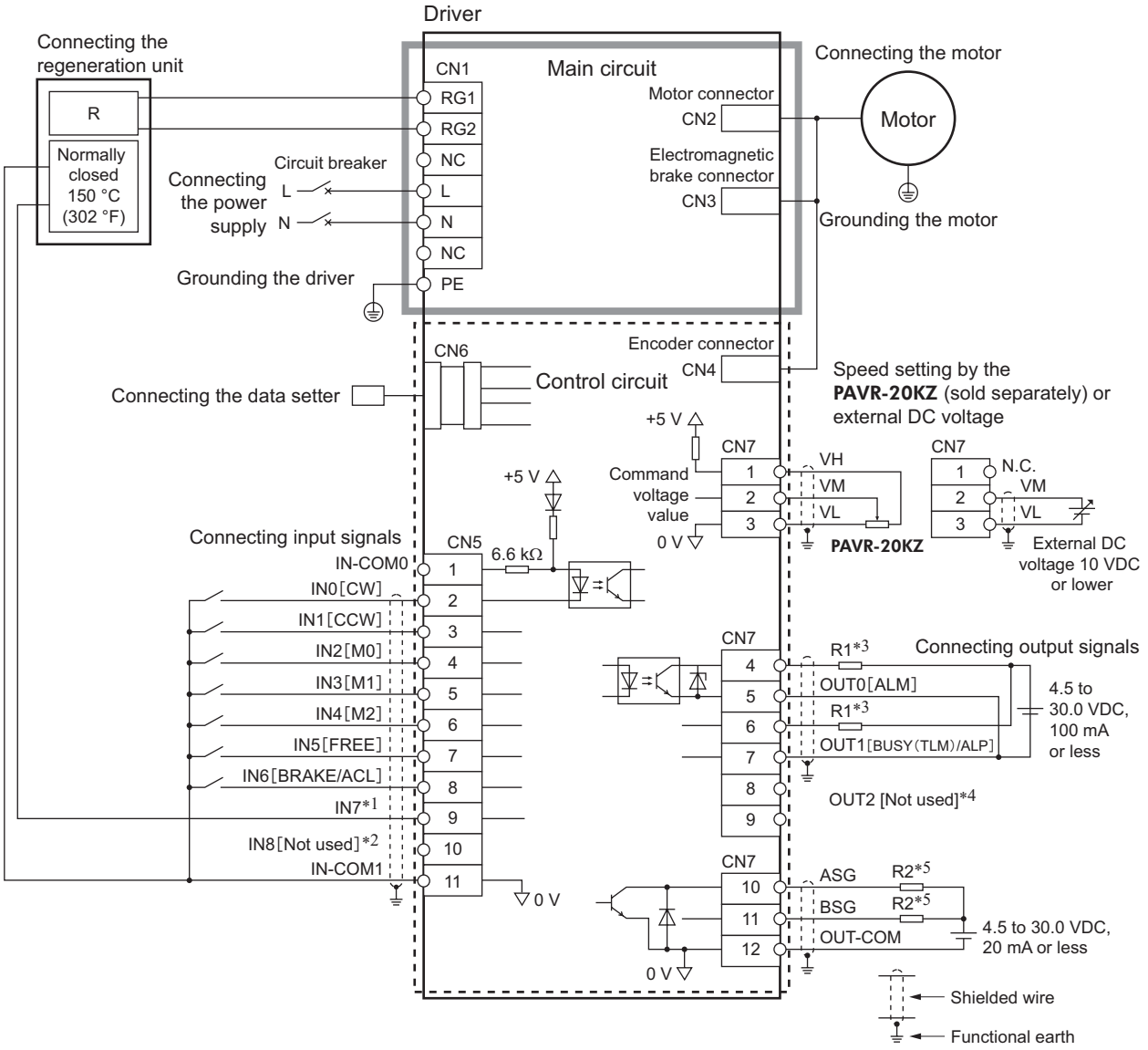
4.1 BX-compatible mode (Speed control)

This is a connection example that the power supply is single-phase 100-120 VAC, the speed is set using an external setter (potentiometer or DC voltage) and the motor is operated with relays, switches and other contact switches. The I/O signal in brackets [ ] is the initial value. Refer to p.101 for the assignment of the I/O signals.

Setting of the SW1



Speed control mode

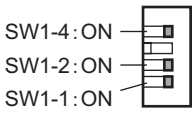


∗1 This is a connection in which the TH input is assigned to the IN7. The initial value is [Not used].
∗2 When using the IN8 by assigning the signal, connect the same as the IN0 to IN6 inputs.
∗3 Connect a current-limiting resistor R1 according to the power supply voltage so that the current will not exceed 100 mA.
∗4 When using the OUT2 by assigning the signal, connect the same as the OUT0 and OUT1 outputs.
∗5 Connect a current-limiting resistor R2 according to the power supply voltage so that the current will not exceed 20 mA.

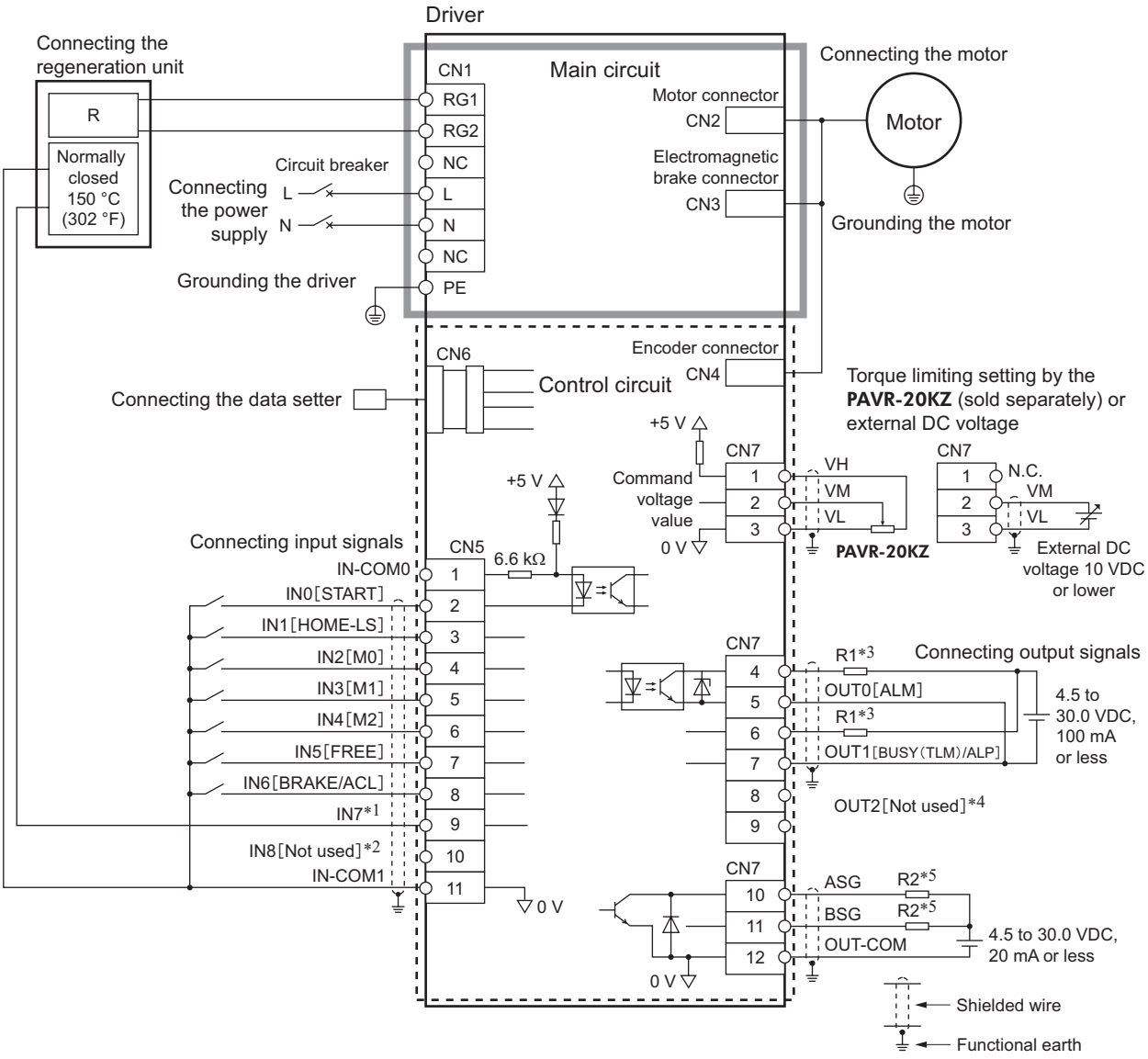
4.2 BX-compatible mode (Position control)

This is a connection example that the power supply is single-phase 100-120 VAC, the torque limiting is set using an external setter (potentiometer or DC voltage) and the motor is operated with relays, switches and other contact switches. The I/O signal in brackets [ ] is the initial value. Refer to p.101 for the assignment of the I/O signals.

Setting of the SW1



Position control mode



∗1 This is a connection in which the TH input is assigned to the IN7. The initial value is [Not used].
∗2 When using the IN8 by assigning the signal, connect the same as the IN0 to IN6 inputs.
∗3 Connect a current-limiting resistor R1 according to the power supply voltage so that the current will not exceed 100 mA.
∗4 When using the OUT2 by assigning the signal, connect the same as the OUT0 and OUT1 outputs.
∗5 Connect a current-limiting resistor R2 according to the power supply voltage so that the current will not exceed 20 mA.

8 Inspection, troubleshooting and remedial action

This part explains the periodical inspection methods as well as confirmation items and remedial actions when problems have happened.

Table of contents

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

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

■ Inspection item

- Are the mounting screws of the motor/gearhead loose?
- Are there any unusual noises in the motor bearings (ball bearings)?
- Are there any unusual noises in the bearings (ball bearings) or gear meshing parts of the gearhead?
- Is the motor/gearhead output shaft misaligned with the load shaft?
- Are there any scratches, signs of stress or loose driver connections in the cable?
- Are the openings in the driver blocked?
- Are any of the mounting screws or main power input terminals of the driver loose?
- Are any unusual smells or appearances in the driver?

2 Alarm, warning

The driver provides alarms that are designed to protect the driver from overheating, poor connection, error in operation, etc. (protective functions), as well as warnings that are output before the corresponding alarms generate (warning functions).

2.1 Alarms

When an alarm generates, the ALM output will turn OFF and the motor will stop. At the same time, the alarm code will be displayed on the operation panel. The alarm code can also be checked using the **MEXE02** or **OPX-2A**.

■ Alarm reset

Before resetting an alarm, always remove the cause of the alarm and ensure safety, and perform one of the reset operations specified below.

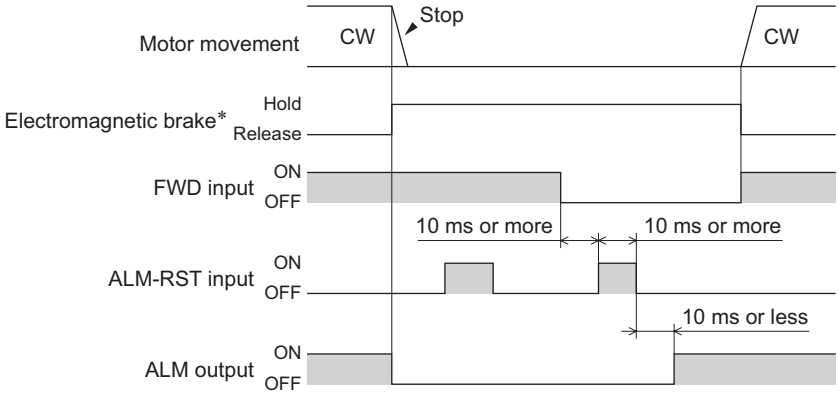
- Turn the ALM-RST input from ON to OFF. (The alarm will be reset at the OFF edge of the input.)
- Execute the alarm reset in the monitor mode of the operation panel.
- Execute an alarm reset using the **MEXE02** or **OPX-2A**.
- Cycle the power.

Note

- Some alarms cannot be reset other than cycling the power. Check the table on and after the next page.
- Continuing the operation without removing the cause of the alarm may cause damage to equipment.

- When resetting with the ALM-RST input

When resetting an alarm with the ALM-RST input, turn the operation signal OFF and remove the cause of the alarm before turning the ALM-RST input ON (keep it ON for 10 ms or more). The ALM-RST input is disabled while the operation signal is being ON. The figure shows an example for which the operation signal is the FWD input.



∗ The electromagnetic brake will hold the load at the moment an alarm generates.

- Display on the operation panel when resetting an alarm

When the alarm is reset with the ALM-RST input, " AL00 " is displayed on the operation panel. If the operation is resumed as it is, the display of AL00 will not clear. When changing from the display of AL00 , change the display item by using [↑] [↓] keys.

■ Alarm records

Up to 10 generated alarms are saved in the non-volatile memory in order of the latest to oldest. Alarm records stored in the non-volatile memory can be read and cleared when performing any of the following items.

- Clear the alarm records in the monitor mode of the operation panel.
- Read and clear the alarm records using the **MEXE02** or **OPX-2A**.

■ Alarm list

Alarm code	Alarm type	Cause	Remedial action	Reset using the ALM-RST input	Motor excitation ∗1
AL 10	Excessive position deviation	• When the motor was in excitation state, the deviation between the command position and actual position at the motor output shaft exceeded the value set in the "excessive position deviation alarm" parameter. • The load is large or acceleration/deceleration time is too short.	• Decrease the load. • Review the operating condition such as acceleration/deceleration time.	Possible	Excitation off
AL20	Overcurrent	Excessive current has flown through the driver due to ground fault, etc.	• Check whether the wiring between the driver and motor has damaged. • If the alarm cannot be cleared even when the power has been cycled, contact your nearest Oriental Motor sales office.	Not possible	
AL22	Overvoltage	• The main power supply voltage exceeded approximately 120% of the rated voltage. • A load exceeding the allowable gravitational capacity of the motor was driven or sudden starting/stopping of a large inertial load was performed.	• Check the main power supply voltage. • If this alarm generates while operating a motor, decrease the load or increase the acceleration/deceleration time. • Connect the regeneration unit.		
AL25	Undervoltage	The power supply voltage became lower than approximately 60% of the rated voltage.	• Check the main power supply voltage. • Check the wiring of the power supply cable.	Possible	
AL28	Sensor error	The encoder cable was disconnected. Or the encoder connector was unplugged.	Check the connection between the driver and motor.	Not possible	
AL2d	Main circuit output error∗2	The motor drive wire was disconnected. Or the motor power connector was unplugged.	Check the connection between the driver and motor.		
AL30	Overload	• A load exceeding the rated torque was applied to the motor for 5 seconds or more. • The motor was started running under the state that the motor temperature was low.	• Decrease the load. • Review the operating condition such as acceleration/deceleration time.	Possible	
AL31	Overspeed	The rotation speed of the motor output shaft exceeded approximately 5200 r/min.	• Decrease the load. • Review the operating condition such as acceleration/deceleration time.		
AL41	EEPROM error	• Stored data was damaged. • Data became no longer writable or readable.	• Initialize all parameters. • If the alarm cannot be cleared even when the power has been cycled, contact your nearest Oriental Motor sales office.	Not possible	
AL42	Sensor error at power-on	The encoder cable was disconnected before turning on the main power supply. Or the encoder connector was unplugged.	Check the connection between the driver and motor.		
AL46	Prevention of operation at power-on ∗3	The main power supply was cycled when the FWD input or RVS input was being ON.	Turn the FWD input or RVS input OFF.	Possible	

∗1 When an alarm generates, the motor operates as follows.
Excitation off: When an alarm generates, the motor current will be cut off and the motor will lose its holding torque.
The electromagnetic brake will automatically actuate and hold the position when using the electromagnetic brake motor.
Excitation on: Even when an alarm is generated, the motor current will not be cut off and the motor excitation state will be continued.
∗2 This alarm does not generate when the torque limit is set to less than 250%.
∗3 This alarm is generated when the "prevention of operation at power-on" function was set to enable.

Alarm code	Alarm type	Cause	Remedial action	Reset using the ALM-RST input	Motor excitation *1
AL51	Regeneration unit overheat	• Regeneration unit is not connected correctly. • Regeneration unit was overheated extraordinarily. • The main power supply of the driver was turned on before turning on the external power supply of input signals.	• Check the connection for the thermostat output and TH input of the regeneration unit. • The allowable power consumption of the regeneration unit was exceeded. Review the load condition and operating conditions. • Turn on the main power supply of the driver after the external power supply of input signals is turned on.	Not possible	Excitation off
AL67	Software overtravel	When the "software overtravel" parameter is set to "enable," the motor position reached the set value of the software limit.	In single-motion operation, check to see if the position exceeds the software limit. In linked-motion operation, check to see if the result of linked position exceeds the software limit.	Possible	Excitation on
AL70	Operation data error	• Data of different directions was linked in linked-motion operation. • The operation data was linked five data or more. • Positioning operation of the operation speed 0 r/min was performed. • Positioning operation was performed at the operation speed 0 r/min for the operation data No.7.	Check the operation data.		

*1 When an alarm generates, the motor operates as follows.
Excitation off: When an alarm generates, the motor current will be cut off and the motor will lose its holding torque.
The electromagnetic brake will automatically actuate and hold the position when using the electromagnetic brake motor.
Excitation on: Even when an alarm is generated, the motor current will not be cut off and the motor excitation state will be continued.

2.2 Warnings

When a warning generates, the WNG output will turn ON. The motor will continue to operate.
Once the cause of the warning is removed, the WNG output will turn OFF automatically.

■ Warning list

Warning code	Warning type	Cause	Remedial action
n010	Excessive position deviation	• When the motor was in excitation state, the deviation between the command position and actual position at the motor output shaft exceeded the value set in the "excessive position deviation warning" parameter. • The load is large or acceleration/deceleration time is too short.	Check the load condition.
n022	Overvoltage	• The power supply voltage exceeded the value set in the "overvoltage warning" parameter. • A load exceeding the allowable gravitational capacity of the motor was driven or sudden starting/stopping of a large inertial load was performed.	• Check the main power supply voltage. • If this alarm generates during operation, check the load condition. • Connect the regeneration unit.
n030	Overload	A load exceeding the value set in the "overload warning" parameter was applied.	Check the load condition.
n06C	Operation prohibited	When the FWD input or RVS input is being ON, the function mode was changed from the test mode to other modes.	Turn the FWD input or RVS input OFF.

■ Warning records

Up to 10 generated warnings are saved in the RAM in order of the latest to oldest. Warning records stored in the RAM can be read or cleared when performing any of the following items.

- Clear the warning records in the monitor mode of the operation panel.
- Read and clear the warning records using the **MEXE02** or **OPX-2A**.

Note The warning records will be cleared by turning off the driver power.

3 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 correctly, 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 operate.	The power supply is not connected properly.	Check the connection between the driver and power supply.
	Both the FWD input and RVS input are being OFF.	Turn either FWD input or RVS input ON.
	Both the FWD input and RVS input are being ON.	
	An alarm is present	An alarm generated due to a protective function being triggered. Refer to p.154 to reset the alarm.
	A load exceeding the setting of the torque limiting value is being applied.	If the setting of the torque limiting value is low, the motor may not start operating. Set the torque limiting value with providing a margin of 20% or more as a guide.
The motor rotates in the direction opposite to the specified direction.	The FWD input and RVS input are connected wrongly or otherwise not connected correctly.	Check the connection of the FWD input and RVS input. The motor rotates in the clockwise direction when turning the FWD input ON, and it rotates in the counterclockwise direction when turning the RVS input ON.
	The combination type parallel shaft gearhead which gear ratio is 30:1 or 50:1 is used.	When the gear ratio of the combination type parallel shaft gearhead is 30:1 or 50:1, the rotation direction of the gear output shaft is opposite the rotation direction of the motor output shaft. Accordingly, reverse the FWD input and RVS input operations.
	A combination type hollow shaft flat gearhead is used.	• With a 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 RVS input operations. • Check the direction from which the gearhead is viewed. With a combination type hollow shaft flat gearhead, the rotation direction of the gearhead changes according to the direction from which the gearhead is viewed.
• Motor operation is unstable. • Motor vibration is too large.	The motor (gearhead) output shaft is misaligned with the load shaft.	Check the coupling condition of the motor (gearhead) output shaft and 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: ・Move the motor and driver farther away from noise generation sources. ・Review the wiring. ・Change the signal cables to a shielded type. ・Install ferrite cores.

Note

- Check the alarm message when the alarm generates.
- The I/O signals can be monitored using the operation panel, **MEXE02** or **OPX-2A**. Use to check the wiring condition of the I/O signals.

9 Reference

This part explains the standards and CE Marking.

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1 Standard and CE Marking

This product is recognized by UL. The CE Marking (Low Voltage Directive and EMC Directive) is affixed to the product in accordance with EN Standards.

■ UL Standards and CSA Standards

		Applicable Standards	Certification Body	Standards File No.
Motor*	30 W 60 W 120 W	UL 60950-1 CSA C22.2 No.60950-1	UL	E208200
	200 W 400 W	UL 1004-1 CSA C22.2 No.100		E335369
Driver		UL 508C CSA C22.2 No.274		E171462

* Thermal class UL/CSA Standards: 105 (A)

■ Low Voltage Directive

- This product has been designed and manufactured for use as a component to be installed in equipment.
- This product cannot be used in IT distribution system.
- Install the product inside an enclosure in order to avoid contact with hands.
- When installing the motor and driver, securely connect their Protective Earth Terminals.
- Isolate the motor cable, power-supply cable and other drive cables from the encoder cable and signal cables (CN5 to CN7) by means of double insulation.

- Applicable standards

Motor: EN 60034-1, EN 60034-5, EN 60664-1
Driver: EN 61800-5-1

Installation conditions (EN Standard)

Motor*	Driver
To be used as a component in equipment Overvoltage category: Ⅲ Pollution degree: 3 Protection against electric shock: Class Ⅰ	To be used as a component in equipment Overvoltage category: Ⅱ Pollution degree: 2 Protection against electric shock: Class Ⅰ

* Thermal class EN Standards: 120 (E)

■ EMC Directive

This product has received EMC compliance under the conditions specified in "Example of motor and driver installation and wiring" on p.161. Since the compliance of the final machinery with the EMC Directive will depend on such factors as the configuration, wiring, layout and risk involved in the control-system equipment and electrical parts, it therefore must be verified through EMC measures by the customer of the machinery.

- Applicable standards

EMI	Emission Tests Harmonics Current Test Voltage Fluctuations Test	EN 61000-6-4, EN 61800-3 C3 EN 61000-3-2 EN 61000-3-3
EMS	Immunity Tests	EN 61000-6-2, EN 61800-3 C3

This type of PDS is not intended to be used on a low-voltage public network which supplies domestic premises; radio frequency interference is expected if used on such a network.

■ Hazardous substances

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

■ Republic of Korea, Radio Waves Act.
한국전파법

Seller and user shall be noticed that this equipment is suitable for electromagnetic equipments for office work (Class A) and it can be used outside home.

이 기기는 업무용(A 급) 전자파적합기기로서 판매자 또는 사용자는 이 점을 주의하시기 바라며, 가정외의 지역에서 사용하는 것을 목적으로 합니다.

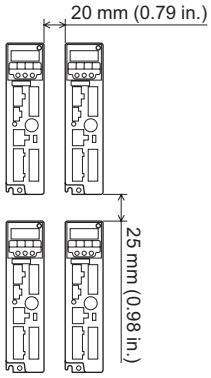
■ UL RECOGNITION OF DRIVER

Drivers are recognized by UL at following condition.

- Maximum Surrounding Air Temperature 50 ° C (122 ° F).
- Install device in pollution degree 2 environment.
- Solid state motor overload protection reacts at less than 156%FLA.
- Suitable For Use On A Circuit Capable Of Delivering Not More Than 5000Arms Symmetrical Amperes, 120 or 240 VAC Maximum Voltage.
- Integral solid state short circuit protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the National Electric Code and any additional local codes.
- Use UL Listed Inverse Time Circuit Breaker rated 120 or 240 VAC, 15 A Only.
- Drives have no provision for motor over temperature protection specified by UL 508C. Motor over temperature protection is required at end application.
- Temperature test are conducted with alumiun plate. Plate size is dependent on the drives' layout. (Refer to following table)

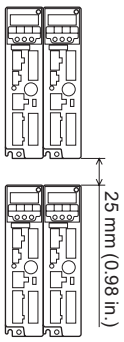
Driver layout (Refer to following figures)	Plate size	Space between drivers		The rate to rated output current	Surrounding air temperature
		Horizontal	Vertical		
1	400×400×2 mm (15.8×15.8×0.08 in.)	20 mm (0.79 in.)	25 mm (0.98 in.)	100%	50 °C (122 °F)
2	350×700×2 mm (13.8×27.6×0.08 in.)	0 mm (0 in.)	25 mm (0.98 in.)	90%	40 °C (104 °F)

[Driver layout 1]



[Driver layout 2]

Drivers fitted with the fixture (Model: **MADP02**) were attached to the DIN rail with a plate.



2 Installing and wiring in compliance with EMC Directive

The **BXⅡ** Series is designed and manufactured for use as a component to be installed in equipment. The EMC Directives require that your mechanical equipment in which the **BXⅡ** Series is installed satisfy the applicable requirements.
The installation/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 Directives.
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/driver, configuration of electrical parts, wiring, layout and hazard level. It therefore must be verified through conducting EMC measures on your mechanical equipment.

Effective measures must be taken against the EMI that the **BXⅡ** Series product may give to adjacent control system equipment, as well as the EMS of the **BXⅡ** Series product itself, in order to prevent a serious functional impediment in the mechanical equipment.
The use of the following installation and wiring methods will enable the **BXⅡ** Series product to be compliant with the EMC directive.

■ Connecting a mains filter

Install a mains filter in the AC power line in order to prevent the noise generated within the driver from propagating outside via the power input line. For mains filters, use the product as shown below, or an equivalent.

Manufacturer	Single-phase 100-120 VAC, Single-phase 200-240 VAC	Three-phase 200-240 VAC
Soshin Electric Co., Ltd.	HF2010A-UPF	HF3010C-SZA, NFU3010C-Z1
Schaffner EMC	FN2070-10-06	FN3025HP-10-71

- The mains filter is a product of overvoltage category II.
- Install the mains filter as close to the driver as possible.
- Secure firmly using a cable clamp etc. so that the input cable and output cable do not come off the enclosure.
- Connect the ground terminal of the mains filter to the grounding point, using as thick and short wire as possible.
- Do not place the AC input cable (AWG18 to 14: 0.75 mm^2 to 2.0 mm^2 or thicker) parallel with the output cable (AWG18 to 14: 0.75 mm^2 to 2.0 mm^2 or thicker) of the mains filter. Parallel placement will reduce mains filter effectiveness if the enclosure's internal noise is directly coupled to the power supply cable by means of stray capacitance.

■ Ferrite core

The ferrite core reduces the negative effects of external noise. Use ferrite core ZCAT3035-1330 (TDK Corporation) or its equivalent.
Install two pieces of ferrite cores each near the driver and motor of the encoder cable.

■ Connecting the AC line reactor

When inputting the voltage of single-phase 200-240 VAC, connect the reactor to the AC power line to conform to the EN61000-3-2.
30 to 120 W (5 A or more, 2 mH or more), 200/400 W (8 A or more, 2 mH or more)

■ Connecting an external power supply

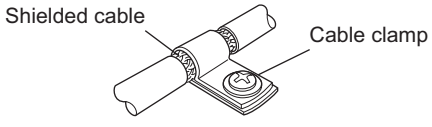
Use an external power supply conforming to the EMC Directive. Wire the external power supply over the shortest possible distance using a shielded cable for wiring. Refer to "Wiring of the power supply cable" on next page for how to ground the shielded cable.

■ How to ground

The cable used to ground the motor, driver, mains filter and power supply cable (shielded cable) must be as thick and short as possible so that no potential difference is generated among the grounding points. Choose a large, thick and uniformly conductive surface for the grounding point. Refer to p.37 for the detailed grounding method.

■ Wiring of the power supply cable

Use a shielded cable of AWG18 to 14 (0.75 to 2.0 mm^2) or thicker for the power supply cable, and wire 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.
Connect both ends (mains filter side and power supply side) of the shielded cable to the grounding points so that no potential difference is generated between grounds.

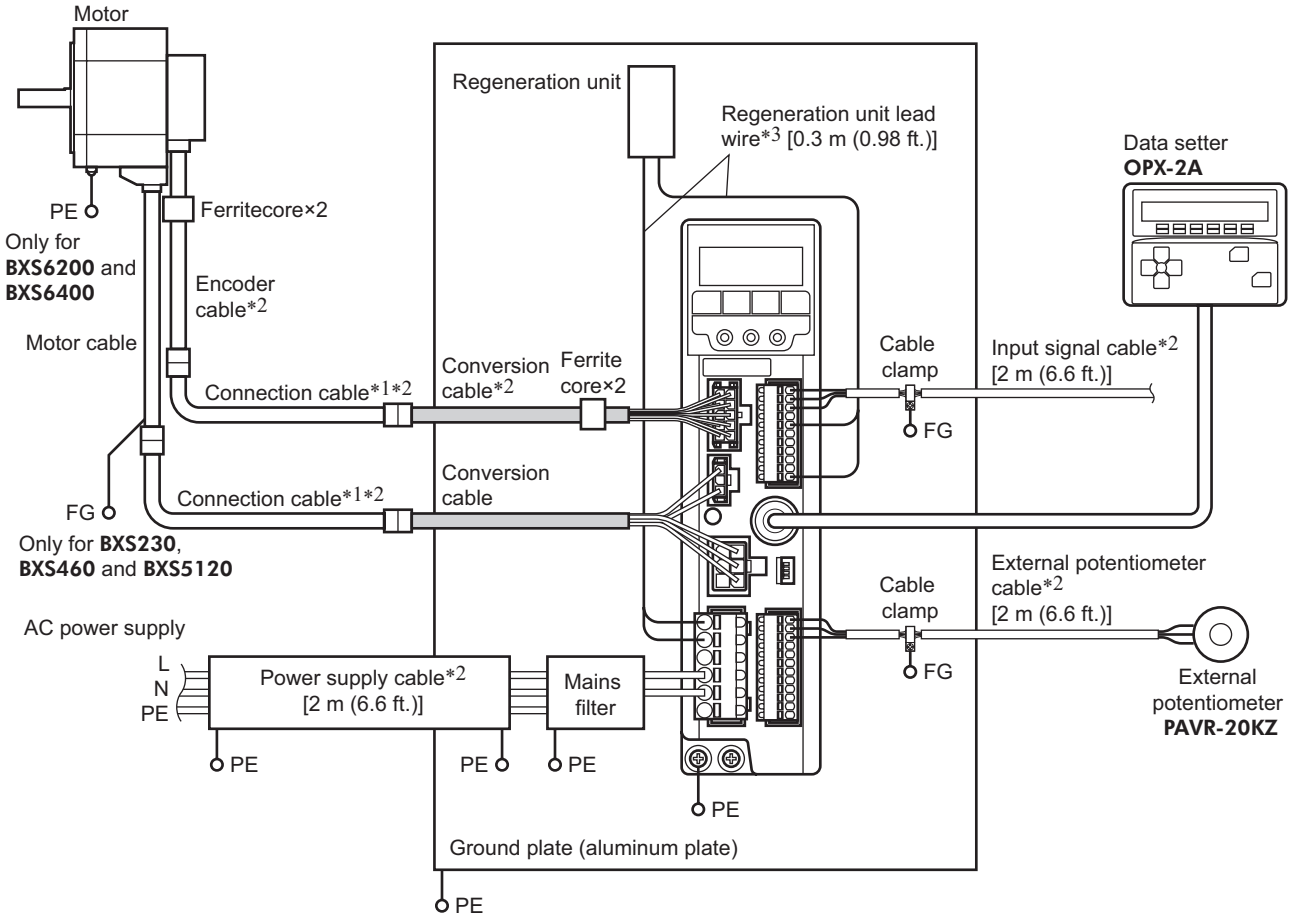


■ Notes about installation and wiring

- Connect the motor, driver and other peripheral control equipment directly to the grounding point so as to prevent a potential difference from developing between grounds.
- When relays or electromagnetic switches are used together with the product, use mains filters or 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. Place the AC input cable and output cable of a mains filter separately from each other.
- When extending the wiring distance between the motor and driver, use the connection cable (supplied or accessory). The EMC measures are conducted using the Oriental Motor connection cable.

■ Example of motor and driver installation and wiring

The figure shown below is the standard type.



*1 Up to 30 m (98.4 ft.) of the connection cables have been evaluated. The connection cable can be connected up to 2 pieces.
*2 Shielded cable
*3 Non-shielded cable

■ Precautions about static electricity

Static electricity may cause the driver to malfunction or suffer damage.
Except when operating the driver front panel, do not come near or touch the driver while the driver power is ON.
Use an insulated screwdriver to change the switches on the driver.

10 Appendix

This part explains accessories (sold separately) that are used in combination with the products.

Table of contents

1 Accessories (sold separately)

■ Connection cable

This cable is used to extend the wiring distance between the driver and motor. Connection can be extended to a maximum of 30 m (98.4 ft.). Flexible connection cables are also available.

Length [m (ft.)]	Model	
	Connection cable	Flexible connection cable
1 (3.3)	**CC01SBF**	**CC01SBR**
2 (6.6)	**CC02SBF**	**CC02SBR**
3 (9.8)	**CC03SBF**	**CC03SBR**
5 (16.4)	**CC05SBF**	**CC05SBR**
7 (23.0)	**CC07SBF**	**CC07SBR**
10 (32.8)	**CC10SBF**	**CC10SBR**
15 (49.2)	**CC15SBF**	**CC15SBR**
20 (65.6)	**CC20SBF**	**CC20SBR**
30 (98.4)	**CC30SBF**	**CC30SBR**

■ Regeneration unit

If vertical drive (gravitational operation) such as elevator applications is performed or if sudden start-stop operation of a large inertial load is repeated frequently, connect the regeneration unit **EPRC-400P** or **RGB100**.

Model: **EPRC-400P** (For **BXS230**, **BXS460** and **BXS5120** types)
RGB100 (For **BXS6200** and **BXS6400** types)

■ DIN rail mounting plate

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

Model: **MADP02**

■ External potentiometer

The motor speed can be set externally. The torque limiting value can also be set.

Model: **PAVR-20KZ**

■ Data setter

The data setter lets you set data and parameters for the **BXⅡ** Series with ease and also functions as a monitor.

Model: **OPX-2A**

■ Data setting software

The data setting software lets you set parameters for the **BXⅡ** Series and monitor its operating condition using a PC. The software comes with a PC interface cable [5 m (16.4 ft.)]. The cable is connected to the USB port on the PC.

Model: **MEXE02**

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

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