



OPERATING MANUAL

Stepping Motor *αSTEP*

AR Series/

Motorized actuator equipped with AR Series

DC power input Pulse input type Driver



KCC-REM-OMC-031

KCC-REM-OMC-079

Introduction

■ Before use

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

Use the product correctly after thoroughly reading the "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 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.

■ Related operating manuals

For operating manuals not included with the product, contact your nearest Oriental Motor sales office or download from Oriental Motor Website Download Page.

Operating manual name	Included or not included with product
AR Series/Motorized actuator equipped with AR Series OPERATING MANUAL Driver (this document)	Included
AR Series/Motorized actuator equipped with AR Series USER MANUAL	Not included
APPENDIX UL Standards for AR Series	Included

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

	Handling the product without observing the instructions that accompany a "WARNING" symbol may result in serious injury or death.
	Handling the product without observing the instructions that accompany a "CAUTION" symbol may result in injury or property damage.
	The items under this heading contain important handling instructions that the user should observe to ensure the safe use of the product.

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.

⚠ WARNING

General

- Do not use the product in explosive or corrosive environments, in the presence of flammable gases, locations subjected to splashing water, or near combustibles. Doing so may result in fire 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, injury, or damage to equipment.
- If the driver generates an alarm (any of the driver protective functions is triggered), the motor will stop and lose its holding torque. Accordingly, provide measures to hold the moving part in place in the event of an alarm. Failure to do so may result in injury or damage to equipment.
- If the driver generates an alarm (any of the driver 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 injury.
- When installing the driver, install it inside an enclosure so that it is out of the direct reach of users. Be sure to ground if users can touch it. Failure to do so may result in electric shock.

Connection

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

Operation

- Turn off the driver power supply in the event of a power failure. Otherwise, the motor may suddenly start when the power is restored, causing injury or damage to equipment.
- Do not turn the FREE input to ON while the motor is operating. The motor will stop and lose its holding power. Doing so may result in injury or damage to equipment.

Repair, disassembly, and modification

- Do not disassemble or modify the driver. Doing so may result in injury. Refer all such internal inspections and repairs to the Oriental Motor sales office from which you purchased the product.

⚠ CAUTION

General

- Do not use the driver beyond its specifications. Doing so may result in 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 or injury.
- Do not touch the driver during operation or immediately after stopping. The surface is hot, and this may cause a skin burn(s).

Installation

- Do not leave anything around the driver that would obstruct ventilation. Doing so may result in damage to equipment.

Connection

- The power supply connector (CN1), data edit connector (CN4), and I/O signals connector (CN5) of the driver 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 these equipment to short, damaging both.

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.
- Before supplying power to the driver, turn all input signals to the driver to OFF. Otherwise, the motor may suddenly start when the power is turned on, leading to injury or damage to equipment.
- Before rotating the motor output shaft manually while the motor stops, confirm that the FREE input turns ON. Failure to do so may result in injury.
- Immediately when trouble has occurred, stop running and turn off the driver power supply. Failure to do so may result in fire or injury.

Precautions for use

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

- **Be sure to use the accessory cable to connect the motor and driver.**
- **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 dielectric strength test with the motor and driver connected may result in damage to the product.

• Preventing electrical noise

Refer to the [USER MANUAL](#) for measures with regard to noise.

• Saving data to the 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 a EEPROM error alarm to generate. The non-volatile memory can be rewritten approximately 100,000 times.

• Motor excitation at power ON

Simply turning on the power will not excite the motor. To excite the motor, always turn the C-ON input ON. It is possible to set the motor to be excited automatically after the power has been turned on, by changing the applicable driver parameter using the support software **MEXE02** or accessory data setter **OPX-2A**.

• When an alarm of overvoltage protection is generated

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, an alarm of overvoltage protection may be detected. If an overvoltage protection alarm is detected, adjust the driving condition.

• Note on connecting a power supply whose positive terminal is grounded

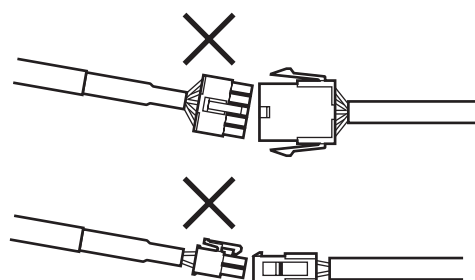
The power supply connector (CN1), data edit connector (CN4) and I/O signals connector (CN5) of the driver are not electrically insulated. When grounding the positive terminal of the power supply, do not connect any equipment (PC, etc.) whose negative terminal is grounded. Doing so may cause the driver and these equipment to short, damaging both. Use the accessory **OPX-2A** to set data, etc.

■ Notes when the connection cable is used

Note the following points when an accessory cable is used.

• When inserting the connector

Hold the connector main body, and insert it in straight securely. Inserting the connector in an inclined state may result in damage to terminals or a connection failure.

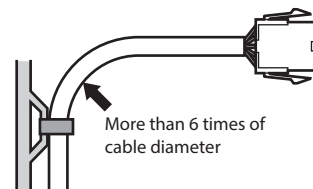


• When unplugging the connector

Pull out the connector in straight while releasing the lock part of the connector. Pulling out the connector with holding the cable (lead wire) may result in damage to the connector.

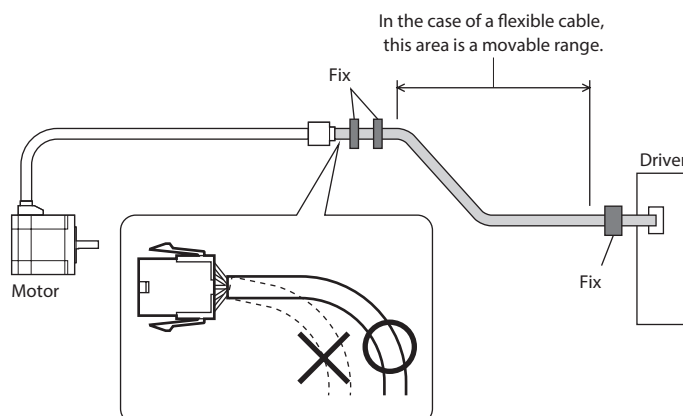
• Bending radius of cable

Use the cable in a state where the bending radius of the cable is more than six times of the cable diameter. In the case of the lead wire type, use in a state where the bending radius is more than four times of the diameter of each lead wire.



• How to fix the cable

Fix the cable at the positions near the connector so as to apply no stress on the connector part. Take measures so as to apply no stress on the connector by using wide clamps or by fixing at two places.



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
- CN1 connector (3 pins)..... 1 pc.
- CN5 connector (36 pins)..... 1 pc.
- Seal (for CN5)..... 1 pc. *1
- OPERATING MANUAL Driver (this document)..... 1 copy
- APPENDIX UL Standards for **AR** Series..... 1 copy *2

*1 To distinguish from connectors of other series, put the seal on the CN5 connector to use.

*2 Included with products conform to the UL Standards.

Included connector model

There are two types of CN5 connectors made by 3M Japan Limited and Molex. Either one of them is included with the product. Check the manufacturer name with the connector case.

Type	Model number (Manufacturer)
CN1 connector	MC1,5/3-STF-3,5 (PHOENIX CONTACT GmbH & Co. KG)
CN5 connector	Case:10336-52A0-008 (3M Japan Limited) Connector: 10136-3000PE (3M Japan Limited)
	or Case: 54331-1361 (Molex) Connector: 54306-3619 (Molex)

■ How to identify the product model

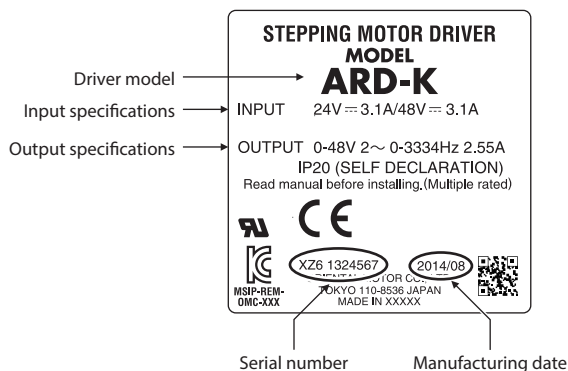
Verify the model number of the purchased product against the number shown on the nameplate.

ARD - K
1 2

1	Series name	ARD: AR Series driver
2	Power supply input	K: 24 VDC/48 VDC

■ Information about nameplate

The figure shows an example.



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

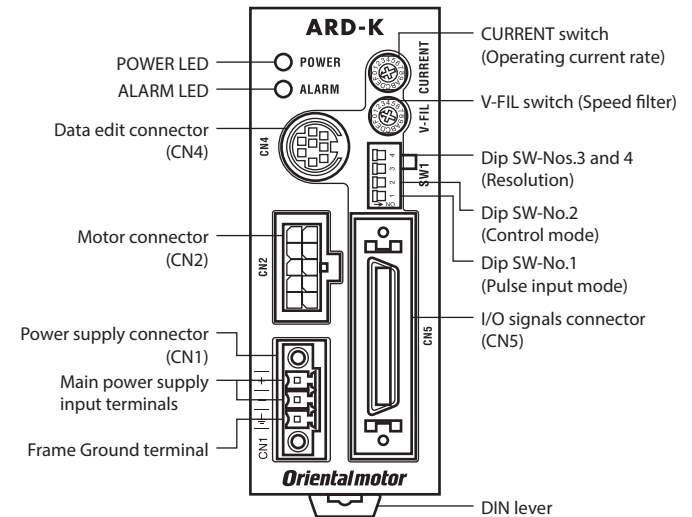
■ Products for possible combinations

Products with which the driver can be combined are listed below. Check the model name with the nameplate.

Driver model	Type	Applicable Series	Model
ARD-K	Stepping motor	AR Series	ARM14, ARM15
	Motorized actuator	EAS Series *	ARM24, ARM26
		EAC Series *	ARM46, ARM66
		EZS Series *	ARM69, ARM98
		DGII Series	DGM60

* For these motorized actuators, check the motor model name.

■ Names and functions of parts



Name	Description
POWER LED (green)	This LED is lit while the main power is input.
ALARM LED (red)	This LED will blink if an alarm generates (a protective function is triggered). It is possible to check the generated alarm (protective function) by counting the number of times the LED blinks.
Main power supply input terminals (CN1)	Connect the main power supply.
Frame Ground terminal (CN1)	Ground using a wire of AWG24 to 16 (0.2 to 1.25 mm ²).
Motor connector (CN2)	Connects the motor.
Data edit connector (CN4)	Connects a PC in which the MEXE02 has been installed, or the accessory OPX-2A .
I/O signals connector (CN5)	Connects the I/O signals of the controller.
CURRENT switch (Operating current rate)	This switch adjusts the operating current. It is used to limit the torque and temperature rise. A desired current can be set as a percentage (%) of the rated output current. Factory setting: F
V-FIL switch (Speed filter)	This switch adjusts the motor response. Use this switch if you want to suppress motor vibration or cause the motor to start/stop smoothly. "0" and "F" correspond to the minimum and maximum speed filter settings, respectively. Factory setting: 1
Dip SW-No.1 (Pulse input mode)	This switch is used to toggle between the 1-pulse input mode and 2-pulse input mode according to the pulse output mode of the controller. Left side (OFF): 2-pulse input mode, active low Right side (ON): 1-pulse input mode, active low The factory setting of the pulse-input mode depends on the destination country.

Name	Description
Dip SW-No.2 (Control mode)	This switch toggles the driver between the normal mode and current control mode. Left side (OFF): Normal mode (Keep the switch in this position in normal conditions of use.) Right side (ON): Current control mode (Set the switch to this position if you want to suppress noise or vibration.) Factory setting: Left side (OFF) [Normal mode]
Dip SW-Nos.3 and 4 (Resolution)	These two switches are used to set the resolution per revolution of the motor output shaft. Factory setting: No.3 and No.4 are both left side (OFF) [1,000 P/R]
DIN lever	Install the driver to a DIN rail.

Installation

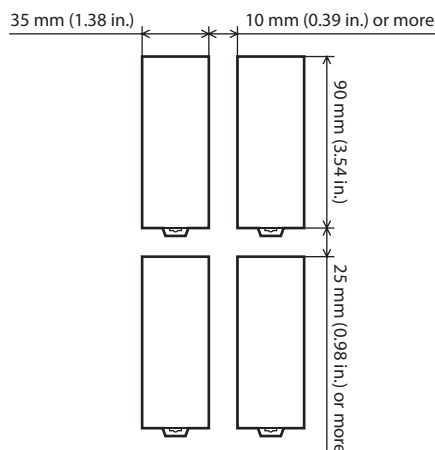
Location for installation

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 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
- 1,000 m (3,300 ft.) or lower above sea level

Installation method

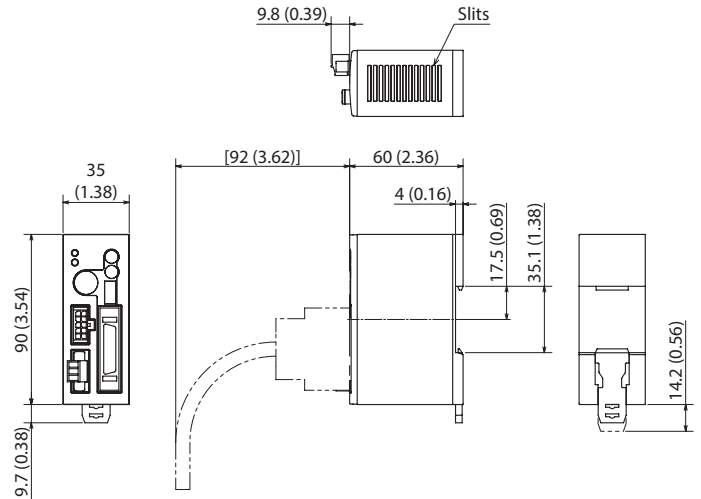
Mount the driver to a 35 mm (1.38 in.) width DIN rail. When two or more drivers are to be installed side by side, provide 10 mm (0.39 in.) and 25 mm (0.98 in.) clearances in the horizontal and vertical directions, respectively.



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

Dimension [unit: mm (in.)]

Mass: 0.17 kg (0.37 lb.)



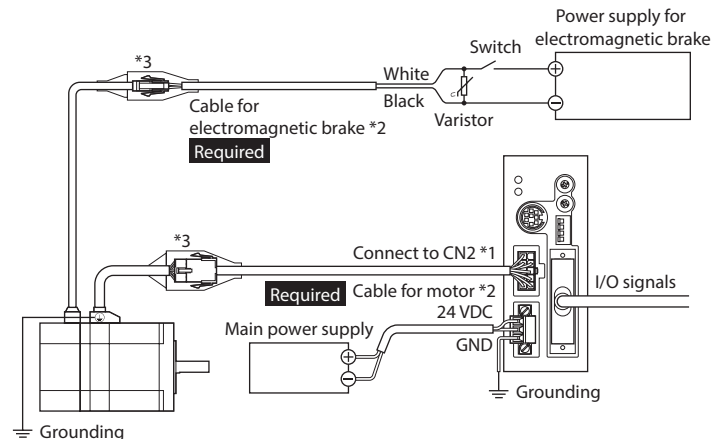
Connection



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

Connection example

The figure shows the electromagnetic brake motor.



- *1 Keep 30 m (98.4 ft.) or less for the wiring distance between the motor and driver.
- *2 Accessory.
- *3 If connector covers are attached on cables, cover the connected connectors using them.



- Have the connector plugged in securely. Insecure connection may cause malfunction or damage to the motor or driver.
- When plugging/unplugging the connector, turn off the power and wait for the POWER LED to turn off before doing so.
- 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 unplugging the connector, do so while pressing the latches on the connector.
- When installing the motor on a moving part, use a flexible cable having excellent flex resistance. Refer to the [USER MANUAL](#) for details.

● Current capacity of DC power supply for electromagnetic brake

The current capacity for the power supply for electromagnetic brake varies depending on the motor combined.

When motorized actuators are used, check while referring to the model name of the equipped motor.

In the case of the **DGII Series**, check the current capacity of a 24 VDC power supply with the **DGII Series OPERATING MANUAL Actuator**.

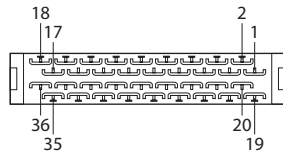
Motor model	Input power supply voltage	Current capacity
ARM24, ARM26	24 VDC±5% *	0.05 A or more
ARM46		0.08 A or more
ARM66, ARM69, ARM98		0.25 A or more

* If the distance between the motor and driver is extended to 20 to 30 m (65.6 to 98.4 ft.), use a power supply of 24 VDC±4%.

■ Connecting the I/O signals

Solder the I/O signals cable (AWG28 to 24: 0.08 to 0.2 mm²) to the CN5 connector (36 pins) while checking the pin numbers in "Connector function table" provided next.

Use a shielded cable for I/O signals.



Connector pin assignment (viewed from soldering side)

● Connector function table

Pin No.	Operating mode		Name	
	Positioning operation	Push-motion operation *	Positioning operation	Push-motion operation *
1	-		-	
2	GND		Ground connection	
3	ASG+		A-phase pulse output (line driver)	
4	ASG-			
5	BSG+		B-phase pulse output (line driver)	
6	BSG-			
7	TIM1+		Timing output (line driver)	
8	TIM1-			
9	ALM+		Alarm output	
10	ALM-			
11	WNG+		Warning output	
12	WNG-			
13	END+		Positioning complete output	
14	END-			
15	READY+/AL0+ *		Operation ready complete output/ Alarm code output 0	
16	READY-/AL0- *			
17	TLC+/AL1+ *		Torque limit output/ Alarm code output 1	
18	TLC-/AL1- *			
19	TIM2+/AL2+ *		Timing signals output (open collector)/ Alarm code output 2	
20	TIM2-/AL2- *			
21	GND		Ground connection	
22	IN-COM		Input signals common	
23	C-ON		Current ON input	
24	CLR/ALM-RST		Deviation counter clear input/ Alarm reset input	
25	CCM		Current control mode ON input	
26	CS	T-MODE *	Resolution selection input	Push-motion operation ON
27	-	M0 *	-	Push-current setting selection input
28	RETURN	M1 *	Return to electrical home operation	

Pin No.	Operating mode		Name	
	Positioning operation	Push-motion operation *	Positioning operation	Push-motion operation *
29	P-RESET	M2 *	Position reset input	Push-current setting selection input
30	FREE		Excitation OFF	
31	CW+/PLS+		CW pulse input/Pulse input (+5 V or line driver)	
32	CW-/PLS-			
33	CW+24 V/PLS+24 V		CW pulse input/Pulse input (+24 V)	
34	CCW+24 V/DIR+24 V		CCW pulse input/Rotation direction input (+24 V)	
35	CCW+/DIR+		CCW pulse input/Rotation direction input (+5 V or line driver)	
36	CCW-/DIR-			

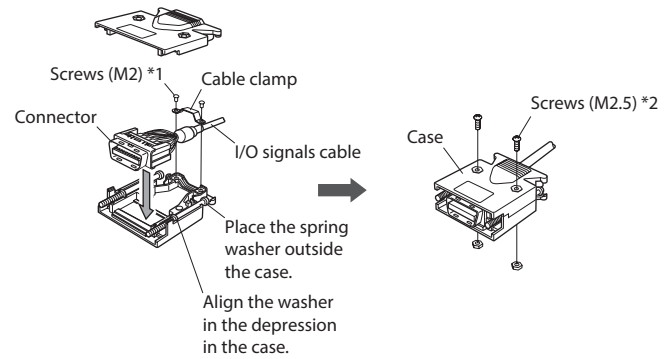
* The signal will be enabled if the applicable setting was changed using the **MEXE02** or **OPX-2A**.



The factory setting of the C-ON input is normally open. Be sure to turn the C-ON input ON when operating the motor. Set the C-ON input to normally closed when the C-ON input is not used.

● Assembling the connector

The tightening torque of a screw varies depending on the manufacturer of the connector. Check the manufacturer and tightening torque of the connector before tightening the screw.



*1 Tightening torques of this screw are shown in the table.

Manufacturer of connector	Tightening torque [N·m (oz·in)]
3M Japan Limited	0.15 to 0.25 (21 to 35)
Molex	0.3 to 0.35 (42 to 49)

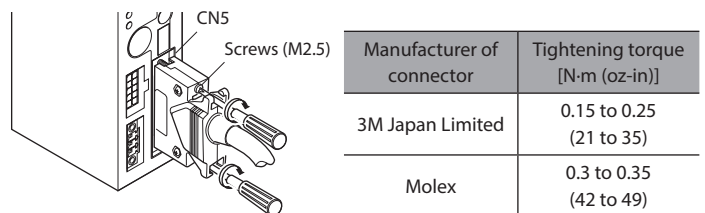
*2 Tightening torques of this screw are shown in the table.

Manufacturer of connector	Tightening torque [N·m (oz·in)]
3M Japan Limited	0.16 to 0.2 (22 to 28)
Molex	0.5 to 0.55 (71 to 78)

● Connecting the connector

Insert the CN5 connector into the I/O signals connector (CN5) on the driver, and tighten the screws.

The tightening torque of a screw varies depending on the manufacturer of the connector. Check the manufacturer and tightening torque of the connector before tightening the screw.

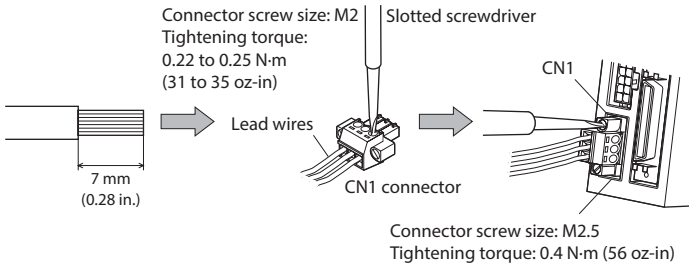


Be certain the I/O signals cable is as short as possible. The maximum input frequency will decrease as the cable length increases.

■ Connecting the main power supply

● Connecting method

Use the CN1 connector (3 pins) to connect the power supply cable (AWG24 to 16: 0.2 to 1.25 mm²) to the main power supply input terminals (CN1) on the driver.



● Main power supply current capacity

The current capacity for the main power supply varies depending on the motor combined.

When motorized actuators are used, check while referring to the model name of the equipped motor.

In the case of the **DGII** Series, check the current capacity of a main power supply with the **DGII** Series **OPERATING MANUAL** Actuator.

Motor model	Power supply input voltage	Power supply current capacity
ARM14	24 VDC±10%	0.4 A or more
ARM15		0.5 A or more
ARM24, ARM26	24 VDC±10%	0.9 A or more
ARM46		1.4 A or more
ARM66	24 VDC±10%	3.1 A or more
ARM69	48 VDC±5%	3.0 A or more
ARM98		2.5 A or more

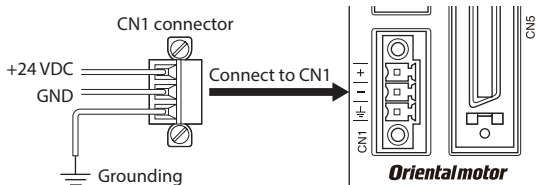
Note

- Pay attention to the polarity of the power supply. Reverse-polarity connection may cause damage to the driver.
- Do not wire the power supply cable of the driver in the same cable duct with other power line or motor cable. Doing so may cause malfunction due to noise.
- When cycling the main power supply or plugging/unplugging the connector, turn off the power and wait for the POWER LED to turn off before doing so.

● Grounding the driver

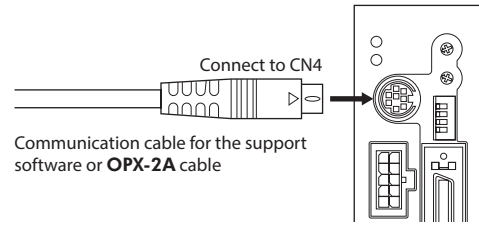
Ground the Frame Ground terminal (CN1) of driver as necessary.

Use a grounding wire of AWG24 to 16 (0.2 to 1.25 mm²), and do not share the Frame Ground terminal with a welder or any other power equipment.



■ Connecting the data setter

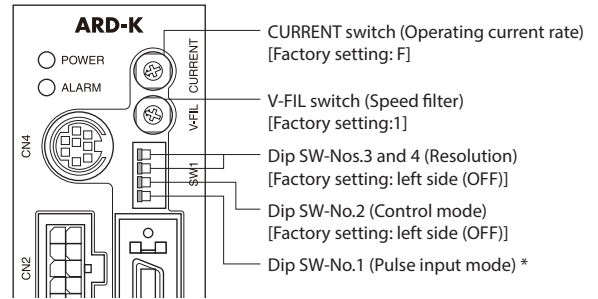
Connect the communication cable for the support software or **OPX-2A** cable to the data edit connector (CN4) on the driver.



⚠ CAUTION

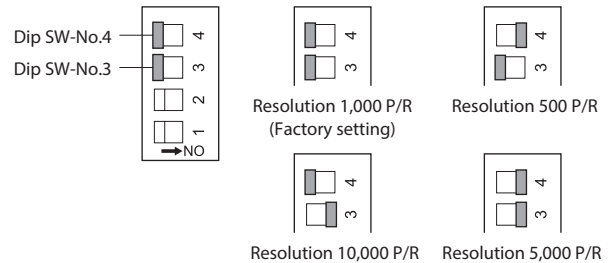
The power supply connector (CN1), data edit connector (CN4) and I/O signals connector (CN5) of the driver are not insulated. When grounding the positive terminal of the power supply, do not connect any equipment (PC, etc.) whose negative terminal is grounded. Doing so may cause the driver and these equipment to short, damaging both.

Setting



* The factory setting of the pulse-input mode depends on the destination country.

■ Resolution



memo

- The new settings of the Dip SW will be enabled after the main power supply is cycled.
- When the resolution is changed with the CS input, set the Dip SW-No.3 to the left side (OFF). If the Dip SW-No.3 is set to the right side (ON), the resolution will not change even when the CS input is turned ON.

■ Pulse input mode

Dip SW-No.1 is set to the left side (OFF): 2-pulse input mode

Dip SW-No.1 is set to the right side (ON): 1-pulse input mode

memo

- The new settings of the Dip SW will be enabled after the main power supply is cycled.
- The factory setting of the pulse-input mode depends on the destination country.

■ Operating current rate

Dial setting	Operating current rate (%)	Dial setting	Operating current rate (%)
0	6.3	8	56.3
1	12.5	9	62.5
2	18.8	A	68.8
3	25.0	B	75.0
4	31.3	C	81.3
5	37.5	D	87.5
6	43.8	E	93.8
7	50.0	F	100 (factory setting)

Note Excessively low operating current rate may cause a problem in starting the motor or holding the load in position. Do not lower the operating current rate more than necessary.

■ Speed filter

Dial setting	Speed filter time constant (ms)	Dial setting	Speed filter time constant (ms)
0	0	8	30
1	1 (factory setting)	9	50
2	2	A	70
3	3	B	100
4	5	C	120
5	7	D	150
6	10	E	170
7	20	F	200

Alarm (protective function)

When an alarm generates, the ALM output will turn OFF and the ALARM LED will blink. Before resetting an alarm, always remove the cause of the alarm and ensure safety.

For details of alarm, refer to the [USER MANUAL](#).

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.

During inspection

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

Note The driver uses semiconductor elements. Handle the driver with care since static electricity may damage semiconductor elements.

■ 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

Check on the Oriental Motor Website for the product specifications.

General specifications

Operation environment	Degree of protection	IP20
	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
Storage environment Shipping environment	Surrounding atmosphere	No corrosive gas, dust, water, or oil
	Ambient temperature	-20 to +60 °C (-4 to +140 °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

■ UL Standards

Check the "APPENDIX UL Standards for AR Series DC power input type" for recognition information about UL Standards.

■ CE Marking

• Low Voltage Directives

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

- This product is designed and manufactured to be incorporated in equipment. Be sure to install the product inside an enclosure.
- For the driver power supply, use a DC power supply with reinforced insulation on its primary and secondary sides.

• EMC Directive

This product is conducted EMC testing under the conditions specified in "Example of installation and wiring" on the [USER MANUAL](#). The conformance of your mechanical equipment with the EMC Directive will vary depending on such factors as the configuration, wiring, and layout for other control system devices and electrical parts used with this product. It therefore must be verified through conducting EMC measures in a state where all parts including this product have been installed in the equipment.

Applicable standards

EMI	EN 55011 group 1 class A, EN 61000-6-4
EMS	EN 61000-6-2

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

Combinations of motors and drivers in compliance with EMC Directive

Check "Products for possible combinations" on p.3 for the combinations of motors and drivers in compliance with EMC Directive.

■ Republic of Korea, Radio Waves Act

This product is affixed the KC Mark under the Republic of Korea, Radio Waves Act.

■ RoHS Directive

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

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Published in December 2018

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