



Closed Loop Stepping Motor and Driver Package

αSTEP

AZ Series 

DC power input Built-in controller type

OPERATING MANUAL Driver

CE

Thank you for purchasing an Oriental Motor product.

This Manual describes product handling procedures and safety precautions.

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

Table of contents

1	Introduction.....	3	10	Setting	28
2	Safety precautions	5	10.1	Address number (slave address)	28
3	Precautions for use	7	10.2	Protocol	29
4	Setup guide	8	10.3	Transmission rate	29
5	CE Marking.....	10	10.4	Termination resistor	29
6	Preparation.....	11	11	Guidance	30
6.1	Checking the product	11	11.1	Guidance for home position setting.....	30
6.2	How to identify the product model.....	11	11.2	Guidance for position operation	32
6.3	Combinations of motors and drivers ...	12	11.3	Guidance for high-speed return-to-home operation	34
6.4	Names and functions of parts	12	12	Operation.....	36
7	Installation.....	14	12.1	Set the home position using the MEXE02	36
7.1	Location for installation	14	12.2	Positioning operation.....	37
7.2	Installation method.....	14	12.3	High-speed return-to-home operation	38
8	Connection.....	16	12.4	JOG operation.....	39
8.1	Connection method.....	16	13	Inspection.....	41
8.2	Connecting the power supply and grounding	17	14	Alarm (protective function).....	42
8.3	Connecting the I/O signals	18	15	Troubleshooting	43
8.4	Connection diagram	19	16	To use the product in more convenient manners.....	45
8.5	Connecting the RS-485 communication cable.....	21	17	Accessories (sold separately).....	46
8.6	Connecting the USB cable	21			
8.7	Noise measures	22			
8.8	Installing and wiring in compliance with EMC Directive	23			
9	Explanation of I/O signals.....	25			
9.1	Input signals	25			
9.2	Output signals	26			

1 Introduction

■ Before use

Only qualified personnel should work with the product.

Use the product correctly after thoroughly reading the "2 Safety precautions" on p.5.

The product described in this manual has been designed and manufactured to be incorporated in general industrial equipment.

Do not use for any other purpose. Oriental Motor Co., Ltd. is not responsible for any damage caused through failure to observe this warning.

■ Operating Manuals for the AZ Series

Operating manuals for the **AZ** Series FLEX Built-in controller type are listed below.

The "OPERATING MANUAL Function Edition" does not come with the product. For details, contact your nearest Oriental Motor sales office or download from Oriental Motor website download page. After reading these manuals, keep them in a convenient place so that you can reference them at any time.

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

■ Hazardous substances

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

■ General specifications

Degree of protection	IP10	
Operation environment	Ambient temperature	0 to +50 °C (+32 to +122 °F) (non-freezing)
	Humidity	85% or less (non-condensing)
	Altitude	Up to 1000 m (3300 ft.) above sea level
	Surrounding atmosphere	No corrosive gas, dust, water or oil
Storage environment	Ambient temperature	-25 to +70 °C (-13 to +158 °F) (non-freezing)
Shipping environment	Humidity	85% or less (non-condensing)
	Altitude	Up to 3000 m (10000 ft.) above sea level
	Surrounding atmosphere	No corrosive gas, dust, water or oil
Insulation resistance	100 MΩ or more when 500 VDC megger is applied between the following places:	
	<ul style="list-style-type: none"> • PE terminal - Power supply terminals 	

2 Safety precautions

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

Description of signs

 Warning	Handling the product without observing the instructions that accompany a "Warning" symbol may result in serious injury or death.
 Caution	Handling the product without observing the instructions that accompany a "Caution" symbol may result in injury or property damage.

Description of graphic symbols

	Indicates "prohibited" actions that must not be performed.		Indicates "compulsory" actions that must be performed.
-----------------------------------------------------------------------------------	------------------------------------------------------------	-----------------------------------------------------------------------------------	--------------------------------------------------------

 Warning	
	<ul style="list-style-type: none"> Do not use the product in explosive or corrosive environments, in the presence of flammable gases, locations subjected to splashing water, or near combustibles. This may cause fire, electric shock or injury. Do not transport, install the product, perform connections or inspections when the power is on. This may cause electric shock. Do not touch the driver while the power is on. This may cause fire or electric shock. Do not forcibly bend, pull or pinch the cable. This may cause fire or electric shock. Do not turn the FREE input to ON while the motor is operating. This may cause injury or damage to equipment. Do not disassemble or modify the product. This may cause injury or damage to equipment.
	<ul style="list-style-type: none"> Assign qualified personnel the task of installing, wiring, operating/controlling, inspecting and troubleshooting the product. Failure to do so may result in fire, electric shock, injury or damage to equipment. If this product is used in a vertical application, be sure to provide a measure for the position retention of moving parts. Failure to do so may result in injury or damage to equipment. When the driver generates an alarm (any of the driver's protective functions is triggered), first remove the cause and then clear the protective function. Continuing the operation without removing the cause of the problem may cause malfunction of the motor and driver, leading to injury or damage to equipment. Install the product in an enclosure. Failure to do so may result in electric shock or injury. Keep the driver's input-power voltage within the specified range. Failure to do so may result in fire or electric shock. The motor and driver are designed with Class I equipment basic insulation. When installing the motor, do not touch the product or be sure to ground them. Failure to do so may result in electric shock. Connect the cables securely according to the wiring diagram. Failure to do so may result in fire or electric shock. Turn off the driver power in the event of a power failure. Failure to do so may result in injury or damage to equipment.

 **Caution**

	<ul style="list-style-type: none"> • Do not use the product beyond its specifications. This may cause electric shock, injury or damage to equipment. • Keep your fingers and objects out of the openings in the product. Failure to do so may result in fire, electric shock or injury. • Do not touch the product during operation or immediately after stopping. This may cause a skin burn(s). • Keep the area around the product free of combustible materials. Failure to do so may result in fire or a skin burn(s). • Leave nothing around the product that would obstruct ventilation. Failure to do so may result in damage to equipment. • Do not forcibly bend or pull the cable that was connected to the driver. Doing so may cause damage. • Do not touch the terminals while conducting the insulation resistance test or dielectric strength test. This may cause electric shock.
	<ul style="list-style-type: none"> • Use a motor and driver only in the specified combination. Failure to do so may result in fire. • Use only an insulated screwdriver to adjust the driver's switches. Failure to do so may result in electric shock. • For the power supply, use a DC power supply with reinforced insulation on its primary and secondary sides. Failure to do so may result in electric shock. • Before supplying power to the driver, turn all input signals to the driver to OFF. Failure to do so may result in injury or damage to equipment. • Provide an emergency stop device or emergency stop circuit external to the equipment so that the entire equipment will operate safely in the event of a system failure or malfunction. Failure to do so may result in injury. • Before moving the motor directly with the hands, confirm that the FREE input turns ON. Failure to do so may result in injury. • When an abnormal condition has occurred, immediately stop operation and turn off the driver power. Failure to do so may result in fire, electric shock or injury. • To dispose of the product, disassemble it into parts and components as much as possible and dispose of individual parts/components as industrial waste.

3 Precautions for use

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

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

Be sure to use the cable (supplied or accessory) to connect the motor and driver. In the following condition, an appropriate accessory cable must be purchased separately.

- If a flexible cable is to be used.
- If a cable of 3 m (9.8 ft.) or longer is to be used.
- If a motor and driver package without a cable was purchased.

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

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

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

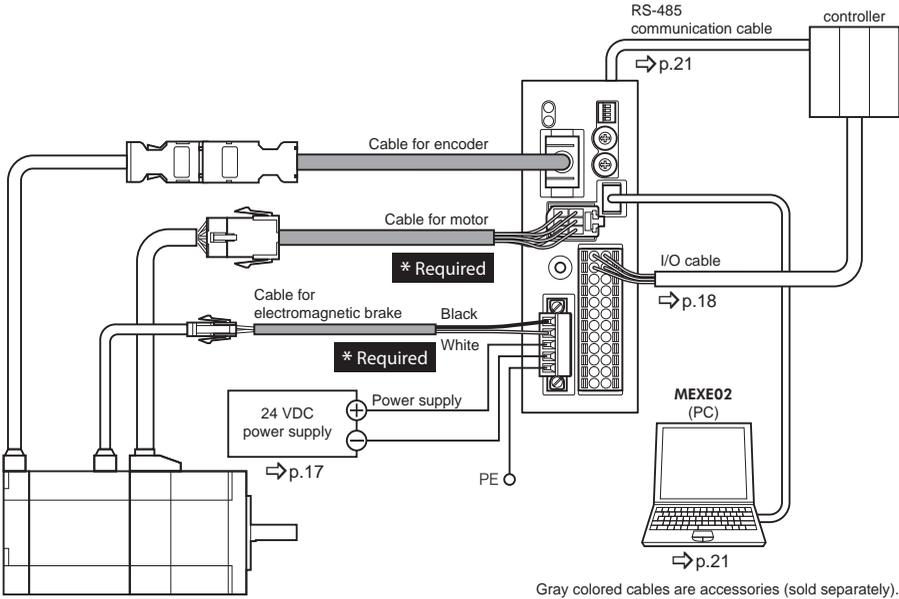
Do not turn off the power supply while writing the data to the non-volatile memory, and also do not turn off for 5 seconds after the completion of writing the data. Doing so may abort writing the data and cause an EEPROM error alarm to generate. The non-volatile memory can be rewritten approximately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

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

The USB communication connector, CN4 connector and CN6/CN7 connectors are not insulated. When grounding the positive terminal of the power supply, do not connect any equipment (PC, etc.) whose negative terminal is grounded. Doing so may cause the driver and this equipment to short, damaging both. When connecting, do not ground equipment.

4 Setup guide

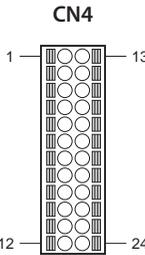
Wiring guide



Gray colored cables are accessories (sold separately).

CN4 pin assignment (⇒ p.18)

Pin No.	Signal name	Description *
1	IN0	Control input 0 (START)
2	IN2	Control input 2 (M1)
3	IN4	Control input 4 (ZHOME)
4	IN6	Control input 6 (STOP)
5	IN-COM [0-7]	IN0 to IN7 input common
6	IN8	Control input 8 (FW-JOG)
7	OUT0	Control output 0 (HOME-END)
8	OUT2	Control output 2 (PLS-RDY)
9	OUT4	Control output 4 (MOVE)
10	OUT-COM	Output common
11	ASG+	A-phase pulse output+
12	BSG+	B-phase pulse output+

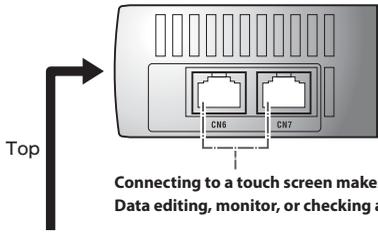


Pin No.	Signal name	Description *
13	IN1	Control input 1 (M0)
14	IN3	Control input 3 (M2)
15	IN5	Control input 5 (FREE)
16	IN7	Control input 7 (ALM-RST)
17	IN-COM [8-9]	IN8, IN9 input common
18	IN9	Control input 9 (RV-JOG)
19	OUT1	Control output 1 (IN-POS)
20	OUT3	Control output 3 (READY)
21	OUT5	Control output 5 (ALM-B)
22	GND	Ground
23	ASG-	A-phase pulse output-
24	BSG-	B-phase pulse output-

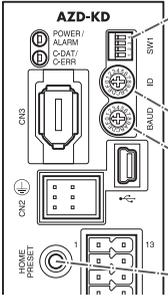
* (): Initial value

* (): Initial value

Setting of switches



Connecting to a touch screen makes a PC unnecessary!
Data editing, monitor, or checking alarm records can be performed.



- Function setting switch (SW1)***
No.3, No.4: Sets the termination resistor. ⇨ p.29
No.2: Sets the protocol. ⇨ p.29
No.1: Sets the address number (slave address). ⇨ p.28
 - Address number setting switch (ID)*** ⇨ p.28
 - Transmission rate setting switch (BAUD)*** ⇨ p.29
- * These are switches for communication.
When controlling via Modbus communication or industrial network, it is required to change the setting.

HOME-PRESET switch ⇨ p.30
The home position can be set easily by pressing and holding the switch.

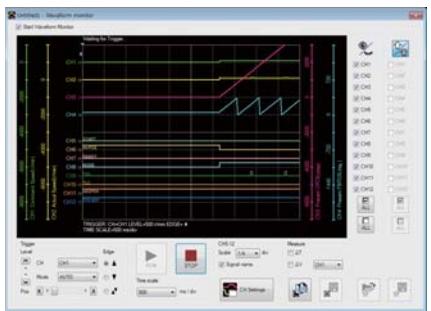
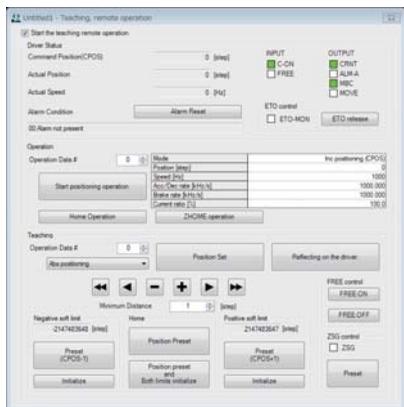
Factory setting of switches

Address number	0 (ID: 0, SW1-No.1: OFF)
Transmission rate	Network converter (BAUD: 7)
Protocol	Connecting with network converter (SW1-No.2: OFF)
Termination resistor	Termination resistor disabled (SW1-No.3, No.4: OFF)

Provide the data setting software MEXE02 and USB cable (commercially available)

The MEXE02 is used for teaching function and others in addition to setting of data and parameters.
Monitor function is also enhanced. Use it to check when designing or developing equipment.

- Teaching/remote operation window
- Waveform monitor window



5 CE Marking

This product is affixed the CE Marking under the Low Voltage Directive and EMC Directive.

■ Low Voltage Directive

Because the input power supply voltage of this product is 24 VDC/48 VDC, it is not subject to the Low Voltage Directive but install and connect this product as follows.

- This product is designed and manufactured to be installed within another device. Install the product in an enclosure.
- For the driver power supply, use a DC power supply with reinforced insulation on its primary and secondary sides.

■ EMC Directive

This product has received EMC compliance under the conditions specified in "Example of motor and driver installation and wiring" on p.24. The conformance of your mechanical equipment to the EMC Directive will vary depending on such factors as the control system equipment used with this product, configuration of electrical parts, wiring and layout. It therefore must be verified through conducting EMC measures in a state that all parts including this product have been installed in the equipment.

Applicable Standards

EMI	EN 55011 Group1 Class A EN 61000-6-4
EMS	EN 61000-6-2

6 Preparation

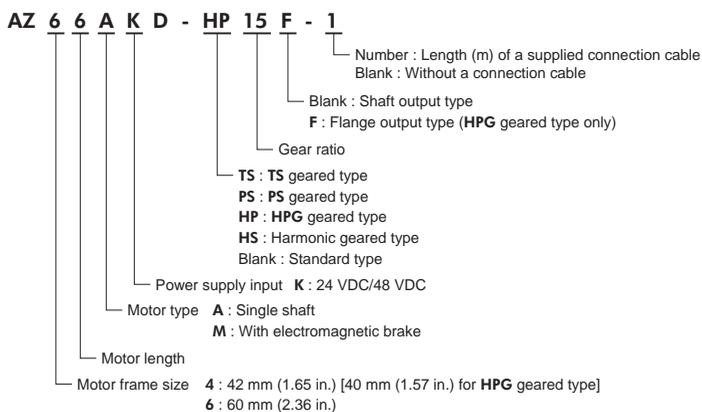
This chapter explains the items you should check, as well as the name and function of each part.

6.1 Checking the product

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

- Driver..... 1 unit
- CN1 connector (5 pins) 1 pc.
- CN4 connector (24 pins) 1 pc.
- OPERATING MANUAL Driver..... 1 copy (this document)

6.2 How to identify the product model



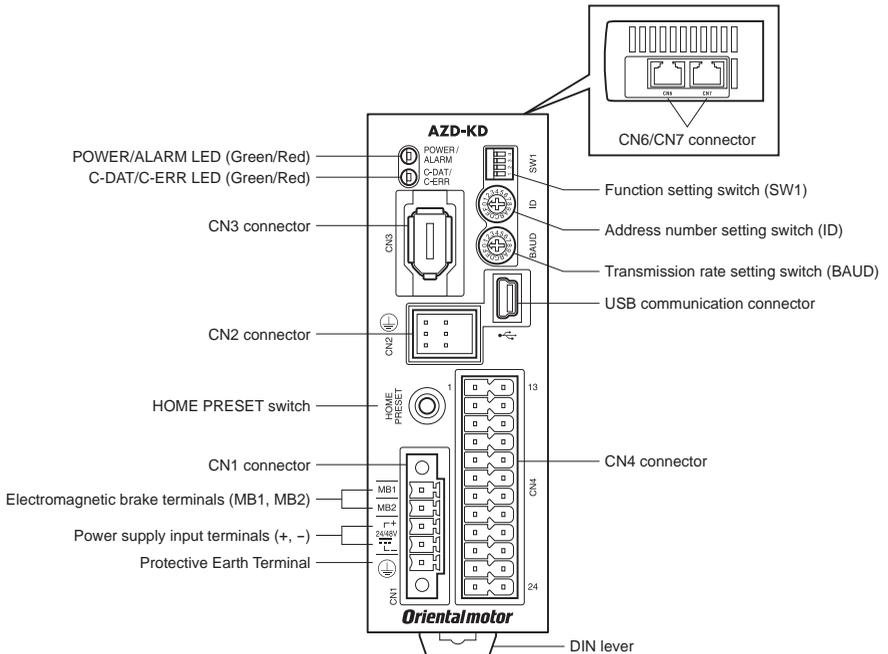
6.3 Combinations of motors and drivers

Verify the model number of the purchased product against the number shown on the package label. Check the model number of the motor and driver against the number shown on the nameplate.

- ■ in the model names indicates a number representing the gear ratio.
- ○ in the model names indicates a number (-1, -2, -3) representing the cable length.

Type	Model	Motor model	Driver model
Standard	AZ46AKD○	AZM46AK	AZD-KD
	AZ66AKD○	AZM66AK	
	AZ69AKD○	AZM69AK	
	AZ46MKD○	AZM46MK	
	AZ66MKD○	AZM66MK	
	AZ69MKD○	AZM69MK	
TS geared	AZ46AKD-TS■○	AZM46AK-TS■	
	AZ66AKD-TS■○	AZM66AK-TS■	
PS geared	AZ46AKD-PS■○	AZM46AK-PS■	
	AZ66AKD-PS■○	AZM66AK-PS■	
HPG geared	AZ46AKD-HP■○	AZM46AK-HP■	
	AZ46AKD-HP■FO	AZM46AK-HP■F	
	AZ66AKD-HP■FO	AZM66AK-HP■F	
Harmonic geared	AZ46AKD-HS■○	AZM46AK-HS■	
	AZ66AKD-HS■○	AZM66AK-HS■	

6.4 Names and functions of parts



Type	Name	Display	Description
LED	POWER/ALARM LED (Green/Red)	POWER/ALARM	<ul style="list-style-type: none"> This LED is lit in green while the power is input. If an alarm (protective function) generates, the LED will blink in red.
	C-DAT/C-ERR LED (Green/Red)	C-DAT/C-ERR	<ul style="list-style-type: none"> This LED will blink or illuminate in green when the driver is communicating with the master station properly via RS-485 communication. This LED will illuminate in red when a RS-485 communication error occurs with the master station.
Switch	Function setting switch	SW1	<p>Use this switch when controlling the system via RS-485 communication.</p> <ul style="list-style-type: none"> No.1: Using this switch and the address number setting switch (ID), set the address number of RS-485 communication. Factory setting: OFF No.2: Sets the protocol of RS-485 communication. Factory setting: OFF No.3, No.4: Use this switch when controlling the system via RS-485 communication. Sets the termination resistor (120 Ω) of RS-485 communication. Factory setting: No.3 and No.4: Both OFF
	Address number setting switch	ID	<p>Use this switch when controlling the system via RS-485 communication. Use this switch and SW1-No.1 of the function setting switch, to set the address number of RS-485 communication. Factory setting: 0</p>
	Transmission rate setting switch	BAUD	<p>Use this switch when controlling the system via RS-485 communication. Sets the transmission rate of RS-485 communication. Factory setting: 7</p>
	HOME PRESET switch	HOME PRESET	<p>This switch is used to set the starting position (home position) when performing positioning operation.</p>
Connector, Terminal	USB communication connector	-	<p>Connects a PC in which the MEXE02 has been installed. (USB2.0 mini-B port)</p>
	Electromagnetic brake terminals (CN1)	MB1, MB2	<p>Connects the lead wires from the electromagnetic brake. MB1: Electromagnetic brake - (Black) MB2: Electromagnetic brake + (White)</p>
	Power supply input terminals (CN1)	+, -	<p>Connects the power supply. +: +24 VDC/48 VDC power supply input -: Power supply ground</p>
	Protective Earth Terminal (CN1)	⊥	<p>Used for grounding via a grounding cable of AWG18 to 16 (0.75 to 1.25 mm²).</p>
	CN2 connector	CN2	<p>Connects the motor.</p>
	CN3 connector	CN3	<p>Connects the ABZO sensor.</p>
	CN4 connector	CN4	<p>Connects the I/O signals.</p>
CN6/CN7 connector	CN6, CN7	<p>Connects the RS-485 communication cable.</p>	

7 Installation

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

7.1 Location for installation

The driver has been designed and manufactured to be incorporated in equipment. Install it in a well-ventilated location that provides easy access for inspection.

The location must also satisfy the following conditions:

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

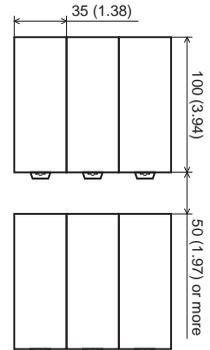
7.2 Installation method

Mount the driver to a 35 mm (1.38 in.) width DIN rail.

When installing two or more drivers in parallel, it is possible to install them closely in the horizontal direction. Provide a minimum clearance of 50 mm (1.97 in.) in the vertical direction.

When installing three or more drivers closely, the heat generation of the inside drivers become high. Install the less frequently used drivers toward the inside.

In this case, use the drivers in conditions that an ambient temperature is 0 to +40 °C (+32 to +104 °F) and the standstill current is 50% or less.

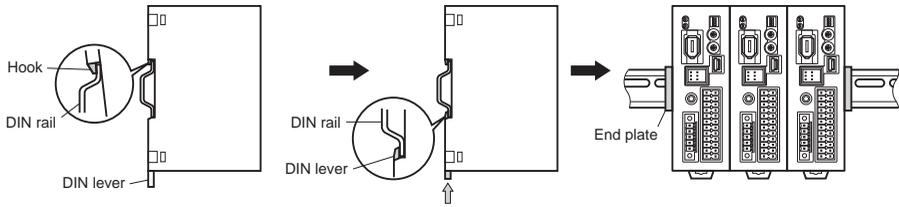


Unit: [mm (in.)]

Note

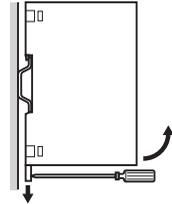
- Install the driver in an enclosure whose pollution degree is 2 or better environment, or whose degree of protection is IP54 minimum.
- Do not install any equipment that generates a large amount of heat or noise near the driver.
- Do not install the driver underneath the controller or other equipment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

1. Pull down the DIN lever of the driver and lock it. Hang the hook at the rear to the DIN rail.
2. Hold the driver to the DIN rail, and push up the DIN lever to secure.
3. Secure both sides of the driver using end plates.



Removing from DIN rail

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

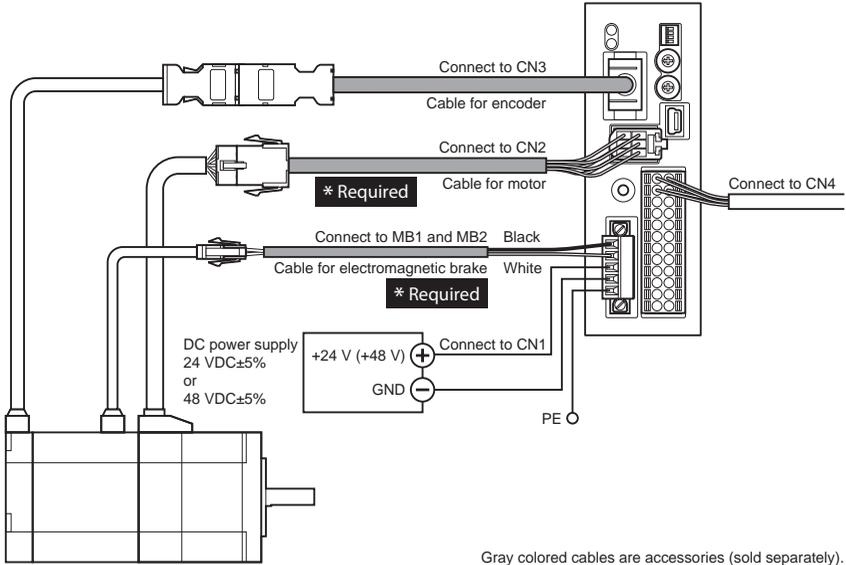


8 Connection

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

8.1 Connection method

The following figure shows models for the electromagnetic brake type.



Gray colored cables are accessories (sold separately).

Note

- Have the connector plugged in securely. Insecure connections may cause malfunction or damage to the motor or driver.
- When unplugging the motor cable, do so while pressing the latches on the connector.
- When plugging/unplugging the connector, turn off the power and wait for the POWER/ALARM LED to turn off before doing so. The residual voltage may cause electric shock.
- Do not wire the power supply cable of the driver in the same cable duct with other power lines or motor cables. Doing so may cause malfunction due to noise.
- The lead wires of the "cable for electromagnetic brake" have polarities, so connect them in the correct polarities. If the lead wires are connected with their polarities reversed, the electromagnetic brake will not operate properly.
- When installing the motor to a moving part, use an accessory flexible cable offering excellent flexibility.
- Keep 20 m (65.6 ft.) or less for the wiring distance between the motor and driver. To extend more than 20 m (65.6 ft.) may result in the driver heat generation or increase of the electrical noise emitted from the product.

8.2 Connecting the power supply and grounding

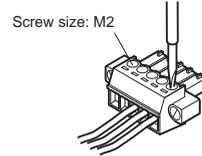
Power supply connection terminals and a protective earth terminal are provided in the CN1 connector. The applicable wire size varies between lead wires for a power supply and protective earth. Be sure to use proper lead wires.

■ Wiring the CN1 connector

- Applicable lead wire: For power supply AWG24 to 16 (0.2 to 1.25 mm²)
For grounding AWG18 to 16 (0.75 to 1.25 mm²)
- Length of the insulation cover which can be peeled: 7 mm (0.28 in.)

1. Strip the insulation cover of the lead wire.
2. Insert each lead wire into the CN1 connector and tighten the screw.

Tightening torque: 0.22 to 0.25 N·m (31 to 35 oz-in)



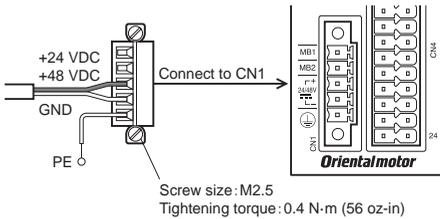
■ Power supply current capacity

Model	Input power supply voltage	Power supply current capacity
AZ46	24 VDC±5% 48 VDC±5%	1.8 A or more
AZ66		3.8 A or more
AZ69		3.7 A or more

■ How to ground

Do not share the grounding wire with a welder or any other power equipment.

When grounding the Protective Earth Terminal, use a round terminal and affix the grounding point near the driver.

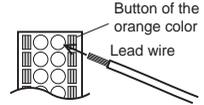


8.3 Connecting the I/O signals

■ Wiring the CN4 connector

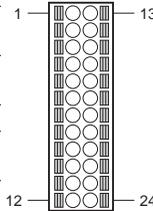
- Applicable lead wire: AWG24 to 16 (0.2 to 1.25 mm²)
- Length of the insulation cover which can be peeled: 10 mm (0.39 in.)

1. Strip the insulation cover of the lead wire.
2. Insert the lead wire while pushing the button of the orange color on the CN4 connector with a screwdriver.
3. After having inserted, release the button to secure the lead wire.



■ Pin assignment list

Pin No.	Signal name	Description *
1	IN0	Control input 0 (START)
2	IN2	Control input 2 (M1)
3	IN4	Control input 4 (ZHOME)
4	IN6	Control input 6 (STOP)
5	IN-COM [0-7]	IN0 to IN7 input common
6	IN8	Control input 8 (FW-JOG)
7	OUT0	Control output 0 (HOME-END)
8	OUT2	Control output 2 (PLS-RDY)
9	OUT4	Control output 4 (MOVE)
10	OUT-COM	Output common
11	ASG+	A-phase pulse output+
12	BSG+	B-phase pulse output+

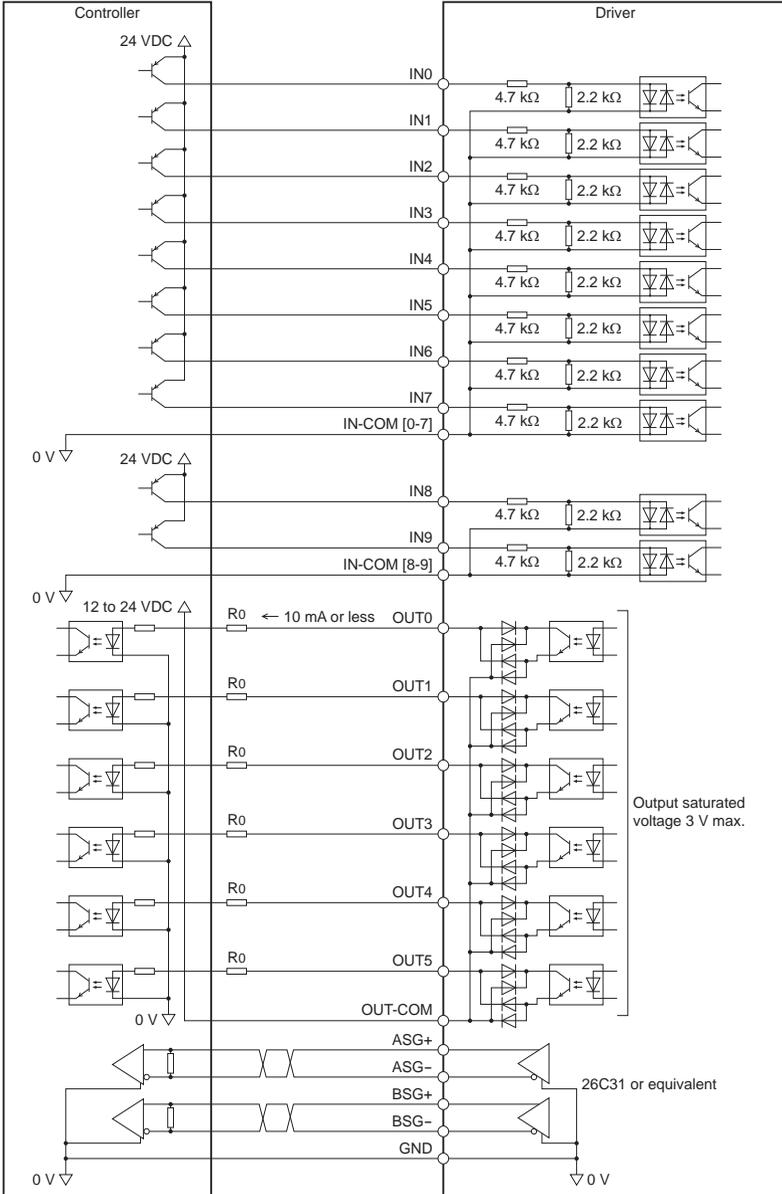


Pin No.	Signal name	Description *
13	IN1	Control input 1 (M0)
14	IN3	Control input 3 (M2)
15	IN5	Control input 5 (FREE)
16	IN7	Control input 7 (ALM-RST)
17	IN-COM [8-9]	IN8, IN9 input common
18	IN9	Control input 9 (RV-JOG)
19	OUT1	Control output 1 (IN-POS)
20	OUT3	Control output 3 (READY)
21	OUT5	Control output 5 (ALM-B)
22	GND	Ground
23	ASG-	A-phase pulse output-
24	BSG-	B-phase pulse output-

* (): Initial value

* (): Initial value

■ Connecting to a current source output circuit

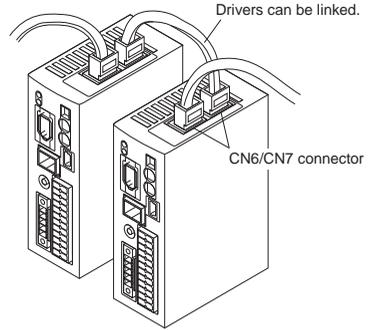


Note

- Use input signals at 24 VDC.
- Use output signals at 12 to 24 VDC, 10 mA or less. If the current exceeds 10 mA, connect an external resistor R₀ so that the current becomes 10 mA or less.
- The saturated voltage of the output signal is 3 VDC maximum.

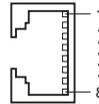
8.5 Connecting the RS-485 communication cable

Connect this cable if you want to control your product via RS-485 communication. Connect the RS-485 communication cable to CN6 or CN7 on the driver. You can use the vacant connectors to connect a different driver. A driver link cable is available as an accessory (sold separately). A commercially-available LAN cable (shielded straight cable) can also be used to link drivers.

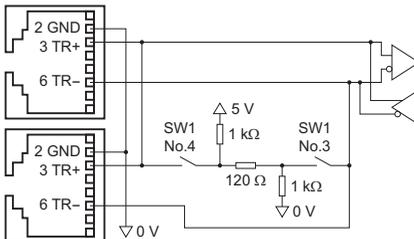


■ Pin assignment list

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



■ Internal input circuit



8.6 Connecting the USB cable

Connect the USB cable that is satisfied the following specification to the USB communication connector.

Specification	USB2.0 (Full Speed)
Cable	Length: 3 m (9.8 ft.) or less Type: A-mini-B

- Note**
- Connect the driver and PC directly using the USB cable.
 - In large electrically noisy environments, use the USB cable with a ferrite core or install a ferrite core to the USB cable.

8.7 Noise measures

The electrical noise is of two types: One is a noise to invade into the driver from the outside and cause the driver malfunction, and the other is a noise to emit from the driver and cause peripheral equipments malfunction.

For the noise that is invaded from the outside, take measures to prevent the driver malfunction. It is needed to take adequate measures because signal lines are very likely to be affected by the noise. For the noise that is emitted from the driver, take measures to suppress it.

■ Measures against electrical noise

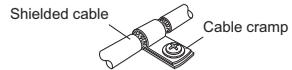
There are the following three methods mainly to take measures against the electrical noise.

● Noise suppression

- When relays or electromagnetic switches are used together with the system, use noise filters and CR circuits to suppress surges generated by them.
- Use an accessory cable (sold separately) when extending a wiring distance between the motor and driver. This is effective in suppressing the electrical noise emitted from the motor.
- Cover the driver by a metal plate such as aluminum. This is effective in shielding the electrical noise emitted from the driver.

● Prevention of noise propagation

- Connect a noise filter on the input side of the DC power supply.
- Place the power lines, such as the motor and power supply cables, keeping a distance of 200 mm (7.87 in.) or more from the signal lines, and also do not bundle them or wire them in parallel. If the power cables and signal cables have to cross, cross them at a right angle.
- Use shielded cables of AWG24 to 16 (0.2 to 1.25 mm²) for power lines and signal lines.
- Keep cables as short as possible without coiling and bundling extra lengths.
- To ground a shielded cable, use a metal cable clamp that will maintain contact with the entire circumference of the cable. Ground the cable clamp near the product.
- When grounding PE terminals of multiple drivers to a grounding point, it becomes more effective to block the electrical noise since impedance on the grounding point is decreased. However, ground them so that a potential difference does not occur among the grounding points. An accessory driver cable including with a ground wire is available (sold separately). Refer to p.46 for details.



● Suppression of effect by noise propagation

Loop the noise propagated cable around a ferrite core. Doing so will prevent the propagated noise invades into the driver or emits from the driver. The frequency band in which an effect by the ferrite core can be seen is generally 1 MHz or more. Check the frequency characteristics of the ferrite core used. To increase the effect of noise attenuation by the ferrite core, loop the cable a lot.

■ Noise suppression parts

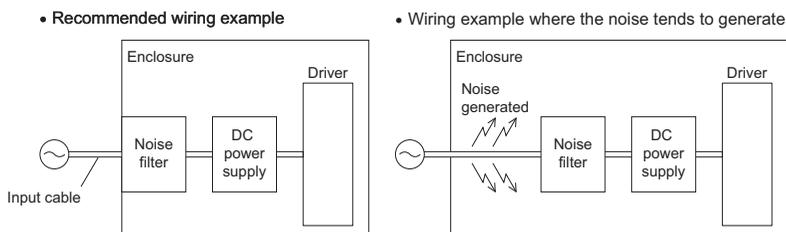
● Noise filter

- Connect a noise filter (or equivalent) in the table below on the input side of the DC power supply. When a power supply transformer is used, be sure to connect a noise filter on the AC input side of the power supply transformer. Doing so will prevent the propagated noise through the power line. Install the noise filter as close to the input terminals of DC power supply as possible.

Manufacture	Model
SOSHIN ELECTRIC CO.,LTD	HF2010A-UPF
Schaffner EMC	FN2070-10-06

- Use the AWG18 (0.75 mm²) or thicker wire for the input and output cables of the noise filter, and secure firmly using a cable clamp etc. so that the cable does not come off the enclosure.

- Place the input cable as far apart as possible from the output cable, and do not wire the cables in parallel. If the input and output cable are placed at a close distance or if they are wired in parallel, the noise in the enclosure affects the power cable through stray capacitance, and the noise suppressing effect will reduce.
- Connect the ground terminal of the noise filter to the grounding point, using as thick and short a wire as possible.
- When connecting a noise filter in an enclosure, wire the input cable of the noise filter as short as possible. Wiring in long distance may reduce the noise suppressing effect.



■ Noise suppression parts (accessories)

Accessories are sold separately. Refer to p.46 for details.

• Driver cable

This cable is a shielded cable for good noise immunity to connect the driver and controller. The ground wires useful to grounding are provided at both ends of the cable. The EMC measures are conducted using the Oriental Motor driver cable.

• Surge suppressor

This product is effective to suppress the surge which occurs in a relay contact part. Connect it when using a relay or electromagnetic switch. CR circuit for surge suppression and CR circuit module are provided.

8.8 Installing and wiring in compliance with EMC Directive

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

Oriental Motor conducts EMC measurements on its motors and drivers in accordance with "Example of motor and driver installation and wiring" on p.24.

The user is responsible for ensuring the machine's compliance with the EMC Directive, based on the installation and wiring explained below.

• Connecting the noise filter

In large electrically noisy environments, connect a noise filter.
Refer to "Noise filter" on p.22.

• Connecting the power supply

Use a DC power supply compliant with the EMC Directive.
Use a shielded cable for the wiring, and keep it as short as possible.
Refer to "Prevention of noise propagation" on p.22 for grounding the shielded cable.

● **Connecting the motor cable**

Use an accessory motor cable (sold separately) when extending the wiring distance between the motor and driver.

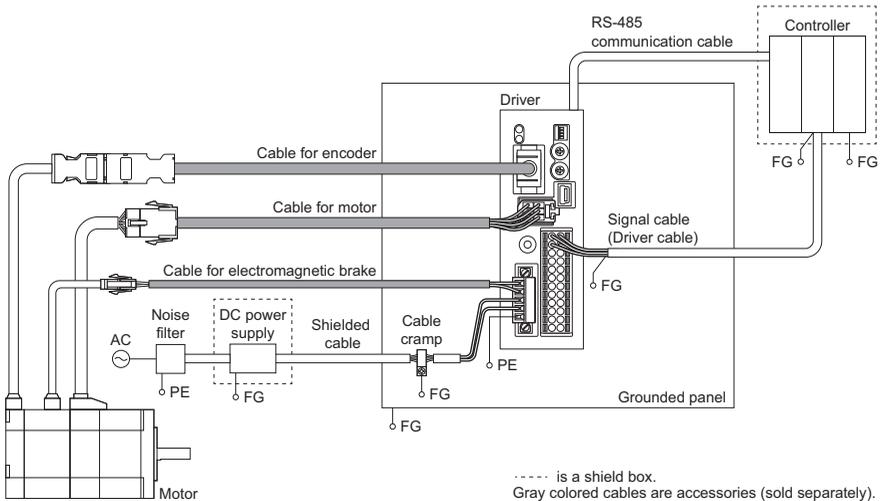
● **Connecting the signal cable**

Refer to "Prevention of noise propagation" on p.22.

● **How to ground**

- The cable used to ground the motor, driver and noise filter must be as thick and short as possible so that no potential difference is generated.
- Choose a large, thick and uniformly conductive surface for the grounding point.
- Be sure to ground the Protective Earth Terminal of the motor and driver. Refer to p.17 for grounding method.

● **Example of motor and driver installation and wiring**



● **Precautions about static electricity**

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

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

9 Explanation of I/O signals

9.1 Input signals

The following input signals of the driver are photocoupler inputs. The signal state represents the "ON: Carrying current" or "OFF: Not carrying current" state of the internal photocoupler rather than the voltage level of the signal.

■ START input

This signal starts the positioning operation.

Select the operation data number and turn the START input to ON to start positioning operation.

■ M0, M1, M2 input

Select a desired operation data number based on a combination of ON/OFF status of the M0 to M2 inputs.

Operation data No.	M2	M1	M0
0	OFF	OFF	OFF
1	OFF	OFF	ON
2	OFF	ON	OFF
3	OFF	ON	ON
4	ON	OFF	OFF
5	ON	OFF	ON
6	ON	ON	OFF
7	ON	ON	ON

■ ZHOME input

When the ZHOME input is turned ON, the motor will move to the home position set by the HOME PRESET switch. Since it does not require sensors, return-to-home is possible at high-speed.

■ FREE input

When the FREE input is turned ON, the motor current will be cut off. When an electromagnetic brake motor is used, the electromagnetic brake will be released.

The motor output shaft can be rotated manually since the motor holding torque is lost.

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

■ STOP input

When the STOP input is turned ON, the motor will stop.

When resuming the operation, input the operation start signal to the driver after turning the STOP input OFF.

■ ALM-RST input

If the ALM-RST input is turned from OFF to ON while an alarm is generated, the alarm will be reset (The alarm will be reset at the ON edge of the ALM-RST input).

Before resetting an alarm, turning the pulse input OFF, and then remove the cause of the alarm and ensure safety.

Note that some alarms cannot be reset with the ALM-RST input.

■ FW-JOG input, RV-JOG input

These signals are used to start JOG operation.

The motor continuously operates in the forward direction when turning the FW-JOG input ON, and the motor continuously operates in the reverse direction when turning the RV-JOG input ON.

If the signal having inputted is turned OFF, the motor will stop. If the FWD-JOG and RVS-JOG inputs are turned ON simultaneously, the motor will stop.

9.2 Output signals

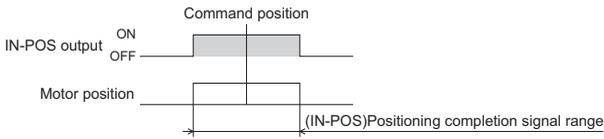
The driver outputs signals in the photocoupler/open-collector output mode or line driver output mode. The signal state represents the "ON: Carrying current" or "OFF: Not carrying current" state of the internal photocoupler rather than the voltage level of the signal.

■ HOME-END output

When the home position is set or when high-speed return-to-home operation is complete, the HOME-END output turns ON.

■ IN-POS output

When the motor has completed its movement, the IN-POS output will turn ON. When the motor detection position is in a range of the "(IN-POS)Positioning completion signal range" parameter (initial value: 1.8°) as a center of the command position, the IN-POS output turns ON.



■ PLS-RDY output

This output signal is not used for the built-in controller type driver.

■ READY output

When the driver is ready to execute operation, the READY output turns ON. Input the operation start signal to the driver after the READY output has turned ON.

■ MOVE output

The MOVE output turns ON while the motor is operating.

■ ALM-B output

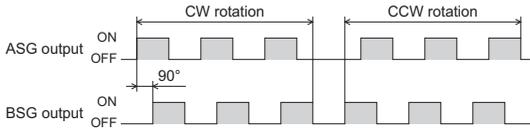
When an alarm generates, the ALM-B output will turn OFF, and the motor will stop. At the same time, the POWER/ALARM LED on the driver will blink in red. The ALM-B output is normally closed.

■ ASG output, BSG output

The ASG output and BSG output are signals output from the ABZO sensor.

The ASG output is used to output pulses according to motor operation. The motor position can be monitored by counting the ASG output pulses. The number of output pulses per motor revolution varies depending on the resolution effective when turning the power on.

The BSG output has a 90° phase difference with respect to the ASG output. The motor rotation direction can be determined by detecting the BSG output level at the rise of the ASG output.

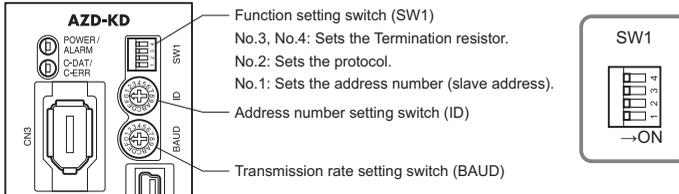


Note

- The ASG output and BSG output are subject to a maximum delay of 0.1 ms with respect to motor operation. Use these outputs to check the position at which the motor is stopped.
- Connect a termination resistor of 100 Ω or more between the driver and the input of the line receiver.

10 Setting

This chapter explains how to set the motor and driver functions.



Note Be sure to turn off the driver power before setting the function setting switch (SW1). The new setting of the SW1 will become effective after the power is cycled.

10.1 Address number (slave address)

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

Factory setting ID: 0, SW1-No.1: OFF

ID	SW1-No.1	Address number (slave address)	ID	SW1-No.1	Address number (slave address)
0	OFF	0 *	0	ON	16
1		1	17		
2		2	18		
3		3	19		
4		4	20		
5		5	21		
6		6	22		
7		7	23		
8		8	24		
9		9	25		
A		10	26		
B		11	27		
C		12	28		
D		13	29		
E		14	30		
F		15	31		

* In the case of Modbus protocol, the address number (slave address) 0 is reserved for broadcasting, so do not use this address.

10.2 Protocol

Set the protocol of RS-485 communication using the SW1-No.2 of the function setting switch.

Factory setting **OFF**

SW1-No.2	Protocol
ON	Modbus RTU mode
OFF	Connecting with network converter

10.3 Transmission rate

Set the transmission rate using transmission rate setting switch (BAUD).

The transmission rate to be set should be the same as the transmission rate of the master controller.

Factory setting **7**

BAUD	Transmission rate (bps)
0	9600
1	19200
2	38400
3	57600
4	115,200
5	230,400
6	Not used.
7	Network converter
8 to F	Not used.

Note | Do not set BAUD to positions 6 and 8 to F.

10.4 Termination resistor

Set a termination resistor to the driver located farthest away (positioned at the end) from the master controller or network converter.

Turn both No.3 and No.4 of the function setting switch (SW1) ON to set the termination resistor (120 Ω) of RS-485 communication.

Factory setting **OFF for both No.3 and No.4 (termination resistor disabled)**

SW1-No.3, No.4	Termination resistor (120 Ω)
Both are OFF	Disabled
Both are ON	Enabled

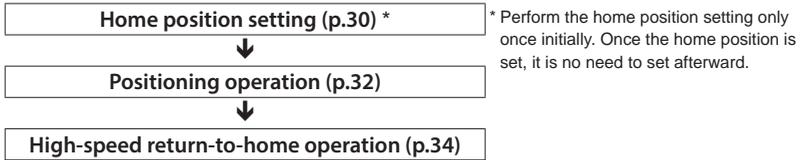
Note | If only one of the two of No.3 and No.4 is turned ON, a communication error may occur.

11 Guidance

If you are new to the **AZ Series**, read this section to understand the operating methods along with the operation flow.

■ How to read the guidance

This chapter explains the operation procedure as follows.



* Perform the home position setting only once initially. Once the home position is set, it is no need to set afterward.

■ Checking the factory setting

The driver is explained as a state of the factory setting.

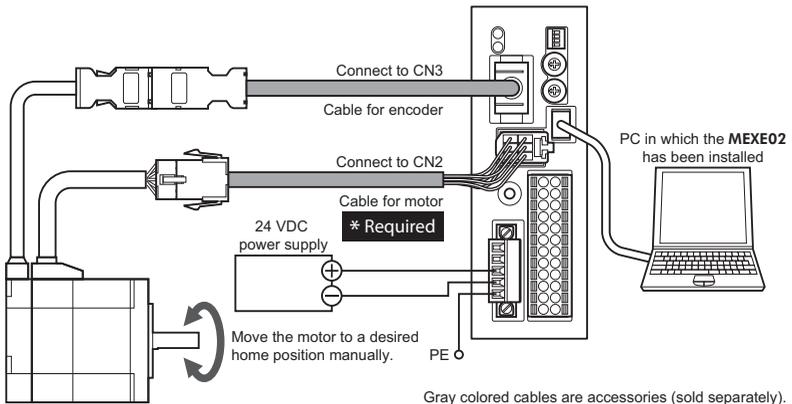
Setting item	Factory setting
Resolution	1000 P/R (0.36°/step)
Operating current	F (Base current 100%)
Command filter time constant	1 (1 ms)
Home position	Motor position at power on

11.1 Guidance for home position setting

The home position has not set at the time of shipment. Before starting operation, be sure to set the home position. Perform the home position setting only once initially. Once the home position is set, the driver keeps the home information even if the power supply is shut down.

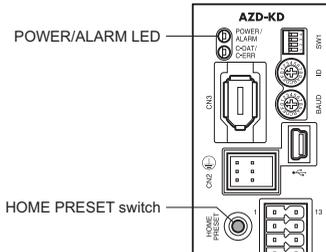
STEP 1 Connect the motor, power supply and MEXE02 to the driver

1. Wire the driver by reference to the figure.
2. Move the motor to a desired home position manually.



STEP 2 Turn on the power and set the home position

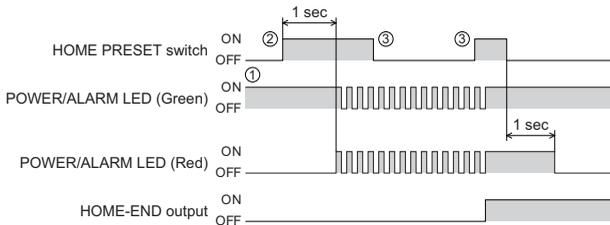
1. Turn on the power supply.
2. Keep pressing the HOME PRESET switch for one second.
Red color and green color on the POWER/ALARM LED blinks simultaneously. (Red and green colors may overlap and it may be visible to orange.)



3. Remove the hand from the HOME PRESET switch within three seconds after the POWER/ALARM LED started blinking, and press the switch again.
After both red color and green color on the POWER/ALARM LED are lit, only green color continues to be lit.
The home position is set.

Note For the procedure 3, be sure to perform within three seconds after the POWER/ALARM LED started blinking. If three seconds were passed, the POWER/ALARM LED will return to the state being lit in green. In this case, perform from the procedure 2 again.

See the following timing charts for the procedure of home position setting.



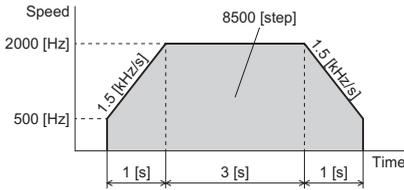
11.2 Guidance for position operation

This section explains an example to perform positioning operation using the **MEXE02**. After performing "11.1 Guidance for home position setting" on p.30, continuously perform test operation.

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

STEP 1 Set the operation data using the MEXE02

1. Start a PC, and continuously start the **MEXE02**. Refer to the "Data setting software **MEXE02** OPERATING MANUAL" for how to start or use the **MEXE02**.
2. Using the **MEXE02**, set the operation data of No.0 as follows.



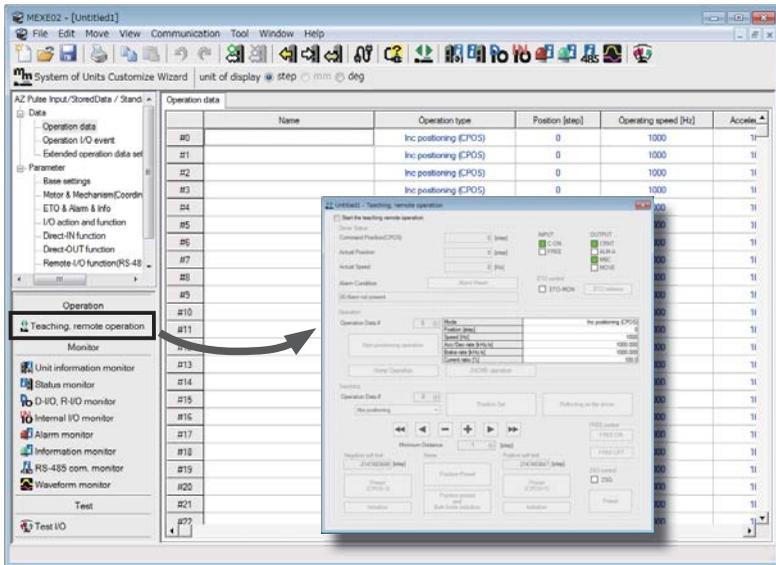
• Setting example of MEXE02

	Operation type	Position [step]	Operating speed [Hz]	Acceleration [kHz/s]	Stopping deceleration [kHz/s]
#0	Inc positioning (CPOS)	8500	2000	1500.000	1500.000
#1	Inc positioning (CPOS)	0	1000	1000.000	1000.000

Input in increments of 0.001 kHz/s.

STEP 2 Operate the motor

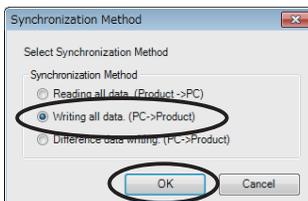
1. Click the [Teaching, remote operation] short-cut button in the left side of the screen. The teaching/remote operation window appears.



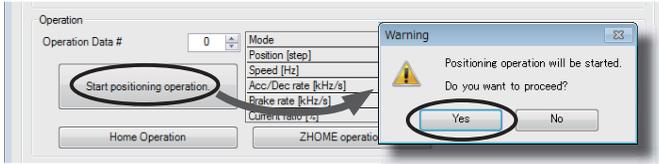
2. Click "Start the teaching remote operation." Since the pop-up window (Warning) is displayed, click [Yes].



3. Write the edited data to the driver. Click "Writing all data. (PC -> Product)," and click [OK]. The contents of the data No.0 will be written to the driver.



- Click [Start positioning operation].
Since the pop-up window (Warning) is displayed, click [Yes].



The motor performs positioning operation.

11.3 Guidance for high-speed return-to-home operation

After operation, return the motor to the home position. Using high-speed return-to-home operation (ZHOME) can return the motor position to the home position easily.
After performing "11.2 Guidance for position operation" on p.32, continuously perform high-speed return-to-home operation.

STEP 1 Check the present position

- Check the "Actual position" in the teaching/remote operation window.

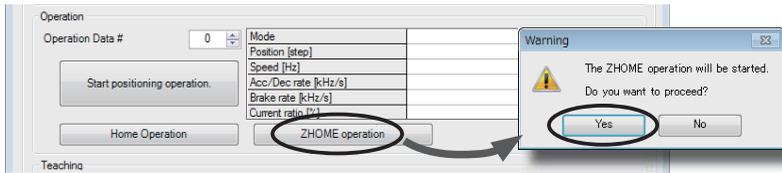


- To check if the ABZO sensor has memorized the home position, once turn off the power, and turn on again.
- Check the "Actual position" again.
Check that the actual position is not 0.



STEP 2 Execute high-speed return-to-home operation

1. Click "ZHOME operation."
Since the pop-up window (Warning) is displayed, click [Yes].



The motor will start high-speed return-to-home operation.

2. After the motor returns to the home position, check that the "actual position" is 0.



STEP 3 End the teaching/remote operation

To end the teaching/remote operation, unselect "Start the teaching remote operation."



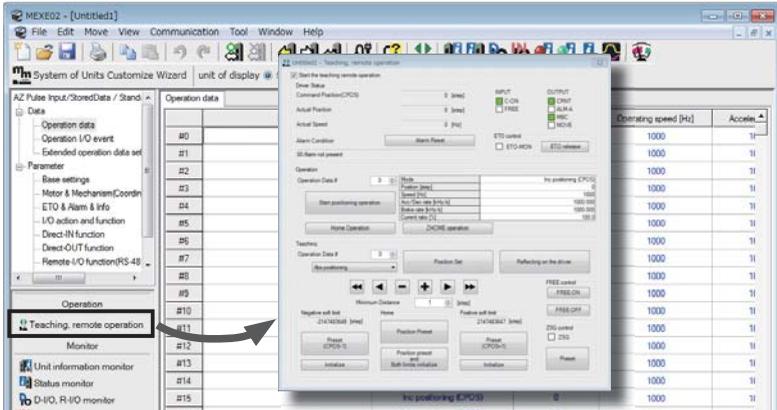
12 Operation

Three types of operation signals are assigned to the CN4 connector at the time of shipment. This chapter explains operations (positioning operation, JOG operation, and high-speed return-to-home operation) that can be performed in the factory setting only.

12.1 Set the home position using the MEXE02

The home position can be set using the **MEXE02** other than the HOME PRESET switch of the driver.

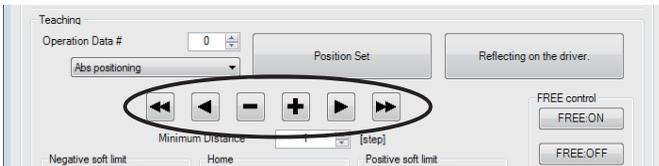
1. Click the [Teaching, remote operation] short-cut button int the left side of the screen. The teaching/remote operation window appears.



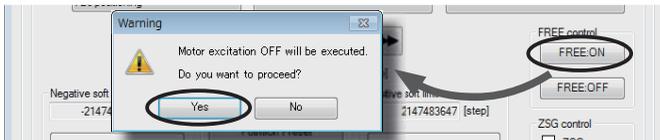
2. Click the "Teaching, remote operation," and click [Yes] on the pop-up window (Warning).



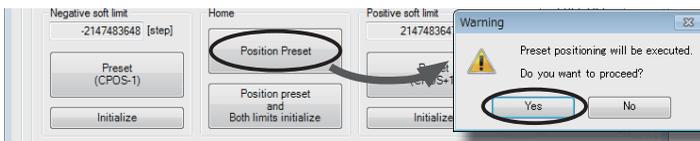
3. Adjust the motor position using the JOG operation switches.



- When adjusting the motor position manually, click [FREE: ON] first, and click [Yes] on the pop-up window (Warning).
The holding power of the motor output shaft is lost, and the output shaft can be turned by hand. After adjustment, click [FREE: OFF], and recover the motor excitation.



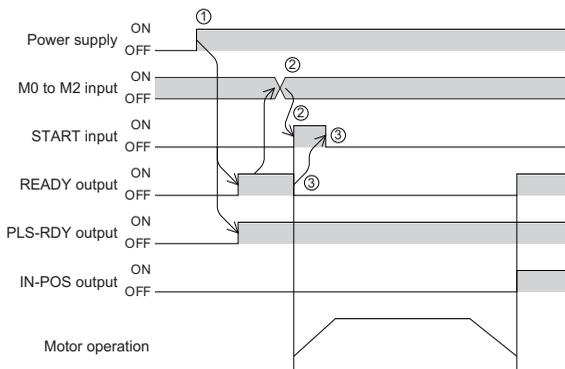
- After setting the motor home position, click [Position Preset], and click [Yes] on the pop-up window (Warning).
The home position is set and written to the driver.



12.2 Positioning operation

Set the operation data and performe positioning operation.

- Turn on the power supply.
The READY output and PLS-RDY output turn ON.
- Check the READY output is turned ON and turn the START input ON by selecting the operation data number with the M0 to M2 outputs.
The motor will start positioning operation.
- Check the READY output has been turned OFF and turn the START input OFF.
When the operation is complete, the READY output will turn ON.

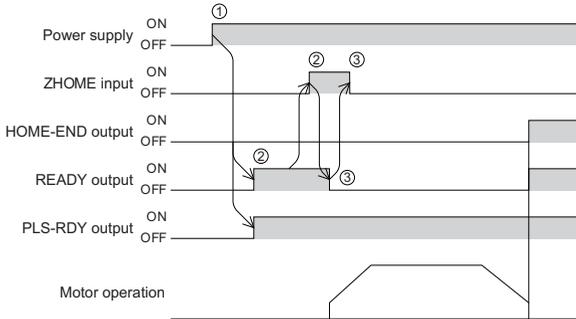


Refer to the OPERATING MANUAL Function Edition for details about operation.

12.3 High-speed return-to-home operation

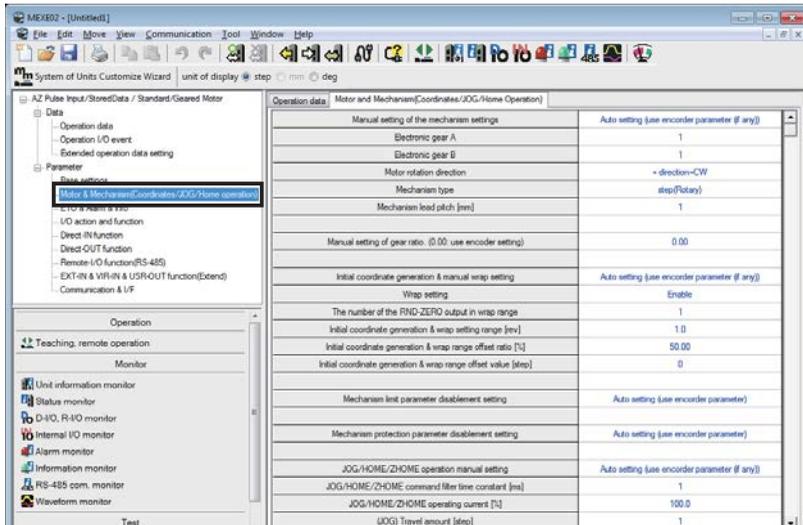
High-speed return-to-home operation is used to return to the home position that is set by the HOME PRESET switch.

1. Turn on the power supply.
The READY output and PLS-RDY output turn ON.
2. Check the READY output has been turned ON and turn the ZHOME input ON.
The READY output turns OFF, and the motor will start high-speed return-to-home operation.
3. If the READY output has been turned OFF, the ZHOME input may be turned OFF.
When the home position is detected, the operation will be stopped.
The HOME-END output and READY output will turn ON.



■ When changing the operating condition of high-speed return-to-home operation

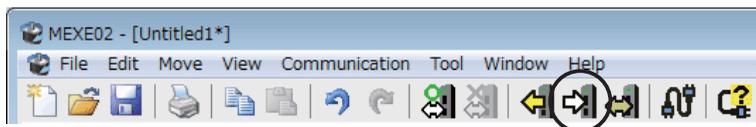
1. Click on the “Parameter,” “Motor and Mechanism(Coordinates/JOG/Home Operation),” in the left side of the screen.
Motor and mechanism parameter window will appears.



2. The operating condition can be changed using three parameters in the figure.

AZ Pulse Input/Stored Data / Stand...		Operation data Motor and Mechanism(Coordinates/JOG/Home Operation)	
...	(JOG)Travel amount [step]		1
...	(JOG)Operating speed [Hz]		1000
...	(JOG)Acceleration/deceleration rate [kHz/s]		1000.000
...	(JOG)Starting speed [Hz]		500
...	(JOG)Operating speed of JOG-H [Hz]		5000
...	(ZHOME)Operating speed [Hz]		5000
...	(ZHOME)Acceleration/deceleration [kHz/s]		1000.000
...	(ZHOME)Starting speed [Hz]		500
...	(HOME)Home-seeking mode		3 sensors
...	(HOME)Starting direction		Positive direction

3. After changing the operating condition, click the [Writing data] icon in the toolbar to download to the driver.

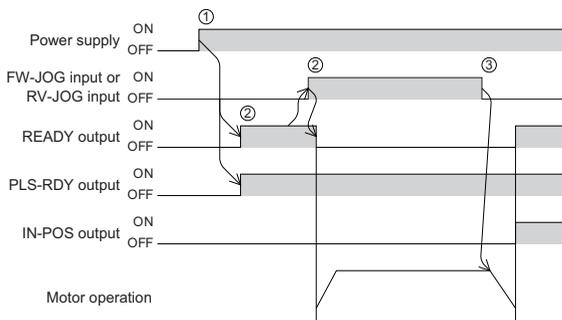


The process has been completed.

12.4 JOG operation

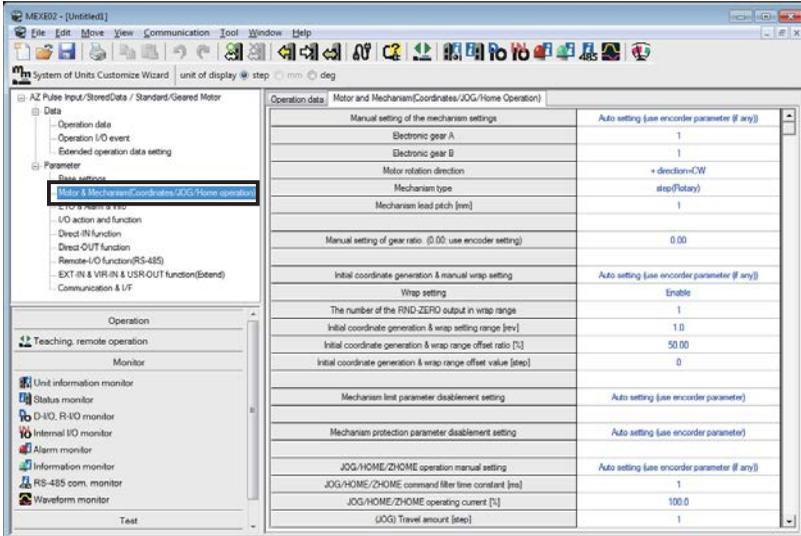
Constant speed operation (inching operation) can be performed with JOG operation. The motor operates continuously while the FW-JOG input or RV-JOG input is being ON.

- Turn on the power supply.
The READY output and PLS-RDY output turn ON.
- Check the READY output has been turned ON and turn the FW-JOG input or RV-JOG input ON.
The motor will start operation.
When the FW-JOG input is turned ON, the motor rotates in the forward direction, and when the RV-JOG input is turned ON, the motor rotates in the reverse direction.
- Turn the input signal OFF.
The motor will decelerate to a stop.
When the motor stops, the READY output will turn ON.

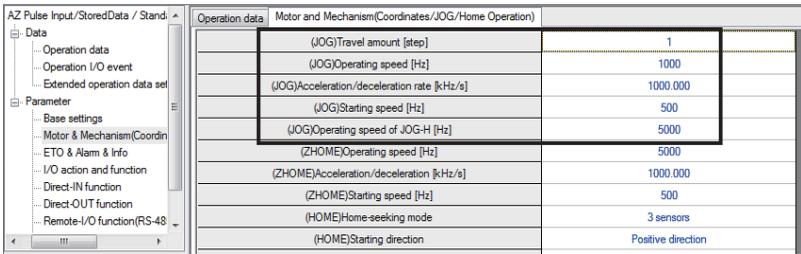


■ When changing the operating condition of JOG operation

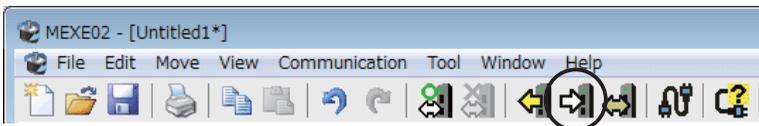
1. Click on the "Parameter," "Motor and Mechanism(Coordinates/JOG/Home Operation)," in the left side of the screen.
Motor and mechanism parameter window will appears.



2. The operating condition can be changed using five parameters in the figure.



3. After changing the operating condition, click the [Writing data] icon in the toolbar to download to the driver.



The process has been completed.

13 Inspection

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

■ During inspection

- Are the openings in the driver blocked?
- Are any of the mounting screws or connection parts of the driver loose?
- Is there attachment of dust, etc., on the driver?
- Are there any strange smells or appearances within the driver?

Note | The driver uses semiconductor elements, so be extremely careful when handling them. Static electricity may damage the driver.

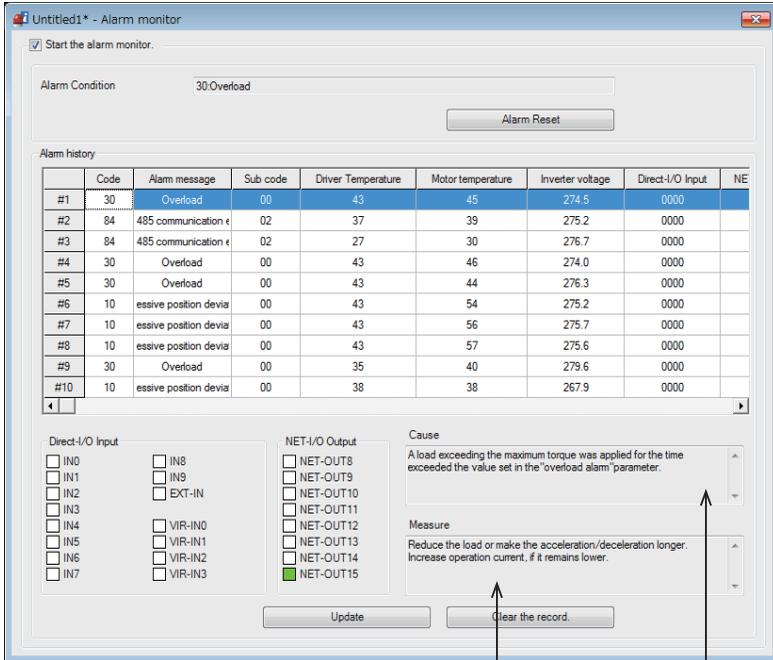
14 Alarm (protective function)

When an alarm generates, the ALM-B output will turn OFF and POWER/ALARM LED will blink in red.

Before resetting an alarm, always remove the cause of the alarm and ensure safety. For details about alarms, refer to the "OPERATING MANUAL Function Edition."

■ Example of the alarm monitor screen of the MEXE02

The alarm message can be checked using the "Alarm monitor" of the MEXE02.



The measures are displayed.

The cause that generated the alarm is displayed.

15 Troubleshooting

During motor operation, the motor or driver may fail to function properly due to an improper 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.

This chapter describes problems that may occur during operation in addition to the initial settings.
Refer to the OPERATING MANUAL Function Edition for these contents.

Phenomenon	Possible cause	Remedial action
<ul style="list-style-type: none"> The motor is not excited. The motor output shaft can be moved by hand. 	The C-ON input is turned OFF.	Turn the C-ON input ON and confirm that the motor will be excited.
	The FREE input is turned ON.	Turn the FREE input OFF.
There is holding torque even if motor excitation is turned OFF.	Effect of dynamic brake.	If motor excitation is turned OFF by C-ON input or STOP input, the holding torque will be generated larger than when the power is shut off (dynamic brake). To release the dynamic brake, shut off the power or turn the FREE input ON.
The motor does not operate.	An electromagnetic brake motor is used and the electromagnetic brake is in the holding state.	Check the connections between electromagnetic brake and driver.
	The STOP input is turned ON.	Turn the STOP input OFF.
	The position (distance) is not set in the operation data while positioning operation.	Check the operation data.
The FWD-JOG input and RVS-JOG input are turned ON simultaneously in the JOG operation.	The FWD-JOG input and RVS-JOG input are turned ON simultaneously in the JOG operation.	Turn either FWD-JOG input or RVS-JOG input ON.
	The "motor rotation direction" parameter is set wrong.	Check the setting of the "motor rotation direction" parameter.
The motor rotates in the direction opposite to the specified direction.		
The gear output shaft rotates in the direction opposite to the motor.	A gear that rotates in the direction opposite to the motor shaft is used.	<ul style="list-style-type: none"> With TS geared motor, the gear output shaft rotates in the direction opposite to the motor when the gear ratio is 20 or 30. With Harmonic geared motors, the gear output shaft always rotates in the direction opposite to the motor.
Motor operation is unstable.	Connection error in the motor or power supply.	Check the connections between the driver, motor and power supply.
	The "Base current" parameter or "Stop current" parameter is too low.	Return the "Base current" parameter or "Stop current" parameter to its initial setting and check the motor operation. If the current is too low, the motor torque will also be too low and operation will be unstable.
Motor vibration is too great.	Load is too small.	Lower the current using the "Base current" parameter. Vibration will increase if the motor's output torque is too large for the load.
The electromagnetic brake does not release.	The power is not supplied to the electromagnetic brake.	Check the connection of the electromagnetic brake.

Note

- When an alarm generates, check the alarm message using the **MEXE02** or via RS-485 communication.
- I/O signals can be monitored using the **MEXE02** or via RS-485 communication. Use to check the wiring condition of the I/O signals.

16 To use the product in more convenient manners

Using the **MEXE02**, you can set the operation data or change I/O signals that assign to the CN4 connector. Also, you can monitor the operating status or perform test operation.

Refer to the OPERATING MANUAL Function Edition for details about operation.

Like to set the resolution
based on the function

Like to change the I/O
assignment

Like to utilize the
sequence function

Like to utilize convenient
functions for maintenance

Like to check operation
by the waveform monitor

Like to change the
alarm conditions

17 Accessories (sold separately)

■ Driver cable

This cable is a shielded cable for the driver control I/O that has good noise immunity. The ground wires useful to grounding are provided at both ends of the cable.

Model	Length [m (ft.)]
CC16D010B-1	1 (3.3)
CC16D020B-1	2 (6.6)

■ RS-485 communication cable

You can link drivers using this cable connected to the CN6/CN7 connectors.

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

■ CR circuit for surge suppression

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

Model: **EPCR1201-2**

■ CR circuit module

This product is effective to suppress the surge which occurs in a relay contact part. Use this product to protect the contacts of the relay or switch.

4 pieces of CR circuit for surge suppression are mounted on the compact circuit, and this product can be installed to the DIN rail. This product can make the wiring easily and securely since it also supports terminal block connection.

Model: **VCS02**

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ORIENTAL MOTOR U.S.A. CORP.
Technical Support Tel:(800)468-3982
8:30 A.M. to 5:00 P.M., P.S.T. (M-F)
7:30 A.M. to 5:00 P.M., C.S.T. (M-F)
www.orientalmotor.com

ORIENTAL MOTOR DO BRASIL LTDA.
Tel:+55-11-3266-6018
www.orientalmotor.com.br

ORIENTAL MOTOR (EUROPA) GmbH
Headquarters Düsseldorf, Germany
Technical Support Tel:00 800/22 55 66 22
www.orientalmotor.de

ORIENTAL MOTOR (UK) LTD.
Tel:01256-347090
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Korea
Tel:080-777-2042
www.inaom.co.kr

ORIENTAL MOTOR CO., LTD.
Hong Kong Branch
Tel:+852-2427-9800

ORIENTAL MOTOR CO., LTD.
Headquarters Tokyo, Japan
Tel:03-6744-0361
www.orientalmotor.co.jp