Oriental motor

HM-60187-6

OPERATING MANUAL

Closed loop stepping motor and driver package

αSTEP AR Series FLEX

DC power input Built-in Controller Type Driver CE

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.

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.

■ Operating manuals for the AR Series

Operating manuals for the **AR** Series FLEX DC power input built-in controller type are listed below.

- **AR** Series OPERATING MANUAL Motor (Supplied with motor)
- **AR** Series FLEX DC power input Built-in Controller Type OPERATING MANUAL Driver (this document)
- **AR** Series FLEX DC power input Built-in Controller Type USER MANUAL

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.

■ Hazardous substances

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

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.
	Do not forcibly bend, pull or pinch the cable.
	Do not turn the FREE input to ON while the motor is operating. The motor will stop and lose its holding power.
	Do not disassemble or modify the driver.
❗	Assign qualified personnel the task of installing, wiring, operating/controlling, inspecting and troubleshooting the product.
	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.
	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.
	Install the driver in the enclosure.
	Keep the driver’s input-power voltage within the specified range.
	For the driver's power supply, use a DC power supply with reinforced insulation on its primary and secondary sides.
	Connect the cables securely according to the wiring diagram.
	Turn off the driver power in the event of a power failure. The motor may suddenly start when the power is restored.

⚠Caution	
⃠	Do not use the driver beyond its specifications.
	Keep your fingers and objects out of the openings in the driver.
	Do not touch the driver during operation or immediately after stopping.
	Do not use other batteries than the accessory dedicated battery (sold separately).
	Do not leave anything around the driver that would obstruct ventilation.
	The power supply connector (CN1), data edit connector (CN3) and RS-485 communication connector (CN6/CN7) 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 data setter **OPX-2A** (sold separately) to set data, etc.
	Do not touch the terminals while performing the insulation resistance test or dielectric strength test.

⚠Caution	
!	When connecting, check the silk screen of the driver and pay attention to the polarity of the power supply. The power-supply circuit and the RS-485 communication circuit are not insulated. When controlling two or more drivers via RS-485 communication, the reverse polarity of the power supply will cause a short circuit and it may result in damage to the drivers.
	Before supplying power to the driver, turn all input signals to the driver OFF.
	Use a motor and driver only in the specified combination.
	Before moving the motor output shaft directly with the hands, confirm that the FREE input turns ON.
	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.
	Immediately when trouble has occurred, stop running and turn off the driver power.
	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

- 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.

- Preventing electrical noise

Refer to USER MANUAL for the noise elimination measures.

- Overvoltage alarm by regeneration energy

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

- Saving data to the non-volatile memory

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

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

The power supply connector (CN1), data edit connector (CN3) and RS-485 communication connector (CN6/CN7) 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.

- Motor excitation at power ON

The motor is excited when the power is on. If the motor is required to be in non-excitation status when turning on the power, assign the C-ON input to the direct I/O or network I/O. In this case, the motor will be excited when turning the C-ON input ON.

General specifications

Degree of protection		IP10
Operation environment	Ambient temperature	0 to +50 °C [+32 to +122 °F] (non-freezing)
	Humidity	85% or less (non-condensing)
	Altitude	Up to 1000 m (3300 ft.) above sea level
	Surrounding atmosphere	No corrosive gas, dust, water or oil
Storage environment 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
Insulation resistance		100 MΩ or more when 500 VDC megger is applied between the following places: · Between FG terminal and power supply terminal
Dielectric strength		Leakage current less than 10 mA when 500 VAC 50/60 Hz is applied for 1 minute between the following places: · Between FG terminal and power supply terminal

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 Directives

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.

Preparation

■ 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 (for power supply input terminals; 5 pins)..... 1 pc.
- CN5 connector (for sensor signals; 5 pins) .....1 pc.
- CN8 connector (for input signals; 9 pins) .....1 pc.
- CN9 connector (for output signals; 7 pins) .....1 pc.
- OPERATING MANUAL Driver (this document).....1 copy

■ 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).
- ○ indicates the cable length (**-1**, **-2**, **-3**) when the connection cable is supplied.
- ■ represents a number indicating the gear ratio.

● Standard type

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

● TH geared type

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

● PS geared type

Model	Motor model	Driver model
AR24SAKD-PS■○	ARM24SAK-PS■	ARD-KD
AR46S□KD-PS■○	ARM46S□K-PS■	
AR46□KD-PS■○	ARM46□K-PS■	
AR66S□KD-PS■○	ARM66S□K-PS■	
AR66□KD-PS■○	ARM66□K-PS■	
AR98S□KD-PS■○	ARM98S□K-PS■	
AR98□KD-PS■○	ARM98□K-PS■	

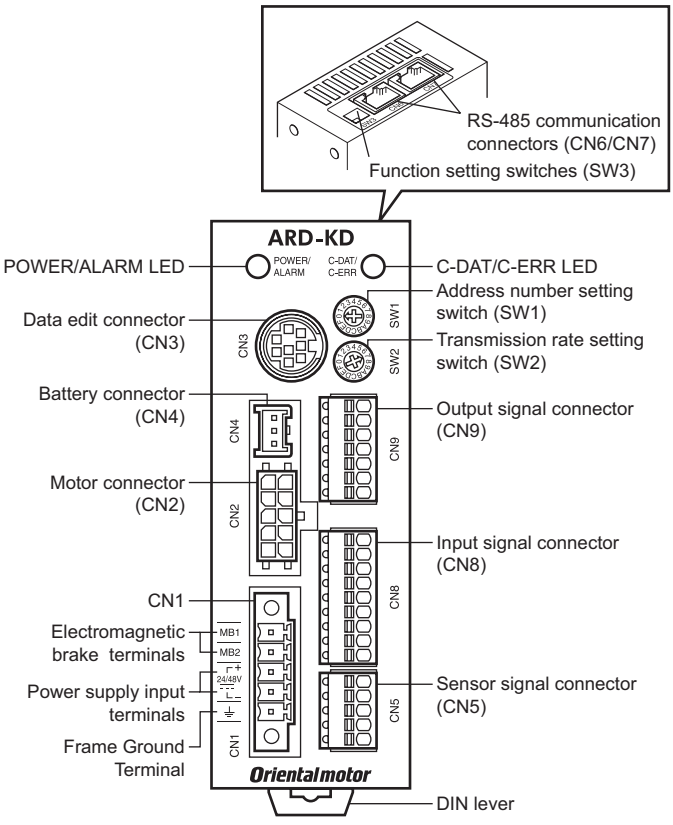
● PN geared type

Model	Motor model	Driver model
AR24SAKD-N■○	ARM24SAK-N■	ARD-KD
AR46S□KD-N■○	ARM46S□K-N■	
AR46□KD-N■○	ARM46□K-N■	
AR66S□KD-N■○	ARM66S□K-N■	
AR66□KD-N■○	ARM66□K-N■	
AR98S□KD-N■○	ARM98S□K-N■	
AR98□KD-N■○	ARM98□K-N■	

● Harmonic geared type

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

■ Names of driver parts



Installation

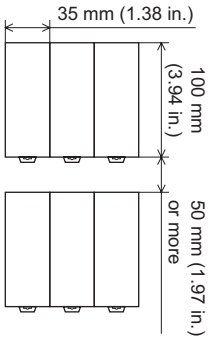
■ Location for installation

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:

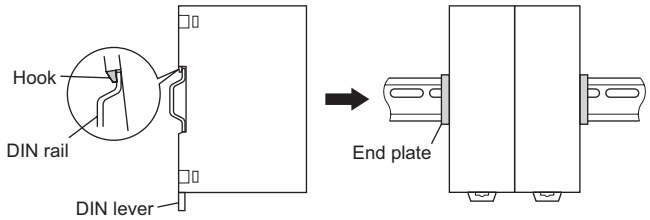
- Inside an enclosure that is installed indoors (provide vent holes)
- Operating ambient temperature 0 to +50 °C (+32 to +122 °F) (non-freezing)
- Operating ambient humidity 85% or less (non-condensing)
- Area that is free of explosive atmosphere or toxic gas (such as sulfuric gas) or liquid
- Area not 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. When installing two or more drivers in parallel, it is possible to install them closely in the horizontal direction. Provide a minimum clearance of 50 mm (1.97 in.) in the vertical direction.
When installing three or more drivers closely, the heat generation of the inside drivers become high. Install the less frequently used drivers toward the inside.



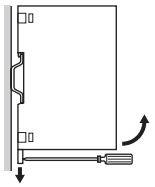
Pull down the driver's DIN lever and lock it. Hang the hook at the rear to the DIN rail, and push in the driver. After installation, secure the both sides of the driver with the end plate.



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

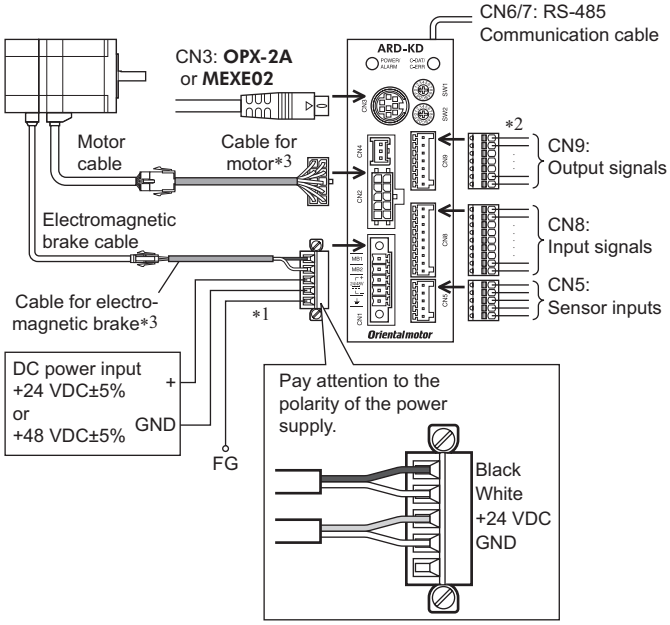
Removing from DIN rail

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



Connection

■ Connection example (electromagnetic brake motor)



*1 Power supply and FG connection cable: AWG24 to 16 (0.2 to 1.25 mm^2)
*2 I/O signals connection cable: AWG26 to 20 (0.14 to 0.5 mm^2)
*3 Connection between the motor and driver can be extended to a maximum of 30 m (98.4 ft.).

Note
- When connecting, check the silk screen of the driver and pay attention to the polarity of the power supply. Reverse-polarity connection may cause damage to the driver. The power-supply circuit and the RS-485 communication circuit are not insulated. Therefore, when controlling multiple drivers via RS-485 communication, the reverse polarity of the power supply will cause a short circuit and may result in damage to the drivers.
- The power supply connector (CN1), data edit connector (CN3) and RS-485 communication connector (CN6/CN7) 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 an accessory motor cable (sold separately) when extending the wiring distance between the motor and driver. When installing the motor to a moving part, use an accessory flexible cable (sold separately) offering excellent flexibility.

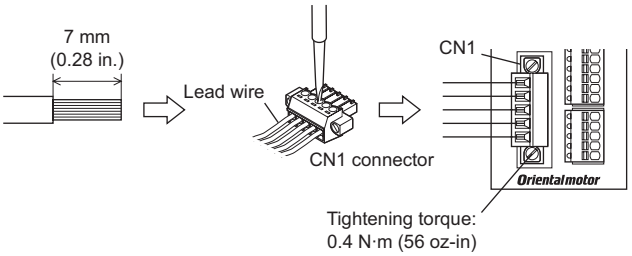
■ Power supply current capacity

Model	Input power supply voltage	Power supply current capacity
AR14	24 VDC±5%	0.4 A or more
AR15		0.5 A or more
AR24 **AR26**		1.3 A or more
AR46	24 VDC±5% 48 VDC±5%	1.8 A or more
AR66		3.8 A or more
AR69		3.7 A or more
AR98		3.1 A or more

■ CN1

● Connecting method

1. Strip the insulation cover of the lead wire by 7 mm (0.28 in.)
2. Insert each lead wire into the CN1 connector and tighten the screw using a screwdriver.
   Tightening torque: 0.22 to 0.25 N·m (31 to 35 oz-in)
3. Insert the CN1 connector into CN1 and tighten the screws.
   Tightening torque: 0.4 N·m (56 oz-in)



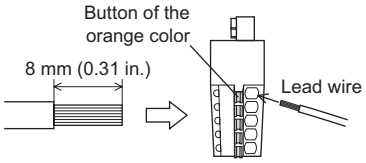
● Pin assignment

Pin No.	Signal name	Description
1	MB1	Electromagnetic brake− (Black)
2	MB2	Electromagnetic brake+ (White)
3	+	+24 VDC/48 VDC power supply input
4	−	GND
5	FG	Frame Ground

■ CN5, CN8, CN9

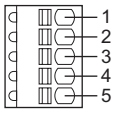
● Connecting method

1. Strip the insulation cover of the lead wire by 8 mm (0.31 in.)
2. Insert the lead wire while pushing the button of the orange color with a screwdriver.
3. After having inserted, release the button to secure the lead wire.



● CN5 pin assignment

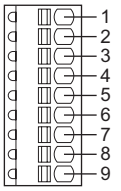
Pin No.	Signal name	Description
1	+LS	+limit sensor input
2	−LS	−limit sensor input
3	HOMES	Mechanical home sensor input
4	SLIT	Slit sensor input
5	IN-COM2	Sensor signals common



● CN8 pin assignment

Pin No.	Signal name	Description ∗
1	IN0	Input signal 0 (HOME)
2	IN1	Input signal 1 (START)
3	IN2	Input signal 2 (M0)
4	IN3	Input signal 3 (M1)
5	IN4	Input signal 4 (M2)
6	IN5	Input signal 5 (FREE)
7	IN6	Input signal 6 (STOP)
8	IN7	Input signal 7 (ALM-RST)
9	IN-COM1	Input signals common

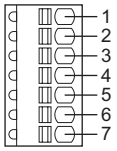
∗ ( ): Initial value



● CN9 pin assignment

Pin No.	Signal name	Description ∗
1	OUT0	Output signal 0 (HOME-P)
2	OUT1	Output signal 1 (END)
3	OUT2	Output signal 2 (AREA1)
4	OUT3	Output signal 3 (READY)
5	OUT4	Output signal 4 (WNG)
6	OUT5	Output signal 5 (ALM)
7	OUT-COM	Output signals common

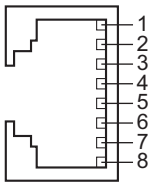
∗ ( ): Initial value



■ CN6, CN7

● Pin assignments

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



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 items

- Are any of the driver DIN rail mounting parts loose?
- Are there any loose driver connectors?
- 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. Handle the driver with care since static electricity may damage semiconductor elements.

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