Oriental motor

HM-60190-7

Closed Loop Stepping Motor and Driver Package

αSTEP AR Series FLEX

DC power input Built-in Controller Type

USER MANUAL

CE

Thank you for purchasing an Oriental Motor product.

This Operating Manual describes product handling procedures and safety precautions.

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

1 Introduction

2 Installation and connection

3 Operation type and setting

4 Method of control via I/O

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

6 Method of control via industrial network

7 Inspection, troubleshooting and remedial actions

8 Appendix

Specification Change of Driver

Some specifications have been changed in this product. There are differences in data setting range, etc. between the product after the change and before the change. For the driver before the specification change, contact your nearest Oriental Motor sales office.

This manual describes contents of the driver which is after the specification change.
When using the driver which is before the specification change, take note of the following points.

1. Some setting items have been changed

■ Push current

Before the specification change	→	After the specification change
0 to 500 (1=0.1%)		0 to 1000 (1=0.1%)

■ NET-IN input function

The following input signals can be assigned in the product after the specification change.

- 24: ALM-RST
- 25: P-PRESET
- 26: P-CLR

■ Pay attention to the data update

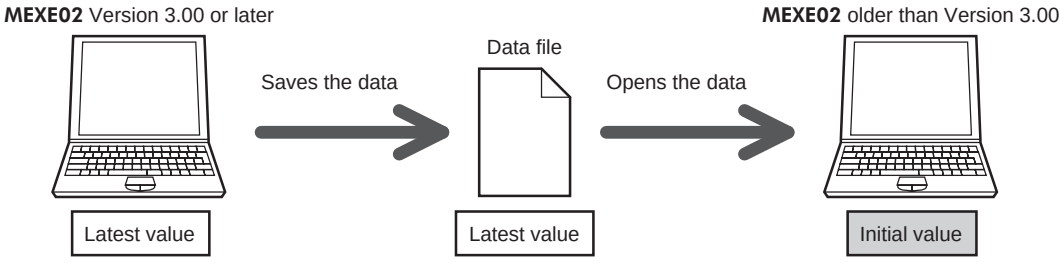
- When the data is set using the **MEXE02**, use the **MEXE02** which software version is 3.00 or later

  If the **MEXE02** is older version than 3.00, the value after the specification change can not be set.

- When the following data passing is performed, the most recent value will not be effective

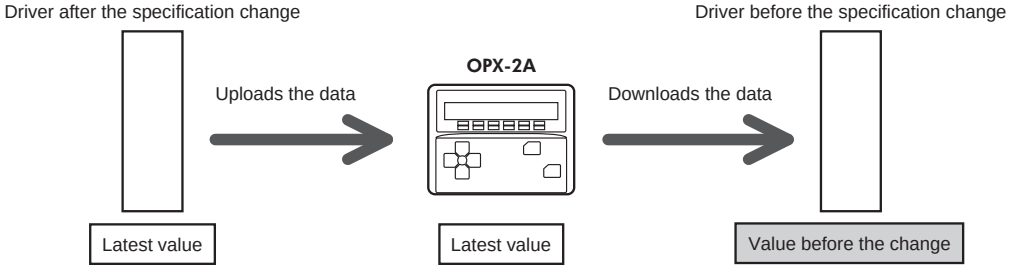
1) When the **MEXE02** data which has set the value after the specification change is opened using the older **MEXE02** than the Version 3.00

If the data is opened by the older **MEXE02** than the Version 3.00, the data will be changed to the initial value.



2) When the **OPX-2A** data which has set the value after the specification change is downloaded to the driver that is before the specification change

The value which is after the specification change will not be updated to the driver which is before the specification change, and the value presently set is kept.



2. The upper limit of the alarm output has been changed

The maximum speed for push-motion operation has been changed. If push-motion operation is started after setting higher speed than 30 r/min in the driver which is before the specification change, an operation data error alarm will generate.

- Maximum speed for push-motion operation

Before the specification change	➔	After the specification change
30 r/min		500 r/min

1 Introduction

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

Table of contents

1 Introduction

■ Before use

Only qualified personnel should work with the product.
Use the product correctly after thoroughly reading the section "5 Safety precautions" on p.13.
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.

■ Hazardous substances

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

■ Notation rules

The following term is used in explanation of this manual.

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

2 Operating Manuals for the AR Series

Operating manuals for the **AR** Series FLEX DC power input built-in controller type are listed below.
The "USER MANUAL" does not come with the product. For details, contact your nearest Oriental Motor sales office or download from Oriental Motor website download page.
After reading these manuals, keep them in a convenient place so that you can reference them at any time.

Applicable product	Type of operating manual	Description of operating manual
AR Series FLEX DC power input Built-in controller type	Motor OPERATING MANUAL (Supplied with motor)	This manual explains the functions as well as the installation method and others for the motor.
	Driver OPERATING MANUAL (Supplied with driver)	This manual explains the functions as well as the installation method and others for the driver.
	USER MANUAL (this document)	This manual explains the functions, installation/ connection method and data setting method as well as the operating method and others for the motor and driver.
Data setting software **MEXE02**	OPERATING MANUAL	This manual explains how to set data using the accessory **MEXE02**.
Data setter **OPX-2A**	OPERATING MANUAL	This manual explains the functions and installation/ connection method as well as data setting method and others for the accessory **OPX-2A** (sold separately).
Network converter	CC-Link compatible **NETC01-CC** USER MANUAL	This manual explains the functions and installation/ connection method as well as the operating method for the network converter.
	MECHATROLINK-Ⅱ compatible **NETC01-M2** USER MANUAL	
	MECHATROLINK-Ⅲ compatible **NETC01-M3** USER MANUAL	
	EtherCAT compatible **NETC01-ECT** OPERATING MANUAL	

With regard to the information required to be certified under the UL Standard, refer to the "APPENDIX UL Standards for **AR** Series DC power input type" (the paper is supplied with the product).

3 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 (RS-485 communication) or industrial network communication using the network converter.
The operation data and parameters can be set using the accessory **OPX-2A** (sold separately) or **MEXE02**, 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 peak torque.

- Three operating patterns

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 Modbus RTU (RS-485 communication)

You can set operation data and parameters or issue operation start/stop commands from the master controller.
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.

- 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.

- 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.

- 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 the accessory **OPX-2A** (sold separately) or **MEXE02**, or via RS-485 communication. Provide the **OPX-2A** or **MEXE02** as necessary.

■ Related products

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

Network converter	Supported network
NETC01-CC	CC-Link communication
NETC01-M2	MECHATROLINK-Ⅱ communication
NETC01-M3	MECHATROLINK-Ⅲ communication
NETC01-ECT	EtherCAT 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**

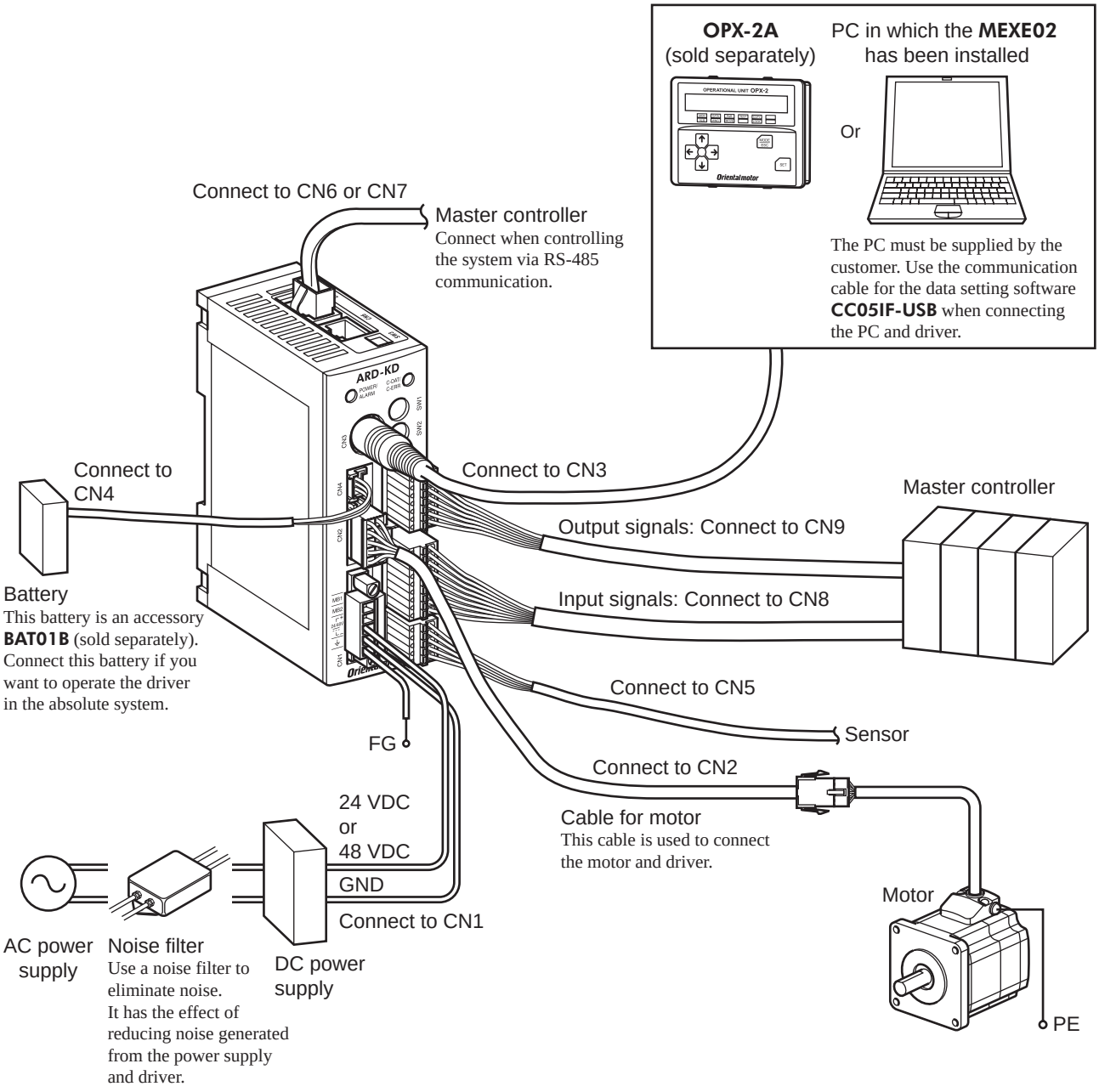
Support functions

[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** Test operation Teaching I/O test • **Operation data setting** • **Download/Upload** • **Parameter setting** • **Data initialization**
RS-485 communication	• **Operation start** • **Monitor function** • **Operation data setting** • **Maintenance function** • **Parameter setting**

4 System configuration



5 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 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, injury or damage to equipment.
- 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

- Install the motor and driver in the enclosure in order to prevent injury.

Connection

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

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.

Repair, disassembly and modification

- Do not disassemble or modify the motor and driver. Doing so may cause 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 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 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 power supply connector (CN1), data edit connector (CN3) 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.
- When connecting, check the silk screen of the driver and pay attention to the polarity of the power supply. Reverse-polarity connection may cause damage to the driver. The power-supply circuit and the RS-485 communication circuit are not insulated. Reverse-polarity connection may cause damage to the driver.

Operation

- Use a motor and driver only in the specified combination. An incorrect combination may cause a fire.
- Do not touch the rotating part (output shaft) during operation. Doing so may cause injury.
- Provide an emergency stop device or emergency stop circuit external to the equipment so that the entire equipment will operate safely in the event of a system failure or malfunction. Failure to do so may result in injury.
- For the power supply to the electromagnetic brake, use a DC power supply with reinforced insulation on its primary and secondary sides. Failure to do so may result in electric shock.
- 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.
- Before moving the motor directly with the hands, confirm that the FREE input turns ON. Failure to do so may result in injury.
- Immediately when trouble has occurred, stop running and turn off the driver power. Failure to do so may result in fire or injury.

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.38 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

6 Precautions for use

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

- Always use the cable (supplied or accessory) to connect the motor and driver.

  Be sure to use the cable (supplied or accessory) to connect the motor and driver.
  In the following condition, an appropriate accessory cable must be purchased separately. Refer to p.208 for details.
  - If a flexible cable is to be used.
  - If a cable of 3 m (9.8 ft.) or longer is to be used.
  - If a motor and driver package without a cable was purchased.

- 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 a radial load and axial load in excess of the specified permissible limit

  Operating the motor under an excessive radial load or axial load may damage the motor bearings (ball bearings). Be sure to operate the motor within the specified permissible limit of radial load and axial load. Refer to p.28 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.

- Holding torque at standstill

  The motor holding torque is reduced by the current cutback function of the driver at motor standstill. When selecting a motor for your application, consider the fact that the holding torque will be reduced at motor standstill.

- 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, radial load or axial load to the output shaft on the opposite side of the motor output shaft.

- Preventing electrical noise

  See "1.7 Installing and wiring in compliance with EMC Directive" on p.30 for measures with regard to noise.

- Peak torque of geared type motor

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

- Grease of geared type motor

  On rare occasions, a small amount of grease may ooze out from the geared type 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 gear part.

- Saving data to the non-volatile memory

Do not turn off the 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 approximately 100,000 times.

- Motor excitation at power ON

The motor is excited when the 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.

- Overvoltage alarm by regeneration energy

The overvoltage alarm will generate depending on the operating condition. When an alarm is generated, review the operating conditions.

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

The power supply connector (CN1), data edit connector (CN3) 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. Use the **OPX-2A** to set data, etc.

7 General specifications

		Motor	Driver
Degree of protection		IP65 (Excluding the motor mounting surface and connectors) IP20 (Double shaft type, models including "S" in the motor identification of motor name.)	IP10
Operation environment	Ambient temperature	−10 to +50 °C (+14 to +122 °F) (non-freezing) ∗1 Harmonic geared type: 0 to +40 °C (+32 to +104 °F) (non-freezing) ∗1	0 to +50 °C (+32 to +122 °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 windings and sensor windings · Case - Electromagnetic brake windings	100 MΩ or more when 500 VDC megger is applied between the following places: · FG terminal - Power supply terminal
Dielectric strength		Sufficient to withstand 1.0 kVAC at 50 Hz or 60 Hz applied between the following places for 1 minute: ∗2 · Case - Motor windings and sensor windings · Case - Electromagnetic brake windings"	Sufficient to withstand 500 VAC at 50 Hz or 60 Hz applied between the following places for 1 minute: · FG terminal - Power supply terminal

*1 When installing a motor to a heat sink of a capacity at least equivalent to an aluminum plate [100×100 mm (3.94×3.94 in.), thickness 6 mm (0.24 in.)].

*2 0.5 kVAC for the ARM14, ARM15, ARM24 and ARM26 types

8 CE Marking

■ Low Voltage Directives

Because the input power supply voltage of this product is 24 VDC/48 VDC, it is not subject to the Low Voltage Directive but install and connect this product as follows.
This product is designed and manufactured to be installed within another device. Install the product in an enclosure.
For the driver power supply, use a DC power supply with reinforced insulation on its primary and secondary sides.

■ EMC Directive

This product has received EMC compliance under the conditions specified in "Example of motor and driver installation and wiring" on p.31. 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 EN 55011 group 1 class A
EMS	EN 61000-6-2 EN 61800-3

9 Preparation

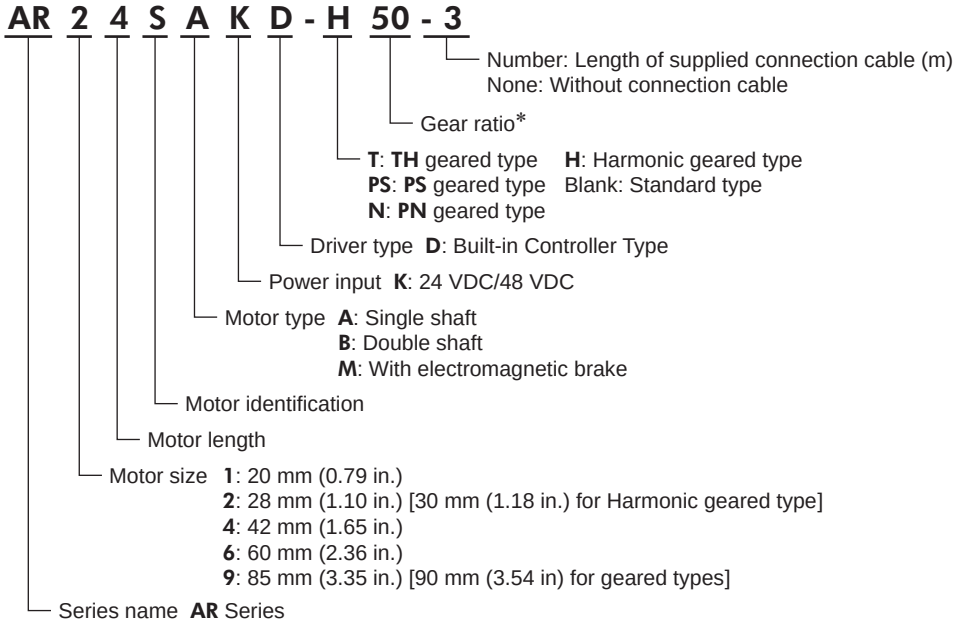
This chapter explains the items you should check, as well as the name and function of each part.

9.1 Checking the product

Verify that the items listed below are included. Report any missing or damaged items to the branch or sales office from which you purchased the product.
Verify the model number of the purchased product against the number shown on the package label.
Check the model number of the motor and driver against the number shown on the nameplate. Model names for motor and driver combinations are shown on p.22.

- Motor.....1 unit
- Parallel key.....1 pc. (Supplied with geared types; except for the **AR24**, **AR46TH** and **AR66TH**)
- Cable for motor.....1 pc. (Supplied with a motor and driver package)
- Cable for electromagnetic brake.....1 pc. (Supplied with an electromagnetic brake motor and driver package)
- Driver.....1 unit
- CN1 connector.....1 pc. (for power supply input terminals; 5 pins)
- CN5 connector.....1 pc. (for sensor signals; 5 pins)
- CN8 connector.....1 pc. (for input signals; 9 pins)
- CN9 connector.....1 pc. (for output signals; 7 pins)
- Motor OPERATING MANUAL.....1 copy
- Driver OPERATING MANUAL.....1 copy

9.2 How to identify the product model



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

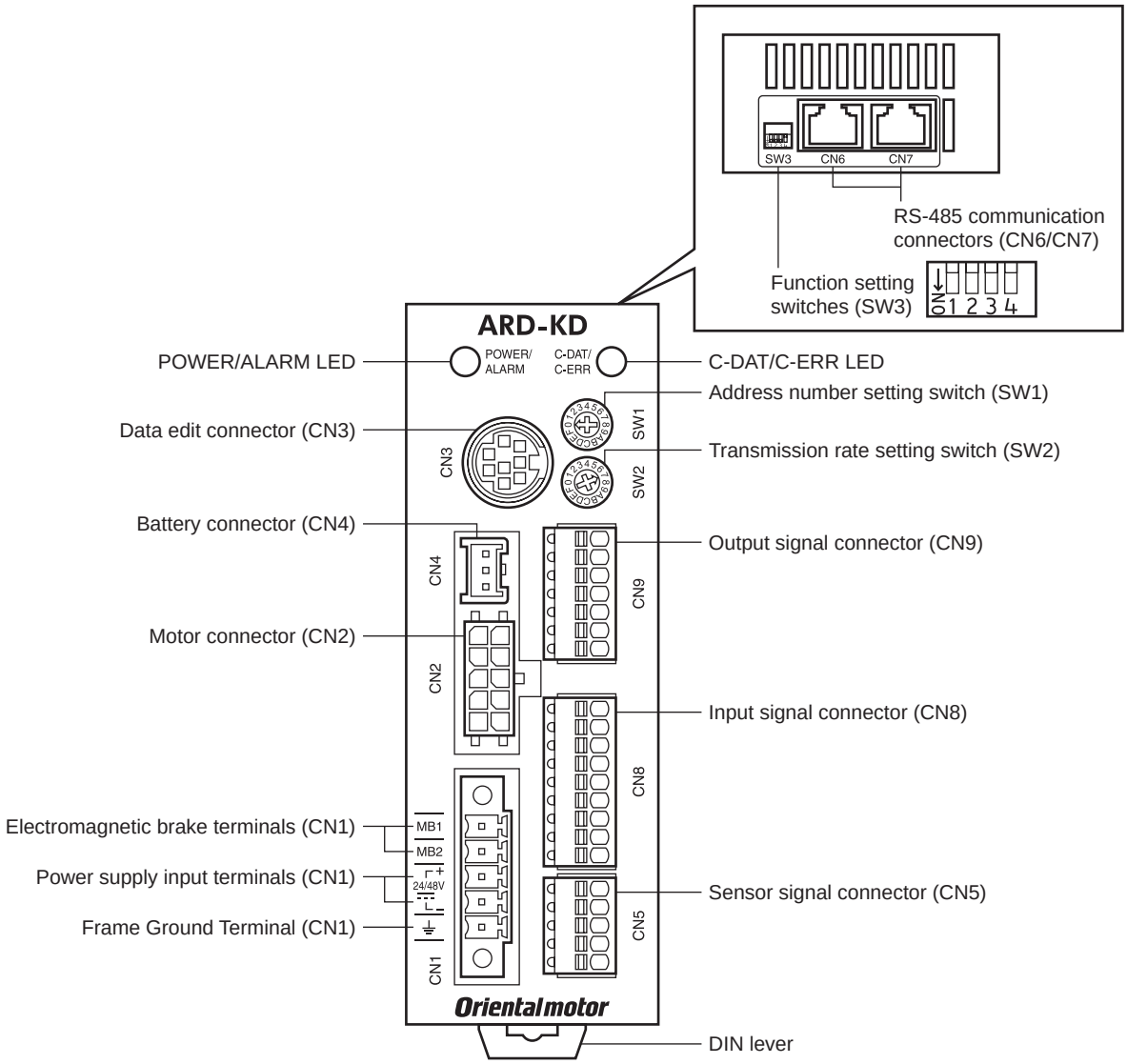
9.3 Combinations of motors and drivers

- □ indicates **A** (single shaft), **B** (double shaft) or **M** (with electromagnetic brake).
  For **AR14S** and **AR15S** , □ indicates **A** (single shaft) or **B** (double shaft).
  For geared type, □ indicates **A** (single shaft) or **M** (with electromagnetic brake).
- When a connection cable is included, ○ in the model names indicates a number (**-1**, **-2**, **-3**) representing the cable length.
- ■ in the model names indicates a number representing the gear ratio.

Type	Model	Motor model	Driver model
Standard type	**AR14S□KD○**	ARM14S□K	ARD-KD
	AR15S□KD○	ARM15S□K	
	AR24S□KD○	ARM24S□K	
	AR26S□KD○	ARM26S□K	
	AR46S□KD○	ARM46S□K	
	AR46□KD○	ARM46□K	
	AR66S□KD○	ARM66S□K	
	AR66□KD○	ARM66□K	
	AR69S□KD○	ARM69S□K	
	AR69□KD○	ARM69□K	
	AR98S□KD○	ARM98S□K	
	AR98□KD○	ARM98□K	
TH geared type	**AR24S□KD-T■○**	ARM24S□K-T■	ARD-KD
	AR46S□KD-T■○	ARM46S□K-T■	
	AR46□KD-T■○	ARM46□K-T■	
	AR66S□KD-T■○	ARM66S□K-T■	
	AR66□KD-T■○	ARM66□K-T■	
	AR98S□KD-T■○	ARM98S□K-T■	
	AR98□KD-T■○	ARM98□K-T■	
PS geared type	**AR24SAKD-PS■○**	ARM24SAK-PS■	ARD-KD
	AR46S□KD-PS■○	ARM46S□K-PS■	
	AR46□KD-PS■○	ARM46□K-PS■	
	AR66S□KD-PS■○	ARM66S□K-PS■	
	AR66□KD-PS■○	ARM66□K-PS■	
	AR98S□KD-PS■○	ARM98S□K-PS■	
	AR98□KD-PS■○	ARM98□K-PS■	
PN geared type	**AR24SAKD-N■○**	ARM24SAK-N■	ARD-KD
	AR46S□KD-N■○	ARM46S□K-N■	
	AR46□KD-N■○	ARM46□K-N■	
	AR66S□KD-N■○	ARM66S□K-N■	
	AR66□KD-N■○	ARM66□K-N■	
	AR98S□KD-N■○	ARM98S□K-N■	
	AR98□KD-N■○	ARM98□K-N■	
Harmonic geared type	**AR24S□KD-H■○**	ARM24S□K-H■	ARD-KD
	AR46S□KD-H■○	ARM46S□K-H■	
	AR46□KD-H■○	ARM46□K-H■	
	AR66S□KD-H■○	ARM66S□K-H■	
	AR66□KD-H■○	ARM66□K-H■	
	AR98S□KD-H■○	ARM98S□K-H■	
	AR98□KD-H■○	ARM98□K-H■	

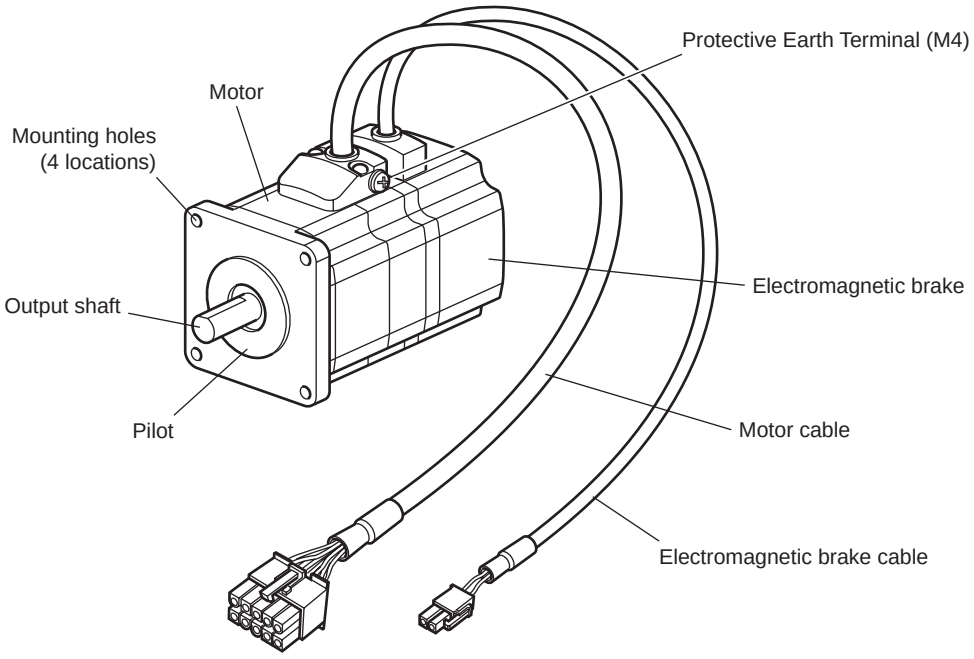
9.4 Names and functions of parts

■ Driver



Name	Description	Page
POWER LED (Green)	This LED is lit while the power is input.	–
ALARM LED (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.199
C-DAT LED (Green)	This LED will blink or illuminate steadily when the driver is communicating with the master station properly via RS-485 communication.	–
C-ERR LED (Red)	This LED will illuminate when a RS-485 communication error occurs with the master station.	–
Address number setting switch (SW1)	Use this switch when controlling the system via RS-485 communication. Use this switch and SW3-No.1 of the function setting switch, to set the address number (slave address) of RS-485 communication. (Factory setting: 0)	p.131 p.167 p.179
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)	
Function setting switches (SW3)	Use this switch when controlling the system via RS-485 communication. No.1: Using this switch and the address number setting switch (SW1), set the address number (slave address) of RS-485 communication. (Factory setting: OFF) No.2: Set the protocol of RS-485 communication. (Factory setting: OFF) No.3: Not used. No.4: Set the termination resistor (120 Ω) of RS-485 communication. (Factory setting: OFF)	
Electromagnetic brake terminals (CN1-MB1/MB2)	Connect the lead wires from the electromagnetic brake. MB1: Electromagnetic brake − (black) MB2: Electromagnetic brake + (white)	p.32
Power supply input terminals (CN1)	Connect the power supply of the driver. +: +24 VDC/48 VDC power supply input −: power supply GND	
Frame Ground Terminal (CN1)	Ground using a wire of AWG24 to 16 (0.2 to 1.25 mm^2).	p.36
Motor connector (CN2)	Connect the motor cable or flexible motor cable to connect the motor.	p.32
Data edit connector (CN3)	Connect a PC in which the **MEXE02** has been installed, or the **OPX-2A**.	p.36
Battery connector (CN4)	Connect the accessory battery (sold separately).	p.38
Sensor signal connector (CN5)	Connects the limit sensor.	p.32
RS-485 communication connectors (CN6/CN7)	Connect the RS-485 communication cable.	p.37
Input signal connector (CN8)	Connect the input signals cable.	p.32
Output signal connector (CN9)	Connect the output signals cable.	

■ Motor (Example: ARM66SMK)



2 Installation and connection

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

Table of contents

1 Installation

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

1.1 Location for installation

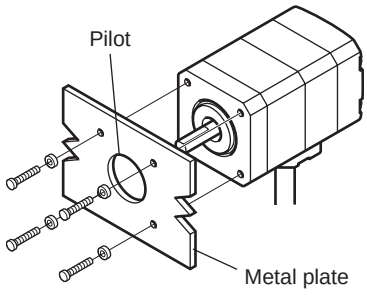
The motor and driver has been designed and manufactured to be installed within another device. Install them in a well-ventilated location that provides easy access for inspection.
The location must also satisfy the following conditions:

- 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 +50 °C (+32 to +122 °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

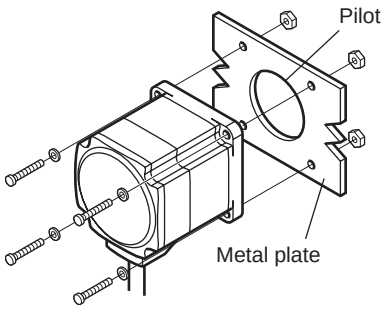
1.2 Installing the motor

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	20 (0.79)	M2	0.25 (35)	2.5 (0.098)	A
	28 (1.10)	M2.5	0.5 (71)	2.5 (0.098)	
	42 (1.65)	M3	1 (142)	4.5 (0.177)	
	60 (2.36)	M4	2 (280)	–	B
	85 (3.35)	M6	3 (420)		
TH geared	28 (1.10)	M2.5	0.5 (71)	4 (0.157)	A
	42 (1.65) 60 (2.36)	M4	2 (280)	8 (0.315)	
	90 (3.54)	M8	4 (560)	15 (0.591)	
PS geared **PN** geared Harmonic geared *1	28 (1.10) 30 (1.18)	M3	1 (142)	6 (0.236)	
	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

*3 **AR24**, **AR46** and **AR66** type only.
*4 **AR98** type only.

1.3 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.

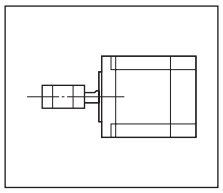
■ Using a belt drive

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.

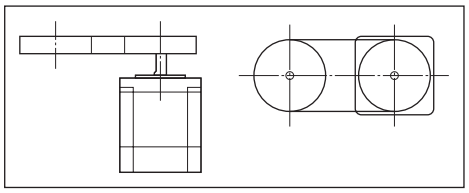
■ Using a gear drive

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.

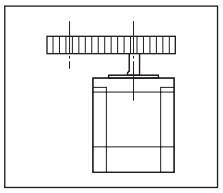
• Using a coupling



• Using a belt drive



• Using a gear drive

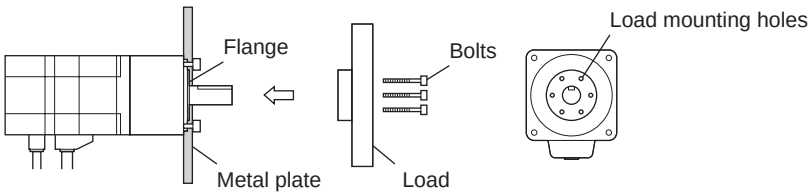


■ Using a parallel key (geared motor)

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.)]
AR24	M3	4	1.4 (198)	4 (0.157)
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.

1.4 Permissible radial load and permissible axial load

Note

- If the radial load or axial load exceeds the specified allowable value, repeated load applications may cause the bearing (ball bearings) or output shaft of the motor to undergo a fatigue failure.
- With a double shaft type, do not apply load torque, radial load or axial load to the output shaft on the opposite side of the motor output shaft.

Type	Model	Gear ratio	Permissible radial load [N (lb.)]					Permissible axial 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	**AR14**	–	12 (2.7)	15 (3.3)	–	–	–	0.7 (0.157)
	AR15							0.9 (0.2)
	AR24		25 (5.6)	34 (7.6)	52 (11.7)	–	–	1.5 (0.33) <2.1 (0.47)> *
	AR26							2.2 (0.49) <2.7 (0.6)> *
	AR46		35 (7.8)	44 (9.9)	58 (13)	85 (19.1)	–	4.6 (1.03) <6.1 (1.37)> *
	AR66		90 (20)	100 (22)	130 (29)	180 (40)	270 (60)	8.8 (1.98) <11.8 (2.6)> *
	AR69							13.7 (3) <16.7 (3.7)> *
	AR98		260 (58)	290 (65)	340 (76)	390 (87)	480 (108)	18 (4) <24 (5.4)> *
TH geared	**AR24**	–	15 (3.3)	17 (3.8)	20 (4.5)	23 (5.1)	–	10 (2.2)
	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	**AR24**	–	45 (10.1)	60 (13.5)	80 (18)	100 (22)	–	20 (4.5)
	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	**AR24**	–	45 (10.1)	60 (13.5)	80 (18)	100 (22)	–	20 (4.5)
	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)	

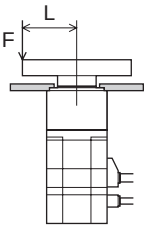
* The brackets < > indicate the value for the electromagnetic brake type.

Type	Model	Gear ratio	Permissible radial load [N (lb.)]					Permissible axial 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)	
Harmonic geared	**AR24**	–	100 (22)	135 (30)	175 (39)	250 (56)	–	140 (31)
	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

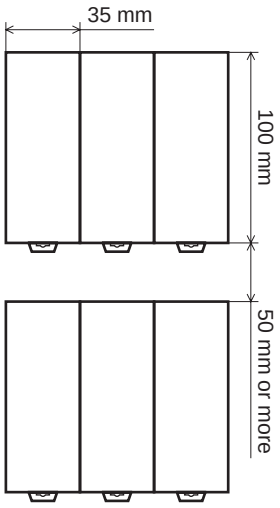
Model	Permissible moment load [N·m (oz-in)]
AR24	2.9 (410)
AR46	5.6 (790)
AR66	11.6 (1640)



1.5 Installing the driver

■ Installation method

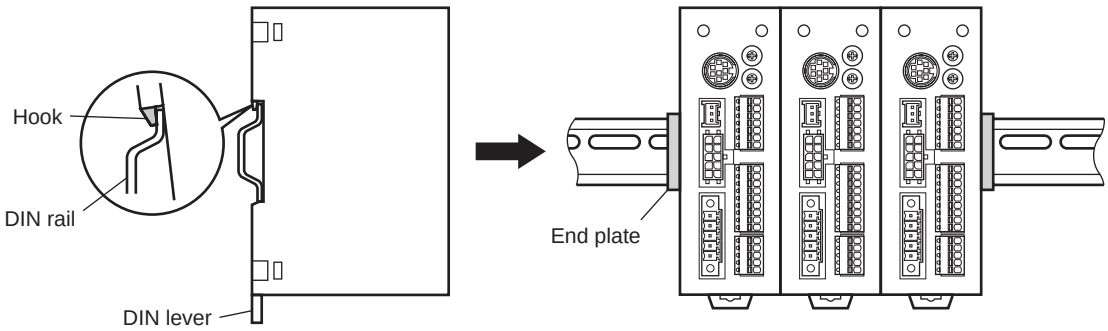
Mount the driver to a 35 mm (1.38 in.) width DIN rail.
When installing two or more drivers in parallel, it is possible to install them closely in the horizontal direction.
Provide a minimum clearance of 50 mm (1.97 in.) in the vertical direction.
When installing three or more drivers closely, the heat generation of the inside drivers become high. Install the less frequently used drivers toward the inside.
Use the "overheat warning" parameter to check the inside temperature of the driver.



Note

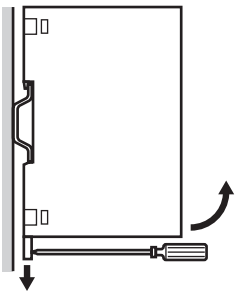
- Install the driver in an enclosure whose pollution degree is 2 or better environment, or whose degree of protection is IP54 minimum.
- Do not install any equipment that generates a large amount of heat or noise near the driver.
- Do not install the driver underneath the controller or other equipment vulnerable to heat.
- If the ambient temperature of the driver exceeds 50 °C (122 °F), improve the ventilation condition such as providing forced cooling by using fans or creating spaces between the drivers.
- Be sure to install the driver vertically (vertical position).

Pull down the driver's DIN lever and lock it. Hang the hook at the rear to the DIN rail, and push in the driver.
After installation, secure the both sides of the driver with the end plate.



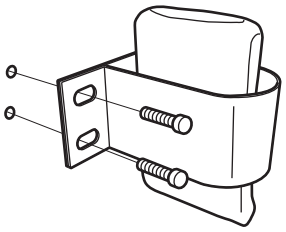
Removing from DIN rail

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

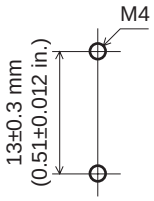


1.6 Installing the battery

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.210 for accessory.



• Battery installation dimensions



1.7 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 "8 CE Marking" on p.19 for the applicable standards.
Oriental Motor conducts EMC measurements on its motors and drivers in accordance with "Example of motor and driver installation and wiring" on p.31. The user is responsible for ensuring the machine's compliance with the EMC Directive, based on the installation and wiring explained below.

■ Connecting the power supply

Use a DC power supply compliant with the EMC Directive.
Use a shielded cable for wiring and wire/ground the power supply over the shortest possible distance.
Refer to "Wiring the power supply cable and I/O signal cable" for how to ground the shielded cable.

■ Connecting noise filter for power supply line

- Connect a noise filter in the DC power supply input to prevent the noise generated in the driver from propagating externally through the power supply line.
- When using a power supply transformer, be sure to connect a noise filter to the AC input side of the power supply transformer.
- For a noise filter, use HF2010A (SOSHIN ELECTRIC CO.,LTD), FN2070-10-06 (Schaffner EMC) or equivalent product.
- Install the noise filter as close to the AC input terminal of DC power supply as possible. Use cable clamps and other means to secure the AC 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 AC 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.

■ How to ground

The cable used to ground the 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.

- Grounding the motor

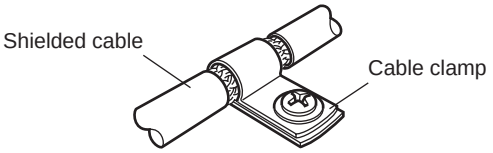
Be sure to ground the Protective Earth Terminal of the motor. Refer to p.36 for grounding method.

- Grounding the driver

Refer to p.36 for grounding method.

■ Wiring the power supply cable and I/O signal cable

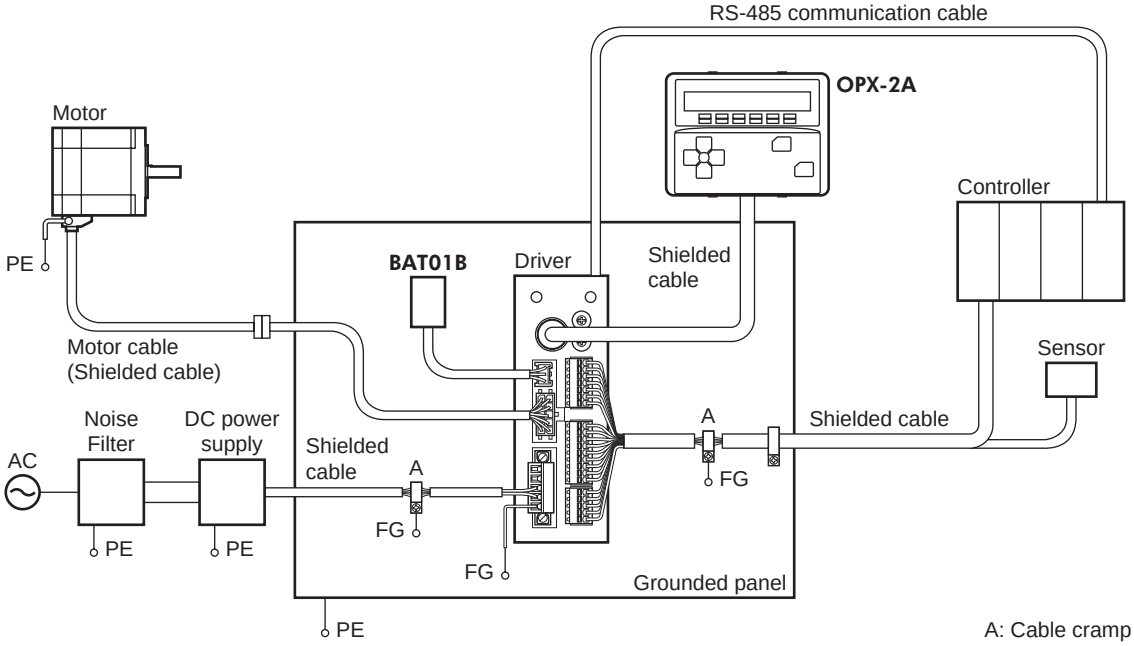
Use a shielded cable for the power supply cable and I/O signal cable, and keep it as short as possible.
To ground a shielded cable, use a metal cable clamp or similar device that will maintain contact with the entire circumference of the cable. Attach a cable clamp as close to the end of the cable as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



■ 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 AC 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 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

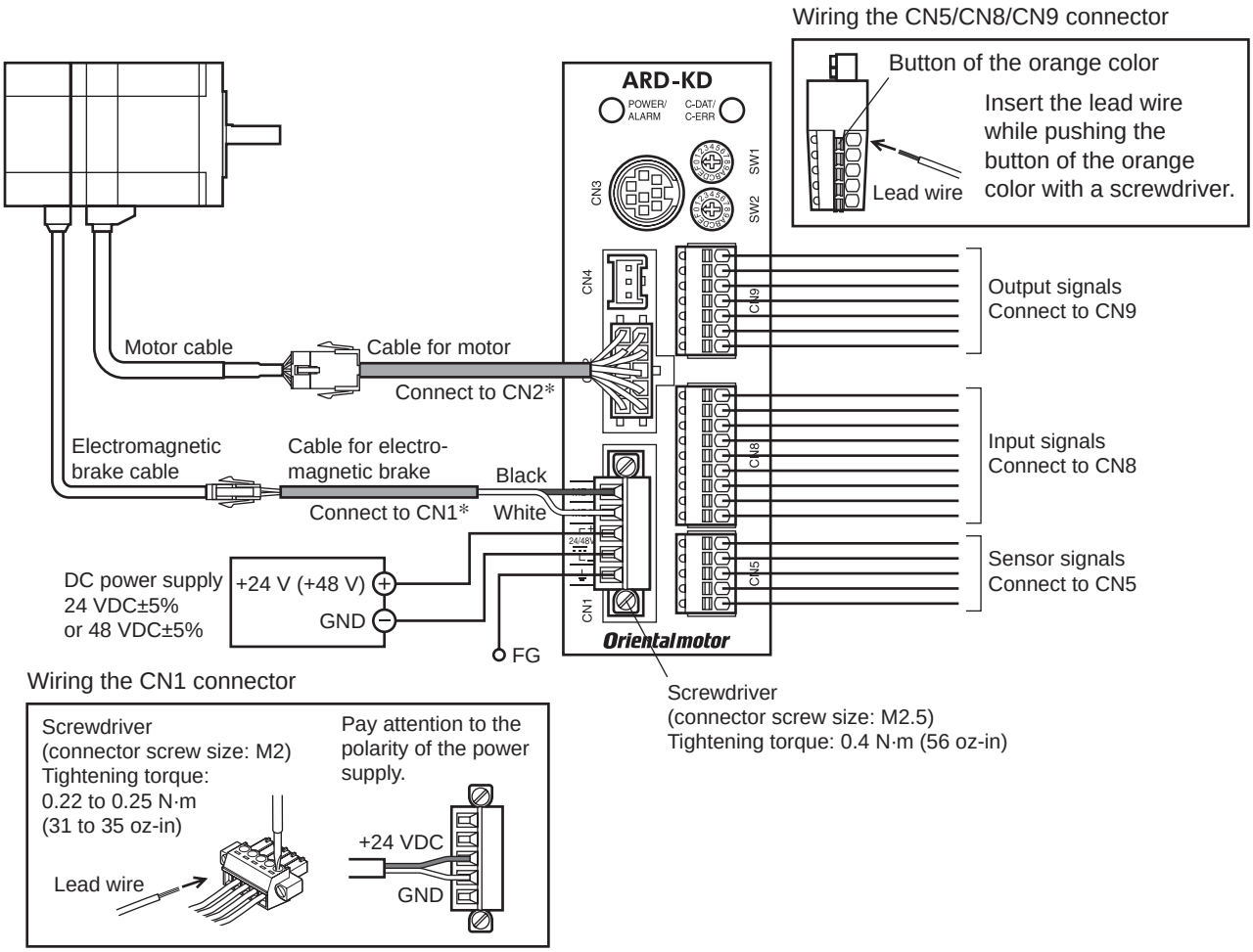
Static electricity may cause the driver to malfunction or suffer damage. While the driver is receiving power, handle the driver with care and do not come near or touch the driver.
Always use an insulated screwdriver to adjust the driver's switches.

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.

2 Connection

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

2.1 Connection example (electromagnetic brake motor)



* Keep 30 m (98.4 ft.) or less for the wiring distance between the motor and driver.

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 POWER LED to turn off before doing so.
- When connecting, check the silk screen of the driver and pay attention to the polarity of the power supply. Reverse-polarity connection may cause damage to the driver. The power-supply circuit and the RS-485 communication circuit are not insulated. Therefore, when controlling multiple drivers via RS-485 communication, the reverse polarity of the power supply will cause a short circuit and may result in damage to the drivers.
- 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.208.
- 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.

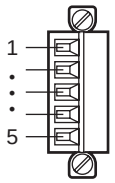
■ Power supply current capacity

Model	Input power supply voltage	Power supply current capacity	
		Standard type	Electromagnetic brake type
AR14	24 VDC±5%	0.4 A or more	−
AR15		0.5 A or more	−
AR24 **AR26**		1.3 A or more	1.37 A or more
AR46	24 VDC±5% 48 VDC±5%	1.72 A or more	1.8 A or more
AR66		3.55 A or more	3.8 A or more
AR69		3.45 A or more	3.7 A or more
AR98		2.85 A or more	3.1 A or more

■ Pin assignment list

- CN1

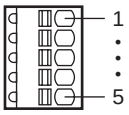
Pin No.	Signal name	Description
1	MB1	Electromagnetic brake − (Black)
2	MB2	Electromagnetic brake + (White)
3	+	24 VDC/48 VDC power supply
4	−	Power supply ground
5	FG	Frame Ground



- Applicable lead wire: AWG24 to 16 (0.2 to 1.25 mm^2)
- Length of the insulation cover which can be peeled: 7 mm (0.28 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

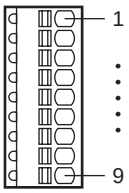


- Applicable lead wire: AWG26 to 20 (0.14 to 0.5 mm^2)
- Length of the insulation cover which can be peeled: 8 mm (0.31 in.)

- CN8

Pin No.	Signal name	Description
1	IN0	Control input 0 [HOME]
2	IN1	Control input 1 [START]
3	IN2	Control input 2 [M0]
4	IN3	Control input 3 [M1]
5	IN4	Control input 4 [M2]
6	IN5	Control input 5 [FREE]
7	IN6	Control input 6 [STOP]
8	IN7	Control input 7 [ALM-RST]
9	IN-COM1	Input signal common

* [ ]: Initial value

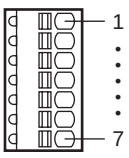


- Applicable lead wire: AWG26 to 20 (0.14 to 0.5 mm^2)
- Length of the insulation cover which can be peeled: 8 mm (0.31 in.)

- CN9

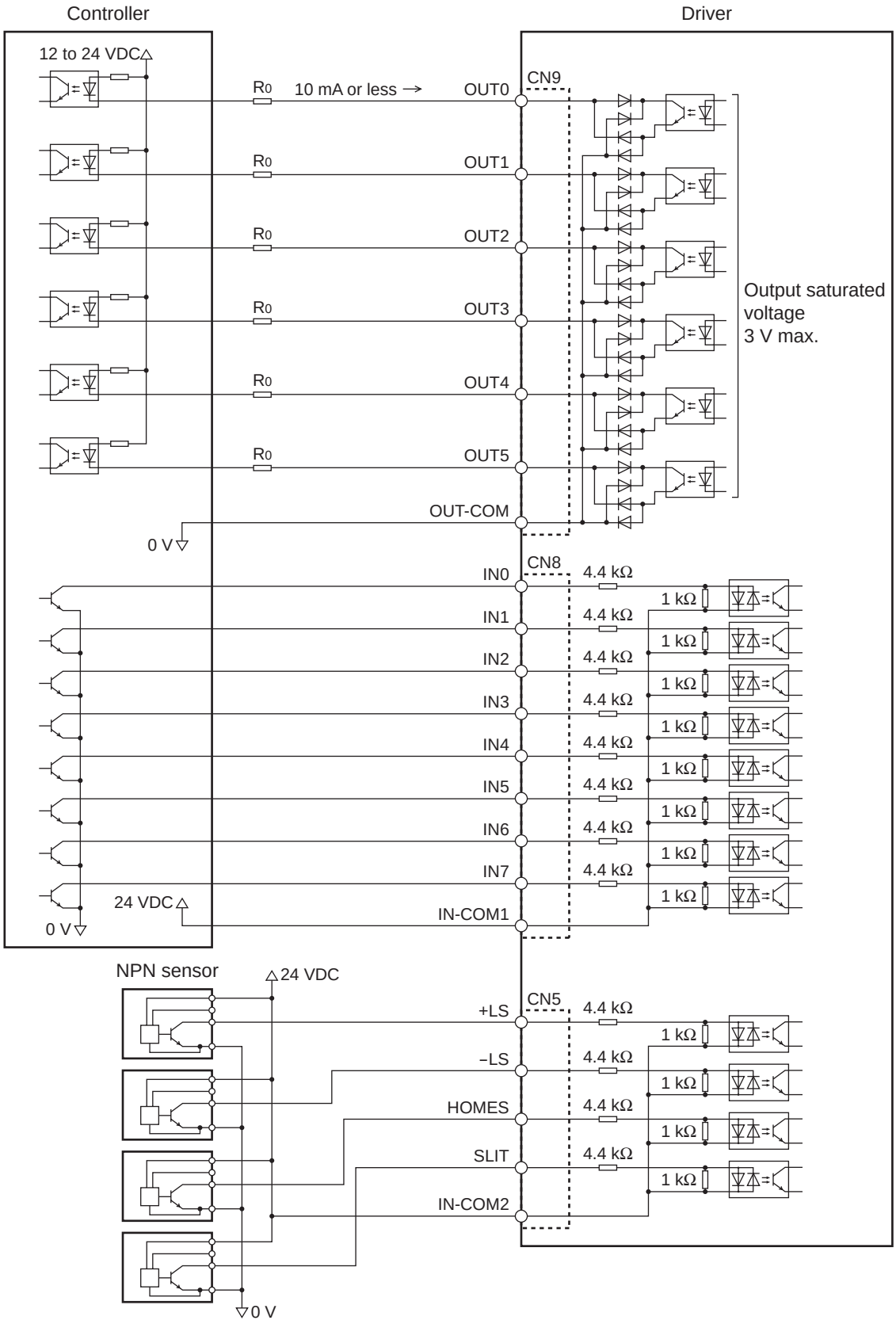
Pin No.	Signal name	Description
1	OUT0	Control output 0 [HOME-P]
2	OUT1	Control output 1 [END]
3	OUT2	Control output 2 [AREA1]
4	OUT3	Control output 3 [READY]
5	OUT4	Control output 4 [WNG]
6	OUT5	Control output 5 [ALM]
7	OUT-COM	Output signal common

* [ ]: 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 (0.31 in.)

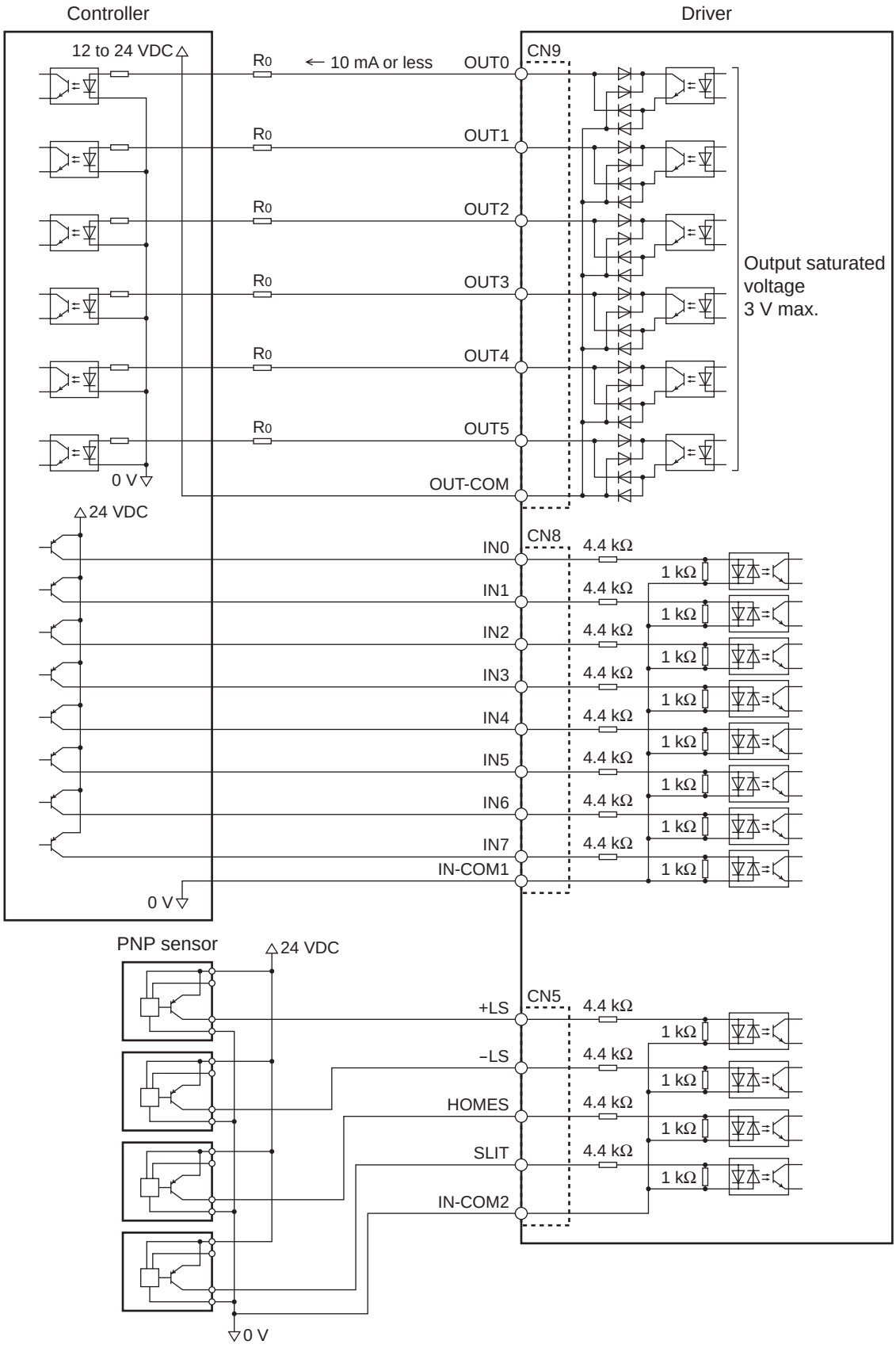
■ Connecting to a current sink output circuit (NPN specifications)



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.

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



Note

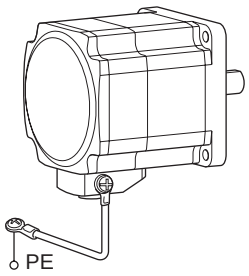
- Use input signals at 24 VDC.
- Use output signals at 24 VDC 10 mA or less. If the current exceeds 10 mA, connect an external resistor R0.
- The saturated voltage of the output signal is 3 VDC maximum.

2.2 Grounding the motor and driver

■ Grounding the motor

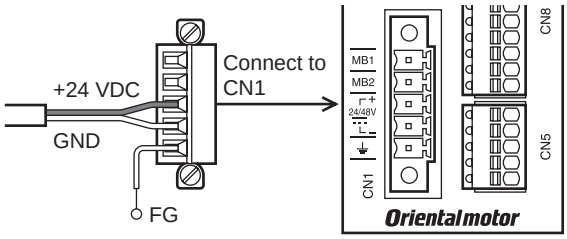
Be sure to ground the Protective Earth Terminal of the motor. (It is no need to ground when the driver power supply voltage is 24 VDC.)
Grounding wire: AWG18 (0.75 mm^2) or more
Tightening torque: 1.2 N·m (170 oz-in)

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



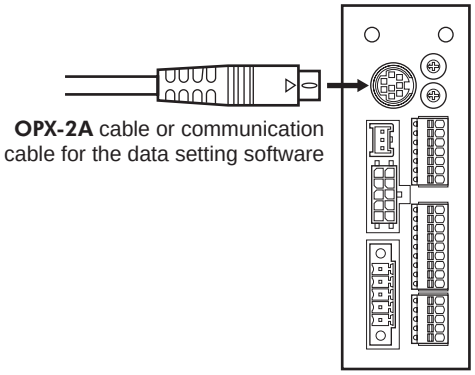
■ Grounding the driver

Ground the FG terminal of power supply connector (CN1) as necessary. Ground using a wire of AWG24 to 16 (0.2 to 1.25 mm^2), and do not share the protective earth terminal with a welder or any other power equipment.



2.3 Connecting the data setter

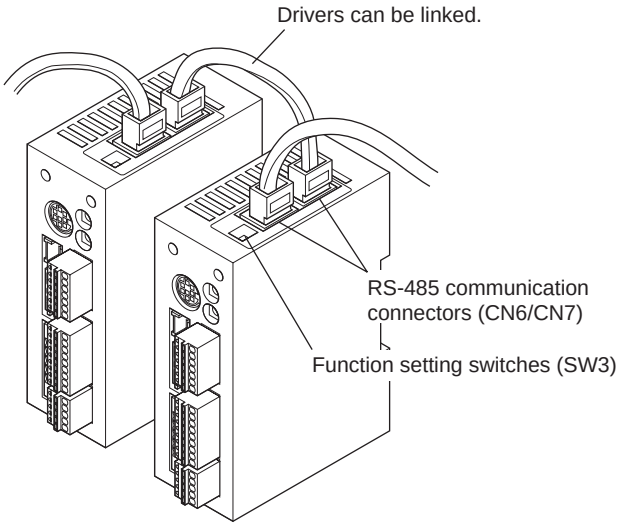
Connect the **OPX-2A** cable or communication cable for the data setting software to the data edit connector (CN3) on the driver.



⚠ Caution The power supply connector (CN1), data edit connector (CN3) and RS-485 communication connectors (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.

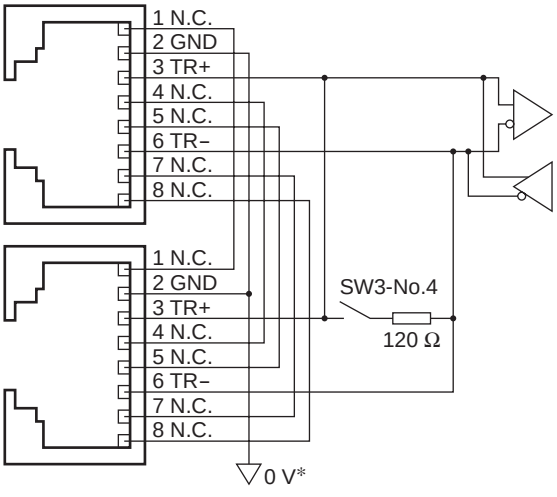
2.4 Connecting the RS-485 communication cable

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.210. You can also use a commercial LAN cable to link drivers.



CN6/CN7 pin assignments

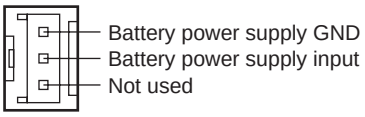
Pin No.	Signal name	Description
1	N.C.	Not used
2	GND	GND
3	TR+	RS-485 communication signal (+)
4	N.C.	Not used
5	N.C.	Not used
6	TR−	RS-485 communication signal (−)
7	N.C.	Not used
8	N.C.	Not used



* The GND line is used in common with CN1 (not insulated).

2.5 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 (CN4) of the driver and the power is turned on, the battery will start charging.
It takes approximately 32 hours to fully charge the battery [at an ambient temperature of 20 °C (68 °F)]. See p.210 for accessories.



Battery specifications

Battery type	Sealed nickel-metal hydride battery
Nominal voltage	2.4 V
Rated capacity	1900 mAh
Mass	0.10 kg
Expected life	Approximately 4 years ∗1
Charging time	32 hours ∗1
Data retention period	Approximately 360 hours (Approximately 15 days) ∗1∗2
Ambient temperature	0 to +40 ˚C (+32 to +104 ˚F) (non-freezing)
Humidity	45 to 85% (non-condensing)

*1 At an ambient temperature of 20 °C (68 °F)
*2 After the power is cut off with the battery fully charged

3 Explanation of I/O signals

In this manual, I/O signals are described as follows.
- Direct I/O: I/O signals accessed via input signal connector (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.

3.1 Assignment of direct I/O

■ Assignment to the input terminals

The input signals shown below can be assigned to the input terminals IN0 to IN7 of CN8 by setting parameters. For details on input signals, refer to p.47.

Direct I/O signal name	Initial value
IN0	3: HOME
IN1	4: START
IN2	48: M0
IN3	49: M1

Direct I/O signal name	Initial value
IN4	50: M2
IN5	16: FREE
IN6	18: STOP
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	Direct positioning operation.
9	MS1	
10	MS2	
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	General signals. Use these signals when controlling the system via RS-485 communication.
33	R1	
34	R2	
35	R3	
36	R4	
37	R5	
38	R6	
39	R7	
40	R8	
41	R9	
42	R10	
43	R11	
44	R12	
45	R13	

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 1: FWD 2: RVS 3: HOME 4: START 5: SSTART 6: +JOG 7: −JOG	8: MS0 9: MS1 10: MS2 11: MS3 12: MS4 13: MS5 16: FREE 17: C-ON	18: STOP 24: ALM-RST 25: P-PRESET 26: P-CLR 27: HMI 32: R0 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 49: M1 50: M2	51: M3 52: M4 53: M5

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	Setting range	Initial value
IN0 input logic level setting	Changes the logic level setting for input terminals IN0 to IN7.	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			

■ 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.52.

Direct I/O signal name	Initial value
OUT0	70: HOME-P
OUT1	69: END
OUT2	73: AREA1

Direct I/O signal name	Initial value
OUT3	67: READY
OUT4	66: WNG
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	Output in response to the MS0 to MS5 input.
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 in response to the R0 to R15 input.
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 input.
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.
61	−LS_R	Output in response to the −LS input.
62	HOMES_R	Output in response to the HOME 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.

Assignment No.	Signal name	Function
68	MOVE	Output when the motor operates.
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.

Related parameters

Parameter name	Description	Initial value
OUT0 output function selection	Assigns the following output signals to OUT0 to OUT5 of the output terminals.	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

0: Not used 1: FWD_R 2: RVS_R 3: HOME_R 4: START_R 5: SSTART_R 6: +JOG_R 7: −JOG_R 8: MS0_R	9: MS1_R 10: MS2_R 11: MS3_R 12: MS4_R 13: MS5_R 16: FREE_R 17: C-ON_R 18: STOP_R 32: R0	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 49: M1_R 50: M2_R	51: M3_R 52: M4_R 53: M5_R 60: +LS_R 61: −LS_R 62: HOMES_R 63: SLIT_R 65: ALM 66: WNG	67: READY 68: MOVE 69: END 70: HOME-P 71: TLC 72: TIM 73: AREA1 74: AREA2 75: AREA3 80: S-BSY

3.2 Assignment of network I/O

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

■ Assignment of input signals

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

Assignment No.	Signal name	Function	Setting range
0	Not used	Set when the input terminal is not used.	−
1	FWD	Continuous operation in the positive direction.	0: Deceleration stop 1: Operation
2	RVS	Continuous operation in the negative direction.	
3	HOME	Return-to-home operation.	0: No operation 1: Start 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	Perform direct positioning operation of the operation data No. set by the I/O parameter.	
9	MS1		
10	MS2		
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
24	ALM-RST *	Reset of the current alarm.	0: No operation 1: Reset alarm
25	P-PRESET *	Position preset.	0: No operation 1: Execute preset
26	P-CLR *	Reset of the absolute position error alarm.	0: No operation 1: Reset alarm
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		

* These three signals cannot be set in the driver which is before the specification change. Refer to p.5 for details.

Assignment No.	Signal name	Function	Setting range
48	M0	Select the operation data No. using these six bits. See p.48 for details on the combination.	0: OFF 1: ON (Operation data No.0 to 63 can be selected.)
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.	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 1: FWD 2: RVS 3: HOME 4: START 5: SSTART 6: +JOG 7: −JOG	8: MS0 9: MS1 10: MS2 11: MS3 12: MS4 13: MS5 16: FREE 17: C-ON	18: STOP 24: ALM-RST * 25: P-PRESET * 26: P-CLR * 27: HMI 32: R0 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 49: M1 50: M2	51: M3 52: M4 53: M5

* These three signals cannot be set in the driver which is before the specification change. Refer to p.5 for details

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 No.	Signal name	Function	Data read
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 input.	
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.	
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.	
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 No.	Signal name	Function	Data read
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

Related parameters

Parameter name	Description	Initial value
NET-OUT0 output function selection	Assigns the following output signals to NET-OUT0 to NET-OUT15.	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

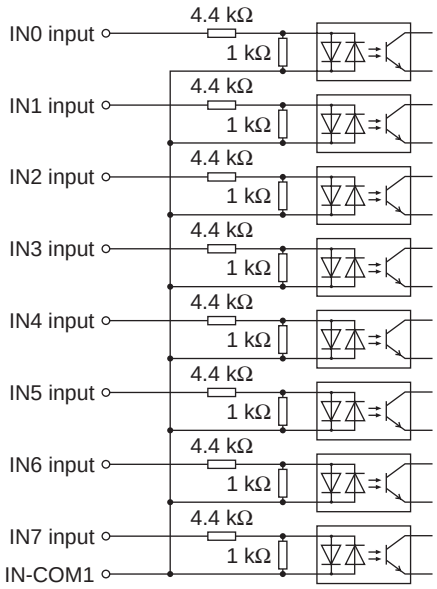
0: Not used 1: FWD_R 2: RVS_R 3: HOME_R 4: START_R 5: SSTART_R 6: +JOG_R 7: −JOG_R 8: MS0_R 9: MS1_R	10: MS2_R 11: MS3_R 12: MS4_R 13: MS5_R 16: FREE_R 17: C-ON_R 18: STOP_R 32: R0 33: R1 34: R2	35: R3 36: R4 37: R5 38: R6 39: R7 40: R8 41: R9 42: R10 43: R11 44: R12	45: R13 46: R14 47: R15 48: M0_R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

3.3 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



■ 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.69 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.68 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. See p.79 for return-to-home operation.

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 or 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	Sets the starting speed for return-to-home operation.	1 to 1,000,000 Hz	500
Position offset of home-seeking	Sets the offset amount 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

Parameter name	Description	Setting range	Initial value
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	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.
See p.86 for continuous operation.

■ +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.
See p.91 for JOG operation.

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 of JOG	Sets the acceleration/deceleration rate or 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.93 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 motor will stop. When the ALM-RST input is turned from ON to OFF, 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.199 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

This signal is used to release the function limitation of the **OPX-2A** or **MEXE02**.
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

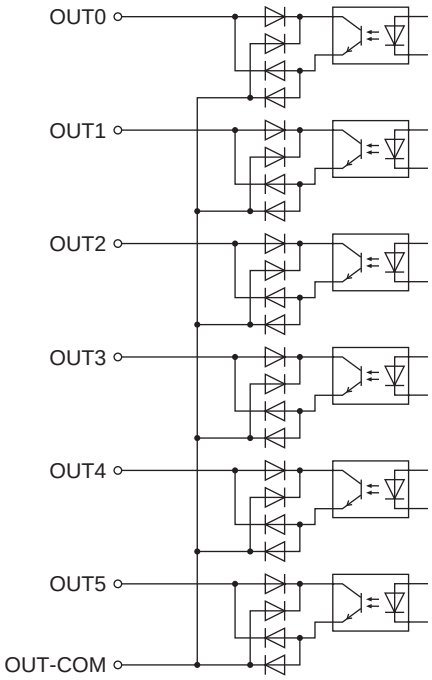
Note When the HMI input is not assigned to the input terminal, this input will always be set to ON. When assigning to both direct I/O and network I/O, the function will be executed when both of them are set to ON.

3.4 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



■ ALM output

See p.199 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 the motor will 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 the motor will 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. It is not monitored when the set value is 0.	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.204 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.	150 to 630 (1=0.1 V)	630
Undervoltage warning	Sets the voltage at which an undervoltage warning generates.		180
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 non-volatile 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.

- 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.
See p.93 for setting 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

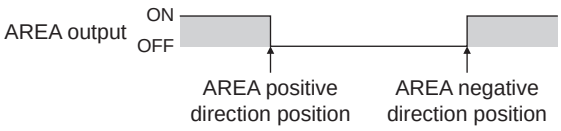
When the load exceeds the motor torque range, the TLC output will turn ON.
When performing push-motion operation, if the load exceeds the torque range calculated from the current ratio of push-motion operation, the TLC output will turn ON.
This output can be used for the completion signal of the push-motion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

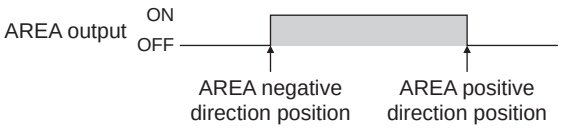
- When the "AREA positive direction position" parameter < "AREA negative direction position" parameter

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



- 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



- 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

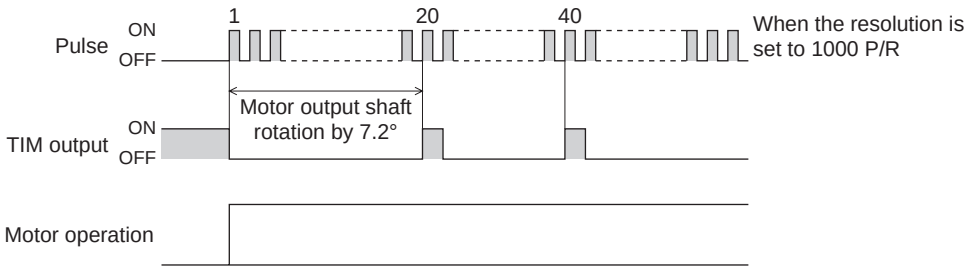
Note When using AREA1 to AREA3 output to confirm the motor position, you can use two types - the command position and the feedback position.
AREA1 and AREA2: Command position
AREA3: Feedback position (Actual motor position)

- Related parameters

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

■ 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

■ Response output

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

Input signal	Output signal
FWD	FWD_R
RVS	RVS_R
HOME	HOME_R
START	START_R
SSTART	SSTART_R
+JOG	+JOG_R
−JOG	−JOG_R
MS0	MS0_R
MS1	MS1_R

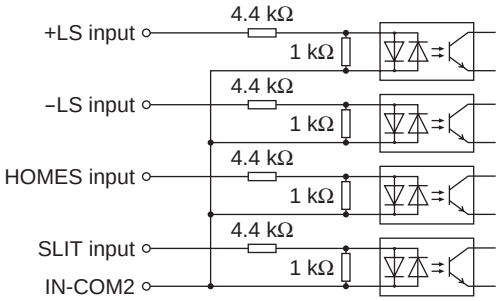
Input signal	Output signal
MS2	MS2_R
MS3	MS3_R
MS4	MS4_R
MS5	MS5_R
FREE	FREE_R
C-ON	C-ON_R
STOP	STOP_R
M0	M0_R
M1	M1_R

Input signal	Output signal
M2	M2_R
M3	M3_R
M4	M4_R
M5	M5_R
+LS	+LS_R
−LS	−LS_R
HOMES	HOMES_R
SLIT	SLIT_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.

3.5 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.93 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" parameter to the 3-sensor mode. See p.79 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.79 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

3.6 General signals (R0 to R15)

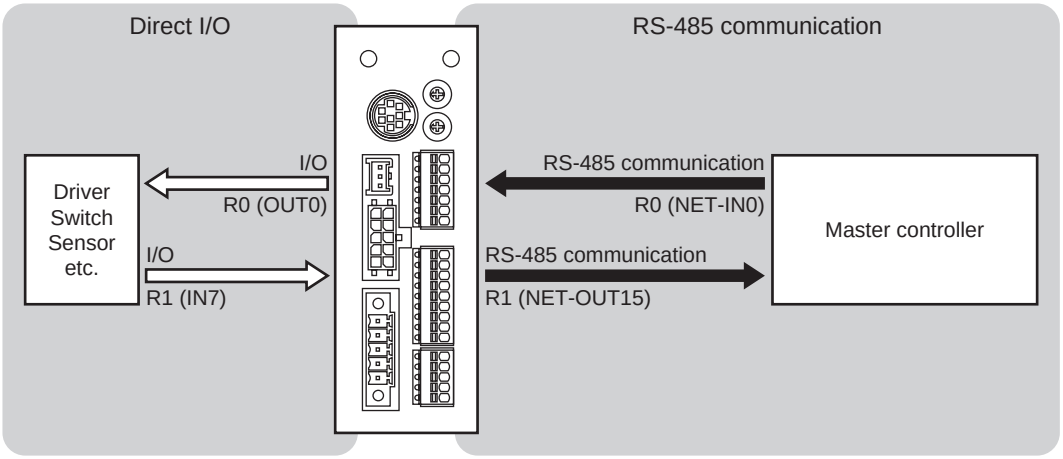
R0 to R15 are general signals that enable control via RS-485 communication.
Using R0 to R15, I/O signals for the external device can be controlled by the master controller via the driver.
The direct I/O of the driver can be used as an I/O unit.
See the following example for setting of the general signals.

- When outputting the signals from the master controller 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 controller

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.



3 Operation type and setting

This part explains the operation functions and the details of parameters.

Table of contents

1 Adjustment and setting

This chapter explains how to adjust/set the motor and driver functions.
When a parameter is changed, the timing the new value becomes effective varies depending on the parameter. See p.97 for details.

1.1 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	Sets the denominator of electric gear	1 to 65535	1
Electronic gear B	Sets 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)]

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

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

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

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

1.2 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.

1.3 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

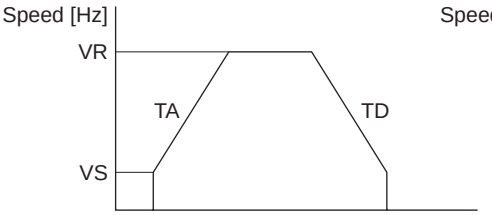
Parameter name	Description	Setting range	Initial value
STOP current	Sets the motor standstill current as a percentage of the rated current, based on the rated current being 100%.	0 to 500 (1=0.1%)	500

1.4 Acceleration/deceleration rate and acceleration/deceleration time

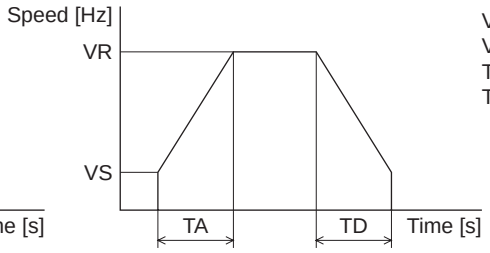
■ Acceleration/deceleration unit

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

• When setting with [ms/kHz]



• When setting with [s]



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

Related parameter

Parameter name	Description	Setting range	Initial value
Acceleration/deceleration unit	Sets 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.

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.89 for the acceleration/deceleration when performing variable speed operation.

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

1.5 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

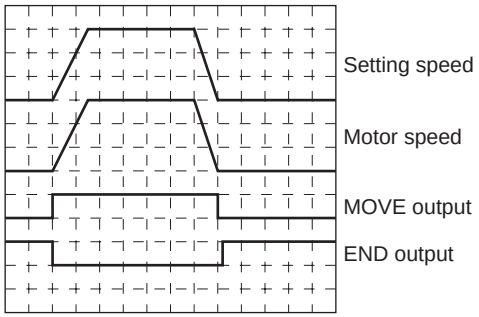
1.6 Speed filter

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.

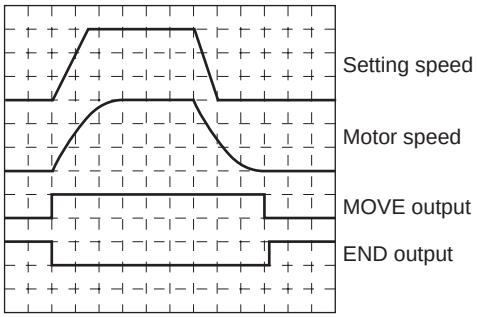
Related parameter

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

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



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



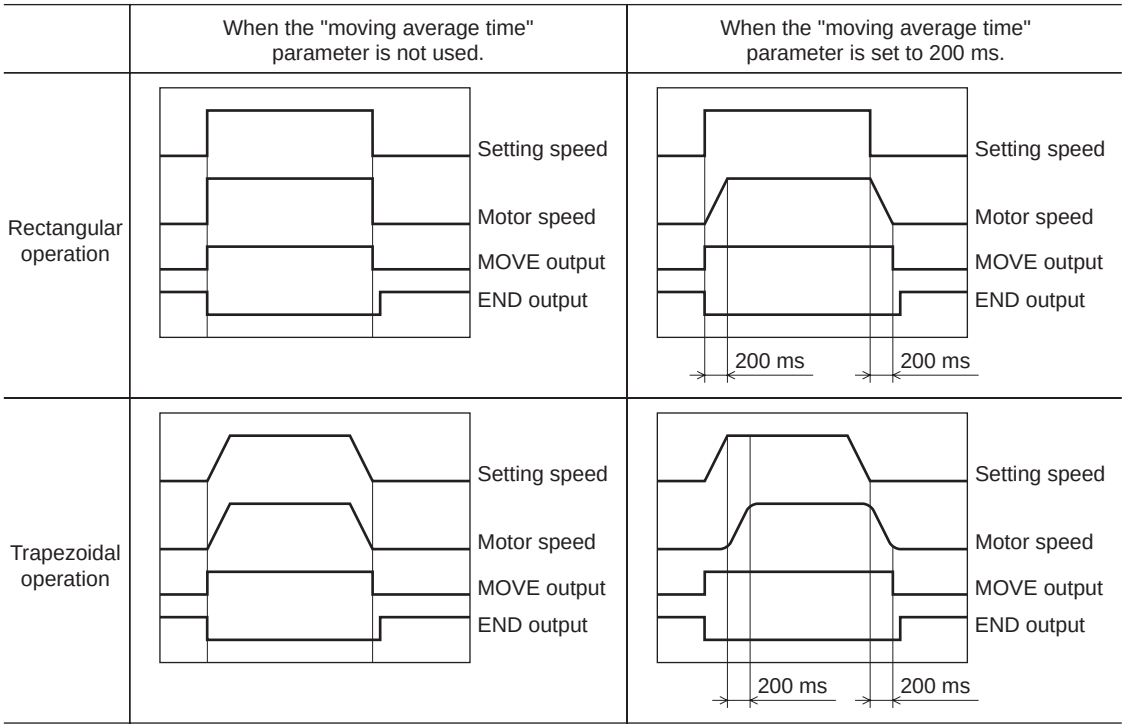
Note When setting the value of the "speed filter" parameter to "0," this function will be invalid.

1.7 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



1.8 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	Adjusts vibration during constant speed operation.	0 to 500	45
Speed error gain 2	Adjusts vibration during acceleration/deceleration.		

1.9 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	Sets the control mode.	0: Normal mode 1: Current control mode	0

1.10 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

1.11 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.9-4 for accessory.

Related parameter

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

■ Setting of the absolute-position backup system

1. Turn off the driver power, and then connect the battery to the battery connector (CN4).
2. Turn on the driver power.
3. Set the "absolute-position backup system" parameter to "enable."
4. Turn off the driver power, and then turn on again.
5. Since the "absolute position error alarm" generates at this time, reset the alarm with reference to p.201.
6. Perform the return-to-home operation or P-PRESET input.

Note

- Do not turn off the driver power before the return-to-home operation or P-PRESET input is completed. The "absolute position error alarm" may generate when turning on the power 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 power and 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

2 Operation

This chapter explains the types of operation and timing charts.

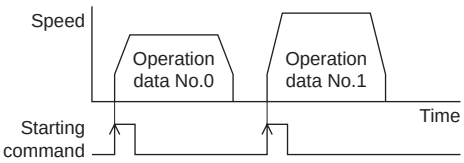
Operation

[Setting by operation data and parameters]

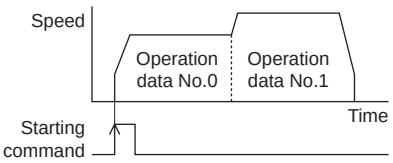
Positioning operation

Operating function

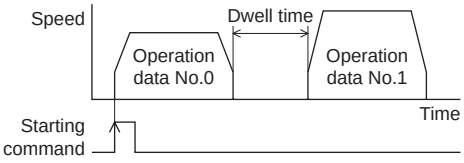
• Single-motion operation



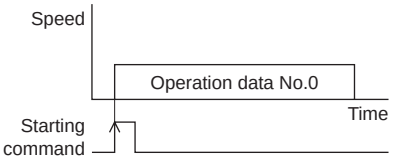
• Linked-motion operation



• Linked-motion operation 2



• Push-motion operation



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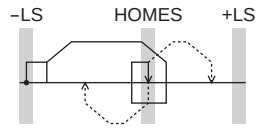
Starting method

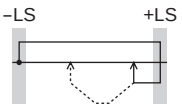
- Data number selecting operation
- Direct positioning operation
- Sequential positioning operation

Return-to-home operation

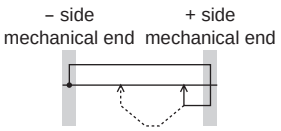
• 3-sensor mode



• 2-sensor mode

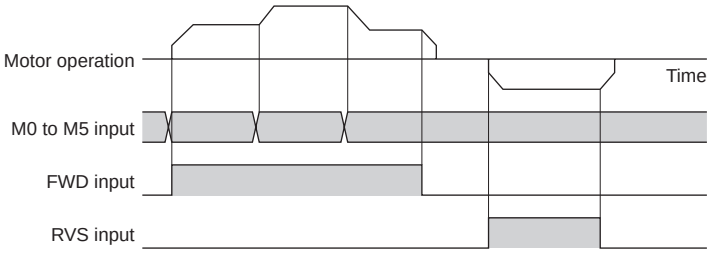


• Push mode



• Position preset

Continuous operation



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

2.1 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.

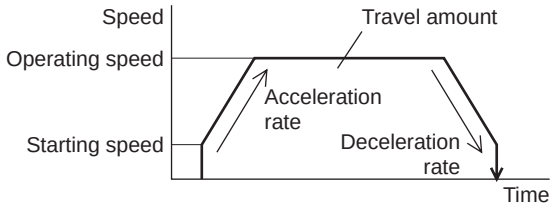
Name	Description	Setting range	Initial value
Position	Sets the position (distance) for positioning operation.	−8,388,608 to +8,388,607 step	0
Operating speed	Sets the operating speed in positioning operation.	0 to 1,000,000 Hz	1000
Acceleration	Sets the acceleration rate or time in positioning operation.	1 to 1,000,000 (1=0.001 ms/kHz or 1=0.001 s)	1000
Deceleration	Sets the deceleration rate or 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	Sets the dwell time to be used in linked-motion operation2.	0 to 50000 (1=0.001 s)	0
Push current	Sets the current value of push-motion operation.	0 to 1000 (1=0.1%) *	200
Sequential positioning	Sets whether to enable or disable sequential positioning operation.	0: Disable 1: Enable	0

* For the driver which is before the specification change, the setting range is 0 to 500 (1=0.1%). Refer to p.5 for details.

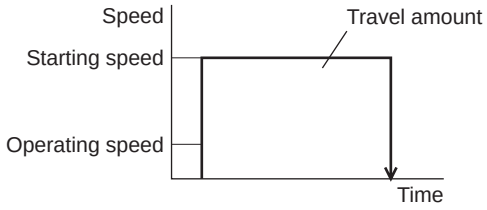
- Position, operating speed, acceleration, deceleration

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



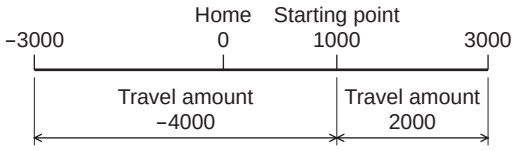
- Operation modes

The following two operation modes are available:

Absolute (ABS) mode

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

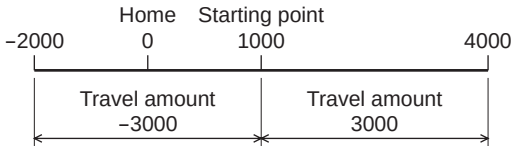
Example: When positioning operation is performed with setting the starting point to 1000 and setting the destination to +3000 and −3000



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.71
Linked-motion	Multiple sets of operation data are linked to perform multi-variable speed operation	p.72
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.73
Push-motion	This is an operation of continuously applying pressure on the load when pressing against the load during positioning operation.	p.75

■ 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.

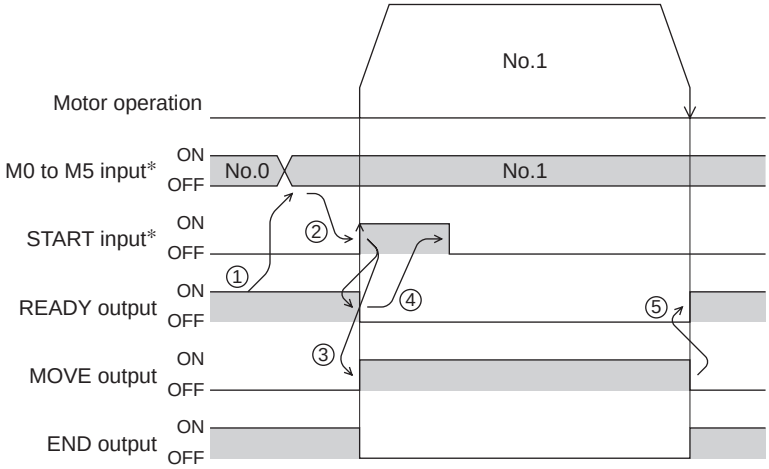
- Data number selecting operation

Select an operation data based on a combination of ON/OFF status of the M0 to M5 inputs. See p.48 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

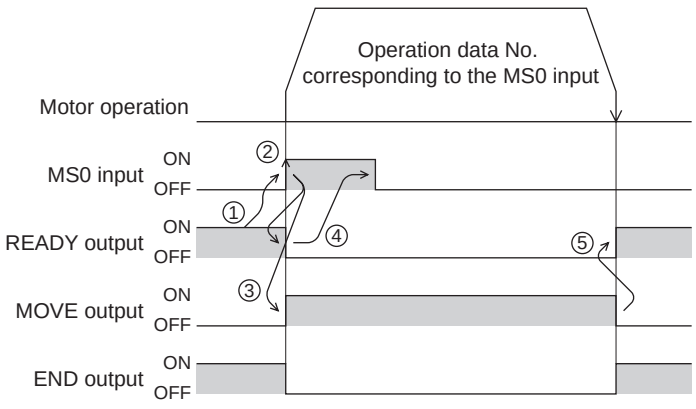
When any of the MS0 to MS5 inputs is turned ON, the positioning operation corresponding to the input data No. will perform. Since the positioning operation is enabled by turning any of the MS0 to MS5 inputs ON, you can save the step of selecting the operation data No.
The operation data assigning to 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	Enable
No.1	
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.

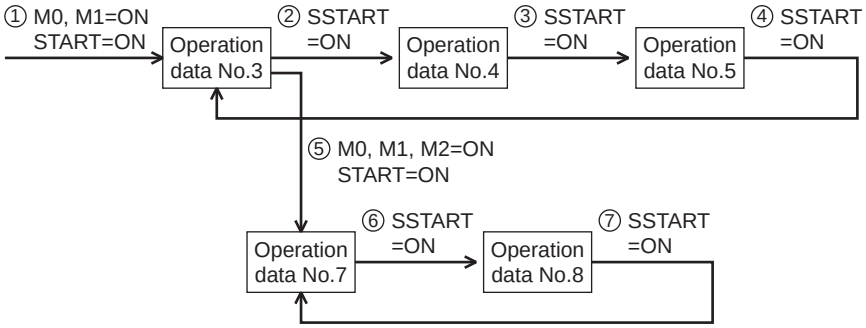
6）The operation data No.7 becomes a starting point for a new sequential positioning operation.

7）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.

8）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	
No.5	
No.6	Disable
No.7	Enable
No.8	
No.9	Disable



• Operating method

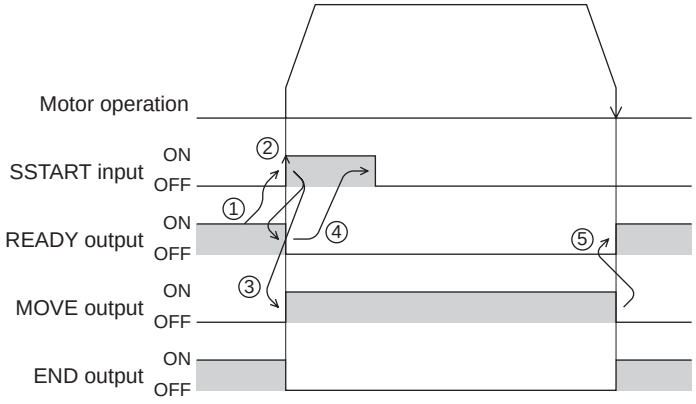
1）Check the READY output is ON.

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 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."

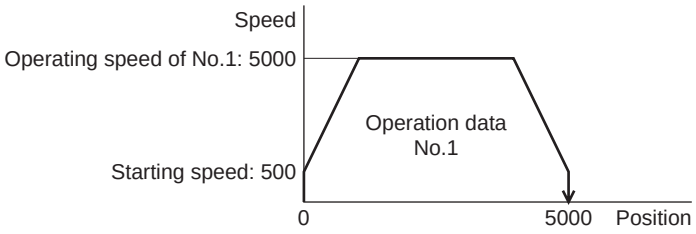
■ Operation function; Single-motion

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

Example of single-motion operation

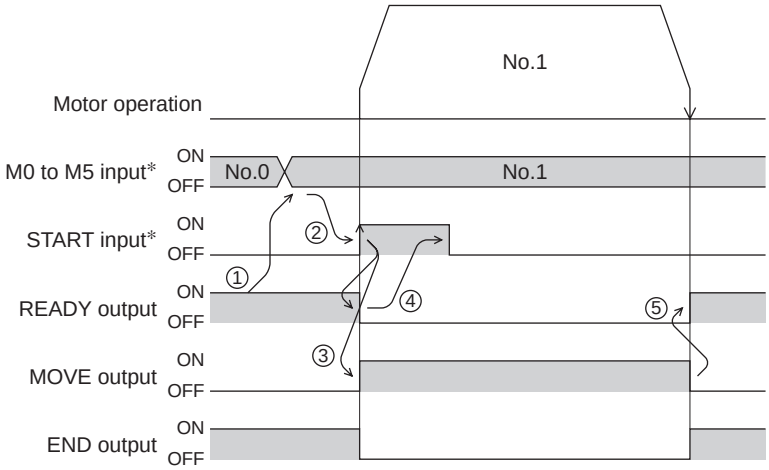
Operation data	Position	Operating speed	Acceleration	Deceleration	Operation mode	Operation function	Dwell time	Push current	Sequential positioning
No.1	5000	5000	1000	1000	INC	Single-motion	Not used	Not used	Not used

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 positioning operation of 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.

■ Operation function; 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.

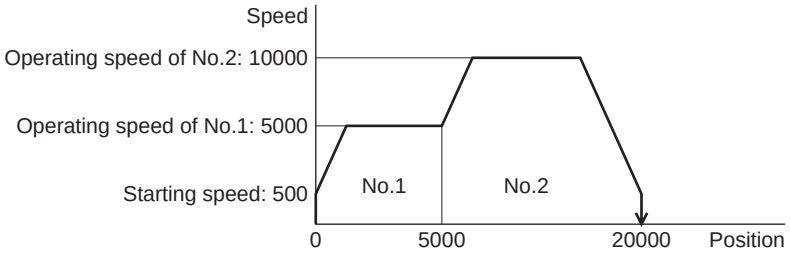
Note

- 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 operation2, 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

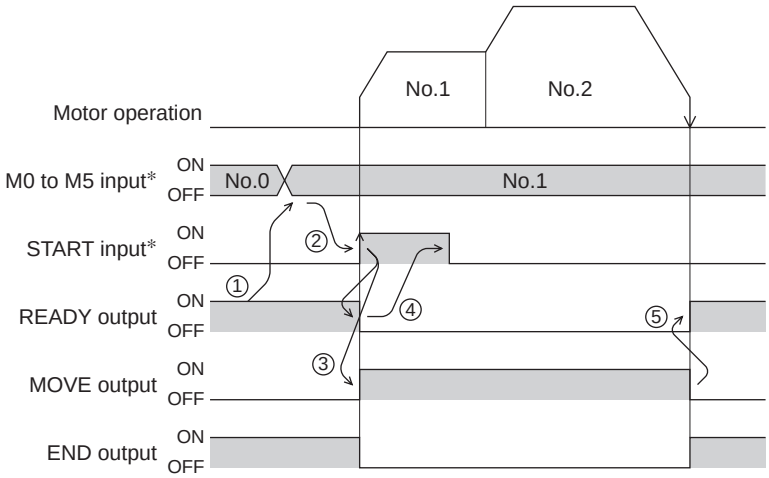
Operation data	Position	Operating speed	Acceleration	Deceleration	Operation mode	Operation function	Dwell time	Push current	Sequential positioning
No.1	5000	5000	1000	1000	INC	Linked-motion	Not used	Not used	Not used
No.2	20000	10000	Not used	Not used	INC	Single-motion	Not used	Not used	Not used

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.

■ Operation function; Linked-motion operation2

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.

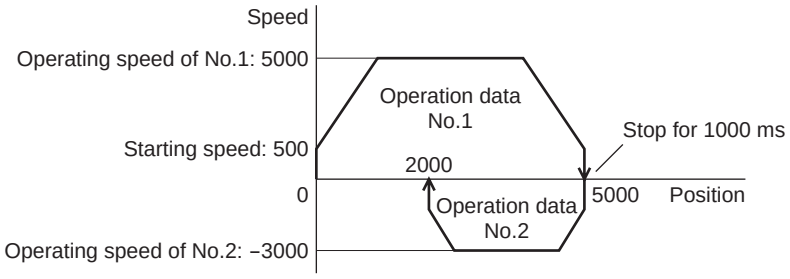
Note

- Up to four sets of operation data can be linked. When combining the linked-motion operation and the linked-motion operation2, 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 operation2

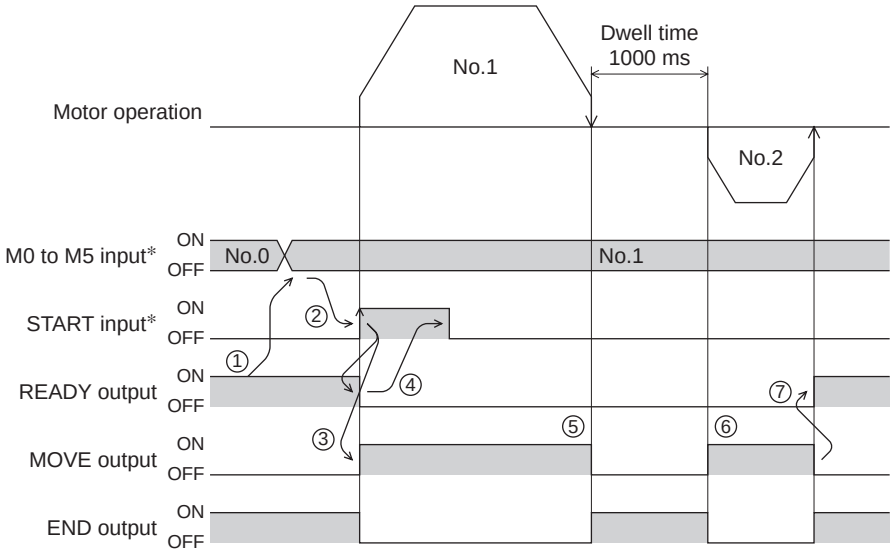
Operation data	Position	Operating speed	Acceleration	Deceleration	Operation mode	Operation function	Dwell time	Push current	Sequential positioning
No.1	5000	5000	1000	1000	INC	Linked-motion2	1000	Not used	Not used
No.2	−3000	3000	1000	1000	INC	Single-motion	0	Not used	Not used

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.

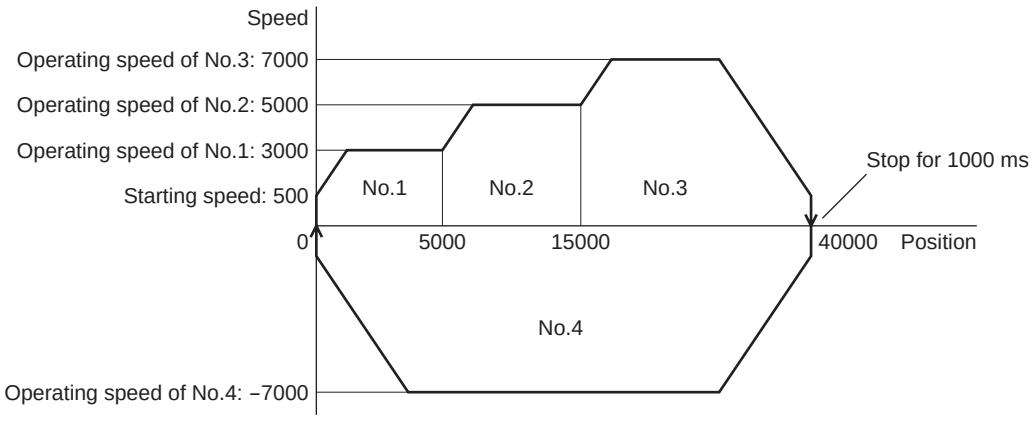


* In direct I/O, turn the START input ON after setting the M0 to M5 inputs. In network I/O, the operation will be performed even when turning the M0 to M5 inputs and the START input ON simultaneously.

Example of linked-motion operation2;
When combining the linked-motion operation and the linked-motion operation2

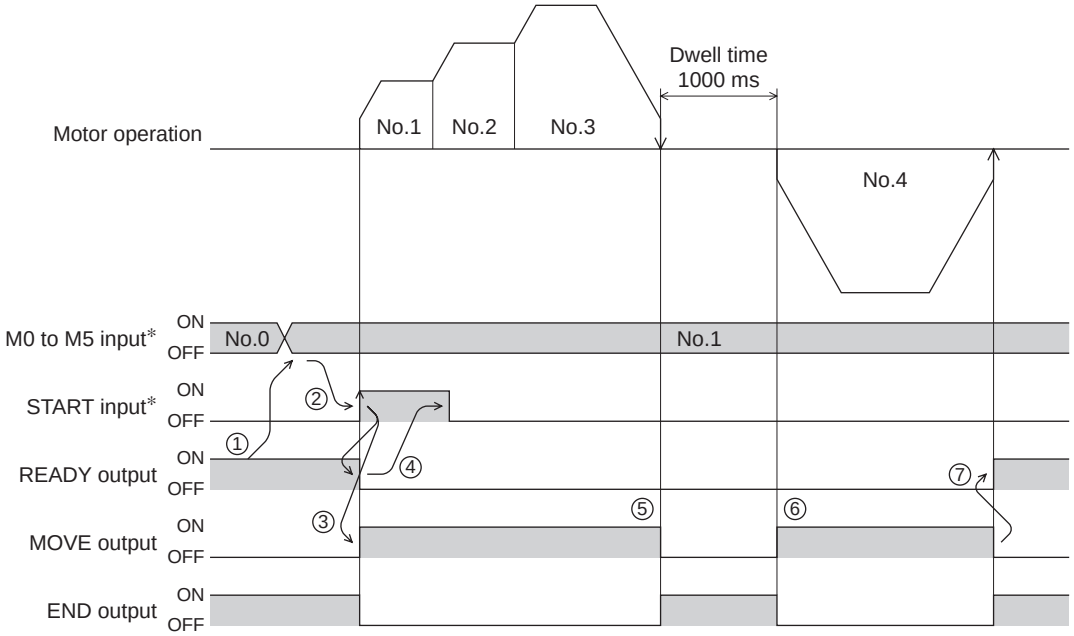
Operation data	Position	Operating speed	Acceleration	Deceleration	Operation mode	Operation function	Dwell time	Push current	Sequential positioning
No.1	5000	3000	1000	1000	INC	Linked-motion	Not used	Not used	Not used
No.2	10000	5000	Not used	Not used	INC	Linked-motion	Not used	Not used	Not used
No.3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



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.



* 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 function; 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.

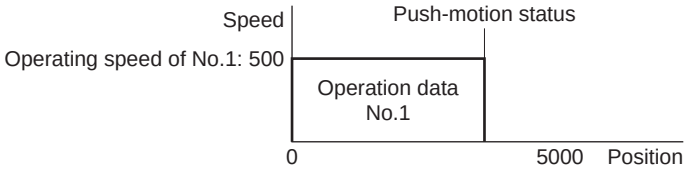
Note

- Regardless of resolution, the maximum speed of push-motion operation is 500 r/min. If the push-motion operation is started by setting higher speed than 500 r/min, an operation data error alarm will generate. For the driver which is before the specification change, the maximum speed of push-motion operation is 30 r/min. Refer to p.6 for details.
- If push-motion operation is performed for long periods of time while a high current value is set in the push current, note that the driver may generate a large amount of heat.
- Do not perform push-motion operation with geared types. Doing so may cause damage to the motor or gear part.

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

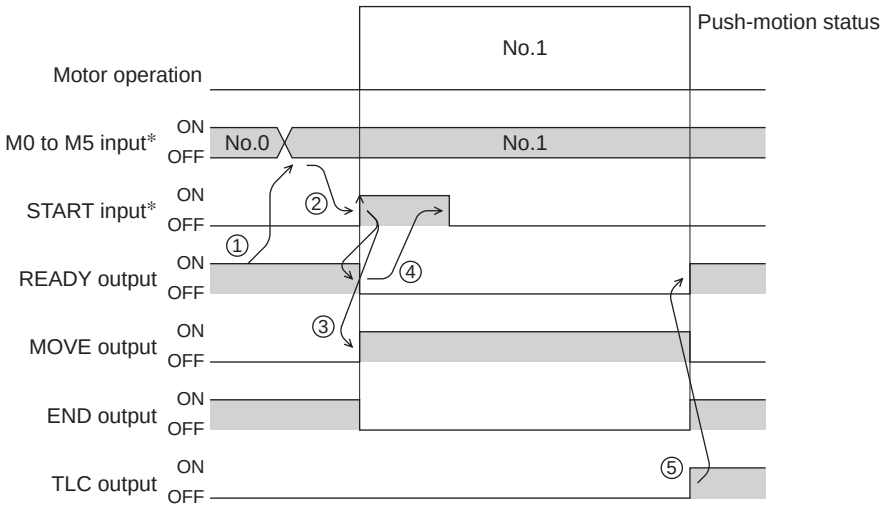
1）Check the READY output is ON.

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.

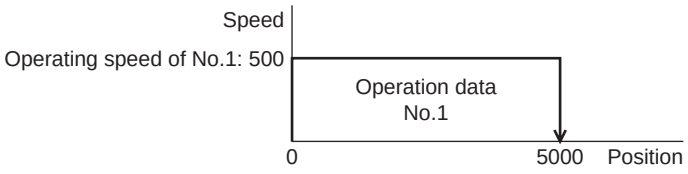
4）Check that the READY output has been turned OFF and turn the START input OFF.

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)



Operating method

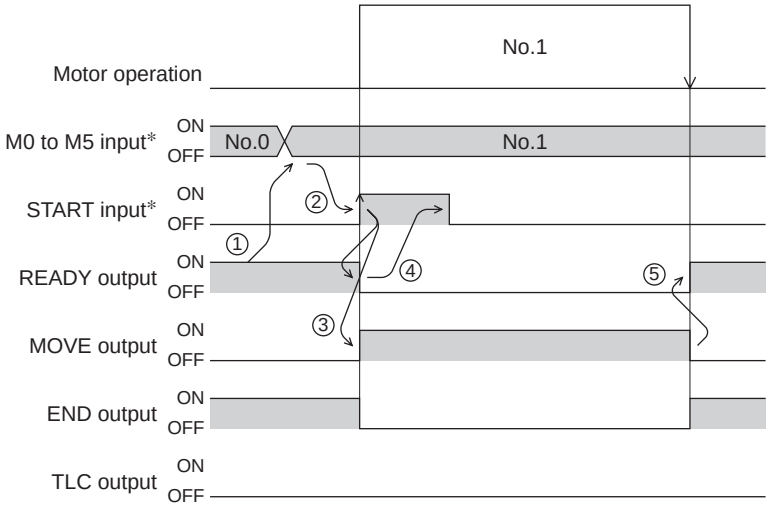
1）Check the READY output is ON.

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.

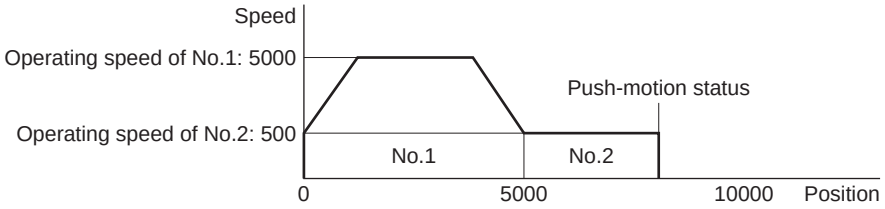


* In direct I/O, turn the START input ON after setting the M0 to M5 inputs. In network I/O, the operation will be performed even when turning the M0 to M5 inputs and the START input ON simultaneously.

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

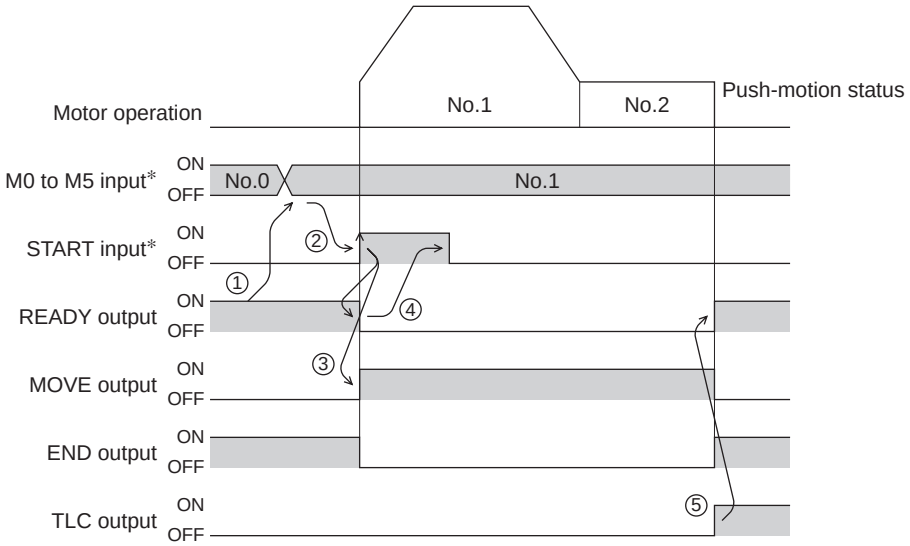
Operation data	Position	Operating speed	Acceleration	Deceleration	Operation mode	Operation function	Dwell time	Push current	Sequential positioning
No.1	5000	5000	1000	1000	INC	Linked-motion	Not used	Not used	Not used
No.2	5000	500	Not used	Not used	INC	Push-motion	Not used	500	Not used

Operation example



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.

2.2 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.

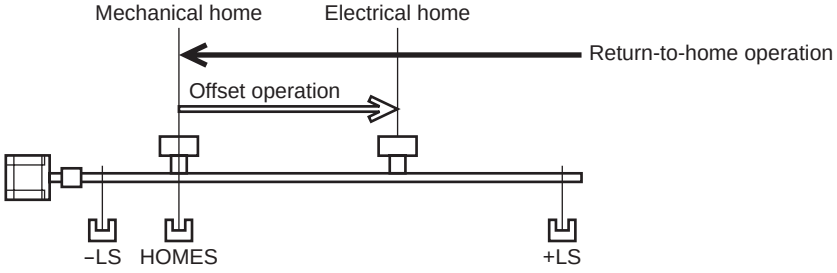
*3 Do not perform push-mode return-to-home operation for geared motors.
*4 It moves 200 steps regardless of resolution. Therefore, the actual travel distance may vary according to resolution.
*5 In the case of a rotating mechanism, even when using one external sensor, the home position can be detected.

■ 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

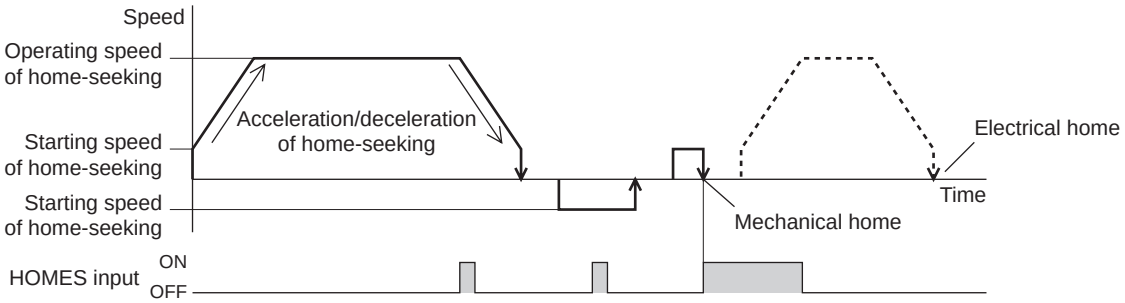
the "preset position" parameter.

■ Parameters related to return-to-home operation

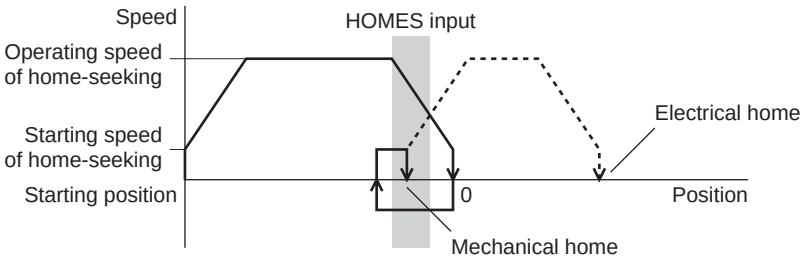
Name	Description	Setting range	Initial value
Home-seeking mode	Set the mode for return-to-home operation.	0: 2-sensor mode 1: 3-sensor mode 2: Push-mode	1
Operating speed of home-seeking	Sets the operating speed for return-to-home operation.	1 to 1,000,000 Hz	1000
Acceleration/deceleration of home-seeking	Sets the acceleration/deceleration rate or 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	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.		

- Operation example (when using 3-sensor mode)

Operating sequence in seeing a time axis

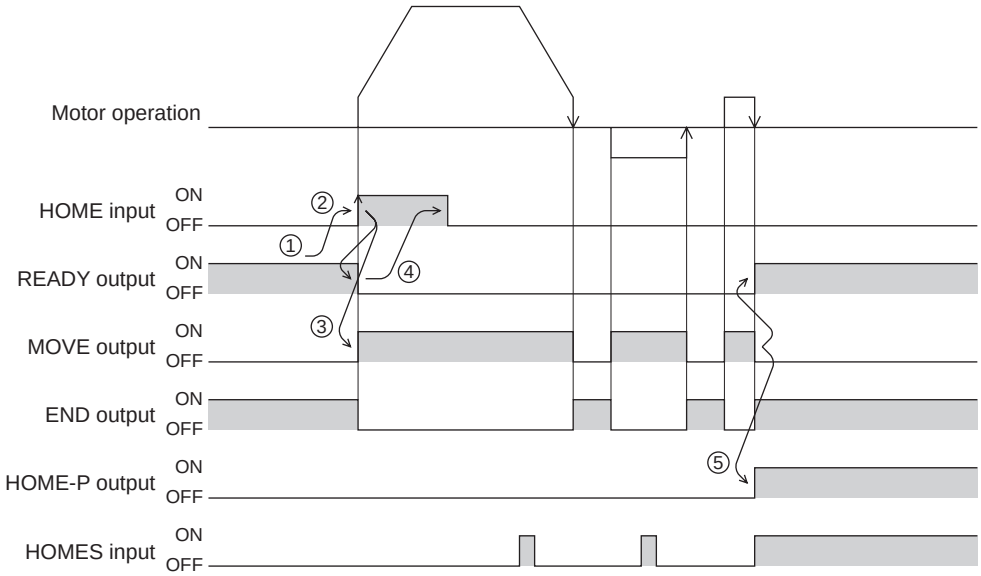


Operating sequence in seeing a travel amount



- Operating method

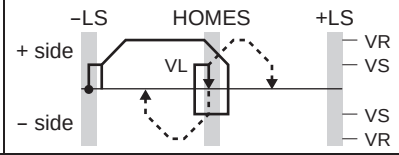
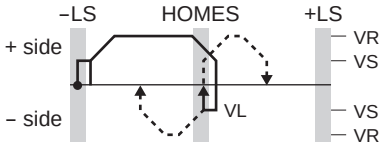
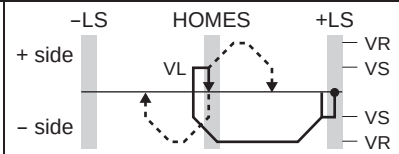
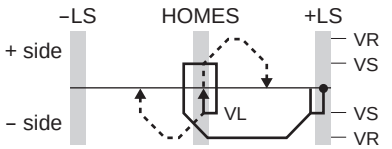
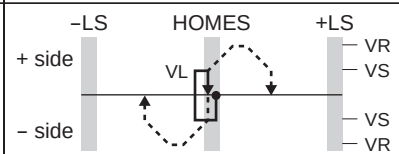
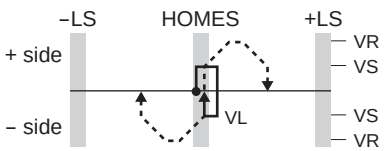
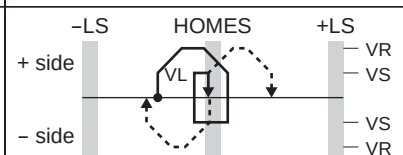
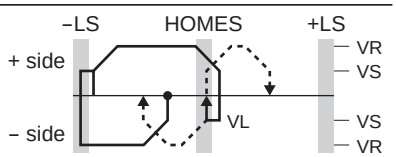
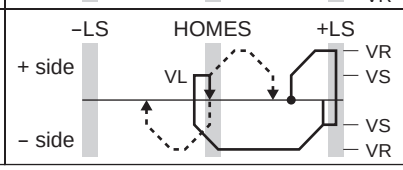
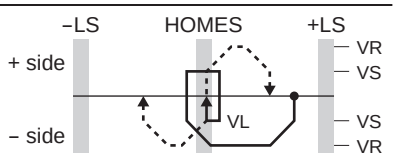
1）Check the READY output is ON.
2）Turn the HOME input ON.
3）Return-to-home operation will be started.
4）Check that the READY output has been turned OFF and turn the HOME input OFF.
5）When return-to-home operation is completed, the HOME-P output will be turned ON.



■ Operation sequence

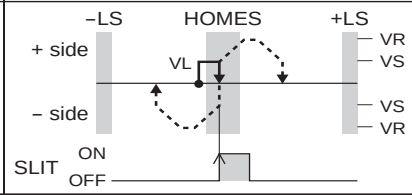
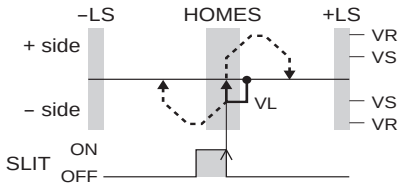
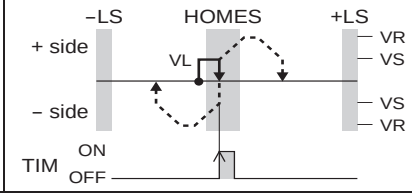
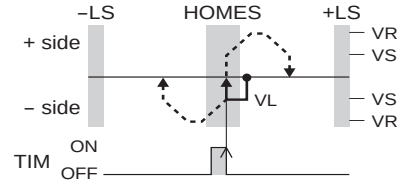
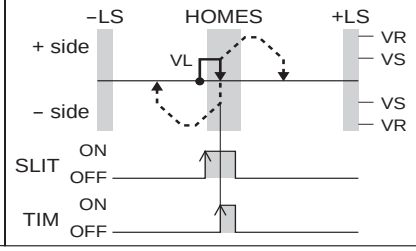
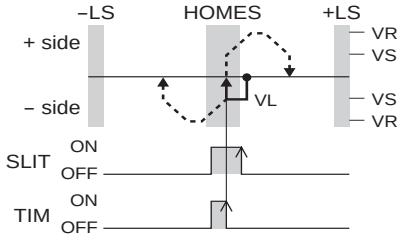
- 3-sensor mode

- Explanation of labels
  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		

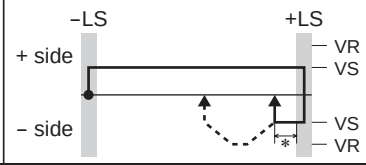
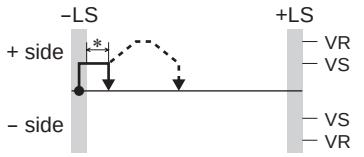
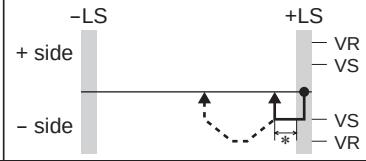
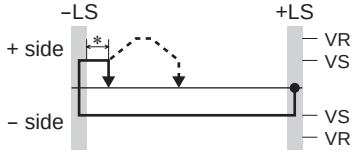
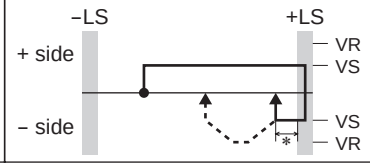
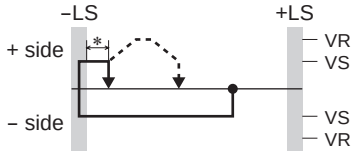
When concurrently using the SLIT input and/or TIM signal

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

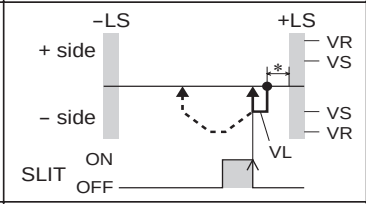
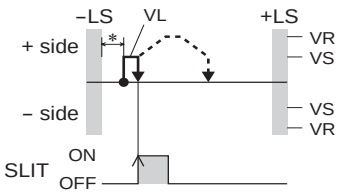
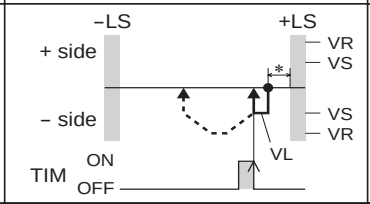
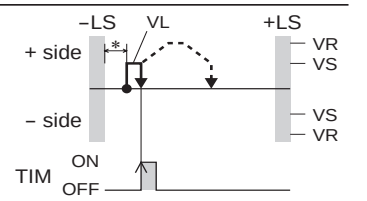
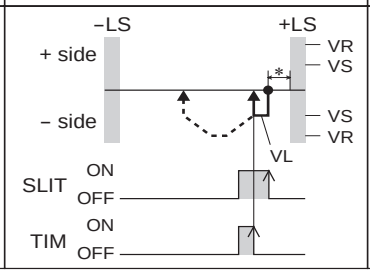
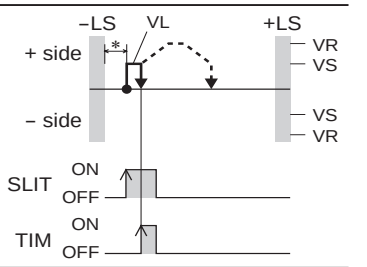
- Explanation of labels
  VS: Starting speed of home-seeking
  VR: Operating speed of home-seeking
  VL: Last speed of return-to-home
  (When VS < 500 Hz: VS, When VS ≥ 500 Hz: 500 Hz)
  - - - Broken line indicates a home offset move.

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

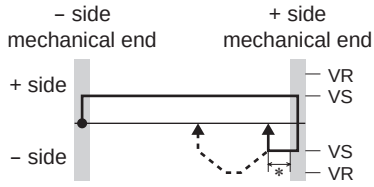
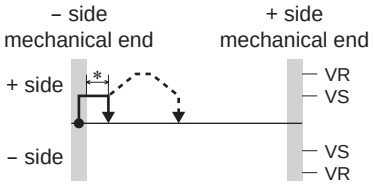
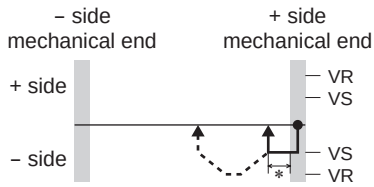
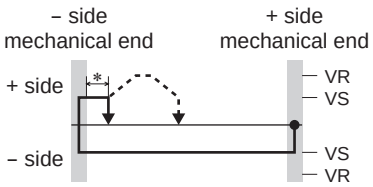
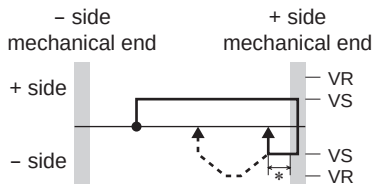
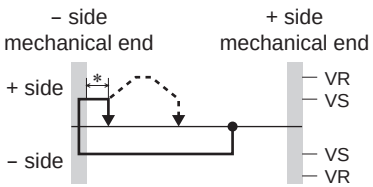
When the limit sensor is detected, the motor will rotate in the reverse direction and escape from the limit sensor. After escaping from the limit sensor, the motor will move 200 steps and stop once. Then, the motor operation will continue until the external sensor (signal) will be detected.
When the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

- Explanation of labels
  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		

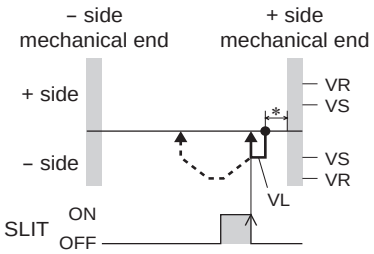
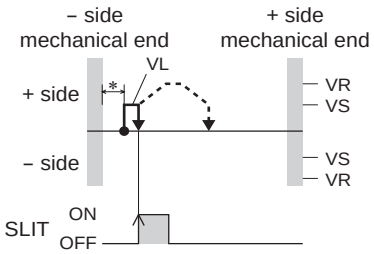
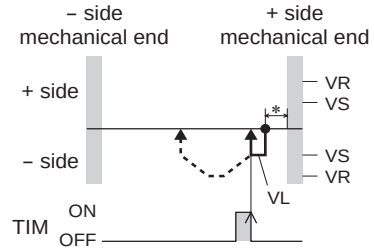
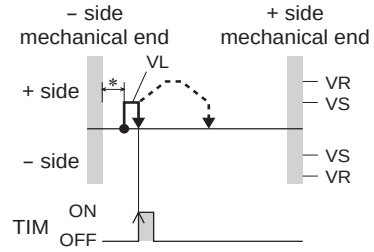
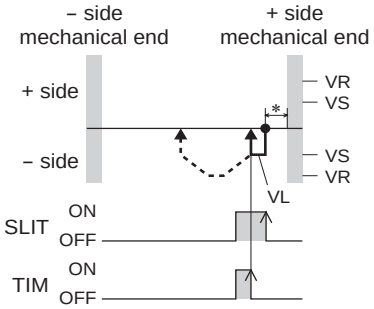
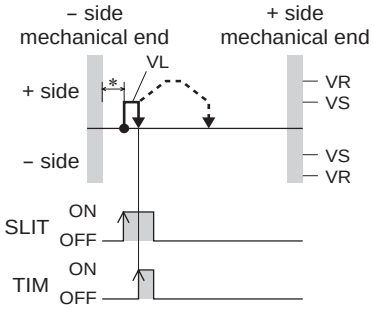
* The motor will move 200 steps from the mechanical end.

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 gear part.
- Do not perform push-mode return-to-home operation for geared motors. Doing so may cause damage to the motor or gear part.

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 500 r/min on the motor output shaft regardless of resolution. Starting return-to-home operation with setting faster speed than 500 r/min may cause damage to the motor.
- Do not perform push-mode return-to-home operation for geared motors. Doing so may cause damage to the motor or gear part.

■ 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.

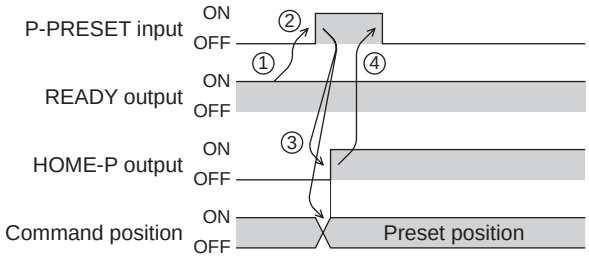
- When the motor is operating
- When an alarm is present

- 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.



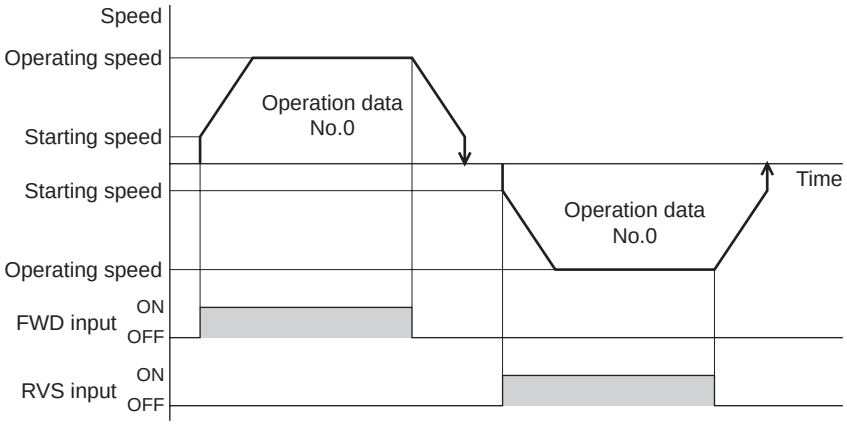
2.3 Continuous operation

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	Sets the operating speed in continuous operation.	1 to 1,000,000 Hz	1000
Acceleration	Sets the acceleration rate or time in continuous operation.	1 to 1,000,000 (1=0.001 ms/kHz or 1=0.001 s)	1000
Deceleration	Sets the deceleration rate or 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)

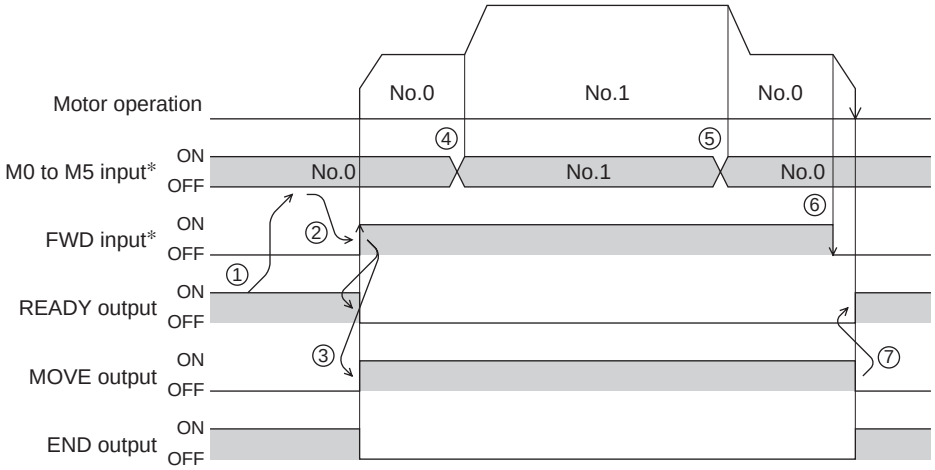
■ Starting method of continuous operation

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.48 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

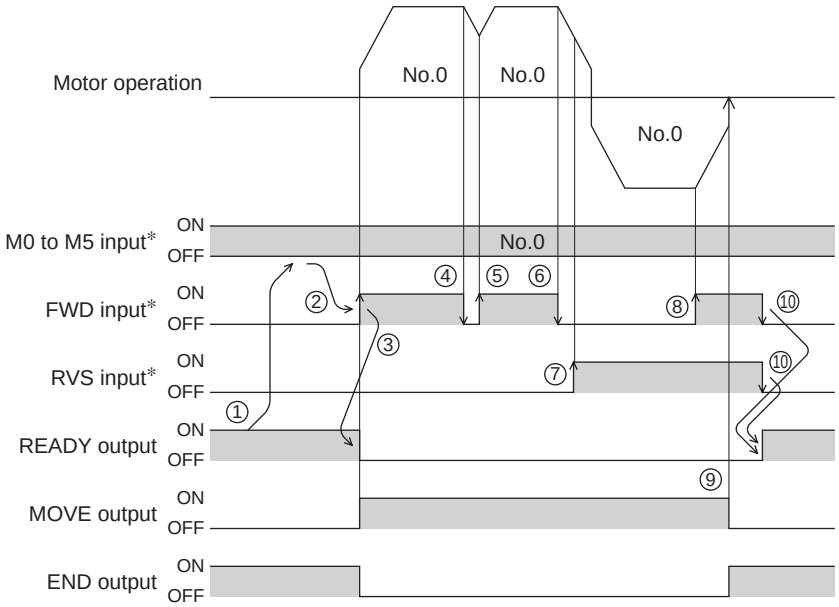
1）Check the READY output is ON.
2）Select the operation data No. by a combination of the M0 to M5 inputs and turn the FWD input ON.
3）The motor starts continuous operation. The READY output will be turned OFF.
4）Select the operation data No.1 by turning the M0 input ON. The motor accelerates to the operating 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.

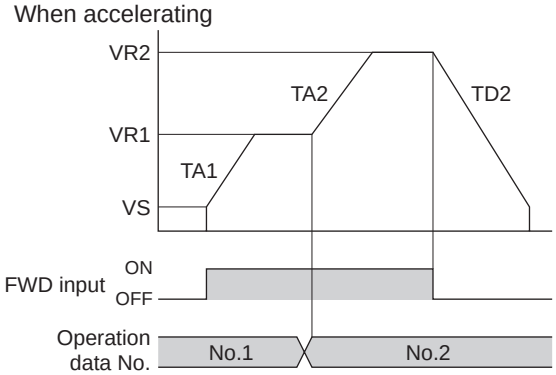


* In direct I/O, turn the FWD input or RVS input ON after setting the M0 to M5 inputs. In network I/O, the operation will be performed even when turning the M0 to M5 inputs and the FWD (RVS) input ON simultaneously.

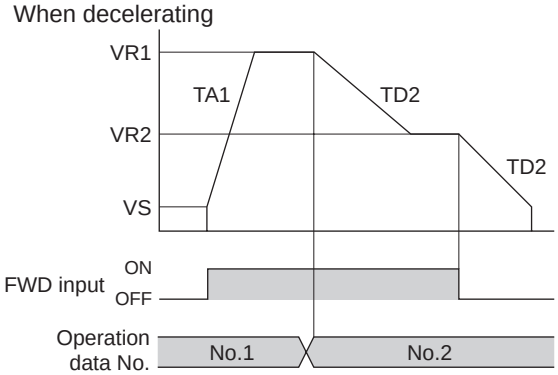
■ Variable speed operation

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

When accelerating

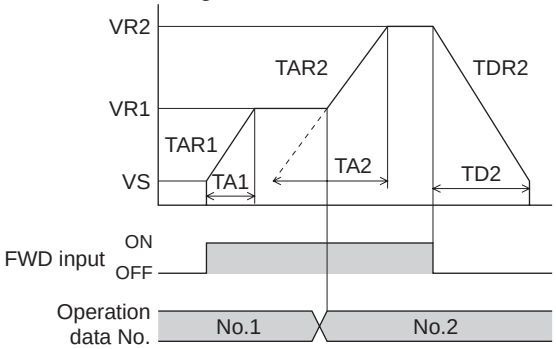


When decelerating

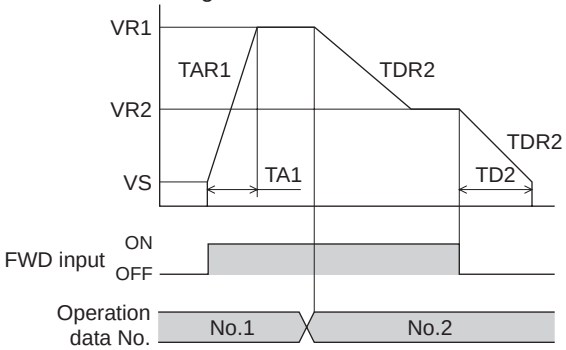


  - Acceleration/deceleration unit: s

When accelerating



When decelerating



- Explanation of labels

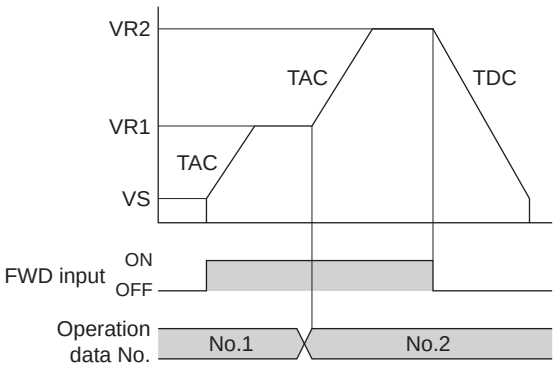
VS: Starting speed (Hz)
VR1: Operating speed of operation data No.1 (Hz)
VR2: Operating speed of operation data No.2 (Hz)
TA1: Acceleration of operation data No.1
TA2: Acceleration of operation data No.2
TD2: Deceleration of operation data No.2
TAR1: Acceleration rate of operation data No.1 (Hz/s)
TAR2: 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

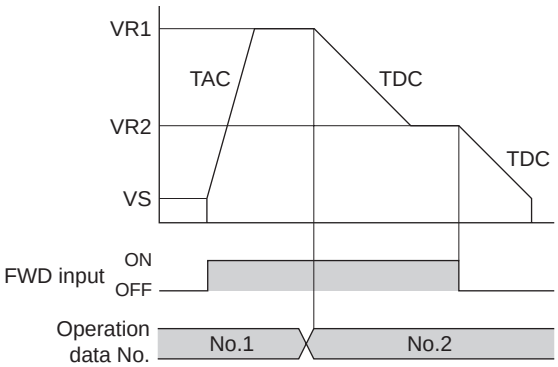
TAR1 = (VR1 − VS)/ TA1
TAR2 = (VR2 − VS)/ TA2
TDR2 = (VR2 − VS)/ TD2

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

When accelerating

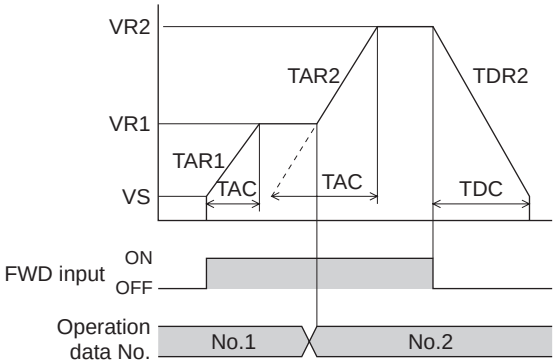


When decelerating

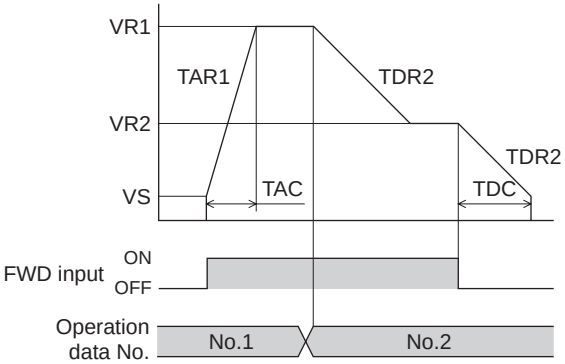


  - Acceleration/deceleration unit: s

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

2.4 Other operation

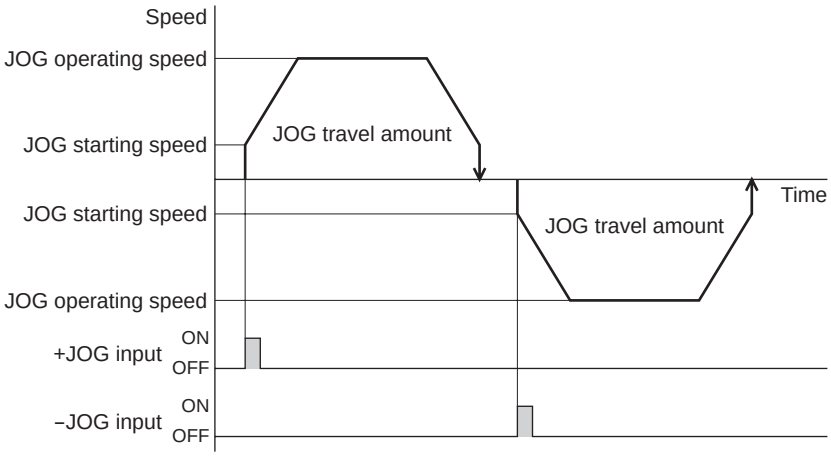
■ JOG operation

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

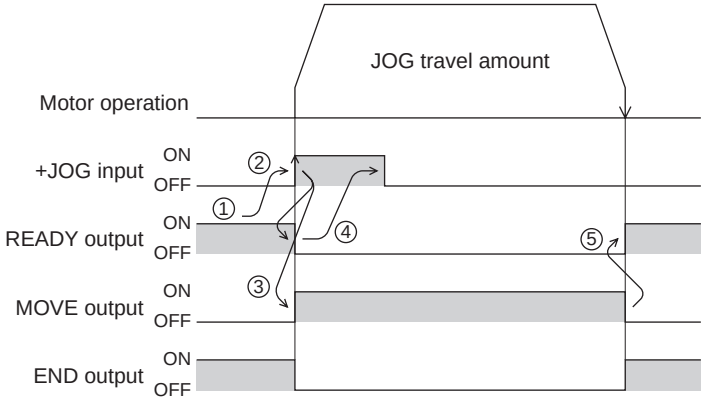
Parameter name	Description	Setting range	Initial value
JOG travel amount	Sets the travel amount for JOG operation.	1 to 8,388,607 step	1
JOG operating speed	Sets the operating speed for JOG operation.	1 to 1,000,000 Hz	1000
Acceleration/deceleration rate of JOG	Sets the acceleration/deceleration rate or 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

- 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.



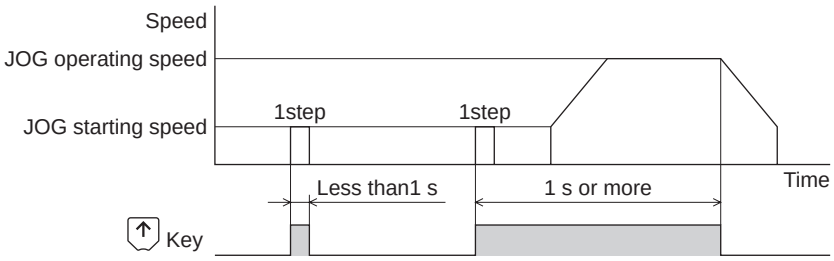
■ Test operation

Test operation is performed using the **OPX-2A** or **MEXE02**. JOG operation and teaching function can be performed. For details, refer to the operating manual for each product.

- JOG operation

Connection condition or operation status for the motor and driver can be checked using JOG operation.

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.3-36 for setting the position origin.

■ Automatic return operation

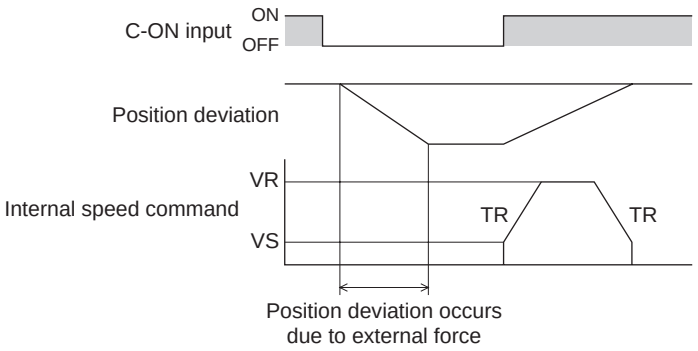
When a position deviation occurs by an external force while the motor is in a non-excitation state, the motor can automatically return to the position where the motor last stopped.
If the motor is reexcited by turning the C-ON input ON or turning the FREE input OFF, automatic return operation will be 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 whether to enable or disable automatic return operation.	0: Disable 1: Enable	0
Operating speed of automatic return	Sets the operating speed for automatic return operation.	1 to 1,000,000 Hz	1000
Acceleration/deceleration of automatic return	Sets the acceleration/deceleration rate or time 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	Sets the starting speed for automatic return operation.	0 to 1,000,000 Hz	500

- Example of automatic return operation



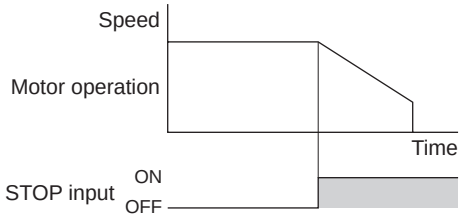
VS: Starting speed of automatic return
VR: Operation speed of automatic return
TR: Acceleration/deceleration rate of automatic return

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

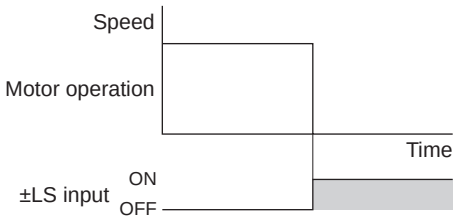
- STOP action

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.



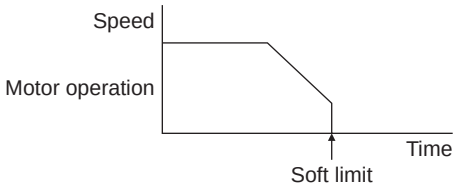
- Hardware overtravel

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 Position coordinate management 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)	

■ 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.210 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.199 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 whether to enable or disable the wrap function.	0: Disable 1: Enable	0
Wrap setting range	Sets the 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

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

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

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.

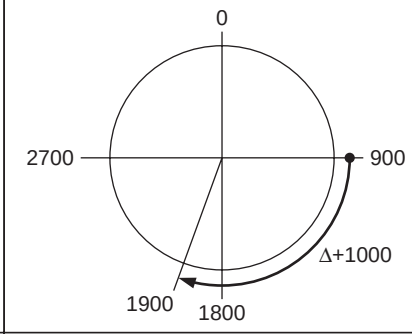
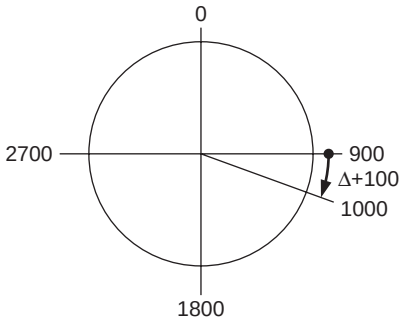
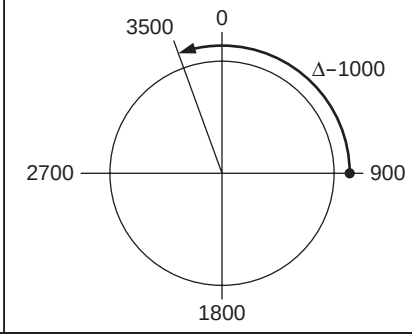
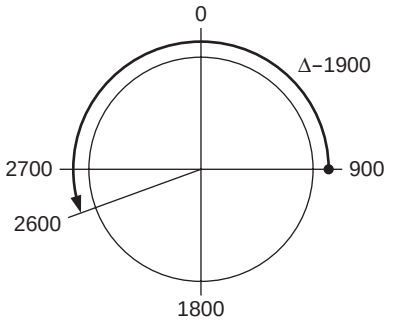
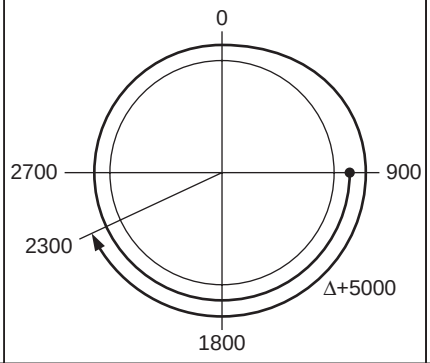
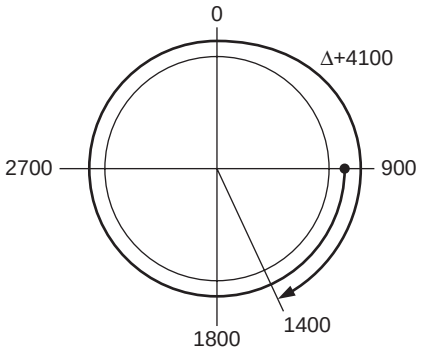
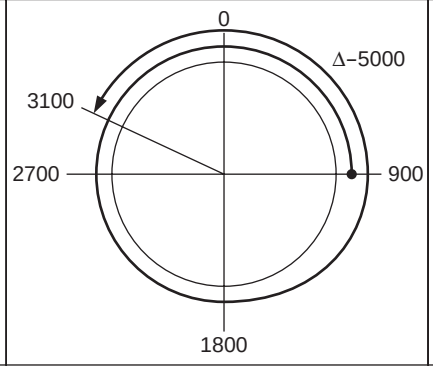
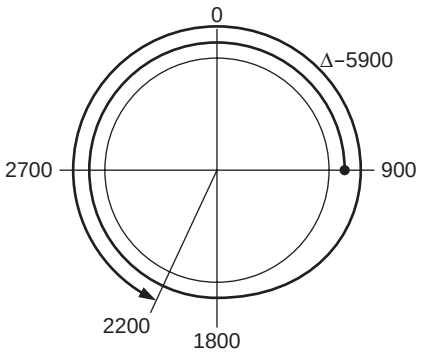
- Example for wrap function

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

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

Condition 2: 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		
−1000		
+5000		
−5000		

3 Operation data

Up to 64 operation data can be set (data Nos.0 to 63).
If the data is changed, a recalculation and setup will be performed after the operation is stopped.

Name	Description	Setting range	Initial value
Position No.0 to Position No.63	Sets the position (distance) for positioning operation.	−8,388,608 to +8,388,607 step	0
Operating speed No.0 to Operating speed No.63	Sets the 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	Sets the acceleration rate or time in positioning operation and continuous operation. ∗1	1 to 1,000,000 (1=0.001 ms/kHz or 1=0.001 s) ∗2	1000
Deceleration No.0 to Deceleration No.63	Sets the deceleration rate or time in positioning operation and continuous operation. ∗1		
Push current No.0 to Push current No.63	Sets the current value of push-motion operation.	0 to 1000 (1=0.1%) ∗3	200
Sequential positioning No.0 to Sequential positioning No.63	Sets whether to enable or disable sequential positioning operation.	0: Disable 1: Enable	0
Dwell time No.0 to Dwell time No.63	Sets the dwell time to be used in linked-motion operation 2.	0 to 50000 (1=0.001 s)	0

*1 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).
*2 Acceleration/deceleration rate (ms/kHz) or acceleration/deceleration time (s) can be selected using "acceleration/deceleration unit" parameter. (initial value: acceleration/deceleration rate).
*3 For the driver which is before the specification change, the setting range is 0 to 500 (1=0.1%). Refer to p.5 for details.

4 Parameter

The parameters are saved in the RAM or non-volatile memory. The data saved in the RAM will be erased once the power supply is turned off. On the other hand, the parameters saved in the non-volatile memory will be retained even after the power supply is turned off.
When turning the driver power supply on, the parameters saved in the non-volatile memory will be sent to the RAM. Then, the recalculation and setup for the parameters are executed in the RAM.

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

4.1 Parameter list

I/O parameters (p.3-41)	• 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 parameters (p.3-42)	• RUN current • STOP current • Position loop gain • Speed loop gain • Speed loop integral time constant • Speed filter	• Moving average time • Filter selection • Speed error gain 1 • Speed error gain 2 • Control mode • Smooth driver
Operation parameters (p.3-42)	• 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 parameters (p.3-43)	• 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 parameters (p.3-43)	• 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 parameters (p.3-44)	• 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 parameters (p.3-44)	• Data setter speed display • Data setter edit • Absolute-position backup system	
Communication parameters (p.3-44)	• Communication timeout • Communication error alarm • Communication parity	• Communication stop bit • Transmission waiting time
I/O function parameters (p.3-45)	• IN0 to IN7 input function selection • IN0 to IN7 input logic level setting • OUT0 to OUT5 output function selection	
I/O function [RS-485] parameters (p.3-46)	• NET-IN0 to NET-IN15 input function selection • NET-OUT0 to NET-OUT15 output function selection	

4.2 I/O parameter

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	Sets the motor action to take place upon the occurrence of overtravel.	0: Immediate stop 1: Deceleration stop	0	
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	
AREA1 positive direction position	Sets the position of AREA1 positive direction.	−8,388,608 to 8,388,607 step	0	
AREA1 negative direction position	Sets the position of AREA1 negative direction.			
AREA2 positive direction position	Sets the position of AREA2 positive direction.			
AREA2 negative direction position	Sets the position of AREA2 negative direction.			
AREA3 positive direction position	Sets the position of AREA3 positive direction.			
AREA3 negative direction position	Sets the position of AREA3 negative direction.			
Minimum ON time for MOVE output	Sets the minimum time during which the MOVE output remains ON	0 to 255 ms	0	
LS logic level	Sets the ±LS input logic.	0: Normally open 1: Normally closed	0	C
HOMES logic level	Sets the HOMES input logic.			
SLIT logic level	Sets the SLIT input logic.			
MS0 operation No. selection	Sets the operation data No. corresponding to MS0 input.	0 to 63	0	B
MS1 operation No. selection	Sets the operation data No. corresponding to MS1 input.		1	
MS2 operation No. selection	Sets the operation data No. corresponding to MS2 input.		2	

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

Name	Description	Setting range	Initial value	Effective *
MS3 operation No. selection	Sets the operation data No. corresponding to MS3 input.	0 to 63	3	B
MS4 operation No. selection	Sets the operation data No. corresponding to MS4 input.		4	
MS5 operation No. selection	Sets the operation data No. corresponding to MS5 input.		5	
HOME-P function selection	Sets the 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)

4.3 Motor parameter

Name	Description	Setting range	Initial value	Effective *
RUN current	Sets the motor operating current based on the rated current being 100%.	0 to 1000 (1=0.1%)	1000	A
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	
Position loop gain	Adjusts the motor response in reaction to the position deviation.	1 to 50	10	
Speed loop gain	Adjusts the motor response in reaction to the speed deviation.	10 to 200	180	
Speed loop integral time constant	Decreases the deviation that cannot be adjusted with the speed loop gain.	100 to 2000 (1=0.1 ms)	1000	
Speed filter	Adjusts the motor response.	0 to 200 ms	1	B
Moving average time	Sets the time constant for the moving average filter.	1 to 200 ms	1	
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.			
Control mode	Sets the 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	

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

4.4 Operation parameter

Name	Description	Setting range	Initial value	Effective ∗1
Common acceleration	Sets the common acceleration rate or 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	Sets the common deceleration rate or time in positioning operation and continuous operation.			
Starting speed	Sets the 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	
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 time for JOG operation.	1 to 1,000,000 (1=0.001 ms/kHz or 1=0.001 s) ∗2	1000	
JOG starting speed	Sets the starting speed for JOG operation.	0 to 1,000,000 Hz	500	
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	
Acceleration/ deceleration unit	Sets the acceleration/ deceleration unit.	0: ms/kHz 1: s	0	C
Automatic return operation	Sets whether to enable or disable automatic return operation.	0: Disable 1: Enable	0	
Operating speed of automatic return	Sets the operating speed for automatic return operation.	1 to 1,000,000 Hz	1000	B
Acceleration/ deceleration of automatic return	Sets the acceleration/deceleration rate or time for automatic return operation.	1 to 1,000,000 (1=0.001 ms/kHz or 1=0.001 s) ∗2	1000	
Starting speed of automatic return	Sets the starting speed for automatic return operation.	0 to 1,000,000 Hz	500	
JOG travel amount	Sets the travel amount for JOG operation.	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).

4.5 Return-to-home parameter

Name	Description	Setting range	Initial value	Effective ∗1
Home-seeking mode	Sets the mode for return-to-home operation.	0: 2-sensor mode 1: 3-sensor mode 2: Push mode	1	B
Operating speed of home-seeking	Sets the operating speed for return-to-home operation.	1 to 1,000,000 Hz	1000	
Acceleration/deceleration of home-seeking	Sets the acceleration/ deceleration rate or 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	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 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).

4.6 Alarm/warning parameter

Name	Description	Setting range	Initial value	Effective *
Overload alarm	Sets the condition in which an overload alarm generates.	1 to 300 (1=0.1 s)	50	A
Overflow rotation alarm during current on	Sets the 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	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	C
Overflow rotation alarm during current off	Sets the 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	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 that an overload warning generates.	1 to 300 (1=0.1 s)	50	
Overspeed warning	Sets the condition that an overspeed warning generates.	1 to 5000 r/min	4500	
Overvoltage warning	Sets the voltage at which an overvoltage warning generates.	150 to 630 (1=0.1 V)	630	
Undervoltage warning	Sets the voltage at which an undervoltage warning generates.		180	
Overflow rotation warning during current on	Sets the 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)

4.7 Coordination parameter

Name	Description	Setting range	Initial value	Effective *
Electronic gear A	Sets the denominator of electric gear.	1 to 65535	1	C
Electronic gear B	Sets the numerator of electric gear.			
Motor rotation direction	Sets the 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	Sets the value of soft limit in positive direction.	−8,388,608 to 8,388,607 step	8,388,607	
Negative software limit	Sets the value of soft limit in negative direction.		−8,388,608	
Preset position	Sets the preset position.		0	
Wrap setting	Sets whether to enable or disable the wrap function.	0: Disable 1: Enable	0	C
Wrap setting range	Sets the 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)

4.8 Common parameter

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

4.9 I/O function parameter

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	
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	

4.10 I/O function [RS-485] parameter

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	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	

* These three signals cannot be set in the driver which is before the specification change. Refer to p.5 for details.

- 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	
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	

4.11 Communication parameter

Name	Description	Setting range	Initial value	Effective *
Communication timeout	Sets the condition in which a communication timeout occurs in RS-485 communication. It is not monitored when the set value is 0.	0 to 10000 ms	0	A
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	
Communication parity	Sets the parity of RS-485 communication.	0: None 1: Even number 2: Odd number	1	D
Communication stop bit	Sets the stop bit of RS-485 communication.	0: 1 bit 1: 2 bit	0	
Transmission waiting time	Sets the transmission waiting time of RS-485 communication.	0 to 10000 (1=0.1 ms)	100	

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

4 Method of control via I/O

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

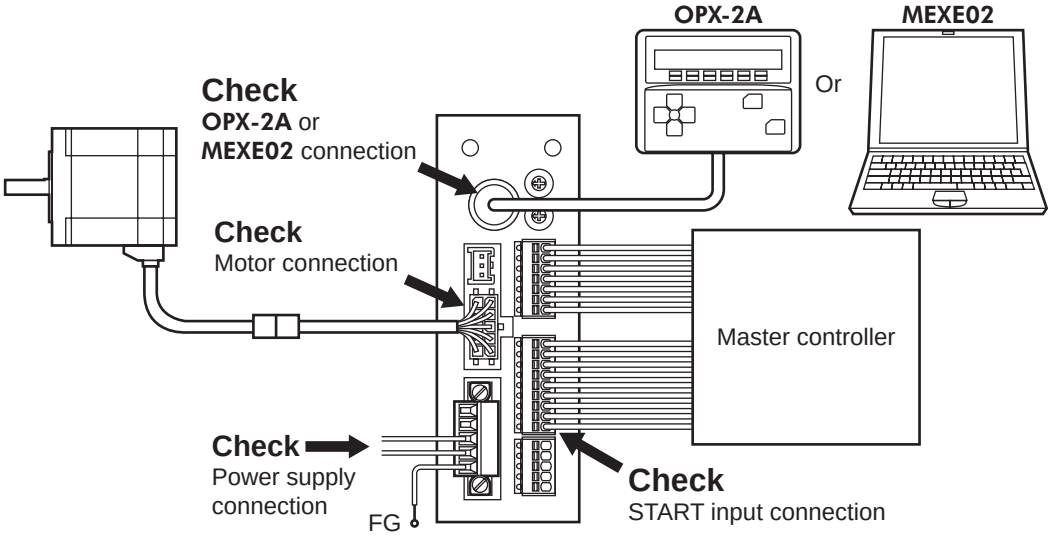
Table of contents

1 Guidance

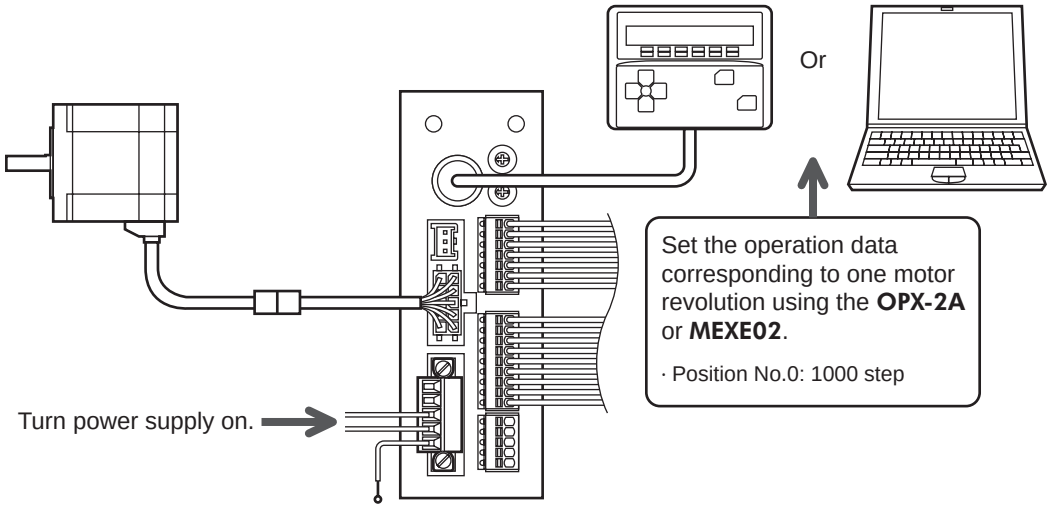
If you are new to the **AR** Series FLEX DC power input built-in controller type, read this section to understand the operating methods along with the operation flow.

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

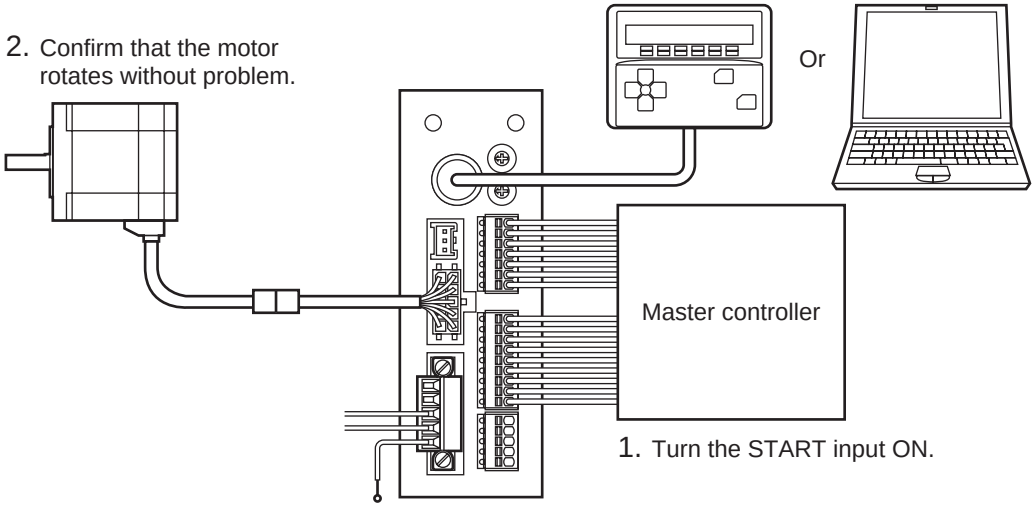
STEP 1 Check the installation and connection



STEP 2 Turn on the power and set the operation data



STEP 3 Operate the motor



STEP 4 Were you able to operate the motor properly?

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

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

For more detailed settings and functions, refer to “3 Operation type and setting.”

2 Operation data

Up to 64 operation data can be set (data Nos.0 to 63).
If the data is changed, a recalculation and setup will be performed after the operation is stopped.

Name	Setting range	Initial value
Position No.0 to Position No.63	−8,388,608 to +8,388,607 step	0
Operating speed No.0 to Operating speed No.63	0 to 1,000,000 Hz	1000
Operation mode No.0 to Operation mode No.63	0: INC (Incremental) 1: ABS (Absolute)	0
Operation function No.0 to Operation function No.63	0: Single-motion 1: Linked-motion 2: Linked-motion 2 3: Push-motion	0
Acceleration No.0 to Acceleration No.63	1 to 1,000,000 (1=0.001 ms/kHz or 1=0.001 s) ∗1∗2	1000
Deceleration No.0 to Deceleration No.63		
Push current No.0 to Push current No.63	0 to 1000 (1=0.1%) ∗3	200
Sequential positioning No.0 to Sequential positioning No.63	0: Disable 1: Enable	0
Dwell time No.0 to Dwell time No.63	0 to 50000 (1=0.001 s)	0

*1 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).
*2 Acceleration/deceleration rate (ms/kHz) or acceleration/deceleration time (s) can be selected using "acceleration/deceleration unit" parameter. (initial value: acceleration/deceleration rate).
*3 For the driver which is before the specification change, the setting range is 0 to 500 (1=0.1%). Refer to p.5 for details.

3 Parameter

3.1 Parameter list

I/O parameters (p.109)	• STOP input action	• Minimum ON time for MOVE output
	• Hardware overtravel	• LS logic level
	• Overtravel action	• HOMES logic level
	• Positioning completion signal range	• SLIT logic level
	• Positioning completion signal offset	• MS0 operation No. selection
	• AREA1 positive direction position	• MS1 operation No. selection
	• AREA1 negative direction position	• MS2 operation No. selection
	• AREA2 positive direction position	• MS3 operation No. selection
	• AREA2 negative direction position	• MS4 operation No. selection
	• AREA3 positive direction position	• MS5 operation No. selection
	• AREA3 negative direction position	• HOME-P output function selection
Motor parameters (p.110)	• RUN current	• Moving average time
	• STOP current	• Filter selection
	• Position loop gain	• Speed error gain 1
	• Speed loop gain	• Speed error gain 2
	• Speed loop integral time constant	• Control mode
	• Speed filter	• Smooth driver
Operation parameters (p.111)	• Common acceleration	• Acceleration/deceleration type
	• Common deceleration	• Acceleration/deceleration unit
	• Starting speed	• Automatic return operation
	• JOG operating speed	• Operating speed of automatic return
	• Acceleration/deceleration rate of JOG	• Acceleration/deceleration of automatic return
	• JOG starting speed	• Starting speed of automatic return
		• JOG travel amount
Return-to-home parameters (p.111)	• Home-seeking mode	• Starting direction of home-seeking
	• Operating speed of home-seeking	• SLIT detection with home-seeking
	• Acceleration/deceleration of home-seeking	• TIM signal detection with home-seeking
	• Starting speed of home-seeking	• Operating current of push-motion home-seeking
	• Position offset of home-seeking	
Alarm/warning parameters (p.112)	• Overload alarm	• Overload warning
	• Overflow rotation alarm during current on	• Overspeed warning
	• Return-to-home incomplete alarm	• Overvoltage warning
	• Overflow rotation alarm during current off	• Undervoltage warning
	• Overheat warning	• Overflow rotation warning during current on
Coordination parameters (p.112)	• Electronic gear A	• Positive software limit
	• Electronic gear B	• Negative software limit
	• Motor rotation direction	• Preset position
	• Software overtravel	• Wrap setting
		• Wrap setting range
Common parameters (p.112)	• Data setter speed display	• Absolute-position backup system
	• Data setter edit	
Communication parameters (p.112)	• Communication timeout	• Communication stop bit
	• Communication error alarm	• Transmission waiting time
	• Communication parity	
I/O function parameters (p.113)	• IN0 to IN7 input function selection	• OUT0 to OUT5 output function selection
	• IN0 to IN7 input logic level setting	
I/O function [RS-485] parameters (p.114)	• NET-IN0 to NET-IN15 input function selection	
	• NET-OUT0 to NET-OUT15 output function selection	

3.2 I/O parameter

Name	Setting range	Initial value	Effective *
STOP input action	0: Immediate stop 1: Deceleration stop 2: Immediate stop & Current OFF 3: Deceleration stop &Current OFF	1	A
Hardware overtravel	0: Disable 1: Enable	1	
Overtravel action	0: Immediate stop 1: Deceleration stop	0	
Positioning completion signal range	0 to 180 (1=0.1°)	18	
Positioning completion signal offset	−18 to 18 (1=0.1°)	0	
AREA1 positive direction position	−8,388,608 to 8,388,607 step	0	
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	0 to 255 ms	0	
LS logic level	0: Normally open 1: Normally closed	0	C
HOMES logic level			
SLIT logic level			
MS0 operation No. selection	0 to 63	0	B
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	
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)

3.3 Motor parameter

Name	Setting range	Initial value	Effective *
RUN current	0 to 1000 (1=0.1%)	1000	A
STOP current	0 to 500 (1=0.1%)	500	
Position loop gain	1 to 50	10	
Speed loop gain	10 to 200	180	
Speed loop integral time constant	100 to 2000 (1=0.1 ms)	1000	
Speed filter	0 to 200 ms	1	B
Moving average time	1 to 200 ms	1	
Filter selection	0: Speed filter 1: Moving average filter	0	C
Speed error gain 1	0 to 500	45	A
Speed error gain 2			
Control mode	0: Normal mode 1: Current control mode	0	C
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)

3.4 Operation parameter

Name	Setting range	Initial value	Effective *1
Common acceleration	1 to 1,000,000 (1=0.001 ms/kHz or 1=0.001 s) *2	1000	B
Common deceleration			
Starting speed	0 to 1,000,000 Hz	500	
JOG operating speed	1 to 1,000,000 Hz	1000	
Acceleration/deceleration rate of JOG	1 to 1,000,000 (1=0.001 ms/kHz or 1=0.001 s) *2	1000	
JOG starting speed	0 to 1,000,000 Hz	500	
Acceleration/deceleration type	0: Common 1: Separate	1	
Acceleration/deceleration unit	0: ms/kHz 1: s	0	C
Automatic return operation	0: Disable 1: Enable	0	
Operating speed of automatic return	1 to 1,000,000 Hz	1000	B
Acceleration/deceleration of automatic return	1 to 1,000,000 (1=0.001 ms/kHz or 1=0.001 s) *2	1000	
Starting speed of automatic return	0 to 1,000,000 Hz	500	
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).

3.5 Return-to-home parameter

Name	Setting range	Initial value	Effective *1
Home-seeking mode	0: 2-sensor mode 1: 3-sensor mode 2: Push mode	1	B
Operating speed of home-seeking	1 to 1,000,000 Hz	1000	
Acceleration/deceleration of home-seeking	1 to 1,000,000 (1=0.001 ms/kHz or 1=0.001 s) *2	1000	
Starting speed of home-seeking	1 to 1,000,000 Hz	500	
Position offset of home-seeking	−8,388,608 to 8,388,607 step	0	
Starting direction of home-seeking	0: Negative direction 1: Positive direction	1	
SLIT detection with home-seeking	0: Disable 1: Enable	0	
TIM signal detection with home-seeking			
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).

3.6 Alarm/warning parameter

Name	Setting range	Initial value	Effective *
Overload alarm	1 to 300 (1=0.1 s)	50	A
Overflow rotation alarm during current on	1 to 30000 (1=0.01 rev)	300	
Return-to-home incomplete alarm	0: Disable 1: Enable	0	C
Overflow rotation alarm during current off	1 to 30000 (1=0.01 rev)	10000	A
Overheat warning	40 to 85 °C (104 to 185 °F)	85	
Overload warning	1 to 300 (1=0.1 s)	50	
Overspeed warning	1 to 5000 r/min	4500	
Overvoltage warning	150 to 630 (1=0.1 V)	630	
Undervoltage warning		180	
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)

3.7 Coordination parameter

Name	Setting range	Initial value	Effective *
Electronic gear A	1 to 65535	1	C
Electronic gear B			
Motor rotation direction	0: Positive direction=CCW 1: Positive direction=CW	1	
Software overtravel	0: Disable 1: Enable	1	A
Positive software limit	−8,388,608 to 8,388,607 step	8,388,607	
Negative software limit		−8,388,608	
Preset position		0	
Wrap setting	0: Disable 1: Enable	0	C
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)

3.8 Common parameter

Name	Setting range	Initial value	Effective *
Data setter speed display	0: Signed 1: Absolute value	0	A
Data setter edit	0: Disable 1: Enable	1	
Absolute-position backup system		0	C

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

3.9 Communication parameter

Name	Setting range	Initial value	Effective *
Communication timeout	0 to 10000 ms	0	A
Communication error alarm	1 to 10 times	3	
Communication parity	0: None 1: Even number 2: Odd number	1	D
Communication stop bit	0: 1 bit 1: 2 bit	0	
Transmission waiting time	0 to 10000 (1=0.1 ms)	100	

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

3.10 I/O function parameter

Name	Setting range	Initial value	Effective *
IN0 input function selection	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	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	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	
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	

3.11 I/O function [RS-485] parameter

Name	Setting range	Initial value	Effective *
NET-IN0 input function selection	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	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	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	

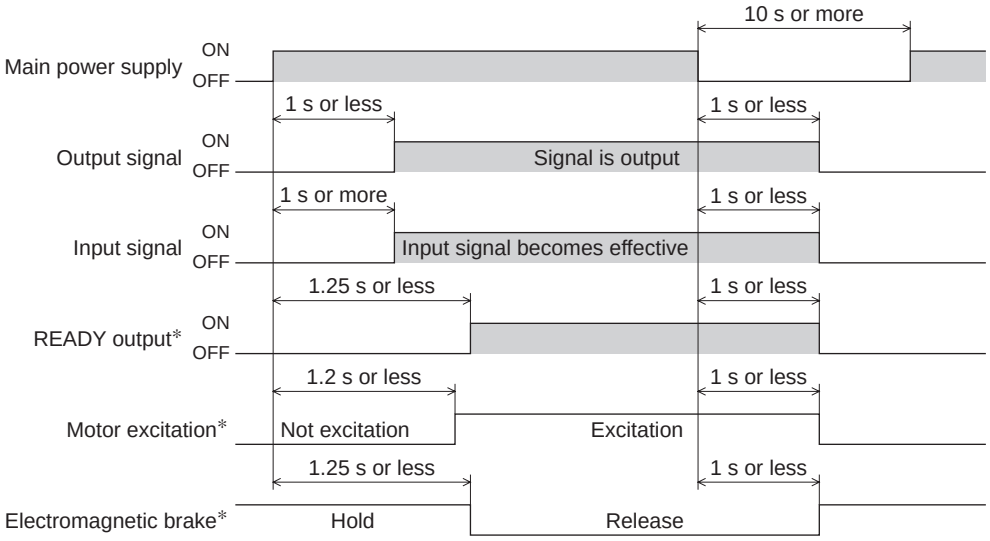
* These three signals cannot be set in the driver which is before the specification change. Refer to p.5 for details.

- 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	
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	

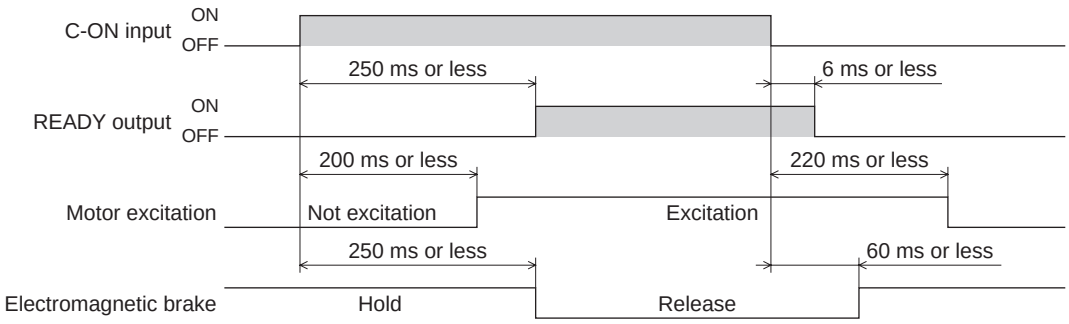
4 Timing charts

■ When the power supply is turned ON



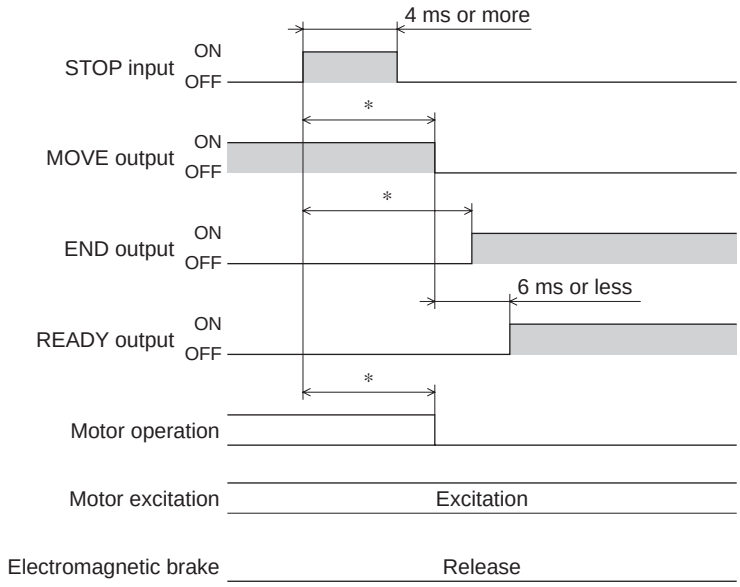
* When the C-ON input is not assigned or when the C-ON input is assigned as normally closed.

■ C-ON input



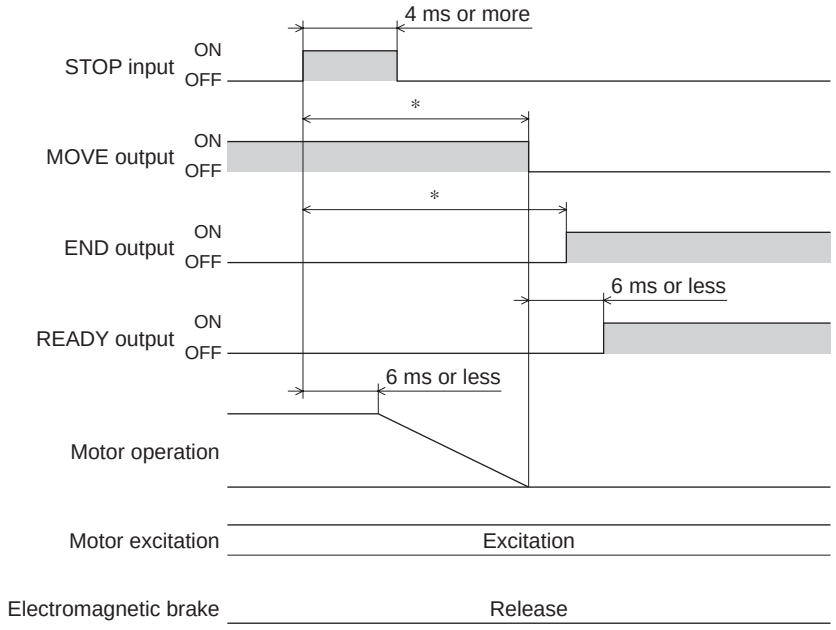
■ STOP input

- When the “STOP input action” parameter is immediate stop.



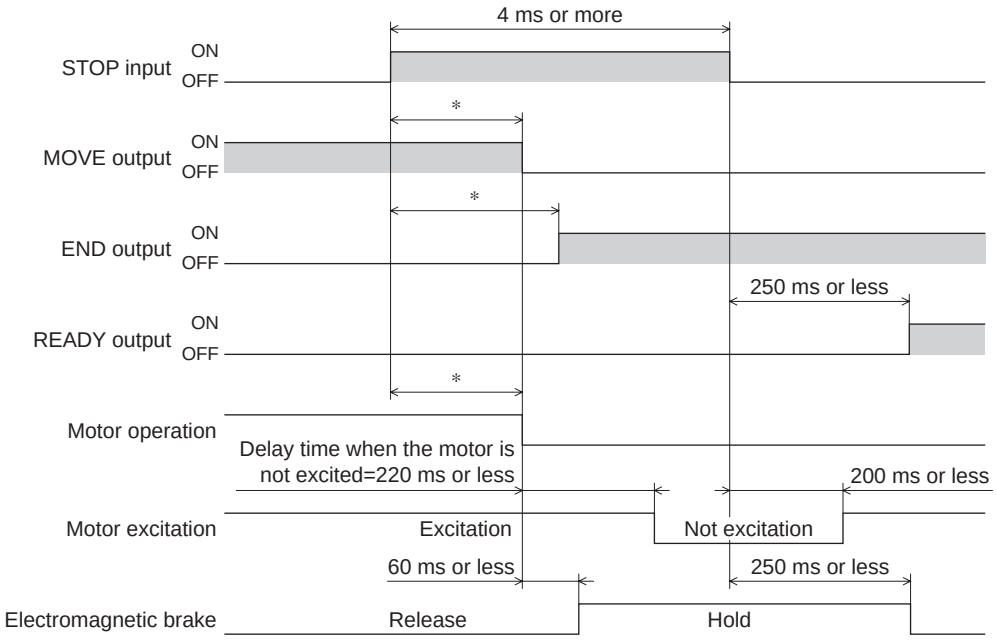
* The specific time varies depending on the load, operating speed, speed filter and other.

- When the “STOP input action” parameter is deceleration stop.



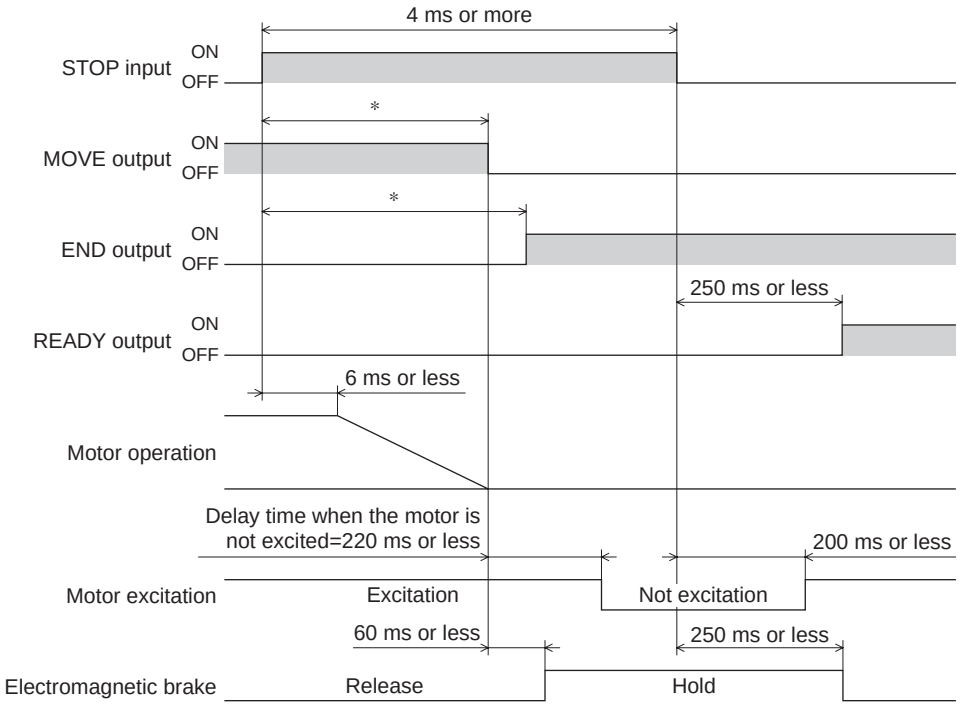
* The specific time varies depending on the load, operating speed, speed filter and other.

- When the “STOP input action” parameter is immediate stop + current off.



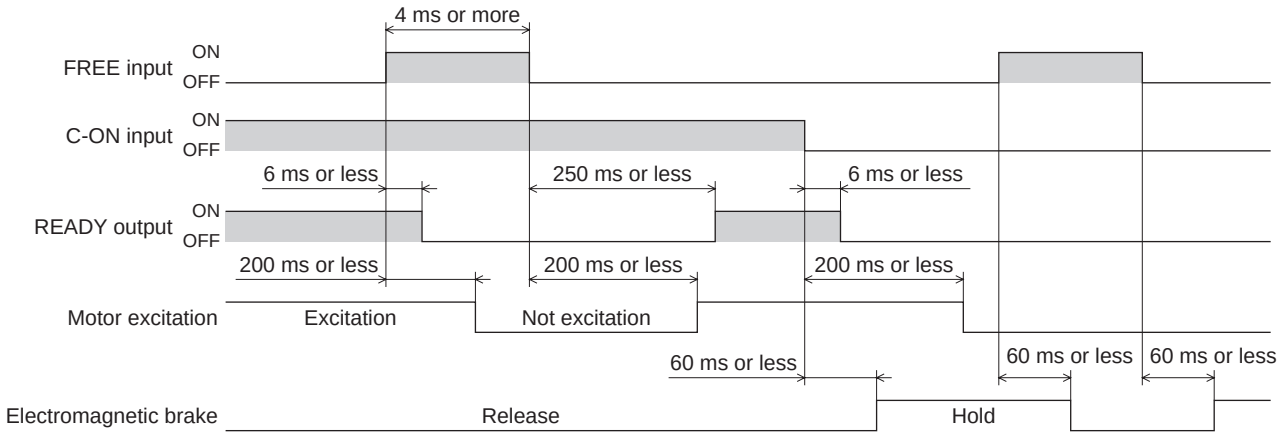
* The specific time varies depending on the load, operating speed, speed filter and other.

- When the “STOP input action” parameter is deceleration stop + current off.



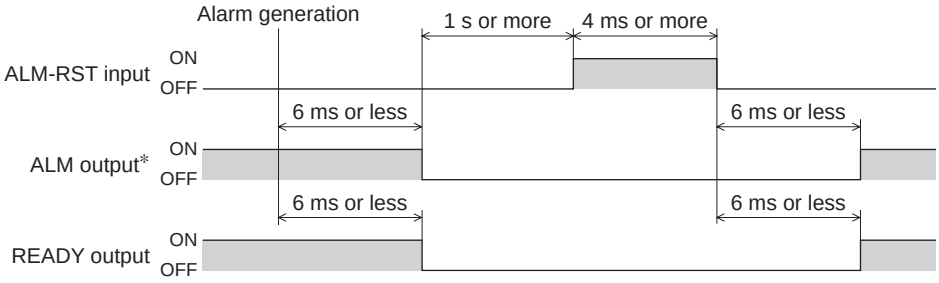
* The specific time varies depending on the load, operating speed, speed filter and other.

■ FREE input



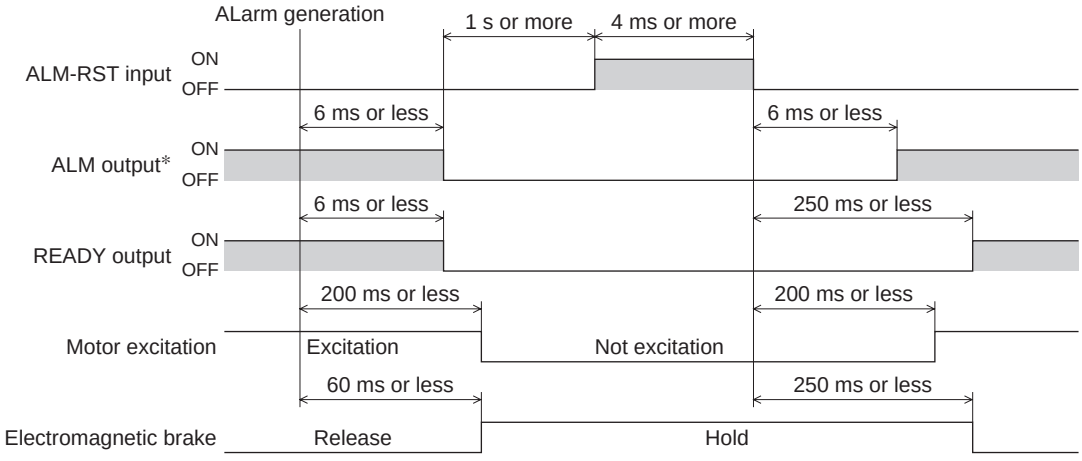
■ ALM-RST input

- When an alarm generates and the motor maintains excitation



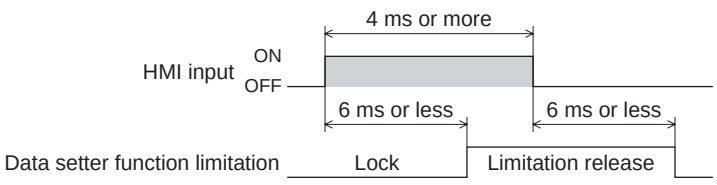
* ALM output is normally closed. It is ON during normal operation and it turns OFF when an alarm generates.

- When an alarm generates and the motor does not maintain excitation

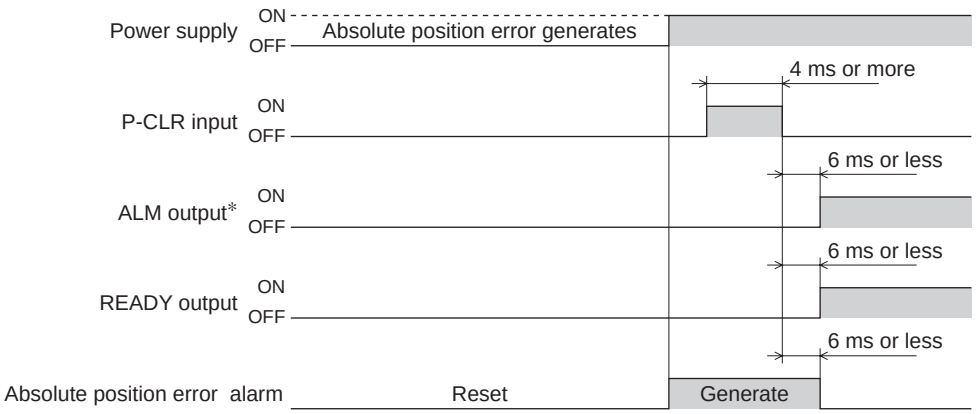


* ALM output is normally closed. It is ON during normal operation and it turns OFF when an alarm generates.

■ HMI input

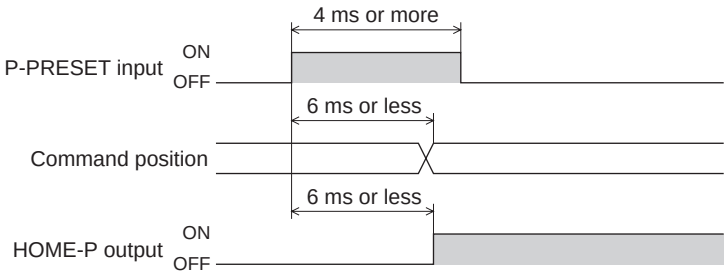


■ P-CLR input

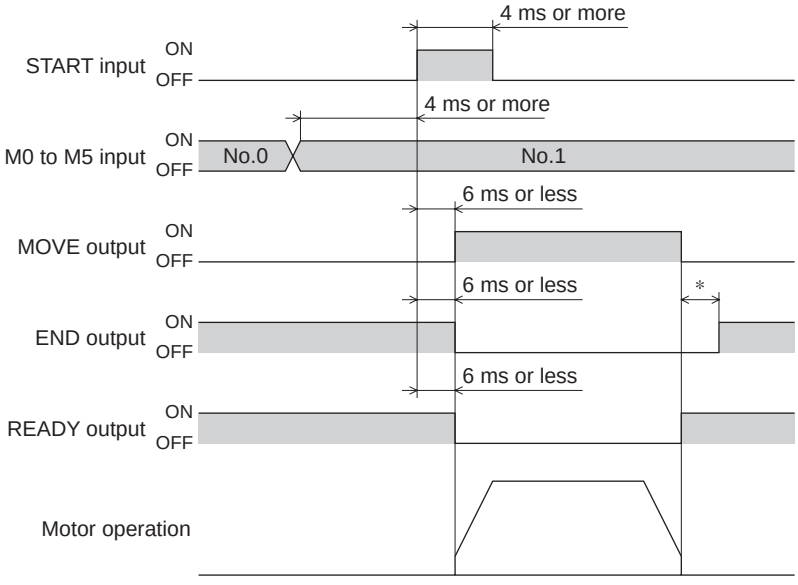


* ALM output is normally closed. It is ON during normal operation and it turns OFF when an alarm generates.

■ P-PRESET input

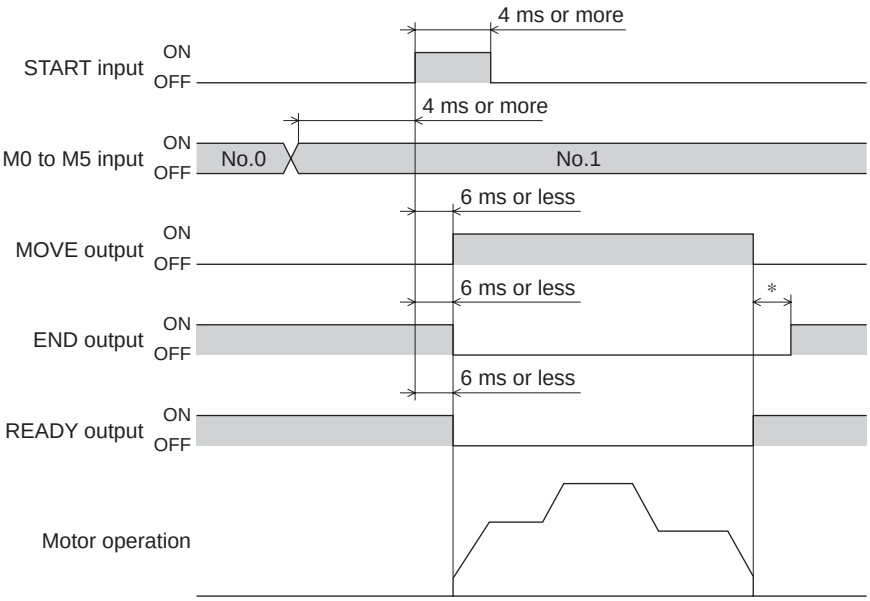


■ Single-motion operation (positioning operation)



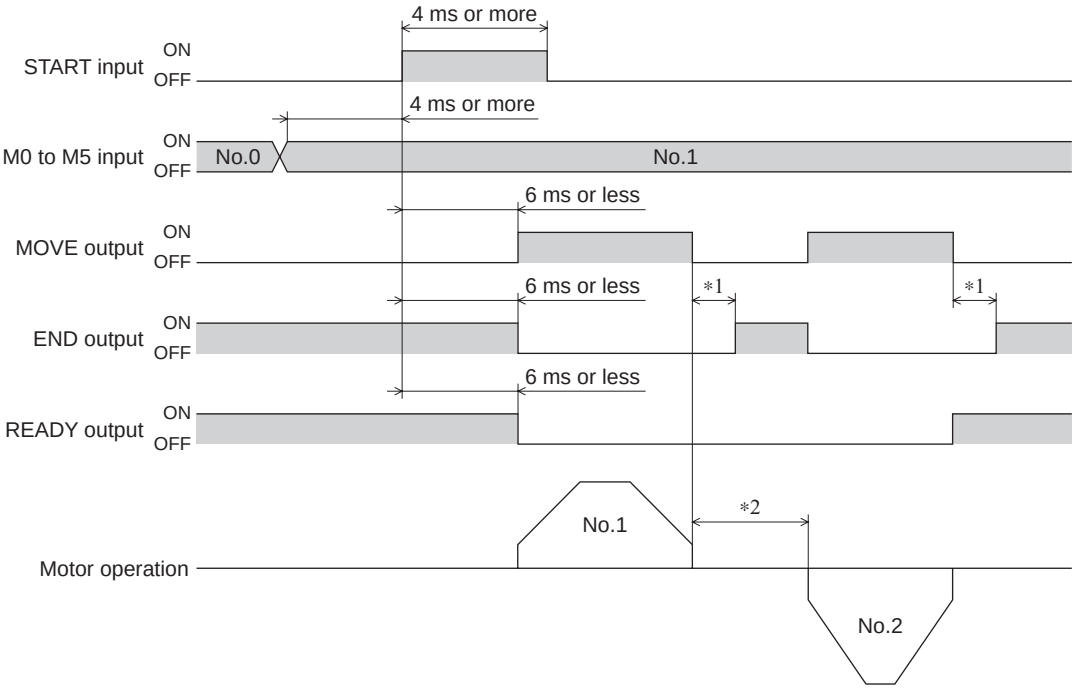
* The specific time varies depending on the load, operating speed, speed filter and other.

■ Linked-motion operation (positioning operation)



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

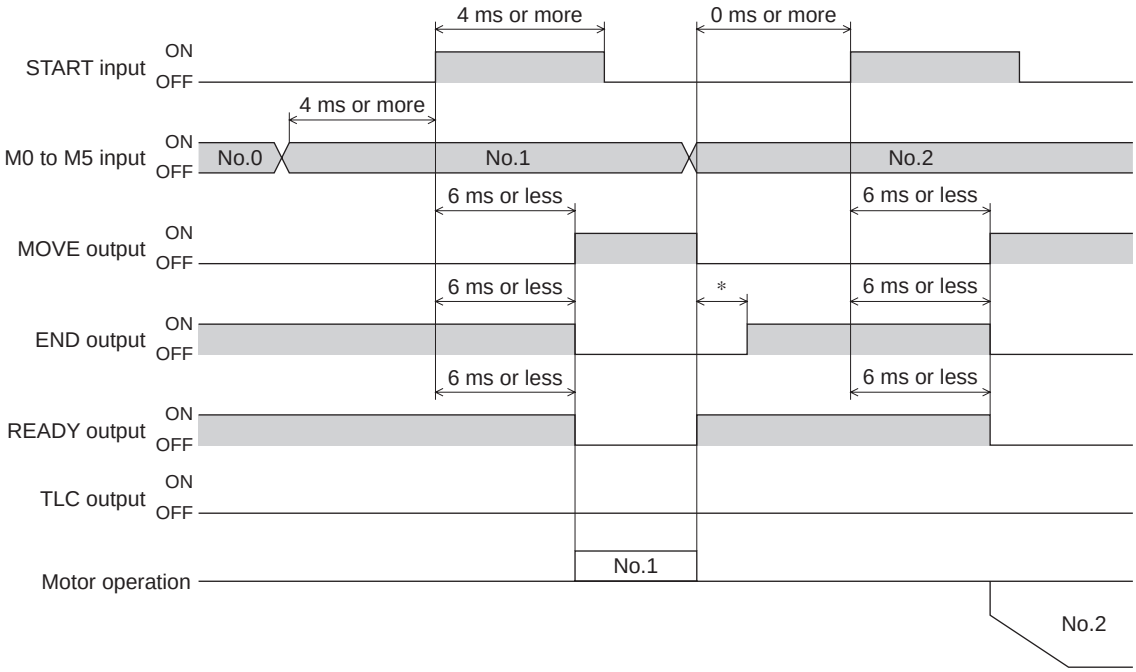
■ Linked-motion operation 2 (positioning operation)



*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.

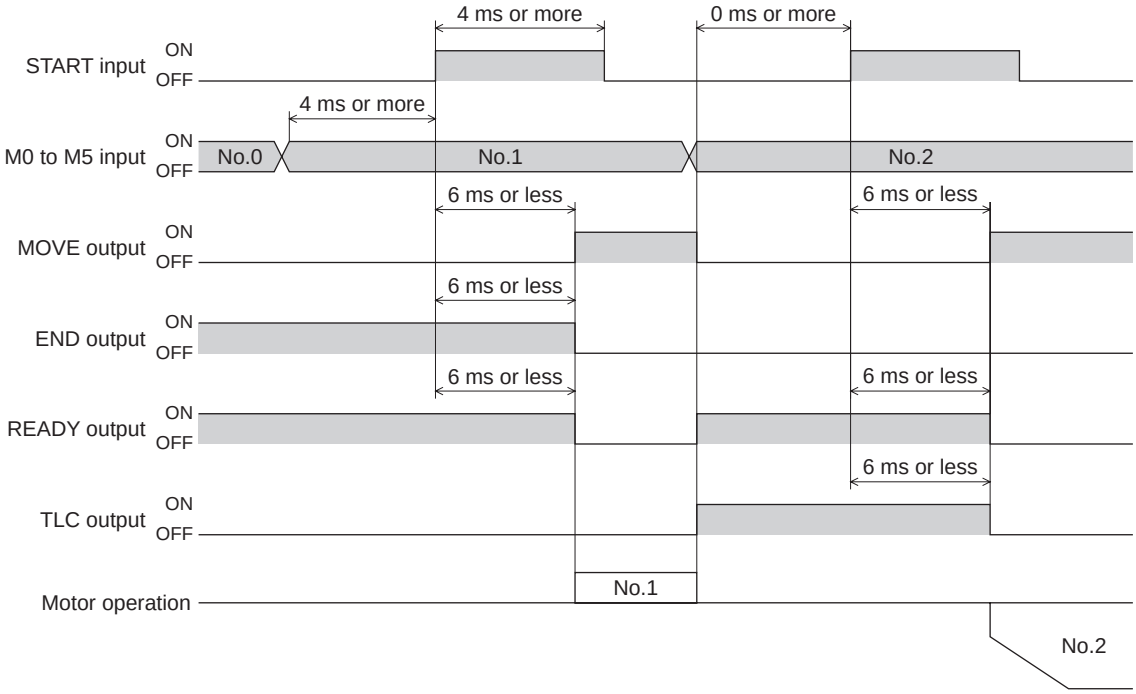
■ Push-motion operation

- When the positioning operation is completed before turning to the "push-motion" status

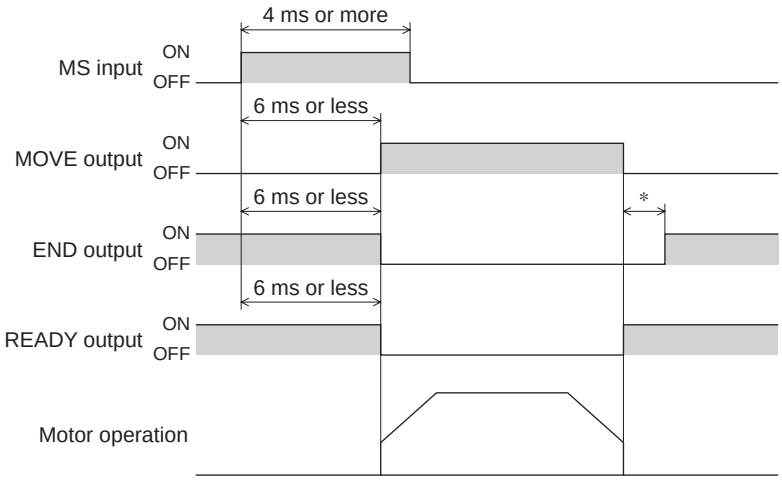


* The specific time varies depending on the load, operating speed, speed filter and other.

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

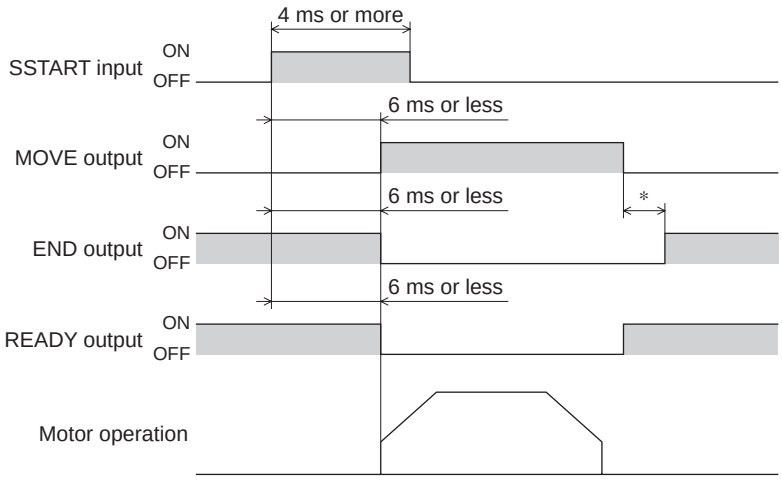


■ Direct positioning operation



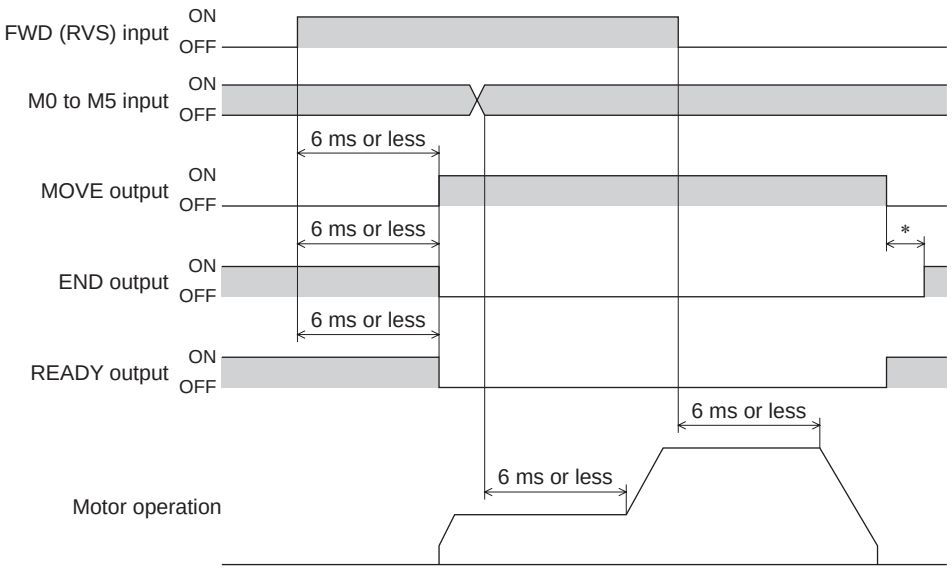
* The specific time varies depending on the load, operating speed, speed filter and other.

■ Sequential operation



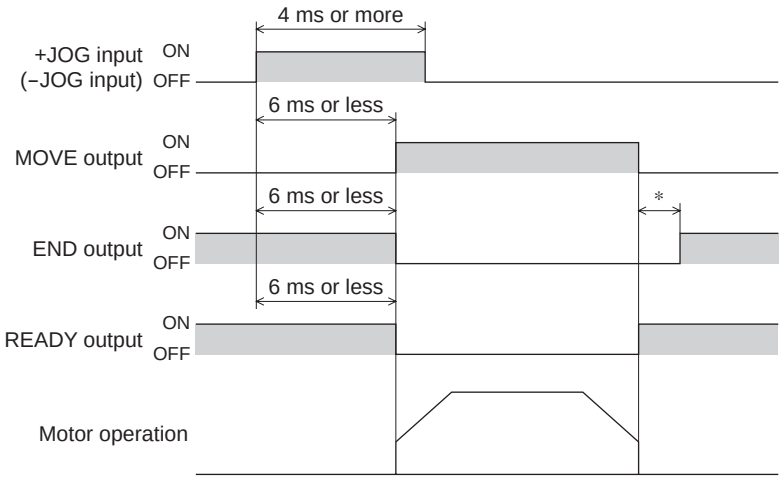
* The specific time varies depending on the load, operating speed, speed filter and other.

■ Continuous operation



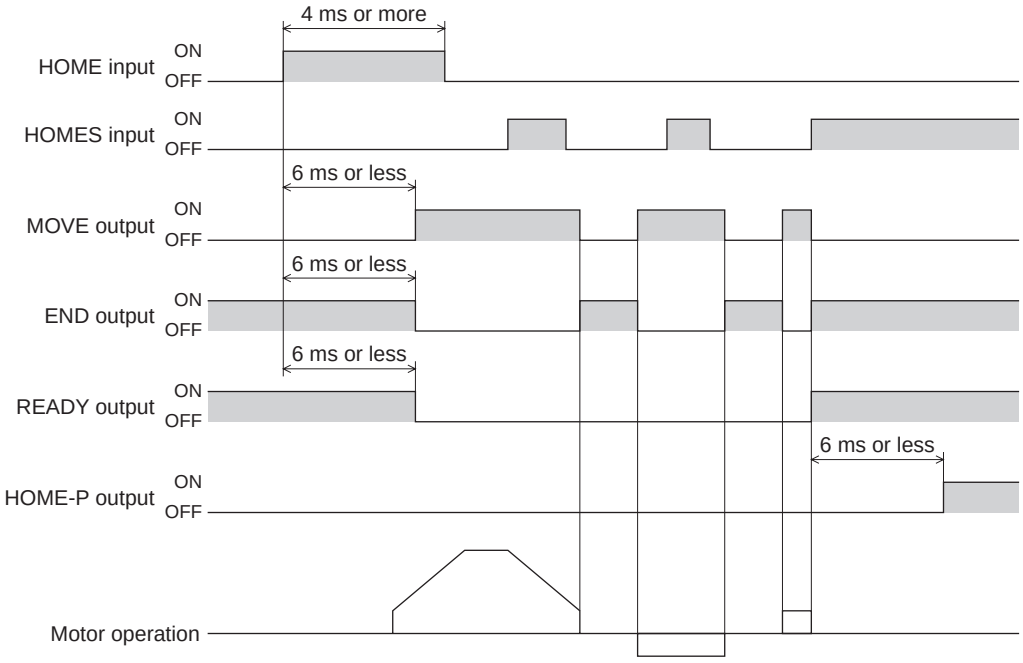
* The specific time varies depending on the load, operating speed, speed filter and other.

■ JOG operation



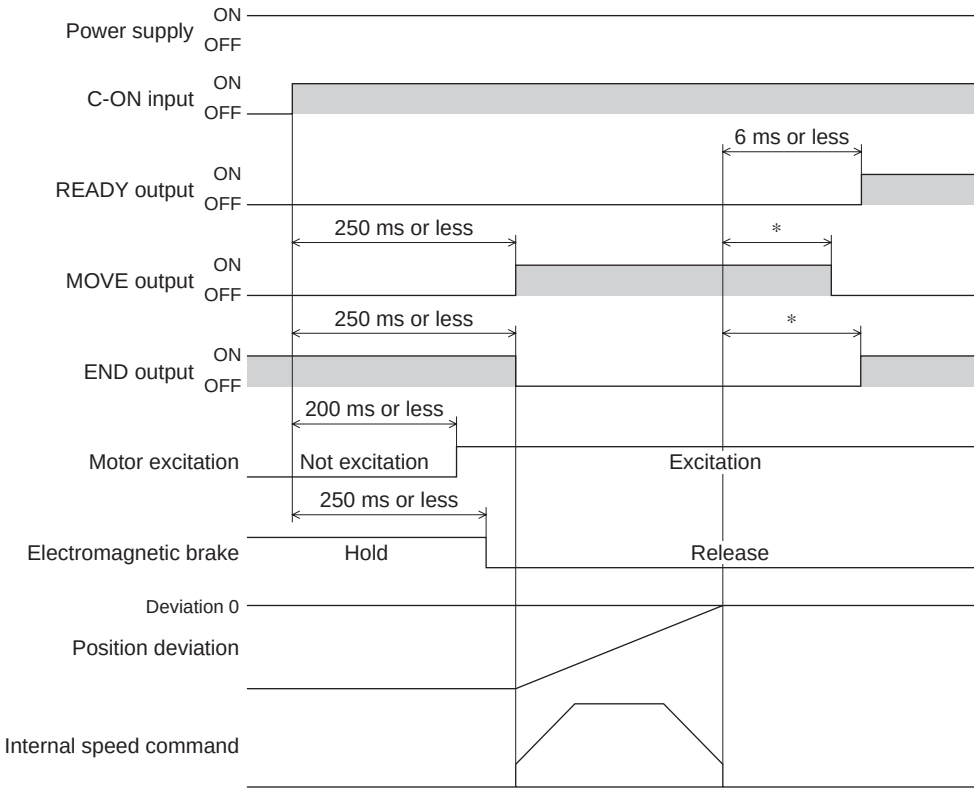
* The specific time varies depending on the load, operating speed, speed filter and other.

■ Return-to-home operation



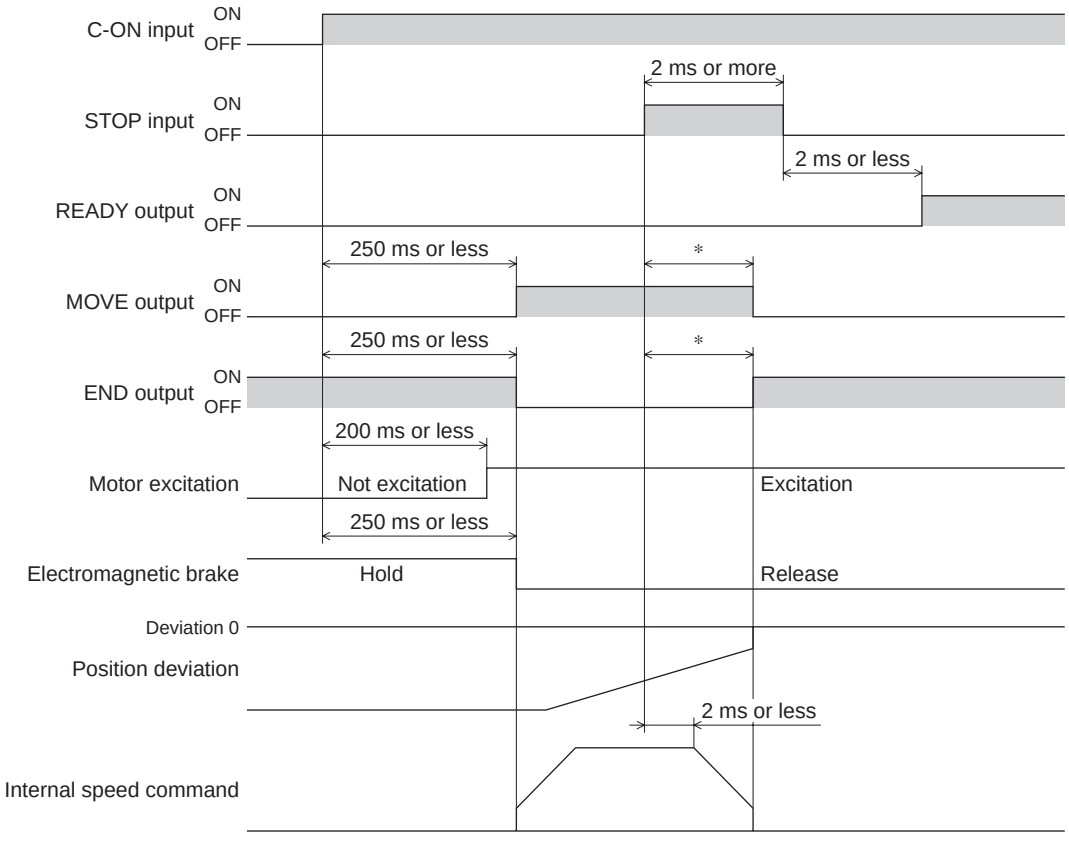
■ Automatic return operation

- When the automatic return operation is performed using the C-ON input



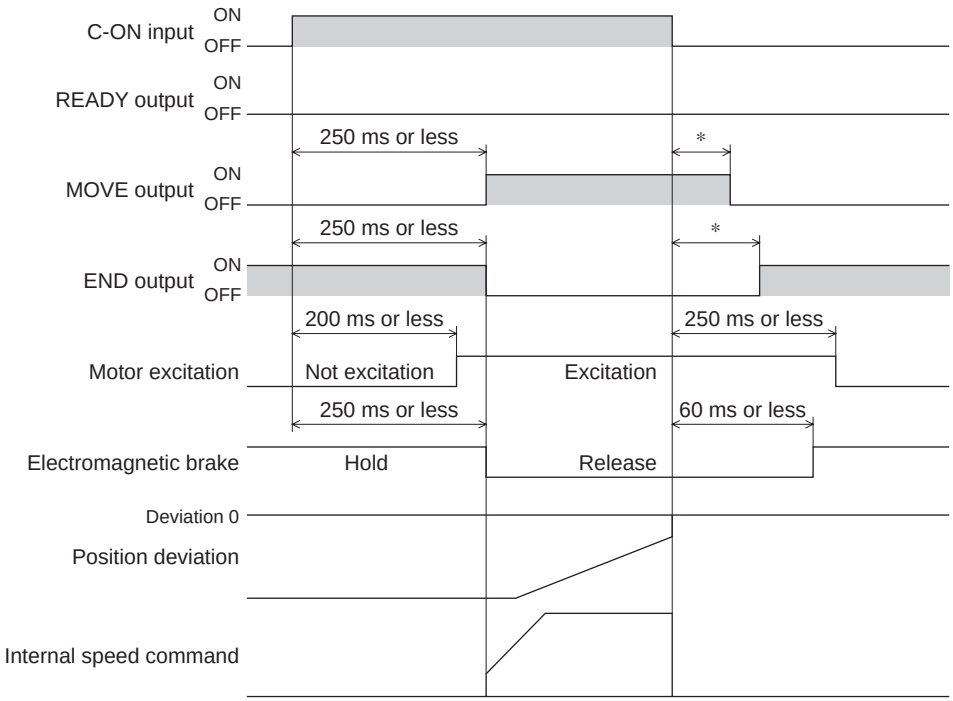
* The specific time varies depending on the load, operating speed, speed filter and other.

- When the operation is completed using the STOP input



* 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



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

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

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

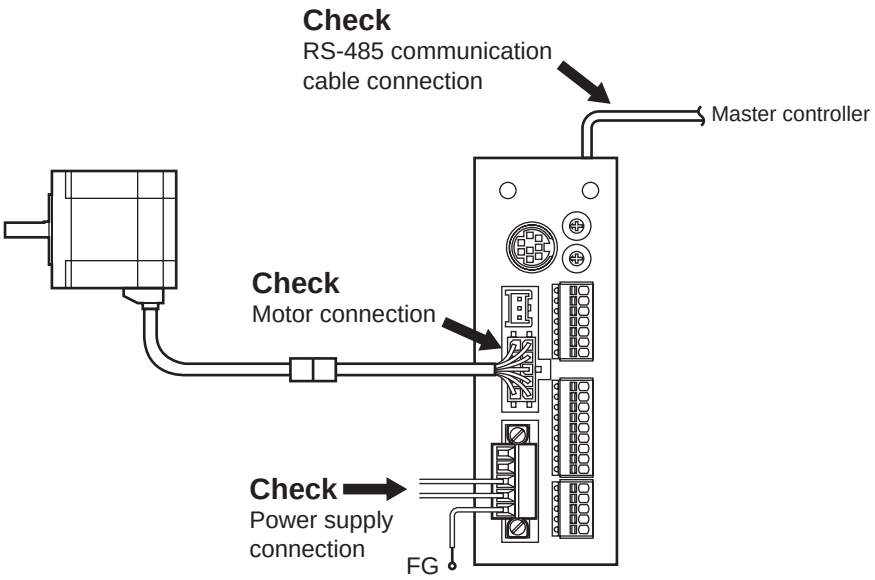
Table of contents

1 Guidance

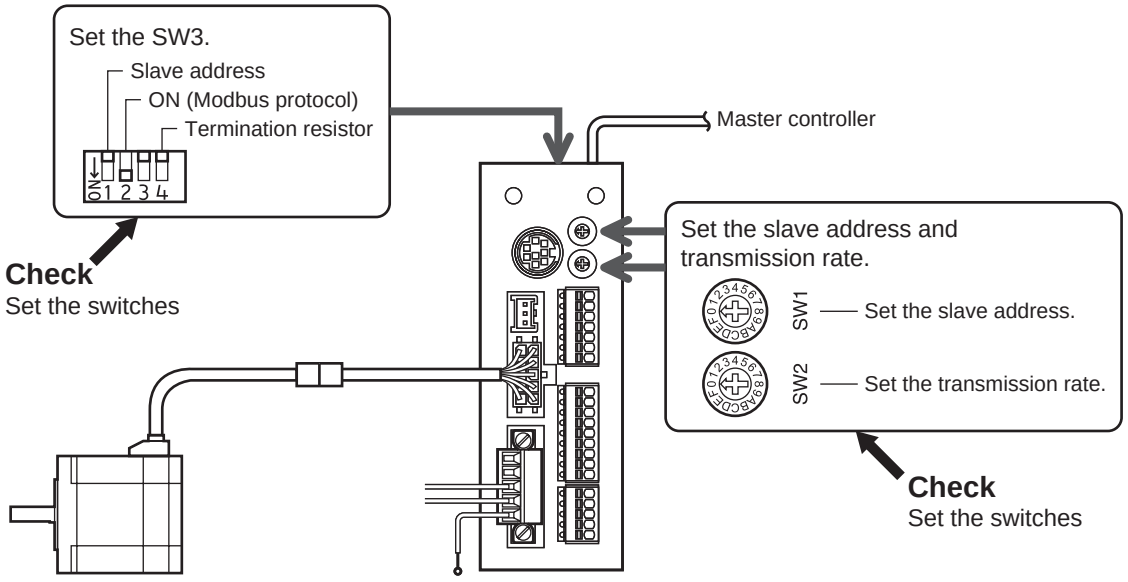
The Modbus protocol is simple and its specification is open to the public, so this protocol is used widely in industrial applications. Modbus communication is based on the single-master/multiple-slave method. Only the master can issue a query (command). Each slave executes the requested process and returns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

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

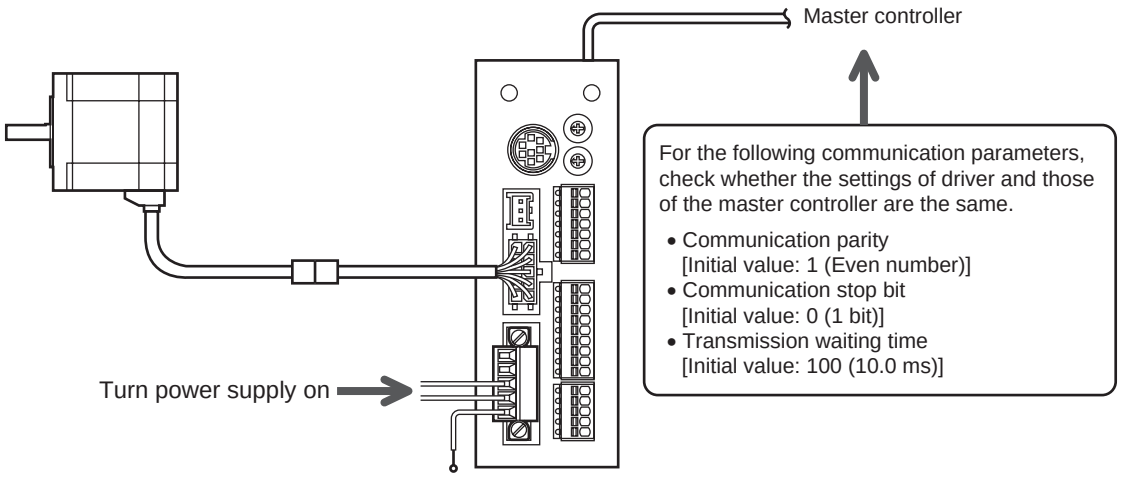
STEP 1 Check the installation and connection



STEP 2 Set the switches



STEP 3 Turn on the power and set the parameters

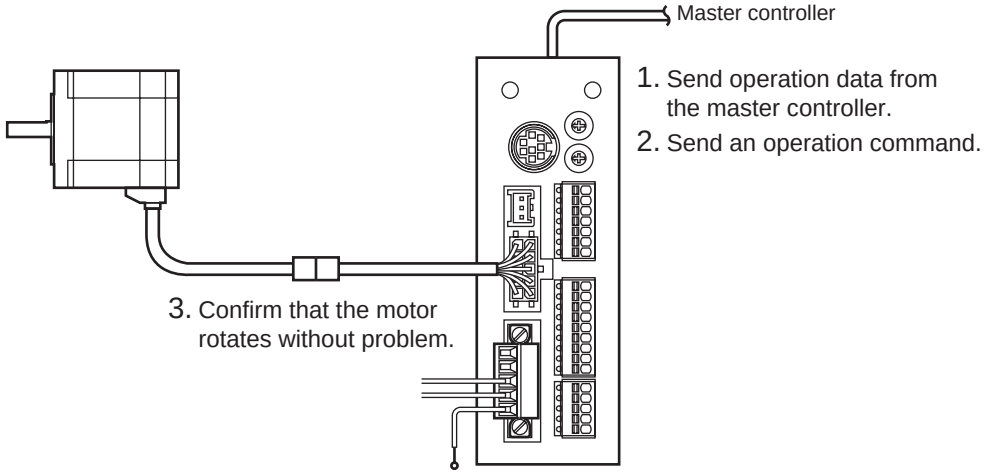


Check that the parameters of the driver and those of the master controller are the same.
Use the **OPX-2A** or **MEXE02** when changing the driver parameters.

STEP 4 Cycle the power

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

STEP 5 Operate the motor



STEP 6 Were you able to operate the motor properly?

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

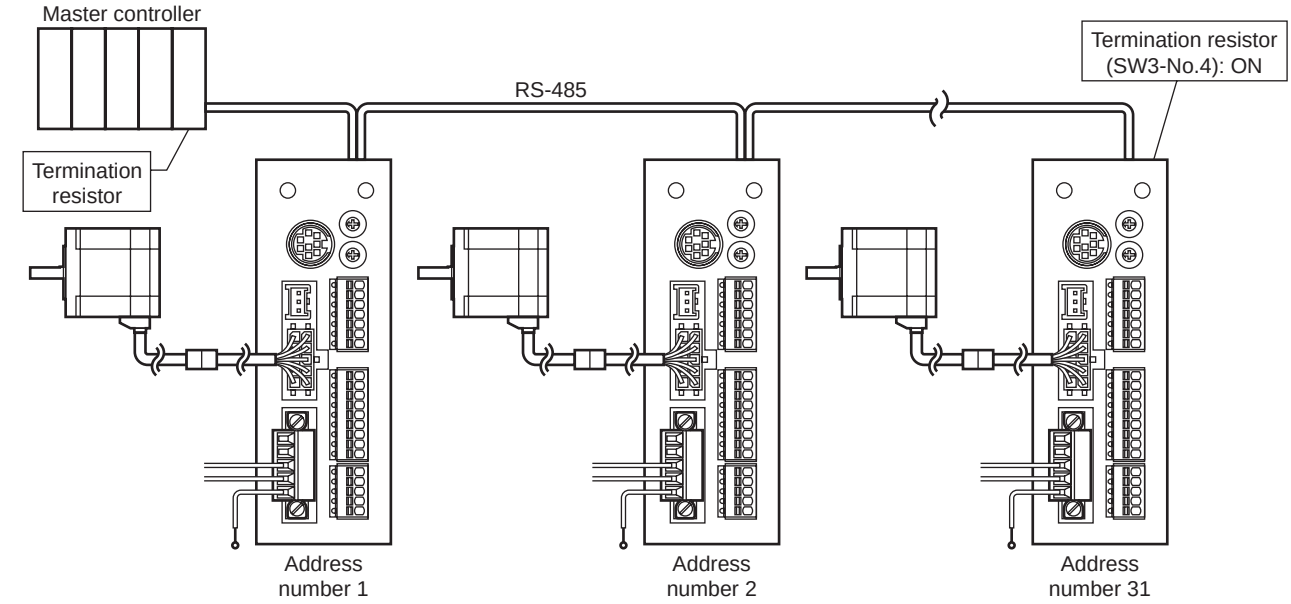
- Is any alarm present?
- Are the power supply, motor and RS-485 communication cable connected securely?
- Are the slave address, transmission rate and termination resistor set correctly?
- Is the C-ERR LED lit?
- Is the C-DAT LED lit or blinking?

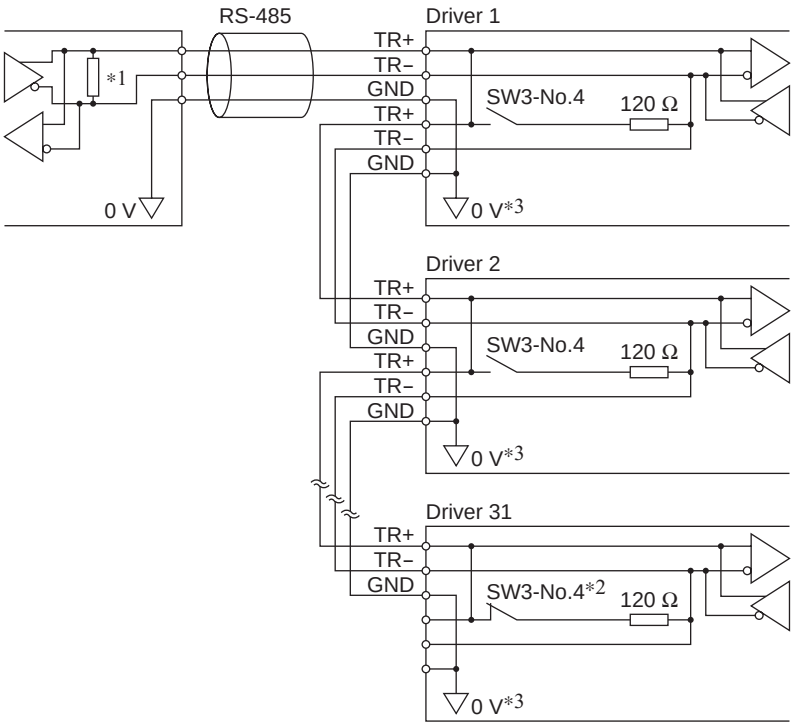
For more detailed settings and functions, refer to the following pages.

2 Communication specifications

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

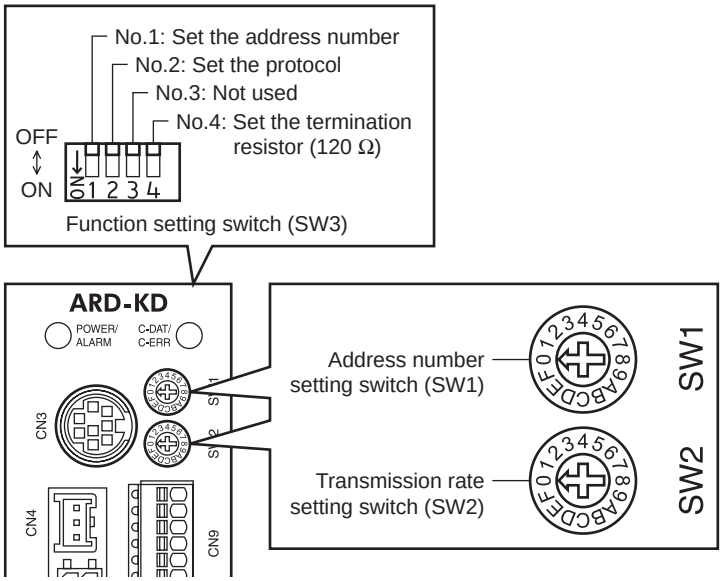
■ Connection example





*1 Termination resistor 120 Ω
*2 Turn the termination resistor (SW3-No.4) to ON.
*3 The GND line is used in common with CN1 (not insulated).

3 Setting the switches



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

■ Protocol

Set the SW3-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 (SW1) and SW3-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 SW1: 0, SW3-No.1: OFF

SW1	SW3-No.1	Address number (slave address)
0	OFF	Not used
1		1
2		2
3		3
4		4
5		5
6		6
7		7
8		8
9		9
A		10
B		11
C		12
D		13
E		14
F		15

SW1	SW3-No.1	Address number (slave address)
0	ON	16
1		17
2		18
3		19
4		20
5		21
6		22
7		23
8		24
9		25
A		26
B		27
C		28
D		29
E		30
F		31

■ Transmission rate

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

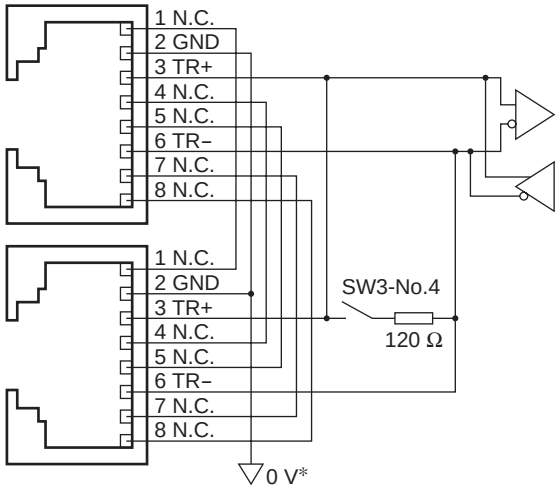
SW2	Transmission rate (bps)
0	9600
1	19200
2	38400
3	57600
4	115,200
5 to F	Not used

Note Do not set SW2 to positions 5 to F.

■ Termination resistor

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

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



* The GND line is used in common with CN1 (not insulated).

4 Setting the RS-485 communication

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

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

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

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

Parameter name	Description	Setting range	Initial value
Communication timeout	Sets the condition in which a communication timeout occurs in RS-485 communication. It is not monitored when the set value is 0.	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

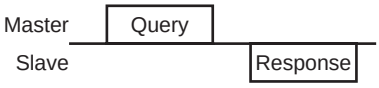
5 Communication mode and communication timing

5.1 Communication mode

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

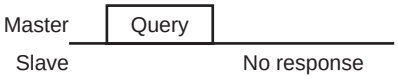
- Unicast mode

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

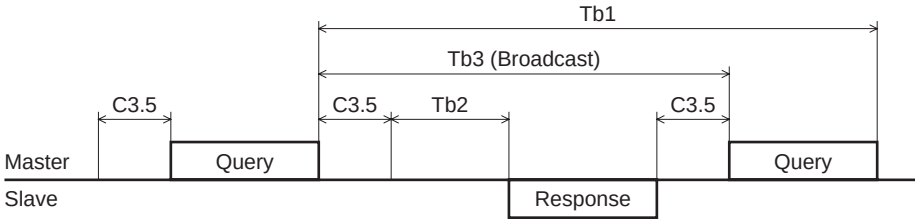


- Broadcast mode

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



5.2 Communication timing



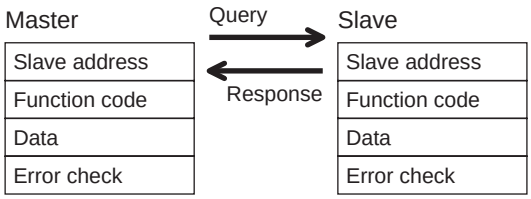
Character	Name	Description
Tb1	Communication timeout	Intervals between received messages are monitored. If no message could be received after the time set in the “communication timeout” parameter, a communication timeout alarm generates.
Tb2	Transmission waiting time	The time after the slave switches 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. See the following table for transmission waiting time.

Transmission waiting time of the “silent interval”

Transmission rate (bps)	Transmission waiting time
9600	4 ms or more
19200	2 ms or more
38400 57600 115,200	1.75 ms or more

6 Message

The message format is shown below.



6.1 Query

The query message structure is shown below.

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

■ Slave address

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

■ Function code

The function codes and message lengths supported by the **AR** series FLEX DC 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.

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

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

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

6.2 Response

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

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

■ Normal response

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

■ No response

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

- Transmission error

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

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

- Other than transmission error

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

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

■ Exception response

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

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

- Function code

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

- Example of exception response

Master

Slave address		01h
Function code		10h
Data	Register address (upper)	02h
	Register address (lower)	42h
	Number of registers (upper)	00h
	Number of registers (lower)	02h
	Number of data bytes	04h
	Value written to register address (upper)	00h
	Value written to register address (upper)	00h
	Value written to register address+1 (upper)	03h
	Value written to register address+1 (upper)	20h
Error check (lower)		6Eh
Error check (upper)		0Eh

Query →
← Response

Slave

Slave address		01h
Function code		90h
Data	Exception code	04h
Error check (lower)		4Dh
Error check (upper)		C3h

- Exception code

This code indicates why the process cannot be executed.

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

7 Function code

7.1 Reading from a holding register(s)

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

■ Example of read

Read operation data for 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	

7.2 Writing to a holding register

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

■ Example of write

Write 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	
Data	Register address (upper)	02h	
	Register address (lower)	4Bh	
	Value write (upper)	00h	
	Value write (lower)	50h	
Error check (lower)		F8h	Calculation result of CRC-16
Error check (upper)		6Bh	

7.3 Diagnosis

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

■ Example of diagnosis

Send arbitrary data (1234h) to the slave.

- Query

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

- Response

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

7.4 Writing to multiple holding registers

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

■ Example of write

Set the following data as acceleration 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	
Data	Register address (upper)	06h	
	Register address (lower)	04h	
	Number of registers (upper)	00h	
	Number of registers (lower)	06h	
Error check (lower)		01h	Calculation result of CRC-16
Error check (upper)		17h	

8 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.

8.1 Operation commands

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

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

■ Group (0030h/0031h)

Multiple slaves are made into a group and a query is sent to all slaves in the group at once. See p.158 for group details. The initial value is −1. When performing read or write for setting a group, set the upper and lower simultaneously.

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

* [ ]: Initial value

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

* [ ]: Initial value

■ Driver input command (007Ch/007Dh)

These are the driver input signals that can be accessed via RS-485 communication. See p.47 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.52 for each output signal.

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

Address (Hex)	Description of address *							
007Fh	bit15	bit14	bit13	bit12	bit11	bit10	bit9	bit8
	NET-OUT15 [TLC]	NET-OUT14 [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

8.2 Maintenance commands

These commands are used to reset alarms and warnings. They are also used to execute the batch processing for the non-volatile memory. All commands can be written (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."	0, 1
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)		
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 non-volatile memory, to their defaults.	
399	018Fh	All data initialization (lower) *		
400	0190h	Batch NV memory read (upper)	Reads the parameters saved in the non-volatile memory, to the RAM. All operation data and parameters previously saved in the RAM are overwritten.	
401	0191h	Batch NV memory read (lower)		
402	0192h	Batch NV memory write (upper)	Writes the parameters saved in the RAM to the non-volatile memory. The non-volatile memory can be rewritten approximately 100,000 times.	
403	0193h	Batch NV memory write (lower)		

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

■ 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.

8.3 Monitor commands

Monitor the operation speed, alarm and warning records, etc. All commands can be read (READ).

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

Register address		Name	Description	Range
Dec	Hex			
156	009Ch	Warning record 3 (upper)	Monitors the warning records.	00h to FFh
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 that have occurred in the past.	
175	00AFh	Communication error code record 1 (lower)		
176	00B0h	Communication error code record 2 (upper)		
177	00B1h	Communication error code record 2 (lower)		
178	00B2h	Communication error code record 3 (upper)		
179	00B3h	Communication error code record 3 (lower)		
180	00B4h	Communication error code record 4 (upper)		
181	00B5h	Communication error code record 4 (lower)		
182	00B6h	Communication error code record 5 (upper)		
183	00B7h	Communication error code record 5 (lower)		
184	00B8h	Communication error code record 6 (upper)		
185	00B9h	Communication error code record 6 (lower)		
186	00BAh	Communication error code record 7 (upper)		
187	00BBh	Communication error code record 7 (lower)		
188	00BCh	Communication error code record 8 (upper)		
189	00BDh	Communication error code record 8 (lower)		
190	00BEh	Communication error code record 9 (upper)		
191	00BFh	Communication error code record 9 (lower)		
192	00C0h	Communication error code record 10 (upper)		
193	00C1h	Communication error code record 10 (lower)		

Register address		Name	Description	Range
Dec	Hex			
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 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/00D5h)

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

8.4 Parameter R/W commands

Write or read parameters. All commands can be read and written (READ/WRITE).
For details on parameters, see p.97 and later.

■ Operation data

If the data is changed, a recalculation and setup will be performed after the operation is stopped.

Register address		Name	Setting range	Initial value
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
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)	1 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) ∗1∗2	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 1000 (1=0.1%) ∗3	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 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).

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

*3 For the driver which is before the specification change, the setting range is 0 to 500 (1=0.1%). Refer to p.5 for details.

■ User parameters

Register address		Name	Setting range	Initial value	Effective *1
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)			

*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)

*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				
4098	1002h	MS1 operation No. selection (upper)	0 to 63	1	B
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)			
580	0244h	Position loop gain (upper)	1 to 50	10	
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 1: Moving average	0	C
4129	1021h	Filter selection (lower)			
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)			
4133	1025h	Speed error gain 2 (lower)			
4134	1026h	Control mode (upper)	0: Normal mode 1: Current control mode	0	C
4135	1027h	Control mode (lower)			
4136	1028h	Smooth driver (upper)	0: Disable 1: Enable	1	
4137	1029h	Smooth driver (lower)			
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)			
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)			

*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)

*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				
650	028Ah	JOG starting speed (upper)	0 to 1,000,000 Hz	500	B
651	028Bh	JOG starting speed (lower)			
652	028Ch	Acceleration/deceleration type (upper)	0: Common 1: Separate	1	
653	028Dh	Acceleration/deceleration type (lower)			
654	028Eh	Acceleration/deceleration unit (upper)	0: ms/kHz 1: s	0	C
655	028Fh	Acceleration/deceleration unit (lower)			
4160	1040h	Automatic return action (upper)	0: Disable 1: Enable	0	
4161	1041h	Automatic return action (lower)			
4162	1042h	Operation speed of automatic return (upper)	1 to 1,000,000 Hz	1000	B
4163	1043h	Operation 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)			
706	02C2h	Operating speed of home-seeking (upper)	1 to 1,000,000 Hz	1000	
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)			

*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)

*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				
718	02CEh	TIM signal detection with home-seeking (upper)	0: Disable 1: Enable	0	B
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 alarm (upper)	1 to 300 (1=0.1 s)	50	A
769	0301h	Overload alarm (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)	150 to 630 (1=0.1 V)	630	
839	0347h	Overvoltage warning (lower)			
840	0348h	Undervoltage warning (upper)		180	
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)			
900	0384h	Motor rotation direction (upper)	0: Positive direction=CCW 1: Positive direction=CW	1	
901	0385h	Motor rotation direction (lower)			
902	0386h	Software overtravel (upper)	0: Disable 1: Enable	1	A
903	0387h	Software overtravel (lower)			
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 1: Enable	0	C
911	038Fh	Wrap setting (lower)			

*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)

*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				
912	0390h	Wrap setting range (upper)	1 to 8,388,607 step	1000	C
913	0391h	Wrap setting range (lower)			
960	03C0h	Data setter speed display (upper)	0: Signed 1: Absolute value	0	A
961	03C1h	Data setter speed display (lower)			
962	03C2h	Data setter edit (upper)	0: Disable 1: Enable	1	
963	03C3h	Data setter edit (lower)			
964	03C4h	Absolute-position backup system (upper)		0	C
965	03C5h	Absolute-position backup system (lower)			
4352	1100h	IN0 input function selection (upper)	See p.157.	3: HOME	
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 1: Normally closed	0	
4385	1121h	IN0 input logic level setting (lower)			
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)			
4416	1140h	OUT0 output function selection (upper)	See p.157.	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)			

*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)

*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				
4420	1144h	OUT2 output function selection (upper)	See p.157.	73: AREA1	C
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.157.	48: M0	
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)			

*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)

*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				
4468	1174h	NET-IN10 input function selection (upper)	See p.157.	10: MS2	C
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.157.	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)			
4490	118Ah	NET-OUT5 output function selection (upper)		67: READY	
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)			

*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)

*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				
4496	1190h	NET-OUT8 output function selection (upper)	See p.157.	80: S-BSY	C
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 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)			

*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)

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

- Setting range for function selection parameters

IN input function selection parameter

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	

OUT output function selection parameter

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

NET-IN input function selection parameter

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	

* These three signals cannot be set in the driver which is before the specification change. Refer to p.5 for details.

NET-OUT output function selection parameter

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

9 Group send

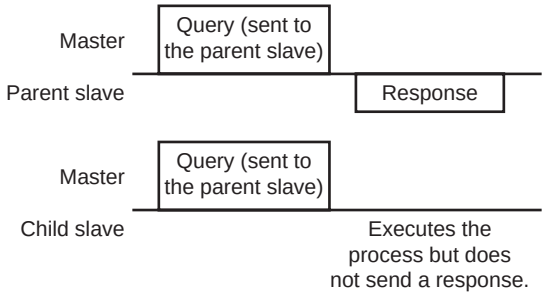
Multiple slaves are made into a group and a query is sent to all slaves in the group at once.

■ Group composition

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

■ Group address

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



- Parent slave

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

When a query is sent to the parent slave from the master, the parent slave executes the requested process and then returns a response (same as with the unicast mode).

- Child slave

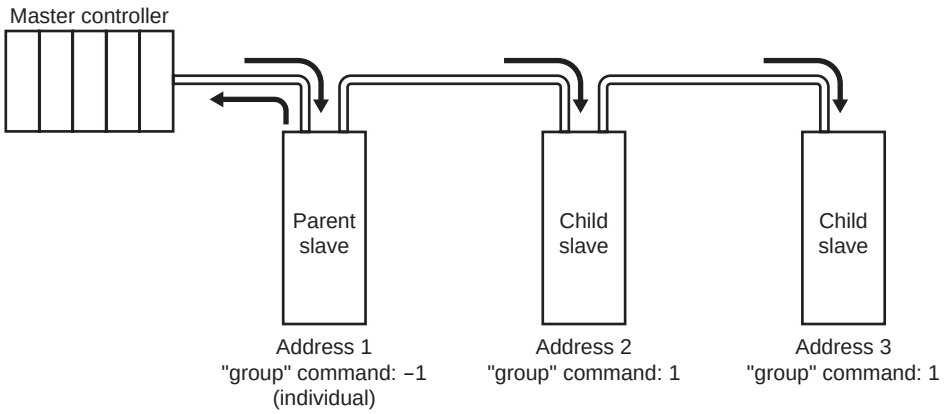
Use a "group" command to set a group address to each child slave. Change the group in the unicast mode.
When performing read or write for setting a group, set the upper and lower simultaneously.

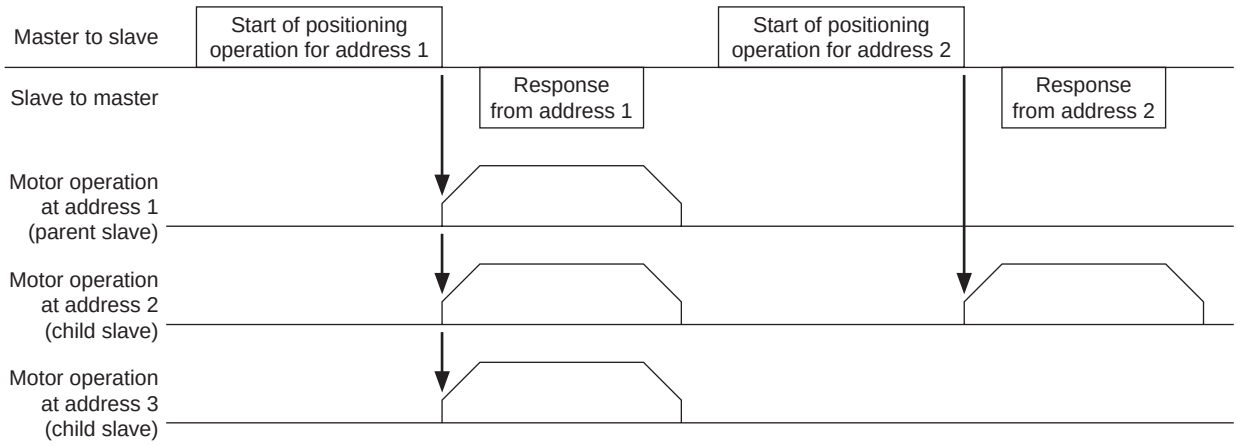
Resister address		Name	Description	READ/ WRITE	Setting range
Dec	Hex				
48	0030h	Group (upper)	Sets the group address.	R/W	−1: No group specification (Group send is not performed) 1 to 31: Group address (Address number of parent slave)
49	0031h	Group (lower)			

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

■ Function code to execute in a group send

Function code	Function
10h	Writing to multiple holding registers




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

10 Detection of communication errors

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

10.1 Communication errors

A communication error record will be saved in the RAM. You can check the communication errors using the "communication error record" command using the **MEXE02** or via RS-485 communication.

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

Type of communication error	Error code	Cause	Ref.
RS-485 communication error	84h	A transmission error was detected.	p.137
Command not yet defined	88h	An exception response (exception code 01h, 02h) was detected.	p.137.
Execution disable due to user I/F communication in progress	89h	An exception response (exception code 04h) was detected.	
Non-volatile memory processing in progress	8Ah		
Outside setting range	8Ch	An exception response (exception code 03h, 04h) was detected.	
Command execute disable	8Dh	An exception response (exception code 04h) was detected.	

10.2 Alarms and warnings

When an alarm generates, the 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.

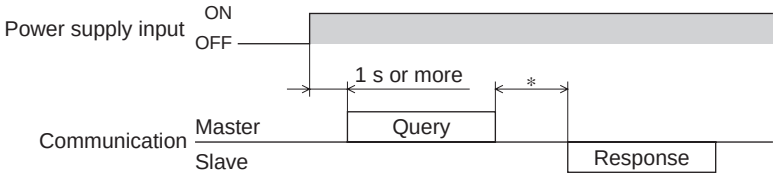
Description of error	Description
Warning	A warning generates when one RS-485 communication error (84h) has been detected. If normal reception occurs while the warning is present, the warning will be reset automatically.
Alarm	An alarm generates when a RS-485 communication error (84h) has been detected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

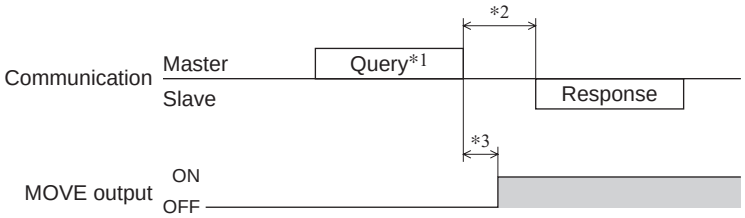
11 Timing charts

■ Communication start



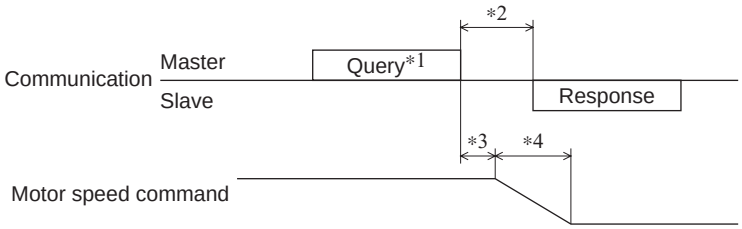
* Tb2 (transmission waiting time) + C3.5 (silent interval) + command processing time

■ Operation start



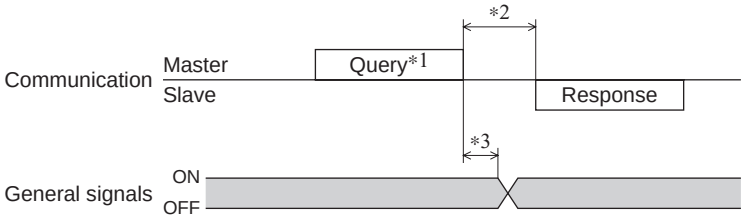
*1 A message including a query to start operation via RS-485 communication.
*2 Tb2 (transmission waiting time) + C3.5 (silent interval) + command processing time
*3 C3.5 (silent interval) + 4 ms or less

■ Operation stop, speed change



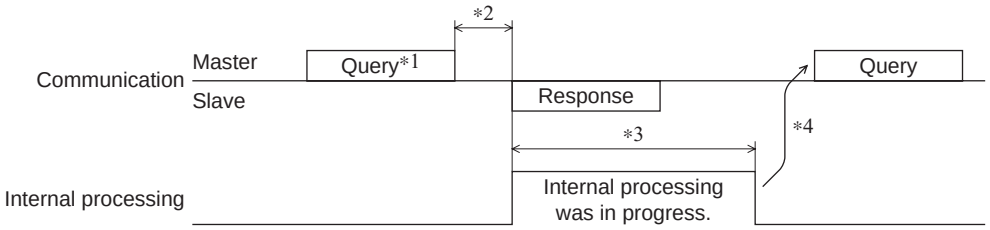
*1 A message including a query to stop operation and another to change the speed via RS-485 communication.
*2 Tb2 (transmission waiting time) + C3.5 (silent interval) + command processing time
*3 The specific time varies depending on the command speed.
*4 The deceleration method to be applied at the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

■ General signals



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

■ Configuration



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

6 Method of control via industrial network

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

Table of contents

1 Method of control via CC-Link communication

See the following explanation when using the **AR** Series FLEX DC power input built-in controller type in combination with the network converter **NETC01-CC** via CC-Link communication.
Refer to "3 Details of remote I/O" on p.184 and "4 Command code list" on p.186 for remote I/O and command code.

1.1 Guidance

If you are new to the **AR** Series FLEX DC 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** USER MANUAL for how to set the parameter.

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

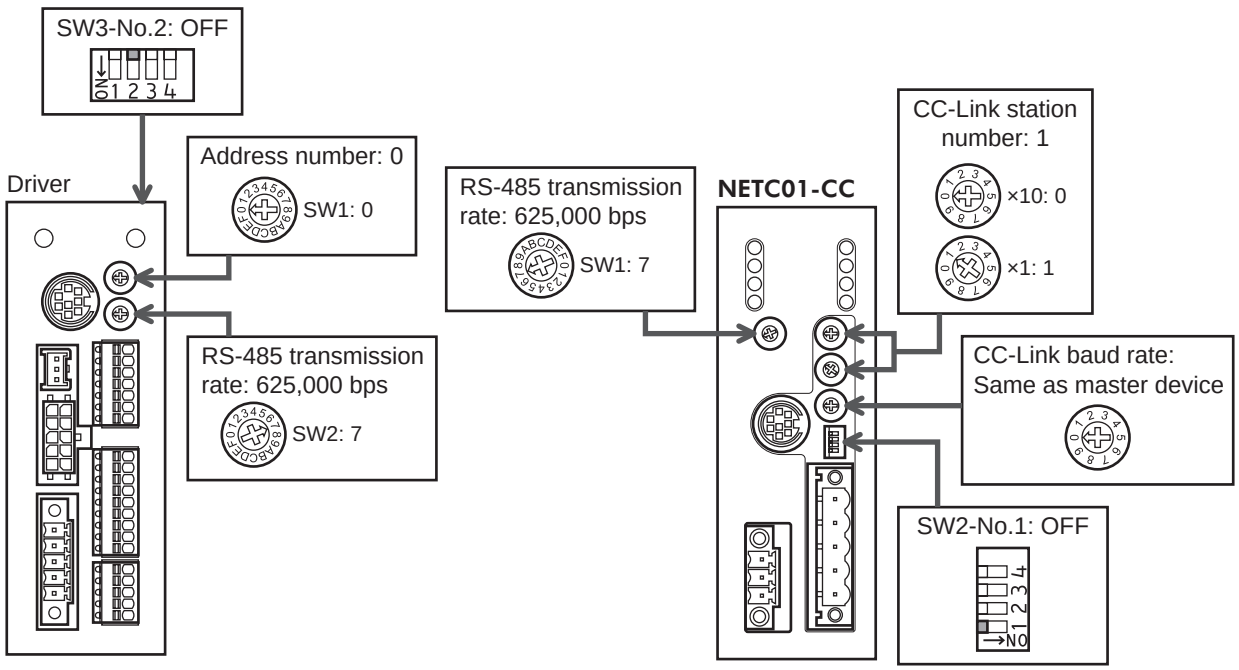
■ Using the parameter

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.

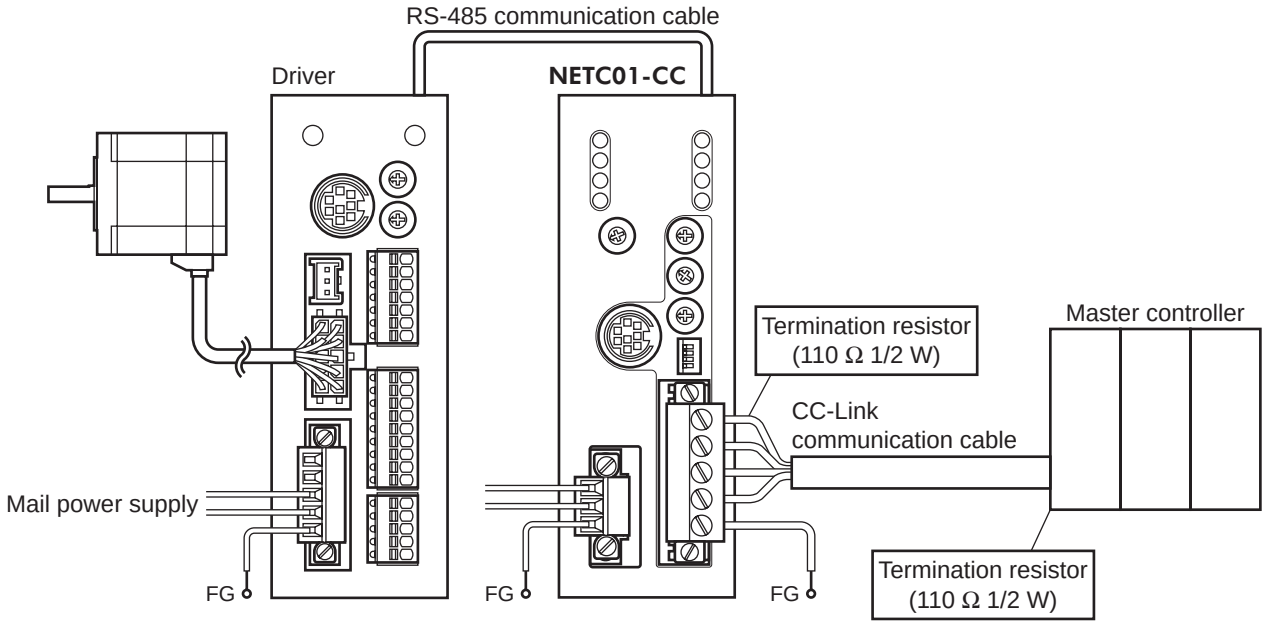
Note "Connection" parameters will be enabled after the power is cycled.

■ Using the switches

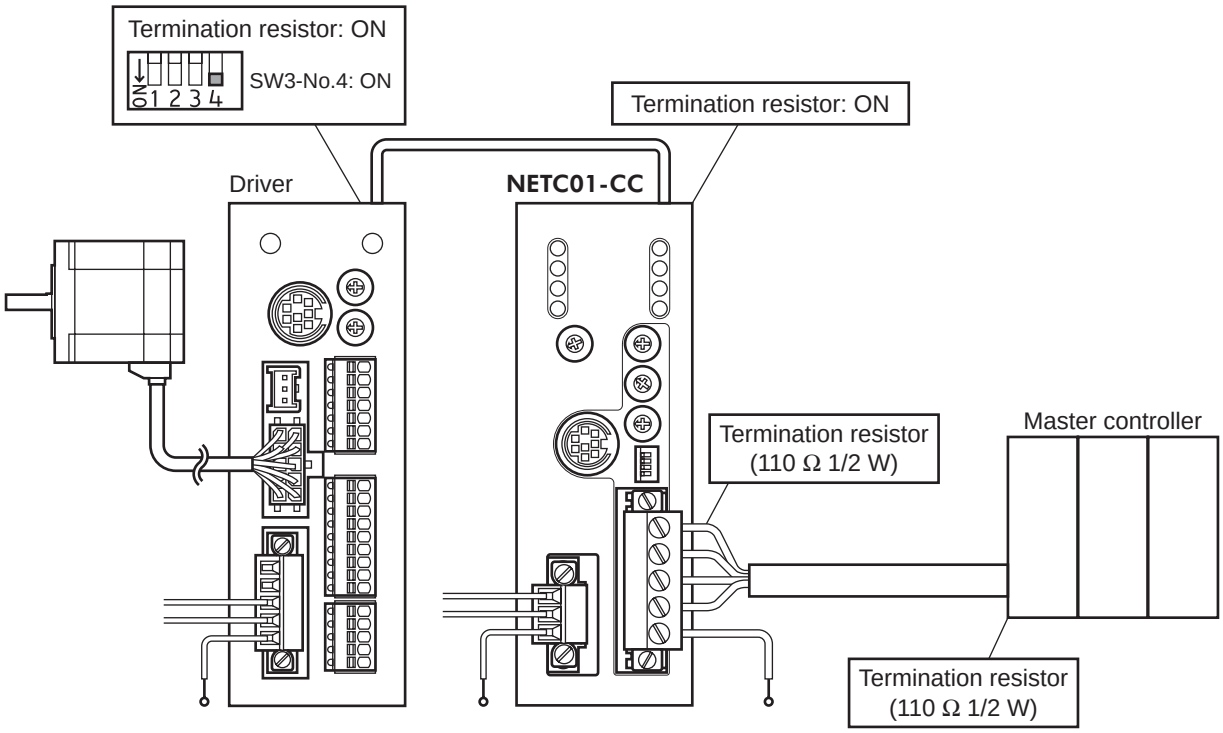
- Setting condition of driver
  - Address number of the driver: 0
  - RS-485 transmission rate: 625,000 bps
  - SW3-No.2 of the function setting switch: OFF
- Setting condition of **NETC01-CC**
  - CC-Link station number: 1
  - RS-485 transmission rate: 625,000 bps
  - CC-Link baud rate: Same as the master station
  - Operation mode: 6 axes connection mode



STEP 2 Check the connection

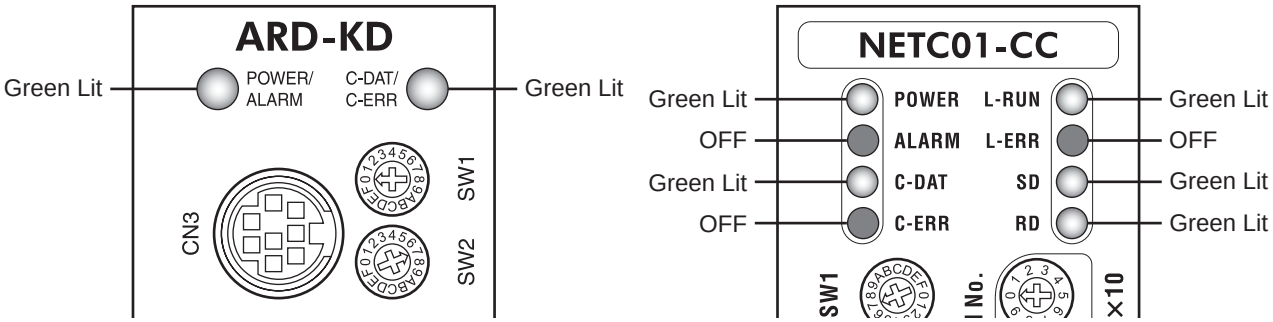


STEP 3 Check the termination resistor



STEP 4 Turn on the power and check the setting

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



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

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

Perform continuous operation by turning ON the FWD of the address number 0 for remote I/O of CC-Link communication.

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

RY (Master to **NETC01-CC**)		
Device No.	Signal name	Initial value
RY8	NET-IN8	MS0
RY9	NET-IN9	MS1
RYA	NET-IN10	MS2
RYB	NET-IN11	SSTART
RYC	NET-IN12	+JOG
RYD	NET-IN13	−JOG
RYE	NET-IN14	FWD
RYF	NET-IN15	RVS

STEP 6 Were you able to operate the motor properly?

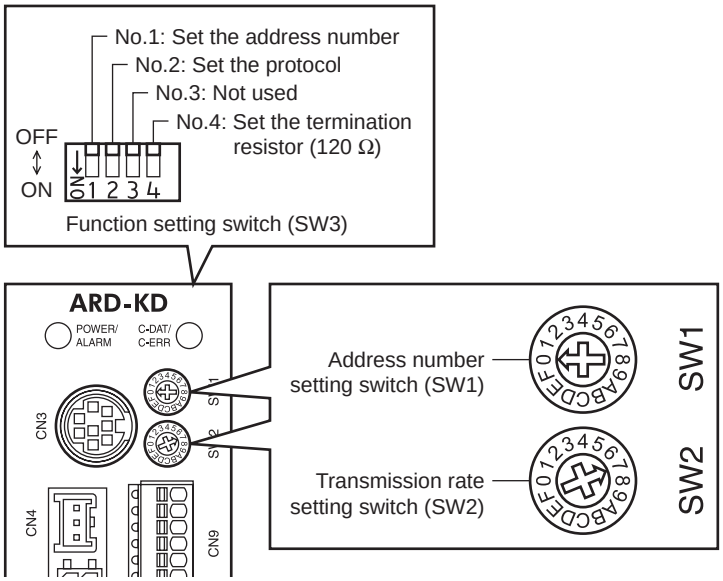
How did it go? Were you able to operate the motor properly? If the motor does not function, check the following points:

- 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 operation data set correctly?
- Is the motor excited? Or is the excitation setting correct?
- 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 network converter **NETC01-CC** USER MANUAL and following pages.

1.2 Setting the switches

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



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 SW3-No.2.
Turn this switch OFF when controlling via the network converter.
Factory setting OFF (Network converter)

■ Address number (slave address)

Set the address number (slave address) using the address number setting switch (SW1) and SW3-No.1 of the function setting switch. Make sure each address number (slave address) you set for each driver is unique.
Factory setting SW1: 0, SW3-No.1: OFF (Address number 0)

Address number (slave address)	0	1	2	3	4	5	6	7	8	9	10	11
SW1	0	1	2	3	4	5	6	7	8	9	A	B
SW3-No.1	OFF											
Connection mode	6 axes connection mode						12 axes connection mode					

■ Transmission rate

Set the transmission rate to 625,000 bps using the transmission rate setting switch (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 network converter.
Turn SW3-No.4 of the function setting switch ON to set the termination resistor for RS-485 communication (120 Ω).
Factory setting OFF (termination resistor disabled)

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

1.3 Remote register list

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

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

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

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

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

■ Assignment list of remote I/O

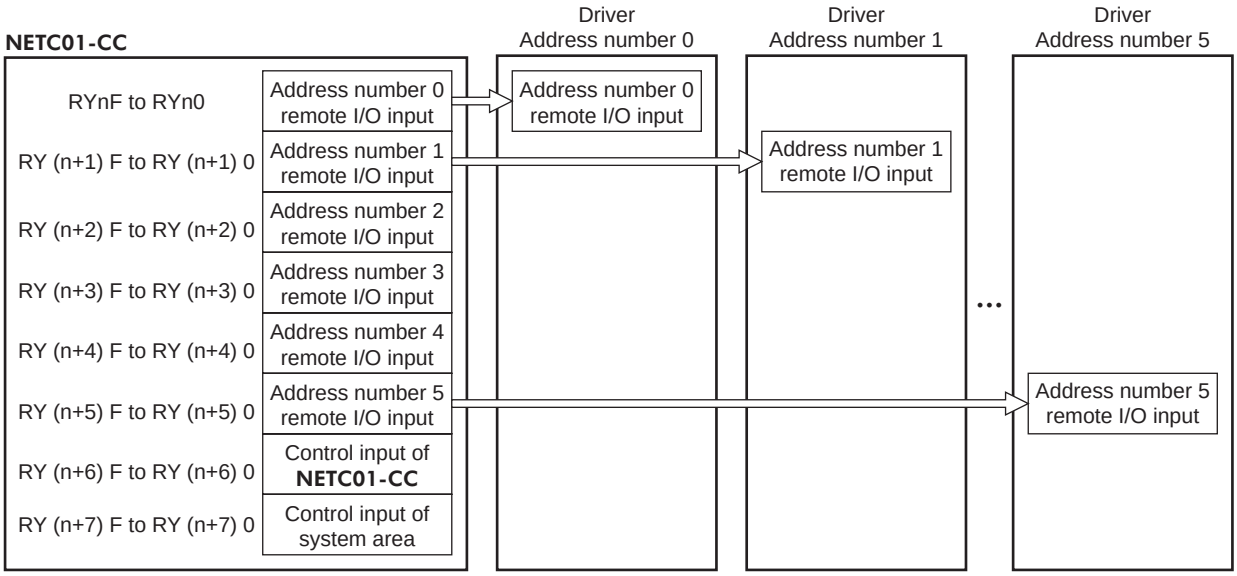
Command RY (Master to **NETC01-CC**)	
Device No.	Description
RYn7 to RYn0	Address number "0" remote I/O input
RYnF to RYn8	
RY (n+1) 7 to RY (n+1) 0	Address number "1" remote I/O input
RY (n+1) F to RY (n+1) 8	
RY (n+2) 7 to RY (n+2) 0	Address number "2" remote I/O input
RY (n+2) F to RY (n+2) 8	
RY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

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

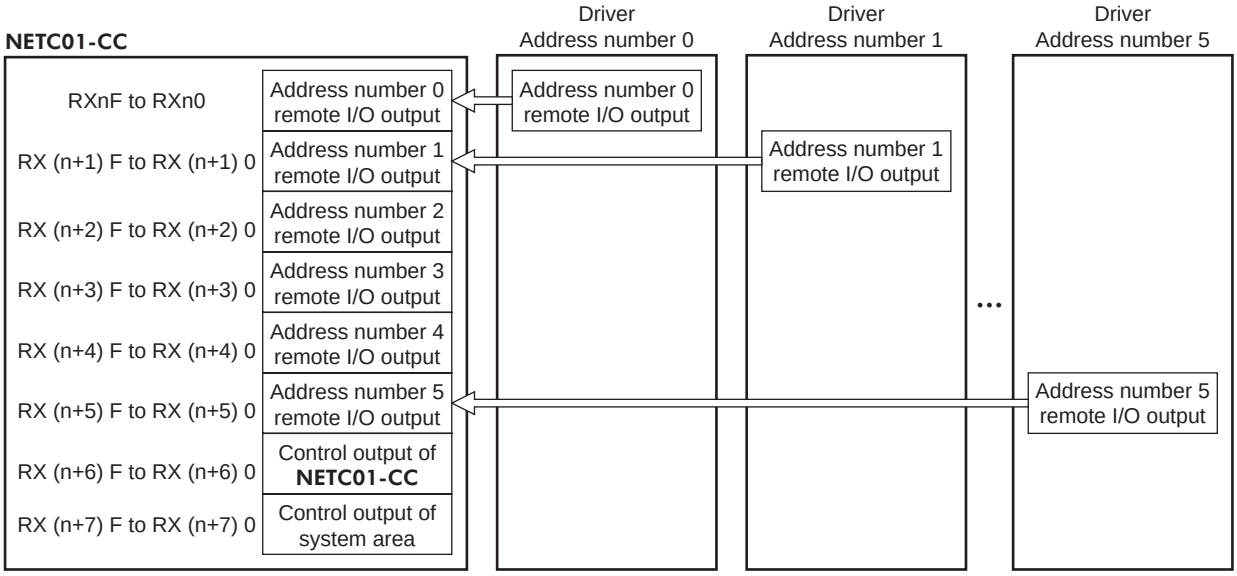
* See the network converter **NETC01-CC** USER MANUAL for details.

■ Input/output of remote I/O

• Remote I/O input



• Remote I/O output



■ Details of remote I/O assignment

	Command RY (Master to **NETC01-CC**)			Response RX (**NETC01-CC** to master)		
	Device No.	Signal name	Description *	Device No.	Signal name	Description *
Address number "0"	RY (n) 0	NET-IN0	[M0]	RX (n) 0	NET-OUT0	[M0_R]
	RY (n) 1	NET-IN1	[M1]	RX (n) 1	NET-OUT1	[M1_R]
	RY (n) 2	NET-IN2	[M2]	RX (n) 2	NET-OUT2	[M2_R]
	RY (n) 3	NET-IN3	[START]	RX (n) 3	NET-OUT3	[START_R]
	RY (n) 4	NET-IN4	[HOME]	RX (n) 4	NET-OUT4	[HOME-P]
	RY (n) 5	NET-IN5	[STOP]	RX (n) 5	NET-OUT5	[READY]
	RY (n) 6	NET-IN6	[FREE]	RX (n) 6	NET-OUT6	[WNG]
	RY (n) 7	NET-IN7	[Not used]	RX (n) 7	NET-OUT7	[ALM]
	RY (n) 8	NET-IN8	[MS0]	RX (n) 8	NET-OUT8	[S-BSY]
	RY (n) 9	NET-IN9	[MS1]	RX (n) 9	NET-OUT9	[AREA1]
	RY (n) A	NET-IN10	[MS2]	RX (n) A	NET-OUT10	[AREA2]
	RY (n) B	NET-IN11	[SSTART]	RX (n) B	NET-OUT11	[AREA3]
	RY (n) C	NET-IN12	[+JOG]	RX (n) C	NET-OUT12	[TIM]
	RY (n) D	NET-IN13	[−JOG]	RX (n) D	NET-OUT13	[MOVE]
	RY (n) E	NET-IN14	[FWD]	RX (n) E	NET-OUT14	[END]
	RY (n) F	NET-IN15	[RVS]	RX (n) F	NET-OUT15	[TLC]
Address number "1"	RY (n+1) 0 to RY (n+1) F	NET-IN0 to NET-IN15	Same as Address number "0"	RX (n+1) 0 to RX (n+1) F	NET-OUT0 to NET-OUT15	Same as Address number "0"
Address number "2"	RY (n+2) 0 to RY (n+2) F	NET-IN0 to NET-IN15	Same as Address number "0"	RX (n+2) 0 to RX (n+2) F	NET-OUT0 to NET-OUT15	Same as Address number "0"
Address number "3"	RY (n+3) 0 to RY (n+3) F	NET-IN0 to NET-IN15	Same as Address number "0"	RX (n+3) 0 to RX (n+3) F	NET-OUT0 to NET-OUT15	Same as Address number "0"
Address number "4"	RY (n+4) 0 to RY (n+4) F	NET-IN0 to NET-IN15	Same as Address number "0"	RX (n+4) 0 to RX (n+4) F	NET-OUT0 to NET-OUT15	Same as Address number "0"
Address number "5"	RY (n+5) 0 to RY (n+5) F	NET-IN0 to NET-IN15	Same as Address number "0"	RX (n+5) 0 to RX (n+5) F	NET-OUT0 to NET-OUT15	Same as Address number "0"
NETC01-CC control input/ status output	RY (n+6) 0	M-REQ0	Monitor request 0	RX (n+6) 0	M-DAT0	During execution of monitor 0
	RY (n+6) 1	M-REQ1	Monitor request 1	RX (n+6) 1	M-DAT1	During execution of monitor 1
	RY (n+6) 2	M-REQ2	Monitor request 2	RX (n+6) 2	M-DAT2	During execution of monitor 2
	RY (n+6) 3	M-REQ3	Monitor request 3	RX (n+6) 3	M-DAT3	During execution of monitor 3
	RY (n+6) 4	M-REQ4	Monitor request 4	RX (n+6) 4	M-DAT4	During execution of monitor 4
	RY (n+6) 5	M-REQ5	Monitor request 5	RX (n+6) 5	M-DAT5	During execution of monitor 5
	RY (n+6) 6	−	−	RX (n+6) 6	WNG	Warning
	RY (n+6) 7	ARM-RST	Reset alarm	RX (n+6) 7	ALM	Alarm
	RY (n+6) 8	−	−	RX (n+6) 8	C-SUC	During execution of RS-485 communication
	RY (n+6) 9			RX (n+6) 9	−	−
	RY (n+6) A			RX (n+6) A		
	RY (n+6) B			RX (n+6) B		
	RY (n+6) C	D-REQ	Command execution request	RX (n+6) C	D-END	Command processing completion
	RY (n+6) D	−	−	RX (n+6) D	R-ERR	Register error
	RY (n+6) E			RX (n+6) E	S-BSY	During system processing

* [ ]: Initial value

	Command RY (Master to **NETC01-CC**)			Response RX (**NETC01-CC** to master)		
	Device No.	Signal name	Description *	Device No.	Signal name	Description *
NETC01-CC control input/ status output	RY (n+6) F	−	−	RX (n+6) F	−	−
System area control input/ status output	RY (n+7) 0 to RY (n+7) F	−	Cannot be used	RX (n+7) 0 to RX (n+7) A	−	Cannot be used
				RX (n+7) B	CRD	Remote station communication ready
				RX (n+7) C to RX (n+7) F	−	Cannot be used

* [ ]: Initial value

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

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

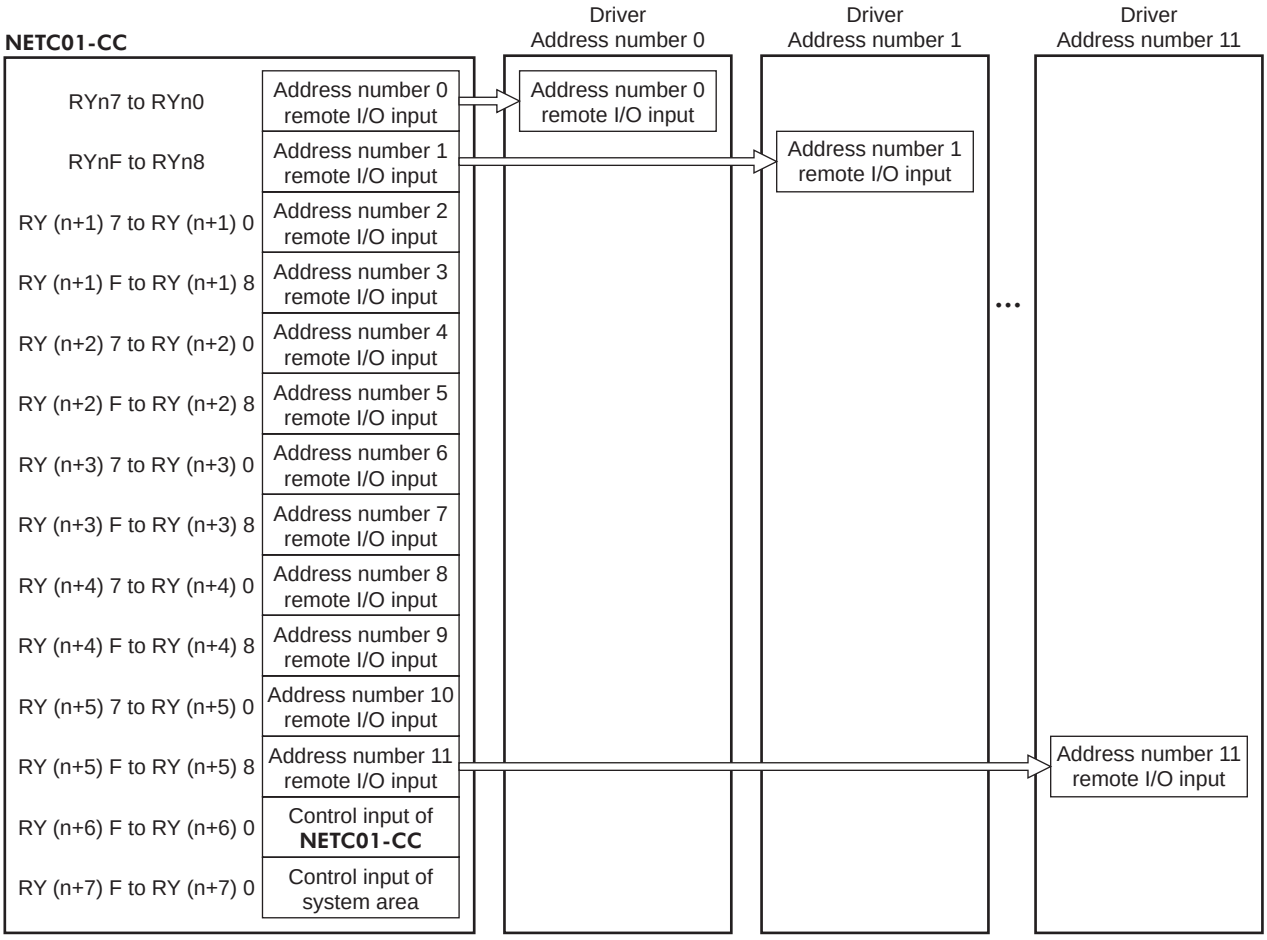
■ Assignment list of remote I/O

Command RY (Master to **NETC01-CC**)		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	

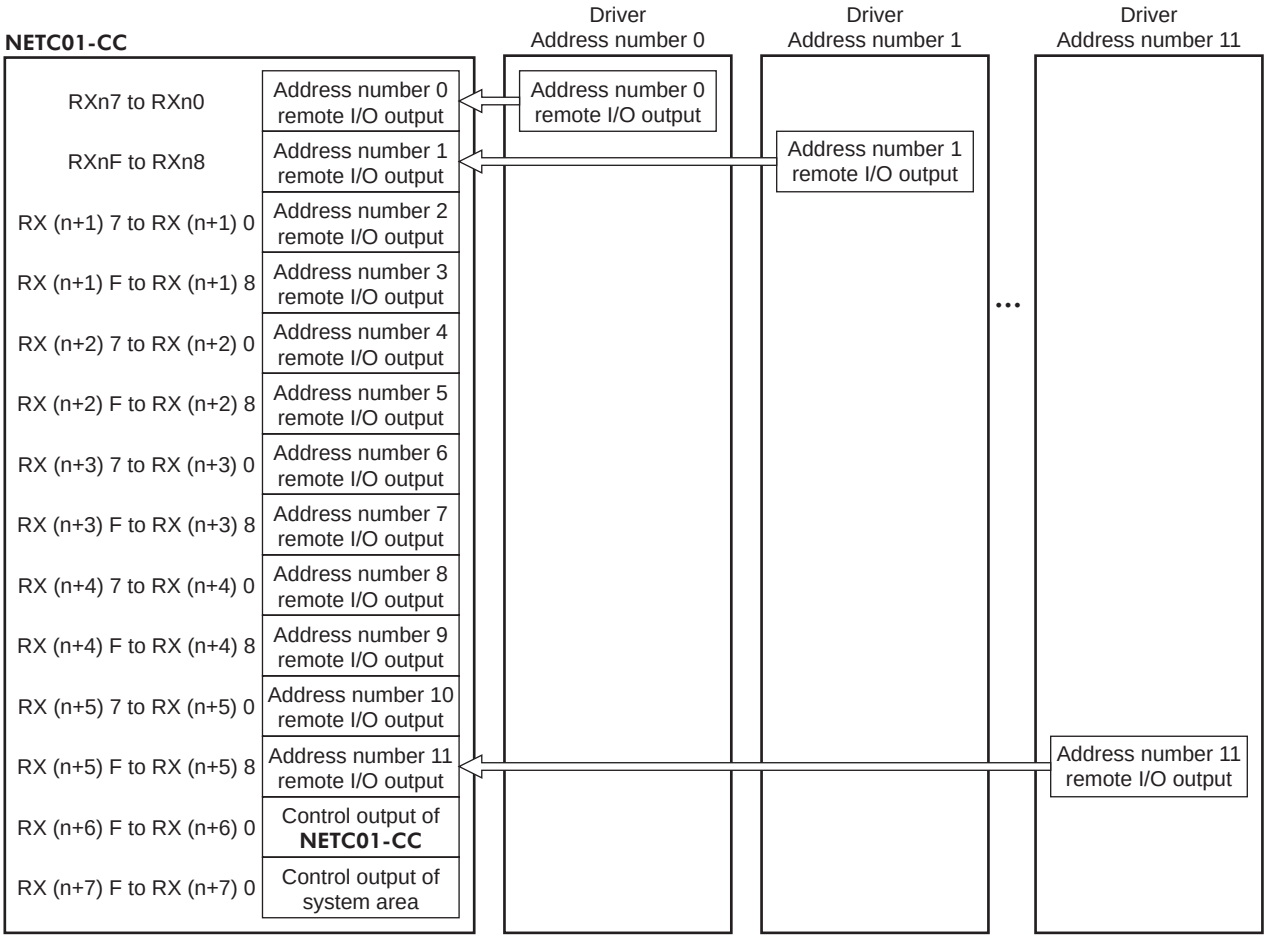
* See the network converter **NETC01-CC** USER MANUAL for details.

■ Input/output of remote I/O

- Remote I/O input



- Remote I/O output



■ Details of remote I/O assignment

	Command RY (Master to **NETC01-CC**)			Response RX (**NETC01-CC** to master)		
	Device No.	Signal name	Description *	Device No.	Signal name	Description *
Address number "0"	RY (n) 0	NET-IN0	[M0]	RX (n) 0	NET-OUT0	[M0_R]
	RY (n) 1	NET-IN1	[M1]	RX (n) 1	NET-OUT1	[M1_R]
	RY (n) 2	NET-IN2	[M2]	RX (n) 2	NET-OUT2	[M2_R]
	RY (n) 3	NET-IN3	[START]	RX (n) 3	NET-OUT3	[START_R]
	RY (n) 4	NET-IN4	[HOME]	RX (n) 4	NET-OUT4	[HOME-P]
	RY (n) 5	NET-IN5	[STOP]	RX (n) 5	NET-OUT5	[READY]
	RY (n) 6	NET-IN6	[FREE]	RX (n) 6	NET-OUT6	[WNG]
	RY (n) 7	NET-IN7	[Not used]	RX (n) 7	NET-OUT7	[ALM]
Address number "1"	RY (n) 8	NET-IN0	[M0]	RX (n) 8	NET-OUT0	[M0_R]
	RY (n) 9	NET-IN1	[M1]	RX (n) 9	NET-OUT1	[M1_R]
	RY (n) A	NET-IN2	[M2]	RX (n) A	NET-OUT2	[M2_R]
	RY (n) B	NET-IN3	[START]	RX (n) B	NET-OUT3	[START_R]
	RY (n) C	NET-IN4	[HOME]	RX (n) C	NET-OUT4	[HOME-P]
	RY (n) D	NET-IN5	[STOP]	RX (n) D	NET-OUT5	[READY]
	RY (n) E	NET-IN6	[FREE]	RX (n) E	NET-OUT6	[WNG]
	RY (n) F	NET-IN7	[Not used]	RX (n) F	NET-OUT7	[ALM]
Address number "2"	RY (n+1) 0 to RY (n+1) 7	NET-IN0 to NET-IN7	Same as Address number "0"	RX (n+1) 0 to RX (n+1) 7	NET-OUT0 to NET-OUT7	Same as Address number "0"
Address number "3"	RY (n+1) 8 to RY (n+1) F	NET-IN0 to NET-IN7	Same as Address number "1"	RX (n+1) 8 to RX (n+1) F	NET-OUT0 to NET-OUT7	Same as Address number "1"
Address number "4"	RY (n+2) 0 to RY (n+2) 7	NET-IN0 to NET-IN7	Same as Address number "0"	RX (n+2) 0 to RX (n+2) 7	NET-OUT0 to NET-OUT7	Same as Address number "0"
Address number "5"	RY (n+2) 8 to RY (n+2) F	NET-IN0 to NET-IN7	Same as Address number "1"	RX (n+2) 8 to RX (n+2) F	NET-OUT0 to NET-OUT7	Same as Address number "1"
Address number "6"	RY (n+3) 0 to RY (n+3) 7	NET-IN0 to NET-IN7	Same as Address number "0"	RX (n+3) 0 to RX (n+3) 7	NET-OUT0 to NET-OUT7	Same as Address number "0"
Address number "7"	RY (n+3) 8 to RY (n+3) F	NET-IN0 to NET-IN7	Same as Address number "1"	RX (n+3) 8 to RX (n+3) F	NET-OUT0 to NET-OUT7	Same as Address number "1"
Address number "8"	RY (n+4) 0 to RY (n+4) 7	NET-IN0 to NET-IN7	Same as Address number "0"	RX (n+4) 0 to RX (n+4) 7	NET-OUT0 to NET-OUT7	Same as Address number "0"
Address number "9"	RY (n+4) 8 to RY (n+4) F	NET-IN0 to NET-IN7	Same as Address number "1"	RX (n+4) 8 to RX (n+4) F	NET-OUT0 to NET-OUT7	Same as Address number "1"
Address number "10"	RY (n+5) 0 to RY (n+5) 7	NET-IN0 to NET-IN7	Same as Address number "0"	RX (n+5) 0 to RX (n+5) 7	NET-OUT0 to NET-OUT7	Same as Address number "0"
Address number "11"	RY (n+5) 8 to RY (n+5) F	NET-IN0 to NET-IN7	Same as Address number "1"	RX (n+5) 8 to RX (n+5) F	NET-OUT0 to NET-OUT7	Same as Address number "1"
NETC01-CC control input/ status output	RY (n+6) 0	M-REQ0	Monitor request 0	RX (n+6) 0	M-DAT0	During execution of monitor 0
	RY (n+6) 1	M-REQ1	Monitor request 1	RX (n+6) 1	M-DAT1	During execution of monitor 1
	RY (n+6) 2	M-REQ2	Monitor request 2	RX (n+6) 2	M-DAT2	During execution of monitor 2
	RY (n+6) 3	M-REQ3	Monitor request 3	RX (n+6) 3	M-DAT3	During execution of monitor 3
	RY (n+6) 4	M-REQ4	Monitor request 4	RX (n+6) 4	M-DAT4	During execution of monitor 4

* [ ]: Initial value

	Command RY (Master to **NETC01-CC**)			Response RX (**NETC01-CC** to master)		
	Device No.	Signal name	Description *	Device No.	Signal name	Description *
NETC01-CC control input/ status output	RY (n+6) 5	M-REQ5	Monitor request 5	RX (n+6) 5	M-DAT5	During execution of monitor 5
	RY (n+6) 6	–	–	RX (n+6) 6	WNG	Warning
	RY (n+6) 7	ARM-RST	Reset alarm	RX (n+6) 7	ALM	Alarm
	RY (n+6) 8	–	–	RX (n+6) 8	C-SUC	During execution of RS-485 communication
	RY (n+6) 9			RX (n+6) 9	–	–
	RY (n+6) A			RX (n+6) A		
	RY (n+6) B			RX (n+6) B		
	RY (n+6) C	D-REQ	Command execution request	RX (n+6) C	D-END	Command processing completion
	RY (n+6) D	–	–	RX (n+6) D	R-ERR	Register error
	RY (n+6) E			RX (n+6) E	S-BSY	During system processing
	RY (n+6) F			RX (n+6) F	–	–
System area control input/ status output	RY (n+7) 0 to RY (n+7) F	–	Cannot be used	RX (n+7) 0 to RX (n+7) A	–	Cannot be used
				RX (n+7) B	CRD	Remote station communication ready
				RX (n+7) C to RX (n+7) F	–	Cannot be used

* [ ]: Initial value

2 Method of control via MECHATROLINK communication

See the following explanation when using the **AR** Series FLEX DC power input built-in controller type in combination with the network converter **NETC01-M2** or **NETC01-M3**, via MECHATROLINK communication. Refer to "3 Details of remote I/O" on p.184 and "4 Command code list" on p.186 for remote I/O and command code.

2.1 Guidance

If you are new to the **AR** Series FLEX DC 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.

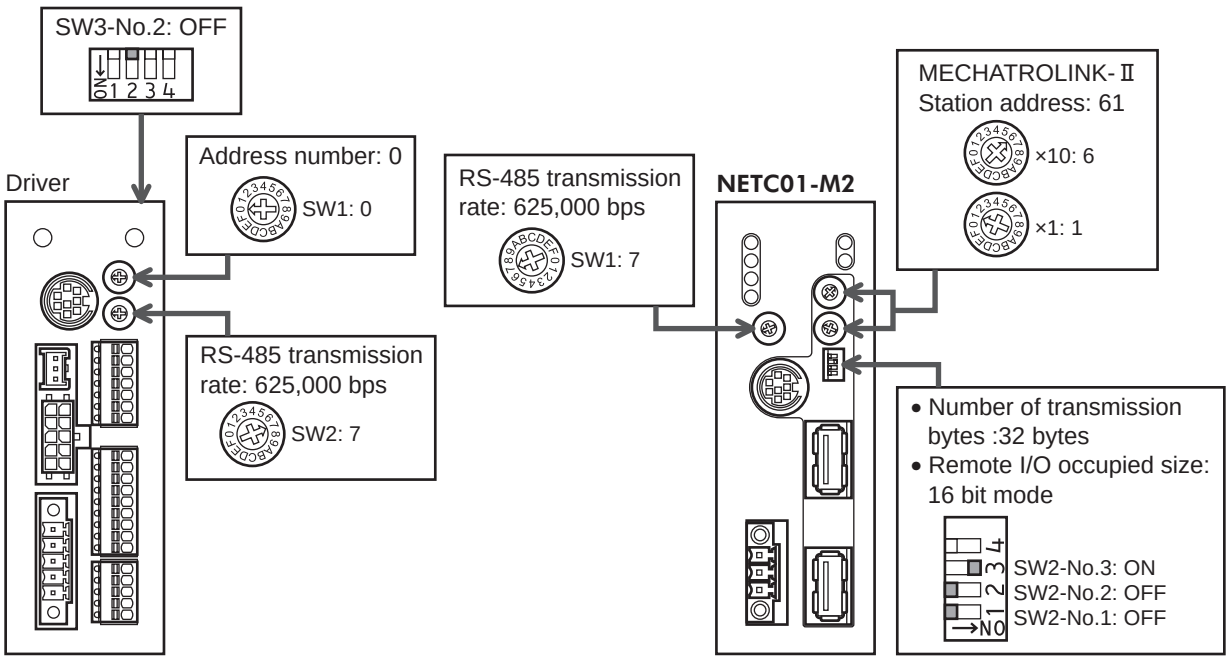
■ Using the parameter

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.

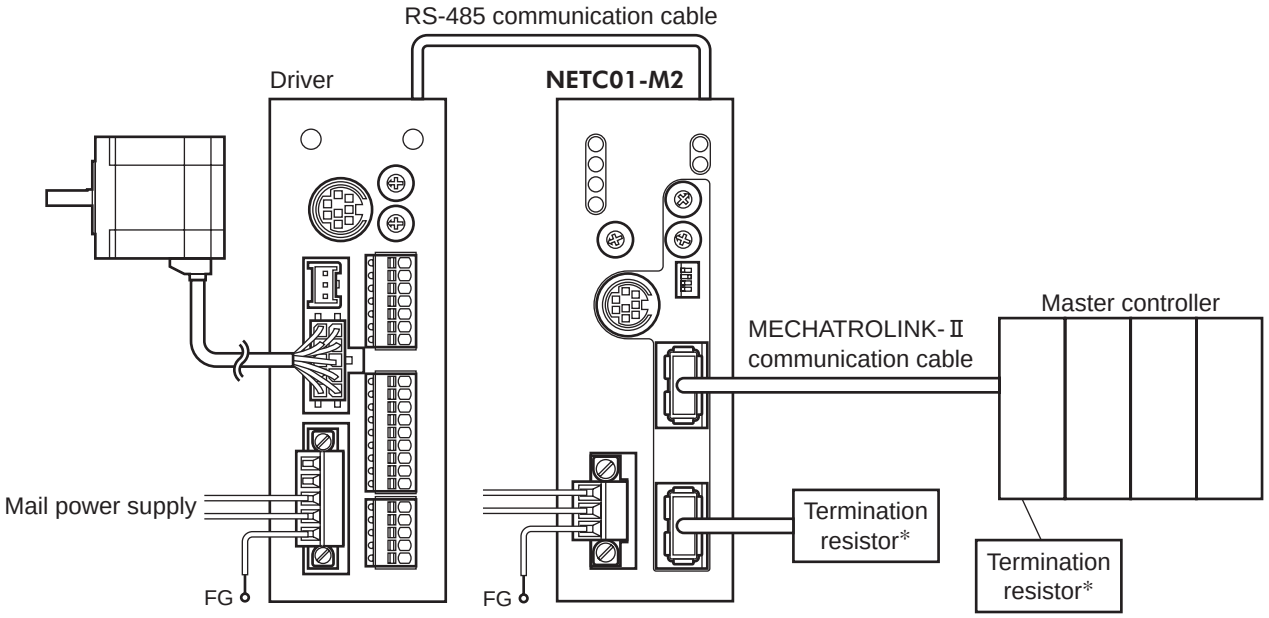
Note
- “Communication” parameters will be enabled after the power is cycled.
- When setting the parameters of the **NETC01-M2**, use the **OPX-2A** or **MEXE02**.

■ Using the switches

- Setting condition of driver
  - Address number of the driver: 0
  - RS-485 transmission rate: 625,000 bps
  - SW3-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

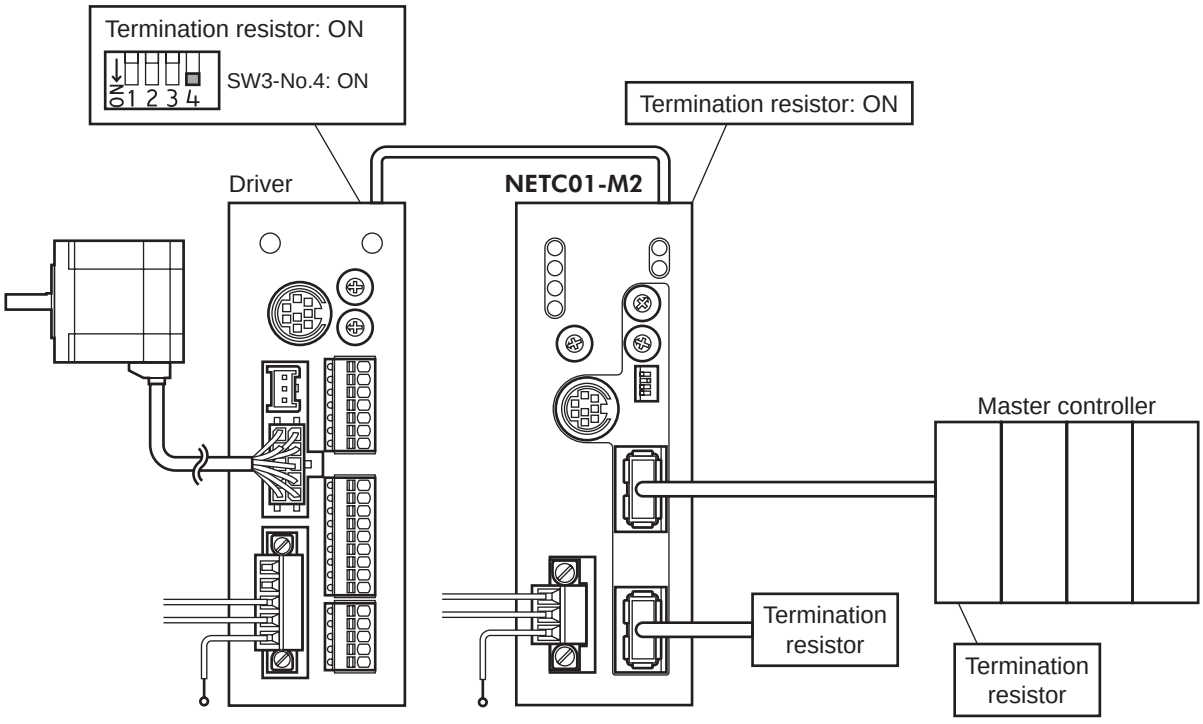


STEP 2 Check the connection



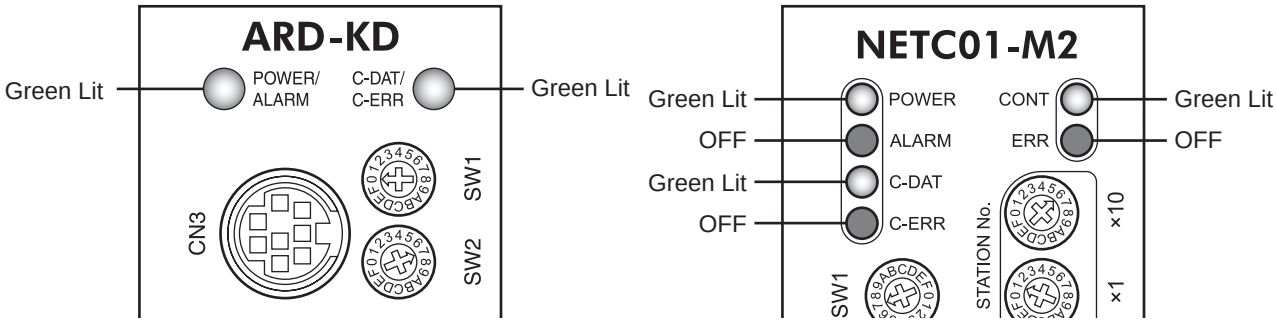
* It is not necessary for the **NETC01-M3**.

STEP 3 Check the termination resistor



STEP 4 Turn on the power and check the setting

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



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

STEP 5 Continuous operation

1. Control the I/O signal of the driver using the I/O command (DATA_RWA: 50h) of MECHATROLINK-II communication.
2. Perform continuous operation by turning ON the FWD of the address number 0.

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?

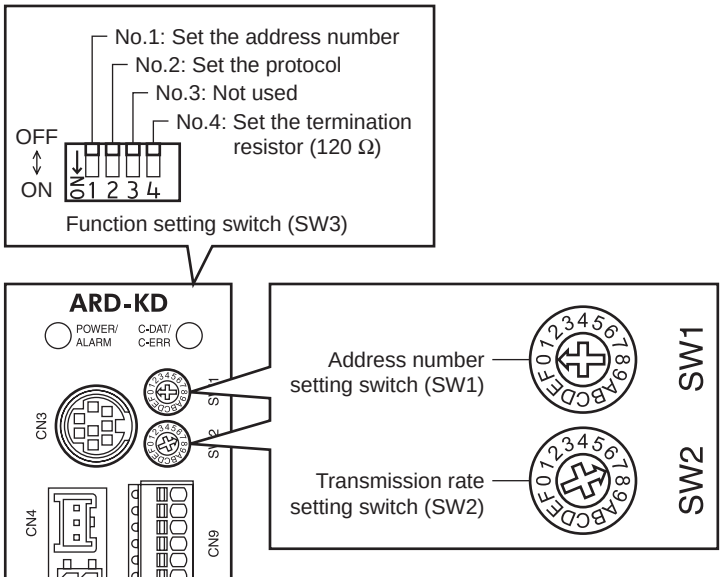
How did it go? Were you able to operate the motor properly? If the motor does not function, check the following points:

- 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/III communication error)
- Is the operation data set correctly?
- Is the motor excited? Or is the excitation setting correct?
- 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 network converter **NETC01-M2** USER MANUAL and following pages.

2.2 Setting the switches

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



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 SW3-No.2.
Turn this switch OFF when controlling via the network converter.
Factory setting OFF (Network converter)

■ Address number (slave address)

Set the address number (slave address) using the address number setting switch (SW1) and SW3-No.1 of the function setting switch. Make sure each address number (slave address) you set for each driver is unique.
Factory setting SW1: 0, SW3-No.1: OFF (Address number 0)

Address number (slave address)	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
SW1	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
SW3-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 network converter.
Turn SW3-No.4 of the function setting switch ON to set the termination resistor for RS-485 communication (120 Ω).
Factory setting OFF (termination resistor disabled)

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

2.3 I/O field map for the NETC01-M2

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

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

2.4 I/O field map for the NETC01-M3

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

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

2.5 Communication format

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

■ Remote I/O input

For details on remote I/O, refer to p.184.

- 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]

[ ]: Initial value

- 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]

* [ ]: Initial value

■ Remote I/O output

- 8 axes connection mode [16 bit mode]

bit15	bit14	bit13	bit12	bit11	bit10	bit9	bit8
NET-OUT15 [TLC]	NET-OUT14 [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

- 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]

* [ ]: Initial value

■ 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).	–

3 Details of remote I/O

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

3.1 Input signals to the driver

The following input signals can be assigned to the NET-IN0 to NET-IN15 of remote I/O using the parameter.
See the following table for the assignments of the NET-IN0 to NET-IN15.
For details on parameter, refer to "I/O function [RS-485] parameter" on p.103.

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 1: Operation
RVS	Continuous operation in the negative direction.	
HOME	Return-to-home operation.	0: No operation 1: Start operation
START	Positioning operation.	
SSTART	Sequential positioning operation.	
+JOG	JOG operation in the positive direction.	
−JOG	JOG operation in the negative direction.	
MS0 to MS5	Perform direct positioning operation of the operation data No. set by the I/O parameter.	
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 the motor	0: No operation 1: Stop operation
ALM-RST *	Reset of the current alarm.	0: No operation 1: Reset alarm
P-PRESET *	Position preset.	0: No operation 1: Execute preset
P-CLR *	Reset of the absolute position error alarm.	0: No operation 1: Reset alarm
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. See p.48 for details on the combination.	0: OFF 1: ON (Operation data No.0 to 63 can be selected.)

* These three signals cannot be set in the driver which is before the specification change. Refer to p.5 for details.

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).

3.2 Output signals from the driver

The following output signals can be assigned to the NET-OUT0 to NET-OUT15 of remote I/O using the parameter.
See the following table for the assignments of the NET-OUT0 to NET-OUT15.
For details on parameter, refer to "I/O function [RS-485] parameter" on p.103.

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.	
+LS_R	Output in response to the +LS.	
−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

4 Command code list

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

4.1 Group function

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

■ Group composition

A group consists of one parent slave and child slaves.

■ Group address

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

- Parent slave

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

- Child slave

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

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

■ Group setting

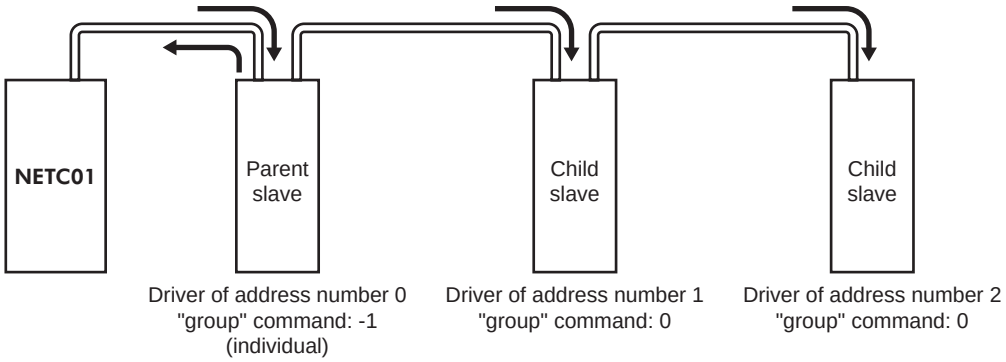
The group setting is not saved in the non-volatile memory even when the maintenance command "batch NV memory write" executes.

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

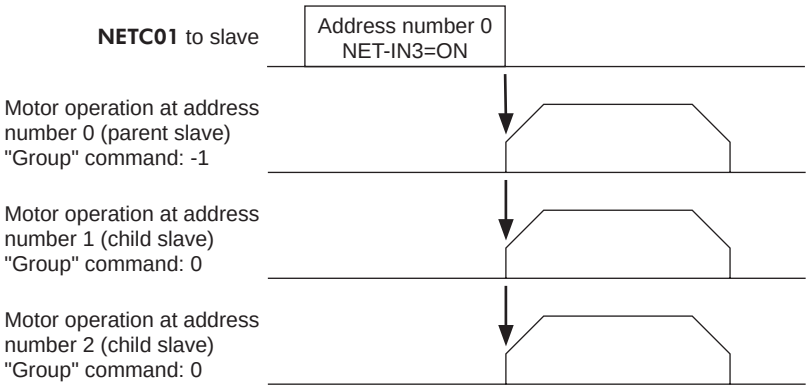
* Set in the 0 to 11 range when using the **NETC01-CC**, and set in the 0 to 15 range when using the **NETC01-M2** or **NETC01-M3**.

■ Example for setting of the group function

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



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



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

4.2 Maintenance command

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

Command code	Name	Description	Setting range
30C0h	Reset alarm	Resets the alarms that are present.	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	Update the command position to the value of the "preset position" parameter.	
30C6h	Configuration	Executes the parameter recalculation and the setup.	
30C7h	All data initialization	Resets the parameters saved in the non-volatile memory to the initial value. Note that “communication parity”, “communication stop bit” and “transmission waiting time” parameters are not initialized.	
30C8h	Batch NV memory read	Reads the parameters saved in the non-volatile memory, to the RAM. All operation data and parameters previously saved in the RAM are overwritten.	
30C9h	Batch NV memory write	Writes the parameters saved in the RAM to the non-volatile memory.	

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

4.3 Monitor command

These commands are used to monitor the driver condition.

Command code	Name	Description
2040h	Present alarm	Monitors the present alarm code.
2041h	Alarm record 1	Monitors the alarm records 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 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

4.4 Operation data

Up to 64 operation data can be set (data Nos.0 to 63).
When the operation data is changed, a recalculation and setup will be performed after the operation is stopped and the changed value will be set.

Command code		Description	Setting range	Initial value
Read	Write			
0200h to 023Fh	1200h to 123Fh	Position No.0 to Position No.63	−8,388,608 to +8,388,607 step	0
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: INC (Incremental) 1: ABS (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) ∗1∗2	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 1000 (1=0.1%) ∗3	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 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).
*2 Acceleration/deceleration rate (ms/kHz) or acceleration/deceleration time (s) can be selected using "acceleration/deceleration unit" parameter. (initial value: acceleration/deceleration rate).
*3 For the driver which is before the specification change, the setting range is 0 to 500 (1=0.1%). Refer to p.5 for details.

4.5 User parameters

The parameters are saved in the RAM or non-volatile memory. The data saved in the RAM will be erased once the power is turned off. On the other hand, the parameters saved in the non-volatile memory will be retained even after the power supply is turned off.
When turning the driver power ON, the parameters saved in the non-volatile memory will be sent to the RAM. Then, the recalculation and setup for the parameters are executed in the RAM.

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 non-volatile memory, execute "batch NV memory write" of the maintenance command.
- The non-volatile memory can be rewritten approximately 100,000 times.

■ I/O parameter

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 parameter

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	100 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	1	
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 parameter

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 parameter

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 parameter

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	150 to 630 (1=0.1 V)	630	
01A4h	11A4h	Undervoltage warning		180	
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 parameter

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			
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 parameter

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 parameter

Command code		Description	Setting range	Initial value	Effective *
Read	Write				
0880h	1880h	IN0 input function selection	See table next.	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 next.	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	9: MS1_R	33: R1	42: R10	51: M3_R	67: READY
1: FWD_R	10: MS2_R	34: R2	43: R11	52: M4_R	68: MOVE
2: RVS_R	11: MS3_R	35: R3	44: R12	53: M5_R	69: END
3: HOME_R	12: MS4_R	36: R4	45: R13	60: +LS_R	70: HOME-P
4: START_R	13: MS5_R	37: R5	46: R14	61: −LS_R	71: TLC
5: SSTART_R	16: FREE_R	38: R6	47: R15	62: HOMES_R	72: TIM
6: +JOG_R	17: C-ON_R	39: R7	48: M0_R	63: SLIT_R	73: AREA1
7: −JOG_R	18: STOP_R	40: R8	49: M1_R	65: ALM	74: AREA2
8: MS0_R	32: R0	41: R9	50: M2_R	66: WNG	75: AREA3
					80: S-BSY

■ I/O function [RS-485] parameter

Command code		Description	Setting range	Initial value	Effective *
Read	Write				
08B0h	18B0h	NET-IN0 input function selection	See table next.	48: M0	C
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		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	See table next.	48: M0_R	
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		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	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	

* These three signals cannot be set in the driver which is before the specification change. Refer to p.5 for details.

- 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	
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 parameter

Command code		Description	Setting range	Initial value	Effective *
Read	Write				
0900h	1900h	Communication timeout	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)

7 Inspection, troubleshooting and remedial actions

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

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1 Inspection

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

■ 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?
- Are any of the driver DIN rail mounting parts loose?
- Are there any loose driver connectors?
- 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.

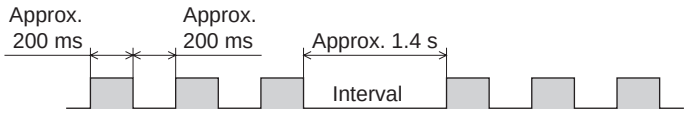
2 Alarms and warnings

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).

2.1 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.118 for the timing chart.

- Turn the ALM-RST input to ON and then OFF. (The alarm will be reset at the OFF edge of the 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 non-volatile memory in order of the latest to oldest.
Alarm records saved in the non-volatile memory can be read and cleared when performing any of the following.

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

■ Alarm list

Code	No. of ALARM LED blinks	Alarm type	Cause	Remedial action	Reset using the ALM-RST input	Motor excitation *1
21h	2	Main circuit overheat	The internal temperature of the driver exceeded 85 °C (185 °F).	Review the ventilation condition in the enclosure.	Possible	Off
30h		Overload	A load exceeding the peak torque was applied for the time exceeded the value set in the "overload alarm" parameter.	• Reduce the load or make the acceleration/ deceleration longer. • 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 rotation speed of the motor output shaft exceeded approximately 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, make the acceleration/ deceleration longer.		
34h		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.		
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 make the acceleration/ deceleration longer.	Possible	Off
25h		Undervoltage	The main power was cut off momentarily or the voltage became low.	Check the input voltage of the main power supply.		
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 is too rapid.	• Reduce the load or make the acceleration/ deceleration longer. • If the driver is in the current control mode, increase the current limit value.	Possible	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.”		
27h	7	Backup battery undervoltage	The battery voltage became below the rated value.	Charge the battery.	Possible	On

*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
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.	• Execute P-PRESET or return-to-home operation after inputting the P-CLR • Check the connection of the battery. Or change the battery.	Not possible *2	On
4Ah		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	
60h		± LS both sides active	Both the +LS and −LS signals were detected when LS detection was enabled.	Check the sensor logic and setting of "LS logic level" parameter.		
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.	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.		

*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
64h	7	TIM, ZSG, 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	On
66h		Hardware overtravel	A +LS or −LS signal was detected when hardware overtravel was enabled.	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.	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 500 r/min was set in the operation speed of push-motion operation. *3	Check the operation data.		
71h		Electronic gear setting error	The resolution set by the "electronic gear" parameter was outside of the specification.	Turn on the power again after setting the "electronic gear" parameter correctly so that the resolution is in a range of "100 to 10000 P/R."	Not possible	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 master controller for the network converter showed a disconnected status.	Check the connector and cable of the master controller.	Possible	On

*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.
*3 For the driver which is before the specification change, the maximum speed of push-motion operation is 30 r/min. Refer to p.5 for details.

Code	No. of ALARM LED blinks	Alarm type	Cause	Remedial action	Reset using the ALM-RST input	Motor excitation *1
83h	7	Communication switch setting error	Transmission rate setting switch (SW2) was out-of-specification.	Check the transmission rate setting switch (SW2).	Not possible	Off
84h		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 master controller and driver. • Check the setting of RS-485 communication.	Possible	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 master controller and driver.		
8Eh		Network converter error	The network converter generated an alarm.	Check the alarm code of the network converter.		
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	Off
42h		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.		
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.	Not possible	Off
41h		EEPROM error	The stored data was damaged.	Initialize the all parameters.		
F0h	Lit	CPU error	CPU malfunctioned.	Cycle the power.	Not possible	Off

*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.

2.2 Warnings

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

■ Warning records

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

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

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

■ 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 is too short.	• Reduce the load or make the acceleration/ deceleration longer. • 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 make the acceleration/ deceleration longer.
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 peak torque was applied for the time set in parameter for the overload warning or longer. • The load is large or acceleration/ deceleration is too short.	• Reduce the load or make the acceleration/ deceleration longer. • 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, make the acceleration/ deceleration longer.
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.	Turn on the power again after setting the "electronic gear" parameter correctly so that the resolution is in a range of "100 to 10000 P/R."
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 master controller and driver. • Check the setting of RS-485 communication.

2.3 Communication errors

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

■ Communication error records

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

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

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

■ Communication error list

Code	Communication error type	Cause	Remedial action
84h	RS-485 communication error	One of the following errors was detected. · Framing error · BCC error	• Check the connection between the master controller and driver. • Check the setting of RS-485 communication.
88h	Command not yet defined	The command requested by the master could not be executed because of being undefined.	• Check the setting value for the command. • Check the flame configuration.
89h	Execution disable due to user I/F communication in progress	The command requested by the master could not be executed 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	Non-volatile memory processing in progress	The command could not be executed because the driver was processing the non-volatile 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.

3 Troubleshooting and remedial actions

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

Phenomenon	Possible cause	Remedial action
• The motor 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.
There is holding torque even if motor excitation is turned OFF.	Effect of dynamic brake.	If motor excitation is turned OFF by C-ON input or STOP input, the holding torque will be generated larger than when the power is shut off (dynamic brake). To release the dynamic brake, shut off the power or turn the FREE input ON.
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 "rotation direction" parameter is set wrong.	Check the "rotation direction" parameter.
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" parameter to its initial value 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.

8 Appendix

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

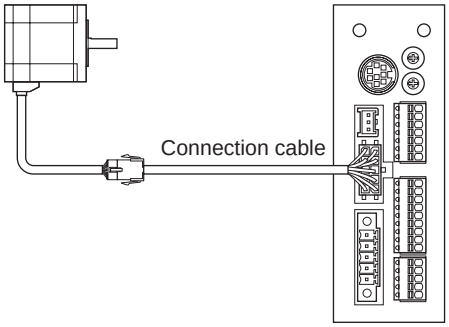
Table of contents

1 Accessories (sold separately)

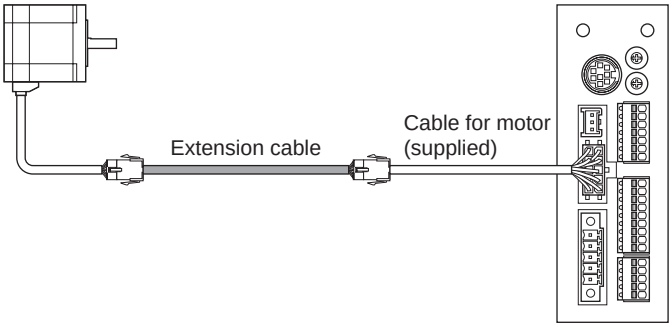
■ Motor cable

This cable is needed to connect the motor and driver.
When installing the motor on a moving part, use a flexible cable offering excellent flexibility.

• Extending the wiring length using a connection cable



• Extending the wiring length using an extension cable



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.209 for connector pin assignments of the cable.

• Connection cable set
For standard motor

Model ∗1	Length [m (ft.)]
CC010VA□F2	1 (3.3)
CC020VA□F2	2 (6.6)
CC030VA□F2	3 (9.8)
CC050VA□F2	5 (16.4)
CC070VA□F2	7 (23.0)
CC100VA□F2	10 (32.8)
CC150VA□F2	15 (49.2)
CC200VA□F2	20 (65.6)
CC300VA□F2	30 (98.4)

• Connection cable set
For electromagnetic brake motor ∗2

Model ∗1	Length [m (ft.)]
CC010VA□FB2	1 (3.3)
CC020VA□FB2	2 (6.6)
CC030VA□FB2	3 (9.8)
CC050VA□FB2	5 (16.4)
CC070VA□FB2	7 (23.0)
CC100VA□FB2	10 (32.8)
CC150VA□FB2	15 (49.2)
CC200VA□FB2	20 (65.6)
CC300VA□FB2	30 (98.4)

*1 For IP20 type motor, enter **2** in the box □ within the model name.
*2 The cable set for electromagnetic brake motors consists of two cables, one for motor and the other for electromagnetic brake.

• Flexible connection cable set
For standard motor

Model ∗1	Length [m (ft.)]
CC010VA□R2	1 (3.3)
CC020VA□R2	2 (6.6)
CC030VA□R2	3 (9.8)
CC050VA□R2	5 (16.4)
CC070VA□R2	7 (23.0)
CC100VA□R2	10 (32.8)
CC150VA□R2	15 (49.2)
CC200VA□R2	20 (65.6)
CC300VA□R2	30 (98.4)

• Flexible connection cable set
For electromagnetic brake motor ∗2

Model ∗1	Length [m (ft.)]
CC010VA□RB2	1 (3.3)
CC020VA□RB2	2 (6.6)
CC030VA□RB2	3 (9.8)
CC050VA□RB2	5 (16.4)
CC070VA□RB2	7 (23.0)
CC100VA□RB2	10 (32.8)
CC150VA□RB2	15 (49.2)
CC200VA□RB2	20 (65.6)
CC300VA□RB2	30 (98.4)

*1 For IP20 type motor, enter **2** in the box □ within the model name.
*2 The cable set for electromagnetic brake motors consists of two cables, one for motor and the other for electromagnetic brake.

• Extension cable set

See the following for connector pin assignments of the cable.

• Extension cable set
For standard motor

Model ∗1∗2	Length [m (ft.)]
CC010VA□F■2	1 (3.3)
CC020VA□F■2	2 (6.6)
CC030VA□F■2	3 (9.8)
CC050VA□F■2	5 (16.4)
CC070VA□F■2	7 (23.0)
CC100VA□F■2	10 (32.8)
CC150VA□F■2	15 (49.2)
CC200VA□F■2	20 (65.6)

• Extension cable set
For electromagnetic brake motor ∗3

Model ∗1	Length [m (ft.)]
CC010VA□FBT2	1 (3.3)
CC020VA□FBT2	2 (6.6)
CC030VA□FBT2	3 (9.8)
CC050VA□FBT2	5 (16.4)
CC070VA□FBT2	7 (23.0)
CC100VA□FBT2	10 (32.8)
CC150VA□FBT2	15 (49.2)
CC200VA□FBT2	20 (65.6)

*1 For IP20 type motor, enter **2** in the box □ within the model name.
*2 For IP54 type motor, enter **T** in the box ■ within the model name.
*3 The cable set for electromagnetic brake motors consists of two cables, one for motor and the other for electromagnetic brake.

• Flexible extension cable set
For standard motor

Model ∗1∗2	Length [m (ft.)]
CC010VA□R■2	1 (3.3)
CC020VA□R■2	2 (6.6)
CC030VA□R■2	3 (9.8)
CC050VA□R■2	5 (16.4)
CC070VA□R■2	7 (23.0)
CC100VA□R■2	10 (32.8)
CC150VA□R■2	15 (49.2)
CC200VA□R■2	20 (65.6)

• Flexible extension cable set
For electromagnetic brake motor ∗3

Model ∗1	Length [m (ft.)]
CC010VA□RBT2	1 (3.3)
CC020VA□RBT2	2 (6.6)
CC030VA□RBT2	3 (9.8)
CC050VA□RBT2	5 (16.4)
CC070VA□RBT2	7 (23.0)
CC100VA□RBT2	10 (32.8)
CC150VA□RBT2	15 (49.2)
CC200VA□RBT2	20 (65.6)

*1 For IP20 type motor, enter **2** in the box □ within the model name.
*2 For IP54 type motor, enter **T** in the box ■ within the model name.
*3 The cable set for electromagnetic brake motors consists of two cables, one for motor and the other for electromagnetic brake.

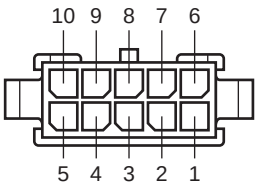
• Connector pin assignments

• Connector pin assignments of "cable for motor"

Pin No.	Color	Lead size
1	White	AWG26 (0.14 mm^2)
2	Black	
3	Purple	
4	Brown	
5 ∗	Green	AWG22 (0.3 mm^2)
6	Red	
7	Gray	
8	Blue	
9	Orange	
10	Drain wire	AWG26 (0.14 mm^2)

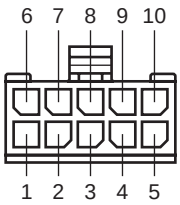
* No wiring for **AR14**, **AR15**, **AR24** and **AR26**.

• Motor side



Model: 43020-1000 (Molex)

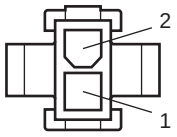
• Driver side



Model: 43025-1000 (Molex)

• Connector pin assignments of "cable for electromagnetic brake"

Pin No.	Color	Lead size
1	White	AWG20 (0.5 mm^2)
2	Black	



Model: 43020-0200 (Molex)
5559-02P-210 (Molex) for the cable of IP54 types

■ Data setter

The data setter lets you set data and parameters for your **AR** Series DC power input built-in controller type with ease and also functions as a monitor.

Model: **OPX-2A**

■ Communication cable for the data setting software

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

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

The **MEXE02** can be downloaded from Oriental Motor Website Download Page. For details, check out our web site or contact your nearest Oriental Motor sales office.

■ RS-485 communication cable

You can link drivers using this cable connected to the RS-485 communication connectors (CN6, CN7).

Model: **CC001-RS4** [0.1 m (0.3 ft.)]
CC002-RS4 [0.25 m (0.8 ft.)]

■ Battery set

This is a battery set (including a battery and battery holder) required in the absolute-position backup system.

Model: **BAT01B**

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