Oriental motor

HM-60242-4

Closed Loop Stepping Motor and Driver Package

αSTEP

AZ Series

AC power input Pulse input type

OPERATING MANUAL Driver

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

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

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1 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 Pulse input 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 AC power input Pulse input 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**.

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

■ Hazardous substances

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

■ General specifications

Degree of protection		IP20
Operation environment	Ambient temperature	0 to +55 °C (+32 to +131 °F) * (non-freezing)
	Humidity	85% or less (non-condensing)
	Altitude	Up to 1000 m (3300 ft.) above sea level
	Surrounding atmosphere	No corrosive gas, dust, water or oil
Storage environment, Shipping environment	Ambient temperature	−25 to +70 °C (−13 to +158 °F) (non-freezing)
	Humidity	85% or less (non-condensing)
	Altitude	Up to 3000 m (10000 ft.) above sea level
	Surrounding atmosphere	No corrosive gas, dust, water or oil

* When installing a driver on a heat sink. [material: aluminum, 200×200×2 mm (7.87×7.87×0.08 in.) equivalent].

Insulation resistance	100 MΩ or more when 500 VDC megger is applied between the following places: • PE terminal - Power supply terminals • Encoder connector - Power supply terminals • Signal I/O terminals - Power supply terminals
Dielectric strength	Sufficient to withstand the following for 1 minute: • PE terminal - Power supply terminals 1.5 kVAC 50/60 Hz • Encoder connector - Power supply terminals 1.8 kVAC 50/60 Hz • Signal I/O terminals - Power supply terminals 1.8 kVAC 50/60 Hz

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	
	• 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. • The terminals on the driver's front panel marked with ⚠ ⚠ symbol indicate the presence of high voltage. Do not touch these terminals while the power is on. 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 touch the connection terminals on the driver immediately (within 10 minute) after the power is turned off. This may cause electric shock. • Do not disassemble or modify the product. This may cause injury or damage to equipment.
	• Assign qualified personnel the task of installing, wiring, operating/controlling, inspecting and troubleshooting the product. Failure to do so my 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	
	• 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.
	• 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 control 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.

- **Preventing leakage current**

  Stray capacitance exists between the driver's current-carrying line and other current-carrying lines, the earth and the motor, respectively. A high-frequency current may leak out through such capacitance, having a detrimental effect on the surrounding equipment. The actual leakage current depends on the driver's switching frequency, the length of wiring between the driver and motor, and so on.When connecting an earth leakage breaker, use one of the following products offering resistance against high frequency current:
  Mitsubishi Electric Corporation: NV series
  Fuji Electric FA Components & Systems Co., Ltd.: EG and SG series

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

  Do not turn off the control 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.

- **If vertical drive (gravitational operation) such as elevator applications is performed or if sudden start-stop operation of a large inertial load is repeated frequently, connect the regeneration unit RGB100.**

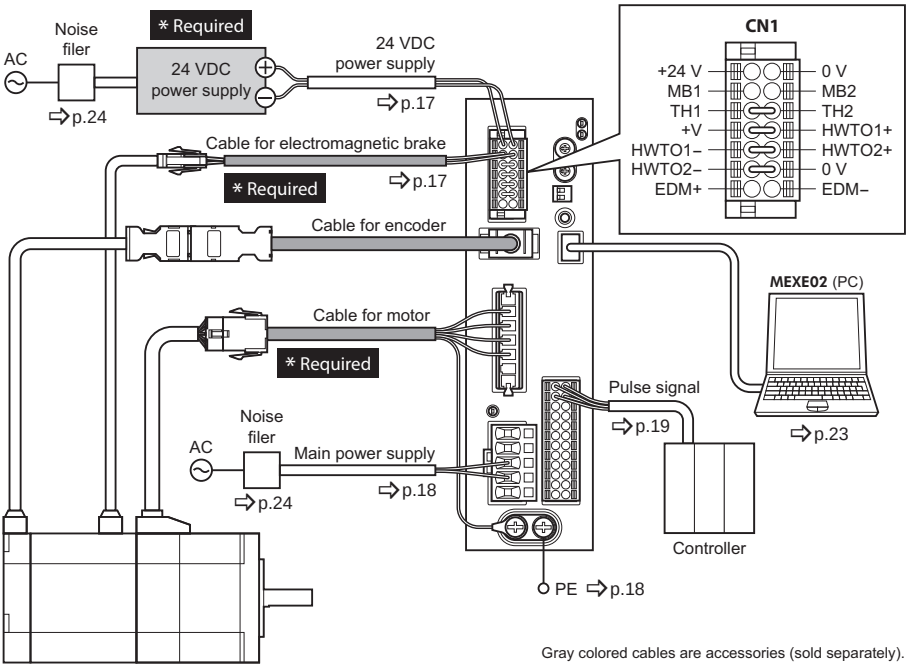
  The overvoltage alarm may generate depending on the operating condition of the motor.
  When the overvoltage alarm has generated, review the operating conditions or connect an accessory regeneration unit **RGB100** (sold separately).
  Refer to p.49 for connection method.

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

  The USB communication connector and CN5 connector 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.

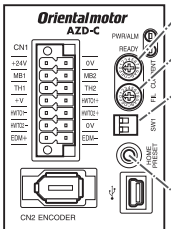
4 Setup guide

Wiring guide



Gray colored cables are accessories (sold separately).

Setting of switches



Current setting switch (CURRENT) ⇨p.30

Command filter setting switch (FIL) ⇨p.31

Function setting switch (SW1)
No.1: Sets the resolution. ⇨p.30
No.2: Sets the pulse input mode. ⇨p.30

HOME-PRESET switch ⇨p.32
The home position can be set easily by pressing and holding the switch.

■ Factory setting of switches

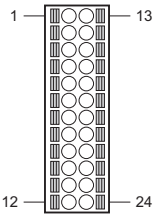
Base current	100% (CURRENT: F)
Command filter	1 ms (FIL: 1)
Resolution	1000 p/r (SW1-No.1: OFF)
Pulse input mode	2-pulse input mode (SW1-No.2: OFF)

CN5 pin assignment (⇨p.19)

Pin No.	Signal name	Description *
1	CW+ [PLS+]	CW pulse input+ [Pulse input+]
2	CCW+ [DIR+]	CCW pulse input+ [Direction input +]
3	IN4	Control input 4 (ZHOME)
4	IN6	Control input 6 (STOP)
5	IN-COM [4-7]	IN4 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+

* ( ): Initial value

CN5



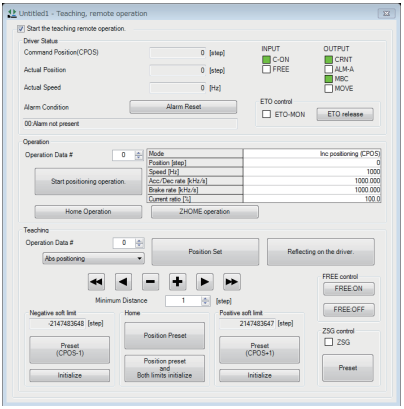
Pin No.	Signal name	Description *
13	CW− [PLS−]	CW pulse input− [Pulse input−]
14	CCW− [DIR−]	CCW pulse input− [Direction input −]
15	IN5	Control input 5 (FREE)
16	IN7	Control input 7 (ALM-RST)
17	IN-COM [8-9]	IN8, IN9 input common
18	IN9	Control input 9 (RV-JOG)
19	OUT1	Control output 1 (IN-POS)
20	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

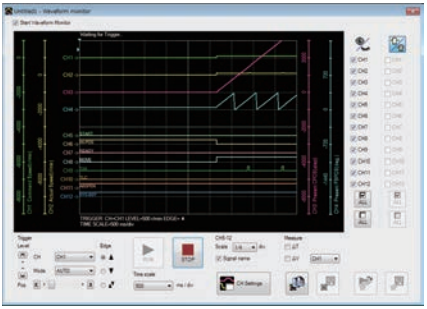
Provide the data setting software MEXE02 and USB cable (commercially available)

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

- The product is a type with machinery incorporated, so it should be installed within an enclosure.
- This product cannot be used with cables normally used for IT equipment.
- Install the product within the enclosure in order to avoid contact with hands.
- When a product can be touched with hands, be sure to ground. When installing the motor and driver, securely connect their Protective Earth Terminals.
- To protect against electric shock using an earth leakage breaker (RCD), connect a type B earth leakage breaker to the primary side of the driver.
- When using a circuit breaker (MCCB), use a unit conforming to the EN or IEC standard.
- Isolate the motor cable, power-supply cable and other drive cables from the signal cables (CN1, CN5) by means of double insulation.
- The temperature of the driver's heat sink may exceed 90 °C (194 °F) depending on the driving conditions. Accordingly, take heed of the following items:
  - Do not touch the driver.
  - Do not use the driver near flammable objects.
  - Always conduct a trial operation to check the driver temperature.

• Applicable Standards

Motor: EN 60034-1, EN 60034-5, EN 60664-1
Driver: EN 61800-5-1

• Installation condition (EN Standards)

Motor	Driver
Motor is to be used as a component within other equipment. Overvoltage category: Ⅱ Pollution degree: 3 Degree of protection: IP65 Protection against electric shock: Class Ⅰ	Driver is to be used as a component within other equipment. Overvoltage category: Ⅱ Pollution degree: 2 Degree of protection: IP20 Protection against electric shock: Class Ⅰ

■ EMC Directive

This product has received EMC compliance under the conditions specified in "Example of motor and driver installation and wiring" on p.26. 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 EN 61800-3 EN 61000-3-2 EN 61000-3-3
EMS	EN 61000-6-2 EN 61800-3

This type of PDS is not intended to be used on a low-voltage public network which supplies domestic premises; radio frequency interference is expected if used on such a network.

6 Preparation

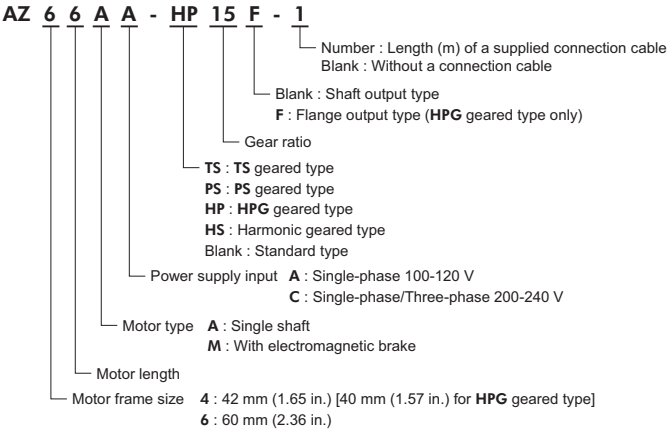
This chapter explains the items you should check, as well as the name and function of each part.

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 (14 pins) ..... 1 pc.
- CN4 connector (5 pins) ..... 1 pc.
- CN5 connector (24 pins) ..... 1 pc.
- Connector wiring lever ..... 1 pc. (for CN4 connector)
- OPERATING MANUAL Driver..... 1 copy (this document)

6.2 How to identify the product model



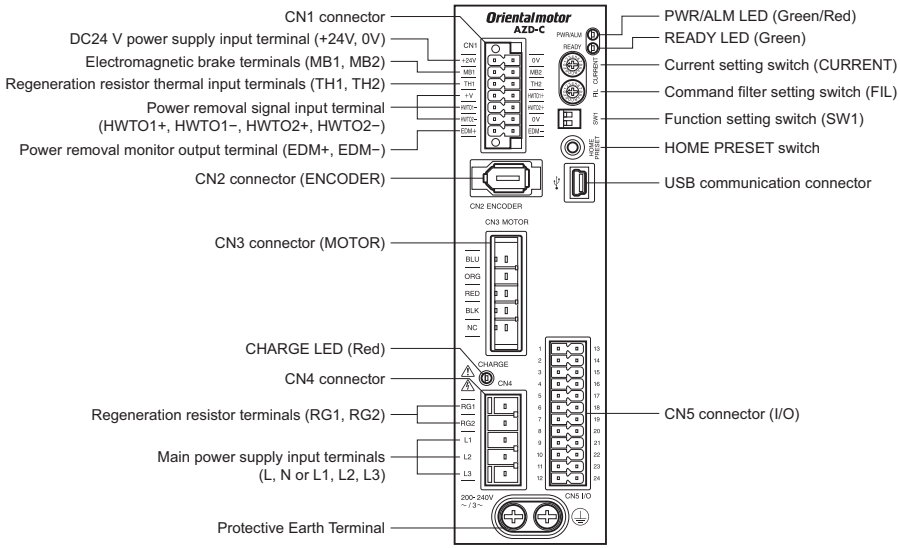
6.3 Combinations of motors and drivers

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.

- ☐ indicates **A** (single shaft) or **M** (with electromagnetic brake).
- ■ in the model names indicates a number representing the gear ratio.
- When a connection cable is included, ○ in the model names indicates a number (**-1**, **-2**, **-3**) representing the cable length.

Type	Model	Motor model	Driver model
Standard type	**AZ46☐A**○	AZM46☐C	AZD-A
	AZ66☐A○	AZM66☐C	
	AZ69☐A○	AZM69☐C	
	AZ46☐C○	AZM46☐C	AZD-C
	AZ66☐C○	AZM66☐C	
	AZ69☐C○	AZM69☐C	
TS geared type	**AZ46AA-TS**■○	AZM46AC-TS■	AZD-A
	AZ66AA-TS■○	AZM66AC-TS■	
	AZ46AC-TS■○	AZM46AC-TS■	AZD-C
	AZ66AC-TS■○	AZM66AC-TS■	
PS geared type	**AZ46AA-PS**■○	AZM46AC-PS■	AZD-A
	AZ66AA-PS■○	AZM66AC-PS■	
	AZ46AC-PS■○	AZM46AC-PS■	AZD-C
	AZ66AC-PS■○	AZM66AC-PS■	
HPG geared type	**AZ46AA-HP**■○	AZM46AC-HP■	AZD-A
	AZ46AA-HP■**F**○	AZM46AC-HP■F	
	AZ66AA-HP■○	AZM66AC-HP■	
	AZ66AA-HP■**F**○	AZM66AC-HP■F	
	AZ46AC-HP■○	AZM46AC-HP■	AZD-C
	AZ46AC-HP■**F**○	AZM46AC-HP■F	
	AZ66AC-HP■○	AZM66AC-HP■	
	AZ66AC-HP■**F**○	AZM66AC-HP■F	
Harmonic geared type	**AZ46AA-HS**■○	AZM46AC-HS■	AZD-A
	AZ66AA-HS■○	AZM66AC-HS■	
	AZ46AC-HS■○	AZM46AC-HS■	AZD-C
	AZ66AC-HS■○	AZM66AC-HS■	

6.4 Names and functions of parts



Type	Name	Display	Description
LED	PWR/ALM LED (Green/Red)	PWR/ALM	• This LED is lit in green while the 24 VDC power is input. • If an alarm (protective function) generates, the LED will blink in red. • If the ETO function (p.42) is triggered, the LED will blink in green.
	READY LED (Green)	READY	This LED is lit while the READY output is ON. It is not lit when the READY output is OFF.
	CHARGE LED (Red)	CHARGE	This LED is lit while the main power is input. After the main power has been turned off, the LED will turn off once the residual voltage in the driver drops to a safe level.
Switch	Current setting switch	CURRENT	This switch is used to set the base current for the operating current and standstill current. Factory setting: F
	Command filter setting switch	FIL	This switch adjusts the motor response. Factory setting: 1
	Function setting switch	SW1	• No.1: This switch is used to set the resolution per revolution of the motor output shaft. Factory setting: OFF (1000 p/r) • No.2: This switch is used to toggle between the 1-pulse input mode and 2-pulse input mode. The factory setting of the pulse-input mode depends on the destination country.
	HOME PRESET switch	HOME PRESET	This switch is used to set the starting position (home position) when performing positioning operation.

Type	Name	Display	Description
Connector, Terminal	USB communication connector	–	Connects a PC in which the **MEXE02** has been installed. (USB2.0 mini-B port)
	24 VDC power supply input terminals (CN1)	+24V, 0V	Connects the control power supply of the driver. +24V: +24 VDC power supply input 0V: Power supply ground
	Electromagnetic brake terminals (CN1)	MB1, MB2	Connect the lead wires from the electromagnetic brake. MB1: Electromagnetic brake − (Black) MB2: Electromagnetic brake + (White)
	Regeneration resistor thermal input terminals (CN1)	TH1, TH2	Connects the signal line of the accessory regeneration unit **RGB100** (sold separately). If no regeneration unit is connected, short the TH1 and TH2 terminals.
	Power removal signal input terminal (CN1)	HWTO1+, HWTO1− HWTO2+, HWTO2−	Connects the switch or programmable controller.
	Power removal monitor output terminal (CN1)	EDM+, EDM−	Connects the programmable controller.
	CN2 connector	ENCODER	Connects the encoder.
	CN3 connector	MOTOR	Connects the motor.
	Regeneration resistor terminals (CN4)	RG1, RG2	Connects the accessory regeneration unit **RGB100** (sold separately).
	Main power supply input terminals (CN4)	L, N, NC L1, L2, L3	Connects the main power supply.
	CN5 connector	I/O	Connects the I/O signals.
	Protective Earth Terminal	–	Used for grounding via a grounding cable of AWG16 to 14 (1.25 to 2.0 mm^2).

7 Installation

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

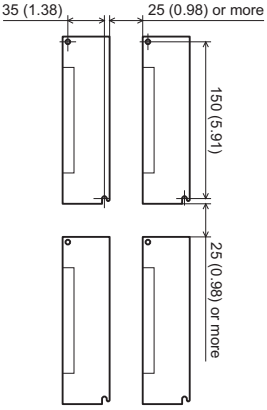
7.1 Location for installation

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 +55 °C (+32 to +131 °F) (non-freezing)
- Operating ambient humidity 85% or less (non-condensing)
- Area that is free of explosive atmosphere or toxic gas (such as sulfuric gas) or liquid
- Area not exposed to direct sun
- Area free of excessive amount of dust, iron particles or the like
- Area not subject to splashing water (rain, water droplets), oil (oil droplets) or other liquids
- Area free of excessive salt
- Area not subject to continuous vibration or excessive shocks
- Area free of excessive electromagnetic noise (from welders, power machinery, etc.)
- Area free of radioactive materials, magnetic fields or vacuum
- 1000 m (3300 ft.) or lower above sea level

7.2 Installation method

The driver is designed so that heat is dissipated via air convection and conduction through the enclosure. Install the driver on a flat metal plate [material: aluminium, 200×200×2 mm equivalent (7.87×7.87×0.08 in.)] having excellent heat conductivity.
There must be a clearance of at least 25 mm (0.98 in.) in the horizontal and vertical directions, between the driver and enclosure or other equipment within the enclosure.
When installing the driver in an enclosure, use two screws (M4, not supplied) to secure the driver through the mounting holes.



Unit: mm (in.)

Note

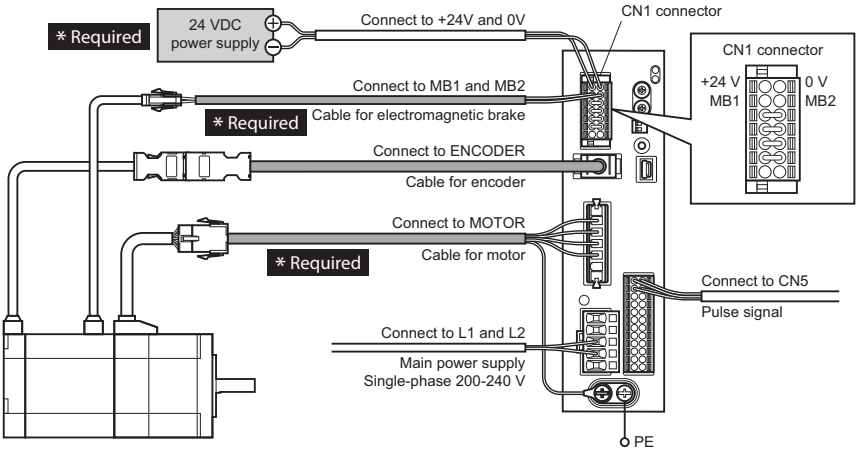
- Install the driver in an enclosure whose pollution degree is 2 or better environment, or whose degree of protection is IP54 minimum.
- Do not install any equipment that generates a large amount of heat or noise near the driver.
- Do not install the driver underneath the controller or other equipment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

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 and single-phase 200 to 240 VAC input.



Gray colored cables are accessories (sold separately).

Note

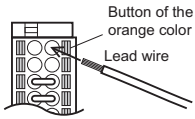
- Have the connector plugged in securely. Insecure connections may cause malfunction or damage to the motor or driver.
- When unplugging the motor cable, do so while pressing the latches on the connector.
- When plugging/unplugging the connector, turn off the power and wait for the CHARGE LED to turn off before doing so. The residual voltage may cause electric shock.
- Do not wire the power supply cable of the driver in the same cable duct with other power lines or motor cables. Doing so may cause malfunction due to noise.
- The lead wires of the "cable for electromagnetic brake" have polarities, so connect them in the correct polarities. If the lead wires are connected with their polarities reversed, the electromagnetic brake will not operate properly.
- 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 to CN1

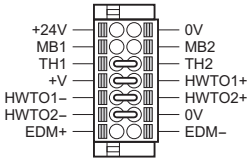
■ Wiring the CN1 connector

- Applicable lead wire: AWG24 to 16 (0.2 to 1.25 mm^2)
- 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 with a slotted screwdriver.
3. After having inserted, release the button to secure the lead wire.



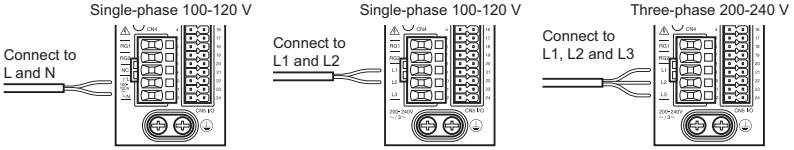
■ Pin assignment list



Display	Description
+24V, 0V	Connects the control power supply. • When the electromagnetic brake is not used: 24 VDC±5% 0.25 A • When the electromagnetic brake is used: 24 VDC±5% 0.5 A (0.33 A for **AZ46**) • When the electromagnetic brake is used and the distance between the motor and driver is 20 m (65.6 ft.): 24 VDC±4% 0.5 A (0.33 A for **AZ46**)
MB1, MB2	Connect the lead wires from the electromagnetic brake. MB1: Electromagnetic brake − (Black) MB2: Electromagnetic brake + (White)
TH1, TH2	Connects the signal line of the accessory regeneration unit **RGB100** (sold separately). Refer to p.49 for connection method. If the regeneration unit is not used, connect a jumper wire between the terminals as shown in the figure.
HWTO1+, HWTO1− HWTO2+, HWTO2−	Connects the switch or programmable controller. If the power removal function is not used, connect a jumper wire between the terminals as shown in the figure.
EDM+, EDM−	Connects the programmable controller.
+V, 0V	For internal connections. Do not connect anything. If the power removal function is not used, connect a jumper wire between the terminals as shown in the figure.

8.3 Connecting the power supply

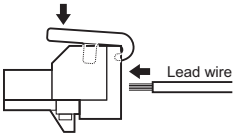
The connecting method varies depending on the power supply specification.



■ Wiring the CN4 connector

- Applicable lead wire: AWG18 to 14 (0.75 to 2.0 mm^2)
- Length of the insulation cover which can be peeled: 9 mm (0.35 in.)

1. Insert the connector lever.
2. Insert the lead wire while pushing down the connector lever.



■ Power supply current capacity

• Single-phase 100-120 V

Model	Power supply current capacity
AZ46	2.7 A or more
AZ66	3.8 A or more
AZ69	5.4 A or more

• Single-phase 200-240 V

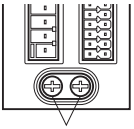
Model	Power supply current capacity
AZ46	1.7 A or more
AZ66	2.3 A or more
AZ69	3.3 A or more

• Three-phase 200-240 V

Model	Power supply current capacity
AZ46	1.0 A or more
AZ66	1.4 A or more
AZ69	2.0 A or more

8.4 Grounding

Two Protective Earth Terminals (screw size: M4) are provided on the driver. Be sure to ground one of the Protective Earth Terminals.
You can ground either of the two Protective Earth Terminals.
Grounding wire: AWG16 to 14 (1.25 to 2.0 mm^2)
Tightening torque: 1.2 N·m (170 oz-in)


Protective Earth Terminal
(Ground one of these terminals.)

Connect the grounding wire of the "cable for motor" to the other terminal to ground the motor.

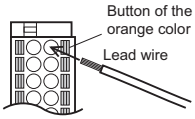
Do not share the grounding wire with a welder or any other power equipment.
When grounding the Protective Earth Terminal, use a round terminal and secure the grounding point near the driver.

8.5 Connecting the I/O signals

■ Wiring the CN5 connector

- Applicable lead wire: AWG24 to 16 (0.2 to 1.25 mm^2)
- Length of the insulation cover which can be peeled: 10 mm (0.39 in.)

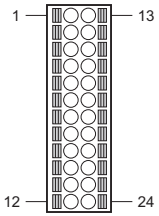
1. Strip the insulation cover of the lead wire.
2. Insert the lead wire while pushing the button of the orange color with a slotted screwdriver.
3. After having inserted, release the button to secure the lead wire.



■ Pin assignment list

Pin No.	Signal name	Description *
1	CW+ [PLS+]	CW pulse input+ [Pulse input+]
2	CCW+ [DIR+]	CCW pulse input+ [Direction input +]
3	IN4	Control input 4 (ZHOME)
4	IN6	Control input 6 (STOP)
5	IN-COM [4-7]	IN4 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+

* ( ): Initial value



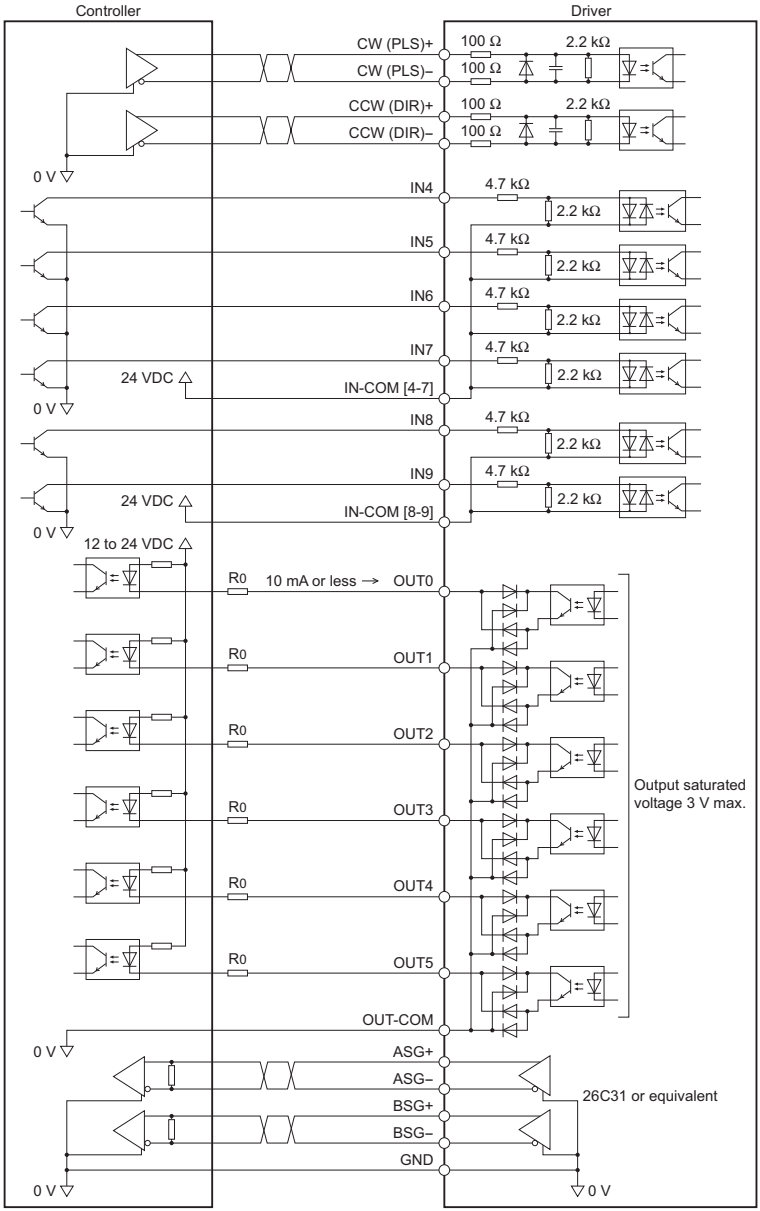
Pin No.	Signal name	Description *
13	CW− [PLS−]	CW pulse input− [Pulse input−]
14	CCW− [DIR−]	CCW pulse input− [Direction input −]
15	IN5	Control input 5 (FREE)
16	IN7	Control input 7 (ALM-RST)
17	IN-COM [8-9]	IN8, IN9 input common
18	IN9	Control input 9 (RV-JOG)
19	OUT1	Control output 1 (IN-POS)
20	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

8.6 Connection diagram

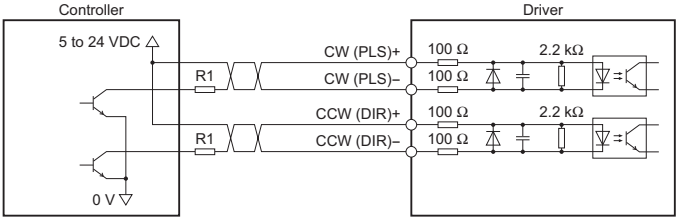
■ Connecting to a current sink output circuit

• When pulse input is of line driver type



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.

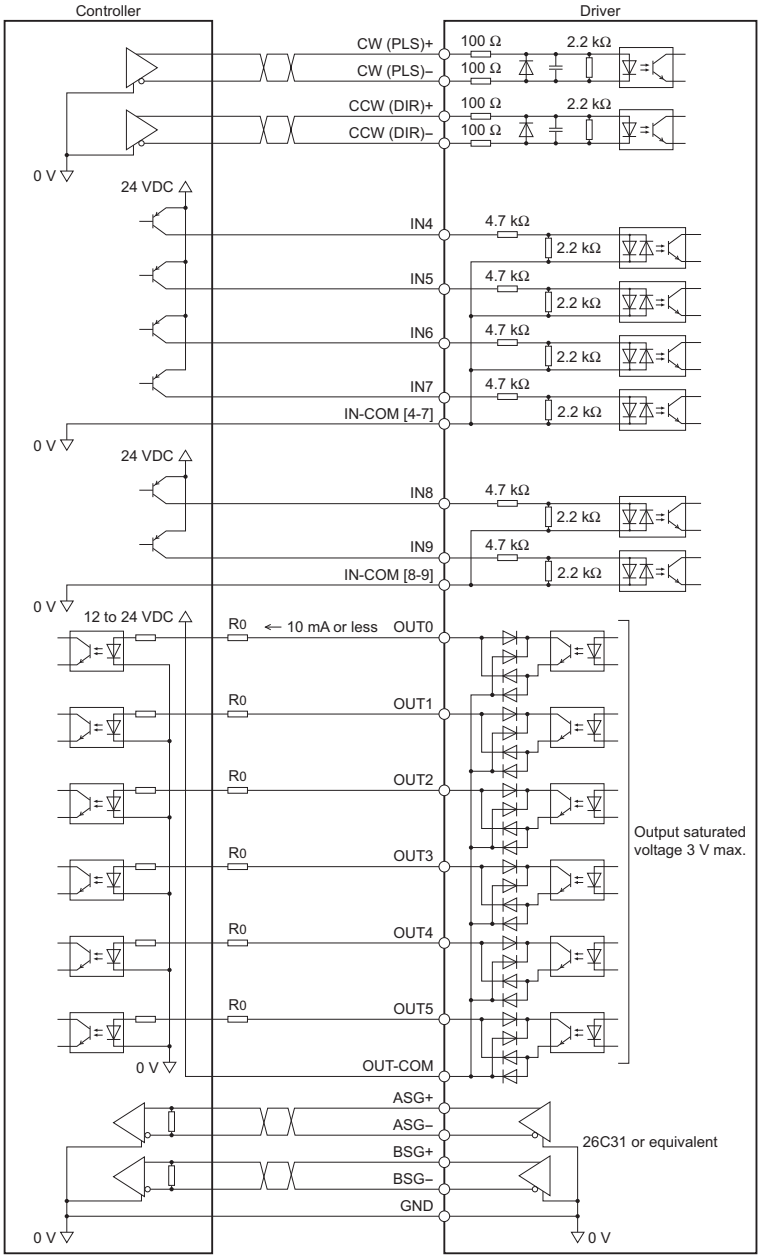
• When pulse input is of open-collector type



Note
- Use the CW (PLS) input and CCW (DIR) input at 5 to 24 VDC. If the voltage exceeding 5 VDC is applied, connect an external resistor R1 so that the input current becomes 7 to 20 mA.
- When using signals at 5 VDC, apply the voltage directly.

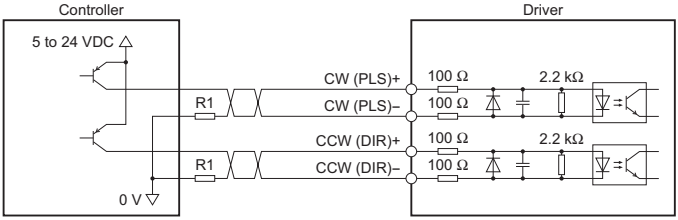
■ Connecting to a current source output circuit

• When pulse input is of line driver type



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.

• When pulse input is of open-collector type



Note
- Use the CW (PLS) input and CCW (DIR) input at 5 to 24 VDC. If the voltage exceeding 5 VDC is applied, connect an external resistor R1 so that the input current becomes 7 to 20 mA.
- When using signals at 5 VDC, apply the voltage directly.

8.7 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.

8.8 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.

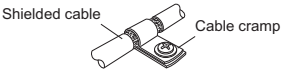
■ Measures against electrical noise

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 in the power supply cable of driver.
- 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 a shielded cable of AWG18 to 14 (0.75 to 2.0 mm^2) for the power lines. Use a shielded cable of AWG24 to 16 (0.2 to 1.25 mm^2) for the 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.49 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.
- Change the transmission method of the pulse signal to the line driver type in order to prevent noise effects. When the pulse signal of the controller is the open collector type, use an accessory pulse signal converter for noise immunity (sold separately). Refer to p.49 for details.

■ Noise suppression parts

• Noise filter

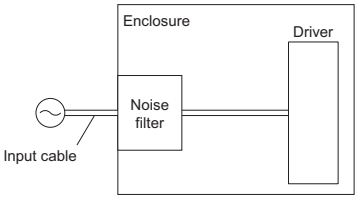
- Connect the following noise filter (or equivalent) to the power line. Doing so will prevent the propagated noise through the power line. Install the noise filter as close to the driver as possible.

Manufacture	Single-phase 100-120 V Single-phase 200-240 V	Three-phase 200-240 V
SOSHIN ELECTRIC CO.,LTD	HF2010A-UPF	HF3010C-SZA
Schaffner EMC	FN2070-10-06	–

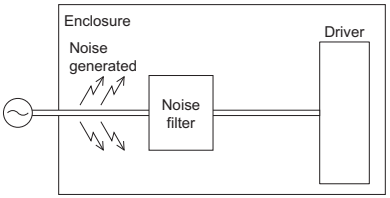
- Use the AWG18 (0.75 mm^2) or thicker wire for the input and output cables of the noise filter, and secure firmly using a cable clamp etc. so that the cable does not come off the enclosure.
- Place the input cable as far apart as possible from the output cable, and do not wire the cables in parallel. 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.

• Recommended wiring example



• Wiring example where the noise tends to generate



■ Noise suppression parts (accessories)

Accessories are sold separately. Refer to p.49 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.

- **Pulse signal converter for noise immunity**

  This is a noise filter for pulse signal lines. It eliminates the noise of the pulse signal and changes the pulse signal to the line driver type.

- **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.

8.9 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.26.
The user is responsible for ensuring the machine's compliance with the EMC Directive, based on the installation and wiring explained below.

- **Connecting noise filter**

  In large electrically noisy environments, connect a noise filter. Refer to "Noise filter" on p.24 for details.

- **Connecting the AC power line reactor**

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

- **Connecting the 24 VDC power supply**

  Use a 24 VDC power supply 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.24 for grounding the shielded cable.

- **Connecting the motor cable**

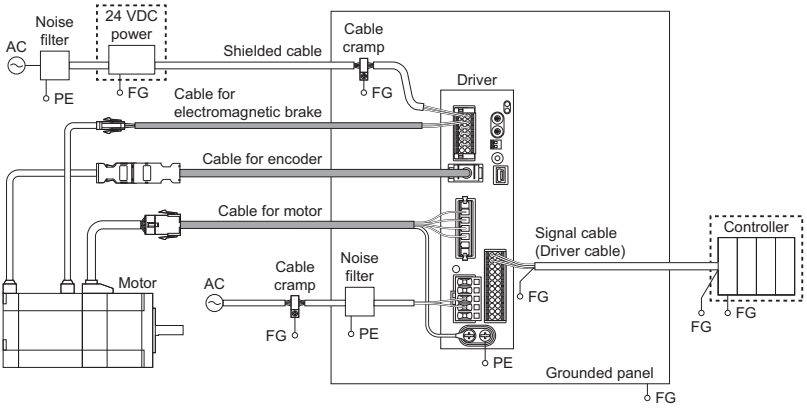
  Use an accessory motor cable (sold separately) when extending the wiring distance between the motor and driver.

- **Connecting the signal cable**

  Refer to "Prevention of noise propagation" on p.24.

- **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.18 for grounding method.

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



----- is a shield box.
Gray colored cables are accessories (sold separately).

Note The driver uses parts that are sensitive to electrostatic charge. Take measures against static electricity since static electricity may cause the driver to malfunction or suffer damage.

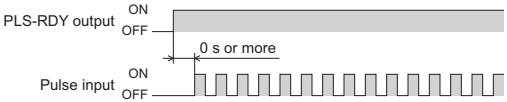
9 Explanation of I/O signals

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.

■ CW (PLS) input, CCW (DIR) input

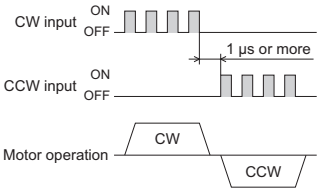
These inputs serve as the CW and CCW inputs in the 2-pulse input mode, or PLS and DIR inputs in the 1-pulse input mode. Set the pulse input mode of the driver according to the pulse output mode of the controller (pulse generator) used with the driver. When inputting the pulse, check the PLS-RDY output is turned ON.



Note When the motor is at standstill, be sure to keep the photocoupler in OFF state.

- **Maximum input pulse frequency**
  - When the controller is of line driver type: 1 MHz (duty cycle is 50%)
  - When the controller is of open-collector type: 250 kHz (duty cycle is 50%)
- **2-pulse input mode**

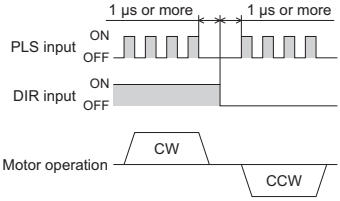
When the CW input is turned from OFF to ON, the motor will rotate by one step in CW direction.
When the CCW input is turned from OFF to ON, the motor will rotate by one step in CCW direction.



Note Do not input the CW signal and CCW signal simultaneously. If the other signal is input while one of the signals is ON, the motor cannot operate normally.

- **1-pulse input mode**

When the PLS input is turned from OFF to ON while the DIR input is ON, the motor will rotate by one step in CW direction.
When the PLS input is turned from OFF to ON while the DIR input is OFF, the motor will rotate by one step in CCW direction.



■ 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. Pulse input will also be disabled. When inputting pulses, turn the STOP input OFF.

Note When the motor was stopped by the STOP input, be sure to turn the pulse input OFF. If the STOP input is turned OFF while inputting pulses, the motor may suddenly start rotating.

■ 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

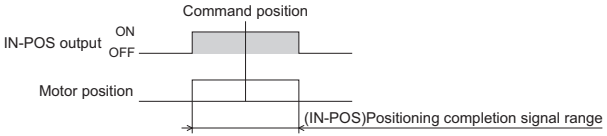
The driver outputs signals in the photocoupler/open-collector output mode or line driver output mode. The signal state represents the "ON: Carrying current" or "OFF: Not carrying current" state of the internal photocoupler rather than the voltage level of the signal.

■ 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

When the driver is ready to execute operation by inputting pulses, the PLS-RDY output turns ON. Input the pulse to the driver after the PLS-RDY output has turned ON.

■ READY output

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

■ MOVE output

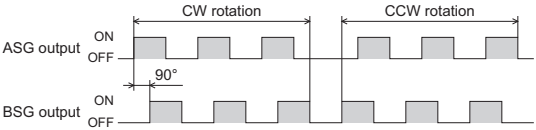
The MOVE output turns ON while the motor is operating.

■ ALM-B output

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

■ ASG output, BSG output

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.

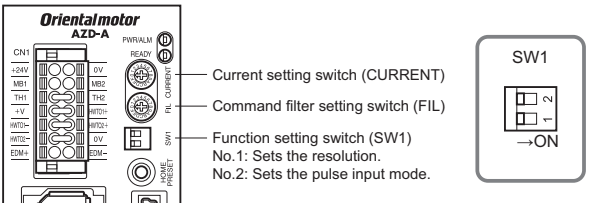


Note

- 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 and adjustment

This chapter explains how to adjust/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 Resolution

Set a resolution per revolution of the motor output shaft using the SW1-No.1 of the function setting switch.

OFF: 1000 p/r (factory setting)
ON: 10000 p/r

10.2 Pulse input mode

Set a pulse input mode of the driver according to the pulse output mode of the controller (pulse generator) used with the driver. Set a desired mode using the SW1-No.2 of the function setting switch. The factory setting of the pulse input mode depends on the destination country.

OFF: 2-pulse input mode
ON: 1-pulse input mode

10.3 Base current

Set the base current rate (%) for the operating current and standstill current. Set using the current setting switch (CURRENT). If the load is small and there is an ample allowance for torque, motor temperature rise can be suppressed by setting a lower operating current.
The actual operating current and standstill current are as follows.

- Operating current: Maximum output current × Base current rate
- Standstill current: Maximum output current × Base current rate × 0.5

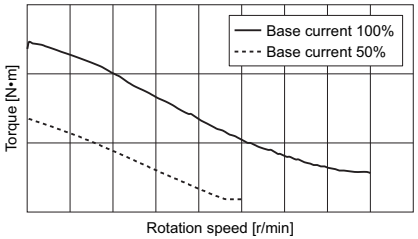
The dial settings and corresponding base current rates are listed below.

Dial setting	Base current rate (%)
0	6.3
1	12.5
2	18.8
3	25.0
4	31.3
5	37.5
6	43.8
7	50.0

Dial setting	Base current rate (%)
8	56.3
9	62.5
A	68.8
B	75.0
C	81.3
D	87.5
E	93.8
F	100 (factory setting)

Note

- Excessively low operating current or standstill current may cause a problem in starting the motor or holding the load in position. Set a suitable current for your application.
- The motor torque is proportional to the current. If the CURRENT switch is set to "7" (50%) while the operating torque is set to 100% (maximum output current), only 50% of the torque is output.



10.4 Command filter

The motor response to input pulses can be adjusted with the command filter setting switch (FIL). When setting a higher value for the command filter, lower vibration at low speed operation or smoother operation at starting/stopping of the motor can be achieved. However, if this setting is too high, synchronization performance is decreased. Set a suitable value based on the load or application.
The dial settings and corresponding command filter time constant are listed below.

Dial setting	Command filter time constant (ms)
0	0
1	1 (factory setting)
2	2
3	3
4	5
5	7
6	10
7	20

Dial setting	Command filter time constant (ms)
8	30
9	50
A	70
B	100
C	120
D	150
E	170
F	200

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.

Home position setting (⇨p.32) *

↓

Trial operation (⇨p.34)

↓

High-speed return-to-home operation (⇨p.35)

* 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.

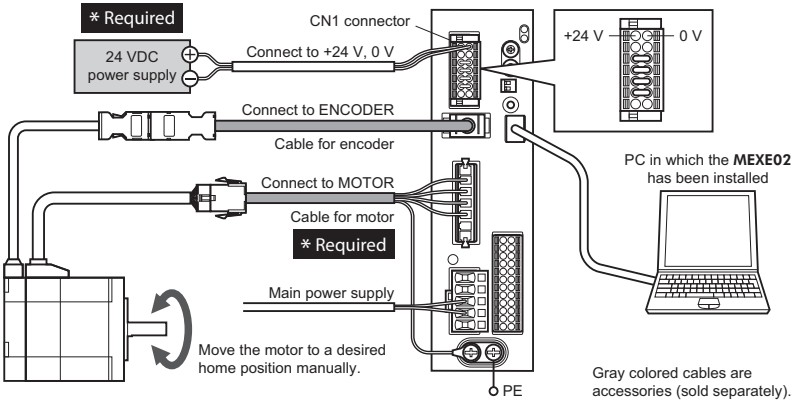
Setting item	Factory setting
Resolution	1000 P/R (0.36°/step)
Operating current	F (Base current 100%)
Command filter time constant	1 (1 ms)
Home position	Motor position at power on

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.

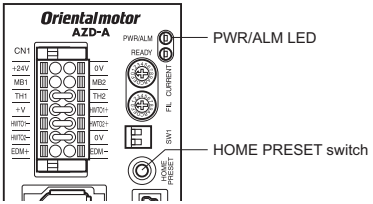
STEP 1 Connect the motor, power supply and MEXE02 to the driver

1. Wire the driver by reference to the figure. Be sure to connect a 24 VDC power supply.
2. Move the motor to a desired home position manually.



STEP 2 Turn on the power and set the home position

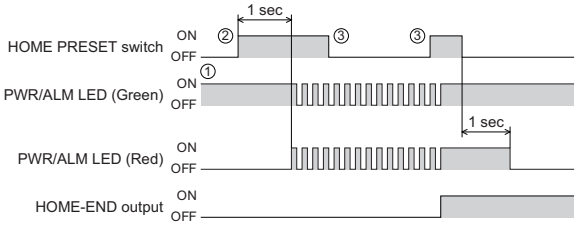
1. Turn on the 24 VDC power supply and main power supply.
2. Keep pressing the HOME PRESET switch for one second.
   Red color and green color on the PWR/ALM LED blinks simultaneously. (Red and green colors may overlap and it may be visible to orange.)



3. Remove the hand from the HOME PRESET switch within three seconds after the PWR/ALM LED started blinking, and press the switch again.
   After both red color and green color on the PWR/ALM 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 PWR/ALM LED started blinking. If three seconds were passed, the PWR/ALM 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.

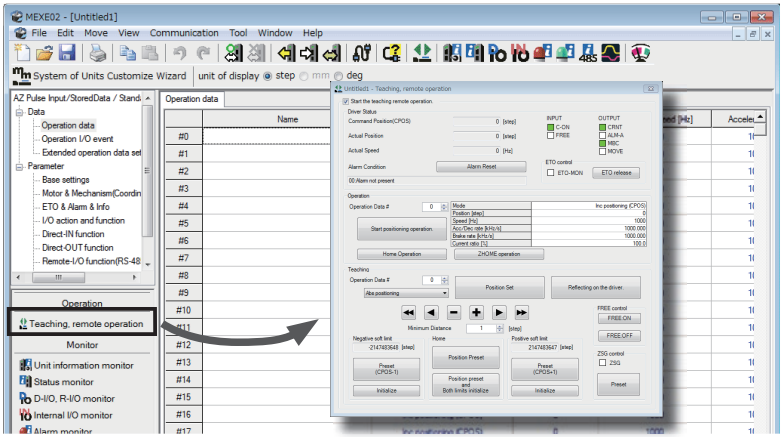


11.2 Guidance for test operation

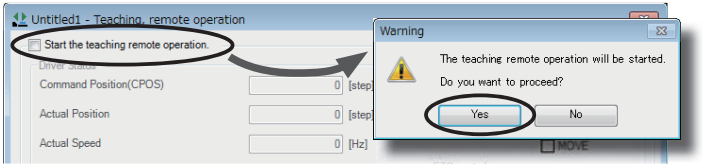
This is an example to perform test operation using the **MEXE02**.
After performing "11.1 Guidance for home position setting" on p.32, continuously perform test operation.

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

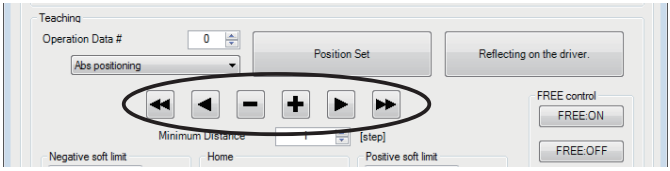
1. Click the [Teaching, remote operation] short-cut button in the left side of the screen.
   The teaching/remote operation window appears.



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



3. Perform test operation of the motor using the JOG operation buttons.

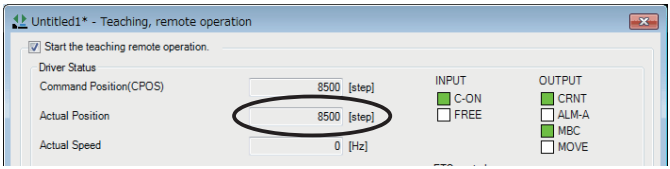


11.3 Guidance for high-speed return-to-home operation

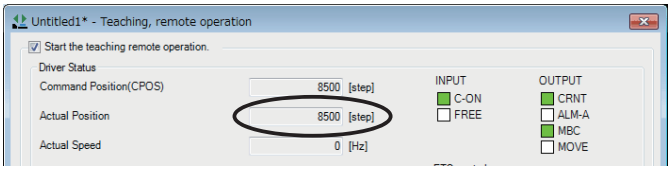
After operation, return the motor to the home position. Using high-speed return-to-home operation (ZHOME) can return the motor position to the home position easily.
After performing "11.2 Guidance for test operation" on p.34, continuously perform high-speed return-to-home operation.

STEP 1 Check the present position

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

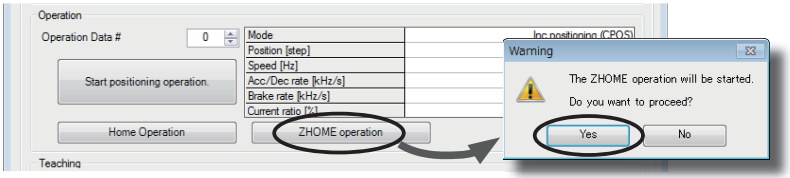


2. To check if the ABZO sensor has memorized the home position, once turn off the power, and turn on again.
3. Check the "Actual position" again.
   Check that the actual position is not 0.

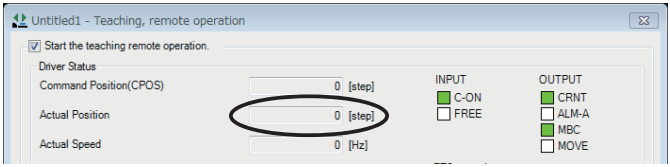


STEP 2 Execute high-speed return-to-home operation

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

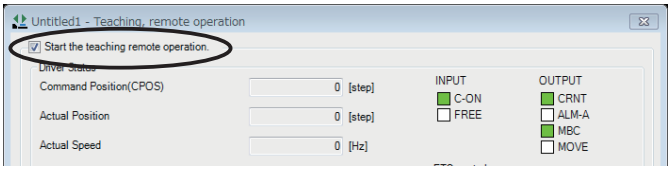


   The motor will start high-speed return-to-home operation.
2. After the motor returns to the home position, check that the "actual position" is 0.



STEP 3 End the teaching/remote operation

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



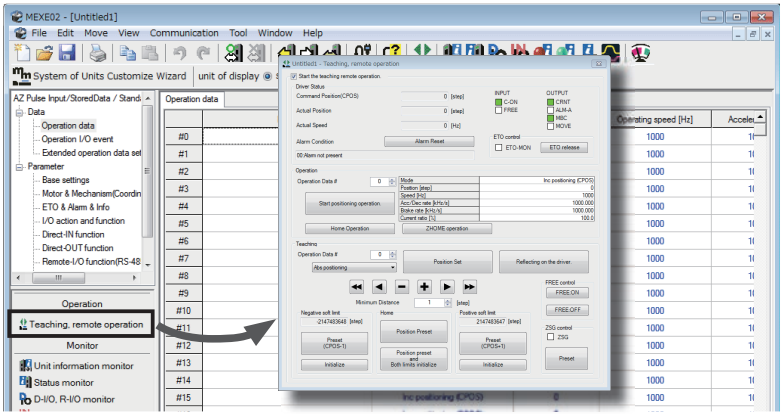
12 Operation

Three types of operation signals are assigned to the CN5 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.

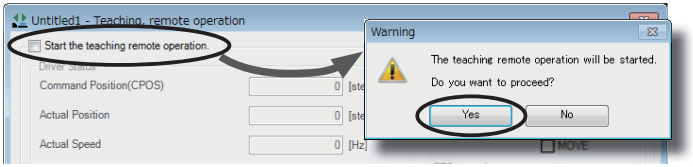
12.1 Set the home position using the MEXE02

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

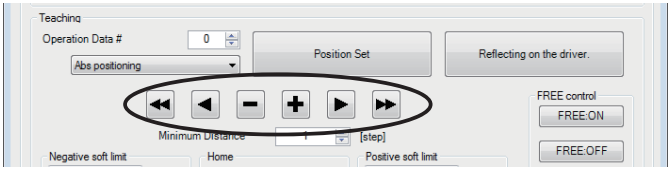
1. Click the [Teaching, remote operation] short-cut button int the left side of the screen.
   The teaching/remote operation window appears.



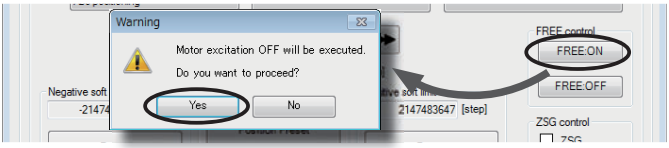
2. Click the "Teaching, remote operation," and click [Yes] on the pop-up window (Warning).



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



4. 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.

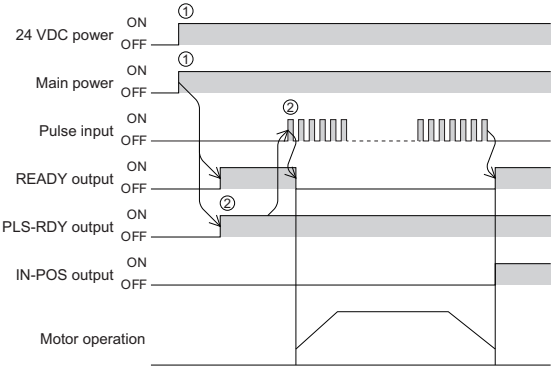


5. After setting the motor home position, click [Position Preset], and click [Yes] on the pop-up window (Warning).
   The home position is set and written to the driver.

12.2 Positioning operation

Positioning operation is performed by inputting pulses.

1. Turn on the 24 VDC power supply and main power supply.
   The READY output and PLS-RDY output turn ON.
2. Check the PLS-RDY output has been turned ON and input pulses.
   The motor will start positioning operation.
   When the pulse is stopped inputting and the operation is complete, the READY output will turn ON.

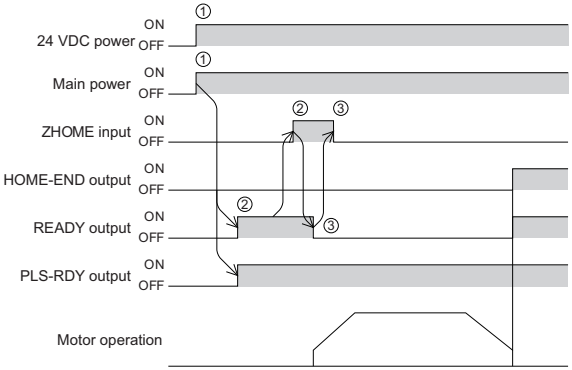


Refer to the OPERATING MANUAL Function Edition for details about operation.

12.3 High-speed return-to-home operation

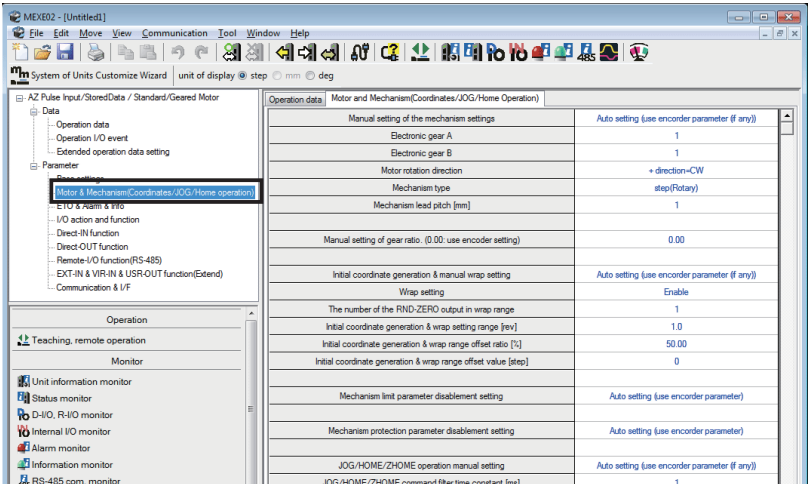
High-speed return-to-home operation is used to return to the home position that is set by the HOME PRESET switch.

1. Turn on the 24 VDC power supply and main 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 reaching the home position, the operation will be stopped.
   The HOME-END output and READY output will turn ON.

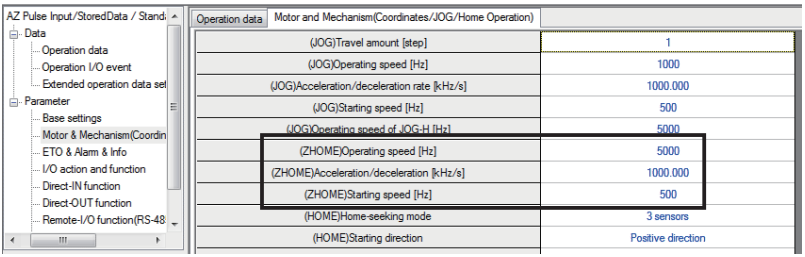


■ When changing the operating condition of high-speed return-to-home operation

1. Click on the “Paremeter,” “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.



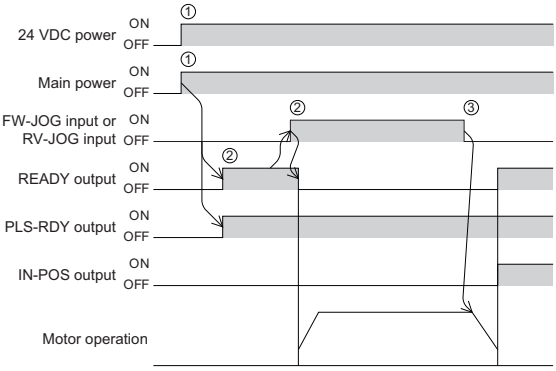
3. After changing the operating condition, click the [Writing data] icon in the toolbar to download to the driver.

The process has been completed.

12.4 JOG operation

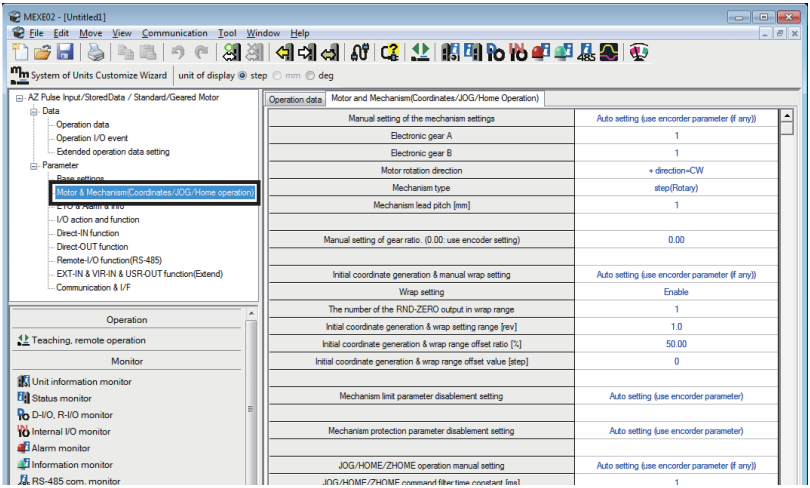
Constant speed operation (inching operation) can be performed with JOG operation.
The motor operates continuously while the FW-JOG input or RV-JOG input is being ON.

1. Turn on the 24 VDC power supply and main power supply.
   The READY output and PLS-RDY output turn ON.
2. 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.
3. Turn the input signal OFF.
   The motor will decelerate to a stop.
   When the motor stops, the READY output will turn ON.

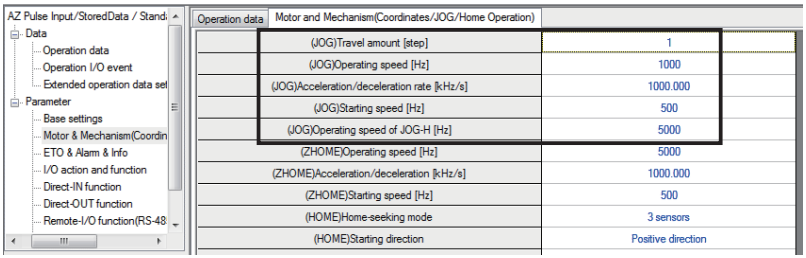


■ When changing the operating condition of JOG operation

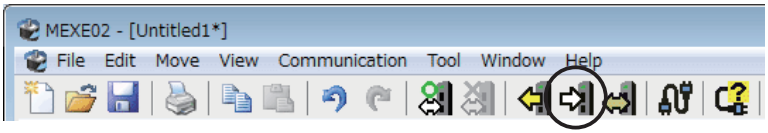
1. Click on the “Paremeter,” “Motor and Mechanism(Coordinates/JOG/Home Operation),” in the left side of the screen.
   Motor and mechanism parameter window will appears.



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.

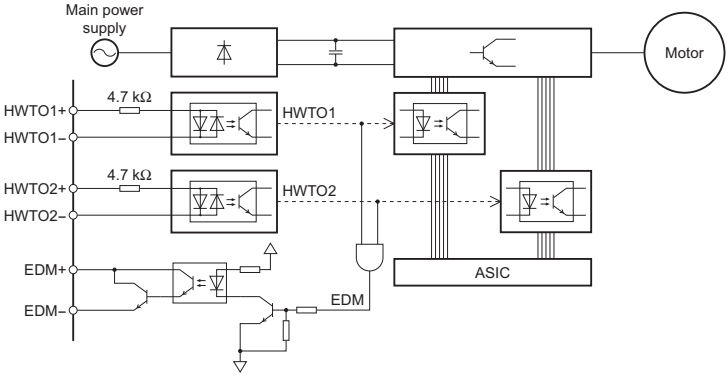


The process has been completed.

13 Power removal function (ETO function)

The power removal function (ETO function) is used to stop the motor forcibly by inputting the signal externally. This function makes the FET turn OFF without involving the CPU. Therefore, it cuts off the power to the motor by the electronic circuit without using the software, causing the motor generating torque to turn to zero.
Related I/O signals are the HWTO input and EDM output.

13.1 Block diagram



Signal name	Specificaion
HWTO1+ input HWTO1− input	24 VDC±10%
HWTO2+ input HWTO2− input	
EDM+ output EDM− output	30 VDC or less, 50 mA or less Output saturated voltage 1.1 V

13.2 Related I/O signals

■ HWTO input

When either of the HWTO1 input or HWTO2 input is turned OFF, the power to the motor is cut off by the electronic circuit without involving the CPU, causing the motor to stop. In this time, the PWR/ALM LED will blink in green.
When an electromagnetic brake motor is used, the electromagnetic brake continues to hold the position.

■ EDM output

If both the HWTO1 input and HWTO2 input are turned OFF, the EDM output will turn ON.

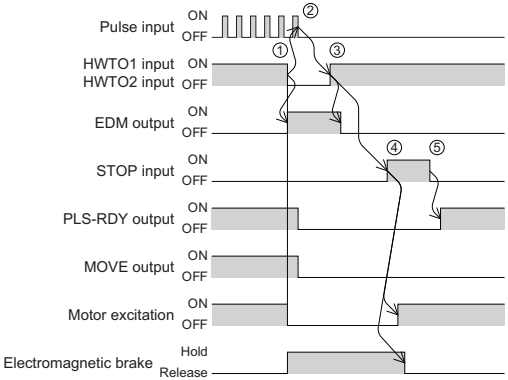
HWTO1 input	HWTO2 input	EDM output	Motor excitation
ON	ON	OFF	Excitation
ON	OFF	OFF	Non-excitation
OFF	ON	OFF	
OFF	OFF	ON	

13.3 Releasing ETO state

If the STOP input is turned ON while the ETO function is activated, the ETO state can be released (effective at the ON edge of the STOP input).
Be sure to turn the STOP input ON after turning the HWTO1 input and HWTO2 input ON.

13.4 Timing chart

1. When both the HWTO1 input and HWTO2 input have been turned OFF, the EDM output will turn ON.
   The power supply to the motor will be shut off.
2. Stop the pulse input.
3. Turn the HWTO1 input and HWTO2 input ON.
4. Turn the STOP input ON.
   The power is supplied to the motor, and the motor will be excited.
5. Turn the STOP input OFF.
   The PLS-RDY input turns ON, and the driver will be ready to operate.



13.5 To use this product safely

- **When the ETO function is used, be sure to conduct a risk assessment of equipment in advance to satisfy the safety requirements of the entire system.**
- **Even if the ETO function is activated, the following potential risks can be estimated. Be sure to confirm the safety by conducting a risk assessment.**
  - The motor output shaft may be rotated by an external force. If the motor output shaft is kept in place, install an external brake mechanism or equivalent. Do not use the brake mechanism of the electromagnetic brake motor for braking the motor rotation.
  - If the ETO function is activated, the driver stops supplying the power to the motor. However, the input power to the driver is not shut off, and the driver is not electrically isolated. Before performing maintenance or inspection, always turn off the driver power, and check the voltage with a circuit tester after the CHARGE LED is turned off.
- **The EDM output is not an output signal to ensure the safety. Do not use the EDM output for any other purpose except for monitoring a failure.**

14 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?

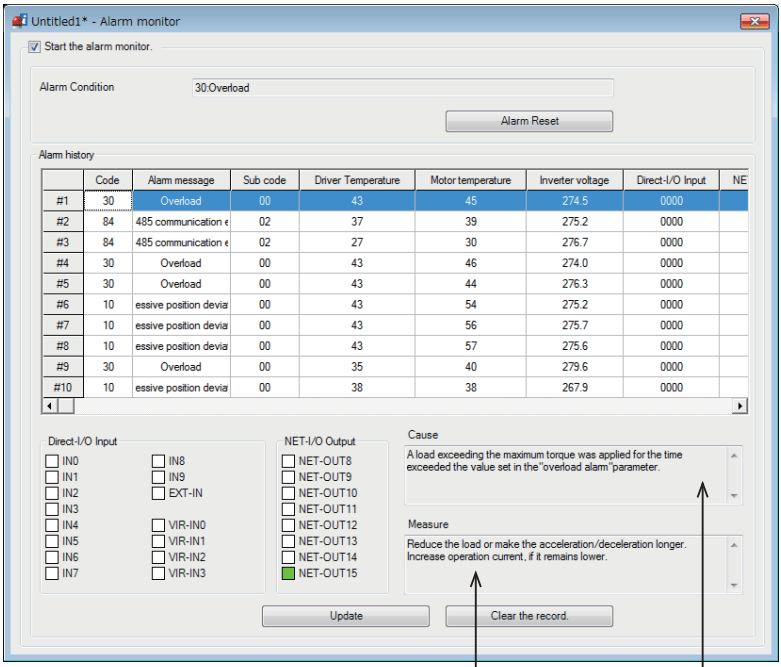
Note The driver uses semiconductor elements, so be extremely careful when handling them. Static electricity may damage the driver.

15 Alarm (protective function)

When an alarm generates, the ALM-B output will turn OFF and PWR/ALM 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**.



16 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
• 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 confrm that the motor will be excited.
	The FREE input is turned ON.	Turn the FREE input OFF.
The motor does not operate.	An electromagnetic brake motor is used and the electromagnetic brake is in the holding state.	Check the connections between electromagnetic brake and driver.
	The STOP input is turned ON.	Turn the STOP input OFF.
	The position (distance) is not set in the operation data while positioning operation.	Check the operation data.
	The FWD-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 does not rotate although the READY LED is lit.	• Signals are not connected properly. • Multiple signals have been input simultaneously.	• Wire signals correctly. • Check if the signal line is disconnected. • Check if the wrong signal is input.
The motor rotates in the direction opposite to the specified direction.	The "motor rotation direction" parameter is set wrong.	Check the setting of the "motor rotation direction" parameter.
The gear output shaft rotates in the direction opposite to the motor.	A gear that rotates in the direction opposite to the motor shaft is used.	• With **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 setting is too low.	Return the CURRENT switch to its initial setting and check. 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 CURRENT switch. Vibration will increase if the motor's output torque is too large for the load.
The electromagnetic brake does not release.	The power is not supplied to the electromagnetic brake.	Check the connection of the electromagnetic brake.

Note
- Check the alarm message using the **MEXE02** when the alarm generates.
- I/O signals can be monitored using the **MEXE02**. Use to check the wiring condition of the I/O signals.

17 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 CN5 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 improve the characteristics
Like to utilize convenient functions for maintenance	Like to check operation by the waveform monitor	Like to change the alarm conditions

18 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)

■ Pulse signal converter for noise immunity

It eliminates the noise of the pulse signal and changes the pulse signal to the line driver type.

Model: **VCS06**

■ CR circuit for surge suppression

This product is effective to suppress the serge 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.

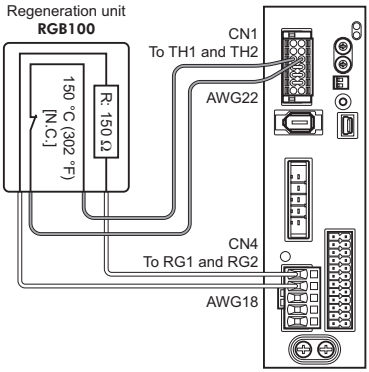
Model: **VCS02**

■ Regeneration unit

Connect the regeneration unit if gravitational operation or other operations involving up/down movement, or sudden starting/stopping of a large inertial load, will be repeated frequently.
Always connect the regeneration unit if an overvoltage protection warning or alarm generates.

Model: **RGB100**

- **Connecting the regeneration unit**
  - The two thin lead wires (AWG22: 0.3 mm^2) of the regeneration unit are the thermostat outputs. Connect them to the TH1 and TH2 using the CN1 connector.
  - Regenerative current flows through the two thick lead wires (AWG18: 0.75 mm^2) of the regeneration unit. Connect them to the RG1 and RG2 using the CN4 connector.



Note

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

• Regeneration unit specification

Model	**RGB100**
Allowable current consumption	Continuous regenerative power: 50 W * Instantaneous regenerative power: 600 W
Resistance value	150 Ω
Thermostat operating temperature	Operation: Opens at 150±7 °C (302±12.6 °F) Reset: Closes at 145±12 °C (293±21.6 °F) [normally closed]
Thermostat electrical rating	120 VAC 4 A, 30 VDC 4 A (minimum current: 5 mA)

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

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