FASTECH

Fast, Accurate, Smooth Motion

BLDC Motor Unit
Ezi-SPEED Series

RS-485 Modbus-RTU communication type

USER MANUAL

- Ezi-SPEED Modbus-RTU

◎ Table of contents ◎

1 Entry

1.1 Before use

(1) Thank you for your purchasing the FASTECH's product.
(2) Ezi-SPEED Modbus-RTU is BLDC motor speed control system that supports a Modbus-RTU network based on RS-485.
(3) Ezi-SPEED series is for industrial use. Do not use it for any other purpose. Our company is not responsible for any damage caused by failure to comply with this.
(4) This instruction User Manual details how to use the product and precautions for safety.
(5) Before operating Ezi-SPEED Modbus-RTU, thoroughly read this User Manual for safety.
(6) After reading User Manual, please keep it near Ezi-SPEED Modbus-RTU so that any user can read the User Manual whenever needed.
(7) The contents or product specification of instruction User Manual may be changed without notice to improve performance. If you need the latest version of the instruction User Manual, please visit our website at www.fastech-motions.com.

1.2 Safety precautions

Must read the instructions carefully until the end to use this product safely. In particular, safety precautions are to prevent unexpected risks or damage, so use product only after fully understanding it. Precautions are divided into two categories: 'Warning' and 'Caution' and each meaning is as follows.

⚠ **Warning** violation of instructions can cause death or serious injury to the user.

⚠ **Caution** violation of instructions can cause personal injury or property damage.

⚠ Warning

■ General instructions

- Only qualified personnel should be allowed to perform installation, connection, operation and inspection/troubleshooting of the product. Handling by unqualified personnel may result in fire, electric shock, injury or equipment damage.
- Do not move, install, connect or inspect the product while the power is supplied. Perform these operations after turning off the power. Failure to comply these instructions may result in electric shock.
- Do not use the product in a place exposed to explosive, flammable or corrosive gases or water splashes or near combustible materials. Doing so may result in fire, electric shock or injury.

- If the driver protective function (Alarm) has been activated, remove the cause and reset the protective function. Continuing to operate the equipment without removing the cause of problem will lead to a malfunction, resulting in injury or equipment damage.

■ Installing

- Install the motor and driver in the housing. Failure to do so may result in electric shock or injury.
- Do not place items on the product or impact it.
- Install each driver at appropriate intervals, to reduce the temperature rise of the driver (see '3.2.2 installation' for more information). Failure to do so may result in a fire or malfunction.

■ Wiring

- Be sure to ground because the casing of this product is insulated from the ground (GND) of the internal circuit by the capacitor. Failure to do so may result in electric shock, fire, or malfunction.
- Keep the input voltage of the driver within the specified range. Failure to do so may result in a fire or electric shock.
- Do not forcibly bend, pull or pinch the cables. Doing so may result in fire or electric shock.
- Do not change the wiring when power is applied. Failure to do so may result in electric shock or damage to the device.

■ Operation · Maintenance · Inspection

- Disconnect the main power and wait at least 2 minutes before checking or repairing. Failure to do so may result in electric shock due to a charge voltage remaining in the internal electrolytic capacitor.
- Do not reconstruct the drive. Failure to do so may result in electric shock or damage to the device. And the reconstructed product cannot get after service.
- Do not touch the connection terminals when power is applied. Failure to do so may result in electric shock.
- Remove all power from the system before cleaning, loosening or tightening screws. Failure to do so may result in electric shock or malfunction.

⚠Caution

■ General instructions

- Use the product according to the specified specifications. Failure to do so may result in electric shock, injury, and damage to the product.

- Do not touch the motor or drive while operating or immediately after stopping. The surface of the motor or drive may be hot and cause a skin burn.
  Do not forcibly bend, pull or pinch the cables. Failure to do so may result in damage to the product.

Installing

- Do not insert an object into the openings in the drive. Doing so may result in fire, electric shock or injury.
- Do not carry the product by holding the motor output shaft or any of cables. Dropping the product may result in damage to the product or injure.
- When installing several products in a sealed place, install a cooling fan to keep the ambient temperature of the product as 40 ℃ or lower. Failure to do so may result in overheating and fire.

Wiring

- Connect certainly according to the wiring diagram. Failure to do so may result in fire or electric shock.

Operation · Maintenance · Inspection

- Use 200 ~ 240VAC to single-phase of three-phase power. And connect the ground of power to the protective ground terminal. Failure to do so may result in electric shock.
- Turn all input signals OFF before supply input voltage. Failure to do so may lead to a motor or driver malfunction, resulting in injury or equipment damage.
- Use the drive and motor in a set combination. Failure to do so may resulted in fire.
- When manually moving the movable part, carry it out in every input signal OFF state. Failure to do so may result in injure.
- All parameter values are set by default factory setting value. Read this User Manual thoroughly to change this value. Failure to do so may result in damage to the product.
- Immediately stop running and turn off the drive power, when trouble has occurred. Failure to do so may result in fire, electric shock or injury.

Dispose

- Dispose of the product as industrial waste. Toxic substances can occur.

1.3 Checking the product

Verify that the items listed below are included. If there is any problem, please contact our company cat +82-32-234-6317.

(a) Drive: 1 EA

(b) Motor: 1 EA

(c) Connector sets

Purpose		Item	Product No.	Manufacturer
Power connection (CN1)		Terminal Block	CPF5.08-05P	STELVIO
Motor connection (CN2)	Drive Side (CN2)	Housing	5557-04R	MOLEX
		Terminal	5556T	
	Motor Side	Housing	5559-04P	MOLEX
		Terminal	5558T	
Sensor connection (CN4)	Drive Side (CN4)	Housing	5557-06R	MOLEX
		Terminal	5556T	
	Motor Side	Housing	5559-06P	MOLEX
		Terminal	5558T	
I/O signal connection (CN7)		Housing	PADP-20V-1S	JST
		Terminal	SPH-002T-P0.5L	

Note

▶ The above connector sets come with the product. Make sure you meet the specifications when using other connectors.

(d) Accessories for Parallel shaft gearhead

▶ Parallel key: 1 EA

(e) Accessories for Hollow shaft gearhead

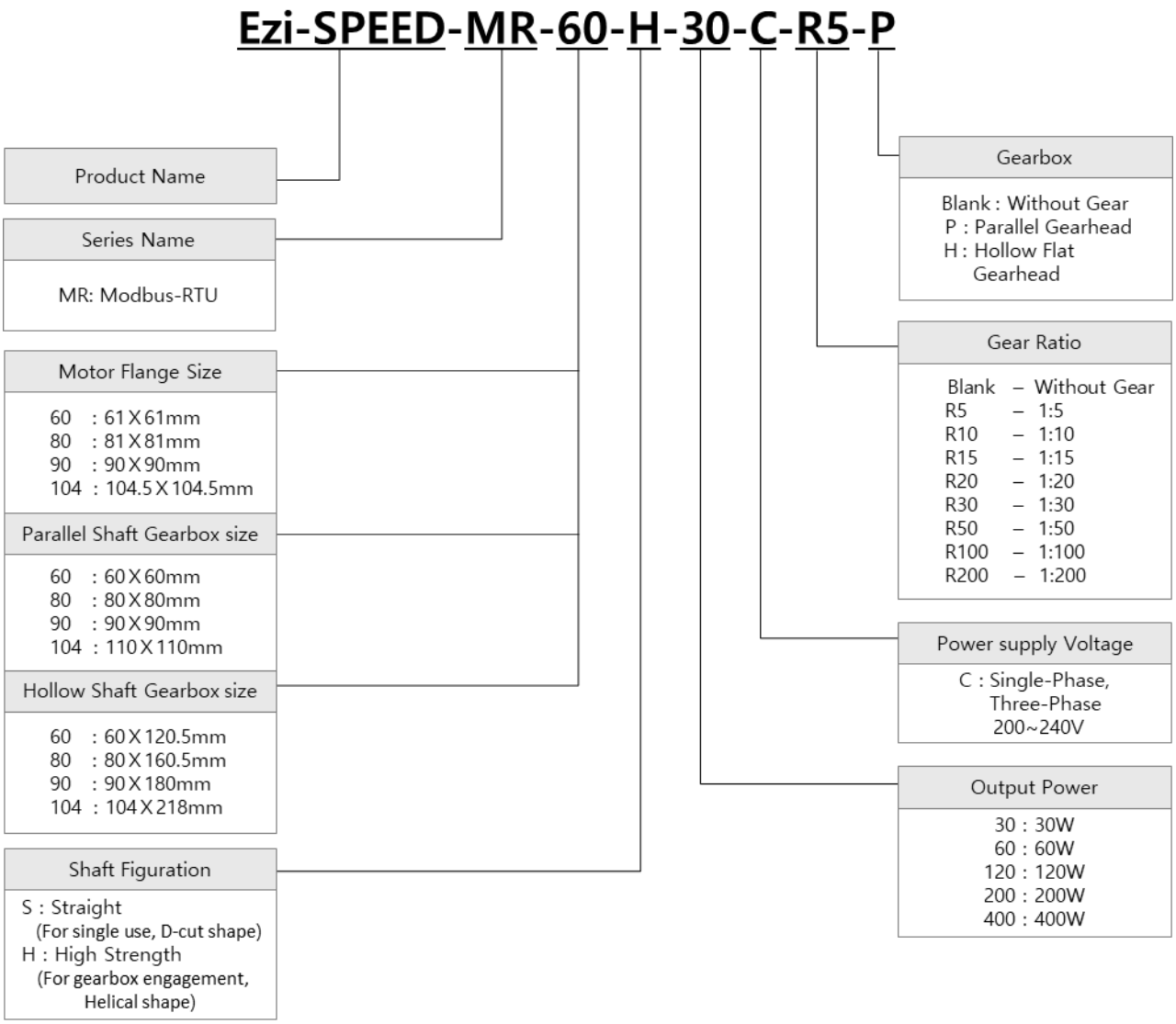
▶ Parallel key: 1 EA

▶ Safety cover: 1 EA

▶ Screws for safety cover assembly (M3): 2 EA

1.4 Product number

Our company sells drive and motor in a set. The product number of units integrating the two products are as follows.



2 Specifications and dimensions of the drive

2.1 Characteristics

The main characteristics of Ezi-SPEED Modbus-RTU are as follows.

(1) BLDC motor unit over RS-485 communication
Ezi-SPEED Modbus-RTU supports the Modbus-RTU protocol based on RS-485 communication, allowing for the construction of various control systems utilizing RS-485 communication in addition to traditional input and output signal-based control.

(2) Precise speed control (speed ripple ±0.2%)
This product always compares the command speed with the feedback signal of the motor to adjust the applied current of the motor by vector control. Therefore, even if load changes, the motor rotates at a steady speed from low to high speed. Accordingly, it offers the optimal solution for applications that prioritize precision and stability in speed.

(3) Wide speed control range (speed ratio 1:80)
This product is available at a wider speed ratio than AC induction motors using inverter. Also, it is suitable for applications that require constant torque from low speed to high speed because there is no limit to the torque used at low speed.

(4) Torque limit function
This product provides the function to control the torque by limiting the current flowing through the motor, which can be used to prevent excessive force.

(5) Holding load function
Holding load function can be used for an electrical retention brake at stop without the need for a mechanical brake. So, this function is suitable for applications that perform work while stopping the transportation conveyors.

(6) High efficiency minimizes heat generation and saves energy
Unlike the AC induction motor, the BLDC motor uses a permanent magnet in the rotor part. This inhibits the secondary loss of the rotor. BLDC motor is more efficient than an AC induction motor controlled by an inverter.

(7) Compact size, lightweight and high power
The BLDC motor uses a permanent magnet for the rotor, so it is compact and lightweight, and has a higher output than the induction motor.

(8) Operation by direct I/O
Control of start/stop, rotation direction change, multi-speed operation, etc. is possible by direct I/O (e.g., PLC). Also, the speed can be changed by rotating the external potentiometer.

(9) Multi-speed operation (16 speeds)
Up to 16 operation data (No.0 to No.15) can be set. Data setting is possible through RS-485 communication or the PC Setting program via USB.

(10) Ezi-SPEED Setting program
With the support of the Ezi-SPEED Setting program, it is easy to set parameters for various functions, and the set parameters can be saved as a file and copied to another drive for quick and easy setup time.

(11) Protection function
This product is equipped with the function to detect abnormal conditions such as overload and overvoltage. If an abnormality is detected, the operation is stopped and an alarm is triggered.
Regenerative resistor connection terminals are provided to enable regenerative resistor for short deceleration times or for large torque.

2.2 General specification

Ezi-SPEED Modbus-RTU drive has the following general specification.

Specification	
Temperature	0 ~ 40 ℃ (Non-freezing)
Temperature	-25 ~ + 70 ℃ (Non-freezing)
Usage Humidity	Less than 85%RH (Non-condensing)
Storage Humidity	85%RH (Non-condensing)
Vibration	In the case of intermittent vibration: - 10~57Hz, Displacement Amplitude of 0.075mm - 57~150Hz, Acceleration Amplitude of 9.8m/s² In the case of continuous vibration: - 10~55Hz, Acceleration Amplitude of 5.9m/s²
Environment	No corrosive gas and dust, No splashing water and oil
Elevation	Usage: Below 1,000 m above sea level Transport/Storage: Below 3,000 m above sea level
IP Rating	IP20

2.3 Performance specification

Ezi-SPEED Modbus-RTU drive has the following performance specification.

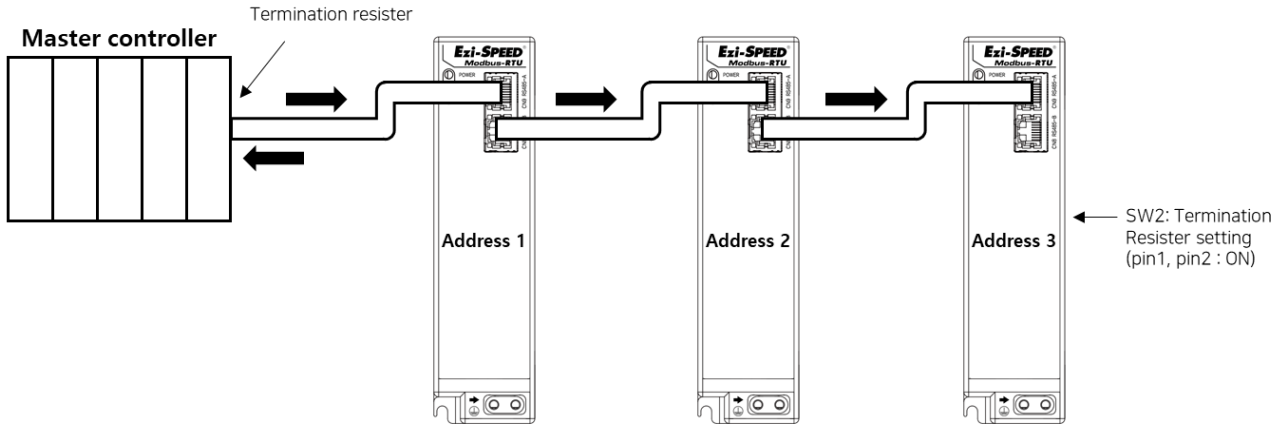
Unit Product Number		ESD-MR-30-C	ESD-MR-60-C	ESD-MR-120-C	ESD-MR-200-C	ESD-MR-400-C
Rated Output Power (Continuous)		30W	60W	120W	200W	400W
Power supply input	Rated Voltage	Single-phase 200~240V / Three-phase 200~240V				
	Permissible Voltage Range	±10 %				
	Frequency	50 / 60 Hz				
	Permissible Frequency Range	±5 %				
	Rated Input Current	2P: 0.88A 3P: 0.51A	2P: 1.55A 3P: 0.90A	2P: 2.43A 3P: 1.41A	2P: 3.42A 3P: 1.97A	2P: 5.64A 3P: 3.26A
	Maximum Input Current	2P: 1.9A 3P: 1.1A	2P: 2.8A 3P: 1.7A	2P: 4.5A 3P: 2.6A	2P: 5.47A 3P: 3.16A	2P: 7.85A 3P: 4.53A
Functions	Speed Control Range	50~4000 r/min				
	Rated Speed	3000 r/min				
	Speed Regulation	±0.2% or less / Conditions: 0 ~ Rated Torque, Rated Speed, Rated Voltage, Normal Temperature				
	Rated Torque	0.096 N·m	0.191 N·m	0.382 N·m	0.637 N·m	1.27 N·m
	Maximum Instantaneous Torque	0.144 N·m	0.287 N·m	0.573 N·m	1.15 N·m	1.91 N·m
	Type of error	Overcurrent, overspeed, overtemperature, overvoltage, sensor error, undervoltage, internal circuit error, EEPROM error, external error, Initial operation inhibition , RS-485 comm error, RS-485 comm time out				
	LED indication	Power, alarm, communication				
	Supporting software	Ezi-SPEED Setting program (PC)				
I/O Signal	Input	7 User Inputs (Photocoupler insulation)				
	Output	2 User Outputs (Photocoupler insulation)				

*2P: Single Phase Power supply / 3P: Three Phase Power supply

2.4 RS-485 communication specifications

Item	Specification
Electrical characteristics	・Complies with EIA-485 standards ・Twisted pair cable (TIA/EIA-568B Cat5e or higher) ・Total length: Within 50m
Transmission mode	Half duplex
Transmission rate	Selectable from 9,600/ 19,200/ 38,400/ 57,600/ 115,200bps (initial value: 115,200bps)
Physical layer	Asynchronous mode (data: 8bits, stop bit: 1bit/2bits, parity: none/even/odd)
Protocol	Modbus RTU mode
Connection pattern	Up to 31 drives can be connected to one master controller.

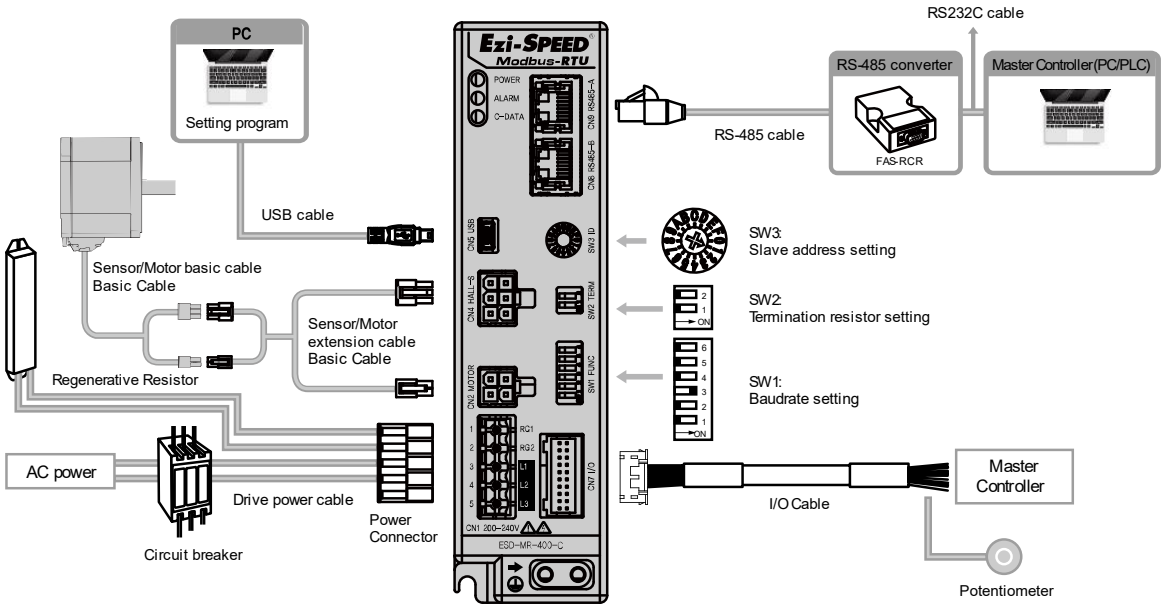
[Example of system configuration]



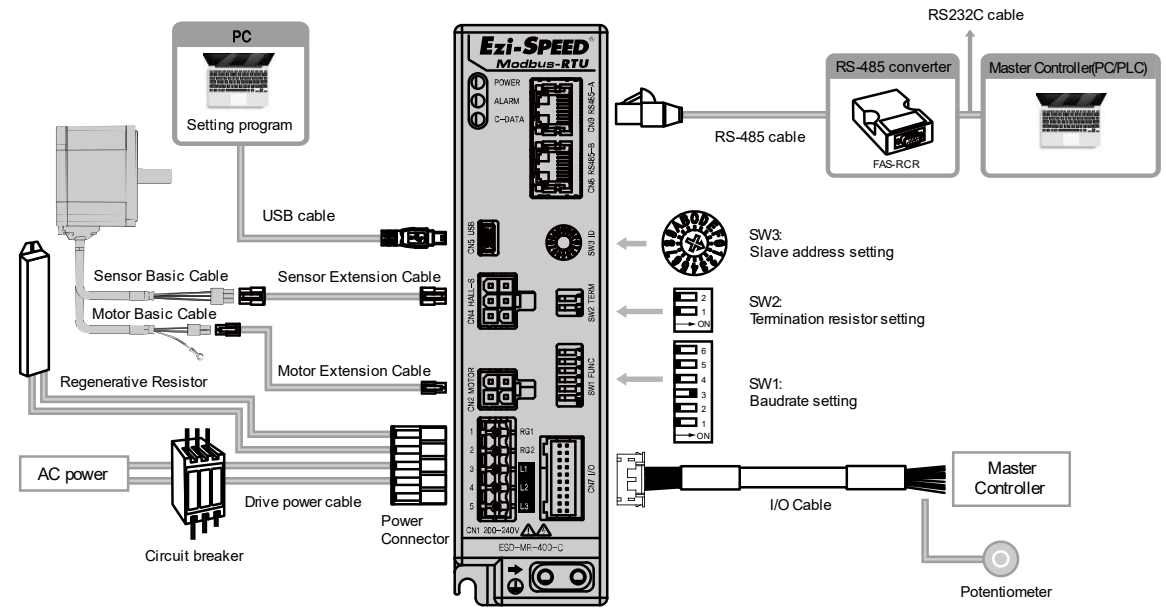
2.5 System configuration

The system configuration of Ezi-SPEED Modbus-RTU is as shown in the diagram below.

▶ 30, 60, 120W Type



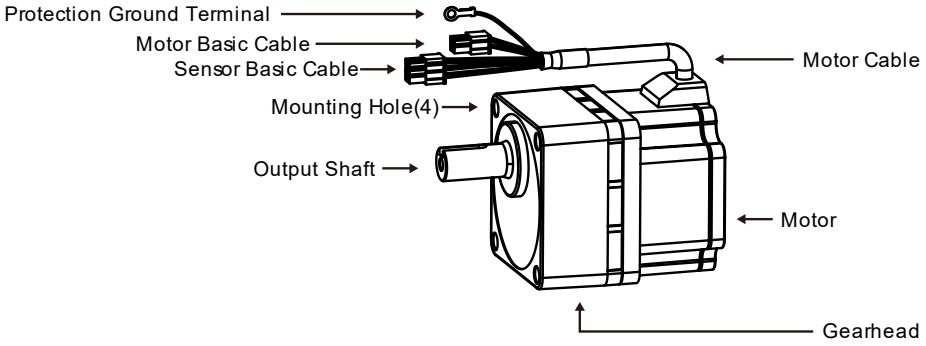
▶ 200, 400W Type



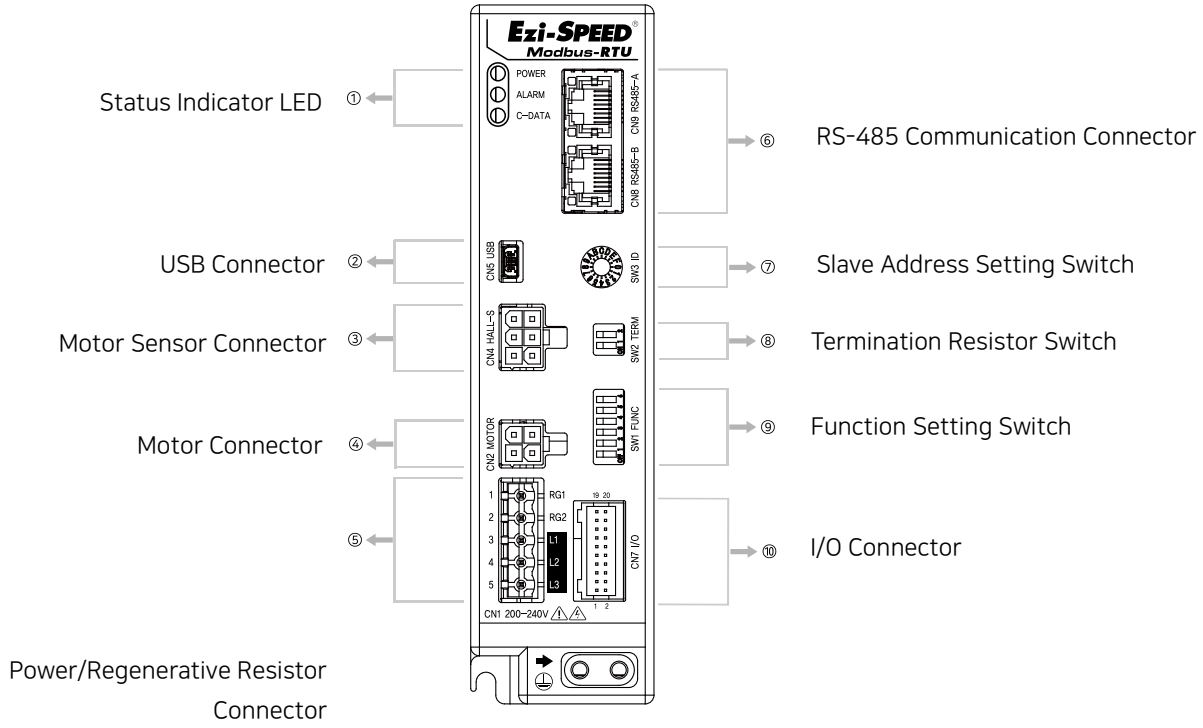
2.6 Names and functions of parts

(1) Motor

The following figure is for 200 and 400W models.



(2) Drive



No.	Name	Description
①	Status Indicator LED	■ Indicates the status of the drive.
②	USB Connector (CN5)	■ Connects a drive to a PC.
③	Motor Sensor Connector (CN4)	■ Connects the motor sensor connector.
④	Motor Connector (CN2)	■ Connects the motor power connector.
⑤	Power/Regenerative Resistor Connector (CN1)	■ Connects to the main power supply and regenerative resistor.
⑥	RS-485 Communication Connector (CN8/CN9)	■ Connects the RS-485 communication cable.
⑦	Slave Address Setting Switch (SW3)	■ Sets the network slave address. This address is used when communicate with RS-485. Maximum of 31 addresses can be set in conjunction with pin4 of the SW1.
⑧	Termination Resistor Switch (SW2)	■ Sets the termination resistor.
⑨	Function Setting Switch (SW1)	■ Sets the baud rate and additional function.
⑩	I/O Connector (CN7)	■ Connects input/output signal line.

2.7 LED indication

Depending on the state of the drive, each LED will display as follows.

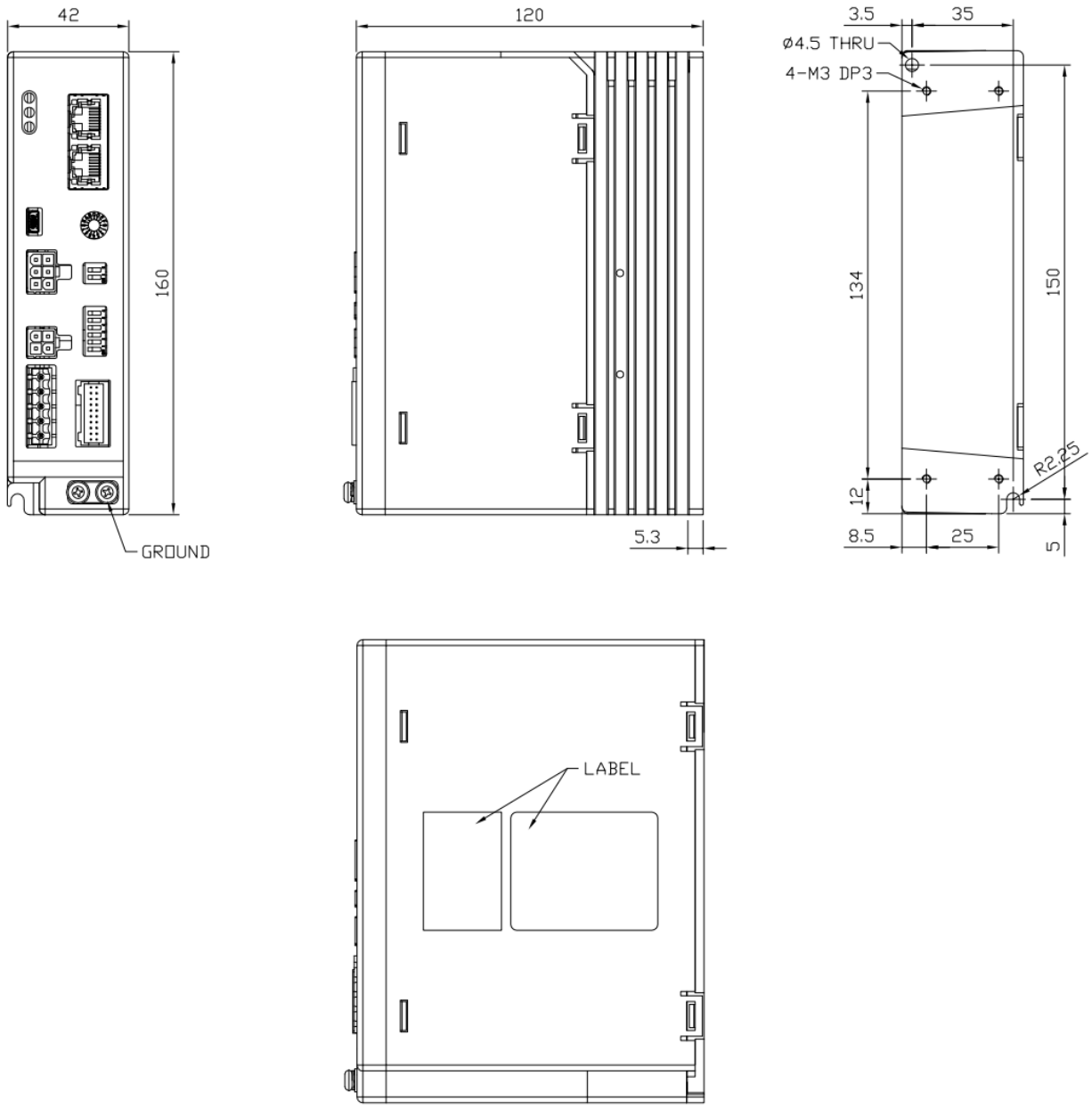
Item	Color	Function	Description
POWER LED	Green	Shows power status	Lights up when AC power is applied and the internal CPU starts operating normally.
ALARM LED	Red	Shows alarm status	Flashes repeatedly when an alarm occurs.
C-DATA LED	Yellow	Shows RS-485 communication status	Flashes when the drive and master communicate with RS-485.

Alarm LED flashing count and error type list

LED flashing count	Error type	Cause
1	Overcurrent	If excessive current flow through the ground of drive, etc.
2	Overspeed	If the rotational speed of the motor output shaft exceeds about 4400r/min.
5	Overtemperature	If the temperature inside the drive is higher than allowed value.
6	Overvoltage	If the power voltage is approximately 20% above the rated voltage. If a vertical drive load is applied to the motor or a sudden load exceeding the allowable load inertia is applied.
8	Sensor error	If the motor sensor signal line is disconnected or the connector is disconnected.
9	Undervoltage	If the power voltage is lowered by about 60% of the rated voltage.
11	internal circuit error	If something is wrong with the internal circuit board.
12	EEPROM error	If the stored data is damaged or the read/write of the EEPROM is failed.
16	External Error	If the EXT-ERROR input set to I/O IN is received.
17	Initial operation inhibition	If power is applied while FWD or REV input is on. (Only works when the 'No operation at initial run' parameter is set to 1)
18	RS-485 comm error	If the number of continuous errors is not less than the number set in the 'communication error alarm' during communicating with RS-485.
19	RS-485 comm time out	If communication with the master is not connected for the time set in the 'communication time out' parameter.

2.8 Dimensions

Ezi-SPEED Modbus-RTU
Weight: 0.7kg



3 Operation

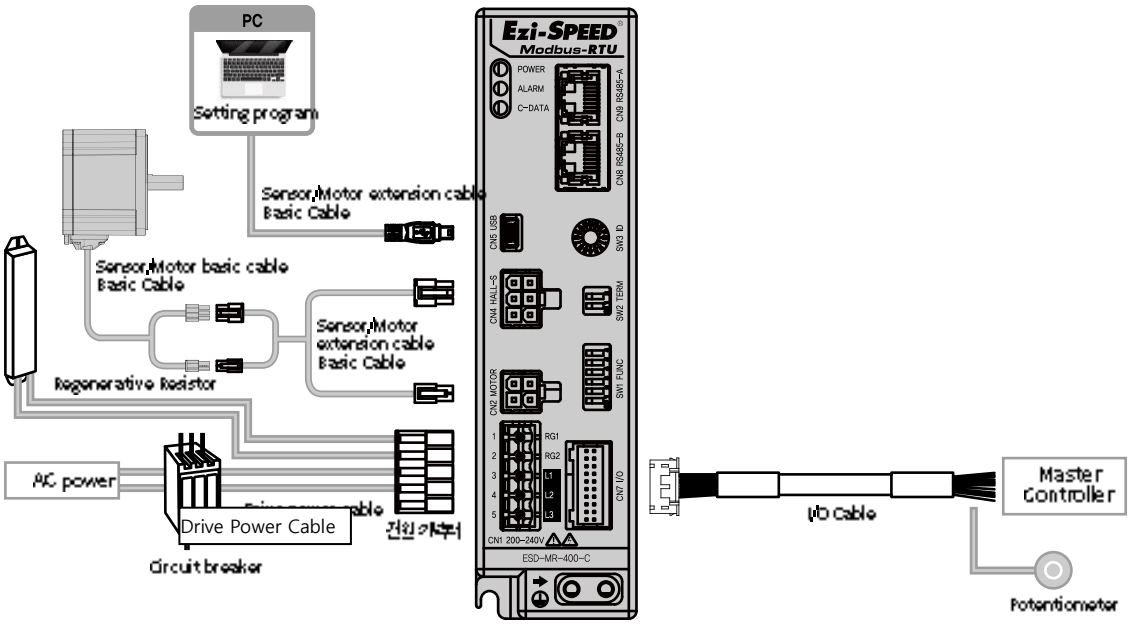
3.1 Operating sequence

Ezi-SPEED Modbus-RTU can be operated using both Input/Output control and Modbus RTU control method. To illustrate the operational methods for each mode, consider the following:

3.1.1 I/O Control Method

You can operate the motor by connecting input/output signal to an upper-level controller, such as a PLC. The rotational speed can be set using Ezi-SPEED Setting program or a potentiometer.

- I/O control method

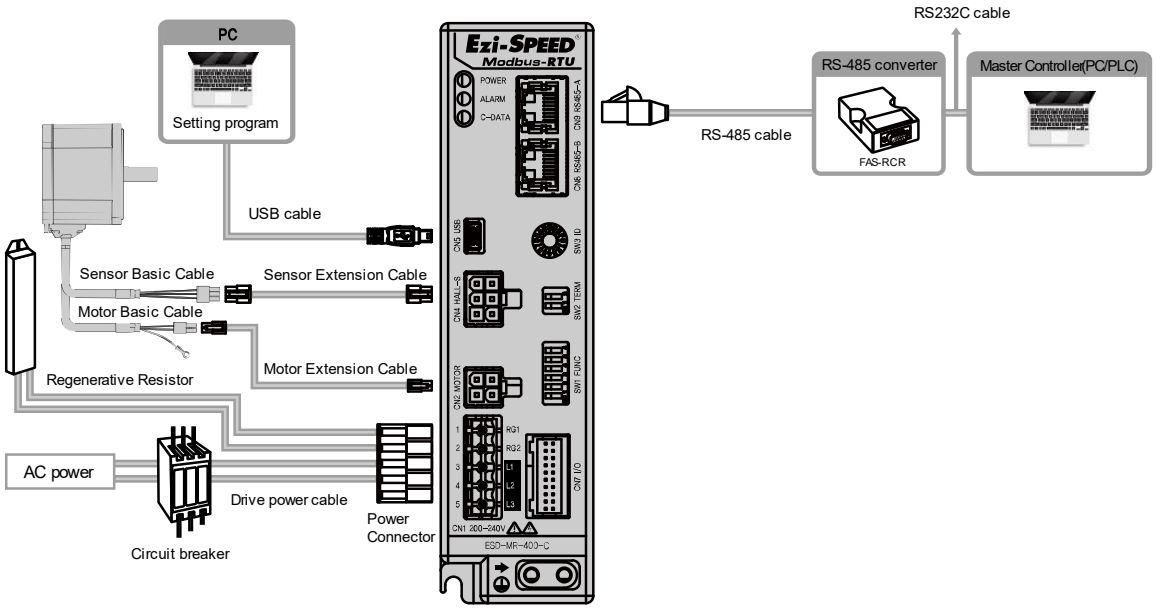


Item	Description
Installation	1) Please install the motor and drive according to the installation conditions. 2) Verify operation in a no-load condition before making connections. 3) Prior to operating the motor, ensure that you have checked the surroundings and secured safety.
⇩	
Wiring/ Connections	1) Ensure proper grounding of the drive and motor according to the conditions. 2) Make sure to securely connect the following types of cables: • Drive power cable • Motor connection cable • Sensor connection cable • USB cable • I/O cable
⇩	
Power on	1) Apply power to the drive 2) Verify that the power LED is turned on as expected
⇩	
Parameter configuration	1) Run the supported software and connect to the drive. 2) Configure 'Operation data' and 'Direct I/O Parameters'.
⇩	
Motor operation	1) Activate the IN0 and IN3 signals via the upper-level controller. Under these conditions, the motor will rotate at the speed set in Operation data #1. *'FWD' function is set as the initial value for IN0, and 'P0' function is set as the initial value for IN3. 2) If using a potentiometer, activate only the IN0 signal. In this case, adjust the variable resistor to control the motor's speed as configured.
⇩	
Status check	Verify that the motor is rotating correctly. If any issues occur, please check the following: • Has an alarm been triggered? • Is the power supply and motor connection secure? Are all connectors properly connected? • Are the parameters related to I/O control correctly configured?

3.1.2 Modbus RTU Control Method

The upper-level controller utilizes RS-485 communication for control, and the protocol used in RS-485 communication is the Modbus RTU protocol. Modbus operates in a single master/multi-slave mode, where only the master can send commands, and each slave responds with the appropriate response message after executing the commands.

■ Modbus RTU Control Method



Item	Description
Installation	1) Please install the motor and drive according to the installation conditions. 2) Verify operation in a no-load condition before making connections. 3) Prior to operating the motor, ensure that you have checked the surroundings and secured safety.

Item	Description
Wiring/ Connections	1) Ensure proper grounding of the drive and motor according to the conditions. 2) Make sure to securely connect the following types of cables: • Drive power cable • Motor connection cable • Sensor connection cable • USB cable • RS-485 communication cable 3) Set the slave address setting switch to 1.
⇩	
Power on	1) Apply power to the drive 2) Verify that the power LED is turned on as expected
⇩	
Parameter configuration	1) Run the Ezi-SPEED Setting program and connect to the drive. 2) Verify that the following three communication parameters match those of the upper-level controller. They should be set the same way in case of differences. • Communication Parity (Initial value: Even) • Communication Stop Bits (Initial value: 1 bit) • Communication Transfer Wait Time (Initial value: 10) 3) If you've made changes to the communication parameters, turn off the drive power and then turn it back on to ensure that the settings take effect.
⇩	
Motor operation	1) Send the rotation speed value for Operation data No.1 via the upper-level controller. For example, if you want to rotate at a speed of 100 r/min, write 64h to the rotational speed register of Operation data No.1(03E9h). 2) To allow NET-IN0 and NET-IN3 to turn on, write 09h to the driver input command (007Dh) register. • * 'P0' function is set as the initial value for NET-IN0, and 'FWD' function is set as the initial value for NET-IN3.
⇩	
Status check	Verify that the motor is rotating correctly. If any issues occur, please check the following: • Has an alarm been triggered? • Is the power supply and motor connection secure? Are all connectors properly connected? • When transmitting communication data from the upper-level controller, is the communication LED flashing? • Are the slave address, RS-485 transmission speed, parity, and termination resistor properly configured?

3.2 Installation

3.2.1 Installation location

To ensure the reliability and stability of the product, you must comply with the instructions in this User Manual. In particular, do not install in the following environments.

(1) Places where ambient temperature or relative humidity exceeds the range of general standards

(2) places where the ambient temperature changes rapidly

(3) places that receive direct sunlight.

(4) Places with corrosive or flammable gases

(5) Places with a splatter of liquid, such as water or oil

(6) Places where continuous vibration or excessive impact is applied

(7) Places full of dust, salts, and iron

(8) Places near a power line

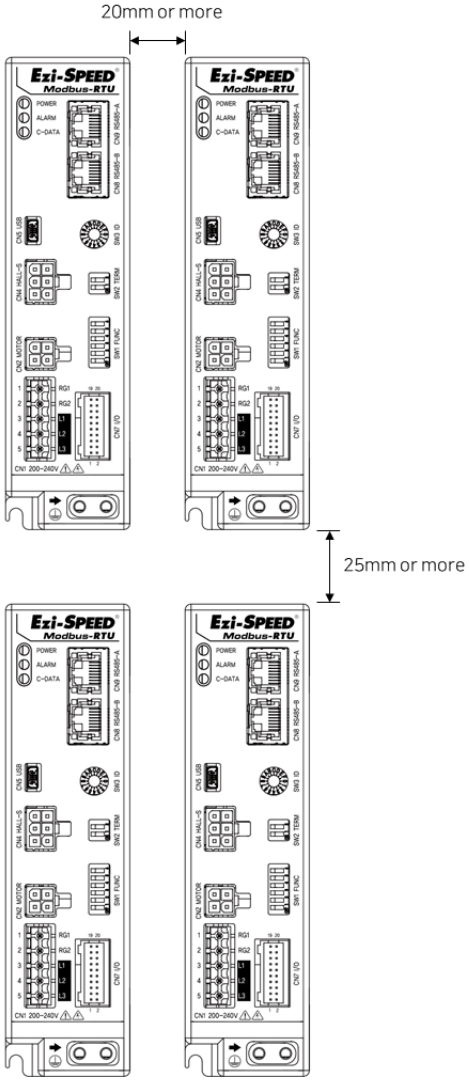
(9) Places with radioactive material

(10) Places where strong electric fields or magnetic fields occur

(11) Places with an altitude exceeding 1,000m above sea level

3.2.2 Installation method

(1) When installing two or more drives side by side, keep a distance of more than 20mm in the horizontal direction and more than 25mm in the vertical direction.



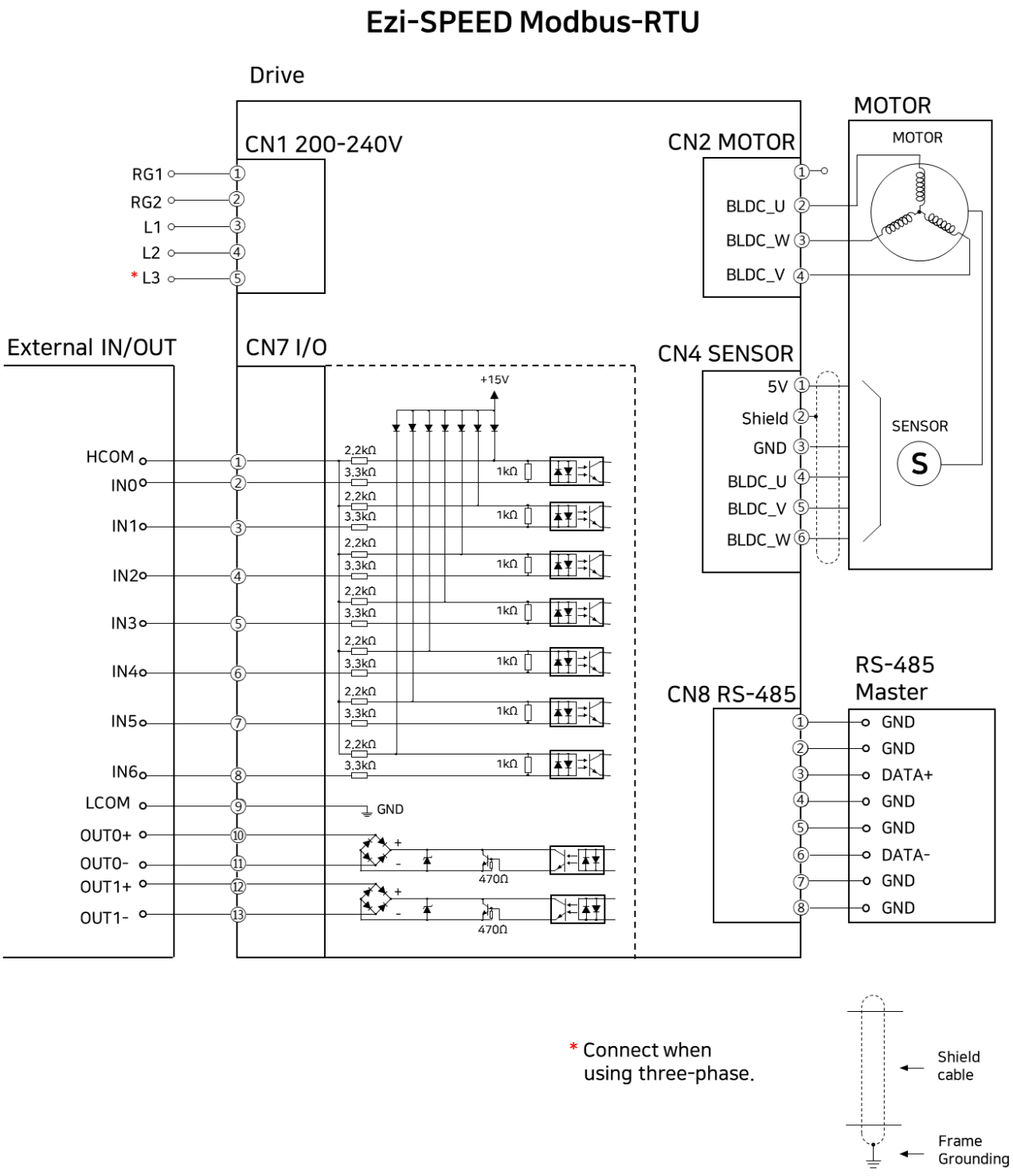
(2) If the ambient temperature exceeds the normal level, install a cooling fan or widen the gap between the drives.

(3) Do not install high-heat or noisy devices around the drive.

(4) Do not install the drive under the master or heat-sensitive device.

3.3 Wiring

3.3.1 External wiring diagram

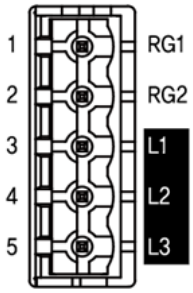


3.3.2 Wiring the power supply

(1) Power supply connector

▶ Product number: CPF5.08-05P [STELVIO]

Pin No.	Purpose
1	Regenerative resistor connection (RG1)
2	Regenerative resistor connection (RG2)
3	Power input (L1)
4	Power input (L2)
5	Power input (L3)



Input voltage supply	Description
Single-phase 200-240V	Connect the wires to the L1 and L2 terminals.
Three-phase 200-240V	Connect the R, S, T phase lines to the L1, L2, and L3 terminals, respectively.

(2) Drive power cable connection method

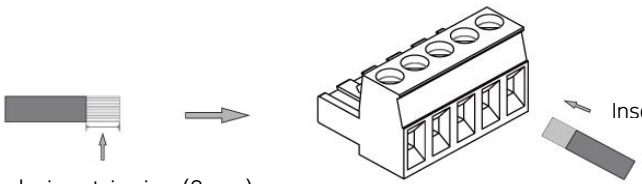
Please create a cable to connect to the power input connector using the following wires:

(a) Wire Specifications: AWG 18 ~ 14 (0.75 ~ 2.0 mm²)

(b) Manufacturing Method:

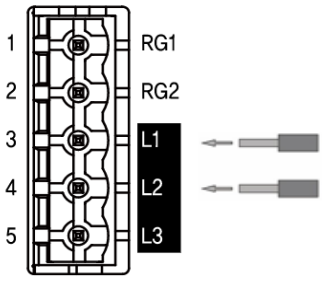
▶ Strip 8mm of insulation from the lead wires, as shown in the diagram below.

▶ Use copper wire as the conductor material.

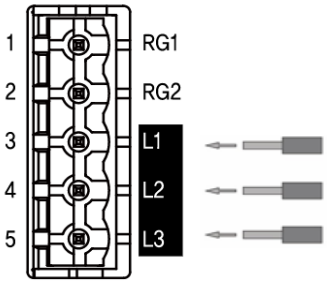


Lead wire stripping (8mm)

Insert lead wire to connector, and fixing with driver



Single-phase 200-240 V



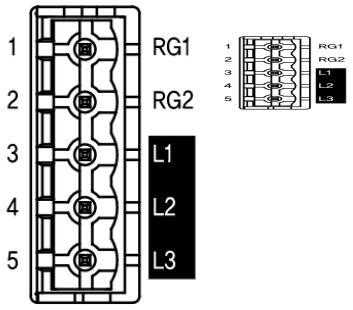
Three-phase 200-240 V

(3) Circuit-Breaker

To protect the primary wiring, be sure to connect the Circuit-Breaker to the power side wiring of the drive.

3.3.3 Regenerative resistor connection

When driving loads with short deceleration times or significant inertia, high voltage may be generated due to counter electro motive Force, leading to overvoltage alarm and motor stoppage. To prevent such issues, connect a regenerative resistor to the RG1 and RG2 terminals. Use a 100W/400Ω rated resistor for this purpose.



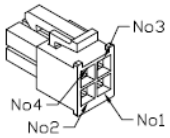
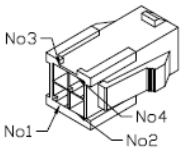
3.3.4 Motor connection

Motor cable consisted with two connectors: a motor connector(4pin) and a sensor connector(6pin). Connect the motor connector to CN2 and the sensor connector to CN4.
Use the connection cable to extend between the motor and the drive. You can connect up to two cables. The distance between the motor and the drive can be extended up to 10.5m. You can create the connection cable using accessories or purchase it separately from our company.

(1) Motor Connection cable

This cable is used to extend the wiring distance between the motor and drive.

▶ Wire Specifications: AWG 18 ~ 14 (0.75 ~ 2.0 mm²)

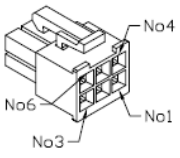
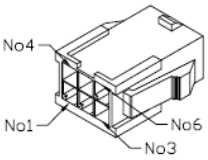
Connector of drive side		Connection	Connector of motor side	
Pinout	Pin number		Pin number	Pinout
	1 2 3 4		1 2 3 4	

Purpose	Item	Specification	Manufacturer
Connector of drive side	Housing	5557-04R	MOLEX
	Terminal	5556T	
Connector of motor side	Housing	5559-04P	MOLEX
	Terminal	5558T	

(2) Sensor Connection cable

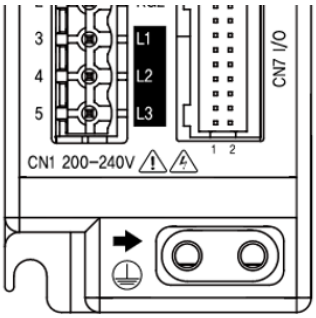
This cable is used to extend the wiring distance between the sensor and drive.

▶ Wire Specifications: AWG 18 ~ 14 (0.75 ~ 2.0 mm²)

Connector of drive side		Connection	Connector of motor side	
Pinout	Pin number		Pin number	Pinout
	1 2 3 4 5 6		1 2 3 4 5 6	

Purpose	Item	Specification	Manufacturer
Connector of drive side	Housing	5557-06R	MOLEX
	Terminal	5556T	
Connector of motor side	Housing	5559-06P	MOLEX
	Terminal	5558T	

3.3.5 Grounding



(1) Grounding of the drive

(a) The drive has two protective ground terminals. Ground one of the terminals. It does not matter which protective ground terminal is grounded. The other ground terminals are spare terminals. Connect the motor with spare terminals or use it as necessary. Do not use ground wires in common with welders or power generators.

(b) Ground terminal

▶ Applicable Compression Terminal: Insulated covering round compression terminal

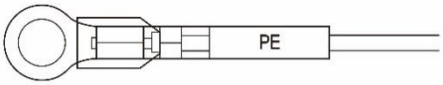
▶ Terminal Screw Specification: M4

(2) Grounding of the motor

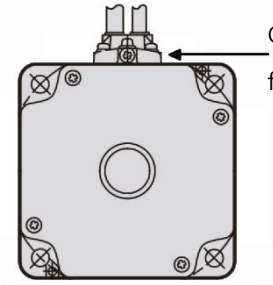
(a) Ground terminal

▶ Applicable Compression Terminal: Insulated covering round compression terminal

▶ Terminal Screw Specification: M4



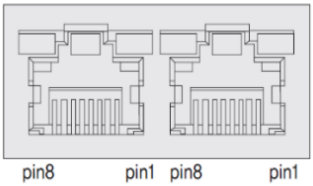
(b) For 200W and 400W motors, additional grounding can be made directly from the motor.



3.3.6 Wiring the RS-485 communication cable

To connect drive and Modbus-RTU master, connect RS-485 cable (UTP/STP CAT5E) to CN8 or CN9 RJ45 connectors.

Pin No.	Terminal name
1	GND
2	GND
3	Data+
4	GND
5	GND
6	Data-
7	GND
8	GND

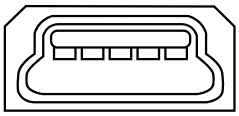


3.3.7 Wiring the USB cable

For connection of the drive and PC, connect below USB cable to CN5 connector.

Specification	USB 2.0 Mini Type B

Pin No.	Terminal name
1	VBUS
2	D-
3	D+
4	---
5	GND

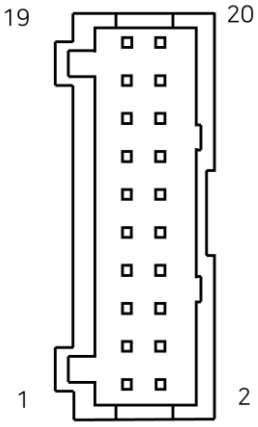


3.3.8 Wiring the I/O signals

I/O cables are used to connect input/output signals.

(1) I/O connector (CN7) Pinout

Pin No.	Terminal Name	Initial value*1	Input/Output
1	HCOM	-	Common
2	IN0	FWD	Input
3	IN1	REV	Input
4	IN2	STOP-MODE	Input
5	IN3	P0	Input
6	IN4	P1	Input
7	IN5	P2	Input
8	IN6	ALARM-RESET	Input
9	LCOM	-	Common
10	OUT0+	SPEED-OUT	Output
11	OUT0-		Output
12	OUT1+	ALARM-OUT	Output
13	OUT1-		Output
14	VH	Analog speed setting	Input
15	VM		Input
16	VL		Input
17	-		-
18	-		-
19	-		-
20	-		-



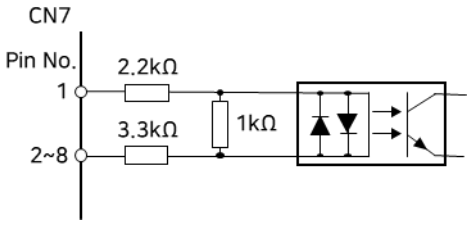
*1: The initial value is a function that is set at the factory.

(a) HCOM: Input signal common when using external power
Connect +24V for Sink Logic and 0V (GND) for Source Logic.

(b) LCOM: Input signal common when using internal power
This terminal is internally connected to GND.

(c) IN0~IN6: Input signal

The input signals are photocoupler inputs and can operate with either internal power or external power. When using external power, you can adapt to either sink or source inputs by changing the wiring. When using sensors, the input 'On' current should be 5mA or higher, and the input Off current should be 0.5mA or lower.

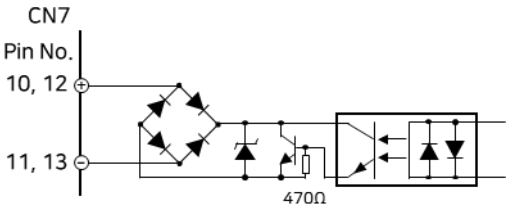


▶ External Power Specifications:

Item	Specifications
Rated input voltage	DC24V
Usable voltage range	DC20.4~28.8V
Current capacity	100mA or more

(d) OUT0~OUT1: Output signal

The output signals are photocoupler open-collector outputs, and the 'On' voltage in the output circuit is a maximum of 1.5V. When driving each component using the output signal circuit, please consider the 'On' voltage.

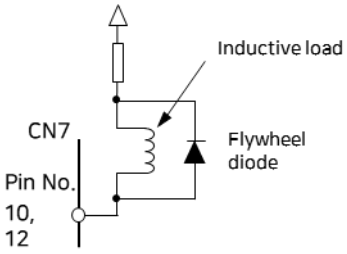


Item	Specifications
Usable load voltage range	DC4.5V~30V
Maximum load current	100mA

▶ For the SPEED-OUT output, ensure a minimum current of 5mA or more.

▶ The current in the output circuit must not exceed 100mA. If it exceeds this value, the product may be damaged, so be sure to connect a current-limiting resistor.

▶ If you are connecting an inductive load, such as a relay, for alarm detection, please use a relay with a flywheel diode.

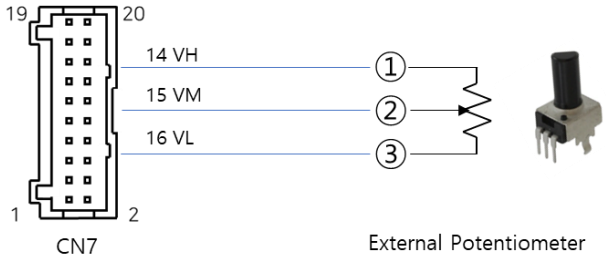


(e) VH/VM/VL: Analog speed setting external input

You can set the rotational speed using analog methods by connecting an potentiometer or DC voltage.

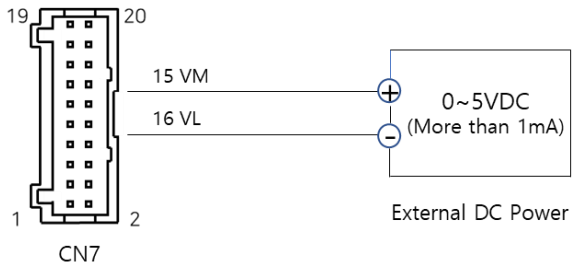
▶ When using a potentiometer:

Connect the potentiometer to CN7, and you can adjust the rotational speed by turning it to the left or right.



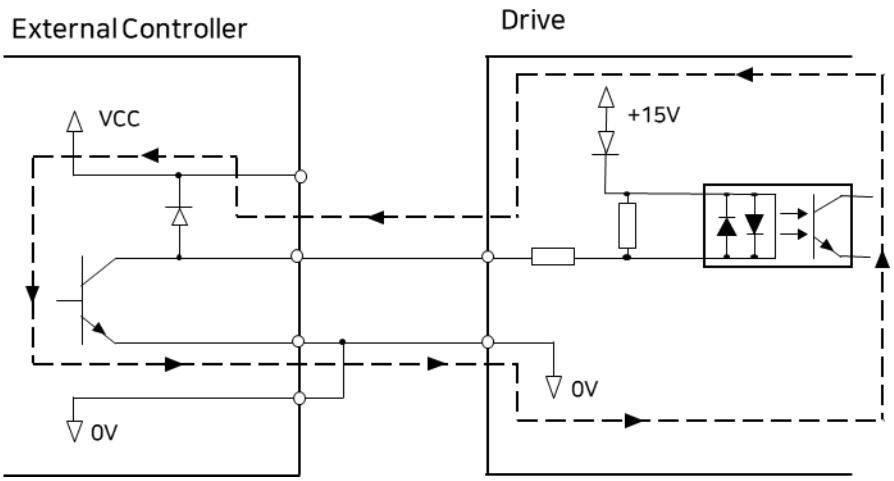
▶ When using DC voltage:

Connect the DC voltage to CN7, and you can adjust the rotational speed by adjusting the DC voltage.



(2) Using an external controller with a built-in clamp diode

Turning off the external controller, when the drive power is still on, may result in leakage current. If the leakage current flows to the photocoupler inside the drive input terminal, the motor may rotate suddenly. In addition, due to the different current capacities of the drive and the external controller, the motor can rotate suddenly even if the power is turned ON/OFF at the same time. Therefore, turn it off in the order of the external controller from the drive and turn it on in the order of the drive from the external controller.



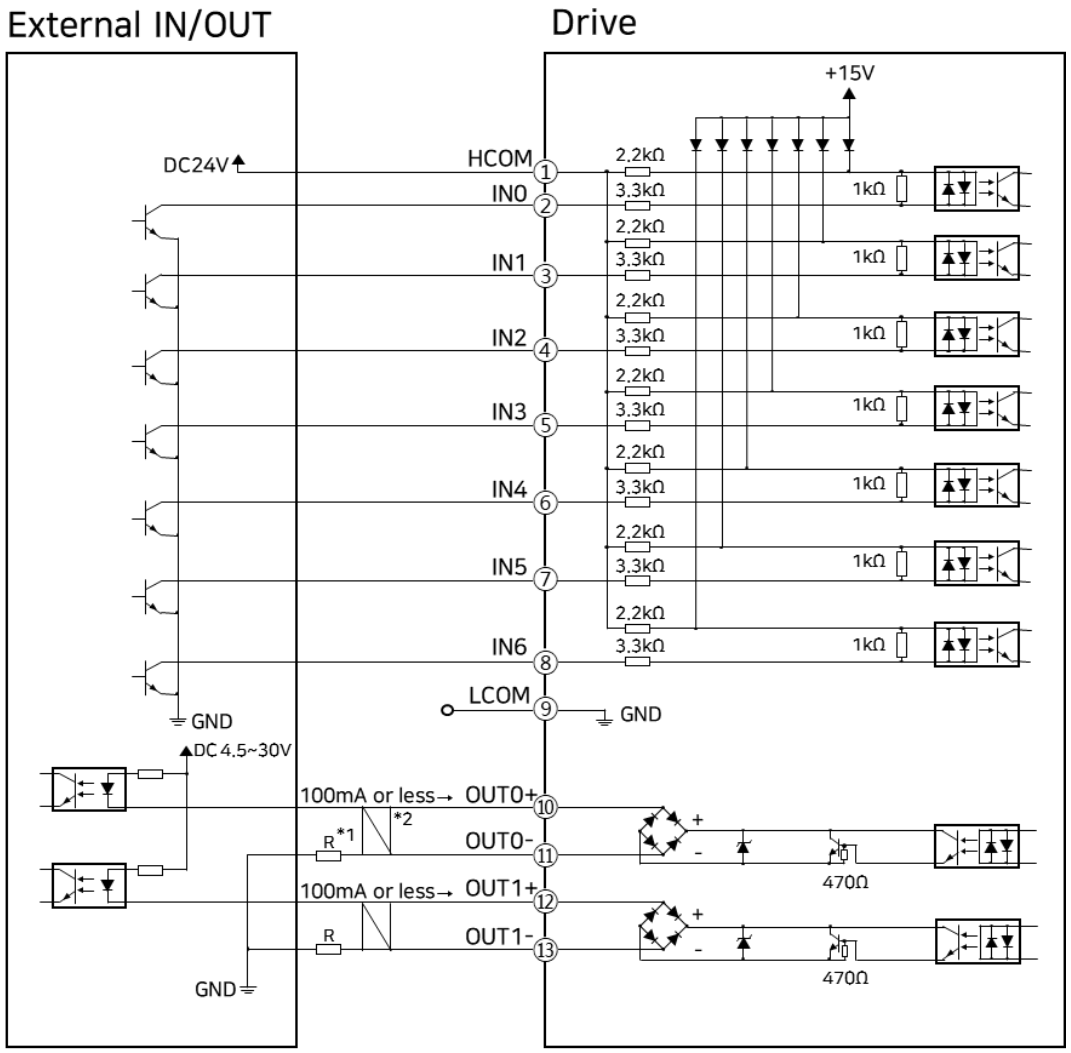
(3) Connection example for I/O signals and External controller

This is connection example for operating a motor using upper-level controller with a transistor output type.

(a) Using external power source

- Before applying power to the drive, please ensure that external power is applied first.
- The output current for OUT0 and OUT1 must not exceed 100mA. If it exceeds this value, please connect an external current-limiting resistor (R).

■ SINK LOGIC

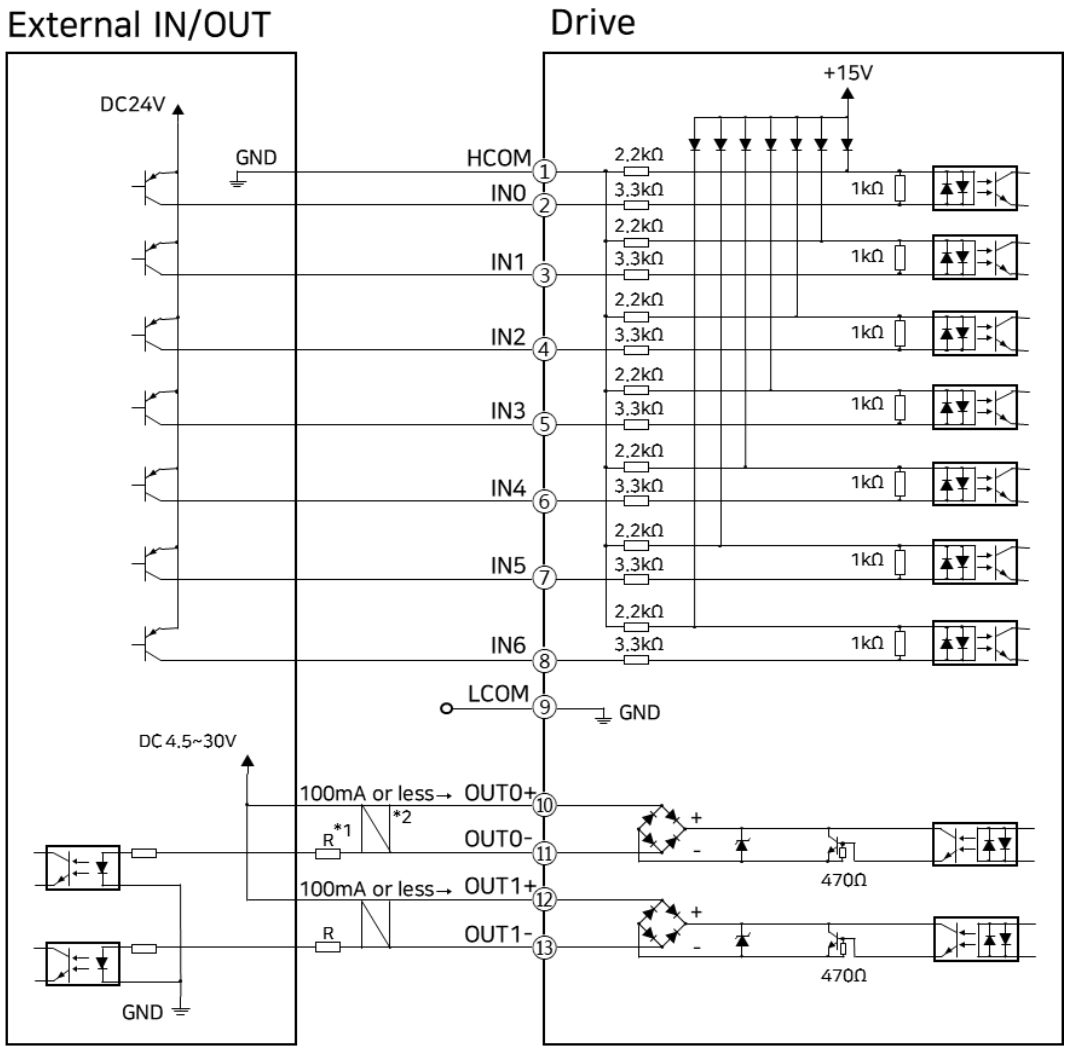


*1) Recommended Resistor

DC24V: 680 Ω ~2.7k Ω (2W)
DC5V: 150 Ω ~560 Ω (0.5W)

*2) Twisted Pair Shield Cable

■ Source LOGIC



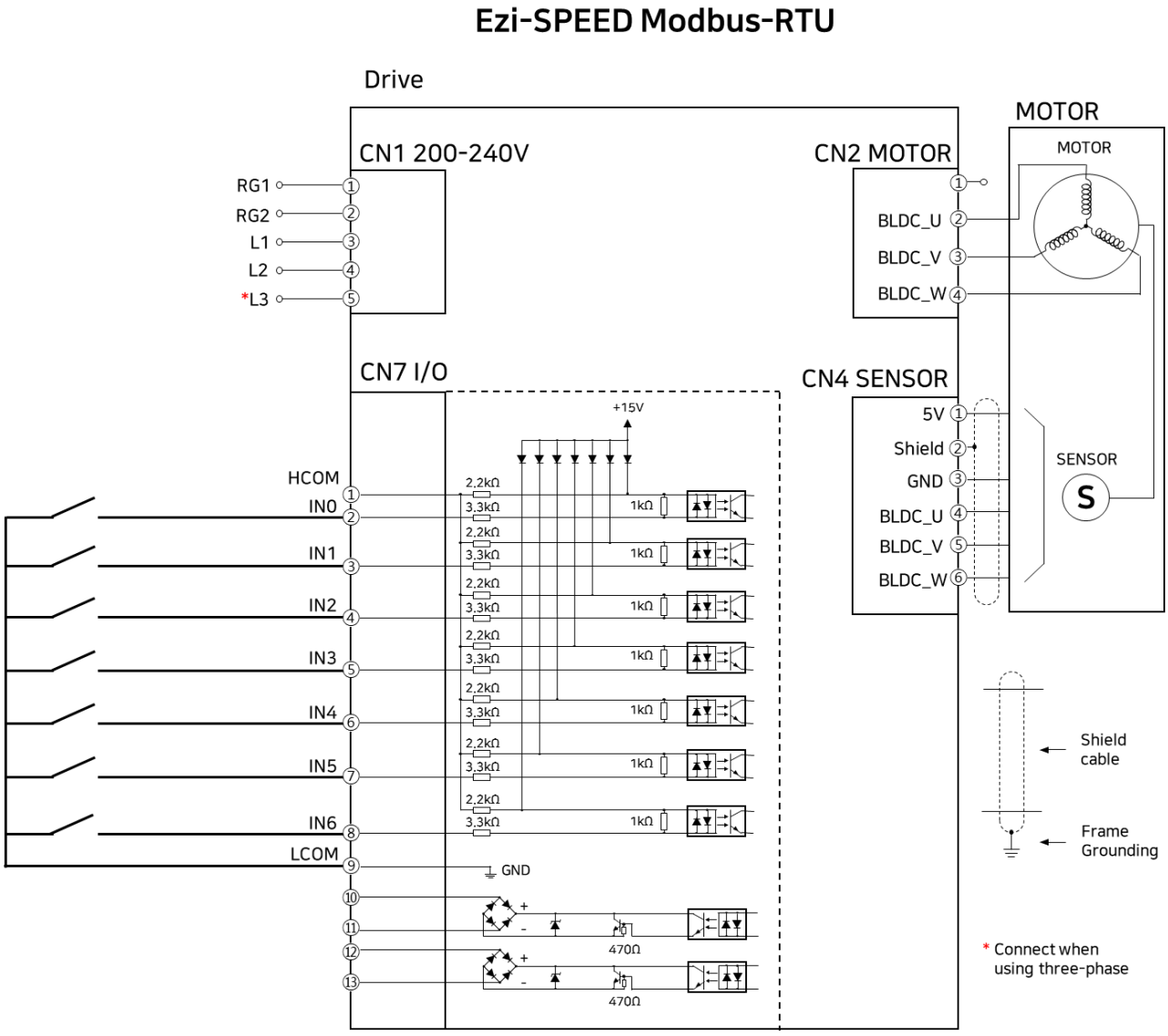
*1) Recommended Resistor

DC24V: 680 Ω ~2.7k Ω (2W)
DC5V: 150 Ω ~560 Ω (0.5W)

*2) Twisted Pair Shield Cable

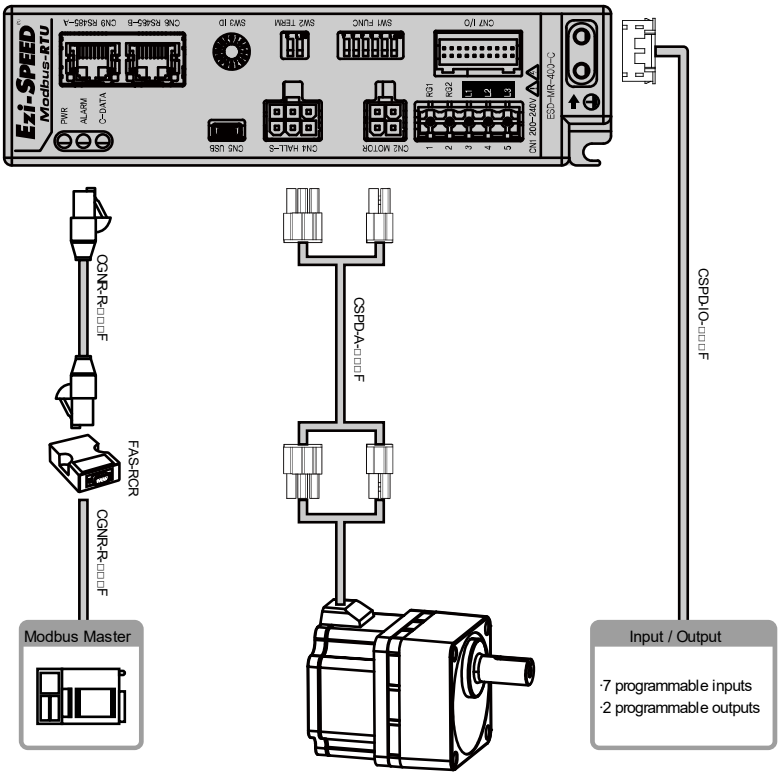
(b) Using internal power source

Below is an example of using input and output devices such as switches and relays.

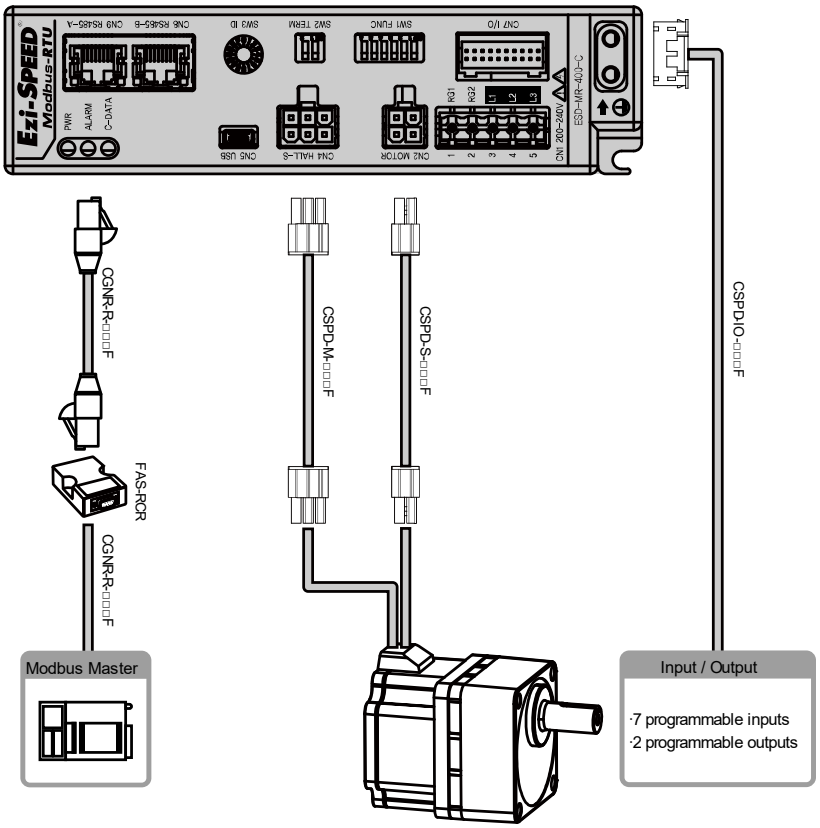


3.3.9 Option (sold separately)

■ 30/60/120W Type



■ 200/400W Type



(1) Sensor/Motor connection cable for 30, 60, 120W

This is the connection cable used to connect a drive to a 30, 60, 120W motor and sensor.

Purpose	Product No.	Length [m]	Cable type	Note
Drive to Sensor/Motor Connection	CSPD-A-001F	1	Stationary cable	Maximum available length: 10m
	CSPD-A-002F	2		
	CSPD-A-003F	3		
	CSPD-A-005F	5		
	CSPD-A-007F	7		
	CSPD-A-010F	10		

(2) Sensor/Motor connection cable for 200, 400W

(a) Sensor connection cable

This is the connection cable used to connect a drive to a 200, 400W sensor.

Purpose	Product No.	Length [m]	Cable type	Note
Drive To Sensor Connection	CSPD-S-001F	1	Stationary cable	Maximum available length: 10m
	CSPD-S-002F	2		
	CSPD-S-003F	3		
	CSPD-S-005F	5		
	CSPD-S-007F	7		
	CSPD-S-010F	10		

(b) Motor connection cable

This is the connection cable used to connect a drive to a 200, 400W motor.

Purpose	Product No.	Length [m]	Cable type	Note
Drive To Motor Connection	CSPD-M-001F	1	Stationary cable	Maximum available length: 10m
	CSPD-M-002F	2		
	CSPD-M-003F	3		
	CSPD-M-005F	5		
	CSPD-M-007F	7		
	CSPD-M-010F	10		

(3) RS-485 communication cable

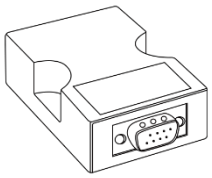
This cable is used to connect drive and RS-485 master or RS-485 converter.

Purpose	Product No.	Length [m]	Cable type	Note
RS-485 Communication Connection	CGNR-R-0R6F	0.6	Stationary cable	Maximum available length: 30m
	CGNR-R-001F	1		
	CGNR-R-1R5F	1.5		
	CGNR-R-002F	2		
	CGNR-R-003F	3		
	CGNR-R-005F	5		

For cable lengths not specified in the table (1m unit), please inquire with FASTECH Co., Ltd. separately.

(4) RS-485 converter

This converter is used to convert RS-485 to RS-232C.

Purpose	Product No.	Specificaitons		Product Image
RS-232C to RS-485 Converter	FAS-RCR	Baud rate	Max. 115.2kbps	
		Comm. Distance	RS-232C: Max. 15m RS-485: Max. 1.2km	
		Connector	RS-232C: DB9 Female RS-485: RJ-45	
		Dimensions	50 X 75 X 23mm	
		Weight	38g	
		Power	Power supplied by RS-232C (DC5~24V external power can be applied)	

(5) RS-232C communication cable

This cable is used to connect RS-485 converter (FAS-RCR) to the port (RS-232C) of higher controller (PLC).

Purpose	Product No.	Length [m]	Cable type	Note
FAS-RCR to RS-232C Connection	CGNR-C-002F	2	Stationary cable	Maximum available length: 5m
	CGNR-C-003F	3		
	CGNR-C-005F	5		

(6) I/O cable

This cable is used to connect a drive to a input/output device.

Purpose	Product No.	Length [m]	Cable type	Note
Drive - I/O device Connection	CSPD-IO-0R6F	0.6	Stationary cable	Maximum available length: 20m
	CSPD-IO-001F	1		
	CSPD-IO-002F	2		
	CSPD-IO-003F	3		
	CSPD-IO-005F	5		
	CSPD-IO-007F	7		
	CSPD-IO-010F	10		
	CSPD-IO-015F	15		
	CSPD-IO-020F	20		

Note

- Please contact us separately for cables other than the length shown in the table above.
- The maximum available length of each cable is as follows.

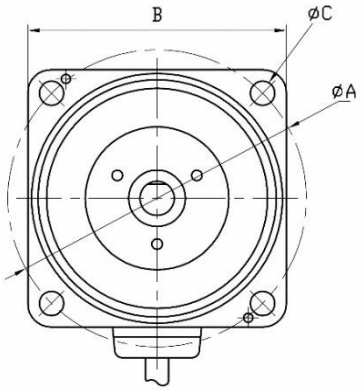
Cable	Maximum available length	Note
I/O cable	20m	Option (sold separately)
Motor connection cable	10m	
Sensor connection cable		
Sensor/Motor connection cable		
Motor basic cable	0.3m (Built-in length)	The basic cable is supplied attached to the motor.
Sensor basic cable		
Sensor/Motor basic cable		
USB cable	5m	We do not provide or sell this cable at our company.
RS-485 comm cable	30m	Option (sold separately)
RS-232C comm cable	5m	Option (sold separately)

3.4 Installing the parallel shaft gearhead

3.4.1 Installing method

- ▶ Make four holes on the mounting plate for attaching the gearhead.
- ▶ Securely fasten the gearhead using hexagon socket set bolts to ensure there is no gap between the gearhead and the mounting surface.

(1) Recommended mounting hole dimensions of gearhead



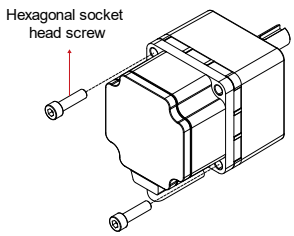
Product No.	ØA	B	ØC
ESM-60-S-30	70	64	4×4.5
ESM-80-S-60	94±0.1	81	4×6.5
ESM-90-S-120	104	90	4×8.5
ESM-104-S-200	120±0.1	104.5	4×8.5
ESM-104-S-400	120±0.1	104.5	4×8.5

(2) Removing/Changing the gearhead

The sequence for removing the gearhead or changing the position of the motor cable is as follows.

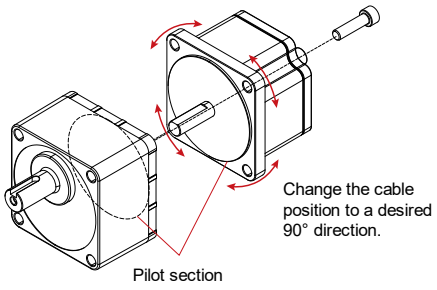
(a) Removing the gearhead

Remove the hexagonal screws binding motor to gearhead. And then detach the motor from the gearhead.



(b) Installing the gearhead

▶ Before assembling the motor and gearhead, please determine the position of the motor cable. The motor cable's position can be changed at 90-degree intervals as shown in the diagram below.



▶ After attaching the motor to the gearhead, tighten the bolts (2) used for assembling the motor and gearhead. Ensure that there is no gap between the motor and the gearhead.

(c) Please pay attention to the following when separating or attaching the gearhead.

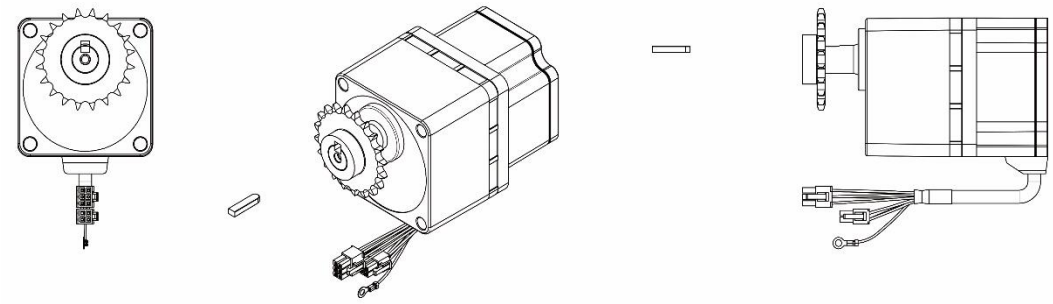
▶ Be especially cautious not to forcefully assemble the gearhead and motor, or allow metallic foreign objects to enter the gearhead, as this can lead to damage to the motor's output shaft or the gearhead. It may result in unusual noises or a shortened lifespan.

▶ Make sure that dust and other particles do not adhere to the pilot section between the gearhead and motor. Additionally, when assembling the gearhead and motor, take care to avoid the O-ring on the motor's pilot section. Failing to do so may cause grease to leak inside the reducer.

▶ The hexagon socket set bolts used for assembling the motor and gearhead are for securing them. Please use the hexagon socket set bolts (4) of the appropriate length when installing them on the mounting plate.

3.4.2 Load connection method

The output shaft of the gearhead has a key slot that is used to secure the load. On the load side, make a key slot and secure it with a parallel key.



When coupling the load, please keep the following points in mind:

▶ When connecting the load, ensure that the gearhead's output shaft or bearings are not subjected to shock. Also, do not apply excessive force to the output shaft, as failure to do so may lead to damage to the output shaft or bearings.

▶ Do not modify or machine the gearhead's output shaft. Doing so may result in damage to the bearings or damage to the gearhead.

3.4.3 Rotation direction of gearhead and transmission efficiency

The output shaft of the gearhead may rotate in the same direction as the motor or in the opposite direction, depending on the gear ratio.

(1) Rotation direction of gearhead

Gearhead Product No.	Gear ratio	
	Same direction to motor	Opposite direction to motor
ESG-60-H-R□-P	5, 10, 15, 20, 200	30, 50, 100
ESG-80-H-R□-P		
ESG-90-H-R□-P		
ESG-104-H-R□-P	5, 10, 15, 20, 100, 200	30, 50

(2) Transmission efficiency of gearhead

Gearhead Product No.	5	10	15	20	30	50	100	200
ESG-60-H-R□-P	90%				86%			81%
ESG-80-H-R□-P								
ESG-90-H-R□-P								
ESG-104-H-R□-P					86%		85%	

3.4.4 Permissible radial load and permissible axial load

The radial and axial loads applied to the gearhead output shaft are as shown in the table.

Product No.	Gear ratio	Permissible radial load [N]*		Permissible axial load [N]
		Distance from the output shaft end		
		10mm	20mm	
Ezi-SPEED-MR-60-H-30-C-R□-P	5	100	150	40
	10~20	150	200	
	30~200	200	300	
Ezi-SPEED-MR-80-H-60-C-R□-P	5	200	250	100
	10~20	300	350	
	30~200	450	550	
Ezi-SPEED-MR-90-H-120-C-R□-P	5	300	400	150
	10~20	400	500	
	30~200	500	650	
Ezi-SPEED-MR-104-H-200-C-R□-P	5~20	550	800	200
	30~50	1000	1250	300
	100~200	1400	1700	400
Ezi-SPEED-MR-104-H-400-C-R□-P	5~20	550	800	200
	30~50	1000	1250	300
	100~200	1400	1700	400

* This value is for a motor shaft rotational speed of 3000r/min.

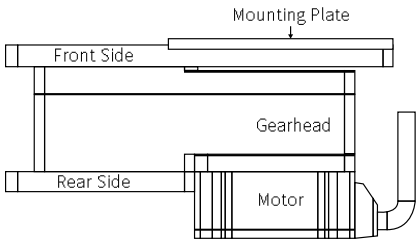
Note

▶ If the radial and axial loads exceed the allowable values, there is a risk of repeated loading causing fatigue-related damage to the motor (reducer) bearings or output shaft. Please exercise caution.

3.5 Installing the hollow shaft gearhead

3.5.1 Installing method

You can install the mounting plate on either the front or rear side of the hollow shaft gearhead.

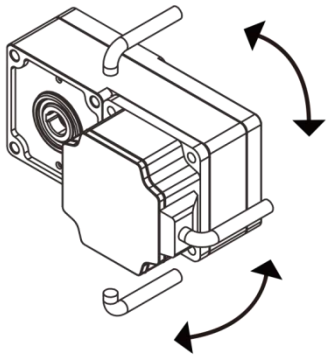


▶ Create four holes on the mounting plate to attach the gearhead.

▶ Securely fasten it with hexagon socket set bolts to ensure there is no gap between the gearhead and the mounting surface.

▶ Attach a safety cover to the hollow output shaft opposite the one connecting the load shaft.

▶ The position of the motor cable can be changed in 90-degree increments as shown in the diagram below.



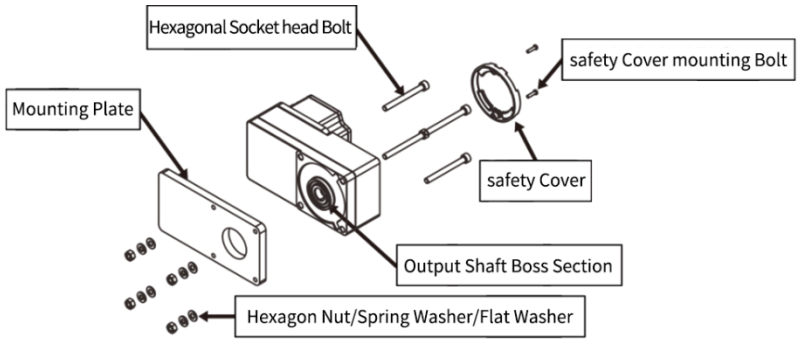
▶ The thickness of the mounting plate used for attaching the gearhead varies depending on the product type. The dimensions in the table below are for use with hexagon socket set bolts.

Product No.	Maximum applicable plate thickness (mm)
ESG-60-H-R□-H	5
ESG-80-H-R□-H	8
ESG-90-H-R□-H	12
ESG-104-H-R□-H	12

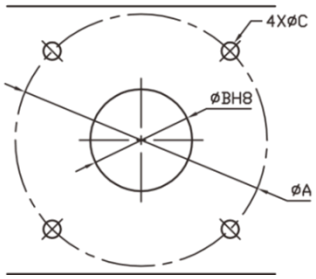
* The number indicating the gear ratio of the gearhead is placed in □.

(1) Using the front side as the mounting surface

When installing the mounting plate on the front, you can align the center using the boss section of the output shaft.



Mounting Hole Dimension : Front Side

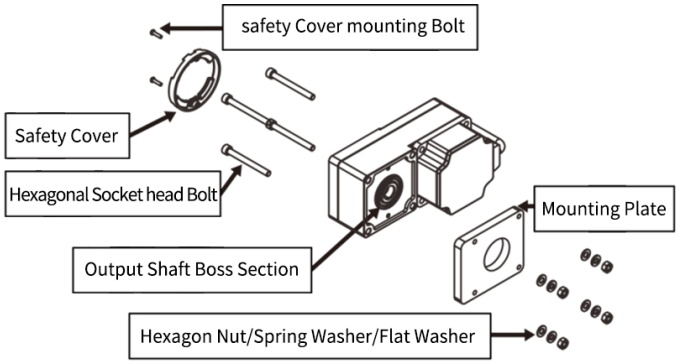


Mounting hole dimension (mm)

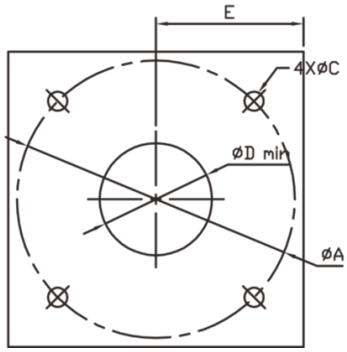
Product No.	ØA	ØB H8	ØC
ESG-60-H-R□-H	70	$34\ ^{0}_{-0.039}$	5.5
ESG-80-H-R□-H	94	$38\ ^{0}_{-0.039}$	6.5
ESG-90-H-R□-H	104	$50\ ^{0}_{-0.039}$	8.5
ESG-104-H-R□-H	120	$58\ ^{0}_{-0.039}$	8.5

* The number indicating the gear ratio of the gearhead is placed in □.

(2) Using the rear side as the mounting surface



Mounting Hole Dimension : Rear Side



Mounting hole dimension (mm)

Product No.	ØA	ØC	ØD	E
ESG-60-H-R□-H	70	5.5	25	29
ESG-80-H-R□-H	94	6.5	30	39
ESG-90-H-R□-H	104	8.5	35	44
ESG-104-H-R□-H	120	8.5	42	57

* The number indicating the gear ratio of the gearhead is placed in □.

Note

▶ In the case of rear installation, please make sure not to exceed the dimensions marked as 'E' to prevent contact between the mounting plate and the motor.

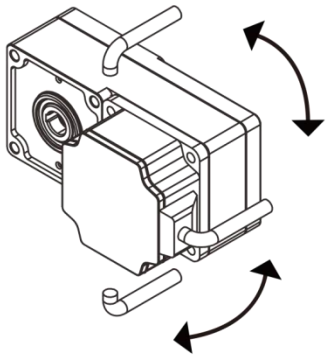
(3) Removing/Changing the gearhead

The sequence for removing the gearhead or changing the position of the motor cable is as follows.

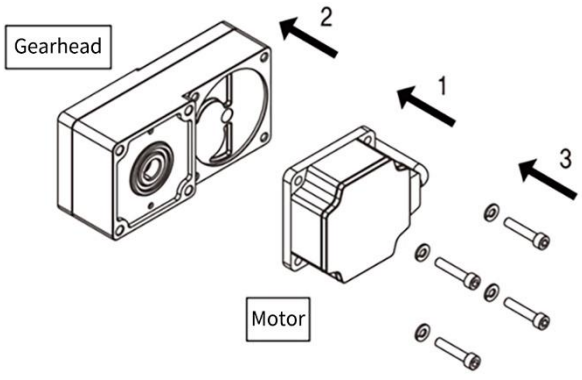
(a) Removing the gearhead
Remove the hexagonal bolts binding motor to gearhead. And then detach the motor from the gearhead.

(b) Installing the gearhead

▶ Before assembling the motor and gearhead, please determine the position of the motor cable. The motor cable's position can be changed at 90-degree intervals as shown in the diagram below.

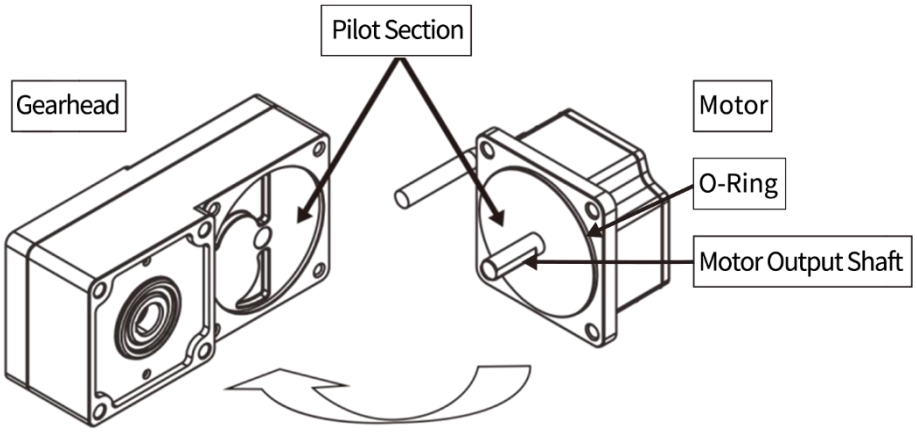


▶ After attaching the motor to the gearhead, tighten the bolts (4) used for assembling the motor and gearhead. Ensure that there is no gap between the motor and the gearhead.



(c) Please pay attention to the following when separating or attaching the gearhead.

- ▶ Be especially cautious not to forcefully assemble the gearhead and motor, or allow metallic foreign objects to enter the gearhead, as this can lead to damage to the motor's output shaft or the gearhead. It may result in unusual noises or a shortened lifespan.
- ▶ The position of the motor cable cannot be changed in the direction of the reducer's output shaft. If the cable gets caught in the reducer's case, proper wiring cannot be achieved.
- ▶ Make sure that dust and other particles do not adhere to the pilot section between the gearhead and motor. Additionally, when assembling the gearhead and motor, take care to avoid the O-ring on the motor's pilot section. Failing to do so may cause grease to leak inside the reducer.



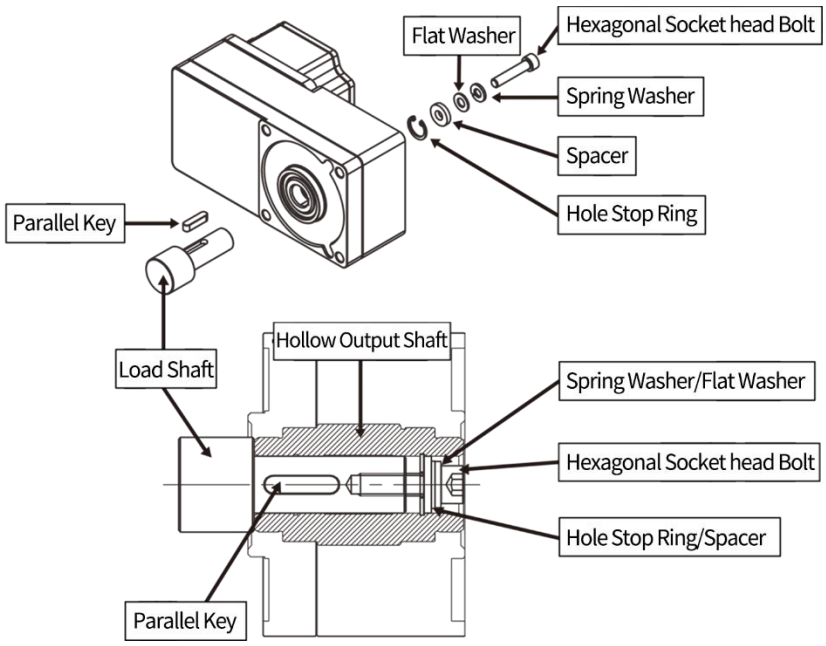
3.5.2 Load connection method

In cases of significant impact due to instantaneous stop or when there is a high radial load, please use a stepped load shaft.

(1) Stepped load shaft

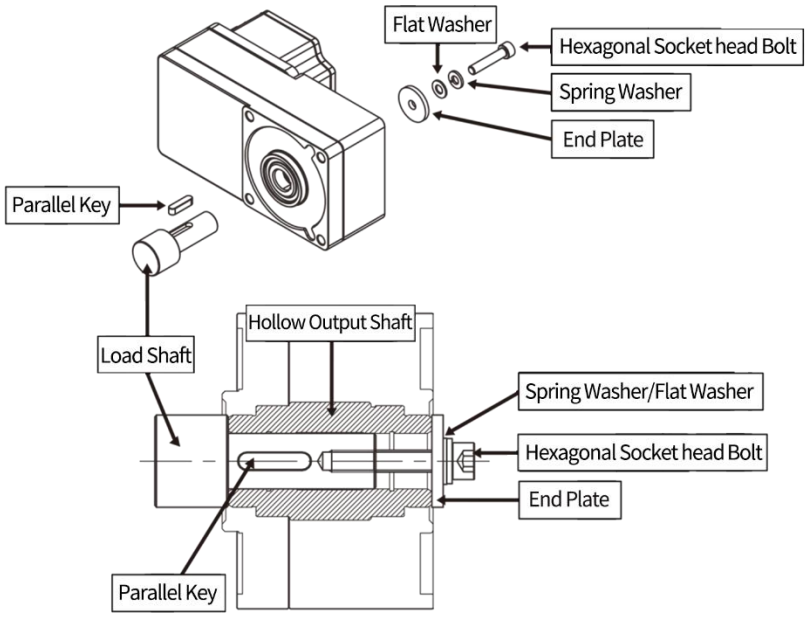
(a) Fixing method using a hole stop ring

Use a spacer, flat washer, and spring washer to tighten the hole stop ring with a hexagonal socket head bolt.



(b) Fixing method using an end plate

Use a flat washer, and spring washer to tighten the hole stop ring with a hexagonal socket head bolt.



Recommended load shaft dimension (mm)

Product No.	Hollow shaft inner diameter (H8)	Recommended load shaft dimension (h7)	Hole stop ring nominal diameter	Suitable bolt	Spacer thickness	Outer diameter of stepped shaft
ESG-60-H-R□-H	Ø12 $^{+0.027}_{0}$	Ø12 $^{0}_{-0.018}$	Ø12	M4	3	20
ESG-80-H-R□-H	Ø15 $^{+0.027}_{0}$	Ø15 $^{0}_{-0.018}$	Ø15	M5	4	25
ESG-90-H-R□-H	Ø20 $^{+0.027}_{0}$	Ø20 $^{0}_{-0.018}$	Ø20	M6	5	30
ESG-104-H-R□-H	Ø25 $^{+0.027}_{0}$	Ø25 $^{0}_{-0.018}$	Ø25	M8	6(3)	40

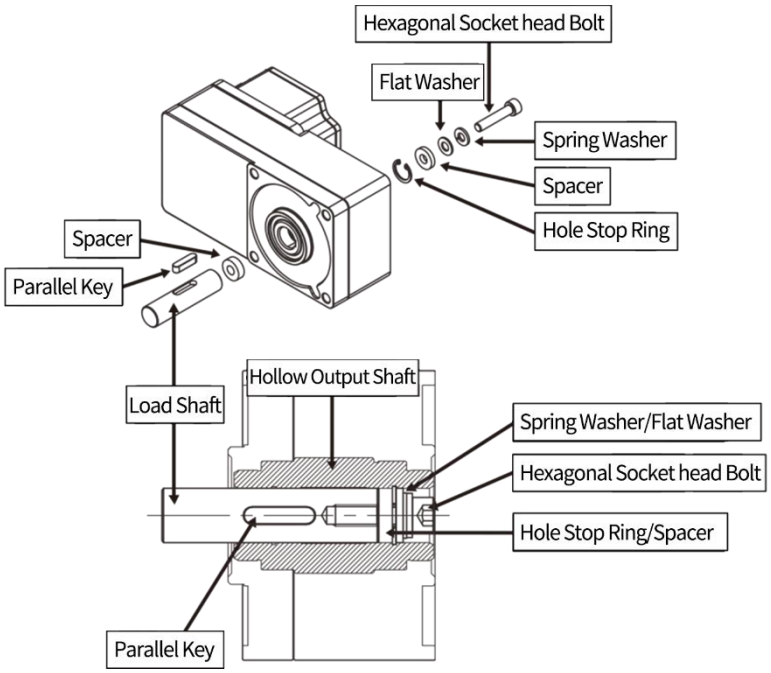
* The number indicating the gear ratio of the gearhead is placed in □.

Note

▶ The safety cover cannot be installed as it interferes with inserting the hexagon socket set screw bolts, so please independently devise a protective measure for the rotating part .

(2) Non-stepped load shaft

On the load shaft side, insert a spacer, and use flat washers and spring washers to tighten the hole stop ring with a hexagonal socket head bolt.



Recommended load shaft dimension (mm)

Product No.	Hollow shaft inner diameter (H8)	Recommended load shaft dimension (h7)	Hole stop ring nominal diameter	Suitable bolt	Spacer thickness
ESG-60-H-R□-H	Ø12 $^{+0.027}_{0}$	Ø12 $^{0}_{-0.018}$	Ø12	M4	3
ESG-80-H-R□-H	Ø15 $^{+0.027}_{0}$	Ø15 $^{0}_{-0.018}$	Ø15	M5	4
ESG-90-H-R□-H	Ø20 $^{+0.027}_{0}$	Ø20 $^{0}_{-0.018}$	Ø20	M6	5
ESG-104-H-R□-H	Ø25 $^{+0.027}_{0}$	Ø25 $^{0}_{-0.018}$	Ø25	M8	6(3)

* The number indicating the gear ratio of the gearhead is placed in □.

* The values within ( ) are for rear installation.

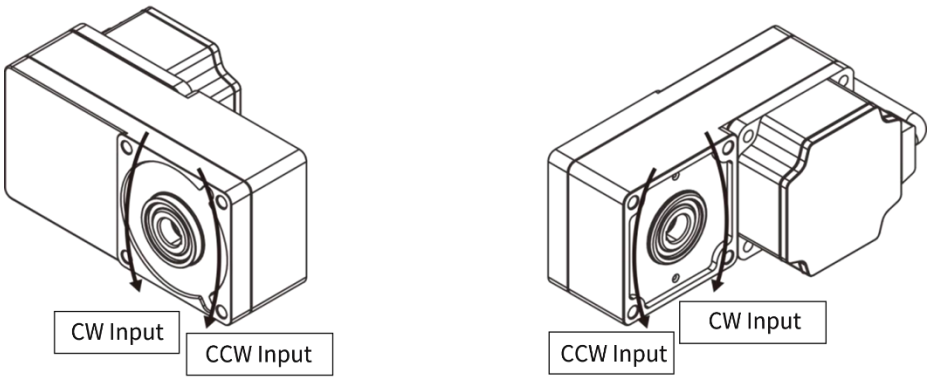
(3) When coupling the load, please keep the following points in mind:

- ▶ When connecting the load, ensure that the gearhead's output shaft or bearings are not subjected to shock. Also, do not apply excessive force to the output shaft, as failure to do so may lead to damage to the output shaft or bearings.
- ▶ To prevent heat damage, apply grease (such as molybdenum grease) to the surface of the load shaft and the inner surface of the hollow output shaft.
- ▶ Do not modify or machine the gearhead's output shaft. Doing so may result in damage to the bearings or damage to the gearhead.

3.5.3 Rotation direction of gearhead and transmission efficiency

(1) Rotation direction of gearhead

When viewed from the front view and the rear view, the rotation direction of hollow shaft is different.



(2) Transmission efficiency of gearhead

Product No.	5	10	15	20	30	50	100	200
ESG-60-H-R□-H	80%		85%					
ESG-80-H-R□-H	85%							
ESG-90-H-R□-H								
ESG-104-H-R□-H	85%							-

※ Gearhead torque = Motor torque X gear ratio X Transmission efficiency of gearhead

3.5.4 Permissible radial load and permissible axial load

The radial and axial loads applied to the gearhead output shaft are as shown in the table.

Product No.	Gear ratio	Permissible radial load [N]*		Permissible axial load [N]
		Distance from the output shaft end		
		10mm	20mm	
ESG-60-H-R□-H	5, 10	450	370	200
	15~200	500	400	
ESG-80-H-R□-H	5, 10	800	660	400
	15~200	1200	1000	
ESG-90-H-R□-H	5, 10	900	770	500
	15, 20	1300	1110	
	30~200	1500	1280	
ESG-104-H-R□-H	5, 10	1230	1070	800
	15, 20	1680	1470	
	30, 50, 100	2040	1780	

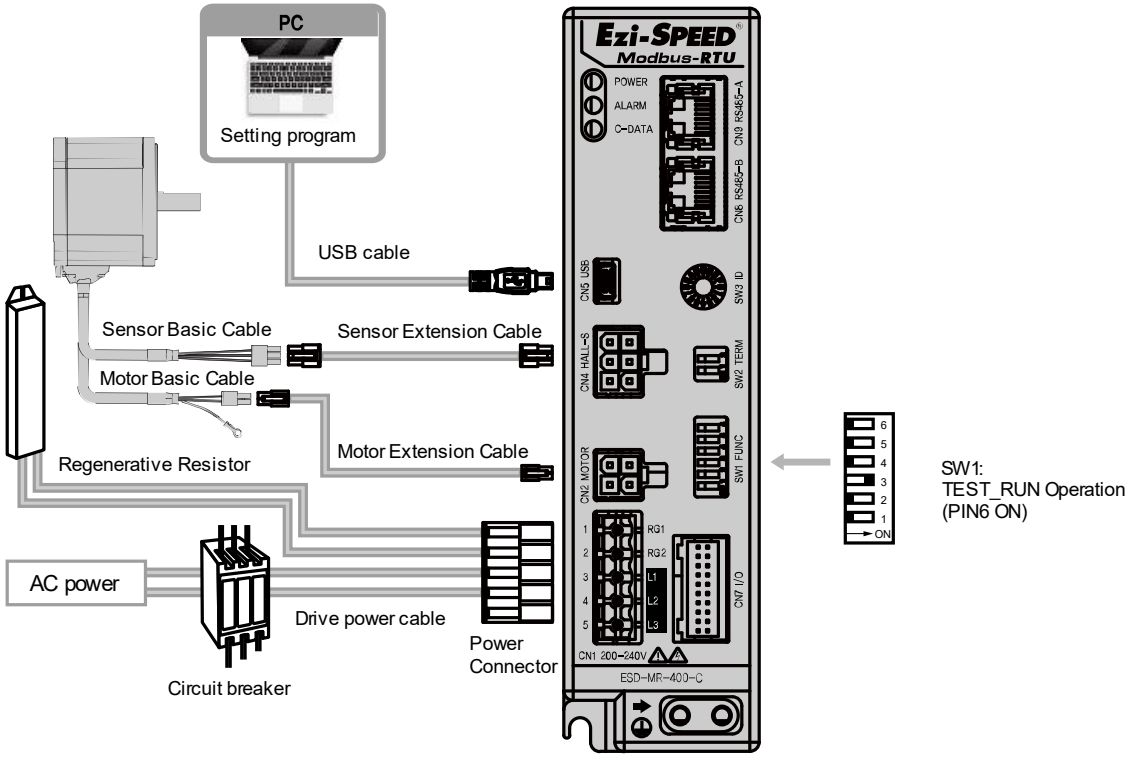
* This value is for a motor shaft rotational speed of 3000r/min.

Note

▶ If the radial and axial loads exceed the allowable values, there is a risk of repeated loading causing damage to the motor (gearhead) bearings or output shaft. Please exercise caution.

3.6 Test run

When using the test run function, simply applying AC power allows you to check the connection status of the drive and motor.



(1) Connect the motor and drive.
(2) Apply AC power.
(3) Turn on the function setting switch No. 6 (SW1-No.6: TEST_RUN).
(4) Check if the motor is rotating in the forward direction at approximately 100 r/min. If the motor is not rotating properly, turn off the power and check the connection status.
(5) After the test run is complete, be sure to set SW1-No.6 to Off.

3.7 Input/Output (I/O) signals

In this product, two types of I/O signals can be used:

- Direct I/O: I/O signals directly connected to the input/output connector (CN7).
- Network I/O: I/O signals transmitted via RS-485 communication.

3.7.1 Assignment of Direct I/O

(1) Direct I/O IN (input terminal) function assignment

Using the Ezi-SPEED Setting program, you can assign the input signals listed in the table to the input terminals IN0~IN6.

Assignment No.	Signal name	Function
0	Not used	Set it when you are not using the input terminals.
1	FWD	Rotate the motor in the forward direction.
2	REV	Rotate the motor in the reverse direction.
19	STOP-MODE	Choose the method for stopping the motor.
21	EXT-ERROR	Generate an external error and stop the motor.
24	ALARM-RESET	Reset of the present alarm.
32	R0	General signals Use these signals when controlling the system via RS-485 communication
33	R1	
34	R2	
35	R3	
36	R4	
37	R5	
38	R6	
39	R7	
40	R8	
41	R9	
42	R10	
43	R11	
44	R12	
45	R13	
46	R14	
47	R15	
48	P0	Select the operation data No., using these four bits.
49	P1	
50	P2	
51	P3	
54	TL	Disable the torque limit.

■ Related parameters

Parameter name	Description	Initial value
IN0 function select	Assigns the input signals to the input terminal IN0 ~ IN6.	1: FWD
IN1 function select		2: REV
IN2 function select		19: STOP-MODE
IN3 function select		48: P0
IN4 function select		49: P1
IN5 function select		50: P2
IN6 function select		24: ALARM-RESET

- ▶ Do not assign the same input signal to multiple input terminals.
- ▶ The ALARM-RESET input will be executed when turning from ON to OFF.
- ▶ If the same input signal is assigned to both direct I/O and network I/O, it operates using an 'OR' logic.

■ Setting the logic level of input signals

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

(2) Direct I/O OUT (output terminal) function assignment

Using the Ezi-SPEED Setting program, you can assign the output signals listed in the table to the output terminals OUT0~OUT1.

Assignment No.	Signal name	Function
0	Not used	Set it when you are not using the output terminals.
1	FWD_R	Output in response to the FWD input
2	REV_R	Output in response to the REV input
19	STOP-MODE_R	Output in response to the STOP-MODE input
32	R0	Output the status of the general signals R0 ~ R15
33	R1	
34	R2	
35	R3	
36	R4	

Assignment No.	Signal name	Function
37	R5	
38	R6	
39	R7	
40	R8	
41	R9	
42	R10	
43	R11	
44	R12	
45	R13	
46	R14	
47	R15	
48	P0_R	Output in response to the P0~P3 inputs
49	P1_R	
50	P2_R	
51	P3_R	
54	TL_R	Output in response to the TL input
65	ALARM-OUT	Output the alarm status of the drive.
66	WNG	Output the warning status of the drive
68	MOVE	Output while the motor operates
71	TLC	Output when the motor torque reaches the torque limiting value
77	VA	Output when the motor speed reaches the setting value
80	S-BSY	Output when reading or writing data to EEPROM
81	OVERLOAD	Output when drive detects overload
84	DIR	Output the rotation direction of motor shaft
85	SPEED-OUT	Output 30 pulses with each revolution of the motor output shaft

■ Related parameters

Parameter name	Description	Initial value
OUT0 function select	Assigns the output signals to the output terminals OUT0 and OUT1.	85: SPEED-OUT
OUT1 function select		65: ALARM-OUT

3.7.2 Assignment of Network I/O

(1) NET-IN function assignment

Using the Ezi-SPEED Setting program, you can assign the input signals listed in the table to NET-IN0~NET-IN15.

Assignment No.	Signal name	Function
0	Not used	Set it when you are not using the input terminals.
1	FWD	Rotate the motor in the forward direction. (1: move, 0: stop)
2	REV	Rotate the motor in the reverse direction. (1: move, 0: stop)
19	STOP-MODE	Choose the method for stopping the motor. (1: instantaneous stop, 0: deceleration stop)
32	R0	General signals Use these signals when controlling the system via RS-485 communication (1: ON, 0: OFF).
33	R1	
34	R2	
35	R3	
36	R4	
37	R5	
38	R6	
39	R7	
40	R8	
41	R9	
42	R10	
43	R11	
44	R12	
45	R13	
46	R14	
47	R15	
48	P0	Select the operation data No., using these four bits. (1: On, 0: Off)
49	P1	
50	P2	
51	P3	
54	TL	Disable the torque limit (1: disable, 0: enable).

■ Related parameters

Parameter name	Description	Initial value
NET-IN0 function select	Assigns the input signals to the NET-IN0 ~ NET-IN15.	48: P0
NET-IN1 function select		49: P1
NET-IN2 function select		50: P2
NET-IN3 function select		1: FWD
NET-IN4 function select		2: REV
NET-IN5 function select		19: STOP-MODE

Parameter name	Description	Initial value
NET-IN6 function select		54: TL
NET-IN7 function select		
NET-IN8 function select		
NET-IN9 function select		
NET-IN10 function select		
NET-IN11 function select		0: Not used
NET-IN12 function select		
NET-IN13 function select		
NET-IN14 function select		
NET-IN15 function select		

- ▶ Do not assign the same input signal to multiple input terminals.
- ▶ The ALARM-RESET input will be executed when turning from ON to OFF.
- ▶ If the same input signal is assigned to both direct I/O and network I/O, it operates using an 'OR' logic.

(2) NET-OUT function assignment

Assignment No.	Signal name	Function
0	Not used	Set it when you are not using the output terminals.
1	FWD_R	Output in response to the FWD input
2	REV_R	Output in response to the REV input
19	STOP-MODE_R	Output in response to the STOP-MODE input
32	R0	Output the status of the general signals R0 ~ R15
33	R1	
34	R2	
35	R3	
36	R4	
37	R5	
38	R6	
39	R7	
40	R8	
41	R9	
42	R10	
43	R11	
44	R12	
45	R13	
46	R14	
47	R15	
48	P0_R	Output in response to the P0~P3 inputs
49	P1_R	
50	P2_R	

Assignment No.	Signal name	Function
51	P3_R	
54	TL_R	Output in response to the TL input
65	ALARM-OUT	Output the alarm status of the drive
66	WNG	Output the warning status of the drive
68	MOVE	Output while the motor operates
71	TLC	Output when the motor torque reaches the torque limiting value
77	VA	Output when the motor speed reaches the setting value
80	S-BSY	Output when reading or writing data to EEPROM
81	OVERLOAD	Output when drive detects overload
84	DIR	Output the rotation direction of motor shaft

■ Related parameters

Parameter name	Description	Initial value
NET-OUT0 function select	Assigns the output signal to the NET-OUT0 ~ NET-OUT15.	48: P0_R
NET-OUT1 function select		49: P1_R
NET-OUT2 function select		50: P2_R
NET-OUT3 function select		1: FWD_R
NET-OUT4 function select		2: REV_R
NET-OUT5 function select		19: STOP-MODE_R
NET-OUT6 function select		66: WNG
NET-OUT7 function select		65: ALARM-OUT
NET-OUT8 function select		80: S-BSY
NET-OUT9 function select		84: DIR
NET-OUT10 function select		0: Not used
NET-OUT11 function select		
NET-OUT12 function select		81: OVERLOAD
NET-OUT13 function select		68: MOVE
NET-OUT14 function select		77: VA
NET-OUT15 function select		71: TLC

3.7.3 Input signals

The state of the input signal refers not to the voltage level of the signal but to the internal photocoupler's 'ON (conducting)' or 'OFF (non-conducting)' status.

(1) FWD input, REV input

The motor rotates forward when the FWD input is On and stops when it's Off. Additionally, it rotates in reverse when the REV input is On and stops when it's Off. When both FWD and REV are On, it performs an instantaneous stop. The forward and reverse directions are determined based on the parameter settings for the motor's rotational direction, with the default value being clockwise for the forward direction.

(2) STOP-MODE input

Select how the motor stops. When the STOP-MODE input is Off, it performs deceleration stop, and when it's On, it performs instantaneous stop. The deceleration stop time is determined by the value set in the operating data parameters.

(3) EXT-ERROR input

The EXT-ERROR input is normally closed.

When the input signal is off, EXT-ERROR is triggered to generate an alarm and the motor stops instantaneously. To release the alarm, turn off both FWD input and REV input, turn on the EXT-ERROR input to stop the EXT-ERROR, and then run ALARM-RESET.

The EXT-ERROR can be used by connecting external error signals or as an emergency stop switch in the workplace.

(4) ALARM-RESET input

When an alarm occurs, the alarm LED lights up, and the motor stops. To clear the alarm, you should turn the ALARM-RESET input on for at least 10ms and then off. When releasing the alarm, please address the cause of the alarm first. Failure to do so may result in injury or damage to the device.

(5) P0 ~ P3 input

Select a desired operation data number for multi-speed operation based on the combination of ON/OFF states of the P0 to P3 inputs.

Operation data No.	P3	P2	P1	P0	Speed setting method
0	Off	Off	Off	Off	Analog setting*/Digital setting
1	Off	Off	Off	On	Digital setting
2	Off	Off	On	Off	
3	Off	Off	On	On	
4	Off	On	Off	Off	

Operation data No.	P3	P2	P1	P0	Speed setting method
5	Off	On	Off	On	
6	Off	On	On	Off	
7	Off	On	On	On	
8	On	Off	Off	Off	
9	On	Off	Off	On	
10	On	Off	On	Off	
11	On	Off	On	On	
12	On	On	Off	Off	
13	On	On	Off	On	
14	On	On	On	Off	
15	On	On	On	On	

*Analog setting is set by the 'Analog input signal select' parameter.

(6) TL input

When this input is turned On, the torque limit is released, and when it's turned Off, the torque limit is activated. When the torque limit is released, the motor can use up to a maximum of 200% of torque regardless of the torque limit value set in any operating data. If the TL input is not assigned as an input signal, torque limit remains active at all times.

3.7.4 Output signals

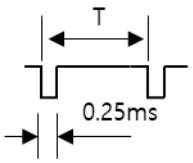
The state of the output signal refers not to the voltage level of the signal but to the internal photocoupler's 'ON (conducting)' or 'OFF (non-conducting)' status.

(1) SPEED-OUT output

Output 30 pulses with each revolution of the motor output shaft. The pulse width of output pulse signals is 0.25ms. So, you can calculate the rotation speed of the motor output shaft using the SPEED-OUT output.

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

Motor output shaft speed [r/min] = $\frac{SPEED-OUT \text{ output frequency}}{30}$ x 60



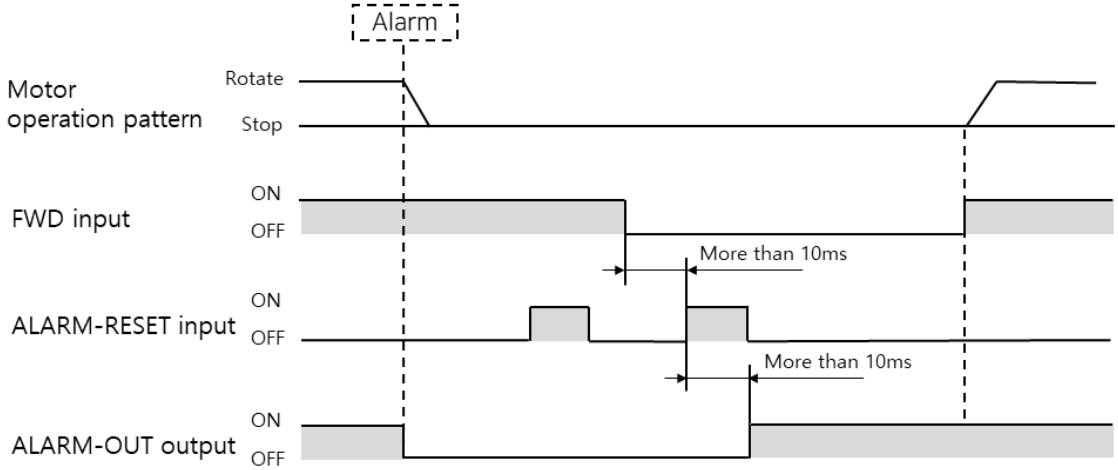
(2) ALARM-OUT output

The ALARM-OUT output is normally closed.

When the driver's protective function actuates, the ALARM-OUT output turns OFF. And the ALM LED blinks and the motor is stopped.

The ALARM-RESET input is disabled while the FWD input or REV input is ON. To reset an alarm, turn both the FWD input and REV input OFF, and remove the cause of the alarm before turning the ALARM-RESET input ON (keep it ON for 10ms or more). If the alarm cannot be reset with the ALARM-RESET input, once turn off the power, wait for at least 30 sec, and turn on the power again.

The following figure illustrates an example where the FWD input must be released to reset the alarm.



(3) MOVE output

The MOVE output turns ON while the motor is operating.

(4) VA output

The VA output turns ON when the motor speed reaches the command speed. The target speed recognition range can be set in 'Velocity attainment width' in 'Function setting parameters'.

(5) DIR output

This output signal shows the rotation direction of motor output shaft.

The DIR output turns ON while the rotation direction is forward. And turns OFF while the rotation direction is reverse.

(6) TLC output

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

(7) OVERLOAD output

When the motor's load exceeds the 'overload warning' level, the output is turned On. Inside the drive, it automatically controls the output by limiting it to the rated torque to prevent the motor from being overloaded.

(8) WNG output

When a warning occurs, the output is turned On. In this case, the motor continues to operate, and when the cause of the warning is resolved, the WNG output is automatically turned Off.

(9) S-BSY output

The S-BSY output turns ON while read or write data to EEPROM from inside of the drive.

(10) Response output

The response output is an output signal that shows the ON/OFF status corresponding to the input signals.

Input signal	Output signal
FWD	FWD_R
REV	REV_R
STOP-MODE	STOP-MODE_R
P0	P0_R
P1	P1_R
P2	P2_R
P3	P3_R
TL	TL_R

3.7.5 General signals (R0 ~ R15)

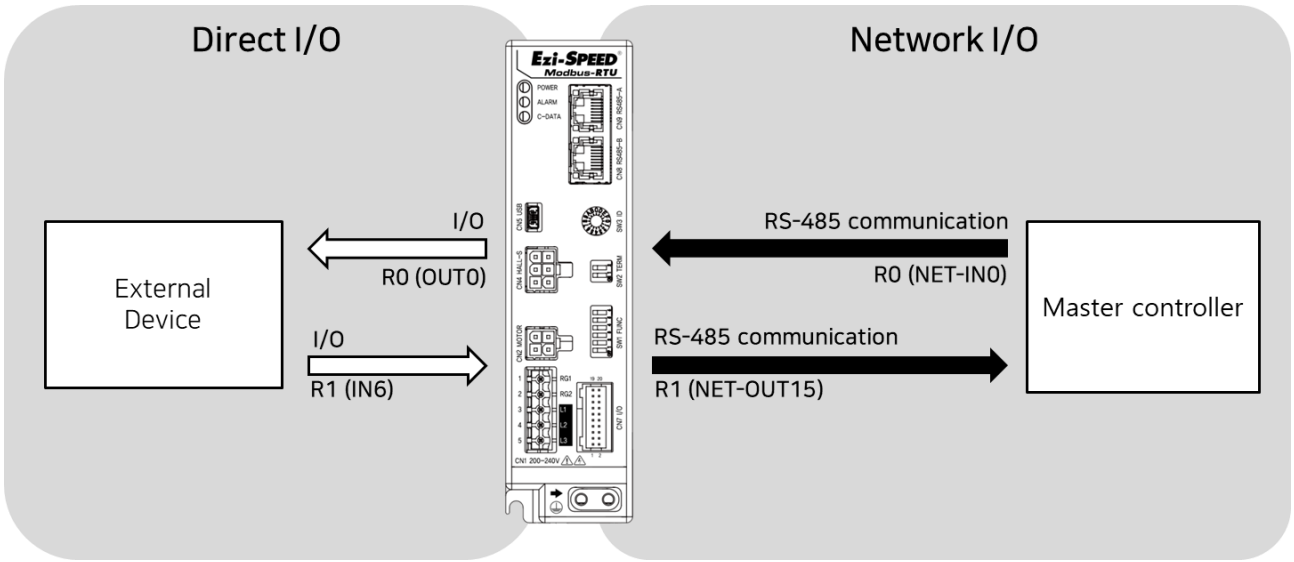
The R0 to R15 are general signals that enable control via RS-485 communication. Using the R0 to R15 signals, the external I/O device can be controlled by master via the drive. The direct I/O of the driver can be used as an I/O unit. See the following example for setting of the general signals.

- Inputting general signals from the master to the external device

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

- Inputting general signals from the external device to the master

  ▶ Assign the general signal R1 to the IN6 input and NET-OUT15.
  ▶ When turn on the IN6 input by the external device, the NET-OUT15 becomes 1. When turn on the IN6 input OFF, the NET-OUT15 becomes 0.



3.8 Maintenance

3.8.1 Inspection

The drive consists of several semiconductor elements. When performing the inspection, handle the product carefully so that the semiconductor elements are not damaged by static electricity. The main inspection items are as follows.

(1) Make sure that the connection between the drive and the motor is not loose.
(2) Make sure that the drive and motor are connected properly.
(3) Make sure the drive's vents are not blocked.
(4) Make sure that the communication cable is connected properly.
(5) Ensure that the AC-input power supply meets the specifications.
(6) Check the cable for damage.

3.8.2 Warranty

(1) Warranty period
The warranty period for the product is 12 months from the date of purchase.

(2) Warranty coverage
If a failure occurs within the warranty period, our company will repair it free of charge. However, we would like to inform you that if it falls under the following, it will be charged even within the free warranty period.

(a) Failure to comply with the 'Precautions for Safety' specified in the instruction User Manual or catalog
(b) Failure due to a product that our company has not made
(c) Failure due to repair or alteration in a place not designated by our company
(d) Failure while using in a manner not specified by our company
(e) Reasons that can't be predicted by the level of science and technology at the time the product is shipped
(f) Failure due to a natural disaster (lighting, fire, earthquake, storm and flood damage, salt damage, gas, etc.)

The warranty covers only drives and motors, so be sure to consider system-level safety measures when applying this product.

4 Method of control via I/O

4.1 Type of Parameters

To control via I/O, below two types of parameters should be set.

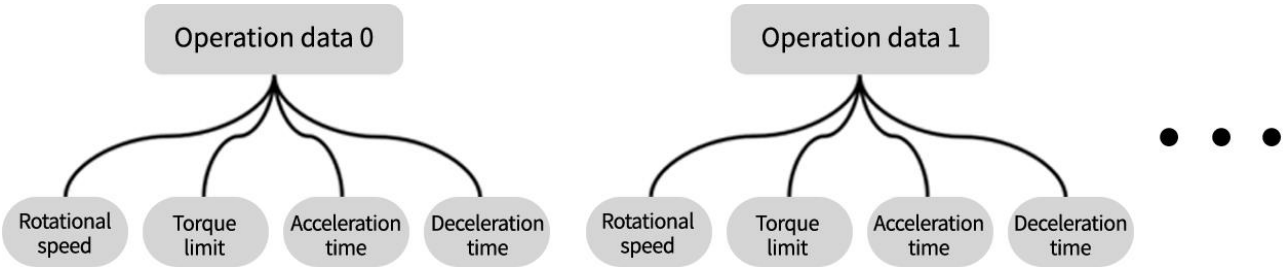
- Operation data
- User parameter

All parameters have their own validation properties for safety. The validation time varies depending on the validation property, and the types of validation properties are as follows.

- A: Effective immediately
- B: Effective after stopping the operation
- C: Effective after executing the configuration
- D: Effective after turning the power ON again

Parameters are stored in RAM or EEPROM. Parameters stored in RAM are erased when the power is turned off, but parameters stored in EEPROM remain intact even when the power is off. When the power is applied, the information from EEPROM is transferred to RAM, so the parameters stored in EEPROM are applied. Therefore, if you have changed parameters during operation, please confirm when those parameter values will take effect and take appropriate action accordingly (for more details on parameter changes and saving functions, please refer to the Ezi-SPEED Setting program User Manual).

4.1.1 Operation data



The 'Operation data' is a set of data associated with the basic operation of the motor, consisting of rotational speed, torque limit, acceleration time, and deceleration time. Up to 16 driving data can be set, and the operation of the motor is performed by selecting one of these operation data. The setting range for the operation data are as follows.

Item	Description	Setting range	Initial value	Effective
Rotational speed No.0 ~ Rotational speed No.15	Sets the rotational speed	Analog setting: 50 ~ 4000r/min	0	A
		Digital setting: 50 ~ 4000r/min		
Acceleration No.0 ~ Acceleration No.15	Sets the time needed for the motor to reach the higher rotation speed	0.2 ~ 15s	0.5	
Deceleration No.0 ~ Deceleration No.15	Sets the time needed for the motor to reach the lower rotation speed			
Torque limit No.0 ~ Torque limit No.15	Sets the motor torque. Sets the maximum torque based on the rated torque being 100%.	0 ~ 200%	200	

4.1.2 User parameter

Parameter list

Category	Item
Function setting parameters	• Reduction gear rate • Decimal place for reduction gear rate • Gear Amplification speed rate • Conveyor reduction gear rate • Decimal place for conveyor reduction gear rate • Conveyor amplification speed rate • Velocity attainment width • Motor rotation direction
Direct I/O parameters	• IN0 ~ IN6 function select • IN0 ~ IN6 contact configuration • OUT0 and OUT1 function select
Network I/O parameters	• NET-IN0 ~ NET-IN15 function select • NET-OUT0 ~ NET-OUT15 function select
Analog adjust parameters	• Analog operation speed command offset • Analog operation speed maximum value for external input • Analog torque limit offset • Analog torque limit maximum value for external input
Operation setting parameters	• Analog input signal select • No operation at initial run • Holding motor at stop

Category	Item
Communication parameters	• Communication time out • Communication error alarm • Communication parity • Communication stop bit • Communication transfer wait time

(1) Function setting parameters

Name	Description	Setting range	Initial value	Effective
Reduction gear rate	If enter the gear ratio of the gearhead, the rotation speed of the gear head output shaft will be displayed. *1 Set the decimal position for the setting value of the gear ratio by this parameter.	100 ~ 9999	100	A
Decimal place for reduction gear rate		0: 0 digit (x1) 1: 1 digit (x0.1) 2: 2 digit (x0.01)	2	
Gear Amplification speed rate	Set the speed increasing ratio relative to the rotation speed of the motor output shaft. When setting the speed increasing ratio to 1, the speed reduction ratio will be effective. When setting the speed increasing ratio to other than 1, the speed increasing ratio will be effective.	1 ~ 5	1	
Conveyor reduction gear rate	If set the conveyor speed reduction ratio, the transfer speed of the conveyor will be displayed. Set the decimal position for the setting value of the speed reduction ratio by this parameter.	100 ~ 9999	100	
Decimal place for conveyor reduction gear rate		0: 0 digit (x1) 1: 1 digit (x0.1) 2: 2 digit (x0.01)	2	
Conveyor amplification speed rate	Sets the conveyor speed-increasing ratio relative to the rotation speed of the motor output shaft.	1 ~ 5	1	
Velocity attainment width	Sets the width within which the rotation speed of the motor is deemed to have reached the set value. It affects the output of VA*2.	0 ~ 400 [r/min]	200	
Motor rotation direction	Sets the motor direction to be applied when the FWD input is turned ON.	0: CCW 1: CW	1	C

*1: The displayed content can be confirmed using support software or RS-485 communication.

*2: An abbreviation for Velocity Attainment. For example, if the velocity attainment range is set to 100 r/min and the target speed is set to 3000 r/min, the VA output is turned on when the current speed is between 2900 r/min and 3100 r/min.

■ Setting the speed reduction ratio

Set the speed reduction ratio as a combination of the 'Reduction gear rate' parameter and 'Decimal place for reduction gear rate' parameter.

[Configuration Example]

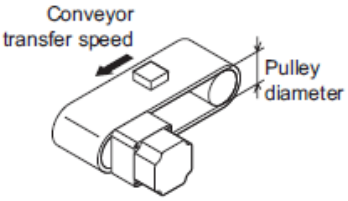
Actual speed reduction ratio	'Reduction gear rate' parameter	'Decimal place for reduction gear rate' parameter
1.00 ~ 9.99	100 ~ 999	2 (x0.01)
10.0 ~ 99.9		1 (x0.1)
100 ~ 999		0 (x1)
10.00 ~ 99.99	1000 ~ 9999	2 (x0.01)
100.0 ~ 999.9		1 (x0.1)
1000 ~ 9999		0 (x1)

■ Displaying the conveyor transfer speed

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

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

This value allows you to know the values that need to be entered into the 'Conveyor Reduction Ratio' parameter and the 'Decimal Position Specification for Conveyor Reduction Rati' parameter.



The conveyor reduction ratio is converted into the conveyor transport speed according to the following equation.

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

e.g.) The Pulley diameter is 0.1m and gear ratio of the gear head is 30

$$\text{Conveyor gear ratio} = \frac{Gearhead\ gear\ ratio}{Pulley\ diameter\ [m] \times \pi} = \frac{30}{0.1\ [m]\ \times \pi} = 95.5$$

A conveyor gear ratio of 95.5 indicates that the 'Conveyor Reduction Ratio' parameter is set to 955, and the 'Decimal Position Specification for Conveyor Reduction Ratio' parameter is set to 1.
With a conveyor reduction ratio of 95.5 and a motor output shaft rotational speed of 1300 r/min, the conveyor transport speed is calculated as follows.

$$\text{Conveyor transfer speed [m/min]} = \frac{1300}{95.5} = 13.6$$

(2) Direct I/O parameters

Name	Description	Setting range	Initial value	Effective
IN0 function select	Assigns the input signals to the input terminals IN0 to IN6.	See table next.	1: FWD	B
IN1 function select			2; REV	
IN2 function select			19: STOP-MODE	
IN3 function select			48: P0	
IN4 function select			49: P1	
IN5 function select			50: P2	
IN6 function select			24: ALARM-RESET	
IN0 contact configuration	Changes the logic level setting for the input terminals IN0 to IN6.	0: Normally Open (N.O) 1: Normally closed (N.C)	0	C
IN1 contact configuration				
IN2 contact configuration				
IN3 contact configuration				
IN4 contact configuration				
IN5 contact configuration				
IN6 contact configuration				
OUT0 function select	Assigns the output signals to the output terminals OUT0 and OUT1.	See table below.	85: SPEED-OUT	A
OUT1 function select			65: ALARM-OUT	

■ Setting range for IN input function selection

0: Not used 1: FWD 2: REV 19: STOP-MODE 21: EXT-ERROR 24: ALARM-RESET	32: R0 33: R1 34: R2 35: R3 36: R4 37: R5	38: R6 39: R7 40: R8 41: R9 42: R10 43: R11	44: R12 45: R13 46: R14 47: R15 48: P0 49: P1	50: P2 51: P3 54: TL

■ Setting range for OUT output function selection

0: Not used 1: FWD_R 2: REV_R 19: STOP-MODE_R 32: R0 33: R1 34: R2	35: R3 36: R4 37: R5 38: R6 39: R7 40: R8 41: R9	42: R10 43: R11 44: R12 45: R13 46: R14 47: R15 48: P0_R	49: P1_R 50: P2_R 51: P3_R 54: TL_R 65: ALARM-OUT 66: WNG 68: MOVE	71: TLC 77: VA 80: S-BSY 81: OVERLOAD 84: DIR 85: SPEED-OUT

(3) Network I/O parameters (RS-485)

Name	Description	Setting range	Initial value	Effective
NET-IN0 function select	Assigns the input signals to the NET-IN0 ~ NET-IN15.	See table next.	48: P0	C
NET-IN1 function select			49: P1	
NET-IN2 function select			50: P2	
NET-IN3 function select			1: FWD	
NET-IN4 function select			2; REV	
NET-IN5 function select			19: STOP-MODE	
NET-IN6 function select			54: TL	
NET-IN7 function select			0: Not used	
NET-IN8 function select				
NET-IN9 function select				
NET-IN10 function select				
NET-IN11 function select				
NET-IN12 function select				
NET-IN13 function select				
NET-IN14 function select				
NET-IN15 function select				
NET-OUT0 function select	Assigns the output signals to the NET-OUT0 ~ NET-OUT15.	See table next.	48: P0_R	
NET- OUT1 function select			49: P1_R	
NET- OUT2 function select			50: P2_R	
NET- OUT3 function select			1: FWD_R	
NET- OUT4 function select			2; REV_R	
NET- OUT5 function select			19: STOP-MODE_R	
NET- OUT6 function select			66: WNG	
NET- OUT7 function select			65: ALARM-OUT	
NET- OUT8 function select			80: S-BSY	
NET- OUT9 function select			84: DIR	
NET- OUT10 function select			0: Not used	
NET- OUT11 function select				
NET- OUT12 function select			81: OVERLOAD	
NET- OUT13 function select			68: MOVE	
NET- OUT14 function select			77: VA	
NET- OUT15 function select			71: TLC	

■ Setting range for NET-IN input function selection

0: Not used 1: FWD 2: REV 19: STOP-MODE 32: R0	33: R1 34: R2 35: R3 36: R4 37: R5	38: R6 39: R7 40: R8 41: R9 42: R10	43: R11 44: R12 45: R13 46: R14 47: R15	48: P0 49: P1 50: P2 51: P3 54: TL

■ Setting range for NET-OUT output function selection

0: Not used 1: FWD_R 2: REV_R 19: STOP-MODE_R 32: R0 33: R1 34: R2	35: R3 36: R4 37: R5 38: R6 39: R7 40: R8 41: R9	42: R10 43: R11 44: R12 45: R13 46: R14 47: R15 48: P0_R	49: P1_R 50: P2_R 51: P3_R 54: TL_R 65: ALARM-OUT 66: WNG 68: MOVE	71: TLC 77: VA 80: S-BSY 81: OVERLOAD 84: DIR

(4) Analog adjust parameters

Name	Description	Setting range	Initial value	Effective
Analog operating speed command offset	Sets the offset for speed command input.	−2000 ~ 2000 r/min	0	A
Analog operating speed maximum value for external input	Sets the maximum value of rotation speed.	0 ~ 4000 r/min	4000	
Analog torque limit offset	Sets the offset for torque limit input.	−50 ~ 50%	0	
Analog torque limit maximum value external input	Sets the maximum value of torque limiting.	0 ~ 200%	200	

(5) Operation setting parameters

Name	Description	Setting range	Initial value	Effective
Analog input signal select	Sets the setting method of operation data. See table next.	0: Analog invalid 1: Analog speed 2: Analog torque	1	C
No operation at initial run	Sets the behavior when the power is turned on with the initial run.	0: Normal operation 1: ALARM occurrence	0	
Holding Motor at Stop	Sets whether to enable or disable the Holding load function. By controlling the stop position using a hall sensor, the position is simply maintained within about ±60° of the motor axis (not used for vertical loads).	0: disable 1: enable	0	

■ 'Analog input signal select' parameter

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

Setting example)

- When setting all operation data with digital setting: Set the 'analog input signal select' parameter to 0
- When setting the rotation speed of the operation data No.0 with analog setting: Set the 'analog input signal select' parameter to 1.
- When setting the torque limit of all operation data with analog setting: Set the 'analog input signal select' parameter to 2.

(6) Communication parameters

Name	Description	Setting range	Initial value	Effective
Communication timeout	Sets the conditions for RS-485 communication timeout to occur.	0: Not Monitored 1 ~ 10000 ms	0	A
Communication error alarm	Sets the condition for RS-485 communication error alarm to occur	0: Not Monitored 0 ~ 10 times	3	
Communication parity	Sets the parity for RS-485 communication.	0: No Parity 1: Even 2: Odd	1	D
Communication stop bit	Sets the stop bit for RS-485 communication.	0: 1 bit 1: 2 bits	0	
Communication transfer wait time	Sets the transmission waiting time for RS-485 communication.	0~100ms	10	

4.2 Operation method

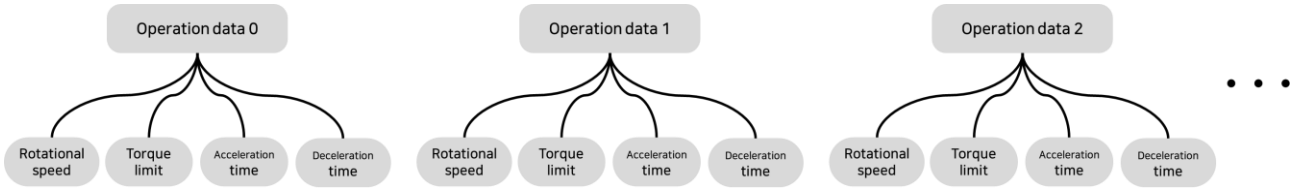
4.2.1 Setting the operation data

When control via I/O, Operation data can be set by analog or digital settings.

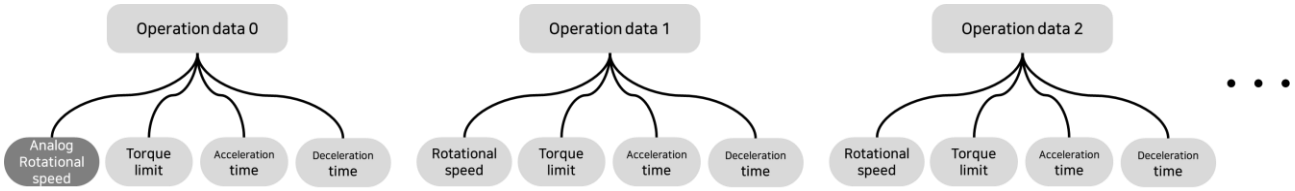
- Digital setting: Setting up to 16 fixed operation data via Ezi-SPEED Setting program or RS-485 communication. In order to change the driving conditions, a combination of P0~P4 must be used to select the appropriate operation data.
- Analog setting: Setting the rotation speed or torque limit using the external potentiometer or external DC voltage.

The configuration method can be selected through the "Analog input signal select" parameter. This parameter has three options as follows.

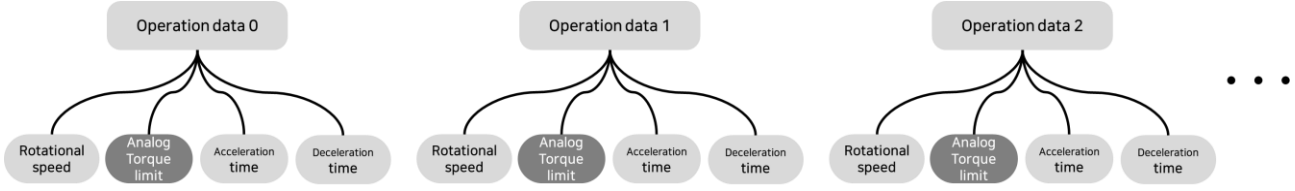
(1) Analog invalid
All operation data follow the values set by the digital settings. Analog method such as potentiometer is not working in this case.



(2) Analog speed
The rotational speed of 'Operation data 0' follow the analog setting. All remaining operation data follow digital setting. The range of rotational speeds set by analog is (80 ~ 4000 r/min).



(3) Analog torque
'Torque limit' of all 'Operation data' follow the analog setting method. All remaining operation data follow digital setting.



When setting the following four pieces of data required for operating the motor, please select the 'Analog input signal select' parameter according to the purpose.

Item	Description	Setting method	Setting range	Initial value
Rotational speed	Sets the rotation speed.	Analog setting	80~4000 r/min	0 r/min
		Digital setting	50~4000 r/min	
Acceleration	Sets the time it takes to reach the rotational speed from a standstill.	Digital setting	0.2~15 sec	0.5 sec
Deceleration	Sets the time it takes to reach a standstill from the rotational speed.			
Torque limit	Sets the maximum motor torque based on the rated torque being 100%.	Analog setting Digital setting	0~200 %	200 %

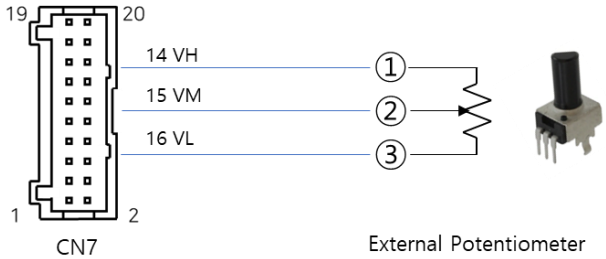
4.2.2 Setting the rotational speed

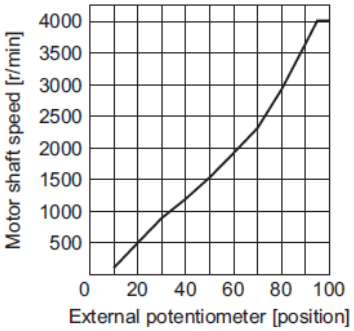
(1) Digital setting
Operation data (No.0 ~ No.15) can be set through the Ezi-SPEED Setting program or RS-485 communication.

(2) Analog setting
Rotational speed of operation data No.0 can be set by the external potentiometer or external DC voltage.

(a) Setting by the external potentiometer

Connect the potentiometer (20kΩ, 1/20W CARBON LINEAR, e.g., PTV09A-4020F-B203) to the 14pin (VH), 15pin (VM) and 16pin (VL) of CN7. You can set the rotational speed while turning to CW or CCW.

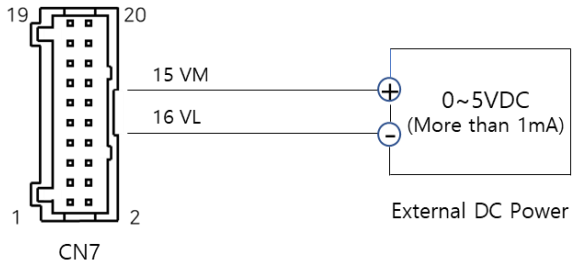




* Potentiometer: PTV09A-4020F-B203 (BOURNS: 1/20W, 20kΩ type)

(b) Setting by the external DC voltage

For the external voltage, use a DC power supply (0 to 5 V) and connect it to the pin 15pin(VM), 16pin(VL) of CN7 of the driver. The input impedance between the VM input and VL input is approximately 47 kΩ. The VL input is connected to LCOM inside the drive.



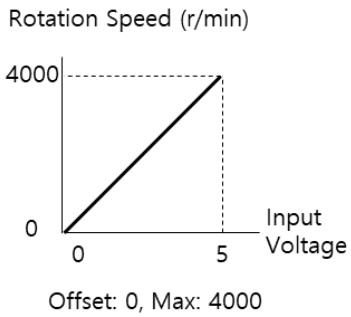
* Be sure to set the external DC voltage to 5V or lower. When connecting the external DC power supply, make sure the polarities are correct. If the polarities are reversed, the driver may be damaged.

(c) Offset and maximum of speed setting when using analog method

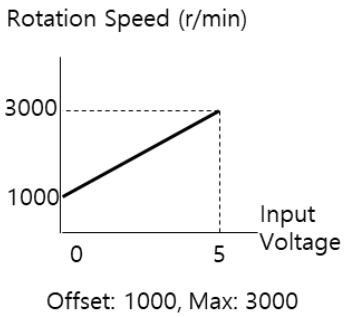
In the case of setting analog speed with an external potentiometer or DC power source, offset and maximum speed values can be set and used as shown below.

Parameter name	Description	Setting range	Initial value
Analog operating speed command offset	Sets the offset for speed command input.	−2000 ~ 2000 r/min	0
Analog operating speed maximum value for external input	Sets the maximum value of rotation speed.	0 ~ 4000 r/min	4000

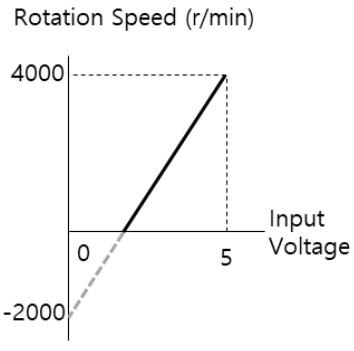
Configuration example) By setting the offset and maximum value for analog speed commands, you can increase the resolution of analog input (potentiometer or DC voltage), allowing for fine adjustments of the speed value.



Offset: 0, Max: 4000



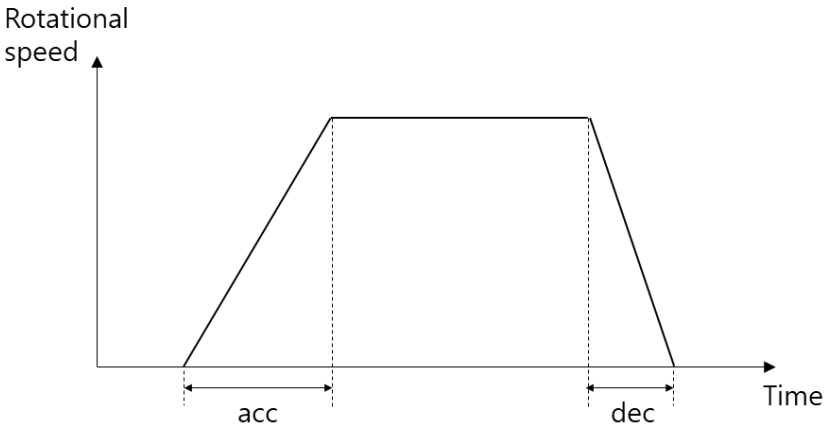
Offset: 1000, Max: 3000



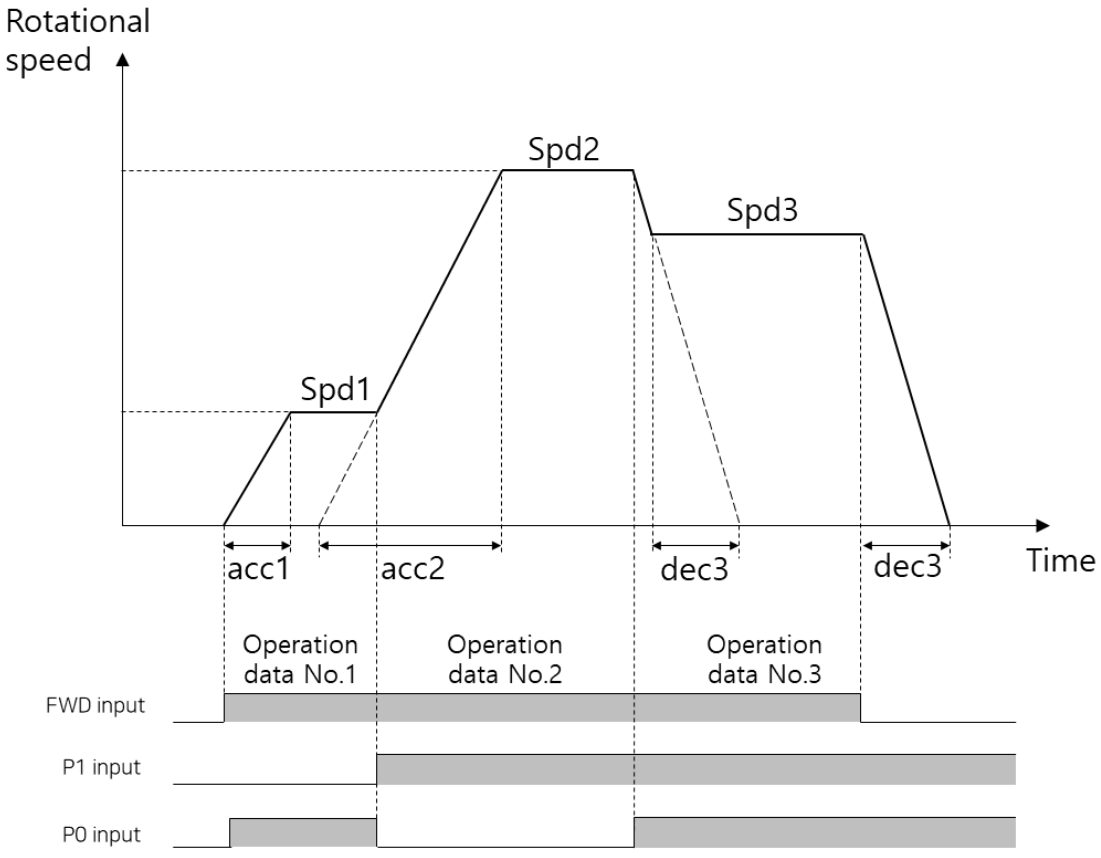
Offset: -2000, Max: 4000

4.2.3 Setting the acceleration time and deceleration time

Acceleration and deceleration times can be set in the operation data No. 0 ~ No. 15. The acceleration time represents the time reached from a standstill to the command speed, and the deceleration time represents the time reached from the command speed to a standstill.



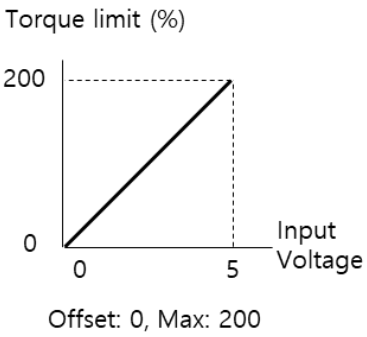
When driving a motor, the acceleration and deceleration time of currently selected operation data are applied. The following diagram shows how the motor behaves based on the acceleration and deceleration times specified for each operation data No. 1 to 3.



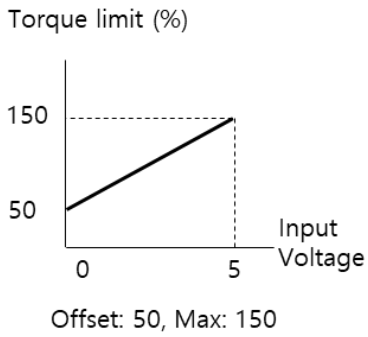
4.2.4 Setting the torque limit

Torque limits can also be set to analog and digital. When setting analog, it can be set with the Potentiometer or DC power input, and the offset and maximum value of the torque limit can be set as in the speed setting.

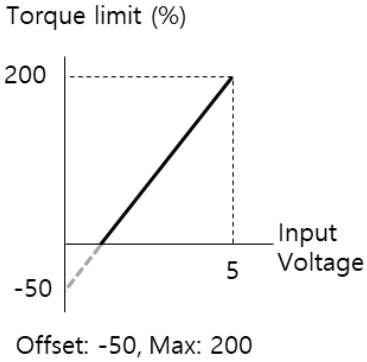
Parameter name	Description	Setting range	Initial value
Analog torque limit offset	Sets the offset for torque limit input	−50 ~ 50 %	0
Analog torque limit maximum value	Sets the maximum value of torque limit	0 ~ 200 %	200



Offset: 0, Max: 200



Offset: 50, Max: 150



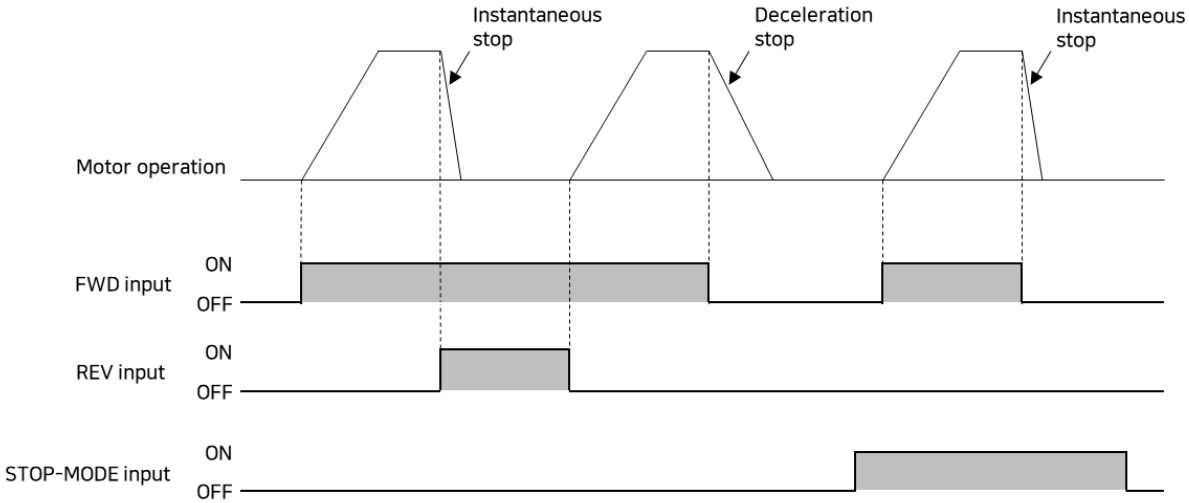
Offset: -50, Max: 200

4.2.5 Running/Stopping the motor

Control the running/stopping of the motor according to the functions set in the I/O input.

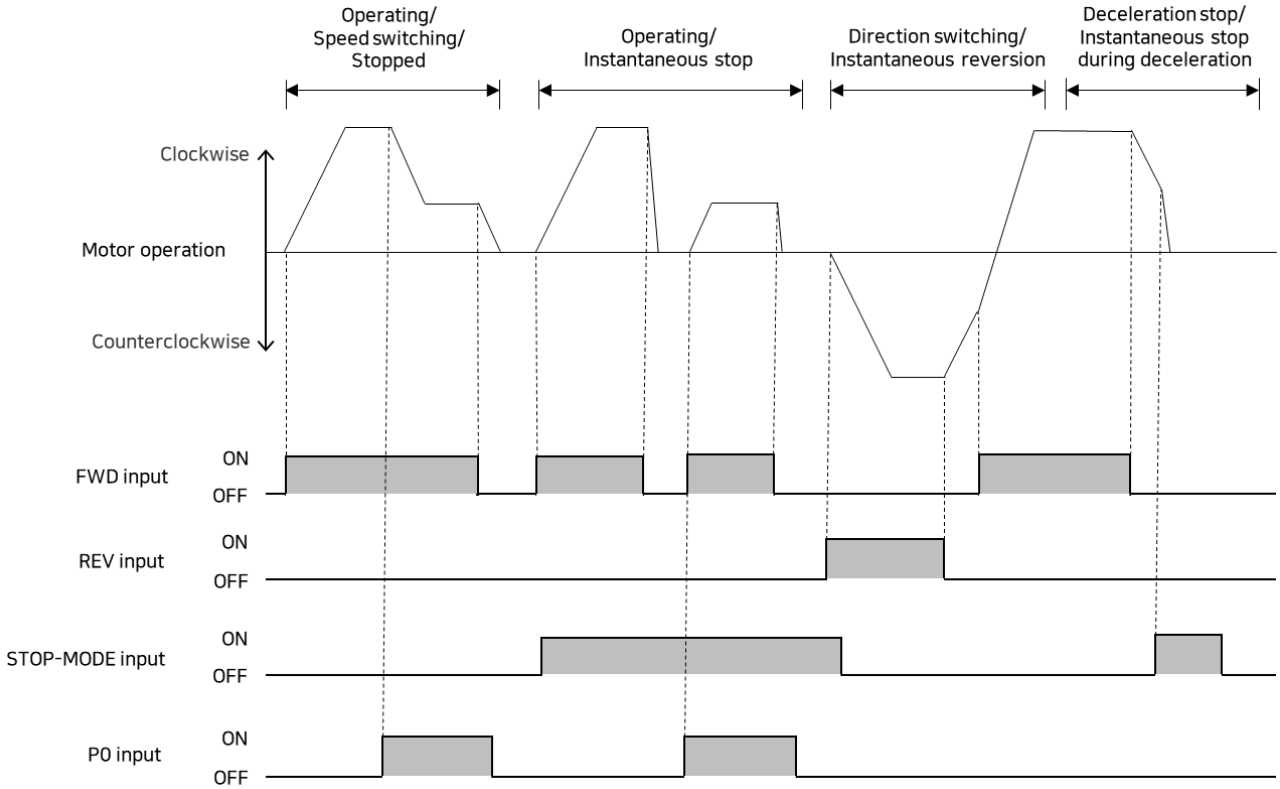
(1) Operation
The motor rotates forward when the FWD input is on, and stops when it's off. Similarly, when the REV input is on, the motor rotates in reverse, and stops when it's off. When both FWD and REV are on, it performs instantaneous stop.

(2) STOP-MODE
The motor stops instantaneously when the STOP-MODE input is on, and decelerates when it’s off.



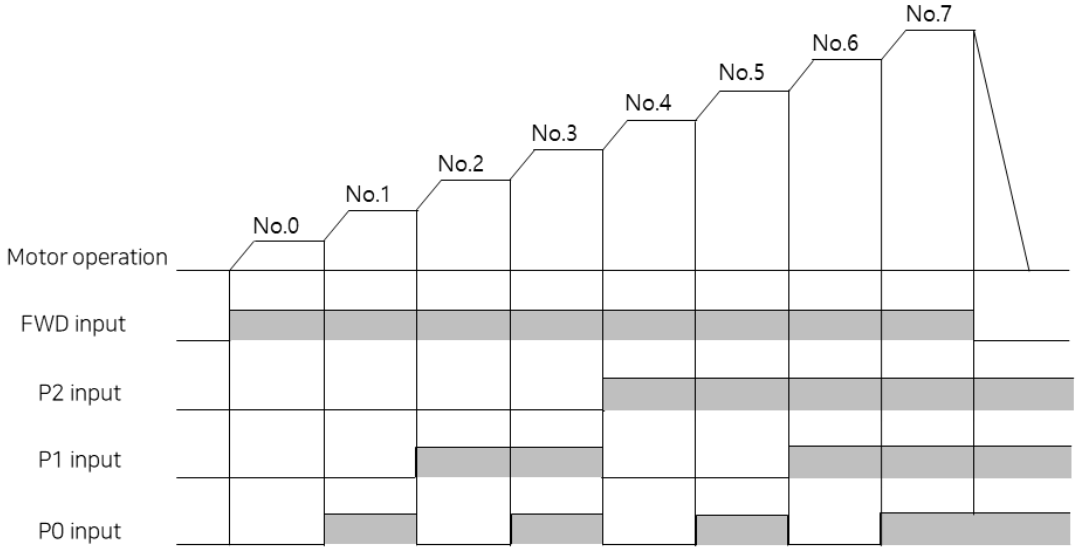
(3) Example of operation pattern

A diagram below is an example of setting the analog speed to 3000 r/min by potentiometer and the rotational speed of the operation data No.1 to 1000 r/min, and switching the speed between these two levels.



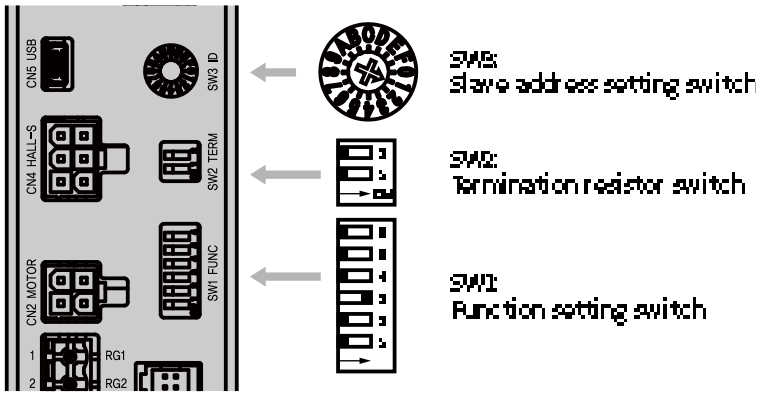
(4) Multi-speed operation

When assigning the (P0 ~ P3) inputs to the CN7 input terminals, the variable-speed driving of the motor is possible using maximum 16 operation data. The picture below shows an example assigning the P0 to P2 inputs and performing multi-speed operation by using 8 operating data.



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

5.1 Setting the switches



(1) Function of SW1

Pin No.	Name	Description
1	Baud1	Set the Baud rate with the combination of pin1 to pin3.
2	Baud2	
3	Baud3	
4	ID_EXT	Use to extend slave address
5	BOOT	Use to update drive programs
6	TEST_RUN	Test operation of motor

(2) Setting the baud rate [bps]

SW1-No.3	SW1-No.2	SW1-No.1	Setting value
OFF	OFF	OFF	9600
OFF	OFF	**ON**	19200
OFF	**ON**	OFF	38400
OFF	**ON**	**ON**	57600
ON	OFF	OFF	115200
ON	OFF	**ON**	Not used
ON	**ON**	OFF	Not used
ON	**ON**	**ON**	Not used

▶ Factory setting:

SW1-No.3: On, SW1-No.2: Off, SW1-No.1: Off

(3) Setting the slave address

SW1-No.4	SW3	Slave address No.
Off	0	Not used
	1	1
	2	2
	3	3
	4	4
	5	5
	6	6
	7	7
	8	8
	9	9
	A	10
	B	11
	C	12
	D	13
	E	14
	F	15

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

▶ Factory setting:
SW1-No.4: Off, SW3: 1

(4) Setting the termination resistor
When multiple drives are interconnected and used on a network, signal distortion can occur due to the reflection wave of communication cables. To ensure system stability, termination resistor should be connected. Therefore, during installation, please use termination resistor of a drive located farthest from the upper-level controller.

SW2-No.1	SW2-No.2	Termination resistor (120Ω)
Off	Off	Not used
On	On	used

▶ Factory setting:
SW2-No.1: Off, SW2-No.2: Off

5.2 Setting the RS-485 communication

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

(1) Parameters set with the Ezi-SPEED Setting program

Parameter name	Description	Setting range	Initial value
Communication parity	Sets the parity for RS-485 communication.	0: No parity 1: Even 2: Odd	1
Communication stop bit	Sets the stop bit for RS-485 communication.	0: 1 bit 1: 2 bits	0
Communication transfer wait time	Sets the transmission waiting time for RS-485 communication.	0 ~ 100 ms	10

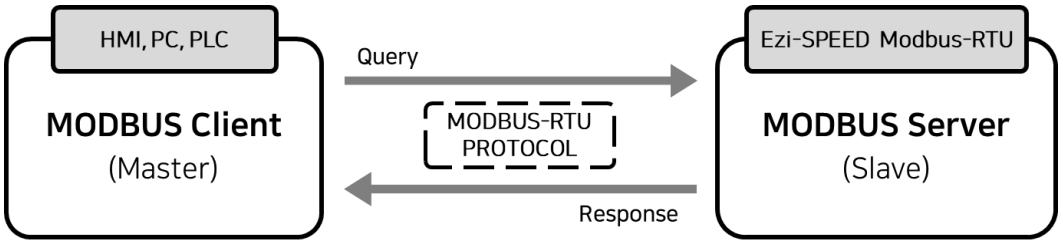
(2) Parameters set with the PC Setting program or RS-485 communication

Parameter name	Description	Setting range	Initial value
Communication time out	Sets the conditions for RS-485 communication timeout to occur.	0: Not Monitored 1 ~ 10000 ms	0
Communication error alarm	Sets the condition for RS-485 communication error alarm to occur	0: Not Monitored 0 ~ 10 times	3

5.3 Communication mode and timing

5.3.1 Modbus-RTU protocol

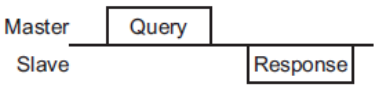
The Modbus-RTU communication standard divides roles into master(client) and slave(server). The slave(server) responds to the data requested by the master(client). Mainly the master is an industrial touch HMI device, or a higher-level device such as PC and PLC, and the Ezi-SPEED Modbus-RTU acts as a slave.



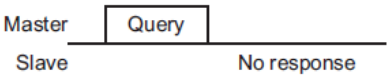
5.3.2 Communication mode

Modbus protocol sends messages in two ways.

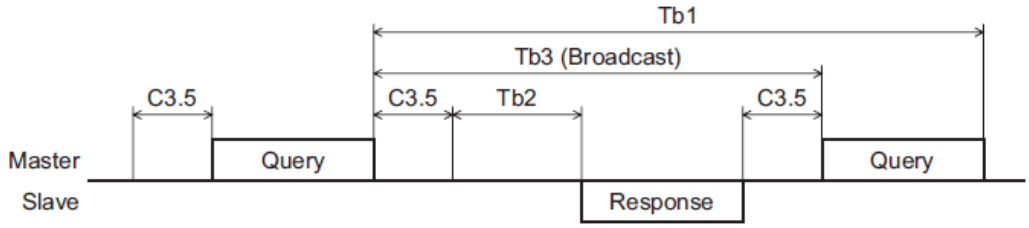
(1) Unicast mode
The master sends a command to only one slave.
The slave executes the process and returns a response.



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



5.3.3 Communication timing



Character	Name	Description
Tb1	Communication time out	Intervals between received messages are monitored. If no message could be received after the time set in the 'communication time out' parameter, the RS-485 communication timeout alarm generates.
Tb2	Transmission waiting time	The time it takes for a slave, after receiving a command from the master, to send a response is called the 'Transmission Wait Time.' The actual transmission wait time is calculated as follows: Silent Interval (C3.5) + Processing Time + Transmission Wait Time (Tb2)
Tb3	Broadcasting interval	When broadcasting, the time it takes to initiate the next command is referred to as the 'Broadcasting interval'. A time longer than the silent interval (C3.5) + 5 ms is required.
C3.5	Silent interval	Be sure to provide a waiting time of 3.5 characters or more. If this waiting time is less than 3.5 characters, the driver cannot respond. See the following table for transmission waiting time.

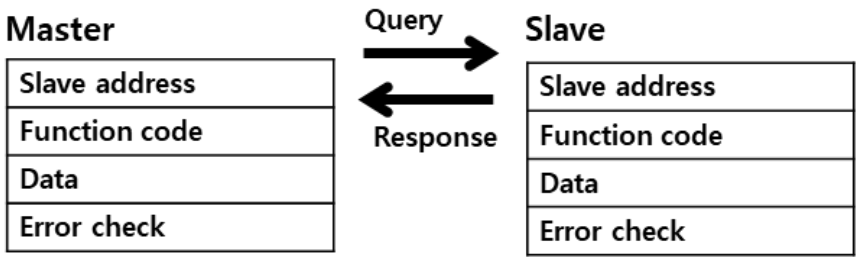
Transmission wait time of the 'Silent interval'

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

5.4 Modbus-RTU frame

5.4.1 Message

The basic structure of massage frame is as follows.



5.4.2 Query

A message that the Modbus master requests to the slave is called a query. Query messages follow the frame of Modbus-RTU, and is shown below.

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

(1) Slave address
Specify the address of the slave to receive the query. The slave address of the Ezi-SPEED-MR can be set from 1 to 31. Setting the slave address to '0' makes it will operate in Broadcast mode.

(2) Function code
Function codes and message length that Ezi-SPEED Modbus-RTU supports are as follows.

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

(3) Data
Sets data associated with the function code. The specific data structure and length varies depending on the function code.

(4) Error check

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

■ CRC-16 calculation method

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

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

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

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

XOR with next byte 07h	0000 0000 0000 0111 1000 0001 0011 1001	-
First shift to right	0100 0000 1001 1100	1
XOR with A001h	1010 0000 0000 0001 1110 0000 1001 1101	-
Second shift to right	0111 0000 0100 1110	1
XOR with A001h	1010 0000 0000 0001 1101 0000 0100 1111	-
Third shift to right	0110 1000 0010 0111	1
XOR with A001h	1010 0000 0000 0001 1100 1000 0010 0110	-
Fourth shift to right	0110 0100 0001 0011	0
Fifth shift to right	0011 0010 0000 1001	1
XOR with A001h	1010 0000 0000 0001 1001 0010 0000 1000	-
Sixth shift to right	0100 1001 0000 0100	0
Seventh shift to right	0010 0100 1000 0010	0
Eighth shift to right	0001 0010 0100 0001	0
Result of CRC-16	0001 0010 0100 0001	-

5.4.3 Response

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

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

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

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

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

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

(b) Other than transmission error
A response may not be returned without any transmission error being detected.

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

(3) Exception response

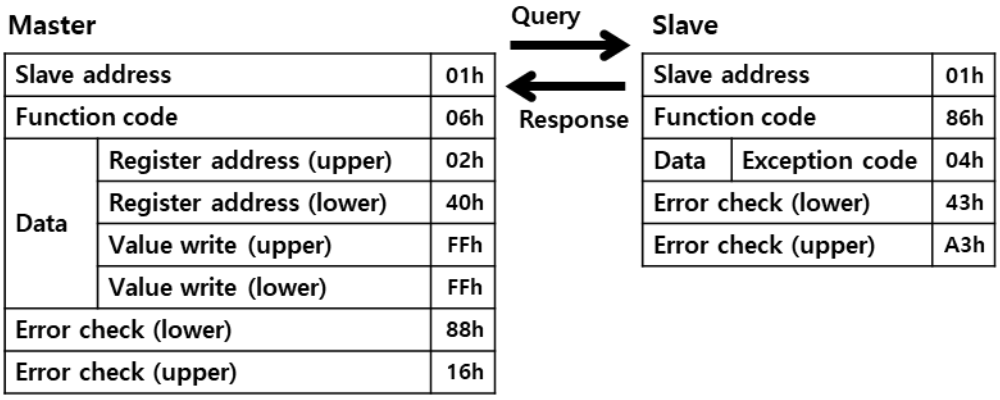
An exception response is returned if the slave cannot execute the process requested by the query. The message structure of exception response is as follows.

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

(a) Function code

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

(b) Example of exception response



Master			Slave		
Slave address		01h	Slave address		01h
Function code		06h	Function code		86h
Data	Register address (upper)	02h	Data	Exception code	04h
	Register address (lower)	40h	Error check (lower)		43h
	Value write (upper)	FFh	Error check (upper)		A3h
	Value write (lower)	FFh			
Error check (lower)		88h			
Error check (upper)		16h			

(c) Exception code

Exception code	Comm. error code	Cause	Description
01h	E0h	Invalid Function	The process could not be executed because the function code was invalid.
02h		Invalid data address	The process could not be executed because the data address was invalid. (Other than 0000h to 1FFFh).
03h	E1h	Invalid data	The process could not be executed because the data was invalid. · The number of registers is 0 or more than 17. · The data length is outside the specified range.
04h	E2h E3h	Slave error	The process could not be executed because an error occurred at the slave. · E2h: Command execute disable · E3h: EEPROM processing in progress

* The communication error codes can be referenced in registers 522 to 532 (decimal).

5.5 Function code

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

This function is used to read Register (16 bits). You can read one register (register address 2 byte, read value 2 byte) or up to 16 consecutive registers (16x16 bits).

[Example]
Read operation data for rotation speed No.0 and No.1 of slave address 1.

Name	Register address	Value read	Corresponding decimal
Rotation speed No.0	03E8h	0064h	100
Rotation speed No.1	03E9h	0FA0h	4000

■ Query

Field name		Data	Description
Slave address		01h	Slave address 1
Function code		03h	Reading from holding registers
Data	Register address(upper)	03h	Register address to start reading from
	Register address(lower)	E8h	
	Number of registers(upper)	00h	Number of registers to be read from the starting register address (2 registers = 0002h)
	Number of registers(lower)	02h	
Error check (lower)		44h	Calculation result of CRC-16
Error check (upper)		7Bh	

■ Response

Field name		Data	Description
Slave address		01h	Slave address 1 (same as query)
Function code		03h	
Data	Number of data bytes	04h	Twice the number of registers in the query
	Value of Register address(upper)	00h	Value read from register address 03E8h
	Value of Register address(lower)	64h	
	Value of Register address(upper)+1	0Fh	Value read from register address 03E9h
	Value of Register address(lower)+1	A0h	
Error check (lower)		BEh	Calculation result of CRC-16
Error check (upper)		64h	

5.5.2 Writing to a holding register (06h)

This function code is used to write data to a specified register address.

[Example]
Write 2000 (07D0h) to rotation speed No.0(03E8h) of slave address 2.

Name	Register address	Value write	Corresponding decimal
Rotation speed No.0	03E8h	07D0h	2000

■ Query

Field name		Data	Description
Slave address		02h	Slave address 2
Function code		06h	Writing to a holding register
Data	Register address(upper)	03h	Register address to be written
	Register address(lower)	E8h	
	Value write (upper)	07h	Value written to the register address
	Value write (lower)	D0h	
Error check (lower)		0Ah	Calculation result of CRC-16
Error check (upper)		25h	

■ Response

Field name		Data	Description
Slave address		02h	Same as query
Function code		06h	
Data	Register address(upper)	03h	
	Register address(lower)	E8h	
	Value write (upper)	07h	
	Value write (lower)	D0h	
Error check (lower)		0Ah	Calculation result of CRC-16
Error check (upper)		25h	

5.5.3 Writing to multiple holding registers (10h)

This function code is used to write data to multiple successive registers. Up to 16 registers can be written.
Note that even when an exception response is returned because some data is invalid as being outside the specified range, etc., other data may have been written properly.

[Example]
Set the following data as acceleration time No.0 ~ No.2 as part of operation data at slave address 4

Name	Register address	Value written	Corresponding decimal
Acceleration time No.0	03F8h	0002h	2
Acceleration time No.1	03F9h	0032h	50
Acceleration time No.2	03FAh	0096h	150

■ Query

Field name		Data	Description
Slave address		04h	Slave address 4
Function code		10h	Writing to multiple holding registers
Data	Register address(upper)	03h	Register address to start writing from
	Register address(lower)	F8h	
	Number of registers (upper)	00h	Number of registers to be written from the starting register address (3 registers=0003h)
	Number of registers (lower)	03h	
	Number of data bytes	06h	Twice the number of registers in the command (3 registers x 2 = 6 registers: 06h)
	Value written to register address(upper)	00h	Value written to register address 03F8h
	Value written to register address(lower)	02h	
	Value written to register address(upper)+1	00h	Value written to register address 03F9h
	Value written to register address(lower)+1	32h	
	Value written to register address(upper)+2	00h	Value written to register address 03FAh
	Value written to register address(lower)+2	96h	
Error check (lower)		39h	Calculation result of CRC-16
Error check (upper)		89h	

■ Response

Field name		Data	Description
Slave address		04h	Same as query
Function code		10h	
Data	Register address(upper)	03h	
	Register address(lower)	F8h	
	Number of registers(upper)	00h	
	Number of registers(lower)	03h	
Error check (lower)		01h	Calculation result of CRC-16
Error check (upper)		E8h	

5.5.4 Diagnosis (08h)

This function code is used to diagnose the communication between the master and slave. Arbitrary data is sent and the returned data is used to determine whether the communication is normal. 0000h is the only sub-function supported by this function code.

[Example]
Send arbitrary data (1234h) to the slave.

■ Query

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

■ Response

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

5.6 Method of control via Modbus RTU

There are two ways to operate the motor via RS-485: 'NET I/O Operation' and 'NET Direct Operation'.

The NET I/O operation selects one of 16-operation data set and operates the motor, and the NET Direct operation operates by inputting a value into the operation data each time.

5.6.1 NET I/O operation

Driving through registers within the drive like a virtual I/O is called network I/O operation. The NET I/O can be used like an I/O device with 16-inputs and 16-outputs, and can be used as needed by assigning functions to each input/output. The Ezi-SPEED Setting program allows you to conveniently set up the function and also check the status of the input/output signal.

The NET I/O operation operates the motor by selecting 16 operation data by combining P0 to P3. In other words, the motor can be operated simply by pre-setting 16 operation data and changing only the combination of P0 to P3.

External I/O and network I/O operate and set up the same way. For more information, see Chapter 5, 'Method of control via I/O.'

■ Example of NET I/O operation

The following example illustrates how to drive from 500 r/min to 1000 r/min using the NET I/O operation method. Network I/O and external I/O are applied to the drive as OR logic. Before performing this example, make sure that all external I/O input signals are turned off (drive has a slave address of 1)

(1) Operation data setting

Set the operation data before giving the FWD or REV command. The operation data consists of rotational speed, acceleration, deceleration and torque limit, and can be set up to 16. This example shows how RS-485 communication changes only the rotational speed of two operation data.

The rotational speed register address of Operation Data No.1 is 03E9h and the rotational speed register of No.2 is 03EAh.

▶ Set the rotational speed of Operation Data No.1 to 500 r/min

Slave address	Function code	Register address		Value written		Error check	
		upper	lower	upper	lower	lower	upper
01h	06h	03h	E9h	01h	F4h	58	6D

▶ Set the rotational speed of Operation Data No.2 to 1000 r/min

Slave address	Function code	Register address		Value written		Error check	
		upper	lower	upper	lower	lower	upper
01h	06h	03h	EAh	03h	E8h	A8	C4

In addition to RS-485 communication, the operation data can be set more easily using the PC Setting program.

(2) NET I/O operation command (operation data No. 1)

FWD and P0 must be entered via NET I/O to drive the motor in the forward direction with Operation Data No. 1. The NET I/O input command register number is 007Dh and the bit functions (initial value) assigned to the register are shown in the following table.

Address (Hex)	Description							
007Dh	bit15	bit14	bit13	bit12	bit11	bit10	bit9	bit8
	NET-IN15 [not used]	NET-IN14 [not used]	NET-IN13 [not used]	NET-IN12 [not used]	NET-IN11 [not used]	NET-IN10 [not used]	NET-IN9 [not used]	NET-IN8 [not used]
	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
	NET-IN7 [not used]	NET-IN6 [TL]	NET-IN5 [STOP-MODE]	NET-IN4 [REV]	NET-IN3 [FWD]	NET-IN2 [P2]	NET-IN1 [P1]	NET-IN0 [P0]

Therefore, please enter 09h value in 007Dh register to input FWD and P0.

Slave address	Function code	Register address		Value written		Error check	
		upper	lower	upper	lower	lower	upper
01h	06h	00h	7Dh	00h	09h	D9	D4

(3) NET I/O operation command (operation data No.2)

FWD and P1 should be entered via NET I/O to drive the motor in the forward direction with Operation Data No.2.

Please enter the 10h value in the 007Dh register to input FWD and P1.

Slave address	Function code	Register address		Value written		Error check	
		upper	lower	upper	lower	lower	upper
01h	06h	00h	7Dh	00h	10h	18	1E

(4) NET I/O stop command

▶ deceleration stops

To decelerate and stop the motor while it is running, the input of the FWD must be released via the NET I/O. When released, the motor will decelerate and stop at the deceleration time set in the currently selected operation data, No.2.

Please enter 02h value in 007Dh register to release FWD and maintain P1.

Slave address	Function code	Register address		Value written		Error check	
		upper	lower	upper	lower	lower	upper
01h	06h	00h	7Dh	00h	02h	98	13

▶ instantaneous stop

To instantaneously stop the motor, the STOP-MODE must be switched on via NET I/O and the FWD input must be released. When released, the motor stops instantaneously regardless of the deceleration time set in the operation data.

Please enter a 20h value in the 007Dh register to input STOP-MODE and release FWD and P1. (Stops quickly regardless of P1, even if you do not turn off the P1 input.)

Slave address	Function code	Register address		Value written		Error check	
		upper	lower	upper	lower	lower	upper
01h	06h	00h	7Dh	00h	20h	18	0A

5.6.2 NET Direct operation

Direct modification of operation data values via RS-485 communication is called NET Direct operation. Operation data can be changed while driving and will be applied immediately. This allows you to operate the motor more finely than selecting the operation data.

■ Example of NET Direct operation

The following example illustrates how to drive from 500 r/min to 1000 r/min using the NET Direct operation method. Assume that Operation Data No.0 is selected in I/O (drive has a slave address of 1)

(1) Input data (500 r/min)

Operation data No.0 is currently selected. So, you should change the value of Rotation Speed No.0. The register address for Rotation Speed No.0 is 03E8h.
Therefore, please enter the value of 01F4h in 03E8h register in order to input 500 in rotation speed.

Slave address	Function code	Register address		Value written		Error check	
		upper	lower	upper	lower	lower	upper
01h	06h	03h	E8h	01h	F4h	09	AD

(2) NET I/O operation command

FWD must be entered via NET I/O to drive the motor in the forward direction with Operation Data No.0. The NET I/O input command register number is 007Dh and the bit functions assigned to the register (initial value) are shown in the following table.

Address (Hex)	Description							
007Dh	bit15	bit14	bit13	bit12	bit11	bit10	bit9	bit8
	NET-IN15 [not used]	NET-IN14 [not used]	NET-IN13 [not used]	NET-IN12 [not used]	NET-IN11 [not used]	NET-IN10 [not used]	NET-IN9 [not used]	NET-IN8 [not used]
	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
	NET-IN7 [not used]	NET-IN6 [TL]	NET-IN5 [STOP-MODE]	NET-IN4 [REV]	NET-IN3 [FWD]	NET-IN2 [P2]	NET-IN1 [P1]	NET-IN0 [P0]

Please enter 08h value in 007Dh register to input FWD.

Slave address	Function code	Register address		Value written		Error check	
		upper	lower	upper	lower	lower	upper
01h	06h	00h	7Dh	00h	08h	18	14

(3) Input data (1000 r/min)

Directly change the value of the currently selected operation data and simply control the motor, The rotational speed register address of the currently selected operation data No.0 is 03E8h.

Therefore, please enter 03E8h value in 03E8h register to input 1000r/min in rotation speed

Slave address	Function code	Register address		Value written		Error check	
		upper	lower	upper	lower	lower	upper
01h	06h	03h	E8h	03h	E8h	09	04

(4) NET I/O stop command

▶Deceleration stops

To decelerate and stop the motor while it is running, the input of the FWD must be released via the NET I/O. When released, the motor will decelerate and stop at the deceleration time set in the currently selected operation data No.0. The initial value of all deceleration times is 0.5s.

Please enter 00h value in 007Dh register to release FWD.

Slave address	Function code	Register address		Value written		Error check	
		upper	lower	upper	lower	lower	upper
01h	06h	00h	7Dh	00h	00h	19	D2

▶Instantaneous stop

To instantaneously stop the motor, the STOP-MODE must be switched on and the FWD input must be released. When released, the motor stops instantaneously regardless of the deceleration time.

Please enter a 20h value in the 007Dh register to enter STOP-MODE and release FWD.

Slave address	Function code	Register address		Value written		Error check	
		upper	lower	upper	lower	lower	upper
01h	06h	00h	7Dh	00h	20h	18	0A

5.7 Register address list

All register address and data are 16 bits each and treated as big endian.

5.7.1 Product version

These commands are used to check the Product code, FW, HW, etc. All commands are 'READ only'.

Register address		Name	Description
Dec	Hex		
2	0002h	Product Number (Model Code)	Corresponding model code for the Ezi-SPEED series (4001: Ezi-SPEED Modbus-RTU)
3	0003h	HW Version	HW version: 1Byte(Major).1Byte(Minor)
4	0004h	FW Version UPPER	FW version upper: 1Byte(Major).1Byte(Minor)
5	0005h	FW Version LOWER	FW version lower: 1Byte(Bug).1Byte(Build)
6	0006h	FW Version Type	FW version type (Add derivatives when they occur)
8	0008h	Motor No.	Motor type 5001: 30W GGM, 5002: 60W GGM, 5003: 90W GGM, 5004: 120W GGM, 5005: 200W GGM, 5006: 400W GGM

5.7.2 Operation commands

These are commands related to motor operation. Operation commands are not saved in the EEPROM.

Register address		Name	Description	Read/ Write	Setting range
Dec	Hex				
49	0031h	Group	Sets the group address	R/W	-1: No group specification 1~31: Group address
125	007Dh	Driver input command	Sets the input command to the drive	R/W	See the following explanation
127	007Fh	Driver output command	Reads the output status of the drive	R	See next page

(1) Group (0031h)

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

* [ ]: Initial value

(2) Drive input command (007Dh)

These are the drive input signals that can be accessed via RS-485 communication.

Address (Hex)	Description							
007Dh	bit15	bit14	bit13	bit12	bit11	bit10	bit9	bit8
	NET-IN15 [not used]	NET-IN14 [not used]	NET-IN13 [not used]	NET-IN12 [not used]	NET-IN11 [not used]	NET-IN10 [not used]	NET-IN9 [not used]	NET-IN8 [not used]
	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
	NET-IN7 [not used]	NET-IN6 [TL]	NET-IN5 [STOP-MODE]	NET-IN4 [REV]	NET-IN3 [FWD]	NET-IN2 [P2]	NET-IN1 [P1]	NET-IN0 [P0]

* [ ]: Initial value

(3) Drive output command (007Fh)

These are the drive output signals that can be received via RS-485 communication.

Address (Hex)	Description							
007Fh	bit15	bit14	bit13	bit12	bit11	bit10	bit9	bit8
	NET-OUT15 [TLC]	NET-OUT14 [VA]	NET-OUT13 [MOVE]	NET-OUT12 [OVER-LOAD]	NET-OUT11 [not used]	NET-OUT10 [not used]	NET-OUT9 [DIR]	NET-OUT8 [S-BSY]
	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
	NET-OUT7 [ALARM-OUT]	NET-OUT6 [WNG]	NET-OUT5 [STOP-MODE_R]	NET-OUT4 [REV_R]	NET-OUT3 [FWD_R]	NET-OUT2 [P2_R]	NET-OUT1 [P1_R]	NET-OUT0 [P0_R]

* [ ]: Initial value

5.7.3 Maintenance commands

These commands are used to reset alarms and records, and thy are also used to execute the batch processing for the EEPROM. All commands are executed when writing from 0 to 1.

Register address		Name	Description	Setting range
Dec	Hex			
300	012Ch	Reset alarm	Resets the alarms that are present.	0,1
301	012Dh	Clear alarm records	Clears alarm records.	
302	012Eh	Clear warning records	Clears warning records.	
303	012Fh	Clear communication error records	Clears the communication error records.	
304	0130h	Configuration	Executes the parameter recalculation and the setup, when there is no alarm and operation.	
305	0131h	All data initialization*1	Resets the operation data and parameters saved in the EEPROM, to their defaults.	
306	0132h	Batch EEPROM read	Reads the parameters saved in the EEPROM, to the RAM. All operation data and parameters previously saved in the RAM are overwritten.	
307	0133h	Batch EEPROM write*2	Writes the parameters saved in the RAM to the EEPROM.	

* 1: Communication parity, communication stop bit and transmission waiting time are not initialized. Initialize them using the PC Setting program.

*2: EEPROM can be rewritten approximately 100,000 times.

5.7.4 Monitor commands

These commands are used to monitor the command position, command speed, alarm and warning records, etc. All commands are 'READ only'.

Register address		Name	Description	Range
Dec	Hex			
500	01F4h	Present alarm	Monitors the present alarm code	00h ~ FFh
501	01F5h	Alarm record 1	Monitors the alarm records	
502	01F6h	Alarm record 2		
503	01F7h	Alarm record 3		
504	01F8h	Alarm record 4		
505	01F9h	Alarm record 5		
506	01FAh	Alarm record 6		
507	01FBh	Alarm record 7		

508	01FCh	Alarm record 8		
509	01FDh	Alarm record 9		
510	01FEh	Alarm record 10		
511	01FFh	Present warning	Monitors the present warning code	00h ~ FFh
512	0200h	Warning record 1	Monitors the warning records	
513	0201h	Warning record 2		
514	0202h	Warning record 3		
515	0203h	Warning record 4		
516	0204h	Warning record 5		
517	0205h	Warning record 6		
518	0206h	Warning record 7		
519	0207h	Warning record 8		
520	0208h	Warning record 9		
521	0209h	Warning record 10		
522	020Ah	Present communication error	Monitors the last received communication error code	00h ~ FFh
523	020Bh	Comm error record 1	Monitors the communication error records that have occurred in the past.	
524	020Ch	Comm error record 2		
525	020Dh	Comm error record 3		
526	020Eh	Comm error record 4		
527	020Fh	Comm error record 5		
528	0210h	Comm error record 6		
529	0211h	Comm error record 7		
530	0212h	Comm error record 8		
531	0213h	Comm error record 9		
532	0214h	Comm error record 10		
533	0215h	Present operation data No.	Monitors the operation data No., corresponding to the data used in the current operation	0 ~ 15
534	0216h	Command speed	Monitors the command speed	-4000~4000 r/min
535	0217h	Feedback speed	Monitors the feedback speed	-5200~5200 r/min
537	0219h	Direct I/O status	Monitors the direct I/O	See next table
538	021Ah	Operation speed	Monitors the feedback speed calculated by the ‘reduction gear rate’ parameter or ‘amplification speed rate’ parameter	−20050 ~ +20050 r/min
539	021Bh	Operation speed decimal position	Monitors the decimal position in the operation speed	0: (x1) 1: (x0.1)

				2: (x0.01) 3: (x0.001)
540	021Ch	Conveyor transfer speed	Monitors the feedback speed calculated by the 'conveyor reduction gear rate' parameter or 'conveyor amplification speed rate' parameter.	−20050 ~ +20050 r/min
541	021Dh	Conveyor transfer speed decimal position	Monitors the decimal position in the conveyor transfer speed	0: (x1) 1: (x0.1) 2: (x0.01) 3: (x0.001)
542	021Eh	Load factor	Monitors the torque that is output by the motor based on the rated torque being 100%	0~200%
543	021Fh	External analog speed setting	Monitors the value of the analog speed setting	0 ~ 4000 r/min
544	0220h	External analog torque limit setting	Monitors the value of the analog torque limiting	0~200%
545	0221h	External analog voltage setting	Monitors the value of the analog voltage setting	0 ~ 50 (1=0.1 V)
547	0223h	Internal IO Input Status (Upper byte)	Monitors the internal input status by external IO input (IN) or NET IO input (NET_IN)	See next table
548	0224h	Internal IO Input Status (Lower byte)	Monitors the internal input status by external IO input (IN) or NET IO input (NET_IN)	See next table
549	0225h	Internal IO Output Status (Upper byte)	Monitors the internal output status by external IO output (OUT) or NET IO output (NET_OUT)	See next table
550	0226h	Internal IO Output Status (Lower byte)	Monitors the internal output status by external IO output (OUT) or NET IO output (NET_OUT)	See next table

- Direct I/O status

Address (Hex)	Description							
0219h	bit15	bit14	bit13	bit12	bit11	bit10	bit9	bit8
	-		-	-	-	-	OUT1	OUT0
	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
	-	IN6	IN5	IN4	IN3	IN2	IN1	IN0

* Each bit of Direct I/O status indicates state of photocouplers. (0: not carrying current, 1: carrying current)

- Internal I/O IN status (Upper)

Address (Hex)	Description							
0223h	bit15	bit14	bit13	bit12	bit11	bit10	bit9	bit8
	-	-	-	-	-	-	EXT-ER-ROR	ALARM-RESET
	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
	P3	P2	P1	P0	TL	STOP-MODE	REV	FWD

- Internal I/O IN status (Lower)

Address (Hex)	Description							
0224h	bit15	bit14	bit13	bit12	bit11	bit10	bit9	bit8
	R15	R14	R13	R12	R11	R10	R9	R8
	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
	R7	R6	R5	R4	R3	R2	R1	R0

- Internal I/O OUT status (Upper)

Address (Hex)	Description							
0225h	bit15	bit14	bit13	bit12	bit11	bit10	bit9	bit8
	-	-	-	-	-	-	-	-
	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
	P3_R	P2_R	P1_R	P0_R	TL_R	STOP-MODE_R	REV_R	FWD_R

- Internal I/O OUT status (Lower)

Address (Hex)	Description							
0226h	bit15	bit14	bit13	bit12	bit11	bit10	bit9	bit8
	-	-	-	-	-	Analog-Torque	Analog-Speed	S-BSY
	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
	SPEED-OUT	ALARM-OUT	WNG	OVER-LOAD	TLC	DIR	VA	MOVE

5.7.5 Parameter R/W commands

These commands are used to write or read parameters.

(1) Operation data

Register address		Name	Setting range	Initial value
Dec	Hex			
1000 ~ 1015	03E8h ~ 03F7h	Rotational speed No.0 ~ Rotational speed No.15	0, 50 ~ 4000 r/min	0
1016 ~ 1031	03F8h ~ 0407h	Acceleration No.0 ~ Acceleration No.15	2 ~ 150 (1=0.1sec)	5
1032 ~ 1047	0408h ~ 0417h	Deceleration No.0 ~ Deceleration No.15		
1048 ~ 1063	0418h ~ 0427h	Torque limit No.0 ~ Torque limit No.15	0 ~ 200 %	200

(2) User parameters

Register address		Name	Setting range	Initial value	Effective
Dec	Hex				
2005	07D5h	Motor rotation direction	0: CCW 1: CW	1	C
2008	07D8h	Reduction gear rate	100 ~ 9999	100	A
2009	07D9h	Decimal place for reduction gear rate	0: (x1) 1: (x0.1) 2: (x0.01)	2	
2010	07DAh	Amplification speed rate	1 ~ 5	1	
2011	07DBh	Conveyor reduction gear rate	100 ~ 9999	100	
2012	07DCh	Decimal place for conveyor reduction gear rate	0: (x1) 1: (x0.1) 2: (x0.01)	2	
2013	07DDh	Conveyor amplification speed rate	1 ~ 5	1	
2015	07DFh	No operation at initial run	0: disable 1: enable	0	C

Register address		Name	Setting range	Initial value	Effective
Dec	Hex				
2019	07E3h	Analog input signal select	0: Analog invalid 1: Analog speed 2: Analog torque	1	
2020	07E4h	Holding Motor at Stop	0: disable 1: enable	0	
2021	07E5h	Velocity attainment width	0~400 r/min	200	A
2100	0834h	IN0 function select	See below table	1: FWD	B
2101	0835h	IN1 function select		2: REV	
2102	0836h	IN2 function select		19: STOP-MODE	
2103	0837h	IN3 function select		48: P0	
2104	0838h	IN4 function select		49: P1	
2105	0839h	IN5 function select		50: P2	
2106	083Ah	IN6 function select		24: ALARM-RE-SET	
2107	083Bh	IN0 contact configuration	0: Normally open 1: Normally closed	0	C
2108	083Ch	IN1 contact configuration			
2109	083Dh	IN2 contact configuration			
2110	083Eh	IN3 contact configuration			
2111	083Fh	IN4 contact configuration			
2112	0840h	IN5 contact configuration			
2113	0841h	IN6 contact configuration			
2114	0842h	OUT0 function select	See below table	85: SPEED-OUT	A
2115	0843h	OUT1 function select		65: ALARM - OUT	
2116	0844h	NET-IN0 function select	See below table	48: P0	C
2117	0845h	NET-IN1 function select		49: P1	
2118	0846h	NET-IN2 function select		50: P2	
2119	0847h	NET-IN3 function select		1: FWD	
2120	0848h	NET-IN4 function select		2: REV	
2121	0849h	NET-IN5 function select		19: STOP-MODE	
2122	084Ah	NET-IN6 function select		54: TL	
2123	084Bh	NET-IN7 function select		0: Not used	
2124	084Ch	NET-IN8 function select			
2125	084Dh	NET-IN9 function select			
2126	084Eh	NET-IN10 function select			
2127	084Fh	NET-IN11 function select			
2128	0850h	NET-IN12 function select			

Register address		Name	Setting range	Initial value	Effective
Dec	Hex				
2129	0851h	NET-IN13 function select			
2130	0852h	NET-IN14 function select			
2131	0853h	NET-IN15 function select			
2132	0854h	NET-OUT0 function select	See below table	48: P0_R	C
2133	0855h	NET-OUT1 function select		49: P1_R	
2134	0856h	NET-OUT2 function select		50: P2_R	
2135	0857h	NET-OUT3 function select		1: FWD_R	
2136	0858h	NET-OUT4 function select		2: REV_R	
2137	0859h	NET-OUT5 function select		19: STOP-MODE_R	
2138	085Ah	NET-OUT6 function select		66: WNG	
2139	085Bh	NET-OUT7 function select		65: ALARM-OUT	
2140	085Ch	NET-OUT8 function select		80: S-BSY	
2141	085Dh	NET-OUT9 function select		84: DIR	
2142	085Eh	NET-OUT10 function select		0: Not used	
2143	085Fh	NET-OUT11 function select			
2144	0860h	NET-OUT12 function select		81: OVERLOAD	
2145	0861h	NET-OUT13 function select		68: MOVE	
2146	0862h	NET-OUT14 function select		77: VA	
2147	0863h	NET-OUT15 function select		71: TLC	
2201	0899h	Analog operating speed command offset	-2000~2000 r/min	0	A
2203	089Bh	Analog torque limit offset	-50~50 %	0	
2204	089Ch	Analog operating speed maximum for external input	0~4000 r/min	4000	
2205	089Dh	Analog torque limit maximum for external input	0~200 %	200	
2300	08FCh	Communication time out	0: Not monitored 1 ~ 10000 ms	0	
2301	08FDh	Communication error alarm	1 ~ 10 times	3	

* Effective indicates the timing for the data to become effective. (A: Effective immediately, B: Effective after stopping the operation, C: Effective after executing the configuration) All parameters become effective when save the parameters to the EEPROM and reboot the power.

(a) 'Analog input signal select' parameter

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

'Analog input signal select'	Operation data No.	Rotation speed	Acceleration / Deceleration	Torque limit
0: Analog invalid	0 ~ 15	Digital setting		
1: Analog speed (initial value)	0	Analog setting	Digital setting	
	1 ~ 15	Digital setting		
2: Analog torque	0 ~ 15	Digital setting		Analog setting

Setting example)

- When setting all operation data with digital setting: 'Analog input signal select' = '0'
- When setting only the rotation speed in the operation data No.0 using the analog setting: 'Analog input signal select' = '1'
- When setting the torque limit using the analog setting: 'Analog input signal select' = '2'

(b) 'No operation at initial run' parameter

Sets the behavior when the power is turned on with the FWD or REV on.

0: Normal operation, 1: Alarm occurrence

(c) 'Holding Motor at Stop' parameter

Electrical brake retention when stopped. For example, it can be used as a conveyer for carrying out work during a stop.

Caution)

- ▶ Loads up to 50% rated torque can be maintained.
- ▶ Limited to 'Torque limit' of Operation data which is on.
- ▶ If the power supply to the drive is turned off, the holding force will disappear, so it can't be used to prevent falls in the event of a power outage.

(3) Setting items for I/O signal assignment

(a) IN function select parameter

0: Not used	32: R0	38: R6	44: R12	50: P2
1: FWD	33: R1	39: R7	45: R13	51: P3
2: REV	34: R2	40: R8	46: R14	54: TL
19: STOP-MODE	35: R3	41: R9	47: R15	
21: EXT-ERROR	36: R4	42: R10	48: P0	
24: ALARM-RESET	37: R5	43: R11	49: P1	

(b) OUT function select parameter

0: Not used	35: R3	42: R10	49: P1_R	71: TLC
1: FWD_R	36: R4	43: R11	50: P2_R	77: VA
2: REV_R	37: R5	44: R12	51: P3_R	80: S-BSY
19: STOP-MODE_R	38: R6	45: R13	54: TL_R	81: OVERLOAD
32: R0	39: R7	46: R14	65: ALARM-OUT	84: DIR
33: R1	40: R8	47: R15	66: WNG	85: SPEED-OUT
34: R2	41: R9	48: P0_R	68: MOVE	

(c) NET-IN function select parameter

0: Not used	33: R1	38: R6	43: R11	48: P0
1: FWD	34: R2	39: R7	44: R12	49: P1
2: REV	35: R3	40: R8	45: R13	50: P2
19: STOP-MODE	36: R4	41: R9	46: R14	51: P3
32: R0	37: R5	42: R10	47: R15	54: TL

(d) NET-OUT function select parameter

0: Not used	35: R3	42: R10	49: P1_R	71: TLC
1: FWD_R	36: R4	43: R11	50: P2_R	77: VA
2: REV_R	37: R5	44: R12	51: P3_R	80: S-BSY
19: STOP-MODE_R	38: R6	45: R13	54: TL_R	81: OVERLOAD
32: R0	39: R7	46: R14	65: ALARM-OUT	84: DIR
33: R1	40: R8	47: R15	66: WNG	
34: R2	41: R9	48: P0_R	68: MOVE	

5.8 Group send

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

(1) Group composition

A group consists of one parent slave and child slaves and only the parent slave returns a response. All slaves have to be connected with master by daisy chain.

(2) Group address setting

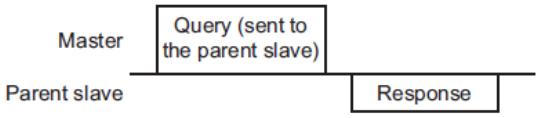
To configure a group, set the same number as the address of the parent slave in the group address of the child slave. At this time, set the group address in unicast mode.

Register address		Name	Description	READ/ WRITE	Setting range
Dec	Hex				
49	0031h	Group	Sets the group address	R/W	-1: No group specification (Group send is not performed) 1~31: Group address (Address number of parent slave)

* Since the group setting is not saved in the EEPROM even when the 'batch NV memory write' executes, the group setting will be cleared when turning the drive power OFF.

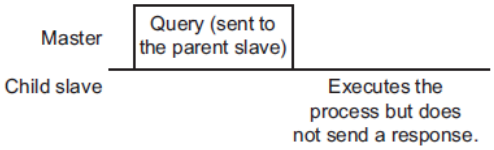
(3) Parent slave

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



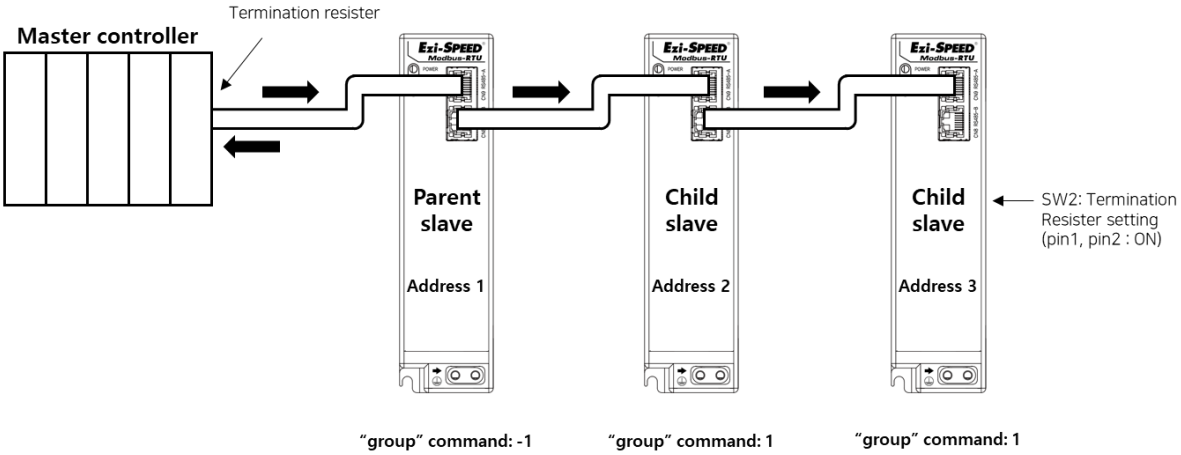
(4) Child slave

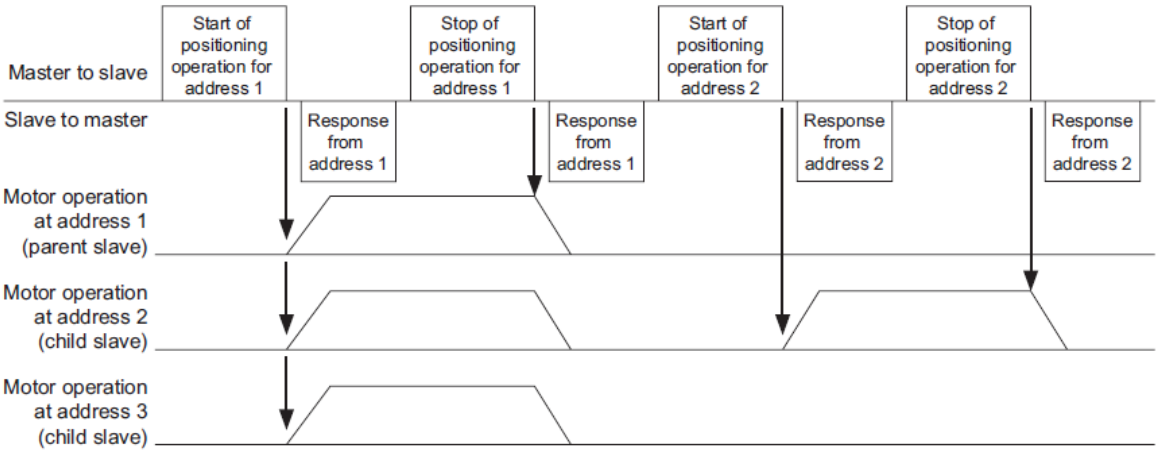
If the slave address sent from the master is the same as the set group address, child slave executes the command but does not send a response.



(5) Example of 'group send'

The following describes the operation when the function code '06h' (write to a holding register) is sent to the group command.





5.9 Detection of communication errors

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

5.9.1 Communication errors

A communication error record will be saved in the RAM. You can check the communication errors via PC Setting program or via RS-485 communication using the 'communication error record' command.
* The communication error record will be cleared once the driver power is turned off.

Type of communication error	Error code	Cause
RS-485 communication error	12h	A transmission error was detected.
RS-485 comm timeout	13h	If communication with the master is not connected.
Command not yet defined	E0h	An exception response (exception code 01h, 02h) was detected.
Outside setting range	E1h	An exception response (exception code 03h) was detected.
Command execute disable	E2h	An exception response (exception code 04h) was detected.
EEPROM processing in progress	E3h	An exception response (exception code 04h) was detected.

5.9.2 Alarms and warning (related to communication error)

When an alarm generates, the ALARM-OUT output will turn OFF and the motor will stop. At the same time, the ALM LED will start blinking. When a warning generates, the WNG output will turn ON. The motor will continue to operate. Once the cause of the warning is removed, the WNG output will turn OFF automatically.

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

Code (HEX)	Items	Description
20h	Warning	Warning generates when a RS-485 comm error (84h) has been detected.
12h	Alarm	An alarm generates when a RS-485 comm error (84h) has been detected consecutively by the number of times set in the 'communication error alarm' parameter.

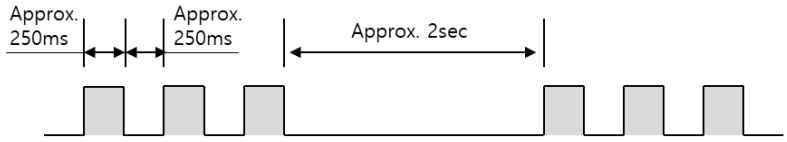
(2) RS-485 communication timeout (13h)
If communication is not established with the master after an elapse of the time set by the 'communication time out' parameter, the RS-485 communication timeout alarm will generate.

6 Troubleshooting

6.1 Alarms

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

e.g., Sensor error alarm (number of blinks :3)

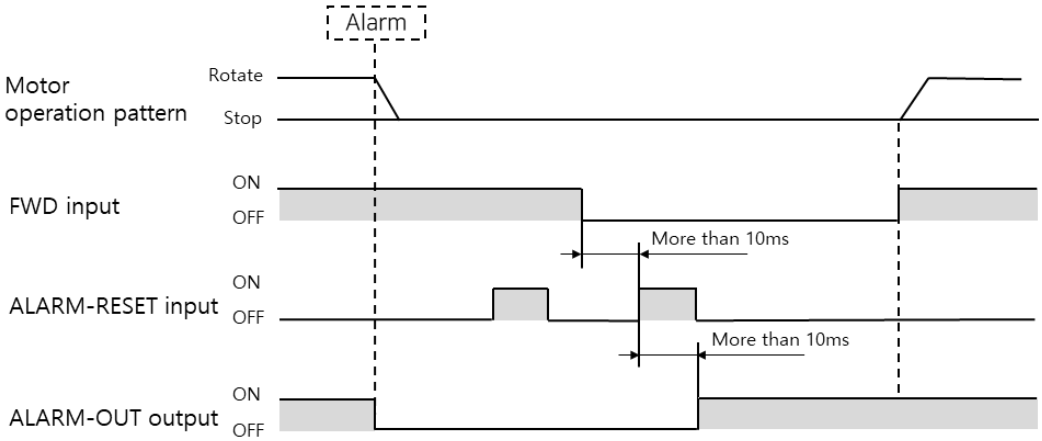


(1) Alarm reset
Before resetting an alarm, always remove the cause of the alarm and ensure safety, and perform one of the reset operations specified below.

(a) Turn the ALARM-RESET input to ON and then OFF.

[Using ALARM-RESET input method]

To reset an alarm, turn both the FWD input and REV input OFF, and remove the cause of the alarm before turning the ALARM-RESET input ON (keep it ON for 10 ms or more). The ALARM-RESET input is disabled while the FWD input or REV input is ON.



(b) Perform an alarm reset using RS-485 communication.

(c) Perform an alarm reset using PC Setting program.

(d) Cycle the power.

(2) Alarm records

Up to 10 generated alarms are saved in the EEPROM in order of the latest to oldest. The alarm records can be read or cleared via PC Setting program or RS-485 communication.

(3) Alarm list

Error Code (HEX)	No. of LED blinks	Alarm type	Cause	Remedial action
1h	1	Overcurrent *1	If excessive current flow through the ground of drive, etc.	Check the wiring between the drive and motor for damage, and then cycled the power.
2h	2	Overspeed	If the rotational speed of the motor output shaft exceeds about 4400r/min.	• Decrease the load. • Review the operation pattern settings such as the acceleration/deceleration time.
5h	5	Overtemperature	If the temperature inside the drive is higher than 85℃.	• Lower the ambient temperature, reducing the load. • make interval distance more than 25mm between the drives.
6h	6	Overvoltage	• If the power voltage is approximately 20% above the rated voltage. • If a vertical drive load is applied to the motor or a sudden load exceeding the allowable load inertia is applied.	• Check the main power supply voltage. • If this alarm occurs during operation, reduce the load or increase the acceleration/deceleration time. • Use a regeneration unit.
8h	8	Sensor error	If the motor sensor signal line is disconnected or the connector is disconnected.	Check the connection between the driver and motor.
9h	9	Undervoltage	If the power voltage is lowered by about 60% of the rated voltage.	Check the main power supply voltage.
Bh	11	Internal circuit error	If something is wrong with the internal circuit.	If the alarm does not reset even after the power

Error Code (HEX)	No. of LED blinks	Alarm type	Cause	Remedial action
				has been cycled, contact your nearest office.
Ch	12	EEPROM error	If the stored data is damaged or the read/write of the EEPROM does not work.	Initialize the parameters via PC Setting program. If the alarm does not reset even after the power has been cycled, contact your nearest office.
10h	16	External Error	If the EXT-ERROR input set to I/O IN is received.	Remove the cause of EXT-ERROR and reset the alarm.
11h	17	Initial operation inhibition	If power is applied while FWD or REV input is on. (Only works when the 'No operation at initial run' parameter is set to 1)	Turn the FWD input and REV input OFF, and then cycle the DC24V power supply.
12h	18	RS-485 comm error	If continuous errors occurred as many times as set in the 'communication error alarm' during communicating with RS-485.	Check the connection between the master controller and drive. Check the setting of RS-485 communication.
13h	19	RS-485 comm timeout	If communication with the master is not connected for the time set in the 'communication time out' parameter.	Check the connection between the master controller and drive.

*1: Resetting the alarm for Overcurrent is not possible with the reset command, but only when the drive is cycled.

⚠ **Caution**	• If the power cycle does not function normally, there is a concern that the internal circuit may be damaged. Please contact the nearest sales office. • Continuing the operation without removing the cause of the alarm may cause the device to fail.

6.2 Warnings

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

(1) Warning list

Code (HEX)	Warning type	Cause	Remedial action
20h	Overload	The load of the motor exceeded the overload warning level.	• Decrease the load. • Review the operation pattern settings such as increasing the acceleration/deceleration time.
21h	RS-485 comm error	The RS-485 communication error was detected.	• Check the connection between the master controller and drive. • Check the setting of RS-485 communication.

(2) Warning records

Up to 10 generated warnings are saved in the RAM in order of the latest to oldest. The warning records can be read or cleared via PC Setting program or RS-485 communication.

⚠ **Caution**	When the drive is powered off, the warning records is cleared.

6.3 Communication errors

If a communication error occurs, the error code is stored in RAM, but the motor continues to operate.

(1) Communication error list

Code (HEX)	Communication error type	Cause	Remedial action
12h	RS-485 comm error	Framing error or CRC error is detected.	• Check the connection between the master controller and drive. • Check the setting of RS-485 communication.
13h	RS-485 comm timeout	If communication with the master is not connected for the time set in the 'communication time out' parameter.	Check the connection between the master controller and drive.
E0h	Command not yet defined	The command requested by the master is undefined.	Check the setting value for the command.
E1h	Outside setting range	The setting data requested by the master could not be executed due to outside the range.	Check the setting data.
E2h	Command executes disable	When the command is unable to execute.	Check the drive status.
E3h	EEPROM processing in progress	The command could not be executed because the driver was performing the EEPROM processing.	Wait until the internal processing will be completed.

(2) Communication error records

Up to 10 generated communication errors are saved in the EEPROM in order of the latest to oldest. The communication error records can be read or cleared via PC Setting program or RS-485 communication.

⚠ **Caution**	When the drive is powered off, the communication error records is cleared.

6.4 Troubleshooting and remedial actions

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

Phenomenon	Possible cause	Remedial action
The motor does not operate.	The power supply is not connected correctly.	Check the connection of the power supply.
	Both the FWD input and REV input are off or on.	Turn on either the FWD input or REV input.
	The ALM LED is blinking.	An alarm generated due to a protective function being triggered.
The motor rotates in the direction opposite to the specified direction.	The FWD input and REV input are not connected correctly.	Check the connection of the FWD input and REV input. The motor rotates in the clockwise direction when the FWD input is on, and in the counterclockwise direction when the REV input is on.
	Parallel gearhead output shaft rotation direction is opposite to the motor output shaft rotation direction.	Check the direction of the gear shaft rotation by gear ratio. To change the direction of rotation of the motor, change the 'Motor rotation direction' setting of 'Function setting parameters' in the Ezi-SPEED Setting program.
Motor operation is unstable. Motor vibration is too loud	The motor (gearhead) output shaft is not misaligned with the load shaft.	Check the coupling condition of the motor (gearhead) output shaft and load shaft.
	Effect of external noise.	If only the motor and driver operate normally and malfunction occurs only when used with other equipment, check as follows. • Increase the distance from sources of noise. • Recheck the wiring condition. • Change the signal cable to a shielded type. • Install a ferrite core.
The motor doesn't stop instantaneously.	The STOP-MODE input is OFF.	To cause the motor to stop instantaneously, turn on the STOP-MODE input.

Appendix 1 Motor/Drive Combination tables

1.1 Standard motor, Drive

Power	Unit Product No.	Motor Product No.	Drive Product No.
30W	Ezi-SPEED-MR-60-S-30-C	ESM-60-S-30	ESD-MR-30-C
60W	Ezi-SPEED-MR-80-S-60-C	ESM-80-S-60	ESD-MR-60-C
120W	Ezi-SPEED-MR-90-S-120-C	ESM-90-S-120	ESD-MR-120-C
200W	Ezi-SPEED-MR-104-S-200-C	ESM-104-S-200	ESD-MR-200-C
400W	Ezi-SPEED-MR-104-S-400-C	ESM-104-S-400	ESD-MR-400-C

1.2 Gearhead mounted motor, Drive

Power	Unit Product No.	Motor Product No.	Drive Product No.	Gearhead Product No.	Gear Ratio
30W	Ezi-SPEED-MR-60-H-30-C-R5-P	ESM-60-H-30	ESD-MR-30-C	ESG-60-H-R5-P	1:5
	Ezi-SPEED-MR-60-H-30-C-R5-H			ESG-60-H-R5-H	
	Ezi-SPEED-MR-60-H-30-C-R10-P			ESG-60-H-R10-P	1:10
	Ezi-SPEED-MR-60-H-30-C-R10-H			ESG-60-H-R10-H	
	Ezi-SPEED-MR-60-H-30-C-R15-P			ESG-60-H-R15-P	1:15
	Ezi-SPEED-MR-60-H-30-C-R15-H			ESG-60-H-R15-H	
	Ezi-SPEED-MR-60-H-30-C-R20-P			ESG-60-H-R20-P	1:20
	Ezi-SPEED-MR-60-H-30-C-R20-H			ESG-60-H-R20-H	
	Ezi-SPEED-MR-60-H-30-C-R30-P			ESG-60-H-R30-P	1:30
	Ezi-SPEED-MR-60-H-30-C-R30-H			ESG-60-H-R30-H	
	Ezi-SPEED-MR-60-H-30-C-R50-P			ESG-60-H-R50-P	1:50
	Ezi-SPEED-MR-60-H-30-C-R50-H			ESG-60-H-R50-H	
	Ezi-SPEED-MR-60-H-30-C-R100-P			ESG-60-H-R100-P	1:100
	Ezi-SPEED-MR-60-H-30-C-R100-H			ESG-60-H-R100-H	
	Ezi-SPEED-MR-60-H-30-C-R200-P			ESG-60-H-R200-P	1:200
	Ezi-SPEED-MR-60-H-30-C-R200-H			ESG-60-H-R200-H	
60W	Ezi-SPEED-MR-80-H-60-C-R5-P	ESM-80-H-60	ESD-MR-60-C	ESG-80-H-R5-P	1:5
	Ezi-SPEED-MR-80-H-60-C-R5-H			ESG-80-H-R5-H	
	Ezi-SPEED-MR-80-H-60-C-R10-P			ESG-80-H-R10-P	1:10
	Ezi-SPEED-MR-80-H-60-C-R10-H			ESG-80-H-R10-H	
	Ezi-SPEED-MR-80-H-60-C-R15-P			ESG-80-H-R15-P	1:15
	Ezi-SPEED-MR-80-H-60-C-R15-H			ESG-80-H-R15-H	
	Ezi-SPEED-MR-80-H-60-C-R20-P			ESG-80-H-R20-P	1:20
	Ezi-SPEED-MR-80-H-60-C-R20-H			ESG-80-H-R20-H	
	Ezi-SPEED-MR-80-H-60-C-R30-P			ESG-80-H-R30-P	1:30
	Ezi-SPEED-MR-80-H-60-C-R30-H			ESG-80-H-R30-H	
	Ezi-SPEED-MR-80-H-60-C-R50-P			ESG-80-H-R50-P	1:50
	Ezi-SPEED-MR-80-H-60-C-R50-H			ESG-80-H-R50-H	

Power	Unit Product No.	Motor Product No.	Drive Product No.	Gearhead Product No.	Gear Ratio
	Ezi-SPEED-MR-80-H-60-C-R100-P			ESG-80-H-R100-P	1:100
	Ezi-SPEED-MR-80-H-60-C-R100-H			ESG-80-H-R100-H	
	Ezi-SPEED-MR-80-H-60-C-R200-P			ESG-80-H-R200-P	1:200
	Ezi-SPEED-MR-80-H-60-C-R200-H			ESG-80-H-R200-H	
120W	Ezi-SPEED-MR-90-H-120-C-R5-P	ESM-90-H-120	ESD-MR-120-C	ESG-90-H-R5-P	1:5
	Ezi-SPEED-MR-90-H-120-C-R5-H			ESG-90-H-R5-H	
	Ezi-SPEED-MR-90-H-120-C-R10-P			ESG-90-H-R10-P	1:10
	Ezi-SPEED-MR-90-H-120-C-R10-H			ESG-90-H-R10-H	
	Ezi-SPEED-MR-90-H-120-C-R15-P			ESG-90-H-R15-P	1:15
	Ezi-SPEED-MR-90-H-120-C-R15-H			ESG-90-H-R15-H	
	Ezi-SPEED-MR-90-H-120-C-R20-P			ESG-90-H-R20-P	1:20
	Ezi-SPEED-MR-90-H-120-C-R20-H			ESG-90-H-R20-H	
	Ezi-SPEED-MR-90-H-120-C-R30-P			ESG-90-H-R30-P	1:30
	Ezi-SPEED-MR-90-H-120-C-R30-H			ESG-90-H-R30-H	
	Ezi-SPEED-MR-90-H-120-C-R50-P			ESG-90-H-R50-P	1:50
	Ezi-SPEED-MR-90-H-120-C-R50-H			ESG-90-H-R50-H	
	Ezi-SPEED-MR-90-H-120-C-R100-P			ESG-90-H-R100-P	1:100
	Ezi-SPEED-MR-90-H-120-C-R100-H			ESG-90-H-R100-H	
	Ezi-SPEED-MR-90-H-120-C-R200-P			ESG-90-H-R200-P	1:200
	Ezi-SPEED-MR-90-H-120-C-R200-H			ESG-90-H-R200-H	
200W	Ezi-SPEED-MR-104-H-200-C-R5-P	ESM-104-H-200	ESD-MR-200-C	ESG-104-H-R5-P	1:5
	Ezi-SPEED-MR-104-H-200-C-R5-H			ESG-104-H-R5-H	
	Ezi-SPEED-MR-104-H-200-C-R10-P			ESG-104-H-R10-P	1:10
	Ezi-SPEED-MR-104-H-200-C-R10-H			ESG-104-H-R10-H	
	Ezi-SPEED-MR-104-H-200-C-R15-P			ESG-104-H-R15-P	1:15
	Ezi-SPEED-MR-104-H-200-C-R15-H			ESG-104-H-R15-H	
	Ezi-SPEED-MR-104-H-200-C-R20-P			ESG-104-H-R20-P	1:20
	Ezi-SPEED-MR-104-H-200-C-R20-H			ESG-104-H-R20-H	
	Ezi-SPEED-MR-104-H-200-C-R30-P			ESG-104-H-R30-P	1:30
	Ezi-SPEED-MR-104-H-200-C-R30-H			ESG-104-H-R30-H	
	Ezi-SPEED-MR-104-H-200-C-R50-P			ESG-104-H-R50-P	1:50
	Ezi-SPEED-MR-104-H-200-C-R50-H			ESG-104-H-R50-H	
	Ezi-SPEED-MR-104-H-200-C-R100-P			ESG-104-H-R100-P	1:100
	Ezi-SPEED-MR-104-H-200-C-R100-H			ESG-104-H-R100-H	
	Ezi-SPEED-MR-104-H-200-C-R200-P			ESG-104-H-R200-P	1:200
400W	Ezi-SPEED-MR-104-H-400-C-R5-P	ESM-104-H-400	ESD-MR-400-C	ESG-104-H-R5-P	1:5
	Ezi-SPEED-MR-104-H-400-C-R5-H			ESG-104-H-R5-H	
	Ezi-SPEED-MR-104-H-400-C-R10-P			ESG-104-H-R10-P	1:10
	Ezi-SPEED-MR-104-H-400-C-R10-H			ESG-104-H-R10-H	
	Ezi-SPEED-MR-104-H-400-C-R15-P			ESG-104-H-R15-P	1:15
	Ezi-SPEED-MR-104-H-400-C-R15-H			ESG-104-H-R15-H	
	Ezi-SPEED-MR-104-H-400-C-R20-P			ESG-104-H-R20-P	1:20
	Ezi-SPEED-MR-104-H-400-C-R20-H			ESG-104-H-R20-H	

Power	Unit Product No.	Motor Product No.	Drive Product No.	Gearhead Product No.	Gear Ratio
	Ezi-SPEED-MR-104-H-400-C-R30-P			ESG-104-H-R30-P	1:30
	Ezi-SPEED-MR-104-H-400-C-R30-H			ESG-104-H-R30-H	
	Ezi-SPEED-MR-104-H-400-C-R50-P			ESG-104-H-R50-P	1:50
	Ezi-SPEED-MR-104-H-400-C-R50-H			ESG-104-H-R50-H	
	Ezi-SPEED-MR-104-H-400-C-R100-P			ESG-104-H-R100-P	1:100
	Ezi-SPEED-MR-104-H-400-C-R100-H			ESG-104-H-R100-H	
	Ezi-SPEED-MR-104-H-400-C-R200-P			ESG-104-H-R200-P	1:200

Appendix 2 Specifications of motor

2.1 General specifications

Item	Specifications
Usage temperature	0~40℃ *1 (Non-freezing)
Storage temperature	-20~60℃ (Non-freezing)
Usage humidity	85%RH or less (non-condensing)
Storage humidity	85%RH or less (non-condensing)
Insulation Resistor	When measured with a DC500V insulation resistance tester, the following areas should have an insulation resistance of 100MΩ or more: · Case ↔ Motor Winding · Case ↔ Electronic Brake Winding
Environment	No corrosive gas and dust, No splashing water and oil
Elevation	Usage: Below 1,000 m above sea level Transport/Storage: Below 3,000 m above sea level
IP Rating	IP40 (excluding motor output shaft and connector section)
Insulation class	Class B (130℃)

*1: Depending on operating conditions, the motor may generate excessive heat. Please exercise special caution to ensure that the motor's surface temperature does not exceed 80°C in order to protect the sensors of the motor.

2.2 Standard motor

Model			UNIT	ESM-60-S-30	ESM-80-S-60	ESM-90-S-120	ESM-104-S-200	ESM-104-S-400
Rated Output Power (Continuous)			W	30	60	120	200	400
Rated Torque			N·m	0.096	0.191	0.382	0.637	1.27
Rated Input Current			A	0.24	0.51	1.23	2.53	2.70
Rated Speed			r/min	3000				
Permissible Load Inertia Moment			$10^{-4}\mathrm{kg\cdot m^2}$	0.5	1.8	5.8	5.8	8.75
Rotor Inertia Moment			$10^{-4}\mathrm{kg\cdot m^2}$	0.086	0.234	0.61	0.66	0.66
Weight			kg	0.5	0.8	1.3	2.4	2.4
Length			mm	62	74	94	156	156
Permissible Radial Load	Distance from shaft end	10 mm	N	70	120	160	197	197
		20 mm		100	140	170	220	220
Permissble Axial Load			N	Avoid axial load. If it is unavoidable, please make it less than 50% of the weight of the motor.				

2.3 Specifications of motor with parallel shaft gearhead

■ 30W

Unit Product No.	Gear Ratio	Permitted Torque [N·m]		Permitted Speed Range [r/min]	Unit Weight [kg]	Permitted Radial Load [N]		Permitted Axial Load [N]
		For 50~3,000 r/min	For 4000 r/min			Distance from shaft end [mm]		
						10	20	
Ezi-SPEED-MR-60-H-30-C-R5-P	5	0.45	0.34	10~800	0.9	100	150	40
Ezi-SPEED-MR-60-H-30-C-R10-P	10	0.9	0.68	5~400		150	200	
Ezi-SPEED-MR-60-H-30-C-R15-P	15	1.35	1	3.3~266.7				
Ezi-SPEED-MR-60-H-30-C-R20-P	20	1.8	1.4	2.5~200				
Ezi-SPEED-MR-60-H-30-C-R30-P	30	2.6	1.9	1.7~133.3		200	300	
Ezi-SPEED-MR-60-H-30-C-R50-P	50	4.3	3.2	1~80				
Ezi-SPEED-MR-60-H-30-C-R100-P	100	6	5.4	0.5~40				
Ezi-SPEED-MR-60-H-30-C-R200-P	200	6	5.4	0.25~20				

■ 60W

Unit Product No.	Gear Ratio	Permitted Torque [N·m]		Permitted Speed Range [r/min]	Unit Weight [kg]	Permitted Radial Load [N]		Permitted Axial Load [N]
		For 50~3,000 r/min	For 4000 r/min			Distance from shaft end [mm]		
						10	20	
Ezi-SPEED-MR-80-H-60-C-R5-P	5	0.9	0.68	10~800	1.6	200	250	100
Ezi-SPEED-MR-80-H-60-C-R10-P	10	1.8	1.4	5~400		300	350	
Ezi-SPEED-MR-80-H-60-C-R15-P	15	2.7	2	3.3~266.7				
Ezi-SPEED-MR-80-H-60-C-R20-P	20	3.6	2.7	2.5~200				
Ezi-SPEED-MR-80-H-60-C-R30-P	30	5.2	3.9	1.7~133.3		450	550	
Ezi-SPEED-MR-80-H-60-C-R50-P	50	8.6	6.5	1~80				
Ezi-SPEED-MR-80-H-60-C-R100-P	100	16	12.9	0.5~40				
Ezi-SPEED-MR-80-H-60-C-R200-P	200	16	14	0.25~20				

■ 120W

Unit Product No.	Gear Ratio	Permitted Torque [N·m]		Permitted Speed Range [r/min]	Unit Weight [kg]	Permitted Radial Load [N]		Per-mitted Axial Load [N]
		For 50~3,000 r/min	For 4000 r/min			Distance from shaft end [mm]		
						10	20	
Ezi-SPEED-MR-90-H-120-C-R5-P	5	2.2	1.4	10~800	2.7	300	400	150
Ezi-SPEED-MR-90-H-120-C-R10-P	10	4.4	2.7	5~400		400	500	
Ezi-SPEED-MR-90-H-120-C-R15-P	15	6.6	4.1	3.3~266.7				
Ezi-SPEED-MR-90-H-120-C-R20-P	20	8.8	5.4	2.5~200				
Ezi-SPEED-MR-90-H-120-C-R30-P	30	12.6	7.7	1.7~133.3		500	650	
Ezi-SPEED-MR-90-H-120-C-R50-P	50	21.1	12.9	1~80				
Ezi-SPEED-MR-90-H-120-C-R100-P	100	30	25.8	0.5~40				
Ezi-SPEED-MR-90-H-120-C-R200-P	200	30	27	0.25~20				

■ 200W

Unit Product No.	Gear Ratio	Permitted Torque [N·m]		Permitted Speed Range [r/min]	Unit Weight [kg]	Permitted Radial Load [N]		Per-mitted Axial Load [N]
		For 50~3,000 r/min	For 4000 r/min			Distance from shaft end [mm]		
						10	20	
Ezi-SPEED-MR-104-H-200-C-R5-P	5	2.9	2	10~800	4.2	550	800	200
Ezi-SPEED-MR-104-H-200-C-R10-P	10	5.9	4.1	5~400				
Ezi-SPEED-MR-104-H-200-C-R15-P	15	8.8	6.1	3.3~266.7				
Ezi-SPEED-MR-104-H-200-C-R20-P	20	11.7	8.1	2.5~200				
Ezi-SPEED-MR-104-H-200-C-R30-P	30	16.8	11.6	1.7~133.3		1000	1250	300
Ezi-SPEED-MR-104-H-200-C-R50-P	50	28	19.4	1~80				
Ezi-SPEED-MR-104-H-200-C-R100-P	100	52.7	36.5	0.5~40		1400	1700	400
Ezi-SPEED-MR-104-H-200-C-R200-P	200	70	63	0.25~20				

■ 400W

Unit Product No.	Gear Ratio	Permitted Torque [N·m]		Permitted Speed Range [r/min]	Unit Weight [kg]	Permitted Radial Load [N]		Per-mitted Axial Load [N]
		For 50~3,000 r/min	For 4000 r/min			Distance from shaft end [mm]		
						10	20	
Ezi-SPEED-MR-104-H-400-C-R5-P	5	5.9	4.3	10~800	4.2	550	800	200
Ezi-SPEED-MR-104-H-400-C-R10-P	10	11.7	8.6	5~400				
Ezi-SPEED-MR-104-H-400-C-R15-P	15	17.6	12.8	3.3~266.7				
Ezi-SPEED-MR-104-H-400-C-R20-P	20	23.4	17.1	2.5~200				
Ezi-SPEED-MR-104-H-400-C-R30-P	30	33.5	24.5	1.7~133.3		1000	1250	300
Ezi-SPEED-MR-104-H-400-C-R50-P	50	55.9	40.9	1~80				
Ezi-SPEED-MR-104-H-400-C-R100-P	100	70	63	0.5~40		1400	1700	400
Ezi-SPEED-MR-104-H-400-C-R200-P	200	70	63	0.25~20				

2.4 Specifications of motor with hollow shaft gearhead

■ 30W

Unit Product No.	Gear Ratio	Permitted Torque [N·m]		Permitted Speed Range [r/min]	Unit Weight [kg]	Permitted Radial Load [N]		Permitted Axial Load [N]
		For 50~3,000 r/min	For 4000 r/min			Distance from shaft end [mm]		
						10	20	
Ezi-SPEED-MR-60-H-30-C-R5-H	5	0.4	0.3	10~800	1.2	450	370	200
Ezi-SPEED-MR-60-H-30-C-R10-H	10	0.85	0.64	5~400				
Ezi-SPEED-MR-60-H-30-C-R15-H	15	1.3	0.96	3.3~266.7		500	400	
Ezi-SPEED-MR-60-H-30-C-R20-H	20	1.7	1.3	2.5~200				
Ezi-SPEED-MR-60-H-30-C-R30-H	30	2.6	1.9	1.7~133.3				
Ezi-SPEED-MR-60-H-30-C-R50-H	50	4.3	3.2	1~80				
Ezi-SPEED-MR-60-H-30-C-R100-H	100	8.5	6.4	0.5~40				
Ezi-SPEED-MR-60-H-30-C-R200-H	200	17	12.8	0.25~20				

■ 60W

Unit Product No.	Gear Ratio	Permitted Torque [N·m]		Permitted Speed Range [r/min]	Unit Weight [kg]	Permitted Radial Load [N]		Permitted Axial Load [N]
		For 50~3,000 r/min	For 4000 r/min			Distance from shaft end [mm]		
						10	20	
Ezi-SPEED-MR-80-H-60-C-R5-H	5	0.85	0.64	10~800	2.2	800	660	400
Ezi-SPEED-MR-80-H-60-C-R10-H	10	1.7	1.3	5~400				
Ezi-SPEED-MR-80-H-60-C-R15-H	15	2.6	1.9	3.3~266.7		1,200	1,000	
Ezi-SPEED-MR-80-H-60-C-R20-H	20	3.4	2.6	2.5~200				
Ezi-SPEED-MR-80-H-60-C-R30-H	30	5.1	3.8	1.7~133.3				
Ezi-SPEED-MR-80-H-60-C-R50-H	50	8.5	6.4	1~80				
Ezi-SPEED-MR-80-H-60-C-R100-H	100	17	12.8	0.5~40				
Ezi-SPEED-MR-80-H-60-C-R200-H	200	34	25.5	0.25~20				

■ 120W

Unit Product No.	Gear Ratio	Permitted Torque [N·m]		Permitted Speed Range [r/min]	Unit Weight [kg]	Permitted Radial Load [N]		Permitted Axial Load [N]
		For 50~3,000 r/min	For 4000 r/min			Distance from shaft end [mm]		
						10	20	
Ezi-SPEED-MR-90-H-120-C-R5-H	5	2.1	1.3	10~800	3.3	900	770	500
Ezi-SPEED-MR-90-H-120-C-R10-H	10	4.2	2.6	5~400				
Ezi-SPEED-MR-90-H-120-C-R15-H	15	6.2	3.8	3.3~266.7		1,300	1,100	
Ezi-SPEED-MR-90-H-120-C-R20-H	20	8.3	5.1	2.5~200				
Ezi-SPEED-MR-90-H-120-C-R30-H	30	12.5	7.7	1.7~133.3		1,500	1,280	
Ezi-SPEED-MR-90-H-120-C-R50-H	50	21	12.8	1~80				
Ezi-SPEED-MR-90-H-120-C-R100-H	100	42	25.5	0.5~40				
Ezi-SPEED-MR-90-H-120-C-R200-H	200	68	51	0.25~20				

■ 200W

Unit Product No.	Gear Ratio	Permitted Torque [N·m]		Permitted Speed Range [r/min]	Unit Weight [kg]	Permitted Radial Load [N]		Permitted Axial Load [N]
		For 50~3,000 r/min	For 4000 r/min			Distance from shaft end [mm]		
						10	20	
Ezi-SPEED-MR-104-H-200-C-R5-H	5	2.8	1.9	10~800	4.2	1230	1070	800
Ezi-SPEED-MR-104-H-200-C-R10-H	10	5.5	3.8	5~400				
Ezi-SPEED-MR-104-H-200-C-R15-H	15	8.3	5.7	3.3~266.7		1680	1470	
Ezi-SPEED-MR-104-H-200-C-R20-H	20	11.1	7.7	2.5~200				
Ezi-SPEED-MR-104-H-200-C-R30-H	30	16.6	11.5	1.7~133.3		2040	1780	
Ezi-SPEED-MR-104-H-200-C-R50-H	50	27.6	19.1	1~80				
Ezi-SPEED-MR-104-H-200-C-R100-H	100	55.3	38.3	0.5~40				

■ 400W

Unit Product No.	Gear Ratio	Permitted Torque [N·m]		Permitted Speed Range [r/min]	Unit Weight [kg]	Permitted Radial Load [N]		Per-mitted Axial Load [N]
		For 50~3,000 r/min	For 4000 r/min			Distance from shaft end [mm]		
						10	20	
Ezi-SPEED-MR-104-H-400-C-R5-H	5	5.5	4.0	10~800	4.2	1230	1070	800
Ezi-SPEED-MR-104-H-400-C-R10-H	10	11.1	8.1	5~400				
Ezi-SPEED-MR-104-H-400-C-R15-H	15	16.6	12.1	3.3~266.7		1680	1470	
Ezi-SPEED-MR-104-H-400-C-R20-H	20	22.1	16.2	2.5~200				
Ezi-SPEED-MR-104-H-400-C-R30-H	30	33.2	24.2	1.7~133.3		2040	1780	
Ezi-SPEED-MR-104-H-400-C-R50-H	50	55.3	40.4	1~80				
Ezi-SPEED-MR-104-H-400-C-R100-H	100	110	80.8	0.5~40				

Appendix 3 Specification compliance

3.1 CE marking

Ezi-SPEED Modbus-RTU is a product that has obtained CE certification, and the CE mark is attached to the product.

1. CE standards

(1) Low voltage directive

(a) Please do not share the wiring system of this product with information and communication equipment.
(b) Ensure that the product is installed inside a housing where it is not accessible by human touch.
(c) Make sure to ground the protective ground terminal of the motor and drive securely.
(d) Keep power cables (such as motor cables and power cables) and signal cables separate with double insulation.
(e) Applicable standards:

Motor	EN 60034-1:2004
Drive	EN 61800-5-1:2007

(2) EMC directive

(a) EMC compliance may vary depending on the control devices, electrical components, and wiring used with the motor and drive. Please perform EMC tests as needed to verify compliance with the system configuration.
(b) Applicable standards:

EMI	EN 61800-3:2004 + A1:2012 EN 61000-3-2:2014 EN 61000-3-3:2013
EMS	EN 61800-3:2004

2. RoHS directive

This product does not contain substances exceeding the threshold values regulated by the RoHS Directive.

Appendix 4 Revised history

Please refer to the revision number of the User Manual on the back cover.

Revision No.	Revision Date	Revisions/Related Pages
Rev.01	2023.11	Issue a full revision

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Fast, Accurate, Smooth Motion

FASTECH Co., Ltd.
(Postal Code:14502) Rm#1202, 401-dong, Bucheon Techno-Park,
655, Pyeongcheon-ro Bucheon-si Gyeonggi-do, Republic of Korea
TEL : +82-32-234-6317 FAX : +82-32-234-6302
E-mail : sales@fastech-motions.com
Homepage : www.fastech-motions.com

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