Oriental motor

HP-5160

Brushless Motor

BLE Series

FLEX RS-485 communication type Driver

OPERATING MANUAL

Thank you for purchasing an Oriental Motor product.
This Operating Manual describes product handling procedures and safety precautions.

- Please read it thoroughly to ensure safe operation.
- Always keep the manual where it is readily available.

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1 Entry

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

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1 Operating Manuals for the BLE Series

Operating manuals for the **BLE** Series FLEX RS-485 communication type are listed below.
After reading the following manuals, keep them in a convenient place so that you can reference them at any time.

	Operating manual name
Driver	**BLE** Series FLEX RS-485 communication type Driver OPERATING MANUAL (this manual)
Motor	**BLE** Series Motor OPERATING MANUAL
Peripheral equipments	Support software **MEXE02** Ver.3 OPERATING MANUAL
Related products	CC-Link Ver.1.1 compatible **NETC01-CC** USER MANUAL
	CC-Link Ver.2 compatible **NETC02-CC** USER MANUAL
	MECHATROLINK-Ⅱ compatible **NETC01-M2** USER MANUAL
	MECHATROLINK-Ⅲ compatible **NETC01-M3** USER MANUAL
	EtherCAT compatible **NETC01-ECT** USER MANUAL

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

2 Introduction

■ Before use

Only qualified personnel of electrical and mechanical engineering should work with the product.
Use the product correctly after thoroughly reading the section p.8 "3 Safety precautions." In addition, be sure to observe the contents described in warning, caution, and note in this manual.
The product described in this manual has been designed and manufactured to be incorporated in general industrial equipment. Do not use for any other purpose. Oriental Motor Co., Ltd. is not responsible for any damage caused through failure to observe this warning.

■ Product overview

This is a motor and driver of a compact, high-torque brushless motor and driver compatible with I/O control and RS-485 communication.
The operation data and parameters can be set using data setter **OPX-2A** (sold separately) or support software **MEXE02**, or via RS-485 communication.

■ Peripheral equipments

The operation data and parameters can be set using data setter **OPX-2A** (sold separately) or support software **MEXE02**, or via RS-485 communication. Provide the **OPX-2A** or **MEXE02** as necessary.

■ Related products

The **BLE** Series FLEX RS-485 communication type can be used via various network when connecting to a network converter.

Network converter	Supported network
NETC01-CC	CC-Link communication (Ver.1.1 compatible)
NETC02-CC	CC-Link communication (Ver.2 compatible)
NETC01-M2	MECHATROLINK-Ⅱ communication
NETC01-M3	MECHATROLINK-Ⅲ communication
NETC01-ECT	EtherCAT communication

■ Notation rules

The following term is used in explanation of this manual.

Term	Description
Master controller	This is a generic name for a programmable controller, master module and so on.

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 the safe use of the product.
memo	The items under this heading contain related information and contents to gain a further understanding of the text in this manual.

⚠WARNING

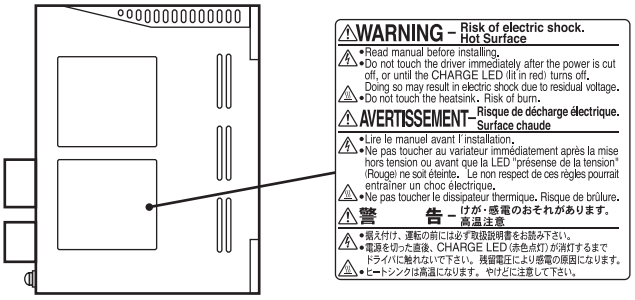
- Do not use the product in a place exposed to explosive, flammable or corrosive gases or water splashes or near combustible materials. Doing so may result in fire, electric shock or injury.
- Only qualified and educated personnel should be allowed to perform installation, connection, operation and inspection/troubleshooting of the product. Handling by unqualified personnel may result in fire, electric shock, injury or equipment damage.
- Do not move, install, connect or inspect the product while the power is supplied. Perform these operations after turning off the power. Failure to observe these instructions may result in electric shock.
- The terminals on the driver's front panel marked with ⚠ ⚠ symbol indicate the presence of high voltage. Do not touch these terminals while the power is on to avoid the risk of fire or electric shock.
- Use an electromagnetic brake motor in an application of vertical drive such as elevating equipment. If a power failure occurs or the driver protective function is activated in a state where the motor without an electromagnetic brake is used, the moving part may fall when the motor stops. This may cause injury or damage to equipment.
- Do not use the brake mechanism of the electromagnetic brake motor as a safety brake. It is intended to hold the moving parts and motor position. Doing so may result in injury or damage to equipment.
- If the driver protective function has been activated, remove the cause and reset the protective function. Continuing to operate the equipment without removing the cause of problem will lead to a motor or driver malfunction, resulting in injury or equipment damage.
- Use a specified motor (gearhead) and driver combination. Failure to do so may result in fire, electric shock or equipment damage.
- The driver is Class I equipment. When installing the driver, ground its Protective Earth Terminals. Failure to do so may result in electric shock.
- Install the driver in an enclosure. Failure to do so may result in electric shock or injury.
- Securely connect the cables in accordance with the connection examples. Failure to do so may result in fire or electric shock.
- Be sure to observe the specified cable sizes. Use of unspecified cable sizes may result in fire.
- Observe the specified screw tightening torque when connecting terminals to the terminal block. Failure to do so may result in 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.
- When using the electromagnetic brake motor, do not turn the MB-FREE input ON while a load is held in vertical direction. Otherwise, the holding power of the motor and electromagnetic brake will be lost, 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 using a **OPX-2A**, **MEXE02** or RS-485 communication, the load may fall. This may result in injury or damage to equipment.
- 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 measuring insulation resistance or performing a dielectric strength test. Accidental contact 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.
- Do not disassemble or modify the driver. Doing so may result in electric shock, injury or equipment damage. Should you require inspection or repair of internal parts, please contact the Oriental Motor branch or sales office from which you purchased the product.

⚠CAUTION

- Do not use the product in conditions exceeding the motor (gearhead) or driver specifications. Doing so may result in electric shock, fire, 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) or driver while operating or immediately after stopping. The surface of the motor (gearhead) or driver may be hot and cause a skin burn(s).
- Do not place around the driver any object blocking the air flow. Doing so may result in equipment damage.
- Be sure to ground the motor and driver to prevent them from being damaged by static electricity. Failure to do so may result in fire or damage to equipment.
- Use a 24 VDC power supply with reinforced insulation on its primary and secondary sides. Failure to do so may result in electric shock.
- 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 running and turn off the driver power. Failure to do so may result in fire, electric shock or injury.
- Use an insulated screwdriver to adjust the switches in the driver. Failure to do so may result in electric shock.

■ 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 explains the restrictions and other items you should take heed of when using the **BLE** Series FLEX RS-485 communication type.

- Connect protective devices to the power line

  Connect a circuit breaker or earth leakage breaker to the driver's power line to protect the primary circuit. If an earth leakage breaker is to be installed, use one incorporating high-frequency noise elimination measures. Refer to "Preventing leakage current" below for the selection of protective devices.

- Use an electromagnetic brake type for an application involving vertical travel

  When the motor is used in an application involving vertical travel, use an electromagnetic brake type to hold the load 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.

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

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

- 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

- Noise elimination measures

  Provide noise elimination measures to prevent a motor or driver malfunction caused by external noise.
  For more effective elimination of noise, use a shielded I/O signal cable or attach ferrite cores if a non-shielded cable is used. Refer to "2.5 Conformity to the EMC" on p.146 for the noise elimination measures.

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

  The data edit connector (CN3), I/O signal connectors (CN5/CN6) and RS-485 communication connectors (CN7/CN8) are not 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 these equipment and driver to short, damaging both.

- The driver uses semiconductor elements, so be extremely careful when handling them Electrostatic discharge can damage the driver.

  Be sure to ground the motor and driver to prevent them from being damaged by electric shock or static electricity.

- Use a connection cable (sold separately) 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 **EPRC-400P** (sold separately).

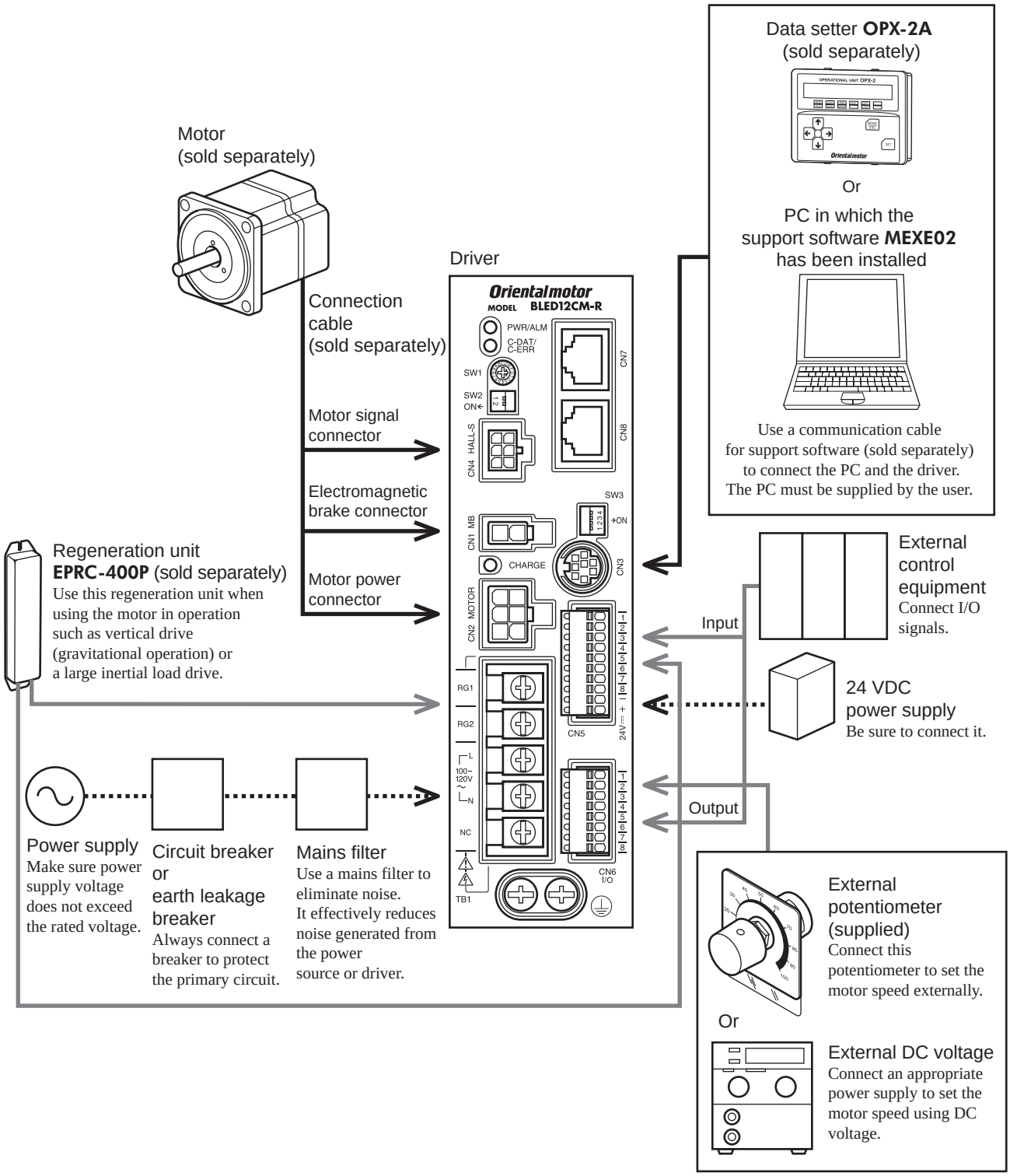
  The driver may be damaged if the regeneration energy generated during vertical drive (gravitational operation) or sudden starting/stopping of a large inertial load exceeds the allowable limit that can be absorbed by the driver.
  The accessory regeneration unit **EPRC-400P** is designed to discharge the regenerated energy, thereby protecting the driver.

- Saving data to the non-volatile memory

  Do not turn off the 24 VDC power supply while writing the data to the non-volatile memory, and also do not turn off within 5 seconds after the completion of writing the data. Doing so may abort writing the data and cause a EEPROM error alarm to generate.
  The non-volatile memory can be rewritten approximately 100,000 times.

5 System configuration

An example of system configuration using the **BLE** Series FLEX RS-485 communication type is shown below. Illustration shows the electromagnetic brake type.



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 nameplate.
Model names for motor and driver combinations are shown on "6.2 Combination tables".

☐ Driver.....1 unit
☐ CN5 connector (10 pins).....1 piece
☐ CN6 connector (8 pins).....1 piece
☐ External potentiometer.....1 piece
☐ Signal cable for external potentiometer [1 m (3.3 ft.)].....1 piece
☐ Instructions and Precautions for Safe Use.....1 copy

6.2 Combination tables

☐ in the model names indicates a number representing the gear ratio.

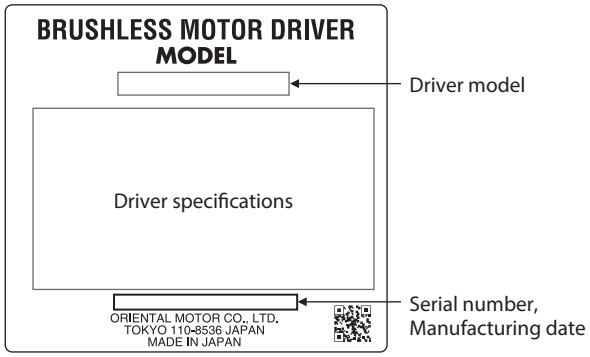
Type	Output power	Power supply voltage	Driver model	Applicable motor	
				Motor model	Gearhead model
Pinion shaft type/ parallel shaft gearhead	30 W	Single-phase 100-120 V	**BLED3AM-R**	**BLEM23-GFS**	**GFS2G☐**
		Single-phase 200-240 V Three-phase 200-240 V	**BLED3CM-R**		
	60 W	Single-phase 100-120 V	**BLED6AM-R**	**BLEM46-GFS**	**GFS4G☐**
		Single-phase 200-240 V Three-phase 200-240 V	**BLED6CM-R**		
	120 W	Single-phase 100-120 V	**BLED12AM-R**	**BLEM512-GFS**	**GFS5G☐**
		Single-phase 200-240 V Three-phase 200-240 V	**BLED12CM-R**		
Pinion shaft type/ hollow shaft flat gearhead	30 W	Single-phase 100-120 V	**BLED3AM-R**	**BLEM23-GFS**	**GFS2G☐ FR**
		Single-phase 200-240 V Three-phase 200-240 V	**BLED3CM-R**		
	60 W	Single-phase 100-120 V	**BLED6AM-R**	**BLEM46-GFS**	**GFS4G☐ FR**
		Single-phase 200-240 V Three-phase 200-240 V	**BLED6CM-R**		
	120 W	Single-phase 100-120 V	**BLED12AM-R**	**BLEM512-GFS**	**GFS5G☐ FR**
		Single-phase 200-240 V Three-phase 200-240 V	**BLED12CM-R**		
Round shaft type	30 W	Single-phase 100-120 V	**BLED3AM-R**	**BLEM23-A**	–
		Single-phase 200-240 V Three-phase 200-240 V	**BLED3CM-R**		
	60 W	Single-phase 100-120 V	**BLED6AM-R**	**BLEM46-A**	
		Single-phase 200-240 V Three-phase 200-240 V	**BLED6CM-R**		
	120 W	Single-phase 100-120 V	**BLED12AM-R**	**BLEM512-A**	
		Single-phase 200-240 V Three-phase 200-240 V	**BLED12CM-R**		

■ Electromagnetic brake type

Type	Output power	Power supply voltage	Driver model	Applicable motor	
				Motor model	Gearhead model
Pinion shaft type/ parallel shaft gearhead	30 W	Single-phase 100-120 V	**BLED3AM-R**	**BLEM23M2-GFS**	**GFS2G□**
		Single-phase 200-240 V Three-phase 200-240 V	**BLED3CM-R**		
	60 W	Single-phase 100-120 V	**BLED6AM-R**	**BLEM46M2-GFS**	**GFS4G□**
		Single-phase 200-240 V Three-phase 200-240 V	**BLED6CM-R**		
	120 W	Single-phase 100-120 V	**BLED12AM-R**	**BLEM512M2-GFS**	**GFS5G□**
		Single-phase 200-240 V Three-phase 200-240 V	**BLED12CM-R**		
Pinion shaft type/ hollow shaft flat gearhead	30 W	Single-phase 100-120 V	**BLED3AM-R**	**BLEM23M2-GFS**	**GFS2G□ FR**
		Single-phase 200-240 V Three-phase 200-240 V	**BLED3CM-R**		
	60 W	Single-phase 100-120 V	**BLED6AM-R**	**BLEM46M2-GFS**	**GFS4G□ FR**
		Single-phase 200-240 V Three-phase 200-240 V	**BLED6CM-R**		
	120 W	Single-phase 100-120 V	**BLED12AM-R**	**BLEM512M2-GFS**	**GFS5G□ FR**
		Single-phase 200-240 V Three-phase 200-240 V	**BLED12CM-R**		
Round shaft type	30 W	Single-phase 100-120 V	**BLED3AM-R**	**BLEM23M2-A**	–
		Single-phase 200-240 V Three-phase 200-240 V	**BLED3CM-R**		
	60 W	Single-phase 100-120 V	**BLED6AM-R**	**BLEM46M2-A**	
		Single-phase 200-240 V Three-phase 200-240 V	**BLED6CM-R**		
	120 W	Single-phase 100-120 V	**BLED12AM-R**	**BLEM512M2-A**	
		Single-phase 200-240 V Three-phase 200-240 V	**BLED12CM-R**		

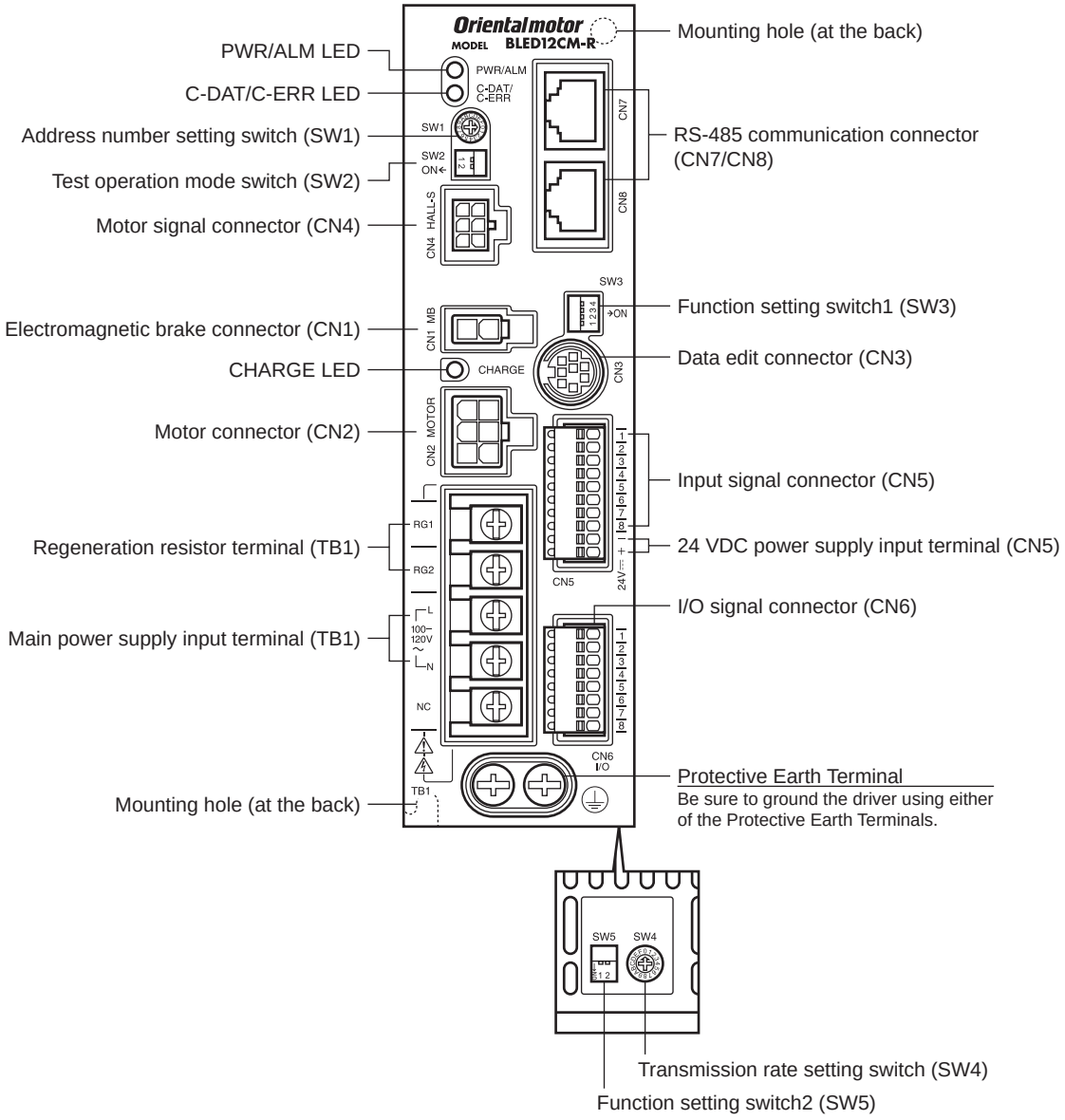
6.3 Information about nameplate

The figure shows an example.



memo The position describing the information may vary depending on the product.

6.4 Names and functions of parts



Name	Description	Ref.
PWR/ALM LED	PWR (Green): This LED is lit while the 24 VDC power is input.	–
	ALM (Red): This LED will blink when an alarm generates. It is possible to check the generated alarm by counting the number of times the LED blinks.	p.133
C-DAT/C-ERR LED	C-DAT (Green): This LED will blink or illuminate steadily when the driver is communicating with the master station properly via RS-485 communication.	–
	C-ERR (Red): This LED will illuminate when the RS-485 communication error occurs with the master station.	
CHARGE LED (Red)	This LED is lit while the main power is input. After the main power has been turned off, the LED will turn off once the residual voltage in the driver drops to a safe level.	
Address number setting switch (SW1)	Use this switch when controlling the system via RS-485 communication. Using this switch in combination with the SW5-No.1 of the function setting switch2, the address number of RS-485 communication can be set. Factory setting: 0	p.71 p.103 p.115

Name	Description	Ref.
Test operation mode switch (SW2)	SW2-No.1: This switch is used to check the connection between the motor and driver before establishing a communication. When having connected properly, setting the SW2-No.1 to the ON side causes the motor to rotate at low speed in the forward direction. Factory setting: OFF	p.29
	SW2-No.2: Not used. (Keep this switch OFF.)	–
Function setting switch1 (SW3)	• SW3-No.1: Not used. (Keep this switch OFF.) • SW3-No.2: Not used. (Keep this switch OFF.)	
	• SW3-No.3: This switch is used to select the power supply for I/O signals (use the built-in power supply or external power supply). To control the operation using relays and switches, set the SW3-No.3 to the ON side to select the built-in power supply. Factory setting: OFF	p.24
	• SW3-No.4: Use this switch when controlling the system via RS-485 communication. The termination resistor (120 Ω) of RS-485 communication can be set. Factory setting: OFF	p.71 p.103 p.115
Transmission rate setting switch (SW4)	Use this switch when controlling the system via RS-485 communication. The transmission rate of RS-485 communication can be set. Factory setting: 7	
Function setting switch2 (SW5)	Use this switch when controlling the system via RS-485 communication. • SW5-No.1: Using this switch in combination with the address number setting switch (SW1), the address number of RS-485 communication can be set. Factory setting: OFF • SW5-No.2: The protocol of RS-485 communication can be set. Factory setting: OFF	
Electromagnetic brake connector (CN1)	Connects the electromagnetic brake connector. (Electromagnetic brake type only)	p.23
Motor connector (CN2)	Connects the motor power connector.	
Data edit connector (CN3)	Connects a PC in which the **MEXE02** has been installed, or the **OPX-2A**.	p.28
Motor signal connector (CN4)	Connects the motor signal connector.	p.23
Input signal connector (CN5)	Connects the input signals.	p.24
24 VCD power input terminals (CN5)	Connects the control power supply of the driver. +: +24 VDC power supply input −: Power supply GND [This is shared with the common wire of input signals (0 V)]	p.24
I/O signal connector (CN6)	• Connects the external potentiometer (supplied) or external DC power supply. • Connects the output signals.	p.24
RS-485 communication connectors (CN7/CN8)	Connects the RS-485 communication cable.	p.28
Regeneration resistor terminal (TB1)	Connects an accessory regeneration unit **EPRC-400P** (sold separately).	p.29
Main power supply input terminal (TB1)	Connects to 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.22
Protective Earth Terminal	Ground this terminal using a grounding wire of AWG18 to 14 (0.75 to 2.0 mm^2).	p.22
Mounting holes (two locations at the back)	These mounting holes are used to install the driver with screws (M4).	p.18

1 Entry

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.

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1 Installation

This chapter explains the installation location and installation methods of the motor and driver, as well as how to install a load and external potentiometer.

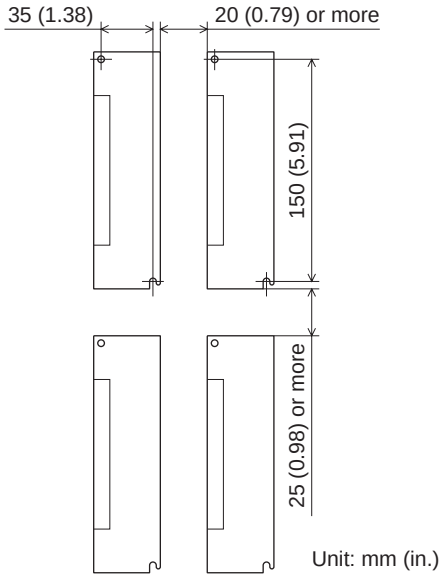
1.1 Installation location

The motor and driver are designed and manufactured for use as a component to be installed inside 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)
- Ambient temperature: 0 to +50 °C (+32 to +122 °F) (non-freezing)
- Ambient humidity: 85% or less (non-condensing)
- Area not exposed to direct sun
- Area free of excessive amount of dust, iron particles or the like
- Area free of excessive salt
- Area that is free of explosive atmosphere or toxic gas (such as sulfuric gas) or liquid
- Area not subject to splashing water (rain, water droplets), oil (oil droplets) or other liquids
- Area not subject to continuous vibration or excessive shocks
- Area free of excessive electromagnetic noise (from welders, power machinery, etc.)
- Area free of radioactive materials, magnetic fields or vacuum
- Altitude Up to 1000 m (3300 ft.) above sea level

1.2 Installing the driver

The driver is designed so that heat is dissipated via air convection and conduction through the enclosure. Install the driver to a flat metal plate offering excellent vibration resistance.
When two or more drivers are 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.

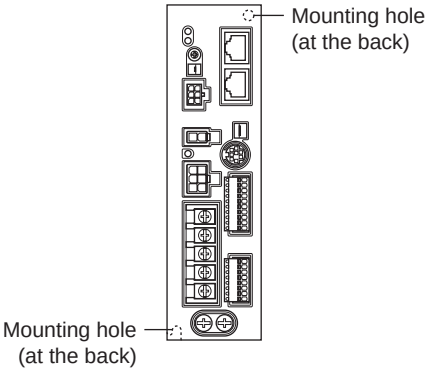


Note

- Install the driver in an enclosure whose degree of protection is IP54 minimum if the driver is used in an environment of pollution degree 3.
- Be sure to install the driver vertically (in vertical position) shown in the figure. Do not block the radiation openings.
- Do not install any equipment that generates a large amount of heat or noise near the driver.
- If the ambient temperature of the driver exceeds the upper limit of the operating ambient temperature, revise the ventilation condition or forcibly cool the area around the driver using a fan in order to keep within the operating ambient temperature.

■ Installing with screws

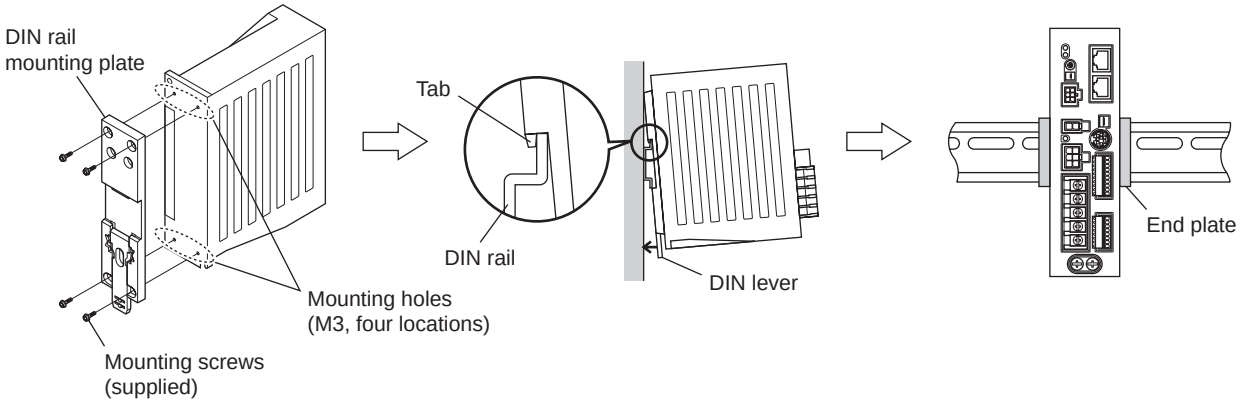
Install the driver vertically (in vertical position) and secure the driver through the mounting holes using two screws (M4: not supplied).



■ Mounting to DIN rail

When mounting the driver to a DIN rail, use a separately sold DIN rail mounting plate (model number: **PADP03**) and attach it to a 35 mm (1.38 in.) wide DIN rail.

1. Attach the DIN rail mounting plate to the back of the driver using the screws supplied with the plate.
   Tightening torque: 0.3 to 0.4 N·m (2.6 to 3.5 lb-in)
2. Pull the DIN lever down, engage the upper tab of the DIN rail mounting plate over the DIN rail, and push the DIN lever until it locks in place.
3. Fix the driver with the end plate (not suupplied).

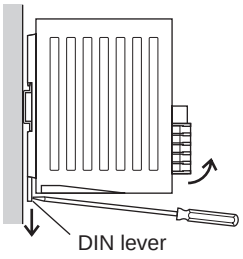


Note

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

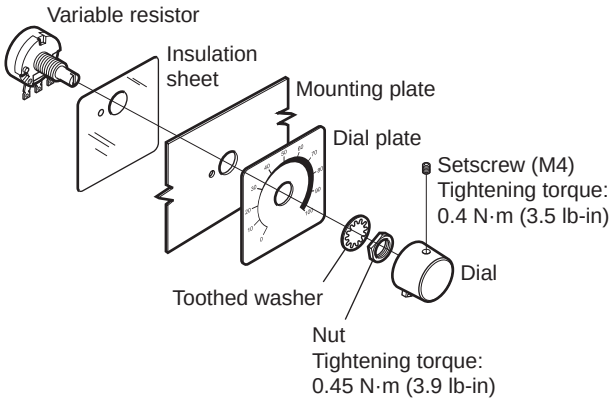
Removing from DIN rail

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

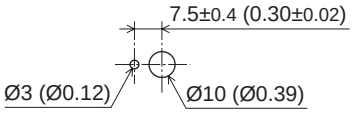


1.3 Installing the external potentiometer (supplied)

Install the external potentiometer as shown below.

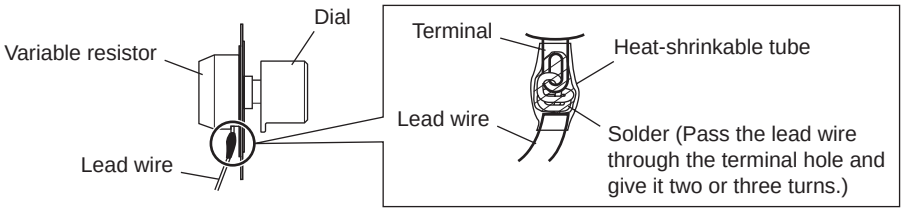


• Reference mounting hole dimensions
[Unit: mm (in.)]



Soldering the variable resister terminal and the lead wires

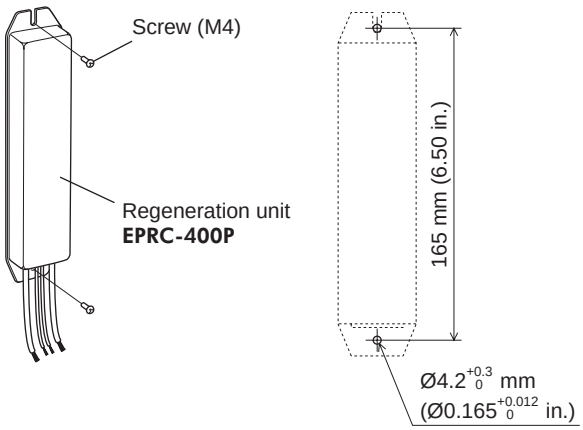
Cover a heat-shrinkable tube over the soldered part to insulate.
Soldering condition: 235 °C (455 °F), less than 5 sec.



1.4 Installing the regeneration unit (sold separately)

Install the regeneration unit **EPRC-400P** in a location where heat dissipation capacity equivalent to a level achieved with a heat sink [made of aluminum alloy, 350×350×3 mm (13.78×13.78×0.12 in.)] is ensured. Secure it on a smooth metal plate offering high heat conductivity, using two screws (M4, not supplied).

• Mounting hole dimension

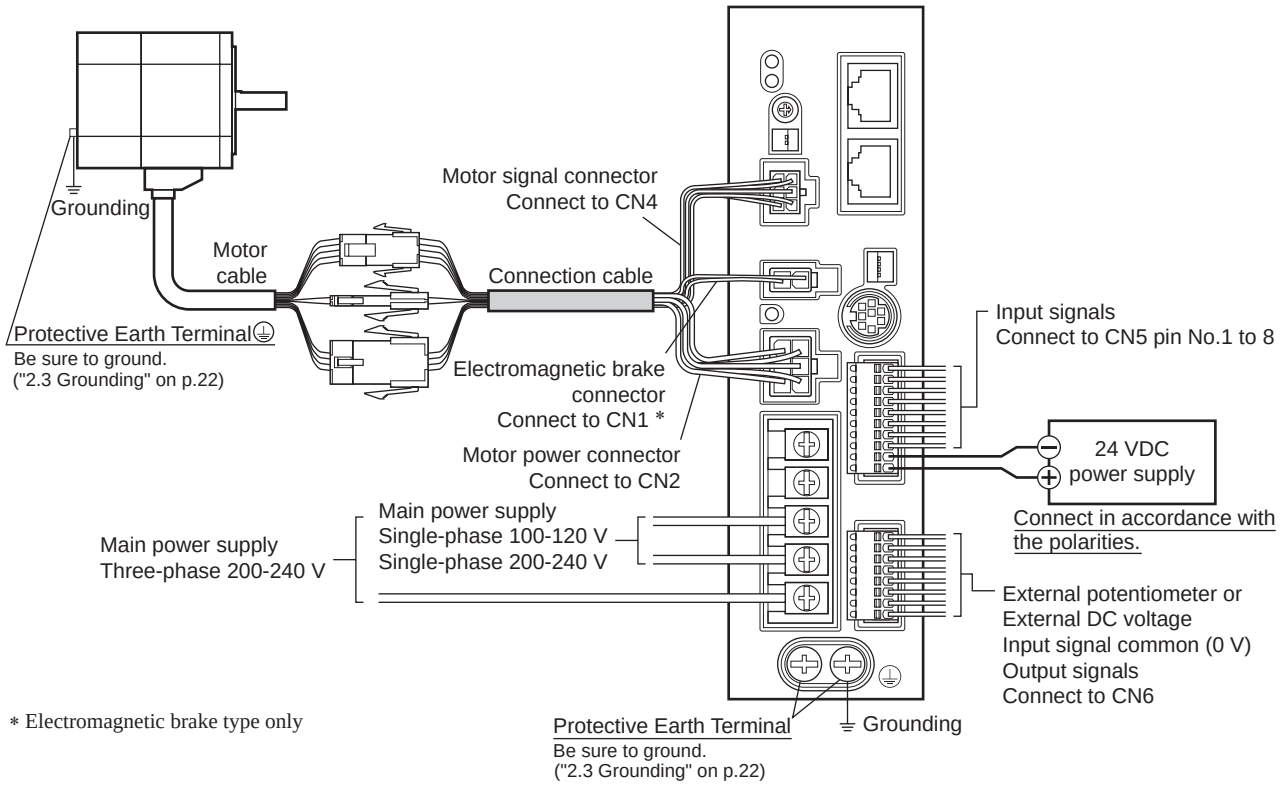


2 Connection

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

2.1 Connection example

The following figure is a connection example when an electromagnetic brake motor is used.



∗ Electromagnetic brake type only

Note

- Have the connector plugged in securely. Insecure connections may cause malfunction or damage to the motor or driver.
- When connecting the 24 VDC power supply, check the indication of the driver case and pay attention to the polarity of the power supply. Reverse-polarity connection may cause damage to the driver.
- When unplugging the connector, do so while pressing the latches on the connector.
- When cycle 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.
- Do not wire the power supply cable of the driver in the same cable duct with other power lines or motor cables. Doing so may cause malfunction due to noise.
- When installing the motor to a moving part, use an accessory flexible cable (sold separately) offering excellent flexibility. For the flexible motor cable, refer to p.150.

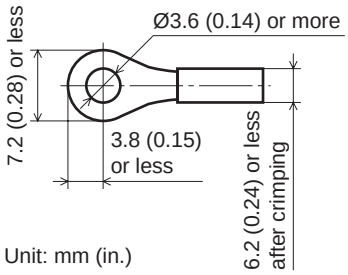
2.2 Connecting the power supply

Connect the power cable to the main power supply input terminals (TB1) on the driver.
The product does not come with a power cable. It must be supplied by the user.

Power supply input	Connecting method
Single-phase 100-120 V	Connect the live side to terminal L, and the neutral side to terminal N.
Single-phase 200-240 V	Connect the live side to terminal L1, and the neutral side to terminal L2.
Three-phase 200-240 V	Connect the R, S and T phase lines to the L1, L2 and L3 terminals, respectively.

Power connection terminal and cable

- Applicable crimp terminal: Round crimp terminal with insulation cover
- Thread size of terminal: M3.5
- Tightening torque: 1.0 N·m (8.8 lb-in)
- Applicable lead wire: AWG18 to 14 (0.75 to 2.0 mm^2)
- Conductive material: Use only copper wire.



Unit: mm (in.)

■ Circuit breaker

Be sure to connect a circuit breaker to the power line of the driver to protect the primary circuit.

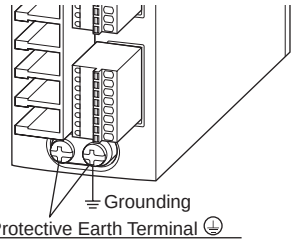
- Rated current of protective device: Single-phase input 10 A, three-phase input 5 A
- Circuit breaker: Mitsubishi Electric Corporation NF30

2.3 Grounding

Note Be sure to ground the motor and driver. Failure to do so may result in electric shock or damage to the product. Static electricity may cause damage to the product if the Protective Earth Terminals are not grounded.

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 the Protective Earth Terminal, secure the grounding point near the driver.

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

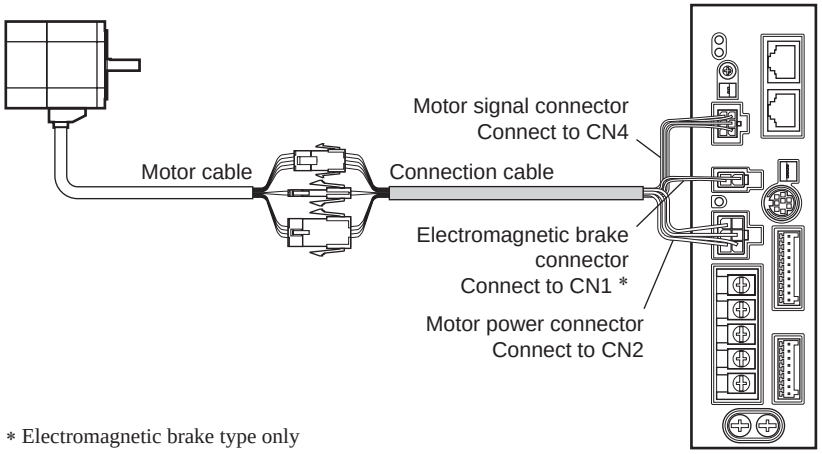


■ Precautions about static electricity

Static electricity may cause the driver to malfunction or suffer damaged.
Be sure to ground the motor and driver to prevent them from being damaged by static electricity.

2.4 Connecting the motor and driver

Connect the motor power connector to the CN2, and the motor signal connector to the CN4 on the driver.
When using an electromagnetic brake type motor, also connect the electromagnetic brake connector to the CN1.
When extending the connection distance between the motor and driver, use the connection cable (sold separately).

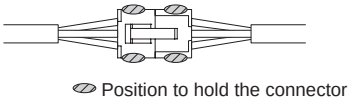


* Electromagnetic brake type only

Note Have the connector plugged in securely. Insecure connector connection may cause malfunction or damage to the motor or driver.

■ Notes about connector connection

Note When inserting connectors or pulling out connectors, be sure to do with holding the connector bodies. Doing with holding the cables may cause a connection failure.

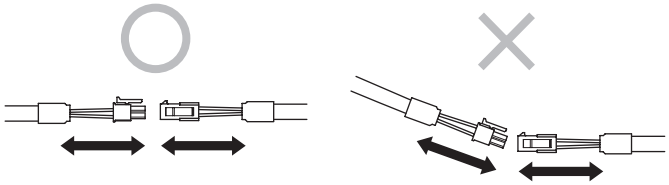


● When inserting the connector

Hold the connector bodies, and insert in straight securely.
Inserting the connector in an inclined state may result in damage to terminals or a connection failure.

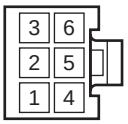
● When pulling out the connector

Pull out the connector in straight while releasing the lock part of the connector.
Pulling out the connector with holding the cable (lead wire) may result in damage to the connector.



- Pin assignment of motor power connector

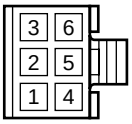
Pin No.	Color	Lead size
1	Blue	AWG18
2	–	–
3	–	Drain (AWG24 or equivalent)
4	Purple	AWG18
5	Gray	
6	–	–



Housing: 5557-06R-210 (Molex)

- Pin assignment of motor signal connector

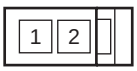
Pin No.	Color	Lead size
1	–	–
2	Green	AWG26
3	Yellow	
4	Brown	
5	Red	
6	Orange	



Housing: 43025-0600 (Molex)
or
794617-6 (TE Connectivity)

- Pin assignment of electromagnetic brake connector

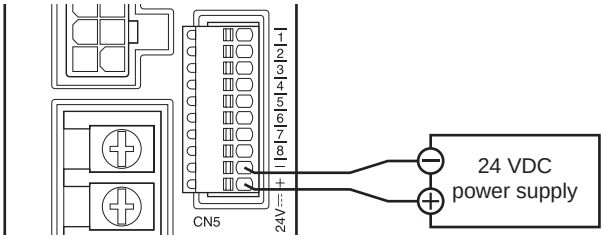
Pin No.	Color	Lead size
1	Black	AWG24
2	White	



Housing: 5557-02R-210 (Molex)

2.5 Connecting the 24 VDC power supply

The 24 VDC power supply is for the control circuit of the driver.
Be sure to connect a power supply which voltage is 24 VDC −15% to +20% and current is 1 A or more, to the CN5.

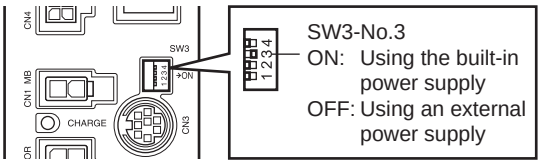


Note

- When connecting the 24 VDC power supply, check the indication of the driver case and pay attention to the polarity of the power supply. Reverse-polarity connection may cause damage to the driver.
- When cycling the 24 VDC power, turn off the power and wait for the PWR/ALM LED to turn off.

2.6 Selecting the input signal power supply

Select the input signal power supply (built-in power supply or external power supply) to be used.
The driver comes with a built-in power supply. To control the operation using relays and switches, set the SW3-No.3 of the function setting switch1 to the ON side to select the built-in power supply.



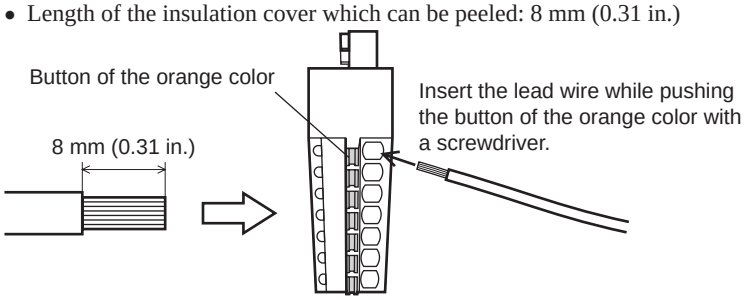
Factory setting: OFF (an external power supply is used)

Note The built-in power supply cannot be used with the source logic. If the source logic is used, do not turn the external voltage selector switch to the ON side.

2.7 Connecting the I/O signals

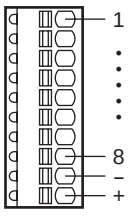
Connect the input signals to the CN5, and connect the analog external speed setting input signals and output signals to the CN6.

- Applicable lead wire: AWG26 to 20 (0.14 to 0.5 mm^2)
- Length of the insulation cover which can be peeled: 8 mm (0.31 in.)



■ CN5 pin assignment

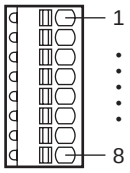
Pin No	Name	Description *
1	IN0	Input terminal 0 [FWD]
2	IN1	Input terminal 1 [REV]
3	IN2	Input terminal 2 [STOP-MODE]
4	IN3	Input terminal 3 [M0]
5	IN4	Input terminal 4 [ALARM-RESET]
6	IN5	Input terminal 5 [MB-FREE]
7	IN6	Input terminal 6 [TH]
8	IN-COM0	Input signal common
–	–	Power supply GND/ Input signal common (0 V)
+	–	24 VDC power supply



* The signal in brackets [ ] is a function that is assigned at the time of shipment. The assignments can be changed using the **OPX-2A** or **MEXE02**, or via RS-485 communication.

■ CN6 pin assignment

Pin No	Name	Description ∗2
1	VH	Analog external speed setting input
2	VM	
3	VL ∗1	
4	IN-COM1	Input signal common (0 V)
5	OUT0+	Output terminal 0 (+) [SPEED-OUT]
6	OUT0−	Output terminal 0 (−) [SPEED-OUT]
7	OUT1+	Output terminal 1 (+) [ALARM-OUT1]
8	OUT1−	Output terminal 1 (−) [ALARM-OUT1]

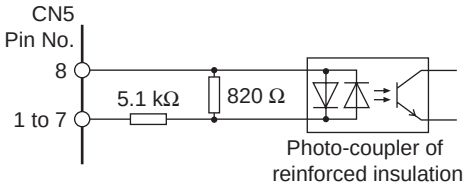


*1 The VL input is connected to IN-COM1 inside the driver.

*2 The signal in brackets [ ] is a function that is assigned at the time of shipment. The assignments can be changed using the **OPX-2A** or **MEXE02**, or via RS-485 communication.

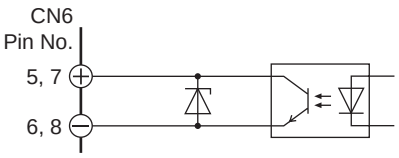
■ Input signal circuit

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



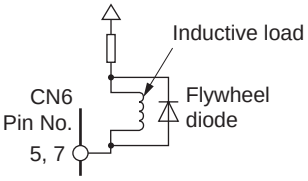
■ Output signal circuit

All output signals of the driver are photocoupler/open-collector outputs. The ON voltage of the output circuit is 1.6 VDC maximum. When driving each element using the output signal circuit, give consideration to this ON voltage.
4.5 to 30 VDC, 40 mA or less (For the SPEED-OUT output, supply at least 5 mA of current.)



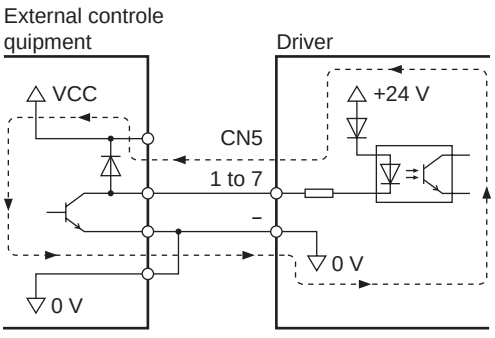
Note

- For output signals, be sure to connect a current-limiting resistor so that the current does not exceed 40 mA.
  When using a programmable controller, check the resistance value inside the controller and connect a currentlimiting resistor as necessary.
- When connecting a relay (inductive load), etc., to detect alarm outputs, use a relay with built-in flywheel diode, or provide a fly-back voltage control measure based on diode, etc., for the inductive load.



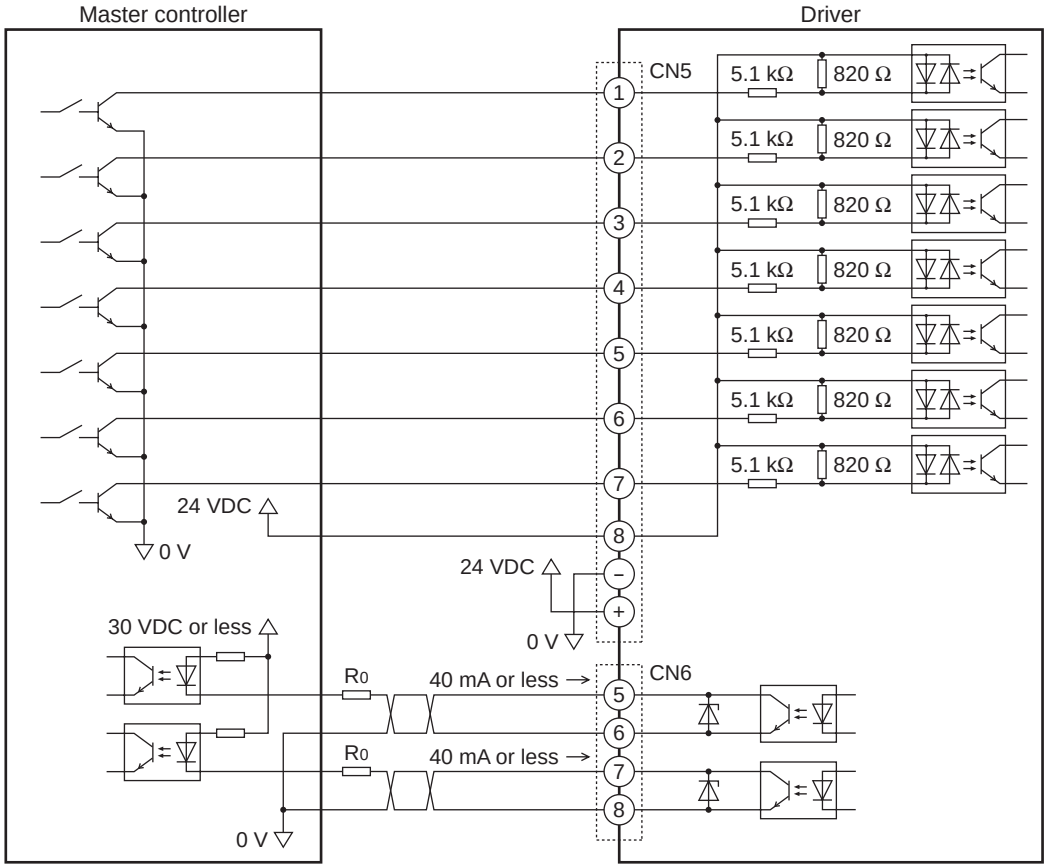
■ Using a controller with a built-in clamp diode

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. When powering up, turn on the controller power first, followed by the driver power.



■ Connection example with I/O signal circuit

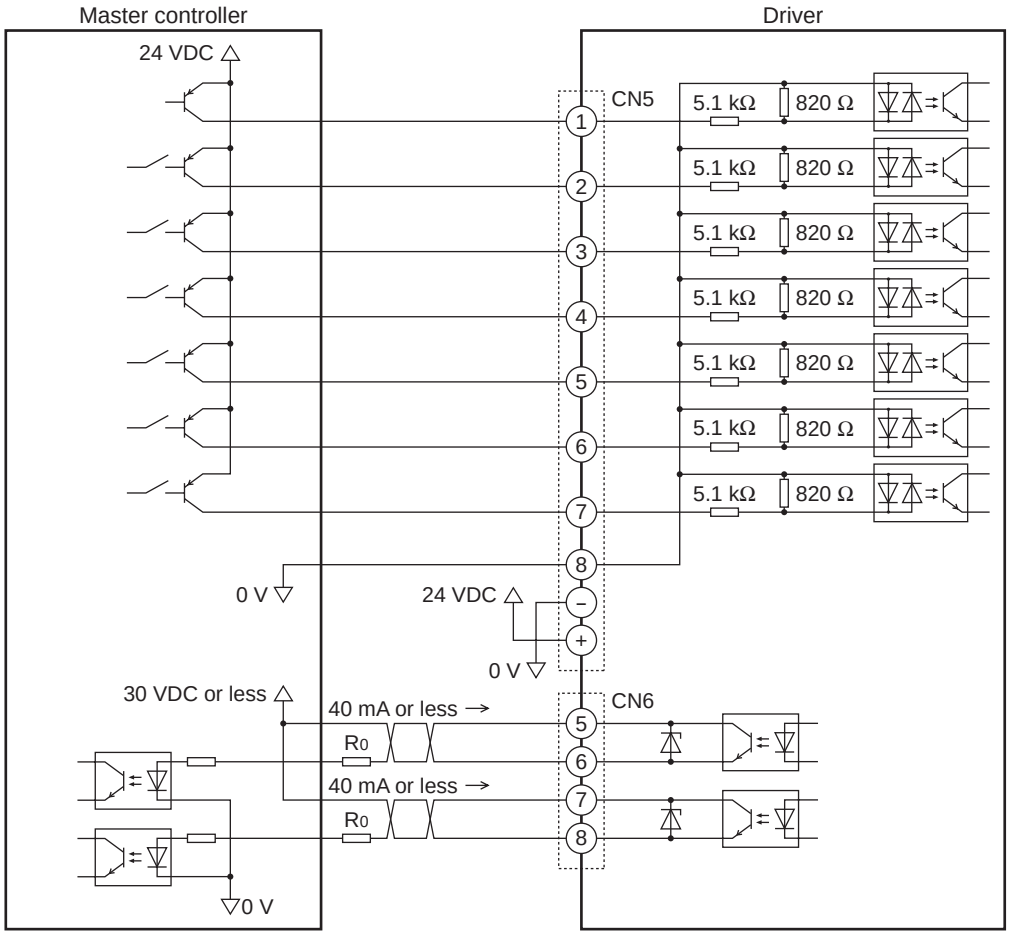
- Sink logic circuit



Note

- Keep the output signal to 30 VDC or less.
- For output signals, be sure to connect a current-limiting resistor R_0 so that the current does not exceed 40 mA.
  When using a programmable controller, check the resistance value inside the controller and connect a currentlimiting resistor R_0 as necessary.

- Source logic circuit



Note

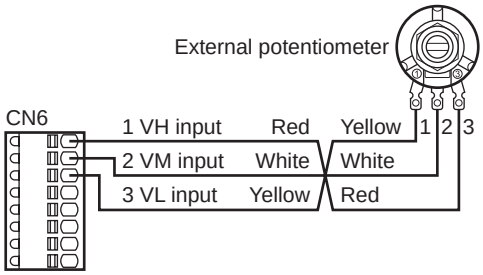
- Keep the output signal to 30 VDC or less.
- For output signals, be sure to connect a current-limiting resistor R_0 so that the current does not exceed 40 mA.
  When using a programmable controller, check the resistance value inside the controller and connect a currentlimiting resistor R_0 as necessary.

2.8 Connecting an external speed setter

The rotation speed can be set using an external potentiometer (supplied) or external DC voltage.
Refer to p.56 for setting method.

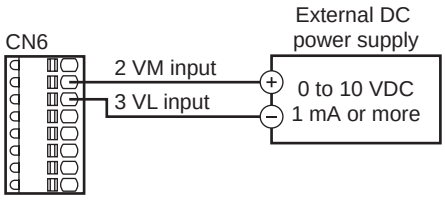
- Using an external potentiometer

Connect the supplied external potentiometer to the pin Nos.1 to 3 of CN6 of the driver. Use the supplied signal wire for this connection.
Connect the shield wire of the signal wire to the VL input terminal. Make sure the shield wire does not contact other terminals.



- Using an external DC voltage

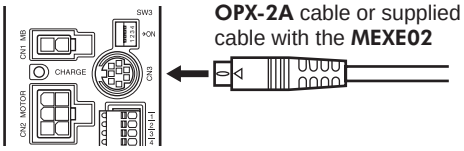
For the external voltage, use a DC power supply (0 to 10 VDC) with reinforced insulation on both the primary side and secondary side, and connect it to the pin Nos. 2 and 3 of CN6 of the driver. The input impedance between the VM input and VL input is approximately 30 kΩ. The VL input is connected to IN-COM1 inside the driver.



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

2.9 Connecting the data setter

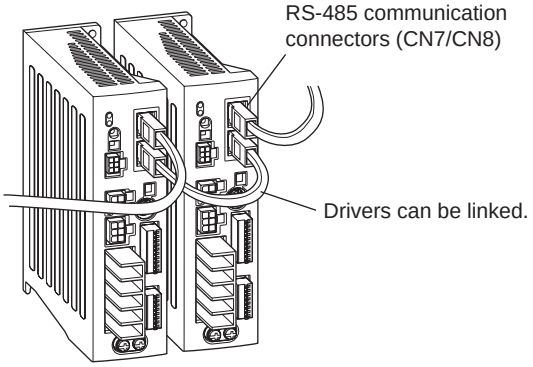
Connect **OPX-2A** cable or supplied cable with the **MEXE02** to CN3 on the driver.



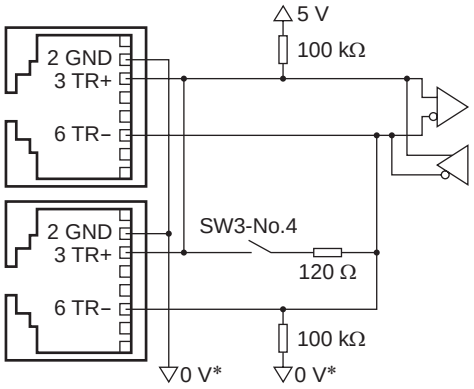
⚠CAUTION The data edit connector (CN3), I/O signal connectors (CN5/CN6) and RS-485 communication connectors (CN7/CN8) are not insulated. When grounding the positive terminal of the power supply, do not connect any equipment (PC, etc.) whose negative terminal is grounded. Doing so may cause the these equipment and driver to short, damaging both.

2.10 Connecting the RS-485 communication cable

Connect this cable when controlling the product via RS-485 communication. Connect the RS-485 communication cable to the CN7 or CN8 on the driver.
The vacant connector can be used to connect a different driver. A driver link cable is available as an accessory (sold separately). See p.150. A commercial LAN cable can be also used to link drivers.



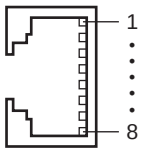
• Internal circuit



* The GND line is used in common with 24 VDC power supply input terminal (CN5).

CN7/CN8 pin assignment

Pin No	Name	Description
1	N.C.	Not used
2	GND	GND
3	TR+	RS-485 communication signal (+)
4	N.C.	Not used
5	N.C.	
6	TR−	RS-485 communication signal (−)
7	N.C.	Not used
8	N.C.	

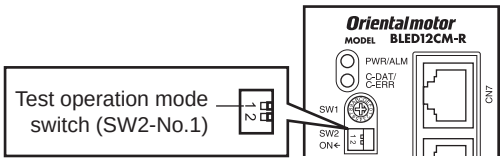


2.11 Test operation

Once a main power supply and 24 VDC power supply are connected, the connection status can be checked by driving the motor tentatively without setting the data.

1. Turn on the main power supply and 24 VDC power supply after completing the wiring.
2. Turn the test operation mode switch (SW2-No.1) ON.
3. Check that the motor rotates at low speed (100 r/min) in the forward direction.
   If the motor did not rotate or malfunction could be seen, check the wiring after turning off the power.

   (If the rotation direction has been changed by the **OPX-2A** or **MEXE02**, or via RS-485 communication, the motor rotates according to the setting.)
4. Turn the test operation mode switch OFF.
   The motor stops.



Note If the FWD input or REV input is turned ON while the motor rotates in test operation, the motor will stop. (A warning or alarm signal is not output.) To reset this condition, turn all of test operation mode switch, FWD input and REV input OFF. The motor will be able to operate after turning all of them OFF.

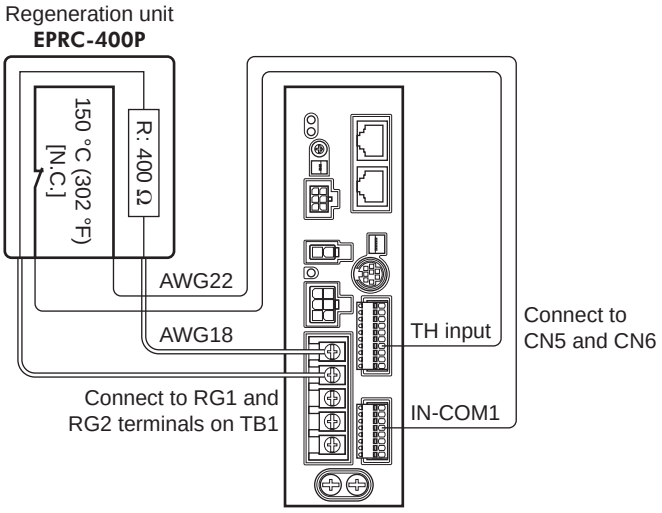
2.12 Connecting the regeneration unit

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 the regeneration unit **EPRC-400P**.
Install the regeneration unit in a location where heat dissipation capacity equivalent to a level achieved with a heat sink [made of aluminum alloy, 350×350×3 mm (13.78×13.78×0.12 in.)] is ensured.

■ Connecting method

The wiring of the regeneration unit to the driver I/O terminals varies depending on the connecting methods.
Refer to p.31, 32, 33 for connecting method.
Connect the regeneration unit before turning on the main power and 24 VDC power. The regeneration unit does not perform its control function if connected after the main power and 24 VDC power has been turned on.

- 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 TB1. The applicable crimp terminal is the same as the one used to connect the power supply. Refer to p.22.
- The two thin lead wires (AWG22: 0.3 mm^2) of the regeneration unit are thermostat outputs. Connect them to CN5 and CN6. Refer to p.24 for connecting method.



Note
- If the current consumption of the regeneration unit exceeds the allowable level, the thermostat will be triggered and a regeneration unit overheat alarm will generate. If a regeneration unit overheat alarm generates, turn off the power and check the content of the error.
- 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.

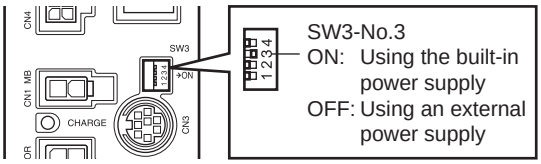
■ Regeneration unit specifications

Model	**EPRC-400P**
Continuous regenerative power	100 W
Resistance	400 Ω
Operating temperature of thermostat	Operation: Opens at 150±7 °C (302±45 °F) Reset: Closes at 145±12 °C (293±54 °F) (normally closed)
Electrical rating of thermostat	120 VAC 4 A, 30 VDC 4 A (minimum current: 5 mA)

2.13 Connection diagram (example)

Each connection diagram (example) is for the electromagnetic brake type. In the case of the standard type, there are no connection for the electromagnetic brake and no connection/input for the MB-FREE input signal.

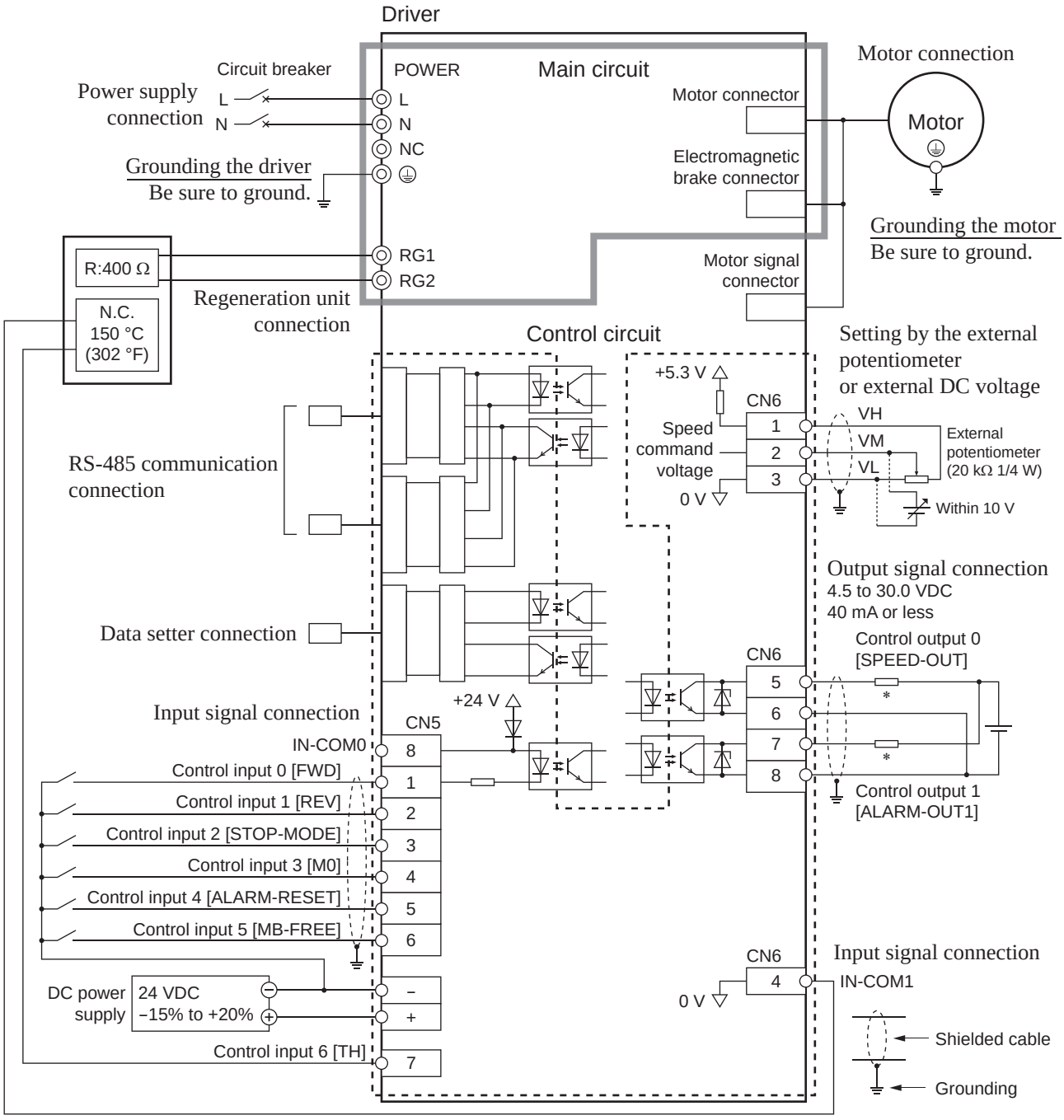
To use the built-in power supply, set the SW3-No.3 of the function setting switch switch1 to the ON side.
The factory setting is OFF (an external power supply is used). To use an external power supply, the factory setting need not be changed.



■ Sink logic

- 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 external potentiometer or external DC voltage, and the motor is operated with relays, switches and other contact switches. For the SPEED-OUT output, supply at least 5 mA of current.

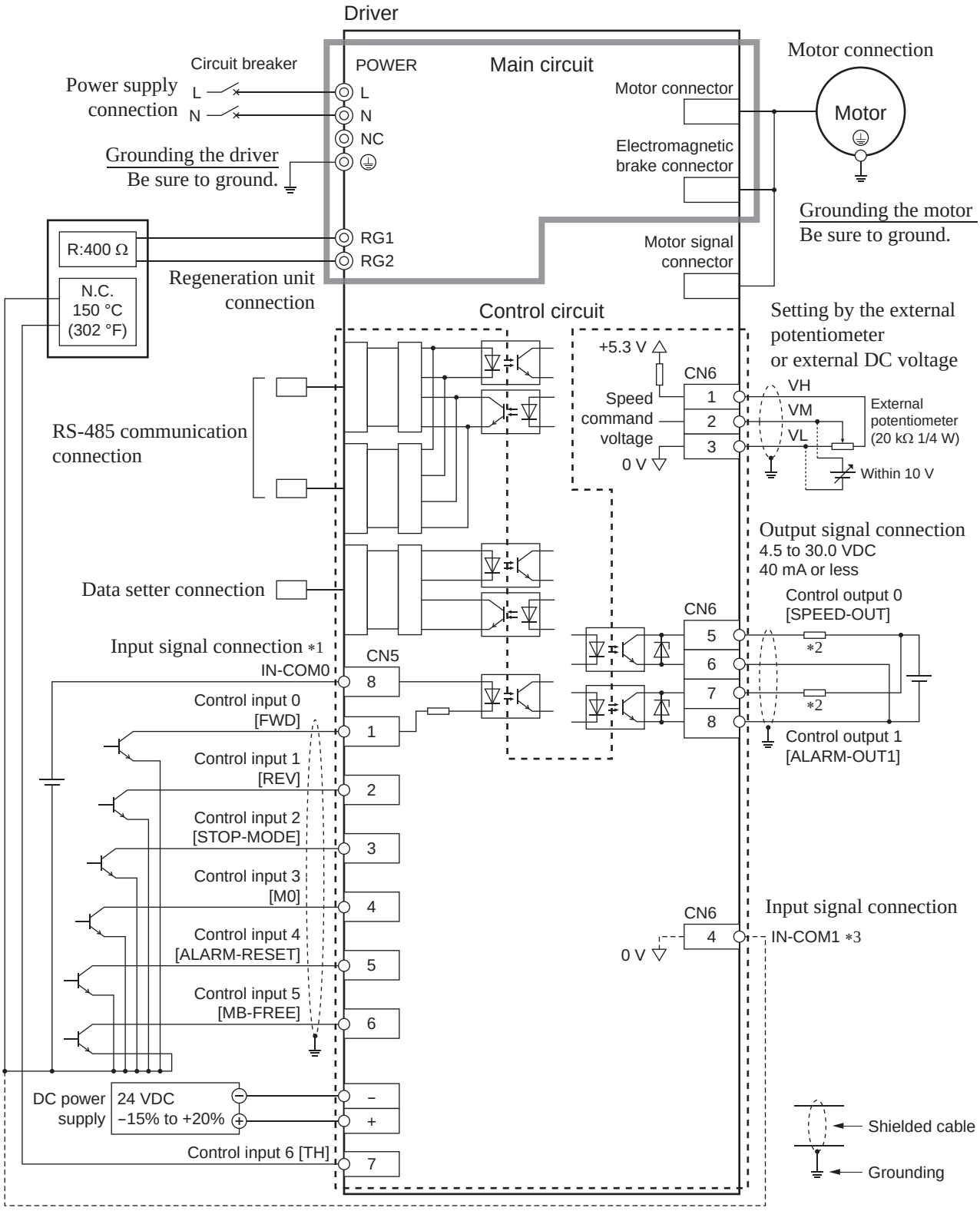


* Recommended resistance 24 VDC: 680 Ω to 4.7 kΩ (2 W) 5 VDC: 150 Ω to 1.0 kΩ (0.5 W)

Note Be sure to ground the motor and driver. Failure to do so may result in electric shock or damage to the product. Static electricity may cause damage to the product if the Protective Earth Terminals are not grounded.

- Using an 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 external potentiometer or external DC voltage, and the motor is operated with sequence connection of transistor type. For the SPEED-OUT output, supply at least 5 mA of current.

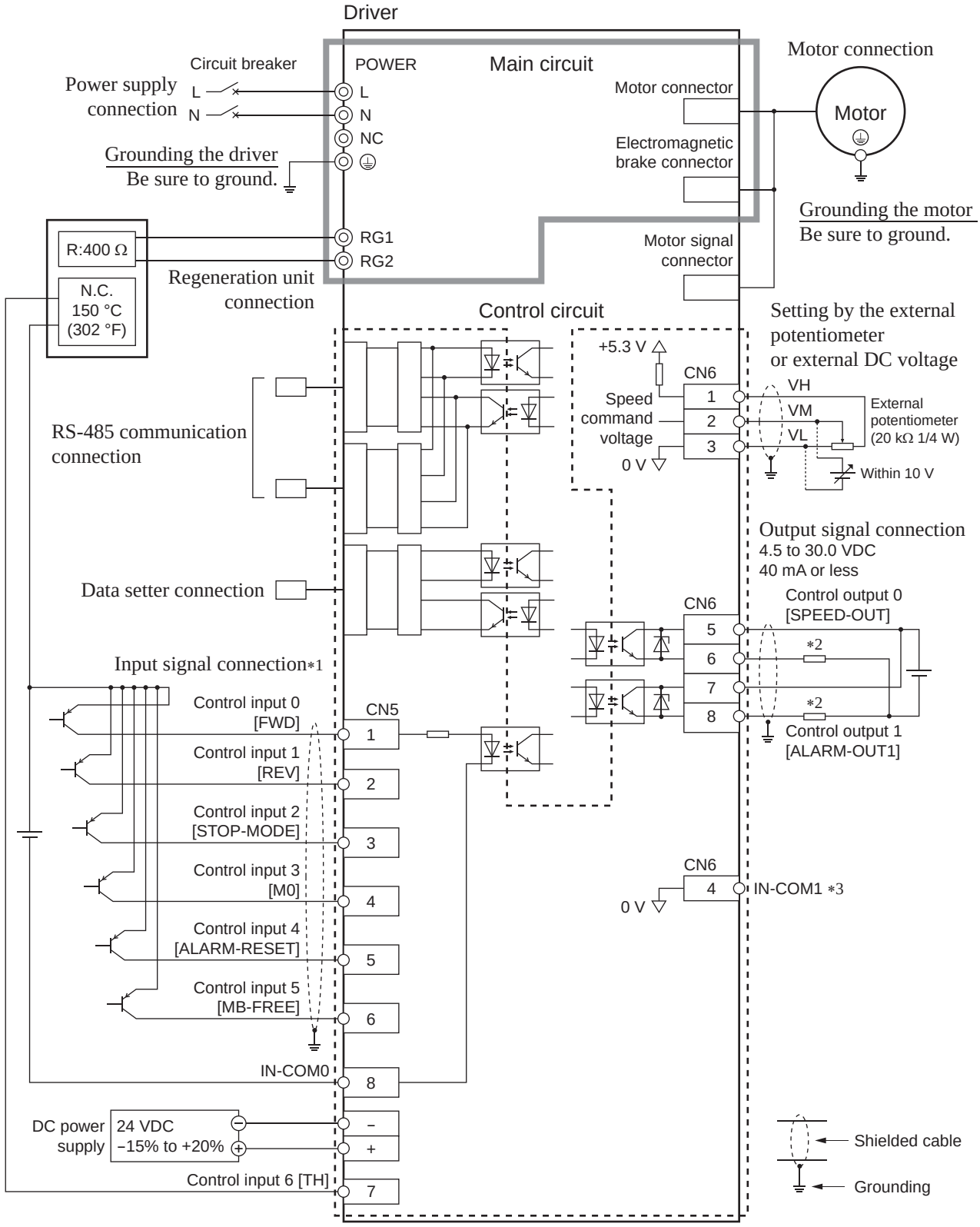


*1 Turn on the external power supply before turning on the driver main power supply.
*2 Recommended resistance 24 VDC: 680 Ω to 4.7 kΩ (2 W) 5 VDC: 150 Ω to 1.0 kΩ (0.5 W)
*3 When connecting one of the lead wires of the thermostat output to the IN-COM1, connect it in common with a GND of the external power supply.

Note Be sure to ground the motor and driver. Failure to do so may result in electric shock or damage to the product.
Static electricity may cause damage to the product if the Protective Earth Terminals are not grounded.

■ Source logic

This is a connection example that the power supply is single-phase 100-120 VAC, the rotation speed is set using an external potentiometer or external DC voltage, and the motor is operated with sequence connection of transistor type. For the SPEED-OUT output, supply at least 5 mA of current.



*1 Turn on the external power supply before turning on the driver main power supply.
*2 Recommended resistance 24 VDC: 680 Ω to 4.7 kΩ (2 W) 5 VDC: 150 Ω to 1.0 kΩ (0.5 W)
*3 When connecting one of the lead wires of the thermostat output to the IN-COM1, connect it in common with a GND of the external power supply.

Note Be sure to ground the motor and driver. Failure to do so may result in electric shock or damage to the product.
Static electricity may cause damage to the product if the Protective Earth Terminals are not grounded.

3 Explanation of I/O signals

In this manual, I/O signals are described as follows.
- Direct I/O: I/O signals accessed via input signal connector (CN5) and I/O signal connector (CN6)
- Network I/O: I/O signals accessed via RS-485 communication

Set the following parameters using any of the **OPX-2A**, **MEXE02** or RS-485 communication.

3.1 Assignment of direct I/O

■ Assignment to the input terminals

The input signals shown below can be assigned to the input terminals IN0 to IN6 of CN5 by setting parameters. For details on input signals, refer to p.40.

Input terminal	Initial value
IN0	1: FWD
IN1	2: REV
IN2	19: STOP-MODE
IN3	48: M0

Input terminal	Initial value
IN4	24: ALARM-RESET
IN5	20: MB-FREE
IN6	22: TH

Assignment No.	Signal name	Function
0	Not used	Set when the input terminal is not used.
1	FWD	Rotate the motor in the forward direction.
2	REV	Rotate the motor in the reverse direction.
19	STOP-MODE	Select instantaneous stop or deceleration stop.
20	MB-FREE	Release the electromagnetic brake.
21	EXT-ERROR	Stop the motor (normally closed).
22	TH	
24	ALARM-RESET	Reset of the present alarm.
27	HMI	Release of the function limitation of the **OPX-2A** or **MEXE02** (normally closed).
32	R0	General signals Use these signals when controlling the system via RS-485 communication.
33	R1	
34	R2	
35	R3	
36	R4	
37	R5	
38	R6	
39	R7	
40	R8	
41	R9	
42	R10	
43	R11	
44	R12	
45	R13	
46	R14	
47	R15	
48	M0	Select the operation data No. using these four bits.
49	M1	
50	M2	
51	M3	
54	TL	Disable the torque limiting. (normally closed).

Related parameters

Parameter name	Description	Initial value
IN0 function select	Assigns the input signals to the input terminal IN0 to IN6. See the table on the previous page for the assignment number and corresponding signal.	1: FWD
IN1 function select		2: REV
IN2 function select		19: STOP-MODE
IN3 function select		48: M0
IN4 function select		24: ALARM-RESET
IN5 function select		20: MB-FREE
IN6 function select		22: TH

Note

- Do not assign the same input signal to multiple input terminals. When the same input signal is assigned to multiple input terminals, the function will be executed if any of the terminals becomes active.
- The ALARM-RESET input will be executed when turning from ON to OFF.
- When the HMI input and TL input are not assigned to the input terminals, these inputs will be always set to ON. When assigning them to multiple terminals (including direct I/O and network I/O), the function will be executed when all terminals are set to ON.

■ Changing the logic level setting of input signals

You can change the logic level setting for input terminals IN0 to IN6 using the parameter.

Related parameters

Parameter name	Description	Initial value
IN0 contact configuration	Changes the logic level setting for the input terminal IN0 to IN6. 0: Normally open 1: Normally closed	0
IN1 contact configuration		
IN2 contact configuration		
IN3 contact configuration		
IN4 contact configuration		
IN5 contact configuration		
IN6 contact configuration		

■ Assignment to the output terminals

The output signals shown below can be assigned to the output terminals OUT0 and OUT1 of CN6 by setting parameters. For details on output signals, refer to p.42.

Output terminal	Initial value
OUT0	85: SPEED-OUT
OUT1	65: ALARM-OUT1

Assignment No.	Signal name	Function
0	Not used	Set when the output terminal is not used.
1	FWD_R	Output in response to the FWD input.
2	REV_R	Output in response to the RVS input.
19	STOP-MODE_R	Output in response to the STOP-MODE input.
20	MB-FREE_R	Output in response to the MB-FREE input.
27	HMI_R	Output in response to the HMI input.
32	R0	Output the status of the general signals R0 to R15.
33	R1	
34	R2	
35	R3	
36	R4	
37	R5	
38	R6	
39	R7	
40	R8	
41	R9	
42	R10	
43	R11	
44	R12	
45	R13	
46	R14	
47	R15	
48	M0_R	Output in response to the M0 to M3 inputs.
49	M1_R	
50	M2_R	
51	M3_R	
54	TL_R	Output in response to the TL input.
65	ALARM_OUT1	Output the alarm status of the driver (normally closed).
66	WNG	Output the warning status of the driver.
68	MOVE	Output while the motor operates.
71	TLC	Output when the motor torque reaches the torque limiting value.
77	VA	Output when the motor speed reaches the setting value.
80	S-BSY	Output when the driver is in internal processing state.
81	ALARM-OUT2	Output when the overload warning detection level is exceeded. Output when the overload alarm generates. (normally closed)
82	MPS	Output the ON-OFF state of the main power supply.
84	DIR	Output the rotation direction of motor shaft.
85	SPEED-OUT	30 pulses are output with each revolution of the motor output shaft.

Related parameters

Parameter name	Description	Initial value
OUT0 function select	Assigns the output signals to the output terminals OUT0 and OUT1. See the table above for the assignment number and corresponding signal.	85: SPEED-OUT
OUT1 function select		65: ALARM-OUT1

3.2 Assignment of network I/O

Assign the I/O function via RS-485 communication.

■ Assignment of input signals

The input signals shown below can be assigned to the NET-IN0 to NET-IN15 of network I/O by setting parameters. See each command description for the assignments of the NET-IN0 to NET-IN15.

Assignment No.	Signal name	Function	Setting range
0	Not used	Set when the input terminal is not used.	–
1	FWD	Rotate the motor to FWD direction.	0: Stop 1: Operation
2	REV	Rotate the motor to REV direction.	
19	STOP-MODE	Select instantaneous stop or deceleration stop.	0: Instantaneous stop 1: Deceleration stop
20	MB-FREE	Release the electromagnetic brake.	0: Electromagnetic brake hold 1: Electromagnetic brake release
27	HMI	Release of the function limitation of the **OPX-2A** or **MEXE02** (normally closed).	0: Function limitation 1: Function limitation release
32	R0	General signals Use these signals when controlling the system via RS-485 communication.	0: OFF 1: ON
33	R1		
34	R2		
35	R3		
36	R4		
37	R5		
38	R6		
39	R7		
40	R8		
41	R9		
42	R10		
43	R11		
44	R12		
45	R13		
46	R14		
47	R15		
48	M0	Select the operation data No. using these four bits.	0: OFF 1: ON (Operation data No.0 to 15 can be selected.)
49	M1		
50	M2		
51	M3		
54	TL	Disable the torque limiting. (normally closed).	0: Torque limiting disable 1: Torque limiting enable

Related parameters

Parameter name	Description	Initial value
NET-IN0 function select	Assigns the input signals to the NET-IN0 to NET-IN15. See the table on the previous page for the assignment number and corresponding signal.	48: M0
NET-IN1 function select		49: M1
NET-IN2 function select		50: M2
NET-IN3 function select		1: FWD
NET-IN4 function select		2: REV
NET-IN5 function select		19: STOP-MODE
NET-IN6 function select		20: MB-FREE
NET-IN7 function select		0: Not used
NET-IN8 function select		
NET-IN9 function select		
NET-IN10 function select		
NET-IN11 function select		
NET-IN12 function select		
NET-IN13 function select		
NET-IN14 function select		
NET-IN15 function select		

Note

- Do not assign the same input signal to multiple input terminals. When the same input signal is assigned to multiple input terminals, the function will be executed if any of the terminals becomes active.
- When the HMI input and TL input are not assigned to the input terminals, these inputs will be always set to ON. When assigning them to multiple terminals (including direct I/O and network I/O), the function will be executed when all terminals are set to ON.

■ Assignment to the output terminals

The output signals shown below can be assigned to the NET-OUT0 to NET-OUT15 of network I/O by setting parameters. See each command description for the assignments of the NET-OUT0 to NET-OUT15.

Assignment No.	Signal name	Function	Data read
0	Not used	Set when the output terminal is not used.	0: OFF 1: ON
1	FWD_R	Output in response to the FWD input.	
2	RVS_R	Output in response to the RVS input.	
19	STOP-MODE_R	Output in response to the STOP-MODE input.	
20	MB-FREE_R	Output in response to the MB-FREE input.	
27	HMI_R	Output in response to the HMI input.	
32	R0	Output the status of the general signals R0 to R15.	
33	R1		
34	R2		
35	R3		
36	R4		
37	R5		
38	R6		
39	R7		
40	R8		
41	R9		
42	R10		
43	R11		
44	R12		
45	R13		
46	R14		
47	R15		
48	M0_R	Output in response to the M0 to M3 inputs.	
49	M1_R		
50	M2_R		
51	M3_R		
54	TL_R	Output in response to the TL input.	
65	ALARM-OUT1	Output the alarm status of the driver (normally closed).	0: Alarm not present 1: Alarm present
66	WNG	Output the warning status of the driver.	0: Warning not present 1: Warning present
68	MOVE	Output while the motor operates.	0: Motor stopped 1: Motor operating
71	TLC	Output when the motor torque reaches the torque limiting value.	0: No torque limiting 1: In torque limiting operation
77	VA	Output when the motor speed reaches the setting value.	0: Speed not attained 1: Speed attainment
80	S-BSY	Output when the driver is in internal processing state.	0: OFF 1: ON
81	ALARM-OUT2	Output when the overload warning detection level is exceeded. Output when the overload alarm generates. (normally closed)	0: Normal operation 1: In overload operation
82	MPS	Output the ON-OFF state of the main power supply.	0: OFF 1: ON
84	DIR	Output the rotation direction of motor shaft.	0: REV direction 1: FWD direction

Related parameters

Parameter name	Description	Initial value
NET-OUT0 function select	Assigns the output signal to the NET-OUT0 to NET-OUT15. See the table on the previous page for the assignment number and corresponding signal.	48: M0_R
NET-OUT1 function select		49: M1_R
NET-OUT2 function select		50: M2_R
NET-OUT3 function select		1: FWD_R
NET-OUT4 function select		2: REV_R
NET-OUT5 function select		19: STOP-MODE_R
NET-OUT6 function select		66: WNG
NET-OUT7 function select		65: ALARM-OUT1
NET-OUT8 function select		80: S-BSY
NET-OUT9 function select		0: Not used
NET-OUT10 function select		
NET-OUT11 function select		
NET-OUT12 function select		81: ALARM-OUT2
NET-OUT13 function select		68: MOVE
NET-OUT14 function select		77: VA
NET-OUT15 function select		71: TLC

3.3 Input signals

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.

■ FWD input and REV input

When the FWD input is turned ON, the motor rotates in the clockwise direction. When the FWD input is turned OFF, the motor stops.
When the REV input is turned ON, the motor rotates in the counterclockwise direction. When the REV input is turned OFF, the motor stops.
If both the FWD input and REV input are turned ON, the motor stops instantaneously.

■ STOP-MODE input

Select how the motor should stop when the FWD input or REV input is turned OFF.
When the STOP-MODE input is ON, the motor decelerates to a stop. When the STOP-MODE input is OFF, the motor stops instantaneously.

■ MB-FREE input

This input signal is used with electromagnetic brake types. Select how the electromagnetic brake would operate when the motor stops.
When the MB-FREE input is ON, the electromagnetic brake will be released.
When the MB-FREE input is OFF, the electromagnetic brake will actuate and hold the shaft in position.

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

■ EXT-ERROR input

The EXT-ERROR input is normally closed.
Connect an error signal detected externally. When the error signal is input, the EXT-ERROR input will be turned OFF and the motor will be stopped.
When operating the motor, turn the EXT-ERROR input ON.

■ TH input

The TH input is normally closed.
When using the regeneration unit, connect the thermostat output of the regeneration unit.

■ ALARM-RESET input

When an alarm generates, the motor will stop. When the ALARM-RESET input is turned from ON to OFF, the alarm will be reset (The alarm will be reset at the OFF edge of the ALARM-RESET input). Always reset an alarm after removing the cause of the alarm and ensuring safety.
Note that some alarms cannot be reset with the ALARM-RESET input. See p.133 for alarm descriptions.

■ HMI input

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

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

Note When the HMI input is not assigned to the input terminal, this input will be always set to ON. When assigning it to multiple terminals (including direct I/O and network I/O), the function will be executed when all terminals are set to ON.

■ M0 to M3 inputs

Select a desired operation data number for multi-speed operation based on the combination of ON/OFF states of the M0 to M3 inputs.
Refer to p.63 for multi-speed operation.

Operation data No.	M3	M2	M1	M0	Speed setting method
0	OFF	OFF	OFF	OFF	Analog setting/digital setting
1	OFF	OFF	OFF	**ON**	Digital setting
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**	

■ TL input

The TL input is normally closed.
When the TL input is turned ON, the torque limiting is enabled.
When the TL input is turned OFF, the torque limiting becomes invalid.

Note When the TL input is not assigned to the input terminal, this input will be always set to ON. When assigning it to multiple terminals (including direct I/O and network I/O), the function will be executed when all terminals are set to ON.

3.4 Output signals

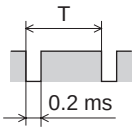
The signal state represents the "ON: Carrying current" or "OFF: Not carrying current" state of the internal photocoupler rather than the voltage level of the signal.

■ SPEED-OUT output

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

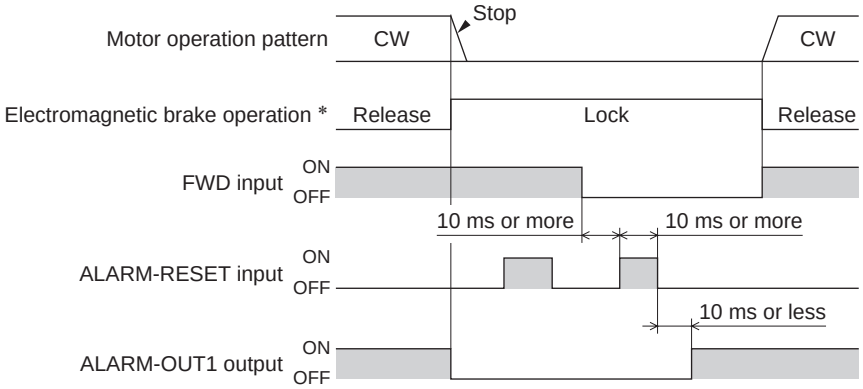
$$\text{SPEED-OUT output frequency (Hz)} = \frac{1}{T}$$

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



■ ALARM-OUT1 output

The ALARM-OUT1 input is normally closed.
When the driver's protective function actuates, the ALARM-OUT1 output turns OFF and the ALM LED blinks .
In the case of a standard type, the motor coasts to a stop. In the case of an electromagnetic brake type, on the other hand, the motor stops instantaneously, upon which the electromagnetic brake actuates and holds the shaft in position.
To reset an alarm, turn both the FWD input and REV input OFF, and remove the cause of the alarm before turning the ALARM-RESET input ON (keep it ON for 10 ms or more). The ALARM-RESET input is disabled while the FWD input or REV input is ON.
If the alarm cannot be reset with the ALARM-RESET input, once turn off the power, wait for at least 30 sec, and turn on the power again.



* When the motor is an electromagnetic brake type, the electromagnetic brake is actuated to hold the shaft in position at the same time that an alarm generates. The setting, which the electromagnetic brake will actuate and hold the position after the motor coasts to a stop, can be selected using the **OPX-2A**, **MEXE02** or RS-485 communication.

■ MOVE output

The MOVE output turns ON while the motor is operating (while any of the input signal for operation is ON).

■ VA output

The VA output turns ON when the motor speed reaches the setting value.

■ ALARM-OUT2 output

The ALARM-OUT2 output is normally closed.
When the "overload warning enable" is set to enable, this signal will be turned OFF if the motor load torque exceeds the overload warning level.
Even if the "overload warning enable" is set to disable, this signal will be turned OFF if the overload alarm generates.

■ WNG output

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.

■ TLC output

The TLC output turns ON when the motor output torque reaches the limit value.

■ S-BSY output

The S-BSY output turns ON while internal processing of the driver is being executed.
In the following condition, the driver will be in an internal processing status.

- Issuing maintenance commands via RS-485 communication

■ MPS output

The MPS output turns ON when the driver main power is ON.

■ DIR output

The DIR output is the output signal that shows the rotation direction of motor output shaft.
The rotation direction shows the forward direction if this signal is ON, and the rotation direction shows the reverse direction if this signal is OFF.

■ Response output

The response output is the output signal that shows the ON/OFF status corresponding to the input signals.
The following tables show the correspondence between the input signals and output signals.

Input signal	Output signal
FWD	FWD_R
REV	REV_R
STOP-MODE	STOP-MODE_R
MB-FREE	MB-FREE_R
HMI	HMI_R

Input signal	Output signal
M0	M0_R
M1	M1_R
M2	M2_R
M3	M3_R
TL	TL_R

3.5 General signals (R0 to R15)

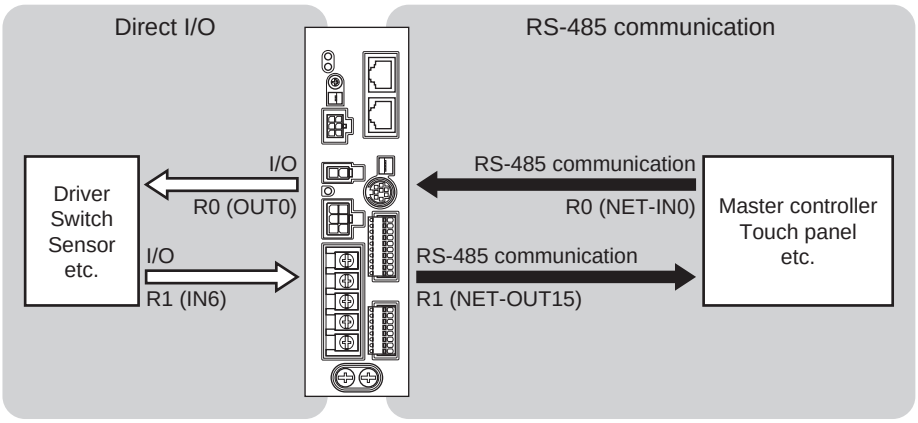
The R0 to R15 are general signals that enable control via RS-485 communication.
Using the R0 to R15 signals, I/O signals for the external device can be controlled by the master device via the driver.
The direct I/O of the driver can be used as an I/O unit.
See the following example for setting of the general signals.

- When outputting the signals from the master device to the external device

Assign the general signal R0 to the OUT0 output and NET-IN0.
When setting the NET-IN0 to 1, the OUT0 output turns ON. When setting the NET-IN0 to 0, the OUT0 output turns OFF.

- When inputting the output of the external device to the master device

Assign the general signal R1 to the IN6 input and NET-OUT15.
When turning the IN6 input ON by the external device, the NET-OUT15 becomes 1. When turning the IN6 input OFF, the NET-OUT15 becomes 0. The logic level of the IN6 input can be set using "IN6 contact configuration" parameter.



3 Method of control via I/O

This part explains when the operation is controlled via I/O after setting the operation data and parameters by the **OPX-2A** or **MEXE02**.

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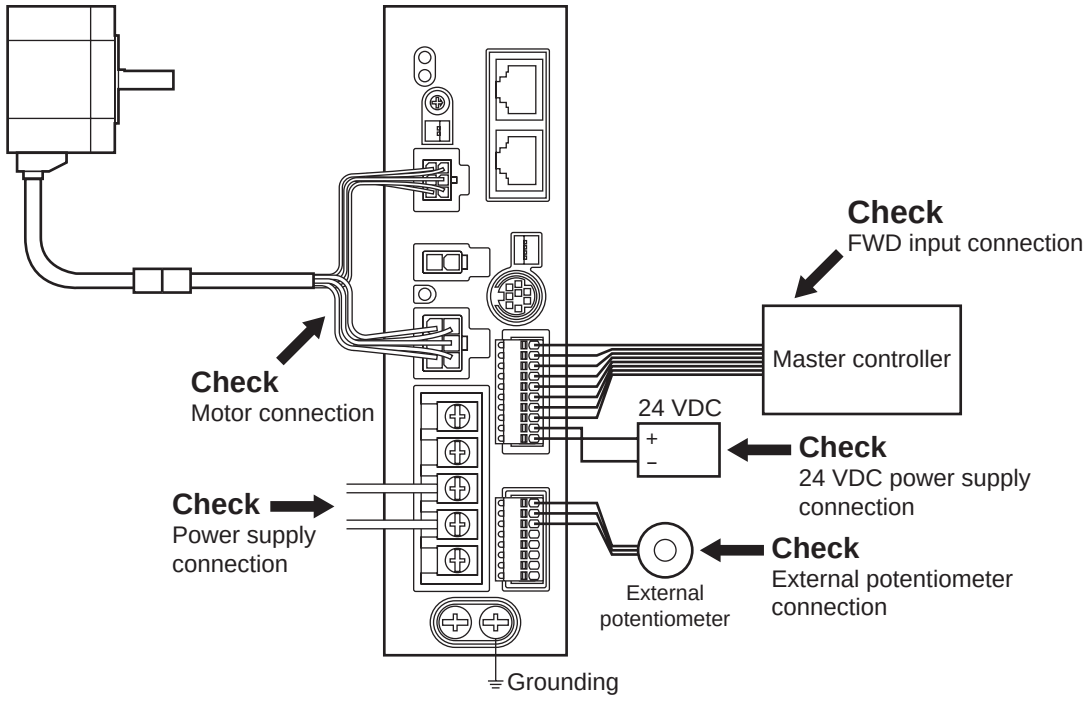
1 Guidance

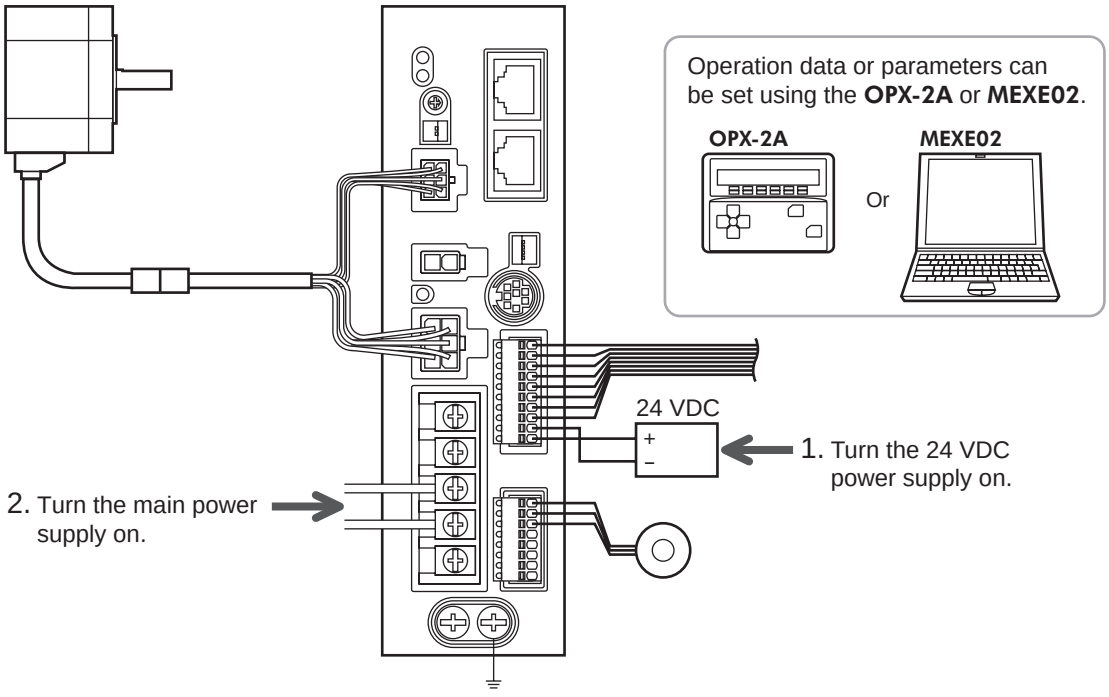
If you are new to the **BLE** Series FLEX RS-485 communication type, read this section to understand the operating methods along with the operation flow.

Note Before operating the motor, check the condition of the surrounding area to ensure safety.

STEP 1 Check the installation and connection

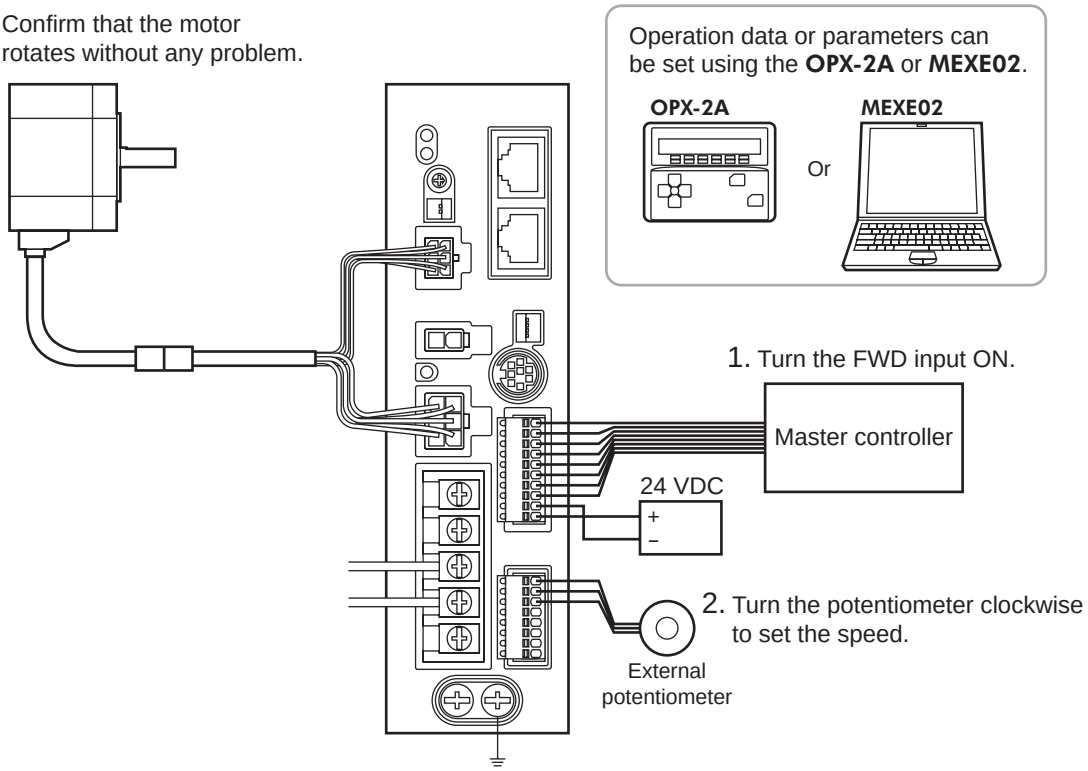


STEP 2 Turn on the power



STEP 3 Operate the motor

3. Confirm that the motor rotates without any problem.



STEP 4 Were you able to operate the motor properly?

How did it go? Were you able to operate the motor properly? If the motor does not function, check the following points:

- Is any alarm present?
- Are the power supply and motor connected securely?
- Is the external potentiometer connected securely?

For more detailed settings and functions, refer to the following pages.

2 Operation data and parameter

The parameters required for motor operation are available in the following two types.

- Operation data
- User parameters

The parameters are saved in the RAM or non-volatile memory. The data saved in the RAM will be erased once the 24 VDC power supply is turned off. On the other hand, the parameters saved in the non-volatile memory will be retained even after the 24 VDC power supply is turned off.
When turning on the driver 24 VDC power supply, the parameters saved in the non-volatile memory will be sent to the RAM. Then, the recalculation and setup for the parameters are executed in the RAM.
Parameters having set via RS-485 communication or industrial network are saved in the RAM. To save the parameters stored in the RAM to the non-volatile memory, execute the "batch NV memory write" of the maintenance command.
The parameters set with the **MEXE02** will be saved in the non-volatile memory if "Data writing" is performed.

When a parameter is changed, the timing to enable the new value varies depending on the parameter. See the following four types.

Update timing		Description
A	Effective immediately	Executes the recalculation and setup immediately when writing the parameter.
B	Effective after stopping the operation	Executes the recalculation and setup after stopping the operation.
C	Effective after executing configuration or effective after turning the power ON again	Executes the recalculation and setup after executing the configuration or turning the 24 VDC power ON again.
D	Effective after turning the power ON again	Executes the recalculation and setup after turning the 24 VDC power ON again.

Note

- Parameters having written via RS-485 communication are written in the RAM. If you change the parameters that become effective after turning on the power again, be sure to save them in the non-volatile memory before turning off the power.
- The non-volatile memory can be rewritten approximately 100,000 times.

2.1 Operation data

The following data is required to operate a motor. Total 16 operation data (No.0 to No.15) can be set in this product. There are the following two setting methods.

- Analog setting for rotation speed: This is a method to set the rotation speed using the external potentiometer or external DC voltage.
- Digital setting for rotation speed: This is a method to set the rotation speed using any of the **OPX-2A**, **MEXE02** or RS-485 communication.

Item	Description	Setting range	Initial value	Effective *1
Rotational speed No.0 to Rotational speed No.15	Sets the rotation speed.	Analog setting: 100 to 4000 r/min Digital setting: 80 to 4000 r/min	0	A
Acceleration No.0 to Acceleration No.15	Sets the time needed for the motor to reach the rotation speed. *2	0.2 to 15 s	0.5	
Deceleration No.0 to Deceleration No.15	Sets the time needed for the motor to stop from the rotation speed. *3			
Torque limit No.0 to Torque limit No.15	Sets the motor torque. Sets the maximum torque based on the rated torque being 100%.	0 to 200%	200	

*1 Indicates the timing for the data to become effective. (A: Effective immediately)

*2 The acceleration time when using the digital setting for rotation speed refers to the time needed for the motor to reach the set rotation speed.
The acceleration time when using the analog setting for rotation speed refers to the time needed for the motor to reach the rated rotation speed (3000 r/min).

*3 The deceleration time when using the digital setting for rotation speed refers to the time needed for the motor to stop from the set rotation speed.
The deceleration time when using the analog setting for rotation speed refers to the time needed for the motor to stop from the rated rotation speed (3000 r/min).

2.2 Parameter

■ Parameter list

Function parameter (p.50)	• Reduction gear rate • Decimal place for reduction gear rate • Amplification speed rate • Conveyor reduction gear rate • Decimal place for conveyor reduction gear rate • Conveyor amplification speed rate • Velocity attainment width • Motor rotation direction
I/O function paramter (p.51)	• IN0 to IN6 function select • IN0 to IN6 contact configuration • OUT0 and OUT1 function select
I/O function parameter (RS-485) (p.52)	• NET-IN0 to NET-IN15 function select • NET-OUT0 to NET-OUT15 function select
Analog adjust parameter (p.53)	• Analog operating speed command gain • Analog operating speed command offset • Analog torque limit gain • Analog torque limit offset • Analog operating speed maximum value for external input • Analog torque limit maximum value external input
Alarm/warning parameter (p.53)	• Over load warning level • Over load warning enable
Utilities parameter (p.53)	• JOG operating speed • JOG operating torque • Display mode of the data setter speed • The data setter editing mode
Operation parameter (p.54)	• Data setter initial display • Analog input signal select • No operation at initial alarm enable • Magnetic brake function at alarm • Initial thermal input detection • Run mode select
Communication parameter (p.55)	• Communication time out • Communication error alarm • Communication parity • Communication stop bit • Communication transfer wait time

■ Function parameter

Name	Description	Setting range	Initial value	Effective *
Reduction gear rate	When entering the gear ratio of the gearhead, the rotation speed of the gearhead output shaft can be displayed. Set the decimal position for the setting value of the gear ratio by the "decimal place for reduction gear rate" parameter.	100 to 9999	100	A
Decimal place for reduction gear rate		0: 1 digit 1: 2 digit 2: 3 digit	2	
Amplification speed rate	Set the speed increasing ratio relative to the rotation speed of the motor output shaft. When setting the speed increasing ratio to 1, the speed reduction ratio will be effective. When setting the speed increasing ratio to other than 1, the speed increasing ratio will be effective.	1 to 5	1	
Conveyor reduction gear rate	When setting the conveyor speed reduction ratio, the transfer speed of the conveyor can be displayed. Set the decimal position for the setting value of the speed reduction ratio by the "decimal place for conveyor reduction gear rate" parameter.	100 to 9999	100	
Decimal place for conveyor reduction gear rate		0: 1 digit 1: 2 digit 2: 3 digit	2	
Conveyor amplification speed rate	Sets the conveyor speed-increasing ratio relative to the rotation speed of the motor output shaft.	1 to 5	1	
Velocity attainment width	Sets the band within which the rotation speed of the motor is deemed to have reached the set value.	0 to 400 r/min	200	
Motor rotation direction	Sets the motor direction to be applied when the FWD input is turned ON.	0: + direction=CCW 1: + direction=CW	1	C

* Indicates the timing for the data to become effective.
(A: Effective immediately, C:Effective after executing configuration or effective after turning the power ON again)

- How to set the speed reduction ratio

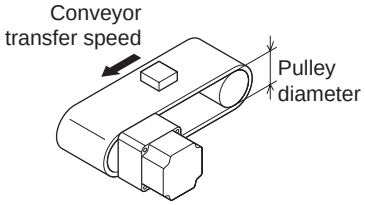
Set the speed reduction ratio as a combination of the "reduction gear rate" parameter and "decimal place for reduction gear rate" parameter. The relationships of speed reduction ratio and decimal position are explained by the combinations shown below.

Actual speed reduction ratio	"Reduction gear rate" parameter	"Decimal place for reduction gear rate" 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

- Display the conveyor transfer speed

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

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



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

$$\text{Conveyor transfer speed [m/min]} = \frac{\text{Motor output shaft rotating speed [r/min]}}{\text{Conveyor gear ratio}}$$

Example: The pulley diameter is 0.1 m and gear ratio of the gear head is 20

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

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

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

Accordingly, “20.4” is shown.

■ I/O function parameter

Name	Description	Setting range	Initial value	Effective *
IN0 function select	Assigns the input signals to the input terminals IN0 to IN6.	See table next.	1: FWD	B
IN1 function select			2: REV	
IN2 function select			19: STOP-MODE	
IN3 function select			48: M0	
IN4 function select			24: ALARM-RESET	
IN5 function select			20: MB-FREE	
IN6 function select			22: TH	
IN0 contact configuration	Changes the logic level setting for the input terminals IN0 to IN6.	0: Make (N.O.) 1: Brake (N.C.)	0	C
IN1 contact configuration				
IN2 contact configuration				
IN3 contact configuration				
IN4 contact configuration				
IN5 contact configuration				
IN6 contact configuration				
OUT0 function select	Assigns the output signals to the output terminals OUT0 and OUT1.	See table next.	85: SPEED-OUT	A
OUT1 function select			65: ALARM-OUT1	

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

- Setting range for IN input function selection

0: No function	22: TH	35: R3	41: R9	47: R15
1: FWD	24: ALARM-RESET	36: R4	42: R10	48: M0
2: REV	27: HMI	37: R5	43: R11	49: M1
19: STOP-MODE	32: R0	38: R6	44: R12	50: M2
20: MB-FREE	33: R1	39: R7	45: R13	51: M3
21: EXT-ERROR	34: R2	40: R8	46: R14	54: TL

- Setting range for OUT output function selection

0: No function	34: R2	42: R10	50: M2_R	80: S-BSY
1: FWD_R	35: R3	43: R11	51: M3_R	81: ALARM-OUT2
2: REV_R	36: R4	44: R12	54: TL_R	82: MPS
19: STOP-MODE_R	37: R5	45: R13	65: ALARM_OUT1	84: DIR
20: MB-FREE_R	38: R6	46: R14	66: WNG	85: SPEED-OUT
27: HMI_R	39: R7	47: R15	68: MOVE	
32: R0	40: R8	48: M0_R	71: TLC	
33: R1	41: R9	49: M1_R	77: VA	

■ I/O function parameter (RS-485)

Name	Description	Setting range	Initial value	Effective *
NET-IN0 function select	Assigns the input signals to the NET-IN0 to NET-IN15.	See table next.	48: M0	C
NET-IN1 function select			49: M1	
NET-IN2 function select			50: M2	
NET-IN3 function select			1: FWD	
NET-IN4 function select			2: REV	
NET-IN5 function select			19: STOP-MODE	
NET-IN6 function select			20: MB-FREE	
NET-IN7 function select			0: No function	
NET-IN8 function select				
NET-IN9 function select				
NET-IN10 function select				
NET-IN11 function select				
NET-IN12 function select				
NET-IN13 function select				
NET-IN14 function select				
NET-IN15 function select				
NET-OUT0 function select	Assigns the output signals to the NET-OUT0 to NET-OUT15.	See table next.	48: M0_R	
NET-OUT1 function select			49: M1_R	
NET-OUT2 function select			50: M2_R	
NET-OUT3 function select			1: FWD_R	
NET-OUT4 function select			2: REV_R	
NET-OUT5 function select			19: STOP-MODE_R	
NET-OUT6 function select			66: WNG	
NET-OUT7 function select			65: ALARM-OUT1	
NET-OUT8 function select			80: S-BSY	
NET-OUT9 function select			0: No function	
NET-OUT10 function select				
NET-OUT11 function select				
NET-OUT12 function select			81: ALARM-OUT2	
NET-OUT13 function select			68: MOVE	
NET-OUT14 function select			77: VA	
NET-OUT15 function select			71: TLC	

* Indicates the timing for the data to become effective. (C: Effective after executing configuration or effective after turning the power ON again)

- Setting range for NET-IN input function selection

0: No function	32: R0	38: R6	44: R12	50: M2
1: FWD	33: R1	39: R7	45: R13	51: M3
2: REV	34: R2	40: R8	46: R14	54: TL
19: STOP-MODE	35: R3	41: R9	47: R15	
20: MB-FREE	36: R4	42: R10	48: M0	
27: HMI	37: R5	43: R11	49: M1	

- Setting range for NET-OUT output function selection

0: No function	34: R2	42: R10	50: M2_R	80: S-BSY
1: FWD_R	35: R3	43: R11	51: M3_R	81: ALARM-OUT2
2: REV_R	36: R4	44: R12	54: TL_R	82: MPS
19: STOP-MODE_R	37: R5	45: R13	65: ALARM_OUT1	84: DIR
20: MB-FREE_R	38: R6	46: R14	66: WNG	
27: HMI_R	39: R7	47: R15	68: MOVE	
32: R0	40: R8	48: M0_R	71: TLC	
33: R1	41: R9	49: M1_R	77: VA	

■ Analog adjust parameter

Name	Description	Setting range	Initial value	Effective *
Analog operating speed command gain	Sets the speed command per 1 VDC of input voltage.	0 to 4000 r/min	800	A
Analog operating speed command offset	Sets the offset for speed command input.	−2000 to 2000 r/min	0	
Analog torque limit gain	Sets the torque limit per 1 VDC of input voltage.	0 to 200%	40	
Analog torque limit offset	Sets the offset for torque limit input.	−50 to 50%	0	
Analog operating speed maximum value for external input	Sets the maximum value of rotation speed.	0 to 4000 r/min	4000	
Analog torque limit maximum value external input	Sets the maximum value of torque limiting.	0 to 200%	200	

* Indicates the timing for the data to become effective. (A: Effective immediately)

■ Alarm/warning parameter

Name	Description	Setting range	Initial value	Effective *
Over load warning level	Sets the percentage to generate the overload warning against the motor load torque.	50 to 100%	100	A
Over load warning enable	Sets whether to enable or disable overload warning function.	0: Disable 1: Enable	0	

* Indicates the timing for the data to become effective. (A: Effective immediately)

■ Utilities parameter

Name	Description	Setting range	Initial value	Effective *
JOG operating speed	Sets the rotation speed at JOG operation.	0, or 80 to 1000 r/min	300	A
JOG operating torque	The torque in JOG operation can be limited. Sets the maximum torque based on the rated torque being 100%.	0 to 200%	200	
Display mode of the data setter speed	Sets the display method of rotation speed in the monitor mode. If "0: Signed" is set, "−" will be displayed when rotating in the reverse direction.	0: Signed 1: Absolute	0	
The data setter editing mode	Editing and clearing the operation data/ parameters can be prohibited by locking operation of the **OPX-2A**.	0: Disable 1: Enable	1	

* Indicates the timing for the data to become effective. (A: Effective immediately)

■ Operation parameter

Name	Description	Setting range	Initial value	Effective *
Data setter initial display	Sets the initial screen to display on the **OPX-2A** when the driver power is turned on.	0: Operating speed 1: Conveyor speed 2: Load factor 3: Operating number 4: Mon top view	0	C
Analog input signal select	Sets the setting method of operation data. See table next.	0: Analog invalid 1: Analog speed 2: Analog torque	1	
No operation at initial alarm enable	Sets whether to enable or disable the "no operation at initial alarm enable."	0: Disable 1: Enable	0	
Magnetic brake function at alarm	Set the actuated timing of the electromagnetic brake when an alarm is generated. When setting to 0, the electromagnetic brake will actuate and hold the position after the motor coasts to a stop.	0: Lock after free stop 1: Lock immediately	1	
Initial thermal input detection	Switches whether to enable or disable the initial thermal input detection. When setting to "1: Enable," the regeneration unit overheat alarm will be generated if the 24 VDC power supply is input while the TH input is not assigned.	0: Disable 1: Enable	0	
Run mode select	The motor excitation can be shut off so that the overvoltage alarm is not generated immediately when driving a large inertia. The time until the motor stops will be longer.	0: PWM shut off mode enable 1: PWM shut off mode disable	1	

* Indicates the timing for the data to become effective. (C:Effective after executing configuration or effective after turning the power ON again)

Note When the electromagnetic brake motor is operated in vertical direction, do not set the "run mode select" parameter to "0."

- Analog input signal selection parameter

Setting method of operation data can be changed using the "analog input signal select" parameter. Others except the following combinations are not available to set.

Analog input signal selection parameter	Operation data No.	Rotational speed	Acceleration Deceleration	Torque limit
0	0 to 15	Digital setting		
1 (Initial value)	0	Analog setting	Digital setting	
	1 to 15	Digital setting		
2	0 to 15	Digital setting		Analog setting

Setting example

- When setting all operation data with digital setting: Set the analog input signal selection parameter to 0.
- When setting the only rotation speed of the operation data No.0 with analog setting: Set the analog input signal selection parameter to 1.

■ Communication parameter

Name	Description	Setting range	Initial value	Effective *
Communication time out	Sets the condition in which the communication timeout occurs in RS-485 communication. When setting to zero (0), the driver does not monitor the condition in which the communication timeout occurs.	0 to 10000 ms	0	A
Communication error alarm	Sets the condition in which the RS-485 communication error alarm generates. The communication error alarm generates after the RS-485 communication error has occurred by the number of times set here.	1 to 10 times	3	
Communication parity	Sets the parity for RS-485 communication.	0: No parity 1: Even 2: Odd	1	D
Communication stop bit	Sets the stop bit for RS-485 communication.	0: 1 bit 1: 2 bit	0	
Communication transfer wait time	Sets the transmission waiting time for RS-485 communication.	0 to 10000 (1=0.1 ms)	100	

* Indicates the timing for the data to become effective. (A: Effective immediately, D: Effective after turning the power ON again)

3 Method of control via I/O

This chapter explains the operations that can be performed with the **BLE** Series FLEX RS-485 communication type.

3.1 Operation data

The following data is required to operate a motor. Total 16 operation data (No.0 to No.15) can be set in this product. There are the following two setting methods.

- Analog setting for rotation speed: This is a method to set the rotation speed using the external potentiometer or external DC voltage.
- Digital setting for rotation speed: This is a method to set the rotation speed using any of the **OPX-2A**, **MEXE02** or RS-485 communication.

Item	Description	Setting method	Setting range	Initial value
Rotational speed	Sets the rotation speed.	Analog setting	100 to 4000 r/min	0 r/min
		Digital setting	80 to 4000 r/min	
Acceleration	Sets the time needed for the motor to reach the rotation speed.	Digital setting	0.2 to 15 s	0.5 s
Deceleration	Sets the time needed for the motor to stop from the rotation speed.			
Torque limit	Sets the motor torque. Sets the maximum torque based on the rated torque being 100%.	Digital setting Analog setting	0 to 200%	200%

When using the digital setting for the rotation speed or torque limiting, enable the digital setting by setting the setting range of the following parameter to "0: Analog invalid."

Parameter name	Description	Setting range	Initial value
Analog input signal select	Sets the setting method of operation data. Refer to p.54 for details.	0: Analog invalid 1: Analog speed 2: Analog torque	1

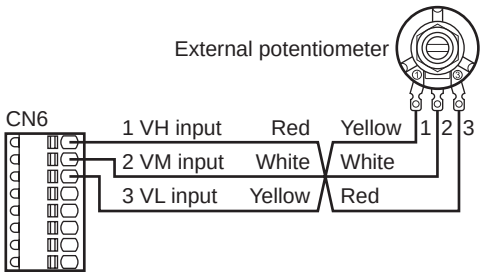
3.2 Setting the rotation speed

■ Analog setting

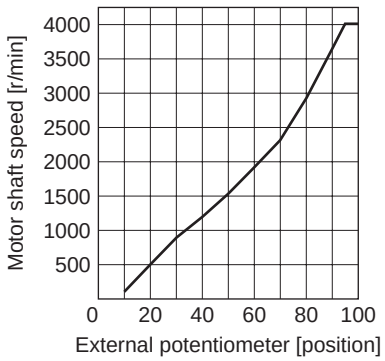
Set the rotation speed by the external potentiometer (supplied) or external DC voltage.

- Setting by the external potentiometer

Connect the supplied external potentiometer to the pin Nos.1 to 3 of CN6 of the driver. Use the supplied signal wire for this connection.
Use the supplied signal wire for this connection.
Connect the shield wire of the signal wire to the VL input terminal.
Make sure the shield wire does not contact other terminals.
Turning the external potentiometer in the clockwise direction makes the motor to rotate faster. Turning it in the counterclockwise direction makes the motor to rotate slower.

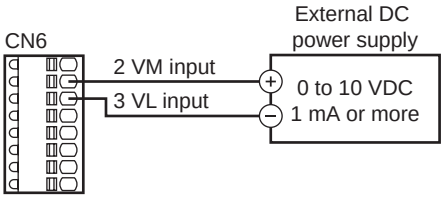


- Speed characteristics (representative values)

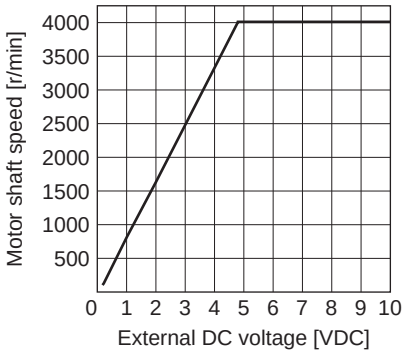


- Setting by the external DC voltage

For the external voltage, use a DC power supply (0 to 10 VDC) with reinforced insulation on both the primary side and secondary side, and connect it to the pin Nos. 2 and 3 of CN6 of the driver.
The input impedance between the VM input and VL input is approx. 30 kΩ. The VL input is connected to IN-COM1 inside the driver.



- Speed characteristics (representative values)

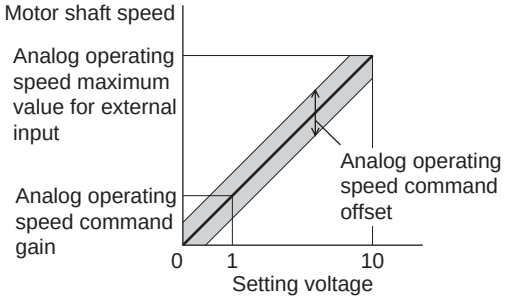


Note Be sure to set the external DC voltage to 10 VDC or lower. When connecting the external DC power supply, make sure the polarities are correct. If the polarities are reversed, the driver may be damaged.

Gain adjustment and offset adjustment for external DC voltage

When setting the rotation speed using the external DC voltage, the relationship between the voltage value and rotation speed can be changed by adjusting the gain or offset. Set the following parameters using any of the **OPX-2A**, **MEXE02** or via RS-485 communication.

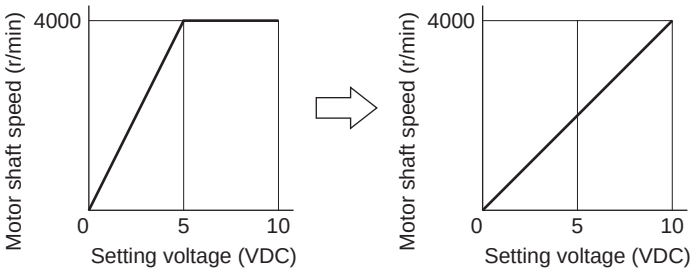
Note The rotation speed corresponding to the voltage value varies depending on the products.



Parameter name	Description	Setting range	Initial value
Analog operating speed command gain	Sets the speed command per 1 VDC of input voltage.	0 to 4000 r/min	800
Analog operating speed maximum value for external input	Sets the maximum value of rotation speed.		4000
Analog operating speed command offset	Sets the offset for speed command input.	−2000 to 2000 r/min	0

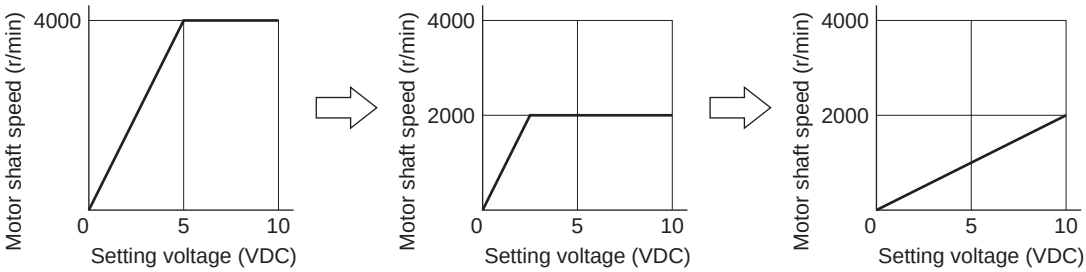
Setting example1:
When setting the rotation speed of the motor output shaft up to 4000 r/min (maximum rotation speed) using 0 to 10 VDC of the external DC voltage

Set the "analog operating speed command gain" to 400.



Setting example2:
When setting the rotation speed of the motor output shaft up to 2000 r/min (maximum rotation speed) using 0 to 10 VDC of the external DC voltage

Set the "analog operating speed maximum value for external input" to 2000, and then set the "analog operating speed command gain" to 200.



■ Digital setting

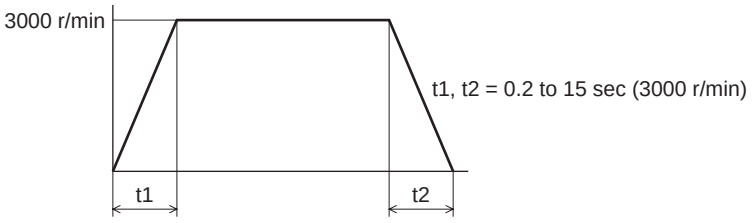
- Using the **OPX-2A**: Refer to the **OPX-2A** OPERATING MANUAL.
- Using the **MEXE02**: Refer to the **MEXE02** OPERATING MANUAL.
- Via RS-485 communication: Refer to "4 Method of control via Modbus RTU (RS-485 communication)" or "5 Method of control via industrial network"

3.3 Setting the acceleration time and deceleration time

The meaning of the acceleration time/deceleration time varies depending on the setting method of the rotation speed.

■ When setting the rotation speed with analog setting

When using the analog setting, the motor is operated at the acceleration time and deceleration time set in the operating data No.0.
Acceleration time (t1) refers to the time needed for the motor to reach the rated speed (3000 r/min) from the standstill status.
Deceleration time (t2) refers to the time needed for the motor to stop from the rated speed (3000 r/min).



■ When setting the rotation speed with digital setting

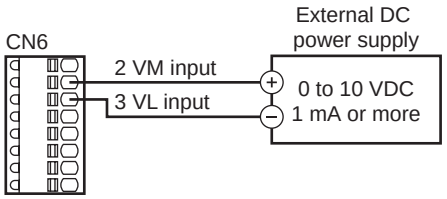
When using the digital setting, the desired value for the acceleration time and deceleration time can be set to the operating data No.0 to No.15 respectively.
Acceleration time refers to the time needed for the motor to reach the setting speed from the standstill status.
Deceleration time refers to the time needed for the motor to stop from the setting speed.

3.4 Setting the torque limiting

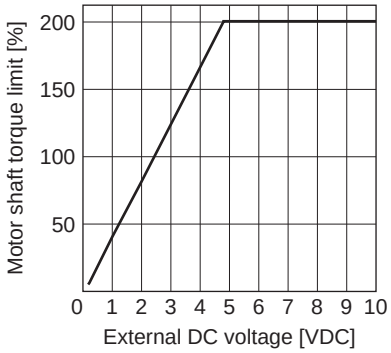
Set the torque limiting when restricting the motor output torque. The torque limiting can be set using either of the analog setting or digital setting. This section explains the analog setting by the external DC voltage.

■ Setting by the external DC voltage

For the external voltage, use a DC power supply (0 to 10 VDC) with reinforced insulation on both the primary side and secondary side, and connect it to the pin Nos. 2 and 3 of CN6 of the driver.
The input impedance between the VM input and VL input is approx. 30 kΩ. The VL input is connected to IN-COM1 inside the driver.



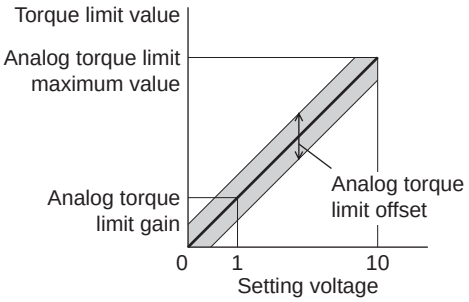
• Torque limiting characteristics (representative values)



Note Be sure to set 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.

Gain adjustment and offset adjustment for external DC voltage

When setting the torque limiting using the analog setting, the relationship between the voltage value and torque limiting value can be changed by adjusting the gain or offset.
Set the following parameters using any of the **OPX-2A**, **MEXE02** or via RS-485 communication.

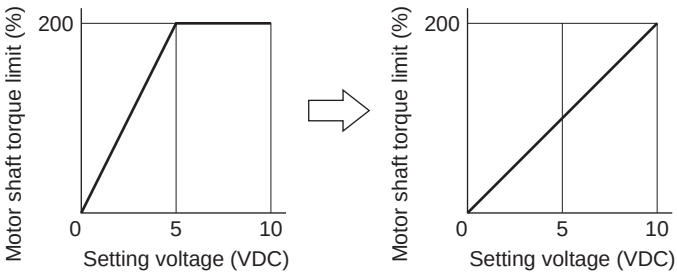


Parameter name	Description	Setting range	Initial value
Analog torque limit gain	Sets the torque limit per 1 VDC of input voltage.	0 to 200%	40
Analog torque limit maximum value	Sets the maximum value of torque limit.		200
Analog torque limit offset	Sets the offset for torque limit input.	−50 to 50%	0

Setting example

When adjusting the torque limiting value up to 200% using 0 to 10 VDC of the external DC voltage

Set the "analog torque limit gain" to 20.

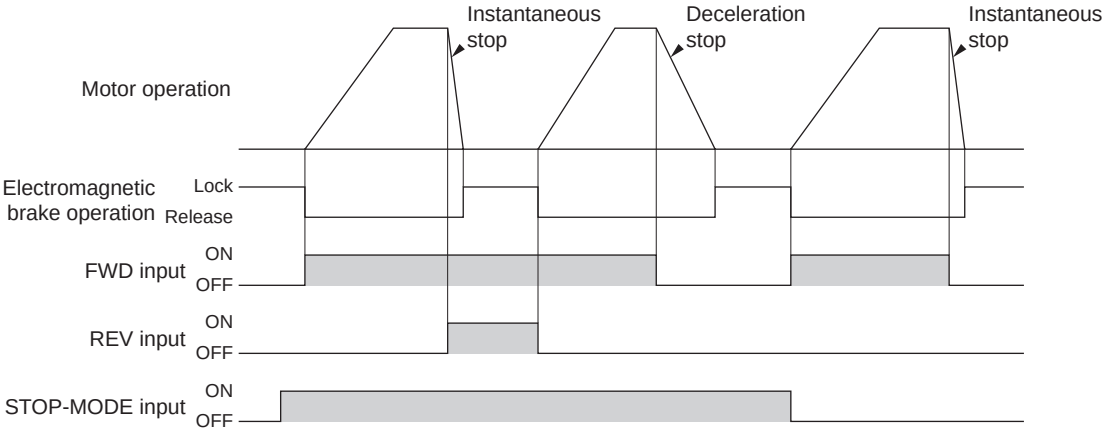


3.5 Running/stopping the motor

Run/stop the motor by inputting operation control signals.

■ Operation

When the FWD input is turned ON, the motor rotates in the clockwise direction. When the FWD input is turned OFF, the motor stops.
When the REV input is turned ON, the motor rotates in the counterclockwise direction. When the REV input is turned OFF, the motor stops.
If both the FWD input and REV input are turned ON, the motor stops instantaneously.



Note When using the motor in vertical drive (gravitational operation), although it depends on the load condition, if operation is performed with the setting below, the motor shaft may momentarily rotate in the reverse direction (about one-fourth revolution of the motor output shaft) at the time of starting/stopping the motor.
• When the set rotation speed is low
• When the acceleration time and deceleration time is long

■ Stop

If the STOP-MODE input is ON, the motor decelerates and stops. If the STOP-MODE input is OFF, the motor stops instantaneously.

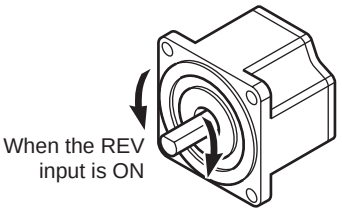
■ Rotation direction

The rotation direction of the motor output shaft represents the direction when viewed from the motor output shaft side.

- Combination type • parallel shaft gearhead

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

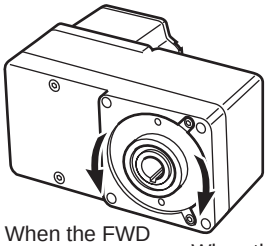
Gear ratio	Rotating direction of gearhead output shaft
5, 10, 15, 20, 200	Same as the motor output shaft
30, 50, 100	Opposite to the motor output shaft



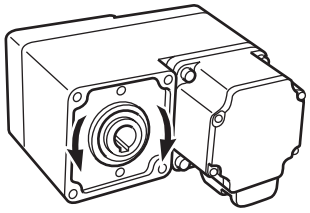
- Combination type • hollow shaft flat gearhead

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

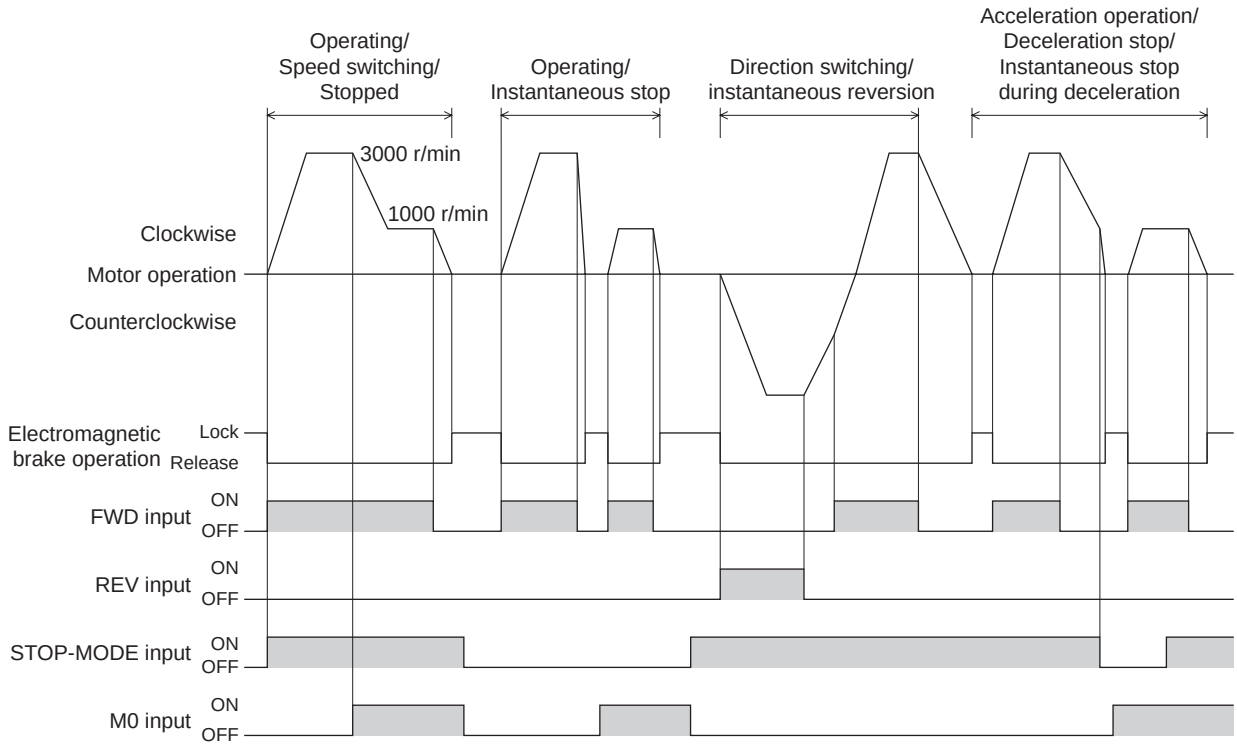


Viewed from Rear



3.6 Example of operation pattern

The charts below are an example of setting the external potentiometer to 3000 r/min and the rotation speed of the operation data No.1 to 1000 r/min, and switching the speed between these two levels.



Note

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

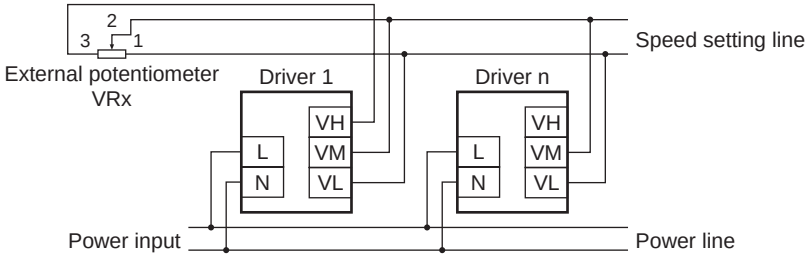
3.7 Multi-motor control

A single external potentiometer (external DC voltage) can be used to operate the same speed for multiple motors.

- The connection examples explained here assume a single-phase specification. In the case of a three-phase specification, connect the power line to a three-phase power supply.
- Connection of a motor and I/O signals is omitted in the figure.

■ Using an external potentiometer

Connect the drivers as shown below. When performing multi-motor control using the external potentiometer, the number of drivers should not exceed 20 units.



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

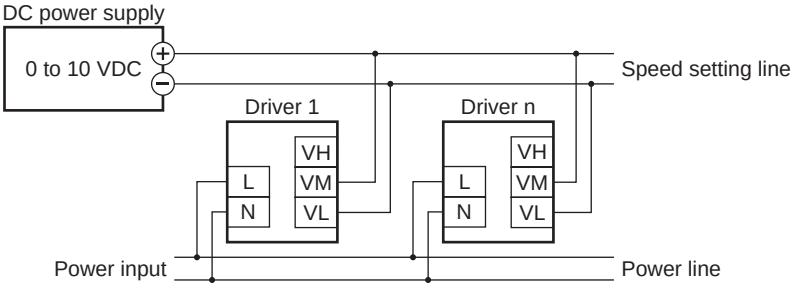
Resistance (VRx) = 20/n (kΩ), n/4 (W)

Example: If two drivers are used

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

■ 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.

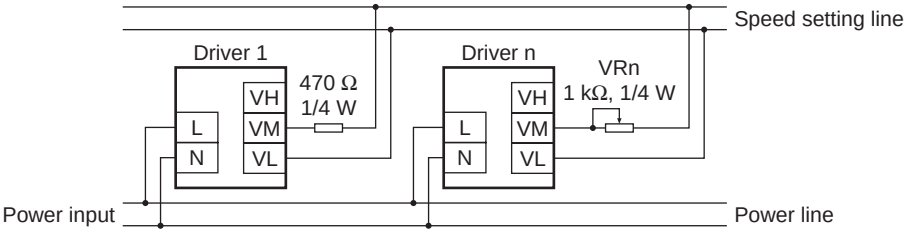
- Adjusting by the parameter

The speed difference can be adjusted by changing the "analog operating speed command gain" parameter and "analog operating speed command offset" parameter for the second and subsequent drivers. This section explains how to adjust by the "analog operating speed command offset" parameter. See p.57 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 operating 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 operating speed command offset" parameter.

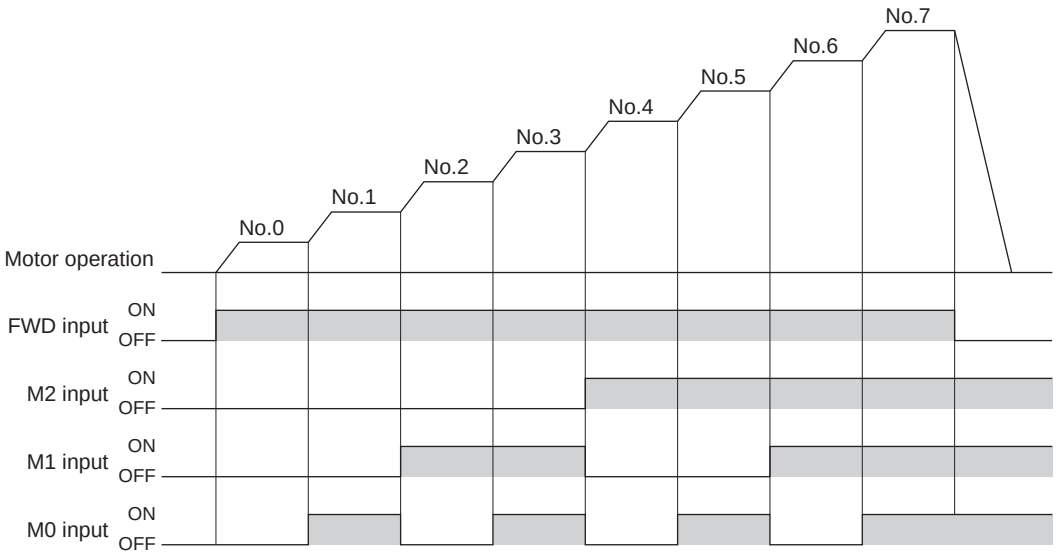
- Adjustment by a resistor

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.



3.8 Multi-speed operation

When assigning the M0 to M3 inputs to the CN5 input terminals, the variable-speed driving of the motor is possible using maximum 16 operation data. This section shows an example assigning the M0 to M2 inputs and performing multi-speed operation by using 8 operating data. See p.41 for the combination of the M0 to M3 inputs and how to select the operating data.



4 Method of control via Modbus RTU (RS-485 communication)

This part explains how to control from the master controller via RS-485 communication. The protocol for the RS-485 communication is the Modbus protocol.

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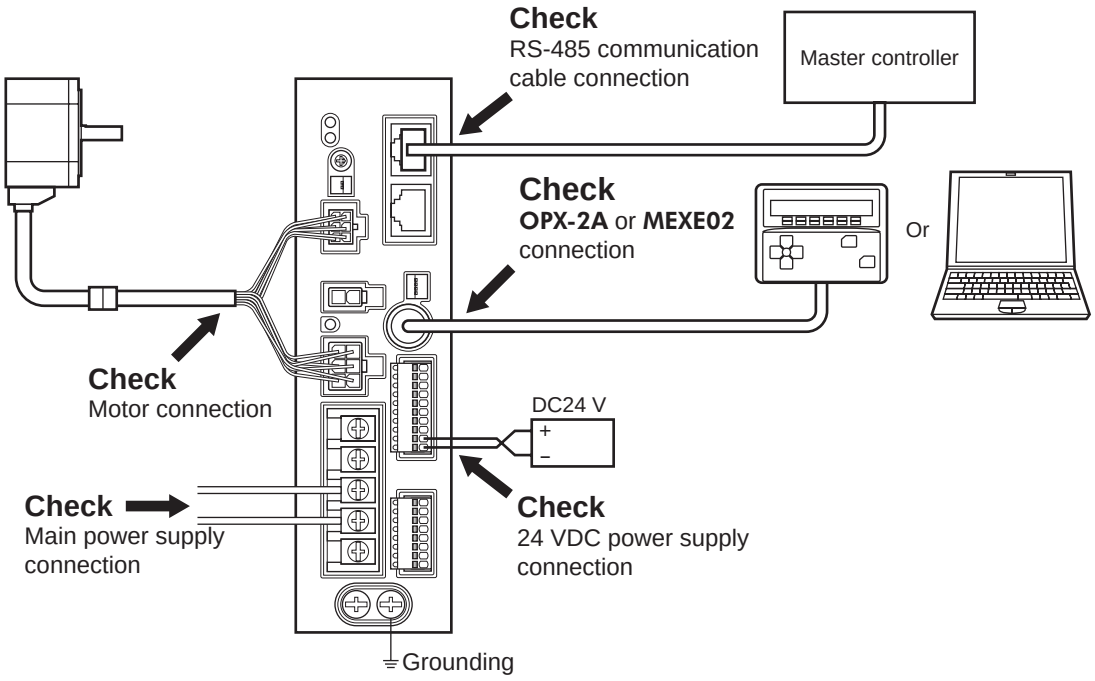
1 Guidance

The Modbus protocol is simple and its specification is open to the public, so this protocol is used widely in industrial applications. Modbus communication is based on the single-master/multiple-slave method. Only the master can issue a query (command). Each slave executes the requested process and returns a response message.
If you are new to the **BLE** Series FLEX RS-485 communication type, read this section to understand the operating methods along with the operation flow.
This is an example how to operate the motor based on the operation data and parameters set to the driver by the master controller.

Note Before operating the motor, check the condition of the surrounding area to ensure safety.

STEP 1 Check the installation and connection

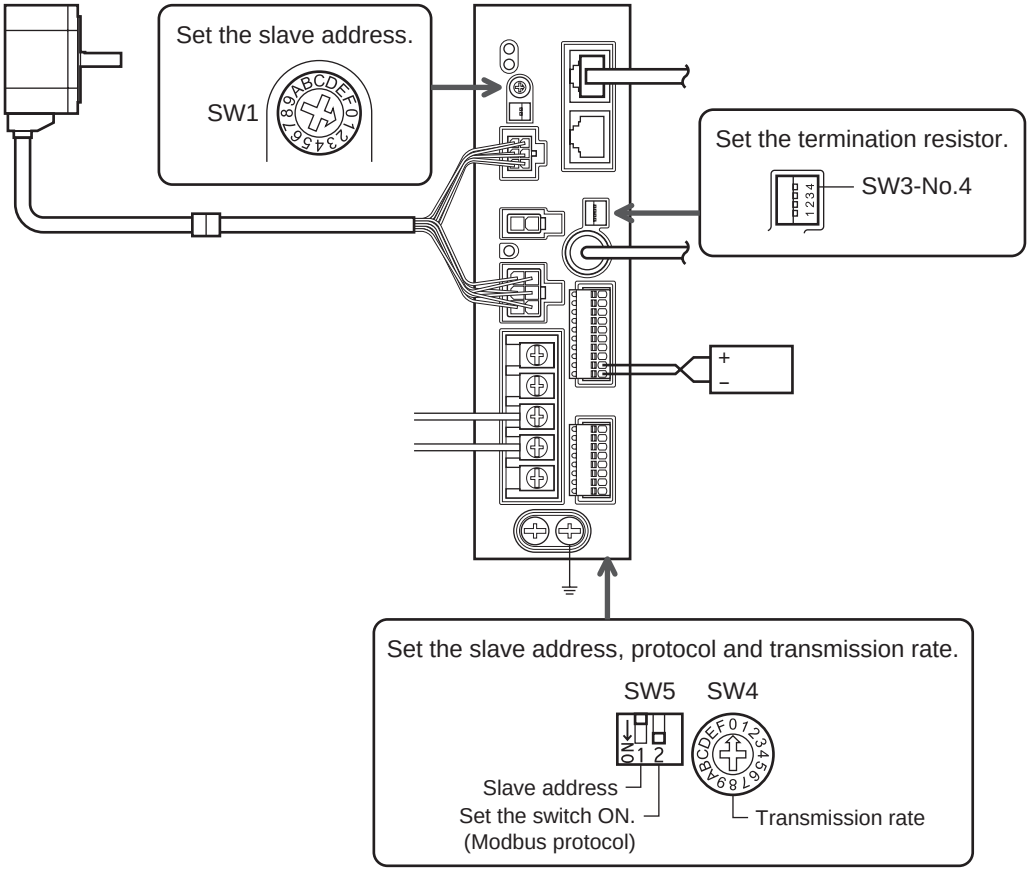


■ Setting method of the operation data

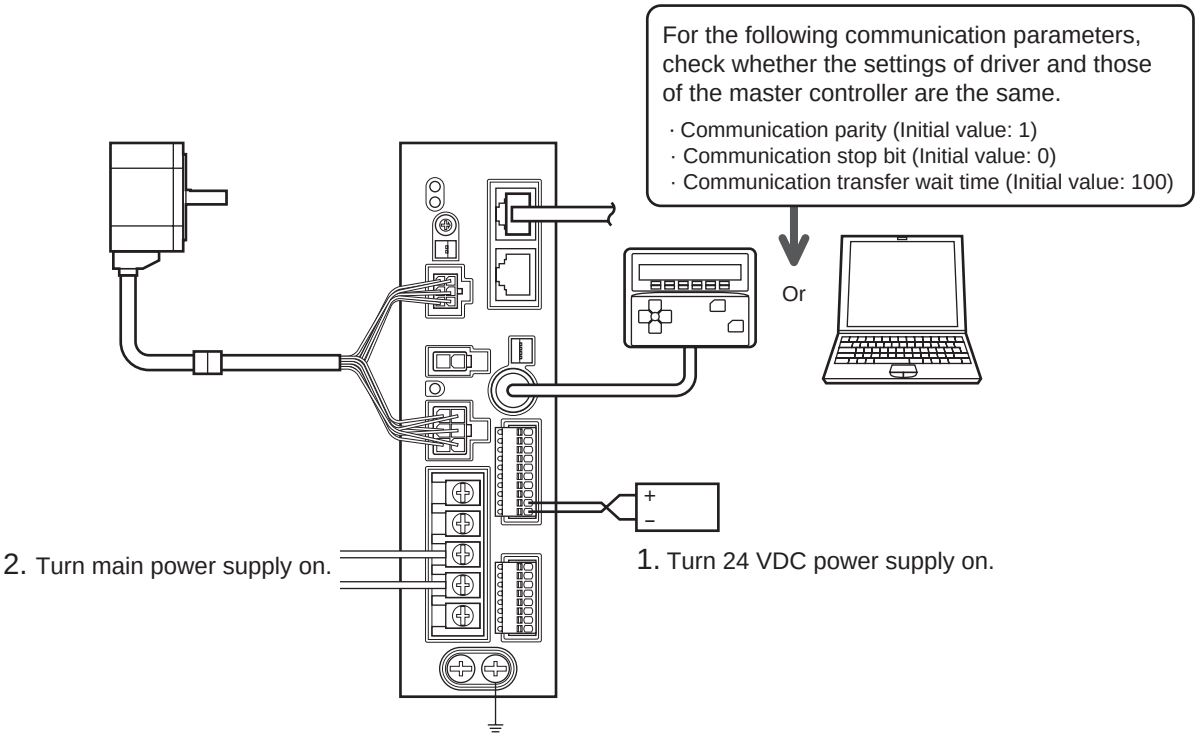
The analog setting, which permits the setting of the rotation speed with an external potentiometer or external DC voltage, is enabled at the time of shipment.
When controlling by a programmable controller via RS-485 communication, change the setting of the "Analog input signal selection" parameter to 0 (digital setting).
Refer to the table below for the parameter setting.

"Analog input signal select" parameter	Operation data No.	Rotational speed	Acceleration Deceleration	Torque limit
0	0 to 15	Digital setting		
1 (Initial value)	0	Analog setting	Digital setting	
	1 to 15	Digital setting		
2	0 ot 15	Digital setting		Analog setting

STEP 2 Set the switches



STEP 3 Turn on the power and check the parameters



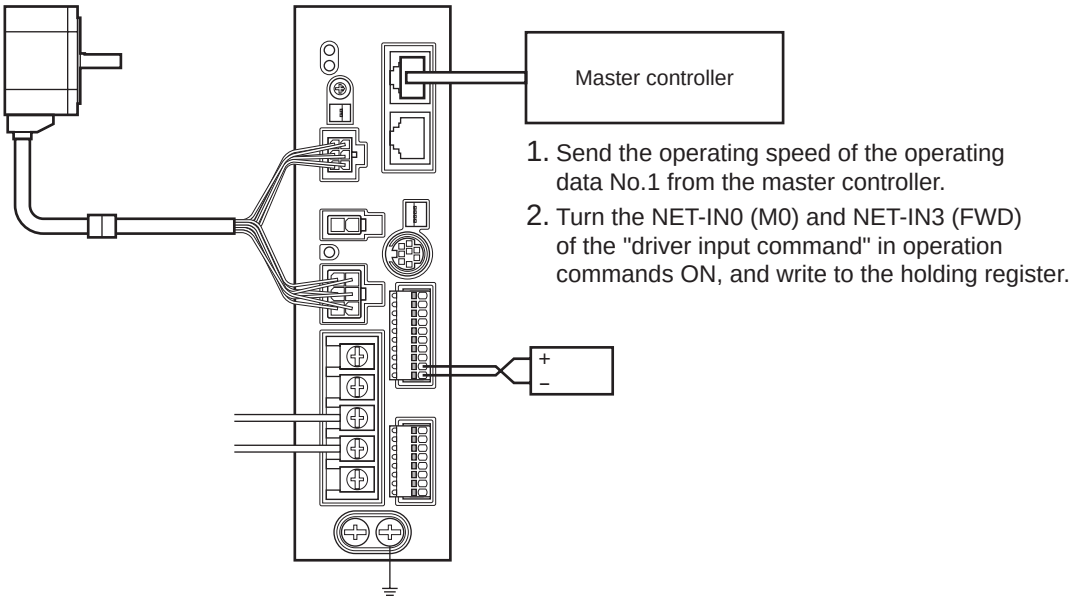
Check that the parameters of the driver and those of the master controller are the same.
Use the **OPX-2A** or **MEXE02** when changing the driver parameters.

STEP 4 Cycle the power

Communication parameters will be enabled after the power is cycled. If you have changed any of the communication parameters, be sure to cycle the power.

STEP 5 Operate the motor

3. Confirm that the motor rotates without any problem.



STEP 6 Were you able to operate the motor properly?

How did it go? Were you able to operate the motor properly? If the motor does not function, check the following points:

- Is any alarm present?
- Are the power supply, motor and RS-485 communication cable connected securely?
- Are the slave address, transmission rate and termination resistor set correctly?
- Is the C-ERR LED lit?
- Is the C-DAT LED lit or blinking?

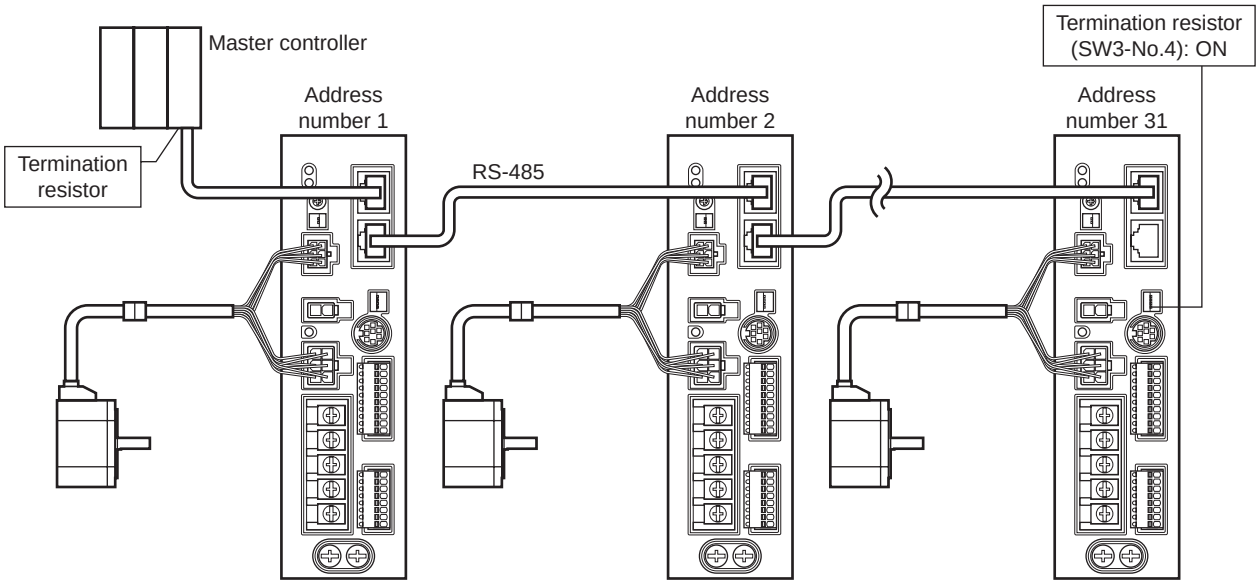
For more detailed settings and functions, refer to following pages.

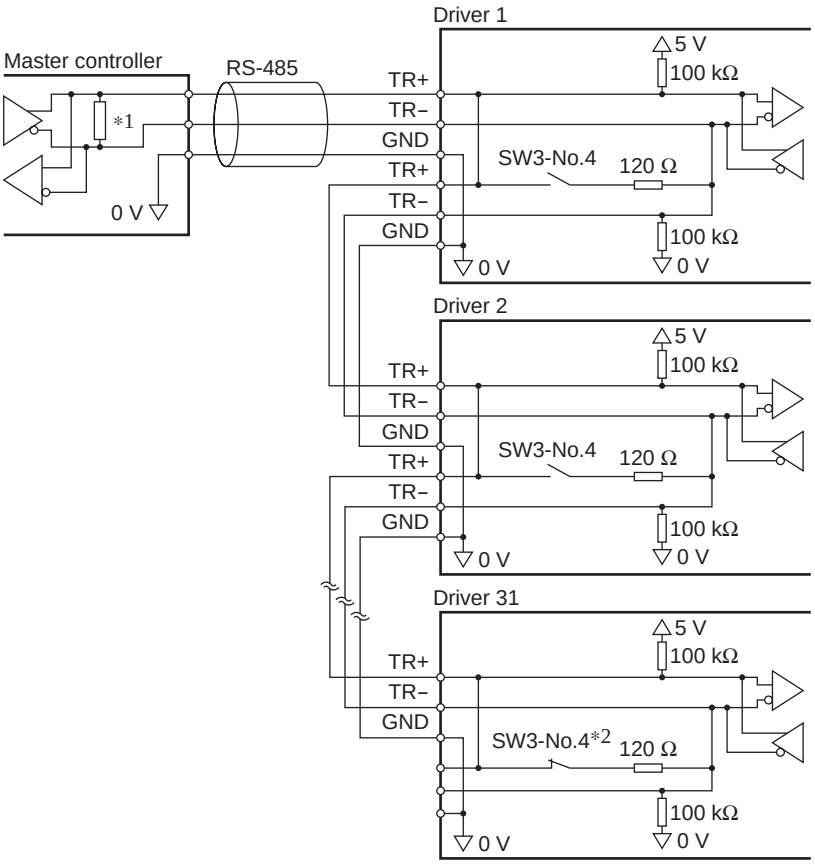
2 Communication specifications

Electrical characteristics	In conformance with EIA-485, straight cable Use a twisted pair cable (TIA/EIA-568B CAT5e or higher is recommended) and keep the total wiring distance including extension to 50 m (164 ft.) or less. *
Transmission mode	Half duplex
Transmission rate	Selectable from 9600 bps, 19200 bps, 38400 bps, 57600 bps and 115,200 bps.
Physical layer	Asynchronous mode (data: 8 bits, stop bit: 1 bit/2 bits, parity: none/even number/odd number)
Protocol	Modbus RTU mode
Connection pattern	Up to 31 drivers can be connected to one master controller.

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

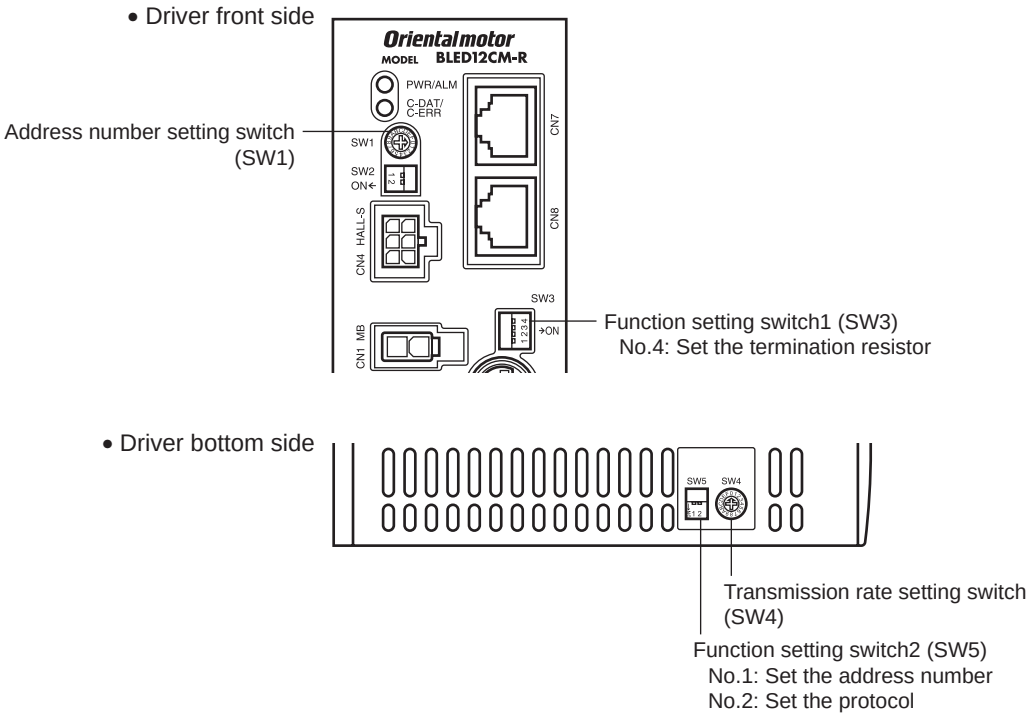
■ Connection example





*1 Termination resistor 120 Ω
*2 Turn the termination resistor (SW3-No.4) to ON.

3 Setting the switches



Note Be sure to turn off the driver power before setting the switches. If the switches are set while the power is still on, the new switch settings will not become effective until the driver power is cycled.

■ Protocol

Set the SW5-No.2 of the function setting switch2 to ON. The Modbus protocol is selected.

Factory setting OFF

■ Address number (slave address)

Set the address number (slave address) using the address number setting switch (SW1) and SW5-No.1 of the function setting switch2. Make sure each address number (slave address) you set for each driver is unique.
Address number (slave address) 0 is reserved for broadcasting, so do not use this address.

Factory setting SW1: 0, SW5-No.1: OFF (Address number 0)

SW1	SW5-No.1	Address number (slave address)
0	OFF	Not used
1		1
2		2
3		3
4		4
5		5
6		6
7		7
8		8
9		9
A		10
B		11
C		12
D		13
E		14
F		15

SW1	SW5-No.1	Address number (slave address)
0	ON	16
1		17
2		18
3		19
4		20
5		21
6		22
7		23
8		24
9		25
A		26
B		27
C		28
D		29
E		30
F		31

■ Transmission rate

Set the transmission rate using transmission rate setting switch (SW4).
The transmission rate to be set should be the same as the transmission rate of the master controller.

Factory setting 7

SW4	Transmission rate (bps)
0	9600
1	19200
2	38400
3	57600
4	115,200
5	Not used
6	Not used
7	Network Converter
8 to F	Not used

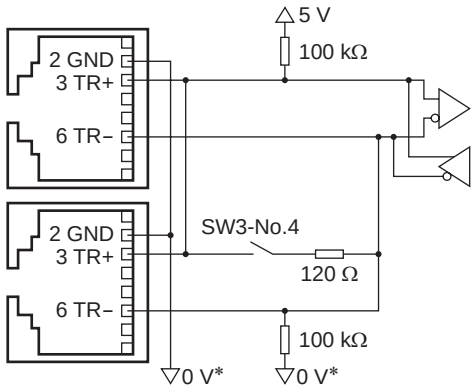
Note Do not set the SW4 to positions 5, 6 and 8 to F.

■ Termination resistor

Use a termination resistor for the driver located farthest away (positioned at the end) from the master controller.
Turn the SW3-No.4 of the function setting switch1 to ON to set the termination resistor for RS-485 communication (120 Ω).

Factory setting OFF (termination resistor disabled)

SW3-No.4	Termination resistor (120 Ω)
OFF	Disabled
ON	Enabled



* The GND line is used in common with 24 VDC power supply input terminal (CN5).

4 Setting the RS-485 communication

Set parameters required to use via RS-485 communication beforehand.

■ Parameters set with the OPX-2A or MEXE02

The following parameters cannot be set via RS-485 communication. Set these parameters using the **OPX-2A** or **MEXE02**

Parameter name	Description	Setting range	Initial value
Communication parity	Sets the parity for RS-485 communication.	0: No parity 1: Even 2: Odd	1
Communication stop bit	Sets the stop bit for RS-485 communication.	0: 1 bit 1: 2 bit	0
Communication transfer wait time	Sets the transmission waiting time for RS-485 communication.	0 to 10000 (1=0.1 ms)	100

■ Parameters set with the OPX-2A, MEXE02 or via RS-485 communication

Set the following parameters using any of the **OPX-2A**, **MEXE02** or RS-485 communication.

Parameter name	Description	Setting range	Initial value
Communication time out	Sets the condition in which the communication timeout occurs in RS-485 communication. When setting to zero (0), the driver does not monitor the condition in which the communication timeout occurs.	0 to 10000 ms	0
Communication error alarm	Sets the condition in which the RS-485 communication error alarm generates. The communication error alarm generates after the RS-485 communication error has occurred by the number of times set here.	1 to 10 times	3

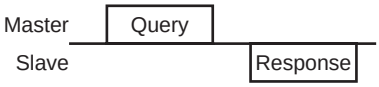
5 Communication mode and communication timing

5.1 Communication mode

Modbus protocol communication is based on the single-master/multiple-slave method. Under this protocol, messages are sent in one of two methods.

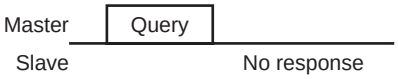
- Unicast mode

The master sends a command to only one slave. The slave executes the process and returns a response.

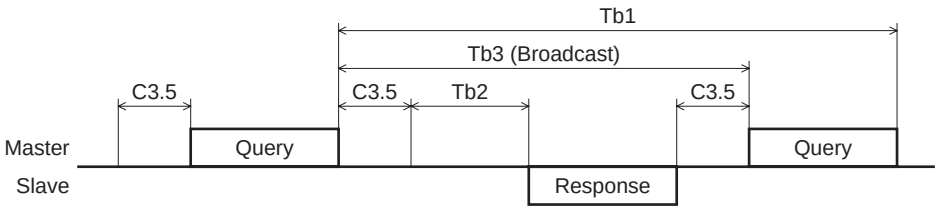


- Broadcast mode

If slave address 0 is specified on the master, the master can send a command to all slaves. Each slave executes the process, but does not return a response.



5.2 Communication timing



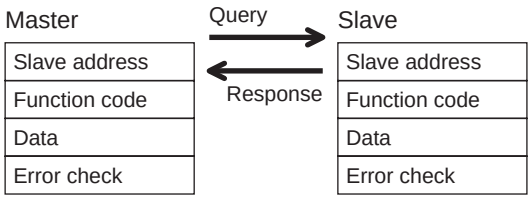
Character	Name	Description
Tb1	Communication timeout	Intervals between received messages are monitored. If no message could be received after the time set in the "communication time out" parameter, the RS-485 communication timeout alarm generates.
Tb2	Transmission waiting time	The time after the slave switches its communication line to the transmission mode upon receiving a query from the master, until it starts sending a response. Sets using the "communication transfer wait time" parameter. The actual transmission waiting time corresponds to the silent interval (C3.5) + transmission waiting time (Tb2).
Tb3	Broadcasting interval	The time until the next query is sent in broadcasting. A time equivalent to or longer than the silent interval (C3.5) plus 5 ms is required.
C3.5	Silent interval	Be sure to provide a waiting time of 3.5 characters or more. If this waiting time is less than 3.5 characters long, the driver cannot respond. See the following table for transmission waiting time.

Transmission waiting time of the "silent interval"

Transmission rate (bps)	Transmission waiting time
9600	5.5 ms or more
19200 38400 57600 115,200	3.5 ms or more

6 Message

The message format is shown below.



6.1 Query

The query message structure is shown below.

Slave address	Function code	Data	Error check
8 bits	8 bits	N×8 bits	16 bits

■ Slave address

Specify the slave address (unicast mode).
If the slave address is set to 0, the master can send a query to all slaves (broadcast mode).

■ Function code

The function codes and message lengths supported by the **BLE** Series FLEX RS-485 communication type are as follows.

Function code	Description	Message length		Broadcast
		Query	Response	
03h	Read from a holding register(s).	8	7 to 37	Impossible
06h	Write to a holding register.	8	8	Possible
08h	Perform diagnosis.	8	8	Impossible
10h	Write to multiple holding registers.	11 to 41	8	Possible

■ Data

Set data associated with the selected function code. The specific data length varies depending on the function code.

■ Error check

In the Modbus RTU mode, error checks are based on the CRC-16 method. The slave calculates a CRC-16 of each received message and compares the result against the error check value included in the message. If the calculated CRC-16 value matches the error check value, the slave determines that the message is normal.

- CRC-16 calculation method

1. Calculate an exclusive-OR (XOR) value of the default value of FFFFh and slave address (8 bits).
2. Shift the result of step 1 to the right by 1 bit. Repeat this shift until the overflow bit becomes "1."
3. Upon obtaining "1" as the overflow bit, calculate an XOR of the result of step 2 and A001h.
4. Repeat steps 2 and 3 until a shift is performed eight times.
5. Calculate an XOR of the result of step 4 and function code (8 bits).
   Repeat steps 2 to 4 for all bytes.
   The final result gives the result of CRC-16 calculation.

- Example of CRC-16 calculation (slave address: 02h, function code: 07h)

The following table is a calculation example when setting the slave address of the first byte to 02h and setting the function code of the second byte to 07h.
The result of actual CRC-16 calculation is calculated including the data on and after the third byte.

Description	Result	Overflow digit
Default value in CRC register FFFFh	1111 1111 1111 1111	−
First byte 02h	0000 0000 0000 0010	−
XOR with default value FFFFh	1111 1111 1111 1101	−
First shift to right	0111 1111 1111 1110	1
XOR with A001h	1010 0000 0000 0001 1101 1111 1111 1111	−
Second shift to right	0110 1111 1111 1111	1
XOR with A001h	1010 0000 0000 0001 1100 1111 1111 1110	−
Third shift to right	0110 0111 1111 1111	0
Fourth shift to right	0011 0011 1111 1111	1
XOR with A001h	1010 0000 0000 0001 1001 0011 1111 1110	−
Fifth shift to right	0100 1001 1111 1111	0
Sixth shift to right	0010 0100 1111 1111	1
XOR with A001h	1010 0000 0000 0001 1000 0100 1111 1110	−
Seventh shift to right	0100 0010 0111 1111	0
Eighth shift to right	0010 0001 0011 1111	1
XOR with A001h	1010 0000 0000 0001 1000 0001 0011 1110	−
XOR with next byte 07h	0000 0000 0000 0111 1000 0001 0011 1001	−
First shift to right	0100 0000 1001 1100	1
XOR with A001h	1010 0000 0000 0001 1110 0000 1001 1101	−
Second shift to right	0111 0000 0100 1110	1
XOR with A001h	1010 0000 0000 0001 1101 0000 0100 1111	−
Third shift to right	0110 1000 0010 0111	1
XOR with A001h	1010 0000 0000 0001 1100 1000 0010 0110	−
Fourth shift to right	0110 0100 0001 0011	0
Fifth shift to right	0011 0010 0000 1001	1
XOR with A001h	1010 0000 0000 0001 1001 0010 0000 1000	−
Sixth shift to right	0100 1001 0000 0100	0
Seventh shift to right	0010 0100 1000 0010	0
Eighth shift to right	0001 0010 0100 0001	0
Result of CRC-16	0001 0010 0100 0001	−

6.2 Response

Slave-returned responses are classified into three types: normal response, no response, and exception response.
The response message structure is the same as the command message structure.

Slave address	Function code	Data	Error check
8 bits	8 bits	N×8 bits	16 bits

■ Normal response

Upon receiving a query from the master, the slave executes the requested process and returns a response.

■ No response

The slave may not return a response to a query sent by the master. This condition is referred to as "No response."
The causes of no response are explained below.

- Transmission error

The slave discards the query and does not return a response if any of the following transmission errors is detected.

Cause of transmission error	Description
Framing error	Stop bit 0 was detected.
Parity error	A mismatch with the specified parity was detected.
Mismatched CRC	The calculated value of CRC-16 was found not matching the error check value.
Invalid message length	The message length exceeded 256 bytes.

- Other than transmission error

A response may not be returned without any transmission error being detected.

Cause	Description
Broadcast	If the query was broadcast, the slave executes the requested process but does not return a response.
Mismatched slave address	The slave address in the query was found not matching the slave address of the driver.

■ Exception response

An exception response is returned if the slave cannot execute the process requested by the query. Appended to this response is an exception code indicating why the process cannot be executed. The message structure of exception response is as follows.

Slave address	Function code	Exception code	Error check
8 bits	8 bits	8 bits	16 bits

- Function code

The function code in the exception response is a sum of the function code in the query and 80h.
Example) query: 03h → Exception response: 83h

- Example of exception response

Master

Slave address		01h
Function code		06h
Data	Register address (upper)	02h
	Register address (lower)	40h
	Value write (upper)	FFh
	Value write (lower)	FFh
Error check (lower)		88h
Error check (upper)		16h

Query →
← Response

Slave

Slave address		01h
Function code		86h
Data	Exception code	04h
Error check (lower)		02h
Error check (upper)		61h

- Exception code

This code indicates why the process cannot be executed.

Exception code	Communication error code	Cause	Description
01h	88h	Invalid function	The process could not be executed because the function code was invalid. • The function code is not supported. • The sub-function code for diagnosis (08h) is other than 00h.
02h		Invalid data address	The process could not be executed because the data address was invalid. • The address is not supported (other than 0000h to 1FFFh). • Register address and number of registers are 2000h or more in total.
03h	8Ch	Invalid data	The process could not be executed because the data was invalid. • The number of registers is 0 or more than 17. • The number of bytes is other than twice the number of registers. • The data length is outside the specified range.
04h	89h 8Ah 8Ch 8Dh	Slave error	The process could not be executed because an error occurred at the slave. • User I/F communication in progress (89h) · Downloading, initializing or teaching function is in progress using the **OPX-2A** · Downloading or initialization is in progress using the **MEXE02** • Non-volatile memory processing in progress (8Ah) · Internal processing is in progress. (S-BSY is ON.) · An EEPROM error alarm is present. • Outside the parameter setting range (8Ch) · The value write is outside the setting range. • Command execute disable (8Dh)

7 Function code

7.1 Reading from a holding register(s)

This function code is used to read a register (16 bits). Up to 16 successive registers (16×16 bits) can be read.
Read the upper and lower data at the same time. If they are not read at the same time, the value may be invalid.
If multiple holding registers are read, they are read in order of register addresses.

Example of read

Read operation data for rotation speed Nos.0 and 1 of slave address 1.

Description	Register address	Value read	Corresponding decimal
Rotation speed No.0 (upper)	0480h	0000h	100
Rotation speed No.0 (lower)	0481h	0064h	
Rotation speed No.1 (upper)	0482h	0000h	4000
Rotation speed No.1 (lower)	0483h	0FA0h	

- Query

Field name		Data	Description
Slave address		01h	Slave address 1
Function code		03h	Reading from holding registers
Data	Register address (upper)	04h	Register address to start reading from
	Register address (lower)	80h	
	Number of registers (upper)	00h	Number of registers to be read from the starting register address (4 registers=0004h)
	Number of registers (lower)	04h	
Error check (lower)		44h	Calculation result of CRC-16
Error check (upper)		D1h	

- Response

Field name		Data	Description
Slave address		01h	Same as query
Function code		03h	
Data	Number of data bytes	08h	Twice the number of registers in the query
	Value read from register address (upper)	00h	Value read from register address 0480h
	Value read from register address (lower)	00h	
	Value read from register address+1 (upper)	00h	Value read from register address 0481h
	Value read from register address+1 (lower)	64h	
	Value read from register address+2 (upper)	00h	Value read from register address 0482h
	Value read from register address+2 (lower)	00h	
	Value read from register address+3 (upper)	0Fh	Value read from register address 0483h
	Value read from register address+3 (lower)	A0h	
Error check (lower)		E1h	Calculation result of CRC-16
Error check (upper)		97h	

7.2 Writing to a holding register

This function code is used to write data to a specified register address.
However, since the result combining the upper and lower may be outside the data range, write the upper and lower at the same time using the "multiple holding registers (10h)."

Example of write

Write 50 (32h) as overload warning lebel (lower) to slave address 2.

Description	Register address	Value write	Corresponding decimal
Overload warning lebel (lower)	10ABh	32h	50

- Query

Field name		Data	Description
Slave address		02h	Slave address 2
Function code		06h	Writing to a holding register
Data	Register address (upper)	10h	Register address to be written
	Register address (lower)	ABh	
	Value write (upper)	00h	Value written to the register address
	Value write (lower)	32h	
Error check (lower)		7Dh	Calculation result of CRC-16
Error check (upper)		0Ch	

- Response

Field name		Data	Description
Slave address		02h	Same as query
Function code		06h	
Data	Register address (upper)	10h	
	Register address (lower)	ABh	
	Value write (upper)	00h	
	Value write (lower)	32h	
Error check (lower)		7Dh	Calculation result of CRC-16
Error check (upper)		0Ch	

7.3 Diagnosis

This function code is used to diagnose the communication between the master and slave. Arbitrary data is sent and the returned data is used to determine whether the communication is normal. 00h (reply to query) is the only sub-function supported by this function code.

Example of diagnosis

Send arbitrary data (1234h) to the slave.

- Query

Field name		Data	Description
Slave address		03h	Slave address 3
Function code		08h	Diagnosis
Data	Sub-function code (upper)	00h	Return the query data
	Sub-function code (lower)	00h	
	Data value (upper)	12h	Arbitrary data (1234h)
	Data value (lower)	34h	
Error check (lower)		ECh	Calculation result of CRC-16
Error check (upper)		9Eh	

- Response

Field name		Data	Description
Slave address		03h	Same as query
Function code		08h	
Data	Sub-function code (upper)	00h	
	Sub-function code (lower)	00h	
	Data value (upper)	12h	
	Data value (lower)	34h	
Error check (lower)		ECh	
Error check (upper)		9Eh	

7.4 Writing to multiple holding registers

This function code is used to write data to multiple successive registers. Up to 16 registers can be written.
Write the data to the upper and lower at the same time. If not, an invalid value may be written.
Registers are written in order of register addresses. Note that even when an exception response is returned because some data is invalid as being outside the specified range, etc., other data may have been written properly.

Example of write

Set the following data as acceleration time Nos.0 to 2 as part of operation data at slave address 4.

Description	Register address	Value written	Corresponding decimal
Operation data acceleration time No.0 (upper)	0600h	0000h	2
Operation data acceleration time No.0 (lower)	0601h	0002h	
Operation data acceleration time No.1 (upper)	0602h	0000h	50
Operation data acceleration time No.1 (lower)	0603h	0032h	
Operation data acceleration time No.2 (upper)	0604h	0000h	150
Operation data acceleration time No.2 (lower)	0605h	0096h	

- Query

Field name		Data	Description
Slave address		04h	Slave address 4
Function code		10h	Writing to multiple holding registers
Data	Register address (upper)	06h	Register address to start writing from
	Register address (lower)	00h	
	Number of registers (upper)	00h	Number of registers to be written from the starting register address (6 registers=0006h)
	Number of registers (lower)	06h	
	Number of data bytes	0Ch	Twice the number of registers in the command (6 registers × 2 = 12 registers: 0Ch)
	Value written to register address (upper)	00h	Value written to register address 0600h
	Value written to register address (lower)	00h	
	Value written to register address+1 (upper)	00h	Value written to register address 0601h
	Value written to register address+1 (lower)	02h	
	Value written to register address+2 (upper)	00h	Value written to register address 0602h
	Value written to register address+2 (lower)	00h	
	Value written to register address+3 (upper)	00h	Value written to register address 0603h
	Value written to register address+3 (lower)	32h	
	Value written to register address+4 (upper)	00h	Value written to register address 0604h
	Value written to register address+4 (lower)	00h	
	Value written to register address+5 (upper)	00h	Value written to register address 0605h
	Value written to register address+5 (lower)	96h	
Error check (lower)		85h	Calculation result of CRC-16
Error check (upper)		70h	

- Response

Field name		Data	Description
Slave address		04h	Same as query
Function code		10h	
Data	Register address (upper)	06h	
	Register address (lower)	00h	
	Number of registers (upper)	00h	
	Number of registers (lower)	06h	
Error check (lower)		40h	Calculation result of CRC-16
Error check (upper)		D6h	

8 Register address list

All data used by the driver is 32-bit wide. The register for the Modbus protocol is 16-bit wide, and one data is described by two registers. Since the address assignment is big endian, the even number addresses become the upper and the odd number addresses become the lower.

8.1 Operation commands

These are commands related to motor operation. Operation commands are not saved in the non-volatile memory.

Register address		Name	Description	READ/ WRITE	Setting range
Dec	Hex				
48	0030h	Group (upper)	Sets the group address.	R/W	−1: No group specification (Group send is not performed) 1 to 31: Group address (Address number of parent slave)
49	0031h	Group (lower)			
124	007Ch	Driver input command (upper)	Sets the input command to the driver.	R/W	See the following explanation.
125	007Dh	Driver input command (lower)			
126	007Eh	Driver output command (upper)	Reads the output status of the driver.	R	See next page.
127	007Fh	Driver output command (lower)			

- Group (0030h, 0031h)

Multiple slaves are made into a group and a query is sent to all slaves in the group at once. See p.94 for group details. The initial value is −1. When performing read or write for setting a group, set the upper and lower simultaneously.

Address (Hex)	Description of address *							
0030h	bit15	bit14	bit13	bit12	bit11	bit10	bit9	bit8
	[FFFFh]							
	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
	[FFFFh]							

* [ ]: Initial value

Address (Hex)	Description of address *							
0031h	bit15	bit14	bit13	bit12	bit11	bit10	bit9	bit8
	1 to 31: Sets the address number for the group send. [FFFFh]							
	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
	1 to 31: Sets the address number for the group send. [FFFFh]							

* [ ]: Initial value

- Driver input command (007Ch, 007Dh)

These are the driver input signals that can be accessed via RS-485 communication. See p.40 for each input signal.

Address (Hex)	Description of address							
007Ch	bit15	bit14	bit13	bit12	bit11	bit10	bit9	bit8
	–	–	–	–	–	–	–	–
	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
	–	–	–	–	–	–	–	–

Address (Hex)	Description of address *							
007Dh	bit15	bit14	bit13	bit12	bit11	bit10	bit9	bit8
	NET-IN15 [Not used]	NET-IN14 [Not used]	NET-IN13 [Not used]	NET-IN12 [Not used]	NET-IN11 [Not used]	NET-IN10 [Not used]	NET-IN9 [Not used]	NET-IN8 [Not used]
	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
	NET-IN7 [Not used]	NET-IN6 [MB-FREE]	NET-IN5 [STOP-MODE]	NET-IN4 [REV]	NET-IN3 [FWD]	NET-IN2 [M2]	NET-IN1 [M1]	NET-IN0 [M0]

* [ ]: Initial value

- Driver output command (007Eh, 007Fh)

These are the driver output signals that can be received via RS-485 communication. See p.42 for each output signal.

Address (Hex)	Description of address							
007Eh	bit15	bit14	bit13	bit12	bit11	bit10	bit9	bit8
	–	–	–	–	–	–	–	–
	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
	–	–	–	–	–	–	–	–

Address (Hex)	Description of address *							
007Fh	bit15	bit14	bit13	bit12	bit11	bit10	bit9	bit8
	NET-OUT15 [TLC]	NET-OUT14 [VA]	NET-OUT13 [MOVE]	NET-OUT12 [ALARM-OUT2]	NET-OUT11 [Not used]	NET-OUT10 [Not used]	NET-OUT9 [Not used]	NET-OUT8 [S-BSY]
	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
	NET-OUT7 [ALARM-OUT1]	NET-OUT6 [WNG]	NET-OUT5 [STOP-MODE_R]	NET-OUT4 [REV_R]	NET-OUT3 [FWD_R]	NET-OUT2 [M2_R]	NET-OUT1 [M1_R]	NET-OUT0 [M0_R]

* [ ]: Initial value

8.2 Maintenance commands

These commands are used to reset alarms and warnings, and they are also used to execute the batch processing for the non-volatile memory. All commands can be written (WRITE). They are executed when writing from 0 to 1.

Register address		Name	Description	Setting range
Dec	Hex			
384	0180h	Reset alarm (upper)	Resets the alarms that are present. Some alarms cannot be reset with the “reset alarm.”	0, 1
385	0181h	Reset alarm (lower)		
388	0184h	Clear alarm records (upper)	Clears alarm records.	
389	0185h	Clear alarm records (lower)		
390	0186h	Clear warning records (upper)	Clears warning records.	
391	0187h	Clear warning records (lower)		
392	0188h	Clear communication error records (upper)	Clears the communication error records.	
393	0189h	Clear communication error records (lower)		
396	018Ch	Configuration (upper)	Executes the parameter recalculation and the setup.	
397	018Dh	Configuration (lower)		
398	018Eh	All data initialization (upper) *	Resets the operation data and parameters saved in the non-volatile memory, to their defaults.	
399	018Fh	All data initialization (lower) *		
400	0190h	Batch NV memory read (upper)	Reads the parameters saved in the non-volatile memory, to the RAM. All operation data and parameters previously saved in the RAM are overwritten.	
401	0191h	Batch NV memory read (lower)		
402	0192h	Batch NV memory write (upper)	Writes the parameters saved in the RAM to the non-volatile memory. The non-volatile memory can be rewritten approximately 100,000 times.	
403	0193h	Batch NV memory write (lower)		

* Communication parity, communication stop bit and transmission waiting time are not initialized. Initialize them using the **OPX-2A** or **MEXE02**.

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

Configuration (018Ch, 018Dh)

Configuration will be executed when all of the following conditions are satisfied:

- An alarm is not present.
- The motor is not operated.
- The **OPX-2A** is in other modes than the test mode or copy mode.
- The **MEXE02** is in other status than downloading, I/O test, test operation or teaching function.

Shows the driver status before and after executing the configuration.

Item	Configuration is ready to execute	Configuration is executing	Configuration is completed
PWR LED	Lit	Lit	Based on the driver condition.
ALM LED	OFF	OFF	
Electromagnetic brake	Hold/release	Hold	
Output signals	Allowed	Indeterminable	Allowed
Input signals		Not allowed	

Note The correct monitor value may not return even when the monitor is executed while executing the configuration.

8.3 Monitor commands

These commands are used to monitor the command position, command speed, alarm and warning records, etc. All commands can be read (READ).

Register address		Name	Description	Range
Dec	Hex			
128	0080h	Present alarm (upper)	Monitors the present alarm code.	00h to FFh
129	0081h	Present alarm (lower)		
130	0082h	Alarm record 1 (upper)	Monitors the alarm records.	
131	0083h	Alarm record 1 (lower)		
132	0084h	Alarm record 2 (upper)		
133	0085h	Alarm record 2 (lower)		
134	0086h	Alarm record 3 (upper)		
135	0087h	Alarm record 3 (lower)		
136	0088h	Alarm record 4 (upper)		
137	0089h	Alarm record 4 (lower)		
138	008Ah	Alarm record 5 (upper)		
139	008Bh	Alarm record 5 (lower)		
140	008Ch	Alarm record 6 (upper)		
141	008Dh	Alarm record 6 (lower)		
142	008Eh	Alarm record 7 (upper)		
143	008Fh	Alarm record 7 (lower)		
144	0090h	Alarm record 8 (upper)		
145	0091h	Alarm record 8 (lower)		
146	0092h	Alarm record 9 (upper)		
147	0093h	Alarm record 9 (lower)		
148	0094h	Alarm record 10 (upper)		
149	0095h	Alarm record 10 (lower)		
150	0096h	Present warning (upper)	Monitors the present warning code.	
151	0097h	Present warning (lower)		
152	0098h	Warning record 1 (upper)	Monitors the warning records.	
153	0099h	Warning record 1 (lower)		
154	009Ah	Warning record 2 (upper)		
155	009Bh	Warning record 2 (lower)		
156	009Ch	Warning record 3 (upper)		
157	009Dh	Warning record 3 (lower)		
158	009Eh	Warning record 4 (upper)		
159	009Fh	Warning record 4 (lower)		

Register address		Name	Description	Range
Dec	Hex			
160	00A0h	Warning record 5 (upper)	Monitors the warning records.	00h to FFh
161	00A1h	Warning record 5 (lower)		
162	00A2h	Warning record 6 (upper)		
163	00A3h	Warning record 6 (lower)		
164	00A4h	Warning record 7 (upper)		
165	00A5h	Warning record 7 (lower)		
166	00A6h	Warning record 8 (upper)		
167	00A7h	Warning record 8 (lower)		
168	00A8h	Warning record 9 (upper)		
169	00A9h	Warning record 9 (lower)		
170	00AAh	Warning record 10 (upper)		
171	00ABh	Warning record 10 (lower)		
172	00ACh	Communication error code (upper)	Monitors the last received communication error code.	
173	00ADh	Communication error code (lower)		
174	00AEh	Communication error code record 1 (upper)	Monitors the communication error records that have occurred in the past.	
175	00AFh	Communication error code record 1 (lower)		
176	00B0h	Communication error code record 2 (upper)		
177	00B1h	Communication error code record 2 (lower)		
178	00B2h	Communication error code record 3 (upper)		
179	00B3h	Communication error code record 3 (lower)		
180	00B4h	Communication error code record 4 (upper)		
181	00B5h	Communication error code record 4 (lower)		
182	00B6h	Communication error code record 5 (upper)		
183	00B7h	Communication error code record 5 (lower)		
184	00B8h	Communication error code record 6 (upper)		
185	00B9h	Communication error code record 6 (lower)		
186	00BAh	Communication error code record 7 (upper)		
187	00BBh	Communication error code record 7 (lower)		
188	00BCh	Communication error code record 8 (upper)		
189	00BDh	Communication error code record 8 (lower)		
190	00BEh	Communication error code record 9 (upper)		
191	00BFh	Communication error code record 9 (lower)		
192	00C0h	Communication error code record 10 (upper)		
193	00C1h	Communication error code record 10 (lower)		

Register address		Name	Description	Range
Dec	Hex			
196	00C4h	Present operation data No. (upper)	Monitors the operation data No. corresponding to the data used in the current operation.	0 to 15
197	00C5h	Present operation data No. (lower)		
200	00C8h	Command speed (upper)	Monitors the command speed.	−4010 to +4010 r/min +: Forward −: Reverse 0: Stop
201	00C9h	Command speed (lower)		
206	00CEh	Feedback speed (upper)	Monitors the feedback speed.	−5200 to +5200 r/min +: Forward −: Reverse 0: Stop
207	00CFh	Feedback speed (lower)		
212	00D4h	Direct I/O and electromagnetic brake status (upper)	Monitors the each direct I/O signal and electromagnetic brake status.	See next table.
213	00D5h	Direct I/O and electromagnetic brake status (lower)		
256	0100h	Operation speed (upper)	Monitors the feedback speed calculated by the "reduction gear rate" parameter or "amplification speed rate" parameter.	−20050 to +20050 r/min +: Forward −: Reverse 0: Stop
257	0101h	Operation speed (lower)		
258	0102h	Operation speed decimal position (upper)	Monitors the decimal position in the operation speed. ∗1	0: No decimal point 1: 1 digit 2: 2 digit 3: 3 digit
259	0103h	Operation speed decimal position (lower)		
260	0104h	Conveyor transfer speed (upper)	Monitors the feedback speed calculated by the "conveyor reduction gear rate" parameter or "conveyor amplification speed rate" parameter.	−20050 to +20050 r/min +: Forward −: Reverse 0: Stop
261	0105h	Conveyor transfer speed (lower)		
262	0106h	Conveyor transfer speed decimal position (upper)	Monitors the decimal position in the conveyor transfer speed. ∗2	0: No decimal point 1: 1 digit 2: 2 digit 3: 3 digit
263	0107h	Conveyor transfer speed decimal position (lower)		
264	0108h	Load factor (upper)	Monitors the torque that is output by the motor based on the rated torque being 100%.	0 to 200%
265	0109h	Load factor (lower)		
268	010Ch	External analog speed setting (upper)	Monitors the value of the analog speed setting. ∗3	0 to 4000 r/min
269	010Dh	External analog speed setting (lower)		
272	0110h	External analog torque limit setting (upper)	Monitors the value of the analog torque limiting. ∗3	0 to 200%
273	0111h	External analog torque limit setting (lower)		
278	0116h	External analog voltage setting (upper)	Monitors the value of the analog voltage setting.	0 to 100 (1=0.1 V)
279	0117h	External analog voltage setting (lower)		

*1 The decimal position is automatically changed based on the setting of the "reduction gear rate" parameter or "decimal place for reduction gear rate" parameter.

*2 The decimal position is automatically changed based on the setting of the "conveyor reduction gear rate" parameter or "decimal place for conveyor reduction gear rate" parameter.

*3 FFFFh is displayed when not selecting by the "analog input signal select" parameter.

■ Direct I/O and electromagnetic brake status (00D4h, 00D5h)

Address (Hex)	Description of address							
00D4h	bit15	bit14	bit13	bit12	bit11	bit10	bit9	bit8
	–	–	–	–	–	–	MB	–
	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
	–	–	–	–	–	–	OUT1	OUT2

Address (Hex)	Description of address							
00D5h	bit15	bit14	bit13	bit12	bit11	bit10	bit9	bit8
	–	–	–	–	–	–	–	–
	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
	–	IN6	IN5	IN4	IN3	IN2	IN1	IN0

8.4 Parameter R/W commands

These commands are used to write or read parameters. All commands can be read and written (READ/WRITE). When the operation data is changed, a recalculation and setup will be performed immediately and the changed value will be set. For details on parameters, see p.49 and later.

■ Operation data

Register address		Name	Setting range	Initial value
Dec	Hex			
1152	0480h	Rotational speed No.0 (upper)	0, or 80 to 4000 r/min	0
1153	0481h	Rotational speed No.0 (lower)		
to	to	to		
1182	049Eh	Rotational speed No.15 (upper)		
1183	049Fh	Rotational speed No.15 (lower)		
1536	0600h	Acceleration No.0 (upper)	2 to 150 (1=0.1 s)	5
1537	0601h	Acceleration No.0 (lower)		
to	to	to		
1566	061Eh	Acceleration No.15 (upper)		
1567	061Fh	Acceleration No.15 (lower)		
1664	0680h	Deceleration No.0 (upper)		
1665	0681h	Deceleration No.0 (lower)		
to	to	to		
1694	069Eh	Deceleration No.15 (upper)		
1695	069Fh	Deceleration No.15 (lower)		
1792	0700h	Torque limit No.0 (upper)	0 to 200%	200
1793	0701h	Torque limit No.0 (lower)		
to	to	to		
1822	071Eh	Torque limit No.15 (upper)		
1823	071Fh	Torque limit No.15 (lower)		

■ User parameters

Register address		Name	Setting range	Initial value	Effective *
Dec	Hex				
646	0286h	JOG operating speed (upper)	0, or 80 to 1000 r/min	300	A
647	0287h	JOG operating speed (lower)			
900	0384h	Motor rotation direction (upper)	0: + direction=CCW 1: + direction=CW	1	C
901	0385h	Motor rotation direction (lower)			
960	03C0h	Display mode of the data setter speed (upper)	0: Signed 1: Absolute	0	A
961	03C1h	Display mode of the data setter speed (lower)			
962	03C2h	The data setter editing mode (upper)	0: Disable 1: Enable	1	
963	03C3h	The data setter editing mode (lower)			
4140	102Ch	Run mode select (upper)	0: PWM shut off mode enable 1: PWM shut off mode disable	1	C
4141	102Dh	Run mode select (lower)			
4162	1042h	JOG operation torque (upper)	0 to 200%	200	A
4163	1043h	JOG operation torque (lower)			
4170	104Ah	Reduction gear rate (upper)	100 to 9999	100	
4171	104Bh	Reduction gear rate (lower)			
4172	104Ch	Decimal place for reduction gear rate (upper)	0: 1 digit 1: 2 digit 2: 3 digit	2	
4173	104Dh	Decimal place for reduction gear rate (lower)			
4174	104Eh	Amplification speed rate (upper)	1 to 5	1	
4175	104Fh	Amplification speed rate (lower)			
4176	1050h	Conveyor reduction gear rate (upper)	100 to 9999	100	
4177	1051h	Conveyor reduction gear rate (lower)			
4178	1052h	Decimal place for conveyor reduction gear rate (upper)	0: 1 digit 1: 2 digit 2: 3 digit	2	
4179	1053h	Decimal place for conveyor reduction gear rate (lower)			
4180	1054h	Conveyor amplification speed rate (upper)	1 to 5	1	
4181	1055h	Conveyor amplification speed rate (lower)			
4224	1080h	Magnetic brake function at alarm (upper)	0: Lock after free stop 1: Lock immediately	1	C
4225	1081h	Magnetic brake function at alarm (lower)			
4226	1082h	No operation at initial alarm enable (upper)	0: Disable 1: Enable	0	
4227	1083h	No operation at initial alarm enable (lower)			
4230	1086h	Initial thermal input detection (upper)		0	
4231	1087h	Initial thermal input detection (lower)			
4258	10A2h	Over load warning enable (upper)		0	A
4259	10A3h	Over load warning enable (lower)			
4266	10AAh	Over load warning level (upper)	50 to 100%	100	
4267	10ABh	Over load warning level (lower)			
4320	10E0h	Data setter initial display (upper)	0: Operating speed 1: Conveyor speed 2: Load factor 3: Operating number 4: Mon top view	0	C
4321	10E1h	Data setter initial display (lower)			

* Indicates the timing for the data to become effective. (A: Effective immediately, C: Effective after executing configuration or effective after turning the power ON again)

Register address		Name	Setting range	Initial value	Effective *
Dec	Hex				
4322	10E2h	Analog input signal select (upper)	0: Analog invalid 1: Analog speed 2: Analog torque (See p.92 for details)	1	C
4323	10E3h	Analog input signal select (lower)			
4430	114Eh	Velocity attainment width (upper)	0 to 400 r/min	200	A
4431	114Fh	Velocity attainment width (lower)			
4352	1100h	IN0 function select (upper)	See table on p.92.	1: FWD	B
4353	1101h	IN0 function select (lower)			
4354	1102h	IN1 function select (upper)		2: REV	
4355	1103h	IN1 function select (lower)			
4356	1104h	IN2 function select (upper)		19: STOP-MODE	
4357	1105h	IN2 function select (lower)			
4358	1106h	IN3 function select (upper)		48: M0	
4359	1107h	IN3 function select (lower)			
4360	1108h	IN4 function select (upper)		24: ALARM-RESET	
4361	1109h	IN4 function select (lower)			
4362	110Ah	IN5 function select (upper)		20: MB-FREE	
4363	110Bh	IN5 function select (lower)			
4364	110Ch	IN6 function select (upper)		22: TH	
4365	110Dh	IN6 function select (lower)			
4384	1120h	IN0 contact configuration (upper)	0: Make (N.O.) 1: Brake (N.C.)	0	C
4385	1121h	IN0 contact configuration (lower)			
4386	1122h	IN1 contact configuration (upper)			
4387	1123h	IN1 contact configuration (lower)			
4388	1124h	IN2 contact configuration (upper)			
4389	1125h	IN2 contact configuration (lower)			
4390	1126h	IN3 contact configuration (upper)			
4391	1127h	IN3 contact configuration (lower)			
4392	1128h	IN4 contact configuration (upper)			
4393	1129h	IN4 contact configuration (lower)			
4394	112Ah	IN5 contact configuration (upper)			
4395	112Bh	IN5 contact configuration (lower)			
4396	112Ch	IN6 contact configuration (upper)			
4397	112Dh	IN6 contact configuration (lower)			
4416	1140h	OUT0 function select (upper)	See table on p.92.	85: SPEED-OUT	A
4417	1141h	OUT0 function select (lower)			
4418	1142h	OUT1 function select (upper)		65: ALARM-OUT1	
4419	1143h	OUT1 function select (lower)			
4448	1160h	NET-IN0 function select (upper)	See table on p.92.	48: M0	C
4449	1161h	NET-IN0 function select (lower)			
4450	1162h	NET-IN1 function select (upper)		49: M1	
4451	1163h	NET-IN1 function select (lower)			
4452	1164h	NET-IN2 function select (upper)		50: M2	
4453	1165h	NET-IN2 function select (lower)			
4454	1166h	NET-IN3 function select (upper)		1: FWD	
4455	1167h	NET-IN3 function select (lower)			
4456	1168h	NET-IN4 function select (upper)		2: REV	
4457	1169h	NET-IN4 function select (lower)			
4458	116Ah	NET-IN5 function select (upper)		19: STOP-MODE	
4459	116Bh	NET-IN5 function select (lower)			
4460	116Ch	NET-IN6 function select (upper)		20: MB-FREE	
4461	116Dh	NET-IN6 function select (lower)			

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

Register address		Name	Setting range	Initial value	Effective *
Dec	Hex				
4462	116Eh	NET-IN7 function select (upper)	See table on p.92.	0: No function	C
4463	116Fh	NET-IN7 function select (lower)			
4464	1170h	NET-IN8 function select (upper)			
4465	1171h	NET-IN8 function select (lower)			
4466	1172h	NET-IN9 function select (upper)			
4467	1173h	NET-IN9 function select (lower)			
4468	1174h	NET-IN10 function select (upper)			
4469	1175h	NET-IN10 function select (lower)			
4470	1176h	NET-IN11 function select (upper)			
4471	1177h	NET-IN11 function select (lower)			
4472	1178h	NET-IN12 function select (upper)			
4473	1179h	NET-IN12 function select (lower)			
4474	117Ah	NET-IN13 function select (upper)			
4475	117Bh	NET-IN13 function select (lower)			
4476	117Ch	NET-IN14 function select (upper)			
4477	117Dh	NET-IN14 function select (lower)			
4478	117Eh	NET-IN15 function select (upper)			
4479	117Fh	NET-IN15 function select (lower)			
4480	1180h	NET-OUT0 function select (upper)	See table on p.92.	48: M0_R	
4481	1181h	NET-OUT0 function select (lower)			
4482	1182h	NET-OUT1 function select (upper)		49: M1_R	
4483	1183h	NET-OUT1 function select (lower)			
4484	1184h	NET-OUT2 function select (upper)		50: M2_R	
4485	1185h	NET-OUT2 function select (lower)			
4486	1186h	NET-OUT3 function select (upper)		1: FWD_R	
4487	1187h	NET-OUT3 function select (lower)			
4488	1188h	NET-OUT4 function select (upper)		2: REV_R	
4489	1189h	NET-OUT4 function select (lower)			
4490	118Ah	NET-OUT5 function select (upper)		19: STOP-MODE_R	
4491	118Bh	NET-OUT5 function select (lower)			
4492	118Ch	NET-OUT6 function select (upper)		66: WNG	
4493	118Dh	NET-OUT6 function select (lower)			
4494	118Eh	NET-OUT7 function select (upper)		65: ALARM-OUT1	
4495	118Fh	NET-OUT7 function select (lower)			
4496	1190h	NET-OUT8 function select (upper)		80: S-BSY	
4497	1191h	NET-OUT8 function select (lower)			
4498	1192h	NET-OUT9 function select (upper)		0: No function	
4499	1193h	NET-OUT9 function select (lower)			
4500	1194h	NET-OUT10 function select (upper)			
4501	1195h	NET-OUT10 function select (lower)			
4502	1196h	NET-OUT11 function select (upper)			
4503	1197h	NET-OUT11 function select (lower)			
4504	1198h	NET-OUT12 function select (upper)		81: ALARM-OUT2	
4505	1199h	NET-OUT12 function select (lower)			
4506	119Ah	NET-OUT13 function select (upper)		68: MOVE	
4507	119Bh	NET-OUT13 function select (lower)			
4508	119Ch	NET-OUT14 function select (upper)		77: VA	
4509	119Dh	NET-OUT14 function select (lower)			
4510	119Eh	NET-OUT15 function select (upper)		71: TLC	
4511	119Fh	NET-OUT15 function select (lower)			

* Indicates the timing for the data to become effective. (C: Effective after executing configuration or effective after turning the power ON again)

Register address		Name	Setting range	Initial value	Effective *
Dec	Hex				
4512	11A0h	Analog operating speed command gain (upper)	0 to 4000 r/min	800	A
4513	11A1h	Analog operating speed command gain (lower)			
4514	11A2h	Analog operating speed command offset (upper)	−2000 to 2000 r/min	0	
4515	11A3h	Analog operating speed command offset (lower)			
4516	11A4h	Analog torque limit gain (upper)	0 to 200%	40	
4517	11A5h	Analog torque limit gain (lower)			
4518	11A6h	Analog torque limit offset (upper)	−50 to 50%	0	
4519	11A7h	Analog torque limit offset (lower)			
4522	11AAh	Analog operating speed maximum value for external input (upper)	0 to 4000 r/min	4000	
4523	11ABh	Analog operating speed maximum value for external input (lower)			
4526	11AEh	Analog torque limit maximum value external input (upper)	0 to 200%	200	
4527	11AFh	Analog torque limit maximum value external input (lower)			
4608	1200h	Communication time out (upper)	0: Not monitored 1 to 10000 ms	0	
4609	1201h	Communication time out (lower)			
4610	1202h	Communication error alarm (upper)	1 to 10 times	3	
4611	1203h	Communication error alarm (lower)			

* Indicates the timing for the data to become effective. (A: Effective immediately)

- "Analog input signal select" parameter

Setting method of operation data can be changed using the "analog input signal select" parameter.
Others except the following combinations are not available to set.

"Analog input signal select" parameter	Operation data No.	Rotational speed	Acceleration Deceleration	Torque limit
0	0 to 15	Digital setting		
1 (Initial value)	0	Analog setting	Digital setting	
	1 to 15	Digital setting		
2	0 ot 15	Digital setting		Analog setting

Setting example

- When setting all operation data with digital setting: Set the "analog input signal select" parameter to "0."
- When setting only the rotation speed in the operation data No.0 using the analog setting: Set the "analog input signal select" parameter to "1."

- Setting items for I/O signal assignment

IN function select prameter

0: No function	22: TH	35: R3	41: R9	47: R15
1: FWD	24: ALARM-RESET	36: R4	42: R10	48: M0
2: REV	27: HMI	37: R5	43: R11	49: M1
19: STOP-MODE	32: R0	38: R6	44: R12	50: M2
20: MB-FREE	33: R1	39: R7	45: R13	51: M3
21: EXT-ERROR	34: R2	40: R8	46: R14	54: TL

OUT function select prameter

0: No function	32: R0	38: R6	44: R12	50: M2_R	71: TLC
1: FWD_R	33: R1	39: R7	45: R13	51: M3_R	77: VA
2: REV_R	34: R2	40: R8	46: R14	54: TL_R	80: S-BSY
19: STOP-MODE_R	35: R3	41: R9	47: R15	65: ALARM-OUT1	81: ALARM-OUT2
20: MB-FREE_R	36: R4	42: R10	48: M0_R	66: WNG	82: MPS
27: HMI_R	37: R5	43: R11	49: M1_R	68: MOVE	84: DIR
					85: SPEED-OUT

NET-IN function select parameter

0: No function	32: R0	38: R6	44: R12	50: M2
1: FWD	33: R1	39: R7	45: R13	51: M3
2: REV	34: R2	40: R8	46: R14	54: TL
19: STOP-MODE	35: R3	41: R9	47: R15	
20: MB-FREE	36: R4	42: R10	48: M0	
27: HMI	37: R5	43: R11	49: M1	

NET-OUT function select parameter

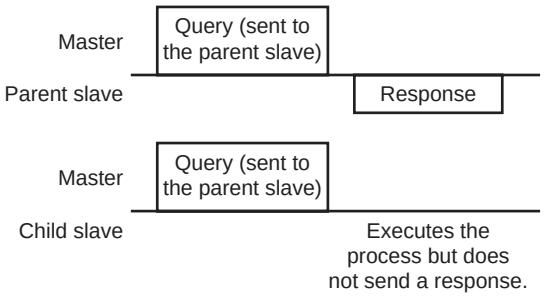
0: No function	32: R0	38: R6	44: R12	50: M2_R	71: TLC
1: FWD_R	33: R1	39: R7	45: R13	51: M3_R	77: VA
2: REV_R	34: R2	40: R8	46: R14	54: TL_R	80: S-BSY
19: STOP-MODE_R	35: R3	41: R9	47: R15	65: ALARM-OUT1	81: ALARM-OUT2
20: MB-FREE_R	36: R4	42: R10	48: M0_R	66: WNG	82: MPS
27: HMI_R	37: R5	43: R11	49: M1_R	68: MOVE	84: DIR

9 Group send

Multiple slaves are made into a group and a query is sent to all slaves in the group at once.

■ Group composition

A group consists of one parent slave and child slaves and only the parent slave returns a response.



■ Group address

To perform a group send, set a group address to the child slaves to be included in the group.
The child slaves to which the group address has been set can receive a query sent to the parent slave.

■ Parent slave

No special setting is required on the parent slave to perform a group send. The address of the parent slave becomes the group address. When a query is sent to the parent slave from the master, the parent slave executes the requested process and then returns a response (same as with the unicast mode).

■ Child slave

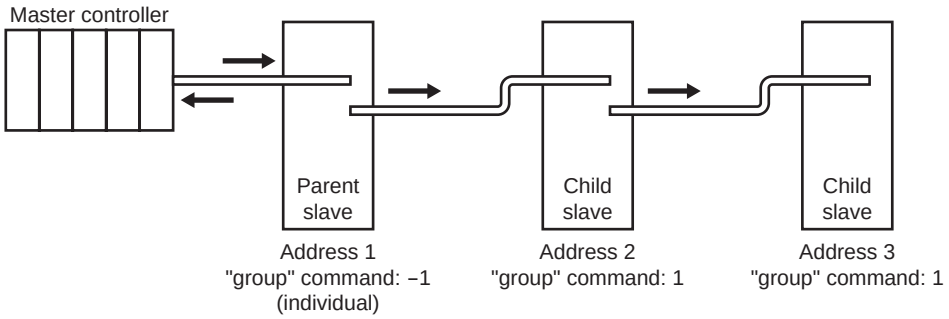
Use a "group" command to set a group address to each child slave. Change the group in the unicast mode.
When performing read or write for setting a group, set the upper and lower simultaneously.

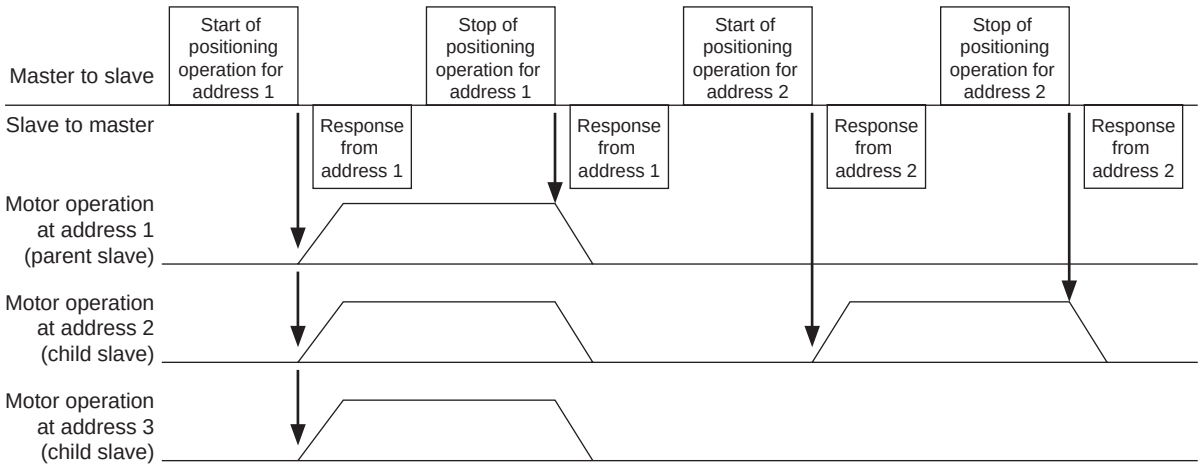
Resister address		Name	Description	READ/ WRITE	Setting range
Dec	Hex				
48	0030h	Group (upper)	Sets the group address.	R/W	−1: No group specification (Group send is not performed) 1 to 31: Group address (Address number of parent slave)
49	0031h	Group (lower)			

Note Since the group setting is not saved in the non-volatile memory even when the "batch NV memory write" executes, the group setting will be cleared when turning the driver power OFF.

■ Function code to execute in a group send

Function code	Function
10h	Writing to multiple holding registers




Master to slave
Start of positioning operation for address 1
Stop of positioning operation for address 1
Start of positioning operation for address 2
Stop of positioning operation for address 2
Slave to master
Response from address 1
Response from address 1
Response from address 2
Response from address 2
Motor operation at address 1 (parent slave)
Motor operation at address 2 (child slave)
Motor operation at address 3 (child slave)

10 Detection of communication errors

This function detects abnormalities that may occur during RS-485 communication. The abnormalities that can be detected include alarms, warnings and communication errors.

10.1 Communication errors

A communication error record will be saved in the RAM. You can check the communication errors using the "communication error record" command via RS-485 communication.

Note The communication error record will be cleared once the driver power is turned off.

Type of communication error	Error code	Cause	Ref.
RS-485 communication error	84h	A transmission error was detected.	p.77
Command not yet defined	88h	An exception response (exception code 01h, 02h) was detected.	
Execution disable due to user I/F communication in progress	89h	An exception response (exception code 04h) was detected.	
Non-volatile memory processing in progress	8Ah		
Outside setting range	8Ch	An exception response (exception code 03h, 04h) was detected.	
Command execute disable	8Dh	An exception response (exception code 04h) was detected.	

10.2 Alarms and warnings

When an alarm generates, the ALARM-OUT1 output will turn OFF and the motor will stop. At the same time, the ALM LED will start blinking.
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.

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

■ Communication switch setting error (83h)

When setting the transmission rate setting switch (SW4) to positions 8 to F, the transmission rate setting switch error will occur.

■ RS-485 communication error (84h)

The table below shows the relationship between alarms and warnings when an RS-485 communication error occurs.

Description of error	Description
Warning	A warning generates when one RS-485 communication error (84h) has been detected. If normal reception occurs while the warning is present, the warning will be reset automatically.
Alarm	An alarm generates when a RS-485 communication error (84h) has been detected consecutively by the number of times set in the "communication error alarm" parameter.

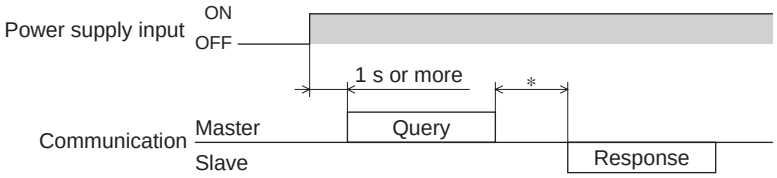
■ RS-485 communication timeout (85h)

If communication is not established with the master after an elapse of the time set by the "communication time out" parameter, the RS-485 communication timeout alarm will generate.

11 Timing charts

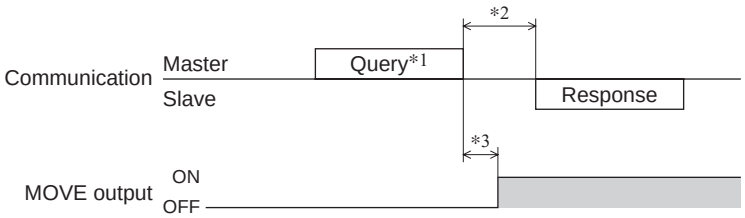
See p.74 "5.2 Communication timing" for codes in the timing chart.

■ Communication start



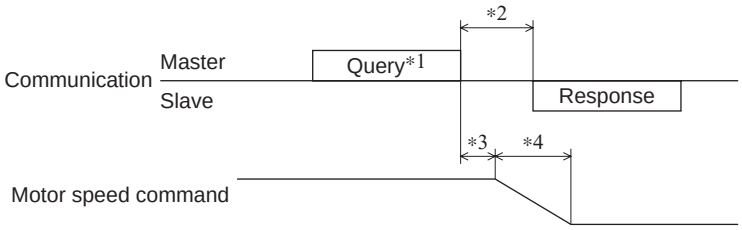
* Tb2 (transmission waiting time) + C3.5 (silent interval) + command processing time

■ Operation start



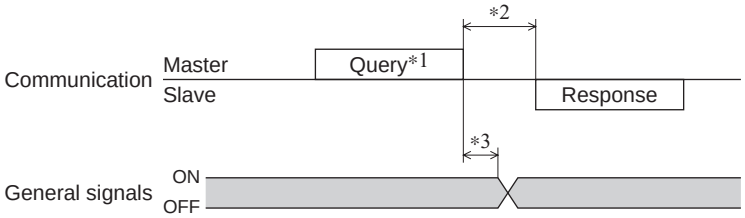
*1 A message including a query to start operation via RS-485 communication.
*2 Tb2 (transmission waiting time) + C3.5 (silent interval) + command processing time
*3 C3.5 (silent interval) + 4 ms or less

■ Operation stop, speed change



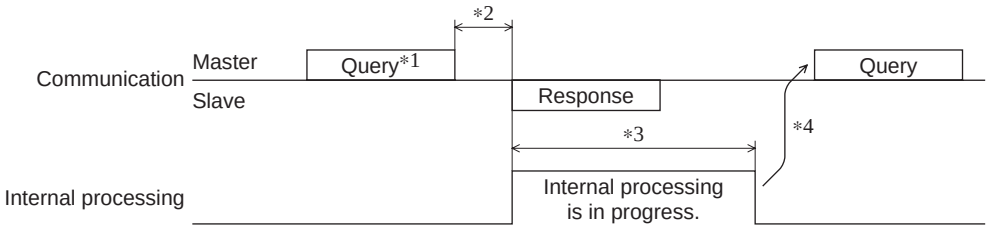
*1 A message including a query to stop operation and another to change the speed via RS-485 communication.
*2 Tb2 (transmission waiting time) + C3.5 (silent interval) + command processing time
*3 The specific time varies depending on the command speed.
*4 It varies based on the stopping method selected by the STOP-MODE input.

■ General signals



*1 A message including a query for remote output via RS-485 communication.
*2 Tb2 (transmission waiting time) + C3.5 (silent interval) + command processing time
*3 C3.5 (silent interval) + 4 ms or less

■ Configuration



*1 A message including a query for configuration via RS-485 communication.
*2 Tb2 (transmission waiting time) + C3.5 (silent interval) + command processing time
*3 Internal processing time + 1 s or less
*4 Execute a query after the driver internal processing has been completed.

5 Method of control via industrial network

This part explains how to control via industrial network. This product can be controlled via CC-Link communication or MECHATROLINK communication in combination with a network converter (sold separately).

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1 Method of control via CC-Link communication

See the following explanation when using the **BLE** Series FLEX RS-485 communication type in combination with the network converter **NETC01-CC** via CC-Link communication. Refer to p.120 "3 Details of remote I/O" and p.122 "4 Command code list" for remote I/O and command code.

1.1 Guidance

If you are new to the **BLE** Series FLEX RS-485 communication type, read this section to understand the operating methods along with the operation flow.

Note
- Before operating the motor, check the condition of the surrounding area to ensure safety.
- See the network converter **NETC01-CC** USER MANUAL for how to set the parameter.

STEP 1 Set the transmission rate, station address and address number.

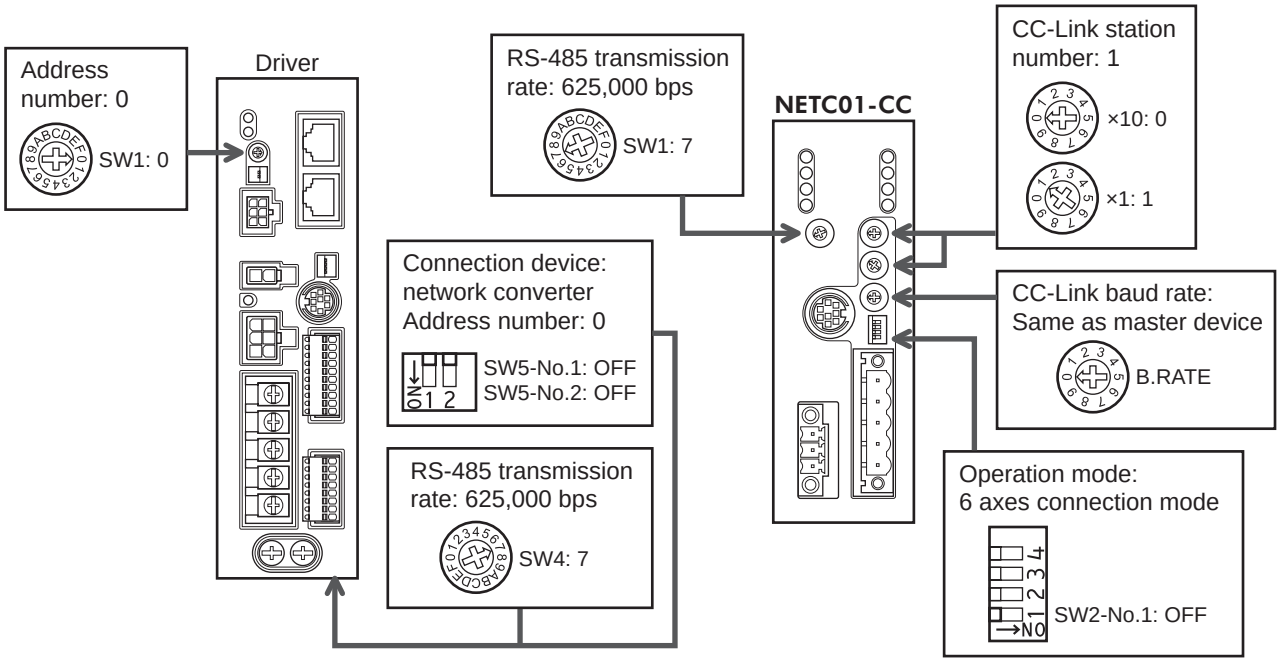
■ Using the switches

Setting condition of driver

- Address number of the driver: 0
- RS-485 transmission rate: 625,000 bps
- SW5-No.2 of the function setting switch2: OFF

Setting condition of **NETC01-CC**

- CC-Link station number: 1
- RS-485 transmission rate: 625,000 bps
- CC-Link baud rate: Same as the master station
- Operation mode: 6 axes connection mode

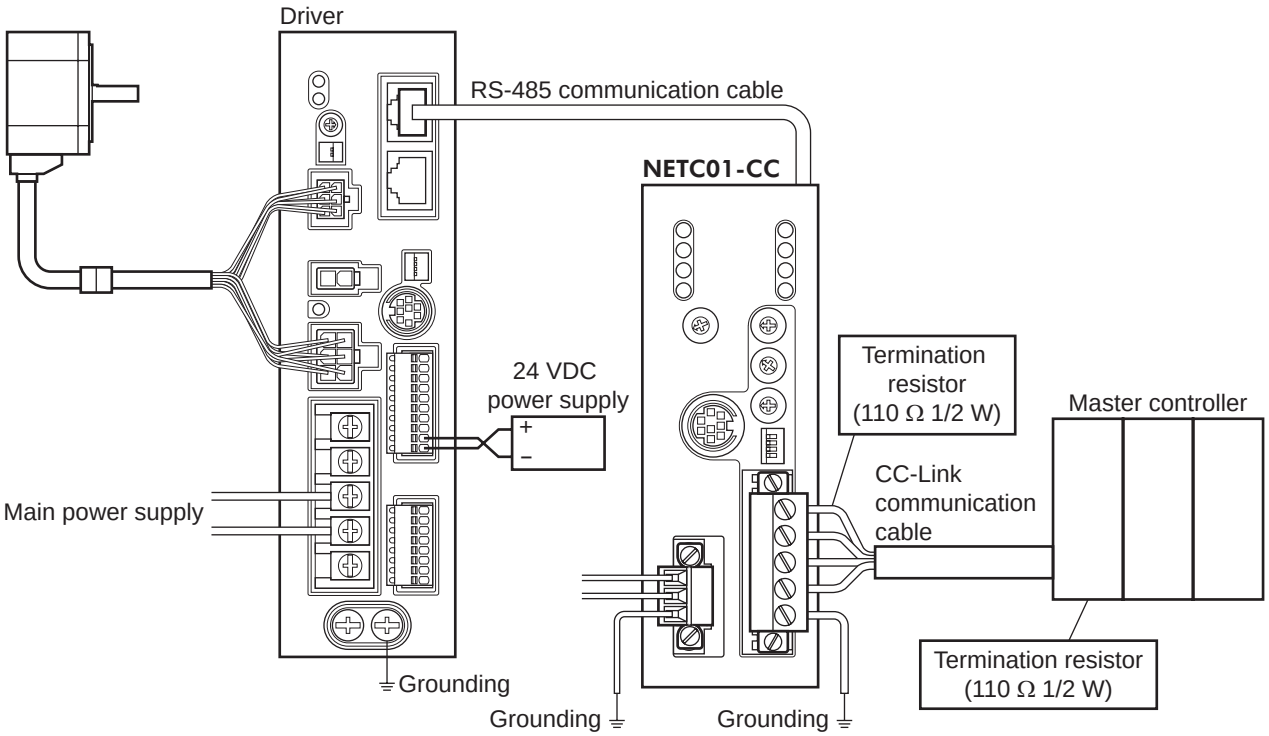


■ Using the parameter

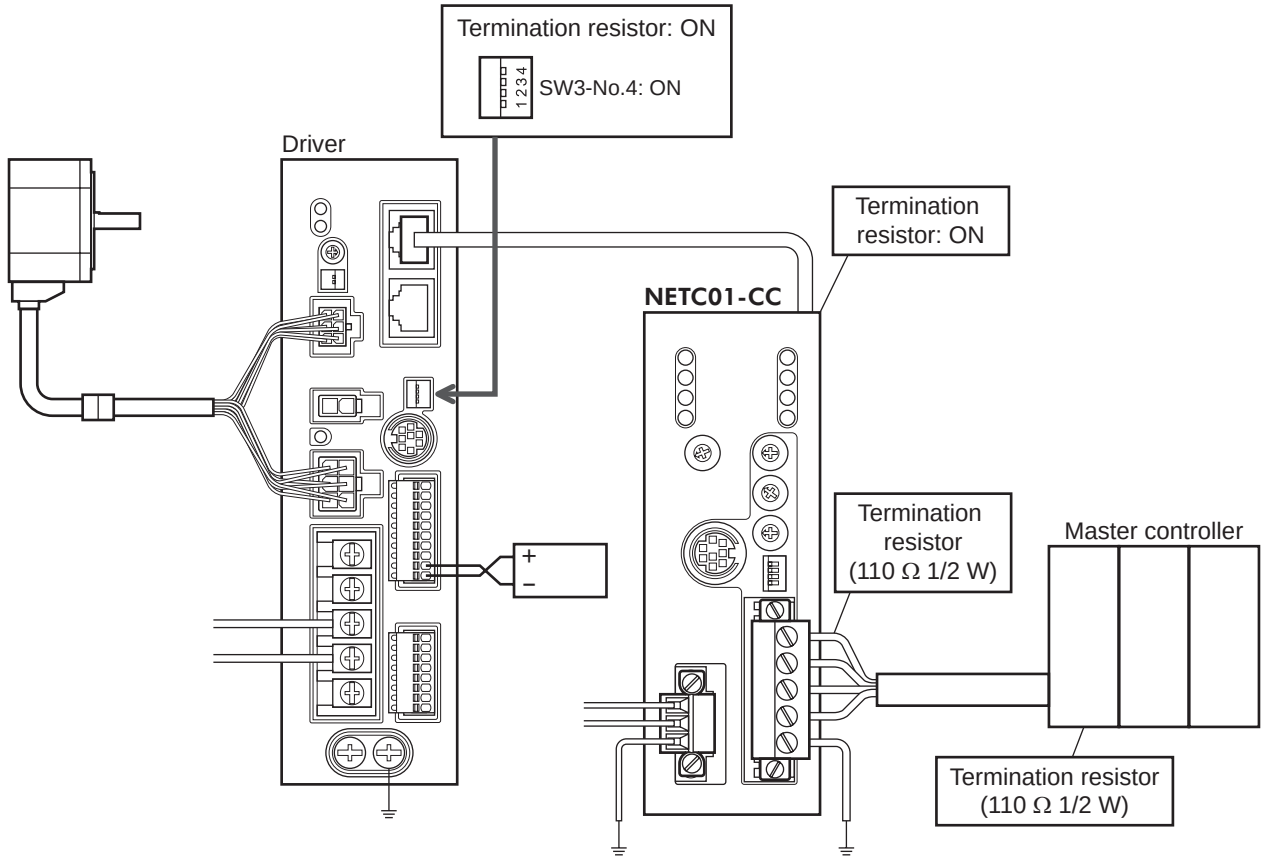
1. Set the "connection (address number 0) (1D80h)" parameter of the **NETC01-CC** to "Enable."
2. Execute the "batch NV memory write (3E85h)" of the **NETC01-CC**.
3. Cycle the **NETC01-CC** power.

Note "Connection" parameters will be enabled after the power is cycled.

STEP 2 Check the connection

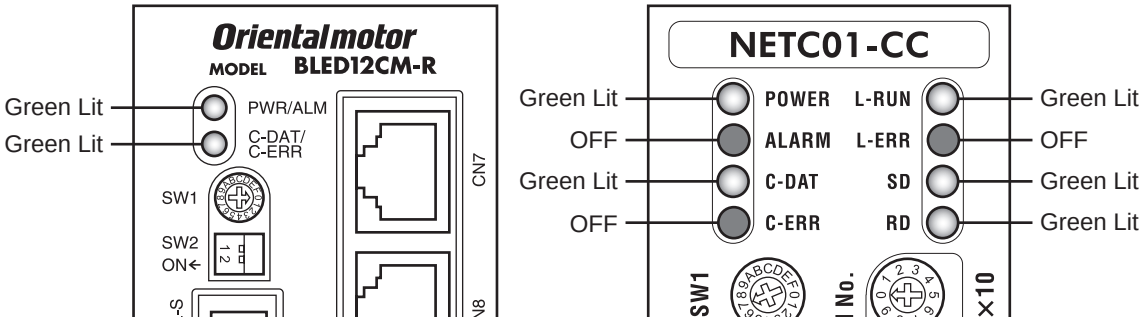


STEP 3 Check the termination resistor



STEP 4 Turn on the power and check the setting

Check that the LED condition has become as shown in the figures.



- When C-ERR (red) of the driver or **NETC01-CC** is lit:
  Check the transmission rate or address number of RS-485 communication.
- When L-ERR (red) of the **NETC01-CC** is lit:
  Check the type of the CC-Link communication error.

STEP 5 Execute continuous operation via remote I/O of CC-Link communication.

1. Set the rotation speed (1241h) for the operation data No.1 of the driver.
2. Perform continuous operation by turning ON the M0 and FWD of the address number 0 for remote I/O of CC-Link communication.

RY (Master to **NETC01-CC**)		
Device No.	Signal name	Initial value
RY0	NET-IN0	M0
RY1	NET-IN1	M1
RY2	NET-IN2	M2
RY3	NET-IN3	FWD
RY4	NET-IN4	REV
RY5	NET-IN5	STOP-MODE
RY6	NET-IN6	MB-FREE
RY7	NET-IN7	Not used

RY (Master to **NETC01-CC**)		
Device No.	Signal name	Initial value
RY8	NET-IN8	Not used
RY9	NET-IN9	
RYA	NET-IN10	
RYB	NET-IN11	
RYC	NET-IN12	
RYD	NET-IN13	
RYE	NET-IN14	
RYF	NET-IN15	

STEP 6 Were you able to operate the motor properly?

How did it go? Were you able to operate the motor properly? If the motor does not function, check the following points:

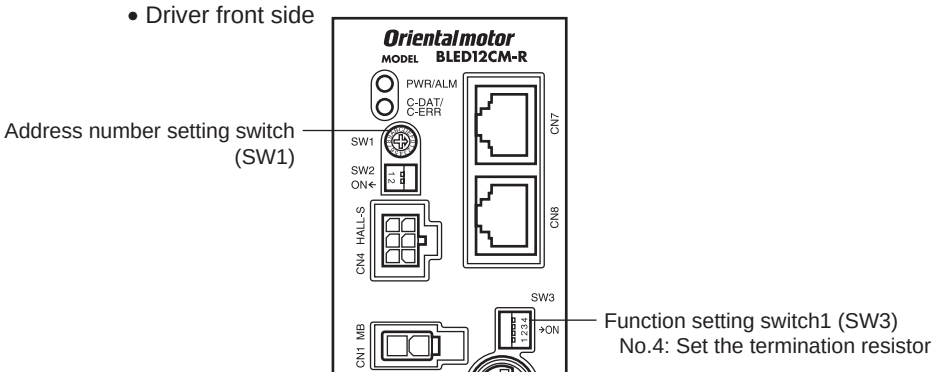
- Is any alarm present in the driver or **NETC01-CC**?
- Are the address number, transmission rate and termination resistor set correctly?
- Is the "connection" parameter of the **NETC01-CC** set correctly?
- Is the C-ERR LED lit? (RS-485 communication error)
- Is the L-ERR LED lit? (CC-Link communication error)
- Is the operation data (rotation speed) set correctly?
- Are the driver parameters set correctly?

For more detailed settings and functions, refer to next page and later, and the **NETC01-CC** USER MANUAL.

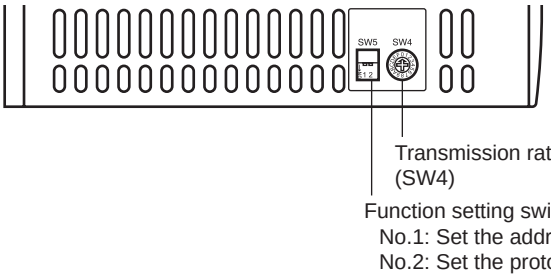
1.2 Setting the switches

When using the driver in combination with the network converter, set the switches before use.

• Driver front side



• Driver bottom side



Note Be sure to turn off the driver power before setting the switches. If the switches are set while the power is still on, the new switch settings will not become effective until the driver power is cycled.

■ Setting the connection device

Set the connection device of RS-485 communication using the function setting switch2 SW5-No.2.
Turn this switch OFF when controlling via the network converter.

Factory setting OFF (Network converter)

■ Address number (slave address)

Set the address number (slave address) using the address number setting switch (SW1) and SW5-No.1 of the function setting switch2. Make sure each address number (slave address) you set for each driver is unique.

Factory setting SW1: 0, SW5-No.1: OFF (Address number 0)

Address number (slave address)	0	1	2	3	4	5	6	7	8	9	10	11
SW1	0	1	2	3	4	5	6	7	8	9	A	B
SW5-No.1	OFF											
Connection mode	6 axes connection mode						12 axes connection mode					

■ Transmission rate

Set the transmission rate to 625,000 bps using the transmission rate setting switch (SW4).

Factory setting 7 (625,000 bps)

■ Termination resistor

Use a termination resistor for the driver located farthest away (positioned at the end) from the network converter. Turn the SW3-No.4 of the function setting switch1 ON to set the termination resistor for RS-485 communication (120 Ω).

Factory setting OFF (termination resistor disabled)

SW3-No.4	Termination resistor (120 Ω)
OFF	Disabled
ON	Enabled

1.3 Remote register list

Remote register is common to 6-axes connection mode and 12-axes connection mode.
"Monitor", "read and write of parameters" and "maintenance command" for the driver or **NETC01-CC** are executed using remote register.
"n" is an address assigned to the master station by the CC-Link station number setting.

RWw (Master to **NETC01-CC**)	
Address No.	Description
RWwn0	Command code of monitor 0
RWwn1	Address number of monitor 0
RWwn2	Command code of monitor 1
RWwn3	Address number of monitor 1
RWwn4	Command code of monitor 2
RWwn5	Address number of monitor 2
RWwn6	Command code of monitor 3
RWwn7	Address number of monitor 3
RWwn8	Command code of monitor 4
RWwn9	Address number of monitor 4
RWwnA	Command code of monitor 5
RWwnB	Address number of monitor 5
RWwnC	Command code
RWwnD	Address number
RWwnE	Data (lower)
RWwnF	Data (upper)

RWr (**NETC01-CC** to master)	
Address No.	Description
RWrn0	Data of monitor 0 (lower 16 bit)
RWrn1	Data of monitor 0 (upper 16 bit)
RWrn2	Data of monitor 1 (lower 16 bit)
RWrn3	Data of monitor 1 (upper 16 bit)
RWrn4	Data of monitor 2 (lower 16 bit)
RWrn5	Data of monitor 2 (upper 16 bit)
RWrn6	Data of monitor 3 (lower 16 bit)
RWrn7	Data of monitor 3 (upper 16 bit)
RWrn8	Data of monitor 4 (lower 16 bit)
RWrn9	Data of monitor 4 (upper 16 bit)
RWrnA	Data of monitor 5 (lower 16 bit)
RWrnB	Data of monitor 5 (upper 16 bit)
RWrnC	Command code response
RWrnD	Address number response
RWrnE	Data (lower)
RWrnF	Data (upper)

1.4 Assignment for remote I/O of 6 axes connection mode

Remote I/O assignments of the driver are as follows. "n" is an address assigned to the master station by the CC-Link station number setting. See the network converter **NETC01-CC** USER MANUAL for 6-axes.

■ Assignment list of remote I/O

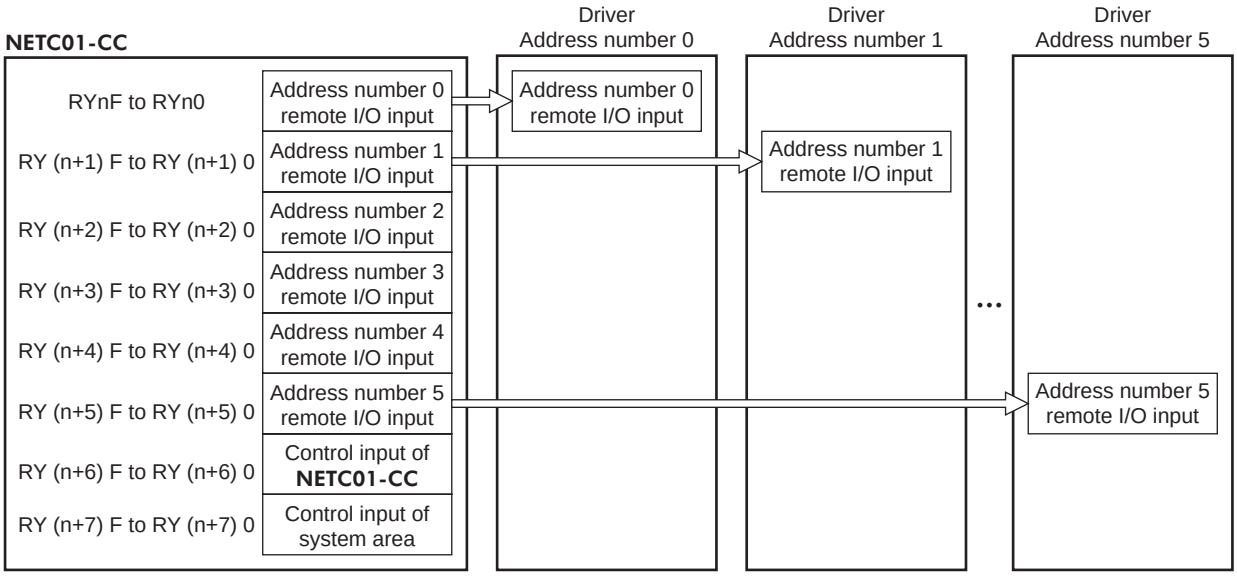
Command RY (Master to **NETC01-CC**)	
Device No.	Description
RYn7 to RYn0	Address number "0" remote I/O input
RYnF to RYn8	
RY (n+1) 7 to RY (n+1) 0	Address number "1" remote I/O input
RY (n+1) F to RY (n+1) 8	
RY (n+2) 7 to RY (n+2) 0	Address number "2" remote I/O input
RY (n+2) F to RY (n+2) 8	
RY (n+3) 7 to RY (n+3) 0	Address number "3" remote I/O input
RY (n+3) F to RY (n+3) 8	
RY (n+4) 7 to RY (n+4) 0	Address number "4" remote I/O input
RY (n+4) F to RY (n+4) 8	
RY (n+5) 7 to RY (n+5) 0	Address number "5" remote I/O input
RY (n+5) F to RY (n+5) 8	
RY (n+6) 7 to RY (n+6) 0	Control input of **NETC01-CC** *
RY (n+6) F to RY (n+6) 8	
RY (n+7) 7 to RY (n+7) 0	Control input of system area *
RY (n+7) F to RY (n+7) 8	

Response RX (**NETC01-CC** to master)	
Device No.	Description
RXn7 to RXn0	Address number "0" remote I/O output
RXnF to RXn8	
RX (n+1) 7 to RX (n+1) 0	Address number "1" remote I/O output
RX (n+1) F to RX (n+1) 8	
RX (n+2) 7 to RX (n+2) 0	Address number "2" remote I/O output
RX (n+2) F to RX (n+2) 8	
RX (n+3) 7 to RX (n+3) 0	Address number "3" remote I/O output
RX (n+3) F to RX (n+3) 8	
RX (n+4) 7 to RX (n+4) 0	Address number "4" remote I/O output
RX (n+4) F to RX (n+4) 8	
RX (n+5) 7 to RX (n+5) 0	Address number "5" remote I/O output
RX (n+5) F to RX (n+5) 8	
RX (n+6) 7 to RX (n+6) 0	Status output of **NETC01-CC** *
RX (n+6) F to RX (n+6) 8	
RX (n+7) 7 to RX (n+7) 0	Status output of system area *
RX (n+7) F to RX (n+7) 8	

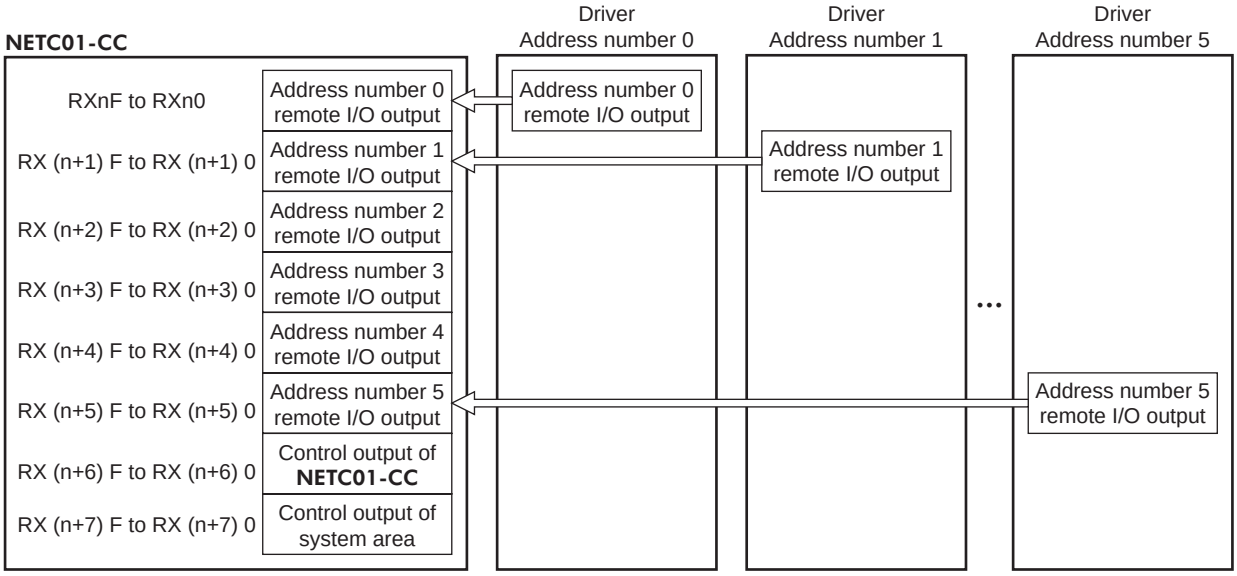
* See the network converter **NETC01-CC** USER MANUAL for details.

■ Input/output of remote I/O

- Remote I/O input



- Remote I/O output



■ Details of remote I/O assignment

* [ ]: Initial value

	Command RY (Master to **NETC01-CC**)			Response RX (**NETC01-CC** to master)		
	Device No.	Signal name	Description	Device No.	Signal name	Description
Address number "0"	RY(n)0	NET-IN0	[M0] ∗	RX(n)0	NET-OUT0	[M0_R] ∗
	RY(n)1	NET-IN1	[M1] ∗	RX(n)1	NET-OUT1	[M1_R] ∗
	RY(n)2	NET-IN2	[M2] ∗	RX(n)2	NET-OUT2	[M2_R] ∗
	RY(n)3	NET-IN3	[FWD] ∗	RX(n)3	NET-OUT3	[FWD_R] ∗
	RY(n)4	NET-IN4	[REV] ∗	RX(n)4	NET-OUT4	[REV_R] ∗
	RY(n)5	NET-IN5	[STOP-MODE] ∗	RX(n)5	NET-OUT5	[STOP-MODE_R] ∗
	RY(n)6	NET-IN6	[MB-FREE] ∗	RX(n)6	NET-OUT6	[WNG] ∗
	RY(n)7	NET-IN7	[Not used] ∗	RX(n)7	NET-OUT7	[ALARM-OUT1] ∗
	RY(n)8	NET-IN8		RX(n)8	NET-OUT8	[S-BSY] ∗
	RY(n)9	NET-IN9		RX(n)9	NET-OUT9	[Not used] ∗
	RY(n)A	NET-IN10		RX(n)A	NET-OUT10	
	RY(n)B	NET-IN11		RX(n)B	NET-OUT11	
	RY(n)C	NET-IN12		RX(n)C	NET-OUT12	[ALARM-OUT2] ∗
	RY(n)D	NET-IN13		RX(n)D	NET-OUT13	[MOVE] ∗
	RY(n)E	NET-IN14		RX(n)E	NET-OUT14	[VA] ∗
	RY(n)F	NET-IN15		RX(n)F	NET-OUT15	[TLC] ∗
Address number "1"	RY(n+1)0 to RY(n+1)F	NET-IN0 to NET-IN15	Same as Address number "0"	RX(n+1)0 to RX(n+1)F	NET-OUT0 to NET-OUT15	Same as Address number "0"
Address number "2"	RY(n+2)0 to RY(n+2)F	NET-IN0 to NET-IN15	Same as Address number "0"	RX(n+2)0 to RX(n+2)F	NET-OUT0 to NET-OUT15	Same as Address number "0"
Address number "3"	RY(n+3)0 to RY(n+3)F	NET-IN0 to NET-IN15	Same as Address number "0"	RX(n+3)0 to RX(n+3)F	NET-OUT0 to NET-OUT15	Same as Address number "0"
Address number "4"	RY(n+4)0 to RY(n+4)F	NET-IN0 to NET-IN15	Same as Address number "0"	RX(n+4)0 to RX(n+4)F	NET-OUT0 to NET-OUT15	Same as Address number "0"
Address number "5"	RY(n+5)0 to RY(n+5)F	NET-IN0 to NET-IN15	Same as Address number "0"	RX(n+5)0 to RX(n+5)F	NET-OUT0 to NET-OUT15	Same as Address number "0"
NETC01-CC control input/ status output	RY(n+6)0	M-REQ0	Monitor request 0	RX(n+6)0	M-DAT0	During execution of monitor 0
	RY(n+6)1	M-REQ1	Monitor request 1	RX(n+6)1	M-DAT1	During execution of monitor 1
	RY(n+6)2	M-REQ2	Monitor request 2	RX(n+6)2	M-DAT2	During execution of monitor 2
	RY(n+6)3	M-REQ3	Monitor request 3	RX(n+6)3	M-DAT3	During execution of monitor 3
	RY(n+6)4	M-REQ4	Monitor request 4	RX(n+6)4	M-DAT4	During execution of monitor 4
	RY(n+6)5	M-REQ5	Monitor request 5	RX(n+6)5	M-DAT5	During execution of monitor 5
	RY(n+6)6	−	−	RX(n+6)6	WNG	Warning
	RY(n+6)7	ALM-RST	Reset alarm	RX(n+6)7	ALM	Alarm
	RY(n+6)8	−	−	RX(n+6)8	C-SUC	During execution of RS-485 communication
	RY(n+6)9			RX(n+6)9	−	−
	RY(n+6)A			RX(n+6)A		
	RY(n+6)B			RX(n+6)B		
	RY(n+6)C	D-REQ	Command execution request	RX(n+6)C	D-END	Command processing completion

	Command RY (Master to **NETC01-CC**)		
	Device No.	Signal name	Description
NETC01-CC control input/ status output	RY(n+6)D	−	−
	RY(n+6)E		
	RY(n+6)F		
System area control input/ status output	RY(n+7)0 to RY(n+7)F	−	Cannot be used

Response RX (**NETC01-CC** to master)		
Device No.	Signal name	Description
RX(n+6)D	R-ERR	Register error
RX(n+6)E	S-BSY	During system processing
RX(n+6)F	−	−
RX(n+7)0 to RX(n+7)A	−	Cannot be used
RX(n+7)B	CRD	Remote station communication ready
RX(n+7)C to RX(n+7)F	−	Cannot be used

1.5 Assignment for remote I/O of 12 axes connection mode

Remote I/O assignments of the driver are as follows. "n" is an address assigned to the master station by the CC-Link station number setting. See the network converter **NETC01-CC** USER MANUAL for 12-axes.

■ Assignment list of remote I/O

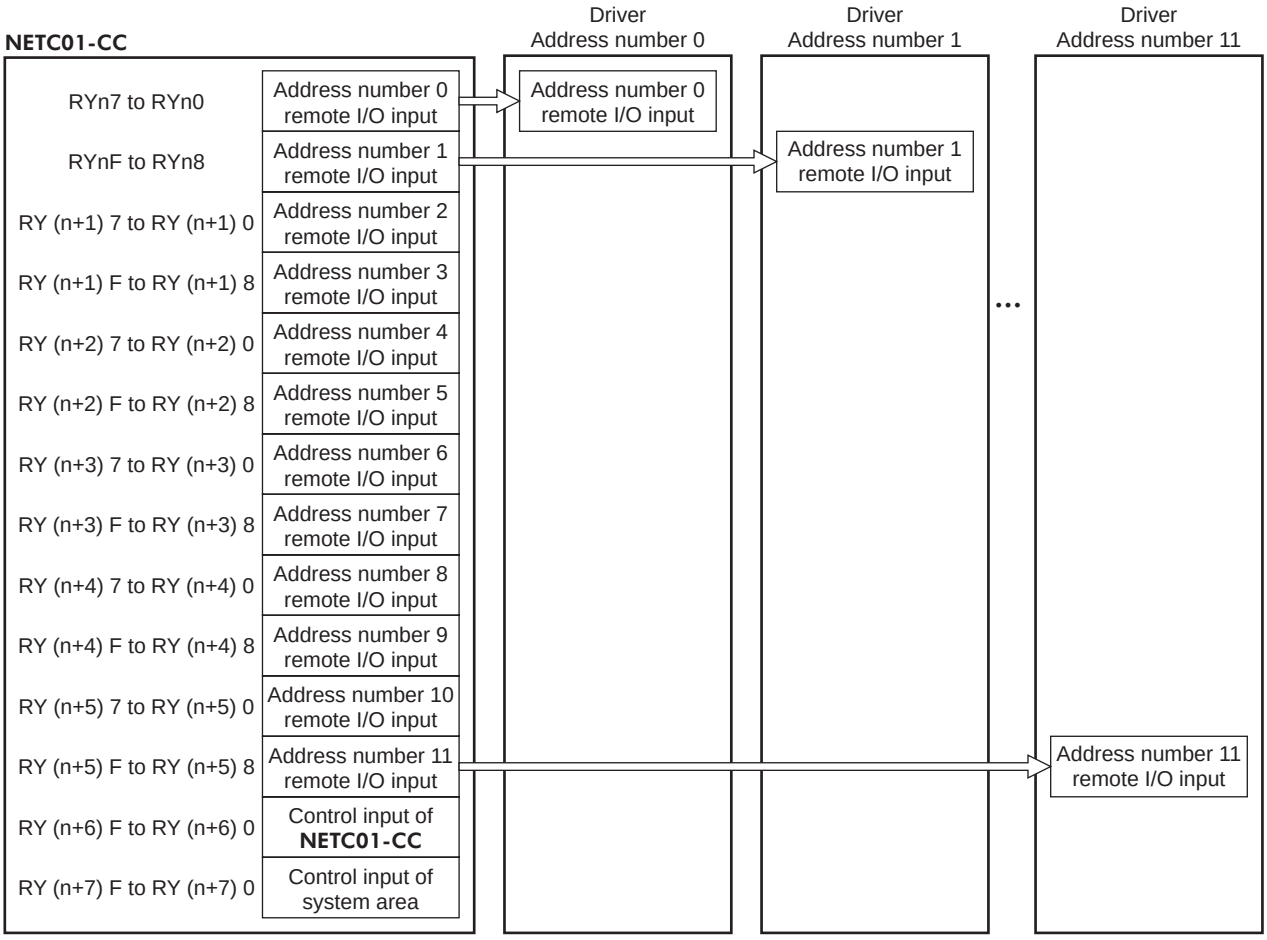
Command RY (Master to **NETC01-CC**)	
Device No.	Description
RYn7 to RYn0	Address number "0" remote I/O input
RYnF to RYn8	Address number "1" remote I/O input
RY (n+1) 7 to RY (n+1) 0	Address number "2" remote I/O input
RY (n+1) F to RY (n+1) 8	Address number "3" remote I/O input
RY (n+2) 7 to RY (n+2) 0	Address number "4" remote I/O input
RY (n+2) F to RY (n+2) 8	Address number "5" remote I/O input
RY (n+3) 7 to RY (n+3) 0	Address number "6" remote I/O input
RY (n+3) F to RY (n+3) 8	Address number "7" remote I/O input
RY (n+4) 7 to RY (n+4) 0	Address number "8" remote I/O input
RY (n+4) F to RY (n+4) 8	Address number "9" remote I/O input
RY (n+5) 7 to RY (n+5) 0	Address number "10" remote I/O input
RY (n+5) F to RY (n+5) 8	Address number "11" remote I/O input
RY (n+6) 7 to RY (n+6) 0	Control input of **NETC01-CC** *
RY (n+6) F to RY (n+6) 8	
RY (n+7) 7 to RY (n+7) 0	Control input of system area *
RY (n+7) F to RY (n+7) 8	

Response RX (**NETC01-CC** to master)	
Device No.	Description
RXn7 to RXn0	Address number "0" remote I/O output
RXnF to RXn8	Address number "1" remote I/O output
RX (n+1) 7 to RX (n+1) 0	Address number "2" remote I/O output
RX (n+1) F to RX (n+1) 8	Address number "3" remote I/O output
RX (n+2) 7 to RX (n+2) 0	Address number "4" remote I/O output
RX (n+2) F to RX (n+2) 8	Address number "5" remote I/O output
RX (n+3) 7 to RX (n+3) 0	Address number "6" remote I/O output
RX (n+3) F to RX (n+3) 8	Address number "7" remote I/O output
RX (n+4) 7 to RX (n+4) 0	Address number "8" remote I/O output
RX (n+4) F to RX (n+4) 8	Address number "9" remote I/O output
RX (n+5) 7 to RX (n+5) 0	Address number "10" remote I/O output
RX (n+5) F to RX (n+5) 8	Address number "11" remote I/O output
RX (n+6) 7 to RX (n+6) 0	Status output of **NETC01-CC** *
RX (n+6) F to RX (n+6) 8	
RX (n+7) 7 to RX (n+7) 0	Status output of system area *
RX (n+7) F to RX (n+7) 8	

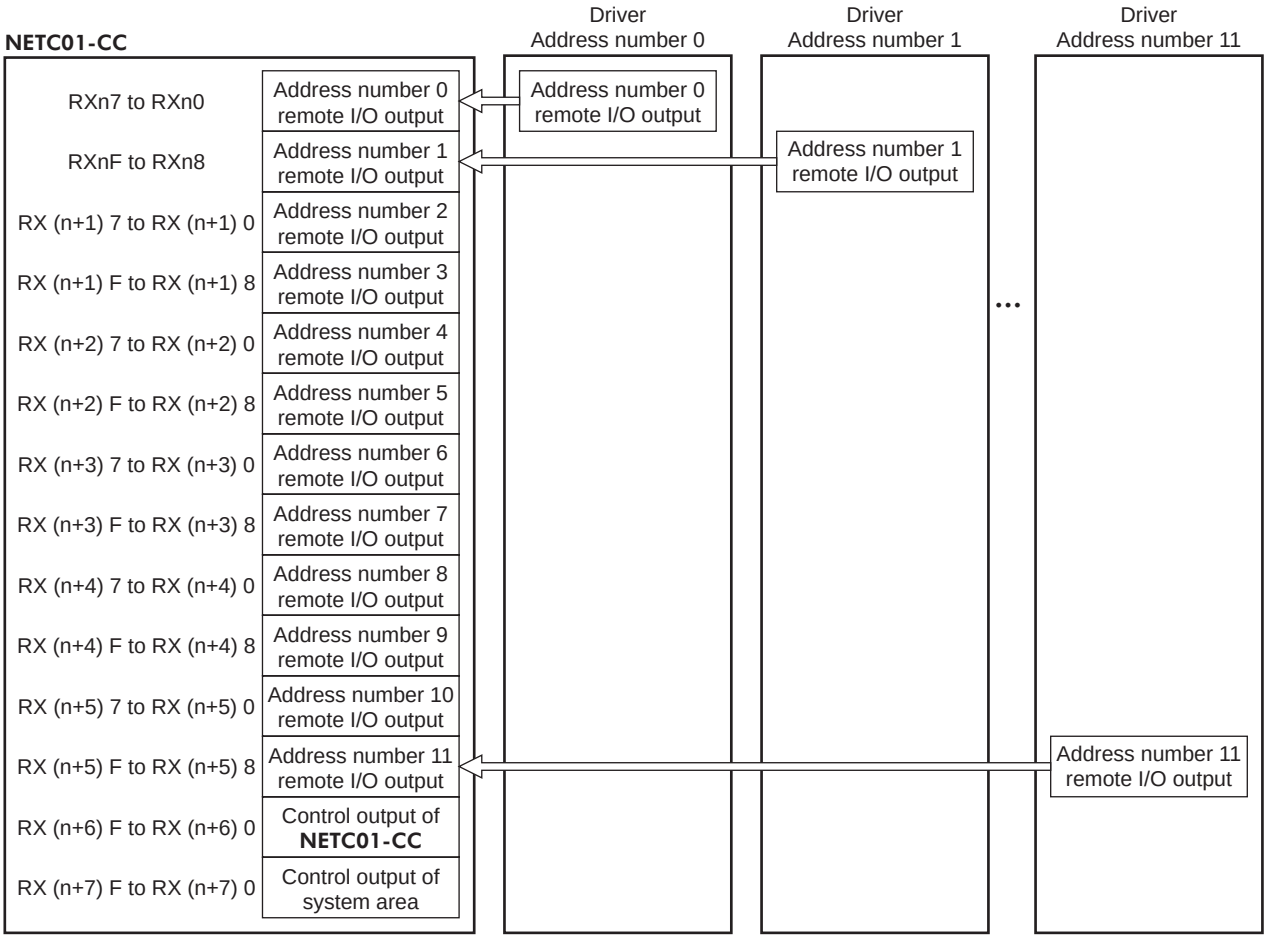
* See the network converter **NETC01-CC** USER MANUAL for details.

■ Input/output of remote I/O

• Remote I/O input



- Remote I/O output



■ Details of remote I/O assignment

* [ ]: Initial value

	Command RY (Master to **NETC01-CC**)			Response RX (**NETC01-CC** to master)		
	Device No.	Signal name	Description	Device No.	Signal name	Description
Address number "0"	RY(n)0	NET-IN0	[M0] ∗	RX(n)0	NET-OUT0	[M0_R] ∗
	RY(n)1	NET-IN1	[M1] ∗	RX(n)1	NET-OUT1	[M1_R] ∗
	RY(n)2	NET-IN2	[M2] ∗	RX(n)2	NET-OUT2	[M2_R] ∗
	RY(n)3	NET-IN3	[FWD] ∗	RX(n)3	NET-OUT3	[FWD_R] ∗
	RY(n)4	NET-IN4	[REV] ∗	RX(n)4	NET-OUT4	[REV_R] ∗
	RY(n)5	NET-IN5	[STOP-MODE] ∗	RX(n)5	NET-OUT5	[STOP-MODE_R] ∗
	RY(n)6	NET-IN6	[MB-FREE] ∗	RX(n)6	NET-OUT6	[WNG] ∗
	RY(n)7	NET-IN7	[Not used] ∗	RX(n)7	NET-OUT7	[ALARM-OUT1] ∗
	RY(n)8	NET-IN0		RX(n)8	NET-OUT8	[S-BSY] ∗
	RY(n)9	NET-IN1		RX(n)9	NET-OUT9	[Not used] ∗
	RY(n)A	NET-IN2		RX(n)A	NET-OUT10	
	RY(n)B	NET-IN3		RX(n)B	NET-OUT11	
	RY(n)C	NET-IN4		RX(n)C	NET-OUT12	[ALARM-OUT2] ∗
	RY(n)D	NET-IN5		RX(n)D	NET-OUT13	[MOVE] ∗
	RY(n)E	NET-IN6		RX(n)E	NET-OUT14	[VA] ∗
	RY(n)F	NET-IN7		RX(n)F	NET-OUT15	[TLC] ∗
Address number "1"	RY(n+1)0 to RY(n+1)F	NET-IN0 to NET-IN15	Same as Address number "0"	RX(n+1)0 to RX(n+1)F	NET-OUT0 to NET-OUT15	Same as Address number "0"
Address number "2"	RY(n+2)0 to RY(n+2)F	NET-IN0 to NET-IN15	Same as Address number "0"	RX(n+2)0 to RX(n+2)F	NET-OUT0 to NET-OUT15	Same as Address number "0"
Address number "3"	RY(n+3)0 to RY(n+3)F	NET-IN0 to NET-IN15	Same as Address number "0"	RX(n+3)0 to RX(n+3)F	NET-OUT0 to NET-OUT15	Same as Address number "0"
Address number "4"	RY(n+4)0 to RY(n+4)F	NET-IN0 to NET-IN15	Same as Address number "0"	RX(n+4)0 to RX(n+4)F	NET-OUT0 to NET-OUT15	Same as Address number "0"
Address number "5"	RY(n+5)0 to RY(n+5)F	NET-IN0 to NET-IN15	Same as Address number "0"	RX(n+5)0 to RX(n+5)F	NET-OUT0 to NET-OUT15	Same as Address number "0"
NETC01-CC control input/ status output	RY(n+6)0	M-REQ0	Monitor request 0	RX(n+6)0	M-DAT0	During execution of monitor 0
	RY(n+6)1	M-REQ1	Monitor request 1	RX(n+6)1	M-DAT1	During execution of monitor 1
	RY(n+6)2	M-REQ2	Monitor request 2	RX(n+6)2	M-DAT2	During execution of monitor 2
	RY(n+6)3	M-REQ3	Monitor request 3	RX(n+6)3	M-DAT3	During execution of monitor 3
	RY(n+6)4	M-REQ4	Monitor request 4	RX(n+6)4	M-DAT4	During execution of monitor 4
	RY(n+6)5	M-REQ5	Monitor request 5	RX(n+6)5	M-DAT5	During execution of monitor 5
	RY(n+6)6	−	−	RX(n+6)6	WNG	Warning
	RY(n+6)7	ALM-RST	Reset alarm	RX(n+6)7	ALM	Alarm
	RY(n+6)8	−	−	RX(n+6)8	C-SUC	During execution of RS-485 communication
	RY(n+6)9			RX(n+6)9	−	−
	RY(n+6)A			RX(n+6)A		
	RY(n+6)B			RX(n+6)B		
	RY(n+6)C	D-REQ	Command execution request	RX(n+6)C	D-END	Command processing completion

	Command RY (Master to **NETC01-CC**)		
	Device No.	Signal name	Description
NETC01-CC control input/ status output	RY(n+6)D	−	−
	RY(n+6)E		
	RY(n+6)F		
System area control input/ status output	RY(n+7)0 to RY(n+7)F	−	Cannot be used

Response RX (**NETC01-CC** to master)		
Device No.	Signal name	Description
RX(n+6)D	R-ERR	Register error
RX(n+6)E	S-BSY	During system processing
RX(n+6)F	−	−
RX(n+7)0 to RX(n+7)A	−	Cannot be used
RX(n+7)B	CRD	Remote station communication ready
RX(n+7)C to RX(n+7)F	−	Cannot be used

2 Method of control via MECHATROLINK communication

See the following explanation when using the **BLE** Series FLEX RS-485 communication type in combination with the network converter **NETC01-M2** or **NETC01-M3**, via MECHATROLINK communication.
Refer to p.120 "3 Details of remote I/O" and p.122 "4 Command code list" for remote I/O and command code.

2.1 Guidance

If you are new to the **BLE** Series FLEX RS-485 communication type, read this section to understand the operating methods along with the operation flow.
This section explains the operation method in combination with the **NETC01-M2** as an example.

Note
- Before operating the motor, check the condition of the surrounding area to ensure safety.
- See the network converter **NETC01-M2**/**NETC01-M3** USER MANUAL for how to set the parameter.

STEP 1 Set the transmission rate, station address and address number.

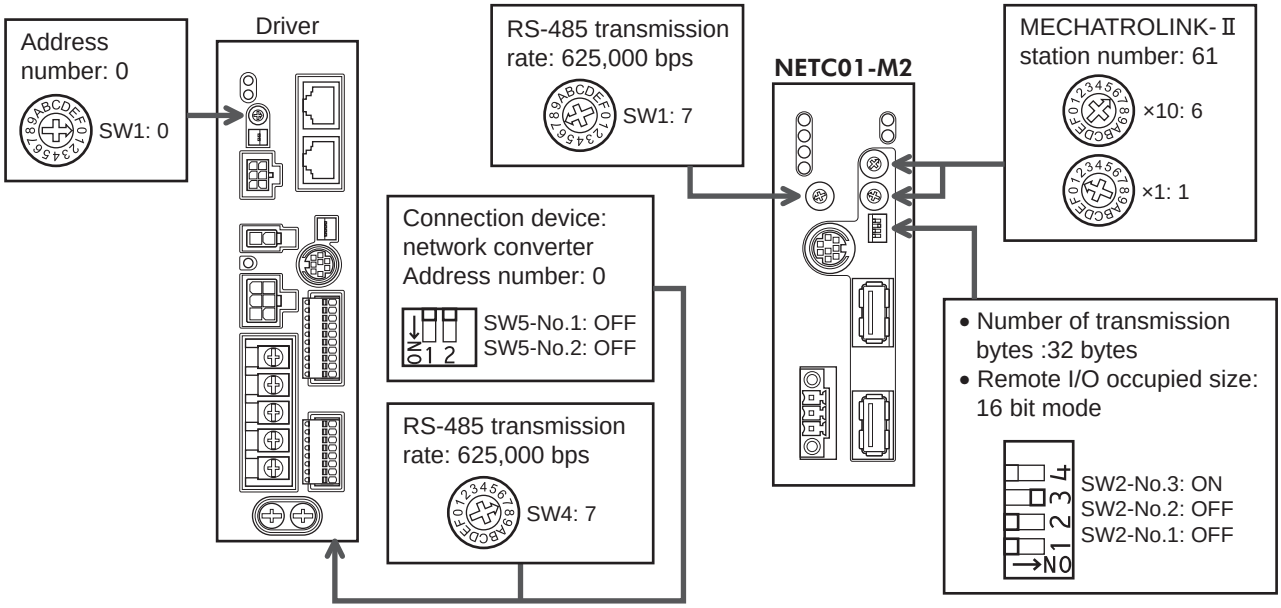
■ Using the switches

Setting condition of driver

- Address number of the driver: 0
- RS-485 transmission rate: 625,000 bps
- SW5-No.2 of the function setting switchs: OFF

Setting condition of **NETC01-M2**

- MECHATROLINK-Ⅱ station address: 61
- RS-485 transmission rate: 625,000 bps
- Remote I/O occupied size: 16 bit mode
- Number of transmission bytes: 32 bytes

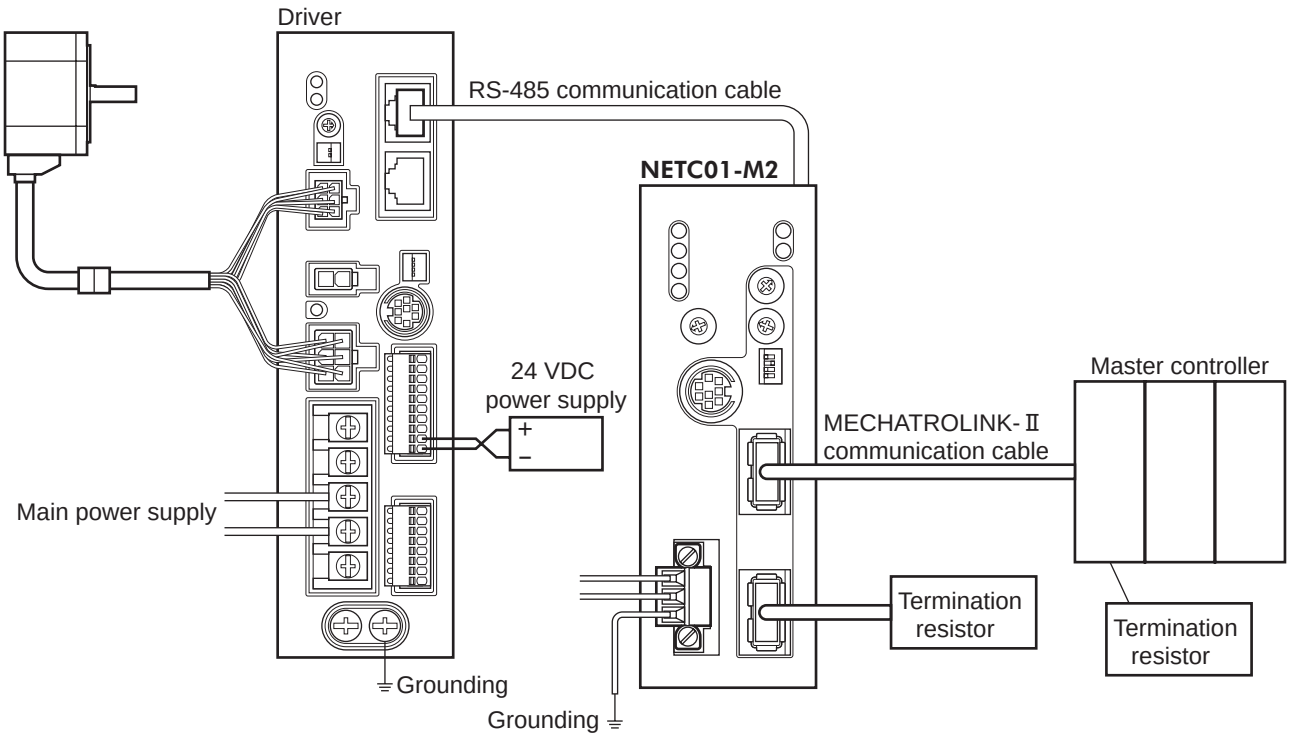


■ Using the parameter

1. Set the "communication (address number 0) " parameter of the **NETC01-M2** to " Enable" using the **OPX-2A** or **MEXE02**.
2. Cycle the **NETC01-M2** power.

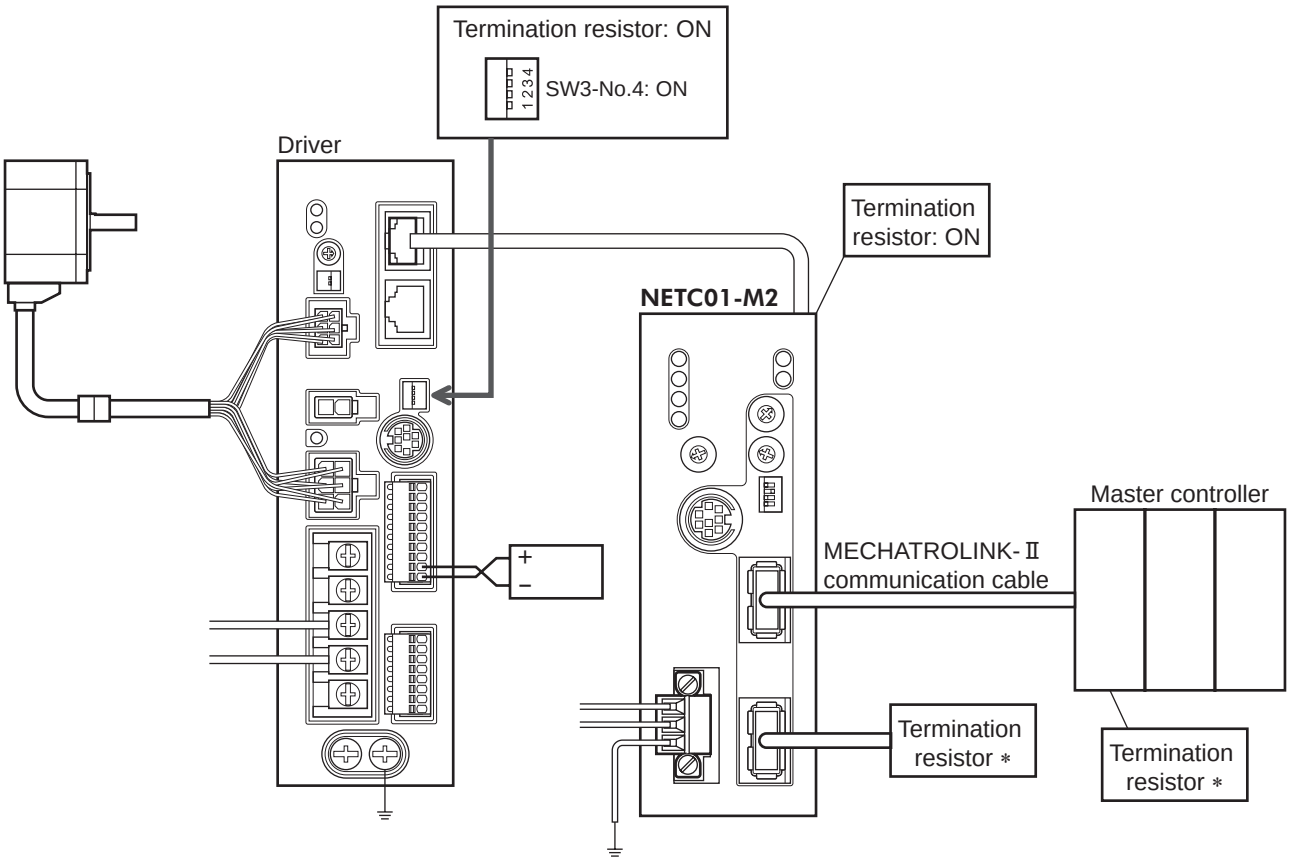
Note
- "Communication" parameter will be enabled after the power is cycled.
- When setting the parameters of the **NETC01-M2**, use the **OPX-2A** or **MEXE02**.

STEP 2 Check the connection



* It is not necessary for the **NETC01-M3**.

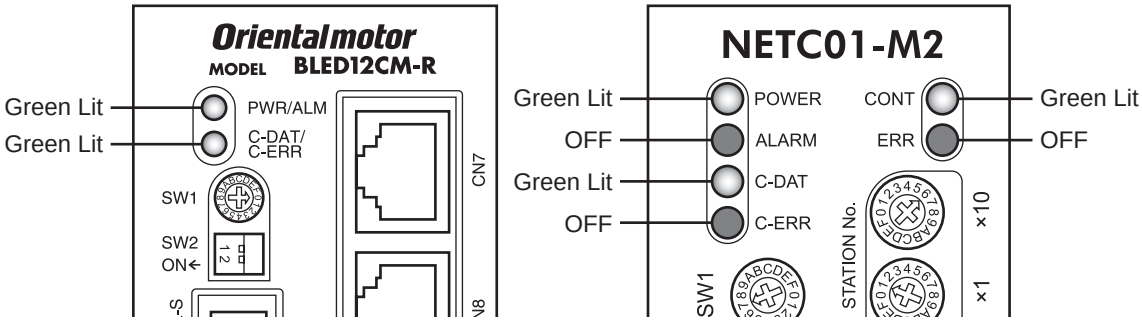
STEP 3 Check the termination resistor



* It is not necessary for the **NETC01-M3**.

STEP 4 Turn on the power and check the setting

Check that the LED condition has become as shown in the figures.



- When C-ERR (red) of the driver or **NETC01-M2** is lit:
  Check the transmission rate or address number of RS-485 communication.
- When ERR (red) of the **NETC01-M2** is lit: Check the MECHATROLINK-Ⅱ communication error.

STEP 5 Continuous operation

Control the I/O signal of the driver using the I/O command (DATA_RWA: 50h) of MECHATROLINK-II communication.

1. Set the rotation speed (1241h) for the operation data No.1 of the driver.
2. Perform continuous operation by turning ON the M0 and FWD of the address number 0.

bit15	bit14	bit13	bit12	bit11	bit10	bit9	bit8
NET-IN15 [Not used]	NET-IN14 [Not used]	NET-IN13 [Not used]	NET-IN12 [Not used]	NET-IN11 [Not used]	NET-IN10 [Not used]	NET-IN9 [Not used]	NET-IN8 [Not used]
bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
NET-IN7 [Not used]	NET-IN6 [MB-FREE]	NET-IN5 [STOP-MODE]	NET-IN4 [REV]	NET-IN3 [FWD]	NET-IN2 [M2]	NET-IN1 [M1]	NET-IN0 [M0]

* [ ]: Initial value

STEP 6 Were you able to operate the motor properly?

How did it go? Were you able to operate the motor properly? If the motor does not function, check the following points:

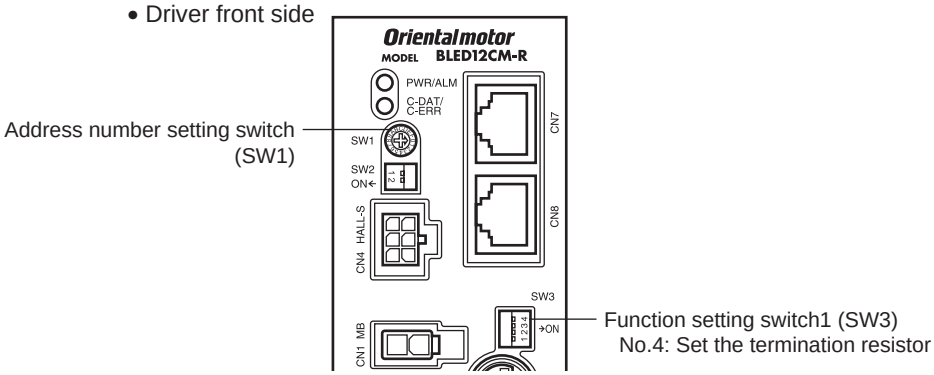
- Is any alarm present in the driver or **NETC01-M2**?
- Are the address number, transmission rate and termination resistor set correctly?
- Is the "connection" parameter of the **NETC01-M2** set correctly?
- Is the C-ERR LED lit? (RS-485 communication error)
- Is the ERR LED of the **NETC01-M2** lit? (MECHATROLINK-II/III communication error)
- Is the operation data (rotation speed) set correctly?
- Are the driver parameters set correctly?

For more detailed settings and functions, refer to next page and later, and the **NETC01-M2** USER MANUAL.

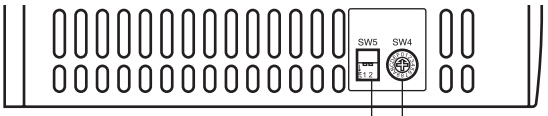
2.2 Setting the switches

When using the driver in combination with the network converter, set the switches before use.

• Driver front side



• Driver bottom side



Note Be sure to turn off the driver power before setting the switches. If the switches are set while the power is still on, the new switch settings will not become effective until the driver power is cycled.

■ Setting the connection device

Set the connection device of RS-485 communication using the function setting switch2 SW5-No.2.
Turn this switch OFF when controlling via the network converter.

Factory setting OFF (Network converter)

■ Address number (slave address)

Set the address number (slave address) using the address number setting switch (SW1) and SW5-No.1 of the function setting switch2. Make sure each address number (slave address) you set for each driver is unique.

Factory setting SW1: 0, SW5-No.1: OFF (Address number 0)

Address number (slave address)	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
SW1	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
SW5-No.1	OFF															
Connection mode	8 axes connection mode								16 axes connection mode							

■ Transmission rate

Set the transmission rate to 625,000 bps using the transmission rate setting switch (SW4).

Factory setting 7 (625,000 bps)

■ Termination resistor

Use a termination resistor for the driver located farthest away (positioned at the end) from the network converter. Turn the SW3-No.4 of the function setting switch1 ON to set the termination resistor for RS-485 communication (120 Ω).

Factory setting OFF (termination resistor disabled)

SW3-No.4	Termination resistor (120 Ω)
OFF	Disabled
ON	Enabled

2.3 I/O field map for the NETC01-M2

Update of remote I/O data (asynchronous) is executed by the “DATA_RWA” Command (50h). When the remote I/O occupied size is 16-bit mode and the number of transmission bytes is 32 bytes (initial value), I/O field map will be as follows. See the network converter **NETC01-M2** USER MANUAL for other I/O field map.

Byte	Part	Type	Command	Response
1	Header field	–	DATA_RWA (50h)	DATA_RWA (50h)
2			OPTION	ALARM
3				STATUS
4				
5	Data field	–	Reserved	Connection status
6				
7		Remote I/O	Address number "0" remote I/O input	Address number "0" remote I/O output
8				
9			Address number "1" remote I/O input	Address number "1" remote I/O output
10				
11			Address number "2" remote I/O input	Address number "2" remote I/O output
12				
13			Address number "3" remote I/O input	Address number "3" remote I/O output
14				
15			Address number "4" remote I/O input	Address number "4" remote I/O output
16				
17			Address number "5" remote I/O input	Address number "5" remote I/O output
18				
19			Address number "6" remote I/O input	Address number "6" remote I/O output
20				
21			Address number "7" remote I/O input	Address number "7" remote I/O output
22				
23		Remote resistor	Register address number	Register address number response
24				
25			Command code + TRIG	Command code response + TRIG response + STATUS
26				
27			DATA	DATA response
28				
29				
30				
31		–	Reserved	Reserved

2.4 I/O field map for the NETC01-M3

Update of remote I/O data (asynchronous) is executed by “DATA_RWA” Command (20h). When the remote I/O occupied size is 16-bit mode and the number of transmission bytes is 32 bytes (initial value), I/O field map will be as follows. See the network converter **NETC01-M3** USER MANUAL for other I/O field map.

Byte	Type	Command	Response
0	–	DATA_RWA (20h)	DATA_RWA (20h)
1	–	WDT	RWDT
2	–	CMD_CTRL	CMD_STAT
3			
4	–	Reserved	Connection status
5			
6	Remote I/O	Address number "0" remote I/O input	Address number "0" remote I/O output
7			
8		Address number "1" remote I/O input	Address number "1" remote I/O output
9			
10		Address number "2" remote I/O input	Address number "2" remote I/O output
11			
12		Address number "3" remote I/O input	Address number "3" remote I/O output
13			
14		Address number "4" remote I/O input	Address number "4" remote I/O output
15			
16		Address number "5" remote I/O input	Address number "5" remote I/O output
17			
18		Address number "6" remote I/O input	Address number "6" remote I/O output
19			
20		Address number "7" remote I/O input	Address number "7" remote I/O output
21			
22	Remote resistor	Register address number	Register address number response
23			
24		Command code + TRIG	Command code response + TRIG response + STATUS
25			
26		DATA	DATA response
27			
28			
29			
30	–	Reserved	Reserved
31			

2.5 Communication format

Communication formats to the driver and **NETC01-M2** (**NETC01-M3**) are as follows.

■ Remote I/O input

For details on remote I/O, refer to p.120.

• 8 axes connection mode [16 bit mode]

bit15	bit14	bit13	bit12	bit11	bit10	bit9	bit8
NET-IN15 [Not used]	NET-IN14 [Not used]	NET-IN13 [Not used]	NET-IN12 [Not used]	NET-IN11 [Not used]	NET-IN10 [Not used]	NET-IN9 [Not used]	NET-IN8 [Not used]
bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
NET-IN7 [Not used]	NET-IN6 [MB-FREE]	NET-IN5 [STOP-MODE]	NET-IN4 [REV]	NET-IN3 [FWD]	NET-IN2 [M2]	NET-IN1 [M1]	NET-IN0 [M0]

* [ ]: Initial value

• 16 axes connection mode [8 bit mode]

bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
NET-IN7 [Not used]	NET-IN6 [MB-FREE]	NET-IN5 [STOP-MODE]	NET-IN4 [REV]	NET-IN3 [FWD]	NET-IN2 [M2]	NET-IN1 [M1]	NET-IN0 [M0]

* [ ]: Initial value

■ Remote I/O output

• 8 axes connection mode [16 bit mode]

bit15	bit14	bit13	bit12	bit11	bit10	bit9	bit8
NET-OUT15 [TLC]	NET-OUT14 [VA]	NET-OUT13 [MOVE]	NET-OUT12 [ALARM-OUT2]	NET-OUT11 [Not used]	NET-OUT10 [Not used]	NET-OUT9 [Not used]	NET-OUT8 [S-BSY]
bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
NET-OUT7 [ALARM-OUT1]	NET-OUT6 [WNG]	NET-OUT5 [STOP-MODE_R]	NET-OUT4 [REV_R]	NET-OUT3 [FWD_R]	NET-OUT2 [M2_R]	NET-OUT1 [M1_R]	NET-OUT0 [M0_R]

* [ ]: Initial value

• 16 axes connection mode [8 bit mode]

bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
NET-OUT7 [ALARM-OUT1]	NET-OUT6 [WNG]	NET-OUT5 [STOP-MODE_R]	NET-OUT4 [REV_R]	NET-OUT3 [FWD_R]	NET-OUT2 [M2_R]	NET-OUT1 [M1_R]	NET-OUT0 [M0_R]

* [ ]: Initial value

■ Remote register input

• Command [**NETC01-M2** (**NETC01-M3**) to driver]

bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
Command code							
–	TRIG						
DATA							

• Explanation of command

Name	Description	Setting range
Command code	The command sets the command code for “write and read of parameters,” “monitor” and “maintenance."	–
TRIG	This is the trigger for handshake to execute the command code. When turning the TRIG from 0 to 1, the command code and DATA will be executed.	0: No motion 1: Execution
DATA	This is the data writing to the driver (little endian).	–

■ Remote register output

- Response [Driver to **NETC01-M2** (**NETC01-M3**)]

bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
STATUS	TRIG_R	Command code					
DATA_R							

- Explanation of command

Name	Description	Setting range
Command code	The response returns the command code of the command.	–
TRIG_R	This is the trigger for handshake indicating the completion of the command code. When the command code is completed, the TRIG_R will be turned from 0 to 1.	0: Not processing 1: Execution completion
STATUS	This indicates the result that executed the command code.	0: Normal operation 1: Error
DATA_R	This is the data reading from the driver (little endian).	–

3 Details of remote I/O

This is common to **NETC01-CC**, **NETC01-M2** and **NETC01-M3**.

3.1 Input signals to the driver

The following input signals can be assigned to the NET-IN0 to NET-IN15 of remote I/O using the parameter.
See the following table for the assignments of the NET-IN0 to NET-IN15.
For details on parameter, refer to p.127 "I/O function parameter (RS-485)".

bit15	bit14	bit13	bit12	bit11	bit10	bit9	bit8
NET-IN15 [Not used]	NET-IN14 [Not used]	NET-IN13 [Not used]	NET-IN12 [Not used]	NET-IN11 [Not used]	NET-IN10 [Not used]	NET-IN9 [Not used]	NET-IN8 [Not used]
bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
NET-IN7 [Not used]	NET-IN6 [MB-FREE]	NET-IN5 [STOP-MODE]	NET-IN4 [REV]	NET-IN3 [FWD]	NET-IN2 [M2]	NET-IN1 [M1]	NET-IN0 [M0]

* [ ]: Initial value

Signal name	Function	Setting range
Not used	Set when the input terminal is not used.	–
FWD	Rotate the motor in the forward direction.	0: Stop 1: Operation
REV	Rotate the motor in the reverse direction.	
STOP-MODE	Select instantaneous stop or deceleration stop.	0: Instantaneous stop 1: Deceleration stop
MB-FREE	Release the electromagnetic brake.	0: Electromagnetic brake hold 1: Electromagnetic brake release
HMI	Release of the function limitation of the **OPX-2A** or **MEXE02** (normally closed)	0: Function limitation 1: Function limitation release
R0 to R15	General signals. Use these signals when controlling the system via RS-485 communication.	0: OFF 1: ON
M0 to M3	Select the operation data No. using these four bits.	0: OFF 1: ON (Operation data No.0 to 15 can be selected.)
TL	Disable the torque limiting. (normally closed).	0: Torque limiting disabled 1: Torque limiting enabled

Note

- Do not assign the same input signal to multiple input terminals. When the same input signal is assigned to multiple input terminals, the function will be executed if any of the terminals becomes active.
- When the HMI input and TL input are not assigned to the input terminals, these inputs will be always set to ON (1). When assigning them to multiple terminals (including direct I/O and network I/O), the function will be executed when all terminals are set to ON (1).

3.2 Output signals from the driver

The following output signals can be assigned to the NET-OUT0 to NET-OUT15 of remote I/O using the parameter.
See the following table for the assignments of the NET-OUT0 to NET-OUT15.
For details on parameter, refer to p.127 "I/O function parameter (RS-485)".

bit15	bit14	bit13	bit12	bit11	bit10	bit9	bit8
NET-OUT15 [TLC]	NET-OUT14 [VA]	NET-OUT13 [MOVE]	NET-OUT12 [ALARM-OUT2]	NET-OUT11 [Not used]	NET-OUT10 [Not used]	NET-OUT9 [Not used]	NET-OUT8 [S-BSY]
bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
NET-OUT7 [ALARM-OUT1]	NET-OUT6 [WNG]	NET-OUT5 [STOP-MODE_R]	NET-OUT4 [REV_R]	NET-OUT3 [FWD_R]	NET-OUT2 [M2_R]	NET-OUT1 [M1_R]	NET-OUT0 [M0_R]

* [ ]: Initial value

Signal name	Function	Data read
Not used	Set when the output terminal is not used.	–
FWD_R	Output in response to the FWD input.	0: OFF 1: ON
REV_R	Output in response to the RVS input.	
STOP-MODE_R	Output in response to the STOP-MODE input.	
MB-FREE_R	Output in response to the MB-FREE input.	
HMI_R	Output in response to the HMI input.	
R0 to R15	Output the status of the general signals R0 to R15.	
M0_R to M3_R	Output in response to the M0 to M3 inputs.	
TL_R	Output in response to the TL. input	
ALARM_OUT1	Output the alarm status (normally open).	0: Alarm not present 1: Alarm present
WNG	Output the warning status.	0: Warning not present 1: Warning present
MOVE	Output when the motor operates.	0: Motor stopped 1: Motor operating
TLC	Output when the motor torque reaches the limit value.	0: No torque limiting 1: In torque limiting operation
VA	Output when the motor speed reaches the setting value.	0: Speed not attained 1: Speed attainment
S-BSY	Output when the motor is in internal processing state.	0: No internal processing 1: During internal processing
ALARM-OUT2	Output when the overload warning detection level is exceeded. Output when an overload alarm generates. (normally closed)	0: Normal operation 1: In overload operation
MPS	Output the ON-OFF state of the main power supply.	0: Main power-OFF 1: Main power-ON
DIR	Output the motor rotation direction.	0: REV direction 1: FWD direction

4 Command code list

This is common to **NETC01-CC**, **NETC01-M2** and **NETC01-M3**.

4.1 Group function

The driver has a group function. Multiple slaves are made into a group and a operation command is sent to all slaves in the group at once.

■ Group composition

A group consists of one parent slave and child slaves.

- Group address

To perform a group send, set a group address to the child slaves to be included in the group.
The child slaves to which the group address has been set can receive a command sent to the parent slave.
The operation command will be sent to the child slaves in the same group by sending it to the parent slave.

- Parent slave

No special setting is required on the parent slave to perform a group send. The address of the parent slave becomes the group address.

- Child slave

Use a "group" (1018h) to set a group address to each child slave.

Note Only remote I/O input can execute the group function. Read from commands and parameters or write to commands and parameters cannot be executed.

■ Group setting

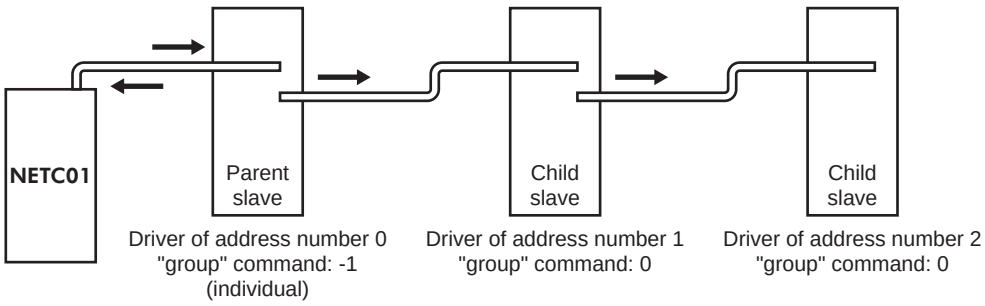
The group setting is not saved in the non-volatile memory even when the maintenance command "batch NV memory write" executes.

Command code		Description	Setting range	Initial value
Read	Write			
0018h	1018h	Group	Set the group. −1: Individual (No group setting) 0 to 15: Set the group address. (Address number of parent slave) *	−1: Individual

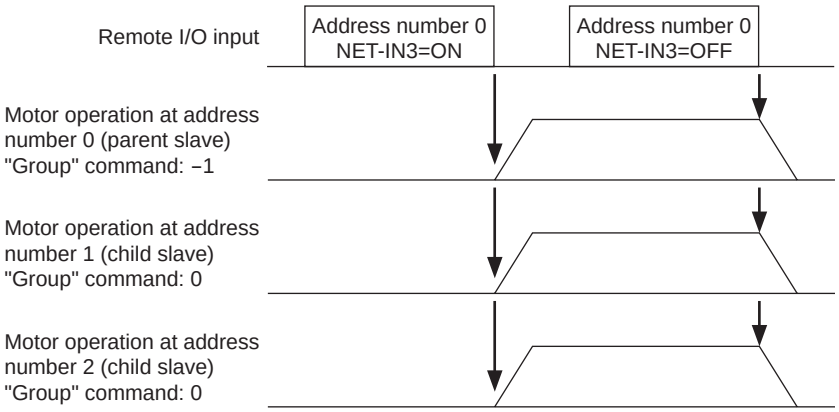
* Set in the 0 to 11 range when using the **NETC01-CC**, and set in the 0 to 15 range when using the **NETC01-M2** or **NETC01-M3**.

■ Example for setting of the group function

Set as follows when making a group by setting the driver of address number 0 to the parent slave and by setting the driver of address number 1 and 2 to the child slaves.



This is a timing chart for when assigning the FWD signal to NET-IN3 (remote I/O) of the driver in the group.



Note When inputting a command to the parent slave with remote I/O, the motors of the parent slave and child slaves will operate. The motors will not operate if the command is input to the child slaves.

4.2 Maintenance command

These commands are used to clear the alarm records and warning records. They are also used to execute the batch processing for the non-volatile memory.

Command code	Name	Description	Setting range
30C0h	Reset alarm	Resets the alarms that are present. Some alarms cannot be reset with the “reset alarm.”	1: Execute
30C2h	Clear alarm records	Clears alarm records.	
30C3h	Clear warning records	Clears warning records.	
30C4h	Clear communication error records	Clears the communication error records.	
30C6h	Configuration	Executes the parameter recalculation and the setup.	
30C7h	All data initialization *	Resets the parameters saved in the non-volatile memory to the initial value.	
30C8h	Batch NV memory read	Reads the parameters saved in the non-volatile memory, to the RAM. All operation data and parameters previously saved in the RAM are overwritten.	
30C9h	Batch NV memory write	Writes the parameters saved in the RAM to the non-volatile memory.	

* Communication parity, communication stop bit and transmission waiting time are not initialized. Initialize them using the **OPX-2A** or **MEXE02**.

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

4.3 Monitor command

These commands are used to monitor the driver condition.

Command code	Name	Description
2040h	Present alarm	Monitors the present alarm code.
2041h	Alarm record 1	Monitors the alarm records.
2042h	Alarm record 2	
2043h	Alarm record 3	
2044h	Alarm record 4	
2045h	Alarm record 5	
2046h	Alarm record 6	
2047h	Alarm record 7	
2048h	Alarm record 8	
2049h	Alarm record 9	
204Ah	Alarm record 10	
204Bh	Present warning	Monitors the present warning code.
204Ch	Warning record 1	Monitors the warning records.
204Dh	Warning record 2	
204Eh	Warning record 3	
204Fh	Warning record 4	
2050h	Warning record 5	
2051h	Warning record 6	
2052h	Warning record 7	
2053h	Warning record 8	
2054h	Warning record 9	
2055h	Warning record 10	
2056h	Present communication error code	Monitors the last received communication error code.
2057h	Communication error code record 1	Monitors the communication error records that have occurred in the past.
2058h	Communication error code record 2	
2059h	Communication error code record 3	
205Ah	Communication error code record 4	
205Bh	Communication error code record 5	
205Ch	Communication error code record 6	
205Dh	Communication error code record 7	
205Eh	Communication error code record 8	
205Fh	Communication error code record 9	
2060h	Communication error code record 10	
2062h	Present operation data No.	Monitors the operation data No. corresponding to the data used in the current operation. While the motor is stopped, the last used operation data number is indicated.
2064h	Command speed	Monitors the command speed.
2067h	Feedback speed	Monitors the feedback speed.
206Ah	Direct I/O and electromagnetic brake status	Monitors the each direct I/O signal and electromagnetic brake status. See the following table for the assignments.
2080h	Operation speed	Monitors the feedback speed calculated by the "reduction gear rate" parameter or "amplification speed rate" parameter. (unit: r/min)
2081h	Operation speed decimal position	Monitors the decimal position in the operation speed. ∗1
2082h	Conveyor transfer speed	Monitors the feedback speed calculated by the "conveyor reduction gear rate" parameter or "conveyor amplification speed rate" parameter. (unit: m/min)
2083h	Conveyor transfer speed decimal position	Monitors the decimal position in the conveyor transfer speed. ∗2
2084h	Load factor	Monitors the torque that is output by the motor based on the rated torque being 100%. (unit: %)
2086h	External analog speed setting	Monitors the speed setting value by the external potentiometer. (unit: r/min) ∗3

Command code	Name	Description
2088h	External analog torque limit setting	Monitors the torque limiting value by the external potentiometer. (unit: %) *3
208Bh	External analog voltage setting	Monitors the setting voltage by external voltage. (unit: 0.1 V)

*1 The decimal position is automatically changed based on the setting of the "reduction gear rate" parameter or "decimal place for reduction gear rate" parameter.
*2 The decimal position is automatically changed based on the setting of the "conveyor reduction gear rate" parameter or "decimal place for conveyor reduction gear rate" parameter.
*3 FFFFh is displayed when not selecting by the "analog input signal select" parameter.

- Direct I/O and electromagnetic brake status (206Ah)

Byte	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
0	−	IN6	IN5	IN4	IN3	IN2	IN1	IN0
1	−	−	−	−	−	−	−	−
2	−	−	−	−	−	−	OUT1	OUT2
3	−	−	−	−	−	−	MB	−

4.4 Operation data

Up to 16 operation data can be set (data Nos.0 to 15).
When the operation data is changed, a recalculation and setup will be performed after the operation is stopped and the changed value will be set.

Command code		Description	Setting range	Initial value
Read	Write			
0240h to 024Fh	1240h to 124Fh	Rotational speed No.0 to Rotational speed No.15	0, or 80 to 4000 r/min	0
0300h to 030Fh	1300h to 130Fh	Acceleration No.0 to Acceleration No.15	2 to 150 (1=0.1 s)	5
0340h to 034Fh	1340h to 134Fh	Deceleration No.0 to Deceleration No.15		
0380h to 038Fh	1380h to 138Fh	Torque limit No.0 to Torque limit No.15	0 to 200%	200

4.5 User parameters

The parameters are saved in the RAM or non-volatile memory. The data saved in the RAM will be erased once the 24 VDC power supply is turned off. On the other hand, the parameters saved in the non-volatile memory will be retained even after the 24 VDC power supply is turned off.
When turning on the driver 24 VDC power supply, the parameters saved in the non-volatile memory will be sent to the RAM. Then, the recalculation and setup for the parameters are executed in the RAM.
Parameters having set via RS-485 communication or industrial network are saved in the RAM. To save the parameters stored in the RAM to the non-volatile memory, execute the "batch NV memory write" of the maintenance command.
The parameters set with the **MEXE02** will be saved in the non-volatile memory if "Data writing" is performed.

When a parameter is changed, the timing to enable the new value varies depending on the parameter. See the following four types.

Update timing		Description
A	Effective immediately	Executes the recalculation and setup immediately when writing the parameter.
B	Effective after stopping the operation	Executes the recalculation and setup after stopping the operation.
C	Effective after executing configuration or effective after turning the power ON again	Executes the recalculation and setup after executing the configuration or turning the 24 VDC power ON again.
D	Effective after turning the power ON again	Executes the recalculation and setup after turning the 24 VDC power ON again.

Note

- The parameters are written in the RAM area when writing via the **NETC01-CC**, **NETC01-M2** or **NETC01-M3**. When saving data to the non-volatile memory, execute "batch NV memory write" of the maintenance command.
- The non-volatile memory can be rewritten approximately 100,000 times.

■ Function parameter

Command code		Description	Setting range	Initial value	Effective *
Read	Write				
01C2h	11C2h	Motor rotation direction	0: + direction=CCW 1: + direction=CW	1	C
0825h	1825h	Reduction gear rate	100 to 9999	100	A
0826h	1826h	Decimal place for reduction gear rate	0: 1 digit 1: 2 digit 2: 3 digit	2	
0827h	1827h	Amplification speed rate	1 to 5	1	
0828h	1828h	Conveyor reduction gear rate	100 to 9999	100	
0829h	1829h	Decimal place for conveyor reduction gear rate	0: 1 digit 1: 2 digit 2: 3 digit	2	
082Ah	182Ah	Conveyor amplification speed rate	1 to 5	1	
08A7h	18A7h	Velocity attainment width	0 to 400 r/min	200	

* Indicates the timing for the data to become effective. (A: Effective immediately, C: Effective after executing configuration or effective after turning the power ON again)

■ I/O function parameter

Command code		Description	Setting range	Initial value	Effective *
Read	Write				
0880h	1880h	IN0 function select	See table next.	1: FWD	B
0881h	1881h	IN1 function select		2: REV	
0882h	1882h	IN2 function select		19: STOP-MODE	
0883h	1883h	IN3 function select		48: M0	
0884h	1884h	IN4 function select		24: ALARM-RESET	
0885h	1885h	IN5 function select		20: MB-FREE	
0886h	1886h	IN6 function select		22: TH	
0890h	1890h	IN0 contact configuration	0: Make (N.O.) 1: Brake (N.C.)	0	C
0891h	1891h	IN1 contact configuration			
0892h	1892h	IN2 contact configuration			
0893h	1893h	IN3 contact configuration			
0894h	1894h	IN4 contact configuration			
0895h	1895h	IN5 contact configuration			
0896h	1896h	IN6 contact configuration			
08A0h	18A0h	OUT0 function select	See table next.	85: SPEED-OUT	A
08A1h	18A1h	OUT1 function select		65: ALARM-OUT1	

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

- Setting range for IN input function selection

0: No function	22: TH	35: R3	41: R9	47: R15
1: FWD	24: ALARM-RESET	36: R4	42: R10	48: M0
2: REV	27: HMI	37: R5	43: R11	49: M1
19: STOP-MODE	32: R0	38: R6	44: R12	50: M2
20: MB-FREE	33: R1	39: R7	45: R13	51: M3
21: EXT-ERROR	34: R2	40: R8	46: R14	54: TL

- Setting range for OUT output function selection

0: No function	34: R2	42: R10	50: M2_R	80: S-BSY
1: FWD_R	35: R3	43: R11	51: M3_R	81: ALARM-OUT2
2: REV_R	36: R4	44: R12	54: TL_R	82: MPS
19: STOP-MODE_R	37: R5	45: R13	65: ALARM-OUT1	84: DIR
20: MB-FREE_R	38: R6	46: R14	66: WNG	85: SPEED-OUT
27: HMI_R	39: R7	47: R15	68: MOVE	
32: R0	40: R8	48: M0_R	71: TLC	
33: R1	41: R9	49: M1_R	77: VA	

■ I/O function parameter (RS-485)

Command code		Description	Setting range	Initial value	Effective *
Read	Write				
08B0h	18B0h	NET-IN0 function select	See table next.	48: M0	C
08B1h	18B1h	NET-IN1 function select		49: M1	
08B2h	18B2h	NET-IN2 function select		50: M2	
08B3h	18B3h	NET-IN3 function select		1: FWD	
08B4h	18B4h	NET-IN4 function select		2: REV	
08B5h	18B5h	NET-IN5 function select		19: STOP-MODE	
08B6h	18B6h	NET-IN6 function select		20: MB-FREE	
08B7h	18B7h	NET-IN7 function select		0: No function	
08B8h	18B8h	NET-IN8 function select			
08B9h	18B9h	NET-IN9 function select			
08BAh	18BAh	NET-IN10 function select			
08BBh	18BBh	NET-IN11 function select			
08BCh	18BCh	NET-IN12 function select			
08BDh	18BDh	NET-IN13 function select			
08BEh	18BEh	NET-IN14 function select			
08BFh	18BFh	NET-IN15 function select			
08C0h	18C0h	NET-OUT0 function select	See table next.	48: M0_R	
08C1h	18C1h	NET-OUT1 function select		49: M1_R	
08C2h	18C2h	NET-OUT2 function select		50: M2_R	
08C3h	18C3h	NET-OUT3 function select		1: FWD_R	
08C4h	18C4h	NET-OUT4 function select		2: REV_R	
08C5h	18C5h	NET-OUT5 function select		19: STOP-MODE_R	
08C6h	18C6h	NET-OUT6 function select		66: WNG	
08C7h	18C7h	NET-OUT7 function select		65: ALARM-OUT1	
08C8h	18C8h	NET-OUT8 function select		80: S-BSY	
08C9h	18C9h	NET-OUT9 function select		0: No function	
08CAh	18CAh	NET-OUT10 function select			
08CBh	18CBh	NET-OUT11 function select			
08CCh	18CCh	NET-OUT12 function select		81: ALARM-OUT2	
08CDh	18CDh	NET-OUT13 function select		68: MOVE	
08CEh	18CEh	NET-OUT14 function select		77: VA	
08CFh	18CFh	NET-OUT15 function select		71: TLC	

* Indicates the timing for the data to become effective. (C: Effective after executing configuration or effective after turning the power ON again)

- Setting range for NET-IN input function selection

0: No function	32: R0	38: R6	44: R12	50: M2
1: FWD	33: R1	39: R7	45: R13	51: M3
2: REV	34: R2	40: R8	46: R14	54: TL
19: STOP-MODE	35: R3	41: R9	47: R15	
20: MB-FREE	36: R4	42: R10	48: M0	
27: HMI	37: R5	43: R11	49: M1	

- Setting range for NET-OUT output function selection

0: No function	33: R1	40: R8	47: R15	66: WNG
1: FWD_R	34: R2	41: R9	48: M0_R	68: MOVE
2: REV_R	35: R3	42: R10	49: M1_R	71: TLC
19: STOP-MODE_R	36: R4	43: R11	50: M2_R	77: VA
20: MB-FREE_R	37: R5	44: R12	51: M3_R	80: S-BSY
27: HMI_R	38: R6	45: R13	54: TL_R	81: ALARM-OUT2
32: R0	39: R7	46: R14	65: ALARM_OUT1	82: MPS
				84: DIR

■ Analog adjust parameter

Command code		Description	Setting range	Initial value	Effective *
Read	Write				
08D0h	18D0h	Analog operating speed command gain	0 to 4000 r/min	800	A
08D1h	18D1h	Analog operating speed command offset	−2000 to 2000 r/min	0	
08D2h	18D2h	Analog torque limit gain	0 to 200%	40	
08D3h	18D3h	Analog torque limit offset	−50 to 50%	0	
08D5h	18D5h	Analog operating speed maximum value for external input	0 to 4000 r/min	4000	
08D7h	18D7h	Analog torque limit maximum value external input	0 to 200%	200	

* Indicates the timing for the data to become effective. (A: Effective immediately)

■ Alarm/warning parameter

Command code		Description	Setting range	Initial value	Effective *
Read	Write				
0851h	1851h	Over load warning enable	0: Disable 1: Enable	0	A
0855h	1855h	Over load warning level	50 to 100%	100	

* Indicates the timing for the data to become effective. (A: Effective immediately)

■ Utilities parameter

Command code		Description	Setting range	Initial value	Effective *
Read	Write				
0143h	1143h	JOG operating speed	0, or 80 to 1000 r/min	300	A
01E0h	11E0h	Display mode of the data setter speed	0: Signed 1: Absolute	0	
01E1h	11E1h	The data setter editing mode	0: Disable 1: Enable	1	
0821h	1821h	JOG operating torque	0 to 200%	200	

* Indicates the timing for the data to become effective. (A: Effective immediately)

■ Operation parameter

Command code		Description	Setting range	Initial value	Effective *
Read	Write				
0816h	1816h	Run mode select	0: PWM shut off mode enable 1: PWM shut off mode disable	1	C
0840h	1840h	Magnetic brake function at alarm	0: Lock after free stop 1: Lock immediately	1	
0841h	1841h	No operation at initial alarm enable	0: Disable 1: Enable	0	
0843h	1843h	Initial thermal input detection		0	
0870h	1870h	Data setter initial display	0: Operating speed 1: Conveyor speed 2: Load factor 3: Operating number 4: Mon top view	0	
0871h	1871h	Analog input signal select	0: Analog invalid 1: Analog speed 2: Analog torque (See next page for details.)	1	

* Indicates the timing for the data to become effective. (C: Effective after executing configuration or effective after turning the power ON again)

- "Analog input signal select" parameter

Setting method of operation data can be changed using the "analog input signal select" parameter.
Others except the following combinations are not available to set.

"Analog input signal select" parameter	Operation data No.	Rotational speed	Acceleration Deceleration	Torque limit
0	0 to 15	Digital setting		
1 (Initial value)	0	Analog setting	Digital setting	
	1 to 15	Digital setting		
2	0 ot 15	Digital setting		Analog setting

Setting example

- When setting all operation data with digital setting: Set the "analog input signal select" parameter to "0."
- When setting only the rotation speed in the operation data No.0 using the analog setting: Set the "analog input signal select" parameter to "1."

■ Communication parameter

Command code		Description	Setting range	Initial value	Effective *
Read	Write				
0900h	1900h	Communication time out	0: Not monitored 1 to 10000 ms	0	A
0901h	1901h	Communication error alarm	1 to 10 times	3	

* Indicates the timing for the data to become effective. (A: Effective immediately)

6 Inspection, troubleshooting and remedial actions

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

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1 Maintenance and inspection

1.1 Inspection

It is recommended that periodic inspections for the items listed below are conducted 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. Handle the driver with care since static electricity may damage semiconductor elements. Static electricity may damage the driver.

■ During inspection

- Are the openings in the driver blocked?
- The driver mounting screws and power connection terminal screws are not loose.
- Are there any strange smells or appearances within the driver?

1.2 Warranty

Check on the Oriental Motor Website for the product warranty.

1.3 Disposal

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

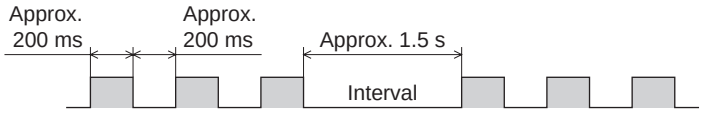
2 Alarms, warnings and communication errors

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).
Communication error will generate when the process requested by the master could not be executed.

2.1 Alarms

When an alarm generates, the ALARM-OUT1 output will turn OFF and the motor will stop. At the same time, the PWR/ALM LED will start blinking.
The present alarm can be checked by counting the number of times the PWR/ALM LED blinks. The alarm can be also checked using any of the **OPX-2A**, **MEXE02** or RS-485 communication.

Example: Sensor error alarm (number of blinks: 3)



■ 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. Refer to p.42 for the timing chart.

- Turn the ALARM-RESET input to ON and then OFF. (This signal will become effective when turning from ON to OFF.)
- Perform an alarm reset using RS-485 communication.
- Perform an alarm reset using the **OPX-2A** or **MEXE02**.
- Cycle the power.

Note Some alarms cannot be reset with the ALARM-RESET input, **OPX-2A**, **MEXE02** or RS-485 communication. Check the following table to identify which alarms meet this condition. To reset these alarms, cycle the power.

■ Alarm records

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

- Read the alarm records by the monitor command via RS-485 communication.
- Clear the alarm records by the maintenance command via RS-485 communication.
- Read and clear the alarm records using the **OPX-2A** or **MEXE02**.

■ Alarm list

Code	No. of LED blinks	Alarm type	Cause	Remedial action	Reset using the ALARM-RESET input
30h	2	Overload	A load exceeding the rated torque was applied to the motor for 5 seconds or more.	• Decrease the load. • Review the operation pattern settings such as the acceleration/ deceleration time.	Possible
28h	3	Sensor error	The motor sensor signal line experienced an open circuit during operation, or the signal connector came off.	Check the connection between the driver and motor.	
42h		Initial sensor error	The motor sensor signal line broke or signal connector came off before the main power supply was turned on.		
22h	4	Overvoltage	• The main power-supply voltage became higher than the rated voltage by approx. 20%. • A load exceeding the allowable gravitational capacity of the motor is driven or sudden starting/stopping of a large inertial load is performed.	• Check the main power supply voltage. • If this alarm occurs during operation, reduce the load or increase the acceleration/ deceleration time. • Use a regeneration unit.	
25h	5	Undervoltage	The main power-supply voltage became lower than the rated voltage by approx. 40%	• Check the main power supply voltage. • Check the wiring of the power supply cable.	
31h	6	Overspeed	The rotation speed of the motor output shaft exceeded approx. 4800 r/min	• Decrease the load. • Review the operation pattern settings such as the acceleration/ deceleration time.	
20h	7	Overcurrent	Excessive current has flown through the driver due to ground fault, etc.	Check the wiring between the driver and motor for damage, and then cycled the power.	Not possible
41h	8	EEPROM error	• Stored data was damaged. • Data became no longer writable or readable.	Initialize the parameters if the **OPX-2A** or **MEXE02** is used. If the alarm does not reset even after the power has been cycled, contact your nearest office.	
51h	9	Overheated regeneration unit	• Overheating of the regeneration unit was detected. • Lead wires of the thermostat output of the regeneration unit broke during operation.	• The power consumption of the regeneration unit exceeds the permissible level. Review the load condition and operating conditions. • Check the connection of the regeneration unit.	Possible
6Eh	10	External stop *1	The EXT-ERROR input turned OFF.	Check the EXT-ERROR input.	
46h	11	Initial operation inhibition *2	The 24 VDC power supply was cycled when the FWD input or REV input was ON.	Turn the FWD input and REV input OFF, and then cycle the 24 VDC power supply.	
81h	12	Network bus error	When the motor operates, the master controller for the network converter shows a disconnection status.	Check the connector or cable of the master controller.	
83h		Communication switch setting error	Transmission rate setting switch (SW4) was out-of-specification.	Check the transmission rate setting switch (SW4).	Not possible
84h		RS-485 communication error	The number of consecutive RS-485 communication errors reached the set value of the "communication error alarm" parameter.	• Check the connection between the master controller and driver. • Check the setting of RS-485 communication.	Possible

*1 It generates when assigning the EXT-ERROR to the IN0 to IN6 inputs.
*2 It generates when setting the "no operation at initial alarm enable" parameter to "Enable."

Code	No. of LED blinks	Alarm type	Cause	Remedial action	Reset using the ALARM-RESET input
85h	12	RS-485 communication timeout	The time set in the "communication time out" parameter has elapsed, and yet the communication could not be established with the master controller.	Check the connection between the master controller and driver.	Possible
8Eh		Network converter error	An alarm was generated in the network converter.	Check the alarm code of the network converter.	
23h	13	Main power off	• The main power supply was shut off while operating. • Although the 24 VDC power supply has been turned on, the operation command was input while the main power supply was shut off.	• Check the connections between the driver and power supply. • Check the power supply cable wiring.	
2Dh	14	Main circuit output error *	The motor drive wire broke or motor power connector came off.	Check the connection between the driver and motor.	

* This alarm does not generate when the torque limiting value is set to less than 200% .

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

Code	Warning type	Cause	Remedial action
30h	Overload *	The load torque of the motor exceeded the overload warning level.	• Decrease the load. • Review the operation pattern settings such as the acceleration/ deceleration time.
6Ch	Operation error	• When moving from the test mode to other mode using the **OPX-2A** or **MEXE02**, the FWD input or REV input was turned ON. • When changing the assignment of the input terminal using any of the **OPX-2A**, **MEXE02** or RS-485 communication, the assigned terminal was ON.	Turn the input signals OFF.
84h	RS-485 communication error	The RS-485 communication error was detected.	• Check the connection between the master controller and driver. • Check the setting of RS-485 communication.

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

■ Warning records

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

- Read the warning records by the monitor command via RS-485 communication.
- Clear the warning records by the maintenance command via RS-485 communication.
- Read and reset the warning records using the **OPX-2A** or **MEXE02**.

Note You can also clear the warning records by turning off the driver power.

2.3 Communication errors

Up to 10 communication errors are saved in the RAM in order of the latest to the oldest and you can check using the **MEXE02** or via RS-485 communication.

■ Communication error list

Code	Communication error type	Cause	Remedial action
84h	RS-485 communication error	One of the following errors was detected. · Framing error · BCC error	• Check the connection between the master controller and driver. • Check the setting of RS-485 communication.
88h	Command not yet defined	The command requested by the master could not be executed because of being undefined.	• Check the setting value for the command. • Check the flame configuration.
89h	Execution disable due to user I/F communication in progress	The command requested by the master could not be executed because the **OPX-2A** or **MEXE02** was communicating with the driver.	Wait until the processing for the **OPX-2A** or **MEXE02** will be completed.
8Ah	Non-volatile memory processing in progress	The command could not be executed because the driver was performing the non-volatile memory processing. · Internal processing was in progress. (S-BSY is ON.) · An EEPROM error alarm was present.	• Wait until the internal processing will be completed. • When the EEPROM error was generated, initialize all parameters using any of the **OPX-2A**, **MEXE02** or RS-485 communication.
8Ch	Outside setting range	The setting data requested by the master could not be executed due to outside the range.	Check the setting data.
8Dh	Command execute disable	When the command is unable to execute, it was tried to execute.	Check the driver status.

■ Communication error records

Up to 10 communication errors are saved in the RAM in order of the latest to oldest.
Communication error records saved in the RAM can be read or cleared when performing any of the following.

- Read the communication error records by the monitor command via RS-485 communication.
- Clear the communication error records by the maintenance command via RS-485 communication.
- Clear the communication error records by the RS-485 communication monitor of the **MEXE02**.

Note You can also clear the communication records 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 section 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 correctly.	Check the connection of the power supply.
	Both the FWD input and REV input are OFF.	Turn ON either the FWD input or REV input one at a time.
	Both the FWD input and REV input are ON.	
	The ALM LED (red) is blinking.	An alarm generated due to a protective function being triggered. Refer to p.133 to reset the alarm.
	Electromagnetic brake is not released. (electromagnetic brake motor only)	Turn ON the MB-FREE input.
The motor rotates in the direction opposite to the specified direction.	The FWD input and REV input are connected wrongly or otherwise not connected correctly.	Check the connection of the FWD input and REV input. The motor rotates in the clockwise direction when the FWD input is ON, and in the counterclockwise direction when the REV input is ON.
	The combination type • parallel shaft gearhead is using a gear with a gear ratio of 30, 50 or 100.	When the gear ratio of the combination type • parallel shaft gearhead is 30, 50 or 100, the rotation direction of the gear output shaft is opposite the rotation direction of the motor output shaft. Accordingly, reverse the FWD input and REV 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 the rotation direction of the motor output shaft. Accordingly, reverse the FWD input and REV input operations. • Is the gearhead viewed in the correct direction? With a combination type • hollow shaft flat gearhead, the rotation direction of the gearhead changes according to the direction in which the gearhead is viewed.
• Motor operation is unstable. • Motor vibration is too great.	The motor (gearhead) output shaft is not misaligned with the load shaft.	Check the coupling condition of the motor (gearhead) output shaft and load shaft.
	Effect of 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.
The motor doesn't stop instantaneously.	The STOP-MODE input is ON.	To cause the motor to stop instantaneously, turn OFF the STOP-MODE input.
	The inertial load is large.	Reduce the load inertia or connect the accessory regeneration unit (sold separately).
The electromagnetic brake does not hold.	The MB-FREE input is ON.	Turn OFF the MB-FREE input.

Note

- Check the alarm message when the alarm generates.
- I/O signals can be monitored using the **OPX-2A**, **MEXE02** or RS-485 communication. Use to check the wiring condition of the I/O signals.

7 Reference

This part explains the standards and CE Marking.

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1 Specifications

1.1 Specifications

Model	Motor	BLEM23-GFS BLEM23-A		BLEM46-GFS BLEM46-A	
	Driver	BLED3AM-R	BLED3CM-R	BLED6AM-R	BLED6CM-R
Rated output power (Continuous)		30 W		60 W	
Power supply input	Rated voltage	Single-phase 100-120 VAC	Single-phase 200-240 VAC Three-phase 200-240 VAC	Single-phase 100-120 VAC	Single-phase 200-240 VAC Three-phase 200-240 VAC
	Permissible voltage range	−15 to +10%			
	Rated frequency	50/60 Hz			
	Permissible frequency range	±5%			
	Rated input current	1.3 A	Single-phase: 0.8 A Three-phase: 0.45 A	2.0 A	Single-phase: 1.2 A Three-phase: 0.7 A
	Maximum input current	3.5 A	Single-phase: 2.1 A Three-phase: 1.2 A	4.5 A	Single-phase: 2.6 A Three-phase: 1.5 A
Control Power Supply	Voltage	24 VDC			
	Permissible Voltage Range	−15 to +20%			
Rated torque		0.1 N·m (14.2 oz-in)		0.2 N·m (28 oz-in)	
Maximum instantaneous torque∗1		0.2 N·m (28 oz-in)		0.4 N·m (56 oz-in)	
Rated rotation speed		3000 r/min			
Speed control range		100 to 4000 r/min (Analog setting) 80 to 4000 r/min (Setting in 1 r/min increments during digital setting)∗2			

*1 The maximum instantaneous torque can be used for up to approximately 5 seconds.
*2 These specifications apply when the RS-485 communication is used with either the **OPX-2A** or **MEXE02**.

Model	Motor	BLEM512-GFS BLEM512-A	
	Driver	BLED12AM-R	BLED12CM-R
Rated output power (Continuous)		120 W	
Power supply input	Rated voltage	Single-phase 100-120 VAC	Single-phase 200-240 VAC Three-phase 200-240 VAC
	Permissible voltage range	−15 to +10%	
	Rated frequency	50/60 Hz	
	Permissible frequency range	±5%	
	Rated input current	3.3 A	Single-phase: 2.0 A Three-phase: 1.2 A
	Maximum input current	8.2 A	Single-phase: 4.4 A Three-phase: 2.5 A
Control Power Supply	Voltage	24 VDC	
	Permissible Voltage Range	−15 to +20%	
Rated torque		0.4 N·m (56 oz-in)	
Maximum instantaneous torque∗1		0.8 N·m (113 oz-in)	
Rated rotation speed		3000 r/min	
Speed control range		100 to 4000 r/min (Analog setting) 80 to 4000 r/min (Setting in 1 r/min increments during digital setting)∗2	

*1 The maximum instantaneous torque can be used for up to approximately 5 seconds.
*2 These specifications apply when the RS-485 communication is used with either the **OPX-2A** or **MEXE02**.

■ Electromagnetic brake type

Model	Motor	BLEM23M2-GFS BLEM23M2-A		BLEM46M2-GFS BLEM46M2-A	
	Driver	BLED3AM-R	BLED3CM-R	BLED6AM-R	BLED6CM-R
Rated output power (Continuous)		30 W		60 W	
Power supply input	Rated voltage	Single-phase 100-120 VAC	Single-phase 200-240 VAC Three-phase 200-240 VAC	Single-phase 100-120 VAC	Single-phase 200-240 VAC Three-phase 200-240 VAC
	Permissible voltage range	−15 to +10%			
	Rated frequency	50/60 Hz			
	Permissible frequency range	±5%			
	Rated input current	1.3 A	Single-phase: 0.8 A Three-phase: 0.45 A	2.0 A	Single-phase: 1.2 A Three-phase: 0.7 A
	Maximum input current	3.5 A	Single-phase: 2.1 A Three-phase: 1.2 A	4.5 A	Single-phase: 2.6 A Three-phase: 1.5 A
Control Power Supply	Voltage	24 VDC			
	Permissible Voltage Range	−15 to +20%			
Rated torque		0.1 N·m (14.2 oz-in)		0.2 N·m (28 oz-in)	
Maximum instantaneous torque∗1		0.2 N·m (28 oz-in)		0.4 N·m (56 oz-in)	
Rated rotation speed		3000 r/min			
Speed control range		100 to 4000 r/min (Analog setting) 80 to 4000 r/min (Setting in 1 r/min increments during digital setting)∗2			
Electromagnetic Brake∗3	Brake Type	Power off activated type, automatically controlled by the driver			
	Static Friction Torque	0.1 N·m (14.2 oz-in)		0.2 N·m (28 oz-in)	

*1 The maximum instantaneous torque can be used for up to approximately 5 seconds.
*2 These specifications apply when the RS-485 communication is used with either the **OPX-2A** or **MEXE02**.
*3 Do not start or stop the motor by turning the power supply ON/OFF, as this will cause the electromagnetic brake to wear abnormally.

Model	Motor	BLEM512M2-GFS BLEM512M2-A	
	Driver	BLED12AM-R	BLED12CM-R
Rated output power (Continuous)		120 W	
Power supply input	Rated voltage	Single-phase 100-120 VAC	Single-phase 200-240 VAC Three-phase 200-240 VAC
	Permissible voltage range	−15 to +10%	
	Rated frequency	50/60 Hz	
	Permissible frequency range	±5%	
	Rated input current	3.3 A	Single-phase: 2.0 A Three-phase: 1.2 A
	Maximum input current	8.2 A	Single-phase: 4.4 A Three-phase: 2.5 A
Control Power Supply	Voltage	24 VDC	
	Permissible Voltage Range	−15 to +20%	
Rated torque		0.4 N·m (56 oz-in)	
Maximum instantaneous torque∗1		0.8 N·m (113 oz-in)	
Rated rotation speed		3000 r/min	
Speed control range		100 to 4000 r/min (Analog setting) 80 to 4000 r/min (Setting in 1 r/min increments during digital setting)∗2	
Electromagnetic Brake∗3	Brake Type	Power off activated type, automatically controlled by the driver	
	Static Friction Torque	0.4 N·m (56 oz-in)	

*1 The maximum instantaneous torque can be used for up to approximately 5 seconds.
*2 These specifications apply when the RS-485 communication is used with either the **OPX-2A** or **MEXE02**.
*3 Do not start or stop the motor by turning the power supply ON/OFF, as this will cause the electromagnetic brake to wear abnormally.

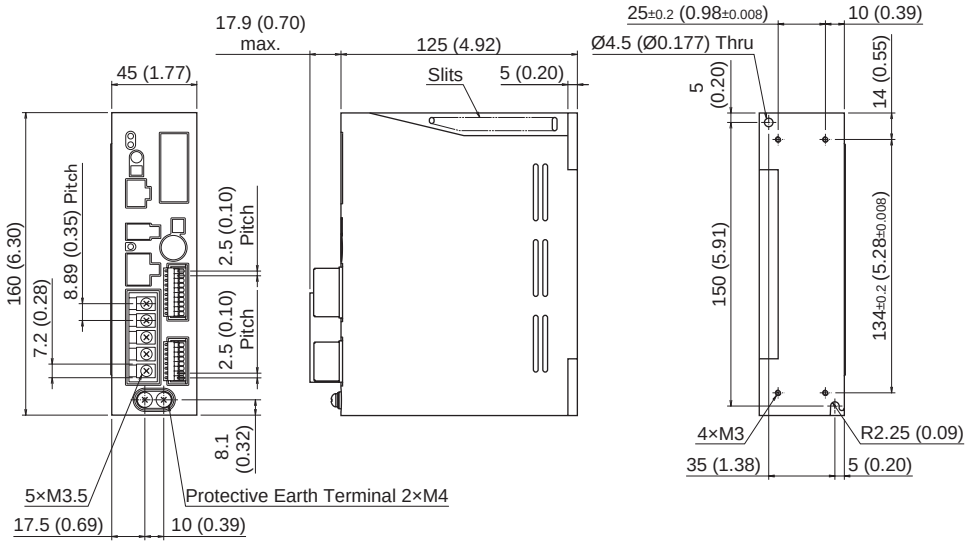
1.2 General specifications

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

1.3 Dimension

Mass: 0.7 kg (1.54 lb.)

[Unit: mm (in.)]



2 Regulations and standards

2.1 UL Standards and CSA Standards

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

2.2 CE Marking

This product is affixed with the marks under the following directives.

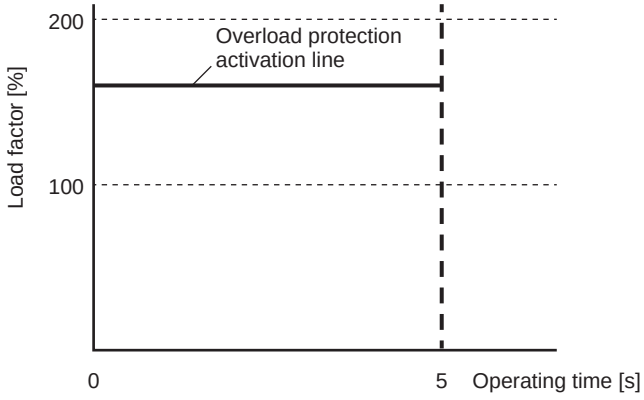
■ Low Voltage Directive

Installation conditions

Overvoltage category	Ⅱ
Pollution degree	2
Degree of protection	IP20
Protection against electric shock	Class Ⅰ equipment

- This product cannot be used in IT power distribution systems.
- Isolate power cables such as the connection cable, power supply cable and other drive cables from the signal cable (CN3, CN5 to CN8) by means of double insulation.
- Use a circuit breaker conforming to EN or IEC Standards.
- The driver is not provided with the motor overtemperature protection specified in EN Standards.
- The driver is provided with the electronic motor overload protection specified in EN Standards.

Overload protection characteristics



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

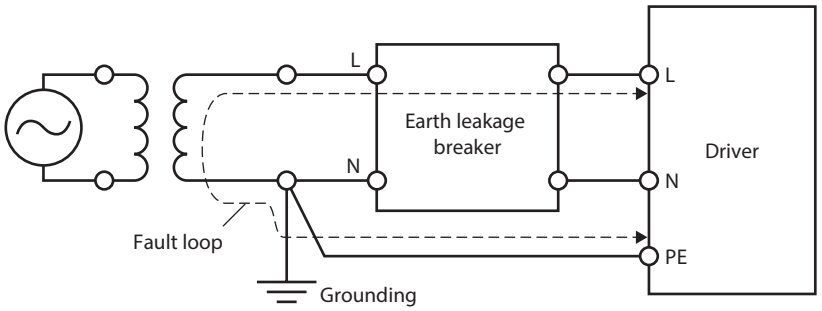
- The driver is not provided with the ground fault protection. Wire the product in accordance with “Wiring example having considered ground fault protection.” Also observe the followings.
  - Earth leakage breaker: Rated sensitivity current 30 mA
  - Fault loop impedance: Equal to or less than the value in table
  - When connecting to a power supply of Overvoltage category III, use an insulation transformer to ground its secondary side (N for single-phase, Neutral point for three-phase).

Driver power supply specifications	Fault loop impedance
Single-phase 100-120 V	500 Ω
Single-phase 200-240 V Three-phase 200-240 V	1000 Ω

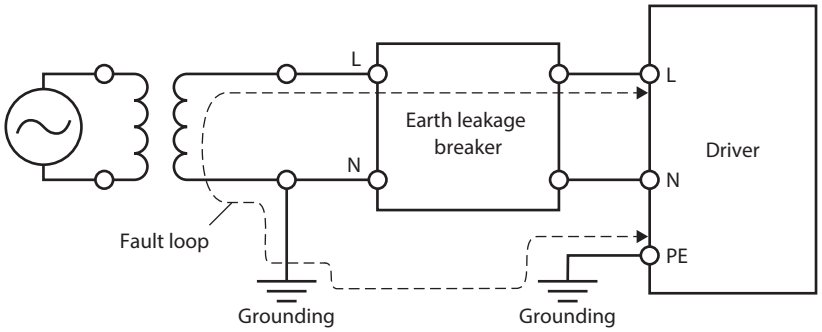
- Wiring example having considered ground fault protection

  Single-phase 100-120 V

• TN power distribution systems

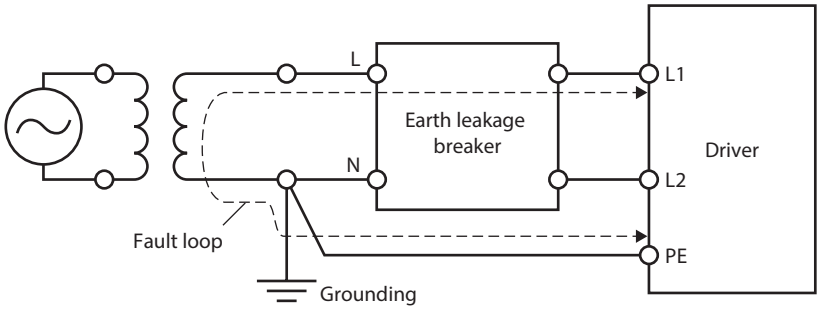


• TT power distribution systems

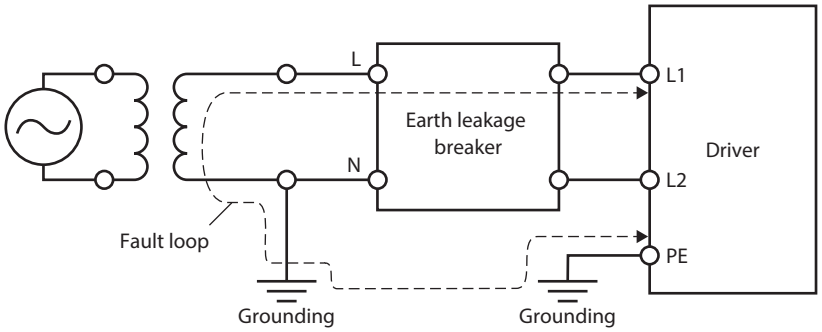


Single-phase 200-240 V

• TN power distribution systems

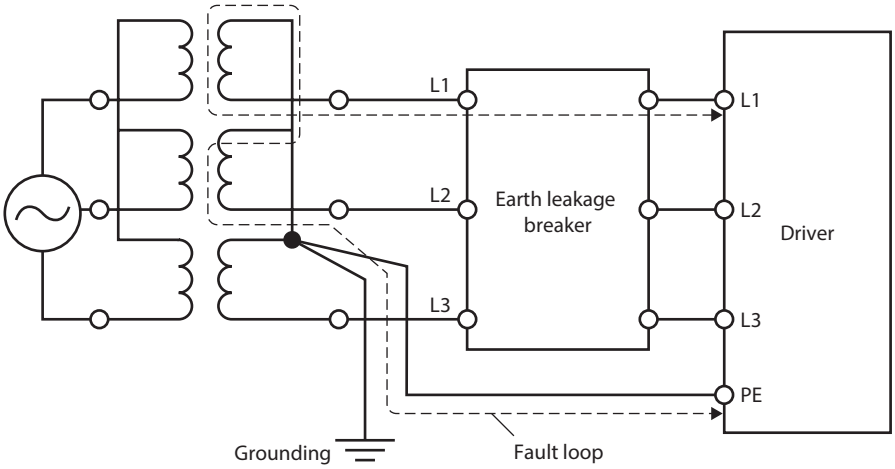


• TT power distribution systems

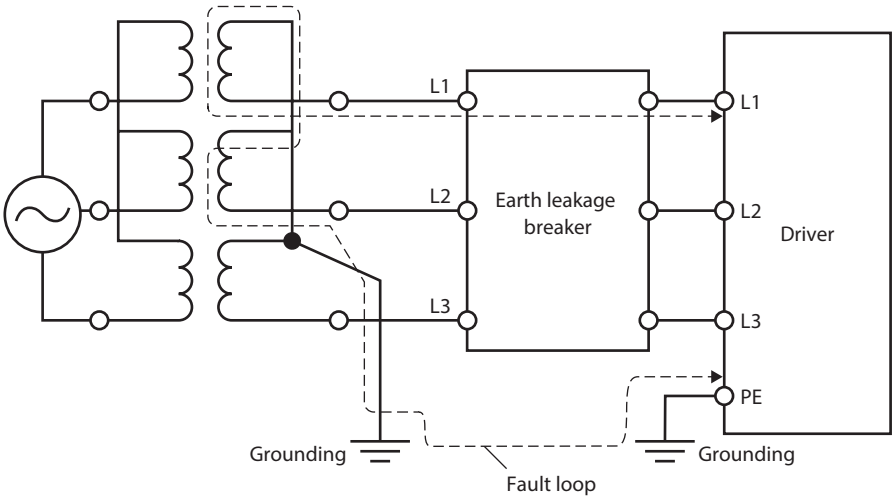


Three-phase 200-240 V

• TN power distribution systems



• TT power distribution systems



■ EMC Directive

Refer to "2.5 Conformity to the EMC" for details about conformity.

2.3 RoHS Directive

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

2.4 Republic of Korea, Radio Waves Act.

This product is affixed with the KC Mark under the Radio Waves Act, the Republic of Korea.

2.5 Conformity to the EMC

Effective measures must be taken against the EMI that the motor and driver may give to adjacent controlsystem equipment, as well as the EMS of the motor and driver itself, in order to prevent a serious functional impediment in the machinery. The use of the following installation and wiring methods will enable the motor and driver to be compliant with the EMC.
Oriental Motor conducts EMC testing on its motors and driver in accordance with "Example of motor and driver installation and wiring" on p.147.
The user is responsible for ensuring the machine's compliance with the EMC, based on the installation and wiring explained below.

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

■ Connecting a mains filter

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

Manufacturer	Single-phase 100-120 V Single-phase 200-240 V	Three-phase 200-240 V
SOSHIN ELECTRIC CO.,LTD	HF2010A-UPF	HF3010C-SZA, NFU3010C-Z1
Schaffner EMC	FN2070-10-06	FN3025HP-10-71

- Overvoltage category II applies to the mains filter.
- Install the mains filter as close to the driver as possible.
- Use cable clamps and other means to secure the input and output cables firmly to the surface of the enclosure.
- Connect the ground terminal of the mains filter to the grounding point, using as thick and short a wire as possible.
- Do not place the AC input cable (AWG18 to 14: 0.75 to 2.0 mm^2) parallel with the mains-filter output cable (AWG18 to 14: 0.75 to 2.0 mm^2). 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.

■ Connecting the external power supply

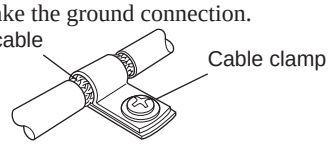
Use an external power supply conforming to the EMC. Use a shielded cable for wiring and wire/ground the external power supply over the shortest possible distance. Refer to "Wiring the power supply cable" for how to ground the shielded cable.

■ Grounding procedure

The cable used to ground the motor, driver, mains filter and power supply cable (shielded cable) must be as thick and short to the grounding point as possible so that no potential difference is generated. Choose a large, thick and uniformly conductive surface for the grounding point. Refer to the p.22 for the recommended grounding method.

■ Wiring the power supply cable

Use a shielded cable of AWG18 to 14 (0.75 to 2.0 mm^2) in diameter for the driver power supply cable and keep it as short as possible. Strip a part of the shielded cable and ground the stripped part using a metal cable clamp that contacts the stripped cable around its entire circumference, or use a drain wire to make the ground connection. When grounding the shielded cable, connect both ends (mains filter side and power supply side) to earth to prevent a potential difference from generating in the shielded cable.

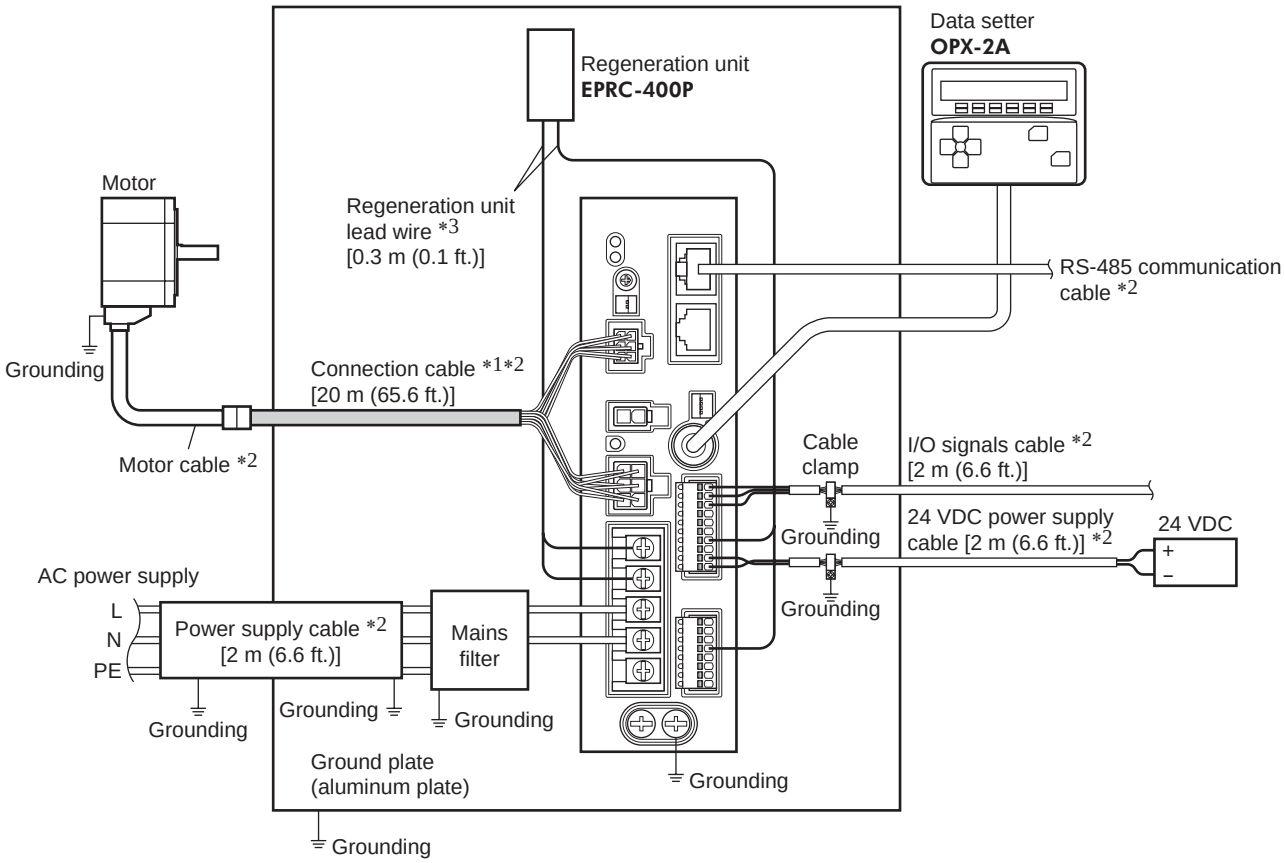


■ Notes about installation and wiring

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

■ Example of motor and driver installation and wiring

Illustration shows the standard type.



*1 Performance has been evaluated based on connection cable lengths of up to 20 m (65.6 ft.). You can connect up to three connection cables.
*2 Shielded cable
*3 Unshielded cable

■ Precautions about static electricity

Static electricity may cause the driver to malfunction or become damaged. Do not come close to or touch the driver while the power is on except when operating the switch of the front of driver.
To change the settings of driver switches, be sure to use an insulated screwdriver.

8 Appendix

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

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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 20.4 m (66.9 ft.). Flexible connection cables are also available. You can connect up to three connection cables.

- Standard type

• Connection cable

Length [m (ft.)]	Model
1 (3.3)	**CC01BLE**
2 (6.6)	**CC02BLE**
3 (9.8)	**CC03BLE**
5 (16.4)	**CC05BLE**
7 (23.0)	**CC07BLE**
10 (32.8)	**CC10BLE**
15 (49.2)	**CC15BLE**
20 (65.6)	**CC20BLE**

• Flexible connection cable

Length [m (ft.)]	Model
1 (3.3)	**CC01BLER**
2 (6.6)	**CC02BLER**
3 (9.8)	**CC03BLER**
5 (16.4)	**CC05BLER**
7 (23.0)	**CC07BLER**
10 (32.8)	**CC10BLER**
15 (49.2)	**CC15BLER**
20 (65.6)	**CC20BLER**

- Electromagnetic brake type

• Connection cable

Length [m (ft.)]	Model
1 (3.3)	**CC01BLEM**
2 (6.6)	**CC02BLEM**
3 (9.8)	**CC03BLEM**
5 (16.4)	**CC05BLEM**
7 (23.0)	**CC07BLEM**
10 (32.8)	**CC10BLEM**
15 (49.2)	**CC15BLEM**
20 (65.6)	**CC20BLEM**

• Flexible connection cable

Length [m (ft.)]	Model
1 (3.3)	**CC01BLEMR**
2 (6.6)	**CC02BLEMR**
3 (9.8)	**CC03BLEMR**
5 (16.4)	**CC05BLEMR**
7 (23.0)	**CC07BLEMR**
10 (32.8)	**CC10BLEMR**
15 (49.2)	**CC15BLEMR**
20 (65.6)	**CC20BLEMR**

■ Data setter

The data setter lets you set data and parameters for your **BLE** Series FLEX RS-485 communication type with ease and also functions as a monitor.

Model: **OPX-2A**

■ Communication cable for the support software

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

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

The **MEXE02** can be downloaded from Oriental Motor Web site Download Page.

■ RS-485 communication cable

You can link drivers using this cable connected to the RS-485 communication connectors (CN7, CN8).

Model: **CC002-RS4** [0.25 m (0.8 ft.)]

■ DIN rail mounting plate

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

Model: **PADP03**

■ 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**.

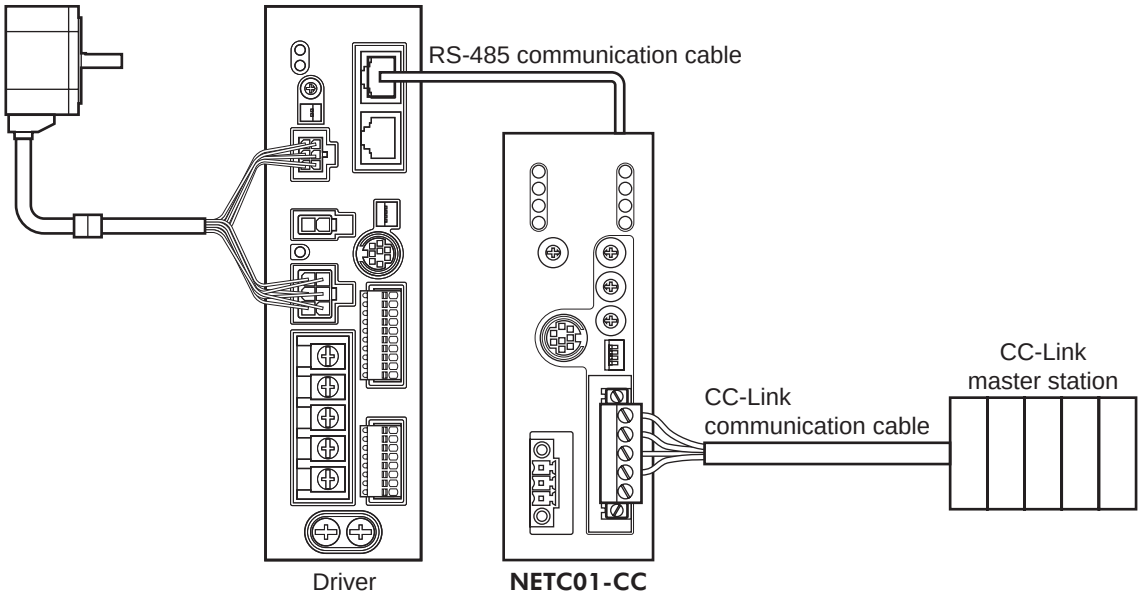
Model: **EPRC-400P**

2 Related products (sold separately)

■ Network converter
NETC01-CC (CC-Link Ver.1.1 compatible)
NETC02-CC (CC-Link Ver.2 compatible)
NETC01-M2 (MECHATROLINK-Ⅱ compatible)
NETC01-M3 (MECHATROLINK-Ⅲ compatible)
NETC01-ECT (EtherCAT compatible)

When the **BLE** Series FLEX RS-485 communication type is used in a CC-Link system or MECHATROLINK system, EtherCAT system while connecting the driver via the network converter, the converted data from the each communication protocol to the RS-485 communication protocol can be sent to the driver.
Alarms and other data output from the driver, which normally conform to the RS-485 communication protocol, can also be converted to each communication protocol and sent to the master station accordingly.

Example: Connecting to the network converter **NETC01-CC**



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