

## General-purpose Encoder with External Diameter of 50 mm



- Incremental model
- External diameter of 50 mm.
- Resolution of up to 2,000 ppr.
- IP64 (improved oil-proof construction with sealed bearings)
- Side or back connections are possible. Pre-wired Models with cable connected at an angle.



Be sure to read *Safety Precautions* on page 4.

For the most recent information on models that have been certified for safety standards, refer to your OMRON website.

## Ordering Information

### Encoders [Refer to *Dimensions* on page 5.]

Power supply voltage	Output configuration	Resolution (pulses/rotation)	Model
5 to 24 VDC	Open-collector output (NPN)	10, 20, 30, 40, 50, 60, 100, 200, 300, 360, 400, 500, 600	<b>E6C2-CWZ6C (resolution) 2M</b> Example: E6C2-CWZ6C 10P/R 2M
		720, 800, 1,000, 1,024, 1,200, 1,500, 1,800, 2,000	
12 to 24 VDC	Open-collector output (PNP)	100, 200, 360, 500, 600	<b>E6C2-CWZ5B (resolution) 2M</b> Example: E6C2-CWZ5B 100P/R 2M
		1,000, 2,000	
5 to 12 VDC	Voltage output	10, 20, 30, 40, 50, 60, 100, 200, 300, 360, 400, 500, 600	<b>E6C2-CWZ3E (resolution) 2M</b> Example: E6C2-CWZ3E 10P/R 2M
		720, 800, 1,000, 1,024, 1,200, 1,500, 1,800, 2,000	
5 VDC	Line-driver output	10, 20, 30, 40, 50, 60, 100, 200, 300, 360, 400, 500, 600	<b>E6C2-CWZ1X (resolution) 2M</b> Example: E6C2-CWZ1X 10P/R 2M
		720, 800, 1,000, 1,024, 1,200, 1,500, 1,800, 2,000	

### Accessories (Order Separately) [Refer to *Dimensions* on *Rotary Encoder Accessories*.]

Name	Model	Remarks
Couplings	E69-C06B	---
	E69-C68B	Different end diameter
	E69-C610B	Different end diameter
	E69-C06M	Metal construction
Flanges	E69-FCA	---
	E69-FCA02	E69-2 Servo Mounting Bracket provided.
Servo Mounting Bracket	E69-2	Provided with E69-FCA02 Flange.

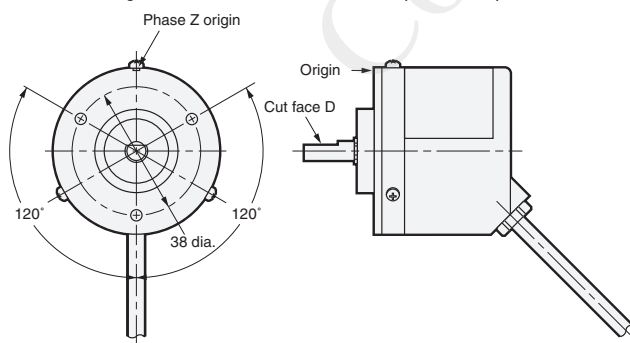
Refer to *Accessories* for details.

## Ratings and Specifications

Item	Model	E6C2-CWZ6C	E6C2-CWZ5B	E6C2-CWZ3E	E6C2-CWZ1X
Power supply voltage		5 VDC -5% to 24 VDC +15%, ripple (p-p): 5% max.	12 VDC -10% to 24 VDC +15%, ripple (p-p): 5% max.	5 VDC -5% to 12 VDC +10%, ripple (p-p): 5% max.	5 VDC ±5%, ripple (p-p): 5% max.
Current consumption*1		0.6 W max. (80 mA max.)	0.8 W max. (100 mA max.)	0.6 W max. (100 mA max.)	160 mA max.
Resolution (pulses/rotation)		10, 20, 30, 40, 50, 60, 100, 200, 300, 360, 400, 500, 600, 720, 800, 1,000, 1,024, 1,200, 1,500, 1,800, 2,000	100, 200, 360, 500, 600, 1,000, 2,000	10, 20, 30, 40, 50, 60, 100, 200, 300, 360, 400, 500, 600, 720, 800, 1,000, 1,024, 1,200, 1,500, 1,800, 2,000	
Output phases		Phases A, B, and Z			Phases A, $\bar{A}$ , B, $\bar{B}$ , Z, and $\bar{Z}$
Output configuration		NPN open-collector output	PNP open-collector output	Voltage output (NPN output)	Line driver output*2
Output capacity		Applied voltage: 30 VDC max. Sink current: 35 mA max. Residual voltage: 0.4 V max. (at sink current of 35 mA)	Applied voltage: 30 VDC max. Source current: 35 mA max. Residual voltage: 0.4 V max. (at source current of 35 mA)	Output resistance: 2 k $\Omega$ Output current: 20 mA max. Residual voltage: 0.4 V max. (at sink current of 20 mA)	AM26LS31 equivalent Output voltage: High level: $I_o = -20$ mA Low level: $I_s = 20$ mA Output voltage: $V_o = 2.5$ V min. $V_s = 0.5$ V max.
Maximum response frequency*3		100 kHz	50 kHz	100 kHz	
Phase difference between outputs		90°±45° between A and B (1/4 T ± 1/8 T)			
Rise and fall times of output		1 $\mu$ s max. (Control output voltage: 5 V, Load resistance: 1 k $\Omega$ , Cable length: 2 m)	1 $\mu$ s max. (Cable length: 2 m, Load current: 10 mA)		0.1 $\mu$ s max. (Cable length: 2 m, $I_o = -20$ mA, $I_s = 20$ mA)
Starting torque		10 mN·m max.			
Moment of inertia		1×10 <sup>-6</sup> kg·m <sup>2</sup> max.; 3 × 10 <sup>-7</sup> kg·m <sup>2</sup> max. at 600 P/R max.			
Shaft loading	Radial	50 N			
	Thrust	30 N			
Maximum permissible speed		6,000 r/min			
Protection circuits		Power supply reverse polarity protection, Load short-circuit protection			---
Ambient temperature range		Operating: -10 to 70°C (with no icing), Storage: -25 to 85°C (with no icing)			
Ambient humidity range		Operating/Storage: 35% to 85% (with no condensation)			
Insulation resistance		100 M $\Omega$ min. (at 500 VDC) between current-carrying parts and case			
Dielectric strength		500 VAC, 50/60 Hz for 1 min between current-carrying parts and case			
Vibration resistance		Destruction: 10 to 500 Hz, 150 m/s <sup>2</sup> or 2-mm double amplitude for 11 min 3 times each in X, Y, and Z directions			
Shock resistance		Destruction: 1,000 m/s <sup>2</sup> 3 times each in X, Y, and Z directions			
Degree of protection		IEC 60529 IP64, in-house standards: oilproof			
Connection method		Pre-wired Models (Standard cable length: 2 m)			
Material		Case: Zinc alloy, Main unit: Aluminum, Shaft: SUS420J2			
Weight (packed state)		Approx. 400 g			
Accessories		Instruction manual Note: Coupling, mounting bracket and hex-head spanner are sold separately.			

Note: Origin Indication

The following illustration shows the relationship between phase Z and the origin. Set cut face D to the phase Z origin as shown in the illustration.



\*1. An inrush current of approximately 9 A will flow for approximately 0.3 ms when the power is turned ON.

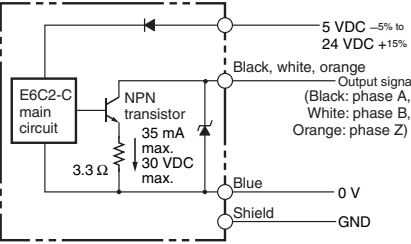
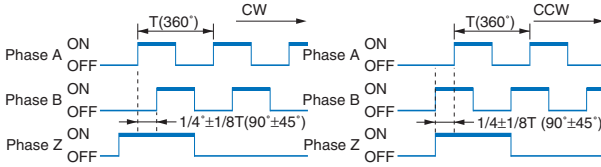
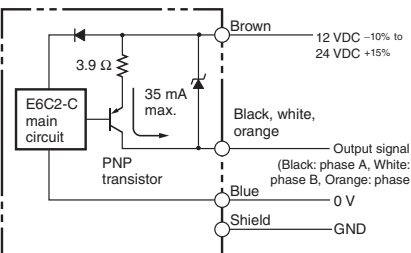
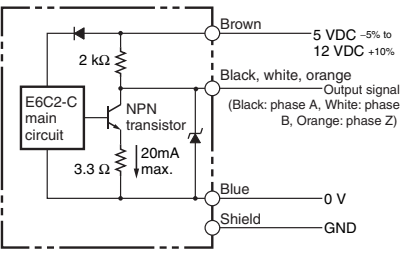
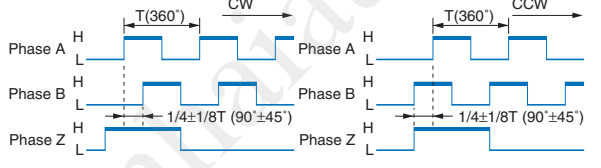
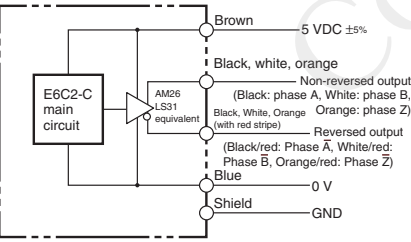
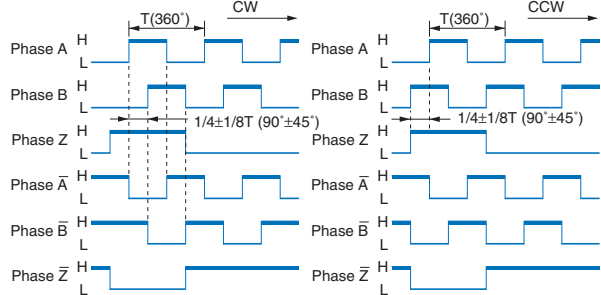
\*2. The line driver output is a data transmission circuit compatible with RS-422A and long-distance transmission is possible with a twisted-pair cable. (AM26LS31 equivalent)

\*3. The maximum electrical response speed is determined by the resolution and maximum response frequency as follows:

$$\text{Maximum electrical response speed (rpm)} = \frac{\text{Maximum response frequency}}{\text{Resolution}} \times 60$$

This means that the E6C2-C Rotary Encoder will not operate electrically if its speed exceeds the maximum electrical response speed.

# I/O Circuit Diagrams

Model/Output Circuits	Output mode	Connection																		
<div>E6C2-CWZ6C</div> <div></div>	<div>E6C2-CWZ6C NPN Open-collector Output Model</div> <div>E6C2-CWZ5B PNP Open-collector Output Model</div> <div>Direction of rotation: CW (as viewed from end of shaft)</div> <div>Direction of rotation: CCW (as viewed from end of shaft)</div> <div></div> <div>Note: Phase A is <math>1/4 T \pm 1/8 T</math> faster than phase B.</div> <div>Note: Phase A is <math>1/4 T \pm 1/8 T</math> slower than phase B.</div> <div>(The ONs in the above timing chart mean that the output transistor is ON and the OFFs mean that the output transistor is OFF.)</div>	<table><tr><th>Color</th><th>Terminal</th></tr><tr><td>Brown</td><td>Power supply (+Vcc)</td></tr><tr><td>Black</td><td>Output phase A</td></tr><tr><td>White</td><td>Output phase B</td></tr><tr><td>Orange</td><td>Output phase Z</td></tr><tr><td>Blue</td><td>0 V (common)</td></tr></table>	Color	Terminal	Brown	Power supply (+Vcc)	Black	Output phase A	White	Output phase B	Orange	Output phase Z	Blue	0 V (common)						
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<div>E6C2-CWZ3E</div> <div></div>	<div>E6C2-CWZ3E Voltage Output Model</div> <div>Direction of rotation: CW (as viewed from end of shaft)</div> <div>Direction of rotation: CCW (as viewed from end of shaft)</div> <div></div> <div>Note: Phase A is <math>1/4 T \pm 1/8 T</math> faster than phase B.</div> <div>Note: Phase A is <math>1/4 T \pm 1/8 T</math> slower than phase B.</div> <div>(“H” and “L” in the diagrams are the output voltage levels of phases A, B, and Z.)</div>																			
<div>E6C2-CWZ1X</div> <div></div>	<div>E6C2-CWZ1X Line Driver Output Model</div> <div>Direction of rotation: CW (as viewed from end of shaft)</div> <div>Direction of rotation: CCW (as viewed from end of shaft)</div> <div></div> <div>Note: Phase A is <math>1/4 T \pm 1/8 T</math> faster than phase B.</div> <div>Note: Phase A is <math>1/4 T \pm 1/8 T</math> slower than phase B.</div> <div>(“H” and “L” in the diagrams are the output voltage levels of phases A, B, and Z.)</div>	<table><tr><th>Color</th><th>Terminal</th></tr><tr><td>Brown</td><td>Power supply (+Vcc)</td></tr><tr><td>Black</td><td>Output phase A</td></tr><tr><td>White</td><td>Output phase B</td></tr><tr><td>Orange</td><td>Output phase Z</td></tr><tr><td>Black/red stripes</td><td>Output phase A̅</td></tr><tr><td>White/red stripes</td><td>Output phase B̅</td></tr><tr><td>Orange/red stripes</td><td>Output phase Z̅</td></tr><tr><td>Blue</td><td>0 V (common)</td></tr></table> <div>Note: Receiver: AM26LS32 equivalent</div>	Color	Terminal	Brown	Power supply (+Vcc)	Black	Output phase A	White	Output phase B	Orange	Output phase Z	Black/red stripes	Output phase A̅	White/red stripes	Output phase B̅	Orange/red stripes	Output phase Z̅	Blue	0 V (common)
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Note: 1. The shielded cable outer core (shield) is not connected to the inner area or to the case.  
2. The phase A, phase B, and phase Z circuits are all identical.  
3. Normally, connect GND to 0 V or to an external ground.

## Safety Precautions

Refer to *Warranty and Limitations of Liability*.

### WARNING

This product is not designed or rated for ensuring safety of persons either directly or indirectly. Do not use it for such purposes.



### Precautions for Safe Use

- (1) Do not use the product in excess of the rated voltage. Applying voltages beyond the rated voltage range may cause the product to break or burn; During operating, if applying voltages below the rated voltage range may cause the output to shut down. At that time, please restart the power.
- (2) Avoid wiring the product's cables parallel to power lines or high-voltage lines. Doing so may cause the product to malfunction due to induction or may cause the damage the product.
- (3) If surge occurs in the power supply, connect a surge absorber between the power supply terminals to absorb the surge. Minimize the wiring length to prevent the product from being affected by noise, etc.
- (4) Since improper pulses may occur when the power is turned on or off, use the devices connected to this product at least 1.0 seconds before or after the power is turned on or off.
- (5) Be careful when wiring, such as being careful with the polarities of the power supply. Incorrect wiring may break or burn the product.
- (6) Do not short-circuit the load. Doing so may break or burn the product. In case of load short-circuit (except E6C2-CWZ1X), the product will shut down the output. At that time, please solve the short-circuit and restart the power.
- (7) Do not use the encoder under the environment with explosive or ignition gas.
- (8) Never disassemble, repair nor tamper with the product.

### Precautions for Correct Use

- (1) Since the product consists of high-precision components, handle it with utmost care.
- (2) Be careful not to expose the product to water or oil.
- (3) Be sure to turn off the power supply before wiring. If the output line contacts the power supply line while the power is being supplied, the output circuit may be damaged.
- (4) If the product is mounted and wired with a cord, do not pull the cord with force greater than 29.4 N.
- (5) If securing the product with screws, tighten the screws to a torque of less than 0.49 N·m.
- (6) Be careful not to apply excessive load to the shaft. Excessive load may cause the product break. Especially when linking with a chain, timing belt, or gears, connect a separate bearing before the coupling to the product.
- (7) If an installation error such as misalignment is too large, (in case using the coupling or without coupling) the shaft will be subjected to an excessive load which will damage it or shorten its service life. Be careful when installing.
- (8) When inserting the shaft in the coupling, do not use excessive force (by striking it with hammer, for example).
- (9) When installing or removing the coupling, do not apply an excessive being, compressing, or tensile force.

### ● Wiring

#### Cable Extension Characteristics

- When the cable length is extended, the output waveform startup time is lengthened and it affects the phase difference characteristics of phases A and B. Conditions will change according to frequency, noise, and other factors. As a guideline, use a cable length of 10 m\* or less. If the cable must be more than 2 m, use a Model with a Line-driver Output (max. length for line-driver output: 100 m).

\* Recommended Cable

Conductor cross section: 0.2 mm<sup>2</sup>

Spiral shield

Conductor resistance: 92 Ω/km max. (20°C)

Insulation resistance: 5 Ω/km min. (20°C)

- The output waveform startup time changes not only according to the length of the cable, but also according to the load resistance and the cable type.
- Extending the cable length not only changes the startup time, but also increases the output residual voltage.

### ● Connection

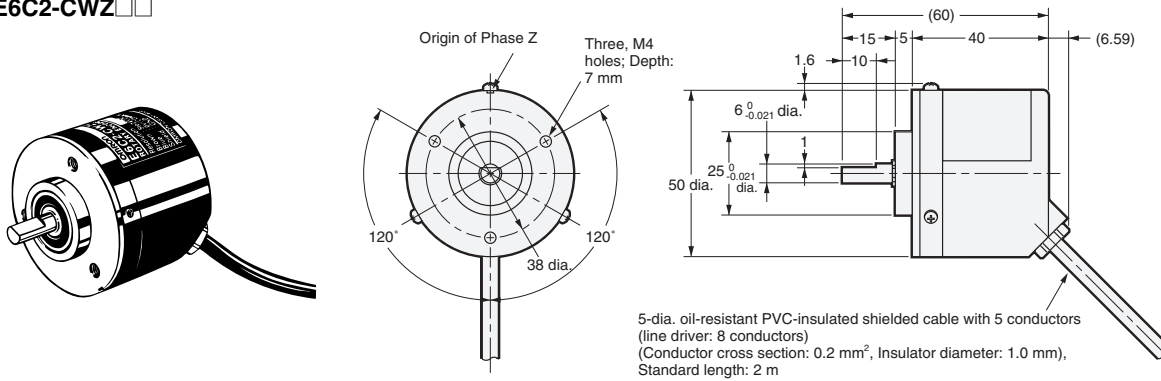
Spurious pulses may be generated when power is turned ON and OFF. Wait at least 0.1 s after turning ON the power to the Encoder before using the connected device, and stop using the connected device at least 0.1 s before turning OFF the power to the Encoder. Also, turn ON the power to the load only after turning ON the power to the Encoder.

## Dimensions

Tolerance class IT16 applies to dimensions in this datasheet unless otherwise specified.

### Encoder

E6C2-CWZ□□



### Accessories (Order Separately)

#### Couplings

E69-C06B  
E69-C68B  
E69-C610B  
E69-C06M

#### Flanges

E69-FCA  
E69-FCA02

#### Servo Mounting Bracket

E69-2 (Three brackets in a set.)

Refer to *Accessories* for details.