Orientalmotor

Stepping motor and driver package αSTEP

High-efficiency **AR Series** FLEX

AC power input   Built-in Controller Type

USER MANUAL

c ⓤ us C E

Thank you for purchasing an Oriental Motor product.

This manual describes product handling procedures and safety precautions.

• Please read it thoroughly to ensure safe operation.

• Always keep the manual where it is readily available.

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1 Safety precautions

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

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

⚠ Warning

General

- Do not use the product in explosive or corrosive environments, in the presence of flammable gases, locations subjected to splashing water, or near combustibles. Doing so may result in fire, electric shock or injury.
- Assign qualified personnel the task of installing, wiring, operating/controlling, inspecting and troubleshooting the product. Failure to do so may result in fire, electric shock, injury or damage to equipment.
- Do not transport, install the product, perform connections or inspections when the power is on. Always turn the power off before carrying out these operations. Failure to do so 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.
- Take measures to keep the moving parts in position for vertical operations such as elevator applications. The motor loses holding torque when the power is shut off, allowing the moving parts to fall and possibly cause injury or damage to equipment.
- The brake mechanism of an electromagnetic brake motor is used to keep the moving part and motor in position. Do not use it as a deceleration/safety brake. Doing so may result in injury or damage to the equipment.
- When the driver generates an alarm (any of the driver's protective functions is triggered), take measures to hold the moving part in place since the motor stops and loses its holding torque. Failure to do so may result in injury or damage to equipment.
- When the driver generates an alarm (any of the driver's protective functions is triggered), first remove the cause and then clear the protection function. Continuing the operation without removing the cause of the problem may cause malfunction of the motor and driver, leading to injury or damage to equipment.

Installation

- The motor and driver are designed with Class I equipment basic insulation. When installing the motor and driver, install them inside enclosures so that they are out of the direct reach of users. Be sure to ground if users can touch them. Failure to do so may result in electric shock.
- Install the motor and driver in the enclosure in order to prevent electric shock or injury.

Connection

- Keep the driver's input power voltage within the specified range. Failure to do so may result in electric shock or fire.
- Connect the cables securely according to the wiring diagram. Failure to do so may result in electric shock or fire.
- Do not forcibly bend, pull or pinch the cable. Doing so may cause electric shock or fire.

Operation

- Turn off the driver power in the event of a power failure. Or the motor may suddenly start when the power is restored and may cause injury or damage to equipment.
- Do not turn the FREE input to ON while the motor is operating. The motor will stop and lose its holding power. Doing so may result in injury or damage to equipment.

Maintenance and inspection

- Do not touch the connection terminals on the driver while the power is supplied or for at least 10 minutes after turning off the power. Before making wiring connections or carrying out checks, also wait for the CHARGE LED to turn off and check the voltage with a tester, etc. Failure to do so may result in electric shock.

Repair, disassembly and modification

- Do not disassemble or modify the motor and driver. Doing so may cause electric shock or injury. Refer all such internal inspections and repairs to the branch or sales office from which you purchased the product.

⚠ **Caution**

General

- Do not use the motor and driver beyond its specifications. Doing so may result in electric shock, injury or damage to equipment.
- Keep your fingers and objects out of the openings in the motor and driver. Failure to do so may result in electric shock, fire or injury.
- Do not touch the motor and driver during operation or immediately after stopping. The surface is hot and may cause a skin burn(s).
- Do not use other batteries than the accessory dedicated battery **BAT01B** (sold separately). Doing so may result in injury or damage to equipment.

Transportation

- Do not carry the motor by holding the motor output shaft or motor cable. Doing so may cause injury.

Installation

- Provide a cover over the rotating parts (output shaft) of the motor. Failure to do so may result in injury.
- Do not leave anything around the motor and driver that would obstruct ventilation. Doing so may result in damage to equipment.

Connection

- The data edit connector (CN4) and RS-485 communication connector (CN6/CN7) of the driver are not electrically insulated. When grounding the positive terminal of the power supply, do not connect any equipment (PC, etc.) whose negative terminal is grounded. Doing so may cause the driver and these equipment to short, damaging both.

Operation

- Use a motor and driver only in the specified combination. An incorrect combination may cause a fire.
- 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.
- Before supplying power to the driver, turn all input signals to the driver OFF. Otherwise, the motor may start suddenly at power ON and cause injury or damage to equipment.
- Do not touch the rotating part (output shaft) during operation. Doing so may cause injury.
- The motor surface temperature may exceed 70 °C (158 °F) even under normal operating conditions. If the operator is allowed to approach the running motor, attach a warning label as shown below in a conspicuous position. Failure to do so may result in skin burn(s).

  Warning label

- Before moving the motor directly with the hands, confirm that the FREE input turns ON. Failure to do so may result in injury.
- For the 24 VDC power supply, use a DC power supply with reinforced insulation on its primary and secondary sides. Failure to do so may result in electric shock.
- Immediately when trouble has occurred, stop running and turn off the driver power. Failure to do so may result in electric shock, fire or injury.
- To prevent electric shock, use only an insulated screwdriver to adjust the driver's switches.

Maintenance and inspection

- To prevent the risk of electric shock, do not touch the terminals while performing the insulation resistance test or dielectric strength test.

Disposal

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

■ Handling the battery

Be sure to observe the following instructions when using the accessory battery (sold separately). Handling the battery without observing the instructions may cause the liquid leakage, heat generation and explosion, etc., which may result in injury or damage to equipment.

⚠ **Warning**

- Do not heat the battery or throw it into a fire.
- Never short-circuit the battery or connect the positive and negative terminals in reverse.
- When carrying/storing the battery, do not place it together with metal necklaces, hairpins, coins, keys or other conductive objects. When storing the battery, store it away from direct sunlight in a place not subject to high temperature or high humidity.
- Do not disassemble or modify the battery.
- Do not apply solder directly to the battery.
- Use a dedicated driver to charge the battery.
- The battery has a vent structure for the release of internal gas. Do not apply a strong force to the battery, since it may cause this structure to deform.
- When installing the battery into the machine, never place it inside a sealed structure. The battery sometimes generates gas, which, if trapped, may cause a burst or an explosion due to ignition.
- The battery contains an alkali solution. If the alkali solution comes in contact with the skin or clothes, flush the area thoroughly with clean water. If the alkali solution gets into the eyes, do not rub. Flush the eyes thoroughly with clean water and seek immediate medical attention.
- Do not use the battery if there is leakage, discoloration, deformation or another abnormality.
- Do not immerse the battery in water or seawater, nor allow it to become wet. Doing so may cause the battery to generate heat or rust.
- Do not scratch the battery and battery cable. A scratched battery easily causes shorting, resulting in leakage, heat generation or bursting.
- The battery is connected to the primary circuit, so do not touch the battery while the power is on.
- Do not forcibly bend, pull or pinch the cable. Also, do not bend and flex the cable repeatedly.
- Do not make a continuous vibration or excessive impact.

Note
- Always charge the battery connecting to the driver before use. Refer to p.30 for charging method.
- Nickel-metal-hydride cell is used in this battery. Disposal of the used batteries is subject to each country's regulations on environmental control. Contact your nearest Oriental Motor office if you have any questions.

Ni-MH

2 Overview of the product

This product is a motor and driver package product consisting of a high-efficiency stepping motor equipped with a rotor position detection sensor, and a driver with built-in controller function.
This product can be controlled via I/O, Modbus (RTU) or industrial network communication using the network converter.
The operation data and parameters can be set using an accessory data setter **OPX-2A** or data setting software **MEXE02** (both are sold separately), or via RS-485 communication.

■ Main features

● Introducing closed loop control

The **AR** Series can continue its operation even upon encountering quick acceleration or an abrupt change in load. Monitoring the speed and amount of rotation while the motor is running, the **AR** Series performs the closed-loop control under overload and similar conditions to continue its operation at the maximum torque.

● Three operation types

You can perform positioning operation, return-to-home operation and continuous operation.
Up to 64 operation data points can be set, and multi-point positioning is also possible.

● Compatible with RS-485 communication (Modbus RTU)

You can set operation data and parameters or issue operation start/stop commands from the master station.
Up to 31 drivers can be connected to one master.

● Absolute-position backup system

When connecting an accessory battery set **BAT01B** (sold separately), this product can be used in the absolute-position backup system. Positions will be retained in the event of a power outage or after turning off the driver power.

● Energy-saving

Motor and driver losses have been substantially reduced to achieve low heat generation and save energy.
Since the motor and driver generate much less heat, they can now be operated for longer hours at high speed, which was not possible with conventional motors/drivers.

● Supporting sink output and source output

The driver supports both the current sink output circuit and the current source output circuit.

● Automatic control of the electromagnetic brake

This driver controls the electromagnetic brake automatically. The control signal input or the troublesome ladder logic design can be saved.

● Alarm and warning functions

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).

■ Accessories

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

■ Related products

The **AR** Series AC power input built-in controller type can be used via various network when connecting to a network converter.

Network converter model	Supported network
NETC01-CC	CC-Link communication
NETC01-M2	MECHATROLINK-Ⅱ communication
NETC01-M3	MECHATROLINK-Ⅲ communication

■ **Function list**

Main functions

Return-to-home operation [Setting by parameters]	• **2-sensor mode** • **Push-mode** • **3-sensor mode** • **Data setting mode (Position preset)**

Motor operation [Setting by operation data and parameters]	• **Positioning operation** **Operation function** Single-motion operation Linked-motion operation Linked-motion operation 2 Push-motion **+** **Starting method** Data number selecting operation Direct positioning operation Sequential positioning operation • **Continuous operation**

Other operations [Setting by parameters]	• **JOG operation** • **Automatic return operation**

Support functions

[Setting by parameters]	• **Protective function** Alarm detection Warning detection • **I/O function** Input function selection Output function selection Input logic level setting • **Coordination setting** Resolution (Electronic gear) Wrap function Motor rotation direction	• **Return-to-home function** Home position offset External sensor signal detection • **Stop operation** STOP input action Hardware overtravel Software overtravel • **Motor function setting** Operating current Standstill current Speed filter Moving average filter

External interface

Data setter	• **Monitor function** • **Data storing** • **Test function** • **Operation data setting** • **Download/Upload** Test operation • **Parameter setting** • **Data initialization** Teaching I/O test

RS-485 communication	• **Operation start** • **Monitor function** • **Operation data setting** • **Maintenance function** • **Parameter setting**

3 System configuration

Regeneration unit **RGB100**
(sold separatery)
Connect this unit if gravitational operation or other operations involving up/down movement, or sudden starting/stopping of a large inertial load, will be repeated frequently.
P.29

Cable for motor
This cable is used to connect the motor and driver.
P.25

Thermostat output (AWG22)

Connect to N2

Regeneration unit (AWG18)

Battery **BAT01B**
(sold separatery)
Connect this battery if you want to operate the driver in the absolute system.
P.30

PE
P.29

Connect to CN10

PE
P.29

Single-phase 100-120 V
Single-phase 200-240 V

Power supply
Use the power supply within the rated voltage range.
P.25

Circuit breaker or ground fault interrupt circuit
Be sure to connect a circuit breaker or ground fault interrupt circuit to protect the wiring on the primary side.

Noise filter
Use a noise filter to eliminate noise. It has the effect of reducing noise generated from the power supply and driver.
P.23

Connect to CN1

24 VDC

GND

24 VDC power supply
Be sure to connect a 24 VDC power supply.
P.29

Programmable controller P.25

Output signals:
Connect to CN9

Input signals:
Connect to CN8

Sensor signals:
Connect to CN5
P.25

Connect to CN4

P.30

Data setter
OPX-2A
(sold separatery)

Or

PC in which the data setting software **MEXE02** (sold separatery) has been installed

The customer must provide a PC.

4 Introduction

■ Before use

Only qualified personnel should work with the product.
Use the product correctly after thoroughly reading the section "1 Safety precautions" on p.4.
The product described in this manual has been designed and manufactured for use 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.

■ Operating Manuals for the AR Series

After reading the following manuals, keep them in a convenient place so that you can reference them at any time.

- **AR** Series Motor <u>OPERATING MANUAL</u>

  This manual explains the motor functions and how to install the motor, among others.

- **AR** Series AC power input FLEX Built-in Controller Type Driver <u>OPERATING MANUAL</u>

  This manual explains the driver functions and how to install the driver, among others.

- **AR** Series AC power input FLEX Built-in Controller Type <u>USER MANUAL</u> (this document)

  This manual explains the function, installation and connection of the motor and driver as well as operating method.

- Data setter **OPX-2A** <u>OPERATING MANUAL</u>

  This manual explains how to set data using the accessory **OPX-2A** (sold separately).
  It consists of two parts, which are "Data Setter **OPX-2A** <u>OPERATING MANUAL Before Use</u>" and "Data setter
  OPX-2A For the **AR** Series FLEX Built-in Controller (RS-485 communication function) <u>OPERATING MANUAL</u>."

- Data setting software **MEXE02** <u>OPERATING MANUAL</u>

  This manual explains how to set data using the accessory **MEXE02** (sold separately).
  It consists of three parts, which are "<u>INSTALLATION MANUAL</u>," "Data setting software **MEXE02** <u>OPERATING
  MANUAL</u> Before Use" and "Data setting software **MEXE02** For the **AR** Series FLEX Built-in Controller Type
  (RS-485 communication function) <u>OPERATING MANUAL</u>."

- Network converter <u>USER MANUAL</u>

  This manual explains how to install the network converter, and also explains how to set operation data, parameters,
  etc.

■ Standard and CE Marking

This product is recognized by UL under the UL Standards and CSA standards.
The motors are certified by TÜV Rheinland under the EN 60034-1.

- Applicable Standards

	Applicable Standards	Certification Body	Standards File No.
Motor	UL 1004 UL 2111 CSA C22.2 No.100 CSA C22.2 No.77	UL	E64199
	EN 60034-1	TÜV	R 50124201
	EN 60034-5	Conforming to the respective standards.	
Driver	UL 508C CSA C22.2 No.14	UL	E171462
	EN 61800-5-1	Conforming to the respective standards.	

■ WARNING FOR CE MARKING

● Installation conditions (EN Standard)

Motor	Driver
Motor is to be used as a component within other equipment.	Driver is to be used as a component within other equipment.
Overvoltage category: Ⅱ	Overvoltage category: Ⅱ
Pollution degree: 3 (2 for double shaft)	Pollution degree: 2
Protection against electric shock: Class Ⅰ	Protection against electric shock: Class Ⅰ

● Low Voltage Directives

- The product is a type with machinery incorporated, so it should be installed within an enclosure.
- This product cannot be used with cables normally used for IT equipment.
- Install the product within the enclosure in order to avoid contact with hands.
- Be sure to maintain a protective ground in case hands should make contact with the product. Be sure to connect the Protective Earth lead of the cable for motor to the Protective Earth Terminal on the driver, and ground the driver's Protective Earth Terminal.
- To protect against electric shock using an earth leakage breaker (RCD), connect a type B earth leakage breaker to the primary side of the driver.
- When using a circuit breaker (MCCB), use a unit conforming to the EN or IEC standard.
- Isolate the motor cable, power-supply cable and other drive cables from the signal cables (CN1, CN4 to CN9) by means of double insulation.
- The temperature of the driver's heat sink may exceed 90 °C (194 °F) depending on the driving conditions. Accordingly, take heed of the following items:
  · Do not touch the driver.
  · Do not use the driver near flammable objects.
  · Always conduct a trial operation to check the driver temperature.

● EMC Directive

This product has received EMC compliance under the conditions specified in "Example of motor and driver installation and wiring" on p.24. Since the compliance of the final machinery with the EMC Directive will depend on such factors as the configuration, wiring, layout and risk involved in the control-system equipment and electrical parts, it therefore must be verified through EMC measures by the customer of the machinery.

Applicable standards

EMI	EN 61000-6-4 EN 61800-3 C3 EN 61000-3-2 EN 61000-3-3
EMS	EN 61000-6-2 EN 61800-3 C3

■ WARNING FOR UL MARKING ON DRIVER

- Drivers have no provision for solid state motor overload protection. Motor overload protection is required at end application.
- Drivers have no provision for motor over temperature protection. Motor over temperature protection is required at end application.
- For UL standard (UL 508C), the product is recognized for the condition of Maximum Surrounding Air Temperature 55 °C (131 °F).
- Class 2
- Drivers have no provision for solid state short circuit protection. Short circuit protection is required at end application.
- For a circuit breaker or fuse that connects in the power line of the driver, use the UL listing product.

■ Hazardous substances

RoHS (Directive   2002/95/EC   27Jan.2003) compliant

5 Precautions for use

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

- **Use the supplied cable to connect the motor and driver.**

  Always use the supplied cable to connect the motor and driver. If a flexible cable or cable of 3 m (9.8 ft.) or longer is to be used, an appropriate cable must be purchased separately. Refer to p.169 for details.

- **Perform the insulation resistance test or dielectric strength test separately on the motor and the driver.**

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

- **Do not apply an overhung load and thrust load in excess of the specified permissible limit**

  Operating the motor under an excessive overhung load or thrust load may damage the motor bearings (ball bearings). Be sure to operate the motor within the specified permissible limit of overhung load and thrust load. See p.21 for details.

- **Use the motor in conditions where its surface temperature will not exceed 100 °C (212 °F).**

  The driver has an overheat protection function, but the motor has no such feature. The motor surface temperature may exceed 100 °C (212 °F) under certain conditions (ambient temperature, operating speed, duty cycle, etc.). To prevent the motor bearings (ball bearings) from reaching its usable life quickly, use the motor in conditions where the surface temperature will not exceed 100 °C (212 °F).
  Use the geared type motor in a condition where the gear case temperature does not exceed 70 °C (158 °F), in order to prevent deterioration of grease and parts in the gear case.
  If the motor is to be operated continuously, install the motor in a location where heat dissipation capacity equivalent to a level achieved with a heat sink [made of aluminum, 250×250×6 mm (9.84×9.84×0.24 in.)] is ensured.

- **Maximum static torque at excitation**

  When the motor stops, the maximum static torque at excitation of the motor will drop by about 50% by the current cutback function. When operating the motor, take account of the motor torque drop at the time of stopping.

- **Do not use the electromagnetic brake to reduce speed or as a safety brake.**

  Do not use the electromagnetic brake as a means to decelerate and stop the motor. The brake hub of the electromagnetic brake will wear significantly and the braking force will drop. Since the power off activated type electromagnetic brake is equipped, it helps maintain the position of the load when the power is cut off, but this brake cannot securely hold the load in place. Accordingly, do not use the electromagnetic brake as a safety brake. To use the electromagnetic brake to hold the load in place, do so after the motor has stopped.

- **Double shaft type motor**

  Do not apply load torque, overhung load or thrust load to the output shaft on the opposite side of the motor output shaft.

- **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 providing a leakage current breaker, use the following products, for example, which have high-frequency signal protection:
  Mitsubishi Electric Corporation: NV series
  Fuji Electric FA Components & Systems Co., Ltd.: EG and SG series

- **Preventing electrical noise**

  See "7.8 Installing and wiring in compliance with EMC Directive" on p.23 for measures with regard to noise.

- **Maximum torque of geared type motor**

  Always operate the geared type motor under a load not exceeding the maximum torque. If the load exceeds the maximum torque, the gear will be damaged.

- **Grease of geared motor**

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

- Rotation direction of the gear output shaft

The relationship between the rotation direction of the motor shaft and that of the gear output shaft changes as follows, depending on the gear type and gear ratio.

Type of gear	Gear ratio	Rotation direction (relative to the motor rotation direction)
TH geared	3.6, 7.2, 10	Same direction
	20, 30	Opposite direction
PS geared **PN** geared	All gear ratios	Same direction
Harmonic geared	All gear ratios	Opposite direction

- Do not perform push-motion operation with geared types.

Doing so may cause damage to the motor or gearhead.

- 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 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 approx. 100,000 times.

- Motor excitation at power ON

The motor is excited when the 24 VDC and main power is on. If the motor is required to be in non-excitation status when turning on the power, assign the C-ON input to the direct I/O or network I/O.

- Use the accessory regeneration unit **RGB100** (sold separately) if gravitational operation or other operation involving up/down movement, or sudden starting/stopping of a large inertial load, will be repeated frequently.

An overvoltage protection alarm will generate depending on the operating condition. If the overvoltage protection alarm is detected, adjust the driving condition or use the accessory regeneration unit **RGB100** (sold separately).

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

The data edit connector (CN4) and RS-485 communication connector (CN6/CN7) of the driver are not electrically insulated. When grounding the positive terminal of the power supply, do not connect any equipment (PC, etc.) whose negative terminal is grounded. Doing so may cause the driver and these equipment to short, damaging both.

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 unit against the number shown on the package label.
Check the model number of the motor and driver against the number shown on the nameplate. The unit models and corresponding motor/driver combinations are listed on p.15.

- Motor .... 1 unit
- Driver .... 1 unit
- CN1 connector (6 pins) .... 1 pc.
- CN3 connector (5 pins) .... 1 pc.
- CN5 connector (5 pins) .... 1 pc.
- CN8 connector (9 pins) .... 1 pc.
- CN9 connector (7 pins) .... 1 pc.
- Connector wiring lever (for CN3)................................ 1 pc.
- **AR** Series Motor <u>OPERATING MANUAL</u> .... 1 copy
- **AR** Series AC power input Driver <u>OPERATING MANUAL</u> ...... 1 copy
- **AR** Series <u>USER MANUAL</u> (CD-ROM) .... 1 pc.
- Cable for motor.. 1 pc.
  (Included in a motor and driver package product)
- Cable for electromagnetic brake .... 1 pc.
  (Supplied with electromagnetic brake motor package)
- Parallel key .... 1 pc.
  (Supplied with geared types; except for the **AR46TH** and **AR66TH**)

6.2 How to identify the product model

```
AR  6  6  A  A  D  -  H  50  -  □
```

Length of supplied cable **1**: 1 m (3.3 ft.)
2: 2 m (6.6 ft.)
3: 3 m (9.8 ft.)

Gear ratio*

T: **TH** geared type
PS: **PS** geared type
N: **PN** geared type
H: Harmonic geared type
Blank: Standard type

Driver type **D**: Built-in Controller Type

Power input   **A**: Single-phase 100-120 V
C: Single-phase 200-240 V

Motor type   **A**: Single shaft
B: Double shaft
M: With electromagnetic brake

Motor length

Motor size   **4**: 42 mm (1.65 in.)
6: 60 mm (2.36 in.)
9: 85 mm (3.35 in.) [90 mm (3.54 in) for geared types]

Series name   **AR** Series

∗ The model name is "**7**" for the gear ratio "7.2" of the **PS** geared type.

6.3　Combinations of motors and drivers

- □ indicates **A** (single shaft), **B** (double shaft) or **M** (with electromagnetic brake).
  In **AR911**, □ indicates **A** (single shaft) or **B** (double shaft).
  For geared type, □ indicates **A** (single shaft) or **M** (with electromagnetic brake).
- ■ in the unit model represents a number indicating the gear ratio.
- ○ indicates the cable length.

■ Standard type

Model	Motor model	Driver model
AR46□AD-○	ARM46□C	
AR66□AD-○	ARM66□C	
AR69□AD-○	ARM69□C	ARD-AD
AR98□AD-○	ARM98□C	
AR911□AD-○	ARM911□C	
AR46□CD-○	ARM46□C	
AR66□CD-○	ARM66□C	
AR69□CD-○	ARM69□C	ARD-CD
AR98□CD-○	ARM98□C	
AR911□CD-○	ARM911□C	

■ PN geared type

Model	Motor model	Driver model
AR46□AD-N■-○	ARM46□C-N■	
AR66□AD-N■-○	ARM66□C-N■	ARD-AD
AR98□AD-N■-○	ARM98□C-N■	
AR46□CD-N■-○	ARM46□C-N■	
AR66□CD-N■-○	ARM66□C-N■	ARD-CD
AR98□CD-N■-○	ARM98□C-N■	

■ TH geared type

Model	Motor model	Driver model
AR46□AD-T■-○	ARM46□C-T■	
AR66□AD-T■-○	ARM66□C-T■	ARD-AD
AR98□AD-T■-○	ARM98□C-T■	
AR46□CD-T■-○	ARM46□C-T■	
AR66□CD-T■-○	ARM66□C-T■	ARD-CD
AR98□CD-T■-○	ARM98□C-T■	

■ Harmonic geared type

Model	Motor model	Driver model
AR46□AD-H■-○	ARM46□C-H■	
AR66□AD-H■-○	ARM66□C-H■	ARD-AD
AR98□AD-H■-○	ARM98□C-H■	
AR46□CD-H■-○	ARM46□C-H■	
AR66□CD-H■-○	ARM66□C-H■	ARD-CD
AR98□CD-H■-○	ARM98□C-H■	

■ PS geared type

Model	Motor model	Driver model
AR46□AD-PS■-○	ARM46□C-PS■	
AR66□AD-PS■-○	ARM66□C-PS■	ARD-AD
AR98□AD-PS■-○	ARM98□C-PS■	
AR46□CD-PS■-○	ARM46□C-PS■	
AR66□CD-PS■-○	ARM66□C-PS■	ARD-CD
AR98□CD-PS■-○	ARM98□C-PS■	

6.4　Input/output power ratings

- □ indicates **A** (single shaft), **B** (double shaft) or **M** (with electromagnetic brake).
  In **AR911**, □ indicates **A** (single shaft) or **B** (double shaft).
  For geared type, □ indicates **A** (single shaft) or **M** (with electromagnetic brake).
- For geared type, ● represents the type of gear and number indicating the gear ratio.
- ○ indicates the cable length.

Model	Motor model	Driver model	Input			Output current
			Voltage	Frequency	Current	
AR46□AD●-○	ARM46□C●				2.4 A	0.49 A
AR66□AD●-○	ARM66□C●				3.6 A	0.74 A
AR69□AD-○	ARM69□C	ARD-AD	Single-phase 100-120 V		4.9 A	0.92 A
AR98□AD●-○	ARM98□C●				4.6 A	1.13 A
AR911□AD-○	ARM911□C			50/60 Hz	5.9 A	1.27 A
AR46□CD●-○	ARM46□C●				1.5 A	0.49 A
AR66□CD●-○	ARM66□C●				2.3 A	0.74 A
AR69□CD-○	ARM69□C	ARD-CD	Single-phase 200-240 V		3.0 A	0.92 A
AR98□CD●-○	ARM98□C●				2.9 A	1.13 A
AR911□CD-○	ARM911□C				3.7 A	1.27 A

6.5   Names and functions of parts

■ Driver (Example: ARD-CD)

Mounting hole (at the back)

PWR/ALM LED

C-DAT/C-ERR LED

24 VDC power supply input terminals (CN1)

Regeneration unit thermal input terminals (CN1)

Electromagnetic brake terminals (CN1)

Address number setting switch (ID)

Termination resistor setting switch (TERM.)

RS-485 communication connectors (CN6/CN7)

Motor connector (CN2)

Output signal connector (CN9)

CHARGE LED

Input signal connector (CN8)

Regeneration unit terminals (CN3)

Sensor signal connector (CN5)

Main power supply input terminals (CN3)

Data edit connector (CN4)

Protective Earth Terminals

Mounting hole (at the back)

Transmission rate setting switch (SW2)

Function setting switches (SW4)

Battery connector (CN10)

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.158
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 a RS-485 communication error occurs with he master station.	–
Address number setting switch (ID)	Use this switch when controlling the system via RS-485 communication. Use this switch and SW4-No.1 of the function setting switch, to set the address number of RS-485 communication. (Factory setting: 0)	P.109 P.135 P.141
Termination resistor setting switch (TERM.)	Use this switch when controlling the system via RS-485 communication. Set the termination resistor (120 Ω) of RS-485 communication. (Factory setting: OFF)	
RS-485 communication connectors (CN6/CN7)	Connect the RS-485 communication cable.	P.30
Output signal connector (CN9)	Connect the output signals cable.	P.25
Input signal connector (CN8)	Connect the input signals cable.	
Sensor signal connector (CN5)	Connect the sensor.	
Data edit connector (CN4)	Connect a PC in which the **MEXE02** has been installed, or the **OPX-2A**.	P.30
Protective Earth Terminals	Used for grounding via a grounding cable of AWG16 to 14 (1.25 to 2.0 mm^2) or more.	P.29
24 VDC power supply input terminals (CN1-24V)	Connect the control power supply of the driver. +: +24 VDC power supply input −: Power supply GND	P.29
Regeneration unit thermal input terminals (CN1-TH1/TH2)	Connect the accessory regeneration unit **RGB100** (sold separately). If no regeneration unit is connected, short the TH1 and TH2 terminals.	
Electromagnetic brake terminals (CN1-MB1/MB2)	Connect the lead wires from the electromagnetic brake. MB1: Electromagnetic brake − (Black) MB2: Electromagnetic brake + (White)	P.25
Motor connector (CN2)	Connect the motor.	P.25
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.	–
Regeneration unit terminals (CN3-RG1/RG2)	Connect the accessory regeneration unit **RGB100** (sold separately).	P.29
Main power supply input terminals (CN3-L/N)	Connect the main power supply. L: Live N: Neutral	P.25
Mounting holes (2 locations at the back)	These mounting holes are used to affix the driver with screws.	P.22
Transmission rate setting switch (SW2)	Use this switch when controlling the system via RS-485 communication. Set the transmission rate of RS-485 communication. (Factory setting: 7)	P.109 P.135 P.141
Function setting switches (SW4)	Use this switch when controlling the system via RS-485 communication. • No.1: Using this switch and the address number setting switch (ID), set the address number of RS-485 communication. (Factory setting: OFF) • No.2: Set the protocol of RS-485 communication. (Factory setting: OFF)	
Battery connector (CN10)	Connect the accessory battery **BAT01B** (sold separately).	P.23

■ **Motor (Example:** ARM66MC**)**

Motor

Protective Earth Terminal (M4)

Mounting holes (4 locations)

Output shaft

Pilot

Electromagnetic brake

Motor cable

Electromagnetic brake cable

Connector cover
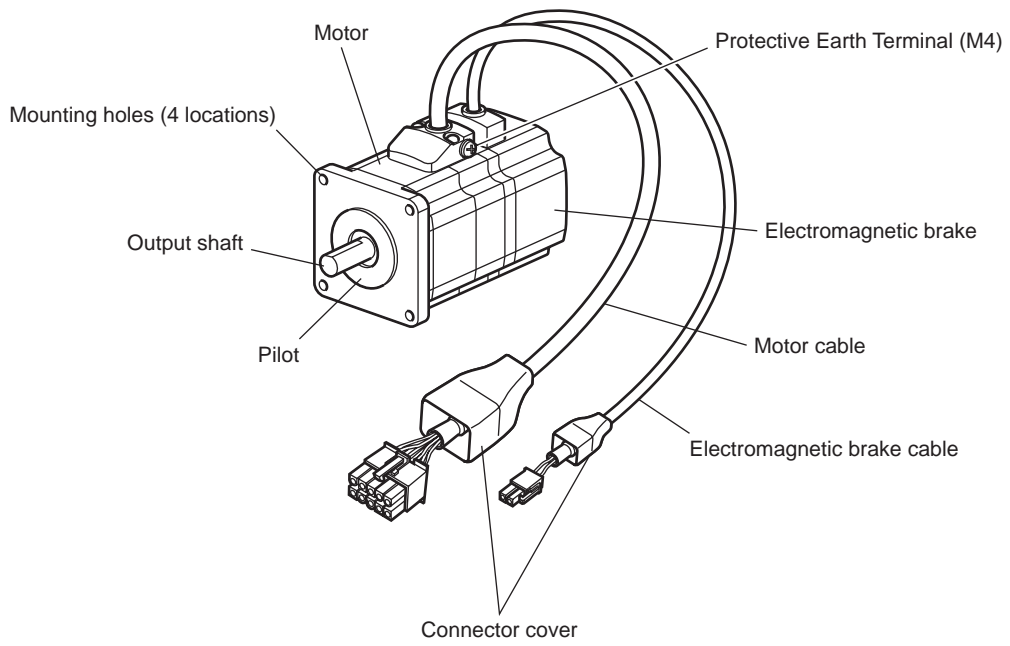
7 Installation

This chapter explains the installation location and installation methods of the motor and driver, along with regeneration unit installation.
The installation and wiring methods in compliance with the EMC Directive are also explained.

7.1 Location for installation

The motor and driver has been designed and manufactured to be installed within another device. Install them in a well-ventilated location that provides easy access for inspection.
The location must also satisfy the following conditions:

- Inside an enclosure that is installed indoors (provide vent holes)
- Operating ambient temperature
  Motor: −10 to +50 °C (+14 to +122 °F) (non-freezing)
  Harmonic geared type: 0 to +40 °C (+32 to +104 °F) (non-freezing)
  Driver: 0 to +55 °C (+32 to +131 °F) (non-freezing)
- Operating ambient humidity 85% or less (non-condensing)
- Area that is free of explosive atmosphere or toxic gas (such as sulfuric gas) or liquid
- Area not exposed to direct sun
- Area free of excessive amount of dust, iron particles or the like
- Area not subject to splashing water (rain, water droplets), oil (oil droplets) or other liquids
- Area free of excessive salt
- Area not subject to continuous vibration or excessive shocks
- Area free of excessive electromagnetic noise (from welders, power machinery, etc.)
- Area free of radioactive materials, magnetic fields or vacuum
- 1000 m (3300 ft.) or lower above sea level

7.2 Installing the motor

The motor can be installed in any direction.
To allow for heat dissipation and prevent vibration, install the motor on a metal surface of sufficient strength.

- Installation method A
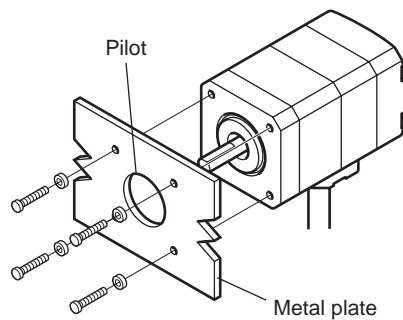
- Installation method B
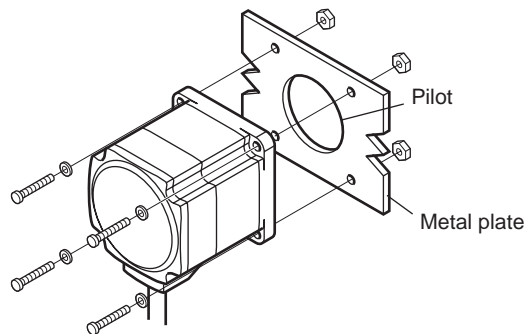
Type	Frame size [mm (in.)]	Nominal size	Tightening torque [N·m (oz-in)]	Effective depth of bolt [mm (in.)]	Installation method
Standard	42 (1.65)	M3	1 (142)	4.5 (0.177)	A
	60 (2.36)	M4	2 (280)	−	B
	85 (3.35)	M6	3 (420)	−	
TH geared	42 (1.65) 60 (2.36)	M4	2 (280)	8 (0.315)	A
	90 (3.54)	M8	4 (560)	15 (0.591)	
PS geared **PN** geared Harmonic geared[*1]	42 (1.65)	M4	2 (280)	8 (0.315)	
	60 (2.36)	M5	2.5 (350)	10 (0.394)	
	90 (3.54)	M8	4 (560)	15 (0.591)	
Harmonic geared[*2]	90 (3.54)	M8	4 (560)	−	B

∗1 **AR46** and **AR66** type only.

∗2 **AR98** type only.

7.3 Installing a load

When connecting a load to the motor, align the centers of the motor output shaft and load shaft.
Flexible couplings are available as accessories.

> **Note**
> - When coupling the load to the motor, pay attention to the centering of the shafts, belt tension, parallelism of the pulleys, and so on. Securely tighten the coupling and pulley set screws.
> - Be careful not to damage the output shaft or bearings when installing a coupling or pulley to the motor output shaft.
> - Do not modify or machine the motor output shaft. Doing so may damage the bearings and destroy the motor.
> - Do not apply strong force using hammer or other tools when removing the parallel key. Doing so may damage the motor output shaft and bearings (ball bearings).

- Using a coupling

Align the centers of the motor output shaft and load shaft in a straight line.

- Using a belt drive

Align the motor output shaft and load shaft in parallel with each other, and position both pulleys so that the line connecting their centers is at a right angle to the shafts.

- Using a gear drive

Align the motor output shaft and gear shaft in parallel with each other, and let the gears mesh at the center of the tooth widths.
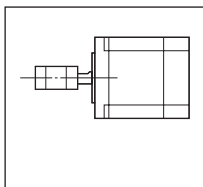
- Using a coupling   • Using a belt drive   • Using a gear drive
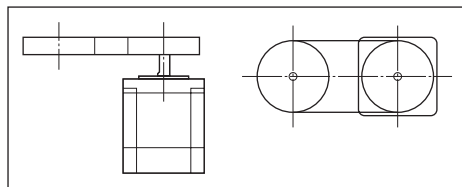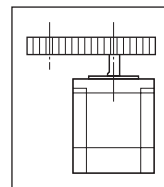
- Using a parallel key (geared motor)

When connecting the load and gear output shaft with a key slot, secure the load using the key supplied with the gear output shaft after machining the key slot on the load.

- Installing on the flange surface (Harmonic geared type)

With a Harmonic geared type (excluding **AR98**), a load can be installed directly to the gear using the load mounting holes provided on the flange surface.
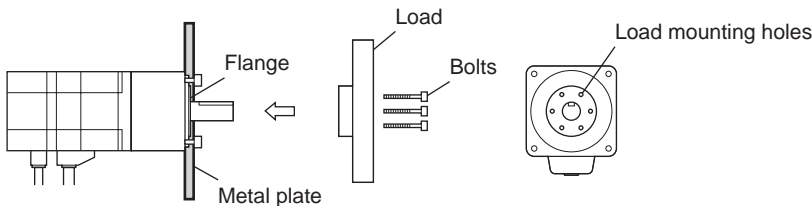
Model	Nominal size	Number of bolts	Tightening torque [N·m (oz-in)]	Effective depth of bolt [mm (in.)]
AR46	M3	6	1.4 (198)	5 (0.2)
AR66	M4	6	2.5 (350)	6 (0.24)

> **Note**
> - When installing a load on the flange surface, the load cannot be mounted using the key slot in the output shaft.
> - Design an appropriate installation layout so that the load will not contact the metal plate or bolts used for installing the motor.

7.4   Permissible overhung load and permissible thrust load

Note With a double shaft type, do not apply load torque, overhung load or thrust load to the output shaft on the opposite side of the motor output shaft.

| Type	Model	Gear ratio	Permissible overhung load [N (lb.)]					Permissible thrust load [N (lb.)]
			Distance from the tip of motor output shaft [mm (in.)]					
			0 (0)	5 (0.2)	10 (0.39)	15 (0.59)	20 (0.79)	
Standard	AR46	–	35 (7.8)	44 (9.9)	58 (13)	85 (19.1)	–	4.6 (1.03)
	AR46M							6.1 (1.37)
	AR66		90 (20)	100 (22)	130 (29)	180 (40)	270 (60)	8.8 (1.98)
	AR66M							11.8 (2.6)
	AR69							13.7 (3)
	AR69M							16.7 (3.7)
	AR98		260 (58)	290 (65)	340 (76)	390 (87)	480 (108)	18 (4)
	AR98M							24 (5.4)
	AR911							29 (6.5)
TH geared	AR46	–	10 (2.2)	14 (3.1)	20 (4.5)	30 (6.7)	–	15 (3.3)
	AR66		70 (15.7)	80 (18)	100 (22)	120 (27)	150 (33)	40 (9)
	AR98		220 (49)	250 (56)	300 (67)	350 (78)	400 (90)	100 (22)
PS geared	AR46	5 7.2 10	73 (16.4)	84 (18.9)	100 (22)	123 (27)	–	50 (11.2)
		25 36 50	109 (24)	127 (28)	150 (33)	184 (41)	–	
	AR66	5	200 (45)	220 (49)	250 (56)	280 (63)	320 (72)	100 (22)
		7.2 10	250 (56)	270 (60)	300 (67)	340 (76)	390 (87)	
		25 36 50	330 (74)	360 (81)	400 (90)	450 (101)	520 (117)	
	AR98	5 7.2 10	480 (108)	540 (121)	600 (135)	680 (153)	790 (177)	300 (67)
		25	850 (191)	940 (210)	1050 (230)	1190 (260)	1380 (310)	
		36	930 (200)	1030 (230)	1150 (250)	1310 (290)	1520 (340)	
		50	1050 (230)	1160 (260)	1300 (290)	1480 (330)	1710 (380)	
PN geared	AR46	–	100 (22)	120 (27)	150 (33)	190 (42)	–	100 (22)
	AR66	5	200 (45)	220 (49)	250 (56)	280 (63)	320 (72)	
		7.2 10	250 (56)	270 (60)	300 (67)	340 (76)	390 (87)	
		25 36 50	330 (74)	360 (81)	400 (90)	450 (101)	520 (117)	
	AR98	5	480 (108)	520 (117)	550 (123)	580 (130)	620 (139)	300 (67)
		7.2 10	480 (108)	540 (121)	600 (135)	680 (153)	790 (177)	
		25	850 (191)	940 (210)	1050 (230)	1110 (240)	1190 (260)	
		36	930 (200)	1030 (230)	1150 (250)	1220 (270)	1300 (290)	
		50	1050 (230)	1160 (260)	1300 (290)	1380 (310)	1490 (330)	
Harmonic geared	AR46	–	180 (40)	220 (49)	270 (60)	360 (81)	510 (114)	220 (49)
	AR66		320 (72)	370 (83)	440 (99)	550 (123)	720 (162)	450 (101)
	AR98		1090 (240)	1150 (250)	1230 (270)	1310 (290)	1410 (310)	1300 (290)

■ Permissible moment load of the Harmonic geared type

When installing an arm or table on the flange surface, calculate the moment load using the formula below if the flange surface receives any eccentric load. The moment load should not exceed the permissible value specified in the table.

Moment load: M [N·m (oz-in)] = F × L

Model	Permissible moment load [N·m (oz-in)]
AR46	5.6 (790)
AR66	11.6 (1640)
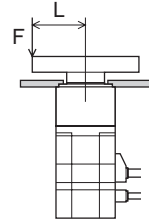
7.5 Installing the driver

The driver is designed so that heat is dissipated via air convection and conduction through the enclosure. Install the driver on a flat metal plate [material: aluminium, 200×200×2 mm (7.87×7.87×0.08 in.) equivalent] having excellent heat conductivity. 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.

When installing the driver in an enclosure, use two screws (M4, not supplied) to affix the driver through the mounting holes.

| Note |

- Install the driver in an enclosure whose pollution degree is 2 or better environment, or whose degree of protection is IP54 minimum.
- Do not install any equipment that generates a large amount of heat or noise near the driver.
- Do not install the driver underneath the controller or other equipment vulnerable to heat.
- Check ventilation if the ambient temperature of the driver exceeds 55 °C (131 °F).
- Be sure to install the driver vertically (vertical position).

35 (1.38)   20 (0.79) or more

150 (5.91)

25 (0.98) or more

Unit: mm (in.)
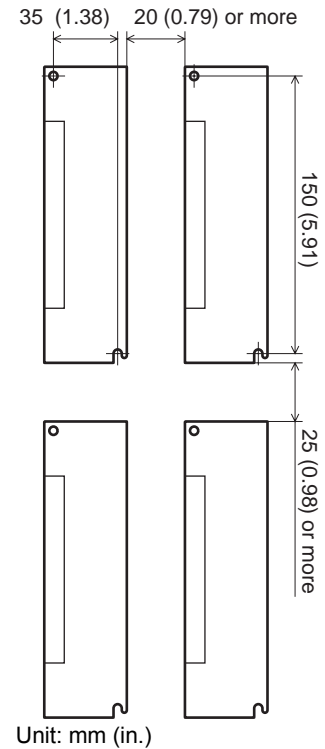
7.6 Installing the regeneration unit

Install the accessory regeneration unit **RGB100** (sold separately) in a location where heat dissipation capacity equivalent to a level achieved with a heat sink [made of aluminum, 350×350×3 mm (13.78×13.78×0.12 in.)] is ensured. Affix the **RGB100** on a smooth metal plate offering high heat conductivity, using two screws (M4, not supplied). See p.169 for accessory.

Screw (M4) (not supplied)

Regeneration unit **RGB100**

- Plate cutout for mounting [Unit: mm (in.)]

165 (6.50)

$\varnothing 4.2^{+0.3}_{0}$

$(\varnothing 0.1654^{+0.012}_{0})$
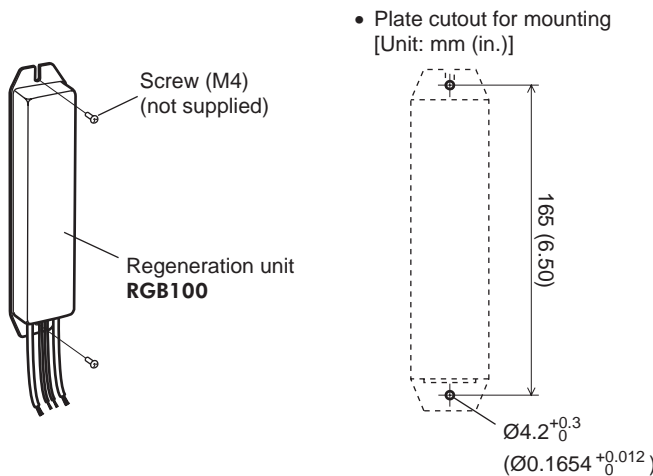
7.7   Installing the battery

A battery and battery holder are included in an accessory battery set **BAT01B** (sold separately). Use the battery holder to secure the battery. See p.171 for accessory.

- Battery installation dimensions

M4

13 ± 0.3 mm
$(0.51 \pm 0.012$ in.)
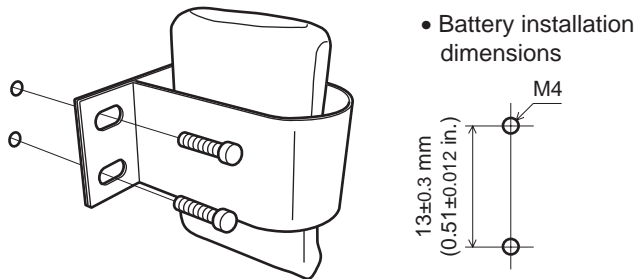
7.8   Installing and wiring in compliance with EMC Directive

Effective measures must be taken against the EMI that the motor and driver may give to adjacent control-system equipment, as well as the EMS of the motor and driver itself, in order to prevent a serious functional impediment in the machinery. The use of the following installation and wiring methods will enable the motor and driver to be compliant with the EMC directive. Refer to "Standard and CE Marking" on p.10 for the applicable standards.

■ Connecting noise filter for power supply line

- Connect a noise filter in the AC input line to prevent the noise generated in the driver from propagating externally through the power supply line. For a noise filter, use MC1210 (TDK-Lambda Corporation) or equivalent product.
- Install the noise filter as close to the driver as possible.
- Use cable clamps and other means to secure the input cables (AWG18: 0.75 mm^2 or more) and output cables (AWG18: 0.75 mm^2 or more) firmly to the surface of the enclosure.
- Connect the ground terminal of the noise filter to the grounding point, using as thick and short a wire as possible.
- Do not place the input cable parallel with the noise-filter output cable. Parallel placement will reduce noise-filter effectiveness if the enclosure's internal noise is directly coupled to the power supply cable by means of stray capacitance.

■ Connecting surge arrester

For a surge arrester, use R·A·V-781BWZ-4 (OKAYA ELECTRIC INDUSTRIES CO., LTD.).

Note   When measuring dielectric strength of the equipment, be sure to remove the surge arrester, or the surge arrester may be damaged.

■ Connecting the AC power line reactor

When inputting single-phase 240 V, insert a reactor (5 A, 5 mH) in the AC power line to ensure compliance with EN 61000-3-2.

■ Connecting the 24 VDC power supply

Use a 24 VDC power supply conforming to the EMC Directive.
Use a shielded cable for wiring, and wire/ground the power supply cable over the shortest possible distance.
Refer to "Wiring the power supply cable and signal cable" for how to ground the shielded cable.

■ How to ground

The cable used to ground the motor, driver and noise filter must be as thick and short as possible so that no potential difference is generated. Choose a large, thick and uniformly conductive surface for the grounding point.
See p.29 for grounding the motor and driver.

■ Wiring the power supply cable and signal cable

- Use a shielded cable for the power supply cable and signal cable, and keep it as short as possible.
- To ground a shielded cable, use a metal cable clamp or similar device that will maintain contact with the entire circumference of the cable. Attach a cable clamp as close to the end of the cable as possible, and connect it as shown in the figure.

Shielded cable

Cable cramp
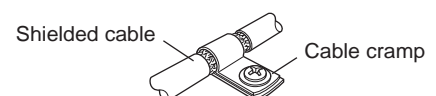
■ Notes about installation and wiring

- 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 noise filters and CR circuits to suppress surges generated by them.
- Keep cables as short as possible without coiling and bundling extra lengths.
- Place the power cables such as the motor and power supply cables as far apart [200 mm (7.87 in.)] as possible from the signal cables. If the power cables and signal cables have to cross, cross them at a right angle. Place the input cable and output cable of a noise filter separately from each other.
- When extending the distance between the motor and driver, it is recommended that an accessory motor connection cable (sold separately) should be used. The EMC measures are conducted using the Oriental Motor extension cable.

■ Example of motor and driver installation and wiring
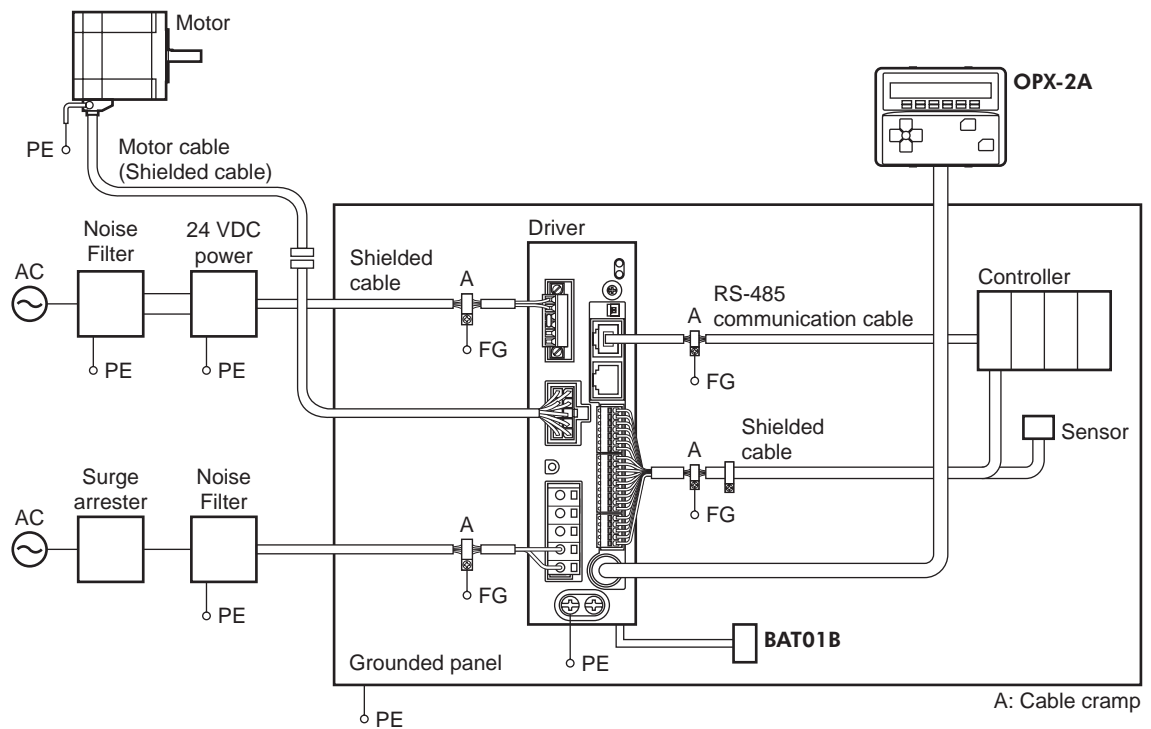
■ Precautions about static electricity

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

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

8 Connection

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

8.1 Connection example

The following figure is a connection example when an electromagnetic brake motor is used. Refer to p.29 for the connection method of 24 VDC power supply.

Wiring method of connector for CN1
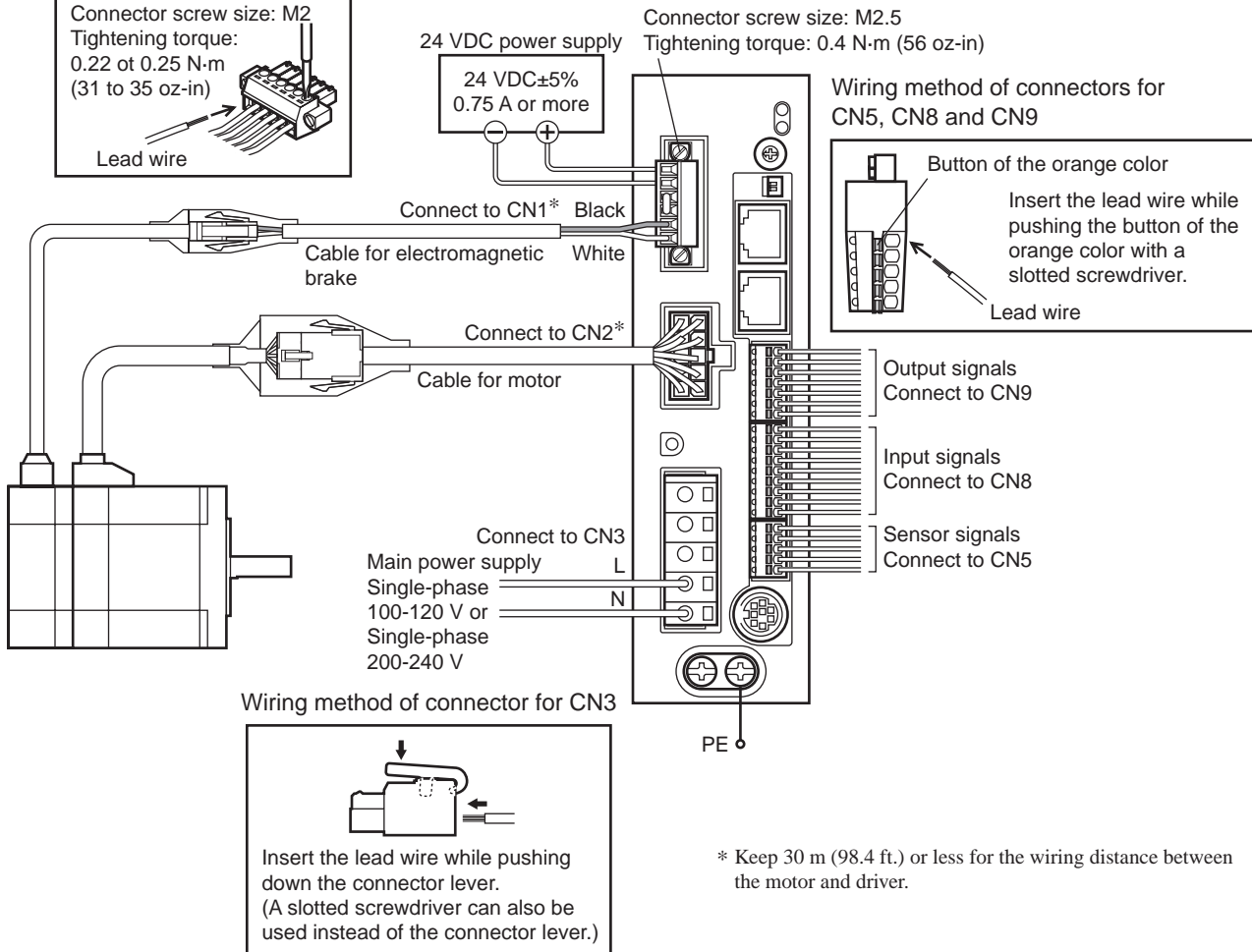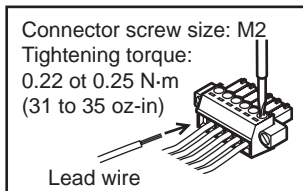
Note
- Have the connector plugged in securely. Insecure connections may cause malfunction or damage to the motor or driver.
- When unplugging the connector, do so while pressing the latches on the connector.
- When plugging/unplugging the connector, turn off the power and wait for the CHARGE LED to turn off before doing so. The 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.
- The lead wires of the "cable for electromagnetic brake" have polarities, so connect them in the correct polarities. If the lead wires are connected with their polarities reversed, the electromagnetic brake will not operate properly.
- If the distance between the motor and driver is extended to 20 m (65.6 ft.) or longer, use a power supply of 24 VDC±4%.
- When installing the motor to a moving part, use an accessory flexible cable offering excellent flexibility. For the flexible motor cable, refer to p.169.

■ Power supply current capacity

• Single-phase 100-120 V

Model	Power supply current capacity
AR46	2.4 A or more
AR66	3.6 A or more
AR69	4.9 A or more
AR98	4.6 A or more
AR911	5.9 A or more

• Single-phase 200-240 V

Model	Power supply current capacity
AR46	1.5 A or more
AR66	2.3 A or more
AR69	3.0 A or more
AR98	2.9 A or more
AR911	3.7 A or more

■ Pin assignment list

• CN1

Display	Description
24V+	24 VDC power supply input
24V−	
TH1	Regeneration unit thermal input (If these terminals are not used, short-circuit them using a jumper wire.)
TH2	
MB1	Electromagnetic brake −
MB2	Electromagnetic brake +
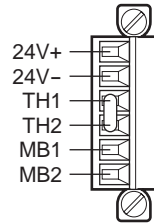
• Applicable lead wire: AWG28 to 16 (0.08 to 1.25 mm^2)
• Length of the insulation cover which can be peeled: 7 mm (0.28 in.)

• CN3

Display	Description
RG1	Regeneration unit input
RG2	
NC	Not used.
L	Main power supply input
N	L: Live, N: Neutral
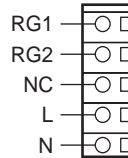
• Applicable lead wire: AWG16 to 14 (1.25 to 2.0 mm^2)
• Length of the insulation cover which can be peeled: 8 to 9 mm (0.32 to 0.35 in.)

• CN5

Pin No.	Signal name	Description
1	+LS	Limit sensor input +
2	−LS	Limit sensor input −
3	HOMES	Mechanical home sensor input
4	SLIT	Slit sensor input
5	IN-COM2	Sensor common input
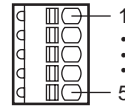
• Applicable lead wire: AWG26 to 20 (0.14 to 0.5 mm^2)
• Length of the insulation cover which can be peeled: 8 mm (0.32 in.)

• CN8

Pin No.	Signal name	Description*
1	IN0	Control input0 (HOME)
2	IN1	Control input1 (START)
3	IN2	Control input2 (M0)
4	IN3	Control input3 (M1)
5	IN4	Control input4 (M2)
6	IN5	Control input5 (FREE)
7	IN6	Control input6 (STOP)
8	IN7	Control input7 (ALM-RST)
9	IN-COM1	Input signal common
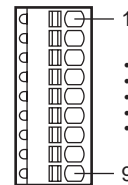
* ( ): Initial value

• Applicable lead wire: AWG26 to 20 (0.14 to 0.5 mm^2)
• Length of the insulation cover which can be peeled: 8 mm (0.32 in.)

• CN9

Pin No.	Signal name	Description*
1	OUT0	Control output0 (HOME-P)
2	OUT1	Control output1 (END)
3	OUT2	Control output2 (AREA1)
4	OUT3	Control output3 (READY)
5	OUT4	Control output4 (WNG)
6	OUT5	Control output5 (ALM)
7	OUT-COM	Output signal common
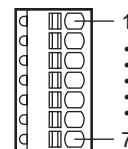
* ( ): Initial value

• Applicable lead wire: AWG26 to 20 (0.14 to 0.5 mm^2)
• Length of the insulation cover which can be peeled: 8 mm (0.32 in.)

■ Connecting to a current source output circuit (PNP specifications)
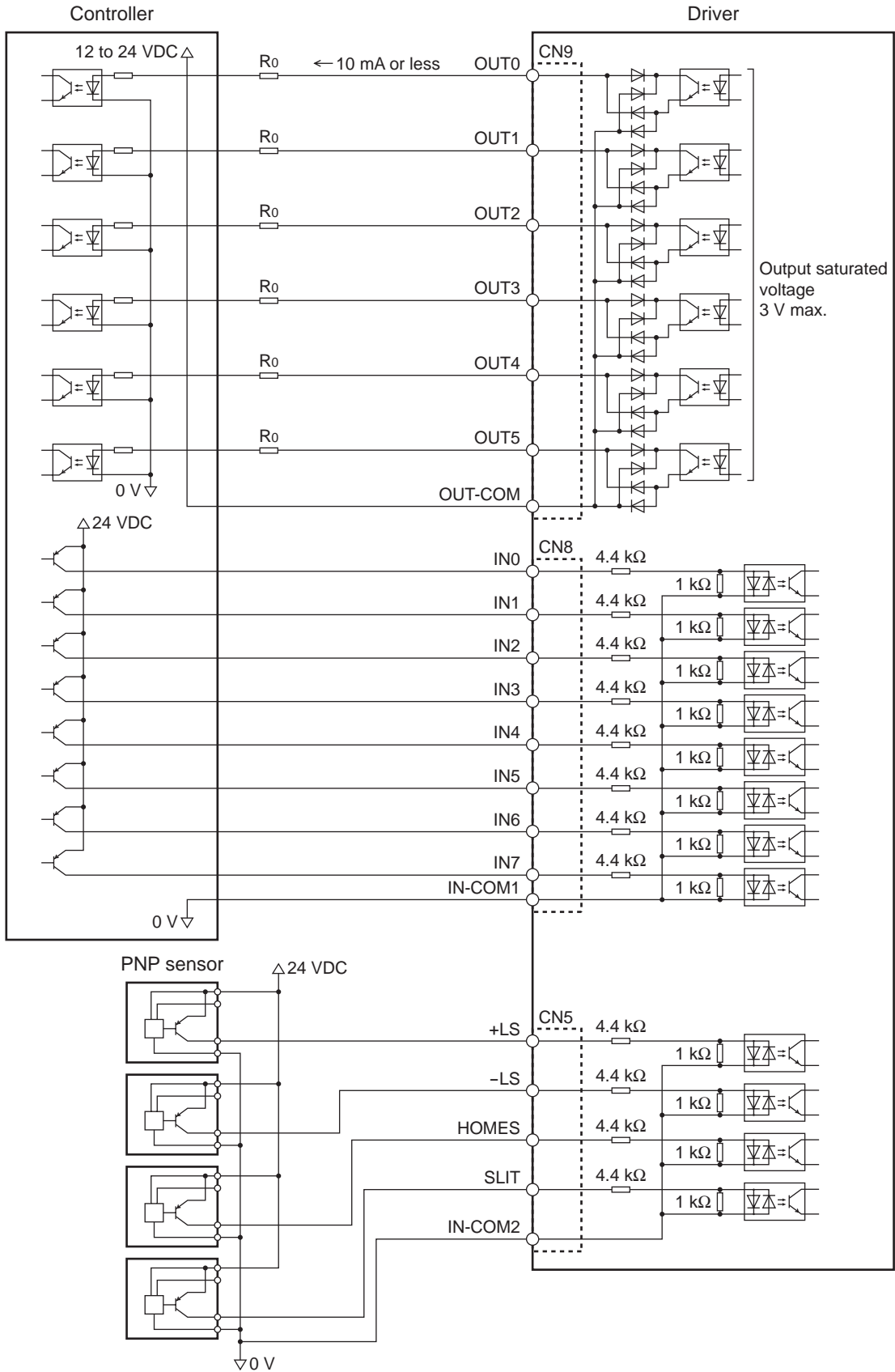
Controller   Driver

12 to 24 VDC	CN9

R0   ← 10 mA or less   OUT0
R0   OUT1
R0   OUT2
R0   OUT3
R0   OUT4
R0   OUT5
0 V   OUT-COM

Output saturated voltage 3 V max.

24 VDC

CN8
IN0   4.4 kΩ   1 kΩ
IN1   4.4 kΩ   1 kΩ
IN2   4.4 kΩ   1 kΩ
IN3   4.4 kΩ   1 kΩ
IN4   4.4 kΩ   1 kΩ
IN5   4.4 kΩ   1 kΩ
IN6   4.4 kΩ   1 kΩ
IN7   4.4 kΩ   1 kΩ
IN-COM1   1 kΩ

0 V

PNP sensor   24 VDC

CN5
+LS   4.4 kΩ   1 kΩ
−LS   4.4 kΩ   1 kΩ
HOMES   4.4 kΩ   1 kΩ
SLIT   4.4 kΩ   1 kΩ
IN-COM2   1 kΩ

0 V

> **Note**
> - Use input signals at 24 VDC.
> - Use output signals at 24 VDC 10 mA or less. If the current exceeds 10 mA, connect an external resistor R0.
> - The saturated voltage of the output signal is 3 VDC maximum.

■ Connecting to a current sink output circuit (NPN specifications)
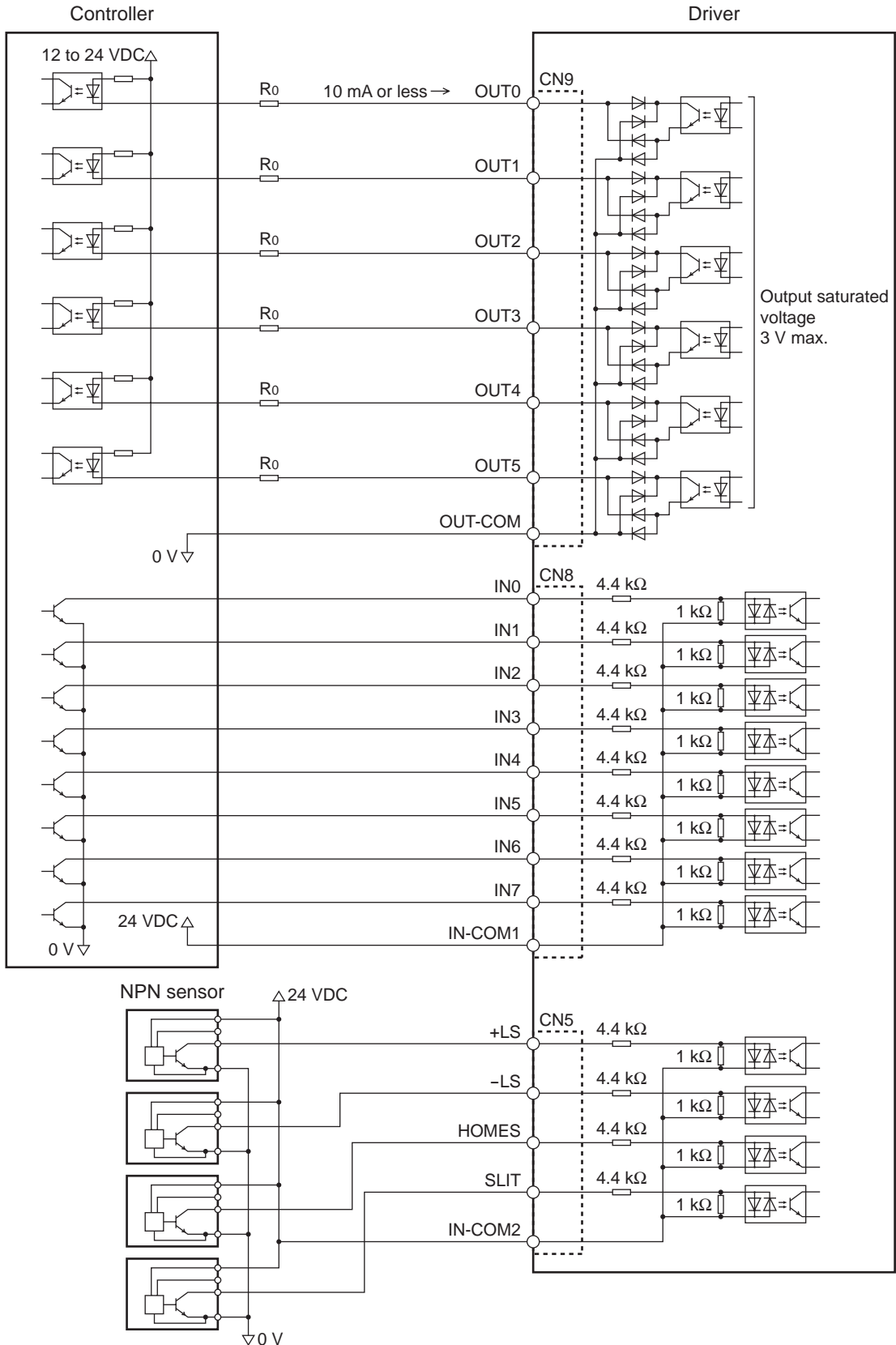
Note
- Use input signals at 24 VDC.
- Use output signals at 24 VDC 10 mA or less. If the current exceeds 10 mA, connect an external resistor R0.
- The saturated voltage of the output signal is 3 VDC maximum.

8.2 Grounding the motor and driver

■ Grounding the motor

Be sure to ground the Protective Earth Terminal of the motor.
Grounding wire: AWG18 (0.75 mm^2) or more
Tightening torque: 1.2 N·m (170 oz-in)

When grounding, use a round terminal and secure it with a mounting screw with a washer. Ground wires and crimp terminals are not supplied.

PE
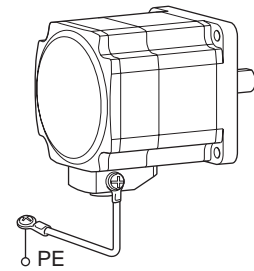
■ Grounding the driver

Be sure to ground the Protective Earth Terminal (screw size: M4) of the driver.
Grounding wire: AWG16 to 14 (1.25 to 2.0 mm^2)
Tightening torque: 1.2 N·m (170 oz-in)

You can ground either of the two Protective Earth Terminals. The terminal that is not grounded is used as a service terminal. Use the service terminal according to your specific need, such as connecting it to the motor in order to ground the motor.
Do not share the grounding wire with a welder or any other power equipment. When grounding the Protective Earth Terminal, use a round terminal and affix the grounding point near the driver.
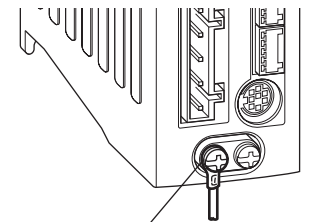
Protective Earth Terminal
(Ground one of these terminals.)

8.3 Connecting the 24 VDC power supply input and regeneration unit

■ Connecting the 24 VDC power supply input

The 24 VDC power supply is for the control circuit of the driver. Connect a power supply of 24 VDC±5%, 0.75 A or more.

| Note | • If the distance between the motor and driver is extended to 20 m (65.6 ft.) or longer, use a power supply of 24 VDC±4%.
• When cycling the 24 VDC power supply, turn off the power and turn on the power again after waiting for 1 second or more. |

■ Connecting the regeneration unit

Use the accessory regeneration unit **RGB100** (sold separately) if gravitational operation or other operation involving up/down movement, or sudden starting/ stopping of a large inertia load, will be repeated frequently.
• The two thin lead wires (AWG22: 0.3 mm^2) of the regeneration unit are the thermostat outputs. Connect them to the TH1 and TH2 terminals using the CN1 connector.
• 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 using the CN3 connector.

Regeneration unit
RGB100

150 °C (302 °F) [N.C.]

R: 150 Ω

To TH1 and TH2 terminals on CN1

AWG22

To RG1 and RG2 terminals on CN3

AWG18
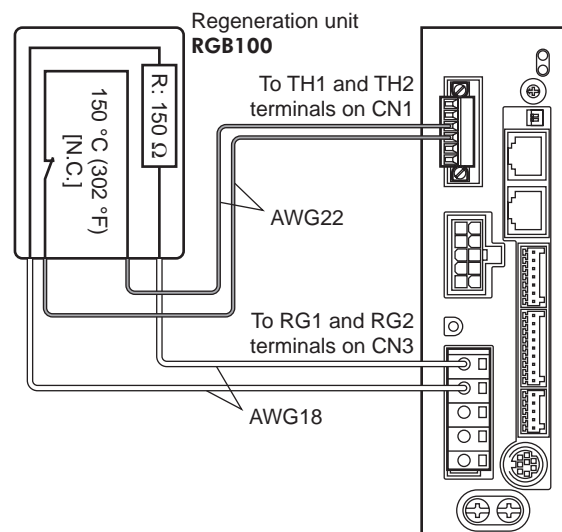
| Note | • Before connecting the regeneration unit, be sure to remove the jumper wire from the CN1 connector.
• If the allowable power consumption of the regeneration unit exceeds the allowable level, the thermostat will be triggered and the regeneration unit overheat alarm of the driver will generate. If the regeneration unit overheat alarm generates, turn off the power and check the connection or operating condition. |

Regeneration unit specifications

Model	**RGB100**
Allowable current consumption	Continuous regenerative power *: 50 W Instantaneous regenerative power: 600 W
Resistance value	150 Ω
Thermostat operating temperature	Operation: Opens at 150±7 °C (302±13 °F) Reset: Closes at 145±12 °C (293±22 °F) (normally closed)
Thermostat electrical rating	120 VAC 4 A, 30 VDC 4 A (minimum current: 5 mA)

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

8.4 Connecting the data setter

Connect **OPX-2A** cable or supplied cable with the **MEXE02** to the data edit connector (CN4) on the driver.

Cable for **OPX-2A** or cable supplied with the **MEXE02**
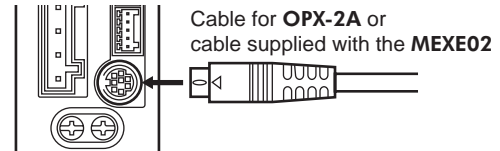
⚠ **Caution** | The data edit connector (CN4) and RS-485 communication connector (CN6/CN7) of the driver are not electrically insulated. When grounding the positive terminal of the power supply, do not connect any equipment (PC, etc.) whose negative terminal is grounded. Doing so may cause the driver and these equipment to short, damaging both.

8.5 Connecting the RS-485 communication cable

Connect this cable if you want to control your product via RS-485 communication. Connect the RS-485 communication cable to CN6 or CN7 on the driver.

You can use the vacant connectors to connect a different driver. A driver link cable is available as an accessory (sold separately). See p.171. You can also use a commercial LAN cable to link drivers.

RS-485 communication connector (CN6/CN7)

Drivers can be linked.

2 GND
3 TR+
6 TR−

2 GND
3 TR+
6 TR−

5 V
1 kΩ
TERM. No.2
TERM. No.1
120 Ω
1 kΩ
0 V
0 V
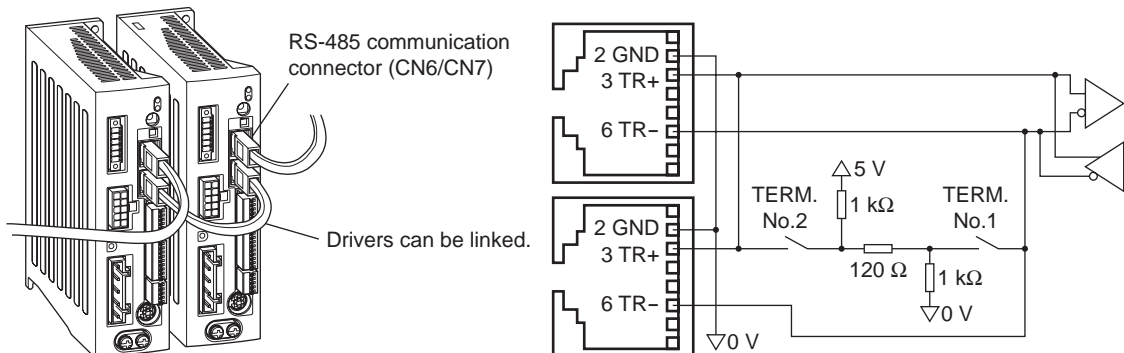
CN6/CN7 pin assignments

Pin No.	Signal 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.	

1
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8
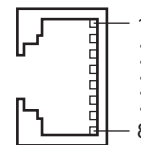
8.6 Connecting and charging the battery

Connect an accessory battery set **BAT01B** (sold separately) for the absolute-position backup system.

When the battery is connected to the battery connector (CN10) of the driver and the 24 VDC power is turned on, the battery will start charging. It takes approx. 32 hours to fully charge the battery [at an ambient temperature of 20 °C (68 °F)].

See p.171 for accessories.

Battery power supply GND

Battery power supply input

Not used
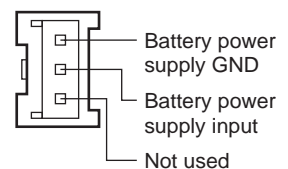
9   Explanation of I/O signals

In this manual, I/O signals are described as follows.
- Direct I/O: I/O signals accessed via input signal connector (CN8) and output signal connector (CN9)
- Network I/O: I/O signals accessed via RS-485 communication

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

9.1   Assignment of direct I/O

■ Assignment to the input terminals

The input signals shown below can be assigned to the input terminals IN0 to IN7 of CN8 by setting parameters.
For details on input signals, refer to p.38.

Direct I/O signal name	Initial setting	Direct I/O signal name	Initial setting
IN0	3: HOME	IN4	50: M2
IN1	4: START	IN5	16: FREE
IN2	48: M0	IN6	18: STOP
IN3	49: M1	IN7	24: ALM-RST

Assignment No.	Signal name	Function
0	Not used	Set when the input terminal is not used.
1	FWD	Continuous operation in the positive direction.
2	RVS	Continuous operation in the negative direction.
3	HOME	Return-to-home operation.
4	START	Positioning operation.
5	SSTART	Sequential positioning operation.
6	+JOG	JOG operation in the positive direction.
7	−JOG	JOG operation in the negative direction.
8	MS0	
9	MS1	
10	MS2	Direct positioning operation.
11	MS3	
12	MS4	
13	MS5	
16	FREE	Stop the motor excitation and release the electromagnetic brake.
17	C-ON	Motor excitation switching between excitation and non-excitation.
18	STOP	Stop of the motor operation.
24	ALM-RST	Reset of the current alarm.
25	P-PRESET	Position preset.
26	P-CLR	Reset of the absolute position error alarm.
27	HMI	Release of the function limitation of the **OPX-2A** or **MEXE02**.
32	R0	
33	R1	
34	R2	
35	R3	
36	R4	
37	R5	
38	R6	General signals. Use these signals when controlling the system via RS-485 communication.
39	R7	
40	R8	
41	R9	
42	R10	
43	R11	
44	R12	
45	R13	

Assignment No.	Signal name	Function
46	R14	General signals. Use these signals when controlling the system via RS-485 communication.
47	R15	
48	M0	Select the operation data No. using these six bits.
49	M1	
50	M2	
51	M3	
52	M4	
53	M5	

Related parameters

Parameter name	Description	Initial value
IN0 input function selection	Assigns the following input signals to IN0 to IN7 of the input terminals.	3: HOME
IN1 input function selection		4: START
IN2 input function selection		48: M0
IN3 input function selection		49: M1
IN4 input function selection		50: M2
IN5 input function selection		16: FREE
IN6 input function selection		18: STOP
IN7 input function selection		24: ALM-RST

0: Not used	8: MS0	18: STOP	35: R3	43: R11	51: M3
1: FWD	9: MS1	24: ALM-RST	36: R4	44: R12	52: M4
2: RVS	10: MS2	25: P-PRESET	37: R5	45: R13	53: M5
3: HOME	11: MS3	26: P-CLR	38: R6	46: R14	
4: START	12: MS4	27: HMI	39: R7	47: R15	
5: SSTART	13: MS5	32: R0	40: R8	48: M0	
6: +JOG	16: FREE	33: R1	41: R9	49: M1	
7: −JOG	17: C-ON	34: R2	42: R10	50: M2	

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 ALM-RST input and P-CLR input will be executed when turning from ON to OFF. The P-PRESET input will be executed when turning from OFF to ON.

• When the C-ON input and HMI input are not assigned to the input terminals, these inputs will always be set to ON. When assigning to both direct I/O and network I/O, the function will be executed when both of them are set to ON.

■ Changing the logic level setting of input signals

You can change the logic level setting for input terminals IN0 to IN7 using the parameter.

Related parameters

Parameter name	Description	Initial value
IN0 input logic level setting to IN7 input logic level setting	Changes the logic level setting for input terminals IN0 to IN7. 0: Normally open 1: Normally closed	0: Normally open

■ Assignment to the output terminals

The output signals shown below can be assigned to the output terminals OUT0 to OUT5 of CN9 by setting parameters. For details on output signals, refer to p.43.

Direct I/O signal name	Initial value	Direct I/O signal name	Initial value
OUT0	70: HOME-P	OUT3	67: READY
OUT1	69: END	OUT4	66: WNG
OUT2	73: AREA1	OUT5	65: ALM

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	RVS_R	Output in response to the RVS input.
3	HOME_R	Output in response to the HOME input.
4	START_R	Output in response to the START input.
5	SSTART_R	Output in response to the SSTART input.
6	+JOG_R	Output in response to the +JOG input.
7	−JOG_R	Output in response to the −JOG input.
8	MS0_R	
9	MS1_R	
10	MS2_R	
11	MS3_R	Output in response to the MS0 to MS5 input.
12	MS4_R	
13	MS5_R	
16	FREE_R	Output in response to the FREE input.
17	C-ON_R	Output in response to the C-ON input.
18	STOP_R	Output in response to the STOP input.
32	R0	
33	R1	
34	R2	
35	R3	
36	R4	
37	R5	
38	R6	
39	R7	
40	R8	Output the status of the general signal R0 to R15.
41	R9	
42	R10	
43	R11	
44	R12	
45	R13	
46	R14	
47	R15	
48	M0_R	
49	M1_R	
50	M2_R	
51	M3_R	Output in response to the M0 to M5 input.
52	M4_R	
53	M5_R	
60	+LS_R	Output in response to the +LS input.
61	−LS_R	Output in response to the −LS input.
62	HOMES_R	Output in response to the HOMES input.
63	SLIT_R	Output in response to the SLIT input.
65	ALM	Output the alarm status of the driver (normally closed).
66	WNG	Output the warning status of the driver.
67	READY	Output when the driver is ready.
68	MOVE	Output when the motor operates.

Assignment No.	Signal name	Function
69	END	Output when the positioning operation is completed.
70	HOME-P	Output when the motor is in home position.
71	TLC	Output when the load is outside of the motor torque range.
72	TIM	Output once every 7.2° rotation of the motor output shaft.
73	AREA1	Output when the motor is within the area 1.
74	AREA2	Output when the motor is within the area 2.
75	AREA3	Output when the motor is within the area 3.
80	S-BSY	Output when the driver is in internal processing state.
82	MPS	Output the ON-OFF state of the main power supply.

Related parameters

Parameter name	Description	Initial value
OUT0 output function selection		70: HOME-P
OUT1 output function selection		69: END
OUT2 output function selection	Assigns the following output signals to OUT0 to OUT5 of the output terminals.	73: AREA1
OUT3 output function selection		67: READY
OUT4 output function selection		66: WNG
OUT5 output function selection		65: ALM

0: Not used	10: MS2_R	35: R3	45: R13	61: −LS_R	72: TIM
1: FWD_R	11: MS3_R	36: R4	46: R14	62: HOMES_R	73: AREA1
2: RVS_R	12: MS4_R	37: R5	47: R15	63: SLIT_R	74: AREA2
3: HOME_R	13: MS5_R	38: R6	48: M0_R	65: ALM	75: AREA3
4: START_R	16: FREE_R	39: R7	49: M1_R	66: WNG	80: S-BSY
5: SSTART_R	17: C-ON_R	40: R8	50: M2_R	67: READY	82: MPS
6: +JOG_R	18: STOP_R	41: R9	51: M3_R	68: MOVE	
7: −JOG_R	32: R0	42: R10	52: M4_R	69: END	
8: MS0_R	33: R1	43: R11	53: M5_R	70: HOME-P	
9: MS1_R	34: R2	44: R12	60: +LS_R	71: TLC	

9.2 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 the network I/O by setting parameters. See each command description for the assignment of the NET-IN0 to NET-IN15.

Assignment value	Signal name	Function	Setting range
0	Not used	Set when the input terminal is not used.	−
1	FWD	Continuous operation in the positive direction.	0: Deceleration stop
2	RVS	Continuous operation in the negative direction.	1: Operation
3	HOME	Return-to-home operation.	
4	START	Positioning operation.	
5	SSTART	Sequential positioning operation.	
6	+JOG	JOG operation in the positive direction.	
7	−JOG	JOG operation in the negative direction.	
8	MS0		0: No operation
9	MS1		1: Start operation
10	MS2	Direct positioning operation.	
11	MS3		
12	MS4		
13	MS5		
16	FREE	Stop the motor excitation and release the electromagnetic brake.	0: No operation 1: Electromagnetic brake release+motor non-excitation
17	C-ON	Motor excitation switching between excitation and non-excitation.	0: Motor non-excitation 1: Motor excitation
18	STOP	Stop of the motor operation.	0: No operation 1: Stop operation

Assignment value	Signal name	Function	Setting range
27	HMI	Release of the function limitation of the **OPX-2A** or **MEXE02**.	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 six bits.	0 to 63: Operation data No.
49	M1		
50	M2		
51	M3		
52	M4		
53	M5		

Related parameters

Parameter name	Description	Initial value
NET-IN0 input function selection	Assigns the following input signals to NET-IN0 to NET-IN15 of the input terminals.	48: M0
NET-IN1 input function selection		49: M1
NET-IN2 input function selection		50: M2
NET-IN3 input function selection		4: START
NET-IN4 input function selection		3: HOME
NET-IN5 input function selection		18: STOP
NET-IN6 input function selection		16: FREE
NET-IN7 input function selection		0: Not used
NET-IN8 input function selection		8: MS0
NET-IN9 input function selection		9: MS1
NET-IN10 input function selection		10: MS2
NET-IN11 input function selection		5: SSTART
NET-IN12 input function selection		6: +JOG
NET-IN13 input function selection		7: −JOG
NET-IN14 input function selection		1: FWD
NET-IN15 input function selection		2: RVS

0: Not used	7: −JOG	16: FREE	35: R3	42: R10	49: M1
1: FWD	8: MS0	17: C-ON	36: R4	43: R11	50: M2
2: RVS	9: MS1	18: STOP	37: R5	44: R12	51: M3
3: HOME	10: MS2	27: HMI	38: R6	45: R13	52: M4
4: START	11: MS3	32: R0	39: R7	46: R14	53: M5
5: SSTART	12: MS4	33: R1	40: R8	47: R15	
6: +JOG	13: MS5	34: R2	41: R9	48: M0	

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 C-ON input and HMI input are not assigned to the input terminals, these inputs will always be set to ON. When assigning to both direct I/O and network I/O, the function will be executed when both of them 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 the network I/O by setting parameters. See each command description for the assignment of the NET-OUT0 to NET-OUT15.

Assignment value	Signal name	Function	Setting range
0	Not used	Set when the output terminal is not used.	−
1	FWD_R	Output in response to the FWD input.	0: OFF 1: ON
2	RVS_R	Output in response to the RVS input.	
3	HOME_R	Output in response to the HOME input.	
4	START_R	Output in response to the START input.	
5	SSTART_R	Output in response to the SSTART input.	
6	+JOG_R	Output in response to the +JOG input.	
7	−JOG_R	Output in response to the −JOG input.	
8	MS0_R	Output in response to the MS0 to MS5 inputs.	
9	MS1_R		
10	MS2_R		
11	MS3_R		
12	MS4_R		
13	MS5_R		
16	FREE_R	Output in response to the FREE input.	
17	C-ON_R	Output in response to the C-ON input.	
18	STOP_R	Output in response to the STOP input.	
32	R0	Output the status of the general signal 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 M5 inputs.	0 to 63: Operation data No.
49	M1_R		
50	M2_R		
51	M3_R		
52	M4_R		
53	M5_R		
60	+LS_R	Output in response to the +LS input.	0: OFF 1: ON
61	−LS_R	Output in response to the −LS input.	
62	HOMES_R	Output in response to the HOMES input.	
63	SLIT_R	Output in response to the SLIT input.	
65	ALM	Output the alarm of the driver (normally open).	0: Alarm not present 1: Alarm present
66	WNG	Output the warning of the driver.	0: Warning not present 1: Warning present
67	READY	Output when the driver is ready.	0: Not ready 1: Ready
68	MOVE	Output when the motor operates.	0: Motor stopped 1: Motor operating

Assignment value	Signal name	Function	Setting range
69	END	Output when the positioning operation is completed.	0: Motor operating 1: Motor operating completion
70	HOME-P	Output when the motor is in home position.	0: Not home position 1: Home position
71	TLC	Output when the load is outside of the motor torque range.	0: Inside torque range 1: Outside torque range
72	TIM	Output once every 7.2° rotation of the motor output shaft.	0: OFF 1: ON
73	AREA1	Output when the motor is within the area 1.	0: Outside area 1: Inside area
74	AREA2	Output when the motor is within the area 2.	
75	AREA3	Output when the motor is within the area 3.	
80	S-BSY	Output when the driver is in internal processing status.	0: OFF 1: ON
82	MPS	Output the ON-OFF state of the main power supply.	0: Main power supply OFF 1: Main power supply ON

Related parameters

Parameter name	Description	Initial value
NET-OUT0 output function selection		48: M0_R
NET-OUT1 output function selection		49: M1_R
NET-OUT2 output function selection		50: M2_R
NET-OUT3 output function selection		4: START_R
NET-OUT4 output function selection		70: HOME-P
NET-OUT5 output function selection		67: READY
NET-OUT6 output function selection		66: WNG
NET-OUT7 output function selection	Assigns the following output signals to NET-OUT0 to NET-OUT15.	65: ALM
NET-OUT8 output function selection		80: S-BSY
NET-OUT9 output function selection		73: AREA1
NET-OUT10 output function selection		74: AREA2
NET-OUT11 output function selection		75: AREA3
NET-OUT12 output function selection		72: TIM
NET-OUT13 output function selection		68: MOVE
NET-OUT14 output function selection		69: END
NET-OUT15 output function selection		71: TLC

0: Not used	10: MS2_R	35: R3	45: R13	61: −LS_R	72: TIM
1: FWD_R	11: MS3_R	36: R4	46: R14	62: HOMES_R	73: AREA1
2: RVS_R	12: MS4_R	37: R5	47: R15	63: SLIT_R	74: AREA2
3: HOME_R	13: MS5_R	38: R6	48: M0_R	65: ALM	75: AREA3
4: START_R	16: FREE_R	39: R7	49: M1_R	66: WNG	80: S-BSY
5: SSTART_R	17: C-ON_R	40: R8	50: M2_R	67: READY	82: MPS
6: +JOG_R	18: STOP_R	41: R9	51: M3_R	68: MOVE	
7: −JOG_R	32: R0	42: R10	52: M4_R	69: END	
8: MS0_R	33: R1	43: R11	53: M5_R	70: HOME-P	
9: MS1_R	34: R2	44: R12	60: +LS_R	71: TLC	

9.3 Input signals

The input signals of the driver are photocoupler inputs.
- Direct I/O .... I/O for normally open: "ON: Current-carrying", "OFF: Not current-carrying"
    I/O for normally closed: "ON: Not current-carrying", "OFF: Current-carrying"
- Network I/O ...... "ON: 1", "OFF: 0"

■ Internal input circuit

IN0 input 4.4 kΩ 1 kΩ

IN1 input 4.4 kΩ 1 kΩ

IN2 input 4.4 kΩ 1 kΩ

IN3 input 4.4 kΩ 1 kΩ

IN4 input 4.4 kΩ 1 kΩ

IN5 input 4.4 kΩ 1 kΩ

IN6 input 4.4 kΩ 1 kΩ

IN7 input 4.4 kΩ 1 kΩ

IN-COM1
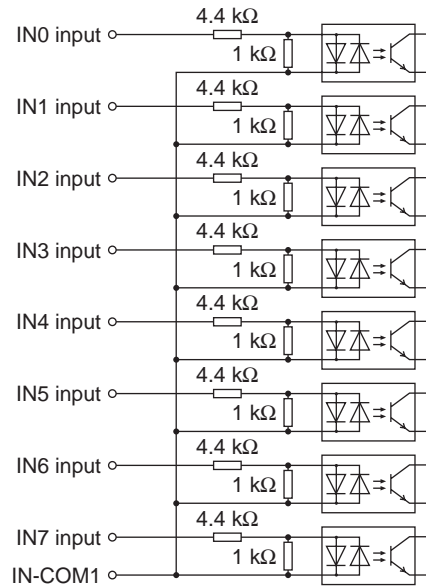
■ M0 to M5 input

Select a desired operation data number for positioning operation or continuous operation based on the combination of ON/OFF states of the M0 to M5 inputs.

Operation data No.	M5	M4	M3	M2	M1	M0
0	OFF	OFF	OFF	OFF	OFF	OFF
1	OFF	OFF	OFF	OFF	OFF	ON
2	OFF	OFF	OFF	OFF	ON	OFF
3	OFF	OFF	OFF	OFF	ON	ON
4	OFF	OFF	OFF	ON	OFF	OFF
5	OFF	OFF	OFF	ON	OFF	ON
6	OFF	OFF	OFF	ON	ON	OFF
7	OFF	OFF	OFF	ON	ON	ON
8	OFF	OFF	ON	OFF	OFF	OFF
9	OFF	OFF	ON	OFF	OFF	ON
10	OFF	OFF	ON	OFF	ON	OFF
11	OFF	OFF	ON	OFF	ON	ON
12	OFF	OFF	ON	ON	OFF	OFF
13	OFF	OFF	ON	ON	OFF	ON
14	OFF	OFF	ON	ON	ON	OFF
15	OFF	OFF	ON	ON	ON	ON
16	OFF	ON	OFF	OFF	OFF	OFF
17	OFF	ON	OFF	OFF	OFF	ON
18	OFF	ON	OFF	OFF	ON	OFF
19	OFF	ON	OFF	OFF	ON	ON
20	OFF	ON	OFF	ON	OFF	OFF
21	OFF	ON	OFF	ON	OFF	ON
22	OFF	ON	OFF	ON	ON	OFF
23	OFF	ON	OFF	ON	ON	ON
24	OFF	ON	ON	OFF	OFF	OFF
25	OFF	ON	ON	OFF	OFF	ON
26	OFF	ON	ON	OFF	ON	OFF
27	OFF	ON	ON	OFF	ON	ON
28	OFF	ON	ON	ON	OFF	OFF
29	OFF	ON	ON	ON	OFF	ON
30	OFF	ON	ON	ON	ON	OFF
31	OFF	ON	ON	ON	ON	ON

Operation data No.	M5	M4	M3	M2	M1	M0
32	ON	OFF	OFF	OFF	OFF	OFF
33	ON	OFF	OFF	OFF	OFF	ON
34	ON	OFF	OFF	OFF	ON	OFF
35	ON	OFF	OFF	OFF	ON	ON
36	ON	OFF	OFF	ON	OFF	OFF
37	ON	OFF	OFF	ON	OFF	ON
38	ON	OFF	OFF	ON	ON	OFF
39	ON	OFF	OFF	ON	ON	ON
40	ON	OFF	ON	OFF	OFF	OFF
41	ON	OFF	ON	OFF	OFF	ON
42	ON	OFF	ON	OFF	ON	OFF
43	ON	OFF	ON	OFF	ON	ON
44	ON	OFF	ON	ON	OFF	OFF
45	ON	OFF	ON	ON	OFF	ON
46	ON	OFF	ON	ON	ON	OFF
47	ON	OFF	ON	ON	ON	ON
48	ON	ON	OFF	OFF	OFF	OFF
49	ON	ON	OFF	OFF	OFF	ON
50	ON	ON	OFF	OFF	ON	OFF
51	ON	ON	OFF	OFF	ON	ON
52	ON	ON	OFF	ON	OFF	OFF
53	ON	ON	OFF	ON	OFF	ON
54	ON	ON	OFF	ON	ON	OFF
55	ON	ON	OFF	ON	ON	ON
56	ON	ON	ON	OFF	OFF	OFF
57	ON	ON	ON	OFF	OFF	ON
58	ON	ON	ON	OFF	ON	OFF
59	ON	ON	ON	OFF	ON	ON
60	ON	ON	ON	ON	OFF	OFF
61	ON	ON	ON	ON	OFF	ON
62	ON	ON	ON	ON	ON	OFF
63	ON	ON	ON	ON	ON	ON

■ START input

This signal starts the positioning operation.
Select the operation data No. and turn the START input to ON to start positioning operation.

Related parameters

Parameter name	Description	Setting range	Initial value
Return-to-home incomplete alarm	Sets the alarm signal status: When the positioning operation is started while the position origin has not been set, selects whether the alarm generates or not.	0: Disable 1: Enable	0

Note When the "return-to-home incomplete alarm" parameter is set to "enable", the return-to-home incomplete alarm will generate if the positioning operation is started while the position origin has not been set.

■ SSTART input

This signal starts the sequential positioning operation.
Positioning operation based on the next operation data No. will be performed every time the SSTART input turns ON. This function is useful when multiple positioning operations must be performed sequentially, because there is no need to repeatedly select each operation data No.
See p.58 for sequential positioning operation.

Related parameters

Parameter name	Description	Setting range	Initial value
Return-to-home incomplete alarm	Sets the alarm signal status: When the positioning operation is started while the position origin has not been set, selects whether the alarm generates or not.	0: Disable 1: Enable	0

Note	When the "return-to-home incomplete alarm" parameter is set to "enable", the return-to-home incomplete alarm will generate if the positioning operation is started while the position origin has not been set.

■ MS0 to MS5 input

This signal starts the direct positioning operation.
When any of the MS0 to MS5 inputs is turned ON, the positioning operation corresponding to the input data No. will be performed. Since the positioning operation is enabled by turning any of the MS0 to MS5 inputs ON, you can save the steps of selecting the operation data No.
See p.57 for direct positioning operation.

Related parameters

Parameter name	Description	Setting range	Initial value
Return-to-home incomplete alarm	Sets the alarm signal status: When the positioning operation is started while the position origin has not been set, selects whether the alarm generates or not.	0: Disable 1: Enable	0
MS0 operation data No. selection	Sets operation data No. corresponding to MS0 to MS5 input.	Operation data No.0 to 63	0
MS1 operation data No. selection			1
MS2 operation data No. selection			2
MS3 operation data No. selection			3
MS4 operation data No. selection			4
MS5 operation data No. selection			5

Note	When the "return-to-home incomplete alarm" parameter is set to "enable", the return-to-home incomplete alarm will generate if the positioning operation is started while the position origin has not been set.

■ HOME input

This signal starts the return-to-home operation.

Turn the HOME input ON to start return-to-home operation. When the return-to-home operation is completed and the motor stops, the HOME-P output turns ON.

Related parameters

Parameter name	Description	Setting range	Initial value
Home-seeking mode	Sets the mode for return-to-home operation.	0: 2-sensor mode 1: 3-sensor mode 2: Push mode	1
Operating speed of home-seeking	Sets the operating speed for return-to-home operation.	1 to 1,000,000 Hz	1000
Acceleration/deceleration rate of home-seeking	Sets the acceleration/deceleration rate for return-to-home operation.	1 to 1,000,000 (1=0.001 ms/kHz or 1=0.001 s)	1000
Starting speed of home-seeking	Sets the starting speed for return-to-home operation.	1 to 1,000,000 Hz	500
Position offset of home-seeking	Sets the amount of offset from mechanical home.	−8,388,608 to 8,388,607 step	0
Starting direction of home-seeking	Sets the starting direction for home detection.	0: Negative direction 1: Positive direction	1
SLIT detection with home-seeking	Sets whether or not to concurrently use the SLIT input for return-to-home operation.	0: Disable 1: Enable	0
TIM signal detection with home-seeking	Sets whether or not to concurrently use the TIM signal for return-to-home operation.		
Operating current of push-motion home-seeking	Sets the operating current, based on the rated current being 100%, for push-motion return-to-home operation.	0 to 1000 (1=0.1%)	1000

■ FWD input, RVS input

These signals start the continuous operation.

Operation is performed based on the FWD or RVS input and the operating speed corresponding to the selected operation data No.

Turn the FWD signal to ON, to perform continuous operation in the positive direction.

Turn the RVS signal to ON, to perform continuous operation in the negative direction.

If the signal of the same direction is turned ON again during deceleration, the motor will accelerate and continue operating.

If the FWD and RVS inputs are turned ON simultaneously, the motor will decelerate to a stop.

When the operation data No. is changed during continuous operation, the speed will change to the one specified for the new operation data No.

■ +JOG input, −JOG input

These signals start the JOG operation.

Turn the +JOG signal to ON, to perform JOG operation in the positive direction.

Turn the −JOG signal to ON, to perform JOG operation in the negative direction.

Related parameters

Parameter name	Description	Setting range	Initial value
JOG travel amount	Sets the travel amount for JOG operation.	1 to 8,388,607 step	1
JOG operating speed	Sets the operating speed for JOG operation.	1 to 1,000,000 Hz	1000
Acceleration/deceleration rate of JOG	Sets the acceleration/deceleration rate or acceleration/deceleration time for JOG operation.	1 to 1,000,000 (1=0.001 ms/kHz or 1=0.001 s)	1000
JOG starting speed	Sets the starting speed for JOG operation.	0 to 1,000,000 Hz	500

■ STOP input

When the STOP input turns ON, the motor will stop. When the STOP input turns ON while a positioning operation is being performed, the balance of the travel amount will be cleared. See p.81 for stop action.

Related parameters

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

■ C-ON input

This signal is used to excite the motor. The motor will be excited when the C-ON input is ON, while the motor will become non-excitation status when the C-ON input is OFF.
When an electromagnetic brake motor is used, the electromagnetic brake will be released after the motor is excited.

Note When the C-ON input is not assigned to the direct I/O or network I/O, this input will always be set to ON. When assigning to both direct I/O and network I/O, the function will be executed when both of them are set to ON.

■ FREE input

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

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

■ P-PRESET input

This signal is used to set the command position (current position) to the preset position.
When the P-PRESET input is turned ON, the command position is set as the value of the "preset position" parameter. (This signal will become effective when turning from OFF to ON)
However, the preset will not execute in the following conditions.
- When an alarm is present
- When the motor is operating

Related parameters

Parameter name	Description	Setting range	Initial value
Preset position	Sets the preset position.	−8,388,608 to 8,388,607 step	0

■ ALM-RST input

When an alarm generates, the ALM output will turn OFF and the motor will stop. When the ALM-RST input is turned from ON to OFF, the ALM output will turn ON and the alarm will be reset. (The alarm will be reset at the OFF edge of the ALM-RST input.) Always reset an alarm after removing the cause of the alarm and after ensuring safety. Note that some alarms cannot be reset with the ALM-RST input. See p.158 for alarm descriptions.

■ P-CLR input

If the P-CLR input is turned from ON to OFF while an absolute position error alarm is generated, the alarm will be reset (The alarm will be reset at the OFF edge of the P-CLR input).
The P-CLR input can reset the absolute position error alarm only.

■ HMI input

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 always be set to ON. When assigning to both direct I/O and network I/O, the function will be executed when both of them are set to ON.

9.4 Output signals

The output signals of the driver are photocoupler/open-collector output.
- Direct I/O .... I/O for normally open: "ON: Current-carrying", "OFF: Not current-carrying"
  - I/O for normally closed: "ON: Not current-carrying", "OFF: Current-carrying"
- Network I/O ...... "ON: 1", "OFF: 0"

■ Internal output circuit

OUT0

OUT1

OUT2

OUT3

OUT4

OUT5

OUT-COM
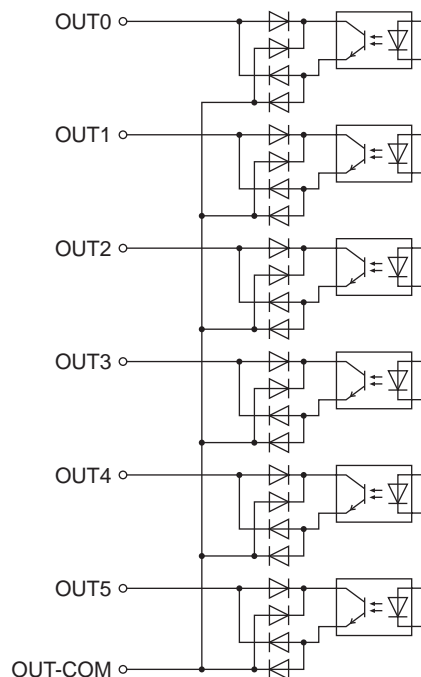
■ ALM output

See p.158 for alarm.

- Direct I/O

When an alarm generates, the ALM output will turn OFF. At the same time, the ALARM LED of the driver will blink and the motor current will be cut off and stop. The ALM output is normally closed.

- Network I/O

When an alarm generates, the ALM output will turn ON. At the same time, the ALARM LED of the driver will blink and the motor current will be cut off and stop. The ALM output is normally open.

- Related parameters

Parameter name	Description	Setting range	Initial value
Overload alarm	Sets the condition in which the overload alarm generates.	1 to 300 (1=0.1 s)	50
Overflow rotation alarm during current ON	Sets the condition under which an excessive position deviation alarm generates when the motor is excited.	1 to 30000 (1=0.01 rev)	300
Return-to-home incomplete alarm	Sets the alarm signal status: When the positioning operation is started while the position origin has not been set, selects whether the alarm generates or not.	0: Disable 1: Enable	0
Overflow rotation alarm during current OFF	Sets the condition under which an excessive position deviation alarm generates when the motor is in a state of current OFF.	1 to 30000 (1=0.01 rev)	10000
Communication timeout	Sets the condition in which a communication timeout occurs in RS-485 communication.	0: Not monitored 0 to 10000 ms	0
Communication error alarm	Sets the condition in which a RS-485 communication error alarm generates. A communication error alarm generates after a RS-485 communication error has occurred by the number of times set here.	1 to 10 times	3

■ WNG output

When a warning generates, the WNG output turns ON. See p.164 for warning.

Related parameters

Parameter name	Description	Setting range	Initial value
Overheat warning	Sets the temperature at which a main circuit overheat warning generates.	40 to 85 °C (104 to 185 °F)	85
Overload warning	Sets the condition in which an overload warning generates.	1 to 300 (1=0.1 s)	50
Overspeed warning	Sets the condition at which an overspeed warning generates.	1 to 5000 r/min	4500
Overvoltage warning	Sets the voltage at which an overvoltage warning generates.	120 to 450 V	435
Undervoltage warning	Sets the voltage at which an undervoltage warning generates.	120 to 280 V	120
Overflow rotation warning during current ON	Sets the condition under which an excessive position deviation warning generates when the motor is in a state of current ON.	1 to 30000 (1=0.01 rev)	300

■ READY output

When the driver becomes ready, the READY output turns ON. Input operating commands to the driver after the READY output has turned ON.
The READY output turns ON when all of the following conditions are satisfied.
- The driver main power supply is turned ON.
- All inputs which start operation are OFF
- The FREE input is OFF
- The C-ON input is ON (When the C-ON input is assigned)
- The STOP input is OFF
- An alarm is not present.
- The motor is not operating.
- Test operation, downloading, initializing or teaching function was not performed using the **OPX-2A**.
- Test function, downloading or teaching function was not performed using the **MEXE02**.
- Configuration commands, all data initialization commands and batch NV memory read commands are not executed via RS-485 communication.

■ HOME-P output

The HOME-P output turns ON corresponding to the setting of the "HOME-P function selection" parameter.
See p.81 for setting the position origin.

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

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

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

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

- Related parameters

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

■ MOVE output

The MOVE output turns ON while the motor is operating.

Related parameters

Parameter name	Description	Setting range	Initial value
Minimum ON time for MOVE output	Sets the minimum ON time for MOVE output.	0 to 255 ms	0

■ END output

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

Related parameters

Parameter name	Description	Setting range	Initial value
Positioning completion signal range	Sets the output range of the END signal (the motor operation converges within this angular range).	0 to 180 (1=0.1°)	18
Positioning completion signal offset	Sets the offset for the END signal (the offset for converging angular range).	−18 to 18 (1=0.1°)	0

■ TLC output

When the load exceeds the motor torque range, the TLC output will turn ON.
When performing push-motion operation, if the load exceeds the torque range calculated from the current ratio of push-motion operation, the TLC output will turn ON.
This output can be used for the completion signal of the push-motion operation.

■ AREA1 to AREA3 output

The AREA output turns ON when the motor is inside the area set by the parameters.
It turns ON when the motor is inside the area even when the motor stops.

Related parameters

Parameter name	Description	Setting range	Initial value
AREA1 positive direction position	Sets the AREA1 positive direction position.		
AREA1 negative direction position	Sets the AREA1 negative direction position.		
AREA2 positive direction position	Sets the AREA2 positive direction position.	−8,388,608 to 8,388,607 step	0
AREA2 negative direction position	Sets the AREA2 negative direction position.		
AREA3 positive direction position	Sets the AREA3 positive direction position.		
AREA3 negative direction position	Sets the AREA3 negative direction position.		

- When the "AREA positive direction position" parameter < "AREA negative direction position" parameter

To turn the AREA output ON: Motor position ≤ AREA positive direction position, or Motor position ≥ AREA negative direction position
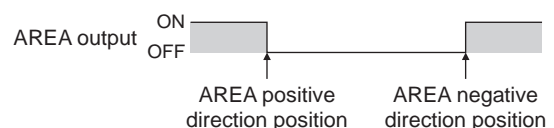
AREA output ON OFF

AREA positive direction position   AREA negative direction position

- When the "AREA positive direction position" parameter > "AREA negative direction position" parameter

To turn the AREA output ON: AREA negative direction position ≤ Motor position ≤ AREA positive direction position

AREA output ON OFF

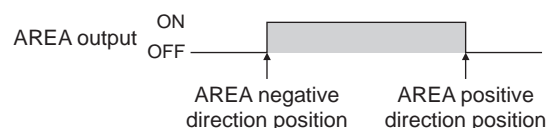AREA negative direction position   AREA positive direction position

- When the "AREA positive direction position" parameter = "AREA negative direction position" parameter

To turn the AREA output ON: Motor position = AREA negative direction position = AREA positive direction position

Note When using AREA1 to AREA3 output to confirm the motor position, you can use two types - the command position and the feedback position.
AREA1 and AREA2: Command position
AREA3: Feedback position (Actual motor position)

■ TIM output

The TIM output will turn ON every time the motor output shaft rotates by 7.2°. If the command speed is faster than 30 r/min, TIM output will not be output correctly.
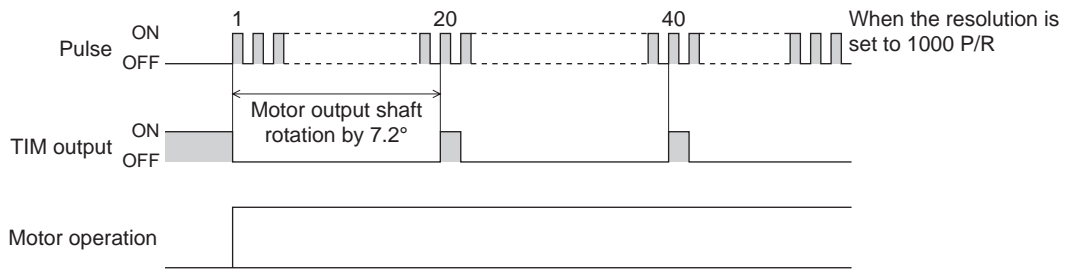
Note	The TIM output is a signal that is output for 50 times per revolution of the motor output shaft. When the TIM output is used, set the "electronic gear" parameters to be an integral multiple of 50.

■ 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.

■ 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	Input signal	Output signal	Input signal	Output signal
FWD	FWD_R	MS2	MS2_R	M2	M2_R
RVS	RVS_R	MS3	MS3_R	M3	M3_R
HOME	HOME_R	MS4	MS4_R	M4	M4_R
START	START_R	MS5	MS5_R	M5	M5_R
SSTART	SSTART_R	FREE	FREE_R	+LS	+LS_R
+JOG	+JOG_R	C-ON	C-ON_R	−LS	−LS_R
−JOG	−JOG_R	STOP	STOP_R	HOMES	HOMES_R
MS0	MS0_R	M0	M0_R	SLIT	SLIT_R
MS1	MS1_R	M1	M1_R		

Note	The response output is the output signal to return the status of the input signal. Therefore, the output signals corresponding to the input signals for motor operation (START_R output etc.) do not show the movement of the motor itself.

9.5   Sensor input

■ Internal input circuit
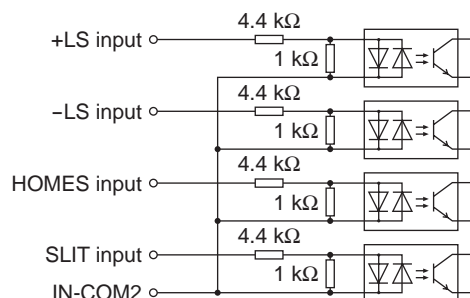
■ +LS input, −LS input

These signals are input from the applicable limit sensors. The +LS input is for the +side sensor and the −LS input is for the −side sensor.

- Return-to-home operation .... When the +LS or −LS input is detected, perform the return-to-home operation according to the setting of the "Home-seeking mode" parameter.
- Any other operation .... Detect the hardware overtravel and stop the motor. See p.81 for hardware overtravel.

Related parameters

Parameter name	Description	Setting range	Initial value
Hardware overtravel	Sets whether to enable or disable hardware overtravel detection using ±LS inputs.	0: Disable 1: Enable	1
Overtravel action	Sets the motor stop action to take place upon the occurrence of overtravel.	0: Immediate stop 1: Deceleration stop	0
LS contact setting	Sets the ±LS input logics.	0: Normally open 1: Normally closed	0

■ HOMES input

The HOMES input is the input for the mechanical home sensor when setting the "home-seeking mode" operation parameter to the 3-sensor mode. See p.67 for return-to-home operation.

Related parameters

Parameter name	Description	Setting range	Initial value
HOMES logic level setting	Sets the HOMES input logic.	0: Normally open 1: Normally closed	0

■ SLIT input

Connect the SLIT input when using motorized linear slides equipped with a slit.
When detecting the home, use of the SLIT input in addition to the HOMES will increase the accuracy of home detection. See p.67 for return-to-home operation.

Related parameters

Parameter name	Description	Setting range	Initial value
SLIT logic level setting	Sets the SLIT input logic.	0: Normally open 1: Normally closed	0

9.6 General signals (R0 to R15)

R0 to R15 are general signals that enable control via RS-485 communication.
Using R0 to R15, 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 IN7 input and NET-OUT15.
When turning the IN7 input ON by the external device, the NET-OUT15 becomes 1. When turning the IN7 input OFF, the NET-OUT15 becomes 0. The logic level of the IN7 input can be set using "IN7 logic level setting" parameter.
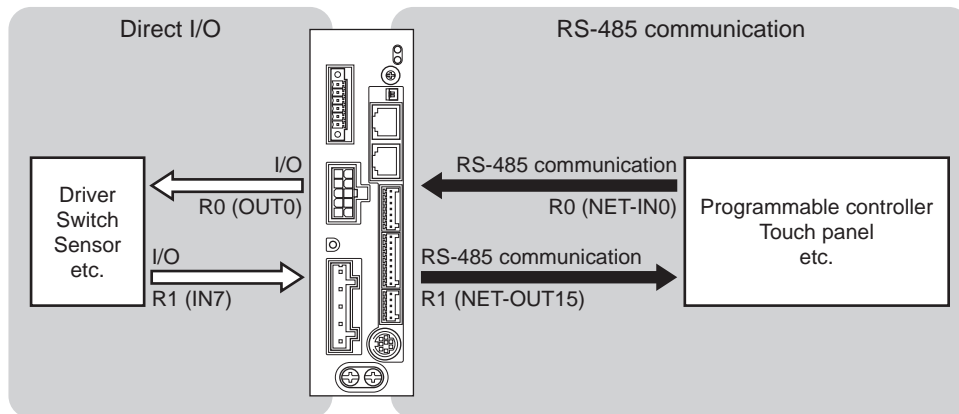
10 Adjustment and setting

This chapter explains how to adjust/set the motor and driver functions.
When a parameter is changed, the timing to reflect the new value varies depending on the parameter. See p.84 for details.

10.1 Resolution

When the "electronic gear A" and "electronic gear B" parameters are set, the resolution per one rotation of the motor output shaft can be set. Note that the calculated value must fall within the setting range specified below:
Resolution setting range: 100 to 10000 P/R

$$\text{Resolution} = 1000 \times \frac{\text{Electronic gear B}}{\text{Electronic gear A}}$$

Related parameters

Parameter name	Description	Setting range	Initial value
Electronic gear A	Set the denominator of electric gear	1 to 65535	1
Electronic gear B	Set the numerator of electric gear		

> **Note**
> - If the value outside of the setting range is set, the "electronic gear setting error warning" will generate. If the power is cycled or the configuration is executed while the "electronic gear setting error warning" is present, an "electronic gear setting error alarm" will generate.
> - If the resolution was changed while the absolute-position backup system was in enable status, perform the return-to-home operation or P-PRESET input.
> - When the TIM output is used, set the "electronic gear" parameters to be an integral multiple of 50.

■ Calculation of electronic gear A and B

Calculation of electronic gear A and B is explained with examples of a ball screw and rotary table.

- Example: Ball screw

Ball screw lead	: 12 mm (0.47 in.)
Minimum travel amount	: 0.01 mm (0.000394 in.)
Gear ratio	: 1 (No speed reduction mechanism between the motor and ball screw)

$$\text{Resolution} = 1000 \times \frac{\text{Electronic gear B}}{\text{Electronic gear A}} = \frac{\text{Ball screw lead}}{\text{Minimum travel amount}} \times \text{Gear ratio}$$

$$\text{In this example: } 1000 \times \frac{\text{Electronic gear B}}{\text{Electronic gear A}} = \frac{12 \text{ mm}}{0.01 \text{ mm}} \times 1$$

$$\text{Result: } \frac{\text{Electronic gear B}}{\text{Electronic gear A}} = \frac{12}{10}$$

Therefore, the electronic gear A and B are 10 and 12 respectively, and the resolution will be 1200 P/R.

- Example: Rotary table

Step angle per one rotation	: 360°
Minimum step angle	: 0.01°
Gear ratio	: 10 [Using the geared motor (gear ratio 10:1)]

$$\text{Resolution} = 1000 \times \frac{\text{Electronic gear B}}{\text{Electronic gear A}} = \frac{\text{Minimum step angle}}{\text{Step angle per one rotation}} \times \text{Gear ratio}$$

$$\text{In this example: } 1000 \times \frac{\text{Electronic gear B}}{\text{Electronic gear A}} = \frac{360°}{0.01°} \times \frac{1}{10}$$

$$\text{Result: } \frac{\text{Electronic gear B}}{\text{Electronic gear A}} = \frac{36}{10}$$

Therefore, the electronic gear A and B are 10 and 36 respectively, and the resolution will be 3600 P/R.

10.2 Operating current

The maximum driver operating current can be changed using the "RUN current" parameter. If the load is small and there is an ample allowance for torque, the motor temperature rise can be suppressed by setting a lower operating current.

Related parameters

Parameter name	Description	Setting range	Initial value
RUN current	Sets the motor operating current based on the rated current being 100%.	0 to 1000 (1=0.1%)	1000

Note Excessively low operating current may cause a problem in starting the motor or holding the load in position. Do not lower the operating current more than necessary.

10.3 Standstill current

When the motor stops, the current cutback function will be actuated to lower the motor current to the standstill current. The standstill current is a value in which the set value of the "STOP current" is multiplied by the rated current (100%). The standstill current does not change even when the "RUN current" parameter has been changed.
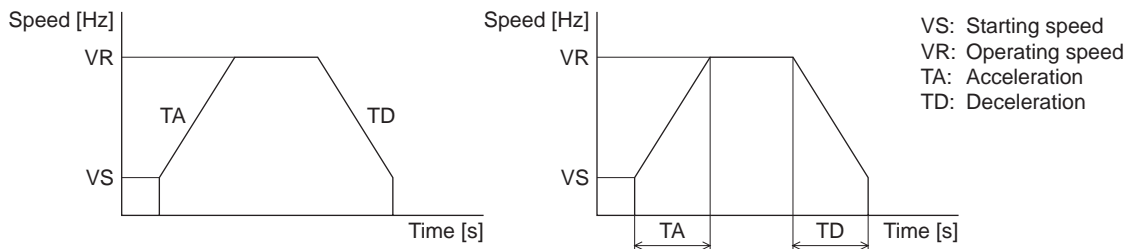
Related parameters

Parameter name	Description	Setting range	Initial value
STOP current	Sets the motor standstill current as a percentage of the rated current, based on the rated current being 100%.	0 to 500 (1=0.1%)	500

10.4 Acceleration/deceleration rate and acceleration/deceleration time

■ Acceleration/deceleration unit

Set the acceleration/deceleration unit using the "acceleration/deceleration unit" parameter.
Acceleration/deceleration rate (ms/kHz) or acceleration/deceleration time (s) can be set.

• Acceleration/deceleration unit: ms/kHz   • Acceleration/deceleration unit: s

VS: Starting speed
VR: Operating speed
TA: Acceleration
TD: Deceleration

Related parameter

Parameter name	Description	Setting range	Initial value
Acceleration/deceleration unit	Set the acceleration/deceleration unit.	0: ms/kHz 1: s	0

■ Common setting and separate setting of the acceleration/deceleration

The acceleration/deceleration for positioning operation or continuous operation can be set as follows using the "acceleration/deceleration type" parameter:
Separate: The acceleration/deceleration set under the applicable operation data No. will be followed.
Common: The setting of the "common acceleration" and "common deceleration" parameter will be followed.

Related parameter

Parameter name	Description	Setting range	Initial value
Acceleration/deceleration type	Sets whether to use the common acceleration/deceleration or the acceleration/deceleration specified for the operation data.	0: Common 1: Separate	1

Note
• When performing linked operation, the acceleration/deceleration for the starting linked operation data No. is applied even when the "acceleration/deceleration type" parameter is set to "separate".
• See p.77 for the acceleration/deceleration when performing variable speed operation.

10.5 Smooth drive

You can achieve lower vibration and smoother movement using the smooth drive function.
You may feel vibration in the low speed range when this function is set to "disable." Set the function to "enable" under normal conditions of use.

Related parameter

| Parameter name	Description	Setting range	Initial value
Smooth drive	Sets whether to enable or disable smooth drive.	0: Disable 1: Enable	1

10.6 Speed filter

The motor response can be adjusted by setting the "speed filter" parameter when selecting the "speed filter" with the "filter selection" parameter.
When the speed filter level is raised, vibration can be suppressed during low-speed operation, and starting/stopping of the motor will become smooth. Note, however, that an excessively high filter level will result in lower synchronicity with commands. Set an appropriate value according to the specific load and purpose.

Related parameter

Parameter name	Description	Setting range	Initial value
Filter selection	Sets the filter function to adjust the motor response.	0: Speed filter 1: Moving average filter	0
Speed filter	Adjusts the motor response.	0 to 200 ms	1
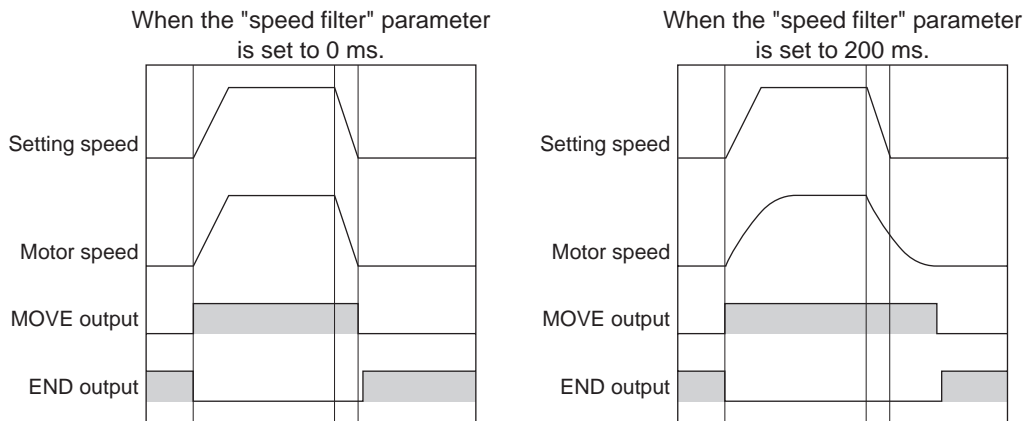
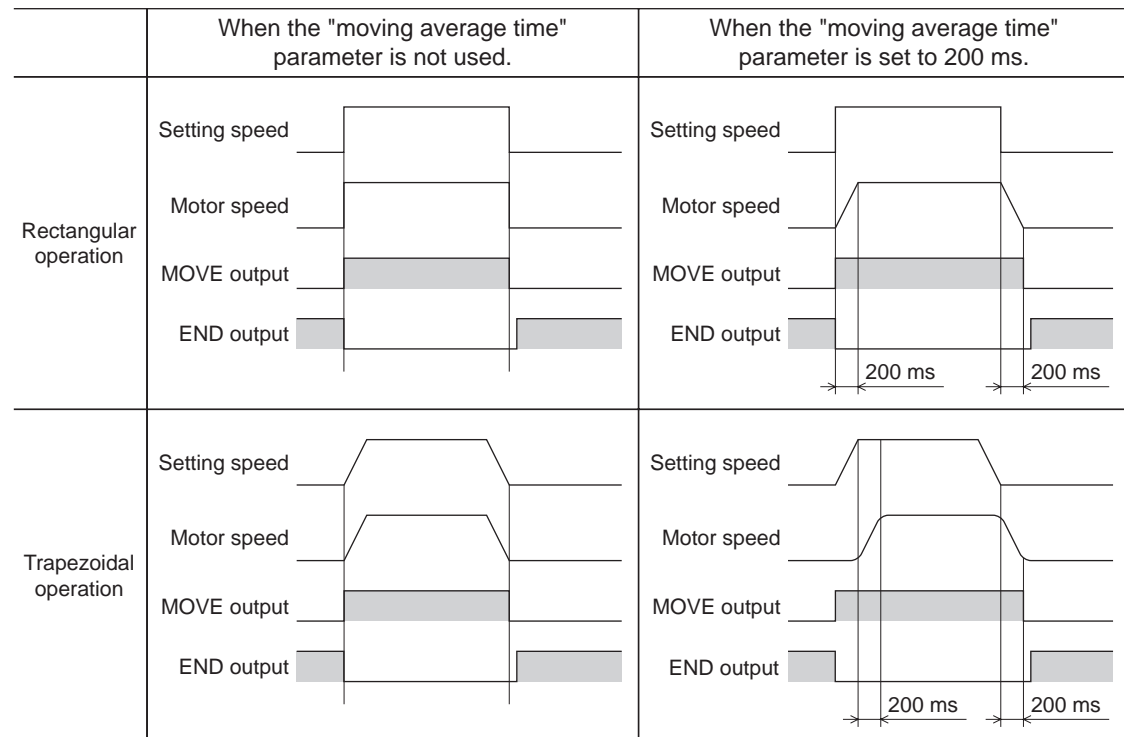| Note | When setting the value of the "speed filter" parameter to "0," this function will be invalid. |

10.7 Moving average filter

The motor response can be adjusted when setting the "Filter selection" parameter to "moving average filter" and setting the value for the "moving average time" parameter. The positioning time can be shortened by suppressing the residual vibration for the positioning operation.
Optimum value for the "moving average time" parameter varies depending on the load or operation condition.
Set a suitable value based on the load or application.

Related parameter

Parameter name	Description	Setting range	Initial value
Filter selection	Sets the filter function to adjust the motor response.	0: Speed filter 1: Moving average filter	0
Moving average time	Sets the time constant for the moving average filter.	1 to 200 ms	1

	When the "moving average time" parameter is not used.	When the "moving average time" parameter is set to 200 ms.
Rectangular operation	Setting speed Motor speed MOVE output END output	Setting speed Motor speed MOVE output END output 200 ms · 200 ms
Trapezoidal operation	Setting speed Motor speed MOVE output END output	Setting speed Motor speed MOVE output END output 200 ms · 200 ms

10.8 Speed error gain

The speed error gain is used to suppress vibration while the motor is operating or accelerating/decelerating.

Related parameter

Parameter name	Description	Setting range	Initial value
Speed error gain 1	This adjusts vibration during constant speed operation.	0 to 500	45
Speed error gain 2	This adjusts vibration during acceleration/deceleration.		

10.9 Control mode

The driver operates in one of two control modes: the normal mode, and the current control mode. If noise is heard during high-speed operation or there is notable vibration, it may be effective to switch to the current control mode. Note, however, that a slight delay may occur in the current control mode, compared to the normal mode, depending on the condition of the load. Keep the driver in the normal mode during normal conditions of use.

Related parameter

Parameter name	Description	Setting range	Initial value
Control mode	Set the control mode.	0: Normal mode 1: Current control mode	0

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

These items are effective in the current control mode.
Vibration that occurs while the motor is accelerating/decelerating or at standstill can be adjusted to an optimal value.
(The optimal value varies depending on the equipment and operating conditions.)

Related parameter

Parameter name	Description	Setting range	Initial value
Position loop gain	This adjusts the motor response in reaction to the position deviation. When this value is increased, the deviation between the command position and actual position will be small. An excessively high value may increase the motor overshooting or cause motor hunting.	1 to 50	10
Speed loop gain	This adjusts the motor response in reaction to the speed deviation. When this value is increased, the deviation between the command speed and actual speed will be small. An excessively high value may increase the motor overshooting or cause motor hunting.	10 to 200	180
Speed loop integral time constant	This decreases the deviation that cannot be adjusted with the speed loop gain. An excessively high value may slow the motor response. On the other hand, an excessively low value may cause motor hunting.	100 to 2000 (1=0.1 ms)	1000

10.11　Absolute-position backup system

This product can be used in the absolute-position backup mode when connecting an accessory battery set **BAT01B** (sold separately). Since the absolute position can be kept during an electrical outage or after turning off the power, the return-to-home operation is not required when the power is turned on. Refer to p.171 for accessory.

Related parameter

Parameter name	Description	Setting range	Initial value
Absolute-position backup system	Sets enable or disable of the absolute-position backup system.	0: Disable 1: Enable	0

■ Setting of the absolute-position backup system

1. Turn off the driver power and 24 VDC power supply, and then connect the battery to the battery connector (CN10).

2. Turn on the driver power and 24 VDC power supply.

3. Set the "absolute-position backup system" parameter to "enable."

4. Turn off the driver power and 24 VDC power supply, and then turn on again.

5. Since the "absolute position error alarm" generates at this time, reset the alarm with reference to p.158.

6. Perform the return-to-home operation or P-PRESET input.

Note
- Do not turn off the 24 VDC power supply before the return-to-home operation or P-PRESET input is completed. The "absolute position error alarm" may generate when turning on the 24 VDC power supply next time.
- Even when the absolute-position backup system is used, the absolute position may be lost if the motor cable is disconnected. If this occurs, turn off the main power and 24 VDC power supply, disconnect the battery, and then set up again following above steps.

■ Specification of the absolute-position backup system

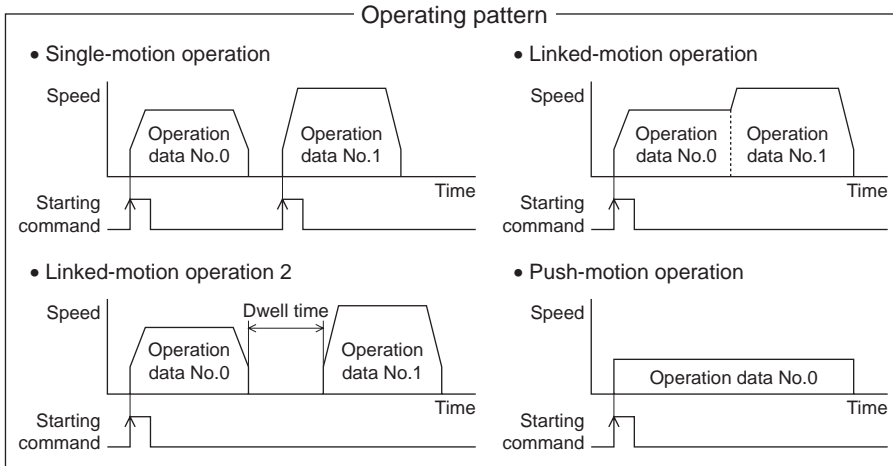|	
Data retention period	15 days [At an ambient temperature of 20 °C (68 °F), fully charged, motor standstill]
Charging time	32 hours [At an ambient temperature of 20 °C (68 °F)]
Operation range of multi-rotation	−167,772 to +167,772 revolutions

11 Operation

This chapter explains the types of operation and timing charts.

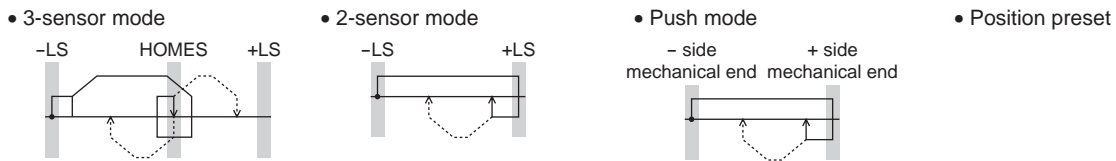## Operation

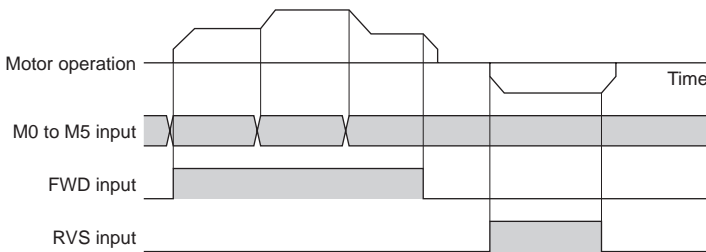[Setting by operation data and parameters]

Positioning operation

Operating pattern

- Single-motion operation

Speed

Operation data No.0 | Operation data No.1

Time

Starting command

- Linked-motion operation 2

Speed

Dwell time

Operation data No.0 | Operation data No.1

Time

Starting command

- Linked-motion operation

Speed

Operation data No.0 | Operation data No.1

Time

Starting command

- Push-motion operation

Speed

Operation data No.0

Time

Starting command

+

Starting method

- Data number selecting operation
- Direct positioning operation
- Sequential positioning operation

Return-to-home operation

- 3-sensor mode

−LS   HOMES   +LS

- 2-sensor mode

−LS   +LS

- Push mode

− side mechanical end   + side mechanical end

- Position preset

Continuous operation

Motor operation

Time

M0 to M5 input

FWD input

RVS input

Other operations

- JOG operation
- Automatic return operation

Function

[Setting by parameters]

- I/O
  - Input logic level
  - STOP input action
  - Overtravel action
- I/O function
  - Input function
  - Input logic level
  - Output function

- Motor function
  - Operating current
  - Standstill current
  - Speed filter
  - Moving average filter
- I/O function (RS-485)
  - Input function
  - Output function

- Operation function
  - Acceleration/deceleration type
  - Acceleration/deceleration unit
  - JOG operation
  - Automatic return operation
- Alarm/warning
  - Alarm detection
  - Warning detection

- Return-to-home function
  - Home position offset
  - External sensor signal detection
  - Return-to-home speed
  - Return-to-home starting direction
- Coordination setting
  - Resolution (Electronic gear)
  - Wrap function
  - Motor rotation direction

11.1 Positioning operation

Positioning operation is one in which motor operating speed, position (travel amount) and other items are set as operation data and then executed. When the positioning operation is executed, the motor begins at the starting speed and accelerates until the operating speed is reached. Then, once the operating speed is reached, that speed is maintained. The motor decelerates when the stopping position approaches, and finally comes to a stop.
The operation function can also be set in operation data. The operation function is how to operate consecutive operation data (example: operation data No.0, No.1, No.2).

■ Operation data

The following data are the operation data for positioning operation.

Name	Description	Setting range	Initial value
Position	Position (distance) for positioning operation.	−8,388,608 to +8,388,607 step	0
Operating speed	Operating speed in positioning operation.	0 to 1,000,000 Hz	1000
Acceleration	Acceleration rate or acceleration time in positioning operation.	1 to 1,000,000 (1=0.001 ms/kHz or 1=0.001 s)	1000
Deceleration	Deceleration rate or deceleration time in positioning operation.		
Operation mode	Selects how to specify the position (travel amount) in positioning operation.	0: Incremental (INC) 1: Absolute (ABS)	0
Operation function	Selects how to operate consecutive operation data.	0: Single-motion 1: Linked-motion 2: Linked-motion 2 3: Push-motion	0
Dwell time	Dwell time to be used in linked-motion operation 2.	0 to 50000 (1=0.001 s)	0
Push current	Current value of push-motion operation.	0 to 500 (1=0.1%)	200
Sequential positioning	Sets enable or disable sequential positioning operation.	0: Disable 1: Enable	0

● Position, operating speed, acceleration, deceleration

The acceleration/deceleration for positioning operation can be set as follows using the "acceleration/deceleration type" parameter:
Separate: The acceleration/deceleration set under the applicable operation data No. will be followed. (Each 64 data for acceleration and deceleration)
Common: The setting of the "common acceleration" and "common deceleration" parameter will be followed. (Each 1 data for acceleration and deceleration)

When the starting speed < operating speed
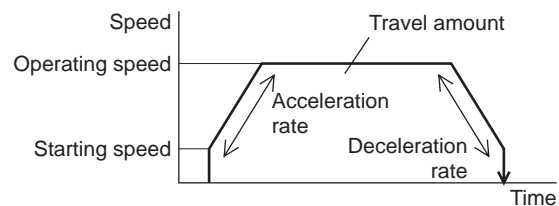
When the starting speed ≥ operating speed

● Operation modes

The following two operation modes are available:

Absolute (ABS) mode

The position (distance) from home is set [Absolute positioning].

Example: When positioning operation is performed with setting the starting point to 1000 and setting the destination to +3000 and −3000
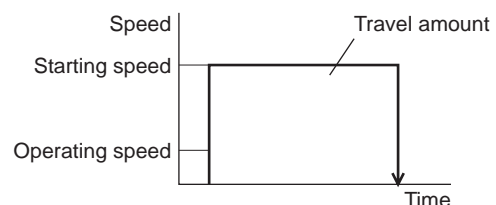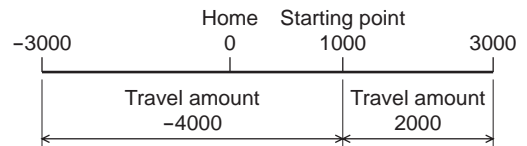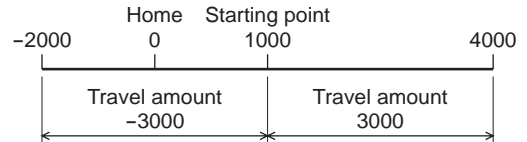
Incremental (INC) mode

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

Example: When positioning operation is performed with setting the starting point to 1000 and setting the destination to +3000 and −3000

● Operation function, Dwell time

The following four operation function are available:

Name	Description	Ref.
Single-motion	A single operation data set is executed.	P.60
Linked-motion	Multiple sets of operation data are linked to perform multi-variable speed operation	P.61
Linked-motion2	Dwell time (stop waiting time) can be set between operation data. Operation data whose rotation direction is different can also be linked.	P.62
Push-motion	This is an operation of continuously applying pressure on the load when pressing against the load during positioning operation.	P.65

■ Starting method of positioning operation

The following three types are available in the starting method.

Name	Description
Data number selecting operation	When the START input is turned ON with selecting the operation data No. by a combination of the M0 to M5 inputs, the positioning operation will perform.
Direct positioning operation	When any of the MS0 to MS5 inputs is turned ON, the positioning operation corresponding to the input data No. will perform.
Sequential positioning operation	Positioning operation is performed to the next operation data No. every time a SSTART input signal is input.

● Data number selecting operation

Select an operation data based on a combination of ON/OFF status of the M0 to M5 inputs. See p.39 for details.

Operation data No.	M5	M4	M3	M2	M1	M0
0	OFF	OFF	OFF	OFF	OFF	OFF
1	OFF	OFF	OFF	OFF	OFF	**ON**
2	OFF	OFF	OFF	OFF	**ON**	OFF
•	•	•	•	•	•	•
•	•	•	•	•	•	•
•	•	•	•	•	•	•
61	**ON**	**ON**	**ON**	**ON**	OFF	**ON**
62	**ON**	**ON**	**ON**	**ON**	**ON**	OFF
63	**ON**	**ON**	**ON**	**ON**	**ON**	**ON**

Operating method

① Check the READY output is ON.

② Select the operation data No. by a combination of the M0 to M5 inputs and turn the START input ON.

③ The motor starts positioning operation.

④ Check that the READY output has been turned OFF and turn the START input OFF.

⑤ When the positioning operation is completed, the READY output will be turned ON.

∗ In direct I/O, turn the START input ON after setting the M0 to M5 inputs. In network I/O, the operation will be performed even when turning the M0 to M5 inputs and the START input ON simultaneously.

- Direct positioning operation

When any of the MS0 to MS5 inputs is turned ON, the positioning operation corresponding to the input data No. will perform. Since the positioning operation is enabled by turning any of the MS0 to MS5 inputs ON, you can save the step of selecting the operation data No.

The operation data assigning to the MS0 to MS5 inputs will be set by parameters.

Related parameters

Parameter name	Description	Setting range	Initial value
MS0 operation No. selection	Sets the operation data No. corresponding to MS0 to MS5 input.	0 to 63	0
MS1 operation No. selection			1
MS2 operation No. selection			2
MS3 operation No. selection			3
MS4 operation No. selection			4
MS5 operation No. selection			5

Operating method

① Check the READY output is ON.

② Turn the MS0 input ON.

③ The motor starts positioning operation.

④ Check that the READY output has been turned OFF and turn the MS0 input OFF.

⑤ When the positioning operation is completed, the READY output will be turned ON.
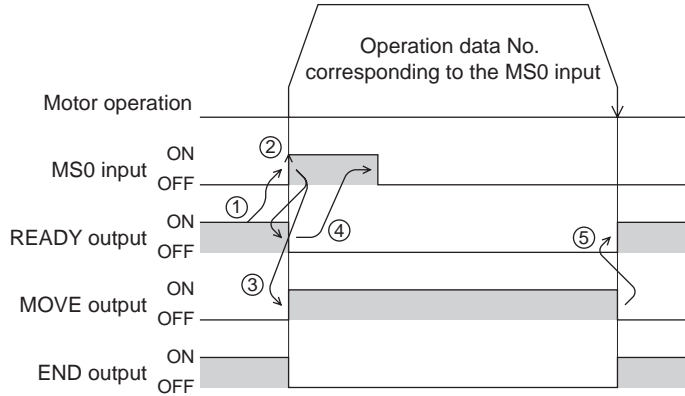
- Sequential positioning operation

In sequential positioning operation, whenever turning the SSTART input ON, the positioning operation for the following operation data No. will be performed.

This function is useful when multiple positioning operations must be performed sequentially, because there is no need to select each data number.

When the "sequential positioning" of operation data is executed up to the data No. set to "disable", the operation returns to the original data No. that was selected before starting the sequential positioning operation. And the sequential positioning operation will start again.

If the starting point for the sequential positioning operation is changed using the M0 to M5 inputs or the MS0 to MS5 inputs, multiple sequential positioning operations can be set. It is convenient for setting a different operating pattern for each component or each process of works.

When the operating pattern is one type

① The positioning operation for the operation data No.0 is performed by turning the SSTART input ON.

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

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

④ After the operation ③ is completed, when turning the SSTART input ON again, the positioning operation will be performed by returning to the operation data No.0 because the sequential positioning for the operation data No.3 has been set to "disable."

- Setting example

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

When the operating patterns are multiple

① After selecting the operation data No.3 that is the starting point for the sequential positioning operation, the positioning operation will be performed by turning the START input ON.

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

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

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

⑤ After the operation ④ is completed, the positioning operation is performed by selecting the operation No.7 and turning the START input ON.
The operation data No.7 becomes a starting point for a new sequential positioning operation.

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

⑦ When turning the SSTART input ON again after the operation ⑥ is completed, the positioning operation will be performed by returning to the operation data No.7 because the sequential positioning for the operation data No.9 has been set to "disable."

• Setting example

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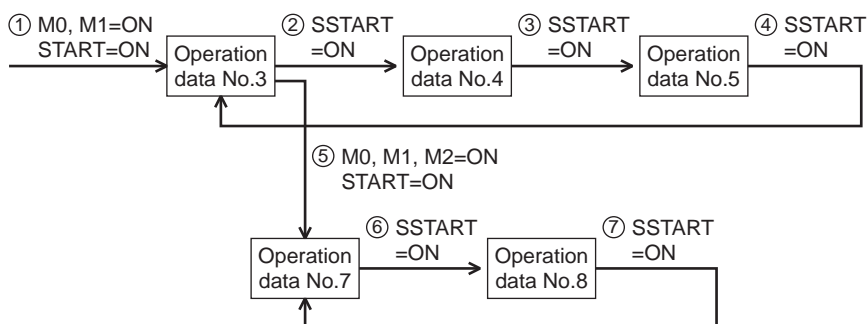
Operating method

① Check the READY output is ON.

② Turn the SSTART input ON.

③ The motor starts positioning operation.

④ Check that the READY output has been turned OFF and turn the SSTART input OFF.

⑤ When the positioning operation is completed, the READY output will be turned ON.
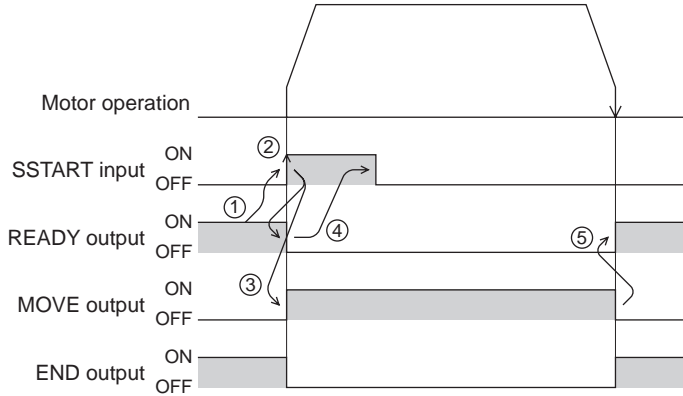
Key points about sequential positioning operation

When performing any of the following operations while sequential positioning operation is performed, the starting point for sequential positioning will be changed to the operation data No.0. And the current operation data No. is set to "−1".

• When the 24 VDC power supply is turned ON
• When operations other than the positioning operation are performed (return-to home operation, continuous operation, etc.)
• When an alarm is generated and reset
• When the STOP input is turned ON
• When the command turning the excitation OFF is input (When the FREE input is turned ON or the C-ON input is turned OFF)
• When the P-PRESET is executed
• When a configuration is executed

Note Set "enable" the "sequential positioning" even when sequential positioning is performed by the operation data being set to "Linked-motion" or "Linked-motion2" in the "operation function."

■ Operation function

• Single-motion

The positioning operation is performed only once using a single operation data set.

Example of single-motion operation

Operation data	Position	Operating speed	Acceleration	Deceleration	Operation mode	Operation function	Dwell time	Push current	Sequential positioning
No.1	5000	5000	1000	1000	INC	Single-motion	Not used	Not used	Not used
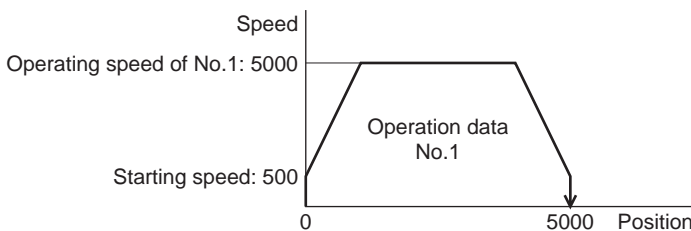
Operation example

Operating method

① Check the READY output is ON.

② Select the operation data No.1 by turning the M0 input ON and turn the START input ON.

③ The motor starts the positioning operation for the operation data No.1.

④ Check that the READY output has been turned OFF and turn the START input OFF.

⑤ When the positioning operation is completed, the READY output will be turned ON.

* In direct I/O, turn the START input ON after setting the M0 to M5 inputs. In network I/O, the operation will be performed even when turning the M0 to M5 inputs and the START input ON simultaneously.

- Linked-motion operation

  When the "operation function" is set to "linked-motion" using operation data, positioning operation based on the next data number will be performed without stopping the motor.

  If operation data includes data for which "single-motion" or "push-motion" is set, the motor will stop after the positioning with respect to the "single" or "push-motion" operation data is completed.

  A maximum of 4 operation data can be linked. Note that only operation data of the same direction can be linked.

  | Note | • Multiple operation data of different directions cannot be linked. An operation data error alarm will generate during operation.
  • Up to four sets of operation data can be linked. When combining the linked-motion operation and the linked-motion operation 2, make sure the total number of linked operation data sets does not exceed four. When linked-motion operation is performed with five or more sets of operation data linked together, an operation data error alarm will generate upon start of operation.
  • No.0 will not be linked even when "linked-motion" is set for data No.63, because the operation pertaining to No.63 will be processed independently.
  • The acceleration/deceleration in linked-motion operation corresponds to the acceleration/deceleration specified for the operation data No. with which the linked-motion operation is started.
  • When the operation data being set to "push-motion" is linked, the push-motion operation is performed at starting speed.

Example of linked-motion operation
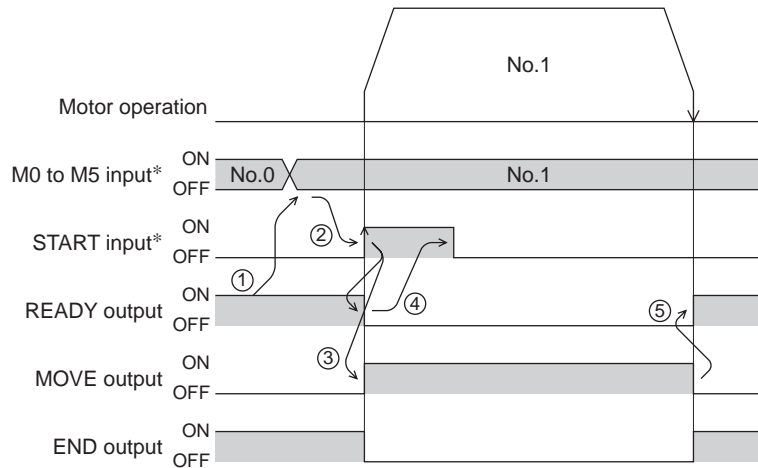
Operation data	Position	Operating speed	Acceleration	Deceleration	Operation mode	Operation function	Dwell time	Push current	Sequential positioning
No.1	5000	5000	1000	1000	INC	Linked-motion	Not used	Not used	Not used
No.2	20000	10000	Not used	Not used	INC	Single-motion	Not used	Not used	Not used
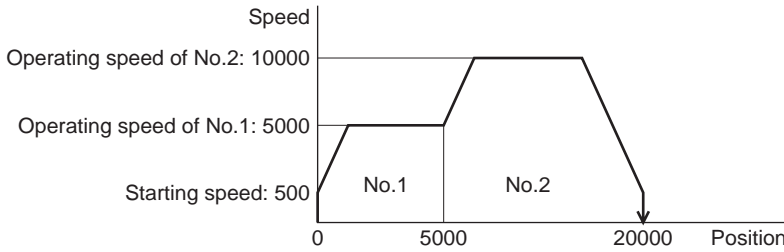
Operation example

Operating method

① Check the READY output is ON.

② Select the operation data No.1 by turning the M0 input ON and turn the START input ON.

③ The motor starts the positioning operation in which the operation data No.1 and No.2 are linked.

④ Check that the READY output has been turned OFF and turn the START input OFF.

⑤ When the positioning operation is completed, the READY output will be turned ON.

∗ In direct I/O, turn the START input ON after setting the M0 to M5 inputs. In network I/O, the operation will be performed even when turning the M0 to M5 inputs and the START input ON simultaneously.

- Linked-motion operation 2

  By setting the "operation function" of operation data to "Linked-motion2," an operation data whose rotation direction is different can be linked. In this case, the system stops for the dwell time after each positioning operation, and then performs operation according to the next operation data. If operation data includes data for which "single-motion" or "push-motion" is set, the motor will stop after the positioning with respect to the "single" or "push-motion" operation data is completed.

Note	• Up to four sets of operation data can be linked. When combining the linked-motion operation and the linked-motion operation 2, make sure the total number of linked operation data sets does not exceed four. When linked-motion operation is performed with five or more sets of operation data linked together, an operation data error alarm will generate upon start of operation.
	• No.0 will not be linked even when "linked-motion2" is set for data No.63, because the operation pertaining to No.63 will be processed independently.

Example of linked-motion operation 2
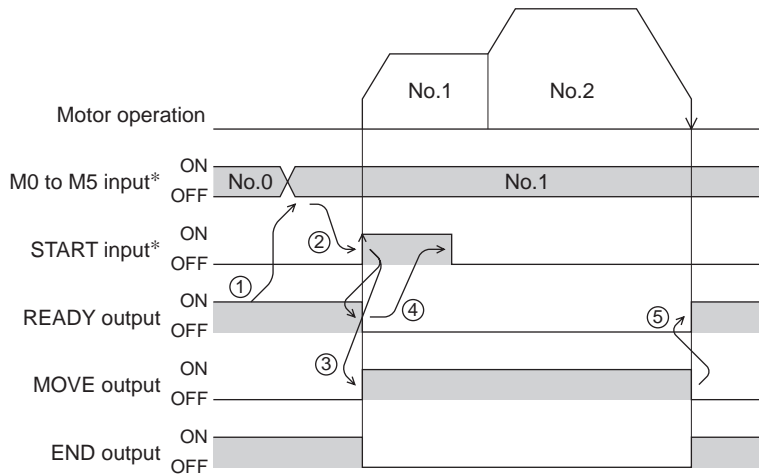
Operation data	Position	Operating speed	Acceleration	Deceleration	Operation mode	Operation function	Dwell time	Push current	Sequential positioning
No.1	5000	5000	1000	1000	INC	Linked-motion2	1000	Not used	Not used
No.2	−3000	3000	1000	1000	INC	Single-motion	0	Not used	Not used

Operation example
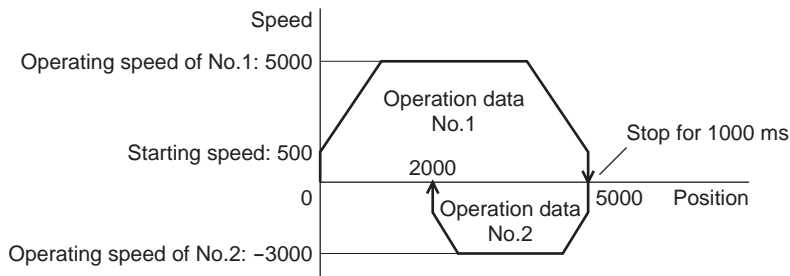
Operating method

① Check the READY output is ON.

② Select the operation data No.1 by turning the M0 input ON and turn the START input ON.

③ The motor starts the positioning operation for the operation data No.1.

④ Check that the READY output has been turned OFF and turn the START input OFF.

⑤ When the positioning operation ③ is completed, the MOVE output will be turned OFF.

⑥ When the dwell time has passed, the positioning operation for the operation data No.2 will automatically start. At the same time, the MOVE output will be turned ON.

⑦ When the positioning operation for the operation data No.2 is completed, the READY output will be turned ON.
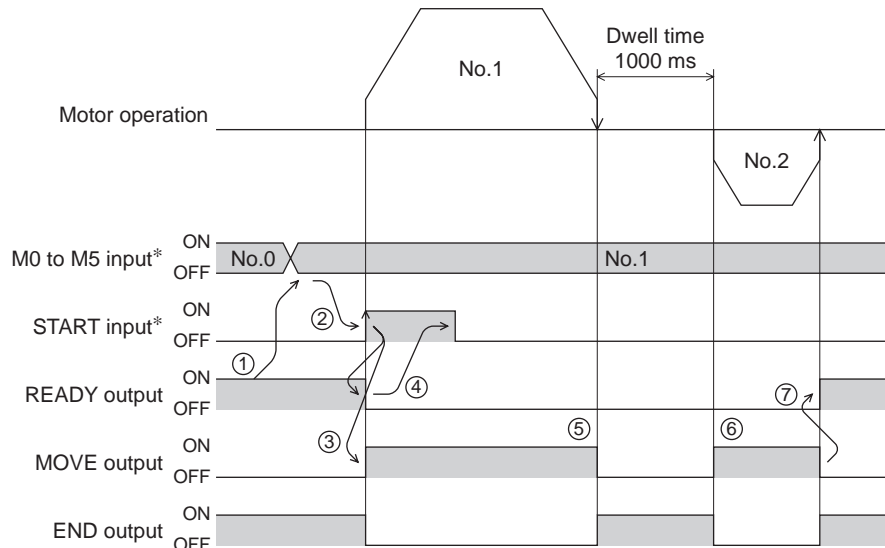
∗ In direct I/O, turn the START input ON after setting the M0 to M5 inputs. In network I/O, the operation will be performed even when turning the M0 to M5 inputs and the START input ON simultaneously.

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

Operation data	Position	Operating speed	Acceleration	Deceleration	Operation mode	Operation function	Dwell time	Push current	Sequential positioning
No.1	5000	3000	1000	1000	INC	Linked-motion	Not used	Not used	Not used
No.2	10000	5000	Not used	Not used	INC	Linked-motion	Not used	Not used	Not used
No.3	25000	7000	Not used	Not used	INC	Linked-motion2	1000	Not used	Not used
No.4	0	7000	1000	1000	ABS	Single-motion	Not used	Not used	Not used

Operation example

Speed

Operating speed of No.3: 7000

Operating speed of No.2: 5000

Operating speed of No.1: 3000

Starting speed: 500

| No.1 | No.2 | No.3 |

Stop for 1000 ms

0   5000   15000   40000   Position

No.4

Operating speed of No.4: −7000

Operating method

① Check the READY output is ON.

② Select the operation data No.1 by turning the M0 input ON and turn the START input ON.

③ The motor starts the positioning operation in which the operation data from No.1 to No.3 are linked.

④ Check that the READY output has been turned OFF and turn the START input OFF.

⑤ When the positioning operation ③ is completed, the MOVE output will be turned OFF.

⑥ When the dwell time has passed, the positioning operation for the operation data No.4 will automatically start. At the same time, the MOVE output will be turned ON.

⑦ When the positioning operation for the operation data No.4 is completed, the READY output will be turned ON.

Motor operation

No.1 | No.2 | No.3

Dwell time 1000 ms

No.4

M0 to M5 input∗   ON / OFF   No.0   No.1

START input∗   ON / OFF

READY output   ON / OFF
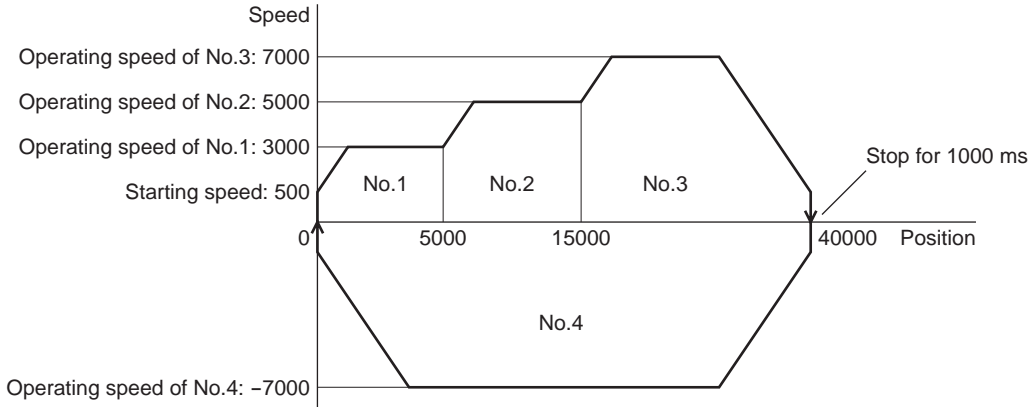
MOVE output   ON / OFF

END output   ON / OFF

∗ In direct I/O, turn the START input ON after setting the M0 to M5 inputs. In network I/O, the operation will be performed even when turning the M0 to M5 inputs and the START input ON simultaneously.

● Push-motion operation

When the "operation function" is set to "push-motion," the motor performs an operation of continuously applying pressure on the load when pressing against the load.

In push-motion operation, the motor performs constant speed operation at the operating speed of the selected operation data No. but the acceleration/deceleration will not be applied.

The motor becomes "push-motion" status when pressing against the load, and the TLC output and READY output are turned ON. The set current value of push-motion operation is applied to the motor current.

When the operation was completed with non-push-motion status, the motor stops, and the END output and READY output are turned ON. The set current of push-motion operation is applied to the motor current at standstill.

When the STOP input is turned ON, the motor stops, and the END output and READY output are turned ON. The STOP current is applied to the motor current at standstill.

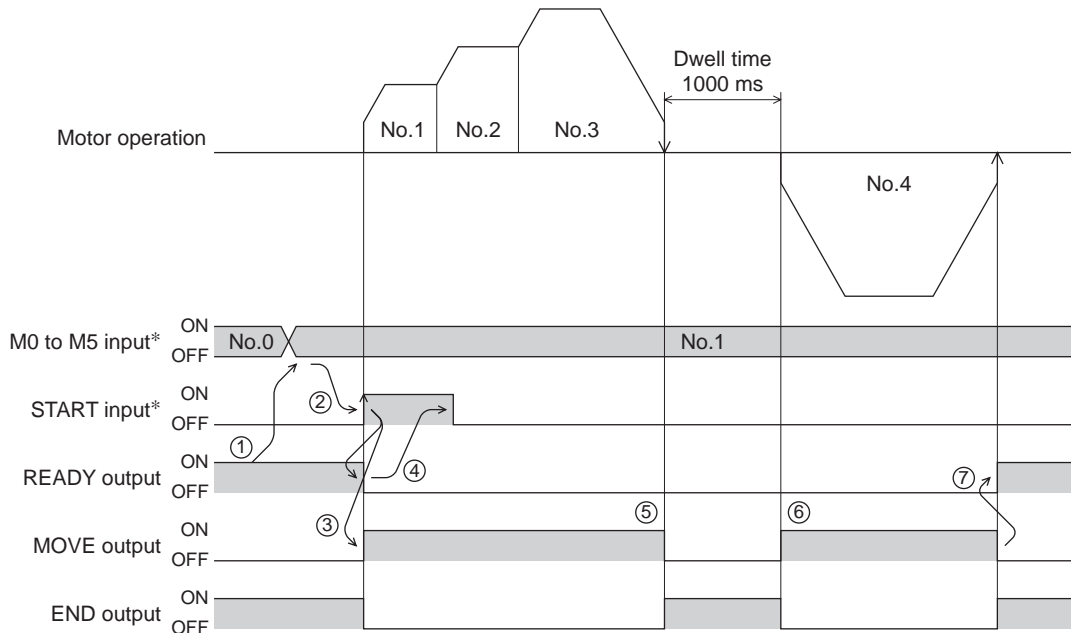| Note	• Regardless of resolution, the maximum speed of push-motion operation is 30 r/min. If the push-motion operation is started by setting higher speed than 30 r/min, an operation data error alarm will generate.
	• Do not perform push-motion operation with geared types. Doing so may cause damage to the motor or gearhead.

Example of push-motion operation

Operation data	Position	Operating speed	Acceleration	Deceleration	Operation mode	Operation function	Dwell time	Push current	Sequential positioning
No.1	5000	500	Not used	Not used	INC	Push-motion	Not used	500	Not used

Operation example (when it had pressed against the load)
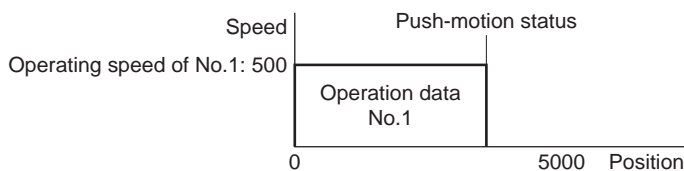
Operating method

① Check the READY output is ON.

② Select the operation data No.1 by turning the M0 input ON and turn the START input ON.

③ The motor starts the positioning operation for the operation data No.1.

④ Check that the READY output has been turned OFF and turn the START input OFF.

⑤ When the motor becomes "push-motion" status, the TLC output will be turned ON and then the READY output will be turned ON.

* In direct I/O, turn the START input ON after setting the M0 to M5 inputs. In network I/O, the operation will be performed even when turning the M0 to M5 inputs and the START input ON simultaneously.

Operation example (when it had not pressed against the load)

Speed

Operating speed of No.1: 500

Operation data No.1

0   5000   Position

Operating method

① Check the READY output is ON.

② Select the operation data No.1 by turning the M0 input ON and turn the START input ON.

③ The motor starts the positioning operation for the operation data No.1.

④ Check that the READY output has been turned OFF and turn the START input OFF.

⑤ When the motor reaches to the target position, the operation will be stopped and the READY output will be turned ON. Since the motor did not become "push-motion" status, the TLC output remains OFF.

∗ In direct I/O, turn the START input ON after setting the M0 to M5 inputs. In network I/O, the operation will be performed even when turning the M0 to M5 inputs and the START input ON simultaneously.

Example of push-motion operation;
When combining the linked-motion operation and the push-motion operation

Operation data	Position	Operating speed	Acceleration	Deceleration	Operation mode	Operation function	Dwell time	Push current	Sequential positioning
No.1	5000	5000	1000	1000	INC	Linked-motion	Not used	Not used	Not used
No.2	5000	500	Not used	Not used	INC	Push-motion	Not used	500	Not used

Operation example

Speed

Operating speed of No.1: 5000

Push-motion status

Operating speed of No.2: 500

No.1   No.2

0   5000   10000   Position

Operating method

① Check the READY output is ON.

② Select the operation data No.1 by turning the M0 input ON and turn the START input ON.

③ The motor starts the positioning operation in which the operation data No.1 and No.2 are linked.

④ Check that the READY output has been turned OFF and turn the START input OFF.

⑤ When the motor becomes "push-motion" status, the TLC output will be turned ON and then the READY output will be turned ON.

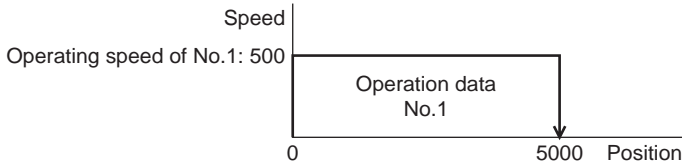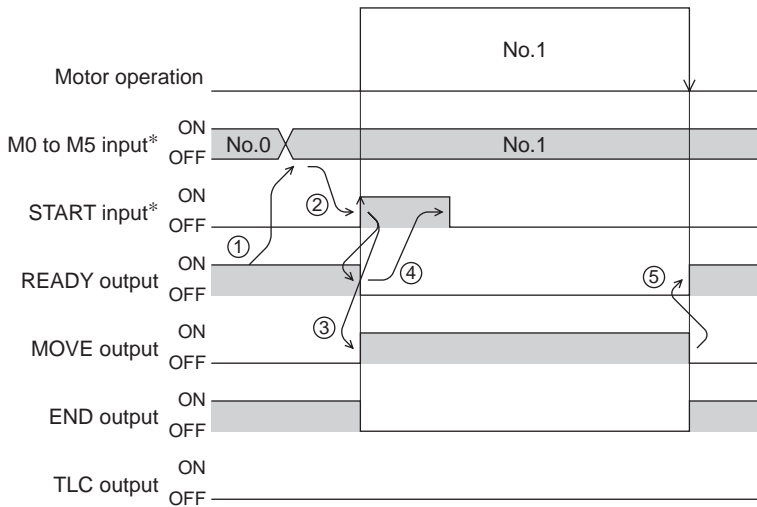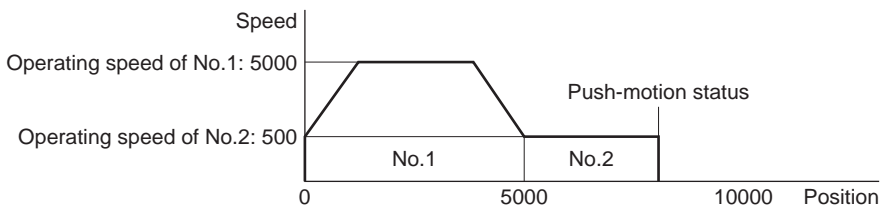* In direct I/O, turn the START input ON after setting the M0 to M5 inputs. In network I/O, the operation will be performed even when turning the M0 to M5 inputs and the START input ON simultaneously.

11.2 Return-to-home operation

Return-to-home is an operation in which the reference point of positioning (mechanical home position) is detected automatically. Return-to-home operation is performed to return to the home position from the current position when the power supply is turned on or the positioning operation is completed.

Return-to-home operation can be performed in the following four modes:

Item	Description	Feature
3-sensor mode	The motor operates at the "operating speed of home-seeking." When the HOME sensor is detected, the motor will stop and the stop position will be the home position.	• 3 external sensors are needed [3] • Operating speed is high (Operating speed of return-to-home)
2-sensor mode	The motor operates at the "starting speed of home-seeking." When the limit sensor is detected, the motor will rotate in the reverse direction and escape from the limit sensor. After escaping from the limit sensor, the motor will move 200 steps and stop, and then the stop position will be the home position.[2]	• 2 external sensors are needed • Operating speed is low (Starting speed of return-to-home)
Push-mode [1]	The motor operates at the "starting speed of home-seeking." When the moving part for the motor is pressed against a mechanical stopper etc., the motor will rotates in the reverse direction. After reversing, the motor will move 200 steps and stop, and then the stop position will be the home position. [2]	• No external sensor is needed • Operating speed is low (Starting speed of return-to-home)
Position preset	When executing the P-PRESET input at the position that the motor stops, the command position will be the value of the "preset position" parameter. The home position can be set to any position.	• No external sensor is needed • The home position can be set to any position.

*1 Do not perform push-mode return-to-home operation for geared motors.

*2 It moves 200 steps regardless of resolution. Therefore, the actual travel distance may vary according to resolution.

*3 In the case of a rotating mechanism, even when using one external sensor, the home position can be detected.

■ Additional function

Item	2-sensor mode 3-sensor mode Push-mode	Position preset	Related parameter
Home offset	Possible	Not possible	• Position offset of home-seeking
External sensor (signal) detection	Possible	Not possible	• SLIT detection with home-seeking • TIM signal detection with home-seeking
Command position after returning to home	The position becomes "0"	Any position	• Preset position

● Home offset

This is a function to perform positioning operation of the offset amount set by the parameter after return-to-home operation and to set the stop position to the home position. The position set by the home offset is called "electrical home" in distinction from the usual home position.

If the amount of offset from mechanical home is "0," the mechanical home and electrical home will become the same.
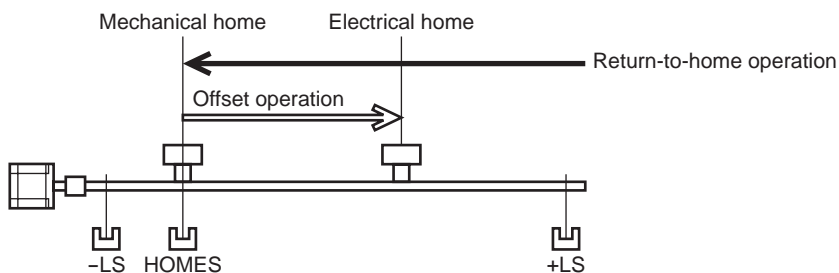
● Detecting the external sensor (signal)

When detecting the home, use of the SLIT input and/or TIM signal will increase the accuracy of home detection.

Note | When the TIM output is used, set the resolution to be an integral multiple of 50.

● Command position after returning to home

When executing the P-PRESET input at the position that the motor stops, the command position will be the value of the "preset position" parameter.

■ Parameters related to return-to-home operation

Name	Description	Setting range	Initial value
Home-seeking mode	Set the mode for return-to-home operation.	0: 2-sensor mode 1: 3-sensor mode 2: Push-mode	1
Operating speed of home-seeking	Operating speed for return-to-home operation.	1 to 1,000,000 Hz	1000
Acceleration/deceleration of home-seeking	Acceleration/deceleration rate or acceleration/deceleration time for return-to-home operation.	1 to 1,000,000 (1=0.001 ms/kHz or 1=0.001 s)	1000
Starting speed of home-seeking	Starting speed for return-to-home operation.	1 to 1,000,000 Hz	500
Position offset of home-seeking	The amount of offset from mechanical home.	−8,388,608 to 8,388,607 step	0
Starting direction of home-seeking	Starting direction for home detection.	0: Negative direction 1: Positive direction	1
SLIT detection with home-seeking	Sets whether or not to concurrently use the SLIT input for return-to-home operation.	0: Disable 1: Enable	0
TIM signal detection with home-seeking	Sets whether or not to concurrently use the TIM signal for return-to-home operation.		

- Operation example (when using 3-sensor mode)

Operating sequence in seeing a time axis
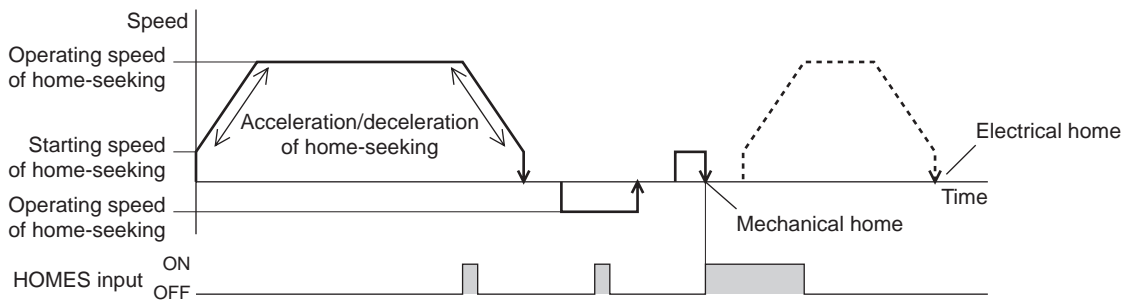
Operating sequence in seeing a travel amount
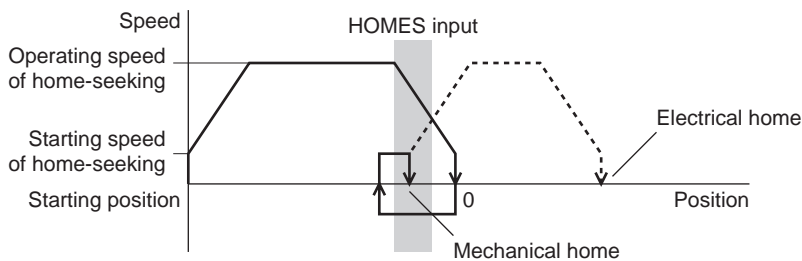
- Operating method

① Check the READY output is ON.

② Turn the HOME input ON.

③ Return-to-home operation will be started.

④ Check that the READY output has been turned OFF and turn the HOME input OFF.

⑤ When return-to-home operation is completed, the HOME-P output will be turned ON.
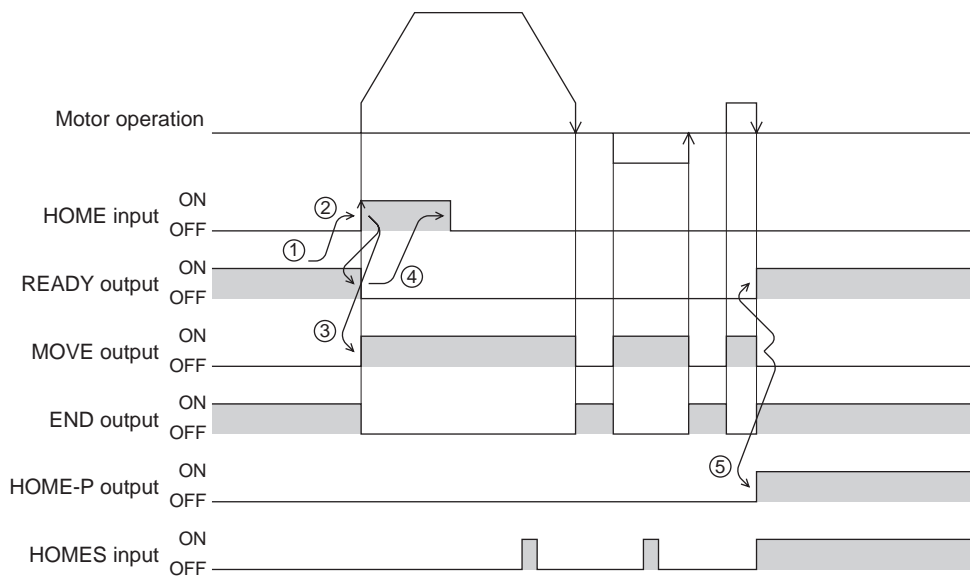
■ **Operation sequence**

● 3-sensor mode

VS: Starting speed of home-seeking
VR: Operating speed of home-seeking
VL: Last speed of return-to-home (When VS < 500 Hz: VS, When VS ≥ 500 Hz: 500 Hz)
- - - Broken line indicates a home offset move.

Starting position of return-to-home operation	Starting direction of return-to-home operation: Positive side	Starting direction of return-to-home operation: Negative side
−LS		
+LS		
HOMES		
Between HOMES and −LS		
Between HOMES and +LS		
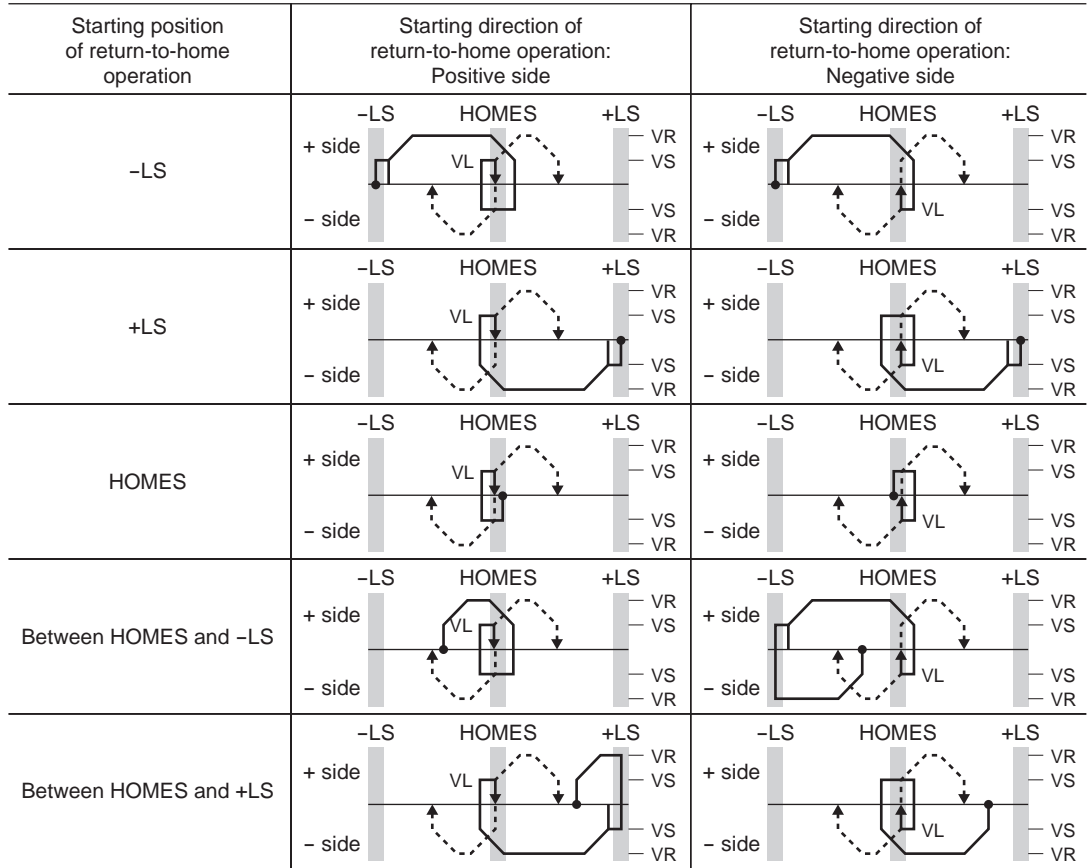
When concurrently using the SLIT input and/or TIM signal

After the HOME sensor is detected, the operation will continue until the external sensor (signal) will be detected.
If the external sensor (signal) is detected while the HOME sensor is ON, the return-to-home operation will complete.

Signal type	Starting direction of return-to-home operation: Positive side	Starting direction of return-to-home operation: Negative side
SLIT input		
TIM signal		
SLIT input and TIM signal		

- 2-sensor mode

  VS: Starting speed of home-seeking
  VR: Operating speed of home-seeking
  VL: Last speed of return-to-home (When VS < 500 Hz: VS, When VS ≥ 500 Hz: 500 Hz)
  - - - Broken line indicates a home offset move.

Starting position of return-to-home operation	Starting direction of return-to-home operation: Positive side	Starting direction of return-to-home operation: Negative side
−LS		
+LS		
Between −LS and +LS		

∗ After pulling out of the limit sensor, the motor will move 200 steps.

When concurrently using the SLIT input and/or TIM signal

When the limit sensor is detected, the motor will rotate in the reverse direction and escape from the limit sensor. After escaping from the limit sensor, the motor will move 200 steps and stop once. Then, the motor operation will continue until the external sensor (signal) will be detected.

When the external sensor (signal) is detected, return-to-home operation will complete.

Signal type	Starting direction of return-to-home operation: Positive side	Starting direction of return-to-home operation: Negative side
SLIT input		
TIM signal		
SLIT input and TIM signal		

∗ After pulling out of the limit sensor, the motor will move 200 steps.

● Push-mode

VS: Starting speed of home-seeking
VR: Operating speed of home-seeking
VL: Last speed of return-to-home (When VS < 500 Hz: VS, When VS ≥ 500 Hz: 500 Hz)
- - - Broken line indicates a home offset move.

Starting position of return-to-home operation	Starting direction of return-to-home operation: Positive side	Starting direction of return-to-home operation: Negative side
– side mechanical end		
+ side mechanical end		
Between mechanical ends		

∗ The motor will move 200 steps from the mechanical end.

When concurrently using the SLIT input and/or TIM signal

When the moving part for the motor is pressed against a mechanical stopper etc., the motor will rotates in the reverse direction. After reversing, the motor will move 200 steps and stop once. Then, the motor operation will continue until the external sensor (signal) will be detected.
When the external sensor (signal) is detected, return-to-home operation will complete.

Signal type	Starting direction of return-to-home operation: Positive side	Starting direction of return-to-home operation: Negative side
SLIT input		
TIM signal		
Between SLIT input and TIM signal		

∗ The motor will move 200 steps from the mechanical end.

Note
- The maximum speed for the push-mode is 30 r/min on the motor output shaft regardless of resolution. Starting return-to-home operation with setting faster speed than 30 r/min may cause damage to the motor or gearhead.
- Do not perform push-mode return-to-home operation for geared motors. Doing so may cause damage to the motor or gearhead.

■ Position preset

When the P-PRESET input is turned ON, the command position is set as the value of the "preset position" parameter. However, the preset will not execute in the following conditions.
- When the motor is operating
- When an alarm is present

- Related parameters

Parameter name	Description	Setting range	Initial value
Preset position	Sets the preset position.	−8,388,608 to 8,388,607 step	0

- Operating method

① Check the READY output is ON.

② Turn the P-PRESET input ON

③ When the driver internal processing is completed, the HOME-P output will be turned ON.

④ Check the HOME-P output has been turned ON, and then turn the P-PRESET input OFF.
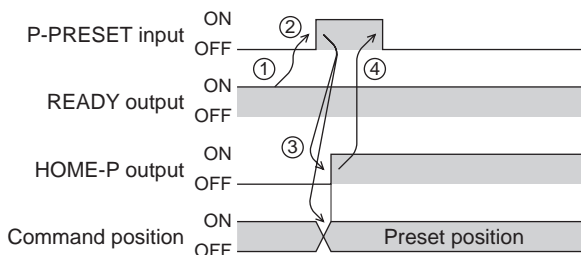
11.3 Continuous operation

The motor operates continuously while the FWD or RVS input is ON.

Operation is performed based on the FWD or RVS input and the operating speed corresponding to the selected operation data No.

When the operation data No. is changed during continuous operation, the speed will change to the speed specified by the new operation data No.

When the FWD or RVS input is turned OFF, the motor will decelerate to a stop. If the signal of the same direction is turned ON again during deceleration, the motor will accelerate and continue operating.

If the FWD and RVS inputs are turned ON simultaneously, the motor will decelerate to a stop.

■ Operation data

Operation data for continuous operation are as follows.

Name	Description	Setting range	Initial value
Operating speed	Operating speed in continuous operation.	1 to 1,000,000 Hz	1000
Acceleration	Acceleration rate or acceleration time in continuous operation.	1 to 1,000,000 (1=0.001 ms/kHz or 1=0.001 s)	1000
Deceleration	Deceleration rate or deceleration time in continuous operation.		
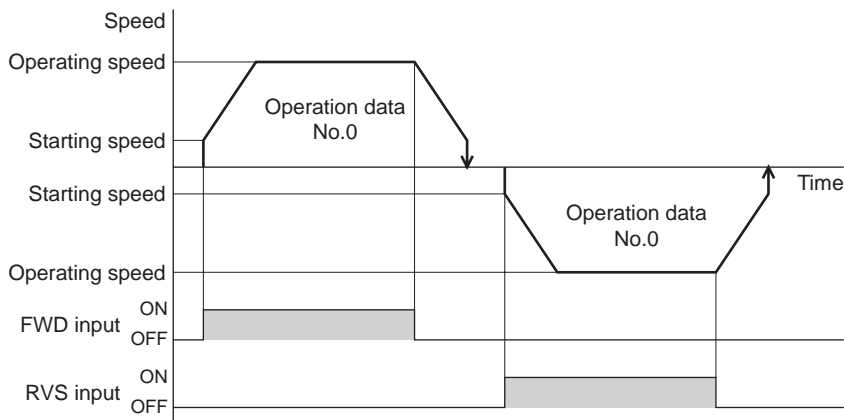
* The acceleration/deceleration for continuous operation can be set as follows using the "acceleration/deceleration type" parameter:
  Separate: The acceleration/deceleration set under the applicable operation data No. will be followed. (Each 64 data for acceleration and deceleration)
  Common: The setting of the "common acceleration" and "common deceleration" parameter will be followed. (Each 1 data for acceleration and deceleration)

■ Starting method of continuous operation

When selecting the operation data No. and turning the FWD input or RVS input ON, continuous operation will be started.

Select an operation data based on a combination of ON/OFF status of the M0 to M5 inputs. See p.39 for details.

Operation data No.	M5	M4	M3	M2	M1	M0
0	OFF	OFF	OFF	OFF	OFF	OFF
1	OFF	OFF	OFF	OFF	OFF	**ON**
2	OFF	OFF	OFF	OFF	**ON**	OFF
•	•	•	•	•	•	•
•	•	•	•	•	•	•
•	•	•	•	•	•	•
61	**ON**	**ON**	**ON**	**ON**	OFF	**ON**
62	**ON**	**ON**	**ON**	**ON**	**ON**	OFF
63	**ON**	**ON**	**ON**	**ON**	**ON**	**ON**

● Operating method

① Check the READY output is ON.

② Select the operation data No. by a combination of the M0 to M5 inputs and turn the FWD input ON.

③ The motor starts continuous operation. The READY output will be turned OFF.

④ Select the operation data No.1 by turning the M0 input ON. The motor accelerates to the operating speed of the operation data No.1.

⑤ Select the operation data No.0 by turning the M0 input OFF. The motor decelerates to the operating speed of the operation data No.0.

⑥ Turn the FWD input OFF.

⑦ The motor will decelerate to a stop and the READY output will be turned ON.
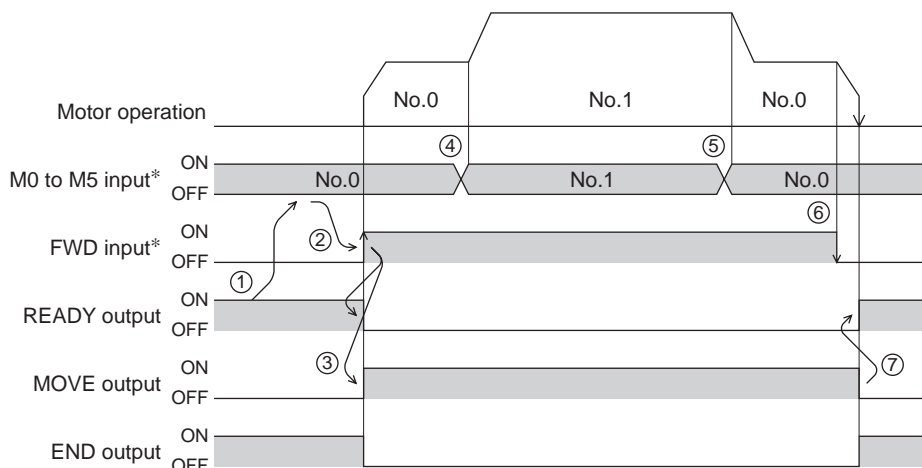
* In direct I/O, turn the FWD input or RVS input ON after setting the M0 to M5 inputs. In network I/O, the operation will be performed even when turning the M0 to M5 inputs and the FWD (RVS) input ON simultaneously.

- Operating method; When combining the FWD input and RVS input

① Check the READY output is ON.

② Select the operation data No. by a combination of the M0 to M5 inputs and turn the FWD input ON.

③ The motor starts continuous operation. The READY output will be turned OFF.

④ Turn the FWD input OFF. The motor will decelerate.

⑤ Turn the FWD input ON while the motor is decelerating. The motor accelerates again.

⑥ Turn the FWD input OFF. The motor will decelerate.

⑦ Turn the RVS input ON while the motor is decelerating. The motor will stop once, and start rotating in the reverse direction.

⑧ When turning the FWD input ON while the RVS input is ON, the motor will decelerate.

⑨ The motor will decelerate to a stop and the MOVE output will be turned OFF.

⑩ When turning both the FWD input and RVS input OFF, the READY output will be turned ON.
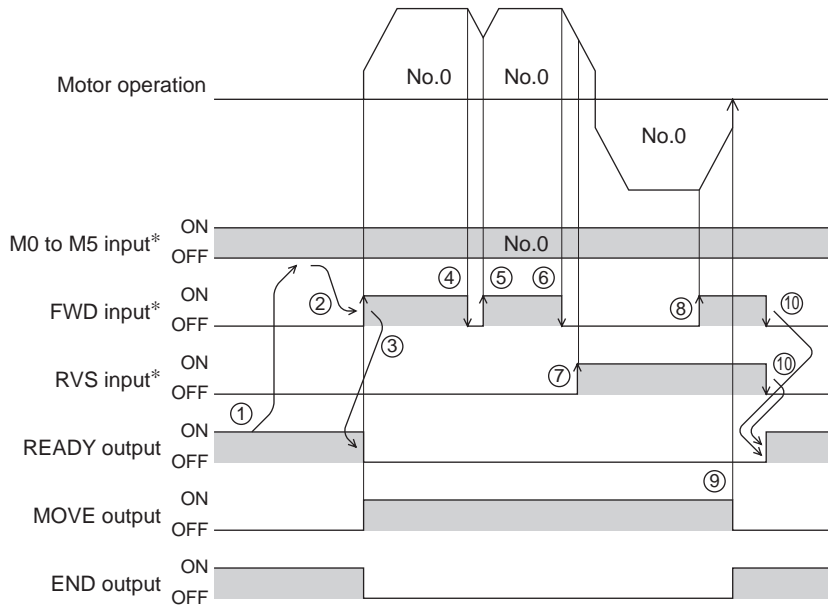
∗ In direct I/O, turn the FWD input or RVS input ON after setting the M0 to M5 inputs. In network I/O, the operation will be performed even when turning the M0 to M5 inputs and the FWD (RVS) input ON simultaneously.

■ **Variable speed operation**

- When acceleration/deceleration is "separate"
  - Acceleration/deceleration unit: ms/kHz
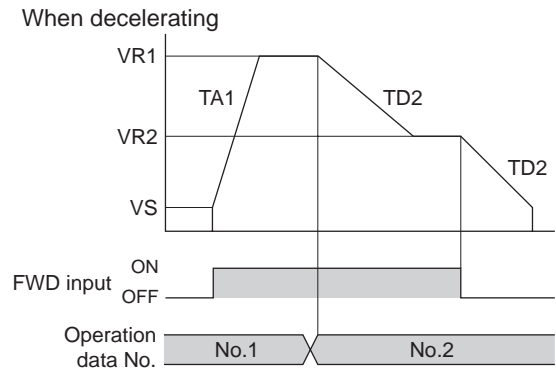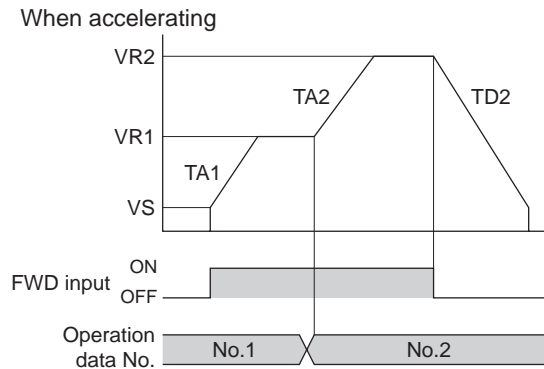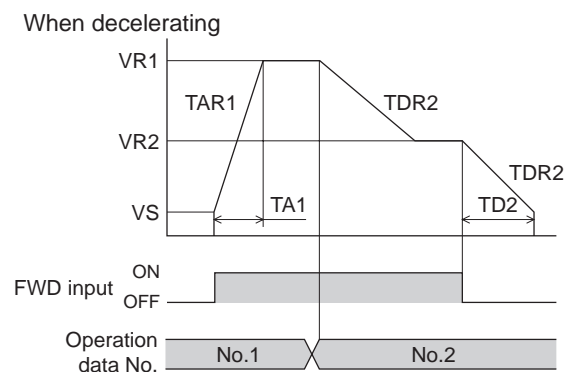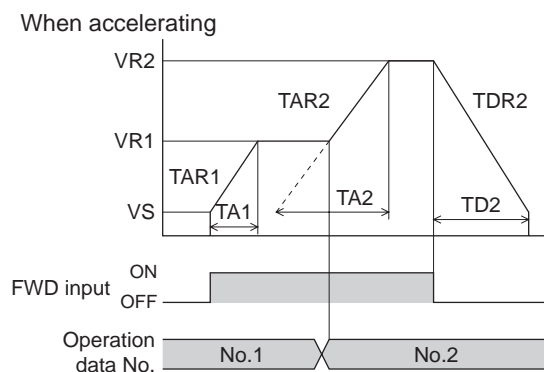
When accelerating

When decelerating

- Acceleration/deceleration unit: s

When accelerating

When decelerating

- Explanation of labels

VS: Starting speed (Hz)
VR1: Operating speed of operation data No.1 (Hz)
VR2: Operating speed of operation data No.2 (Hz)
TA1: Acceleration of operation data No.1
TA2: Acceleration of operation data No.2

TD2: Deceleration of operation data No.2
TAR1: Acceleration rate of operation data No.1 (Hz/s)
TAR2: Acceleration rate of operation data No.2 (Hz/s)
TDR2: Deceleration rate of operation data No.2 (Hz/s)

- Calculation method for acceleration/deceleration rate

$TAR1 = (VR1 - VS) / TA1$
$TAR2 = (VR2 - VS) / TA2$
$TDR2 = (VR2 - VS) / TD2$

- When acceleration/deceleration is "common"
  - Acceleration/deceleration unit: ms/kHz
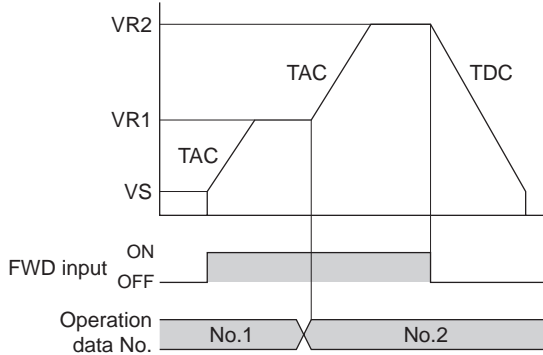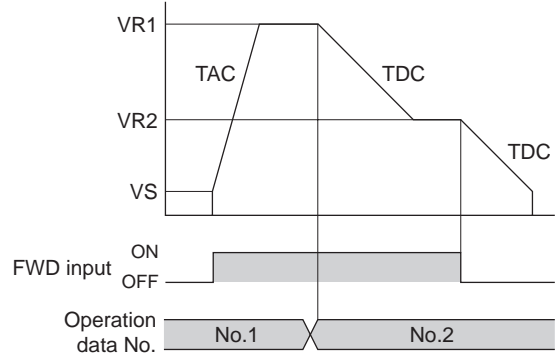
When accelerating

When decelerating

- Acceleration/deceleration unit: s
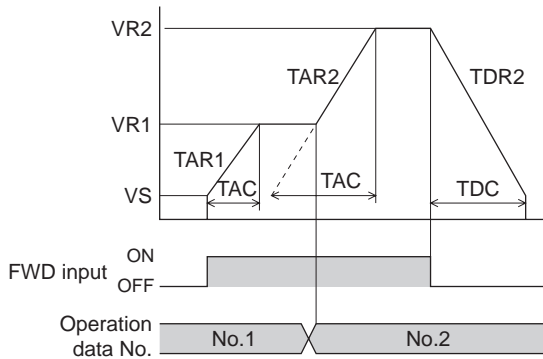
When accelerating
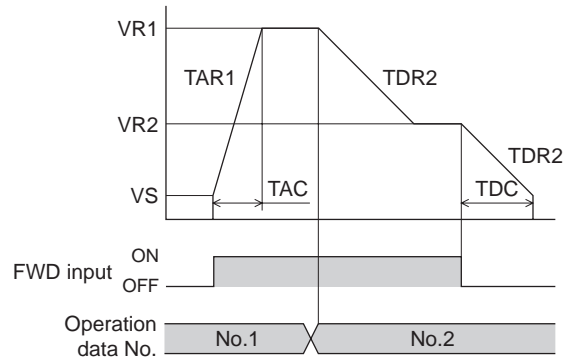
When decelerating

- Explanation of labels

VS: Starting speed (Hz)
VR1: Operating speed of operation data
　　No.1 (Hz)
VR2: Operating speed of operation data
　　No.2 (Hz)
TAC: Common acceleration
TDC: Common deceleration

TAR1: Acceleration rate of operation data
　　No.1 (Hz/s)
TAR2: Acceleration rate of operation data
　　No.2 (Hz/s)
TDR1: Deceleration rate of operation data
　　No.1 (Hz/s)
TDR2: Deceleration rate of operation data
　　No.2 (Hz/s)

- Calculation method for
  acceleration/deceleration rate

TAR1 = (VR1 - VS)/ TAC
TAR2 = (VR2 - VS)/ TAC
TDR2 = (VR2 - VS)/ TDC

11.4 Other operation

■ JOG operation

JOG operation is a function to perform positioning operation of the travel amount set in the "JOG travel amount" parameter.
When the +JOG signal to ON, JOG operation is in the positive direction.
When the −JOG signal to ON, JOG operation is in the negative direction.
This function is convenient for fine adjustment of the position.

- Related parameters

Parameter name	Description	Setting range	Initial value
JOG travel amount	Travel amount for JOG operation.	1 to 8,388,607 step	1
JOG operating speed	Operating speed for JOG operation.	1 to 1,000,000 Hz	1000
Acceleration/deceleration rate of JOG	Acceleration/deceleration rate or acceleration/deceleration time for JOG operation.	1 to 1,000,000 (1=0.001 ms/kHz or 1=0.001 s)	1000
JOG starting speed	Starting speed for JOG operation.	0 to 1,000,000 Hz	500

- Operation example
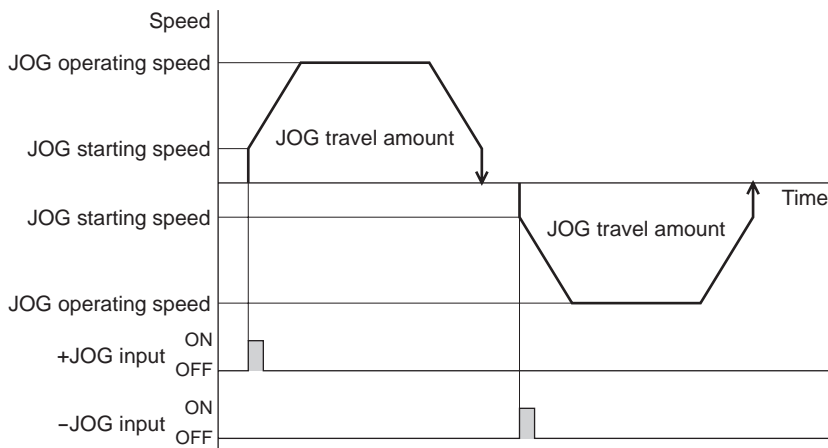
- Operating method

① Check the READY output is ON.

② Turn the +JOG input ON.

③ The motor starts positioning operation.

④ Check the READY output has been turned OFF and turn the +JOG input OFF.

⑤ When the positioning operation is completed, the READY output will be turned ON.
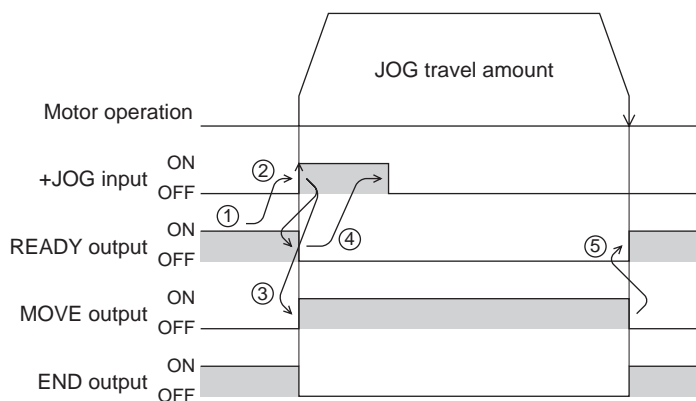
■ Test operation

Test operation is performed using the **OPX-2A** or **MEXE02**. JOG operation and teaching function can be performed.

- JOG operation

Connection condition or operation status for the motor and driver can be checked using JOG operation.
Refer to the operating manual for each product.

Example: When performing test operation with the **OPX-2A**
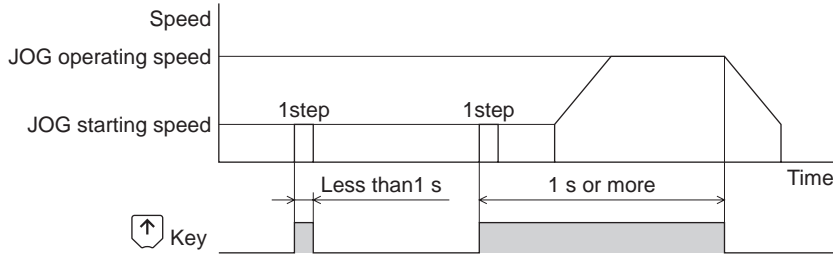
- Teaching function

This is a function to move the motor using the **OPX-2A** or **MEXE02** and set the current position as the position (travel amount) of the operation data. When the position (travel amount) is set using teaching function, the "operation mode" will always be the absolute mode. The operating speed, acceleration/deceleration and starting speed of teaching function are same as those of JOG operation.

> **Note** | Perform teaching function when the position origin is set. See p.81 for setting the position origin.

■ Automatic return operation

When a position deviation occurs by an external force while the motor is in a non-excitation state, the motor can automatically return to the position where the motor last stopped.
If the motor is reexcited by turning the C-ON input ON or turning the FREE input OFF, automatic return operation will be executed under the following conditions;
- When the main power is turned on
- When the C-ON input is turned from OFF to ON
- When the FREE input is turned from ON to OFF

- Related parameters

Parameter name	Description	Setting range	Initial value
Automatic return action	Sets enable or disable for the automatic return operation.	0: Disable 1: Enable	0
Operating speed of automatic return	Operating speed for automatic return operation.	1 to 1,000,000 Hz	1000
Acceleration/deceleration of automatic return	Acceleration/deceleration rate for automatic return operation.	1 to 1,000,000 (1=0.001 ms/kHz or 1=0.001 s)	1000
Starting speed of automatic return	Starting speed for automatic return operation.	0 to 1,000,000 Hz	500

- Example of automatic return operation

VS: Starting speed of automatic return
VR: Operating speed of automatic return
TR: Acceleration/deceleration rate of automatic return
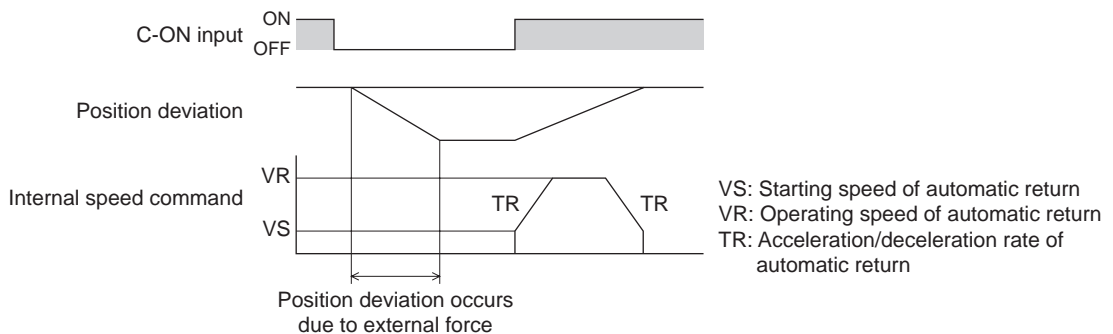
> **Note**
> - Automatic return operation will not be executed immediately after turning on the 24 VDC power supply or executing the configuration command.
> - If an alarm generates while the motor is in a non-excitation state, the automatic return operation will not executed normally.

■ Stop operation

● STOP action

When the STOP input is turned ON or STOP is commanded via RS-485 communication while the motor is operating, the motor will stop.
The stopping mode is determined by the setting of the "STOP input action" parameter.
For example, the operation when setting "STOP input action" parameter to "deceleration stop" is shown in the figure to the right.
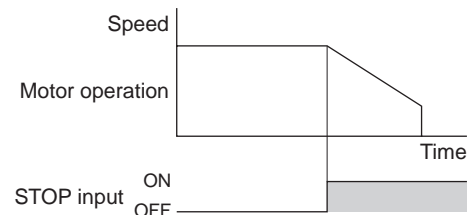
● Hardware overtravel

Hardware overtravel is the function that limits the operation range by installing the limit sensor (±LS) at the upper and lower limit of the operation range.
If the "hardware overtravel" parameter is set to "enable", the motor can be stopped when detecting the limit sensor.
The stopping mode is determined by the setting of "overtravel action" parameter.
The operation example when setting the "overtravel action" parameter to "immediate stop" is shown in the figure to the right.
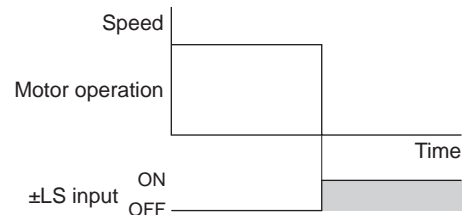
● Software overtravel

The software overtravel is a function that limits the range of movement via software settings.
If the "software overtravel" parameter is set to "enable", the motor can be stopped when exceeding the software limit.
The stopping mode is determined by the setting of "overtravel action" parameter.
The operation example shown on the right applies when an operation where a software limit is to be exceeded is started.
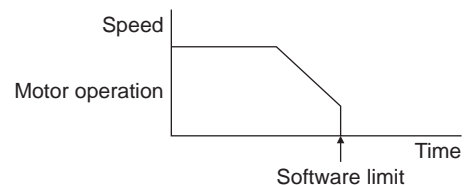
> **Note** Software overtravel will become effective after the position origin is set. See p.81 for setting the position origin.

● Escape from the limit sensor

It is possible to escape in the negative direction when detecting the positive direction limit, and possible to escape in the positive direction when detecting the negative direction limit.
The following operations can be used when escaping from the limit sensor.

Types of operation	Limit sensors (±LS)	Software limit
Positioning operation	Will not operate (unable to escape)	Allowed to operate (able to escape)
Continuous operation Test operation Return-to-home operation	Allowed to operate (able to escape)	Allowed to operate (able to escape)

■ Position coordinate management

The driver manages the motor position information. If the absolute-position backup system is used connecting an accessory battery set **BAT01B** (sold separately), the position information is kept even when the power is turned off. Refer to p.169 for accessories.

● Position origin for the driver

When the absolute-position backup system is disabled

The position origin will be set whenever one of the following operations is executed:
● Return-to-home operation
● P-PRESET input is turned ON

When the absolute-position backup system is enabled

When the absolute-position backup system is enabled, once the position origin is set, there is no need to set the position origin again even if the power is turned off. However, if the absolute position error alarm generates, the position origin will be lost. In this case, after clearing the absolute position error alarm by the P-CLR input, set the position origin by executing one of the followings.
● Return-to-home operation
● P-PRESET input is turned ON

- When the position origin has not been set

If the "return-to-home incomplete alarm" parameter is set to "enable", positioning operations can be prohibited while the position origin has not been set.

The return-to-home incomplete alarm will generate if the START input, SSTART input or the MS0 to MS5 inputs are turned ON while the position origin has not been set. See p.158 for alarm.

Related parameters

Parameter name	Description	Setting range	Initial value
Return-to-home incomplete alarm	Sets the alarm signal status: When the positioning operation is started while the position origin has not been set, selects whether the alarm generates or not.	0: Disable 1: Enable	0

■ Wrap function

The wrap function is a function that resets the command position or multi-rotation data to 0 whenever the command position exceeds the set value by the "wrap setting range" parameter. Since the multi-rotation data is also reset to 0, the unidirectional continuous rotation with the absolute-position backup system will be possible.
The command position varies in a range of "0 to (wrap setting value−1)."

- Related parameters

Parameter name	Description	Setting range	Initial value
Wrap setting	Sets enable/disable for the wrap function.	0: Disable 1: Enable	0
Wrap setting range	Wrap setting range.	1 to 8,388,607 step	1000

> **Note**
> - When setting the " wrap setting" parameter to "enable", the software overtravel will be disabled. (It is disabled even when setting the "software overtravel" parameter to "enable".)
> - If the "wrap setting" parameter or "wrap setting range" parameter is changed while the "absolute-position backup system" parameter is "enable", the absolute position may be lost. Perform return-to-home operation or the P-PRESET input when the wrap settings are changed.

- Setting condition of wrap function

$$\text{Condition 1: } \frac{\text{Electronic gear B} \times 1000}{\text{Electronic gear A} \times 50} = \text{An integer}$$

$$\text{Condition 2: } \text{Wrap setting value} \times \frac{\text{Electronic gear A} \times 50}{\text{Electronic gear B} \times 1000} = \text{An integer}$$

The wrap setting error warning will generate when not meeting these formulas.

> **Note**
> When not meeting these formulas while the "wrap setting" parameter is "enable", the wrap setting error warning will generate. If the power is turned on again or the configuration is executed while the wrap setting error warning is present, the wrap setting error alarm will generate.

- Example for wrap function

  Example of operation when the positioning operation is performed in the following conditions.
  - Wrap setting range: 3600
  - Resolution: 1000 P/R (electronic gear A=1, electronic gear B=1)
  - Command position: 900

$$\text{Condition 1:}\quad \frac{\text{Electronic gear B} \times 1000}{\text{Electronic gear A} \times 50} = \frac{1 \times 1000}{1 \times 50} = 20$$

$$\text{Condition 2:}\quad \text{Wrap setting value} \times \frac{\text{Electronic gear A} \times 50}{\text{Electronic gear B} \times 1000} = 3600 \times \frac{1 \times 50}{1 \times 1000} = 180$$

The calculation result of these two formulas is an integer and this meets the setting condition.
Following tables are examples when the positioning operation is performed from 900 steps of the command position.

Position	Operation mode: Incremental	Operation mode: Absolute
+1000	Start 900, Δ+1000, to 1900 (positions 0, 2700, 1800)	Start 900, Δ+100, to 1000 (positions 0, 2700, 1800)
−1000	Start 900, Δ−1000, to 3500 (positions 0, 2700, 1800)	Start 900, Δ−1900, to 2600 (positions 0, 2700, 1800)
+5000	Start 900, Δ+5000, to 2300 (positions 0, 2700, 1800)	Start 900, Δ+4100, to 1400 (positions 0, 2700, 1800)
−5000	Start 900, Δ−5000, to 3100 (positions 0, 2700, 1800)	Start 900, Δ−5900, to 2200 (positions 0, 2700, 1800)

11.5 Operation data and parameters

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 NV 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 NV memory will be retained even after the 24 VDC power supply is turned off.
When turning the driver 24 VDC power supply on, the parameters saved in the NV memory will be sent to the RAM. Then, the recalculation and setup for the parameters are executed in the RAM.

When a parameter is changed, the timing to reflect the new value varies depending on the parameter. See the following four types.
- Effective immediately .... Executes the recalculation and setup immediately when writing the parameter.
- Effective after stopping the operation .... Executes the recalculation and setup after stopping the operation.
- Effective after executing the configuration .... Executes the recalculation and setup after executing the configuration.
- 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 when writing via RS-485 communication.
	• The NV memory can be rewritten approx. 100,000 times.

■ Setting the operation data

Up to 64 operation data can be set (data Nos.0 to 63).

Name	Description	Setting range	Initial value	Effective[1]
Position No.0 to Position No.63	Position (distance) for positioning operation.	−8,388,608 to +8,388,607 step	0	B
Operating speed No.0 to Operating speed No.63	Operating speed in positioning operation and continuous operation.	0 to 1,000,000 Hz	1000	
Operation mode No.0 to Operation mode No.63	Selects how to specify the position (travel amount) in positioning operation (absolute mode or incremental mode).	0: INC (Incremental) 1: ABS (Absolute)	0	
Operation function No.0 to Operation function No.63	Selects how to operate consecutive operation data.	0: Single-motion 1: Linked-motion 2: Linked-motion 2 3: Push-motion	0	
Acceleration No.0 to Acceleration No.63	Acceleration rate or acceleration time in positioning operation and continuous operation.[2]	1 to 1,000,000 (1=0.001 ms/kHz or 1=0.001 s) [3]	1000	
Deceleration No.0 to Deceleration No.63	Deceleration rate or deceleration time in positioning operation and continuous operation.[2]		1000	
Push current No.0 to Push current No.63	Current value of push-motion operation.	0 to 500 (1=0.1%)	200	
Sequential positioning No.0 to Sequential positioning No.63	Sets enable or disable sequential positioning operation.	0: Disable 1: Enable	0	
Dwell time No.0 to Dwell time No.63	Dwell time to be used in linked-motion operation 2.	0 to 50000 (1=0.001 s)	0	

[1] Indicates the timing for the data to become effective. (B: Effective after stopping the operation)
[2] This item is effective when the "acceleration/deceleration type" parameter is set to "separate". If this parameter is set to "common", the values of the "common acceleration" and "common deceleration" parameters will be used (initial value: separate).
[3] Acceleration/deceleration rate (ms/kHz) or acceleration/deceleration time (s) can be selected using "acceleration/deceleration unit" parameter. (initial value: acceleration/deceleration rate).

■ Parameter list

The setting items for each parameter are as follows.

I/O (p.86)	• STOP input action • Hardware overtravel • Overtravel action • Positioning completion signal range • Positioning completion signal offset • AREA1 positive direction position • AREA1 negative direction position • AREA2 positive direction position • AREA2 negative direction position • AREA3 positive direction position • AREA3 negative direction position	• Minimum ON time for MOVE output • LS logic level • HOMES logic level • SLIT logic level • MS0 operation No. selection • MS1 operation No. selection • MS2 operation No. selection • MS3 operation No. selection • MS4 operation No. selection • MS5 operation No. selection • HOME-P output function selection
Motor (p.87)	• RUN current • STOP current • Position loop gain • Speed loop gain • Speed loop integral time constant • Speed filter	• Moving average time • Filter selection • Moving average1 • Moving average2 • Control mode • Smooth driver
Operation (p.87)	• Common acceleration • Common deceleration • Starting speed • JOG operating speed • Acceleration/deceleration rate of JOG • JOG starting speed • Acceleration/deceleration type	• Acceleration/deceleration unit • Automatic return operation • Operating speed of automatic return • Acceleration/deceleration of automatic return • Starting speed of automatic return • JOG travel amount

Return-to-home
(p.88)
	• Home-seeking mode
	• Operating speed of home-seeking
	• Acceleration/deceleration of
	  home-seeking
	• Starting speed of home-seeking
	• Position offset of home-seeking
		• Starting direction of home-seeking
		• SLIT detection with home-seeking
		• TIM signal detection with home-seeking
		• Operating current of push-motion
		  home-seeking

Alarm/warning (p.88)	• Overload alarm • Overflow rotation alarm during current on • Return-to-home incomplete alarm • Overflow rotation alarm during current off • Overheat warning	• Overload warning • Overspeed warning • Overvoltage warning • Undervoltage warning • Overflow rotation warning during current on
Coordination (p.89)	• Electronic gear A • Electronic gear B • Motor rotation direction • Software overtravel	• Positive software limit • Negative software limit • Preset position • Wrap setting • Wrap setting range
Common (p.89)	• Data setter speed display • Data setter edit • Absolute-position backup system	
I/O function (p.89)	• IN0 to IN7 input function selection • IN0 to IN7 input logic level setting • OUT0 to OUT5 output function selection	
I/O function [RS-485] (p.90)	• NET-IN0 to NET-IN15 input function selection • NET-OUT0 to NET-OUT15 output function selection	
Communication (p.91)	• Communication timeout • Communication error alarm • Communication parity	• Communication stop bit • Transmission waiting time

■ I/O

Name	Description	Setting range	Initial value	Effective[*]
STOP input action	Sets how the motor should stop when a STOP input is turned ON.	0: Immediate stop 1: Deceleration stop 2: Immediate stop & Current OFF 3: Deceleration stop &Current OFF	1	A
Hardware overtravel	Sets whether to enable or disable hardware overtravel detection using ±LS inputs.	0: Disable 1: Enable	1	
Overtravel action	Motor action to take place upon the occurrence of overtravel.	0: Immediate stop 1: Deceleration stop	0	
Positioning completion signal range	Output range of the END signal (the motor operation converges within this angular range).	0 to 180 (1=0.1°)	18	
Positioning completion signal offset	Offset for the END signal (the offset for converging angular range).	−18 to 18 (1=0.1°)	0	
AREA1 positive direction position	Position of AREA1 positive direction.	−8,388,608 to 8,388,607 step	0	
AREA1 negative direction position	Position of AREA1 negative direction.			
AREA2 positive direction position	Position of AREA2 positive direction.			
AREA2 negative direction position	Position of AREA2 negative direction.			
AREA3 positive direction position	Position of AREA3 positive direction.			
AREA3 negative direction position	Position of AREA3 negative direction.			
Minimum ON time for MOVE output	Minimum time during which the MOVE output remains ON	0 to 255 ms	0	
LS logic level	±LS input logic.	0: Normally open 1: Normally closed	0	C
HOMES logic level	HOMES input logic.			
SLIT logic level	SLIT input logic.			
MS0 operation No. selection	Operation data No. corresponding to MS0 input.	0 to 63	0	B
MS1 operation No. selection	Operation data No. corresponding to MS1 input.		1	
MS2 operation No. selection	Operation data No. corresponding to MS2 input.		2	
MS3 operation No. selection	Operation data No. corresponding to MS3 input.		3	
MS4 operation No. selection	Operation data No. corresponding to MS4 input.		4	
MS5 operation No. selection	Operation data No. corresponding to MS5 input.		5	
HOME-P function selection	Timing to output the HOME-P output.	0: Home output 1: Return-to-home complete output	0	A

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

■ Motor

Name	Description	Setting range	Initial value	Effective*
RUN current	Motor operating current based on the rated current being 100%.	0 to 1000 (1=0.1%)	1000	A
STOP current	Motor standstill current as a percentage of the rated current, based on the rated current being 100%.	0 to 500 (1=0.1%)	500	A
Position loop gain	Adjusts the motor response in reaction to the position deviation.	1 to 50	10	A
Speed loop gain	Adjusts the motor response in reaction to the speed deviation.	10 to 200	180	A
Speed loop integral time constant	Decreases the deviation that cannot be adjusted with the speed loop gain.	10 to 2000 (1=0.1 ms)	1000	A
Speed filter	Adjusts the motor response.	0 to 200 ms	1	B
Moving average time	Time constant for the moving average filter.	1 to 200 ms	1	B
Filter selection	Sets the filter function to adjust the motor response.	0: Speed filter 1: Moving average filter	0	C
Speed error gain 1	Adjusts vibration during operation.	0 to 500	45	A
Speed error gain 2	Adjusts vibration during acceleration/deceleration.	0 to 500	45	A
Control mode	Control mode of the driver.	0: Normal mode 1: Current control mode	0	C
Smooth driver	Sets whether to enable or disable smooth drive function.	0: Disable 1: Enable	1	C

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

■ Operation

Name	Description	Setting range	Initial value	Effective [*1]
Common acceleration	Common acceleration rate or common acceleration time in positioning operation and continuous operation.	1 to 1,000,000 (1=0.001 ms/kHz or 1=0.001 s) [*2]	1000	B
Common deceleration	Common deceleration rate or common deceleration time in positioning operation and continuous operation.	1 to 1,000,000 (1=0.001 ms/kHz or 1=0.001 s) [*2]	1000	B
Starting speed	Starting speed in positioning operation and continuous operation. The motor will operate at the starting speed if the operating speed is below the starting speed.	0 to 1,000,000 Hz	500	B
JOG operating speed	Operating speed for JOG operation.	1 to 1,000,000 Hz	1000	B
Acceleration/deceleration rate of JOG	Acceleration/deceleration rate or acceleration/deceleration time for JOG operation.	1 to 1,000,000 (1=0.001 ms/kHz or 1=0.001 s) [*2]	1000	B
JOG starting speed	Starting speed for JOG operation.	0 to 1,000,000 Hz	500	B
Acceleration/deceleration type	Sets whether to use the common acceleration/deceleration or the acceleration/deceleration specified for the operation data.	0: Common 1: Separate	1	B
Acceleration/deceleration unit	Acceleration/deceleration unit.	0: ms/kHz 1: s	0	C
Automatic return operation	Sets enable or disable for the automatic return operation.	0: Disable 1: Enable	0	C
Operating speed of automatic return	Operating speed for automatic return operation.	1 to 1,000,000 Hz	1000	B
Acceleration/deceleration of automatic return	Acceleration/deceleration rate or acceleration/deceleration time for automatic return operation.	1 to 1,000,000 (1=0.001 ms/kHz or 1=0.001 s) [*2]	1000	B

*1 Indicates the timing for the data to become effective. (B: Effective after stopping the operation, C: Effective after executing the configuration)

*2 Acceleration/deceleration rate (ms/kHz) or acceleration/deceleration time (s) can be selected using "acceleration/deceleration unit" parameter. (initial value: acceleration/deceleration rate).

Name	Description	Setting range	Initial value	Effective *
Starting speed of automatic return	Starting speed for automatic return operation.	0 to 1,000,000 Hz	500	B
JOG travel amount	Travel amount for JOG operation.	1 to 8,388,607 step	1	

* Indicates the timing for the data to become effective. (B: Effective after stopping the operation)

■ Return-to-home

Name	Description	Setting range	Initial value	Effective [*1]
Home-seeking mode	Mode for return-to-home operation.	0: 2-sensor mode 1: 3-sensor mode 2: Push mode	1	B
Operating speed of home-seeking	Operating speed for return-to-home operation.	1 to 1,000,000 Hz	1000	
Acceleration/deceleration of home-seeking	Acceleration/ deceleration rate or acceleration/deceleration time for return-to-home operation.	1 to 1,000,000 (1=0.001 ms/kHz or 1=0.001 s) [*2]	1000	
Starting speed of home-seeking	Starting speed for return-to-home operation.	1 to 1,000,000 Hz	500	
Position offset of home-seeking	Amount of offset from mechanical home.	−8,388,608 to 8,388,607 step	0	
Starting direction of home-seeking	Starting direction for home detection.	0: Negative direction 1: Positive direction	1	
SLIT detection with home-seeking	Sets whether or not to concurrently use the SLIT input for return-to-home operation.	0: Disable 1: Enable	0	
TIM signal detection with home-seeking	Sets whether or not to concurrently use the TIM signal for return-to-home operation.		0	
Operating current of push-motion home-seeking	Operating current for push-motion return-to-home operation based on the rated current being 100%.	0 to 1000 (1=0.1%)	1000	

*1 Indicates the timing for the data to become effective. (B: Effective after stopping the operation)
*2 Acceleration/deceleration rate (ms/kHz) or acceleration/deceleration time (s) can be selected using "acceleration/deceleration unit" parameter. (initial value: acceleration/deceleration rate).

■ Alarm/warning

Name	Description	Setting range	Initial value	Effective *
Overload alarm	Condition in which an overload alarm generates.	1 to 300 (1=0.1 s)	50	A
Overflow rotation alarm during current on	Condition that an excessive position deviation alarm generates when the motor is in a state of current ON.	1 to 30000 (1=0.01 rev)	300	
Return-to-home incomplete alarm	Alarm signal status: When the positioning operation is started while the position origin has not been set, selects whether the alarm generates or not.	0: Disable 1: Enable	0	C
Overflow rotation alarm during current off	Condition that an excessive position deviation alarm generates when the motor is in a state of current OFF.	1 to 30000 (1=0.01 rev)	10000	A
Overheat warning	Temperature at which a main circuit overheat warning generates.	40 to 85 °C (104 to 185 °F)	85	
Overload warning	Condition that an overload warning generates.	1 to 300 (1=0.1 s)	50	
Overspeed warning	Condition that an overspeed warning generates.	1 to 5000 r/min	4500	
Overvoltage warning	Voltage at which an overvoltage warning generates.	120 to 450 V	435	
Undervoltage warning	Voltage at which an undervoltage warning generates.	120 to 280 V	120	
Overflow rotation warning during current on	Condition that an excessive position deviation warning generates.	1 to 30000 (1=0.01 rev)	300	

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

■ Coordination

Name	Description	Setting range	Initial value	Effective *
Electronic gear A	Denominator of electric gear.	1 to 65535	1	C
Electronic gear B	Numerator of electric gear.		1	
Motor rotation direction	Rotation direction of motor output shaft.	0: Positive direction=CCW 1: Positive direction=CW	1	
Software overtravel	Sets whether to enable or disable software overtravel detection using soft limits.	0: Disable 1: Enable	1	A
Positive software limit	Value of soft limit in positive direction.	−8,388,608 to 8,388,607 step	8,388,607	
Negative software limit	Value of soft limit in negative direction.		−8,388,608	
Preset position	Preset position.		0	
Wrap setting	Sets enable/disable for the wrap function.	0: Disable 1: Enable	0	C
Wrap setting range	Wrap setting range.	1 to 8,388,607 step	1000	

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

■ Common

Name	Description	Setting range	Initial value	Effective *
Data setter speed display	Display method of the speed monitor for the **OPX-2A**.	0: Signed 1: Absolute value	0	A
Data setter edit	Sets whether it is possible to edit using the **OPX-2A**.	0: Disable 1: Enable	1	
Absolute-position backup system	Sets enable or disable of the absolute-position backup system.		0	C

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

■ I/O function

Name	Description	Setting range	Initial value	Effective *
IN0 input function selection	Function of input terminals IN0 to IN7.	See table next.	3: HOME	C
IN1 input function selection			4: START	
IN2 input function selection			48: M0	
IN3 input function selection			49: M1	
IN4 input function selection			50: M2	
IN5 input function selection			16: FREE	
IN6 input function selection			18: STOP	
IN7 input function selection			24: ALM-RST	
IN0 input logic level setting	IN0 to IN7 input logic.	0: Normally open 1: Normally closed	0	
IN1 input logic level setting				
IN2 input logic level setting				
IN3 input logic level setting				
IN4 input logic level setting				
IN5 input logic level setting				
IN6 input logic level setting				
IN7 input logic level setting				
OUT0 output function selection	Function of output terminals OUT0 to OUT5.	See table next.	70: HOME-P	
OUT1 output function selection			69: END	
OUT2 output function selection			73: AREA1	
OUT3 output function selection			67: READY	
OUT4 output function selection			66: WNG	
OUT5 output function selection			65: ALM	

* Indicates the timing for the data to become effective. (C: Effective after executing the configuration)

- Setting range for IN input function selection

0: Not used	8: MS0	18: STOP	35: R3	43: R11	51: M3
1: FWD	9: MS1	24: ALM-RST	36: R4	44: R12	52: M4
2: RVS	10: MS2	25: P-PRESET	37: R5	45: R13	53: M5
3: HOME	11: MS3	26: P-CLR	38: R6	46: R14	
4: START	12: MS4	27: HMI	39: R7	47: R15	
5: SSTART	13: MS5	32: R0	40: R8	48: M0	
6: +JOG	16: FREE	33: R1	41: R9	49: M1	
7: −JOG	17: C-ON	34: R2	42: R10	50: M2	

- Setting range for OUT output function selection

0: Not used	10: MS2_R	35: R3	45: R13	61: −LS_R	72: TIM
1: FWD_R	11: MS3_R	36: R4	46: R14	62: HOMES_R	73: AREA1
2: RVS_R	12: MS4_R	37: R5	47: R15	63: SLIT_R	74: AREA2
3: HOME_R	13: MS5_R	38: R6	48: M0_R	65: ALM	75: AREA3
4: START_R	16: FREE_R	39: R7	49: M1_R	66: WNG	80: S-BSY
5: SSTART_R	17: C-ON_R	40: R8	50: M2_R	67: READY	82: MPS
6: +JOG_R	18: STOP_R	41: R9	51: M3_R	68: MOVE	
7: −JOG_R	32: R0	42: R10	52: M4_R	69: END	
8: MS0_R	33: R1	43: R11	53: M5_R	70: HOME-P	
9: MS1_R	34: R2	44: R12	60: +LS_R	71: TLC	

■ I/O function [RS-485]

Name	Description	Setting range	Initial value	Effective *
NET-IN0 input function selection	Function of NET-IN0 to NET-IN15.	See table next.	48: M0	C
NET-IN1 input function selection			49: M1	
NET-IN2 input function selection			50: M2	
NET-IN3 input function selection			4: START	
NET-IN4 input function selection			3: HOME	
NET-IN5 input function selection			18: STOP	
NET-IN6 input function selection			16: FREE	
NET-IN7 input function selection			0: Not used	
NET-IN8 input function selection			8: MS0	
NET-IN9 input function selection			9: MS1	
NET-IN10 input function selection			10: MS2	
NET-IN11 input function selection			5: SSTART	
NET-IN12 input function selection			6: +JOG	
NET-IN13 input function selection			7: −JOG	
NET-IN14 input function selection			1: FWD	
NET-IN15 input function selection			2: RVS	
NET-OUT0 output function selection	Function of NET-OUT0 to NET-OUT15.	See table next.	48: M0_R	
NET-OUT1 output function selection			49: M1_R	
NET-OUT2 output function selection			50: M2_R	
NET-OUT3 output function selection			4: START_R	
NET-OUT4 output function selection			70: HOME-P	
NET-OUT5 output function selection			67: READY	
NET-OUT6 output function selection			66: WNG	
NET-OUT7 output function selection			65: ALM	
NET-OUT8 output function selection			80: S-BSY	
NET-OUT9 output function selection			73: AREA1	
NET-OUT10 output function selection			74: AREA2	
NET-OUT11 output function selection			75: AREA3	
NET-OUT12 output function selection			72: TIM	
NET-OUT13 output function selection			68: MOVE	
NET-OUT14 output function selection			69: END	
NET-OUT15 output function selection			71: TLC	

* Indicates the timing for the data to become effective. (C: Effective after executing the configuration)

- Setting range for NET-IN input function selection

0: Not used	8: MS0	18: STOP	38: R6	46: R14
1: FWD	9: MS1	27: HMI	39: R7	47: R15
2: RVS	10: MS2	32: R0	40: R8	48: M0
3: HOME	11: MS3	33: R1	41: R9	49: M1
4: START	12: MS4	34: R2	42: R10	50: M2
5: SSTART	13: MS5	35: R3	43: R11	51: M3
6: +JOG	16: FREE	36: R4	44: R12	52: M4
7: −JOG	17: C-ON	37: R5	45: R13	53: M5

- Setting range for NET-OUT output function selection

0: Not used	10: MS2_R	35: R3	45: R13	61: −LS_R	72: TIM
1: FWD_R	11: MS3_R	36: R4	46: R14	62: HOMES_R	73: AREA1
2: RVS_R	12: MS4_R	37: R5	47: R15	63: SLIT_R	74: AREA2
3: HOME_R	13: MS5_R	38: R6	48: M0_R	65: ALM	75: AREA3
4: START_R	16: FREE_R	39: R7	49: M1_R	66: WNG	80: S-BSY
5: SSTART_R	17: C-ON_R	40: R8	50: M2_R	67: READY	82: MPS
6: +JOG_R	18: STOP_R	41: R9	51: M3_R	68: MOVE	
7: −JOG_R	32: R0	42: R10	52: M4_R	69: END	
8: MS0_R	33: R1	43: R11	53: M5_R	70: HOME-P	
9: MS1_R	34: R2	44: R12	60: +LS_R	71: TLC	

■ Communication

Name	Description	Setting range	Initial value	Effective [*]
Communication timeout	Condition in which a communication timeout occurs in RS-485 communication.	0: Not monitored 0 to 10000 ms	0	A
Communication error alarm	Condition in which a RS-485 communication error alarm generates. A communication error alarm generates after a RS-485 communication error has occurred by the number of times set here.	1 to 10 times	3	A
Communication parity	Parity of RS-485 communication.	0: None 1: Even number 2: Odd number	1	D
Communication stop bit	Stop bit of RS-485 communication.	0: 1 bit 1: 2 bit	0	D
Transmission waiting time	Transmission waiting time of RS-485 communication.	0 to 10000 (1=0.1 ms)	100	D

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

12   Method of control via I/O

This chapter explains the I/O operation control to be performed based on operation data and parameters set by the accessory **OPX-2A** or **MEXE02** (sold separately). For the specific setting methods, refer to each <u>OPERATING MANUAL</u>.

12.1 Guidance

If you are new to the **AR** Series AC power input built-in controller 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

Check
24 VDC power supply connection

Check
Motor connection

Check
START input connection

Programmable controller

Or

Check
Power supply connection

Check
OPX-2A or **MEXE02** connection

PE
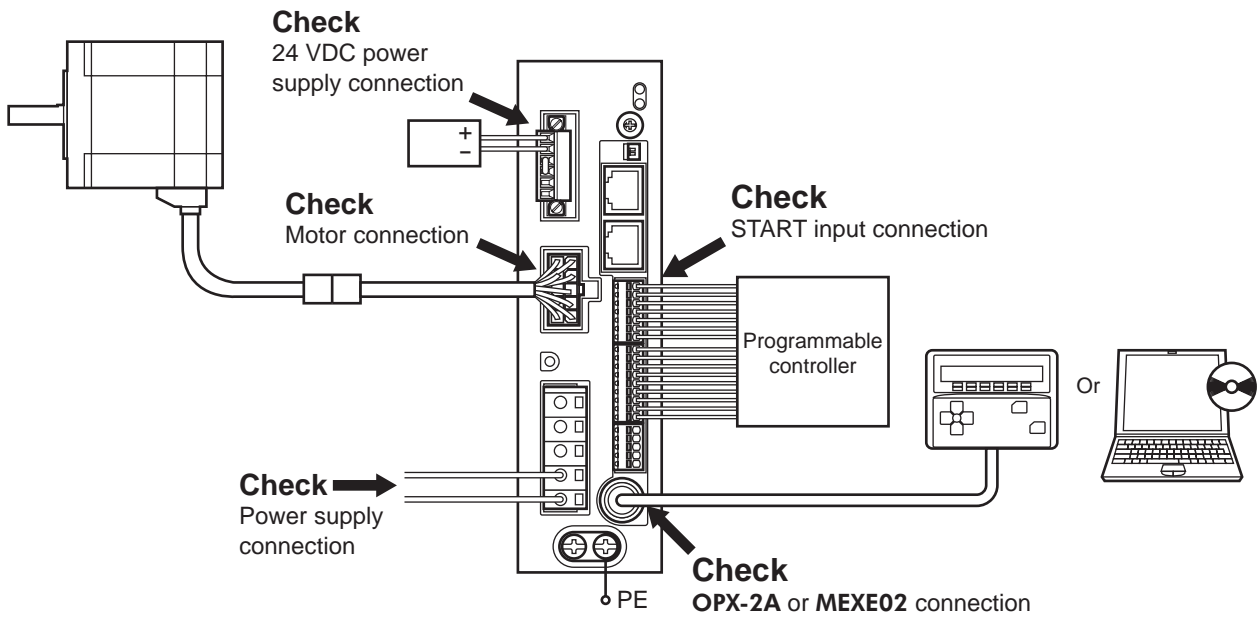
STEP 2   Turn on the power and set the operation data

1. Turn 24 VDC power supply on.

Set the operation data corresponding to one motor revolution.
• Operation data No.0
• Position: 1000 step

Or

2. Turn power supply on.
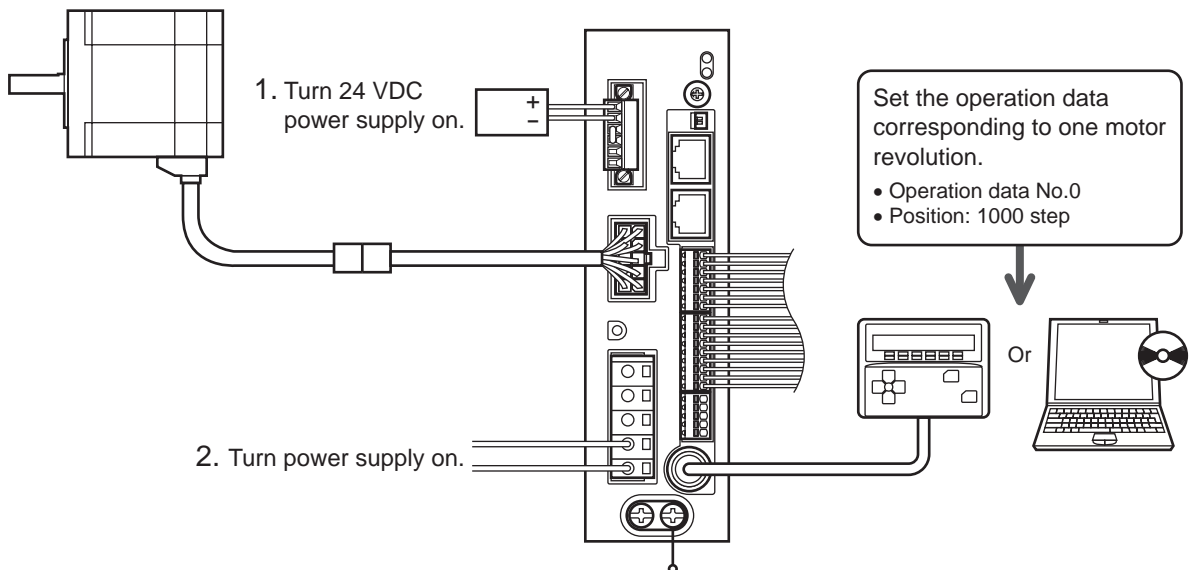
STEP 3   Operate the motor

2. Confirm that the motor
   rotates without problem.

1. Turn the START input ON.

Programmable controller

Or
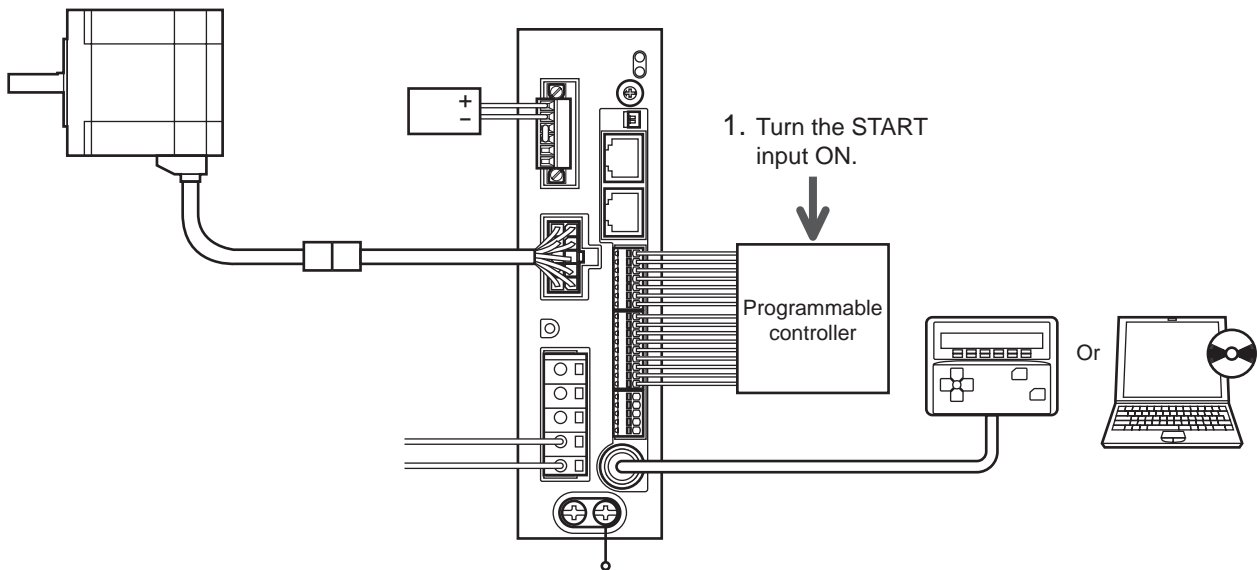
STEP 4   Were you able to operate the motor properly?

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

- Are the regeneration unit thermal input terminals (TH1 and TH2) on the CN1 short-circuited?
- Is any alarm present?
- Are the power supply and motor connected securely?

For more detailed settings and functions, refer to "11 Operation" on p.54.

12.2 Timing chart

■ When the power supply is turned ON
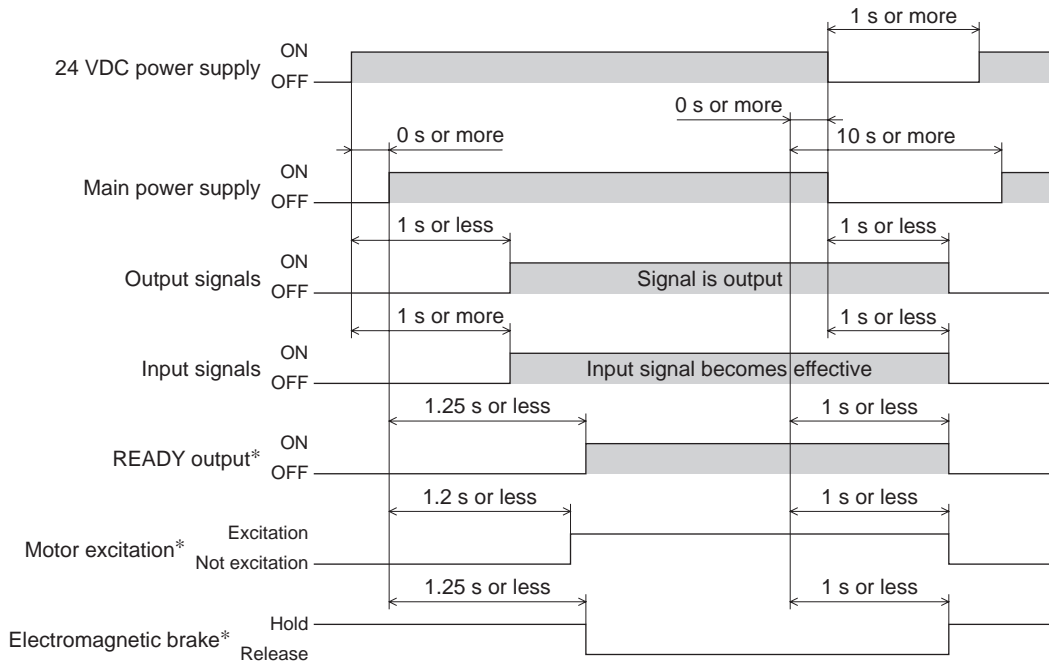
* When the C-ON input is not assigned or when the C-ON input is assigned as normally closed.

■ C-ON input
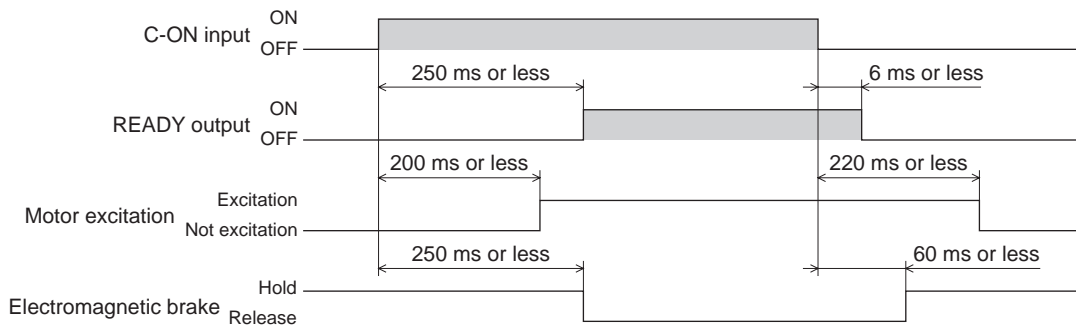
■ STOP input

- When the "STOP input action" parameter is immediate stop.
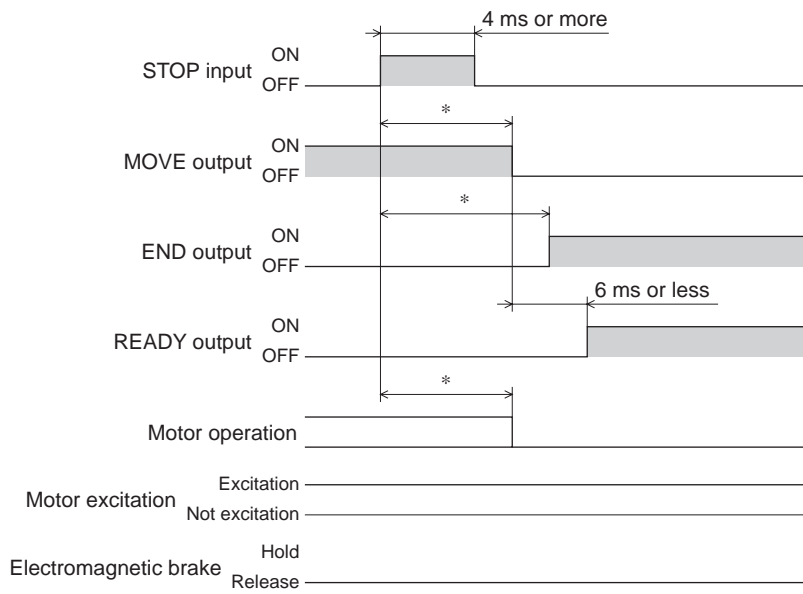
* The specific time varies depending on the load, operating speed, speed filter and other.

- When the "STOP input action" parameter is deceleration stop.
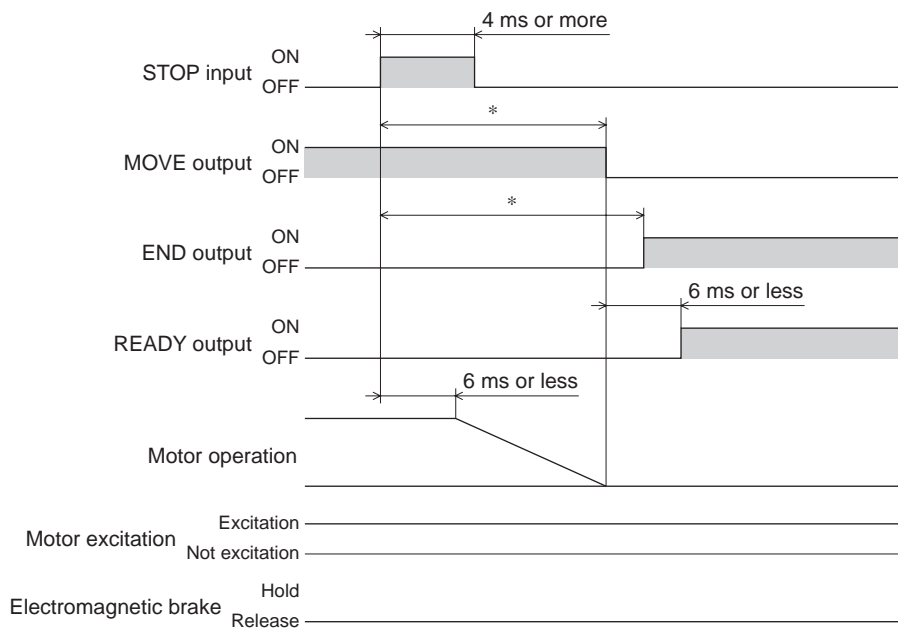
* The specific time varies depending on the load, operating speed, speed filter and other.

● When the "STOP input action" parameter is immediate stop+current off.
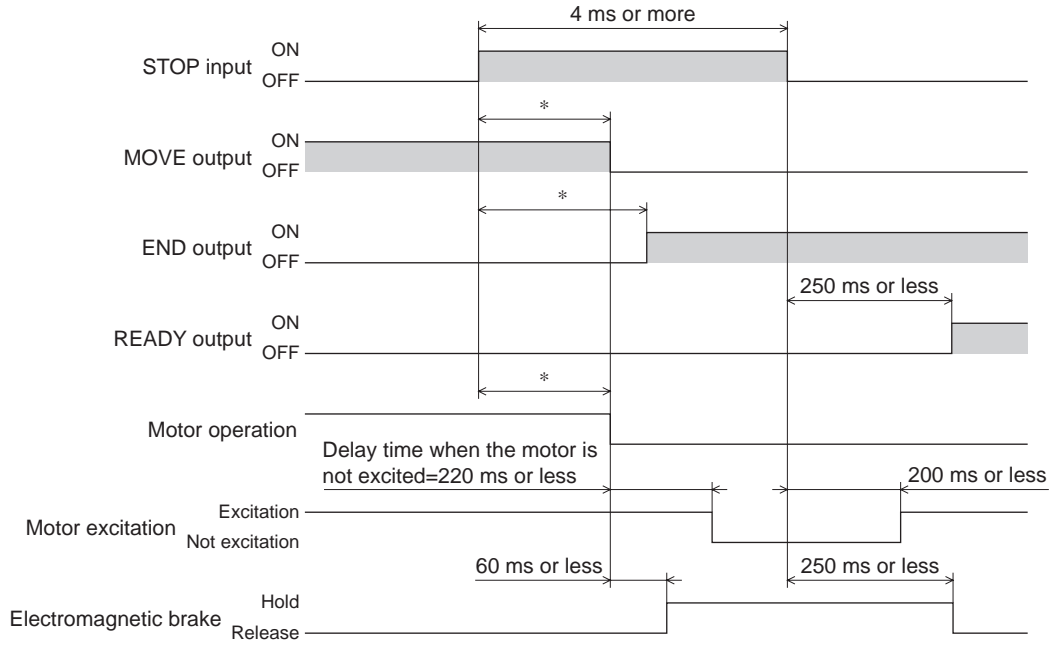
∗ The specific time varies depending on the load, operating speed, speed filter and other.

● When the "STOP input action" parameter is deceleration stop+current off.
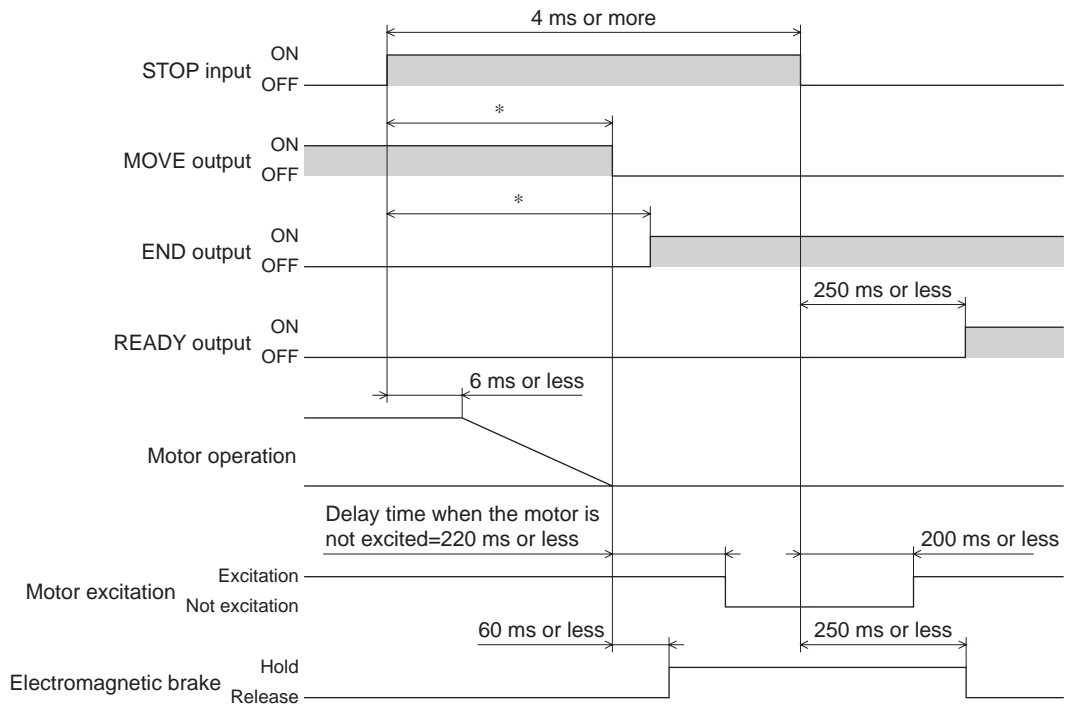
∗ The specific time varies depending on the load, operating speed, speed filter and other.

■ FREE input
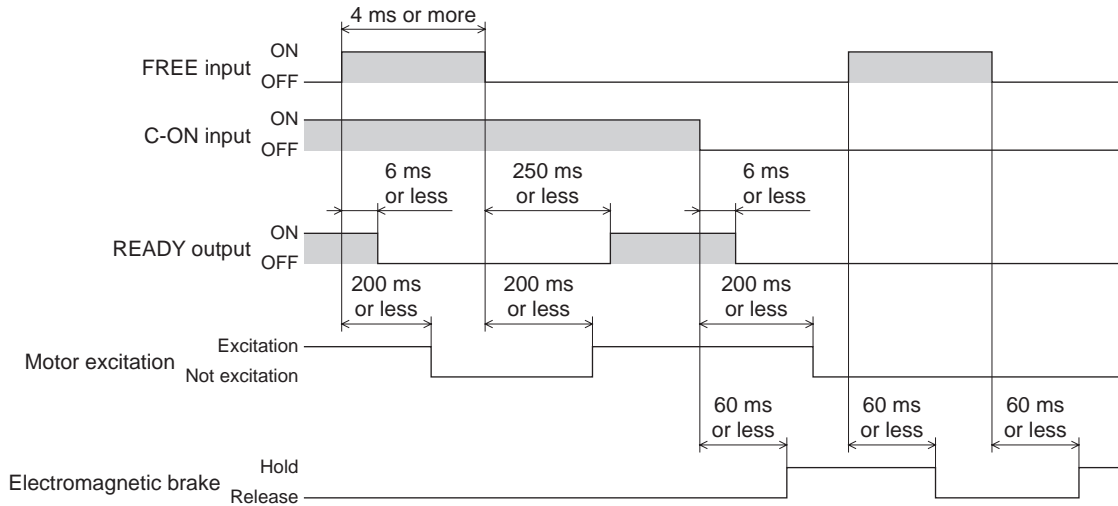
■ ALM-RST input

- When an alarm generates and the motor maintains excitation
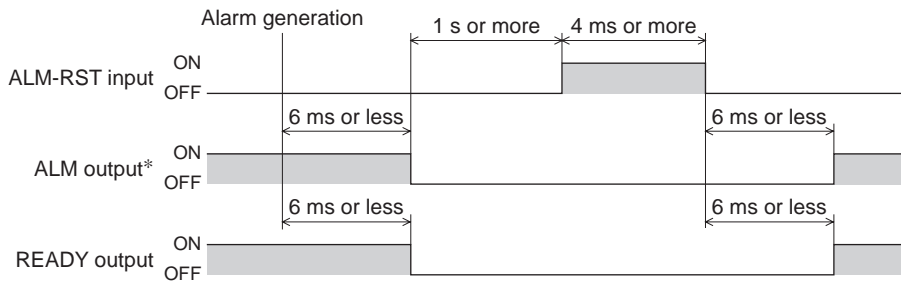
∗ ALM output is normally closed. It is ON during normal operation and it turns OFF when an alarm generates.

- When an alarm generates and the motor does not maintain excitation
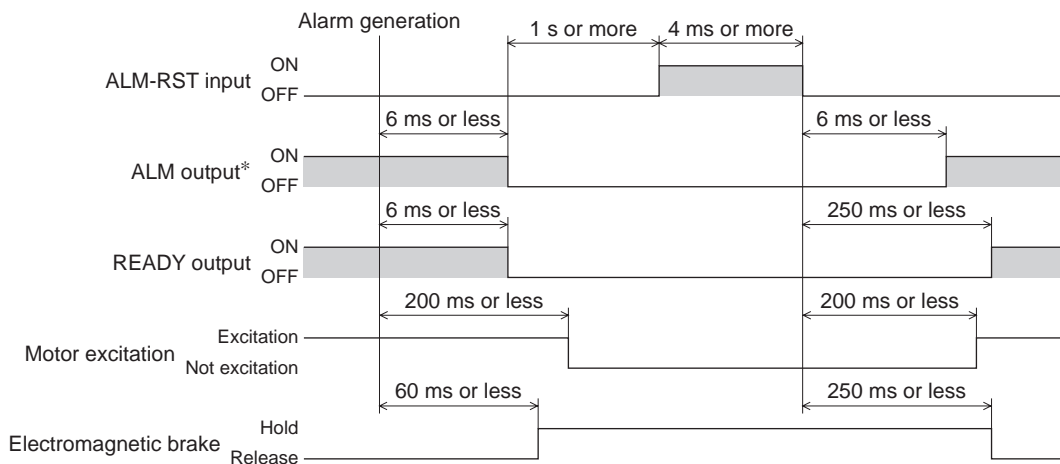
∗ ALM output is normally closed. It is ON during normal operation and it turns OFF when an alarm generates.

■ HMI input
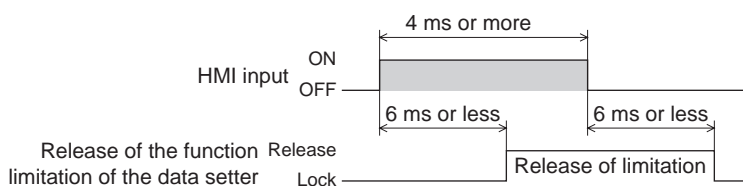
■ P-CLR input
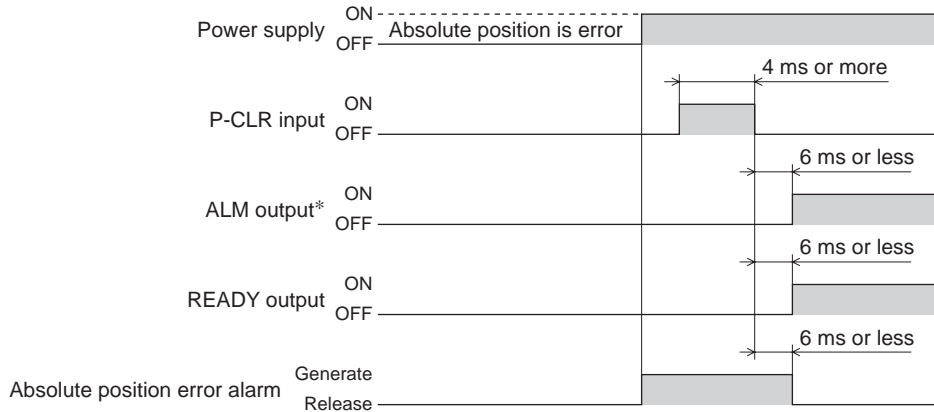
∗ ALM output is normally closed. It is ON during normal operation and it turns OFF when an alarm generates.

■ P-PRESET input
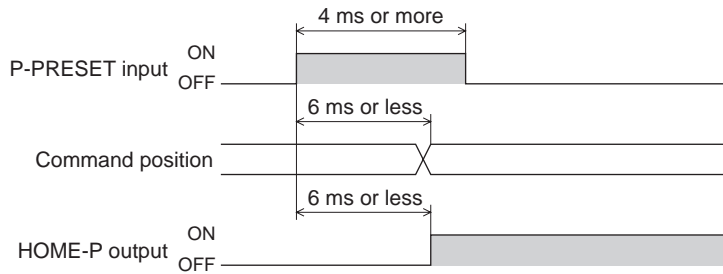
■ Single-motion operation (positioning operation)
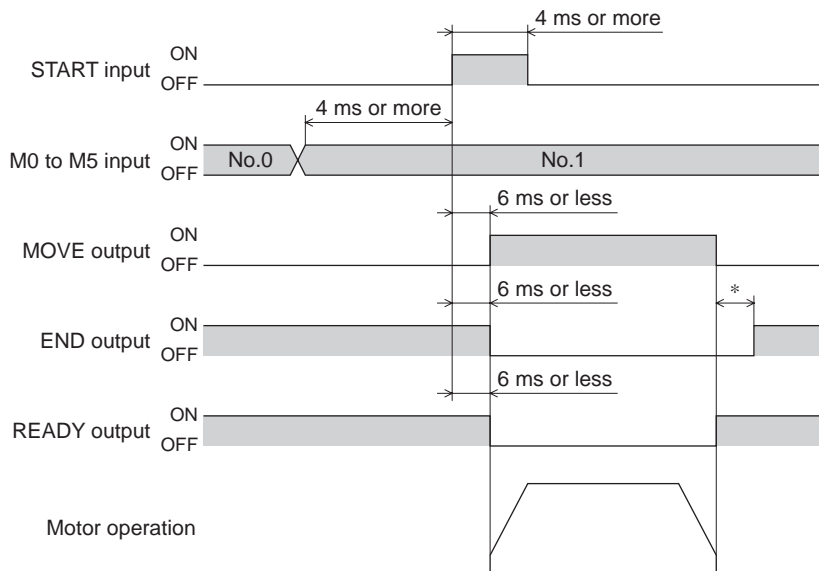
∗ The specific time varies depending on the load, operating speed, speed filter and other.

■ Linked-motion operation (positioning operation)
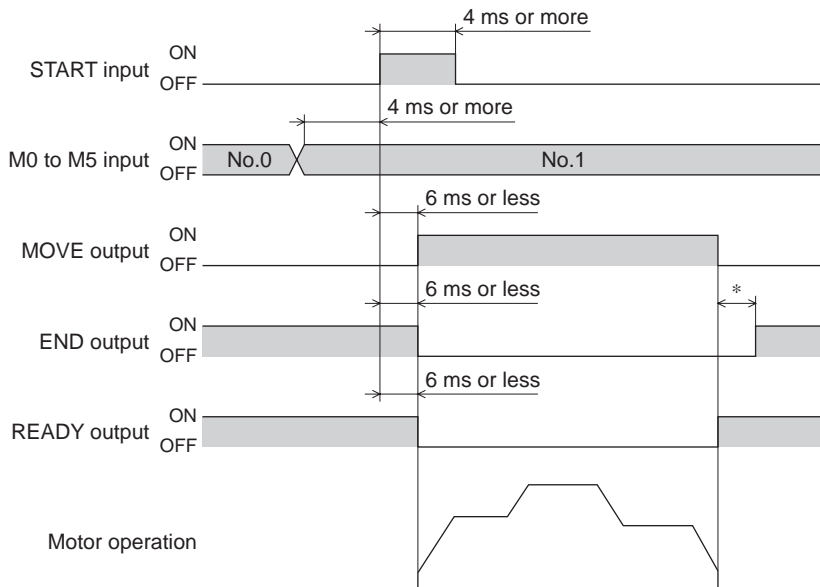
∗ The specific time varies depending on the load, operating speed, speed filter and other.

■ Linked-motion operation 2 (positioning operation)
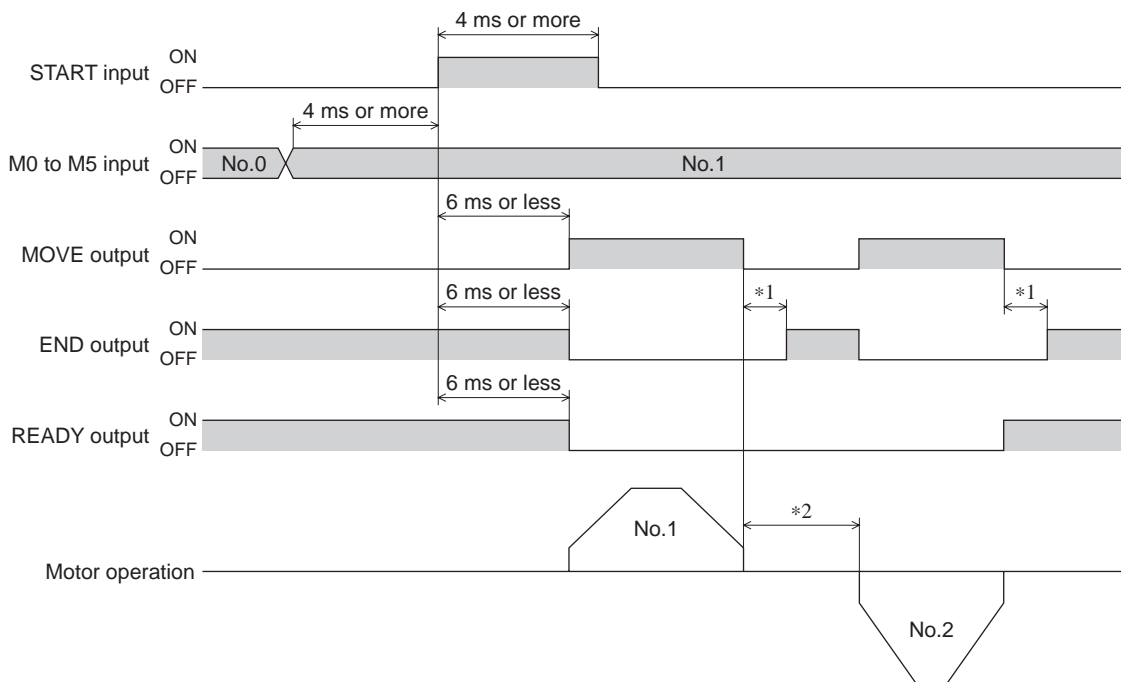
∗1 The specific time varies depending on the load, operating speed, speed filter and other.
∗2 This is the value of the dwell time to be set in operation data No.1.

■ Push-motion operation

● When the positioning operation is completed before turning to the "push-motion" status
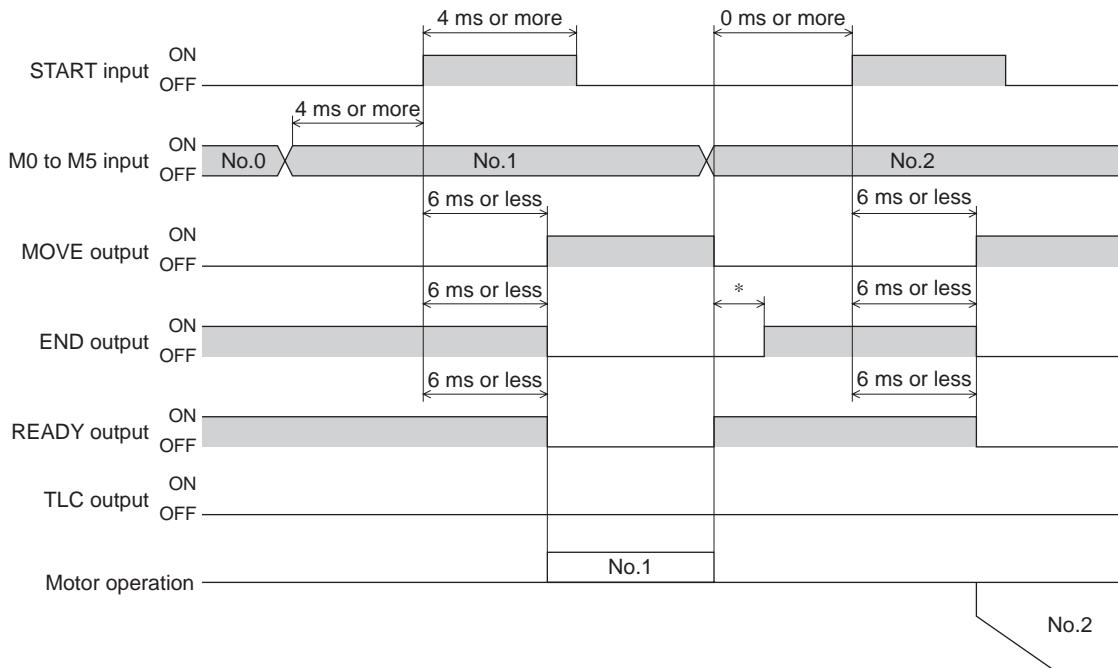
* The specific time varies depending on the load, operating speed, speed filter and other.

● When the positioning operation is started from the "push-motion" status
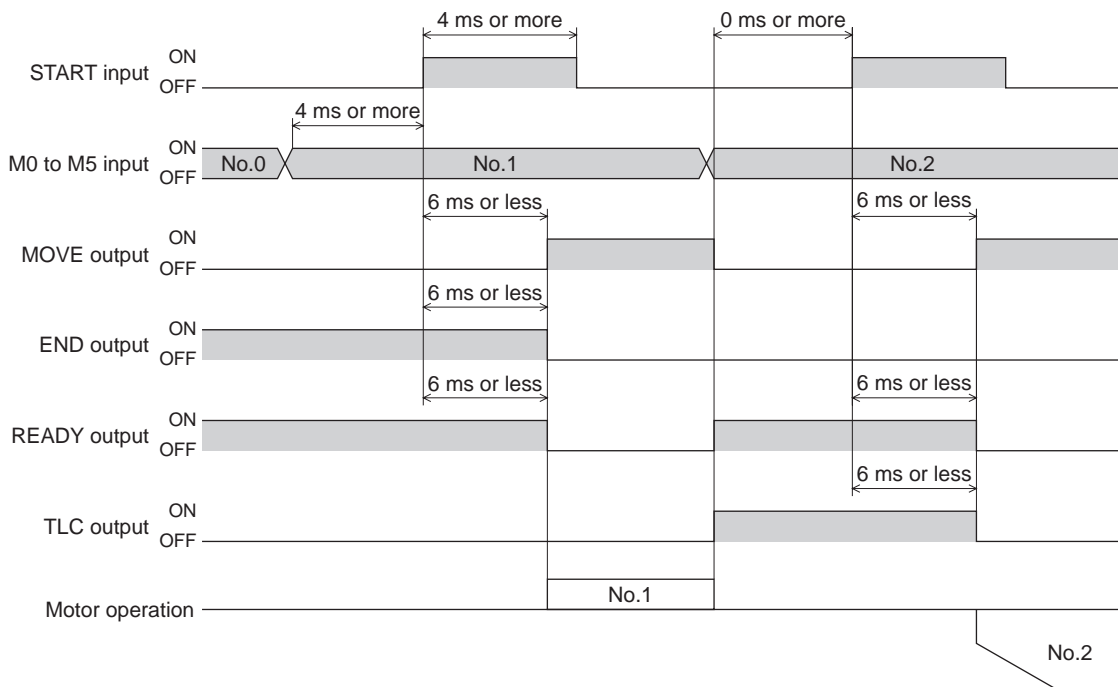
■ Direct positioning operation

4 ms or more

MS input — ON / OFF

MOVE output — ON / OFF — 6 ms or less

END output — ON / OFF — 6 ms or less — *

READY output — ON / OFF — 6 ms or less

Motor operation
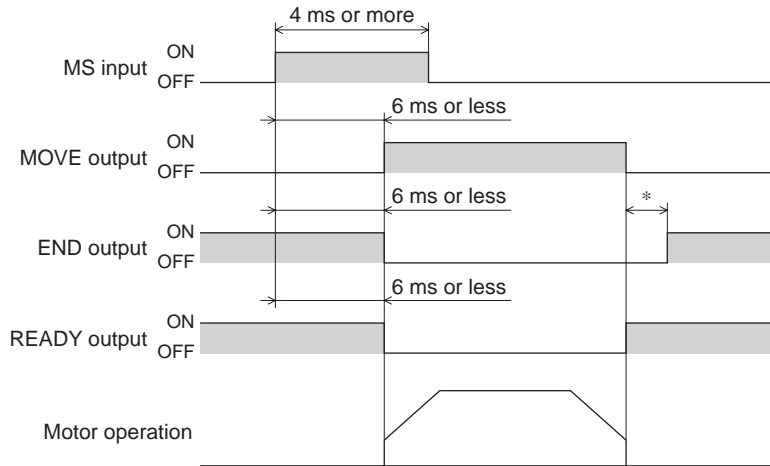
∗ The specific time varies depending on the load, operating speed, speed filter and other.

■ Sequential positioning operation

4 ms or more

SSTART input — ON / OFF

MOVE output — ON / OFF — 6 ms or less

END output — ON / OFF — 6 ms or less — *

READY output — ON / OFF — 6 ms or less

Motor operation
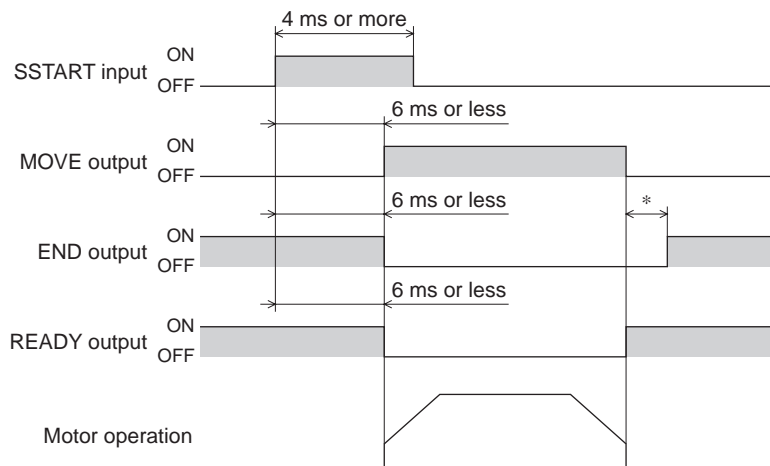
∗ The specific time varies depending on the load, operating speed, speed filter and other.

■ Continuous operation

FWD (RVS) input — ON / OFF

M0 to M5 input — ON / OFF

MOVE output — ON / OFF — 6 ms or less

END output — ON / OFF — 6 ms or less — *

READY output — ON / OFF — 6 ms or less

Motor operation — 6 ms or less — 6 ms or less
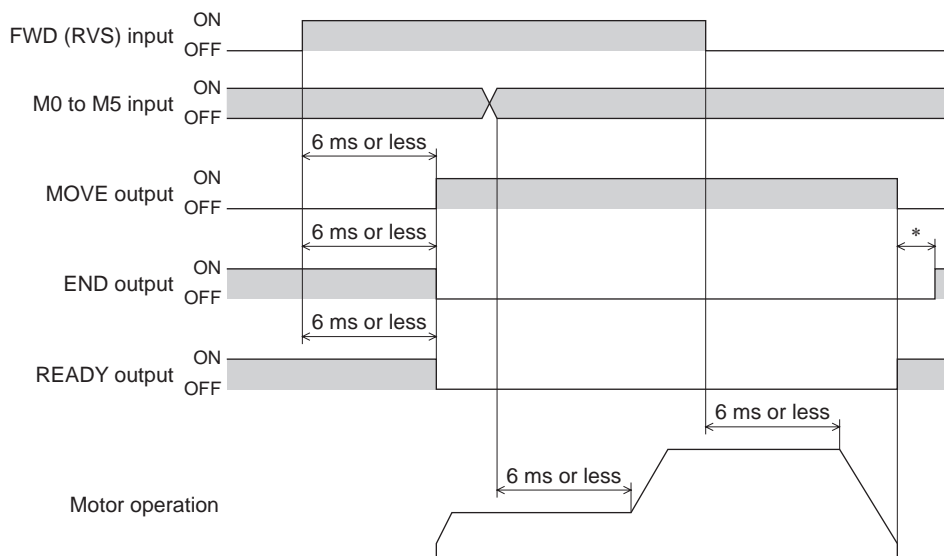
∗ The specific time varies depending on the load, operating speed, speed filter and other.

■ JOG operation
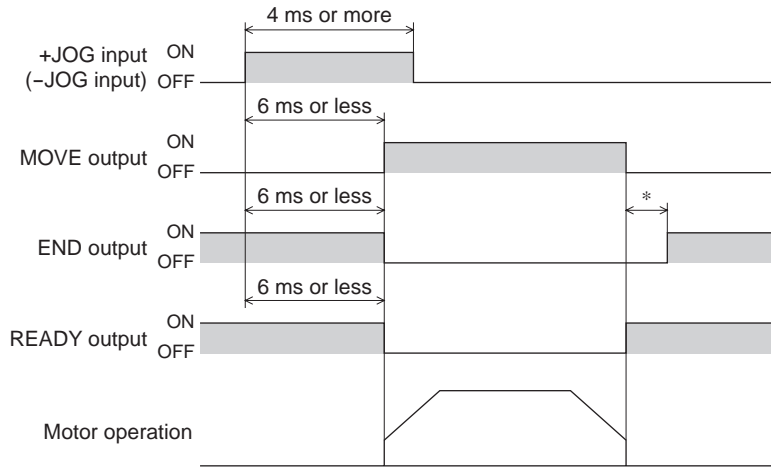
* The specific time varies depending on the load, operating speed, speed filter and other.

■ Return-to-home operation
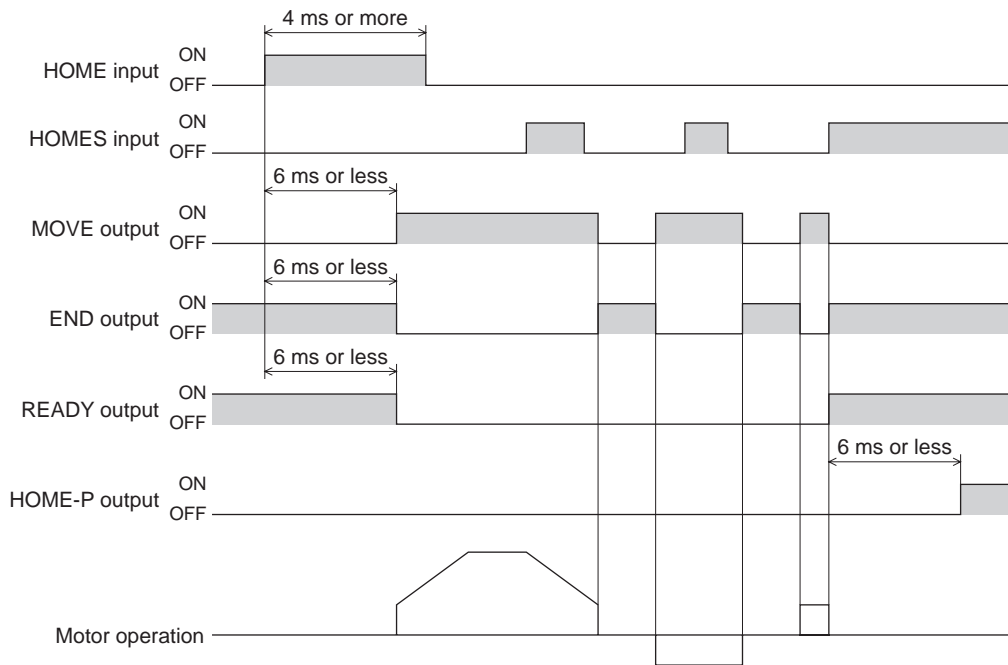
■ Automatic return operation

- When the automatic return operation is performed using the main power supply
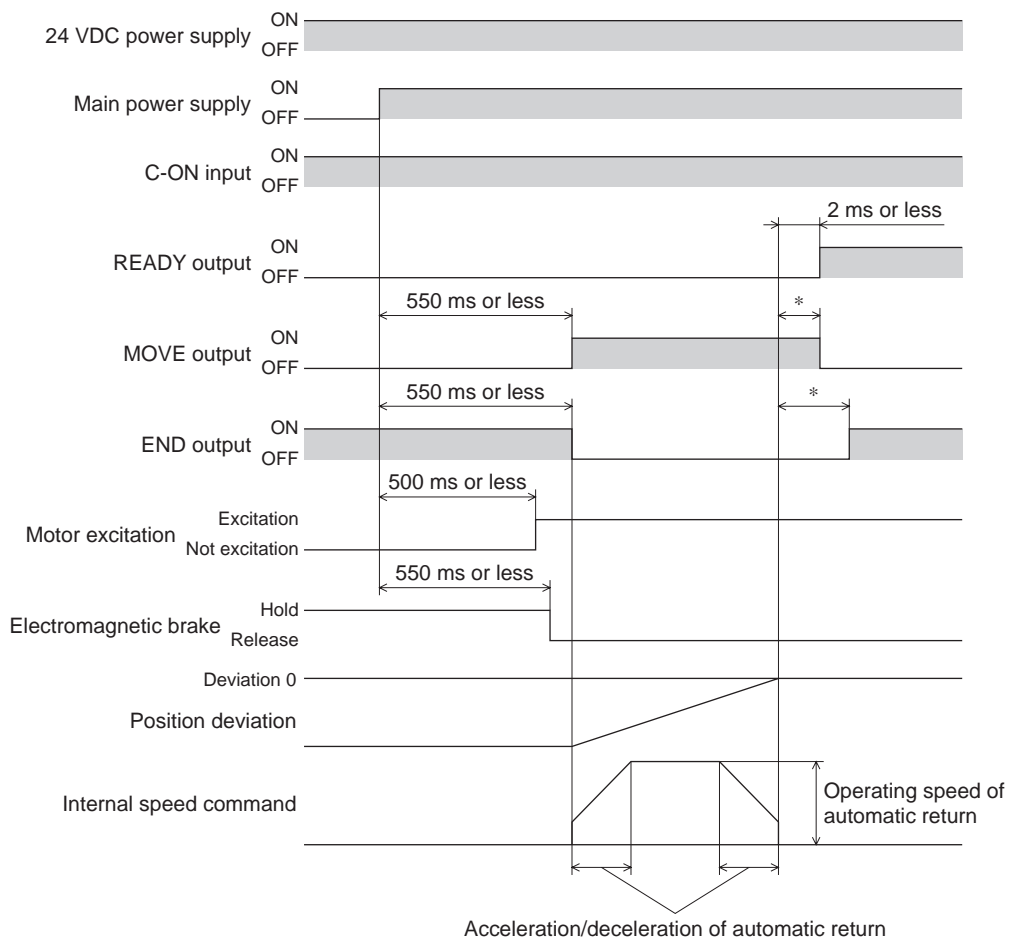
* The specific time varies depending on the load, operating speed, speed filter and other.

- When the automatic return operation is performed using the C-ON input
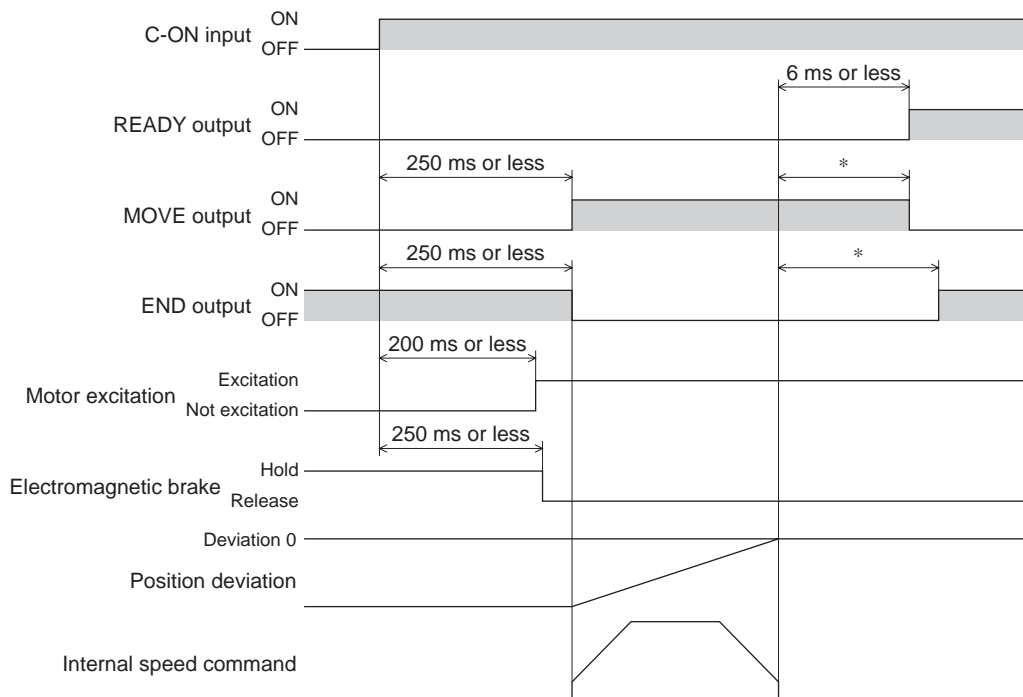
* The specific time varies depending on the load, operating speed, speed filter and other.

● When the operation is completed using the STOP input
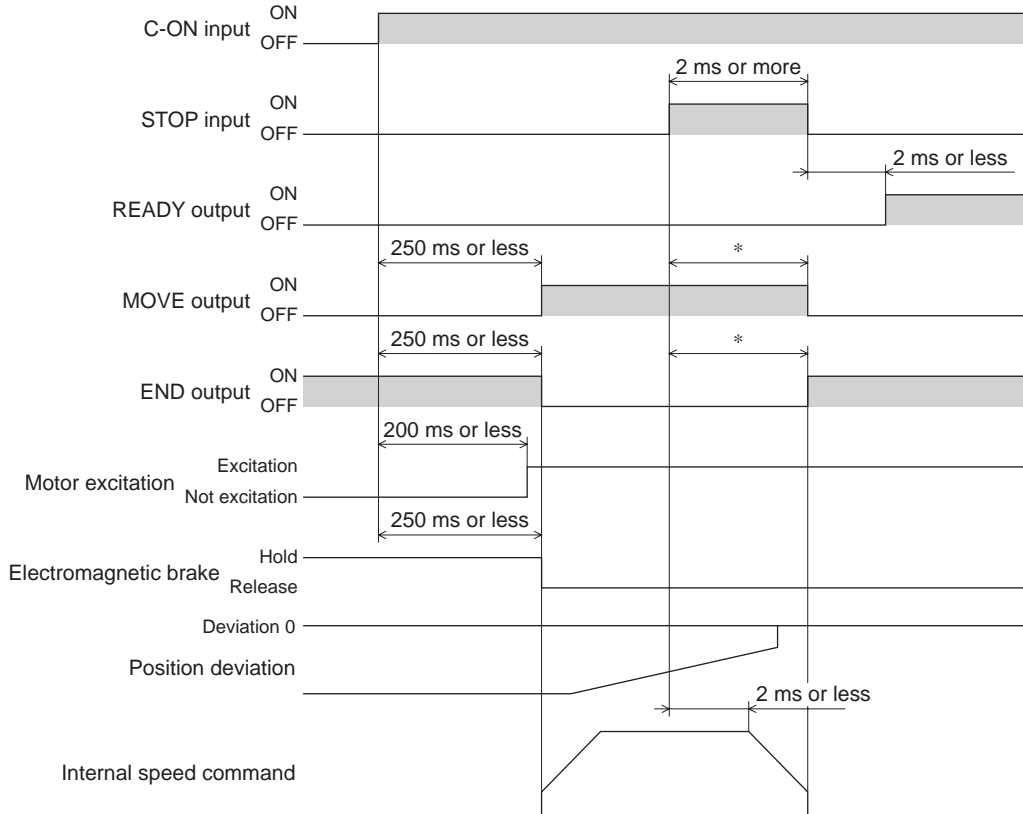
C-ON input — ON / OFF

STOP input — ON / OFF — 2 ms or more

READY output — ON / OFF — 2 ms or less

MOVE output — ON / OFF — 250 ms or less — *

END output — ON / OFF — 250 ms or less — *

Motor excitation — Excitation / Not excitation — 200 ms or less

Electromagnetic brake — Hold / Release — 250 ms or less

Position deviation — Deviation 0

Internal speed command — 2 ms or less

* The specific time varies depending on the load, operating speed, speed filter and other.

● When the C-ON input is turned OFF while performing the automatic return operation

C-ON input — ON / OFF

READY output — ON / OFF

MOVE output — ON / OFF — 250 ms or less — *

END output — ON / OFF — 250 ms or less — *

Motor excitation — Excitation / Not excitation — 200 ms or less — 250 ms or less

Electromagnetic brake — Hold / Release — 250 ms or less — 60 ms or less

Position deviation — Deviation 0

Internal speed command
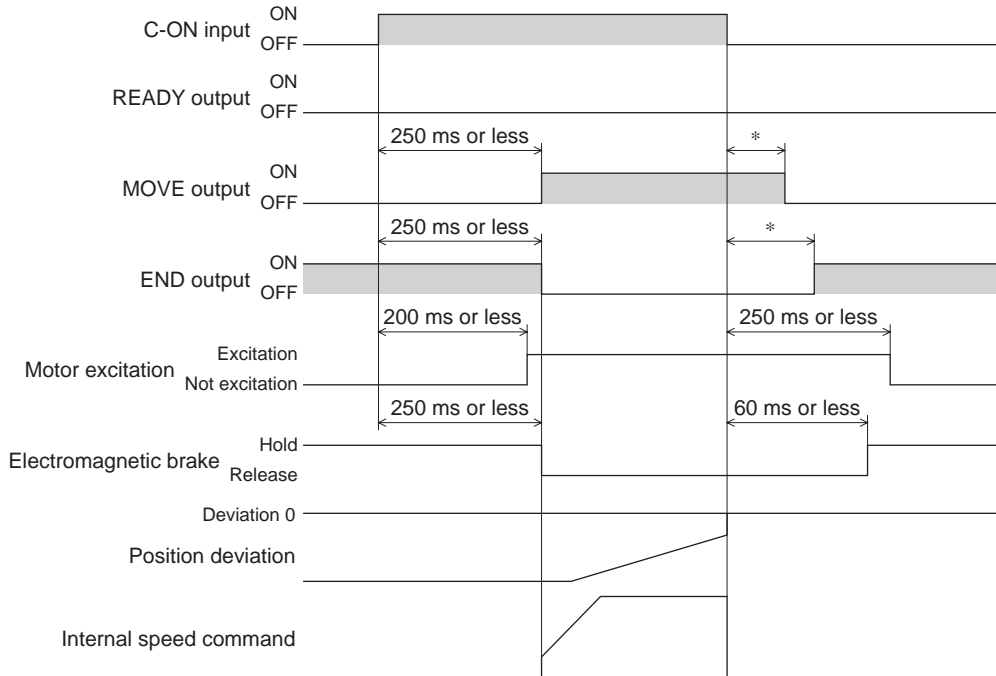
* The specific time varies depending on the load, operating speed, speed filter and other.

13   Method of control via Modbus protocol

The following explains how to implement control from a programmable controller via RS-485 communication.
The protocol for the RS-485 communication is the Modbus protocol.
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.

13.1 Guidance

If you are new to the **AR** Series AC power input built-in controller 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   Set the switches

Set the slave address and termination resistor

ID — Slave address

TERM. — Termination resistor

Check
Set the switches

Set the slave address, protocol and transmission rate

SW4   SW2

Slave address

ON
(Modbus protocol)

Transmission rate
[Factory setting:
0 (9600 bps)]
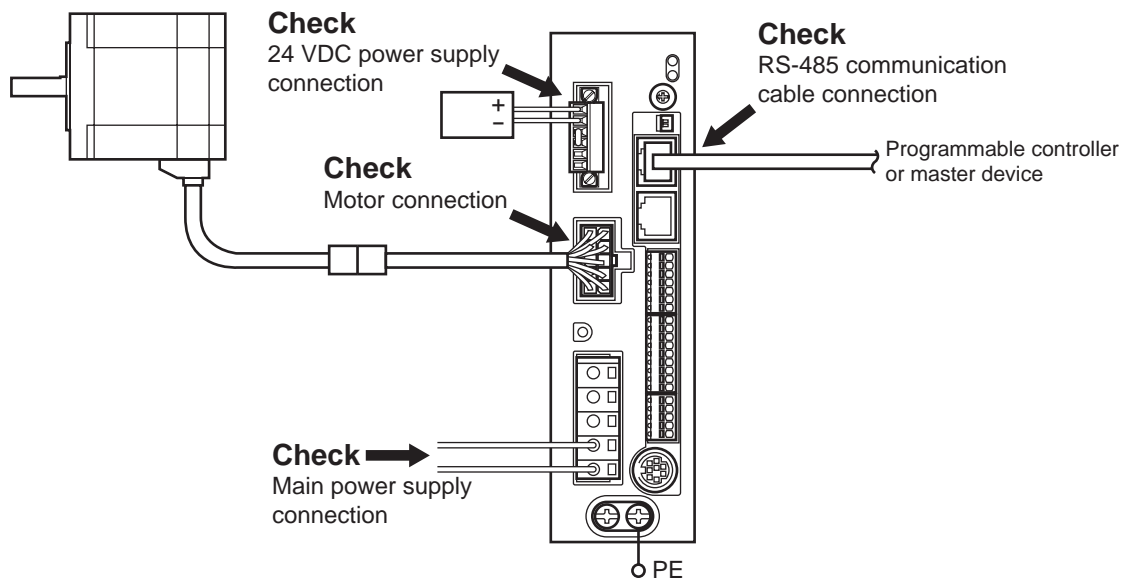
Check
Set the switches
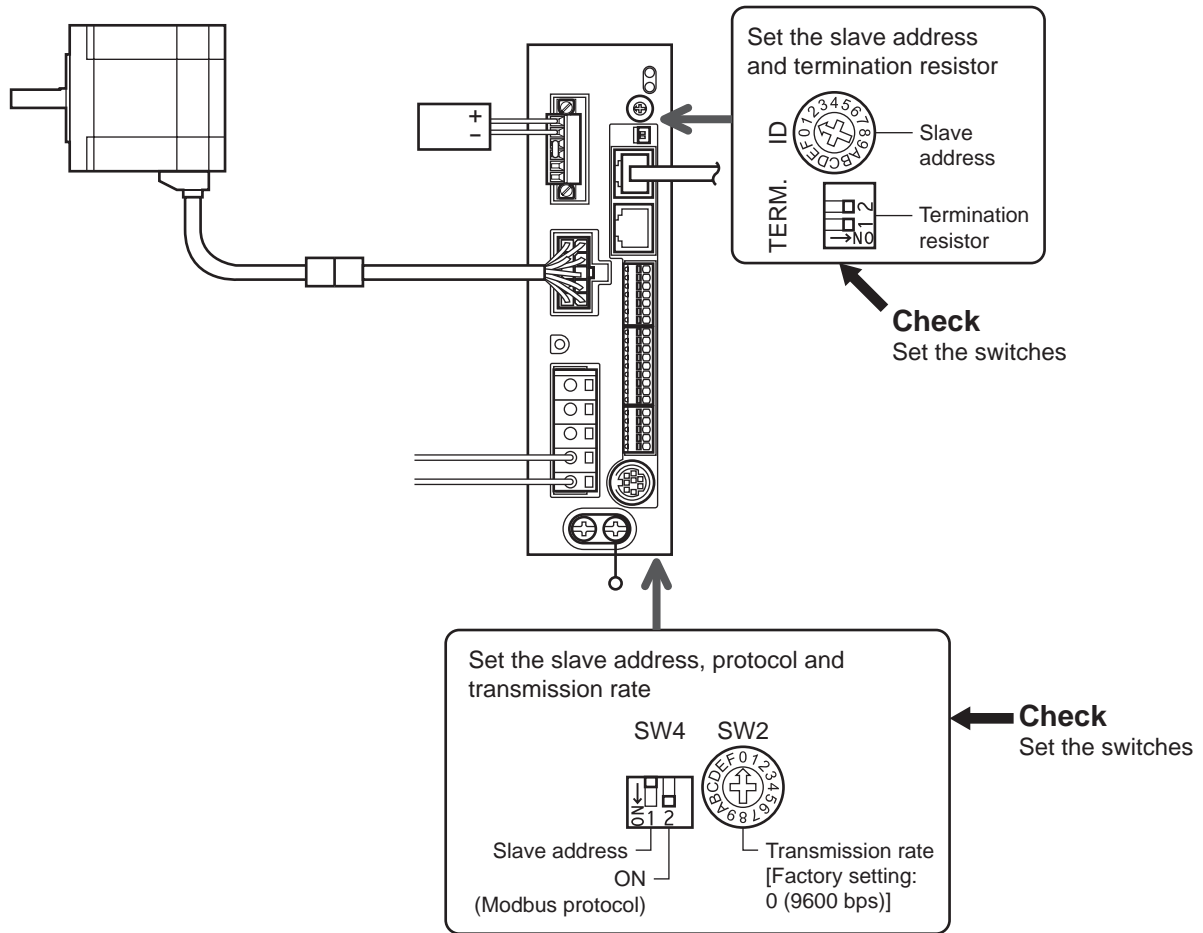
STEP 3   Turn on the power and check the parameters

1. Turn the 24 VDC power supply on

Programmable controller or master device

Check whether the values in the driver and master are same for the following communication parameters.

• Communication parity (Initial value: 1)
• Communication stop bit (Initial value: 0)
• Transmission waiting time (Initial value: 100)

2. Turn the main power supply on
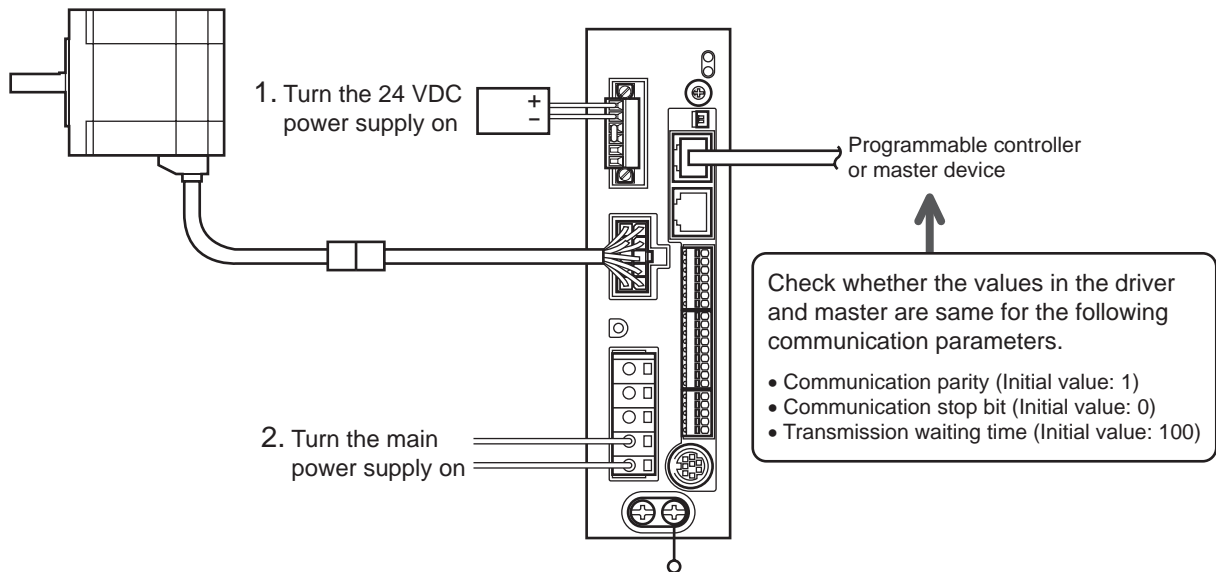
Check that the parameters in the driver and master device (programmable controller) are same.
When changing the driver parameter, use the **OPX-2A** or **MEXE02**.

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 problem.
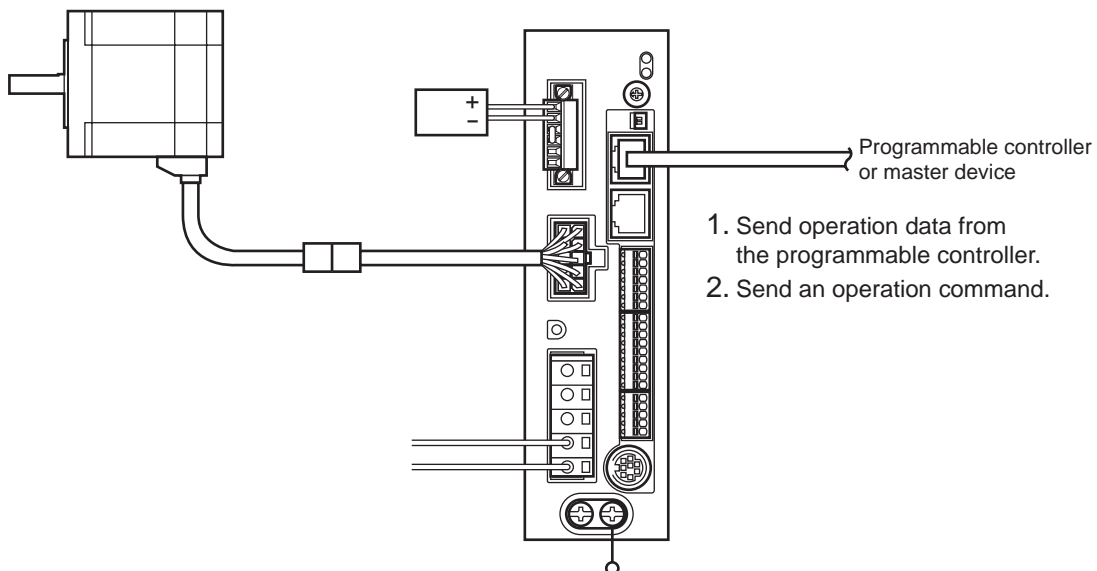
Programmable controller or master device

1. Send operation data from the programmable controller.
2. Send an operation command.

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?

For more detailed settings and functions, refer to "11 Operation" on p.54 or the following pages.

13.2 Communication specifications

Electrical characteristics	In conformance with EIA-485 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 figure	Up to 31 drivers can be connected to one programmable controller (master device).

■ Connection example
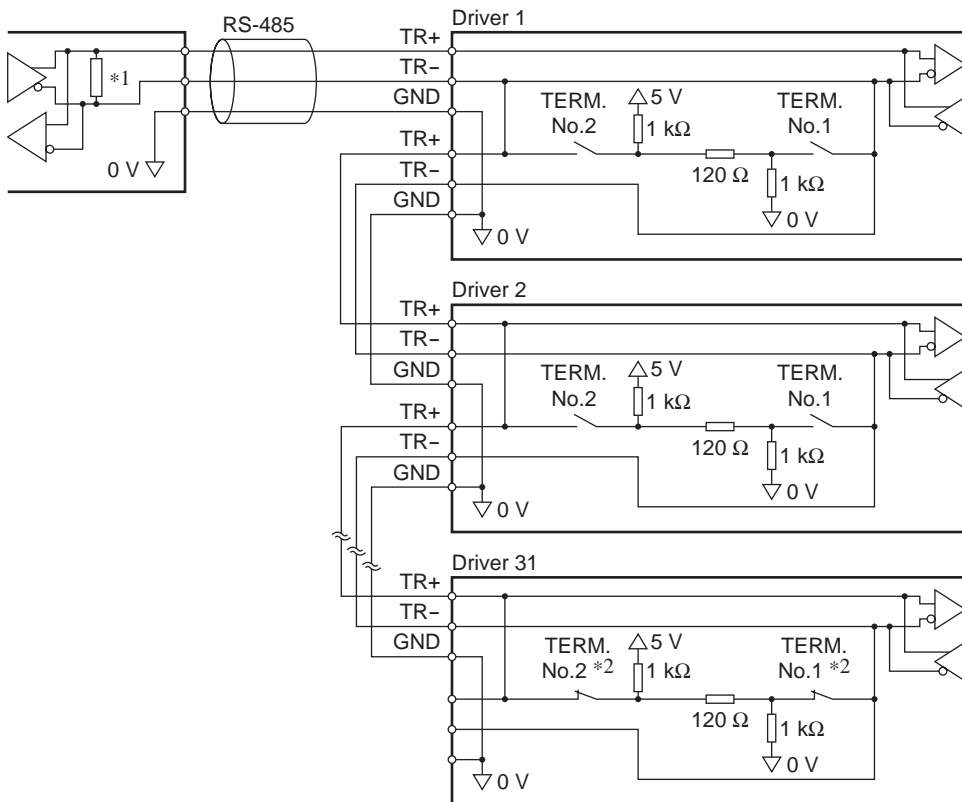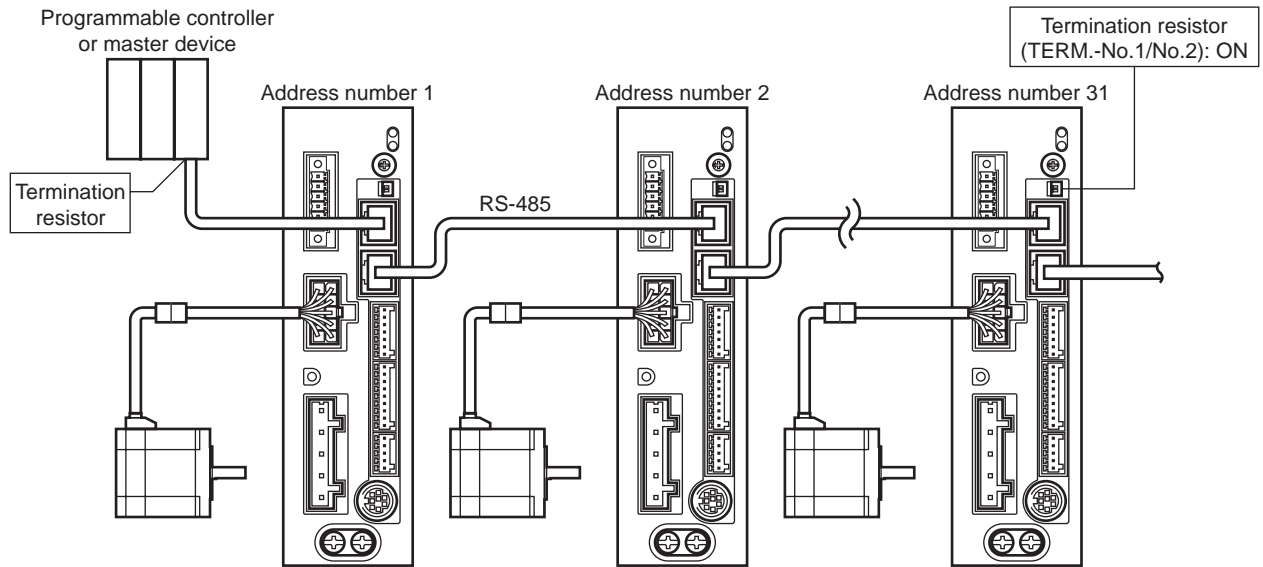
*1 Termination resistor 120 Ω
*2 Turn the termination resistor (TERM.-No.1 and No.2) to ON.

13.3 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.

• Driver front face

Address number setting switch (ID)
Termination resistor setting switch (TERM.)

• Driver bottom face

Transmission rate setting switch (SW2)

Function setting switch (SW4)
  No.1: Set the address number
  No.2: Set the protocol
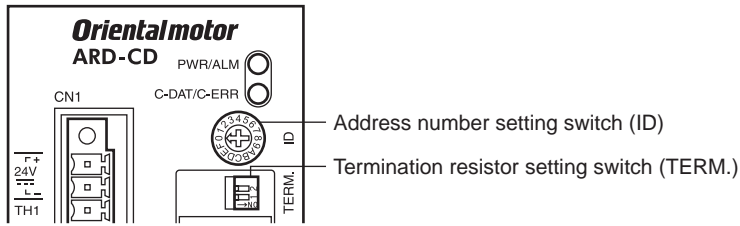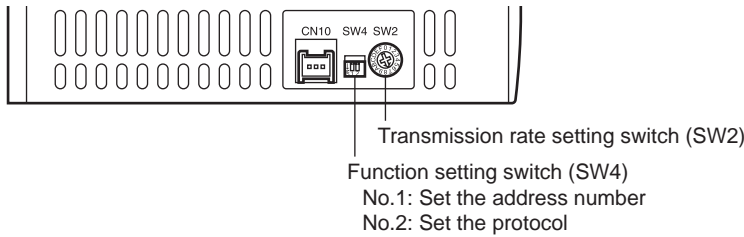
■ Protocol

Set the SW4-No.2 of the function setting switch 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 (ID) and SW4-No.1 of the function setting switch. 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   ID: 0, SW4-No.1: OFF

ID	SW4-No.1	Address number (slave address)	ID	SW4-No.1	Address number (slave address)
0		Not used	0		16
1		1	1		17
2		2	2		18
3		3	3		19
4		4	4		20
5		5	5		21
6		6	6		22
7	OFF	7	7	ON	23
8		8	8		24
9		9	9		25
A		10	A		26
B		11	B		27
C		12	C		28
D		13	D		29
E		14	E		30
F		15	F		31

■ Transmission rate

Set the transmission rate using transmission rate setting switch (SW2).
The transmission rate to be set should be the same as the transmission rate of the master device.
Factory setting   7

Note   Do not set SW2 to positions 5 to F.

SW2	Transmission rate (bps)
0	9600
1	19200
2	38400
3	57600
4	115,200
5 to F	Not used

■ Termination resistor

Use a termination resistor for the driver located farthest away (positioned at the end) from the programmable controller (master device).
Turn the termination resistor setting switch (TERM.-No.1 and No.2) ON to set the termination resistor for RS-485 communication (120 Ω).
Factory setting   No.1 and No.2: Both OFF
(termination resistor disabled)

TERM.-No.1 and No.2	Termination resistor (120 Ω)
Both are OFF	Disabled
Both are ON	Enabled
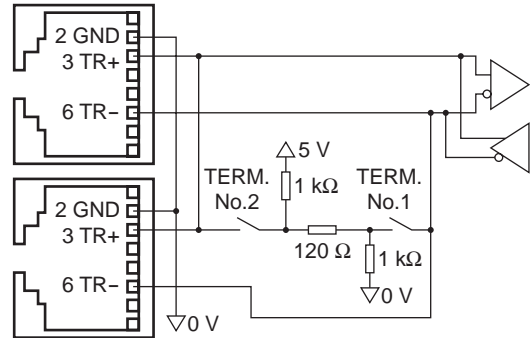
Note   If only one of No.1 or No.2 is turned ON, a communication error may occur.

13.4 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.
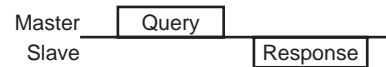
● Broadcast mode

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.
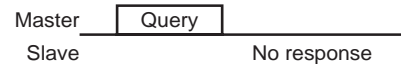
13.5 Communication timing
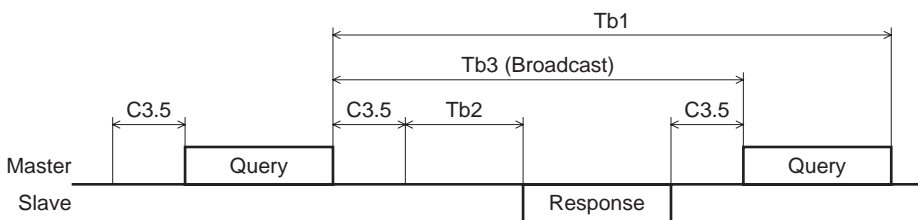
Character	Name	Description
Tb1	Communication timeout	Intervals between received messages are monitored. If no message could be received after the time set in the "communication timeout" parameter, a communication timeout alarm generates.
Tb2	Transmission waiting time	The time after the slave switches its communication line to the transmission mode upon receiving a query from the master, until it starts sending a response. Sets using the "transmission waiting time" parameter. The actual transmission waiting time corresponds to the silent interval (C3.5) + processing time + 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. The silent interval should be 1.75 ms or more when the transmission rate is 19200 bps or more.

13.6 Message

The message format is shown below.

Master   Query   Slave

Slave address		Slave address
Function code	Response	Function code
Data		Data
Error check		Error check
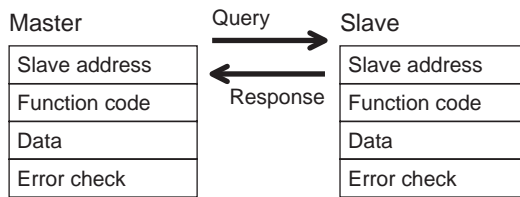
■ Query

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 **AR** Series AC power input built-in controller 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.

■ 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

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.

Exception code	Communication error code	Cause	Description
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** • NV memory processing in progress (8Ah) · Internal processing was in progress. (S-BSY is ON.) · An EEPROM error alarm was present. • Outside the parameter setting range (8Ch) The value write is outside the setting range. • Command execute disable (8Dh)

Example of exception response

Master   Query   Slave

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

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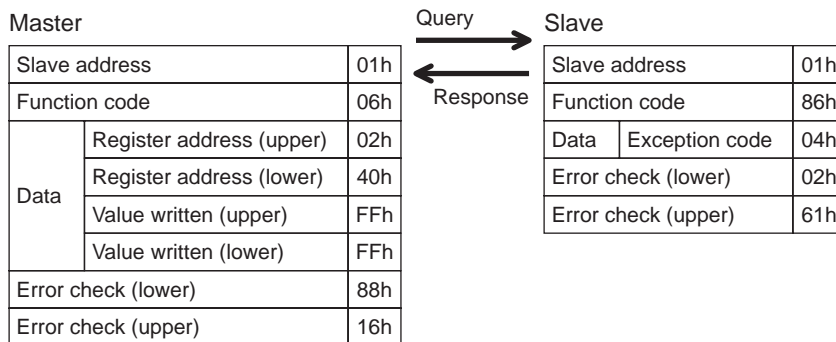
13.7 Function code

■ Reading from a holding register(s) (03h)

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 positions Nos.1 and 2 of slave address 1.

Description	Register address	Value read	Corresponding decimal
Operation data position No.1 (upper)	0402h	0000h	10000
Operation data position No.1 (lower)	0403h	2710h	
Operation data position No.2 (upper)	0404h	FFFFh	−10000
Operation data position No.2 (lower)	0405h	D8F0h	

• 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)	02h	
	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)		E4h	Calculation result of CRC-16
Error check (upper)		F9h	

● Response

Field name		Data	Description
Slave address		01h	Same as query
Function code		03h	Same as query
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 0402h
	Value read from register address (lower)	00h	
	Value read from register address+1 (upper)	27h	Value read from register address 0403h
	Value read from register address+1 (lower)	10h	
	Value read from register address+2 (upper)	FFh	Value read from register address 0404h
	Value read from register address+2 (lower)	FFh	
	Value read from register address+3 (upper)	D8h	Value read from register address 0405h
	Value read from register address+3 (lower)	F0h	
Error check (lower)		08h	Calculation result of CRC-16
Error check (upper)		A3h	

■ Writing to a holding register (06h)

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 80 (50h) as speed filter to slave address 2.

Description	Register address	Value write	Corresponding decimal
Speed filter	024Bh	50h	80

● Query

Field name		Data	Description
Slave address		02h	Slave address 2
Function code		06h	Writing to a holding register
Data	Register address (upper)	02h	Register address to be written
	Register address (lower)	4Bh	
	Value write (upper)	00h	Value written to the register address
	Value write (lower)	50h	
Error check (lower)		F8h	Calculation result of CRC-16
Error check (upper)		6Bh	

● Response

Field name		Data	Description
Slave address		02h	Same as query
Function code		06h	Same as query
Data	Register address (upper)	02h	Same as query
	Register address (lower)	4Bh	
	Value write (upper)	00h	Same as query
	Value write (lower)	50h	
Error check (lower)		F8h	Calculation result of CRC-16
Error check (upper)		6Bh	

■ Diagnosis (08h)

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	Same as query
Data	Sub-function code (upper)	00h	Same as query
	Sub-function code (lower)	00h	
	Data value (upper)	12h	Same as query
	Data value (lower)	34h	
Error check (lower)		ECh	Same as query
Error check (upper)		9Eh	

■ Writing to multiple holding registers (10h)

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 Nos.2 to 4 as part of operation data at slave address 4.

Description	Register address	Value written	Corresponding decimal
Operation data acceleration No.2 (upper)	0604h	0000h	10000
Operation data acceleration No.2 (lower)	0605h	2710h	
Operation data acceleration No.3 (upper)	0606h	0000h	20000
Operation data acceleration No.3 (lower)	0607h	4E20h	
Operation data acceleration No.4 (upper)	0608h	0007h	500,000
Operation data acceleration No.4 (lower)	0609h	A120h	

● 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)	04h	
	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
	Value written to register address (upper)	00h	Value written to register address 0604h
	Value written to register address (lower)	00h	
	Value written to register address+1 (upper)	27h	Value written to register address 0605h
	Value written to register address+1 (lower)	10h	
	Value written to register address+2 (upper)	00h	Value written to register address 0606h
	Value written to register address+2 (lower)	00h	
	Value written to register address+3 (upper)	4Eh	Value written to register address 0607h
	Value written to register address+3 (lower)	20h	
	Value written to register address+4 (upper)	00h	Value written to register address 0608h
	Value written to register address+4 (lower)	07h	
	Value written to register address+5 (upper)	A1h	Value written to register address 0609h
	Value written to register address+5 (lower)	20h	
Error check (lower)		1Dh	Calculation result of CRC-16
Error check (upper)		A9h	

● Response

Field name		Data	Description
Slave address		04h	Same as query
Function code		10h	Same as query
Data	Register address (upper)	06h	Same as query
	Register address (lower)	04h	
	Number of registers (upper)	00h	Same as query
	Number of registers (lower)	06h	
Error check (lower)		01h	Calculation result of CRC-16
Error check (upper)		17h	

13.8 Setting of RS-485 communication

Set parameters required RS-485 communication first.

● Parameters set with the **OPX-2A** or **MEXE02**

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

Parameter name	Setting range	Initial value	Description
Communication parity	0: None 1: Even number 2: Odd number	1	Parity for RS-485 communication.
Communication stop bit	0: 1 bit 1: 2 bits	0	Stop bit for RS-485 communication.
Transmission waiting time	0 to 10000 (1=0.1 ms)	100	Transmission waiting time for RS-485 communication.

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

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

Parameter name	Setting range	Initial value	Description
Communication timeout	0: Not monitored 0 to 10000 ms	0	Condition in which a communication timeout occurs in RS-485 communication.
Communication error alarm	1 to 10 times	3	Condition in which a RS-485 communication error alarm generates. A communication error alarm generates after a RS-485 communication error has occurred by the number of times set here.

13.9 Register address list

All data used by the driver is 32-bit wide. Since the register for the Modbus protocol is 16-bit wide, 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.

■ Operation commands

Commands related to motor operation. Operation commands are not saved in the NV memory.

Register address		Name	Description	READ/ WRITE	Setting range
Dec	Hex				
48	0030h	Group (upper)	Sets the address number for the group send.	R/W	−1: No group specification (Group send is not performed) 1 to 31: Sets a group address.
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)	Sets the output status of the driver.	R	See the following explanation.
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.129 for group details.
The initial value is −1. When setting a group, read/write to the upper and lower at the same time.

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

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

∗ ( ): Initial value

● Driver input command (007Ch/007Dh)

These are the driver input signals that can be accessed via RS-485 communication. See p.38 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 (RVS)	NET-IN14 (FWD)	NET-IN13 (−JOG)	NET-IN12 (+JOG)	NET-IN11 (SSTART)	NET-IN10 (MS2)	NET-IN9 (MS1)	NET-IN8 (MS0)
	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
	NET-IN7 (Not used)	NET-IN6 (FREE)	NET-IN5 (STOP)	NET-IN4 (HOME)	NET-IN3 (START)	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.43 for each output signal.

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

Address (Hex)	Description of address *							
	bit15	bit14	bit13	bit12	bit11	bit10	bit9	bit8
007Fh	NET-OUT15 (TLC)	NET-OUT14 (END)	NET-OUT13 (MOVE)	NET-OUT12 (TIM)	NET-OUT11 (AREA3)	NET-OUT10 (AREA2)	NET-OUT9 (AREA1)	NET-OUT8 (S-BSY)
	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
	NET-OUT7 (ALM)	NET-OUT6 (WNG)	NET-OUT5 (READY)	NET-OUT4 (HOME-P)	NET-OUT3 (START_R)	NET-OUT2 (M2_R)	NET-OUT1 (M1_R)	NET-OUT0 (M0_R)

∗ ( ): Initial value

■ Maintenance commands

These commands are used to reset alarms and warnings. They are also used to execute the batch processing for the NV memory. All commands can be read and written (READ/WRITE). Executes 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."	
385	0181h	Reset alarm (lower)		
386	0182h	Absolute position error alarm reset (upper)	Resets the absolute position error alarm.	
387	0183h	Absolute position error alarm reset (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)		0, 1
394	018Ah	P-PRESET execute (upper)	Presets the command position.	
395	018Bh	P-PRESET execute (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 NV memory, to their defaults.	
399	018Fh	All data initialization (lower)*		
400	0190h	Batch NV memory read (upper)	Reads the parameters saved in the NV 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 NV memory. The NV memory can be rewritten approx. 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**.

● Configuration (018Ch)

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
POWER LED	Lit	Lit	Based on the driver condition.
ALM LED	OFF	OFF	
Electromagnetic brake	Hold/Release	Hold	
Motor excitation	Excitation/no excitation	No excitation	
Output signals	Allowed	Indeterminable	Allowed
Input signals	Allowed	Not allowed	Allowed
Sensor input	Allowed	Not allowed	Allowed

Note	• The correct monitor value may not return even when the monitor is executed while executing the configuration.
	• If the "automatic return action" parameter is "enable" while meeting the conditions performing the automatic return operation, the automatic return operation will not perform immediately after executing the configuration.

■ Monitor commands

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

Register address		Name	Description	Setting 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 1 to 10.	
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)		

Register address		Name	Description	Setting range
Dec	Hex			
152	0098h	Warning record 1 (upper)	Monitors the warning records 1 to 10.	
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)		
160	00A0h	Warning record 5 (upper)		
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 1 to 10 that have occurred in the past.	00h to FFh
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)		

Register address		Name	Description	Setting range
Dec	Hex			
191	00BFh	Communication error code record 9 (lower)	Monitors the communication error records 1 to 10 that have occurred in the past.	00h to FFh
192	00C0h	Communication error code record 10 (upper)		
193	00C1h	Communication error code record 10 (lower)		
194	00C2h	Present selected data No. (upper)	Monitors the operation data No. currently selected.	0 to 63
195	00C3h	Present selected data No. (lower)		
196	00C4h	Present operation data No. (upper)	Monitors the operation data No. corresponding to the data used in the current positioning operation. This address is used in linked-motion operation and sequential positioning operation. While the motor is stopped, the last used operation data number is indicated. "−1" is indicated until the positioning operation is performed after turning the power on.	−1 to 63
197	00C5h	Present operation data No. (lower)		
198	00C6h	Command position (upper)	Monitors the command position.	−2,147,483,648 to 2,147,483,647 step
199	00C7h	Command position (lower)		
200	00C8h	Command speed (upper)	Monitors the current command speed.	−4500 to +4500 r/min +: Forward −: Reverse 0: Stop
201	00C9h	Command speed (lower)		
204	00CCh	Feedback position (upper)	Monitors the feedback position.	−2,147,483,648 to 2,147,483,647 step
205	00CDh	Feedback position (lower)		
206	00CEh	Feedback speed (upper)	Monitors the feedback speed.	−4500 to +4500 r/min
207	00CFh	Feedback speed (lower)		
210	00D2h	Remaining dwell time (upper)	Monitors how much of the dwell time used in the linked-motion operation 2 remains.	0 to 50000 ms
211	00D3h	Remaining dwell time (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)		

- Direct I/O and electromagnetic brake status (00D4h)

Address (Hex)		bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
00D4h	Upper	–	–	–	–	–	–	–	MB
	Lower	–	–	OUT5	OUT4	OUT3	OUT2	OUT1	OUT0
00D5h	Upper	–	–	IN7	IN6	IN5	IN4	IN3	IN2
	Lower	IN1	IN0	–	–	SLIT	HOMES	−LS	+LS

■Parameter R/W commands

Write or read parameters. All commands can be read and written (READ/WRITE).
For details on parameters, see p.85 and later.

• Operation data

Register address		Name	Setting range	Initial value	Effective[*1]
Dec	Hex				
1024 1025 to 1150 1151	0400h 0401h to 047Eh 047Fh	Position No.0 (upper) Position No.0 (lower) to Position No.63 (upper) Position No.63 (lower)	−8,388,608 to 8,388,607 step	0	B
1152 1153 to 1278 1279	0480h 0481h to 04FEh 04FFh	Operating speed No.0 (upper) Operating speed No.0 (lower) to Operating speed No.63 (upper) Operating speed No.63 (lower)	0 to 1,000,000 Hz	1000	
1280 1281 to 1406 1407	0500h 0501h to 057Eh 057Fh	Operation mode No.0 (upper) Operation mode No.0 (lower) to Operation mode No.63 (upper) Operation mode No.63 (lower)	0: Incremental 1: Absolute	0	
1408 1409 to 1534 1535	0580h 0581h to 05FEh 05FFh	Operation function No.0 (upper) Operation function No.0 (lower) to Operation function No.63 (upper) Operation function No.63 (lower)	0: Single-motion 1: Linked-motion 2: Linked-motion 2 3: Push-motion	0	
1536 1537 to 1662 1663	0600h 0601h to 067Eh 067Fh	Acceleration No.0 (upper) Acceleration No.0 (lower) to Acceleration No.63 (upper) Acceleration No.63 (lower)	1 to 1,000,000 (1=0.001 ms/kHz or 1=0.001 s) [*2][*3]	1000	
1664 1665 to 1790 1791	0680h 0681h to 06FEh 06FFh	Deceleration No.0 (upper) Deceleration No.0 (lower) to Deceleration No.63 (upper) Deceleration No.63 (lower)			
1792 1793 to 1918 1919	0700h 0701h to 077Eh 077Fh	Push current No.0 (upper) Push current No.0 (lower) to Push current No.63 (upper) Push current No.63 (lower)	0 to 500 (1=0.1%)	200	
1920 1921 to 2046 2047	0780h 0781h to 07FEh 07FFh	Sequential positioning No.0 (upper) Sequential positioning No.0 (lower) to Sequential positioning No.63 (upper) Sequential positioning No.63 (lower)	0: Disable 1: Enable	0	
2048 2049 to 2174 2175	0800h 0801h to 087Eh 087Fh	Dwell time No.0 (upper) Dwell time No.0 (lower) to Dwell time No.63 (upper) Dwell time No.63 (lower)	0 to 50000 (1=0.001 s)	0	

∗1 Indicates the timing for the data to become effective. (B: Effective after stopping the operation)
∗2 This item is effective when the "acceleration/deceleration type" parameter is set to "separate". If this parameter is set to "common", the values of the "common acceleration" and "common deceleration" parameters will be used (initial value: separate).
∗3 Acceleration/deceleration rate (ms/kHz) or acceleration/deceleration time (s) can be selected using "acceleration/deceleration unit" parameter. (initial value: acceleration/deceleration rate).

● User parameter

Register address		Name	Setting range	Initial value	Effective*
Dec	Hex				

512	0200h	STOP input action (upper)	0: Immediate stop
			1: Deceleration stop
			2: Immediate stop &
			  Current OFF
			3: Deceleration stop &
			  Current OFF
				1	A

513	0201h	STOP input action (lower)			
514	0202h	Hardware overtravel (upper)	0: Disable 1: Enable	1	
515	0203h	Hardware overtravel (lower)			
516	0204h	Overtravel action (upper)	0: Immediate stop 1: Deceleration stop	0	
517	0205h	Overtravel action (lower)			
518	0206h	Positioning completion signal range (upper)	0 to 180 (1=0.1°)	18	
519	0207h	Positioning completion signal range (lower)			
520	0208h	Positioning completion signal offset (upper)	−18 to 18 (1=0.1°)	0	
521	0209h	Positioning completion signal offset (lower)			
522	020Ah	AREA1 positive direction position (upper)	−8,388,608 to 8,388,607 step	0	
523	020Bh	AREA1 positive direction position (lower)			
524	020Ch	AREA1 negative direction position (upper)			
525	020Dh	AREA1 negative direction position (lower)			
526	020Eh	AREA2 positive direction position (upper)			
527	020Fh	AREA2 positive direction position (lower)			
528	0210h	AREA2 negative direction position (upper)			
529	0211h	AREA2 negative direction position (lower)			
530	0212h	AREA3 positive direction position (upper)			
531	0213h	AREA3 positive direction position (lower)			
532	0214h	AREA3 negative direction position (upper)			
533	0215h	AREA3 negative direction position (lower)			
534	0216h	Minimum ON time for MOVE output (upper)	0 to 255 ms	0	
535	0217h	Minimum ON time for MOVE output (lower)			
536	0218h	LS logic level (upper)	0: Normally open 1: Normally closed	0	C
537	0219h	LS logic level (lower)			
538	021Ah	HOMES logic level (upper)			
539	021Bh	HOMES logic level (lower)			
540	021Ch	SLIT logic level (upper)			
541	021Dh	SLIT logic level (lower)			
4096	1000h	MS0 operation No. selection (upper)	0 to 63	0	B
4097	1001h	MS0 operation No. selection (lower)			
4098	1002h	MS1 operation No. selection (upper)		1	
4099	1003h	MS1 operation No. selection (lower)			
4100	1004h	MS2 operation No. selection (upper)		2	
4101	1005h	MS2 operation No. selection (lower)			
4102	1006h	MS3 operation No. selection (upper)		3	
4103	1007h	MS3 operation No. selection (lower)			
4104	1008h	MS4 operation No. selection (upper)		4	
4105	1009h	MS4 operation No. selection (lower)			
4106	100Ah	MS5 operation No. selection (upper)		5	
4107	100Bh	MS5 operation No. selection (lower)			
4108	100Ch	HOME-P function selection (upper)	0: Home output 1: Return-to-home complete output	0	A
4109	100Dh	HOME-P function selection (lower)			
576	0240h	RUN current (upper)	0 to 1000 (1=0.1%)	1000	
577	0241h	RUN current (lower)			
578	0242h	STOP current (upper)	0 to 500 (1=0.1%)	500	
579	0243h	STOP current (lower)			

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

Register address		Name	Setting range	Initial value	Effective[1]
Dec	Hex				
580	0244h	Position loop gain (upper)	1 to 50	10	A
581	0245h	Position loop gain (lower)			
582	0246h	Speed loop gain (upper)	10 to 200	180	
583	0247h	Speed loop gain (lower)			
584	0248h	Speed loop integral time constant (upper)	100 to 2000 (1=0.1 ms)	1000	
585	0249h	Speed loop integral time constant (lower)			
586	024Ah	Speed filter (upper)	0 to 200 ms	1	B
587	024Bh	Speed filter (lower)			
588	024Ch	Moving average time (upper)	1 to 200 ms	1	
589	024Dh	Moving average time (lower)			
4128	1020h	Filter selection (upper)	0: Speed filter	0	C
4129	1021h	Filter selection (lower)	1: Moving average filter		
4130	1022h	Speed error gain 1 (upper)	0 to 500	45	A
4131	1023h	Speed error gain 1 (lower)			
4132	1024h	Speed error gain 2 (upper)		45	
4133	1025h	Speed error gain 2 (lower)			
4134	1026h	Control mode (upper)	0: Normal mode	0	C
4135	1027h	Control mode (lower)	1: Current control mode		
4136	1028h	Smooth driver (upper)	0: Disable	1	
4137	1029h	Smooth driver (lower)	1: Enable		
640	0280h	Common acceleration (upper)	1 to 1,000,000 (1=0.001 ms/kHz or 1=0.001 s) [2]	1000	B
641	0281h	Common acceleration (lower)			
642	0282h	Common deceleration (upper)		1000	
643	0283h	Common deceleration (lower)			
644	0284h	Starting speed (upper)	0 to 1,000,000 Hz	500	
645	0285h	Starting speed (lower)			
646	0286h	JOG operating speed (upper)	1 to 1,000,000 Hz	1000	
647	0287h	JOG operating speed (lower)			
648	0288h	Acceleration/deceleration rate of JOG (upper)	1 to 1,000,000 (1=0.001 ms/kHz or 1=0.001 s) [2]	1000	
649	0289h	Acceleration/deceleration rate of JOG (lower)			
650	028Ah	JOG starting speed (upper)	0 to 1,000,000 Hz	500	
651	028Bh	JOG starting speed (lower)			
652	028Ch	Acceleration/deceleration type (upper)	0: Common	1	
653	028Dh	Acceleration/deceleration type (lower)	1: Separate		
654	028Eh	Acceleration/deceleration unit (upper)	0: ms/kHz	0	C
655	028Fh	Acceleration/deceleration unit (lower)	1: s		
4160	1040h	Automatic return action (upper)	0: Disable	0	
4161	1041h	Automatic return action (lower)	1: Enable		
4162	1042h	Operating speed of automatic return (upper)	1 to 1,000,000 Hz	1000	B
4163	1043h	Operating speed of automatic return (lower)			
4164	1044h	Acceleration/deceleration of automatic return (upper)	1 to 1,000,000 (1=0.001 ms/kHz or 1=0.001 s) [2]	1000	
4165	1045h	Acceleration/deceleration of automatic return (lower)			
4166	1046h	Starting speed of automatic return (upper)	0 to 1,000,000 Hz	500	
4167	1047h	Starting speed of automatic return (lower)			
4168	1048h	JOG travel amount (upper)	1 to 8,388,607 step	1	
4169	1049h	JOG travel amount (lower)			
704	02C0h	Home-seeking mode (upper)	0: 2-sensor mode 1: 3-sensor mode 2: Push mode	1	
705	02C1h	Home-seeking mode (lower)			

[1] "Effective" Indicates the timing for the data to become effective. (A: Effective immediately, B: Effective after stopping the operation, C: Effective after executing the configuration)

[2] Acceleration/deceleration rate (ms/kHz) or acceleration/deceleration time (s) can be selected using "acceleration/deceleration unit" parameter. (initial value: acceleration/deceleration rate).

Register address		Name	Setting range	Initial value	Effective[1]
Dec	Hex				
706	02C2h	Operating speed of home-seeking (upper)	1 to 1,000,000 Hz	1000	B
707	02C3h	Operating speed of home-seeking (lower)			
708	02C4h	Acceleration/deceleration of home-seeking (upper)	1 to 1,000,000 (1=0.001 ms/kHz or 1=0.001 s) [2]	1000	
709	02C5h	Acceleration/deceleration of home-seeking (lower)			
710	02C6h	Starting speed of home-seeking (upper)	1 to 1,000,000 Hz	500	
711	02C7h	Starting speed of home-seeking (lower)			
712	02C8h	Position offset of home-seeking (upper)	−8,388,608 to 8,388,607 step	0	
713	02C9h	Position offset of home-seeking (lower)			
714	02CAh	Starting direction of home-seeking (upper)	0: Negative direction 1: Positive direction	1	
715	02CBh	Starting direction of home-seeking (lower)			
716	02CCh	SLIT detection with home-seeking (upper)	0: Disable 1: Enable	0	
717	02CDh	SLIT detection with home-seeking (lower)			
718	02CEh	TIM signal detection with home-seeking (upper)			
719	02CFh	TIM signal detection with home-seeking (lower)			
720	02D0h	Operating current of push-motion home-seeking (upper)	0 to 1000 (1=0.1%)	1000	
721	02D1h	Operating current of push-motion home-seeking (lower)			
768	0300h	Overload (upper)	1 to 300 (1=0.1 s)	50	A
769	0301h	Overload (lower)			
770	0302h	Overflow rotation alarm during current on (upper)	1 to 30000 (1=0.01 rev)	300	
771	0303h	Overflow rotation alarm during current on (lower)			
776	0308h	Return-to-home incomplete alarm (upper)	0: Disable 1: Enable	0	C
777	0309h	Return-to-home incomplete alarm (lower)			
4224	1080h	Overflow rotation alarm during current off (upper)	1 to 30000 (1=0.01 rev)	10000	A
4225	1081h	Overflow rotation alarm during current off (lower)			
832	0340h	Overheat warning (upper)	40 to 85 °C (104 to 185 °F)	85	
833	0341h	Overheat warning (lower)			
834	0342h	Overload warning (upper)	1 to 300 (1=0.1 s)	50	
835	0343h	Overload warning (lower)			
836	0344h	Overspeed warning (upper)	1 to 5000 r/min	4500	
837	0345h	Overspeed warning (lower)			
838	0346h	Overvoltage warning (upper)	120 to 450 V	435	
839	0347h	Overvoltage warning (lower)			
840	0348h	Undervoltage warning (upper)	120 to 280 V	120	
841	0349h	Undervoltage warning (lower)			
842	034Ah	Overflow rotation warning during current on (upper)	1 to 30000 (1=0.01 rev)	300	
843	034Bh	Overflow rotation warning during current on (lower)			
896	0380h	Electronic gear A (upper)	1 to 65535	1	C
897	0381h	Electronic gear A (lower)			
898	0382h	Electronic gear B (upper)			
899	0383h	Electronic gear B (lower)			

[1] "Effective" Indicates the timing for the data to become effective. (A: Effective immediately, B: Effective after stopping the operation, C: Effective after executing the configuration)

[2] Acceleration/deceleration rate (ms/kHz) or acceleration/deceleration time (s) can be selected using "acceleration/deceleration unit" parameter. (initial value: acceleration/deceleration rate).

Register address		Name	Setting range	Initial value	Effective*
Dec	Hex				
900	0384h	Motor rotation direction (upper)	0: Positive direction =CCW	1	C
901	0385h	Motor rotation direction (lower)	1: Positive direction =CW		
902	0386h	Software overtravel (upper)	0: Disable	1	A
903	0387h	Software overtravel (lower)	1: Enable		
904	0388h	Positive software limit (upper)	−8,388,608 to 8,388,607 step	8,388,607	
905	0389h	Positive software limit (lower)			
906	038Ah	Negative software limit (upper)		−8,388,608	
907	038Bh	Negative software limit (lower)			
908	038Ch	Preset position (upper)		0	
909	038Dh	Preset position (lower)			
910	038Eh	Wrap setting (upper)	0: Disable	0	C
911	038Fh	Wrap setting (lower)	1: Enable		
912	0390h	Wrap setting range (upper)	1 to 8,388,607 step	1000	
913	0391h	Wrap setting range (lower)			
960	03C0h	Data setter speed display (upper)	0: Signed	0	A
961	03C1h	Data setter speed display (lower)	1: Absolute value		
962	03C2h	Data setter edit (upper)	0: Disable	1	
963	03C3h	Data setter edit (lower)	1: Enable		
964	03C4h	Absolute-position backup system (upper)		0	
965	03C5h	Absolute-position backup system (lower)			
4352	1100h	IN0 input function selection (upper)	See P.128	3: HOME	C
4353	1101h	IN0 input function selection (lower)			
4354	1102h	IN1 input function selection (upper)		4: START	
4355	1103h	IN1 input function selection (lower)			
4356	1104h	IN2 input function selection (upper)		48: M0	
4357	1105h	IN2 input function selection (lower)			
4358	1106h	IN3 input function selection (upper)		49: M1	
4359	1107h	IN3 input function selection (lower)			
4360	1108h	IN4 input function selection (upper)		50: M2	
4361	1109h	IN4 input function selection (lower)			
4362	110Ah	IN5 input function selection (upper)		16: FREE	
4363	110Bh	IN5 input function selection (lower)			
4364	110Ch	IN6 input function selection (upper)		18: STOP	
4365	110Dh	IN6 input function selection (lower)			
4366	110Eh	IN7 input function selection (upper)		24: ALM-RST	
4367	110Fh	IN7 input function selection (lower)			
4384	1120h	IN0 input logic level setting (upper)	0: Normally open	0	
4385	1121h	IN0 input logic level setting (lower)	1: Normally closed		
4386	1122h	IN1 input logic level setting (upper)			
4387	1123h	IN1 input logic level setting (lower)			
4388	1124h	IN2 input logic level setting (upper)			
4389	1125h	IN2 input logic level setting (lower)			
4390	1126h	IN3 input logic level setting (upper)			
4391	1127h	IN3 input logic level setting (lower)			
4392	1128h	IN4 input logic level setting (upper)			
4393	1129h	IN4 input logic level setting (lower)			
4394	112Ah	IN5 input logic level setting (upper)			
4395	112Bh	IN5 input logic level setting (lower)			
4396	112Ch	IN6 input logic level setting (upper)			
4397	112Dh	IN6 input logic level setting (lower)			
4398	112Eh	IN7 input logic level setting (upper)			
4399	112Fh	IN7 input logic level setting (lower)			

* "Effective" Indicates the timing for the data to become effective. (A: Effective immediately, C: Effective after executing the configuration)

Register address		Name	Setting range	Initial value	Effective*
Dec	Hex				
4416	1140h	OUT0 output function selection (upper)	See P.128	70: HOME-P	
4417	1141h	OUT0 output function selection (lower)			
4418	1142h	OUT1 output function selection (upper)		69: END	
4419	1143h	OUT1 output function selection (lower)			
4420	1144h	OUT2 output function selection (upper)		73: AREA1	
4421	1145h	OUT2 output function selection (lower)			
4422	1146h	OUT3 output function selection (upper)		67: READY	
4423	1147h	OUT3 output function selection (lower)			
4424	1148h	OUT4 output function selection (upper)		66: WNG	
4425	1149h	OUT4 output function selection (lower)			
4426	114Ah	OUT5 output function selection (upper)		65: ALM	
4427	114Bh	OUT5 output function selection (lower)			
4448	1160h	NET-IN0 input function selection (upper)	See P.128	48: M0	C
4449	1161h	NET-IN0 input function selection (lower)			
4450	1162h	NET-IN1 input function selection (upper)		49: M1	
4451	1163h	NET-IN1 input function selection (lower)			
4452	1164h	NET-IN2 input function selection (upper)		50: M2	
4453	1165h	NET-IN2 input function selection (lower)			
4454	1166h	NET-IN3 input function selection (upper)		4: START	
4455	1167h	NET-IN3 input function selection (lower)			
4456	1168h	NET-IN4 input function selection (upper)		3: HOME	
4457	1169h	NET-IN4 input function selection (lower)			
4458	116Ah	NET-IN5 input function selection (upper)		18: STOP	
4459	116Bh	NET-IN5 input function selection (lower)			
4460	116Ch	NET-IN6 input function selection (upper)		16: FREE	
4461	116Dh	NET-IN6 input function selection (lower)			
4462	116Eh	NET-IN7 input function selection (upper)		0: Not used	
4463	116Fh	NET-IN7 input function selection (lower)			
4464	1170h	NET-IN8 input function selection (upper)		8: MS0	
4465	1171h	NET-IN8 input function selection (lower)			
4466	1172h	NET-IN9 input function selection (upper)		9: MS1	
4467	1173h	NET-IN9 input function selection (lower)			
4468	1174h	NET-IN10 input function selection (upper)		10: MS2	
4469	1175h	NET-IN10 input function selection (lower)			
4470	1176h	NET-IN11 input function selection (upper)		5: SSTART	
4471	1177h	NET-IN11 input function selection (lower)			
4472	1178h	NET-IN12 input function selection (upper)		6: +JOG	
4473	1179h	NET-IN12 input function selection (lower)			
4474	117Ah	NET-IN13 input function selection (upper)		7: −JOG	
4475	117Bh	NET-IN13 input function selection (lower)			
4476	117Ch	NET-IN14 input function selection (upper)		1: FWD	
4477	117Dh	NET-IN14 input function selection (lower)			
4478	117Eh	NET-IN15 input function selection (upper)		2: RVS	
4479	117Fh	NET-IN15 input function selection (lower)			
4480	1180h	NET-OUT0 output function selection (upper)	See P.129	48: M0_R	
4481	1181h	NET-OUT0 output function selection (lower)			
4482	1182h	NET-OUT1 output function selection (upper)		49: M1_R	
4483	1183h	NET-OUT1 output function selection (lower)			
4484	1184h	NET-OUT2 output function selection (upper)		50: M2_R	
4485	1185h	NET-OUT2 output function selection (lower)			
4486	1186h	NET-OUT3 output function selection (upper)		4: START_R	
4487	1187h	NET-OUT3 output function selection (lower)			
4488	1188h	NET-OUT4 output function selection (upper)		70: HOME-P	
4489	1189h	NET-OUT4 output function selection (lower)			

* "Effective" Indicates the timing for the data to become effective. (C: Effective after executing the configuration)

Register address		Name	Setting range	Initial value	Effective*
Dec	Hex				
4490	118Ah	NET-OUT5 output function selection (upper)	See P.129	67: READY	C
4491	118Bh	NET-OUT5 output function selection (lower)			
4492	118Ch	NET-OUT6 output function selection (upper)		66: WNG	
4493	118Dh	NET-OUT6 output function selection (lower)			
4494	118Eh	NET-OUT7 output function selection (upper)		65: ALM	
4495	118Fh	NET-OUT7 output function selection (lower)			
4496	1190h	NET-OUT8 output function selection (upper)		80: S-BSY	
4497	1191h	NET-OUT8 output function selection (lower)			
4498	1192h	NET-OUT9 output function selection (upper)		73: AREA1	
4499	1193h	NET-OUT9 output function selection (lower)			
4500	1194h	NET-OUT10 output function selection (upper)		74: AREA2	
4501	1195h	NET-OUT10 output function selection (lower)			
4502	1196h	NET-OUT11 output function selection (upper)		75: AREA3	
4503	1197h	NET-OUT11 output function selection (lower)			
4504	1198h	NET-OUT12 output function selection (upper)		72: TIM	
4505	1199h	NET-OUT12 output function selection (lower)			
4506	119Ah	NET-OUT13 output function selection (upper)		68: MOVE	
4507	119Bh	NET-OUT13 output function selection (lower)			
4508	119Ch	NET-OUT14 output function selection (upper)		69: END	
4509	119Dh	NET-OUT14 output function selection (lower)			
4510	119Eh	NET-OUT15 output function selection (upper)		71: TLC	
4511	119Fh	NET-OUT15 output function selection (lower)			
4608	1200h	Communication timeout (upper)	0: Not monitored 1 to 10000 ms	0	A
4609	1201h	Communication timeout (lower)			
4610	1202h	Communication error alarm (upper)	1 to 10 times	3	
4611	1203h	Communication error alarm (lower)			

* "Effective" Indicates the timing for the data to become effective. (A: Effective immediately, C: Effective after executing the configuration)

- Setting range for IN input function selection

0: Not used	8: MS0	18: STOP	35: R3	43: R11	51: M3
1: FWD	9: MS1	24: ALM-RST	36: R4	44: R12	52: M4
2: RVS	10: MS2	25: P-PRESET	37: R5	45: R13	53: M5
3: HOME	11: MS3	26: P-CLR	38: R6	46: R14	
4: START	12: MS4	27: HMI	39: R7	47: R15	
5: SSTART	13: MS5	32: R0	40: R8	48: M0	
6: +JOG	16: FREE	33: R1	41: R9	49: M1	
7: −JOG	17: C-ON	34: R2	42: R10	50: M2	

- Setting range for OUT output function selection

0: Not used	10: MS2_R	35: R3	45: R13	61: −LS_R	72: TIM
1: FWD_R	11: MS3_R	36: R4	46: R14	62: HOMES_R	73: AREA1
2: RVS_R	12: MS4_R	37: R5	47: R15	63: SLIT_R	74: AREA2
3: HOME_R	13: MS5_R	38: R6	48: M0_R	65: ALM	75: AREA3
4: START_R	16: FREE_R	39: R7	49: M1_R	66: WNG	80: S-BSY
5: SSTART_R	17: C-ON_R	40: R8	50: M2_R	67: READY	82: MPS
6: +JOG_R	18: STOP_R	41: R9	51: M3_R	68: MOVE	
7: −JOG_R	32: R0	42: R10	52: M4_R	69: END	
8: MS0_R	33: R1	43: R11	53: M5_R	70: HOME-P	
9: MS1_R	34: R2	44: R12	60: +LS_R	71: TLC	

- Setting range for NET-IN input function selection

0: Not used	8: MS0	18: STOP	38: R6	46: R14
1: FWD	9: MS1	27: HMI	39: R7	47: R15
2: RVS	10: MS2	32: R0	40: R8	48: M0
3: HOME	11: MS3	33: R1	41: R9	49: M1
4: START	12: MS4	34: R2	42: R10	50: M2
5: SSTART	13: MS5	35: R3	43: R11	51: M3
6: +JOG	16: FREE	36: R4	44: R12	52: M4
7: −JOG	17: C-ON	37: R5	45: R13	53: M5

● Setting range for NET-OUT output function selection

0: Not used	10: MS2_R	35: R3	45: R13	61: −LS_R	72: TIM
1: FWD_R	11: MS3_R	36: R4	46: R14	62: HOMES_R	73: AREA1
2: RVS_R	12: MS4_R	37: R5	47: R15	63: SLIT_R	74: AREA2
3: HOME_R	13: MS5_R	38: R6	48: M0_R	65: ALM	75: AREA3
4: START_R	16: FREE_R	39: R7	49: M1_R	66: WNG	80: S-BSY
5: SSTART_R	17: C-ON_R	40: R8	50: M2_R	67: READY	82: MPS
6: +JOG_R	18: STOP_R	41: R9	51: M3_R	68: MOVE	
7: −JOG_R	32: R0	42: R10	52: M4_R	69: END	
8: MS0_R	33: R1	43: R11	53: M5_R	70: HOME-P	
9: MS1_R	34: R2	44: R12	60: +LS_R	71: TLC	

13.10 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.
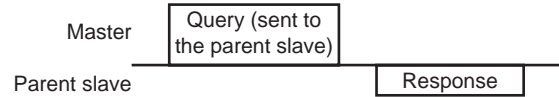
● Group address

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.
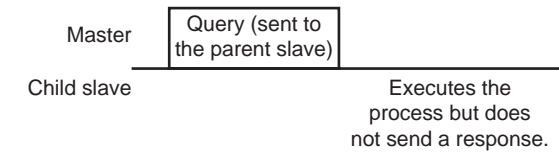
● Parent slave

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 setting a group, read/write to the upper and lower at the same time.

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

Note Since the group setting is not saved in the NV 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

Programmable controller or master device

Parent slave
Address 1
"group" command: −1
(individual)

Child slave
Address 2
"group" command: 1

Child slave
Address 3
"group" command: 1
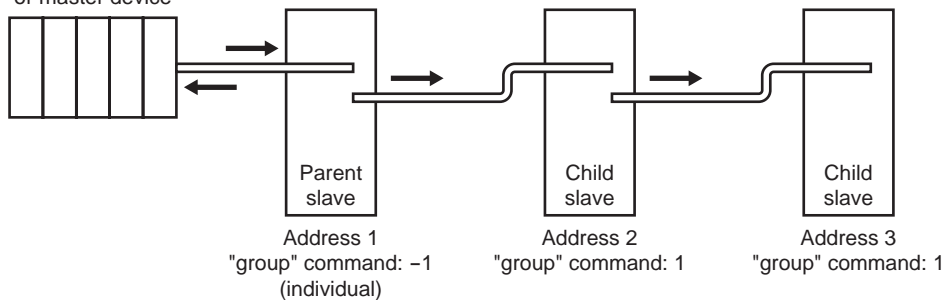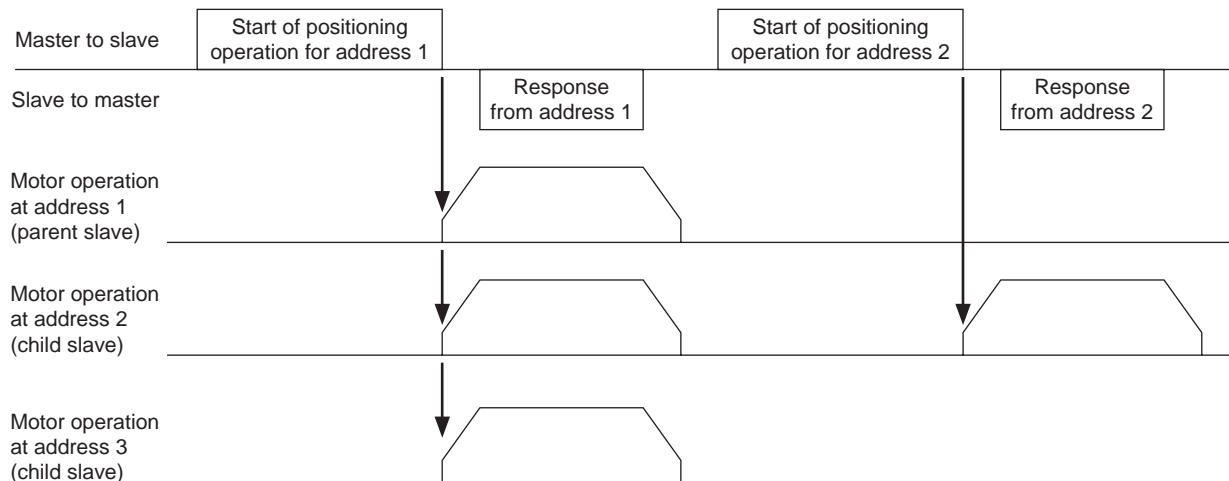
13.11 Detection of communication errors

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

■ 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
RS-485 communication error	84h	A transmission error was detected. See "Transmission error" on p.112.
Command not yet defined	88h	An exception response (exception code 01h, 02h) was detected. See p.112.
Execution disable due to user I/F communication in progress	89h	An exception response (exception code 04h) was detected. See p.112.
NV memory processing in progress	8Ah	
Outside setting range	8Ch	An exception response (exception code 03h, 04h) was detected. See p.112.
Command execute disable	8Dh	An exception response (exception code 04h) was detected. See p.112.

■ Alarms and warnings

When an alarm generates, the ALM output will turn OFF and the motor will stop. At the same time, the ALARM 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 You can also clear the warning records by turning off the driver power.

- Communication switch setting error

When setting the transmission rate setting switch (SW2) 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 timeout" parameter, a RS-485 communication timeout alarm will generate.

13.12 Timing charts

■ Communication start

Power supply input
Communication — Master / Slave
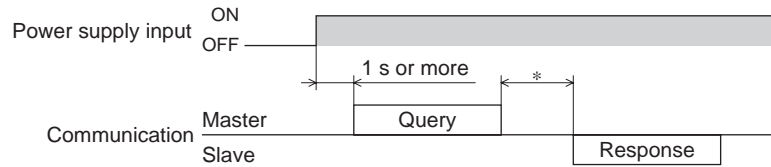
* Tb2 (transmission waiting time) + C3.5 (silent interval) + command processing time

■ Operation start

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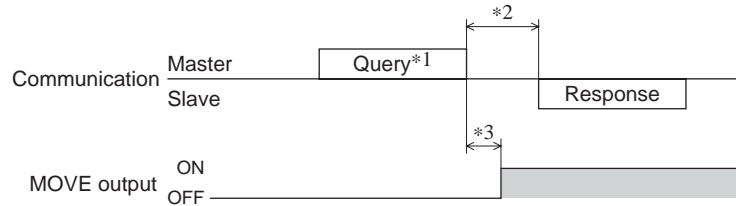
*1 A message including a query to start operation via RS-485 communication.
*2 Tb2 (transmission waiting time) + C3.5 (silent interval) + command processing time
*3 C3.5 (silent interval) + 4 ms or less

■ Operation stop, speed change

Communication — Master / Slave
Motor speed command
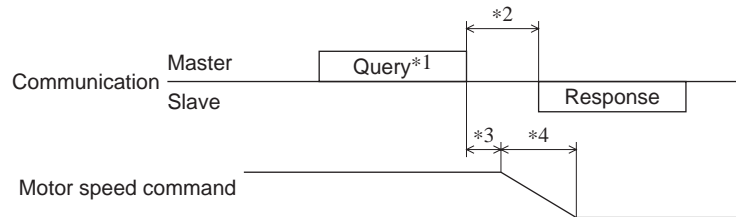
*1 A message including a query to stop operation and another to change the speed via RS-485 communication.
*2 Tb2 (transmission waiting time) + C3.5 (silent interval) + command processing time
*3 The specific time varies depending on the command speed.
*4 The deceleration method to be applied at the time of stopping varies according to the value set by the "STOP input action" parameter.

■ General signals

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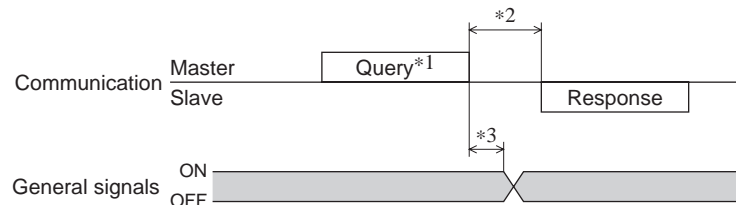
*1 A message including a query for remote output via RS-485 communication.
*2 Tb2 (transmission waiting time) + C3.5 (silent interval) + command processing time
*3 C3.5 (silent interval) + 4 ms or less

■ Configuration

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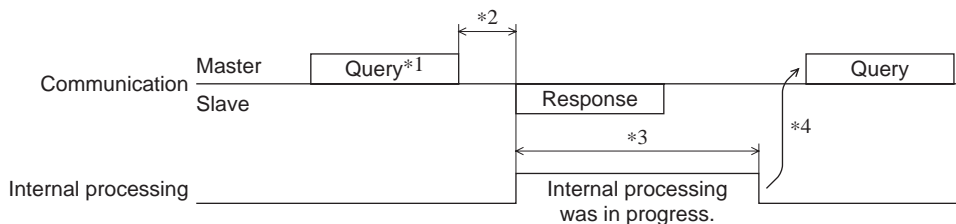
*1 A message including a query for configuration via RS-485 communication.
*2 Tb2 (transmission waiting time) + C3.5 (silent interval) + command processing time
*3 Command processing time + 1 s or less
*4 Execute a query after the driver internal processing is completed.

14 Method of control via CC-Link communication

See the following explanation when using the **AR** Series AC power input built-in controller type in combination with the network converter **NETC01-CC** via CC-Link communication.
Refer to "16 Details of network converter" on p.146 for remote I/O and command code.

14.1 Guidance

If you are new to the **AR** Series AC power input built-in controller 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** <u>USER MANUAL</u> 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
- SW4-No.2 of the function setting switch: 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

Driver

Address number: 0
ID: 0

RS-485 transmission rate: 625,000 bps
SW1: 7

- Connection device: Network converter
- Address number: 0
SW4-No.1: OFF
SW4-No.2: OFF

RS-485 transmission rate: 625,000 bps
SW2: 7

NETC01-CC

CC-Link station number: 1
×10: 0
×1: 1

CC-Link baud rate: Same as master device
B.RATE

Operation mode: 6 axes connection mode
SW2-No.1: OFF
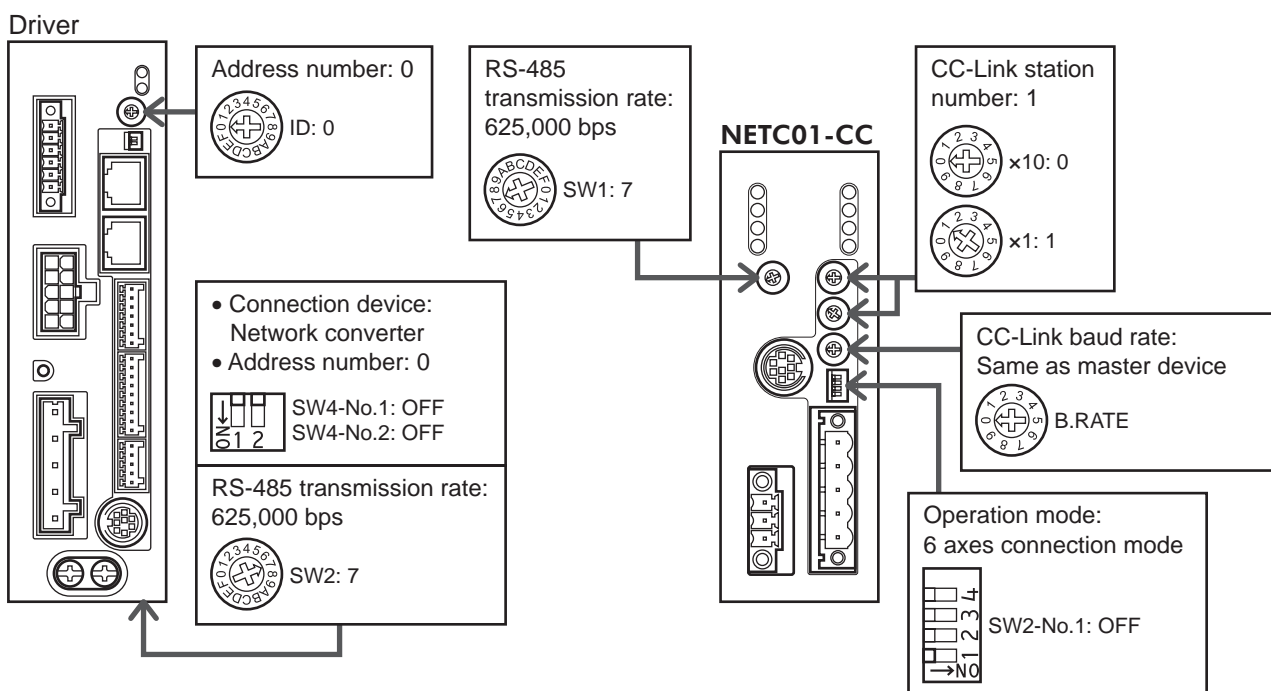
■ Using the parameter

1. Set the "connection (address number 0) (1D80h)" parameter of the **NETC01-CC** to "1: 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

Driver

24 VDC power supply

RS-485 communication cable

NETC01-CC

Programmable controller or master device

CC-Link communication cable

Mail power supply

PE   FG   FG

STEP 3 Check the termination resistor

Termination resistor: ON

TERM.-No.1 and No.2: ON

Driver

NETC01-CC

Termination resistor: ON

Termination resistor (110 Ω 1/2 W)

CC-Link communication cable

Programmable controller or master device
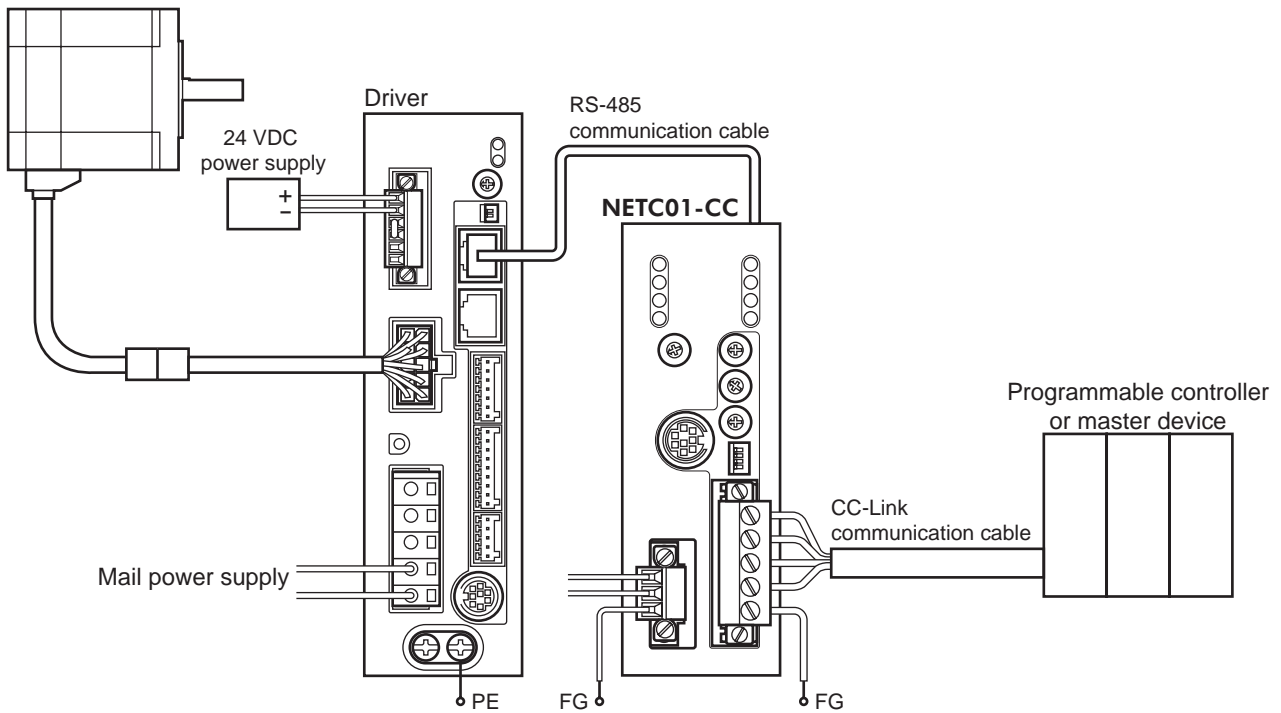
Termination resistor (110 Ω 1/2 W)
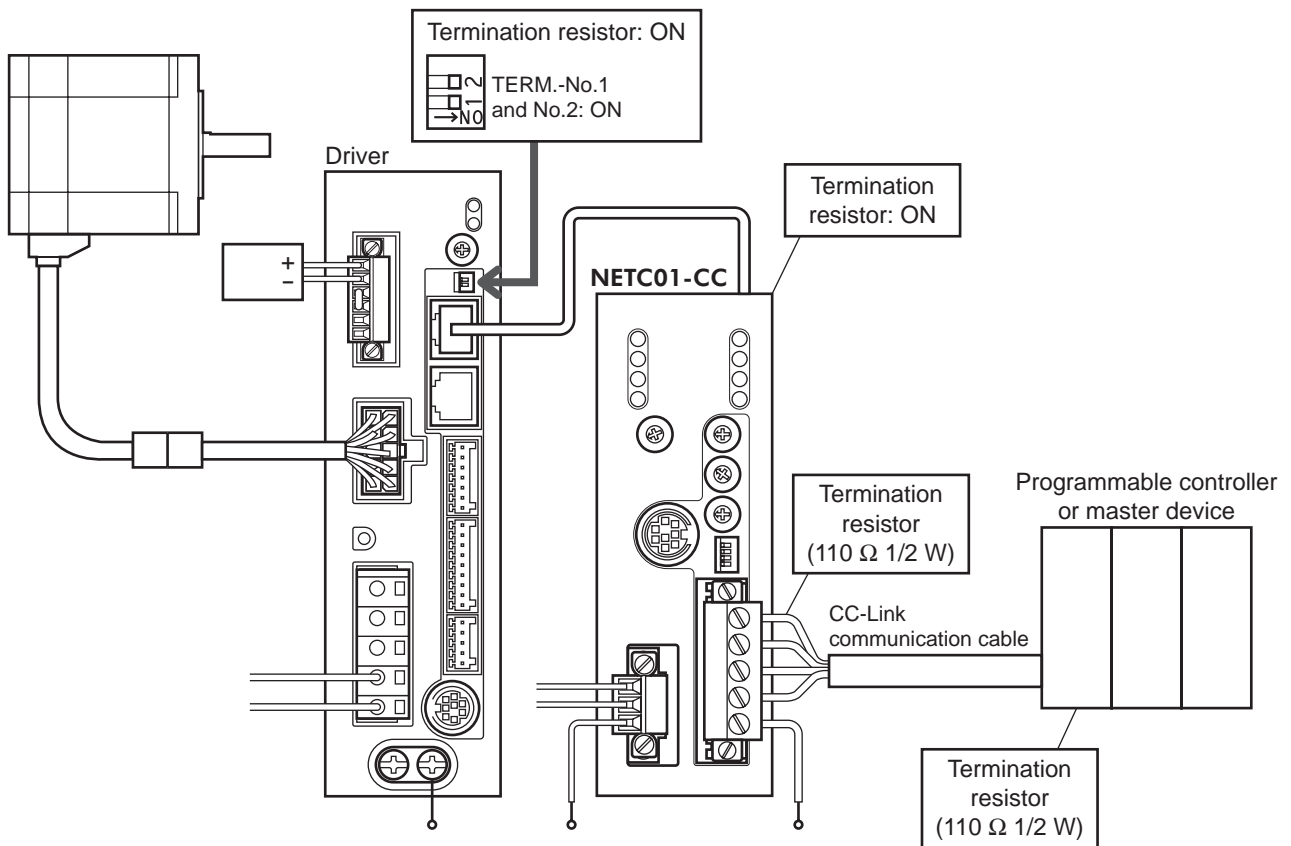
STEP 4 Turn on the power and check the setting
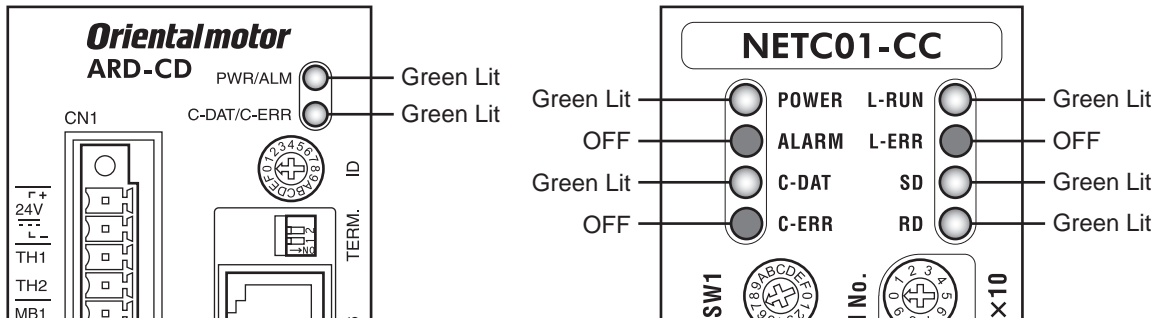
- When C-ERR (red) of the driver or **NETC01-CC** is lit:
  Check the transmission rate or address number of RS-485 communication.

- When L-ERR (red) of the **NETC01-CC** is lit:
  Check the type of the CC-Link communication error.

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

1. Set the position (1200h) and operating speed (1240h) of the operation data No.0 of the driver.

2. Execute positioning operation by turning the START of the CC-Link remote I/O address number 0 to ON.

RY (Master to **NETC01-CC**)			RY (Master to **NETC01-CC**)		
Device No.	Signal name	Initial value	Device No.	Signal name	Initial value
RY0	NET-IN0	M0	RY8	NET-IN8	MS0
RY1	NET-IN1	M1	RY9	NET-IN9	MS1
RY2	NET-IN2	M2	RYA	NET-IN10	MS2
RY3	NET-IN3	START	RYB	NET-IN11	SSTART
RY4	NET-IN4	HOME	RYC	NET-IN12	+JOG
RY5	NET-IN5	STOP	RYD	NET-IN13	−JOG
RY6	NET-IN6	FREE	RYE	NET-IN14	FWD
RY7	NET-IN7	Not used	RYF	NET-IN15	RVS

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 motor excited? Or is the excitation setting correct?
- Is the operation data (position, operating speed) set correctly?
- Are the driver parameters set correctly?
- Is the STOP input of the driver I/O turned ON?

For more detailed settings and functions, refer to "11 Operation" on p.54, network converter **NETC01-CC** USER MANUAL and following pages.

14.2 Setting the switches

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

• Driver front face

Address number setting switch (ID)
Termination resistor setting switch (TERM.)

• Driver bottom face

Transmission rate setting switch (SW2)

Function setting switch (SW4)
No.1: Set the address number
No.2: Set the protocol

Note Be sure to turn off the motor 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 switch SW4-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 (ID) and SW4-No.1 of the function setting switch. Make sure each address number (slave address) you set for each driver is unique.
Factory setting   SW4-No.1: OFF, ID: 0 (Address number 0)

Address number (slave address)	0	1	2	3	4	5	6	7	8	9	10	11
ID	0	1	2	3	4	5	6	7	8	9	A	B
SW4-No.1	OFF											
Operation 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 (SW2).
Factory setting   7 (625,000 bps)

■ Termination resistor

Use a termination resistor for the motor located farthest away (positioned at the end) from the programmable controller (master device).
Turn the termination resistor setting switch (TERM.-No.1 and No.2) ON to set the termination resistor for RS-485 communication (120 Ω).
Factory setting   No.1 and No.2: Both OFF (termination resistor disabled)

TERM.- No.1, No.2	Termination resistor (120 Ω)
Both are OFF	Disabled
Both are ON	Enabled

Note If only one of No.1 or No.2 is turned ON, a communication error may occur.

14.3 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**)		RWr (**NETC01-CC** to master)	
Address No.	Description	Address No.	Description
RWWn0	Command code of monitor 0	RWRn0	Data of monitor 0 (lower 16 bit)
RWWn1	Address number of monitor 0	RWRn1	Data of monitor 0 (upper 16 bit)
RWWn2	Command code of monitor 1	RWRn2	Data of monitor 1 (lower 16 bit)
RWWn3	Address number of monitor 1	RWRn3	Data of monitor 1 (upper 16 bit)
RWWn4	Command code of monitor 2	RWRn4	Data of monitor 2 (lower 16 bit)
RWWn5	Address number of monitor 2	RWRn5	Data of monitor 2 (upper 16 bit)
RWWn6	Command code of monitor 3	RWRn6	Data of monitor 3 (lower 16 bit)
RWWn7	Address number of monitor 3	RWRn7	Data of monitor 3 (upper 16 bit)
RWWn8	Command code of monitor 4	RWRn8	Data of monitor 4 (lower 16 bit)
RWWn9	Address number of monitor 4	RWRn9	Data of monitor 4 (upper 16 bit)
RWWnA	Command code of monitor 5	RWRnA	Data of monitor 5 (lower 16 bit)
RWWnB	Address number of monitor 5	RWRnB	Data of monitor 5 (upper 16 bit)
RWWnC	Command code	RWRnC	Command code response
RWWnD	Address number	RWRnD	Address number response
RWWnE	Data (lower)	RWRnE	Data (lower)
RWWnF	Data (upper)	RWRnF	Data (upper)

14.4 Assignment of remote I/O

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 or 12-axes mode.

■ 6-axes connection mode

Command RY (Master to **NETC01-CC**)		Response RX (**NETC01-CC** to master)	
Device No.	Description	Device No.	Description
RYn7 to RYn0	Address number "0" remote I/O input	RXn7 to RXn0	Address number "0" remote I/O output
RYnF to RYn8		RXnF to RXn8	
RY (n+1) 7 to RY (n+1) 0	Address number "1" remote I/O input	RX (n+1) 7 to RX (n+1) 0	Address number "1" remote I/O output
RY (n+1) F to RY (n+1) 8		RX (n+1) F to RX (n+1) 8	
RY (n+2) 7 to RY (n+2) 0	Address number "2" remote I/O input	RX (n+2) 7 to RX (n+2) 0	Address number "2" remote I/O output
RY (n+2) F to RY (n+2) 8		RX (n+2) F to RX (n+2) 8	
RY (n+3) 7 to RY (n+3) 0	Address number "3" remote I/O input	RX (n+3) 7 to RX (n+3) 0	Address number "3" remote I/O output
RY (n+3) F to RY (n+3) 8		RX (n+3) F to RX (n+3) 8	
RY (n+4) 7 to RY (n+4) 0	Address number "4" remote I/O input	RX (n+4) 7 to RX (n+4) 0	Address number "4" remote I/O output
RY (n+4) F to RY (n+4) 8		RX (n+4) F to RX (n+4) 8	
RY (n+5) 7 to RY (n+5) 0	Address number "5" remote I/O input	RX (n+5) 7 to RX (n+5) 0	Address number "5" remote I/O output
RY (n+5) F to RY (n+5) 8		RX (n+5) F to RX (n+5) 8	
RY (n+6) 7 to RY (n+6) 0	Control input of **NETC01-CC** *	RX (n+6) 7 to RX (n+6) 0	Status output of **NETC01-CC** *
RY (n+6) F to RY (n+6) 8		RX (n+6) F to RX (n+6) 8	
RY (n+7) 7 to RY (n+7) 0	Control input of system area*	RX (n+7) 7 to RX (n+7) 0	Status output of system area*
RY (n+7) F to RY (n+7) 8		RX (n+7) F to RX (n+7) 8	

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

■ 12-axes connection mode

Command RY (Master to **NETC01-CC**)		Response RX (**NETC01-CC** to master)	
Device No.	Description	Device No.	Description
RYn7 to RYn0	Address number "0" remote I/O input	RXn7 to RXn0	Address number "0" remote I/O output
RYnF to RYn8	Address number "1" remote I/O input	RXnF to RXn8	Address number "1" remote I/O output
RY (n+1) 7 to RY (n+1) 0	Address number "2" remote I/O input	RX (n+1) 7 to RX (n+1) 0	Address number "2" remote I/O output
RY (n+1) F to RY (n+1) 8	Address number "3" remote I/O input	RX (n+1) F to RX (n+1) 8	Address number "3" remote I/O output
RY (n+2) 7 to RY (n+2) 0	Address number "4" remote I/O input	RX (n+2) 7 to RX (n+2) 0	Address number "4" remote I/O output
RY (n+2) F to RY (n+2) 8	Address number "5" remote I/O input	RX (n+2) F to RX (n+2) 8	Address number "5" remote I/O output
RY (n+3) 7 to RY (n+3) 0	Address number "6" remote I/O input	RX (n+3) 7 to RX (n+3) 0	Address number "6" remote I/O output
RY (n+3) F to RY (n+3) 8	Address number "7" remote I/O input	RX (n+3) F to RX (n+3) 8	Address number "7" remote I/O output
RY (n+4) 7 to RY (n+4) 0	Address number "8" remote I/O input	RX (n+4) 7 to RX (n+4) 0	Address number "8" remote I/O output
RY (n+4) F to RY (n+4) 8	Address number "9" remote I/O input	RX (n+4) F to RX (n+4) 8	Address number "9" remote I/O output
RY (n+5) 7 to RY (n+5) 0	Address number "10" remote I/O input	RX (n+5) 7 to RX (n+5) 0	Address number "10" remote I/O output
RY (n+5) F to RY (n+5) 8	Address number "11" remote I/O input	RX (n+5) F to RX (n+5) 8	Address number "11" remote I/O output
RY (n+6) 7 to RY (n+6) 0	Control input of **NETC01-CC** *	RX (n+6) 7 to RX (n+6) 0	Status output of **NETC01-CC** *
RY (n+6) F to RY (n+6) 8		RX (n+6) F to RX (n+6) 8	
RY (n+7) 7 to RY (n+7) 0	Control input of system area*	RX (n+7) 7 to RX (n+7) 0	Status output of system area*
RY (n+7) F to RY (n+7) 8		RX (n+7) F to RX (n+7) 8	

∗ See the network converter **NETC01-CC** <u>USER MANUAL</u> for details.

■ Remote I/O input

( ): Initial value

• 6-axes connection mode

Device No.	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
RYn7 to RYn0	NET-IN7 (Not used)	NET-IN6 (FREE)	NET-IN5 (STOP)	NET-IN4 (HOME)	NET-IN3 (START)	NET-IN2 (M2)	NET-IN1 (M1)	NET-IN0 (M0)
RYnF to RYn8	NET-IN15 (RVS)	NET-IN14 (FWD)	NET-IN13 (−JOG)	NET-IN12 (+JOG)	NET-IN11 (SSTART)	NET-IN10 (MS2)	NET-IN9 (MS1)	NET-IN8 (MS0)

• 12-axes connection mode

Device No.	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
RYn7 to RYn0	NET-IN7 (Not used)	NET-IN6 (FREE)	NET-IN5 (STOP)	NET-IN4 (HOME)	NET-IN3 (START)	NET-IN2 (M2)	NET-IN1 (M1)	NET-IN0 (M0)

■ Remote I/O output

( ): Initial value

• 6-axes connection mode

Device No.	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
RXn7 to RXn0	NET-OUT7 (ALM)	NET-OUT6 (WNG)	NET-OUT5 (READY)	NET-OUT4 (HOME-P)	NET-OUT3 (START_R)	NET-OUT2 (M2_R)	NET-OUT1 (M1_R)	NET-OUT0 (M0_R)
RXnF to RXn8	NET-OUT15 (TLC)	NET-OUT14 (END)	NET-OUT13 (MOVE)	NET-OUT12 (TIM)	NET-OUT11 (AREA3)	NET-OUT10 (AREA2)	NET-OUT9 (AREA1)	NET-OUT8 (S-BSY)

• 12-axes connection mode

Device No.	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
RXn7 to RXn0	NET-OUT7 (ALM)	NET-OUT6 (WNG)	NET-OUT5 (READY)	NET-OUT4 (HOME-P)	NET-OUT3 (START_R)	NET-OUT2 (M2_R)	NET-OUT1 (M1_R)	NET-OUT0 (M0_R)

15 Method of control via MECHATROLINK communication

See the following explanation when using the **AR** Series AC power input built-in controller type in combination with the network converter **NETC01-M2** or **NETC01-M3**, via MECHATROLINK communication.
Refer to "16 Details of network converter" on p.146 for remote I/O and command code.

15.1 Guidance

If you are new to the **AR** Series AC power input built-in controller 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
- SW4-No.2 of the function setting switch: 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

Driver
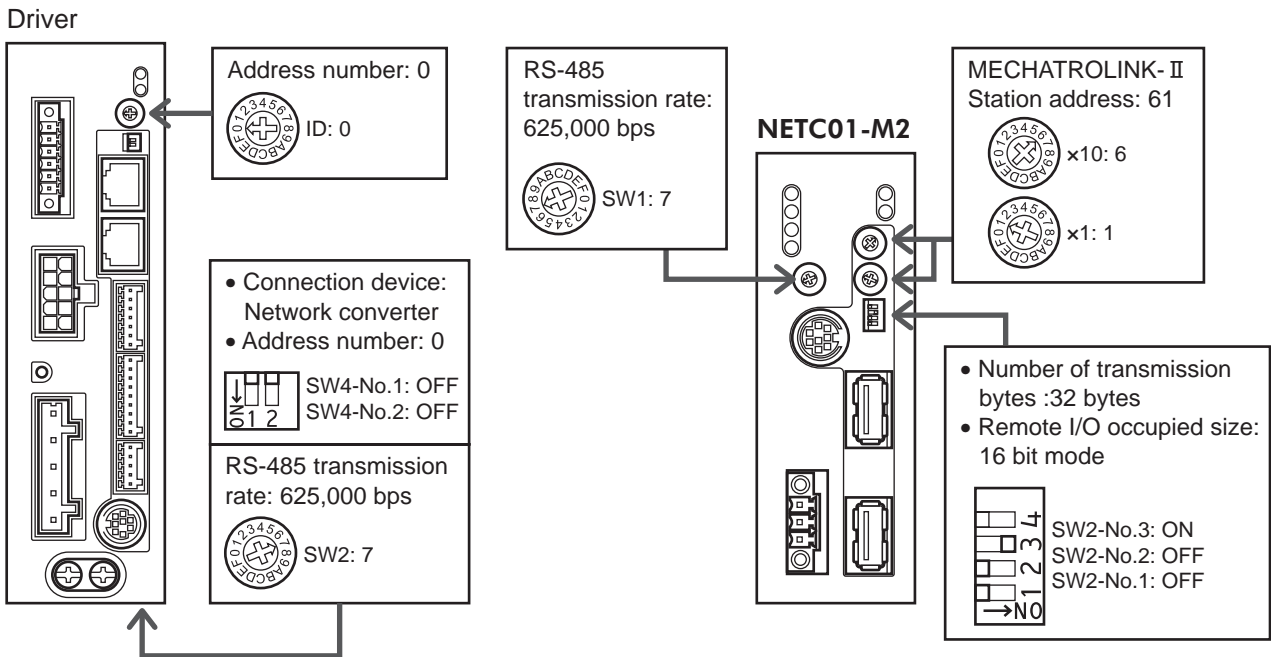
■ Using the parameter

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" parameters 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
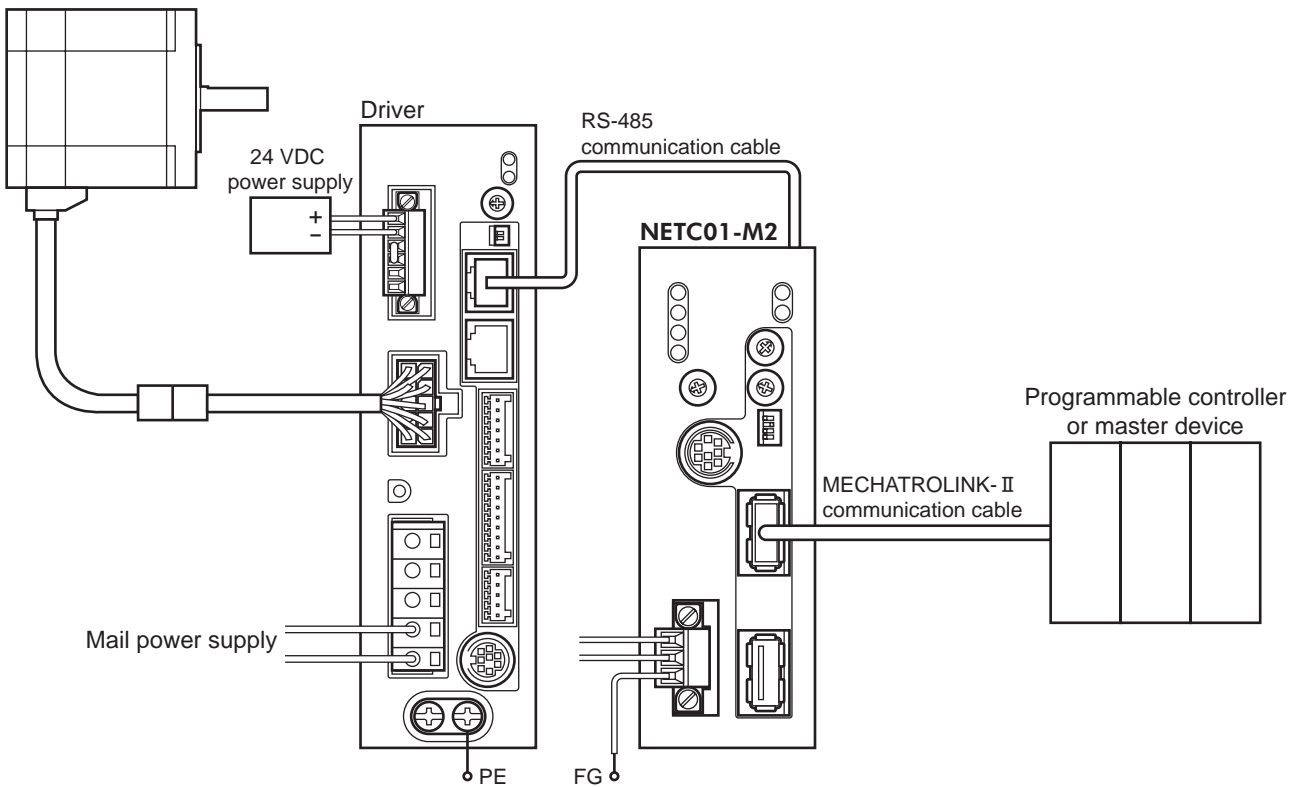
STEP 3 Check the termination resistor

Termination resistor: ON

TERM.-No.1 and No.2: ON

STEP 4   Turn on the power and check the setting

Oriental motor
ARD-CD   PWR/ALM — Green Lit
            C-DAT/C-ERR — Green Lit

NETC01-M2

Green Lit — POWER   CONT — Green Lit
OFF — ALARM   ERR — OFF
Green Lit — C-DAT
OFF — C-ERR
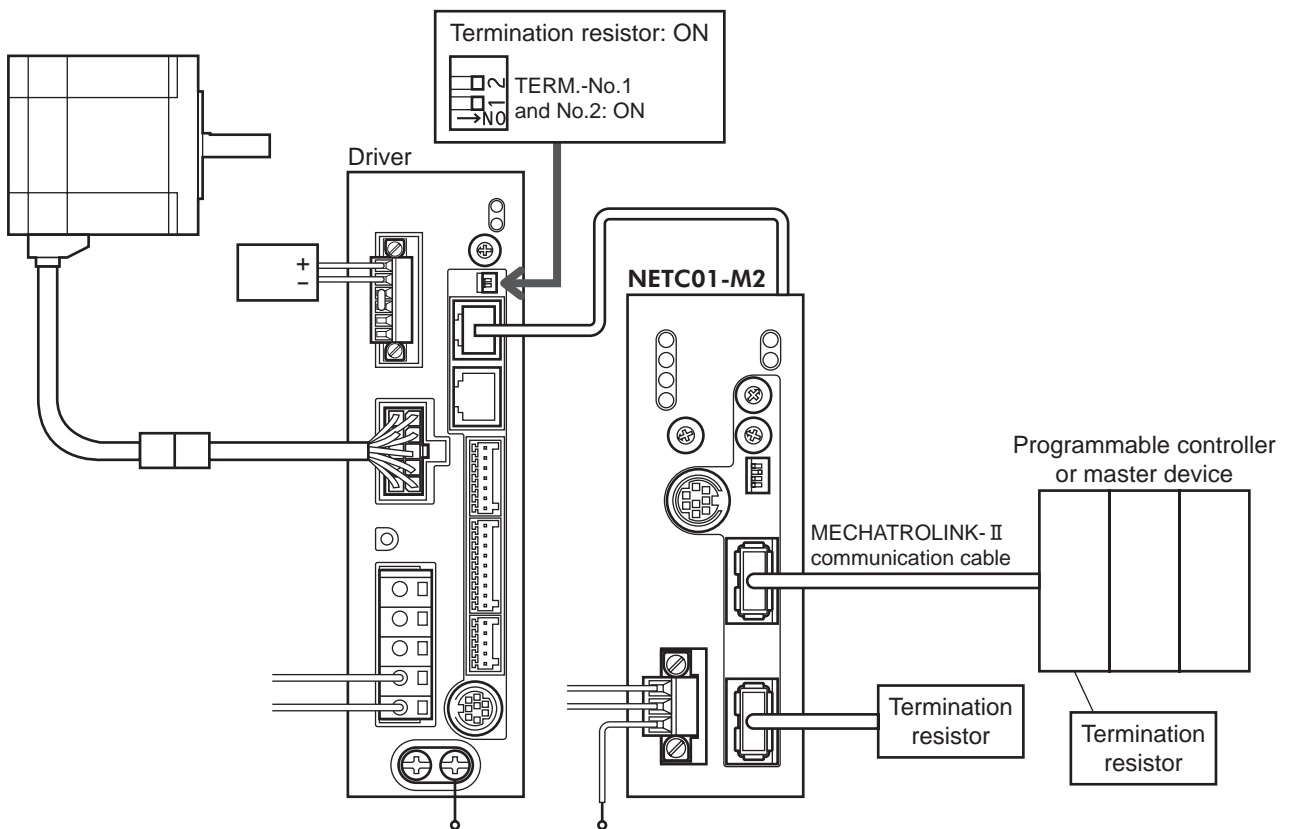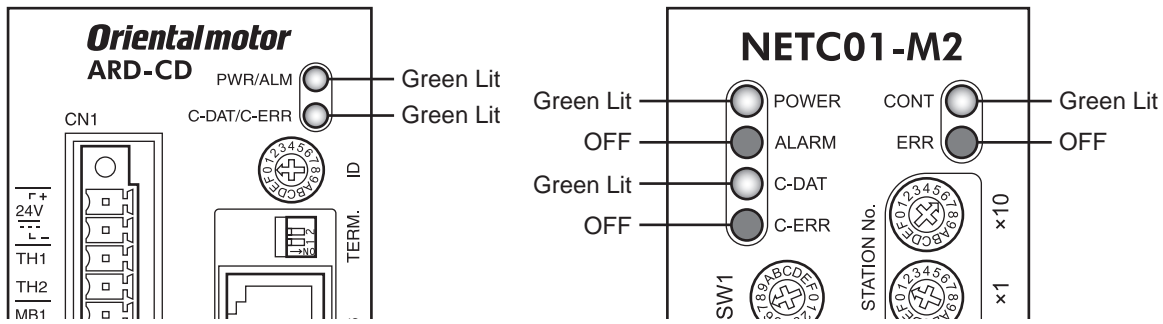
- When C-ERR (red) of the driver or **NETC01-M2** is lit:
  Check the transmission rate or address number of RS-485 communication.

- When ERR (red) of the **NETC01-M2** is lit: Check the MECHATROLINK-II communication error.

STEP 5   Positioning operation

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

1. Set the position (1200h) and operating speed (1240h) of operation data No.0 of the driver.

2. Execute positioning operation by turning the START of the address number 0 to ON.

bit15	bit14	bit13	bit12	bit11	bit10	bit9	bit8
NET-IN15 (RVS)	NET-IN14 (FWD)	NET-IN13 (−JOG)	NET-IN12 (+JOG)	NET-IN11 (SSTART)	NET-IN10 (MS2)	NET-IN9 (MS1)	NET-IN8 (MS0)
bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
NET-IN7 (Not used)	NET-IN6 (FREE)	NET-IN5 (STOP)	NET-IN4 (HOME)	NET-IN3 (START)	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 communication error)
- Is the motor excited? Or is the excitation setting correct?
- Is the operation data (position, operating speed) set correctly?
- Are the driver parameters set correctly?
- Is the STOP input of the driver I/O turned ON?

For more detailed settings and functions, refer to "11 Operation" on p.54, network converter **NETC01-M2** USER MANUAL and following pages.

15.2 Setting the switches

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

- Driver front face

Address number setting switch (ID)

Termination resistor setting switch (TERM.)

- Driver bottom face

Transmission rate setting switch (SW2)

Function setting switch (SW4)
No.1: Set the address number
No.2: Set the protocol

Note Be sure to turn off the motor 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 switch SW4-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 (ID) and SW4-No.1 of the function setting switch. Make sure each address number (slave address) you set for each driver is unique.
Factory setting   SW4-No.1: OFF, ID: 0 (Address number 0)

Address number (slave address)	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
ID	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
SW4-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 (SW2).
Factory setting   7 (625,000 bps)

■ Termination resistor

Use a termination resistor for the driver located farthest away (positioned at the end) from the programmable controller (master device).
Turn the termination resistor setting switch (TERM.-No.1 and No.2) ON to set the termination resistor for RS-485 communication (120 Ω).
Factory setting   No.1 and No.2: Both OFF (termination resistor disabled)

TERM.-No.1, No.2	Termination resistor (120 Ω)
Both are OFF	Disabled
Both are ON	Enabled

Note If only one of No.1 or No.2 is turned ON, a communication error may occur.

15.3 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 setting), 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

15.4 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 setting), 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	–		

15.5 Communication format

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

■ Remote I/O input

For details on remote I/O, refer to p.146.
( ): Initial value

• 8 axes connection mode [16 bit mode]

bit15	bit14	bit13	bit12	bit11	bit10	bit9	bit8
NET-IN15 (RVS)	NET-IN14 (FWD)	NET-IN13 (−JOG)	NET-IN12 (+JOG)	NET-IN11 (SSTART)	NET-IN10 (MS2)	NET-IN9 (MS1)	NET-IN8 (MS0)
bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
NET-IN7 (Not used)	NET-IN6 (FREE)	NET-IN5 (STOP)	NET-IN4 (HOME)	NET-IN3 (START)	NET-IN2 (M2)	NET-IN1 (M1)	NET-IN0 (M0)

• 16 axes connection mode [8 bit mode]

bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
NET-IN7 (Not used)	NET-IN6 (FREE)	NET-IN5 (STOP)	NET-IN4 (HOME)	NET-IN3 (START)	NET-IN2 (M2)	NET-IN1 (M1)	NET-IN0 (M0)

■ Remote I/O output

( ): Initial value

• 8 axes connection mode [16 bit mode]

bit15	bit14	bit13	bit12	bit11	bit10	bit9	bit8
NET-OUT15 (TLC)	NET-OUT14 (END)	NET-OUT13 (MOVE)	NET-OUT12 (TIM)	NET-OUT11 (AREA3)	NET-OUT10 (AREA2)	NET-OUT9 (AREA1)	NET-OUT8 (S-BSY)
bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
NET-OUT7 (ALM)	NET-OUT6 (WNG)	NET-OUT5 (READY)	NET-OUT4 (HOME-P)	NET-OUT3 (START_R)	NET-OUT2 (M2_R)	NET-OUT1 (M1_R)	NET-OUT0 (M0_R)

• 16 axes connection mode [8 bit mode]

bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
NET-OUT7 (ALM)	NET-OUT6 (WNG)	NET-OUT5 (READY)	NET-OUT4 (HOME-P)	NET-OUT3 (START_R)	NET-OUT2 (M2_R)	NET-OUT1 (M1_R)	NET-OUT0 (M0_R)

■ Remote register input

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

bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
−	TRIG	Command code					
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**)]

bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0

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).	–

16   Details of network converter

16.1 Remote I/O

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

■ 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 "I/O function [RS-485]" on p.156

bit15	bit14	bit13	bit12	bit11	bit10	bit9	bit8
NET-IN15 (RVS)	NET-IN14 (FWD)	NET-IN13 (−JOG)	NET-IN12 (+JOG)	NET-IN11 (SSTART)	NET-IN10 (MS2)	NET-IN9 (MS1)	NET-IN8 (MS0)
bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
NET-IN7 (Not used)	NET-IN6 (FREE)	NET-IN5 (STOP)	NET-IN4 (HOME)	NET-IN3 (START)	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	Continuous operation in the positive direction.	0: Deceleration stop
RVS	Continuous operation in the negative direction.	1: Operation
HOME	Return-to-home operation.	
START	Positioning operation.	
SSTART	Sequential positioning operation.	0: No operation
+JOG	JOG operation in the positive direction.	1: Start operation
−JOG	JOG operation in the negative direction.	
MS0 to MS5	Direct positioning operation.	
FREE	Stop the motor excitation and release the electromagnetic brake.	0: No operation 1: Electromagnetic brake release+motor non-excitation
C-ON	Motor excitation switching between excitation and non-excitation.	0: Non-excitation 1: Excitation
STOP	Stop of the motor	0: No operation 1: Stop operation
HMI	Release of the function limitation of the **OPX-2A** or **MEXE02**	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 M5	Select the operation data No. using these six bits.	0 to 63: Operation data No.

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 C-ON input and HMI input are not assigned to the input terminals, these inputs will always be set to ON (1). When assigning to both direct I/O and network I/O, the function will be executed when both of them are set to ON (1).

■ **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 "I/O function [RS-485]" on p.156.

bit15	bit14	bit13	bit12	bit11	bit10	bit9	bit8
NET-OUT15 (TLC)	NET-OUT14 (END)	NET-OUT13 (MOVE)	NET-OUT12 (TIM)	NET-OUT11 (AREA3)	NET-OUT10 (AREA2)	NET-OUT9 (AREA1)	NET-OUT8 (S-BSY)
bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
NET-OUT7 (ALM)	NET-OUT6 (WNG)	NET-OUT5 (READY)	NET-OUT4 (HOME-P)	NET-OUT3 (START_R)	NET-OUT2 (M2_R)	NET-OUT1 (M1_R)	NET-OUT0 (M0_R)

∗ ( ): Initial value

Signal name	Function	Setting range
Not used	Set when the output terminal is not used.	−
FWD_R	Output in response to the FWD.	0: OFF 1: ON
RVS_R	Output in response to the RVS.	
HOME_R	Output in response to the HOME.	
START_R	Output in response to the START	
SSTART_R	Output in response to the SSTART.	
+JOG_R	Output in response to the +JOG.	
−JOG_R	Output in response to the −JOG.	
MS0_R to MS5_R	Output in response to the MS0 to MS5.	
FREE_R	Output in response to the FREE.	
C-ON_R	Output in response to the C-ON.	
STOP_R	Output in response to the STOP.	
R0 to R15	Output the status of the general signal R0 to R15.	
M0_R to M5_R	Output in response to the M0 to M5.	0 to 63: Operation data No.
+LS_R	Output in response to the +LS.	0: OFF 1: ON
−LS_R	Output in response to the −LS.	
HOMES_R	Output in response to the HOMES.	
SLIT_R	Output in response to the SLIT.	
ALM	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
READY	Output when the driver is ready.	0: Not ready 1: Ready
MOVE	Output when the motor operates.	0: Motor stopped 1: Motor operating
END	Output when the positioning operation is completed.	0: Motor operating 1: Motor operating completion
HOME-P	Output when the motor is in home position.	0: Not home position 1: Home position
TLC	Output when the load is outside of the motor torque range.	0: Inside torque range 1: Outside torque range
TIM	Output once every 7.2° rotation of the motor output shaft.	0: OFF 1: ON
AREA1	Output when the motor is within the area 1.	0: Outside area 1: Inside area
AREA2	Output when the motor is within the area 2.	
AREA3	Output when the motor is within the area 3.	
S-BSY	Output when the motor is in internal processing state.	0: OFF 1: ON
MPS	Output the ON-OFF state of the main power supply.	

16.2 Command code list

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

■ 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 NV 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 31: Set the group. *	−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.

NETC01	Parent slave	Child slave	Child slave
	Driver of address number 0 "group" command: −1 (individual)	Driver of address number 1 "group" command: 0	Driver of address number 2 "group" command: 0
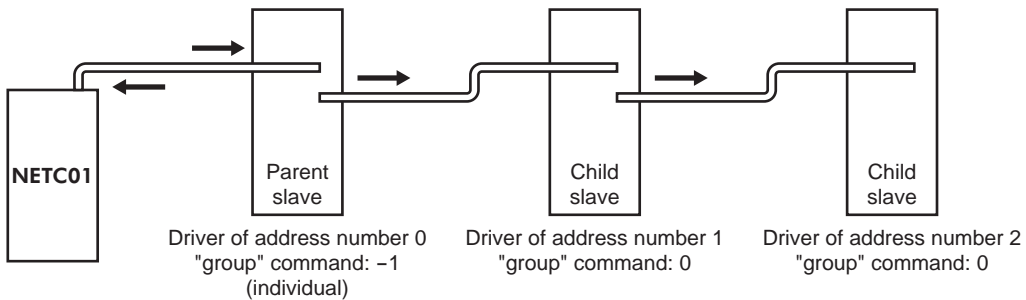
This is a timing chart for when assigning the START signal to NET-IN3 (remote I/O) of the driver in the group.

NETC01 to slave

Address number 0
NET-IN3=ON

Motor operation at address
number 0 (parent slave)
"Group" command: −1

Motor operation at address
number 1 (child slave)
"Group" command: 0

Motor operation at address
number 2 (child slave)
"Group" command: 0
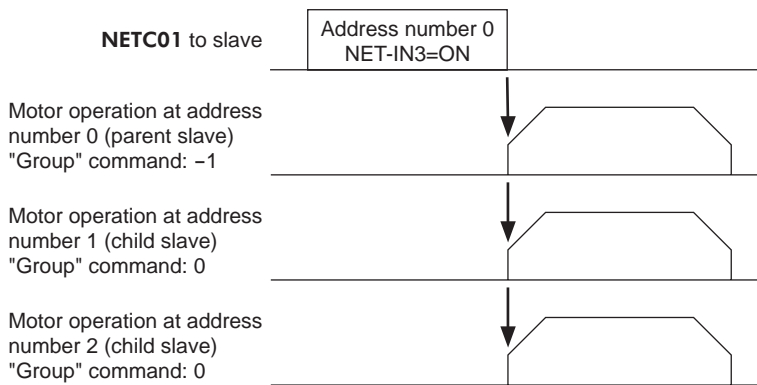
Note | When inputting a command to the parent slave with remote I/O, the motors of the parent slave and child slaves will operate. The motors will not operate if the command is input to the child slaves.

■ Maintenance command

These commands are used to reset alarms and warnings. They are also used to execute the batch processing for the NV memory.

Command code	Name	Description	Setting range
30C0h	Reset alarm	Resets the alarms that are present.	1: Execute
30C1h	Absolute position error alarm reset	Resets the absolute position error alarm. Since this alarm is the dedicated alarm for the absolute position error, other alarms cannot be reset.	
30C2h	Clear alarm records	Clears alarm records.	
30C3h	Clear warning records	Clears warning records.	
30C4h	Clear communication error records	Clears the communication error records.	
30C5h	P-PRESET execute	Presets the command position.	
30C6h	Configuration	Executes the parameter recalculation and the setup.	
30C7h	All data initialization	Resets the parameters saved in the NV memory to the initial settings. Note thad "communication parity", "communication stop bit" and "transmission waiting time" prameters are not initialized.	
30C8h	Batch NV memory read	Reads the parameters saved in the NV 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 NV memory.	

Note | The NV memory can be rewritten approx. 100,000 times.

■ Monitor command

Monitor the command position, command speed, alarm and warning records, etc.

Command code	Name	Description
2040h	Present alarm	Monitors the present alarm code.
2041h	Alarm record 1	Monitors the alarm records 1 to 10.
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 1 to 10.
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	
2057h	Communication error code record 1	Monitors the communication error records 1 to 10 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	
2061h	Present selected data No.	Monitors the operation data No. currently selected.
2062h	Present operation data No.	Monitors the operation data No. corresponding to the data used in the current positioning operation. This address is used in linked-motion operation and sequential positioning operation. While the motor is stopped, the last used operation data number is indicated.
2063h	Command position	Monitors the command position.
2064h	Command speed	Monitors the current command speed.
2066h	Feedback position	Monitors the feedback position.
2067h	Feedback speed	Monitors the feedback speed.
2069h	Remaining dwell time	Monitors how much of the dwell time used in the linked-motion operation 2 remains.
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.

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

Byte	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
0	IN1	IN0	–	–	SLIT	HOMES	−LS	+LS
1	–	–	IN7	IN6	IN5	IN4	IN3	IN2
2	–	–	OUT5	OUT4	OUT3	OUT2	OUT1	OUT0
3	–	–	–	–	–	–	–	MB

■ Operation data

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 NV memory. The data saved in the RAM will be erased once the power is turned off. On the other hand, the parameters saved in the NV memory will be retained even after the power supply is turned off.
When turning the driver power ON, the parameters saved in the NV memory will be sent to the RAM. Then, the recalculation and setup for the parameters are executed in the RAM.

When a parameter is changed, the timing to reflect the new value varies depending on the parameter. See the following four types.
- Effective immediately .... Executes the recalculation and setup immediately when writing the parameter.
- Effective after stopping the operation .... Executes the recalculation and setup after stopping the operation.
- Effective after executing the configuration .... Executes the recalculation and setup after executing the configuration.
- Effective after turning the power ON again .... Executes the recalculation and setup after turning the 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 NV memory, execute "batch NV memory write" of the maintenance command.
- The NV memory can be rewritten approx. 100,000 times.

Command code		Name	Setting range	Initial value	Effective[1]
Read	Write				
0200h to 023Fh	1200h to 123Fh	Position No.0 to Position No.63	−8,388,608 to 8,388,607 step	0	B
0240h to 027Fh	1240h to 127Fh	Operating speed No.0 to Operating speed No.63	0 to 1,000,000 Hz	1000	
0280h to 02BFh	1280h to 12BFh	Operation mode No.0 to Operation mode No.63	0: Incremental 1: Absolute	0	
02C0h to 02FFh	12C0h to 12FFh	Operation function No.0 to Operation function No.63	0: Single-motion 1: Linked-motion 2: Linked-motion 2 3: Push-motion	0	
0300h to 033Fh	1300h to 133Fh	Acceleration No.0 to Acceleration No.63	1 to 1,000,000 (1=0.001 ms/kHz or 1=0.001 s) [2][3]	1000	
0340h to 037Fh	1340h to 137Fh	Deceleration No.0 to Deceleration No.63			
0380h to 03BFh	1380h to 13BFh	Push current No.0 to Push current No.63	0 to 500 (1=0.1%)	200	
03C0h to 03FFh	13C0h to 13FFh	Sequential positioning No.0 to Sequential positioning No.63	0: Disable 1: Enable	0	
0400h to 043Fh	1400h to 143Fh	Dwell time No.0 to Dwell time No.63	0 to 50000 (1=0.001 s)	0	

[1] Indicates the timing for the data to become effective. (B: Effective after stopping the operation)

[2] This item is effective when the "acceleration/deceleration type" parameter is set to "separate". If this parameter is set to "common", the values of the "common acceleration" and "common deceleration" parameters will be used (initial value: separate).

[3] Acceleration/deceleration rate (ms/kHz) or acceleration/deceleration time (s) can be selected using "acceleration/deceleration unit" parameter. (initial value: acceleration/deceleration rate).

■ User parameters

• I/O

Command code		Description	Setting range	Initial value	Effective *
READ	WRITE				
0100h	1100h	STOP input action	0: Immediate stop 1: Deceleration stop 2: Immediate stop & Current OFF 3: Deceleration stop &Current OFF	1	A
0101h	1101h	Hardware overtravel	0: Disable 1: Enable	1	
0102h	1102h	Overtravel action	0: Immediate stop 1: Deceleration stop	0	
0103h	1103h	Positioning completion signal range	0 to 180 (1=0.1°)	18	
0104h	1104h	Positioning completion signal offset	−18 to 18 (1=0.1°)	0	
0105h	1105h	AREA1 positive direction position	−8,388,608 to 8,388,607 step	0	
0106h	1106h	AREA1 negative direction position			
0107h	1107h	AREA2 positive direction position			
0108h	1108h	AREA2 negative direction position			
0109h	1109h	AREA3 positive direction position			
010Ah	110Ah	AREA3 negative direction position			
010Bh	110Bh	Minimum ON time for MOVE output	0 to 255 ms	0	
010Ch	110Ch	LS logic level	0: Normally open 1: Normally closed	0	C
010Dh	110Dh	HOMES logic level			
010Eh	110Eh	SLIT logic level			
0800h	1800h	MS0 operation No. selection	0 to 63	0	B
0801h	1801h	MS1 operation No. selection		1	
0802h	1802h	MS2 operation No. selection		2	
0803h	1803h	MS3 operation No. selection		3	
0804h	1804h	MS4 operation No. selection		4	
0805h	1805h	MS5 operation No. selection		5	
0806h	1806h	HOME-P function selection	0: Home output 1: Return-to-home complete output	0	A

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

● Motor

| Command code | | Description | Setting range | Initial value | Effective* |
READ	WRITE				
0120h	1120h	RUN current	0 to 1000 (1=0.1%)	1000	A
0121h	1121h	STOP current	0 to 500 (1=0.1%)	500	
0122h	1122h	Position loop gain	1 to 50	10	
0123h	1123h	Speed loop gain	10 to 200	180	
0124h	1124h	Speed loop integral time constant	10 to 2000 (1=0.1 ms)	1000	
0125h	1125h	Speed filter	0 to 200 ms	1	B
0126h	1126h	Moving average time	1 to 200 ms		
0810h	1810h	Filter selection	0: Speed filter 1: Moving average filter	0	C
0811h	1811h	Speed error gain 1	0 to 500	45	A
0812h	1812h	Speed error gain 2			
0813h	1813h	Control mode	0: Normal mode 1: Current control mode	0	C
0814h	1814h	Smooth driver	0: Disable 1: Enable	1	

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

● Operation

| Command code | | Description | Setting range | Initial value | Effective[1] |
READ	WRITE				
0140h	1140h	Common acceleration	1 to 1,000,000 (1=0.001 ms/kHz or 1=0.001 s) [2]	1000	B
0141h	1141h	Common deceleration			
0142h	1142h	Starting speed	0 to 1,000,000 Hz	500	
0143h	1143h	JOG operating speed	1 to 1,000,000 Hz	1000	
0144h	1144h	Acceleration/ deceleration rate of JOG	1 to 1,000,000 (1=0.001 ms/kHz or 1=0.001 s) [2]	1000	
0145h	1145h	JOG starting speed	0 to 1,000,000 Hz	500	
0146h	1146h	Acceleration/ deceleration type	0: Common 1: Separate	1	
0147h	1147h	Acceleration/ deceleration unit	0: ms/kHz 1: s	0	C
0820h	1820h	Automatic return operation	0: Disable 1: Enable	0	
0821h	1821h	Operating speed of automatic return	1 to 1,000,000 Hz	1000	B
0822h	1822h	Acceleration/ deceleration of automatic return	1 to 1,000,000 (1=0.001 ms/kHz or 1=0.001 s) [2]	1000	
0823h	1823h	Starting speed of automatic return	0 to 1,000,000 Hz	500	
0824h	1824h	JOG travel amount	1 to 8,388,607 step	1	

[1] Indicates the timing for the data to become effective. (B: Effective after stopping the operation, C: Effective after executing the configuration)

[2] Acceleration/deceleration rate (ms/kHz) or acceleration/deceleration time (s) can be selected using "acceleration/deceleration unit" parameter. (initial value: acceleration/deceleration rate).

• Return-to-home

| Command code | | Description | Setting range | Initial value | Effective[*1] |
READ	WRITE				
0160h	1160h	Home-seeking mode	0: 2-sensor mode 1: 3-sensor mode 2: Push mode	1	B
0161h	1161h	Operating speed of home-seeking	1 to 1,000,000 Hz	1000	
0162h	1162h	Acceleration/deceleration of home-seeking	1 to 1,000,000 (1=0.001 ms/kHz or 1=0.001 s) [*2]	1000	
0163h	1163h	Starting speed of home-seeking	1 to 1,000,000 Hz	500	
0164h	1164h	Position offset of home-seeking	−8,388,608 to 8,388,607 step	0	
0165h	1165h	Starting direction of home-seeking	0: Negative direction 1: Positive direction	1	
0166h	1166h	SLIT detection with home-seeking	0: Disable 1: Enable	0	
0167h	1167h	TIM signal detection with home-seeking			
0168h	1168h	Operating current of push-motion home-seeking	0 to 1000 (1=0.1%)	1000	

∗1 Indicates the timing for the data to become effective. (B: Effective after stopping the operation)
∗2 Acceleration/deceleration rate (ms/kHz) or acceleration/deceleration time (s) can be selected using "acceleration/deceleration unit" parameter. (initial value: acceleration/deceleration rate).

• Alarm/warning

| Command code | | Description | Setting range | Initial value | Effective* |
READ	WRITE				
0180h	1180h	Overload alarm	1 to 300 (1=0.1 s)	50	A
0181h	1181h	Overflow rotation alarm during current on	1 to 30000 (1=0.01 rev)	300	
0184h	1184h	Return-to-home incomplete alarm	0: Disable 1: Enable	0	C
0840h	1840h	Overflow rotation alarm during current off	1 to 30000 (1=0.01 rev)	10000	A
01A0h	11A0h	Overheat warning	40 to 85 °C (104 to 185 °F)	85	
01A1h	11A1h	Overload warning	1 to 300 (1=0.1 s)	50	
01A2h	11A2h	Overspeed warning	1 to 5000 r/min	4500	
01A3h	11A3h	Overvoltage warning	120 to 450 V	435	
01A4h	11A4h	Undervoltage warning	120 to 280 V	120	
01A5h	11A5h	Overflow rotation warning during current on	1 to 30000 (1=0.01 rev)	300	

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

• Coordination

| Command code | | Description | Setting range | Initial value | Effective* |
READ	WRITE				
01C0h	11C0h	Electronic gear A	1 to 65535	1	C
01C1h	11C1h	Electronic gear B		1	
01C2h	11C2h	Motor rotation direction	0: Positive direction=CCW 1: Positive direction=CW	1	
01C3h	11C3h	Software overtravel	0: Disable 1: Enable	1	A
01C4h	11C4h	Positive software limit	−8,388,608 to 8,388,607 step	8,388,607	
01C5h	11C5h	Negative software limit		−8,388,608	
01C6h	11C6h	Preset position		0	
01C7h	11C7h	Wrap setting	0: Disable 1: Enable	0	C
01C8h	11C8h	Wrap setting range	1 to 8,388,607 step	1000	

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

• Common

Command code		Description	Setting range	Initial value	Effective*
READ	WRITE				
01E0h	11E0h	Data setter speed display	0: Signed 1: Absolute value	0	A
01E1h	11E1h	Data setter edit	0: Disable 1: Enable	1	
01E2h	11E2h	Absolute-position backup system		0	C

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

• I/O function

Command code		Description	Setting range	Initial value	Effective*
READ	WRITE				
0880h	1880h	IN0 input function selection	See table below.	3: HOME	C
0881h	1881h	IN1 input function selection		4: START	
0882h	1882h	IN2 input function selection		48: M0	
0883h	1883h	IN3 input function selection		49: M1	
0884h	1884h	IN4 input function selection		50: M2	
0885h	1885h	IN5 input function selection		16: FREE	
0886h	1886h	IN6 input function selection		18: STOP	
0887h	1887h	IN7 input function selection		24: ALM-RST	
0890h	1890h	IN0 input logic level setting	0: Normally open 1: Normally closed	0	
0891h	1891h	IN1 input logic level setting			
0892h	1892h	IN2 input logic level setting			
0893h	1893h	IN3 input logic level setting			
0894h	1894h	IN4 input logic level setting			
0895h	1895h	IN5 input logic level setting			
0896h	1896h	IN6 input logic level setting			
0897h	1897h	IN7 input logic level setting			
08A0h	18A0h	OUT0 output function selection	See table below.	70: HOME-P	
08A1h	18A1h	OUT1 output function selection		69: END	
08A2h	18A2h	OUT2 output function selection		73: AREA1	
08A3h	18A3h	OUT3 output function selection		67: READY	
08A4h	18A4h	OUT4 output function selection		66: WNG	
08A5h	18A5h	OUT5 output function selection		65: ALM	

* Indicates the timing for the data to become effective. (C: Effective after executing the configuration)

• Setting range for IN input function selection

0: Not used	8: MS0	18: STOP	35: R3	43: R11	51: M3
1: FWD	9: MS1	24: ALM-RST	36: R4	44: R12	52: M4
2: RVS	10: MS2	25: P-PRESET	37: R5	45: R13	53: M5
3: HOME	11: MS3	26: P-CLR	38: R6	46: R14	
4: START	12: MS4	27: HMI	39: R7	47: R15	
5: SSTART	13: MS5	32: R0	40: R8	48: M0	
6: +JOG	16: FREE	33: R1	41: R9	49: M1	
7: −JOG	17: C-ON	34: R2	42: R10	50: M2	

• Setting range for OUT output function selection

0: Not used	10: MS2_R	35: R3	45: R13	61: −LS_R	72: TIM
1: FWD_R	11: MS3_R	36: R4	46: R14	62: HOMES_R	73: AREA1
2: RVS_R	12: MS4_R	37: R5	47: R15	63: SLIT_R	74: AREA2
3: HOME_R	13: MS5_R	38: R6	48: M0_R	65: ALM	75: AREA3
4: START_R	16: FREE_R	39: R7	49: M1_R	66: WNG	80: S-BSY
5: SSTART_R	17: C-ON_R	40: R8	50: M2_R	67: READY	82: MPS
6: +JOG_R	18: STOP_R	41: R9	51: M3_R	68: MOVE	
7: −JOG_R	32: R0	42: R10	52: M4_R	69: END	
8: MS0_R	33: R1	43: R11	53: M5_R	70: HOME-P	
9: MS1_R	34: R2	44: R12	60: +LS_R	71: TLC	

● I/O function [RS-485]

Command code		Description	Setting range	Initial value	Effective*
READ	WRITE				
08B0h	18B0h	NET-IN0 input function selection		48: M0	
08B1h	18B1h	NET-IN1 input function selection		49: M1	
08B2h	18B2h	NET-IN2 input function selection		50: M2	
08B3h	18B3h	NET-IN3 input function selection		4: START	
08B4h	18B4h	NET-IN4 input function selection		3: HOME	
08B5h	18B5h	NET-IN5 input function selection		18: STOP	
08B6h	18B6h	NET-IN6 input function selection		16: FREE	
08B7h	18B7h	NET-IN7 input function selection	See table below.	0: Not used	
08B8h	18B8h	NET-IN8 input function selection		8: MS0	
08B9h	18B9h	NET-IN9 input function selection		9: MS1	
08BAh	18BAh	NET-IN10 input function selection		10: MS2	
08BBh	18BBh	NET-IN11 input function selection		5: SSTART	
08BCh	18BCh	NET-IN12 input function selection		6: +JOG	
08BDh	18BDh	NET-IN13 input function selection		7: −JOG	
08BEh	18BEh	NET-IN14 input function selection		1: FWD	
08BFh	18BFh	NET-IN15 input function selection		2: RVS	
08C0h	18C0h	NET-OUT0 output function selection		48: M0_R	C
08C1h	18C1h	NET-OUT1 output function selection		49: M1_R	
08C2h	18C2h	NET-OUT2 output function selection		50: M2_R	
08C3h	18C3h	NET-OUT3 output function selection		4: START_R	
08C4h	18C4h	NET-OUT4 output function selection		70: HOME-P	
08C5h	18C5h	NET-OUT5 output function selection		67: READY	
08C6h	18C6h	NET-OUT6 output function selection		66: WNG	
08C7h	18C7h	NET-OUT7 output function selection	See table below.	65: ALM	
08C8h	18C8h	NET-OUT8 output function selection		80: S-BSY	
08C9h	18C9h	NET-OUT9 output function selection		73: AREA1	
08CAh	18CAh	NET-OUT10 output function selection		74: AREA2	
08CBh	18CBh	NET-OUT11 output function selection		75: AREA3	
08CCh	18CCh	NET-OUT12 output function selection		72: TIM	
08CDh	18CDh	NET-OUT13 output function selection		68: MOVE	
08CEh	18CEh	NET-OUT14 output function selection		69: END	
08CFh	18CFh	NET-OUT15 output function selection		71: TLC	

* Indicates the timing for the data to become effective. (C: Effective after executing the configuration)

● Setting range for NET-IN input function selection

0: Not used	8: MS0	18: STOP	38: R6	46: R14
1: FWD	9: MS1	27: HMI	39: R7	47: R15
2: RVS	10: MS2	32: R0	40: R8	48: M0
3: HOME	11: MS3	33: R1	41: R9	49: M1
4: START	12: MS4	34: R2	42: R10	50: M2
5: SSTART	13: MS5	35: R3	43: R11	51: M3
6: +JOG	16: FREE	36: R4	44: R12	52: M4
7: −JOG	17: C-ON	37: R5	45: R13	53: M5

● Setting range for NET-OUT output function selection

0: Not used	10: MS2_R	35: R3	45: R13	61: −LS_R	72: TIM
1: FWD_R	11: MS3_R	36: R4	46: R14	62: HOMES_R	73: AREA1
2: RVS_R	12: MS4_R	37: R5	47: R15	63: SLIT_R	74: AREA2
3: HOME_R	13: MS5_R	38: R6	48: M0_R	65: ALM	75: AREA3
4: START_R	16: FREE_R	39: R7	49: M1_R	66: WNG	80: S-BSY
5: SSTART_R	17: C-ON_R	40: R8	50: M2_R	67: READY	82: MPS
6: +JOG_R	18: STOP_R	41: R9	51: M3_R	68: MOVE	
7: −JOG_R	32: R0	42: R10	52: M4_R	69: END	
8: MS0_R	33: R1	43: R11	53: M5_R	70: HOME-P	
9: MS1_R	34: R2	44: R12	60: +LS_R	71: TLC	

• Communication

Command code		Description	Setting range	Initial value	Effective*
READ	WRITE				
0900h	1900h	Communication timeout	0: Not monitored 0 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)

17 Alarms and warnings

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).

17.1 Alarms

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

Example: Overvoltage alarm (number of blinks: 3)
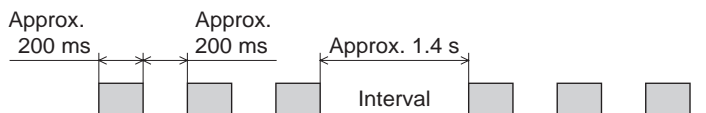
■ Alarm reset

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.94 for the timing chart.

- Turn the ALM-RST input from ON to OFF. (The alarm will be reset at the OFF edge of the ALM-RST input.)
- 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 ALM-RST 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.
	• The absolute position error alarm can be reset by turning the P-CLR input from ON to OFF, or executing the reset of the absolute position error alarm using the **OPX-2A**, **MEXE02** or RS-485 communication. This alarm cannot be reset by any other methods.

■ Alarm records

Up to 10 generated alarms are saved in the NV memory in order of the latest to oldest.
Alarm records saved in the NV 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

*1 When an alarm generates, the motor operates as follows.
  Excitation off: When an alarm generates, the motor current will be cut off and the motor will lose its holding torque. The electromagnetic brake will automatically actuate and hold the position when using the electromagnetic brake motor.
  Excitation on: Even when an alarm generates, the motor current will not be cut off and the motor position will be held.
*2 This alarm cannot be reset by the ALM-RST input. Reset the alarm using the P-CLR input.

Code	No. of ALARM LED blinks	Alarm type	Cause	Remedial action	Reset using the ALM-RST input	Motor excitation *1
10h	4	Excessive position deviation	• When the motor was in a state of current on, the deviation between the command position and actual position exceeded the value set in the parameter for overflow rotation alarm during current on. • The load is large, or the acceleration/deceleration rate or time is too rapid.	• Reduce the load or increase the acceleration/deceleration. • If the driver is in the current control mode, increase the current limit value.	Possible	Excitation off
12h		Excessive position deviation during current OFF	The C-ON input was turned ON while an excessive position deviation warning during current OFF was present.	• Do not turn the C-ON input ON while an excessive position deviation warning at current OFF is present. • Set the parameter for auto return to "disable."		
20h	5	Overcurrent	The motor, cable and driver output circuit were short-circuited.	Turn off the power and turn on the power again after checking that the motor, cable and driver output circuit are not short-circuited.	Not possible	
21h	2	Main circuit overheat	The internal temperature of the driver exceeded 85 °C (185 °F).	Review the ventilation condition in the enclosure.	Possible	
22h	3	Overvoltage	• A voltage exceeding the specification value was applied. • A large inertial load was stopped abruptly or vertical operation was performed.	• Check the input voltage of the power supply. • If this alarm generates during operation, reduce the load or increase the acceleration/deceleration.	Not possible	
23h		Main power off	The motor was started when the main power supply had been cut off.	Check if the main power supply has been input normally.	Possible	
25h		Undervoltage	The main power was cut off momentarily or the voltage became low.	Check the input voltage of the main power supply.		
27h	7	Backup battery undervoltage	The battery voltage became below the rated value.	Charge the battery.		Excitation on
28h	8	Sensor error	A sensor error occurred while the motor was operating.	Turn off the power and check the connection of the motor cable and driver, and then cycle the power.	Not possible	Excitation off
29h	9	CPU peripheral circuit error	Error occurred in the CPU.	Cycle the power. Be sure to perform return-to-home operation after cycling the power.		
2Dh	5	Main circuit output error	The motor cable was disconnected.	Turn off the power and turn on the power again after checking the connection for the motor cable and driver.		

Code	No. of ALARM LED blinks	Alarm type	Cause	Remedial action	Reset using the ALM-RST input	Motor excitation *1
30h	2	Overload	A load exceeding the maximum torque was applied for the time exceeded the value set in the "overload alarm" parameter.	• Reduce the load or increase the acceleration/ deceleration. • If the driver is in the current control mode, increase the current limit value. • Check the connection between the driver and electromagnetic brake.	Possible	Excitation off
31h		Overspeed	The rotation speed of the motor output shaft exceeded approx. 4500 r/min.	• Check the "electronic gear" setting and set the speed of the motor output shaft to 4500 r/min or less. • If the motor is overshooting at the time of acceleration, increase the acceleration.		
33h	7	Absolute position error	When one of the following conditions is satisfied while the "absolute-position backup system" parameter was "enable," this alarm was generated. • The power was turned on while the position origin was not set. • The power was turned on while the battery was not connected. • The power was turned on while operation range of multi-rotation was exceeded the specification.	• Perform the P-PRESET or return-to-home operation. • Check the connection of the battery. Or change the battery.	Possible or not possible *2	Excitation on
34h	2	Command pulse error	The command pulse frequency exceeded the specified value.	Check the "electronic gear" parameter setting and reduce the speed of the motor output shaft to 4500 r/min or less.	Possible	
41h	9	EEPROM error	The stored data was damaged.	Initialize the all parameters.	Not possible	Excitation off
42h	8	Initial sensor error	A sensor error occurred when the power was turned on.	Turn off the power and check the connection of the motor cable and driver, and then cycle the power.		
43h		Initial rotor rotation error	The motor output shaft did not stand still when the power was turned on.	Make sure the motor output shaft does not turn by an external force when the power is turned on.		
45h		Motor combination error	A motor not supported by the driver is connected.	Check the model name of motor and driver, and use the motor and driver in the correct combination.		
4Ah	7	Return-to-home incomplete	The positioning operation was started when the position origin has not been set.	Perform the position preset or return-to-home operation.	Possible	Excitation on

Code	No. of ALARM LED blinks	Alarm type	Cause	Remedial action	Reset using the ALM-RST input	Motor excitation *1
51h	2	Regeneration unit overheat	• The regeneration unit is not connected correctly. • The regeneration unit was overheated abnormally.	Turn off the power and turn on the power again after checking the following items. • When the regeneration unit is not used, short-circuit the TH1 terminal and TH2 terminal on the CN1. • Connect the regeneration unit correctly. • Regenerative power from the motor exceeds the allowable regenerative power of the regeneration unit. Make sure the load and operating condition.	Not possible	Excitation off
60h	7	±LS both sides active	Both the +LS and −LS signals were detected when LS detection was enabled.	Reset alarm using the ALM-RST input, and then check the sensor logic and setting of "LS logic level" parameter.	Possible	Excitation on
61h		Reverse limit sensor connection	The LS opposite to the operating direction has detected during a return-to-home operation in 2-sensor mode or 3-sensor mode.	Reset alarm using the ALM-RST input, and then check the ±LS wiring.		
62h		Home seeking error	Return-to-home operation did not complete normally.	• An unanticipated load may have been applied during the return-to-home operation. Check the load. • If the installation positions of ±LS and HOMES are close to one another, the return-to-home sequence may not end properly, depending on the starting direction of return-to-home operation. Review the sensor installation positions and the starting direction of return-to-home operation. • Return-to-home operation may have been performed in a condition where both +LS and −LS were detected. Check the sensor logic and the setting of "LS logic level" parameter.		
63h		No HOMES	The HOMES is not detected at a position between +LS and −LS during return-to-home operation in 3-sensor mode.	Set a HOMES between +LS and −LS.		

Code	No. of ALARM LED blinks	Alarm type	Cause	Remedial action	Reset using the ALM-RST input	Motor excitation *1
64h	7	TIM, SLIT signal error	None of the SLIT input or TIM output could be detected during return-to-home operation.	• Adjust the connection condition of the motor output shaft and load as well as the HOMES position so that at least one of the SLIT input or TIM output will turn ON while HOMES is ON. • Set the "SLIT detection with home-seeking" parameter to "disable" if the SLIT input are not used with HOMES, while set the "TIM signal detection with home-seeking" parameter to "disable" if the TIM output are not used with HOMES.	Possible	Excitation on
66h		Hardware overtravel	A +LS or −LS signal was detected when hardware overtravel was enabled.	Reset alarm using the ALM-RST input, and then pull out from the limit sensor via continuous operation or return-to-home operation.		
67h		Software overtravel	A software limit was reached when software overtravel was enabled.	In single-motion operation, check to see if the position exceeds the softlimit. In linked-motion operation, check to see if the result of linked position exceeds the softlimit.		
6Ah		Home seeking offset error	A limit sensor signal was detected during offset movement as part of return-to-home operation.	Reset alarm using the ALM-RST input, and then check the offset value.		
70h		Abnormal operation data	• Data of different directions may be linked in linked-motion operation. • Five or more data may be linked. • Positioning operation of the operating speed 0 r/min was performed. • The larger value than 30 r/min was set in the operating speed of push-motion operation.	Reset alarm using the ALM-RST input, and then check the operation data.		
71h		Electronic gear setting error	The resolution set by the "electronic gear" parameter was outside of the specification.	Set the electronic gear correctly, and then cycle the power.	Not possible	Excitation off
72h		Wrap setting error	The resolution and "wrap setting range" parameter was inconsistent.	Set the "wrap setting range" parameter correctly and cycle the power.		
81h		Network bus error	When the motor operates, the host system for the network converter shows a disconnected status.	Check the host system connector or cable.	Possible	Excitation on
83h		Communication switch setting error	Transmission rate setting switch (SW2) was out-of-specification.	Check the transmission rate setting switch (SW2).	Not possible	Excitation off

Code	No. of ALARM LED blinks	Alarm type	Cause	Remedial action	Reset using the ALM-RST input	Motor excitation *1
84h	7	RS-485 communication error	The number of consecutive RS-485 communication errors reached the value set in the "communication error alarm" parameter.	• Check the connection between the host system and driver. • Check the setting of RS-485 communication.	Possible	Excitation on
85h		RS-485 communication timeout	The time set in the "communication timeout" parameter has elapsed, and yet the communication could not be established with the host system.	Check the connection between the host system and driver.		
8Eh		Network converter error	The network converter generated an alarm.	Check the alarm code of the network converter.		
F0h	Lit	CPU error	CPU malfunctioned.	Cycle the power.	Not possible	Excitation off

17.2 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
10h	Excessive position deviation	• When the motor was in a state of current ON, the deviation between the command position and actual position exceeded the value set in the parameter for overflow warning rotation during current on. • The load is large or acceleration/deceleration rate is too short.	• Reduce the load or increase the acceleration/deceleration rate. • If the driver is in the current control mode, increase the current limit value.
12h	Excessive position deviation during current OFF	When the motor was in a state of current OFF, the deviation between the command position and actual position exceeded the value set in the parameter for overflow rotation during current off. (This warning is output when the parameter for auto return is set to "Enable".)	Reduce the amount of rotation at current OFF to the specified setting value or less. Or, change the setting value.
21h	Main circuit overheat	The temperature inside the driver exceeded the value set in the parameter for overheat warning.	Review the ventilation condition in the enclosure.
22h	Overvoltage	• The voltage of the power supply exceeded the value set in the parameter for overvoltage warning. • A large inertial load was stopped abruptly or vertical operation was performed.	• Check the input voltage of the power supply. • If this alarm generates during operation, decrease the load or increase the acceleration/deceleration rate.
25h	Undervoltage	• The power supply voltage dropped from the value set in the parameter for undervoltage warning. • The main power was cut off momentarily or the voltage became low.	Check the input voltage of the power supply.
30h	Overload	• A load exceeding the maximum torque was applied for the time set in parameter for the overload warning or longer. • The load is large or acceleration/deceleration rate is too short.	• Reduce the load or increase the acceleration/deceleration rate. • If the driver is in the current control mode, increase the current limit value. • Check the connection between the driver and electromagnetic brake.
31h	Overspeed	The detected motor speed exceeded the value set in the parameter for overspeed warning.	• Check the electronic gear setting and reduce the speed of the motor output shaft to the value set in the parameter or less. • If the motor is overshooting at the time of acceleration, increase the acceleration/deceleration rate.
48h	Battery connection error	The battery was unconnected while the absolute-position backup system was "enable."	Check the battery connection.
71h	Electronic gear setting error	The resolution set in the parameter for electronic gear is outside the specified range.	Set the electronic gear correctly, and then cycle the power.
72h	Wrap setting error	The resolution and "wrap setting range" parameter was inconsistent.	Set the "wrap setting range" parameter correctly and cycle the power.
84h	RS-485 communication error	A RS-485 communication error was detected.	• Check the connection between the host system and driver. • Check the setting of RS-485 communication.

■ 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 clear the warning records using the **OPX-2A** or **MEXE02**.

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

17.3 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 host system 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 since the **OPX-2A** or **MEXE02** was communicating with the driver.	Wait until the processing for the **OPX-2A** or **MEXE02** will be completed.
8Ah	NV memory processing in progress	The command could not be executed because the driver was processing the NV memory. · Internal processing was in progress. (S-BSY is ON.) · An EEPROM error alarm was present.	• Wait until the internal processing will complete. • When the EEPROM error was generated, initialize the parameter using 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 could not be executed, it tried to do it.	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.
- Read and clear the communication error records using the status monitor of the **MEXE02**.

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

18 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 is not excited. • The motor output shaft can be moved by hand.	The C-ON input is turned OFF.	Turn the C-ON input ON and confirm that the motor will be excited.
	The FREE input is turned ON.	Turn the FREE input OFF.
The motor does not operate.	An electromagnetic brake motor is used and the electromagnetic brake is in the holding state.	Check the connections between electromagnetic brake and driver.
	The STOP input is turned ON.	Turn the STOP input OFF.
	The position (distance) is not set in the operation data while positioning operation.	Check the operation data.
	The FWD input and RVS input are turned ON simultaneously in the continuous operation.	Turn either FWD input or RVS input ON.
The motor rotates in the direction opposite to the specified direction.	The parameter for rotation direction is set wrong.	Check the setting of the parameter for rotation direction.
The gear output shaft rotates in the direction opposite to the motor.	A gear that rotates in the direction opposite to the motor shaft is used.	• With **TH** geared motors, the gear output shaft rotates in the direction opposite to the motor when the gear ratio is 20 or 30. • With Harmonic geared motors, the gear output shaft always rotates in the direction opposite to the motor.
Motor operation is unstable.	Connection error in the motor or power supply.	Check the connections between the driver, motor and power supply.
	The "RUN current" or "STOP current" parameter is too low.	Return the "RUN current" or "STOP current" to its initial setting and check. If the operating current is too low, the motor torque will also be too low and operation will be unstable.
Motor vibration is too great.	Load is too small.	Lower the operating current using the "RUN current" parameter. Vibration will increase if the motor's output torque is too large for the load.
The electromagnetic brake does not release.	The power is not supplied to the electromagnetic brake.	Check the connection of the electromagnetic brake.

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.

19 Inspection

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

■ During inspection

- Are any of the motor mounting screws loose?
- Check for any unusual noises in the motor bearings (ball bearings) or other moving parts.
- Are there any scratches, signs of stress or loose driver connections in the motor cable?
- Are the motor output shaft and load shaft out of alignment?
- Check for a blocked opening of the driver case.
- Are any of the driver mounting screws or connection loose?
- Is there attachment of dust, etc., on the driver?
- Are there any strange smells or appearances within the driver?

Note The driver uses semiconductor elements. Handle the driver with care since static electricity may damage semiconductor elements. Static electricity may damage the driver.

20 General specifications

		Motor	Driver
Degree of protection		IP54* (IP20 for double shaft type)	IP10
Operation environment	Ambient temperature	−10 to +50 °C (+14 to +122 °F) (non-freezing) Harmonic geared type: 0 to +40 °C (+32 to +104 °F) (non-freezing)	0 to +55 °C (+32 to +131 °F) (non-freezing)
	Humidity	85% or less (non-condensing)	
	Altitude	Up to 1000 m (3300 ft.) above sea level	
	Surrounding atmosphere	No corrosive gas, dust, water or oil	
Storage environment	Ambient temperature	−20 to +60 °C (−4 to +140 °F) (non-freezing)	−25 to +70 °C (−13 to +158 °F) (non-freezing)
	Humidity	85% or less (non-condensing)	
	Altitude	Up to 3000 m (10000 ft.) above sea level	
	Surrounding atmosphere	No corrosive gas, dust, water or oil	
Shipping environment	Ambient temperature	−20 to +60 °C (−4 to +140 °F) (non-freezing)	−25 to +70 °C (−13 to +158 °F) (non-freezing)
	Humidity	85% or less (non-condensing)	
	Altitude	Up to 3000 m (10000 ft.) above sea level	
	Surrounding atmosphere	No corrosive gas, dust, water or oil	
Insulation resistance		100 MΩ or more when 500 VDC megger is applied between the following places: · Case - Motor and sensor windings · Case - Electromagnetic brake windings	100 MΩ or more when 500 VDC megger is applied between the following places: · Protective Earth Terminal - Power supply terminals · Signal I/O terminals - Power supply terminals
Dielectric strength		Sufficient to withstand 1.5 kVAC at 50/60 Hz applied between the following places for 1 minute: · Case - Motor and sensor windings · Case - Electromagnetic brake windings	Sufficient to withstand the following for 1 minute, leak current 13 mA or less. · Protective Earth Terminal - Power supply terminals: 1.8 kVAC 50/60 Hz · Signal I/O terminals - Power supply terminals : 1.9 kVAC 50/60 Hz

∗ Excluding the mounting surface and connectors.

21 Accessories (sold separately)
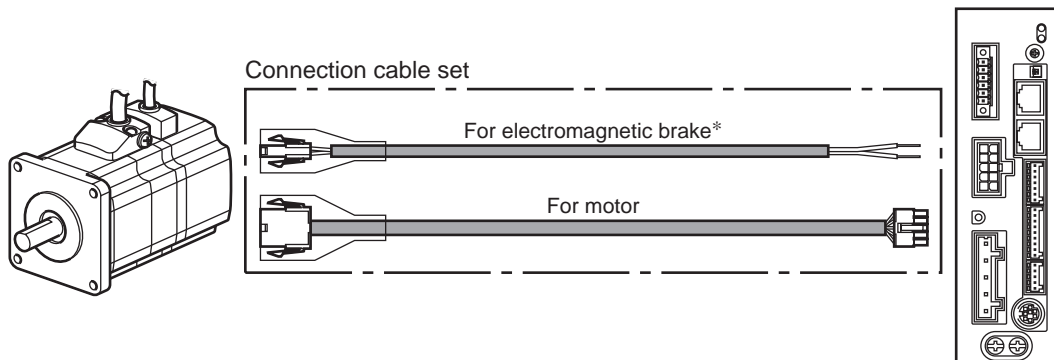
■ Motor connection cable

The cable supplied with the **AR** Series AC power input built-in controller type is all you need to connect the motor and driver.

Take note, however, that if you wish to connect the motor and driver over a distance of 3 m (9.8 ft.) or more, the supplied cable is not long enough and you must use a connection cable set or extension cable set.

A cable set for the electromagnetic brake motor consists of a motor cable and an electromagnetic brake cable.

When installing the motor on a moving part, use a flexible cable offering excellent flexibility.

● Extending the wiring length using a connection cable set

Do not use the supplied cable.

∗ Only when the motor is of electromagnetic brake type.

● Extending the wiring length using an extension cable set

Connect an extension cable to the supplied cable.
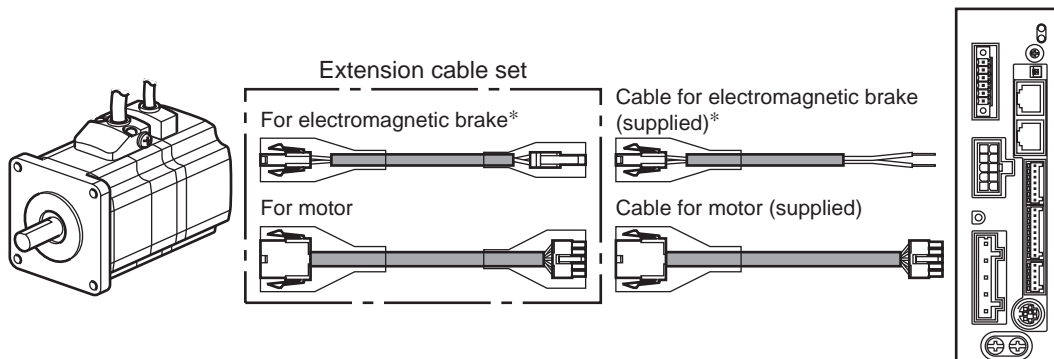
∗ Only when the motor is of electromagnetic brake type.

Note | When extending the wiring length by connecting an extension cable to the supplied cable, keep the total cable length to 30 m (98.4 ft.) or less.

● Connection cable set

See p.171 for connector pin assignments of the cable.

● For motor

Model	Length [m (ft.)]
CC050VAF	5 (16.4)
CC070VAF	7 (23.0)
CC100VAF	10 (32.8)
CC150VAF	15 (49.2)
CC200VAF	20 (65.6)
CC300VAF	30 (98.4)

● For electromagnetic brake

Model	Length [m (ft.)]
CC050VAFB	5 (16.4)
CC070VAFB	7 (23.0)
CC100VAFB	10 (32.8)
CC150VAFB	15 (49.2)
CC200VAFB	20 (65.6)
CC300VAFB	30 (98.4)

● Flexible connection cable set

● For motor

Model	Length [m (ft.)]
CC010VAR	1 (3.3)
CC020VAR	2 (6.6)
CC030VAR	3 (9.8)
CC050VAR	5 (16.4)
CC070VAR	7 (23.0)
CC100VAR	10 (32.8)
CC150VAR	15 (49.2)
CC200VAR	20 (65.6)
CC300VAR	30 (98.4)

● For electromagnetic brake

Model	Length [m (ft.)]
CC010VARB	1 (3.3)
CC020VARB	2 (6.6)
CC030VARB	3 (9.8)
CC050VARB	5 (16.4)
CC070VARB	7 (23.0)
CC100VARB	10 (32.8)
CC150VARB	15 (49.2)
CC200VARB	20 (65.6)
CC300VARB	30 (98.4)

● Extension cable set

● For motor

Model	Length [m (ft.)]
CC010VAFT	1 (3.3)
CC020VAFT	2 (6.6)
CC030VAFT	3 (9.8)
CC050VAFT	5 (16.4)
CC070VAFT	7 (23.0)
CC100VAFT	10 (32.8)
CC150VAFT	15 (49.2)
CC200VAFT	20 (65.6)

● For electromagnetic brake

Model	Length [m (ft.)]
CC010VAFBT	1 (3.3)
CC020VAFBT	2 (6.6)
CC030VAFBT	3 (9.8)
CC050VAFBT	5 (16.4)
CC070VAFBT	7 (23.0)
CC100VAFBT	10 (32.8)
CC150VAFBT	15 (49.2)
CC200VAFBT	20 (65.6)

● Flexible extension cable set

● For motor

Model	Length [m (ft.)]
CC010VART	1 (3.3)
CC020VART	2 (6.6)
CC030VART	3 (9.8)
CC050VART	5 (16.4)
CC070VART	7 (23.0)
CC100VART	10 (32.8)
CC150VART	15 (49.2)
CC200VART	20 (65.6)

● For electromagnetic brake

Model	Length [m (ft.)]
CC010VARBT	1 (3.3)
CC020VARBT	2 (6.6)
CC030VARBT	3 (9.8)
CC050VARBT	5 (16.4)
CC070VARBT	7 (23.0)
CC100VARBT	10 (32.8)
CC150VARBT	15 (49.2)
CC200VARBT	20 (65.6)

- Connector pin assignments
  - Pin assignment of "cable for motor"

Pin No.	Color	Lead size
1	White	AWG26 (0.14 mm^2)
2	Purple	
3	Red	AWG22 (0.3 mm^2)
4	Blue	
5	Green	
6	Black	AWG26 (0.14 mm^2)
7	Brown	
8	Gray	AWG22 (0.3 mm^2)
9	Orange	
10	Drain wire	AWG26 (0.14 mm^2)

- Motor side
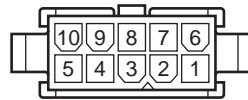
Model: 5559-10P-210 (Molex)

- Driver side
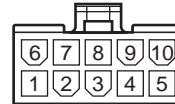
Model: 5557-10R-210 (Molex)

- Pin assignment of "cable for electromagnetic brake"

Pin No.	Color	Lead size
1	White	AWG20 (0.5 mm^2)*
2	Black	

* AWG21 (0.5 mm^2) for flexible cable
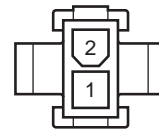
Model: 5559-02P-210 (Molex)

■ Data setter

The data setter lets you set operation data and parameters for your **AR** Series FLEX AC power input built-in controller type with ease and also functions as a monitor.

Model: **OPX-2A**

■ Data setting software

The data setting software lets you set parameters for your **AR** Series FLEX AC power input built-in controller type and monitor its operating condition using a PC. The software comes with a PC interface cable [5 m (16.4 ft.)]. The cable is connected to the USB port on the PC.

Model: **MEXE02**

■ RS-485 communication cable

You can link drivers using this cable connected to the RS-485 communication connectors (CN6, CN7).

Model: **CC002-RS4** [0.25 m (1 ft.)]

■ Battery set

This is a battery set (including a battery and battery holder) required in the absolute-position backup system.

Model: **BAT01B**

■ Regeneration unit

Connect the regeneration unit if gravitational operation or other operations involving up/down movement, or sudden starting/stopping of a large inertial load, will be repeated frequently. Always connect the regeneration unit if an overvoltage protection warning or alarm generates.

Model: **RGB100**

22 Related products (sold separately)

■ **Network converter**
 **NETC01-CC; supporting CC-Link communication**
  NETC01-M2; supporting MECHATROLINK-Ⅱ communication
  NETC01-M3; supporting MECHATROLINK-Ⅲ communication

When the **AR** Series FLEX AC power input built-in controller type is used in a CC-Link system or
MECHATROLINK 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**
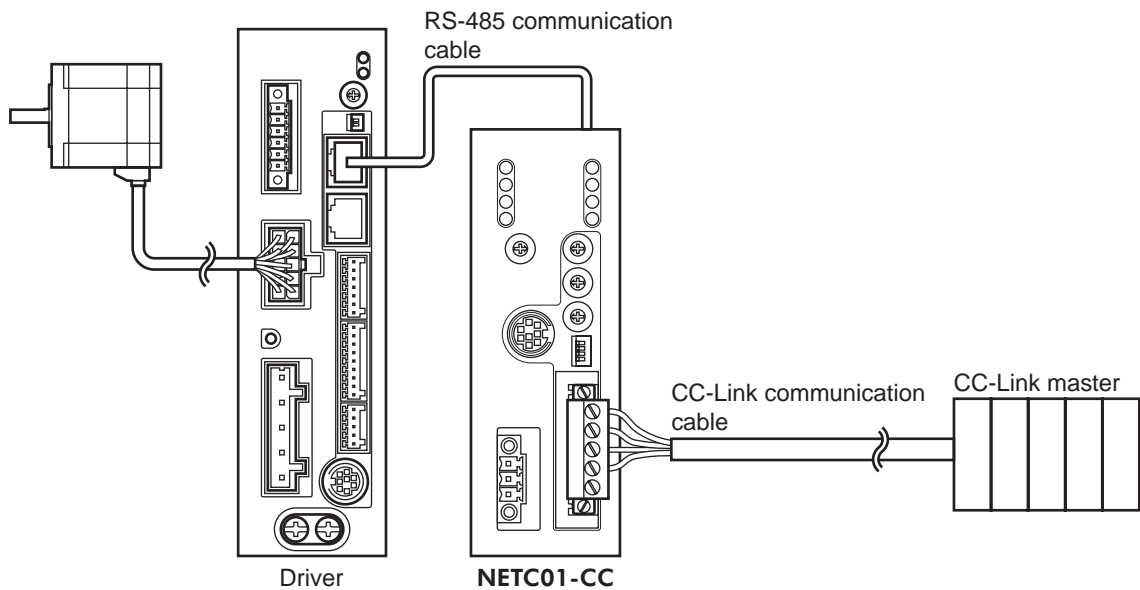
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