Oriental motor

HP-6138-2

Mobile Robot Controller

MVC01

USER MANUAL

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

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

1 Introduction

2 Hardware

3 Operation

4 Modbus RTU control (RS-485 communication)

5 Address and code lists

6 I/O signals

7 Other functions

8 Troubleshooting

1 Introduction

This part explains safety precautions and other important information.

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1 Before using the product

Only qualified personnel of electrical and mechanical engineering should work with the product.
Read the section "2 Safety precautions" on p.9 thoroughly before using the product. In addition, be sure to observe the contents described in warning, caution, and note in this manual.
The product described in this manual is designed and manufactured to be incorporated into general industrial equipment. Do not use it for any other purpose.
Oriental Motor Co., Ltd. is not responsible for any compensation for damage caused through failure to observe this warning.

■ Overview of the product

This controller is equipped with the control functions necessary for AGVs (automated guided vehicles) and AMRs (autonomous mobile robots) to travel.
Using the controller can calculate the movement of each wheel and perform synchronous control of the output shaft. This reduces the operational workload of software development for customers and also contributes to shortening the system startup time.
The controller can be combined with the **BLV** Series **R** Type brushless motors.

● Applicable robot type

This controller can be used to control the following robot types.
- Differential two-wheel type
- Mecanum wheel type

● Equipped with IMU (Inertial measurement unit)

The controller is equipped with an IMU, which allows it to detect the translational motion and rotational motion of the robot in three-dimensional space. The IMU consists of the following sensors.
- Acceleration sensor (3-axis): Detects acceleration caused by translational motion.
- Gyro sensor (3-axis): Detects angular speed caused by rotational motion.
- Temperature sensor (1 piece): Detects the temperature of the IMU.

● MVC Studio

The **MVC Studio** support software is software dedicated to the **MVC01** robot controller. The setup of the controller, setting and editing of parameters, operations, and various monitors can be performed. The **MVC Studio** software can be downloaded from the Oriental Motor website.

● Control methods

- Control via RS-485 communication (Modbus RTU).
- Control using I/O signals.

● Setting method

The **MVC Studio** software is used for setup.
Parameters can be set using the **MVC Studio** software or via RS-485 communication (Modbus RTU).

2 Safety precautions

The precautions described below are intended to ensure the safe and proper use of the product and to prevent the user and other personnel from exposure to the risk of injury. Use the product only after carefully reading and fully understanding these instructions.
In regard to a controller, it is prohibited to start operating the robot (i.e., to operate the device in accordance with the specified purpose) when the machine in which the controller is incorporated does not meet the relevant safety standards. The factory safety manager or safety personnel in charge of the applicable machine must ensure that the machine is operated only by qualified personnel who has expert knowledge on safety, and thereby prevent injury or damage to the machine.
The term "qualified personnel" refers to persons who have received the necessary training or education and have pertinent experience; who are familiar with the relevant standards and regulations; who are authorized by the factory safety manager to engage in the necessary activities; and who have the ability to discern and prevent potential dangers.

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

⚠WARNING

General

- Never use the product for equipment in connection with the maintenance or management of human life or health.
- Do not use the product in explosive or corrosive environments, in the presence of flammable gases, in areas subjected to splashing water, or near combustible materials. Doing so may result in fire or injury.
- Assign qualified personnel having expert knowledge on electrical and mechanical engineering as well as safety to the task of installing, wiring, operating/controlling, inspecting and troubleshooting the product. Handling by unqualified personnel may result in fire, injury, or damage to equipment.
- Conduct a risk assessment in a state where all parts and components including the controller have been installed in the equipment. Failure to do so may result in injury or damage to equipment.
- Use the product in a state where the entire equipment complies with relevant standards and regulations including ISO 3691-4, ISO 12100, ISO 10218-1, ISO 10218-2, and the Industrial Safety and Health Act. Failure to do so may result in injury or damage to equipment.
- Provide appropriate safety measures 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.
- Provide an emergency stop function for the equipment. Failure to do so may result in injury.
- The function and performance of the safety-related control system are appropriately determined according to the results of the risk assessment of the entire equipment. This may result in injury.
- Do not touch the controller while the power is on. Doing so may result in fire.
- When an alarm of the controller is generated (any of the controller's protective functions is triggered), remove the cause before resetting the alarm (protective function). Continuing the operation without removing the cause of the problem may cause the controller to malfunction, resulting in injury or damage to equipment.
- Do not disassemble or modify the controller. Doing so may result in injury or damage to equipment.

Installation and wiring

- Install the controller inside an enclosure. Failure to do so may result in injury.
- Keep the input power voltage of the controller within the specified range. Failure to do so may result in fire.
- Connect the product securely according to the connection diagram. Failure to do so may result in fire.
- Do not forcibly bend, pull, or pinch the cable. Doing so may result in fire or damage to equipment.

Operation

- Turn all input signals to the controller OFF before turning on the power supply. Failure to do so may result in injury or damage to equipment.
- Before operating a robot, check the condition of the surrounding area to ensure safety. Failure to do so may result in injury or damage to equipment.
- Before operating a robot, check the setting value of the parameters. Failure to do so may result in injury or damage to equipment.
- Take appropriate safety measures when placing the motor in a non-excitation state. Failure to do so may result in injury or damage to equipment.
- Do not turn off the power or input a signal to place the motor in a non-excitation state during operation. The robot may operate unexpectedly, causing injury or damage to equipment. This may cause injury or damage to equipment.

⚠CAUTION

- Do not use the controller beyond its specifications. Doing so may result in injury or damage to equipment.
- Use the controller and driver only in the specified combination. An incorrect combination may cause a fire.
- Do not place combustibles around the controller. Doing so may result in fire or a skin burn(s).
- Do not leave anything around the controller that would obstruct ventilation. Doing so may result in damage to equipment.
- Keep your fingers and objects out of the openings in the controller. Failure to do so may result in fire or injury.
- Do not forcibly bend or pull the cable that is connected to the controller. Doing so may cause damage to the product.
- If any abnormality is observed, stop the operation immediately to turn off the power supply. Failure to do so may result in fire or injury.
- For a power supply, use a battery or DC power supply with reinforced insulation on its primary and secondary sides. Failure to do so may result in electric shock.
- Do not touch the terminals while conducting the insulation resistance measurement or the dielectric strength test. Accidental contact may result in electric shock.

3 Precautions for use

This chapter explains restrictions and requirements that the user should consider when using the product.

■ General

- **When conducting the insulation resistance measurement or the dielectric strength test, be sure to disconnect the controller from other products.**

  Conducting the insulation resistance measurement or the dielectric strength test with the controller and other products connected may result in damage to the product.

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

  The USB connector on the controller is 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 a short circuit in the controller and the equipment, damaging both. When connecting, do not ground equipment.

- **Saving data to non-volatile memory**

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

- **Noise elimination measures**

  Refer to p.25 for noise elimination measures.

- **Static electricity measures for the controller**

  The controller uses components that are sensitive to static electricity. Take measures against static electricity since it may cause the controller to malfunction or suffer damage.

2 Hardware

This part explains the names and functions of each part of the driver, installation and connection methods, etc.

◆Table of contents

1 Preparation

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

1-1 Checking the Product

Verify that the items listed below are included. Report any missing or damaged items to the Oriental Motor sales office from which you purchased the product.

- Controller..... 1 unit
- CN2 connector (26 pins) ..... 1 piece
- Instructions and Precautions for Safe Use..... 1 copy

Included connector model

Type	Part number	Manufacturer
CN2 connector	DFMC 0,5/13-ST-2,54	PHOENIX CONTACT GmbH & Co. KG

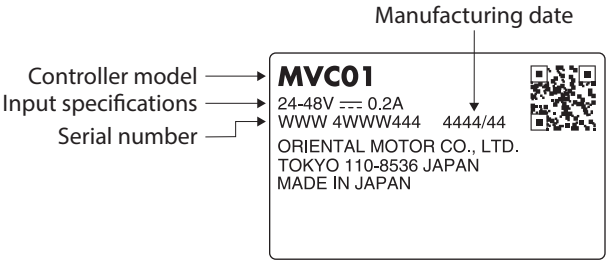
1-2 Drivers that can be combined

The drivers that can be combined with this controller are listed below. Check the driver model with the nameplate.

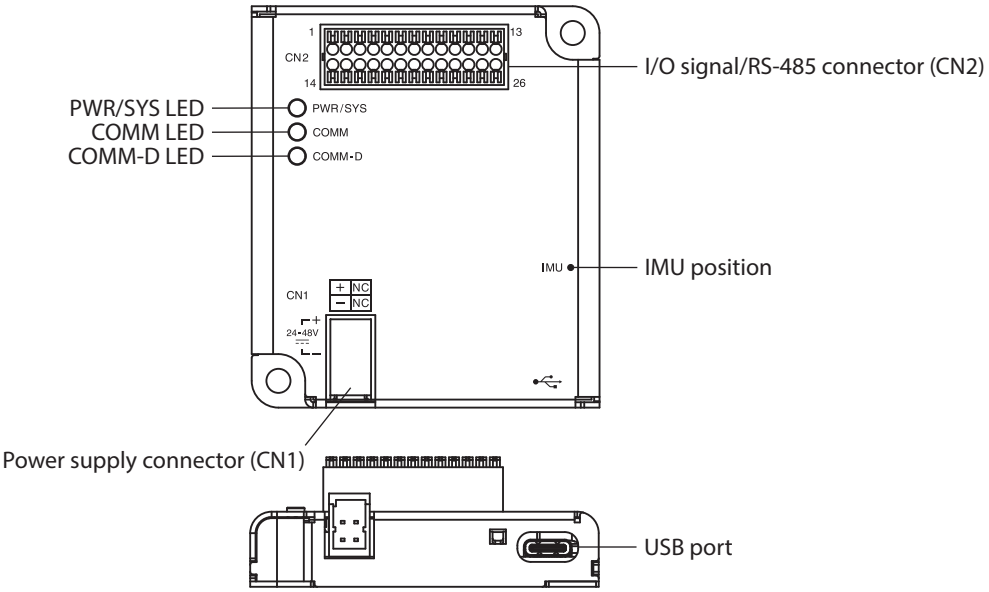
Series	Model
BLV Series **R** Type	**BLVD-KRD**
	BLVD-KBRD

1-3 Information about nameplate

The figure shows an example.



1-4 Names and functions of parts



Type	Name	Sign	Description
LED	PWR/SYS LED	PWR/SYS	This LED indicates the status of the controller.
	COMM LED	COMM	This LED indicates the communication status with the host controller via RS-485 communication.
	COMM-D LED	COMM-D	This LED indicates the communication status with the driver via RS-485 communication.
Connector	Power supply connector	CN1	Connects a power supply.
	I/O signal/RS-485 connector	CN2	Connects the driver and external equipment.
	USB port		Connects a PC in which the **MVC Studio** software has been installed. (USB2.0 Type-C)
IMU position		IMU ●	This indicates the position where the IMU is equipped. The detection accuracy of the sensor is improved if the controller is installed so that the IMU is positioned in the center of the axle.

1-5 Indication of LEDs

■ PWR/SYS LED

This LED indicates the status of the controller.

LED status	Description
No light	The power supply is not turned on.
White light	The power supply is on.
Blinking red	An alarm is being generated. The alarm item generated can be checked by counting the number of times the LED blinks. The LED will be lit in white when the alarm is reset.
Blinking blue	• Information is being generated. The LED will be lit in white when the information is cleared. • The operation window is open on the **MVC Studio** software. When the operation window is closed, the LED is lit in white.

■ COMM LED

This LED indicates the communication status with the host controller via RS-485 communication.

LED status	Description
No light	• The power supply is not turned on. • Communication with the host controller is not performed.
White light or blinking white	Communication with the host controller is properly performed.
Red light	An error occurs in communication with the host controller. The LED will be lit or blink in white when the communication status returns to the normal state.

■ COMM-D LED

This LED indicates the communication status with the driver via RS-485 communication.

LED status	Description
No light	• The power supply is not turned on. • Communication is not performed with the driver.
White light	Communication is performed with the driver properly.
Blinking white	Communication is being established with the driver.
Red light	An error occurs in communication with the driver. The LED will be lit in white when the communication status returns to the normal state.

2 Installation

This chapter explains the installation location and installation method of the controller.

2-1 Installation Location

The controller is designed and manufactured to be incorporated into equipment. Install it in a well-ventilated location that provides easy access for inspection. The location must also satisfy the following conditions:

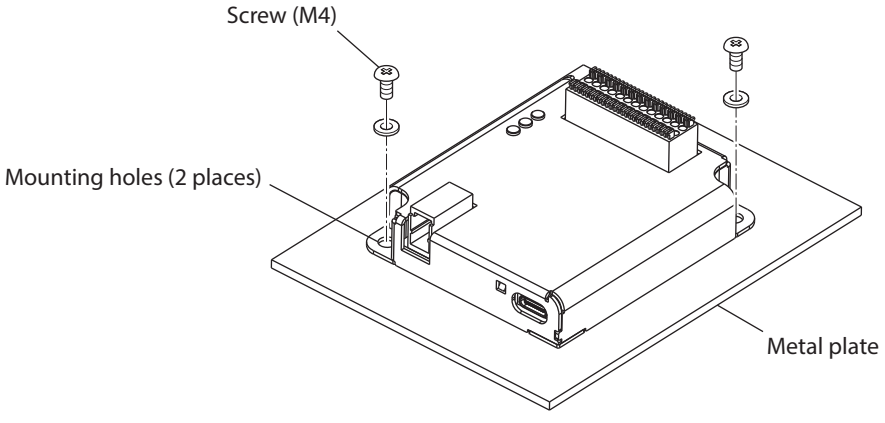
- Inside an enclosure installed indoors (provide ventilation holes)
- Operating ambient temperature: 0 to +50 °C [+32 to 122 °F] (non-freezing)
- Operating ambient humidity: 85 % or less (non-condensing)
- Area free of explosive atmosphere, toxic gas (such as sulfuric gas), or liquid
- Area not exposed 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
- Up to 1,000 m (3,300 ft.) above sea level

2-2 Installation method

This controller can be installed in any direction.
Install the controller on a metal plate that offers high heat conductivity.
When installing the controller, use the mounting holes to secure it to the metal plate with two screws (M4: not included).
When installing the controller and drivers side by side, observe the installation conditions of the drivers.

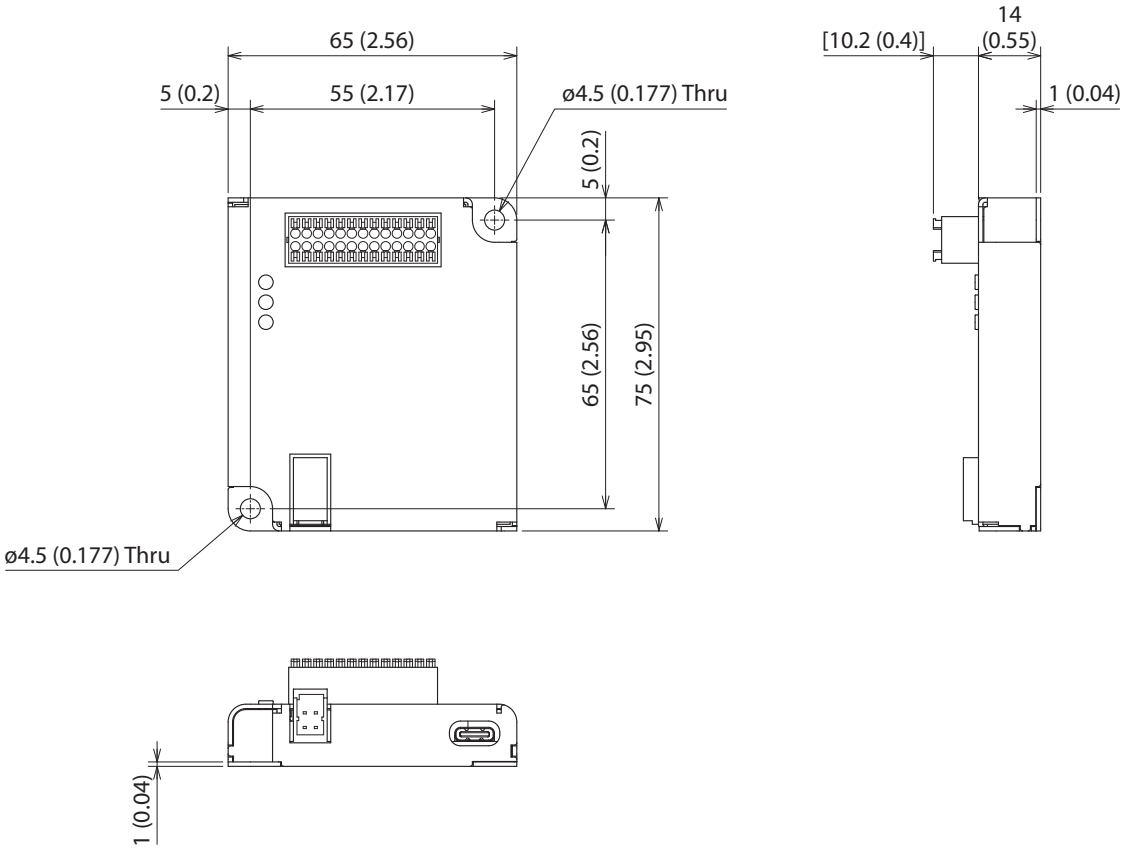
Note

- Install the controller in an enclosure.
- Do not install any equipment that generates a large amount of heat or noise near the controller.
- Do not install the controller under a host controller or other heat-sensitive equipment.
- If the ambient temperature of the controller exceeds 50 °C (122 °F), reconsider the ventilation condition such as providing forced cooling by using fans or creating spaces between the controller and other products.



■ Dimensions [Unit: mm (in.)]

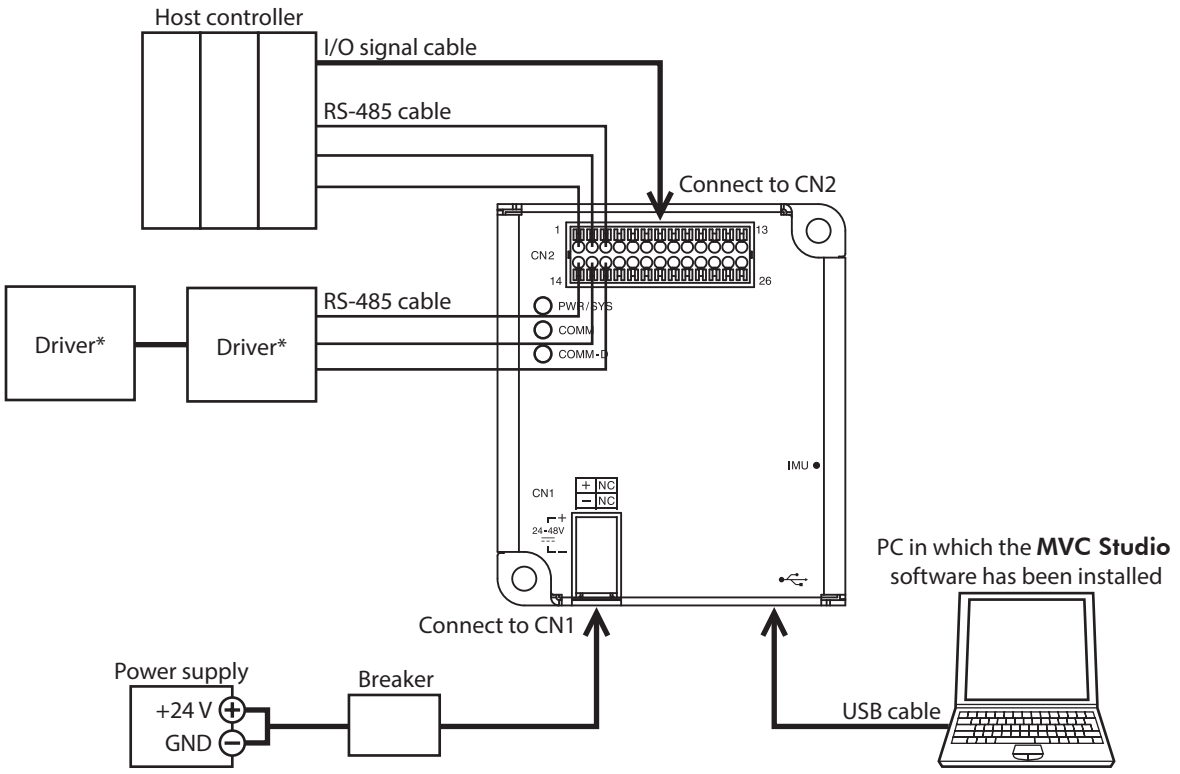
Mass: 60 g (2.1 oz.)



3 Connection

This chapter explains a connection example of the controller, a connection method of a power supply, a grounding method, etc.

3-1 Connection example



* Connect each driver to a separate power supply.

Note

- Connect the connector securely. Insecure connector connections may cause malfunction or damage to the controller.
- Do not wire the power supply cable of the controller in the same cable duct with other power lines or motor cables. Doing so may cause malfunction due to noise.
- Maintain a wiring distance of 50 m (164 ft.) or less between the controller and a driver located at the end. Exceeding 50 m (164 ft.) may cause malfunction.

memo

Before connecting or disconnecting a connector, make sure to turn off the power supply and check that the PWR/SYS LED is off.

3-2 Connecting the power supply (CN1)

Use the CN1 connector (4 pins) to connect the power supply.

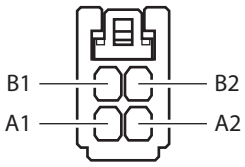
■ Applicable connector

Type	Part number	Applicable lead wire
Connector housing	1-1827864-2 (TE Connectivity)	AWG22 (0.34 to 0.37 mm^2) AWG20 (0.51 to 0.53 mm^2) AWG18 (0.85 to 0.87 mm^2) Lead wire insulation outer diameter: ø1.4 to 2.2 mm (ø0.055 to 0.087 in.) Lead wire insulation strip length: 1.7 to 2.3 mm (0.067 to 0.091 in.)
Contact	1827589-2 (TE Connectivity)	
Designated crimp tool	2119142-1 (TE Connectivity)	

■ Pin assignment

The figure shows the view from the insert side of the contacts.

Pin number	Name	Description
A1	GND	Power supply ground
A2	N.C.	Not used
B1	VIN	Power supply input
B2	N.C.	Not used



■ Voltage specifications

Rated voltage	24 to 48 VDC
Allowable operating voltage	15 to 55 VDC
Input current	0.2 A

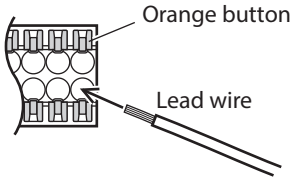
3-3 Connecting the I/O signal cable and RS-485 cable (CN2)

Use the CN2 connector (26 pins) to connect the I/O signal cable and RS-485 cable.

■ Wiring method of CN2 connector

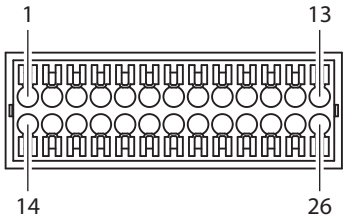
- Applicable lead wire: AWG26 to 20 (0.14 to 0.5 mm^2)
- Stripping length of wire insulation: 7 mm (0.28 in.)

1. Strip the insulation of the lead wires.
2. Insert the lead wire while pressing the orange button with a screwdriver.
3. After having inserted, release the button to secure the lead wire.



memo Wire the I/O signal cable as short as possible.

■ Pin assignment

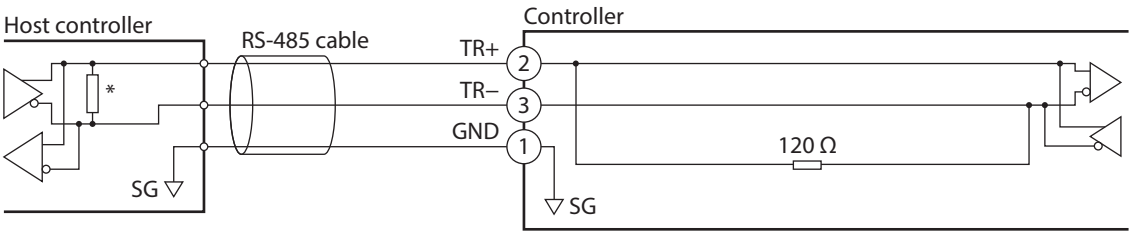


Pin number	Signal name	Description*
1	GND	Ground for host controller communication
2	TR+	Signal for host controller communication (positive)
3	TR–	Signal for host controller communication (negative)
4	N.C.	Not used
5	IN1	Control input 1 (FREE)
6	IN3	Control input 3 (ETO-CLR-DRV)
7	IN5	Control input 5 (No function)
8	IN7	Control input 7 (No function)
9	N.C.	Not used
10	OUT1	Control output 1 (MOVE)
11	OUT3	Control output 3 (ALM-B)
12	OUT5	Control output 5 (S-ON-MON)
13	OUT7	Control output 7 (No function)

Pin number	Signal name	Description*
14	GND-D	Ground for driver
15	TR-D+	Signal for driver communication (positive)
16	TR-D–	Signal for driver communication (negative)
17	IN-COM	Input common
18	IN0	Control input 0 (STOP)
19	IN2	Control input 2 (ALM-RST)
20	IN4	Control input 4 (STOP-H)
21	IN6	Control input 6 (No function)
22	OUT-COM	Output common
23	OUT0	Control output 0 (READY)
24	OUT2	Control output 2 (ETO-MON-DRV)
25	OUT4	Control output 4 (RDY-DD-OPE)
26	OUT6	Control output 6 (No function)

* Values in parentheses ( ) are initial values.

■ Connection example with the host controller (RS-485 communication)



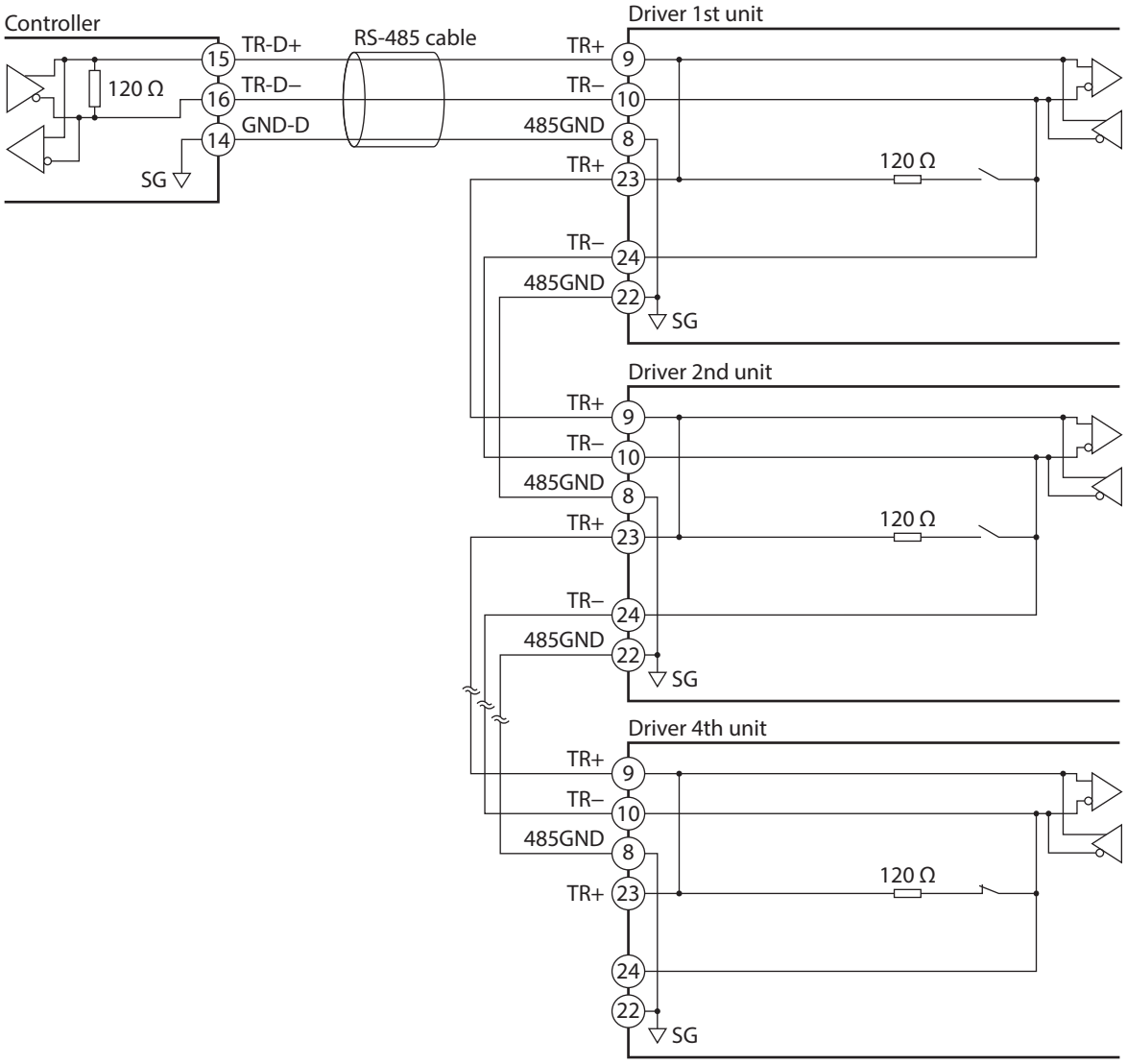
* Termination resistor 120 Ω

Note

- Use twisted-pair wires for the RS-485 cable and ensure that the total extension distance is 50 m (164 ft.) or less.
- The signal ground (SG) is electrically isolated from the power ground (GND) of the CN1 connector.

memo Refer to p.42 for the communication specifications.

■ Connection example with the driver (RS-485 communication)



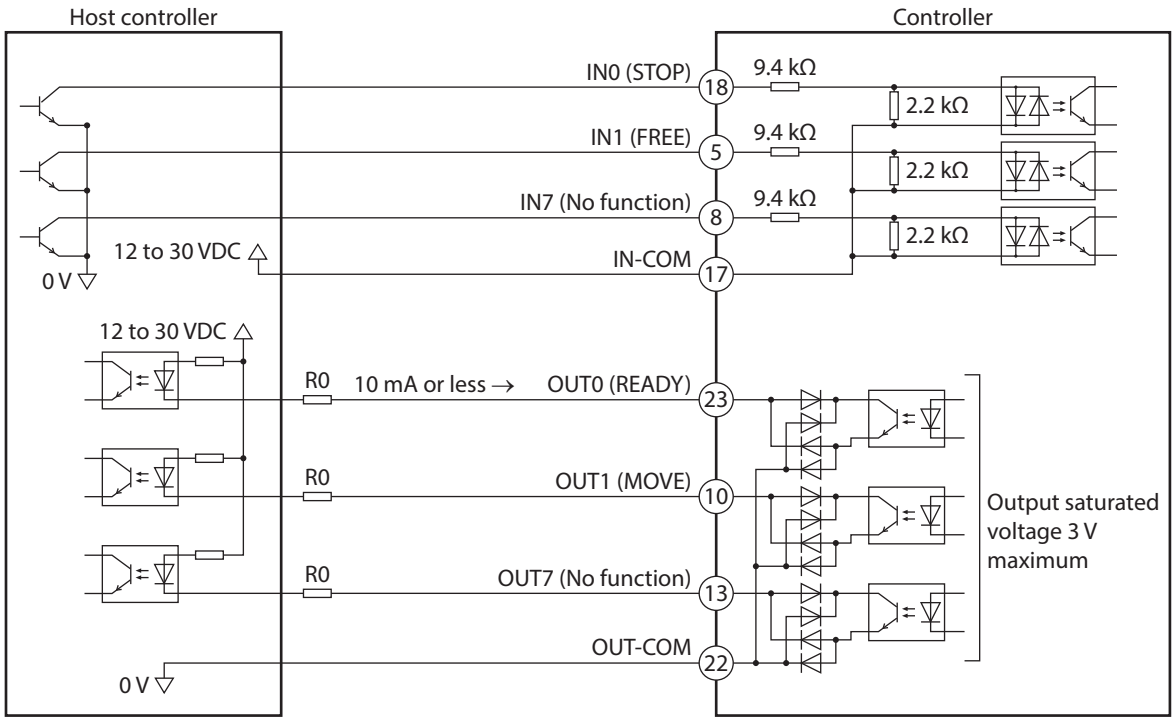
Note

- Use twisted-pair wires for the RS-485 cable and ensure that the total extension distance is 50 m (164 ft.) or less.
- The signal ground (SG) is electrically isolated from the power ground (GND) of the CN1 connector.

memo Refer to p.42 for the communication specifications.

■ Connection example with a current sink output circuit

Values in parentheses ( ) in the figure are initial values.



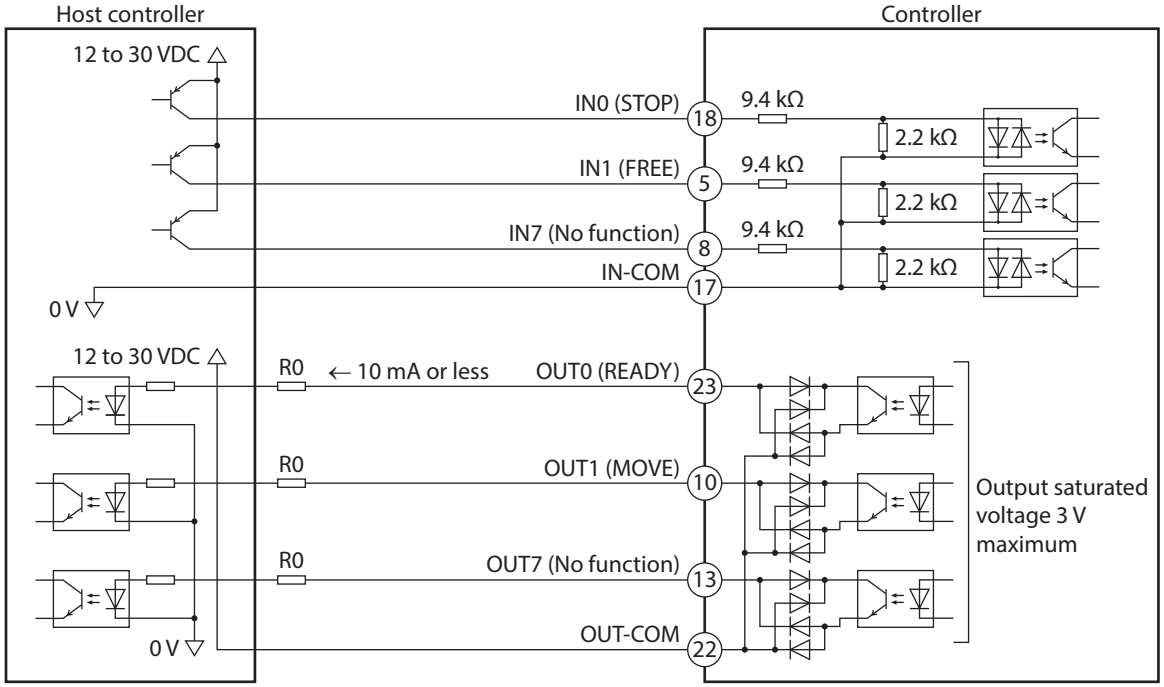
Note

- Use input signals ranging from 12 to 30 VDC.
- Use output signals ranging from 12 to 30 VDC and 10 mA or less. If the current exceeds 10 mA, connect an external resistor R0 to keep the current to 10 mA or less.

memo The saturation voltage of the output signal is 3 V maximum.

■ Connection example with a current source output circuit

Values in parentheses ( ) in the figure are initial values.



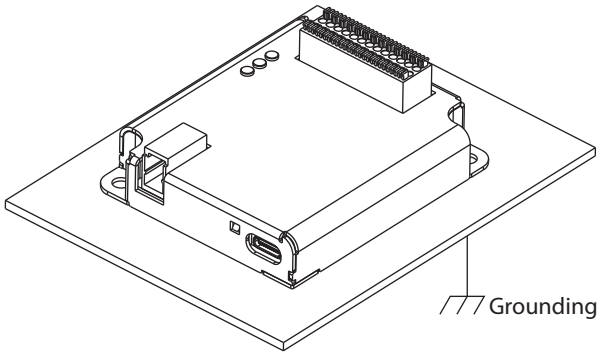
Note

- Use input signals ranging from 12 to 30 VDC.
- Use output signals ranging from 12 to 30 VDC and 10 mA or less. If the current exceeds 10 mA, connect an external resistor R0 to keep the current to 10 mA or less.

memo The saturation voltage of the output signal is 3 V maximum.

3-4 Grounding the controller

Install the controller on a metal surface that is grounded.
Do not share the grounding wire with a welder or any other power equipment.



Note Be sure to ground the controller. Static electricity may damage the controller.

3-5 Connecting the USB cable

Using a USB cable with the following specifications, connect a PC on which the **MVC Studio** software has been installed to the USB connector.

Specifications	USB2.0 (Full speed)
Cable	Length: 3 m (9.8 ft.) or less Shape: Type-C

memo

- Connect the controller and a PC directly using a USB cable.
- In large electrically noisy environments, use the USB cable with a ferrite core or install a ferrite core on the USB cable.

3-6 Noise elimination measures

There are two types of electrical noise: One is noise that enters the controller from the outside and causes it to malfunction, and the other is noise that is emitted from the controller and causes peripheral equipment to malfunction.
For noise entering the controller from the outside, take measures to prevent the controller from malfunctioning. It is necessary to take appropriate measures because the signal lines are very likely to be affected by the noise.
For the noise that is emitted by the controller, take measures to suppress it.

■ Measures to eliminate electrical noise

- Use a DC power supply that complies with the EMC Directive/Regulations.
- When relays or electromagnetic switches are used, use noise filters or CR circuits to suppress the surge generated by these devices.
- Keep the cables as short as possible.
- Use shielded twisted pair cables for power lines and signal lines.
- Keep power lines, such as motor and power supply cables, at least 100 mm (3.94 in.) away from signal lines. Also, do not bundle the cables or wire them in parallel. If the power cables and signal cables must cross, cross them at right angles.
- Wrap the cable around a ferrite core. This prevents the propagated noise from entering the controller or from being emitted from the controller. To increase the effect of noise attenuation by the ferrite core, wrap the cable several more turns.
- To ground a shielded cable, use a conductive cable clamp that ensures contact with the entire circumference of the shielded cable, and ground it as close to the equipment as possible.
- Use the shortest, thickest grounding wire possible.
- Choose a large and uniformly conductive surface for the grounding point.
- Ground the motor, controller, driver and other peripheral control equipment so that a potential difference does not occur among the grounds.

■ Oriental Motor noise suppression products

● **I/O signal cables**

This is a shielded cable to connect a controller and a host controller. The ground wires (drain wires) useful for grounding come out of both ends of the cable. Refer to p.28 for the model name.

● **Surge suppressors**

This product is effective in suppressing the surge that occurs in a contact part of the relay or electromagnetic switch. Connect it when using a relay or electromagnetic switch. A CR circuit for surge suppression and a CR circuit module are provided. Refer to p.29 for the model name.

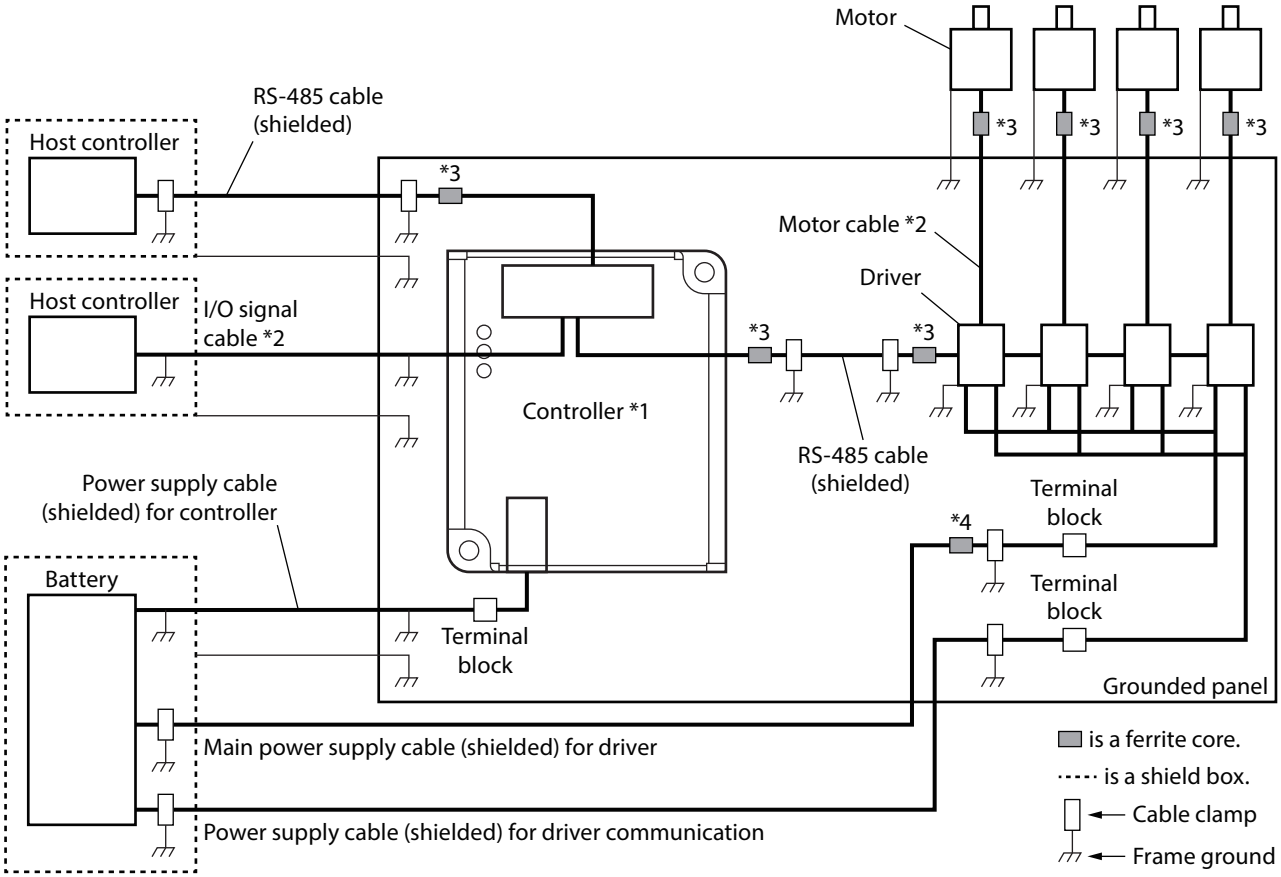
3-7 Compliance with the EMC Directive/Regulations

Oriental Motor products are compliant with the EMC Directive/Regulations in accordance with the contents of "3-6 Noise elimination measures" on p.25 under the terms of "Example of installation and wiring."
The results of EMC testing of the equipment will vary depending on the type, layout, wiring method, etc. of the parts and components used.
Verify compliance with the EMC Directive/Regulations in a condition where all parts and components, including Oriental Motor products, are assembled into the equipment.

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

Example of installation and wiring

The cables are wired in a enclosure.



*1 The controller is connected to the frame ground by installing it to the grounded panel.
*2 Oriental Motor cables are used.
*3 Part No.: ZCAT3035-1330 (TDK Corporation)
*4 Part No.: E04SR401938 (SEIWA ELECTRIC MFG. CO., LTD.)

4 Inspection and maintenance

4-1 Inspection

It is recommended that the following items be inspected periodically after each operation of the robot. If any abnormality occurs, stop using the product and contact your nearest Oriental Motor sales office.

■ Inspection items

- Check to see if the openings in the controller are clogged.
- Check to see if there is no dust adhering to the controller.
- Check to see if the installation place secured the controller is loose.
- Check to see if the connection part to the controller is loose.
- Check to see if there is any unusual smell or appearance to the controller.

Note The controller uses semiconductor components. Since static electricity may damage semiconductor components, be extremely careful when handling it.

4-2 Warranty

Check on the Oriental Motor Website for the product warranty.

4-3 Disposal

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

5 Cable

5-1 I/O signal cables

These cables are shielded cables for control I/O of the controller offering excellent noise resistance. Ground wires (drain wires) are provided at both ends of the cable to facilitate grounding.
Select the cable suitable for the number of I/O signals connected.

Model list

Length [m (ft.)]	Number of lead wires			
	6 pieces	10 pieces	12 pieces	16 pieces
0.5 (1.6)	**CC06D005B-1**	**CC10D005B-1**	**CC12D005B-1**	**CC16D005B-1**
1 (3.3)	**CC06D010B-1**	**CC10D010B-1**	**CC12D010B-1**	**CC16D010B-1**
1.5 (4.9)	**CC06D015B-1**	**CC10D015B-1**	**CC12D015B-1**	**CC16D015B-1**
2 (6.6)	**CC06D020B-1**	**CC10D020B-1**	**CC12D020B-1**	**CC16D020B-1**

6 Accessories

6-1 Relay contact protection parts/circuits

- **CR circuit for surge suppression**

  This product is effective in suppressing the surge that occurs in a contact part of the relay. Use it to protect the contacts of the relay or switch.

  Model: **EPCR1201-2**

- **CR circuit module**

  This product is effective in suppressing the surge that occurs in a contact part of the relay. Use it to protect the contacts of the relay or switch.
  Four pieces of CR circuit for surge suppression are mounted on the compact circuit, and this product can be installed to a DIN rail. This product can make the wiring easy and reliable as it also allows terminal block connection.

  Model: **VCS02**

7 Specifications

7-1 Product specifications

Check on the Oriental Motor website for the product specifications.

7-2 General specifications

Degree of protection		IP10
Operating environment	Ambient temperature	0 to +50 °C [+32 to +122 °F] (non-freezing)
	Humidity	85 % or less (non-condensing)
	Altitude	Up to 1,000 m (3,300 ft.) above sea level
	Surrounding atmosphere	No corrosive gas or dust. No exposure to water or oil.
Storage environment Shipping environment	Ambient temperature	−25 to +70 °C [−13 to +158 °F] (non-freezing)
	Humidity	85 % or less (non-condensing)
	Altitude	Up to 3,000 m (10,000 ft.) above sea level
	Surrounding atmosphere	No corrosive gas or dust. No exposure to water or oil.

8 Regulations and standards

8-1 CE Marking / UKCA Marking

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

■ EU EMC Directive / UK EMC Regulations

Refer to "3-7 Compliance with the EMC Directive/Regulations" on p.26 for details on compliance.

■ EU RoHS Directive / UK RoHS Regulations

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

3 Operation

This part explains the contents to be performed before starting the operation and the commands.

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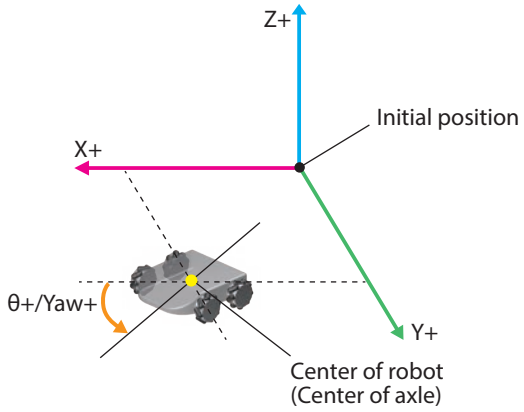
1 Coordinate system

1-1 Global coordinate system

This controller manages the position of the robot in a global coordinate system.
The global coordinate system is a Cartesian coordinate system with respect to the initial position of the robot. The position of the robot when the power supply is turned on will be its initial position, and the position information is cleared when the power is turned off.
The range of each coordinate is shown in the table below. If the present position is reached to the upper or lower limit, the robot will continue to move, but the numerical value will not change.

Coordinate	Range
X	–2,147,483.648 to 2,147,483.647 m
Y	–2,147,483.648 to 2,147,483.647 m
Z	–2,147,483.648 to 2,147,483.647 m
θ/Yaw	–3.141592 to 3.141592 rad



■ Type of present position (odometry)

Odometry is a method of estimating the position and posture of a robot based on accumulated values obtained by calculating the travel distance, speed, and rotation angle using information such as the number of wheel revolutions and the wheel rotation angle.
The controller uses the odometry information as the present position.
However, the present position may gradually shift due to drift in the IMU (*).
* Drift in the IMU is a phenomenon where the accumulated sensor errors cause a large deviation from the actual position and posture of the robot.

Type	Description
Wheel odometry data	This is the position information, which is calculated based on the amount of motor rotation.
Displacement data	This is the displacement of the movement, which is calculated based on the amount of motor rotation.
Gyro odometry data	This is the position information, which is calculated based on the amount of motor rotation and the angular speed detected in the IMU. The coordinate Yaw may be shifted due to drift in the IMU.

■ Changing the present position (odometry)

Use the coordinate command to apply the robot position calculated by the host controller to the controller. Setting the value of the coordinate to be changed and writing the corresponding trigger will rewrite the present position (odometry).
However, the command cannot be set if the controller is in the following states:

- Configuration is being executed.
- The ROBOT-EN output is an OFF state.
- The SYS-BSY output is in an ON state.

Related commands

Register address		Name	Description	Setting range	Initial value	NET-ID
Upper	Lower					
8998 (2326h)	8999 (2327h)	Wheel odometry data set trigger	This is used to set the trigger for the wheel odometry data set. If a value other than "0" is set, the trigger will return to "0" after writing the value to the target coordinate.	0 bit: X 1 bit: Y 2 bit: θ	0	4499 (1193h)
9000 (2328h)	9001 (2329h)	Wheel odometry data set X	These are used to set the value to be written to the coordinate.	−2,147,483,648 to 2,147,483,647 (1=0.001 m)	0	4500 (1194h)
9002 (232Ah)	9003 (232Bh)	Wheel odometry data set Y				4501 (1195h)
9004 (232Ch)	9005 (232Dh)	Wheel odometry data set θ		−6,283,186 to 6,283,186* (1=0.000001 rad)	0	4502 (1196h)
9014 (2336h)	9015 (2337h)	Displacement data set trigger	This is used to set the trigger for the displacement data set. If a value other than "0" is set, the trigger will return to "0" after writing the value to the target coordinate.	0 bit: Forward/reverse 1 bit: Left/right	0	4507 (119Bh)
9016 (2338h)	9017 (2339h)	Displacement data set forward/reverse	Thee are used to set the value to be written to the displacement data of the robot.	−2,147,483,648 to 2,147,483,647 (1=0.001 m)	0	4508 (119Ch)
9018 (233Ah)	9019 (233Bh)	Displacement data set left/right				4509 (119Dh)
9022 (233Eh)	9023 (233Fh)	Gyro odometry data set trigger	This is used to set the trigger for the gyro odometry data set. If a value other than "0" is set, the trigger will return to "0" after writing the value to the target coordinate.	0 bit: X 1 bit: Y 5 bit: Yaw	0	4511 (119Fh)
9024 (2340h)	9025 (2341h)	Gyro odometry data set X	These are used to set the value to be written to the coordinate.	−2,147,483,648 to 2,147,483,647 (1=0.001 m)	0	4512 (11A0h)
9026 (2342h)	9027 (2343h)	Gyro odometry data set Y				4513 (11A1h)
9034 (234Ah)	9035 (234Bh)	Gyro odometry data set Yaw		−6,283,186 to 6,283,186* (1=0.000001 rad)	0	4517 (11A5h)

* Set a value within the range of coordinate (−3.141592 to 3.141592 rad). If a value outside the range is set, it is automatically converted to a value within the range.

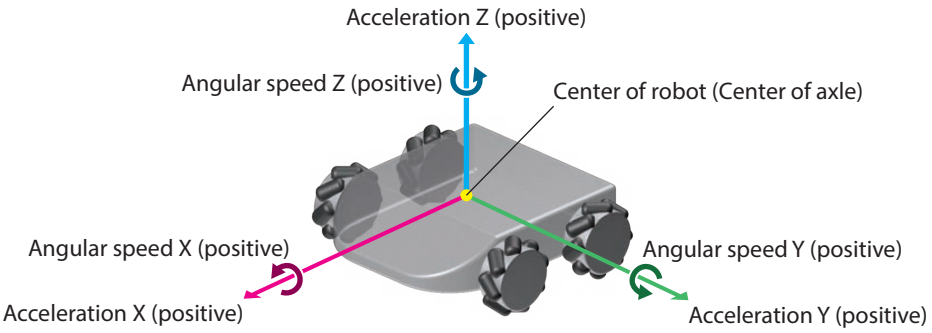
memo The set value is cleared when the power supply of the controller is turned off because it is stored in RAM.

2 IMU

2-1 Overview

The controller is equipped with an IMU that consists of the following sensors. Acceleration and angular speed can be monitored using the **MVC Studio** software or via RS-485 communication.

- Acceleration sensor (3-axis): Detects acceleration caused by translational motion.
- Gyro sensor (3-axis): Detects angular speed caused by rotational motion.
- Temperature sensor (1 piece): Detects the temperature of the IMU.



Related commands

Register address		Name	Description	NET-ID
Upper	Lower			
2084 (0824h)	2085 (0825h)	IMU data acceleration X	The acceleration value detected by the acceleration sensor is indicated. (1=0.001 m/s^2)	1042 (0412h)
2086 (0826h)	2087 (0827h)	IMU data acceleration Y		1043 (0413h)
2088 (0828h)	2089 (0829h)	IMU data acceleration Z		1044 (0414h)
2090 (082Ah)	2091 (082Bh)	IMU data angular speed X	The angular speed value detected by the gyro sensor is indicated. (1=0.000001 rad/s)	1045 (0415h)
2092 (082Ch)	2093 (082Dh)	IMU data angular speed Y		1046 (0416h)
2094 (082Eh)	2095 (082Fh)	IMU data angular speed Z		1047 (0417h)

2-2 Calibration

The controller performs calibration when the power supply is turned on.
Calibration is a function that corrects the output errors of the acceleration sensors and gyro sensors contained in the IMU when the robot is in a standstill state. Performing calibration will make accurate data output from the IMU.
The READY output is turned OFF during calibration.

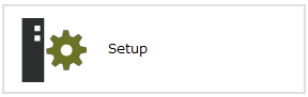
Note Operating the robot during calibration will not properly correct the output errors of the IMU, which will decrease the accuracy of the monitor values for "IMU data" and "gyroodometry data" of the monitor command. Therefore, do not operate the robot during the calibration.

3 Before starting operation

3-1 Setting of robot

Set the information of the robot with the **MVC Studio** software.

1. Start the **MVC Studio** software.
2. Click [COM port] to select "**MVC01**."
3. Click [Setup] on the start screen.



4. Set the robot type and the mechanism information according to the instructions on the screen.

memo To change the robot type, perform the setup again from the start screen. Except for the robot type, using [Re-setup] in the [Maintenance] menu can change even after the setup is completed.

3-2 Backup of data

Save the data that was set in the **MVC Studio** software to a PC.
Backing up the data is recommended in case the controller is replaced for maintenance or the controller is damaged.

1. Click [Save As] under the [File] menu.
2. Input a file name and click [Save].
   A desired file name and storage destination can be used. The saving format is ".mvcx."

3-3 Maintenance

When the controller, driver, or motor is replaced, the data stored as backup can be applied to use.

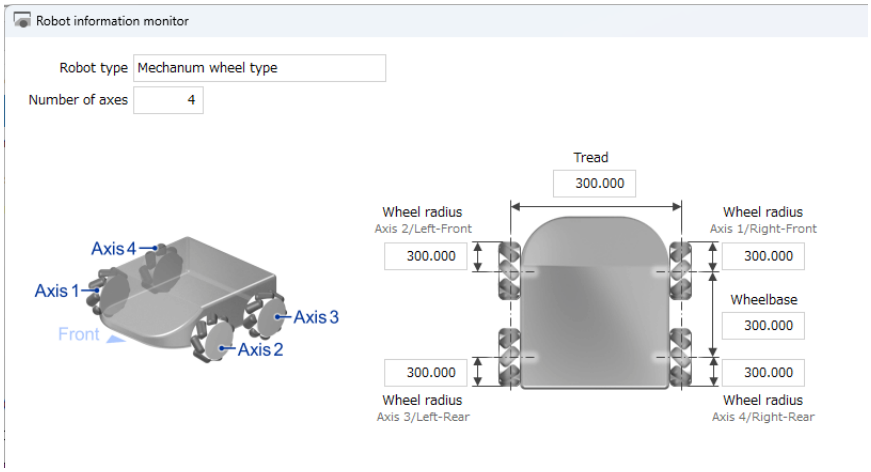
■ When the controller is replaced

1. Replace the controller.
2. Turn on the power supply of the controller.
3. Open the backup data using the **MVC Studio** software.
   1) Click [Open] on the start screen.
   2) Select the stored mvcx file and click [Open].
4. Click [Writing all data (including robot information)] under the [Maintenance] menu.
   The backup data is written to the controller.

   memo When the message "Turn on the power again" appears, turn off the power supply of the controller and then turn on it again.

5. Click [Monitor] > [Robot information monitor] on the tool bar.
   The robot information monitor screen appears.

6. Check the robot information.
   1) Set the [Communication] icon on the tool bar to ON.
   2) Check that the robot type and the number of axes match the connected robot.

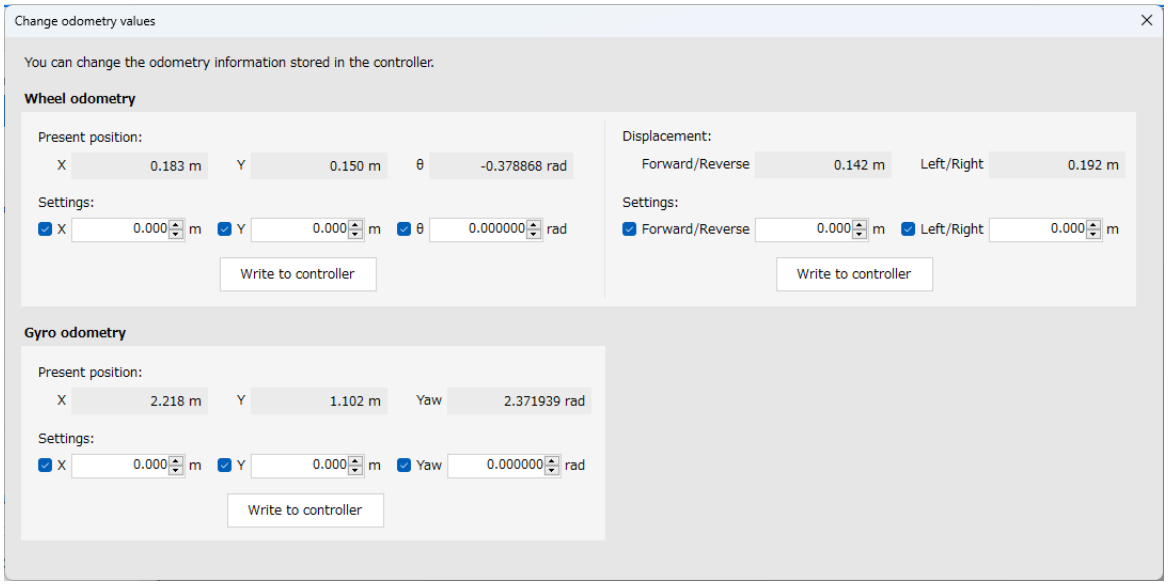


■ When a motor or a driver is replaced

1. Replace a motor or a driver.
2. Turn on the power supplies of the controller and the driver.
3. Open the backup data in the **MVC Studio** software.
   1) Click [Open] on the start screen.
   2) Select the stored mvcx file and click [Open].
4. Click [Re-setup] under the [Maintenance] menu.
   When the setup wizard appears, perform the "Driver connection settings," "Axis settings," and "Robot information settings."

■ When the present position (odometry) is changed

1. Click "Change odometry values" under the [Maienance] menu in the **MVC Studio**.
   The window to change the odmetry values appears.
2. Check the coordinates of the [Settings] to be changed and input a value.



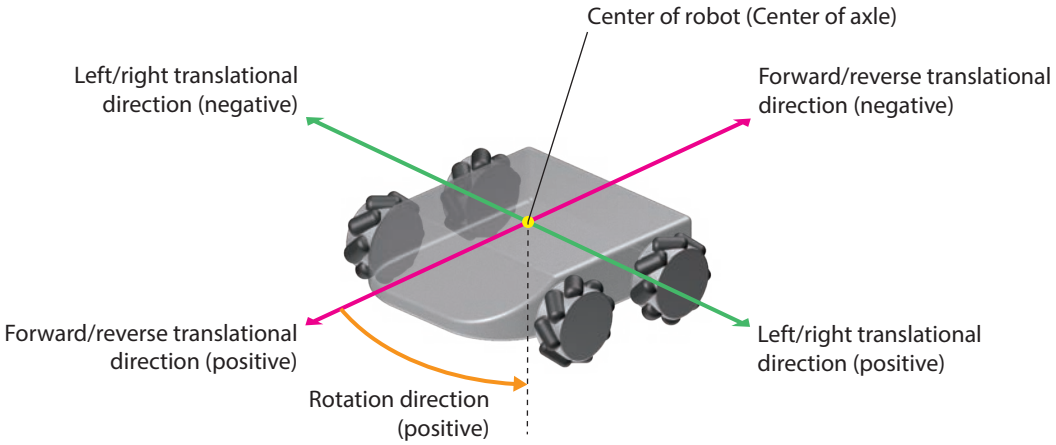
3. Click [Write to controller].

4. Click [Monitor] > [Status monitor] on the tool bar.
   The status monitor window appears.
5. Check the odometry information.
   1) Set the [Communication] icon on the tool bar to ON.
   2) Verify that the displacement, position (wheel odometry), and position (gyro odometry) match the values that were input in step 2.

4 Travel control commands

4-1 vω control

The vω control is an operation type of direct data operation.
Set the translational speed (v) and rotation speed (ω) to control the robot.
Refer to p.67 for direct data operation.



Related commands

Register address		Name	Description	Setting range	Initial value	NET-ID
Upper	Lower					
1988 (07C4h)	1989 (07C5h)	Direct data operation forward/ reverse translational speed	These are used to set the speed.	−2,000 to 2,000 (1=0.001 m/s)	0	994 (03E2h)
1990 (07C6h)	1991 (07C7h)	Direct data operation rotation speed		−6,283,186 to 6,283,186 (1=0.000001 rad/s)	0	995 (03E3h)
1992 (07C8h)	1993 (07C9h)	Direct data operation left/right translational speed		−2,000 to 2,000 (1=0.001 m/s)	0	996 (03E4h)
8380 (20BCh)	8381 (20BDh)	Direct data operation forward/ reverse translational acceleration	These are used to set the acceleration.	1 to 2,147,483,647 (1=0.001 m/s^2)	10,000	4190 (105Eh)
8382 (20BEh)	8383 (20BFh)	Direct data operation rotation acceleration		1 to 2,147,483,647 (1=0.000001 rad/s^2)	3,141,592	4191 (105Fh)
8384 (20C0h)	8385 (20C1h)	Direct data operation left/right translational acceleration		1 to 2,147,483,647 (1=0.001 m/s^2)	10,000	4192 (1060h)
8386 (20C2h)	8387 (20C3h)	Direct data operation forward/ reverse translational deceleration	These are used to set the deceleration.	1 to 2,147,483,647 (1=0.001 m/s^2)	10,000	4193 (1061h)
8388 (20C4h)	8389 (20C5h)	Direct data operation rotation deceleration		1 to 2,147,483,647 (1=0.000001 rad/s^2)	3,141,592	4194 (1062h)
8390 (20C6h)	8391 (20C7h)	Direct data operation left/right translational deceleration		1 to 2,147,483,647 (1=0.001 m/s^2)	10,000	4195 (1063h)
8392 (20C8h)	8393 (20C9h)	Direct data operation forward/ reverse translational jerk	These are used to set the jerk.	0: Disable 1 to 2,147,483,647 (1=0.001 m/s^3)	0	4196 (1064h)
8394 (20CAh)	8395 (20CBh)	Direct data operation rotation jerk		0: Disable 1 to 2,147,483,647 (1=0.000001 rad/s^3)	0	4197 (1065h)
8396 (20CCh)	8397 (20CDh)	Direct data operation left/right translational jerk		0: Disable 1 to 2,147,483,647 (1=0.001 m/s^3)	0	4198 (1066h)

4 Modbus RTU control (RS-485 communication)

This part explains how to control via RS-485 communication using a host controller. The protocol used for RS-485 communication is the Modbus protocol.

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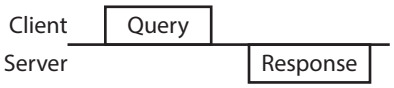
1 Modbus RTU specifications

The Modbus protocol is easy to use and its specification is open to the public, so it is widely used in industrial applications.
Modbus communication is based on the single-client/multi-server method. Only the client can issue a query (command).
Each server executes the processing requested by the query and returns a response message.
This controller supports the RTU mode only as the transmission mode. The ASCII mode is not supported.
Under this protocol, messages are sent in one of two methods.

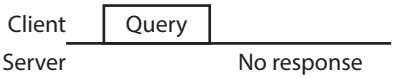
- **Unicast mode**

The client sends a query to a single server. The server executes the processing and returns a response.



- **Broadcast mode**

If the client specifies the server address 0, it can send a query to all servers. Each server executes the processing, but does not return a response.



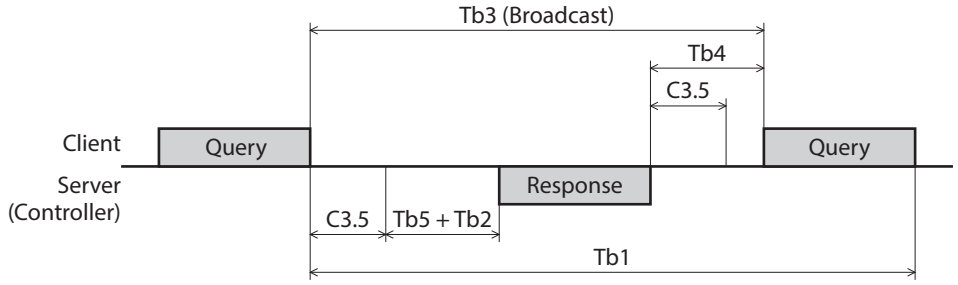
1-1 Communication specifications

Electrical characteristics	In conformance with EIA-485 Use a twisted pair cable (TIA/EIA-568B CAT5e or higher is recommended) and keep the total wiring distance including extension to 50 m (164 ft.) or less.*1
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 9,600 bps, 19,200 bps, 38,400 bps, 57,600 bps, 115,200 bps, and 230,400 bps (initial value).
Protocol	Modbus RTU mode
Type of connection*2	Host controller: Only one controller can be connected to a single host controller. Driver: Up to four drivers can be connected to a single controller.

*4 If the motor cable or power supply cable generates an unwanted amount of noise, depending on the wiring or configuration, shield the cable or install a ferrite core.
*5 The termination resistor is always in an ON state.

1-2 Communication timing

The communication time monitored by the controller and the communication timing of the client are as follows.



Code	Name	Description
Tb1	Communication timeout (Controller)	The controller monitors an interval between received queries. If the controller could not receive a query within the time period set with the "Communication timeout" parameter, an alarm of Communication timeout will be generated. An alarm of Communication timeout is not generated when normal messages, including messages to other servers, are received.
Tb2	Transmission waiting time (Controller)	This is the time period from when the controller receives a query from the client to when it starts sending a response. Set using the "Transmission waiting time" parameter.
Tb3	Broadcast interval (Client)	In broadcast, this is the time period until the client sends the next query. A time equal to or longer than the silent interval (C3.5) plus 5 ms is required.
Tb4	Transmission waiting time (Client)	This is the time period from when the client receives the response to when it sends the next query (setting on the client side). Set it so that it is equal to or longer than the time of the silent interval (C3.5). If the "Silent interval" parameter is set to "0: Set automatically," set the client side according to the "Estimate of transmission waiting time (client) (Tb 4)" in the table below.
Tb5	Query processing time (Controller)	This is the time period that the controller processes a received query. The query processing time varies depending on the message structure of the received query.
C3.5	Silent interval	This is the time period to determine the end of a query or response message. An interval equal to or longer than the time of the silent interval (C3.5) is required when the message ends. If the "Silent interval" parameter of the controller is set to "0: Set automatically," the silent interval (C3.5) varies depending on the transmission rate. For details, refer to the "Silent interval (C3.5)" shown in the table below.

When the "Silent interval" parameter is set to "0: Set automatically"

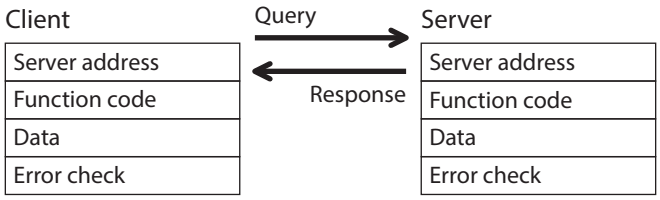
Transmission rate (bps)	Silent interval (C3.5)	Estimate of transmission waiting time (client) (Tb4)
9,600	4.0 ms or more	5.0 ms or more
19,200 or more	2.5 ms or more	3.0 ms or more

Note

- If the transmission waiting time (Tb4) of the client is shorter than the silent interval, the server discards the message and a communication error occurs. When a communication error occurs, check the silent interval of the server and set the transmission waiting time (Tb4) of the client again.
- The silent interval (C3.5) may vary depending on the connected product series. When connecting multiple product series, set the parameters of the controller as follows.
  - "Silent interval" parameter: "0: Set automatically"
  - "Transmission waiting time" parameter: 1.0 ms or more
- In a system where only products with the "Silent interval" parameter are connected, communication cycles can be improved by setting this parameter as common to all connected products. Use in a state of setting to "0: Set automatically" normally.

2 Message structure

The message format is shown below.



2-1 Query

The query message structure is shown below.

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

■ Server address

Specify the server address. (Unicast mode)
If the server address is set to "0" (zero), the client can send a query to all servers. (Broadcast mode)

■ Function codes

The function codes and message lengths supported by the controller are as follows.

Function code	Function	Number of registers	Broadcast
03h	Reading from a holding register(s)	1 to 125	Not possible
06h	Writing to a holding register	1	Possible
08h	Diagnosis	–	Not possible
10h	Writing to multiple holding registers	1 to 123	Possible
17h	Reading/writing from/to multiple holding registers	Read: 1 to 125 Write: 1 to 121	Not possible

■ Data

Set the data related to the function code. The 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 server 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 server determines that the message is normal.

- **CRC-16 calculation method**

1. Calculate an exclusive-OR (XOR) value of the default value of FFFFh and server 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.

- **Calculation example of CRC-16**

The table shows a calculation example when setting the server address of the first byte to 02h and 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	Bit shifted out
CRC register initial value FFFFh	1111 1111 1111 1111	–
Lead byte 02h	0000 0000 0000 0010	–
Initial value FFFFh and XOR	1111 1111 1111 1101	–
First time of right shift	0111 1111 1111 1110	1
A001h and XOR	1010 0000 0000 0001 1101 1111 1111 1111	–
Second time of right shift	0110 1111 1111 1111	1
A001h and XOR	1010 0000 0000 0001 1100 1111 1111 1110	–
Third time of right shift	0110 0111 1111 1111	0
Fourth time of right shift	0011 0011 1111 1111	1
A001h and XOR	1010 0000 0000 0001 1001 0011 1111 1110	–
Fifth time of right shift	0100 1001 1111 1111	0
Sixth time of right shift	0010 0100 1111 1111	1
A001h and XOR	1010 0000 0000 0001 1000 0100 1111 1110	–
Seventh time of right shift	0100 0010 0111 1111	0
Eighth time of right shift	0010 0001 0011 1111	1
A001h and XOR	1010 0000 0000 0001 1000 0001 0011 1110	–
Next byte 07h and XOR	0000 0000 0000 0111 1000 0001 0011 1001	–
First time of right shift	0100 0000 1001 1100	1
A001h and XOR	1010 0000 0000 0001 1110 0000 1001 1101	–
Second time of right shift	0111 0000 0100 1110	1
A001h and XOR	1010 0000 0000 0001 1101 0000 0100 1111	–
Third time of right shift	0110 1000 0010 0111	1
A001h and XOR	1010 0000 0000 0001 1100 1000 0010 0110	–
Fourth time of right shift	0110 0100 0001 0011	0
Fifth time of right shift	0011 0010 0000 1001	1
A001h and XOR	1010 0000 0000 0001 1001 0010 0000 1000	–
Sixth time of right shift	0100 1001 0000 0100	0
Seventh time of right shift	0010 0100 1000 0010	0
Eighth time of right shift	0001 0010 0100 0001	0
Result of CRC-16	0001 0010 0100 0001	–

2-2 Response

Responses returned by the server are classified into three types: normal response, no response, and exception response.
The response message structure is the same as the query message structure.

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

■ Normal response

Upon receiving a query from the client, the server executes the requested processing and returns a response corresponding to the function code.

■ No response

The server may not return a response even if the the client sends a query. This state is called no response.
The causes of no response are listed below.

- **Transmission error**

The server discards the query if it detects any of the transmission errors listed in the table below. No response is returned.

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 inconsistent with the error check value.
Invalid message length	The message length exceeded 256 bytes.

- **Other than transmission error**

A response may not be returned without detecting a transmission error.

Cause	Description
Broadcast	If the query was broadcast, the server executes the requested processing but does not return a response.
Mismatched server address	When the server address in the query is not matched the server address of the controller.

■ Exception response

An exception response is returned if the server cannot execute the processing requested by the query. This response is appended with an exception code that indicates the reason why the processing cannot be executed. The message structure of an exception response is as follows.

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

- **Function codes**

The function code in an exception response is the sum of the function code in the query and 80h.

Function code of query	Exception response
03h	83h
06h	86h
08h	88h
10h	90h
17h	97h

- **Example of exception response**

Server address		01h
Function code		10h
Data	Register address (Upper)	02h
	Register address (Lower)	4Ch
	Number of registers (Upper)	00h
	Number of registers (Lower)	02h
	Number of data bytes	04h
	Write value of register address (Upper)	00h
	Write value of register address (Lower)	00h
	Write value of register address +1 (Upper)	03h
	Write value of register address +1 (Lower)	E9h
Error check (Lower)		2Fh
Error check (Upper)		D4h

Query →

← Response

Server address		01h
Function code		90h
Data	Exception code	04h
Error check (Lower)		4Dh
Error check (Upper)		C3h

- **Exception code**

This code indicates the reason why the processing cannot be executed.

Exception code	Communication error code	Cause	Description
01h	88h	Invalid function	The processing 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	88h	Invalid data address	The processing could not be executed because the data address was invalid. • The register address is not supported (other than 0000h to 57FFh). • The sum of the register address and the number of registers is 5800h or more.
03h	8Ch	Invalid data	The processing could not be executed because the data was invalid. • The number of registers is 0. • The number of bytes is a value other than "the number of register ×2." • Invalid data length
04h	89h 8Ah 8Ch 8Dh	Server error	The processing could not be executed because an error occurred on the server. • Communication with user I/F is in progress (89h). Download or initialization is in progress with the **MVC Studio** software. • Non-volatile memory processing is in progress (8Ah). - Internal processing is in progress (SYS-BSY is ON). - An alarm of EEPROM error is present. • The parameter is outside the setting range (8Ch). The write value is outside the setting range. • The command cannot be executed (8Dh).

- **About server errors**

When the "Server error response mode" parameter is set to "0: Normal response," a normal response is returned even if a server error occurs. Set it when no exception response is required, such as in the case of a touch screen.

3 Function codes

This chapter explains the function codes supported by the controller.
Note that if a function code other than those introduced here is sent, it cannot be executed.

3-1 Reading of a holding register(s) (03h)

This function code is used to read a register (16 bits). Up to 125 consecutive registers (125 × 16 bits) can be read.
Read the upper and lower data at the same time. If not, an invalid value may be read.
When multiple holding registers are read, they are read in order of register address.

■ Example of read

This is an example of reading the acceleration for direct data operation of the server address 1.

Item	Register address	Value read	Corresponding decimal
Direct data operation forward/reverse translational acceleration (Upper)	8380 (20BCh)	0000h	10,000
Direct data operation forward/reverse translational acceleration (Lower)	8381 (20BDh)	2710h	
Direct data operation rotation acceleration (Upper)	8382 (20BEh)	002Fh	3,141,592
Direct data operation rotation acceleration (Lower)	8383 (20BFh)	EFD8h	
Direct data operation left/right translational acceleration (Upper)	8384 (20C0h)	0000h	10,000
Direct data operation left/right translational acceleration (Lower)	8385 (20C1h)	2710h	

- **Query**

Field name		Data	Description
Server address		01h	Server address 1
Function code		03h	Reading from a holding register(s)
Data	Register address (Upper)	20h	Register address to start reading from
	Register address (Lower)	BCh	
	Number of registers (Upper)	00h	Number of registers to be read from the starting register address (6 registers = 0006h)
	Number of registers (Lower)	06h	
Error check (Lower)		0Fh	Calculation result of CRC-16
Error check (Upper)		ECh	

● **Response**

Field name		Data	Description
Server address		01h	Same as query
Function code		03h	Same as query
Data	Number of data bytes	0Ch	Twice the number of registers in the query
	Read value of register address (Upper)	00h	Value read from register address 20BCh
	Read value of register address (Lower)	00h	
	Read value of register address +1 (Upper)	27h	Value read from register address 20BDh
	Read value of register address +1 (Lower)	10h	
	Read value of register address +2 (Upper)	00h	Value read from register address 20BEh
	Read value of register address +2 (Lower)	2Fh	
	Read value of register address +3 (Upper)	EFh	Value read from register address 20BFh
	Read value of register address +3 (Lower)	D8h	
	Read value of register address +4 (Upper)	00h	Value read from register address 20C0h
	Read value of register address +4 (Lower)	00h	
	Read value of register address +5 (Upper)	27h	Value read from register address 20C1h
	Read value of register address +5 (Lower)	10h	
Error check (Lower)		1Ch	Calculation result of CRC-16
Error check (Upper)		72h	

3-2 Writing to a holding register (06h)

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

■ Example of write

This is an example of setting the following data to the server address 2.

Item	Register address	Value written	Corresponding decimal
Controller temperature information (INFO-CNTTMP) (Lower)	833 (0341h)	50h	80

● **Query**

Field name		Data	Description
Server address		02h	Server address 2
Function code		06h	Writing to a holding register
Data	Register address (Upper)	03h	Register address to be written
	Register address (Lower)	41h	
	Write value (Upper)	00h	Value written to the register address
	Write value (Lower)	50h	
Error check (Lower)		D9h	Calculation result of CRC-16
Error check (Upper)		95h	

- **Response**

Field name		Data	Description
Server address		02h	Same as query
Function code		06h	Same as query
Data	Register address (Upper)	03h	Same as query
	Register address (Lower)	41h	
	Write value (Upper)	00h	Same as query
	Write value (Lower)	50h	
Error check (Lower)		D9h	Calculation result of CRC-16
Error check (Upper)		95h	

3-3 Diagnosis (08h)

This function code is used to diagnose communication between the client and the server. Arbitrary data is sent and the result of the returned data is used to determine if the communication is normal. 00h (reply to query) is the only sub-function.

■ Example of diagnosis

This is an example of sending arbitrary data (1234h) to the server to diagnose.

- **Query**

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

3-4 Writing to multiple holding registers (10h)

This function code is used to write data to multiple consecutive registers. Up to 123 registers can be written.
Write the upper and lower data at the same time. If not, an invalid value may be written.
Registers are written in order of register address. Note that even when an exception response is returned because some data is invalid, such as data outside the specified range, etc., other data may have been written properly.

■ Example of write

This is an example of setting the following data to the server address 4.

Item	Register address	Value written	Corresponding decimal
Robot speed information (INFO-RBSPD) forward/reverse translational speed (Upper)	836 (0344h)	0000h	2,000
Robot speed information (INFO-RBSPD) forward/reverse translational speed (Lower)	837 (0345h)	07D0h	
Robot speed information (INFO-RBSPD) rotation speed (Upper)	838 (0346h)	002Fh	3,141,592
Robot speed information (INFO-RBSPD) rotation speed (Lower)	839 (0347h)	EFD8h	
Robot speed information (INFO-RBSPD) left/ right translational speed (Upper)	840 (0348h)	0000h	2,000
Robot speed information (INFO-RBSPD) left/ right translational speed (Lower)	841 (0349h)	07D0h	

- **Query**

Field name		Data	Description
Server address		04h	Server address 4
Function code		10h	Writing to multiple holding registers
Data	Register address (Upper)	03h	Register address to start writing from
	Register address (Lower)	44h	
	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 query
	Write value of register address (Upper)	00h	Value written to register address 0344h
	Write value of register address (Lower)	00h	
	Write value of register address +1 (Upper)	07h	Value written to register address 0345h
	Write value of register address +1 (Lower)	D0h	
	Write value of register address +2 (Upper)	00h	Value written to register address 0346h
	Write value of register address +2 (Lower)	2Fh	
	Write value of register address +3 (Upper)	EFh	Value written to register address 0347h
	Write value of register address +3 (Lower)	D8h	
	Write value of register address +4 (Upper)	00h	Value written to register address 0348h
	Write value of register address +4 (Lower)	00h	
	Write value of register address +5 (Upper)	07h	Value written to register address 0349h
	Write value of register address +5 (Lower)	D0h	
Error check (Lower)		C2h	Calculation result of CRC-16
Error check (Upper)		25h	

- **Response**

Field name		Data	Description
Server address		04h	Same as query
Function code		10h	Same as query
Data	Register address (Upper)	03h	Same as query
	Register address (Lower)	44h	
	Number of registers (Upper)	00h	Same as query
	Number of registers (Lower)	06h	
Error check (Lower)		00h	Calculation result of CRC-16
Error check (Upper)		0Fh	

3-5 Read/write of multiple holding registers (17h)

With a single function code, reading data and writing data for multiple consecutive registers can be performed.
Data is written first, and then data is read from the specified registers.

■ Read

Data can be read from up to 125 consecutive registers.
Read the upper and lower data at the same time. If not, an invalid value may be read.
If multiple registers are read, they are read in order of register address.

■ Write

Data can be written to up to 121 consecutive registers.
Write the upper and lower data at the same time. If not, an invalid value may be written.
Registers are written in order of register address. Note that even when an exception response is returned because some data is invalid, such as data outside the specified range, etc., other data may have been written properly.

■ Example of read/write

Prepare the read address and write address in a single query.
In this example, the following data is first written to server address 1, and then the number of power-on times and the power supply voltage are read.

Item	Register address	Value written	Corresponding decimal
Wheel speed information (INFO-AXISSPD) Axis 1 (Upper)	780 (030Ch)	0000h	2,000
Wheel speed information (INFO-AXISSPD) Axis 1 (Lower)	781 (030Dh)	07D0h	
Wheel speed information (INFO-AXISSPD) Axis 2 (Upper)	782 (030Eh)	0000h	2,000
Wheel speed information (INFO-AXISSPD) Axis 2 (Lower)	783 (030Fh)	07D0h	

Description	Register address	Value read	Corresponding decimal
Number of power-on times (Upper)	324 (0144h)	0000h	6
Number of power-on times (Lower)	325 (0145h)	0006h	
Power supply voltage (Upper)	326 (0146h)	0000h	229
Power supply voltage (Lower)	327 (0147h)	00E5h	

- **Query**

Field name		Data	Description
Server address		01h	Server address 1
Function code		17h	Reading/writing from/to multiple holding registers
Data	(Read) Register address (Upper)	01h	Register address to start reading from
	(Read) Register address (Lower)	44h	
	(Read) Number of registers (Upper)	00h	Number of registers to be read from the starting register address (4 registers = 0004h)
	(Read) Number of registers (Lower)	04h	
	(Write) Register address (Upper)	03h	Register address to start writing from
	(Write) Register address (Lower)	0Ch	
	(Write) Number of registers (Upper)	00h	Number of registers to be written from the starting register address (4 registers = 0004h)
	(Write) Number of registers (Lower)	04h	
	(Write) Number of data bytes	08h	Value of twice the number of (Write) registers in the query
	(Write) Write value of register address (Upper)	00h	Value written to register address 030Ch
	(Write) Write value of register address (Lower)	00h	
	(Write) Write value of register address +1 (Upper)	07h	Value written to register address 030Dh
	(Write) Write value of register address +1 (Lower)	D0h	
	(Write) Write value of register address +2 (Upper)	00h	Value written to register address 030Eh
	(Write) Write value of register address +2 (Lower)	00h	
	(Write) Write value of register address +3 (Upper)	07h	Value written to register address 030Fh
	(Write) Write value of register address +3 (Lower)	D0h	
Error check (Lower)		3Bh	Calculation result of CRC-16
Error check (Upper)		00h	

- **Response**

Field name		Data	Description
Server address		01h	Same as query
Function code		17h	Same as query
Data	(Read) Number of data bytes	08h	Twice the number of (Read) registers in the query
	(Read) Read value of register address (Upper)	00h	Value read from register address 0144h
	(Read) Read value of register address (Lower)	00h	
	(Read) Read value of register address +1 (Upper)	00h	Value read from register address 0145h
	(Read) Read value of register address +1 (Lower)	06h	
	(Read) Read value of register address +2 (Upper)	00h	Value read from register address 0146h
	(Read) Read value of register address +2 (Lower)	00h	
	(Read) Read value of register address +3 (Upper)	00h	Value read from register address 0147h
	(Read) Read value of register address +3 (Lower)	E5h	
Error check (Lower)		9Ch	Calculation result of CRC-16
Error check (Upper)		1Ch	

4 Guidance

If you are new to this product, read this chapter to understand the operating methods and procedures.
This is an example of how to operate a robot in direct data operation.

STEP 1	**Installation and connection**
↓	
STEP 2	**Before starting operation**
↓	
STEP 3	**Power-on and communication parameter check**
↓	
STEP 4	**Power-on again**
↓	
STEP	**Operation of robot**

The communication parameter is enabled after the power supply is turned off and on again.

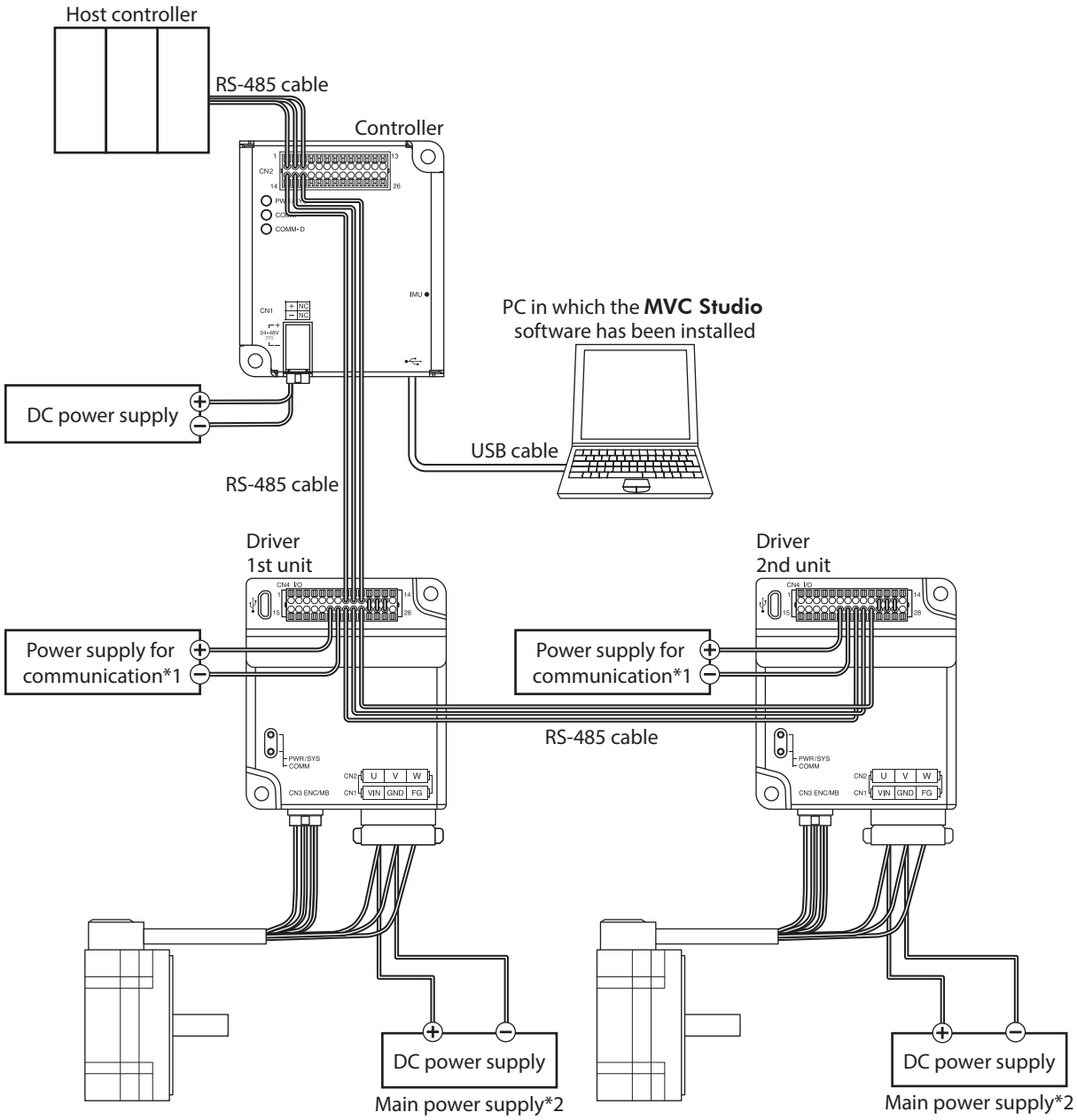
- **Operating conditions**

This operation is performed under the following conditions.

- Setting of robot
  Robot type: Differential two wheels type
- Setting of driver
  Connected driver: **BLVD-KRD** 2 units
- Communication ID (Modbus): 1, 2
- Transmission rate: 230,400 bps
- Communication protocol: Modbus RTU (RS-485 communication)

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

STEP 1 Check the installation and the connection.



*1 Be sure to connect a power supply for communication when using the **BLVD-KRD**.
*2 Connect each driver to a separate main power supply.

Note For details on connecting the driver power supply and the motor, refer to the operating manuals for products used and connect them properly according to the connection diagram.

STEP 2 Before starting operation

Refer to "3 Before starting operation" on p.37.

STEP 3 Turn on the power supply and set the communication parameters.

Use the **MVC Studio** software to check the following communication parameters.
If communication cannot be established, reconsider the communication parameters of the controller.

Register address		Name	Description	Setting range	Initial value	NET-ID
Upper	Lower					
4992 (1380h)	4993 (1381h)	Communication ID*	This is used to set the server address.	0 to 31: Server address (Do not use 0.)	1	2496 (09C0h)
4994 (1382h)	4995 (1383h)	Baudrate	This is used to set the transmission rate.	0: 9,600 bps 1: 19,200 bps 2: 38,400 bps 3: 57,600 bps 4: 115,200 bps 5: 230,400 bps	5	2497 (09C1h)
4996 (1384h)	4997 (1385h)	Communication order	This is used to set the byte order of 32-bit data. Set when the arrangement of communication data is different from that of the client. (Setting example⇨ p.59)	0: Even Address-High Word & Big-Endian 1: Even Address-Low Word & Big-Endian 2: Even Address-High Word & Little-Endian 3: Even Address-Low Word & Little-Endian	0	2498 (09C2h)
4998 (1386h)	4999 (1387h)	Communication parity	This is used to set the communication parity.	0: None 1: Even parity 2: Odd parity	1	2499 (09C3h)
5000 (1388h)	5001 (1389h)	Communication stop bit	This is used to set the communication stop bit.	0: 1 bit 1: 2 bits	0	2500 (09C4h)
5006 (138Eh)	5007 (138Fh)	Transmission waiting time	This is used to set the transmission waiting time for RS-485 communication.	0 to 10,000 (1=0.1 ms)	30	2503 (09C7h)
5008 (1390h)	5009 (1391h)	Silent interval	This is used to set the silent interval.	0: Set automatically 1 to 100 (1=0.1 ms)	0	2504 (09C8h)

* When writing is performed with the **MVC Studio** software, the value written is updated immediately.

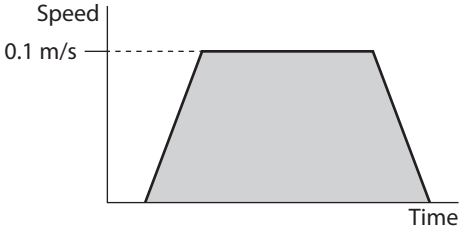
Note Set the transmission interval for frames sent by the client to be longer than the silent interval of the controller. When the transmission rate is 115,200 bps, the silent interval of the controller is 2.5 ms.

STEP 4 Turn the power supply off and on again.

The communication parameter of the controller is enabled after the power supply is turned off and on again.

STEP 5 Send a message to operate the robot.

As an example, this section explains how to specify the speed and operate in direct data operation.



1. Send the following two queries to set the data.

Communication data (Hex)	Description
01 10 07 C2 00 02 04 00 00 00 01 99 D6	Direct data operation operation type = 1: vω control
01 10 07 C4 00 02 04 00 00 00 64 D9 D7	Direct data operation forward/reverse translational speed = 0.1 m/s

2. Send the trigger with the following query.

Communication data (Hex)	Description
01 10 07 EE 00 02 04 00 00 00 01 9B 9B	Direct data operation trigger = 1: All data updated

3. Check that the robot is operating properly.
4. Send the following two queries to set the data.

Communication data (Hex)	Description
01 10 07 C2 00 02 04 00 00 00 01 99 D6	Direct data operation operation type = 1: vω control
01 10 07 C4 00 02 04 00 00 00 00 D8 3C	Direct data operation forward/reverse translational speed = 0 m/s

5. Send the trigger with the following query.

Communication data (Hex)	Description
01 10 07 EE 00 02 04 00 00 00 01 9B 9B	Direct data operation trigger = 1: All data updated

6. The robot stops.

STEP 6 Were you able to operate?

How did it go? Were you able to operate properly? If the robot does not operate properly, check the following points.

- Are the power supply, the motor, and the RS-485 cable connected securely?
- Is the PWR/SYS LED blinking in red?
  An alarm is being generated. Refer to "2 Alarms" on p.141 for details
- Was the setup wizard of the **MVC Studio** software completed successfully?
  If the ROBOT-EN output is in an OFF state, the setting of the robot has not been completed successfully. Set from STEP 2 again.
- Is the COMM LED or the COMM-D LED lit in red?
  A communication error of RS-485 communication is being detected. Refer to "1 Detection of communication errors" on p.140 for details.

5 Setting of RS-485 communication

Set the parameters required for RS-485 communication before starting communication.

5-1 Parameters updated when the power supply is turned on

These are parameters related to sending and receiving via RS-485 communication. Set using the **MVC Studio** software.

- These parameters are excluded from Configuration.
- They are not initialized even if "Batch data initialization (excluding parameters for mechanism and communication) of the maintenance command is executed.
- They are initialized if "Batch data initialization (excluding mechanism parameters)" of the maintenance command is executed. After executing "Batch data initialization (excluding mechanism parameters)," turning on the power supply again may change the communication setting, thereby disabling communication.
- They are initialized if [Restoring parameters to the factory settings (except for robot information)] under the [Communication] menu of the **MVC Studio** software is executed.

Register address		Name	Description	Setting range	Initial value	NET-ID
Upper	Lower					
4992 (1380h)	4993 (1381h)	Communication ID*	This is used to set the server address.	0 to 31: Server address (Do not use 0.)	1	2496 (09C0h)
4994 (1382h)	4995 (1383h)	Baudrate	This is used to set the transmission rate.	0: 9,600 bps 1: 19,200 bps 2: 38,400 bps 3: 57,600 bps 4: 115,200 bps 5: 230,400 bps	5	2497 (09C1h)
4996 (1384h)	4997 (1385h)	Communication order	This is used to set the byte order of 32-bit data. Set when the arrangement of communication data is different from that of the client. (Setting example⇨p.59)	0: Even Address-High Word & Big-Endian 1: Even Address-Low Word & Big-Endian 2: Even Address-High Word & Little-Endian 3: Even Address-Low Word & Little-Endian	0	2498 (09C2h)
4998 (1386h)	4999 (1387h)	Communication parity	This is used to set the communication parity.	0: None 1: Even parity 2: Odd parity	1	2499 (09C3h)
5000 (1388h)	5001 (1389h)	Communication stop bit	This is used to set the communication stop bit.	0: 1 bit 1: 2 bits	0	2500 (09C4h)
5006 (138Eh)	5007 (138Fh)	Transmission waiting time	This is used to set the transmission waiting time for RS-485 communication.	0 to 10,000 (1=0.1 ms)	30	2503 (09C7h)
5008 (1390h)	5009 (1391h)	Silent interval	This is used to set the silent interval.	0: Set automatically 1 to 100 (1=0.1 ms)	0	2504 (09C8h)

* When writing is performed with the **MVC Studio** software, the value written is updated immediately.

■ Setting examples of "Communication order" parameter

When 32-bit data "1234 5678h" is stored in the register address 1000h and 1001h, the arrangement changes to the following according to the setting of the parameter.

Parameter setting	1000h (even number address)		1001h (odd number address)	
	Upper	Lower	Upper	Lower
0: Even Address-High Word & Big-Endian	12h	34h	56h	78h
1: Even Address-Low Word & Big-Endian	56h	78h	12h	34h
2: Even Address-High Word & Little-Endian	34h	12h	78h	56h
3: Even Address-Low Word & Little-Endian	78h	56h	34h	12h

memo This manual describes based on "Even Address-High Word & Big-Endian."

5-2 Parameters updated immediately after rewriting

Set the following parameters using the **MVC Studio** software or via RS-485 communication.

Register address		Name	Description	Setting range	Initial value	NET-ID
Upper	Lower					
5002 (138Ah)	5003 (138Bh)	Communication timeout	This is used to set the condition under which a communication timeout occurs in RS-485 communication.	0: Disable 1 to 10,000 ms	0	2501 (09C5h)
5004 (138Ch)	5005 (138Dh)	Communication error alarm	If the RS-485 communication error occurs for the set number of times, an alarm of RS-485 communication error is generated.	0: Disable 1 to 10 times	3	2502 (09C6h)
5010 (1392h)	5011 (1393h)	Server error response mode	This is used to set the response when the server error occurs.	0: Normal response 1: Exception response	1	2505 (09C9h)

memo To communicate with the client periodically, set the "Communication timeout" parameter. If this parameter is set, an alarm of RS-485 communication timeout can be generated when communication between the client and the controller is lost.

6 Data setting method

6-1 Overview of setting methods

There are three methods to set data via Modbus communication.
When handling multiple pieces of data, the communication specifications of Modbus allow reading from and writing to consecutive addresses.

■ When operating

Input method	Features
Direct data operation	Rewriting of data and start of operation can be executed at the same time. (Reference ⇨ p.67)
Direct reference	• Data is set by specifying addresses. • If the data consists of consecutive addresses, multiple pieces of data can be handled with a single query. • Remote I/O or direct I/O is input to execute JOG operation.
Indirect reference	• This is a method in which data is stored in addresses exclusive for sending (indirect reference addresses) and set. • Even if addresses of the data to be set are not consecutive, multiple pieces of data can be handled with a single query because the indirect reference addresses are consecutive. • Remote I/O or direct I/O is input to execute JOG operation.

■ When setting the parameters or monitoring, etc.

- When addresses of data are consecutive: Set by direct reference.
- When addresses of data are not consecutive: When indirect reference is used, multiple commands can be executed with a single query.

Direct and indirect references are described below.

6-2 Direct reference

Direct reference is a method in which data is set by specifying addresses. Consecutive multiple addresses can be sent with a single query. However, if the addresses to be set are not consecutive, as many queries as the number of addresses should be sent.

6-3 Indirect reference

Indirect reference is a method in which data is stored in addresses exclusive for sending (indirect reference addresses) and set. Even if the addresses of the data to be set are not consecutive, a single query can read from and write to multiple register addresses because the register addresses in the indirect reference area are consecutive.
However, this method requires registering the register addresses to be read and written in indirect reference addresses.
Refer to p.64 for the setting example.

■ Addresses and areas of indirect reference

Indirect reference has 32 addresses and areas (0 to 31).

Name	Description
Indirect reference address (0)	The NET-ID of the data to be sent in indirect reference is stored. NET-ID is a unique number that is stored internally by the controller and assigned to each setting item. In Modbus communication, be sure to input the "value half of the register address" because the value twice the NET-ID is the register address.
Indirect reference address (1)	
• • •	
Indirect reference address (30)	
Indirect reference address (31)	
Indirect reference area 0	The setting value of data to be sent in indirect reference is stored.
Indirect reference area 1	
• • •	
Indirect reference area 30	
Indirect reference area 31	

● Indirect reference address setting

Register address		Name	Description	Setting range	Initial value	NET-ID
Upper	Lower					
4864 (1300h)	4865 (1301h)	Indirect reference address setting (0)	These are used to set the NET-ID of commands or parameters to be registered in the indirect reference addresses.	0 to 65,535 (0 to FFFFh)	0	2432 (0980h)
4866 (1302h)	4867 (1303h)	Indirect reference address setting (1)			0	2433 (0981h)
4868 (1304h)	4869 (1305h)	Indirect reference address setting (2)			0	2434 (0982h)
4870 (1306h)	4871 (1307h)	Indirect reference address setting (3)			0	2435 (0983h)
4872 (1308h)	4873 (1309h)	Indirect reference address setting (4)			0	2436 (0984h)
4874 (130Ah)	4875 (130Bh)	Indirect reference address setting (5)			0	2437 (0985h)
4876 (130Ch)	4877 (130Dh)	Indirect reference address setting (6)			0	2438 (0986h)
4878 (130Eh)	4879 (130Fh)	Indirect reference address setting (7)			0	2439 (0987h)
4880 (1310h)	4881 (1311h)	Indirect reference address setting (8)			0	2440 (0988h)
4882 (1312h)	4883 (1313h)	Indirect reference address setting (9)			0	2441 (0989h)
4884 (1314h)	4885 (1315h)	Indirect reference address setting (10)			0	2442 (098Ah)
4886 (1316h)	4887 (1317h)	Indirect reference address setting (11)			0	2443 (098Bh)
4888 (1318h)	4889 (1319h)	Indirect reference address setting (12)			0	2444 (098Ch)

Register address		Name	Description	Setting range	Initial value	NET-ID
Upper	Lower					
4890 (131Ah)	4891 (131Bh)	Indirect reference address setting (13)	These are used to set the NET-ID of commands or parameters to be registered in the indirect reference addresses.	0 to 65,535 (0 to FFFFh)	0	2445 (098Dh)
4892 (131Ch)	4893 (131Dh)	Indirect reference address setting (14)			0	2446 (098Eh)
4894 (131Eh)	4895 (131Fh)	Indirect reference address setting (15)			0	2447 (098Fh)
4896 (1320h)	4897 (1321h)	Indirect reference address setting (16)			0	2448 (0990h)
4898 (1322h)	4899 (1323h)	Indirect reference address setting (17)			0	2449 (0991h)
4900 (1324h)	4901 (1325h)	Indirect reference address setting (18)			0	2450 (0992h)
4902 (1326h)	4903 (1327h)	Indirect reference address setting (19)			0	2451 (0993h)
4904 (1328h)	4905 (1329h)	Indirect reference address setting (20)			0	2452 (0994h)
4906 (132Ah)	4907 (132Bh)	Indirect reference address setting (21)			0	2453 (0995h)
4908 (132Ch)	4909 (132Dh)	Indirect reference address setting (22)			0	2454 (0996h)
4910 (132Eh)	4911 (132Fh)	Indirect reference address setting (23)			0	2455 (0997h)
4912 (1330h)	4913 (1331h)	Indirect reference address setting (24)			0	2456 (0998h)
4914 (1332h)	4915 (1333h)	Indirect reference address setting (25)			0	2457 (0999h)
4916 (1334h)	4917 (1335h)	Indirect reference address setting (26)			0	2458 (099Ah)
4918 (1336h)	4919 (1337h)	Indirect reference address setting (27)			0	2459 (099Bh)
4920 (1338h)	4921 (1339h)	Indirect reference address setting (28)			0	2460 (099Ch)
4922 (133Ah)	4923 (133Bh)	Indirect reference address setting (29)			0	2461 (099Dh)
4924 (133Ch)	4925 (133Dh)	Indirect reference address setting (30)			0	2462 (099Eh)
4926 (133Eh)	4927 (133Fh)	Indirect reference address setting (31)			0	2463 (099Fh)

● Indirect reference area

Register address		Name	NET-ID
Upper	Lower		
4928 (1340h)	4929 (1341h)	Indirect reference area 0	2464 (09A0h)
4930 (1342h)	4931 (1343h)	Indirect reference area 1	2465 (09A1h)
4932 (1344h)	4933 (1345h)	Indirect reference area 2	2466 (09A2h)
4934 (1346h)	4935 (1347h)	Indirect reference area 3	2467 (09A3h)
4936 (1348h)	4937 (1349h)	Indirect reference area 4	2468 (09A4h)
4938 (134Ah)	4939 (134Bh)	Indirect reference area 5	2469 (09A5h)
4940 (134Ch)	4941 (134Dh)	Indirect reference area 6	2470 (09A6h)
4942 (134Eh)	4943 (134Fh)	Indirect reference area 7	2471 (09A7h)
4944 (1350h)	4945 (1351h)	Indirect reference area 8	2472 (09A8h)
4946 (1352h)	4947 (1353h)	Indirect reference area 9	2473 (09A9h)
4948 (1354h)	4949 (1355h)	Indirect reference area 10	2474 (09AAh)
4950 (1356h)	4951 (1357h)	Indirect reference area 11	2475 (09ABh)
4952 (1358h)	4953 (1359h)	Indirect reference area 12	2476 (09ACh)
4954 (135Ah)	4955 (135Bh)	Indirect reference area 13	2477 (09ADh)
4956 (135Ch)	4957 (135Dh)	Indirect reference area 14	2478 (09AEh)
4958 (135Eh)	4959 (135Fh)	Indirect reference area 15	2479 (09AFh)

Register address		Name	NET-ID
Upper	Lower		
4960 (1360h)	4961 (1361h)	Indirect reference area 16	2480 (09B0h)
4962 (1362h)	4963 (1363h)	Indirect reference area 17	2481 (09B1h)
4964 (1364h)	4965 (1365h)	Indirect reference area 18	2482 (09B2h)
4966 (1366h)	4967 (1367h)	Indirect reference area 19	2483 (09B3h)
4968 (1368h)	4969 (1369h)	Indirect reference area 20	2484 (09B4h)
4970 (136Ah)	4971 (136Bh)	Indirect reference area 21	2485 (09B5h)
4972 (136Ch)	4973 (136Dh)	Indirect reference area 22	2486 (09B6h)
4974 (136Eh)	4975 (136Fh)	Indirect reference area 23	2487 (09B7h)
4976 (1370h)	4977 (1371h)	Indirect reference area 24	2488 (09B8h)
4978 (1372h)	4979 (1373h)	Indirect reference area 25	2489 (09B9h)
4980 (1374h)	4981 (1375h)	Indirect reference area 26	2490 (09BAh)
4982 (1376h)	4983 (1377h)	Indirect reference area 27	2491 (09BBh)
4984 (1378h)	4985 (1379h)	Indirect reference area 28	2492 (09BCh)
4986 (137Ah)	4987 (137Bh)	Indirect reference area 29	2493 (09BDh)
4988 (137Ch)	4989 (137Dh)	Indirect reference area 30	2494 (09BEh)
4990 (137Eh)	4991 (137Fh)	Indirect reference area 31	2495 (09BFh)

■ Setting example

This section explains an example of sending and receiving data to and from the server address 1 using indirect reference.

- **STEP 1: Registration in indirect reference addresses**

Setting data

Indirect reference address	Register address			Data to be sent	NET-ID
	Upper	Lower			
Indirect reference address setting (0)	4864 (1300h)	4865 (1301h)	←	JOG operation translational acceleration/deceleration speed	0E17h (Half the value of register address 1E2Eh)
Indirect reference address setting (1)	4866 (1302h)	4867 (1303h)	←	Direct data operation forward/ reverse translational deceleration	1061h (Half the value of register address 20C2h)
Indirect reference address setting (2)	4868 (1304h)	4869 (1305h)	←	Stop action preset forward/reverse translational deceleration	1067h (Half the value of register address 20CEh)

Send the following query and register the NET-ID of the data to be sent in the indirect reference addresses.

Query

Field name		Data	Description
Server address		01h	Server address 1
Function code		10h	Writing to multiple holding registers
Data	Register address (Upper)	13h	Register address to start writing from = Indirect reference address setting (0) (1300h)
	Register address (Lower)	00h	
	Number of registers (Upper)	00h	Number of registers to be written from the starting register address = 6 registers (0006h)
	Number of registers (Lower)	06h	
	Number of data bytes	0Ch	Twice the number of registers in the query = 12
	Write value of register address (Upper)	00h	Value written to register address 1300h = NET-ID of JOG operation translational acceleration/ deceleration speed (0E17h)
	Write value of register address (Lower)	00h	
	Write value of register address +1 (Upper)	0Fh	
	Write value of register address +1 (Lower)	17h	
	Write value of register address +2 (Upper)	00h	Value written to register addresses 1302h = NET-ID of Direct data operation forward/reverse translational deceleration (1061h)
	Write value of register address +2 (Lower)	00h	
	Write value of register address +3 (Upper)	10h	
	Write value of register address +3 (Lower)	61h	
	Write value of register address +4 (Upper)	00h	Value written to register address 1304h = NET-ID of Stop action preset forward/reverse translational deceleration (1067h)
	Write value of register address +4 (Lower)	00h	
	Write value of register address +5 (Upper)	10h	
	Write value of register address +5 (Lower)	67h	
Error check (Lower)		DFh	Calculation result of CRC-16
Error check (Upper)		50h	

- **STEP 2: Writing to indirect reference areas**

Setting data

Indirect reference area	Register address			Data to be sent	Setting value
	Upper	Lower			
Indirect reference area 0	4928 (1340h)	4929 (1341h)	←	JOG operation translational acceleration/deceleration speed	9,500 (251Ch)
Indirect reference area 1	4930 (1342h)	4931 (1343h)	←	Direct data operation forward/ reverse translational deceleration	5,000 (1388h)
Indirect reference area 2	4932 (1344h)	4933 (1345h)	←	Stop action preset forward/reverse translational deceleration	7,500 (1D4Ch)

Send the following query to write the setting values of the data to be sent in indirect reference areas.

Query

Field name		Data	Description
Server address		01h	Server address 1
Function code		10h	Writing to multiple holding registers
Data	Register address (Upper)	13h	Register address to start writing from = Indirect reference area 0 (1340h)
	Register address (Lower)	40h	
	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 query = 12
	Write value of register address (Upper)	00h	Value written to register address 1340h = JOG operation translational acceleration/ deceleration speed 9,500 (251Ch)
	Write value of register address (Lower)	00h	
	Write value of register address +1 (Upper)	25h	
	Write value of register address +1 (Lower)	1Ch	
	Write value of register address +2 (Upper)	00h	Value written to register addresses 1342h = Direct data operation forward/reverse translational deceleration 5,000 (1388h)
	Write value of register address +2 (Lower)	00h	
	Write value of register address +3 (Upper)	13h	
	Write value of register address +3 (Lower)	88h	
	Write value of register address +4 (Upper)	00h	Value written to register address 1344h = Stop action preset forward/reverse translational deceleration 7,500 (1D4Ch)
	Write value of register address +4 (Lower)	00h	
	Write value of register address +5 (Upper)	1Dh	
	Write value of register address +5 (Lower)	4Ch	
Error check (Lower)		A5h	Calculation result of CRC-16
Error check (Upper)		B1h	

- **STEP 3: Reading from indirect reference areas**

  Send the following query to read the data written in indirect reference areas.

Query

Field name		Data	Description
Server address		01h	Server address 1
Function code		03h	Reading from a holding register(s)
Data	Register address (Upper)	13h	Register address to start reading from = Indirect reference area 0 (1340h)
	Register address (Lower)	40h	
	Number of registers (Upper)	00h	Number of registers to be read from the starting register address = 6 registers (0006h)
	Number of registers (Lower)	06h	
Error check (Lower)		C0h	Calculation result of CRC-16
Error check (Upper)		98h	

Response

Field name		Data	Description
Server address		01h	Same as query
Function code		03h	Same as query
Data	Number of data bytes	0Ch	Twice the number of registers in the query = 12
	Read value of register address (Upper)	00h	Value read from register address 1340h = 9,500 (251Ch)
	Read value of register address (Lower)	00h	
	Read value of register address +1 (Upper)	25h	
	Read value of register address +1 (Lower)	1Ch	
	Read value of register address +2 (Upper)	00h	Value read from register address 1342h = 5,000 (1388h)
	Read value of register address +2 (Lower)	00h	
	Read value of register address +3 (Upper)	13h	
	Read value of register address +3 (Lower)	88h	
	Read value of register address +4 (Upper)	00h	Value read from register address 1344h = 7,500 (1D4Ch)
	Read value of register address +4 (Lower)	00h	
	Read value of register address +5 (Upper)	1Dh	
	Read value of register address +5 (Lower)	4Ch	
Error check (Lower)		F0h	Calculation result of CRC-16
Error check (Upper)		D3h	

It was found that the data had been written normally using indirect reference.

7 Direct data operation

7-1 Overview of direct data operation

Direct data operation is a mode that allows the data to be rewritten and the operation to be started at the same time. It is suitable for applications where the speed is frequently changed.
When the trigger and data are sent, operation is started at the same time that the data is rewritten.

7-2 Command necessary for direct data operation

The set values of acceleration, deceleration, and jerk are saved in non-volatile memory. The other setting values are stored in RAM.

Related commands

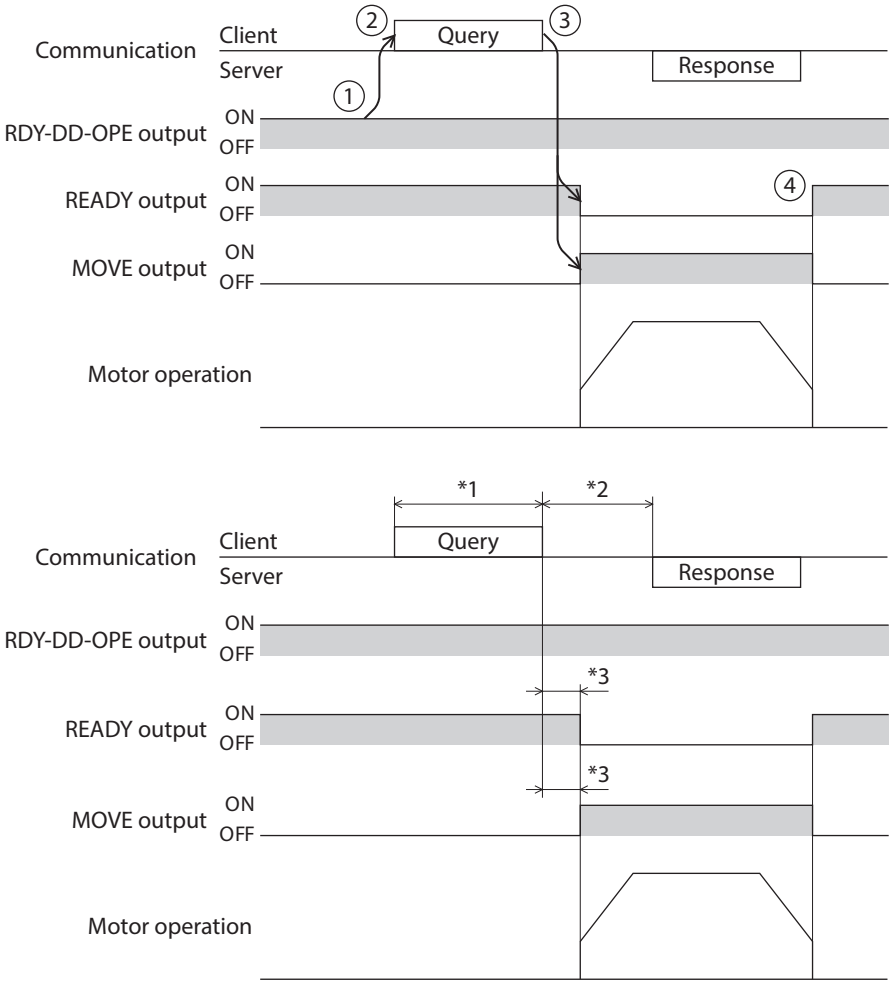
Register address		Name	Description	Setting range	Initial value	NET-ID
Upper	Lower					
1986 (07C2h)	1987 (07C3h)	Direct data operation operation type	This is used to set the operation type. The robot will stop if a value outside the setting range is set.	0: Disable 1: vω control	0	993 (03E1h)
1988 (07C4h)	1989 (07C5h)	Direct data operation forward/reverse translational speed	These are used to set the speed.	−2,000 to 2,000 (1=0.001 m/s)	0	994 (03E2h)
1990 (07C6h)	1991 (07C7h)	Direct data operation rotation speed		−6,283,186 to 6,283,186 (1=0.000001 rad/s)	0	995 (03E3h)
1992 (07C8h)	1993 (07C9h)	Direct data operation left/right translational speed		−2,000 to 2,000 (1=0.001 m/s)	0	996 (03E4h)
2030 (07EEh)	2031 (07EFh)	Direct data operation trigger	This is used to set the trigger.	0: Disable 1: All data updated	0	1015 (03F7h)
8380 (20BCh)	8381 (20BDh)	Direct data operation forward/reverse translational acceleration	These are used to set the acceleration.	1 to 2,147,483,647 (1=0.001 m/s^2)	10,000	4190 (105Eh)
8382 (20BEh)	8383 (20BFh)	Direct data operation rotation acceleration		1 to 2,147,483,647 (1=0.000001 rad/s^2)	3,141,592	4191 (105Fh)
8384 (20C0h)	8385 (20C1h)	Direct data operation left/right translational acceleration		1 to 2,147,483,647 (1=0.001 m/s^2)	10,000	4192 (1060h)
8386 (20C2h)	8387 (20C3h)	Direct data operation forward/reverse translational deceleration	These are used to set the deceleration.	1 to 2,147,483,647 (1=0.001 m/s^2)	10,000	4193 (1061h)
8388 (20C4h)	8389 (20C5h)	Direct data operation rotation deceleration		1 to 2,147,483,647 (1=0.000001 rad/s^2)	3,141,592	4194 (1062h)
8390 (20C6h)	8391 (20C7h)	Direct data operation left/right translational deceleration		1 to 2,147,483,647 (1=0.001 m/s^2)	10,000	4195 (1063h)
8392 (20C8h)	8393 (20C9h)	Direct data operation forward/reverse translational jerk	These are used to set the jerk.	0: Disable 1 to 2,147,483,647 (1=0.001 m/s^3)	0	4196 (1064h)
8394 (20CAh)	8395 (20CBh)	Direct data operation rotation jerk		0: Disable 1 to 2,147,483,647 (1=0.000001 rad/s^3)	0	4197 (1065h)
8396 (20CCh)	8397 (20CDh)	Direct data operation left/right translational jerk	These are used to set the jerk.	0: Disable 1 to 2,147,483,647 (1=0.001 m/s^3)	0	4198 (1066h)

■ Trigger

This is a trigger that starts operation at the same time as the rewriting of data in direct data operation.
When "1" is written to the trigger, all data is written and direct data operation is started at the same time.
When operation is started, the trigger automatically returns to "0."

● Timing chart

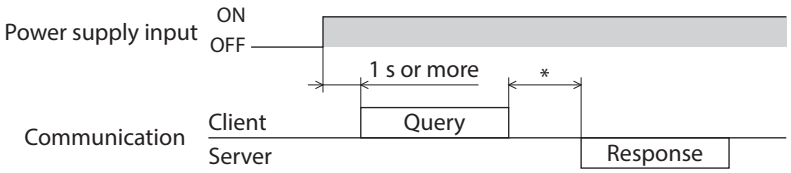
1. Check that the RDY-DD-OPE output is being ON.
2. Send a query (including the trigger and data) to perform direct data operation.
3. When the client receives a query, the READY output is turned OFF, the MOVE output is turned ON, and operation is started.
4. When the motor stops, the READY output is turned ON.



*1 Query via RS-485 communication
*2 C3.5 (silent interval) + Tb5 (query processing time (controller)) + Tb2 (transmission waiting time (controller side))
*3 C3.5 (silent interval) + 4 ms or less

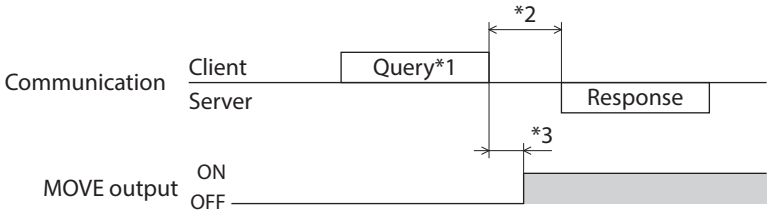
8 Timing chart

8-1 Communication start



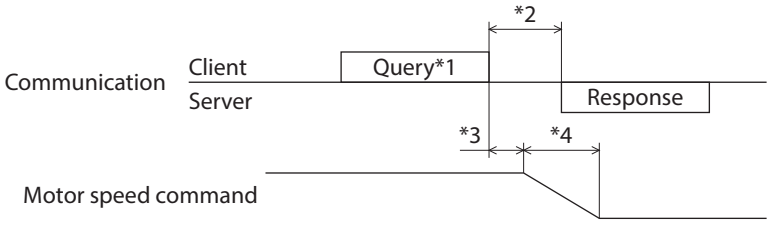
* C3.5 (silent interval) + Tb5 (query processing time (controller)) + Tb2 (transmission waiting time (controller side))

8-2 Operation start



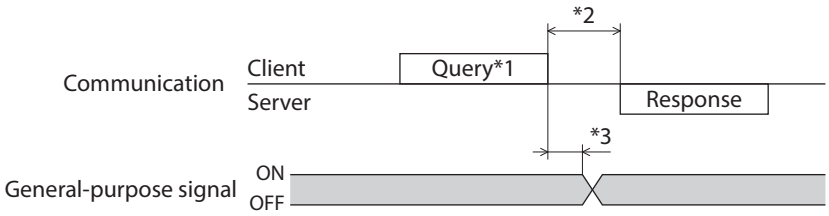
*1 A message including a query to start operation via RS-485 communication
*2 C3.5 (silent interval) + Tb5 (query processing time (controller)) + Tb2 (transmission waiting time (controller side))
*3 C3.5 (silent interval) + 2 ms or less

8-3 Operation stop, speed change



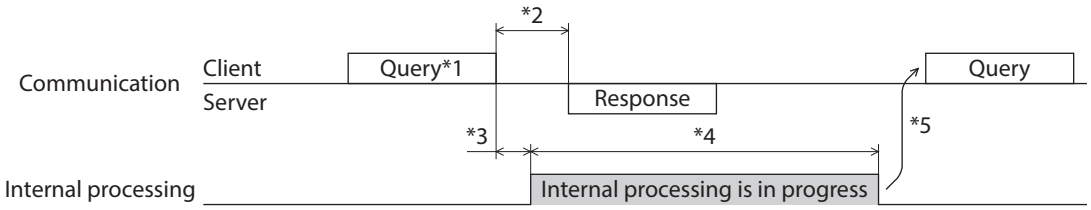
*1 A message including a query to stop operation and another to change the speed via RS-485 communication
*2 C3.5 (silent interval) + Tb5 (query processing time (controller)) + Tb2 (transmission waiting time (controller side))
*3 It varies depending on the operating condition.
*4 It varies depending on the settings of the "Stop action at alarm generation," "STOP input action," and "STOP-H input action" parameters.

8-4 General-purpose signal



*1 A message including a query for remote output via RS-485 communication
*2 C3.5 (silent interval) + Tb5 (query processing time (controller)) + Tb2 (transmission waiting time (controller side))
*3 C3.5 (silent interval) + 2 ms or less

8-5 Configuration



*1 A message including a query for configuration via RS-485 communication
*2 C3.5 (silent interval) + Tb5 (query processing time (controller)) + Tb2 (transmission waiting time (controller side))
*3 C3.5 (silent interval) + 2 ms or less
*4 1 s or less
*5 Do not execute writing while Configuration is executed.

5 Address and code lists

This part shows lists of the addresses and codes used in the MVC Studio software and Modbus communication.

◆Table of contents

1 Timing of the update of parameters

All data used in the controller is 32 bits wide. With the Modbus protocol, since the register is 16 bits wide, two registers represent a single piece of data.
Parameters are stored in RAM or non-volatile memory. The parameters stored in RAM are erased when the power supply is shut off, but those stored in non-volatile memory are retained even if the power supply is shut off.
When the power supply of the controller is turned on, the parameters stored in non-volatile memory are sent to RAM, and recalculation and setup for the parameters are executed in RAM.

Parameters set with the **MVC Studio** software are stored in non-volatile memory if [Write data] is performed.
Parameters set via RS-485 communication are stored in RAM. To save the parameters stored in RAM to non-volatile memory, execute "Write batch NV memory" of the maintenance command.
When a parameter is changed, the timing for updating the new value varies depending on the parameter. Refer to "Notation rules" for the update timing.

memo

- Parameters set via RS-485 communication are stored in RAM. For parameters that require the power supply to be turned on again to update, be sure to save them to non-volatile memory before turning off the power supply.
- Non-volatile memory can be rewritten approximately 100,000 times.

■ Notation rules

● Timing of the update

In this manual, each update time is represented in an alphabet.

Notation	Description
A	Recalculation and setup are immediately executed when the parameter is written.
B	Recalculation and setup are executed when the operation is stopped.
C	Recalculation and setup are executed after Configuration is executed or the power supply is turned on again.
D	Recalculation and setup are executed after the power supply is turned on again.

● READ and WRITE

In this manual, READ and WRITE may be represented as follows.

Notation	Item
R	READ
W	WRITE
R/W	READ/WRITE

2 I/O commands

These are commands related to I/O (input and output). The set value is stored in RAM.

Register address		Name	Description	Initial value	R/W	NET-ID
Upper	Lower					
124 (007Ch)	125 (007Dh)	Controller input command	This is used to set the input command to the controller. (Details of bits arrangement ⇨"Controller input command")	0	R/W	62 (003Eh)
126 (007Eh)	127 (007Fh)	Controller output status	This is used to read the output status of the controller. (Details of bits arrangement ⇨"Controller output status")	–	R	63 (003Fh)

■ Controller input command

The controller input command refers to the input signals of the controller that can be accessed via Modbus communication. They can also be accessed in units of one register (16 bits).

● Upper

Register address	Description							
124 (007Ch)	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
	–	–	–	–	–	–	–	–
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	–	–	–	–	–	–	–	–

● Lower

Values in brackets [ ] are initial values. They can be changed using the parameter. (Parameters ⇨p.95, assignment of input signals ⇨p.116)

Register address	Description							
125 (007Dh)	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
	R-IN15 [No function]	R-IN14 [No function]	R-IN13 [No function]	R-IN12 [No function]	R-IN11 [No function]	R-IN10 [No function]	R-IN9 [No function]	R-IN8 [No function]
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	R-IN7 [No function]	R-IN6 [No function]	R-IN5 [No function]	R-IN4 [No function]	R-IN3 [No function]	R-IN2 [No function]	R-IN1 [No function]	R-IN0 [No function]

■ Controller output status

The controller output status refers to the output signals of the controller that can be accessed via Modbus communication. They can also be accessed in units of one register (16 bits).

- **Upper**

Register address	Description							
126 (007Eh)	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
	–	–	–	–	–	–	–	–
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	–	–	–	–	–	–	–	–

- **Lower**

Values in brackets [ ] are initial values. They can be changed using the parameter. (Parameters ⇨p.95, assignment of output signals ⇨p.117)

Register address	Description							
127 (007Fh)	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
	R-OUT15 [No function]	R-OUT14 [No function]	R-OUT13 [No function]	R-OUT12 [No function]	R-OUT11 [No function]	R-OUT10 [No function]	R-OUT9 [No function]	R-OUT8 [No function]
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	R-OUT7 [No function]	R-OUT6 [No function]	R-OUT5 [No function]	R-OUT4 [No function]	R-OUT3 [No function]	R-OUT2 [No function]	R-OUT1 [No function]	R-OUT0 [No function]

3 Protect release command

Register address		Name	Description	Initial value	Key code	NET-ID
Upper	Lower					
68 (0044h)	69 (0045h)	HMI release key	This is used to input a key code to release a state of limiting the functions of the **MVC Studio** software.	0	864617234 (33890312h)	34 (0022h)

memo A state of limiting the functions of the **MVC Studio** software can also be released with the HMI input.

4 Direct data operation commands

Direct data operation commands are used when direct data operation is performed. The setting values of acceleration, deceleration, and jerk are saved in non-volatile memory. The other setting values are stored in RAM.

Register address		Name	Description	Setting range	Initial value	NET-ID
Upper	Lower					
1986 (07C2h)	1987 (07C3h)	Direct data operation operation type	This is used to set the operation type. The robot will stop if a value outside the setting range is set.	0: Disable 1: vω control	0	993 (03E1h)
1988 (07C4h)	1989 (07C5h)	Direct data operation forward/ reverse translational speed	These are used to set the speed.	−2,000 to 2,000 (1=0.001 m/s)	0	994 (03E2h)
1990 (07C6h)	1991 (07C7h)	Direct data operation rotation speed		−6,283,186 to 6,283,186 (1=0.000001 rad/s)	0	995 (03E3h)
1992 (07C8h)	1993 (07C9h)	Direct data operation left/right translational speed		−2,000 to 2,000 (1=0.001 m/s)	0	996 (03E4h)
2030 (07EEh)	2031 (07EFh)	Direct data operation trigger	This is used to set the trigger.	0: Disable 1: All data updated	0	1015 (03F7h)
8380 (20BCh)	8381 (20BDh)	Direct data operation forward/ reverse translational acceleration	These are used to set the acceleration.	1 to 2,147,483,647 (1=0.001 m/s^2)	10,000	4190 (105Eh)
8382 (20BEh)	8383 (20BFh)	Direct data operation rotation acceleration		1 to 2,147,483,647 (1=0.000001 rad/s^2)	3,141,592	4191 (105Fh)
8384 (20C0h)	8385 (20C1h)	Direct data operation left/right translational acceleration		1 to 2,147,483,647 (1=0.001 m/s^2)	10,000	4192 (1060h)
8386 (20C2h)	8387 (20C3h)	Direct data operation forward/ reverse translational deceleration	These are used to set the deceleration.	1 to 2,147,483,647 (1=0.001 m/s^2)	10,000	4193 (1061h)
8388 (20C4h)	8389 (20C5h)	Direct data operation rotation deceleration		1 to 2,147,483,647 (1=0.000001 rad/s^2)	3,141,592	4194 (1062h)
8390 (20C6h)	8391 (20C7h)	Direct data operation left/right translational deceleration		1 to 2,147,483,647 (1=0.001 m/s^2)	10,000	4195 (1063h)
8392 (20C8h)	8393 (20C9h)	Direct data operation forward/ reverse translational jerk	These are used to set the jerk.	0: Disable 1 to 2,147,483,647 (1=0.001 m/s^3)	0	4196 (1064h)
8394 (20CAh)	8395 (20CBh)	Direct data operation rotation jerk		0: Disable 1 to 2,147,483,647 (1=0.000001 rad/s^3)	0	4197 (1065h)
8396 (20CCh)	8397 (20CDh)	Direct data operation left/right translational jerk		0: Disable 1 to 2,147,483,647 (1=0.001 m/s^3)	0	4198 (1066h)

■ Trigger

This is a trigger that starts operation at the same time as the rewriting of data in direct data operation. When "1" is written to the trigger, all data is written and direct data operation is started at the same time. When operation is started, the trigger automatically returns to "0."

5 Coordinate commands

Coordinate commands are used when the present position (odometry) is changed. When setting a value to a command of the coordinate to be changed and writing the trigger, the present position (odometry) is rewritten. The set value is stored in RAM.

Register address		Name	Description	Setting range	Initial value	NET-ID
Upper	Lower					
8980 (2314h)	8981 (2315h)	IMU odometry data update timing	This is used to set the timing to update the wheel odometry data.	0: Always update 1: Only during operation	0	4490 (118Ah)
8998 (2326h)	8999 (2327h)	Wheel odometry data set trigger	This is used to set the trigger for the wheel odometry data set. If a value other than "0" is set, the trigger will return to "0" after writing the value to the target coordinate.	0 bit: X 1 bit: Y 2 bit: θ	0	4499 (1193h)
9000 (2328h)	9001 (2329h)	Wheel odometry data set X	These are used to set the value to be written to the coordinate.	−2,147,483,648 to 2,147,483,647 (1=0.001 m)	0	4500 (1194h)
9002 (232Ah)	9003 (232Bh)	Wheel odometry data set Y				
9004 (232Ch)	9005 (232Dh)	Wheel odometry data set θ		−6,283,186 to 6,283,186 (1=0.000001 rad)	0	4501 (1195h)
9014 (2336h)	9015 (2337h)	Displacement data set trigger	This is used to set the trigger for the displacement data set. If a value other than "0" is set, the trigger will return to "0" after writing the value to the target coordinate.	0 bit: Forward/reverse 1 bit: Left/right	0	4507 (119Bh)
9016 (2338h)	9017 (2339h)	Displacement data set forward/reverse	Thee are used to set the value to be written to the displacement data of the robot.	−2,147,483,648 to 2,147,483,647 (1=0.001 m)	0	4508 (119Ch)
9018 (233Ah)	9019 (233Bh)	Displacement data set left/right				4509 (119Dh)
9022 (233Eh)	9023 (233Fh)	Gyro odometry data set trigger	This is used to set the trigger for the gyro odometry data set. If a value other than "0" is set, the trigger will return to "0" after writing the value to the target coordinate.	0 bit: X 1 bit: Y 5 bit: Yaw	0	4511 (119Fh)
9024 (2340h)	9025 (2341h)	Gyro odometry data set X	These are used to set the value to be written to the coordinate.	−2,147,483,648 to 2,147,483,647 (1=0.001 m)	0	4512 (11A0h)
9026 (2342h)	9027 (2343h)	Gyro odometry data set Y				4513 (44A1h)
9034 (234Ah)	9035 (234Bh)	Gyro odometry data set Yaw		−6,283,186 to 6,283,186 (1=0.000001 rad)	0	4517 (11A5h)

memo The set value is cleared when the power supply of the controller is turned off because it is stored in RAM.

6 Maintenance commands

Maintenance commands are used to execute alarm reset, batch processing of non-volatile memory, etc.

Note The maintenance commands include processing in which the memory is operated, such as batch processing of non-volatile memory. Make sure not to successively execute them unnecessarily.

Register address		Name	Description	NET-ID
Upper	Lower			
384 (0180h)	385 (0181h)	Alarm reset	This is used to reset the alarm being generated presently. Some alarms cannot be reset.	192 (00C0h)
388 (0184h)	389 (0185h)	Clear alarm history	This is used to clear the alarm history.	194 (00C2h)
392 (0188h)	393 (0189h)	Clear communication error history	This is used to clear the communication error history.	196 (00C4h)
396 (018Ch)	397 (018Dh)	Configuration	This is used to execute recalculation and setup of the parameter. Refer to the next section for details about Configuration.	198 (00C6h)
398 (018Eh)	399 (018Fh)	Batch data initialization (excluding parameters for mechanism and communication)	This is used to restore the parameters stored in non-volatile memory to their initial values. (Excluding parameters related to mechanism and communication setting)	199 (00C7h)
400 (0190h)	401 (0191h)	Read batch NV memory	This is used to read the parameters stored in non-volatile memory to RAM. All parameters stored in RAM are overwritten.	200 (00C8h)
402 (0192h)	403 (0193h)	Write batch NV memory	This is used to write the parameters stored in RAM to non-volatile memory. All parameters stored in non-volatile memory are overwritten. Non-volatile memory can be rewritten approximately 100,000 times.	201 (00C9h)
404 (0194h)	405 (0195h)	Batch data initialization (excluding mechanism parameters)	This is used to reset all parameters stored in non-volatile memory to their initial values. (Excluding parameters related to mechanism setting)	202 (00CAh)
416 (01A0h)	417 (01A1h)	Execution of ETO-CLR input for all drivers	This is used to turn the ETO-CLR input for all drivers ON.	208 (00D0h)
422 (01A6h)	423 (01A7h)	Clear information	This is used to clear the information.	211 (00D3h)
424 (01A8h)	425 (01A9h)	Clear information history	This is used to clear the information history.	212 (00D4h)
426 (01AAh)	427 (01ABh)	Alarm history details	When writing the number of history (1 to 10) to this command and executing the "Alarm history details" of the monitor command, the detailed items of the specified alarm history can be checked.	213 (00D5h)

■ Configuration

Configuration can be executed when all of the following conditions are satisfied.

- An alarm is not being generated.
- The robot is not operated.
- Writing data is not being performed using the **MVC Studio** software.

The table below shows the status of the controller before and after Configuration is executed.

Item	Configuration is ready to execute	Configuration is being executed	After Configuration is executed
PWR/SYS LED	White light Blinking blue	Red and green colors blink simultaneously (Red and green colors may overlap and it may be visible to orange.)	It depends on the status of the controller.
Output signal	Enable	Disable	Enable
Input signal	Enable	Disable	Enable

memo Even if monitor is performed while Configuration is in progress, the correct monitor value may not be returned.

6-1 How to execute the maintenance commands

■ To execute via Modbus communication

Reading or writing data can be executed. There are two types of execution methods. Use them selectively in accordance with the intended use.

- **Write "1" to data (recommended)**

  When data is changed from "0" to "1" after "1" is written to it, the command is executed.
  To execute the same command again, restore the data to "0" and then write "1." It is safe because the command will not be executed consecutively even if "1" is written continuously from the client.

- **Write "2" to data**

  When "2" is written to data, the command is executed. It will automatically return to "1" after executing. Data does not need to be restored to "1" and can be written consecutively.
  If commands that take time to write to non-volatile memory, such as the "Write batch NV memory" command, are executed consecutively, increase the length of the intervals between commands.

■ "Alarm history details" command

Write the number of the "alarm history" (1 to 10) of the monitor command to this command.

7 Monitor commands

Monitor commands are used to monitor the command position, the command speed, the alarm and information history, etc.
All commands are used for read (READ).

Register address		Name	Description	NET-ID
Upper	Lower			
128 (0080h)	129 (0081h)	Present alarm	This indicates the alarm code that is being generated.	64 (0040h)
130 (0082h)	131 (0083h)	Alarm history 1	This indicates the most recent item in the alarm history. When an alarm is being generated, its code is also displayed on the alarm history 1 simultaneously.	65 (0041h)
132 (0084h)	133 (0085h)	Alarm history 2	These indicate the alarm history.	66 (0042h)
134 (0086h)	135 (0087h)	Alarm history 3		67 (0043h)
136 (0088h)	137 (0089h)	Alarm history 4		68 (0044h)
138 (008Ah)	139 (008Bh)	Alarm history 5		69 (0045h)
140 (008Ch)	141 (008Dh)	Alarm history 6		70 (0046h)
142 (008Eh)	143 (008Fh)	Alarm history 7		71 (0047h)
144 (0090h)	145 (0091h)	Alarm history 8		72 (0048h)
146 (0092h)	147 (0093h)	Alarm history 9		73 (0049h)
148 (0094h)	149 (0095h)	Alarm history 10	This indicates the oldest item in the alarm history.	74 (004Ah)
150 (0096h)	151 (0097h)	Present alarm (sub code)	This indicates the sub code of the present alarm.	75 (004Bh)
172 (00ACh)	173 (00ADh)	Present communication error	This indicates the communication error code received last time.	86 (0056h)
174 (00AEh)	175 (00AFh)	Communication error history 1	This indicates the most recent communication error code history. When a communication error is present, the code is also displayed in the communication error history 1 at the same time.	87 (0057h)
176 (00B0h)	177 (00B1h)	Communication error history 2	These indicate the communication error code history.	88 (0058h)
178 (00B2h)	179 (00B3h)	Communication error history 3		89 (0059h)
180 (00B4h)	181 (00B5h)	Communication error history 4		90 (005Ah)
182 (00B6h)	183 (00B7h)	Communication error history 5		91 (005Bh)
184 (00B8h)	185 (00B9h)	Communication error history 6		92 (005Ch)
186 (00BAh)	187 (00BBh)	Communication error history 7		93 (005Dh)
188 (00BCh)	189 (00BDh)	Communication error history 8		94 (005Eh)
190 (00BEh)	191 (00BFh)	Communication error history 9		95 (005Fh)
192 (00C0h)	193 (00C1h)	Communication error history 10	This indicates the oldest communication error code history.	96 (0060h)
212 (00D4h)	213 (00D5h)	Direct I/O	This indicates the status of direct I/O. (Details of bits arrangement ⇨ p.85)	106 (006Ah)

Register address		Name	Description	NET-ID
Upper	Lower			
246 (00F6h)	247 (00F7h)	Present information	This indicates the information code being generated. (Details of information code ⇨ p.84)	123 (007Bh)
248 (00F8h)	249 (00F9h)	Controller temperature	This indicates the present temperature of the controller. (1=0.1 °C)	124 (007Ch)
324 (0144h)	325 (0145h)	Number of power-on times	This indicates the number of times the power supply has been turned on.	162 (00A2h)
326 (0146h)	327 (0147h)	Power supply voltage	This indicates the power supply voltage.	163 (00A3h)
336 (0150h)	337 (0151h)	RS-485 reception frame counter	This indicates the number of times a message was received via RS-485 communication (Modbus).	168 (00A8h)
338 (0152h)	339 (0153h)	Elapsed time from BOOT	This indicates the time period that has elapsed since the power supply was turned on. (ms)	169 (00A9h)
352 (0160h)	353 (0161h)	I/O status 1	These indicate the ON/OFF status of the internal I/O. (Bit arrangements ⇨ p.85)	176 (00B0h)
354 (0162h)	355 (0163h)	I/O status 2		177 (00B1h)
356 (0164h)	357 (0165h)	I/O status 3		178 (00B2h)
358 (0166h)	359 (0167h)	I/O status 4		179 (00B3h)
360 (0168h)	361 (0169h)	I/O status 5		180 (00B4h)
362 (016Ah)	363 (016Bh)	I/O status 6		181 (00B5h)
364 (016Ch)	365 (016Dh)	I/O status 7		182 (00B6h)
366 (016Eh)	367 (016Fh)	I/O status 8		183 (00B7h)
368 (0170h)	369 (0171h)	I/O status 9		184 (00B8h)
370 (0172h)	371 (0173h)	I/O status 10		185 (00B9h)
372 (0174h)	373 (0175h)	I/O status 11		186 (00BAh)
374 (0176h)	375 (0177h)	I/O status 12		187 (00BBh)
376 (0178h)	377 (0179h)	I/O status 13		188 (00BCh)
378 (017Ah)	379 (017Bh)	I/O status 14		189 (00BDh)
380 (017Ch)	381 (017Dh)	I/O status 15		190 (00BEh)
382 (017Eh)	383 (017Fh)	I/O status 16		191 (00BFh)
2064 (0810h)	2065 (0811h)	Gyro odometry data X	These indicate the odometry value, which is calculated based on the amount of motor rotation and the angular speed detected in the IMU. (1=0.001 m)	1032 (0408h)
2066 (0812h)	2067 (0813h)	Gyro odometry data Y		1033 (0409h)
2074 (081Ah)	2075 (081Bh)	Gyro odometry data YAW	This indicates the odometry value, which is calculated based on the amount of motor rotation and the angular speed detected in the IMU. (1=0.000001 rad)	1037 (040Dh)
2084 (0824h)	2085 (0825h)	IMU data acceleration X	These indicate the acceleration value detected by the acceleration sensor. (1=0.001 m/s^2)	1042 (0412h)
2086 (0826h)	2087 (0827h)	IMU data acceleration Y		1043 (0413h)
2088 (0828h)	2089 (0829h)	IMU data acceleration Z		1044 (0414h)

Register address		Name	Description	NET-ID
Upper	Lower			
2090 (082Ah)	2091 (082Bh)	IMU data angular speed X	These indicate the angular speed value detected by the gyro sensor. (1=0.000001 rad/s)	1045 (0415h)
2092 (082Ch)	2093 (082Dh)	IMU data angular speed Y		1046 (0416h)
2094 (082Eh)	2095 (082Fh)	IMU data angular speed Z		1047 (0417h)
2096 (0830h)	2097 (0831h)	IMU data temperature	This indicates the value of the temperature sensor. (1=0.001 °C)	1048 (0418h)
2138 (085Ah)	2139 (085Bh)	Wheel odometry data X	These indicate the odometry value, which is calculated based on the amount of motor rotation. (1=0.001 m)	1069 (042Dh)
2140 (085Ch)	2141 (085Dh)	Wheel odometry data Y		1070 (042Eh)
2142 (085Eh)	2143 (085Fh)	Wheel odometry data θ	This indicates the odometry value, which is calculated based on the amount of motor rotation. (1=0.000001 rad)	1071 (042Fh)
2144 (0860h)	2145 (0861h)	Displacement of forward/ reverse	These indicate the value for the displacement data of the robot. (1=0.001 m)	1072 (0430h)
2146 (0862h)	2147 (0863h)	Displacement of left/right		1073 (0431h)
2490 (09BAh)	2491 (09BBh)	Status	This indicates the present status. 0: Normal 1: Error (alarm generated) 2: Stop or non-excitation state	1245 (04DDh)
2492 (09BCh)	2493 (09BDh)	Feedback speed forward/ reverse translational speed	This indicates the present speed of the robot, which is calculated based on the position information of the motor. (1=0.001 m/s)	1246 (04DEh)
2494 (09BEh)	2495 (09BFh)	Feedback speed rotation speed	This indicates the present speed of the robot, which is calculated based on the position information of the motor. (1=0.000001 rad/s)	1247 (04DFh)
2496 (09C0h)	2497 (09C1h)	Feedback speed left/right translational speed	This indicates the present speed of the robot, which is calculated based on the position information of the motor. (1=0.001 m/s)	1248 (04E0h)
2528 (09E0h)	2529 (09E1h)	Torque Axis 1	These indicate the torque of each axis. (1=0.1 %)	1264 (04F0h)
2530 (09E2h)	2531 (09E3h)	Torque Axis 2		1265 (04F1h)
2532 (09E4h)	2533 (09E5h)	Torque Axis 3		1266 (04F2h)
2534 (09E6h)	2535 (09E7h)	Torque Axis 4		1267 (04F3h)
2550 (09F6h)	2551 (09F7h)	Alarm history details (Alarm code)	These indicate the description of the alarm history specified by the "Alarm history details" of the maintenance command.	1275 (04FBh)
2552 (09F8h)	2553 (09F9h)	Alarm history details (Sub code)		1276 (04FCh)
2554 (09FAh)	2555 (09FBh)	Alarm history details (Controller temperature)		1277 (04FDh)
2556 (09FCh)	2557 (09FDh)	Alarm history details (Physical I/O input)		1278 (04FEh)
2558 (09FEh)	2559 (09FFh)	Alarm history details (R-I/O output)		1279 (04FFh)
2582 (0A16h)	2583 (0A17h)	Alarm history details (Elapsed time from Boot)		1291 (050Bh)
2584 (0A18h)	2585 (0A19h)	Alarm history details (Elapsed time from starting operation)		1292 (050Ch)
2592 (0A20h)	2593 (0A21h)	Information history 1	This indicates the most recent information history. When information is being generated, its code is indicated.	1296 (0510h)
2594 (0A22h)	2595 (0A23h)	Information history 2	These indicate the information history.	1297 (0511h)
2596 (0A24h)	2597 (0A25h)	Information history 3		1298 (0512h)
2598 (0A26h)	2599 (0A27h)	Information history 4		1299 (0513h)

Register address		Name	Description	NET-ID
Upper	Lower			
2600 (0A28h)	2601 (0A29h)	Information history 5	These indicate the information history.	1300 (0514h)
2602 (0A2Ah)	2603 (0A2Bh)	Information history 6		1301 (0515h)
2604 (0A2Ch)	2605 (0A2Dh)	Information history 7		1302 (0516h)
2606 (0A2Eh)	2607 (0A2Fh)	Information history 8		1303 (0517h)
2608 (0A30h)	2609 (0A31h)	Information history 9		1304 (0518h)
2610 (0A32h)	2611 (0A33h)	Information history 10		1305 (0519h)
2612 (0A34h)	2613 (0A35h)	Information history 11		1306 (051Ah)
2614 (0A36h)	2615 (0A37h)	Information history 12		1307 (051Bh)
2616 (0A38h)	2617 (0A39h)	Information history 13		1308 (051Ch)
2618 (0A3Ah)	2619 (0A3Bh)	Information history 14		1309 (051Dh)
2620 (0A3Ch)	2621 (0A3Dh)	Information history 15		1310 (051Eh)
2622 (0A3Eh)	2623 (0A3Fh)	Information history 16	This indicates the oldest information history.	1311 (051Fh)
2624 (0A40h)	2625 (0A41h)	Information time history 1	This indicates the history of the time when the most recent information was generated. When information is being generated, the time when the present information was generated is displayed.	1312 (0520h)
2626 (0A42h)	2627 (0A43h)	Information time history 2	These indicate the history of the time when information was generated.	1313 (0521h)
2628 (0A44h)	2629 (0A45h)	Information time history 3		1314 (0522h)
2630 (0A46h)	2631 (0A47h)	Information time history 4		1315 (0523h)
2632 (0A48h)	2633 (0A49h)	Information time history 5		1316 (0524h)
2634 (0A4Ah)	2635 (0A4Bh)	Information time history 6		1317 (0525h)
2636 (0A4Ch)	2637 (0A4Dh)	Information time history 7		1318 (0526h)
2638 (0A4Eh)	2639 (0A4Fh)	Information time history 8		1319 (0527h)
2640 (0A50h)	2641 (0A51h)	Information time history 9		1320 (0528h)
2642 (0A52h)	2643 (0A53h)	Information time history 10		1321 (0529h)
2644 (0A54h)	2645 (0A55h)	Information time history 11		1322 (052Ah)
2646 (0A56h)	2647 (0A57h)	Information time history 12		1323 (052Bh)
2648 (0A58h)	2649 (0A59h)	Information time history 13		1324 (052Ch)
2650 (0A5Ah)	2651 (0A5Bh)	Information time history 14		1325 (052Dh)
2652 (0A5Ch)	2653 (0A5Dh)	Information time history 15		1326 (052Eh)
2654 (0A5Eh)	2655 (0A5Fh)	Information time history 16		1327 (052Fh)

■ Information codes

Information codes are displayed in eight hexadecimal digits. They can also be read in 32 bits.
If multiple information items are generated, the logical sum (OR) of the information codes is displayed.

Example) When information items of Lower voltage and Robot speed are generated

Information code of Lower voltage: 0000 0020h
Information code of Robot speed: 0000 0080h
OR value of two information codes: 0000 00A0h

Information code	32 bits indication	Information item
00000001h	0000 0000 0000 0000 0000 0000 000 0001	Assigned I/O status
00000004h	0000 0000 0000 0000 0000 0000 000 0100	Controller temperature
00000010h	0000 0000 0000 0000 0000 0000 001 0000	Upper voltage
00000020h	0000 0000 0000 0000 0000 0000 0010 0000	Lower voltage
00000080h	0000 0000 0000 0000 0000 0000 1000 0000	Robot speed
00000100h	0000 0000 0000 0000 0000 0001 000 0000	Wheel speed
04000000h	0000 0100 0000 0000 0000 0000 0000 0000	Driver connection setting incomplete
08000000h	0000 1000 0000 0000 0000 0000 0000 0000	Driver information detection
10000000h	0001 0000 0000 0000 0000 0000 0000 0000	Start operation restricted mode
20000000h	0010 0000 0000 0000 0000 0000 0000 0000	I/O test mode
50000000h	0101 0000 0000 0000 0000 0000 0000 0000	Configuration request
90000000h	1001 0000 0000 0000 0000 0000 0000 0000	Reboot request

■ Direct I/O

The arrangement of bits for direct I/O is indicated.

Register address	Description							
212 (00D4h)	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
	–	–	–	–	–	–	–	–
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	DOUT7	DOUT6	DOUT5	DOUT4	DOUT3	DOUT2	DOUT1	DOUT0
213 (00D5h)	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
	–	–	–	–	–	–	–	–
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	DIN7	DIN6	DIN5	DIN4	DIN3	DIN2	DIN1	DIN0

■ I/O status

The arrangement of bits for internal I/O is indicated.

- **Input signals**

Register address	Description							
352 (0160h)	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
	–	HMI	INFO-CLR-DRV	INFO-CLR-CNT	INFO-CLR	–	ETO-CLR-DRV	–
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	–	ALM-RST-DRV	ALM-RST-CNT	ALM-RST	–	–	–	STOP
353 (0161h)	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
	–	–	–	–	STOP-H	–	–	–
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	–	–	–	–	–	–	FREE	–
354 (0162h)	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
	–	–	–	–	–	–	–	–
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	–	–	–	–	–	–	–	–
355 (0163h)	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
	–	–	–	–	–	–	–	–
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	–	–	–	–	–	–	–	–
356 (0164h)	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
	–	–	–	–	–	–	–	–
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	–	–	–	–	–	–	–	–
357 (0165h)	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
	–	–	–	–	–	–	–	–
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	–	–	–	–	–	–	–	–
358 (0166h)	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
	–	–	–	–	–	–	–	–
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	–	–	–	–	–	–	–	–

Register address	Description							
359 (0167h)	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
	–	–	–	–	–	–	JOG-VXVY––	JOG-VXVY–+
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	JOG-VXVY+–	JOG-VXVY++	JOG-VY–	JOG-VY+	JOG-W–	JOG-W+	JOG-VX–	JOG-VX+
360 (0168h)	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
	–	–	–	–	–	–	–	–
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	–	–	–	–	–	–	–	–
361 (0169h)	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
	–	–	–	–	–	–	–	–
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	–	–	–	–	–	–	–	–
362 (016Ah)	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
	–	–	–	–	–	–	–	–
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	–	–	–	–	–	–	–	–
363 (016Bh)	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
	–	–	–	–	–	–	–	–
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	–	–	–	–	–	–	–	–
364 (016Ch)	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
	–	–	–	–	–	–	–	–
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	–	–	–	–	–	–	–	–
365 (016Dh)	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
	–	–	–	–	–	–	–	–
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	–	–	–	–	–	–	–	–
366 (016Eh)	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
	R31	R30	R29	R28	R27	R26	R25	R24
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	R23	R22	R21	R20	R19	R18	R17	R16
367 (016Fh)	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
	R15	R14	R13	R12	R11	R10	R9	R8
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	R7	R6	R5	R4	R3	R2	R1	R0

● **Output signals**

Register address	Description							
368 (0170h)	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
	–	–	–	S-ON-MON	–	–	–	–
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	–	–	ETO-MON-DRV	–	SYS-BSY	INFO-DRV	INFO-CNT	INFO
369 (0171h)	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
	MOVE-CNT	–	–	–	–	–	MOVE	READY
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	SYS-RDY	ALM-B-DRV	ALM-B-CNT	ALM-B	ALM-A-DRV	ALM-A-CNT	ALM-A	CONST-OFF
370 (0172h)	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
	–	–	–	–	–	–	–	–
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	–	–	–	RDY-DD-OPE	–	–	–	–
371 (0173h)	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
	–	–	–	–	–	–	–	–
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	–	–	–	–	–	–	–	VA
372 (0174h)	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
	–	–	–	–	–	–	USR-OUT1	USR-OUT0
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	–	–	–	–	–	–	–	–
373 (0175h)	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
	–	–	–	–	–	–	–	–
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	–	–	–	–	–	–	–	–
374 (0176h)	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
	–	–	–	–	–	–	–	–
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	–	–	–	–	–	–	–	–
375 (0177h)	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
	–	–	–	–	–	–	–	–
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	–	–	–	–	–	–	–	ROBOT-EN
376 (0178h)	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
	–	–	–	–	–	–	–	–
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	–	–	–	–	–	–	–	–
377 (0179h)	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
	–	–	–	–	–	–	–	–
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	–	–	–	–	–	–	–	–
378 (017Ah)	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
	–	–	–	–	–	–	–	–
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	–	–	–	–	–	–	–	–

Register address	Description							
379 (017Bh)	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
	–	–	–	–	–	–	–	–
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	–	–	–	–	–	–	–	–
380 (017Ch)	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
	–	–	–	–	–	–	–	–
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	–	–	–	–	–	–	–	–
381 (017Dh)	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
	–	–	–	–	–	–	–	–
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	–	–	–	–	–	–	–	–
382 (017Eh)	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
	INFO-RBT	INFO-CFG	–	INFO-DSLMTD	INFO-DRVINFO	INFO-DRVDIS	–	–
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	–	–	–	–	–	–	–	–
383 (017Fh)	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
	–	–	–	–	–	–	–	INFO-AXISSPD
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	INFO-RBSPD	–	INFO-VOLT-L	INFO-VOLT-H	–	INFO-CNTTMP	–	INFO-USRIO

8 Parameter R/W commands

These commands are used to read or write parameters. All commands can be read and written (READ/WRITE).

8-1 Basic setting and operation setting

Register address		Name	Description	Setting range	Initial value	Update	NET-ID
Upper	Lower						
604 (025Ch)	605 (025Dh)	ATL function mode setting	This is used to set the ATL function of the driver.	0: Disable 1: Enable	1	D	302 (012Eh)
930 (03A2h)	931 (03A3h)	Operating torque limit value Axis 1	These are used to set the torque limiting value when operating.	1 to 10,000 (1=0.1 %)	10,000	A	465 (01D1h)
932 (03A4h)	933 (03A5h)	Operating torque limit value Axis 2			10,000	A	466 (01D2h)
934 (03A6h)	935 (03A7h)	Operating torque limit value Axis 3			10,000	A	467 (01D3h)
936 (03A8h)	937 (03A9h)	Operating torque limit value Axis 4			10,000	A	468 (01D4h)
970 (03CAh)	971 (03CBh)	Holding torque limit value Axis 1	These are used to set the torque limiting value when stopping.	1 to 10,000 (1=0.1 %)	10,000	A	485 (01E5h)
972 (03CCh)	973 (03CDh)	Holding torque limit value Axis 2			10,000	A	486 (01E6h)
974 (03CEh)	975 (03CFh)	Holding torque limit value Axis 3			10,000	A	487 (01E7h)
976 (03D0h)	977 (03D1h)	Holding torque limit value Axis 4			10,000	A	488 (01E8h)

8-2 JOG

Register address		Name	Description	Setting range	Initial value	Update	NET-ID
Upper	Lower						
7720 (1E28h)	7721 (1E29h)	JOG operation translational speed	These are used to set the speed.	1 to 2000	200	B	3860 (0F14h)
7722 (1E2Ah)	7723 (1E2Bh)	JOG operation rotation speed		1 to 3,141,592	1,570,796	B	3861 (0F15h)
7726 (1E2Eh)	7727 (1E2Fh)	JOG operation translational acceleration/deceleration speed	These are used to set the acceleration/ deceleration speed.	1 to 2,147,483,647	10,000	B	3863 (0F17h)
7728 (1E30h)	7729 (1E31h)	JOG operation rotation acceleration/deceleration speed			6,283,185	B	3864 (0F18h)
7732 (1E34h)	7733 (1E35h)	JOG operation translational jerk	These are used to set the jerk.	0: Disable 1 to 2,147,483,647	0	B	3866 (0F1Ah)
7734 (1E36h)	7735 (1E37h)	JOG operation rotation jerk			0	B	3867 (0F1Bh)

8-3 I/O action and function

Register address		Name	Description	Setting range	Initial value	Update	NET-ID
Upper	Lower						
3582 (0DFEh)	3583 (0DFFh)	STOP input action	This is used to set how to stop when the STOP input is turned ON.	0: Immediate stop 1: Stop with parameter during operation 2: Stop with "Stop action preset" 3: Stop with parameter during operation & non-excitation 4: Stop with "Stop action preset" & non-excitation	1	A	1791 (06FFh)
3584 (0E00h)	3585 (0E01h)	STOP-H input action	This is used to set how to stop when the STOP-H input is turned ON.	0: Immediate stop 1: Stop with parameter during operation 2: Stop with "Stop action preset" 3: Stop with parameter during operation & non-excitation 4: Stop with "Stop action preset" & non-excitation	4	A	1792 (0700h)
8398 (20CEh)	8399 (20CFh)	Stop action preset forward/reverse translational deceleration*	These are used to set the deceleration when stopping with Stop action preset.	1 to 2,147,483,647 (1=0.001 m/s^2)	10,000	A	4199 (1067h)
8400 (20D0h)	8401 (20D1h)	Stop action preset rotation deceleration*		1 to 2,147,483,647 (1=0.000001 rad/s^2)	3,141,592	A	4200 (1068h)
8402 (20D2h)	8403 (20D3h)	Stop action preset left/right translational deceleration*		1 to 2,147,483,647 (1=0.001 m/s^2)	10,000	A	4201 (1069h)
8404 (20D4h)	8405 (20D5h)	Stop action preset forward/reverse translational jerk*	These are used to set the jerk when stopping with Stop action preset.	0: Disable 1 to 2,147,483,647 (1=0.001 m/s^3)	0	A	4202 (106Ah)
8406 (20D6h)	8407 (20D7h)	Stop action preset rotation jerk*		0: Disable 1 to 2,147,483,647 (1=0.000001 rad/s^3)	0	A	4203 (106Bh)
8408 (20D8h)	8409 (20D9h)	Stop action preset left/right translational jerk*		0: Disable 1 to 2,147,483,647 (1=0.001 m/s^3)	0	A	4204 (106Ch)

* It is enabled when the "STOP input action" parameter, "STOP-H input action" parameter, or "Stop action at alarm generation" parameter is set to "3: Stop with parameter during operation & non-excitation" or "4: Stop with 'Stop action preset' & non-excitation."

8-4 Direct-IN (DIN)

Register address		Name	Description	Setting range	Initial value	Update	NET-ID
Upper	Lower						
4224 (1080h)	4225 (1081h)	DIN0 input function	These are used to select an input signal to be assigned to DIN.	Input signal list ⇨p.116	16: STOP	C	2112 (0840h)
4226 (1082h)	4227 (1083h)	DIN1 input function			1: FREE	C	2113 (0841h)
4228 (1084h)	4229 (1085h)	DIN2 input function			20: ALM-RST	C	2114 (0842h)
4230 (1086h)	4231 (1087h)	DIN3 input function			25: ETO-CLR-DRV	C	2115 (0843h)
4232 (1088h)	4233 (1089h)	DIN4 input function			11: STOP-H	C	2116 (0844h)
4234 (108Ah)	4235 (108Bh)	DIN5 input function			0: No function	C	2117 (0845h)
4236 (108Ch)	4237 (108Dh)	DIN6 input function			0: No function	C	2118 (0846h)
4238 (108Eh)	4239 (108Fh)	DIN7 input function			0: No function	C	2119 (0847h)
4256 (10A0h)	4257 (10A1h)	DIN0 logic setting (inverting mode)	These are used to change the ON/OFF setting for DIN.	0: Not invert 1: Invert	0	C	2128 (0850h)
4258 (10A2h)	4259 (10A3h)	DIN1 logic setting (inverting mode)			0	C	2129 (0851h)
4260 (10A4h)	4261 (10A5h)	DIN2 logic setting (inverting mode)			0	C	2130 (0852h)
4262 (10A6h)	4263 (10A7h)	DIN3 logic setting (inverting mode)			0	C	2131 (0853h)
4264 (10A8h)	4265 (10A9h)	DIN4 logic setting (inverting mode)			0	C	2132 (0854h)
4266 (10AAh)	4267 (10ABh)	DIN5 logic setting (inverting mode)			0	C	2133 (0855h)
4268 (10ACh)	4269 (10ADh)	DIN6 logic setting (inverting mode)			0	C	2134 (0856h)
4270 (10AEh)	4271 (10AFh)	DIN7 logic setting (inverting mode)			0	C	2135 (0857h)
4480 (1180h)	4481 (1181h)	DIN0 ON signal dead-time	These are used to set the ON signal dead-time for DIN.	0 to 250 ms	0	C	2240 (08C0h)
4482 (1182h)	4483 (1183h)	DIN1 ON signal dead-time			0	C	2241 (08C1h)
4484 (1184h)	4485 (1185h)	DIN2 ON signal dead-time			0	C	2242 (08C2h)
4486 (1186h)	4487 (1187h)	DIN3 ON signal dead-time			0	C	2243 (08C3h)
4488 (1188h)	4489 (1189h)	DIN4 ON signal dead-time			0	C	2244 (08C4h)
4490 (118Ah)	4491 (118Bh)	DIN5 ON signal dead-time			0	C	2245 (08C5h)
4492 (118Ch)	4493 (118Dh)	DIN6 ON signal dead-time			0	C	2246 (08C6h)
4494 (118Eh)	4495 (118Fh)	DIN7 ON signal dead-time			0	C	2247 (08C7h)

Register address		Name	Description	Setting range	Initial value	Update	NET-ID
Upper	Lower						
4512 (11A0h)	4513 (11A1h)	DIN0 1 shot signal	These are used to set the 1-shot signal function for DIN.	0: Disable 1: Enable	0	C	2256 (08D0h)
4514 (11A2h)	4515 (11A3h)	DIN1 1 shot signal			0	C	2257 (08D1h)
4516 (11A4h)	4517 (11A5h)	DIN2 1 shot signal			0	C	2258 (08D2h)
4518 (11A6h)	4519 (11A7h)	DIN3 1 shot signal			0	C	2259 (08D3h)
4520 (11A8h)	4521 (11A9h)	DIN4 1 shot signal			0	C	2260 (08D4h)
4522 (11AAh)	4523 (11ABh)	DIN5 1 shot signal			0	C	2261 (08D5h)
4524 (11ACh)	4525 (11ADh)	DIN6 1 shot signal			0	C	2262 (08D6h)
4526 (11AEh)	4527 (11AFh)	DIN7 1 shot signal			0	C	2263 (08D7h)
4352 (1100h)	4353 (1101h)	DIN0 composite input function	These are used to select an input signal to be assigned to DIN as the composite input function.	Input signal list ⇨p.116	0: No function	C	2176 (0880h)
4354 (1102h)	4355 (1103h)	DIN1 composite input function			0: No function	C	2177 (0881h)
4356 (1104h)	4357 (1105h)	DIN2 composite input function			0: No function	C	2178 (0882h)
4358 (1106h)	4359 (1107h)	DIN3 composite input function			0: No function	C	2179 (0883h)
4360 (1108h)	4361 (1109h)	DIN4 composite input function			0: No function	C	2180 (0884h)
4362 (110Ah)	4363 (110Bh)	DIN5 composite input function			0: No function	C	2181 (0885h)
4364 (110Ch)	4365 (110Dh)	DIN6 composite input function			0: No function	C	2182 (0886h)
4366 (110Eh)	4367 (110Fh)	DIN7 composite input function			0: No function	C	2183 (0887h)

8-5 Direct-OUT (DOUT)

Register address		Name	Description	Setting range	Initial value	Update	NET-ID
Upper	Lower						
4288 (10C0h)	4289 (10C1h)	DOUT0 output function	These are used to select an output signal to be assigned to DOUT.	Output signal list ⇨p.117	264: READY	C	2144 (0860h)
4290 (10C2h)	4291 (10C3h)	DOUT1 output function			265: MOVE	C	2145 (0861h)
4292 (10C4h)	4293 (10C5h)	DOUT2 output function			277: ETO-MON-DRV	C	2146 (0862h)
4294 (10C6h)	4295 (10C7h)	DOUT3 output function			260: ALM-B	C	2147 (0863h)
4296 (10C8h)	4297 (10C9h)	DOUT4 output function			308: RDY-DD-OPE	C	2148 (0864h)
4298 (10CAh)	4299 (10CBh)	DOUT5 output function			284: S-ON-MON	C	2149 (0865h)
4300 (10CCh)	4301 (10CDh)	DOUT6 output function			0: No function	C	2150 (0866h)
4302 (10CEh)	4303 (10CFh)	DOUT7 output function			0: No function	C	2151 (0867h)
4320 (10E0h)	4321 (10E1h)	DOUT0 logic setting (inverting mode)	These are used to change the ON/OFF setting for DOUT.	0: Not invert 1: Invert	0	C	2160 (0870h)
4322 (10E2h)	4323 (10E3h)	DOUT1 logic setting (inverting mode)			0	C	2161 (0871h)
4324 (10E4h)	4325 (10E5h)	DOUT2 logic setting (inverting mode)			0	C	2162 (0872h)
4326 (10E6h)	4327 (10E7h)	DOUT3 logic setting (inverting mode)			0	C	2163 (0873h)
4328 (10E8h)	4329 (10E9h)	DOUT4 logic setting (inverting mode)			0	C	2164 (0874h)
4330 (10EAh)	4331 (10EBh)	DOUT5 logic setting (inverting mode)			0	C	2165 (0875h)
4332 (10ECh)	4333 (10EDh)	DOUT6 logic setting (inverting mode)			0	C	2166 (0876h)
4334 (10EEh)	4335 (10EFh)	DOUT7 logic setting (inverting mode)			0	C	2167 (0877h)
4544 (11C0h)	4545 (11C1h)	DOUT0 OFF delay time	These are used to set the OFF delay time for DOUT.	0 to 250 ms	0	C	2272 (08E0h)
4546 (11C2h)	4547 (11C3h)	DOUT1 OFF delay time			0	C	2273 (08E1h)
4548 (11C4h)	4549 (11C5h)	DOUT2 OFF delay time			0	C	2274 (08E2h)
4550 (11C6h)	4551 (11C7h)	DOUT3 OFF delay time			0	C	2275 (08E3h)
4552 (11C8h)	4553 (11C9h)	DOUT4 OFF delay time			0	C	2276 (08E4h)
4554 (11CAh)	4555 (11CBh)	DOUT5 OFF delay time			0	C	2277 (08E5h)
4556 (11CCh)	4557 (11CDh)	DOUT6 OFF delay time			0	C	2278 (08E6h)
4558 (11CEh)	4559 (11CFh)	DOUT7 OFF delay time			0	C	2279 (08E7h)

Register address		Name	Description	Setting range	Initial value	Update	NET-ID
Upper	Lower						
4448 (1160h)	4449 (1161h)	DOUT0 composite logical combination	These are used to set the composite logical combination for DOUT.	0: AND 1: OR	1	C	2224 (08B0h)
4450 (1162h)	4451 (1163h)	DOUT1 composite logical combination			1	C	2225 (08B1h)
4452 (1164h)	4453 (1165h)	DOUT2 composite logical combination			1	C	2226 (08B2h)
4454 (1166h)	4455 (1167h)	DOUT3 composite logical combination			1	C	2227 (08B3h)
4456 (1168h)	4457 (1169h)	DOUT4 composite logical combination			1	C	2228 (08B4h)
4458 (116Ah)	4459 (116Bh)	DOUT5 composite logical combination			1	C	2229 (08B5h)
4460 (116Ch)	4461 (116Dh)	DOUT6 composite logical combination			1	C	2230 (08B6h)
4462 (116Eh)	4463 (116Fh)	DOUT7 composite logical combination			1	C	2231 (08B7h)
4384 (1120h)	4385 (1121h)	DOUT0 composite output function	These are used to select an output signal for logical operation with the signal of DOUT.	Output signal list ⇨p.117	256: CONST-OFF	C	2192 (0890h)
4386 (1122h)	4387 (1123h)	DOUT1 composite output function			256: CONST-OFF	C	2193 (0891h)
4388 (1124h)	4389 (1125h)	DOUT2 composite output function			256: CONST-OFF	C	2194 (0892h)
4390 (1126h)	4391 (1127h)	DOUT3 composite output function			256: CONST-OFF	C	2195 (0893h)
4392 (1128h)	4393 (1129h)	DOUT4 composite output function			256: CONST-OFF	C	2196 (0894h)
4394 (112Ah)	4395 (112Bh)	DOUT5 composite output function			256: CONST-OFF	C	2197 (0895h)
4396 (112Ch)	4397 (112Dh)	DOUT6 composite output function			256: CONST-OFF	C	2198 (0896h)
4398 (112Eh)	4399 (112Fh)	DOUT7 composite output function			256: CONST-OFF	C	2199 (0897h)
4416 (1140h)	4417 (1141h)	DOUT0 composite logic setting (inverting mode)	These are used to change the ON/OFF setting for the composite output function of DOUT.	0: Not invert 1: Invert	0	C	2208 (08A0h)
4418 (1142h)	4419 (1143h)	DOUT1 composite logic setting (inverting mode)			0	C	2209 (08A1h)
4420 (1144h)	4421 (1145h)	DOUT2 composite logic setting (inverting mode)			0	C	2210 (08A2h)
4422 (1146h)	4423 (1147h)	DOUT3 composite logic setting (inverting mode)			0	C	2211 (08A3h)
4424 (1148h)	4425 (1149h)	DOUT4 composite logic setting (inverting mode)			0	C	2212 (08A4h)
4426 (114Ah)	4427 (114Bh)	DOUT5 composite logic setting (inverting mode)			0	C	2213 (08A5h)
4428 (114Ch)	4429 (114Dh)	DOUT6 composite logic setting (inverting mode)			0	C	2214 (08A6h)
4430 (114Eh)	4431 (114Fh)	DOUT7 composite logic setting (inverting mode)			0	C	2215 (08A7h)

8-6 Remote-I/O (R-I/O)

Register address		Name	Description	Setting range	Initial value	Update	NET-ID
Upper	Lower						
4608 (1200h)	4609 (1201h)	R-IN0 input function	These are used to select an input signal to be assigned to R-IN.	Input signal list ⇨p.116	0: No function	C	2304 (0900h)
4610 (1202h)	4611 (1203h)	R-IN1 input function			0: No function	C	2035 (0901h)
4612 (1204h)	4613 (1205h)	R-IN2 input function			0: No function	C	2306 (0902h)
4614 (1206h)	4615 (1207h)	R-IN3 input function			0: No function	C	2307 (0903h)
4616 (1208h)	4617 (1209h)	R-IN4 input function			0: No function	C	2308 (0904h)
4618 (120Ah)	4619 (120Bh)	R-IN5 input function			0: No function	C	2309 (0905h)
4620 (120Ch)	4621 (120Dh)	R-IN6 input function			0: No function	C	2310 (0906h)
4622 (120Eh)	4623 (120Fh)	R-IN7 input function			0: No function	C	2311 (0907h)
4624 (1210h)	4625 (1211h)	R-IN8 input function			0: No function	C	2312 (0908h)
4626 (1212h)	4627 (1213h)	R-IN9 input function			0: No function	C	2313 (0909h)
4628 (1214h)	4629 (1215h)	R-IN10 input function			0: No function	C	2314 (090Ah)
4630 (1216h)	4631 (1217h)	R-IN11 input function			0: No function	C	2315 (090Bh)
4632 (1218h)	4633 (1219h)	R-IN12 input function			0: No function	C	2316 (090Ch)
4634 (121Ah)	4635 (121Bh)	R-IN13 input function			0: No function	C	2317 (090Dh)
4636 (121Ch)	4637 (121Dh)	R-IN14 input function			0: No function	C	2318 (090Eh)
4638 (121Eh)	4639 (121Fh)	R-IN15 input function			0: No function	C	2319 (090Fh)
4640 (1220h)	4641 (1221h)	R-OUT0 output function	These are used to select an output signal to be assigned to R-OUT.	Output signal list ⇨p.117	0: No function	C	2320 (0910h)
4642 (1222h)	4643 (1223h)	R-OUT1 output function			0: No function	C	2321 (0911h)
4644 (1224h)	4645 (1225h)	R-OUT2 output function			0: No function	C	2322 (0912h)
4646 (1226h)	4647 (1227h)	R-OUT3 output function			0: No function	C	2323 (0913h)
4648 (1228h)	4649 (1229h)	R-OUT4 output function			0: No function	C	2324 (0914h)
4650 (122Ah)	4651 (122Bh)	R-OUT5 output function			0: No function	C	2325 (0915h)
4652 (122Ch)	4653 (122Dh)	R-OUT6 output function			0: No function	C	2326 (0916h)
4654 (122Eh)	4655 (122Fh)	R-OUT7 output function			0: No function	C	2327 (0917h)
4656 (1230h)	4657 (1231h)	R-OUT8 output function			0: No function	C	2328 (0918h)

Register address		Name	Description	Setting range	Initial value	Update	NET-ID
Upper	Lower						
4658 (1232h)	4659 (1233h)	R-OUT9 output function	These are used to select an output signal to be assigned to R-OUT.	Output signal list ⇨p.117	0: No function	C	2329 (0919h)
4660 (1234h)	4661 (1235h)	R-OUT10 output function			0: No function	C	2330 (091Ah)
4662 (1236h)	4663 (1237h)	R-OUT11 output function			0: No function	C	2331 (091Bh)
4664 (1238h)	4665 (1239h)	R-OUT12 output function			0: No function	C	2332 (091Ch)
4666 (123Ah)	4667 (123Bh)	R-OUT13 output function			0: No function	C	2333 (091Dh)
4668 (123Ch)	4669 (123Dh)	R-OUT14 output function			0: No function	C	2334 (091Eh)
4670 (123Eh)	4671 (123Fh)	R-OUT15 output function			0: No function	C	2335 (091Fh)
4704 (1260h)	4705 (1261h)	R-OUT0 OFF delay time	These are used to set the OFF delay time for R-OUT.	0 to 250 ms	0	C	2352 (0930h)
4706 (1262h)	4707 (1263h)	R-OUT1 OFF delay time			0	C	2353 (0931h)
4708 (1264h)	4709 (1265h)	R-OUT2 OFF delay time			0	C	2354 (0932h)
4710 (1266h)	4711 (1267h)	R-OUT3 OFF delay time			0	C	2355 (0933h)
4712 (1268h)	4713 (1269h)	R-OUT4 OFF delay time			0	C	2356 (0934h)
4714 (126Ah)	4715 (126Bh)	R-OUT5 OFF delay time			0	C	2357 (0935h)
4716 (126Ch)	4717 (126Dh)	R-OUT6 OFF delay time			0	C	2358 (0936h)
4718 (126Eh)	4719 (126Fh)	R-OUT7 OFF delay time			0	C	2359 (0937h)
4720 (1270h)	4721 (1271h)	R-OUT8 OFF delay time			0	C	2360 (0938h)
4722 (1272h)	4723 (1273h)	R-OUT9 OFF delay time			0	C	2361 (0939h)
4724 (1274h)	4725 (1275h)	R-OUT10 OFF delay time			0	C	2362 (093Ah)
4726 (1276h)	4727 (1277h)	R-OUT11 OFF delay time			0	C	2363 (093Bh)
4728 (1278h)	4729 (1279h)	R-OUT12 OFF delay time			0	C	2364 (093Ch)
4730 (127Ah)	4731 (127Bh)	R-OUT13 OFF delay time			0	C	2365 (093Dh)
4732 (127Ch)	4733 (127Dh)	R-OUT14 OFF delay time			0	C	2366 (093Eh)
4734 (127Eh)	4735 (127Fh)	R-OUT15 OFF delay time			0	C	2367 (093Fh)

8-7 Virtual input

Register address		Name	Description	Setting range	Initial value	Update	NET-ID
Upper	Lower						
4736 (1280h)	4737 (1281h)	Virtual input (VIR-IN0) function	These are used to select an input signal to be assigned to VIR-IN.	Input signal list ⇨p.116	0: No function	C	2368 (0940h)
4738 (1282h)	4739 (1283h)	Virtual input (VIR-IN1) function			0: No function	C	2369 (0941h)
4740 (1284h)	4741 (1285h)	Virtual input (VIR-IN2) function			0: No function	C	2370 (0942h)
4742 (1286h)	4743 (1287h)	Virtual input (VIR-IN3) function			0: No function	C	2371 (0943h)
4744 (1288h)	4745 (1289h)	Virtual input (VIR-IN0) source selection	These are used to select an output signal to be the trigger of VIR-IN.	Output signal list ⇨p.117	256: CONST-OFF	C	2372 (0944h)
4746 (128Ah)	4747 (128Bh)	Virtual input (VIR-IN1) source selection			256: CONST-OFF	C	2373 (0945h)
4748 (128Ch)	4749 (128Dh)	Virtual input (VIR-IN2) source selection			256: CONST-OFF	C	2374 (0946h)
4750 (128Eh)	4751 (128Fh)	Virtual input (VIR-IN3) source selection			256: CONST-OFF	C	2375 (0947h)
4752 (1290h)	4753 (1291h)	Virtual input (VIR-IN0) logic setting (inverting mode)	These are used to change the ON/OFF setting for VIR-IN.	0: Not invert 1: Invert	0	C	2376 (0948h)
4754 (1292h)	4755 (1293h)	Virtual input (VIR-IN1) logic setting (inverting mode)			0	C	2377 (0949h)
4756 (1294h)	4757 (1295h)	Virtual input (VIR-IN2) logic setting (inverting mode)			0	C	2378 (094Ah)
4758 (1296h)	4759 (1297h)	Virtual input (VIR-IN3) logic setting (inverting mode)			0	C	2379 (094Bh)
4760 (1298h)	4761 (1299h)	Virtual input (VIR-IN0) ON signal dead-time	These are used to set the ON signal dead-time for VIR-IN.	0 to 250 ms	0	C	2380 (094Ch)
4762 (129Ah)	4763 (129Bh)	Virtual input (VIR-IN1) ON signal dead-time			0	C	2381 (094Dh)
4764 (129Ch)	4765 (129Dh)	Virtual input (VIR-IN2) ON signal dead-time			0	C	2382 (094Eh)
4766 (129Eh)	4767 (129Fh)	Virtual input (VIR-IN3) ON signal dead-time			0	C	2383 (094Fh)
4768 (12A0h)	4769 (12A1h)	Virtual input (VIR-IN0) 1 shot signal mode	These are used to enable the 1-shot signal function for VIR-IN.	0: Disable 1: Enable	0	C	2384 (0950h)
4770 (12A2h)	4771 (12A3h)	Virtual input (VIR-IN1) 1 shot signal mode			0	C	2385 (0951h)
4772 (12A4h)	4773 (12A5h)	Virtual input (VIR-IN2) 1 shot signal mode			0	C	2386 (0952h)
4774 (12A6h)	4775 (12A7h)	Virtual input (VIR-IN3) 1 shot signal mode			0	C	2387 (0953h)

8-8 User output setting

Register address		Name	Description	Setting range	Initial value	Update	NET-ID
Upper	Lower						
4800 (12C0h)	4801 (12C1h)	User output (USR-OUT0) source A function	These are used to set the output source A for USR-OUT.	Output signal list ⇨p.117	256: CONST-OFF	C	2400 (0960h)
4802 (12C2h)	4803 (12C3h)	User output (USR-OUT1) source A function			256: CONST-OFF	C	2401 (0961h)
4804 (12C4h)	4805 (12C5h)	User output (USR-OUT0) source A-logic setting (inverting mode)	These are used to change the ON/OFF setting for the output source A of USR-OUT.	0: Not invert 1: Invert	0	C	2402 (0962h)
4806 (12C6h)	4807 (12C7h)	User output (USR-OUT1) source A-logic setting (inverting mode)			0	C	2403 (0963h)
4808 (12C8h)	4809 (12C9h)	User output (USR-OUT0) source B function	These are used to set the output source B for USR-OUT.	Output signal list ⇨p.117	256: CONST-OFF	C	2404 (0964h)
4810 (12CAh)	4811 (12CBh)	User output (USR-OUT1) source B function			256: CONST-OFF	C	2405 (0965h)
4812 (12CCh)	4813 (12CDh)	User output (USR-OUT0) source B-logic setting (inverting mode)	These are used to change the ON/OFF setting for the output source B of USR-OUT.	0: Not invert 1: Invert	0	C	2406 (0966h)
4814 (12CEh)	4815 (12CFh)	User output (USR-OUT1) source B-logic setting (inverting mode)			0	C	2407 (0967h)
4816 (12D0h)	4817 (12D1h)	User output (USR-OUT0) logical operation	These are used to set the logical combination for the output sources A and B of USR-OUT.	0: AND 1: OR	1	C	2408 (0968h)
4818 (12D2h)	4819 (12D3h)	User output (USR-OUT1) logical operation			1	C	2409 (0969h)

8-9 Alarm/Information

Register address		Name	Description	Setting range	Initial value	Update	NET-ID
Upper	Lower						
772 (0304h)	773 (0305h)	Driver alarm detection	This is used to set whether or not to generate an alarm of "Driver alarm detection" in the controller when an alarm was generated in the driver.	0: Disable 1: Enable	0	A	386 (0182h)
778 (030Ah)	779 (030Bh)	Stop action at alarm generation	This is used to set how to stop when an alarm is generated.	0: Immediate stop 1: Stop with parameter during operation 2: Stop with "Stop action preset" 3: Stop with parameter during operation & non-excitation 4: Stop with "Stop action preset" & non-excitation	2	A	389 (0185h)
780 (030Ch)	781 (030Dh)	Wheel speed information (INFO-AXISSPD) Axis 1	These are used to set the condition under which the information is generated.	0: Disable 1 to 20,000 (1=0.001 m/s)	0	A	390 (0186h)
782 (030Eh)	783 (030Fh)	Wheel speed information (INFO-AXISSPD) Axis 2			0	A	391 (0187h)
784 (0310h)	785 (0311h)	Wheel speed information (INFO-AXISSPD) Axis 3			0	A	392 (0188h)
786 (0312h)	787 (0313h)	Wheel speed information (INFO-AXISSPD) Axis 4			0	A	393 (0189h)

Register address		Name	Description	Setting range	Initial value	Update	NET-ID
Upper	Lower						
832 (0340h)	833 (0341h)	Controller temperature information (INFO-CNTTMP)	These are used to set the condition under which the information is generated.	40 to 85 °C	85	A	416 (01A0h)
836 (0344h)	837 (0345h)	Robot speed information (INFO-RBSPD) forward/ reverse translational speed		0: Disable 1 to 20,000 (1=0.001 m/s)	0	A	418 (01A2h)
838 (0346h)	839 (0347h)	Robot speed information (INFO-RBSPD) rotation speed		0: Disable 1 to 62,831,854 (1=0.000001 rad/s)	0	A	419 (01A3h)
840 (0348h)	841 (0349h)	Robot speed information (INFO-RBSPD) left/right translational speed		0: Disable 1 to 20,000 (1=0.001 m/s)	0	A	420 (01A4h)
846 (034Eh)	847 (034Fh)	Driver information detection (INFO-DRVINFO)		0: Disable 1: Enable	0	A	423 (01A7h)
854 (0356h)	855 (0357h)	Upper voltage information (INFO-VOLT-H)		0: Disable 1 to 1,000 (1=0.1 V)	550	A	427 (01ABh)
856 (0358h)	857 (0359h)	Lower voltage information (INFO-VOLT-L)		0: Disable 1 to 1,000 (1=0.1 V)	180	A	428 (01ACh)
888 (0378h)	889 (0379h)	INFO-USRIO output selection	This is used to select the I/O status to be checked by the INFO-USRIO output.	Output signal list ⇨p.117	256: CONST-OFF	A	444 (01BCh)
890 (037Ah)	891 (037Bh)	INFO-USRIO output inversion	This is used to set the ON/OFF setting for the INFO-USRIO output.	0: Not invert 1: Invert	0	A	445 (01BDh)
892 (037Ch)	893 (037Dh)	Information LED condition	This is used to set whether or not to blink the LED when information is generated.	0: Disable 1: Enable	1	A	446 (01BEh)
894 (037Eh)	895 (037Fh)	Information auto clear	When the cause of the information is removed, the INFO output and the bit output of the corresponding information are automatically turned OFF.	0: Disable 1: Enable	1	A	447 (01BFh)
1016 (03F8h)	1017 (03F9h)	LED (PWR/COMM/ COMM-D) color switching	The lighting colors of the PWR/ SYS LED, COMM LED, and the COMM-D LED can be changed.	0: Green 1: White	1	A	508 (01FCh)
1908 (0774h)	1909 (0775h)	Robot overspeed alarm setting	This is used to set how the robot moves when the maximum speed of the robot is detected.	0: Alarm not generated 1: Alarm generated	1	A	954 (03BAh)
1910 (0776h)	1911 (0777h)	Robot overspeed translational speed	This is used to set the condition under which an alarm of Robot overspeed is generated. Set the maximum speed for the translation speed (composite value) when the robot moves forward, reverse, left, or right.	1 to 20,000 (1=0.001 m/s)	2,000	A	955 (03BBh)
1912 (0778h)	1913 (0779h)	Robot overspeed rotation speed	This is used to set the condition under which an alarm of Robot overspeed is generated. Set the maximum speed for the angular speed when the robot rotates.	1 to 62,831,854 (1=0.000001 rad/s)	6,283,185	A	956 (03BCh)
1926 (0786h)	1927 (0787h)	Wheel overspeed alarm setting	This is used to set how the robot moves when the maximum speed of each axis is detected.	0: Alarm not generated 1: Alarm generated	1	A	963 (03C3h)

Register address		Name	Description	Setting range	Initial value	Update	NET-ID
Upper	Lower						
1928 (0788h)	1929 (0789h)	Wheel overspeed Axis 1	These are used to set the condition under which an alarm of Wheel overspeed is generated. Set the maximum speed of the Axis.	1 to 20,000 (1=0.001 m/s)	5,000	A	964 (03C4h)
1930 (078Ah)	1931 (078Bh)	Wheel overspeed Axis 2			5,000	A	965 (03C5h)
1932 (078Ch)	1933 (078Dh)	Wheel overspeed Axis 3			5,000	A	966 (03C6h)
1934 (078Eh)	1935 (078Fh)	Wheel overspeed Axis 4			5,000	A	967 (03C7h)
8048 (1F70h)	8049 (1F71h)	Robot overspeed forward/reverse translational speed	These are used to set the condition under which an alarm of Robot overspeed is generated. Set the maximum speed for the translational speed of the robot.	0: Disable 1 to 20,000 (1=0.001 m/s)	0	A	4024 (0FB8h)
8050 (1F72h)	8051 (1F73h)	Robot overspeed left/ right translational speed			0	A	4025 (0FB5h)

8-10 Communication setting

Register address		Name	Description	Setting range	Initial value	Update	NET-ID
Upper	Lower						
4992 (1380h)	4993 (1381h)	Communication ID*	This is used to set the server address.	0 to 31: Server address (Do not use 0.)	1	D	2496 (09C0h)
4994 (1382h)	4995 (1383h)	Baudrate	This is used to set the transmission rate.	0: 9,600 bps 1: 19,200 bps 2: 38,400 bps 3: 57,600 bps 4: 115,200 bps 5: 230,400 bps	5	D	2497 (09C1h)
4996 (1384h)	4997 (1385h)	Communication order	This is used to set the byte order of 32-bit data. Set when the arrangement of communication data is different from that of the client. (Setting example ⇨ p.59)	0: Even Address-High Word & Big-Endian 1: Even Address-Low Word & Big-Endian 2: Even Address-High Word & Little-Endian 3: Even Address-Low Word & Little-Endian	0	D	2498 (09C2h)
4998 (1386h)	4999 (1387h)	Communication parity	This is used to set the communication parity.	0: None 1: Even parity 2: Odd parity	1	D	2499 (09C3h)
5000 (1388h)	5001 (1389h)	Communication stop bit	This is used to set the communication stop bit.	0: 1 bit 1: 2 bits	0	D	2500 (09C4h)
5002 (138Ah)	5003 (138Bh)	Communication timeout	This is used to set the condition under which a communication timeout occurs in RS-485 communication.	0: Disable 1 to 10,000 ms	0	A	2501 (09C5h)
5004 (138Ch)	5005 (138Dh)	Communication error alarm	If the RS-485 communication error occurs for the set number of times, an alarm of RS-485 communication error is generated.	0: Disable 1 to 10 times	3	A	2502 (09C6h)
5006 (138Eh)	5007 (138Fh)	Transmission waiting time	This is used to set the transmission waiting time for RS-485 communication.	0 to 10,000 (1=0.1 ms)	30	D	2503 (09C7h)
5008 (1390h)	5009 (1391h)	Silent interval	This is used to set the silent interval.	0: Set automatically 1 to 100 (1=0.1 ms)	0	D	2504 (09C8h)
5010 (1392h)	5011 (1393h)	Server error response mode	This is used to set the response when the server error occurs.	0: Normal response 1: Exception response	1	A	2505 (09C9h)

* When writing is performed with the **MVC Studio** software, the value written is updated immediately.

8-11 Indirect reference setting

● Indirect reference address setting

Register address		Name	Description	Setting range	Initial value	Update	NET-ID
Upper	Lower						
4864 (1300h)	4865 (1301h)	Indirect reference address setting (0)	These are used to set the NET-ID of commands or parameters to be registered in the indirect reference addresses.	0 to 65,535 (0 to FFFFh)	0	A	2432 (0980h)
4866 (1302h)	4867 (1303h)	Indirect reference address setting (1)			0	A	2433 (0981h)
4868 (1304h)	4869 (1305h)	Indirect reference address setting (2)			0	A	2434 (0982h)
4870 (1306h)	4871 (1307h)	Indirect reference address setting (3)			0	A	2435 (0983h)
4872 (1308h)	4873 (1309h)	Indirect reference address setting (4)			0	A	2436 (0984h)
4874 (130Ah)	4875 (130Bh)	Indirect reference address setting (5)			0	A	2437 (0985h)
4876 (130Ch)	4877 (130Dh)	Indirect reference address setting (6)			0	A	2438 (0986h)
4878 (130Eh)	4879 (130Fh)	Indirect reference address setting (7)			0	A	2439 (0987h)
4880 (1310h)	4881 (1311h)	Indirect reference address setting (8)			0	A	2440 (0988h)
4882 (1312h)	4883 (1313h)	Indirect reference address setting (9)			0	A	2441 (0989h)
4884 (1314h)	4885 (1315h)	Indirect reference address setting (10)			0	A	2442 (098Ah)
4886 (1316h)	4887 (1317h)	Indirect reference address setting (11)			0	A	2443 (098Bh)
4888 (1318h)	4889 (1319h)	Indirect reference address setting (12)			0	A	2444 (098Ch)
4890 (131Ah)	4891 (131Bh)	Indirect reference address setting (13)			0	A	2445 (098Dh)
4892 (131Ch)	4893 (131Dh)	Indirect reference address setting (14)			0	A	2446 (098Eh)
4894 (131Eh)	4895 (131Fh)	Indirect reference address setting (15)			0	A	2447 (098Fh)
4896 (1320h)	4897 (1321h)	Indirect reference address setting (16)			0	A	2448 (0990h)
4898 (1322h)	4899 (1323h)	Indirect reference address setting (17)			0	A	2449 (0991h)
4900 (1324h)	4901 (1325h)	Indirect reference address setting (18)			0	A	2450 (0992h)
4902 (1326h)	4903 (1327h)	Indirect reference address setting (19)			0	A	2451 (0993h)
4904 (1328h)	4905 (1329h)	Indirect reference address setting (20)			0	A	2452 (0994h)
4906 (132Ah)	4907 (132Bh)	Indirect reference address setting (21)			0	A	2453 (0995h)
4908 (132Ch)	4909 (132Dh)	Indirect reference address setting (22)			0	A	2454 (0996h)
4910 (132Eh)	4911 (132Fh)	Indirect reference address setting (23)			0	A	2455 (0997h)
4912 (1330h)	4913 (1331h)	Indirect reference address setting (24)			0	A	2456 (0998h)
4914 (1332h)	4915 (1333h)	Indirect reference address setting (25)			0	A	2457 (0999h)
4916 (1334h)	4917 (1335h)	Indirect reference address setting (26)			0	A	2458 (099Ah)

Register address		Name	Description	Setting range	Initial value	Update	NET-ID
Upper	Lower						
4918 (1336h)	4919 (1337h)	Indirect reference address setting (27)	These are used to set the NET-ID of commands or parameters to be registered in the indirect reference addresses.	0 to 65,535 (0 to FFFFh)	0	A	2459 (099Bh)
4920 (1338h)	4921 (1339h)	Indirect reference address setting (28)			0	A	2460 (099Ch)
4922 (133Ah)	4923 (133Bh)	Indirect reference address setting (29)			0	A	2461 (099Dh)
4924 (133Ch)	4925 (133Dh)	Indirect reference address setting (30)			0	A	2462 (099Eh)
4926 (133Eh)	4927 (133Fh)	Indirect reference address setting (31)			0	A	2463 (099Fh)

● Indirect reference area

Register address		Name	NET-ID
Upper	Lower		
4928 (1340h)	4929 (1341h)	Indirect reference area 0	2464 (09A0h)
4930 (1342h)	4931 (1343h)	Indirect reference area 1	2465 (09A1h)
4932 (1344h)	4933 (1345h)	Indirect reference area 2	2466 (09A2h)
4934 (1346h)	4935 (1347h)	Indirect reference area 3	2467 (09A3h)
4936 (1348h)	4937 (1349h)	Indirect reference area 4	2468 (09A4h)
4938 (134Ah)	4939 (134Bh)	Indirect reference area 5	2469 (09A5h)
4940 (134Ch)	4941 (134Dh)	Indirect reference area 6	2470 (09A6h)
4942 (134Eh)	4943 (134Fh)	Indirect reference area 7	2471 (09A7h)
4944 (1350h)	4945 (1351h)	Indirect reference area 8	2472 (09A8h)
4946 (1352h)	4947 (1353h)	Indirect reference area 9	2473 (09A9h)
4948 (1354h)	4949 (1355h)	Indirect reference area 10	2474 (09AAh)
4950 (1356h)	4951 (1357h)	Indirect reference area 11	2475 (09ABh)
4952 (1358h)	4953 (1359h)	Indirect reference area 12	2476 (09ACh)
4954 (135Ah)	4955 (135Bh)	Indirect reference area 13	2477 (09ADh)
4956 (135Ch)	4957 (135Dh)	Indirect reference area 14	2478 (09AEh)
4958 (135Eh)	4959 (135Fh)	Indirect reference area 15	2479 (09AFh)

Register address		Name	NET-ID
Upper	Lower		
4960 (1360h)	4961 (1361h)	Indirect reference area 16	2480 (09B0h)
4962 (1362h)	4963 (1363h)	Indirect reference area 17	2481 (09B1h)
4964 (1364h)	4965 (1365h)	Indirect reference area 18	2482 (09B2h)
4966 (1366h)	4967 (1367h)	Indirect reference area 19	2483 (09B3h)
4968 (1368h)	4969 (1369h)	Indirect reference area 20	2484 (09B4h)
4970 (136Ah)	4971 (136Bh)	Indirect reference area 21	2485 (09B5h)
4972 (136Ch)	4973 (136Dh)	Indirect reference area 22	2486 (09B6h)
4974 (136Eh)	4975 (136Fh)	Indirect reference area 23	2487 (09B7h)
4976 (1370h)	4977 (1371h)	Indirect reference area 24	2488 (09B8h)
4978 (1372h)	4979 (1373h)	Indirect reference area 25	2489 (09B9h)
4980 (1374h)	4981 (1375h)	Indirect reference area 26	2490 (09BAh)
4982 (1376h)	4983 (1377h)	Indirect reference area 27	2491 (09BBh)
4984 (1378h)	4985 (1379h)	Indirect reference area 28	2492 (09BCh)
4986 (137Ah)	4987 (137Bh)	Indirect reference area 29	2493 (09BDh)
4988 (137Ch)	4989 (137Dh)	Indirect reference area 30	2494 (09BEh)
4990 (137Eh)	4991 (137Fh)	Indirect reference area 31	2495 (09BFh)

8-12 USB communicatio

Register address		Name	Description	Setting range	Initial value	Update	NET-ID
Upper	Lower						
996 (03E4h)	997 (03E5h)	USB-ID enable	The COM port can be set.	0: Disable 1: Enable	1	D	498 (01F2h)
998 (03E6h)	999 (03E7h)	USB-ID	This is used to set the ID to the COM port. It can be set when the "USB-ID enable" parameter is set to "Enable."	0 to 999,999,999	0	D	499 (01F3h)
5110 (13F6h)	5111 (13F7h)	USB-PID	This is used to set the product ID to be displayed in the COM port.	0 to 31	0	D	2555 (09FBh)

9 I/O signals assignment list

9-1 Input signals

To assign signals via RS-485 communication, use the "Assignment number" in the table instead of the signal names.

Assignment number	Signal name
0	No function
1	FREE
11	STOP-H
16	STOP
20	ALM-RST
21	ALM-RST-CNT
22	ALM-RST-DRV
25	ETO-CLR-DRV
27	INFO-CLR
28	INFO-CLR-CNT
29	INFO-CLR-DRV
30	HMI
96	JOG-VX+
97	JOG-VX–
98	JOG-W+
99	JOG-W–
100	JOG-VY+
101	JOG-VY–

Assignment number	Signal name
102	JOG-VXVY++
103	JOG-VXVY+–
104	JOG-VXVY–+
105	JOG-VXVY––
224	R0
225	R1
226	R2
227	R3
228	R4
229	R5
230	R6
231	R7
232	R8
233	R9
234	R10
235	R11
236	R12
237	R13

Assignment number	Signal name
238	R14
239	R15
240	R16
241	R17
242	R18
243	R19
244	R20
245	R21
246	R22
247	R23
248	R24
249	R25
250	R26
251	R27
252	R28
253	R29
254	R30
255	R31

9-2 Output signals

To assign signals via RS-485 communication, use the "Assignment number" in the table instead of the signal names.

Assignment number	Signal name
1	FREE_R
11	STOP-H_R
16	STOP_R
20	ALM-RST_R
21	ALM-RST-CNT_R
22	ALM-RST-DRV_R
25	ETO-CLR-DRV_R
27	INFO-CLR_R
28	INFO-CLR-CNT_R
29	INFO-CLR-DRV_R
30	HMI_R
96	JOG-VX+_R
97	JOG-VX−_R
98	JOG-W+_R
99	JOG-W−_R
100	JOG-VY+_R
101	JOG-VY−_R
102	JOG-VXVY++_R
103	JOG-VXVY+−_R
104	JOG-VXVY−+_R
105	JOG-VXVY−−_R
224	R0_R
225	R1_R
226	R2_R
227	R3_R
228	R4_R
229	R5_R
230	R6_R
231	R7_R

Assignment number	Signal name
232	R8_R
233	R9_R
234	R10_R
235	R11_R
236	R12_R
237	R13_R
238	R14_R
239	R15_R
240	R16_R
241	R17_R
242	R18_R
243	R19_R
244	R20_R
245	R21_R
246	R22_R
247	R23_R
248	R24_R
249	R25_R
250	R26_R
251	R27_R
252	R28_R
253	R29_R
254	R30_R
255	R31_R
256	CONST-OFF
257	ALM-A
258	ALM-A-CNT
259	ALM-A-DRV
260	ALM-B

Assignment number	Signal name
261	ALM-B-CNT
262	ALM-B-DRV
263	SYS-RDY
264	READY
265	MOVE
271	MOVE-CNT
272	INFO
273	INFO-CNT
274	INFO-DRV
275	SYS-BSY
277	ETO-MON-DRV
284	S-ON-MON
288	VA
308	RDY-DD-OPE
344	USR-OUT0
345	USR-OUT1
352	ROBOT-EN
480	INFO-USRIO
482	INFO-CNTTMP
484	INFO-VOLT-H
485	INFO-VOLT-L
487	INFO-RBSPD
488	INFO-AXISSPD
506	INFO-DRVDIS
507	INFO-DRVINFO
508	INFO-DSLMTD
510	INFO-CFG
511	INFO-RBT

6 I/O signals

This part explains input signals and output signals.

◆Table of contents

1 Overview of I/O signals

1-1 Overview of input signals

■ Direct input

Direct input (DIN) is a method that the I/O signal cable is connected to the CN2 connector to directly input signals. If the composite input function is used, a single input can turn two signals ON simultaneously, achieving saving of wiring.

Name	Description
Input function	This is used to select an input signal to be assigned to DIN.
Logic setting (inverting mode)	The ON/OFF setting of the signal can be changed.
ON signal dead-time	The input signal is turned ON when the time period having set is exceeded. This can be used to take a measure to eliminate the noise or to adjust the timing between the devices.
1 shot signal	This is used to automatically turn the input signal, which has been turned ON, OFF after 250 μs.
Composite input function	When DIN is turned ON, the signal selected here is also turned ON.

Setting example:
When the ALM-RST input is turned ON, the INFO-CLR is turned ON to clear the information.

Name	Setting
Input function	ALM-RST
Logic setting (inverting mode)	Not invert
ON signal dead-time	0
1 shot signal	Disable
Composite input function	INFO-CLR

■ Virtual input

Virtual input (VIR-IN) is a method in which a signal set in virtual input is input by using the output of a signal set in the virtual input source.
No wiring is required and this function can be used together with direct I/O because of the input method using the internal I/O. Up to four virtual inputs can be set.

Name	Description
Virtual input function	This is used to select an input signal to be assigned to VIR-IN. When a signal of the virtual input source is output, VIR-IN is also turned ON.
Virtual input source selection	This is used to select an output signal to be the trigger of VIR-IN.
Virtual input logic setting (inverting mode)	The ON/OFF setting of the signal can be changed.
Virtual input ON signal dead-time	The input signal is turned ON when the time period having set is exceeded. This can be used to take a measure to eliminate the noise or to adjust the timing between the devices.
Virtual input 1 shot signal mode	This is used to automatically turn the input signal, which has been turned ON, OFF after 250 µs.

Setting example:
When the INFO-RBTSPD is turned ON, turn the STOP input ON to stop the motor.

Name	Setting
Virtual input function	STOP
Virtual input source selection	INFO-RBSPD
Virtual input logic setting (inverting mode)	Not invert
Virtual input ON signal dead-time	0
Virtual input 1 shot signal mode	Disable

1-2 Overview of output signals

■ Direct output

Direct output (DOUT) is a method that the I/O signal cable is connected to the CN2 connector to directly output signals.
If the composite output function is used, the logical combination result of two output signals can be output in a single signal.

Name	Description
Output function	This is used to select an output signal to be assigned to DOUT.
Logic setting (inverting mode)	The ON/OFF setting of the signal can be changed.
OFF delay time	The output signal is turned OFF when the time period that has been set is exceeded. This can be used to take a measure to eliminate the noise or to adjust the timing between the devices.
Composite logical combination	This is used to set the logical combination [AND (logical product) or OR (logical sum)] of the composite output function.
Composite output function	This is used to select an output signal for logical operation with the signal of DOUT. When logical combination of the two signals is established, DOUT is turned ON.
Composite logic setting (inverting mode)	This is used to change the ON/OFF setting of the signal selected in the composite output function.

Setting example:
When the voltage falls below the value set in the "Lower voltage information" parameter during operation, turn the INFO-VOLT-L output (DOUT0) ON.

Name	Setting
Output function	INFO-VOLT-L
Logic setting (inverting mode)	Not invert
OFF delay time	0
Composite logical combination	AND
Composite output function	MOVE
Composite logic setting (inverting mode)	Not invert

■ User output

User output (USR-OUT) is a method of outputting a signal using the internal I/O.
Assign two types of signals (A and B) to a single user output. USR-OUT is output when the logical combination of A and B is established.
No wiring is required and this function can be used together with direct I/O. Up to two user outputs can be set.

Name	Description
User output source A function	This is used to select the output function A.
User output source A-logic setting (inverting mode)	This is used to change the ON/OFF setting for the output function A.
User output source B function	This is used to select the output function B.
User output source B-logic setting (inverting mode)	This is used to change the ON/OFF setting for the output function B.
User output logical operation	This is used to set the logical combination [AND (logical product) or OR (logical sum)] of the output function sources A and B.

Setting example:
When the INFO-RBSPD output and the INFO-AXISSPD output are turned ON, output USR-OUT0.

Name	Setting
User output (USR-OUT0) source A function	INFO-RBSPD
User output (USR-OUT0) source A-logic setting (inverting mode)	Not invert
User output (USR-OUT0) source B function	INFO-AXISSPD
User output (USR-OUT0) source B-logic setting (inverting mode)	Not invert
User output (USR-OUT0) logical operation	AND

1-3 Setting contents of input signals and output signals

■ Direct input

● Input function

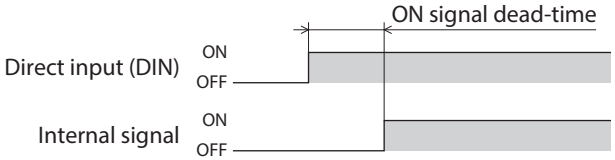
MVC Studio Parameter group	Name	Description	Setting range	Initial value
Direct-IN (DIN)	DIN0 input function	These are used to select an input signal to be assigned to DIN.	Input signal list ⇨p.116	16: STOP
	DIN1 input function			1: FREE
	DIN2 input function			20: ALM-RST
	DIN3 input function			25: ETO-CLR-DRV
	DIN4 input function			11: STOP-H
	DIN5 input function			0: No function
	DIN6 input function			0: No function
	DIN7 input function			0: No function

● Changing the ON/OFF setting of input signals

MVC Studio Parameter group	Name	Description	Setting range	Initial value
Direct-IN (DIN)	Logic setting (inverting mode)	This is used to change the ON/OFF setting for DOUT0 to DOUT7.	0: Not invert 1: Invert	0

● ON signal dead-time

MVC Studio Parameter group	Name	Description	Setting range	Initial value
Direct-IN (DIN)	ON signal dead-time	This is used to set the ON signal dead-time for DIN0 to DIN7.	0 to 250 ms	0



● 1 shot signal

MVC Studio Parameter group	Name	Description	Setting range	Initial value
Direct-IN (DIN)	1 shot signal	This is used to automatically turn the input signal, which has been input to DIN0 to DIN7, OFF (or ON) after 250 µs.	0: Disable 1: Enable	0

Note The HMI input is a signal that is recommended to be used as normally closed (always ON). When the HMI input is assigned to DIN, do not set "1 shot signal" to "Enable."

● Composite input function

MVC Studio Parameter group	Name	Description	Setting range	Initial value
Direct-IN (DIN)	Composite input function	This is used to select the input signals to be assigned to DIN0 to DIN7 as the composite input function.	Input signal list ⇨p.116	0: No function

■ Virtual input

● Virtual input function

MVC Studio Parameter group	Name	Description	Setting range	Initial value
Virtual input (VIR-IN)	Virtual input function	This is used to select the input signals to be assigned to VIR-IN0 to VIR-IN3.	Input signal list ⇨p.116	0: No function

● Virtual input source selection

MVC Studio Parameter group	Name	Description	Setting range	Initial value
Virtual input (VIR-IN)	Virtual input source selection	This is used to select the output signals to be a trigger for VIR-IN0 to VIR-IN3.	Output signal list ⇨p.117	256: CONST-OFF

● Virtual input logic setting (inverting mode)

MVC Studio Parameter group	Name	Description	Setting range	Initial value
Virtual input (VIR-IN)	Virtual input logic setting (inverting mode)	This is used to change the ON/OFF setting for VIR-IN0 to VIR-IN3.	0: Not invert 1: Invert	0

● Virtual input ON signal dead-time

MVC Studio Parameter group	Name	Description	Setting range	Initial value
Virtual input (VIR-IN)	Virtual input ON signal dead-time	This is used to set the ON signal dead-time for VIR-IN0 to VIR-IN3.	0 to 250 ms	0

● Virtual input 1 shot signal mode

MVC Studio Parameter group	Name	Description	Setting range	Initial value
Virtual input (VIR-IN)	Virtual input 1 shot signal mode	This is used to enable the 1-shot signal function for VIR-IN0 to VIR-IN3.	0: Disable 1: Enable	0

■ Direct output

● Output function

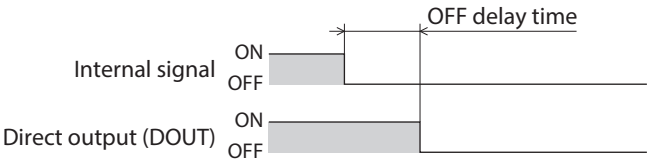
MVC Studio Parameter group	Name	Description	Setting range	Initial value
Direct-OUT (DOUT)	DOUT0 output function	These are used to select an output signal to be assigned to DOUT.	Output signal list ⇨p.117	264: READY
	DOUT1 output function			265: MOVE
	DOUT2 output function			277: ETO-MON-DRV
	DOUT3 output function			260: ALM-B
	DOUT4 output function			308: RDY-DD-OPE
	DOUT5 output function			284: S-ON-MON
	DOUT6 output function			0: No function
	DOUT7 output function			0: No function

● Logic setting (inverting mode)

MVC Studio Parameter group	Name	Description	Setting range	Initial value
Direct-OUT (DOUT)	Logic setting (inverting mode)	This is used to change the ON/OFF setting for DOUT0 to DOUT7.	0: Not invert 1: Invert	0

● OFF delay time

MVC Studio Parameter group	Name	Description	Setting range	Initial value
Direct-OUT (DOUT)	OFF delay time	This is used to set the OFF delay time for DOUT0 to DOUT7.	0 to 250 ms	0



● Composite logical combination

MVC Studio Parameter group	Name	Description	Setting range	Initial value
Direct-OUT (DOUT)	Composite logical combination	This is used to set the composite logical combination for DOUT0 to DOUT7.	0: AND 1: OR	1

● Composite output function

MVC Studio Parameter group	Name	Description	Setting range	Initial value
Direct-OUT (DOUT)	Composite output function	This is used to select the output signals for logical operation with the signals of DOUT0 to DOUT7.	Output signal list ⇨p.117	256: CONST-OFF

● Composite logic setting (inverting mode)

MVC Studio Parameter group	Name	Description	Setting range	Initial value
Direct-OUT (DOUT)	Composite logic setting (inverting mode)	This is used to change the ON/OFF setting for the composite output function of DOUT0 to DOUT7.	0: Not invert 1: Invert	0

■ User output

● User output source A function

MVC Studio Parameter group	Name	Description	Setting range	Initial value
User output (USR-OUT)	User output source A function	This is used to set the output source A of USR-OUT0 and USR-OUT1.	Output signal list ⇨p.117	256: CONST-OFF

● User output source A-logic setting (inverting mode)

MVC Studio Parameter group	Name	Description	Setting range	Initial value
User output (USR-OUT)	User output source A-logic setting (inverting mode)	This is used to change the ON/OFF setting for the output source A of USR-OUT0 and USR-OUT1.	0: Not invert 1: Invert	0

● User output source B function

MVC Studio Parameter group	Name	Description	Setting range	Initial value
User output (USR-OUT)	User output source B function	This is used to set the output source B of USR-OUT0 and USR-OUT1.	Output signal list ⇨p.117	256: CONST-OFF

● User output source B-logic setting (inverting mode)

MVC Studio Parameter group	Name	Description	Setting range	Initial value
User output (USR-OUT)	User output source B-logic setting (inverting mode)	This is used to change the ON/OFF setting for the output source A of USR-OUT0 and USR-OUT1.	0: Not invert 1: Invert	0

● User output logical operation

MVC Studio Parameter group	Name	Description	Setting range	Initial value
User output (USR-OUT)	User output logical operation	This is used to set the logical combination for the output source A and B of USR-OUT0 and USR-OUT1.	0: AND 1: OR	1

2 Signal lists

2-1 Input signal list

Use "Signal name" when assigning signals using the **MVC Studio** software.
To assign signals via RS-485 communication, use the "Assignment number" in the table.
Refer to "4 Input signals" on p.123 for details about each signal.

Assignment number	Signal name	Function
0	No function	This is used to set when the input terminal is not used.
1	FREE	This is used to shut off the motor current and put the motor in a non-excitation state. In the case of an electromagnetic brake motor, the electromagnetic brake is released.
11	STOP-H	This is used to stop the operation.
12	USR-ALM	This is used to generate the user alarm.
16	STOP	This is used to stop the operation.
20	ALM-RST	These are used to reset the alarm presently being generated.
21	ALM-RST-CNT	
22	ALM-RST-DRV	
25	ETO-CLR-DRV	This is used to turn the ETO-CLR input of the driver ON.
27	INFO-CLR	These are used to clear the information status.
28	INFO-CLR-CNT	
29	INFO-CLR-DRV	
30	HMI	This is used to release a state of limiting the functions of the **MVC Studio** software.
96	JOG-VX+	These are used to execute JOG operation.
97	JOG-VX–	
98	JOG-W+	
99	JOG-W–	
100	JOG-VY+	
101	JOG-VY–	
102	JOG-VXVY++	
103	JOG-VXVY+–	
104	JOG-VXVY–+	
105	JOG-VXVY––	
224	R0	These are general signals.
225	R1	
226	R2	
227	R3	
228	R4	
229	R5	
230	R6	
231	R7	
232	R8	
233	R9	
234	R10	
235	R11	

Assignment number	Signal name	Function
236	R12	These are general signals.
237	R13	
238	R14	
239	R15	
240	R16	
241	R17	
242	R18	
243	R19	
244	R20	
245	R21	
246	R22	
247	R23	
248	R24	
249	R25	
250	R26	
251	R27	
252	R28	
253	R29	
254	R30	
255	R31	

2-2 Output signal list

Use "Signal name" when assigning signals using the **MVC Studio** software.
To assign signals via RS-485 communication, use the "Assignment number" in the table.
Refer to "5 Output signals" on p.126 for details about each signal.

Assignment number	Signal name	Function
0	No function	This is used to set when the input terminal is not used.
11	STOP-H_R	Output in response to an input signal.
12	USR-ALM_R	
16	STOP_R	
20	ALM-RST_R	
21	ALM-RST-CNT_R	
22	ALM-RST-DRV_R	
25	ETO-CLR-DRV_R	
27	INFO-CLR_R	
28	INFO-CLR-CNT_R	
29	INFO-CLR-DRV_R	
30	HMI_R	
96	JOG-VX+_R	
97	JOG-VX−_R	
98	JOG-W+_R	
99	JOG-W−_R	
100	JOG-VY+_R	
101	JOG-VY−_R	
102	JOG-VXVY++_R	
103	JOG-VXVY+−_R	

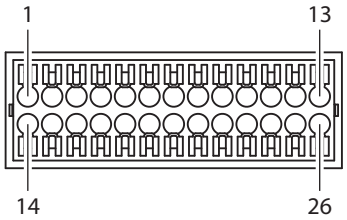
Assignment number	Signal name	Function
104	JOG-VXVY−+_R	Output in response to an input signal.
105	JOG-VXVY−−_R	
224	R0_R	
225	R1_R	
226	R2_R	
227	R3_R	
228	R4_R	
229	R5_R	
230	R6_R	
231	R7_R	
232	R8_R	
233	R9_R	
234	R10_R	
235	R11_R	
236	R12_R	
237	R13_R	
238	R14_R	
239	R15_R	
240	R16_R	
241	R17_R	
242	R18_R	
243	R19_R	
244	R20_R	
245	R21_R	
246	R22_R	
247	R23_R	
248	R24_R	
249	R25_R	
250	R26_R	
251	R27_R	
252	R28_R	
253	R29_R	
254	R30_R	
255	R31_R	
256	CONST-OFF	An OFF state is always output.
257	ALM-A	The alarm status is output (normally open).
258	ALM-A-CNT	
259	ALM-A-DRV	
260	ALM-B	The alarm status is output (normally closed).
261	ALM-B-CNT	
262	ALM-B-DRV	
263	SYS-RDY	Output when the power supply of the controller is turned on.
264	READY	Output when the robot is ready to operate.
265	MOVE	Output while the robot operates.
271	MOVE-CNT	

Assignment number	Signal name	Function
272	INFO	The Information status is output.
273	INFO-CNT	
274	INFO-DRV	
275	SYS-BSY	Output when the controller is in an internal processing state.
277	ETO-MON-DRV	Output when the driver is in the power removal status.
284	S-ON-MON	Output when the motor is in an excitation state.
288	VA	Output when the command speed reaches the target speed.
308	RDY-DD-OPE	Output when the driver is ready to start direct data operation.
344	USR-OUT0	A logical product (AND) or a logical sum (OR) for two types of output signals is output.
345	USR-OUT1	
352	ROBOT-EN	Output while the setup of the robot is properly performed.
480	INFO-USRIO	Output when the corresponding information is generated.
482	INFO-CNTTMP	
484	INFO-VOLT-H	
485	INFO-VOLT-L	
487	INFO-RBSPD	
488	INFO-AXISSPD	
506	INFO-DRVDIS	
507	INFO-DRVINFO	
508	INFO-DSLMTD	
510	INFO-CFG	
511	INFO-RBT	

3 Signal types

3-1 Direct I/O

Direct I/O is I/O accessed via the I/O signal connector. Use parameters to assign the signals to the I/O terminals of the I/O signal connector.



Pin number	Signal name	Initial value
5	DIN1	FREE
6	DIN3	ETO-CLR-DRV
7	DIN5	No function
8	DIN7	No function
10	DOUT1	MOVE
11	DOUT3	ALM-B
12	DOUT5	S-ON-MON
13	DOUT7	No function

Pin number	Signal name	Initial value
18	DIN0	STOP
19	DIN2	ALM-RST
20	DIN4	STOP-H
21	DIN6	No function
23	DOUT0	READY
24	DOUT2	ETO-MON-DRV
25	DOUT4	RDY-DD-OPE
26	DOUT6	No function

Related parameters

MVC Studio Parameter group	Name	Description	Setting range	Initial value
Direct-IN (DIN)	DIN0 input function	These are used to select an input signal to be assigned to DIN.	Input signal list ⇨p.116	16: STOP
	DIN1 input function			1: FREE
	DIN2 input function			20: ALM-RST
	DIN3 input function			25: ETO-CLR-DRV
	DIN4 input function			11: STOP-H
	DIN5 input function			0: No function
	DIN6 input function			0: No function
	DIN7 input function			0: No function
Direct-OUT (DOUT)	DOUT0 output function	These are used to select an output signal to be assigned to DOUT.	Output signal list ⇨p.117	264: READY
	DOUT1 output function			265: MOVE
	DOUT2 output function			277: ETO-MON-DRV
	DOUT3 output function			260: ALM-B
	DOUT4 output function			308: RDY-DD-OPE
	DOUT5 output function			284: S-ON-MON
	DOUT6 output function			0: No function
	DOUT7 output function			0: No function

Note

- When the same input signal is assigned to multiple input terminals, the function will be executed if any of the terminals becomes active.
- When the HMI input is not assigned to an input terminal, this input will always be in an ON state. If it is assigned to both direct I/O and remote I/O, the function will be executed only when both of them are turned ON.

3-2 Remote I/O

Remote I/O is I/O to be accessed via RS-485 communication.

■ Assignment to input signals

Use parameters to assign the input signals to R-IN0 to R-IN15 of remote I/O.

Related parameters

MVC Studio Parameter group	Name	Description	Setting range	Initial value
Remote-IN (R-IN)	R-IN0 input function	These are used to select an input signal to be assigned to R-IN.	Input signal list ⇨p.116	0: No function
	R-IN1 input function			
	R-IN2 input function			
	R-IN3 input function			
	R-IN4 input function			
	R-IN5 input function			
	R-IN6 input function			
	R-IN7 input function			
	R-IN8 input function			
	R-IN9 input function			
	R-IN10 input function			
	R-IN11 input function			
	R-IN12 input function			
	R-IN13 input function			
	R-IN14 input function			
	R-IN15 input function			

Note

- When the same input signal is assigned to multiple input terminals, the function will be executed if any of the terminals becomes active.
- When the HMI input is not assigned to an input terminal, this input will always be in an ON state. If it is assigned to both direct I/O and remote I/O, the function will be executed only when both of them are turned ON.

■ Assignment to output signals

Use parameters to assign the output signals to R-OUT0 to R-OUT15 of remote I/O.

Related parameters

MVC Studio Parameter group	Name	Description	Setting range	Initial value
Remote-OUT (R-OUT)	R-OUT0 output function	These are used to select an output signal to be assigned to R-OUT.	Output signal list ⇨p.117	0: No function
	R-OUT1 output function			
	R-OUT2 output function			
	R-OUT3 output function			
	R-OUT4 output function			
	R-OUT5 output function			
	R-OUT6 output function			
	R-OUT7 output function			
	R-OUT8 output function			
	R-OUT9 output function			
	R-OUT10 output function			
	R-OUT11 output function			
	R-OUT12 output function			
	R-OUT13 output function			
	R-OUT14 output function			
	R-OUT15 output function			

4 Input signals

4-1 Operation control

■ Excitation switching signal

- **FREE input**

  This signal is used to switch the motor excitation state between excitation and non-excitation.
  When the FREE input is turned ON, the current to all motors is shut off, putting them in a non-excitation state.
  In the case of an electromagnetic brake motor, the electromagnetic brake is in a state of releasing the motor shaft when the FREE input is turned ON.

  Note If the FREE input is turned ON, the motor holding force will be lost, which may cause the robot to operate unexpectedly.

  memo This is not a power removal function that can apply to protection measures.

■ Operation stop signal

These signals are used to stop the operation of the robot.

memo
- This is not a stop function that can apply to protection measures.
- When the STOP and STOP-H inputs are turned ON simultaneously, the STOP-H input is prioritized.

- **STOP input**

  When the STOP input is turned ON, all motors stop operating according to the setting of the "STOP input action" parameter.
  For the electromagnetic brake motor, if the STOP input is turned ON when the "STOP input action" parameter is set to "3: Stop with parameter during operation & non-excitation" or "4: Stop with "Stop action preset" & non-excitation," the motor will stop and the electromagnetic brake will activate to hold the motor shaft.

- **STOP-H input**

  When the STOP-H input is turned ON, all motors stop operating according to the setting of the "STOP-H input action" parameter.
  For the electromagnetic brake motor, if the STOP-H input is turned ON when the "STOP-H input action" parameter is set to "3: Stop with parameter during operation & non-excitation" or "4: Stop with "Stop action preset" & non-excitation," the motor will stop and the electromagnetic brake will activate to hold the motor shaft.

■ General purpose inputs for control commands

- **R0 input to R31 input**

  The R0 to R31 inputs are general-purpose signals. Using the R0 to R31 inputs, I/O signals between the host controller and the external equipment can be controlled by the controller. Direct I/O of the controller can be used as an I/O module.

  Example of use: When signals are output from the host controller to external equipment.

  Assign the R0 input to R-IN0 and the R0_R output to DOUT0.
  DOUT0 is turned ON when R-IN0 is set to 1 by the host controller and turned OFF when R-IN0 is set to 0.

  Example of use: When signals output from the external equipment are input to the host controller

  Assign the R1 input to DIN1 and the R1_R output to R-OUT1.
  R-OUT1 is set to 1 when DIN1 is turned ON by the external equipment and set to 0 when DIN1 is turned OFF. The ON/OFF setting of DIN1 can be set using the "DIN1 logic setting (inverting mode)" parameter.

■ Signal used for operation limitation

● HMI input

When the HMI input is turned ON, a state of limiting the functions of the **MVC Studio** software is released. When it is turned OFF, the functions are limited.
The functions that are limited are shown below.

- Setup
- Operation
- Writing data and restoring parameters to the factory setting

Note

- If the HMI input is not assigned to direct I/O or remote I/O, this input is always set to ON. And if it is assigned to both direct I/O and remote I/O, the function will only be executed when both are turned ON.
- If the HMI input is assigned to the DIN input function, do not set the parameter of "1 shot signal" to "Enable."

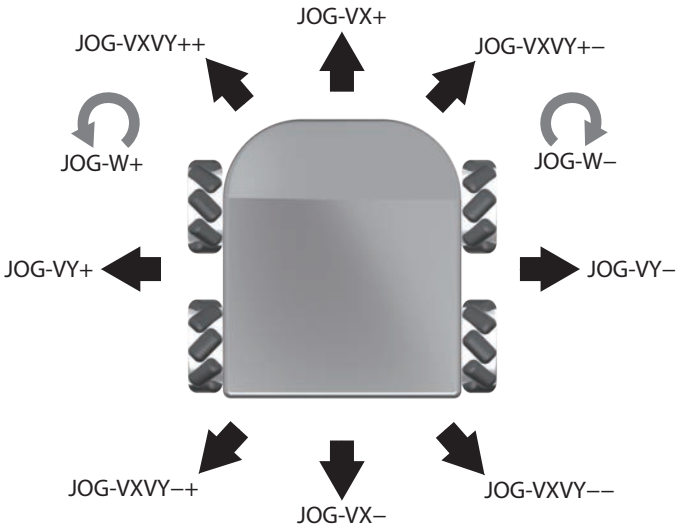
memo A state of limiting the functions can also be released using the "HMI release key" parameter.

■ Signals used for macro operation

● Signals related to JOG operation

The state of the robot when the signal is turned ON is as follows.

Input signal	Status
JOG-VX+	The robot moves forward.
JOG-VX–	The robot moves backward.
JOG-W+	The robot rotates to the left.
JOG-W–	The robot rotates to the right.
JOG-VY+	The robot moves to the left.
JOG-VY–	The robot moves to the right.
JOG-VXVY++	The robot moves to the front left.
JOG-VXVY+–	The robot moves to the front right.
JOG-VXVY–+	The robot moves to the rear left.
JOG-VXVY––	The robot moves to the rear right.



4-2 Controller management

■ Status release signals

These signals are used to release the signal or status that is not automatically released.

● ALM-RST input, ALM-RST-CNT input, ALM-RST-DRV input

These signals are used to reset an alarm.
If an alarm is generated, the robot will stop. Be sure to remove the cause of the alarm and ensure safety before resetting the alarm. Note that some alarms cannot be reset with these signals. Refer to "2-3 Alarm list" on p.142 for alarms.
The state of the robot when each signal is turned from OFF to ON is as follows (they are enabled at the ON edge).

- ALM-RST input: Alarms generated in the controller and all drivers are reset.
- ALM-RST-CNT input: Alarms generated in the controller are reset.
- ALM-RST-DRV input: Alarms generated in all driver are reset.

● ETO-CLR-DRV input

When the ETO-CLR-DRV input is turned ON, the ETO-CLR input for all drivers is turned ON. Refer to the operating manual of the driver for the ETO-CLR input.

Note The ETO-CLR-DRV input is not a safety-related part of a control system.

● INFO-CLR input, INFO-CLR-CNT input, INFO-CLR-DRV input

These signals are used to clear the information status. The state of the robot when each signal is turned ON is as follows.

- INFO-CLR input: The information status for the controller and all drivers is cleared.
- INFO-CLR-CNT input: The information status for the controller is cleared.
- INFO-CLR-DRV input: The information status for all drivers is cleared.

■ User alarm input signal

● USR-ALM input

When the USR-ALM input is turned ON, the user alarm is generated. The robot stops according to the "Stop action at alarm generation" parameter if an alarm is generated.
If a signal, such as one from a sensor, is connected to the control input terminal to which the USR-ALM input is assigned, the user alarm can be generated under a desired condition.

5 Output signals

5-1 Controller management

■ Status indication of controller

- **ALM-A output, ALM-A-CNT output, ALM-A-DRV output**
  ALM-B output, ALM-B-CNT output, ALM-B-DRV output

  These signals are output when an alarm is generated. The "ALM-A- output" is normally open and the "ALM-B- output" is normally closed.
  The state of signals when an alarm is generated is as follows. If an alarm is generated, the PWR/SYS LED of the controller will blink in red to stop the robot.

Product that an alarm is generated	ALM-A	ALM-B	ALM-A-CNT	ALM-B-CNT	ALM-A-DRV	ALM-B-DRV
Controller and driver	**ON**	OFF	**ON**	OFF	**ON**	OFF
Controller	**ON**	OFF	**ON**	OFF	OFF	**ON**
Driver	**ON**	OFF	OFF	**ON**	**ON**	OFF

- **SYS-RDY output**

  After the power supply is turned on, the SYS-RDY output is turned ON when the output signal state is ready for operation and the signals are enabled for input.

- **SYS-BSY output**

  The SYS-BSY output is turned ON while the controller performs the following internal processing.
  - "Operation" is being executed with the **MVC Studio** software.
  - Data writing is being executed using the **MVC Studio** software.
  - "Restoring parameters to the factory settings" is being executed using the **MVC Studio** software.
  - The maintenance command is being executed.

- **INFO output, INFO-CNT output, INFO-DRV output**

  These signals are output when information is generated.
  The state of signals when information is generated is as follows.

Product that information is generated	INFO	INFO-CNT	INFO-DRV
Controller and driver	**ON**	**ON**	**ON**
Controller	**ON**	**ON**	OFF
Driver	**ON**	OFF	**ON**

- **Output of signals for information**

  If corresponding information is generated, each output signal is turned ON.

- **CONST-OFF output**

  An OFF state is output at all times.

■ Status indication of motor

- **S-ON-MON output**

  The S-ON-MON output is turned ON while the motor is in an excitation state.

5-2 Management of operation

■ Status indication of operation

- **READY output**

  The READY output is turned ON when the controller and all drivers are ready to operate. Input the operation start command to the controller after the READY output is turned ON.
  The READY output is turned ON when all of the following conditions are satisfied.
  - The READY output is in an ON state for all drivers.
  - The SYS-BSY output is in an OFF state.
  - Not during initialization.
  - Not during operation.
  - The STOP input is in an OFF state.
  - Not in an alarm status.
  - Communication with the driver is normal.
  - Not during calibration.

- **RDY-DD-OPE output**

  When direct data operation is ready to start, the RDY-DD-OPE output is turned ON.
  Execute direct data operation after the RDY-DD-OPE output is turned ON.

- **MOVE output, MOVE-CNT output**
  - MOVE output:
    The MOVE output is turned ON while the robot operates. When the command from the controller to the driver is stopped and all motors stop the operation, this signal is turned OFF.
  - MOVE-CNT output:
    The MOVE-CNT output is turned ON while the robot operates. When the command from the controller to the driver is stopped, this signal is turned OFF. (It will be turned OFF even if there is a motor in operation.)

- **VA output**

  The VA output is turned ON when the command speed reaches the target speed.

■ Power removal function

- **ETO-MON-DRV output**

  The ETO-MON-DRV output is turned ON when there is a driver in the power removal status.

  Note The ETO-MON-DRV output is not a safety-related part of a control system.

■ Coordinate status indication

- **ROBOT-EN output**

  The ROBOT-EN output is turned ON while the setup of the robot using the **MVC Studio** software is properly completed.

5-3 Response outputs

A response output is a signal that outputs the ON/OFF status of the corresponding input signal.
The table below shows the correspondence between input signals and output signals.

Input signal	Output signal
STOP-H	STOP-H_R
USR-ALM	USR-ALM_R
STOP	STOP_R
ALM-RST	ALM-RST_R
ALM-RST-CNT	ALM-RST-CNT_R
ALM-RST-DRV	ALM-RST-DRV_R
ETO-CLR-DRV	ETO-CLR-DRV_R
LAT-CLR	LAT-CLR_R
INFO-CLR	INFO-CLR_R
INFO-CLR-CNT	INFO-CLR-CNT_R
INFO-CLR-DRV	INFO-CLR-DRV_R
HMI	HMI_R
JOG-VX+	JOG-VX+_R
JOG-VX–	JOG-VX–_R
JOG-W+	JOG-W+_R
JOG-W–	JOG-W–_R
JOG-VY+	JOG-VY+_R
JOG-VY–	JOG-VY–_R

Input signal	Output signal
JOG-VXVY++	JOG-VXVY++_R
JOG-VXVY+–	JOG-VXVY+–_R
JOG-VXVY–+	JOG-VXVY–+_R
JOG-VXVY––	JOG-VXVY––_R
R0	R0_R
R1	R1_R
R2	R2_R
R3	R3_R
R4	R4_R
R5	R5_R
R6	R6_R
R7	R7_R
R8	R8_R
R9	R9_R
R10	R10_R
R11	R11_R
R12	R12_R
R13	R13_R

Input signal	Output signal
R14	R14_R
R15	R15_R
R16	R16_R
R17	R17_R
R18	R18_R
R19	R19_R
R20	R20_R
R21	R21_R
R22	R22_R
R23	R23_R
R24	R24_R
R25	R25_R
R26	R26_R
R27	R27_R
R28	R28_R
R29	R29_R
R30	R30_R
R31	R31_R

6 Control by direct I/O

If you are new to this product, read this section to understand the operation flow.
This example is a method in which parameters are set using the **MVC Studio** software to operate a robot via direct I/O.

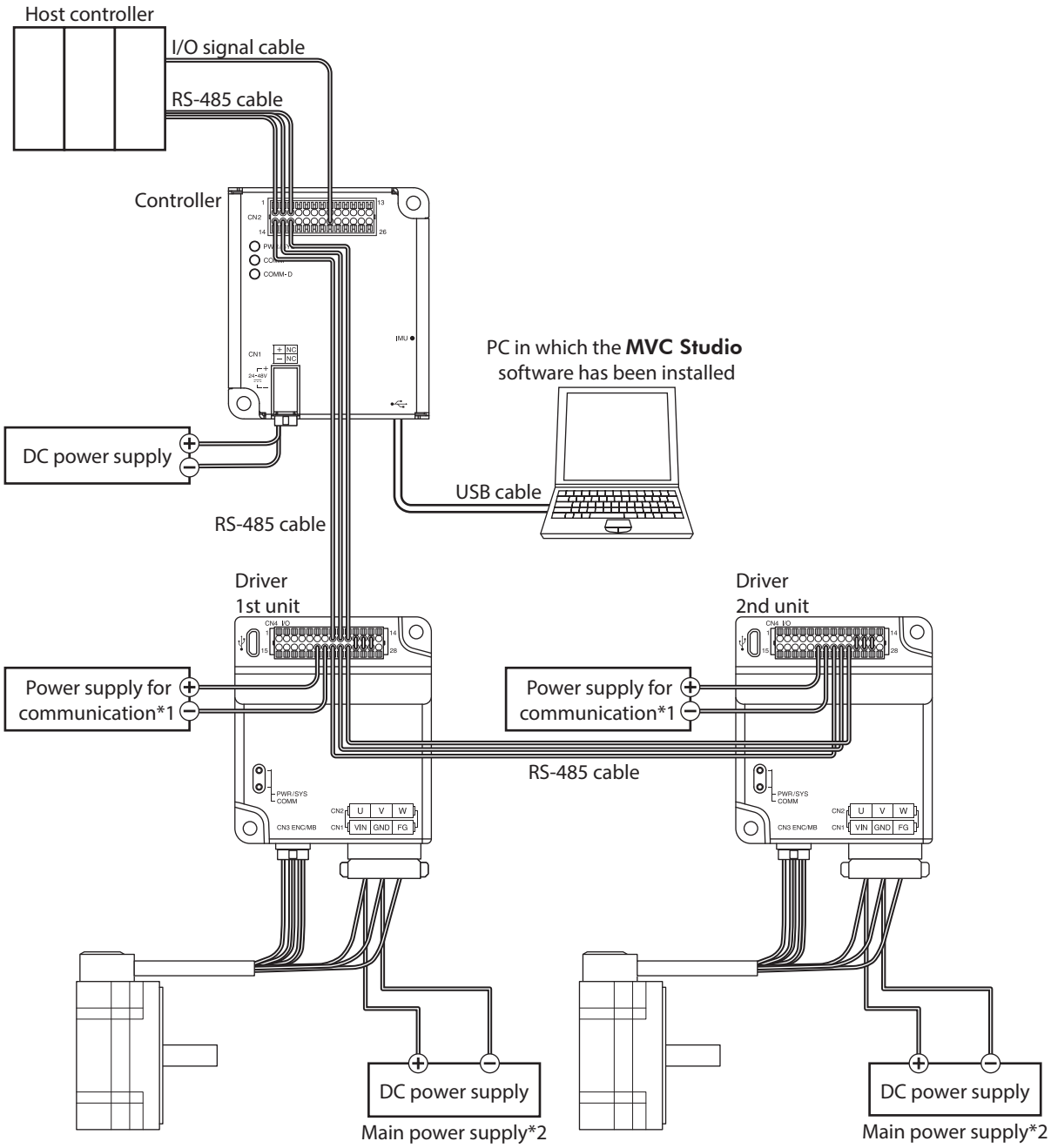
STEP 1	**Installation and connection**
↓	
STEP 2	**Before starting operation**
↓	
STEP 3	**Assignment of direct I/O**
↓	
STEP 4	**Data writing**
↓	
STEP 5	**Operation of robot**

- **Operating conditions**

This operation is performed under the following conditions.
- Setting of robot
  Robot type: Differential two wheels type
- Setting of driver
  Connected driver: **BLVD-KRD** 2 units
- Communication ID (Modbus): 1, 2
- Transmission rate: 230,400 bps
- Communication protocol: Modbus RTU (RS-485 communication)

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

STEP 1 Check the installation and the connection.



*1 Be sure to connect a power supply for communication when using the **BLVD-KRD**.
*2 Connect each driver to a separate main power supply.

Note For details on connecting the driver power supply and the motor, refer to the operating manuals for products used and connect them properly according to the connection diagram.

STEP 2 Before starting operation

Refer to"3 Before starting operation" on p.37.

STEP 3 Assign direct I/O.

In this example, direct I/O is assigned using the **MVC Studio** software.

1. Click [I/O settings] > [Direct-IN (DIN)] on the parameter group on the left side of the screen.
2. Set the "DIN6 input function" parameter to "JOG-VX+" and the "DIN7 input function" parameter to "JOG-W+."

STEP 4 Write the data and turn on the power supply again.

Write the setting of I/O to the controller.

1. Click [Writing data].
2. Click [OK].
3. Turn the power supply of the controller off and then on again.

STEP 5 Execute operation of the robot.

1. Check that the READY output has been turned ON.
2. Turn DIN6 having assigned the JOG-VX+ input ON.
   The robot moves in the forward direction.
3. When the JOG-VX+ input is turned OFF, the robot stops.
4. Turn DIN7 having assigned the JOG-W+ input ON.
   The robot rotates to the left.
5. When the JOG-W+ input is turned OFF, the robot stops.

memo The travel amount of the robot can be checked on the status monitor of the **MVC Studio** software.

STEP 6 Were you able to operate?

How did it go? Were you able to operate properly? If the robot does not operate properly, check the following points.

- Are the power supply, the motor, and the RS-485 cable connected securely?
- Is the PWR/SYS LED blinking in red?
  An alarm is being generated. Refer to "2 Alarms" on p.141 for details.
- Was the setup wizard of the **MVC Studio** software completed successfully?
  If the ROBOT-EN output is in an OFF state, the setting of the robot has not been completed successfully. Set from STEP 2 again.
- Is the COMM LED or the COMM-D LED lit in red?
  A communication error of RS-485 communication is being detected. Refer to "1 Detection of communication errors" on p.140 for details.

7 Other functions

◆Table of contents

1 To monitor using the MVC Studio software

1-1 Monitor types and examples of use

This chapter explains monitor types and examples of use using the **MVC Studio** software.

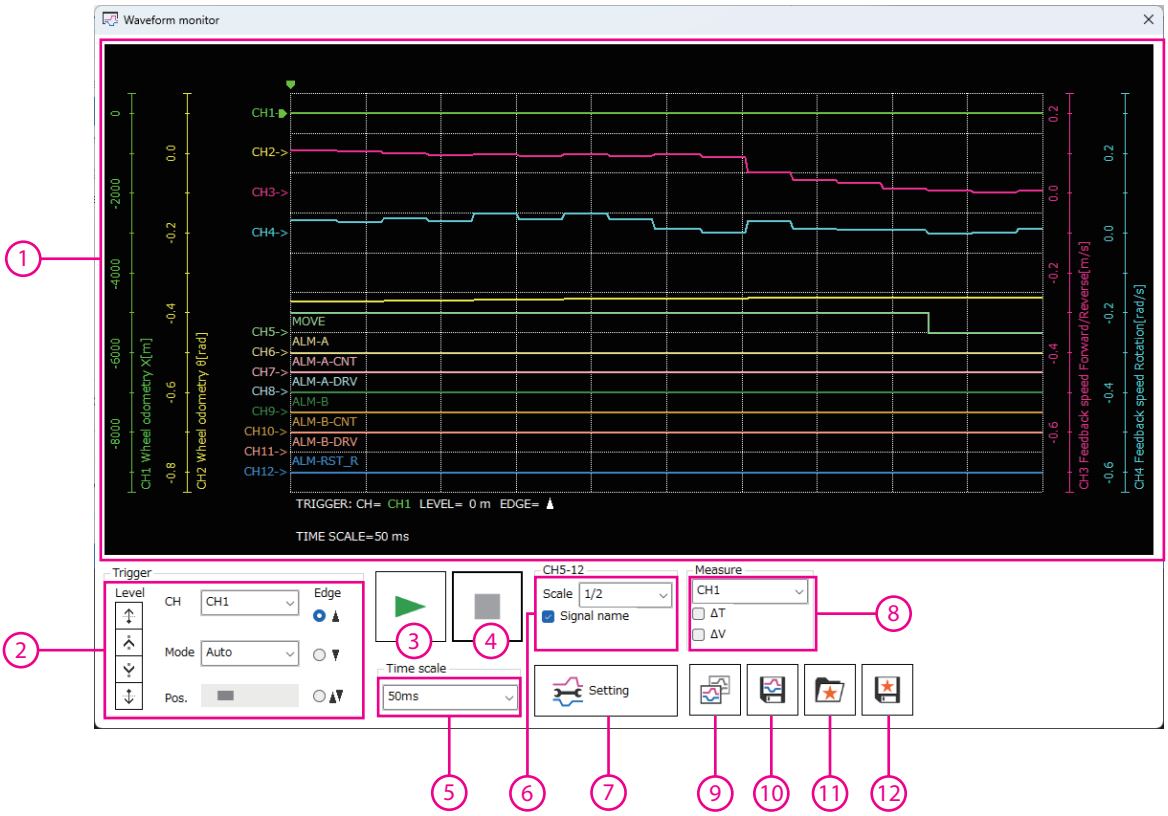
Name	Example of use
Status monitor	• To check the present position of the robot. • To check the command speed and feedback speed. • To check the load factor of each axis.
Controller information monitor	To check the version of the controller.
Information monitor	To check the details of the information.
Alarm monitor	• To check the details of the alarm. • To reset an alarm.
Internal I/O monitor	To check the status of I/O signals.
D-I/O, R-I/O monitor	To check the status of signals assigned to direct I/O or remote I/O.
RS-485 communication monitor	To check the setting of RS-485 communication.
Robot information monitor	To check the information of the robot.
Waveform monitor	To check the speed of the robot and the status of I/O signals using waveforms. Refer to p.135 for how to use the waveform monitor.

2 To utilize the waveform monitor

The waveform monitor is a function that can output the speed of the robot and the status of I/O signals as waveforms. Output signals such as READY and MOVE can be monitored at the same time according to the movement state of the robot.
This chapter explains how to use the waveform monitor window.

2-1 How to read the window

Click [Waveform monitor] on the monitor.

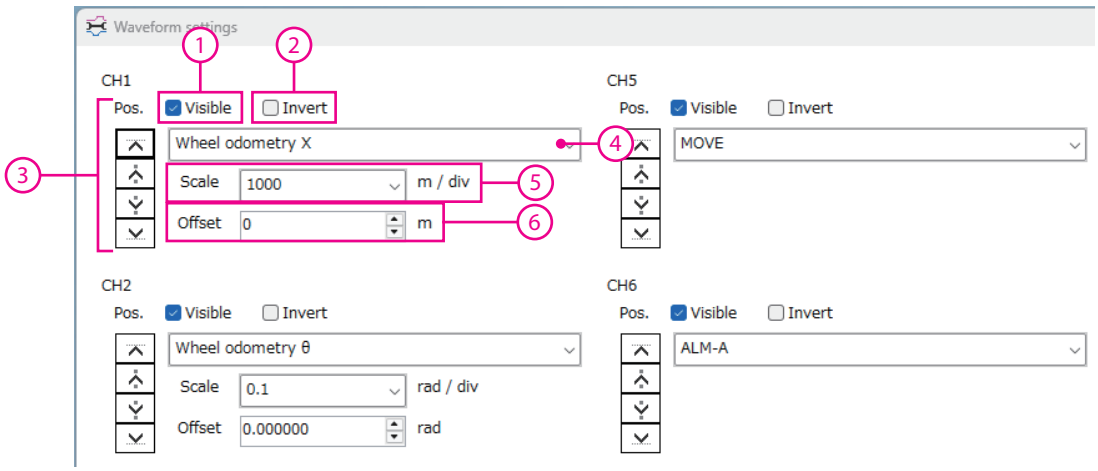


1	Measurement results are drawn in this area. • CH1 to CH4: Used to measure the state of the target product • CH5 to CH12: Used to measure I/O signals
2	Sets the trigger.
3	Starts the measurement.
4	Stops the measurement.
5	Sets the measurement time range (width).
6	Sets the display method for CH5 to CH12. • Scale: Display size • Signal name: Shows or hides the signal name
7	Sets the measurement conditions for each CH.
8	Switches to show or hide the measurement line. Also, selects CH to be measured.
9	Copies the presently displayed waveform to the clipboard.
10	Saves the presently displayed waveform to an external file.*
11	Reads the stored setting from “Favorites.”
12	The setting for measurement can be saved as “Favorites.”

* When saving the data, turn the [Communication] icon OFF to stop measurement.

■ Setting of measurement conditions

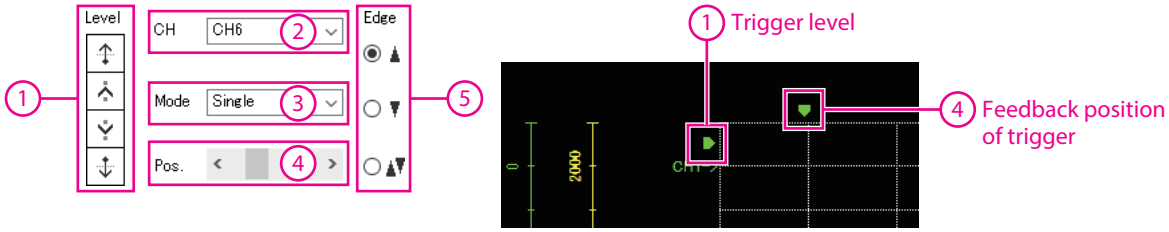
Use the window displayed by clicking Setting to set the measurement condition for each CH.



1	Switches between hiding and showing for each CH.
2	Inversely displays the waveform of the signal that has been measured.
3	Moves the display position of the waveform up or down.
4	Selects the item to be measured.
5	Selects a display scale of CH1 to CH4. The display size can be enlarged in combination with 6.
6	Sets the offset value to be added to the display scale of CH1 to CH4. The display size can be enlarged in combination with 5.

■ Setting of trigger

Setting a trigger to CH can check the waveforms when a certain condition is established, such as the motor speed or the ON/OFF status of signals.



1	Trigger level of CH1 to CH4 The condition to detect a trigger can be set in combination with 5.
2	CH to set a trigger (this is available for only CH being displayed.)
3	Trigger types Refer to "Trigger types" on p.137 for details.
4	Feedback position of trigger
5	Detection conditions of trigger • ▲: CH1 to CH4 are used as a trigger - when the measurement value changes from a value less than Level to that equal to or more than Level. CH5 to CH12 are used as a trigger - when the signal changes from OFF to ON. • ▼: CH1 to CH4 are used as a trigger - when the measurement value changes from a value equal to or more than LEVEL to that less than Level. CH5 to CH12 are used as a trigger - when the signal changes from ON to OFF. • ▲▼: Both ▲ and ▼ are used as a condition.

Trigger types

Auto	Updates the waveform until the measurement is stopped.
Normal	Updates the waveform each time a trigger is detected. The trigger can be detected immediately after the waveform measurement is started.
Single	Updates the waveform when a trigger is first detected, and then stops the measurement. The trigger can be detected immediately after the waveform measurement is started.
Normal (Pre)	Updates the waveform each time a trigger is detected. The waveform before the trigger is detected (the left side of the trigger feedback position) can also be checked. However, the trigger is not detected until a certain period of time (*) has elapsed after the measurement was started.
Single (Pre)	Updates the waveform when a trigger is first detected, and then stops the measurement. The waveform before the trigger is detected (the left side of the trigger feedback position) can also be checked. However, the trigger is not detected until a certain period of time (*) has elapsed after the measurement was started.

* "Time set in Timescale" multiplied by 10

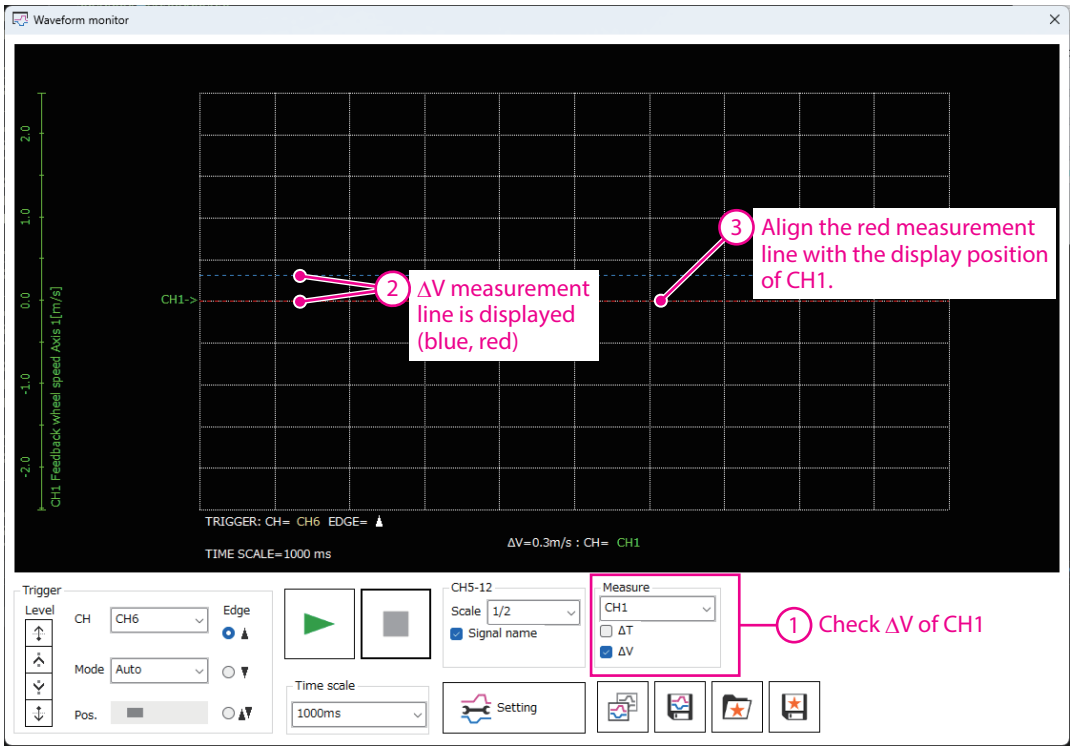
memo

- Select Normal (Pre) or Single (Pre) when checking the waveforms before and after the trigger is detected.
- Select Normal or Single when checking only the waveform after the trigger is detected.
  Although the waveform before the trigger is detected is displayed even in Normal or Single, the old waveform before the measurement is started may be mixed if the time period from when the measurement is started until when the trigger is detected is less than a certain period of time (*).
  * "Time set in Timescale" multiplied by "Number of scales to the trigger feedback position"

2-2 Enlarged view of waveform

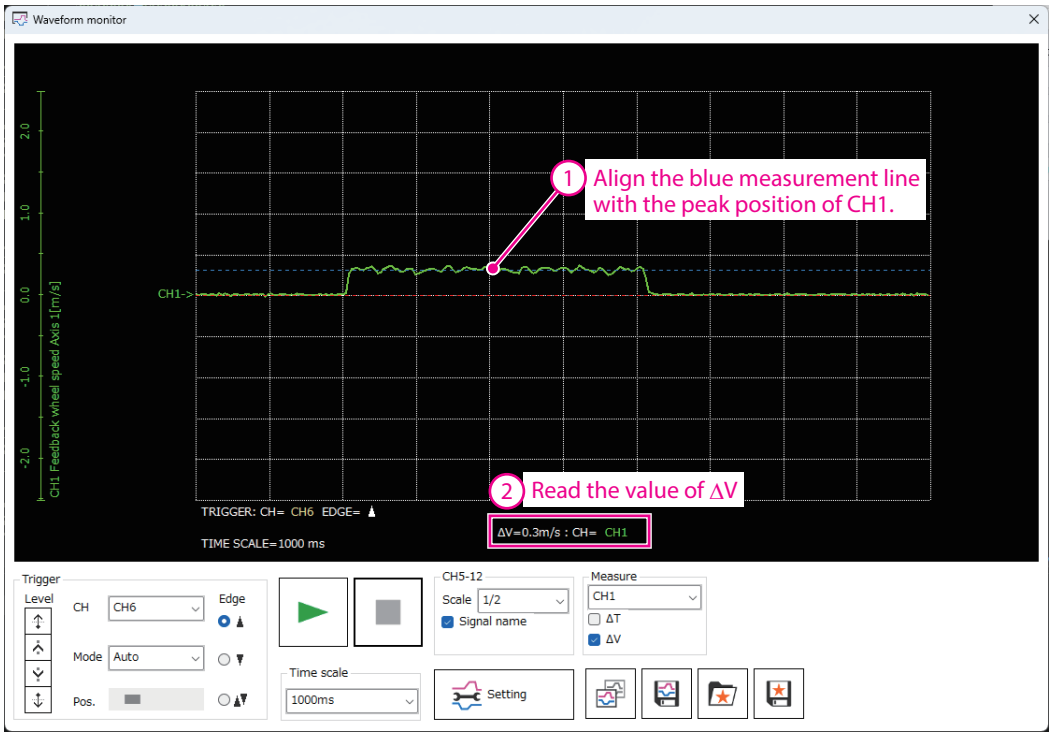
A portion of the measured waveform data can be enlarged to display.
As an example, this section shows how to enlarge and display near the peak value when the "Feedback wheel speed Axis 1" is measured by CH1.

1. Select [CH1] with "Measure" and check ΔV.
   Two lines (blue and red) are displayed to measure ΔV.
2. Align the red measurement line with the display position of CH1.



3. Click ▶ to start measurement.

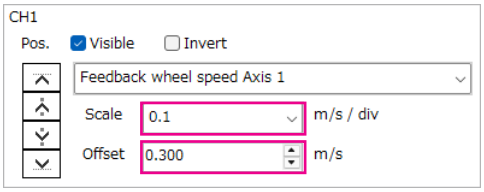
4. Align the blue measurement line with the peak value of CH1 and read the value of ΔV.
   As a result of the measurement, it was found that the peak value of CH1 was around 0.3 m/s.



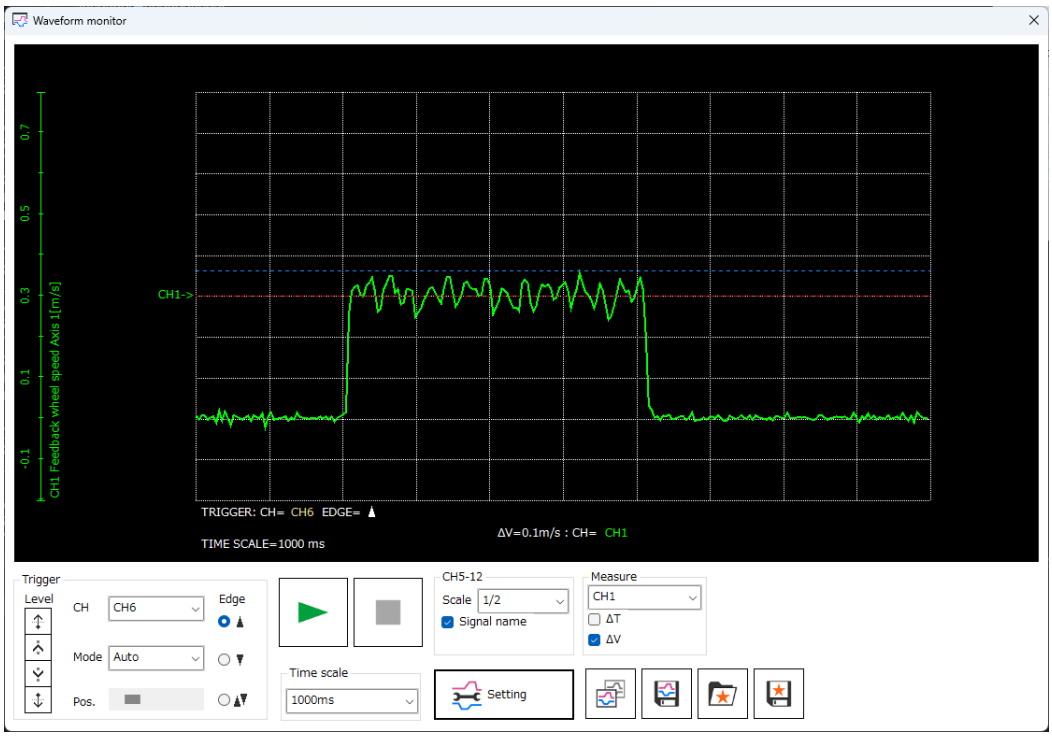
5. Click Setting.

6. Input the center value of the position to be enlarged to "Offset" of CH1.
   To enlarge near the peak value, input 0.3 (m/s) that is the measurement result of the step 4.

7. Use the "Scale" of CH1 to set the speed per one scale on the vertical axis.
   As an example, input 0.1 (m/s /div) this time.



   The waveform is enlarged to display as the center on the value that was input to the offset value.



8 Troubleshooting

This part explains the alarm and information functions.

◆Table of contents

1 Detection of communication errors

1-1 Communication errors

This is a function that detect an error occurred in RS-485 communication.
If the communication error with error code 84h occurs, the COMM LED or COMM-D LED on the controller is lit in red.
For communication errors other than 84h, the LED will not be lit or blink.
The communication error can be checked using the "Communication error history" command via RS-485 communication or using the **MVC Studio** software.

Note The communication error history is cleared when the power supply of the driver is turned off because it is stored in RAM.

■ Communication error list

Type of communication error	Error code	Cause
RS-485 communication error	84h	A transmission error has been detected. (Reference ⇨ p.46)
Command not yet defined	88h	An exception response (exception code 01h, 02h) has been detected. (Reference ⇨ p.47)
Execution disable due to user I/F communication in progress	89h	An exception response (exception code 04h) has been detected. (Reference ⇨ p.47)
Execution disable due to non-volatile memory processing in progress	8Ah	
Out of setting range	8Ch	An exception response (exception code 03h, 04h) has been detected. (Reference ⇨ p.47)
Command execute disable	8Dh	An exception response (exception code 04h) has been detected. (Reference ⇨ p.47)

2 Alarms

This controller is equipped with an alarm function that protects against temperature rise, poor connection, operating error, and other issues.
If an alarm is generated, the ALM-A output is turned ON and the ALM-B output is turned OFF to stop the robot. The PWR/SYS LED blinks in red simultaneously. At this time, the robot stops according to the movement set in the "Stop action at alarm generation" parameter.
The alarm being generated can be checked by counting the number of times the PWR/SYS LED blinks, via RS-485 communication, or using the **MVC Studio** software.

2-1 Alarm Reset

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

- Turn the ALM-RST input from OFF to ON. (It is enabled at the ON edge.)
- Execute the alarm reset by the maintenance command via RS-485 communication.
- Execute the alarm reset using the **MVC Studio** software.
- Turn the power supply off and on again.

Note Some alarms cannot be reset by other methods than turning on the power supply again. Refer to "2-3 Alarm list" on p.142.

2-2 Alarm history

Up to 10 generated alarm items are stored in non-volatile memory in order from most recent to oldest. The stored alarm history can be read or cleared if any of the following operations is performed.

- Read the alarm history with the monitor command via RS-485 communication.
- Clear the alarm history with the maintenance command via RS-485 communication.
- Read or clear the alarm history using the **MVC Studio** software.

2-3 Alarm list

Alarm code	Number of PWR/SYS LED blinks	Alarm type	Cause	Remedial action	How to reset
21h	7	Main circuit overheat	The internal temperature of the controller reached the upper limit of the specification value [85 °C (185 °F)].	Reconsider the ventilation condition in the enclosure.	Any of reset operations
28h	2	IMU error	An IMU error has been detected.	This cannot be reset on the customer side. Contact your nearest Oriental Motor sales office.	–
2Ah	2	IMU communication error	An error occurred in communication with the IMU.	This cannot be reset on the customer side. Contact your nearest Oriental Motor sales office.	–
41h	9	EEPROM error	The data stored in the controller was damaged.	Execute [Restoring parameters to the factory settings] under the [Communication] menu of the **MVC Studio** software.	Turn on the power supply again
6Eh	1	User alarm	The USR-ALM input was turned ON.	Turn the USR-ALM input OFF.	Any of reset operations
81h	8	Driver communication error	• An error was detected in communication with the driver. • The driver was operated or set using the **MEXE02** software in a state where the controller and the driver were connected. The communication ID of the target driver is indicated in the sub code.	• Check the connection with the driver. • Check the settings of the driver such as the transmission rate of RS-485 communication, the communication ID, and the transmission delay time. • Finish the setting and operation of the driver, which is performed using the **MEXE02** software. Then, turn off the power supplies of the driver and controller and turn them on again. • When writing the data to the driver or restoring to the factory settings with the **MEXE02** software, use [Re-setup] under the [Maintenance] menu of the **MVC Studio** software to perform "Driver connection settings."	Any of reset operations
82h	8	Driver communication timeout	Periodic communication with the driver was not performed for a certain period of time. The communication ID of the target driver is indicated in the sub code.	Check the connection with the driver.	Any of reset operations
84h	8	RS-485 communication error	The number of consecutive Modbus communication errors has reached the value set in the "Communication error alarm" parameter.	• Check the connection with the host controller. • Check the setting of RS-485 communication on the controller.	Any of reset operations

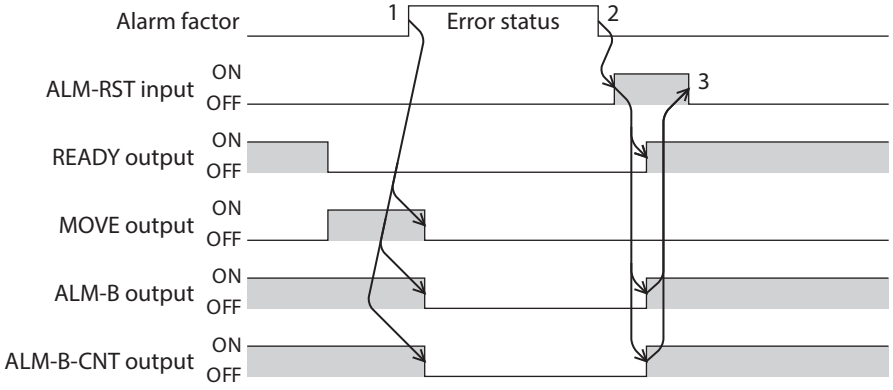
Alarm code	Number of PWR/SYS LED blinks	Alarm type	Cause	Remedial action	How to reset
85h	8	RS-485 communication timeout	The time set in the "Communication timeout" parameter has elapsed, and yet the communication could not be established with the host controller.	Check the connection with the host controller.	Any of reset operations
86h	5	Network product mismatch	• A driver other than possible combinations was connected. • The driver of an unsupported version of the **BLV** Series **R** Type was connected. The following information is indicated in the sub code. • Lower 4 bits Communication ID of the corresponding driver • Upper 4 bits 0: Driver other than possible combinations 1: Unsupported version driver of **BLV** Series **R** Type	• Connect a driver that can be combined. (⇨p.14) • Update the driver firmware with the **MEXE02** software.	Turn on the power supply again
C5h	5	Robot overspeed	When the "Robot overspeed alarm setting" parameter is "1: Alarm generated," the robot speed exceeds the value set in the "Robot overspeed" parameter. The corresponding speed type is indicated in the sub code. 01: Forward/reverse translational speed 02: Rotation speed 03: Left/right translational speed 04: Translational speed	Decrease the operating speed.	Any of reset operations
C7h	8	Wheel overspeed	When the "Wheel overspeed alarm setting" parameter was set to "1: Alarm generated," the setting value of the "Wheel overspeed" parameter was exceeded for one or more axes. The communication ID of the corresponding driver is indicated in the sub code.	Decrease the operating speed.	Any of reset operations
C9h	5	Driver alarm detection	When the "Driver alarm detection" parameter was set to "1: Enable," an alarm was generated in one or more drivers connected to the controller. The communication ID of the corresponding driver is indicated in the sub code.	Check the alarm of the driver and remove the cause before resetting it.	Any of reset operations
CEh	7	Robot mechanism setting error	The power supply was turned on in a state where the mechanism information of the robot was invalid.	Check the mechanism information of the robot.	Turn on the power supply again

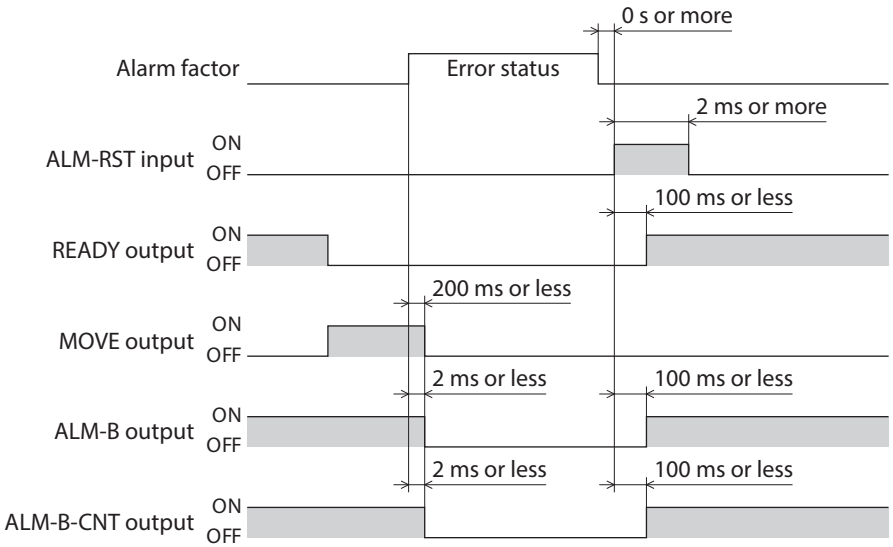
Alarm code	Number of PWR/SYS LED blinks	Alarm type	Cause	Remedial action	How to reset
CFh	4	Axis error during operation	The following error was detected during operation. • The motor was in a non-excitation state. • An alarm was generated in the driver. The following information is indicated in the sub code. • Lower 4 bits Communication ID of the corresponding driver • Upper 4 bits The error content is indicated. 1: The motor is in a non-excitation state 2: An alarm is generated in the driver 4: ETO Status	• Check the connection between the controller and the driver. • Check the status of the driver and the motor.	Any of reset operations
F0h	Light	CPU error	The CPU malfunctioned.	Turn the power supply off and on again.	Turn on the power supply again

2-4 Timing chart

■ When an alarm is generated in the controller

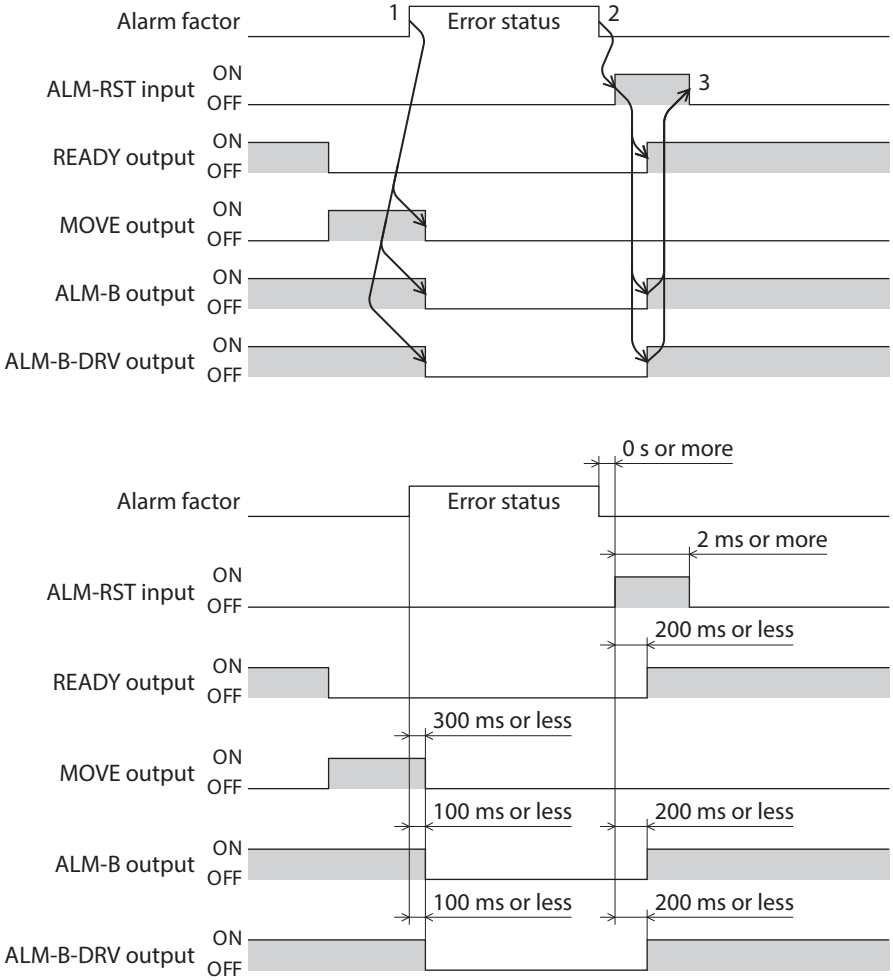
1. If an error occurs, the ALM-B output, the ALM-B-CNT output, and the MOVE output are turned OFF.
   At the same time, all motors stop instantaneously.
2. Remove the cause of the alarm before turning the ALM-RST input ON.
   The alarm is reset, and the ALM-B output, the ALM-B-CNT output, and the READY output are turned ON.
3. Check the ALM-B output and the ALM-B-CNT output have been turned ON before turning the ALM-RST input OFF.





■ When an alarm is generated in the driver

1. If an error occurs, the ALM-B output, the ALM-B-DRV output, and the MOVE output are turned OFF.
   At the same time, all motors stop instantaneously.
2. Remove the cause of the alarm before turning the ALM-RST input ON.
   The alarm is reset, and the ALM-B output, the ALM-B-DRV output, and the READY output are turned ON.
3. Check the ALM-B output and the ALM-B-DRV output have been turned ON before turning the ALM-RST input OFF.



3 Information

The controller is equipped with a function that generates information output before an alarm is generated.
This function can be used for periodic maintenance of equipment by setting an appropriate value in the parameter of each information.

■ Status when information is generated

- **Information bit output**

  If information is generated, a bit output (INFO-** output) of the corresponding information is turned ON.
  A desired output signal can be assigned to the INFO-USRIO output among the bit outputs and used. If the assigned output signal is turned ON, the INFO-USRIO output is also turned ON.
  For details about bit output, refer to p.149.

- **INFO output**

  If information is generated, the INFO output is turned ON.

- **LED indicator**

  If information is generated, the PWR/SYS LED blinks in blue.

- **Operation of robot.**

  The robot continues to operate even while information is being generated, unlike in the case of an alarm. However, in some information, the robot may stop operating when information is generated.

- **Related parameters**

Register address		Name	Description	Setting range	Initial value	NET-ID
Upper	Lower					
780 (030Ch)	781 (030Dh)	Wheel speed information (INFO-AXISSPD) Axis 1	These are used to set the condition under which the information is generated.	0: Disable 1 to 20,000 (1=0.001 m/s)	0	390 (0186h)
782 (030Eh)	783 (030Fh)	Wheel speed information (INFO-AXISSPD) Axis 2			0	391 (0187h)
784 (0310h)	785 (0311h)	Wheel speed information (INFO-AXISSPD) Axis 3			0	392 (0188h)
786 (0312h)	787 (0313h)	Wheel speed information (INFO-AXISSPD) Axis 4			0	393 (0189h)
832 (0340h)	833 (0341h)	Controller temperature information (INFO-CNTTMP)		40 to 85 °C	85	416 (01A0h)
836 (0344h)	837 (0345h)	Robot speed information (INFO-RBSPD) forward/ reverse translational speed		0: Disable 1 to 20,000 (1=0.001 m/s)	0	418 (01A2h)
838 (0346h)	839 (0347h)	Robot speed information (INFO-RBSPD) rotation speed		0: Disable 1 to 62,831,854 (1=0.000001 rad/s)	0	419 (01A3h)
840 (0348h)	841 (0349h)	Robot speed information (INFO-RBSPD) left/right translational speed		0: Disable 1 to 20,000 (1=0.001 m/s)	0	420 (01A4h)
846 (034Eh)	847 (034Fh)	Driver information detection (INFO-DRVINFO)		0: Disable 1: Enable	0	423 (01A7h)
854 (0356h)	855 (0357h)	Upper voltage information (INFO-VOLT-H)		0: Disable 1 to 1,000 (1=0.1 V)	550	427 (01ABh)
856 (0358h)	857 (0359h)	Lower voltage information (INFO-VOLT-L)		0: Disable 1 to 1,000 (1=0.1 V)	180	428 (01ACh)
892 (037Ch)	893 (037Dh)	Information LED condition	This is used to set whether or not to blink the LED when information is generated.	0: Disable 1: Enable	1	446 (01BEh)
894 (037Eh)	895 (037Fh)	Information auto clear	When the cause of the information is removed, the INFO output and the bit output of the corresponding information are automatically turned OFF.	0: Disable 1: Enable	1	447 (01BFh)

3-1 Clearing Information

How to clear the information can be set with the "Information auto clear" parameter.

- **When the "Information auto clear" parameter is set to "1: Enable" (initial value)**

  The generated information will be automatically cleared if the condition for clearing the information is met.

- **When the "Information auto clear" parameter is set to "0: Disable"**

  Even if the condition for clearing the information is met, the information remains generated. The information can be cleared if one of the following methods is performed in a state where the condition for clearing information is satisfied.
  - Execute the Clear information with the maintenance command via RS-485 communication.
  - Execute the Clear information on the information monitor of the **MVC Studio** software.
  - Turn the INFO-CLR input ON.
  - Turn the power supply off and on again.

3-2 Information history

Up to 16 generated information items are stored in RAM in order from most recent to oldest. Information items stored as the information history are the information code, generation time, and information item. The information history can be read or cleared when one of the following methods is performed.
- Read the information history by the monitor command via RS-485 communication.
- Clear the information history by the maintenance command via RS-485 communication.
- Read or clear the information history using the **MVC Studio** software.

The information history is cleared when the power supply of the controller is turned off, as it is stored in RAM.

3-3 Information list

Information item	Information bit output signal	Cause	Condition to clear
Assigned I/O status	INFO-USRIO	The I/O signal set in the "INFO-USRIO output selection" parameter was turned ON.	The I/O signal set in the "INFO-USRIO output selection" parameter was turned OFF.
Controller temperature	INFO-CNTTMP	The internal temperature of the controller exceeded the value set in the "Controller temperature information" parameter.	The internal temperature of the controller fell below the value set in the "Controller temperature information" parameter.
Upper voltage	INFO-VOLT-H	The voltage of the controller exceeded the value set in the "Upper voltage information" parameter.	The voltage of the controller fell below the value set in the "Upper voltage information" parameter.
Lower voltage	INFO-VOLT-L	The voltage of the controller fell below the value set in the "Lower voltage information" parameter.	The voltage of the controller exceeded the value set in the "Lower voltage information" parameter.
Robot speed	INFO-RBSPD	The feedback speed of the robot exceeded the value set in the "Robot speed information" parameter.	The feedback speed of the robot fell below the value set in the "Robot speed information" parameter.
Wheel speed	INFO-AXISSPD	The feedback speed for one or more axes was exceeded the value set in the "Wheel speed information" parameter.	The feedback speed of all axes fell below the value set in the "Wheel speed information" parameter.
Driver connection setting incomplete	INFO-DRVDIS	The connection setting of the driver for one or more axes was not completed in the setup of the **MVC Studio** software.	The setup wizard of the **MVC Studio** software was completed.
Driver information detection	INFO-DRVINFO	When the "Driver information detection" parameter was set to "1: Enable," information was generated in one or more drivers.	The information status for all drivers was cleared.
Start operation restricted mode	INFO-DSLMTD	• "Operation" on the tool bar was executed with the **MVC Studio** software. • Configuration was executed. • Data was written to the controller from the **MVC Studio** software. • "Restoring parameters to the factory settings" was executed with the **MVC Studio** software.	• The operation screen was closed. • Configuration was completed. • Writing data was completed. • Data was restored to the factory setting.
I/O test mode	INFO-IOTEST	Configuration was executed.	Configuration was completed.
Configuration request	INFO-CFG	The parameter that required executing Configuration was changed.	Configuration was executed.
Reboot request	INFO-RBT	The parameter that required rebooting the controller was changed.	The controller was rebooted.

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