



OPERATING MANUAL

Closed loop stepping motor and driver package

αSTEP AR Series

DC power input Pulse input type Driver



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.

Operating Manuals for the AR Series

Manual name	Motor function	Driver function	Installing the motor	Installing the driver	Connection	Operation	Troubleshooting
AR Series <u>OPERATING MANUAL</u> Motor (Supplied with motor)	○	—	○	—	—	—	—
AR Series DC power input Pulse input type <u>OPERATING MANUAL</u> Driver (this document)	—	○	—	○	○	—	—
AR Series DC power input Pulse input type <u>USER MANUAL</u>	○	○	○	○	○	○	○

The "USER MANUAL" does not come with the product. For details, contact your nearest Oriental Motor sales office or download from Oriental Motor website download page.

Introduction

■ Before use

Only qualified personnel should work with the product.

Use the product correctly after thoroughly reading the section "Safety precautions."

The product described in this manual has been designed and manufactured for use 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.

■ Hazardous substances

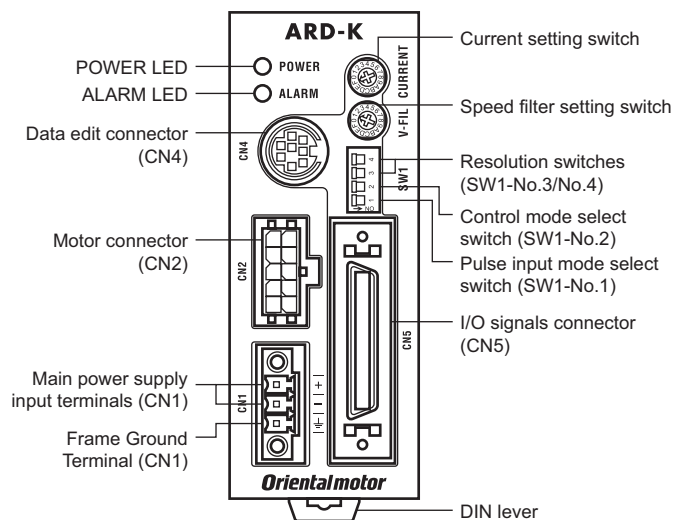
The products do not contain the substances exceeding the restriction values of RoHS Directive (2011/65/EU).

■ 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 (3 pins)1 pc.
- CN5 connector (36 pins)1 pc.
- OPERATING MANUAL Driver (this document)1 copy

Names of parts



Installation

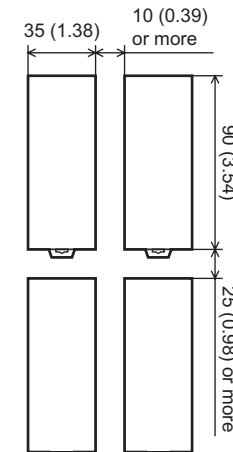
■ Location for installation

The driver is designed and manufactured to be incorporated in equipment. Install them in a well-ventilated location that provides easy access for inspection. The location must also satisfy the following conditions:

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

■ Installation method

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



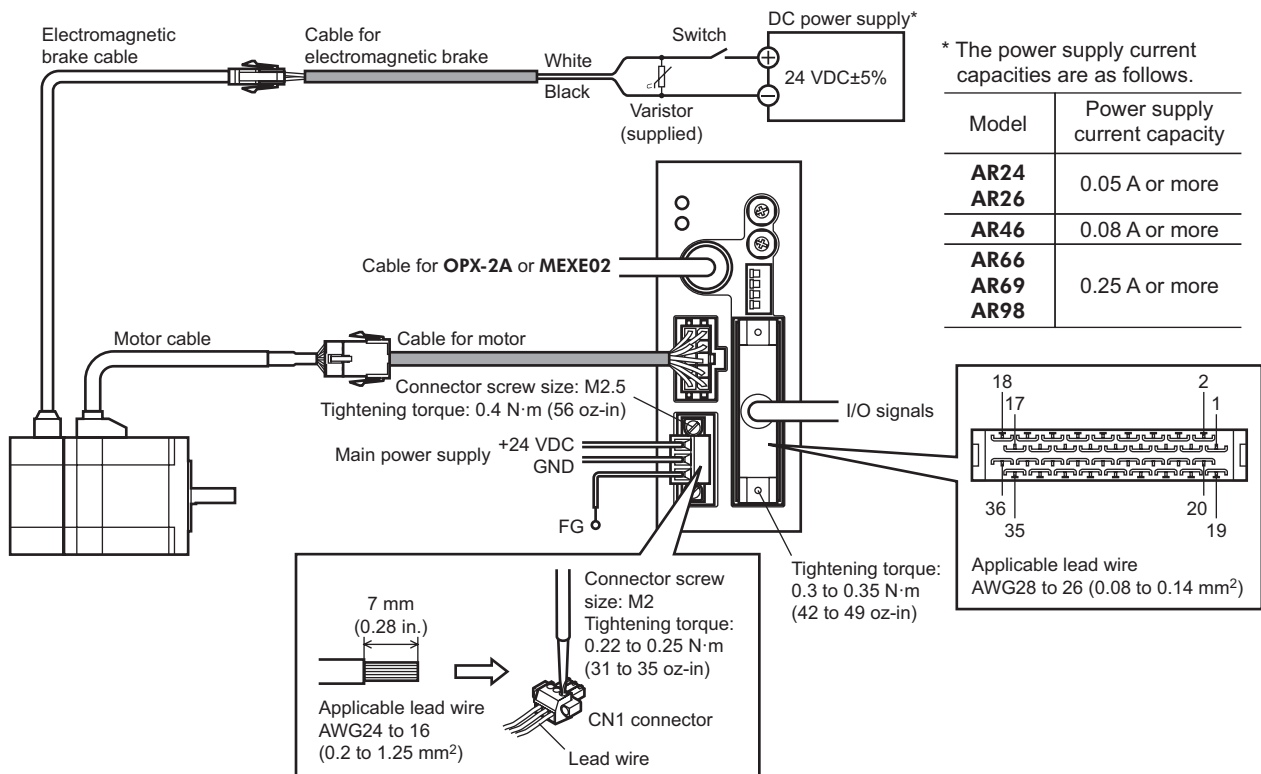
[Unit: mm (in.)]

■ 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.
- Check ventilation if the ambient temperature of the driver exceeds 50 °C (122 °F).
- Be sure to install the driver vertically (vertical position).

Connection

The following figure is a connection example when an electromagnetic brake motor is used.



■ Main power supply current capacity

Model	Input power supply voltage	Power supply current capacity
AR14	24 VDC±10%	0.4 A or more
AR15		0.5 A or more
AR24 AR26		0.9 A or more
AR46	24 VDC±10% 48 VDC±5%	1.4 A or more
AR66		3.1 A or more
AR69		3.0 A or more
AR98		2.5 A or more

■ Notes about connection

● General

- Have the connector plugged in securely. Insecure connector connection may cause malfunction or damage to the motor or driver.
- When cycle the power or plugging/unplugging the connector, turn off the power and wait for the POWER LED to turn off.

● Connecting the motor

- When unplugging the connector, do so while pressing the latches on the connector.
- When installing the motor to a moving part, use an accessory flexible cable offering excellent flexibility.
- If the distance between the motor and driver is extended to 20 m (65.6 ft.) or longer, use a power supply of 24±4% VDC.
- 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.

● Connecting the I/O signals

- 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 power supply

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.

Pay attention to the polarity of the power supply. Reverse-polarity connection may cause damage to the driver.



Caution The main power supply connector (CN1), data edit connector (CN4) and I/O signal 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.

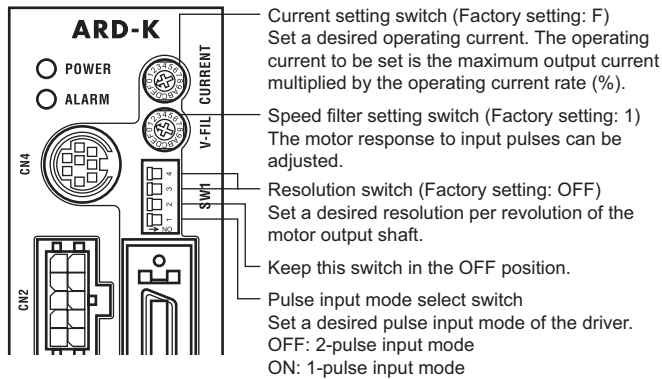
■ I/O connector pin assignment

Pin No	Operating mode		Name	
	Positioning operation	Push-motion operation *1	Positioning operation	Push-motion operation *1
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 completion output	
14	END—			
15	READY+/AL0+ *1		Operation ready complete output/Alarm code output 0	
16	READY—/AL0— *1			
17	TLC+/AL1+ *1		Torque limit output/ Alarm code output 1	
18	TLC—/AL1— *1			
19	TIM2+/AL2+ *1		Timing output (Open collector)/Alarm code output 2	
20	TIM2—/AL2— *1			
21	GND		Ground connection	
22	IN-COM		Input common	
23	C-ON *2		Current ON input	
24	CLR/ALM-RST		Deviation clear input/ Alarm reset input	
25	CCM		Current control mode ON input	
26	CS	T-MODE *1	Resolution selection input	Push-motion operation ON
27	—	M0 *1	—	Push-current setting selection input
28	RETURN	M1 *1	Return to electrical home operation	
29	P-RESET	M2 *1	Position reset 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/Direction input (+24 V)	
35	CCW+/DIR+		CCW pulse input/Direction input (+5 V or line driver)	
36	CCW—/ DIR—			

*1 The signal will become effective if the applicable setting has been changed using the accessory **OPX-2A** (sold separately) or **MEXE02**.

*2 Factory setting of the C-ON input logic is "normally open." Be sure to turn the C-ON input ON when operating the motor. Set the C-ON input logic to "normally closed" when the C-ON input is not used.

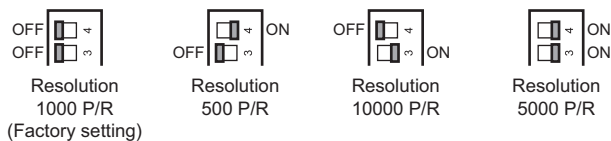
Setting



Note

- The new settings of the resolution switches or pulse input mode select switch will become effective after the power is cycled.
- Excessively low operating current may cause a problem in starting the motor or holding the load in position. Do not lower the operating current more than necessary.
- When changing the resolution using the CS input, use the switches in "No.3: OFF"/"No.4: OFF" or "No.3: OFF"/"No.4: ON" combination. If the CS input is turned ON when "No.3: ON" is selected, the resolution will not be changed.

Resolution



Operating current

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)

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

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.

Warning

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

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. Failure to do so may result in fire or injury.
- Assign qualified personnel 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.
- When the driver generates an alarm (protective functions is triggered), take measures to hold the moving part in place since the motor stops and loses its holding torque. Failure to do so may result in injury or damage to equipment.
- When the driver generates an alarm (protective functions is triggered), first remove the cause and then clear the protection 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 in the enclosure in order to prevent injury.

Connection

- Keep the driver's input power voltage within the specified range. Failure to do so may result in fire.
- For the driver's 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 cable. Doing so may cause fire.

Operation

- Turn off the driver power in the event of a power failure. Or the motor may suddenly start when the power is restored and may cause 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 cause injury. Refer all such internal inspections and repairs to the branch or sales office from which you purchased the product.



Caution

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

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 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 main power supply connector (CN1), data edit connector (CN4) and I/O signal 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.

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 OFF. Otherwise, the motor may start suddenly at power ON and cause injury or damage to equipment.
- Before moving the motor directly with the hands, 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. Failure to do so may result in fire or injury.

Disposal

- To dispose of the driver, disassemble it into parts and components as much as possible and dispose of individual parts/components as industrial waste.

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.

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

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

- Saving data to the NV memory

Do not turn off the main power supply while writing the data to the NV memory and 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 NV memory can be rewritten approx. 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 accessory **OPX-2A** (sold separately) or **MEXE02**.

- Overvoltage alarm by regeneration energy

The overvoltage alarm will generate depending on the operating condition. When an alarm is generated, review the operating conditions.

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

The main power supply connector (CN1), data edit connector (CN4) and I/O signal 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** (sold separately) to set data, etc.

- Do not perform push-motion operation with geared types.

Doing so may cause damage to the motor or gear part.

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 1000 m (3300 ft.) above sea level
	Surrounding atmosphere	No corrosive gas, dust, water or oil
Storage environment Shipping environment	Ambient temperature	-20 to +60 °C (-4 to +140 °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

Combinations of motors and drivers

- will be filled with **A** (single shaft), **B** (double shaft) or **M** (with electromagnetic brake).
For **AR14S** and **AR15S**, □ indicates **A** (single shaft) or **B** (double shaft).
For geared type, □ indicates **A** (single shaft) or **M** (with electromagnetic brake).
- represents a number indicating the gear ratio.
- indicates the cable length (**-1**, **-2**, **-3**) when the connection cable is supplied.

● Standard type

Model	Motor model	Driver model
AR14S □K○	ARM14S□K	ARD-K
AR15S □K○	ARM15S□K	
AR24S □K○	ARM24S□K	
AR26S □K○	ARM26S□K	
AR46S □K○	ARM46S□K	
AR46 □K○	ARM46□K	
AR66S □K○	ARM66S□K	
AR66 □K○	ARM66□K	
AR69S □K○	ARM69S□K	
AR69 □K○	ARM69□K	
AR98S □K○	ARM98S□K	
AR98 □K○	ARM98□K	

● TH geared type

Model	Motor model	Driver model
AR24S □K-T■○	ARM24S□K-T■	ARD-K
AR46S □K-T■○	ARM46S□K-T■	
AR46 □K-T■○	ARM46□K-T■	
AR66S □K-T■○	ARM66S□K-T■	
AR66 □K-T■○	ARM66□K-T■	
AR98S □K-T■○	ARM98S□K-T■	
AR98 □K-T■○	ARM98□K-T■	

● PS geared type

Model	Motor model	Driver model
AR24SAK-PS ■○	ARM24SAK-PS■	ARD-K
AR46S □K-PS■○	ARM46S□K-PS■	
AR46 □K-PS■○	ARM46□K-PS■	
AR66S □K-PS■○	ARM66S□K-PS■	
AR66 □K-PS■○	ARM66□K-PS■	
AR98S □K-PS■○	ARM98S□K-PS■	
AR98 □K-PS■○	ARM98□K-PS■	

● PN geared type

Model	Motor model	Driver model
AR24SAK-N ■○	ARM24SAK-N■	ARD-K
AR46S □K-N■○	ARM46S□K-N■	
AR46 □K-N■○	ARM46□K-N■	
AR66S □K-N■○	ARM66S□K-N■	
AR66 □K-N■○	ARM66□K-N■	
AR98S □K-N■○	ARM98S□K-N■	
AR98 □K-N■○	ARM98□K-N■	

● Harmonic geared type

Model	Motor model	Driver model
AR24S □K-H■○	ARM24S□K-H■	ARD-K
AR46S □K-H■○	ARM46S□K-H■	
AR46 □K-H■○	ARM46□K-H■	
AR66S □K-H■○	ARM66S□K-H■	
AR66 □K-H■○	ARM66□K-H■	
AR98S □K-H■○	ARM98S□K-H■	
AR98 □K-H■○	ARM98□K-H■	

CE Marking

■ Low Voltage Directives

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

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

■ EMC Directive

This product has received EMC compliance under the conditions specified in "Example of 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
	EN 61800-3
EMS	EN 61000-6-2
	EN 61800-3

This product 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.

Input/output power ratings

Frame size [mm (in.)]	Model	Motor model	Driver model	Input		Output current
				Voltage	Current	
20 (0.79)	AR14	ARM14	ARD-K	24 VDC	0.4 A	0.43 A
	AR15	ARM15			0.5 A	0.52 A
28 (1.10)	AR24	ARM24			0.9 A	0.88 A
	30 (1.18)	AR26		ARM26		
42 (1.65)	AR46	ARM46		24 VDC 48 VDC	1.4 A	1.48 A
60 (2.36)	AR66	ARM66			3.1 A	2.55 A
	AR69	ARM69			3.0 A	
85 (3.35)	AR98	ARM98				
90 (3.54)						

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