



OPERATING MANUAL

αSTEP

AZ Series/Actuator equipped with AZ Series

Compact Driver

Driver Edition

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Introduction

■ Before use

Only qualified personnel of electrical and mechanical engineering should work with the product.

Use the product correctly after thoroughly reading the section "Safety precautions." In addition, be sure to observe the contents described in warning, caution, and note in this manual.

The product described in this manual is designed and manufactured to be incorporated in general industrial equipment. Do not use for any other purpose. Oriental Motor Co., Ltd. is not responsible for any compensation for damage caused through failure to observe this warning.

■ Overview of the product

● Compact and lightweight

Downsizing and light weighting are achieved, making the dimensions to 41×49×18.5 mm (1.61×1.93×0.73 in.) and the mass to 39 g (0.086 lb.).

● Simple wiring

Simple wiring achieves space saving for wiring and smaller equipment size since the power and communication lines can be connected in a daisy chain collectively.

● Compatible with industrial network

Operation data and parameters can be set via Modbus RTU (RS-485 communication), and start and stop commands of operation can be executed as well.

Operation data and parameters can also be set using the support software **MEXE02**.

■ Related operating manuals

For operating manuals, download from Oriental Motor website download page or contact your nearest Oriental Motor sales office.

- **AZ Series/Actuator equipped with AZ Series Compact Driver**
OPERATING MANUAL Driver Edition (this document)
- **AZ Series/Actuator equipped with AZ Series**
OPERATING MANUAL Function Edition





Thank you for purchasing an Oriental Motor product.

This Operating Manual describes product handling procedures and safety precautions.

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

Safety precautions

The precautions described below are intended to ensure the safe and correct use of the product, and to prevent the customer and others from exposure to the risk of injury. Use the product only after carefully reading and fully understanding these instructions.

 WARNING	Handling the product without observing the instructions that accompany a "WARNING" symbol may result in serious injury or death.
 CAUTION	Handling the product without observing the instructions that accompany a "CAUTION" symbol may result in injury or property damage.
 Note	The items under this heading contain important handling instructions that the user should observe to ensure the safe use of the product.
 memo	The items under this heading contain related information and contents to gain a further understanding of the text in this manual.

WARNING

General

- Do not use the product in explosive or corrosive environments, in the presence of flammable gases, in places subjected to splashing water, or near combustibles. Doing so may result in fire, electric shock, or injury.
- Assign qualified personnel to 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.
- Do not transport, install, connect or inspect the product while the power is supplied. Doing so may result in electric shock.
- Do not touch the driver while the power is supplied. Doing so may result in fire or electric shock.
- Take measures to keep the moving part in position if the product is used in vertical operations such as elevating equipment. Failure to do so may result in injury or damage to equipment.
- When an alarm is generated in the driver (any of the driver's protective functions is triggered), remove the cause before clearing the alarm (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.

Installation

- Install the driver inside an enclosure. Failure to do so may result in electric shock or injury.

Connection

- Always keep the power supply voltage of the driver within the specified range. Failure to do so may result in fire or electric shock.
- Connect the cables securely according to the wiring diagram. Failure to do so may result in fire or electric shock.
- Do not forcibly bend, pull, or pinch the cable. Doing so may result in fire and electric shock.

Operation

- Turn off the main power supply in the event of a power failure. Failure to do so may result in injury or damage to equipment.

- Do not remove the motor excitation during operation. Doing so may cause the motor to stop and lose the holding force, resulting in injury or damage to equipment.

Repair, disassembly and modification

- Do not disassemble or modify the driver. Doing so may result in injury or damage to equipment.

CAUTION

General

- Do not use the driver beyond its specifications. Doing so may result in electric shock, injury, or damage to equipment.
- Keep your fingers and objects out of the openings in the driver. Failure to do so may result in fire, electric shock, or injury.
- Do not touch the driver during operation or immediately after stopping. Doing so may result in a skin burn(s).

Installation

- Do not place combustibles around the driver. Doing so may result in fire or skin burn(s).
- Do not leave anything around the driver that would obstruct ventilation. Doing so may result in damage to equipment.

Operation

- Use a motor and driver only in the specified combination. An incorrect combination may cause a fire.
- 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.
- When moving the moving part manually, put the motor into a non-excitation state. Continuing the work while the motor is in an excitation state may result in injury.
- For the main 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.
- When an abnormal condition has occurred, immediately stop operation to turn off the main power supply. Failure to do so may result in fire, electric shock, or injury.

Precautions for use

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

- **Be sure to use our cables to connect a motor and a driver.**

Refer to p.8 for the model name of cables.

- **When conducting the insulation resistance measurement or the dielectric strength test, be sure to separate the connection between the motor and the driver.**

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

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

The connectors CN1, CN2, CN3 and CN4 of the driver are not electrically insulated. When grounding the positive terminal of the power supply, do not connect any equipment (PC, etc.) whose negative terminal is grounded. Doing so may cause the driver and these equipment to short, damaging both. When connecting, do not ground equipment.

- **Storing data in non-volatile memory**

Do not turn off the main 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 alarm of the EEPROM error to generate. The non-volatile memory can be rewritten approximately 100,000 times.

Regeneration

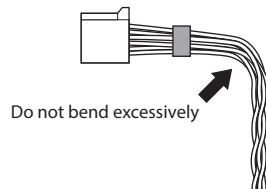
When a large load inertia is operated at a high speed, the power supply voltage may increase by the regenerative energy generated, causing an alarm of overvoltage to generate. This may result in damage to the driver, so reconsider the operating condition so as not to generate the regenerative voltage.

Notes when the connection cable is used

Note the following points when our cable is used.

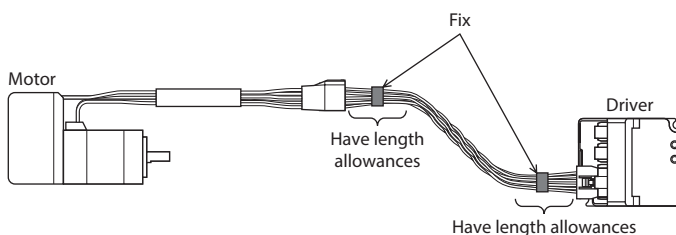
- **When bending the cable**

Do not excessively bend the cable. Applying stress on the cable may cause poor contact or disconnection, leading to malfunction or heat generation.



- **How to fix the cable**

Fix the cable at the positions near the connector so that no stress due to the bending or self-weight of the cable is applied on the connector. Also, do not excessively bend the cable near the connection part of the connector. Applying stress on the cable may cause poor contact or disconnection, leading to malfunction or heat generation.



Preparation

Checking the product

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

- Driver..... 1 unit
- OPERATING MANUAL Driver Edition..... 1 copy (this document)

How to identify the product model

Check the model name of the driver against the model name shown on the nameplate. Refer to "Information about nameplate" on p.3 for how to identify the nameplate.

AZD - K R D
1 2 3 4

1	Series	AZD: AZ Series Driver
2	Power supply input	K: 24 VDC/48 VDC
3	Shape	R: Compact
4	Type	D: Built-in controller type

■ Products for possible combinations

Use the driver in combination with a motor or a motorized actuator of DC power input type. Products with which the driver can be combined are listed below. Check the model name with the nameplate.

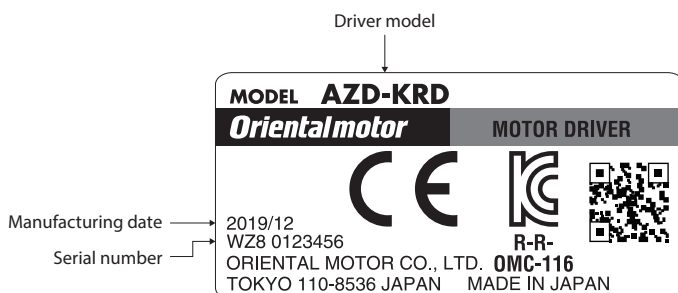
Product Type	Applicable Series	Model representing series name *1	Example of model
Stepping motor	AZ Series	AZM	AZM46AK AZM66AK-TS10
	EAS Series *2	EASM	EASM4NXD005AZAK
	EAC Series *2	EACM	EACM2E05AZAK
	EZS Series *2	EZSM	EZSM6D005AZAK
Motorized actuator	DR Series	DR	DR28G2.5B03-AZAKU DR28T1B03-AZAKD-F
	DRS2 Series	DRSM	DRSM60-05A4AZAK
	DGII Series	DGM DGB	DGM85R-AZAK DGB85R12-AZAKR
	EH Series	EH	EH4-AZAKH
	L Series	LM	LM4F150AZAK-1

*1 The driver described in this manual can be combined with products that begin with these model names.

*2 For these motorized actuators, the equipped motors have been evaluated to affix the CE Marking. Check the model name of the equipped motor with the nameplate.

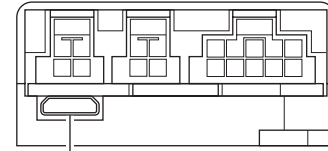
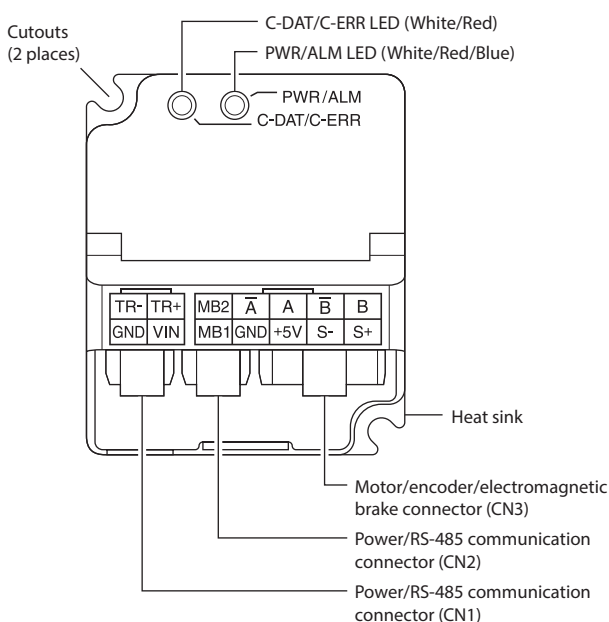
■ Information about nameplate

The figure shows an example.



The position describing the information may vary depending on the product.

■ Name and function of parts



USB communication connector (CN4)

Name	Description
C-DAT/C-ERR (White/Red)	<ul style="list-style-type: none"> This LED blinks or is lit in white when the driver is communicating with the client properly via RS-485 communication. This LED will be lit in red if an error occurs in communication with the client via RS-485 communication.
PWR/ALM LED (White/Red/Blue)	<ul style="list-style-type: none"> This LED is lit in white while the main power supply is input. This LED will blink in red if an alarm (protective function) is generated. This LED will blink in blue when information generates.
Motor/encoder/electromagnetic brake connector (CN3)	Connects the motor, encoder, and electromagnetic brake.
Power/RS-485 communication connectors (CN1, CN2)	<ul style="list-style-type: none"> Connects the main power supply and signal lines of RS-485 communication. Connects a resistor between the TR+ terminal and the TR- terminal of CN1 or CN2 for a driver located the farthest away (positioned at the end) from the host controller.
USB communication connector (CN4)	Connects a PC in which the MEXE02 has been installed. (USB2.0 micro-B port)

Installation

■ Installation location

The driver is 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 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 vibrations or excessive shocks
- Area free of excessive electromagnetic noise (from welders, power machinery, etc.)
- Area free of radioactive materials, magnetic fields or vacuum
- Up to 1,000 m (3,300 ft.) above sea level

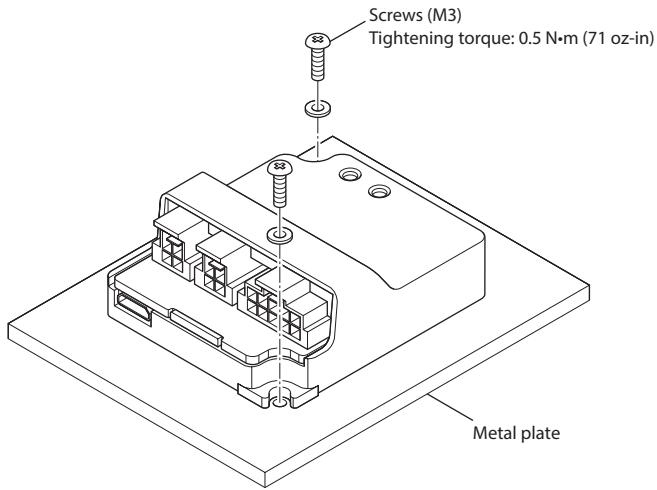
■ Installation method

The driver can be installed in any direction.

Install the driver onto an appropriate flat metal plate (*) having heat conductivity.

When installing the driver, use the cutouts for mounting and secure to the metal plate with two screws (M3: not included).

* Material: aluminum, 150×150×2 mm (5.91×5.91×0.08 in.) equivalent

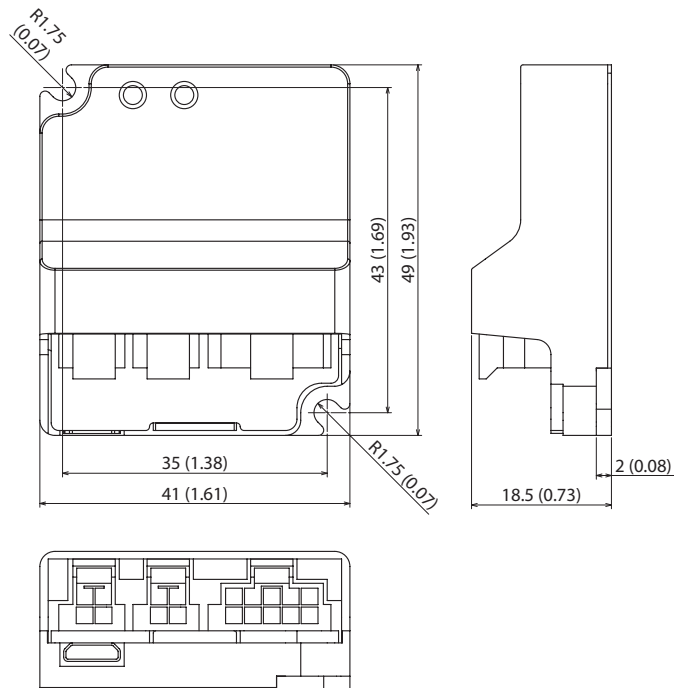


Note

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

● Dimension [unit: mm (in.)]

Mass: 39 g (0.086 lb.)



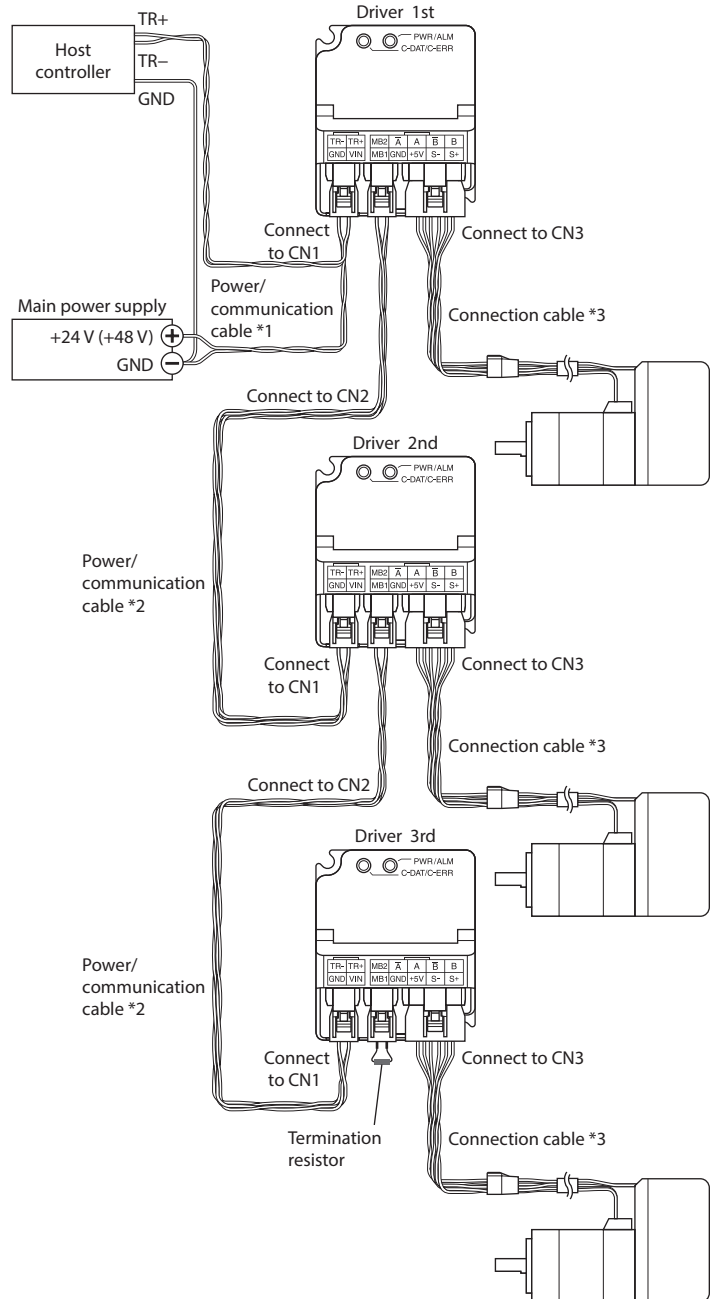
Connection

⚠ WARNING

For protection against electric shock, do not turn on the power supply until the wiring is completed.

■ Connection example

The figure shows an example when three drivers are connected in a daisy chain.



*1 This is a cable for connecting a power supply and a host controller. It is also available in our products.

*2 This is a cable for connecting between drivers. It is also available in our products.

*3 It is our cable. Purchase it separately.

Note

- When connecting a power supply to multiple drivers in a daisy chain, make sure that the total input current of the drivers is 6.5 A or less. Exceeding 6.5 A may cause damage to the driver.
- Connect the connectors securely. Insecure connections may cause malfunction or damage to the motor or driver.
- When connecting the connection cable, secure the cable so that no load is applied to the CN1 to CN3 connectors. Applying a load to the connector may result in a connection failure, and the driver may not operate properly.
- Keep 0.5 m (1.6 ft.) or less for the wiring distance between the motor and driver. To extend more than 0.5 m (1.6 ft.) may result in increase of the electrical noise emitted from the driver.
- Keep 5 m (16.4 ft.) or less for the total wiring distance (*) of the power/communication cable. To extend more than 5 m (16.4 ft.) causes the driver to be affected easily by electrical noise.

* The total wiring distance refers to a wiring distance from the power supply or the host controller, whichever the length of the cable connected to the CN1 connector is longer, to the driver located at the end. In the figure of the connection example, the total wiring distance is from the host controller to the CN1 connector of the third driver.

memo

- Before connecting or disconnecting the connector, turn off the main power supply of the driver, and check the PWR/ALM LED has been turned off.
- When disconnecting the connector, pull out while pressing the latch on the connector.
- Connect GND of the power supply and GND of RS-485 communication to the same ground.

Connecting the main power supply, RS-485 communication, and termination resistor (CN1, CN2)

Connect the main power supply and the RS-485 communication signal to CN1 or CN2. When multiple drivers are used, they can be connected in a daisy chain using CN1 or CN2. Power/communication cables are also available in our products. Refer to p.8 for details.

memo

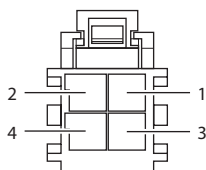
The CN1 connector and CN2 connector are not electrically insulated. You can connect either of the two connectors.

Applicable connector

Type	Model
Connector housing	105308-1204 (Molex Incorporated)
Contact	105300-2200 (Molex Incorporated)
Designated crimping tool	63827-5600 (Molex Incorporated)
Applicable lead wire	<ul style="list-style-type: none"> AWG22 to 20 (0.3 to 0.5 mm²) Outer sheath diameter: ϕ1.3 to 1.55 mm (0.05 to 0.06 in.) Stripping length of wire insulation: 2.5 to 3.5 mm (0.1 to 0.14 in.)

Pin assignment

The figure shows the view from the contact insertion side.



Pin number	Signal name	Description
1	TR+	RS-485 communication signal (+)
2	TR-	RS-485 communication signal (-)
3	VIN	+24 VDC/+48 VDC
4	GND	Power supply GND

Power supply current capacity

The current capacity of the power supply varies depending on the product to be combined.

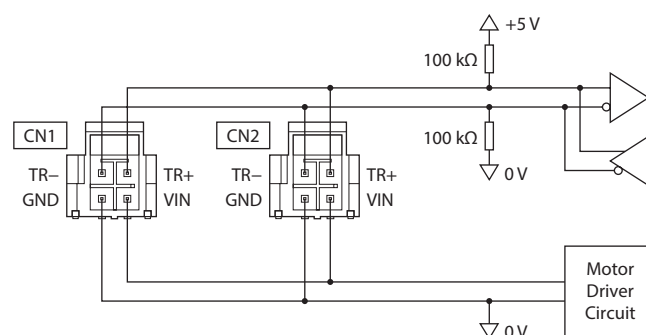
When using the **EAS** Series, the **EAC** Series, and the **EZS** Series, check with reference to the equipped motor model.

Note

When connecting a power supply to multiple drivers in a daisy chain, make sure that the total input current of the drivers is 6.5 A or less. Exceeding 6.5 A may cause damage to the driver.

Series	Model	Input power supply voltage	Power supply current capacity
AZ Series EAS Series EAC Series EZS Series	AZM14	24 VDC \pm 5 %	0.4 A or more
	AZM15		0.5 A or more
	AZM24		1.4 A or more
	AZM26		1.4 A or more
	AZM46	24 VDC \pm 5 % 48 VDC \pm 5 %	1.6 A or more
	AZM48		2.1 A or more
	AZM66		3.7 A or more
DGII Series	AZM69	24 VDC \pm 5 % 48 VDC \pm 5 %	3.5 A or more
	DGM60		1.4 A or more
	DGB85		1.6 A or more
	DGB130		3.7 A or more
	DGM85		1.6 A or more
DR Series	DGM130		3.7 A or more
	DR20	24 VDC \pm 5 %	0.4 A or more
	DR28		1.3 A or more
DRS2 Series	DRSM42	24 VDC \pm 5 % 48 VDC \pm 5 %	1.5 A or more
	DRSM60		2.6 A or more
EH Series	EH3	24 VDC \pm 5 %	0.4 A or more
	EH4		1.4 A or more
L Series	LM2	24 VDC \pm 5 % 48 VDC \pm 5 %	3.7 A or more
	LM4		3.7 A or more

Internal input circuit

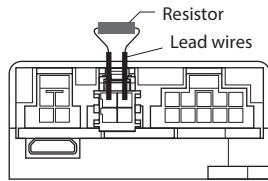


● Connecting the termination resistor

Connect a resistor between the TR+ terminal and the TR– terminal of CN1 or CN2 for a driver located the farthest away (positioned at the end) from the host controller.

Connecting method

1. Connect the lead wires to the resistor.
2. Connect the lead wires between the TR+ terminal and the TR– terminal of CN1 or CN2.



Be sure to connect a resistor between the TR+ terminal and the TR– terminal. Incorrect connection may cause damage to the resistor.



- For a resistor, use a metal film resistor of 120 Ω , 1/2 W or more.
- Do not crimp a resistor directly to the contacts. The contacts are designed on the assumption that the stranded wire is crimped. The resistor cannot be crimped sufficiently due to a single wire.

■ Connecting the USB cable (CN4)

Using a USB cable of the following specification, connect a PC in which the MEXE02 has been installed to the CN4 connector.

Specification	USB2.0 (full speed)
Cable	Length: 3 m (9.8 ft.) or less Shape: A to micro B



- 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.

■ Noise elimination measures

There are two types of electrical noises: 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 equipment 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

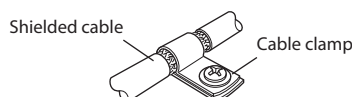
There are the following three methods mainly to take measures against the electrical noise.

● 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.
- 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.
- Use shielded twisted pair cables for power lines and signal lines.
- Keep cables as short as possible without coiling and bundling extra lengths.
- Grounding multiple points will increase effect to block electrical noise because impedance on the grounding points is decreased. However, ground them so that a potential difference does not occur among the grounding points.
- 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.



● 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. When increasing the effect of noise attenuation by the ferrite core, loop the cable a lot.

■ Compliance with the 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. Oriental Motor conducts EMC testing on its motors and drivers in accordance with the "Example of motor and driver installation and wiring." The user is responsible for ensuring the machine's compliance with the EMC Directive, based on the installation and wiring explained below.



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

● Connecting the power supply

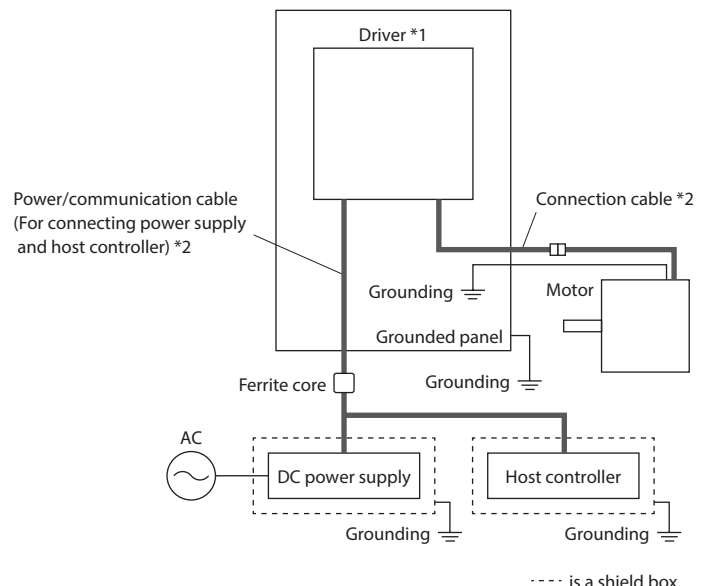
Use a DC power supply conforming to the EMC Directive. Wire and ground the power supply over the shortest possible distance using a shielded cable. Refer to "Prevention of noise propagation" for how to ground the shielded cable.

● How to ground

- The cable used to ground the motor 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.
- Make sure to ground the Protective Earth Terminal of the motor.

● Example of motor and driver installation and wiring

The figure shows a wing example when the compact driver and the motor (AZM66) are used.



*1 The driver is grounded by directly contacting the heat sink to the ground panel.

*2 Our cables are used.



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.

Alarm

When an alarm generates, the motor will stop. At the same time, the PWR/ALM LED will blink in red. Before resetting an alarm, always remove the cause of the alarm and ensure safety.

This section describes an alarm specific to the compact driver.

If an alarm not described here generates, refer to the **AZ Series OPERATING MANUAL** Function Edition.

Alarm code	29h
Number of times LED blinks	9
Alarm type	CPU peripheral circuit error
Reset using the ALM-RST input	Not possible
Motor excitation	Non-excitation *
Cause	The CPU peripheral circuit was damaged.
Remedial action	Contact your nearest Oriental Motor sales office.

* When an alarm generates, the motor current will be cut off and the motor will lose its holding torque.

When an electromagnetic brake motor is used, the electromagnetic brake will hold a load in position.

Inspection and maintenance

■ 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.

● Inspection item

- Check if the openings in the driver are clogged.
- Check if the installation place of the driver is loose.
- Check if any of the connection parts of the driver is loose.
- Check if dust and others attach on the driver.
- Check if the driver has unusual smells or appearance defects.



The driver uses semiconductor components. Static electricity may damage the semiconductor components of the driver, so be extremely careful when handling driver.

■ Warranty

Check on the Oriental Motor Website or General Catalog for the product warranty.

■ Disposal

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

Specifications

■ Product specifications

Main power supply	Input voltage	<ul style="list-style-type: none"> • 24 VDC\pm5 % • 48 VDC\pm5 %
	Input current	0.4 to 3.7 A *
Interface		Modbus RTU (RS-485 communication)

* It varies depending on the motor combined. Check with p.5.

■ Specifications for RS-485 communication

Electrical characteristics	In conformance with EIA-485 Use a twisted pair cable and keep the total wiring distance including extension to 5 m (16.4 ft.) or less.
Communication mode	Half duplex Asynchronous mode • Data: 8 bits • Stop bit: 1 bit/2 bits • Parity: none/even number/odd number
Transmission rate	Selectable from 9,600 bps, 19,200 bps, 38,400 bps, 57,600 bps, 115,200 bps, and 230,400 bps.
Protocol	Modbus RTU protocol
Connection figure	Up to 31 drivers can be connected to one host controller.

■ General specifications

Degree of protection		IP00
Operation environment	Ambient temperature	0 to +50 °C (+32 to +122 °F) (non-freezing)
	Humidity	85 % or less (non-condensing)
	Altitude	Up to 1,000 m (3,300 ft.) above sea level
	Surrounding atmosphere	No corrosive gas, 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 3,000 m (10,000 ft.) above sea level
	Surrounding atmosphere	No corrosive gas, dust, water or oil

Regulations and standards

■ CE Marking

This product is affixed with the mark under the following directives.

● EMC Directive

For details on compliance, refer to "Compliance with the EMC Directive" on p.6.

■ RoHS Directive

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

Cables

■ Connection cables

Use when connecting a motor and a driver.

When using the **EAS** Series, the **EAC** Series, and the **EZS** Series, check with reference to the equipped motor model.

Applicable product		Model	Length [m (ft.)]
Model/Series name	Electromagnetic brake		
AZM14, AZM15 AZM24, AZM26 DR Series EH Series	Not equipped	LC003Z2	0.35 (1.1)
AZM46, AZM48 AZM66, AZM69 DRS2 Series DGII Series L Series	Not equipped	LC002Z	0.2 (0.7)
AZM46, AZM66 AZM69 DRS2 Series DGII Series L Series	Equipped	LC002ZB	0.2 (0.7)

■ Power/communication cables

• For connecting between drivers

This cable is used when multiple drivers are connected in a daisy chain.

Model: **LC005-RW** [0.5 m (1.6 ft.)]

• For connecting power supply and host controller

These cables are used when the driver is connected to the main power supply and signals for RS-485 communication.

Model: **LC010-RS** [1 m (3.3 ft.)]

LC020-RS [2 m (6.6 ft.)]

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- Characteristics, specifications and dimensions are subject to change without notice.
- While we make every effort to offer accurate information in the manual, we welcome your input. Should you find unclear descriptions, errors or omissions, please contact your nearest Oriental Motor sales office.
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