Rotary Encoders

OMRON

Contents

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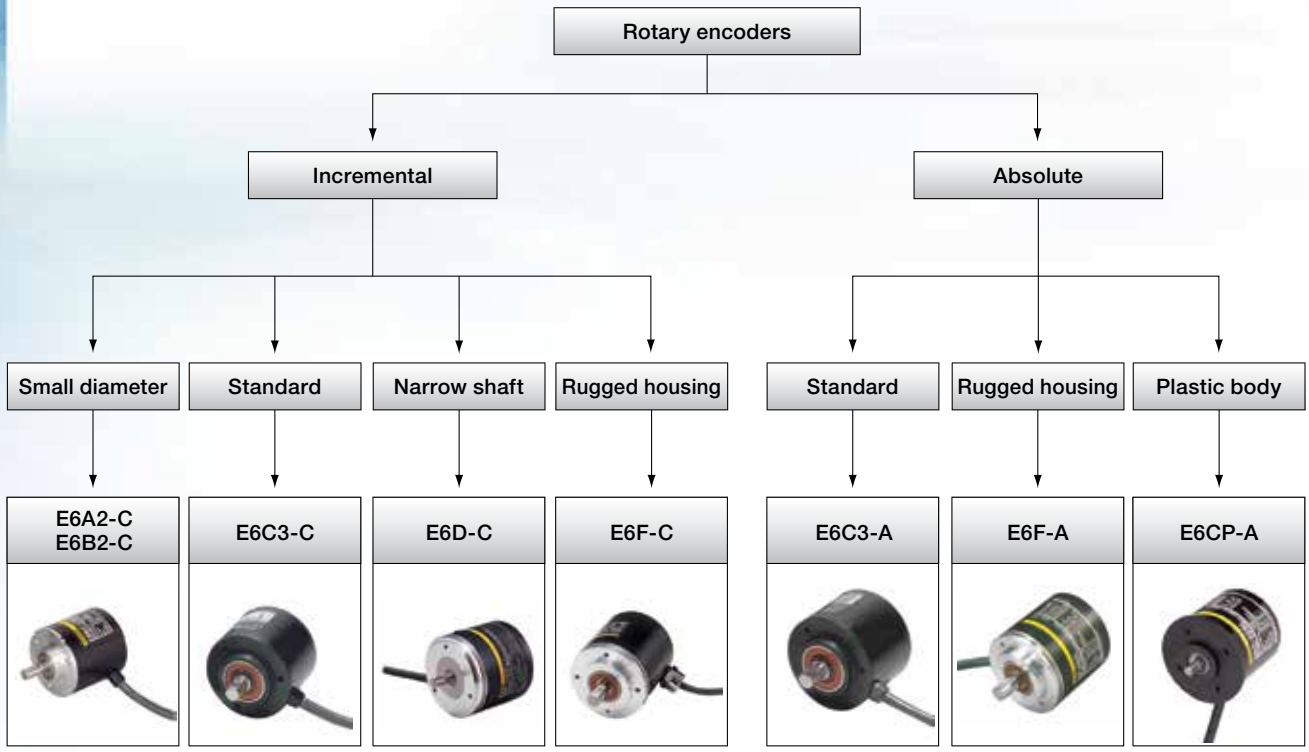
ACCURACY AND ROBUSTNESS MADE RELIABLE

Close the loop – angle, position and velocity on hand

Rotary encoders create information which represent the movement of your application. To meet challenging demands, Omron offers a wide range of absolute and incremental encoders.

- **Wide resolution variety**
- **Models with rugged housing**
- **Models for multi-turn applications**



Output		Incremental				
						
Model		E6A2-C	E6B2-C	E6D-C	E6C3-C	E6F-C
Type		Small diameter shaft	Small diameter shaft	Small diameter shaft	Standard	Rugged housing
Resolution range (Pulse/rev)	Min	10	10	10	100	100
	Max	500	2,000	6,000	3,600	1,000
Output	NPN	■	■	■	■	■
	PNP	–	■	–		
Size dia. (mm)		25	40	55	50	60
Max. force	Radial	10 N	30 N	50 N	80 N	120 N
	Axial	5 N	20 N	30 N	50 N	50 N
IP rating	IP50	■	■	■	–	–
	IP64	–	–	–	–	–
	IP65	–	–	–	■	■
Max. rotation frequency (rpm)		5,000	6,000	12,000	5,000	5,000

Output		Absolute		
				
Model		E6C3-A	E6F-A	E6CP-A
Type		Standard	Rugged housing	Lightweight, plastic body
Resolution range (Pulse/rev)	Min	6	256	10
	Max	1,024	1,024	256
Output	NPN	■	■	■
	PNP	■	■	–
Size dia. (mm)		50	60	50
Max. force	Radial	80 N	120 N	30 N
	Axial	50 N	50 N	20 N
IP rating	IP50	–	–	■
	IP64	–	–	–
	IP65	■	■	–
Max. rotation frequency (rpm)		5,000	5,000	1,000

■ Standard □ Available – No/not available

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Water Resistant Encoder for Tough Environments

- IP65 drip-proof, oil-proof construction with sealed bearing
- 8 mm stainless steel shaft provides superior shaft loading performance: Radial: 8 kg-f; Axial: 5.1 kg-f
- NPN, or PNP open collector or voltage outputs
- Optimum angle control when combined with cam positioner (stand-alone H8PS or PLC-based) or encoder-input PLC position control modules
- Response frequency: 20 kHz max., 5,000 rpm max
- Pre-wired with 1 meter cable; 2 meter cable available, connector version available for direct connection to an H8PS Cam Positioning Unit

Ordering Information

When ordering, specify the resolution in addition to the model number (example: E6C3-AG5C 360P/R 1M).

Size	Shaft	Supply Voltage	Output configuration	Output code	Resolution (pulses/ rotation)	Connection method	Model
50 dia. x 43 D mm	8 dia. x 15 L mm, stainless steel	12 to 24 VDC	NPN open-collector output	Gray	256, 360, 720	2 m connector for H8PS Cam Positioner	E6C3-AG5C-C
					256, 360, 720, 1,024	Pre-wired, 1 m cable	E6C3-AG5C
				Binary	32, 40		E6C3-AN5C
				BCD	6, 8, 12		E6C3-AB5C
			PNP open-collector output	Gray	256, 360, 720, 1,024		E6C3-AG5B
				Binary	32, 40		E6C3-AN5B
				BCD	6, 8, 12		E6C3-AB5B
		5 VDC	Voltage output	Binary	256		E6C3-AN1E
		12 VDC					E6C3-AN2E

Low-Cost Absolute Encoder, 50 mm Diameter

- High-precision detection of automatic machine timing, also ideal for robot limit signals
- Absolute encoder performance at the cost of an incremental encoder
- Gray code output eliminates reading mistakes
- Lightweight, plastic body construction, IP50 enclosure rating
- Shaft loading: Radial: 3 kg-f; Axial: 2 kg-f
- Open collector output
- Response frequency: 5 kHz max., 1,000 rpm max
- Pre-wired with 2 m cable, connector version available for direct connection to an H8PS Cam Positioning unit

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Ordering Information

Size	Shaft	Power supply voltage	Output configuration	Output code	Resolution (pulses/ rotation)	Connection method	Model
50 dia. x 55 D mm	6 dia. x 10 L mm	5 to 12 VDC	Open-collector output	Gray	256 (8-bit)	Pre-wired, 2 m cable	E6CP-AG3C
		12 to 24 VDC					E6CP-AG5C
						2 m cable with connector for H8PS Cam Positioner	E6CP-AG5C-C

Rugged Encoder for High-Precision Detection

- 10 mm stainless steel shaft and rugged construction provide the highest shaft loading among Omron encoders: Radial: 12 kg-f, Thrust: 5 kg-f
- IP65f water and oil-proof construction
- High response speed for faster control: Gray code: 20 kHz; BCD: 10 kHz, 5,000 rpm max
- Combine with H8PS Cam Positioner or PLC encoder input module for optimum angle control
- Pre-wired with 2 m cable, connector version available for direct connection to an H8PS Cam Positioning unit

Ordering Information

When ordering, specify the resolution in addition to the model number (example: E6C3-AG5C 360P/R 1M).

Size	Shaft	Power supply voltage	Output configuration	Output code	Resolution (pulses/ rotation)	Connection method	Model
60 mm dia. x 65 D mm	10 dia. x 20 L mm	5 to 12 VDC	NPN open collector	BCD	360	Pre-wired 2 m cable	E6F-AB3C
		12 to 24 VDC					E6F-AB5C
			PNP open collector				E6F-AB5B
			NPN open collector	Gray code	256, 360, 720	2 m cable with connector for H8PS Cam Positioner	E6F-AG5C-C
			NPN open collector		256, 360, 720, 1,024	Pre-wired 2 m cable	E6F-AG5C
			PNP open collector				E6F-AG5B

Rugged Encoder for High-Precision Detection

- High response frequency and noise immunity make encoders ideal for factory automation applications with 10 to 500 pulses/revolution
- Space saving enclosure: 25 mm dia.
- 4 mm shaft with load rating of: Radial: 1 kg-f; Axial: 0.5 kg-f
- Open collector output, other output types available
- Output phases: A/A, B and A, B, Z (reversible) are available
- Response frequency: 20 kHz max., 5,000 rpm max
- Enclosure rating: IP50
- Pre-wired with 0.5 meter cable

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Ordering Information

Size	Shaft	Supply voltage	Output configuration	Resolution (pulses/revolution)	Model
25 dia. x 31 D mm	4 dia. x 10 L mm	12 to 24 VDC	NPN open collector, 30 mA max	100	E6A2-CW5C 100P/R 05M
				200	E6A2-CW5C 200P/R 05M

General-Purpose Compact Encoders

- High resolution models (up to 2000 pulses per revolution available) substantially improve measuring accuracy
- Rugged construction: 6 mm shaft with load rating of: Radial: 3 kg-f; Axial: 2 kg-f
- Output phases: A, B, Z (reversible)
- Response frequency: up to 100 kHz max., 6,000 rpm max
- Protected against short-circuit and reversed connections for highly reliable operation
- Available with NPN and PNP open collector, voltage and line driver outputs
- Enclosure rating: IP50
- Pre-wired with 0.5- or 2 m cables

Ordering Information

Size	Shaft	Supply voltage	Output configuration	Resolution (pulse/ revolution)	Cable length	Model
40 mm dia. x 44 D mm	6 dia. x 15 L mm	12 to 24 VDC	NPN open collector, 35 mA max	100	2 m	E6B2-CWZ6C 100P/R 2M
				200		E6B2-CWZ6C 200P/R 2M
				360	0.5 m	E6B2-CWZ6C 360P/R 05M
				360	2 m	E6B2-CWZ6C 360P/R 2M
				500		E6B2-CWZ6C 500P/R 2M
				600		E6B2-CWZ6C 600P/R 2M
				1000	0.5 m	E6B2-CWZ6C 1000P/R 05M
					2 m	E6B2-CWZ6C 1000P/R 2M
		5 VDC	Line driver: High: -20 mA or 2.5 V min Low: +20 mA or 0.5 V max		0.5 m	E6B2-CWZ1X 1000P/R 05M

Water Resistant Incremental Encoder for Tough Environments

- High resolution solutions from 100 to 3600 pulses/revolution
- IP65f drip-proof, oil-proof construction with sealed bearing
- 8 mm stainless steel shaft provides a load rating of: Radial: 88 kg-f; Axial: 5 kg-f
- Complementary outputs simplify interfacing to NPN or PNP input devices
- Output phases: A, B and Z (reversible)
- Response frequency: 125 kHz max. (65 kHz for Z-phase), 5,000 rpm max
- Surge protection built-in
- Voltage and line driver output versions available
- Pre-wired with 1 meter cable, 2 meter cable is available

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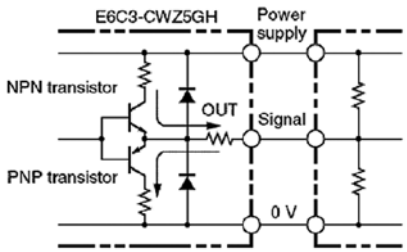
Ordering Information

Size	Shaft	Supply Voltage	Output configuration	Resolution (pulse/ revolution)	Model
50 dia. x 43 D mm	8 dia. x 15 L mm, stain-less steel	12 to 24 VDC	Complementary output (NPN and PNP), 35 mA max. 	100	E6C3-CWZ5GH 100P/R 1M
				200	E6C3-CWZ5GH 200P/R 1M
				360	E6C3-CWZ5GH 360P/R 1M
				500	E6C3-CWZ5GH 500P/R 1M
				720	E6C3-CWZ5GH 720P/R 1M
				800	E6C3-CWZ5GH 800P/R 1M
				1000	E6C3-CWZ5GH 1000P/R 1M
				2048	E6C3-CWZ5GH 2048P/R 1M
				2500	E6C3-CWZ5GH 2500P/R 1M
				3600	E6C3-CWZ5GH 3600P/R 1M

E6D-C Rotary Encoders – Incremental

Quick Link F528 omron247.com

Rugged, High-Resolution Encoder

- Resolution as high as 6,000 pulses/ revolution in a rugged construction
- Outputs: A, B (reversible) and Z (zero)
- 55 mm diameter housing
- Superb reliability and accuracy: phase error as small as 1/4T±0.07T
- High response frequency of 200 kHz, 12,000 rpm max
- 6 mm shaft with load rating of: Radial: 5 kg-f; Axial: 3 kg-f

CE

Ordering Information

Size	Shaft	Supply voltage	Output configuration	Resolution (pulses/ revolution)	Cable length	Model
44 mm dia. x 44 D mm	6 dia. x 15 L mm	12 VDC	NPN open collector, 35 mA max	720, 800, 1000, 1024, 1200, 1500, 1800, 2000, 2048, 2500, 3000, 3200, 3600, 4096, 5000, 6000	0.5 m	E6D-CWZ2C□□□□P/R 05M
		5 VDC				E6D-CWZ1E□□□□P/R 05M

E6F-C Rotary Encoders – Incremental

Quick Link F529 omron247.com

Rugged, High-Resolution Encoder

- 10 mm stainless steel shaft and rugged construction provides the highest shaft loading among Omron encoders; Radial: 12 kg-f, Thrust: 5 kg-f
- IP65f water and oil-proof construction
- 60 mm diameter housing
- Complementary output for longer cable length extension
- High response frequency of 83 kHz, 5,000 rpm max

CE

- Output load short-circuit protection to reduce risks from incorrect wiring
- Pre-wired 2 m cable

Ordering Information

Size	Shaft	Supply voltage	Output configuration	Resolution (pulses/ revolution)	Cable length	Model
60 mm dia. x 65 D mm	10 dia. x 20 L mm	12 to 24 VDC	Complementary NPN and PNP, ±30 mA	100, 200, 360, 500, 600, 1000	2 m	E6F-CWZ5GP/R 2M

Technical Explanation for Rotary Encoders

Introduction

What Is a Rotary Encoder?

Rotary Encoders are sensors that detect position and speed by converting rotational mechanical displacements into electrical signals and processing those signals. Sensors that detect mechanical displacement for straight lines are referred to as Linear Encoders.

Features

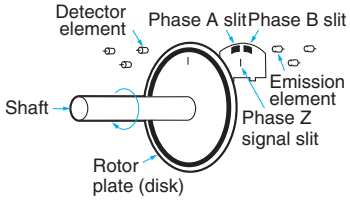
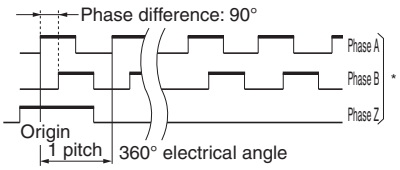
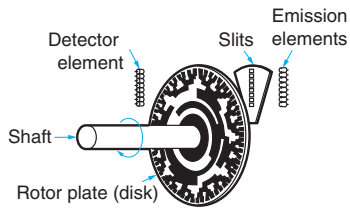
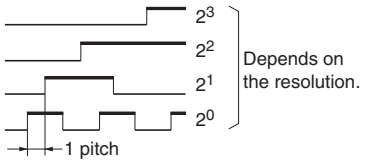
1. The output is controlled according to the rotational displacement of the shaft.
Linking to the shaft using a coupling enables direct detection of rotational displacement.

2. Returning to the origin is not required at startup for Absolute Encoders.
With an Absolute Encoder, the rotational angle is output in parallel as an absolute value. (Refer to *Operating Principles* on page 2.)

3. The rotation direction can also be detected.
The rotation direction is determined by the output timing of phases A and B with an Incremental Encoder, and by the code increase or decrease with an Absolute Encoder. (Refer to *Operating Principles* on page 2.)

4. Choose the optimal Sensor from a wide lineup of resolutions and output types.
Select the Sensor to match the requirements for precision, cost, and connected circuits.

Operating Principles

Item / Classification	Features	Structure	Output waveform
Incremental Encoders **E6A2-C** **E6B2-C** **E6C2-C** **E6C3-C** **E6D-C** **E6F-C** **E6H-C**	• This type of encoder outputs a pulse string in response to the amount of rotational displacement of the shaft. A separate counter counts the number of output pulses to determine the amount of rotation based on the count. • To detect the amount of rotation from a certain input shaft position, the count in the counter is reset at the reference position and the number of pulses from that position is added cumulatively by the counter. For this reason, the reference position can be selected as desired, and the count for the amount of rotation can be unlimited. Another important feature is that a circuit can be added to generate twice or four times the number of pulses for one signal period, for heightened electrical resolution.* Also, the phase-Z signal, which is generated once a revolution, can be used as the origin within a revolution. * When high resolution is necessary, a 4-multiplier circuit is generally used. (4x output is obtained by differentiating the rise and fall waveforms of phase A and phase B, resulting in four times the resolution.)	 When a disk with an optical pattern revolves along with the shaft, light passing through two slits is transmitted or blocked accordingly. The light is converted to electrical currents in the detector elements, which correspond to each slit, and is output as two square waves. The two slits are positioned so that the phase difference between the square wave outputs is 1/4 pitch.	 * Even if resolution changes, the number of phases does not change.
Absolute Encoders **E6CP-A** **E6C3-A** **E6F-A**	• This type of encoder outputs in parallel the rotation angle as an absolute value in 2^n code. It therefore has one output for each output code bit, and as the resolution increases, the value of outputs increases. Rotation position detection is accomplished by directly reading the output code. • When the Encoder is incorporated into a machine, the zero position of the input revolution shaft is fixed, and the rotation angle is always output as a digital value with the zero position as the coordinate origin. Data is never corrupted by noise, and returning to the zero position at startup is not necessary. Furthermore, even when code reading becomes impossible due to high-speed rotation, correct data can be read when the rotation speed slows, and correct rotation data can even be read when the power is restored after a power failure or other interruption in the power supply.	 When a disk with a pattern rotates, light passing through the slits is transmitted or blocked according to the pattern. The received light is converted to electrical currents in the detector elements, takes the form of waves, and becomes digital signals.	

Classification

For details, refer to *Operating Principles* on page 2.

Selection Guidelines

1 **Incremental Encoder or Absolute Encoder?**

Select a type that is suitable in terms of the cost vs. capacity, returning (or not) to the origin at startup, the maximum speed, and noise tolerance.

2 **How much resolution is needed?**

Select the optimal model in view of required precision and cost of machine equipment. We recommend selecting a resolution of from 1/2 to 1/4 of the precision of the machine with which the Encoder will be used.

3 **Dimensions**

Also take into consideration the type of shaft that is required (hollow shaft or regular shaft) in relation to mounting space.

4 **Permitted Shaft Loading**

When selecting, take into consideration how the mounting method affects the load on the shaft and mechanical life.

5 **Maximum Permissible Speed**

Base your selection on the maximum mechanical speed during use.

6 **Maximum Response Frequency**

Base your selection on the maximum shaft speed when the device in which the Encoder is used is in operation.
Maximum response frequency = (Revolutions (RPM) /60) x Resolution.
There are deviations in the actual signal periods, so the specifications of the selected model should provide a certain amount of leeway with respect to the above calculated value.

7 **Degree of Protection**

Select the model based on how much dust, water, and oil there is in the application environment.

- Dust only: IP50
- Water or oil also present: IP52(f), IP64(f) (water-resistant, oilresistant)
- Oil present: Oil-proof construction

8 **Startup Torque of Shaft**

How much torque does the drive have?

9 **Output Circuit Type**

Select the circuit type based on the device to be connected, the frequency of the signal, transmission distance, and noise environment.
For long distance transmission, a line-driver output is recommended.

Explanation of Terms

Resolution

The pulse count of an incremental signal output when the shaft revolves once, or the absolute address count.

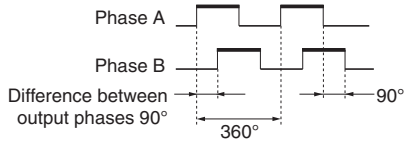
Output Phase

The output signal count for an Incremental Encoder. There are 1- phase models (phase A), 2-phase models (phase A, phase B), and 3- phase models (phase A, phase B, and phase Z). The phase Z is an origin signal that is output once a revolution.

Output Phase Difference

When the shaft is rotated, this is the time difference between the rise or fall of the phase A and phase B signals, expressed as a proportion of the period of one signal, or as an electrical angle where one signal period equals 360°.

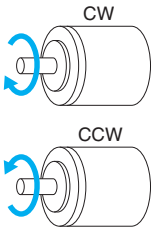
The difference between phase A and phase B as an electrical angle is normally 90°.



CW

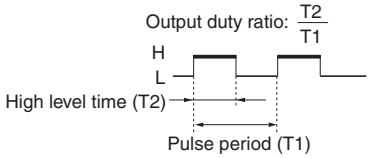
The clockwise direction of rotation. Viewed from the end of the shaft, the shaft rotates clockwise. With an Incremental Encoder, phase A normally leads phase B in this rotation direction. With an Absolute Encoder, this is the direction of code increase.

The reverse of CW rotation is counterclockwise (CCW) rotation.



Output Duty Ratio

This is the ratio of the duration of high level during one period to the average period of pulse output when the shaft is rotated at a constant speed.

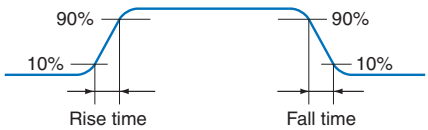


Maximum Response Frequency

The maximum frequency at which the signal can respond.

Rise and Fall Times of Output

The elapsed time from a 10% to 90% change in the output pulse.



Output Circuit

1. Open-collector Output
   An output circuit where the emitter of the output circuit transistor is the common and the collector is open.
2. Voltage Output
   An output circuit where the emitter of the output circuit transistor is the common and a resistor is inserted between the collector and the power supply to convert the output from the collector to a voltage.
3. Line-driver Output
   An output method that uses a special IC for high-speed, long-distance data transmission that complies with the RS-422A standard. The signal is output as a differential secondary signal, and thus is strong with respect to noise. A special IC called a line receiver is used to receive the signal output from a line driver.
4. Complementary Output
   An output circuit with two output transistors (NPN and PNP) on the output.
   These two output transistors alternately turn ON and OFF depending on the high or low output signal. When using them, pull up to the positive power supply voltage level or pull down to 0 V. The complementary output allows flow-in or flow-out of the output current and thus the rising and falling speeds of signals are fast. This allows a long cable distance.
   They can be connected to open-collector input devices (NPN, PNP).

Starting Torque

The torque needed to rotate the shaft of the Rotary Encoder at startup.

The torque during normal rotation is normally lower than the starting torque. A shaft that has a waterproof seal has a higher starting torque.

Moment of Inertia

This expresses the magnitude of inertia when starting and stopping the Rotary Encoder.

Shaft Capacity

This is the load that can be applied to the shaft. The radial load is the load that is perpendicular to the shaft, and the thrust load is the load in the direction along the shaft. Both are permitted on the shaft during rotation, and the size of the load affects the life of the bearings.

Ambient Operating Temperature

The ambient temperature that meets the specifications, consisting of the permitted values for the external air temperature and the temperature of the parts that contact the Rotary Encoder.

Ambient Storage Temperature

The ambient temperature when the power is OFF that does not cause functional deterioration, consisting of the permitted values for the external air temperature and the temperature of the parts that contact the Rotary Encoder.

Degree of Protection

The level of protection against penetration of foreign objects from outside the Rotary Encoder. This is defined in the IEC60529 standard and expressed as IPXX.
The degree of protection against oil is specified by OMRON standards, and is expressed as oil-proof construction or oil resistance.

Absolute Code

(1) Binary Code
A pure binary code, expressed in the format 2^n. Multiple bits may change when an address changes.

(2) Gray Code
A code in which only one bit changes when an address changes. The code plate of the Rotary Encoder uses gray code.

(3) Remainder Gray Code
This code is used when expressing resolutions with gray code that are not 2^n, such as 36, 360, and 720. The nature of gray code is such that when the most significant bit of the code changes from 0 to 1 and the same size of area is used for both the larger value and the smaller value of objects, the signal only changes by 1 bit within this range when changing from the end to the beginning of a code. This enables any resolution that is an even number to be set with gray code. In this case, the code does not begin from 0, but from an intermediate code, and thus when actually using a code it must first be shifted so that it starts from 0.
The example in the code table shows 36 divisions. For the change from address 31 to 32, the code extends from address 14 to 49 when 18 addresses each are taken for the objects. When changing from address 49 to 14, only one bit changes, and we can see that the characteristic of gray code is preserved. By shifting the code 14 addresses, it can be converted to a code that starts from address 0.

(4) BCD
Binary Coded Decimal Code.
Each digit of a decimal number is expressed using a binary value.

Serial Transmission

In contrast to parallel transmission where multiple bits of data are simultaneously output, this method outputs data serially on a single transmission line, enabling the use of fewer wires. The receiving device converts the signals into parallel signals.

Hollow Shaft

The rotating shaft is hollow, and the drive shaft can be directly connected to the hole in the hollow shaft to reduce the length along the direction of the shaft. A leaf spring is used as a buffer to absorb vibration from the drive shaft.

Metal Disk

The rotating slit disk in the Encoder is made of metal for higher shock tolerance than glass. Due to slit machining limitations, the metal disk cannot be used for high-resolution applications.

Servo Mount

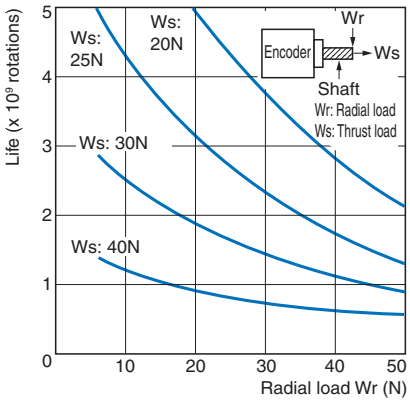
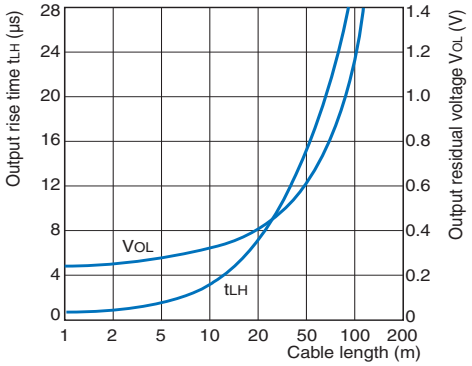
A method of mounting the Encoder in which a Servo Mounting Bracket is used to clamp down the flange of the Encoder. The position of the Encoder in the direction of rotation can be adjusted, and thus this method is used to temporarily mount the Encoder to adjust the origin.

Absolute Code Table

Decimal	Binary	Gray	Gray remainder 14	BCD	
				10	1
0	0 0 0 0 0 0	0 0 0 0 0 0		0 0 0 0	0 0 0 0
1	0 0 0 0 0 1	0 0 0 0 0 1		0 0 0 0	0 0 0 1
2	0 0 0 0 1 0	0 0 0 0 0 1 1		0 0 0 0	0 0 1 0
3	0 0 0 0 1 1	0 0 0 0 0 1 0		0 0 0 0	0 0 1 1
4	0 0 0 1 0 0	0 0 0 0 1 1 0		0 0 0 0	0 1 0 0
5	0 0 0 1 0 1	0 0 0 0 1 1 1		0 0 0 0	0 1 0 1
6	0 0 0 1 1 0	0 0 0 0 1 0 1		0 0 0 0	0 1 1 0
7	0 0 0 1 1 1	0 0 0 0 1 0 0		0 0 0 0	0 1 1 1
8	0 0 1 0 0 0	0 0 0 1 1 0 0		0 0 0 0	1 0 0 0
9	0 0 1 0 0 1	0 0 0 1 1 0 1		0 0 0 0	1 0 0 1
10	0 0 1 0 1 0	0 0 0 1 1 1 1		0 0 0 1	0 0 0 0
11	0 0 1 0 1 1	0 0 0 1 1 1 0		0 0 0 1	0 0 0 1
12	0 0 1 1 0 0	0 0 0 1 0 1 0		0 0 0 1	0 0 1 0
13	0 0 1 1 0 1	0 0 0 1 0 1 1		0 0 0 1	0 0 1 1
14	0 0 1 1 1 0	0 0 0 1 0 0 1	0 0	0 0 0 1	0 1 0 0
15	0 0 1 1 1 1	0 0 0 1 0 0 0	0 1	0 0 0 1	0 1 0 1
16	0 1 0 0 0 0	0 0 1 1 0 0 0	0 2	0 0 0 1	0 1 1 0
17	0 1 0 0 0 1	0 0 1 1 0 0 1	0 3	0 0 0 1	0 1 1 1
18	0 1 0 0 1 0	0 0 1 1 0 1 1	0 4	0 0 0 1	1 0 0 0
19	0 1 0 0 1 1	0 0 1 1 0 1 0	0 5	0 0 0 1	1 0 0 1
20	0 1 0 1 0 0	0 0 1 1 1 1 0	0 6	0 0 1 0	0 0 0 0
21	0 1 0 1 0 1	0 0 1 1 1 1 1	0 7	0 0 1 0	0 0 0 1
22	0 1 0 1 1 0	0 0 1 1 1 0 1	0 8	0 0 1 0	0 0 1 0
23	0 1 0 1 1 1	0 0 1 1 1 0 0	0 9	0 0 1 0	0 0 1 1
24	0 1 1 0 0 0	0 0 1 0 1 0 0	1 0	0 0 1 0	0 1 0 0
25	0 1 1 0 0 1	0 0 1 0 1 0 1	1 1	0 0 1 0	0 1 0 1
26	0 1 1 0 1 0	0 0 1 0 1 1 1	1 2	0 0 1 0	0 1 1 0
27	0 1 1 0 1 1	0 0 1 0 1 1 0	1 3	0 0 1 0	0 1 1 1
28	0 1 1 1 0 0	0 0 1 0 0 1 0	1 4	0 0 1 0	1 0 0 0
29	0 1 1 1 0 1	0 0 1 0 0 1 1	1 5	0 0 1 0	1 0 0 1
30	0 1 1 1 1 0	0 0 1 0 0 0 1	1 6	0 0 1 1	0 0 0 0
31	0 1 1 1 1 1	0 0 1 0 0 0 0	1 7	0 0 1 1	0 0 0 1
32	1 0 0 0 0 0	1 1 0 0 0 0 0	1 8	0 0 1 1	0 0 1 0
33	1 0 0 0 0 1	1 1 0 0 0 0 1	1 9	0 0 1 1	0 0 1 1
34	1 0 0 0 1 0	1 1 0 0 0 1 1	2 0	0 0 1 1	0 1 0 0
35	1 0 0 0 1 1	1 1 0 0 0 1 0	2 1	0 0 1 1	0 1 0 1
36	1 0 0 1 0 0	1 1 0 0 1 1 0	2 2	0 0 1 1	0 1 1 0
37	1 0 0 1 0 1	1 1 0 0 1 1 1	2 3	0 0 1 1	0 1 1 1
38	1 0 0 1 1 0	1 1 0 0 1 0 1	2 4	0 0 1 1	1 0 0 0
39	1 0 0 1 1 1	1 1 0 0 1 0 0	2 5	0 0 1 1	1 0 0 1
40	1 0 1 0 0 0	1 1 1 1 0 0 0	2 6	1 0 0 0	0 0 0 0
41	1 0 1 0 0 1	1 1 1 1 0 0 1	2 7	1 0 0 0	0 0 0 1
42	1 0 1 0 1 0	1 1 1 1 1 1 1	2 8	1 0 0 0	0 0 1 0
43	1 0 1 0 1 1	1 1 1 1 1 1 0	2 9	1 0 0 0	0 0 1 1
44	1 0 1 1 0 0	1 1 1 1 0 1 0	3 0	1 0 0 0	0 1 0 0
45	1 0 1 1 0 1	1 1 1 1 0 1 1	3 1	1 0 0 0	0 1 0 1
46	1 0 1 1 1 0	1 1 1 1 0 0 1	3 2	1 0 0 0	0 1 1 0
47	1 0 1 1 1 1	1 1 1 1 0 0 0	3 3	1 0 0 0	0 1 1 1
48	1 1 0 0 0 0	1 0 1 0 0 0 0	3 4	1 0 0 0	1 0 0 0
49	1 1 0 0 0 1	1 0 1 0 0 0 1	3 5	1 0 0 0	1 0 0 1
50	1 1 0 0 1 0	1 0 1 0 0 1 1		1 0 0 1	0 0 0 0
51	1 1 0 0 1 1	1 0 1 0 0 1 0		1 0 0 1	0 0 0 1
52	1 1 0 1 0 0	1 0 1 1 1 1 0		1 0 0 1	0 0 1 0
53	1 1 0 1 0 1	1 0 1 1 1 1 1		1 0 0 1	0 0 1 1
54	1 1 0 1 1 0	1 0 1 1 1 0 1		1 0 0 1	0 1 0 0
55	1 1 0 1 1 1	1 0 1 1 1 0 0		1 0 0 1	0 1 0 1
56	1 1 1 0 0 0	1 0 0 1 1 0 0		1 0 0 1	0 1 1 0
57	1 1 1 0 0 1	1 0 0 1 1 0 1		1 0 0 1	0 1 1 1
58	1 1 1 0 1 0	1 0 0 1 1 1 1		1 0 0 1	1 0 0 0
59	1 1 1 0 1 1	1 0 0 1 1 1 0		1 0 0 1	1 0 0 1
60	1 1 1 1 0 0	1 0 0 0 1 1 0		1 1 0 0	0 0 0 0
61	1 1 1 1 0 1	1 0 0 0 1 1 1		1 1 0 0	0 0 0 1
62	1 1 1 1 1 0	1 0 0 0 0 0 1		1 1 0 0	0 0 1 0
63	1 1 1 1 1 1	1 0 0 0 0 0 0		1 1 0	0 1 1 1

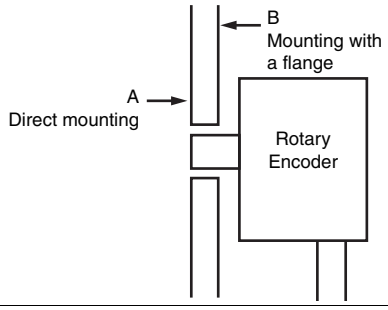
Further Information

Interpreting Engineering Data

Bearing Life	Cable Extension Characteristics
E6B2-C	E6B2-CWZ6C
	 Measurement Example Power supply voltage: 5 VDC Load resistance: 1 kΩ (Output residual voltage is measured at a 35 mA load current.) Cable: Special Cable
• This graph shows the relationship between mechanical life and the load applied to the shaft. • The size of the load during rotation affects the life of the bearings.	• This graph shows the effect of the output waveform if the cable is extended. • Extending the cable length not only changes the startup time, but also increases the output residual voltage.

Mounting

To mount the Rotary Encoder directly, secure it with screws from direction A. If a servo mount is used, attach a Flange to the Rotary Encoder and mount the Rotary Encoder from direction B.



Example: Attaching an E69-FCA02 Flange to the E6C2-C