OPERATING MANUAL

Rotary Encoder
Incremental Type

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.

Table of contents

Before using the product

Only qualified personnel of electrical and mechanical engineering should work with the product. Use the product properly 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 into general industrial equipment. Do not use it for any other purpose. Oriental Motor Co., Ltd. is not responsible for any compensation for damage caused through failure to observe this warning.

Safety precautions

The precautions described below are intended to ensure the safe and proper use of the product and to prevent the user and other personnel 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 safe use of the product.

⚠WARNING

- Do not use the product in explosive or corrosive environments, in the presence of flammable gases, in areas subjected to splashing water, or near combustible materials. Doing so may result in fire or injury.
- Do not transport, install, connect, or inspect the product while the power is supplied. Doing so may result in electric shock.
- Do not disassemble or modify the encoder. Doing so may result in injury.
- Connect the product securely according to the connection method. Failure to do so may result in fire.
- Use a DC power supply with reinforced insulation on its primary and secondary sides for a power supply. Failure to do so may result in electric shock.

⚠CAUTION

- Do not use the encoder beyond its specifications. Doing so may result in injury or damage to equipment.

Precautions for use

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

- **Keep the encoder away from a strong magnetic field.**

Note: A magnetic sensor is built into the encoder. Installing the encoder near equipment that generates a strong magnetic field may affect the angular accuracy of the encoder. Pay attention to the installation location of the encoder when using it.

- **Take measures against static electricity when handling the encoder.**

The encoder uses semiconductor components. Since static electricity may damage semiconductor components, be extremely careful when handling it.

- **Do not to apply a strong shock to the encoder.**

This will damage the encoder.

- **Do not make any wiring connections while the power is on.**

Doing so may result in damage to the product.

- **Use the encoder in a condition where a radial load and an axial load are equal to or less than the permissible values.**

Continuing to operate the encoder under excessive radial load or axial load may cause damage to the bearings (ball bearings). Be sure to operate the encoder within the specified values for the radial load and axial load.

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.
- Rotary encoder ..... 1 unit
- Instructions and Precautions for Safe Use ..... 1 copy

■ How to identify the product model

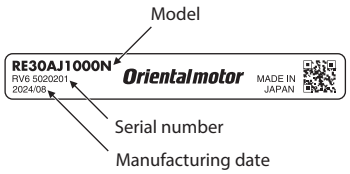
Check the model name of the encoder against that shown on the nameplate. Refer to "Information about nameplate" on p.2 for how to identify the nameplate.

RE 30 A J 1000 N
1 2 3 4 5

1	Mounting size (mm)	
2	Shaft shape	**A**: Round shaft **H**: Hollow shaft
3	Encoder type	**J**: Incremental type
4	Resolution (P/R)	
5	Output circuit type	**E**: Voltage output **F**: Open collector output (Power supply voltage 5 to 24 VDC) **L**: Line driver output **N**: Open collector output (Power supply voltage 5 VDC)

■ Information about nameplate

The figure shows an example.

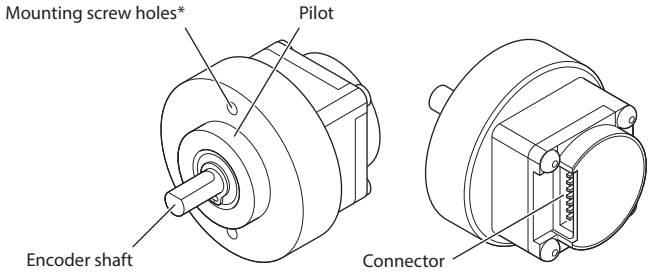


memo The position describing the information may vary depending on the product.

■ Names of parts

● Round shaft type

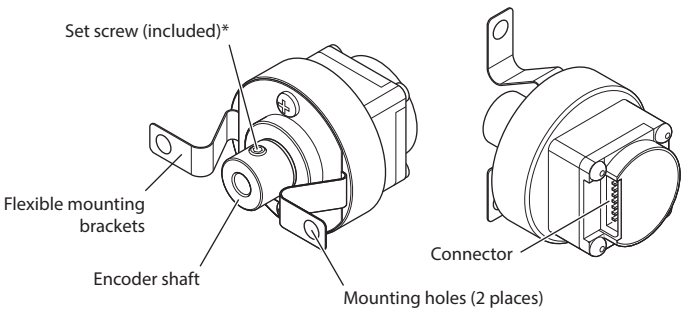
The figure shows the model **RE30**.



* The model **RE30** has two mounting screw holes.
The model **RE40** has three mounting screw holes.

● Hollow shaft type

The figure shows the model **RE30**.



* The model **RE30** has a set screw.
The model **RE40** has two set screws.

Installation

■ Installation location

Install the encoder in a well-ventilated location that provides easy access for inspection. The location must also satisfy the following conditions:

- Inside an enclosure installed indoors (provide a ventilation hole)
- Operating ambient temperature: –10 to +85 °C [+14 to 185 °F] (non-freezing)
  –10 to +70 °C [+14 to 158 °F] for the encoder that the end of the model name is **F** (non-freezing)
- Operating ambient humidity: 85 % or less (non-condensing)
- Area free of explosive atmosphere, 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 vibration or shock beyond specifications
- 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

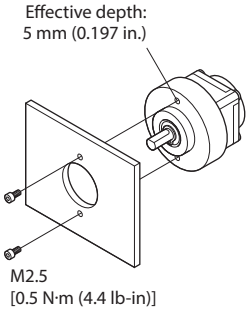
■ Installation method

The encoder can be installed in any direction. Install it securely to a metal surface as strong as possible in consideration of heat dissipation and vibration prevention.
When installing the encoder in equipment, align the encoder shaft (axis) with the axis of the equipment. When installing a coupling or pulley on the encoder shaft, be careful not to damage the encoder shaft or the bearing (ball bearings).
The values of the tightening torque are recommended. Tighten the screws to an appropriate torque according to the design conditions of the metal plate being installed.

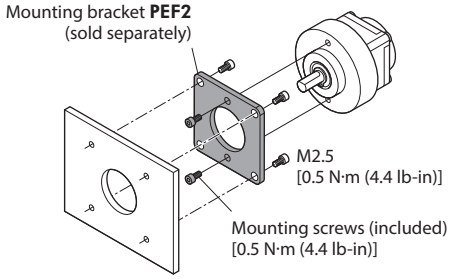
● Round shaft type

The values in brackets [ ] are the tightening torques.

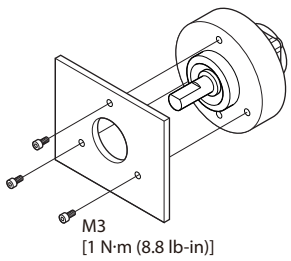
- **RE30**



- **RE30 (When using a mounting bracket of Oriental Motor)**



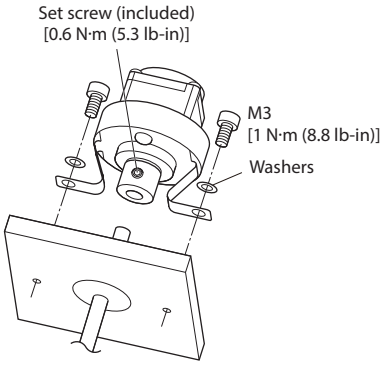
- **RE40**



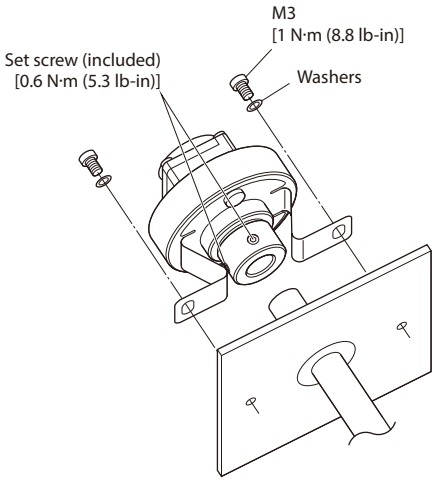
● Hollow shaft type

Mount the shaft of the rotary encoder to the shaft of the equipment, and then secure the flexible mounting brackets with the screw.
The values in brackets [ ] are the tightening torques.

• RE30

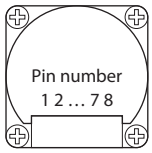


• RE40



Connection

■ Pin assignment



Pin number	Lead wire color*	Output circuit type		Function
		Line driver output	Voltage output / open-collector output	
1	Black	GND	GND	Power supply input (Ground)
2	Red	A+	A	Phase A output positive side
3	Brown	A–	No connection	Phase A output negative side
4	Green	B+	B	Phase B output positive side
5	Blue	B–	No connection	Phase B output negative side
6	Yellow	Z+	Z	Phase Z output positive side
7	Orange	Z–	No connection	Phase Z output negative side
8	White	Vcc	Vcc	Power supply input

* It indicates the colors of the lead wires used in the Oriental Motor connection cables **LCE05A-006** and **LCE08A-006**.

■ Applicable connector, cable

Connector	Housing: 51021-0800 (Molex, LLC) Contact: 50079-8X00 (Molex, LLC) Crimping tool: 200218-1900 (Molex, LLC)
Cable	Applicable cable: AWG 28 to 26 (0.08 to 0.128 mm^2) Lead wire insulation outer diameter: ø0.5 to 1.04 mm (0.020 to 0.041 in.) Lead wire insulation strip length: 1.4 to 1.9 mm (0.06 to 0.07 in.)

Note Use a shielded cable to extend the wiring or reduce the influence of noise. Also, keep the product away from power cables, such as motor or power supply cables, and wire it at the shortest possible distance.

■ Oriental Motor cables

These are encoder connection cables. One end of the cable has a connector for connecting the encoder.

Model	Length [m (ft.)]	Lead size	Output circuit type
LCE05A-006	0.6 (2.0)	AWG 26 (0.13 mm^2)	Voltage output, open collector output
LCE08A-006			Line driver output

These are flexible shielded cables. One end of the cable has a connector for connecting the encoder. The shielded ground wire useful for grounding comes out of the end of the cable.

Model	Length [m (ft.)]	Lead size
CC010E1R	1 (3.3)	AWG 26 (0.13 mm^2)
CC020E1R	2 (6.6)	
CC030E1R	3 (9.8)	

Inspection and maintenance

■ Inspection

It is recommended that the following items be checked periodically after each operation of the product. If any abnormality occurs, discontinue use of the product and contact your nearest Oriental Motor sales office.

● Inspection items

- Check to see if the mounting screw is loose.
- Check to see if the bearing (ball bearings) makes an unusual noise.
- Check to see if the lead wire is not damaged or stressed.
- Make sure there is no center misalignment between the encoder shaft and the rotation axis of the equipment.

■ Warranty

Check on the Oriental Motor Website for the product warranty.

■ Disposal

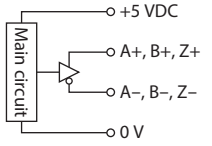
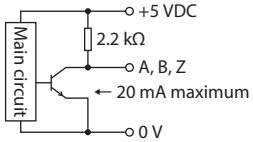
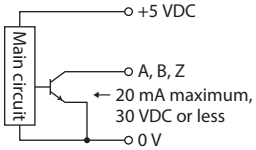
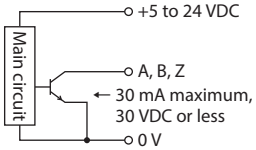
Dispose the product correctly in accordance with laws and regulations, or instructions of local governments.

Specifications

■ Electrical specifications

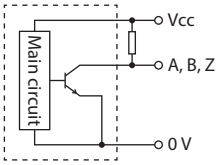
Encoder type		Incremental type			
Resolution (P/R)		100, 200, 360, 400, 500, 600, 720, 800, 1,000, 1,800, 2,000, 2,500, 3,600, 4,000			
Output circuit type		Line driver output (Equivalent to 26C31)	Voltage output	Open collector output	
Power supply voltage		5 VDC±10 %			5 to 24 VDC ±10 %
Current consumption (No load)		30 mA or less	45 mA or less	40 mA or less	18 mA or less
Output voltage	H level	2.5 V or more	4.3 V or more (No load)	–	
	L level	0.5 V or less			
Maximum lead-in current		20 mA			30 mA
Response frequency		200 kHz or less	100 kHz or less		
Output signals		Phase A, Phase B, Phase Z: 3 Channels			
Angular accuracy		±0.36°			

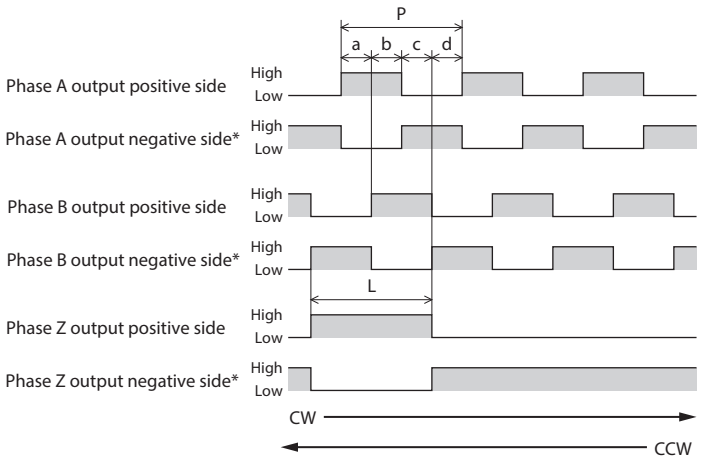
■ Output circuit

Output circuit type	Output circuit
Line driver output (Equivalent to 26C31)	
Voltage output	
Open collector output (Power supply voltage 5 VDC)	
Open collector output (Power supply voltage 5 to 24 VDC)	

• **Output waveform**

"High" and "Low" in the timing chart represent the voltage state of the output terminals.
For the open collector output, they represent the voltage state of the output terminals when connected as shown in the figure on the right.





* Line driver output only

• **Waveform accuracy**

- Duty ratio: 50 %±12.5 % for both phase A output and phase B output
- Phase Z output: L=P
- Phase difference: a, b, c, d=P/4±P/8
- Rise and fall time of signal: 1 µs or less (at connector terminal)

■ Mechanical specifications

RE30

Inertia	Round shaft: 1.0×10^{-7} kg·m^2 (0.0055 oz-in^2) Hollow shaft: 1.6×10^{-7} kg·m^2 (0.0088 oz-in^2)
Permissible radial load	10 N (2.2 lb.) [Shaft end]
Permissible axial load	5 N (1.1 lb.)
Maximum rotation speed	6,000 r/min (Equal to or less than response frequency)
Mass	Round shaft: 33 g (1.2 oz.) Hollow shaft: 38 g (1.4 oz.)

RE40

Inertia	Round shaft: 1.2×10^{-7} kg·m^2 (0.0066 oz-in^2) Hollow shaft: 5.9×10^{-7} kg·m^2 (0.032 oz-in^2)
Permissible radial load	30 N (6.7 lb.) [Shaft end]
Permissible axial load	20 N (4.5 lb.)
Maximum rotation speed	6,000 r/min (Equal to or less than response frequency)
Mass	Round shaft: 58 g (2.1oz.) Hollow shaft: 71 g (2.5 oz.)

Note If the radial load or the axial load exceeds the specified permissible value, repeated load application may cause the encoder shaft or the bearing (ball bearings) to occur a fatigue failure.

■ General specifications

Operating environment	Ambient temperature	−10 to +85 °C [+14 to +185 °F] (non-freezing) −10 to +70 °C [+14 to 158 °F] for the encoder that the end of the model name is **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 or dust. No exposure to water or oil.
Storage environment Shipping environment	Ambient temperature	−20 to +85 °C [−4 to +185 °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 or dust. No exposure to water or oil.
Degree of protection	IP20	
Insulation resistance	100 MΩ or more when 500 VDC megger is applied between the power supply terminal and frame.	
Dielectric strength	Sufficient to withstand 0.5 kVAC at 50/60 Hz applied between the power supply terminal and frame for 1 minute.	
Vibration	10 to 55 Hz, double amplitude 1.5 mm, 2 hours each in X, Y, and Z directions	
Shock	490 m/s^2, 11 ms, 3 times each in X, Y, and Z directions	

Regulations and standards

■ RoHS Directive

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

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• Please contact your nearest Oriental Motor office for further information.

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