


**General-purpose Encoder with  
External Diameter of 40 mm**

- Incremental model
- External diameter of 40 mm.
- Resolution of up to 2,000 ppr.



 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          | NPN open-collector output | 10, 20, 30, 40, 50, 60, 100, 200, 300, 360, 400, 500, 600 | <b>E6B2-CWZ6C (resolution) 0.5M</b><br>Example: E6B2-CWZ6C 10P/R 0.5M  |
|                      |                           | 720, 800, 1,000, 1,024                                    |  |
|                      |                           | 1,200, 1,500, 1,800, 2,000                                |  |
| 12 to 24 VDC         | PNP open-collector output | 100, 200, 360, 500, 600                                   | <b>E6B2-CWZ5B (resolution) 0.5M</b><br>Example: E6B2-CWZ5B 100P/R 0.5M |
|                      |                           | 1,000   |  |
|                      |                           | 2,000   |  |
| 5 to 12 VDC          | Voltage output            | 10, 20, 30, 40, 50, 60, 100, 200, 300, 360, 400, 500, 600 | <b>E6B2-CWZ3E (resolution) 0.5M</b><br>Example: E6B2-CWZ3E 10P/R 0.5M  |
|                      |                           | 1,000   |  |
|                      |                           | 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>E6B2-CWZ1X (resolution) 0.5M</b><br>Example: E6B2-CWZ1X 10P/R 0.5M  |
|                      |                           | 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              | <b>E69-C06B</b>  | Provided with the product.             |
|                        | <b>E69-C68B</b>  | Different end diameter                 |
|                        | <b>E69-C610B</b> | Different end diameter                 |
|                        | <b>E69-C06M</b>  | Metal construction                     |
| Flanges                | <b>E69-FBA</b>   | ---                                    |
|                        | <b>E69-FBA02</b> | E69-2 Servo Mounting Bracket provided. |
| Servo Mounting Bracket | <b>E69-2</b>     | ---                                    |

Note: 1. Refer to *Rotary Encoders Accessories* on your OMRON website for details.

2. Refer to *Precautions For Correct Use of Rotary Encoders* on your OMRON website when using the Rotary Encoders together with a Coupling.

## Ratings and Specifications

| Item                             | Model  | E6B2-CWZ6C   | E6B2-CWZ5B  | E6B2-CWZ3E   | E6B2-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, 1,000, 1,200, 1,500, 1,800, 2,000                   | 10, 20, 30, 40, 50, 60, 100, 200, 300, 360, 400, 500, 600, 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 $\bar{Z}$  |
| Phase difference between outputs |        | 90°±45° between A and B (1/4 T ± 1/8 T)  |   |  |  |
| 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.<br>Sink current: 35 mA max.<br>Residual voltage: 0.4 V max. (at sink current of 35 mA)        | Applied voltage: 30 VDC max.<br>Source current: 35 mA max.<br>Residual voltage: 0.4 V max. (at source current of 35 mA) | Output resistance: 2 kΩ<br>Sink current: 20 mA max.<br>Residual voltage: 0.4 V max. (at sink current of 20 mA) | AM26LS31 equivalent<br>Output current<br>High level: $I_o = -20$ mA<br>Low level: $I_s = 20$ mA<br>Output voltage:<br>$V_o = 2.5$ V min.<br>$V_s = 0.5$ V max. |
| Maximum response frequency *3    |        | 100 kHz  | 50 kHz  | 100 kHz  |  |
| Rise and fall times of output    |        | 1 μs max. (Control output voltage: 5 V, Load resistance: 1 kΩ, Cable length: 2 m max.)                                     | 1 μs max. (Cable length: 2 m max., Sink current: 10 mA)   |  | 0.1 μs max. (Cable length: 2 m max., $I_o = -20$ mA, $I_s = 20$ mA)  |
| Starting torque                  |        | 0.98 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 | 30 N   |   |  |  |
|                                  | Thrust | 20 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            |        | 20 MΩ 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: 1,000m/s <sup>2</sup> 3 times each in X, Y, and Z directions  |   |  |  |
| Degree of protection             |        | IEC 60529 IP50   |   |  |  |
| Connection method                |        | Pre-wired Models (Standard cable length: 500 mm)   |   |  |  |
| Materials                        |        | Case: ABS, Main unit: Aluminum, Shaft: SUS420J2  |   |  |  |
| Weight (packed state)            |        | Approx. 100 g  |   |  |  |
| Accessories                      |        | Coupling, Hexagonal wrench, Instruction manual   |   |  |  |

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

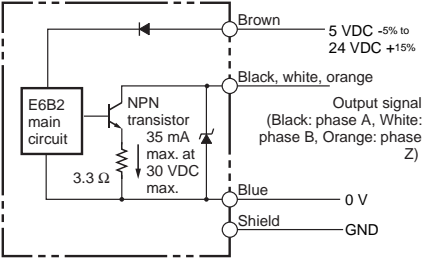
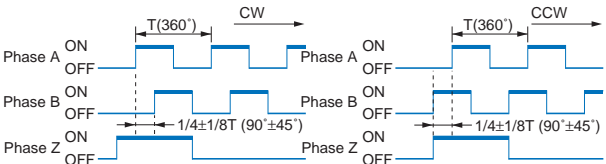
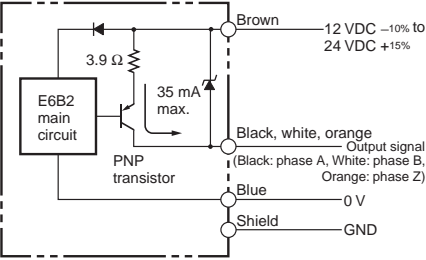
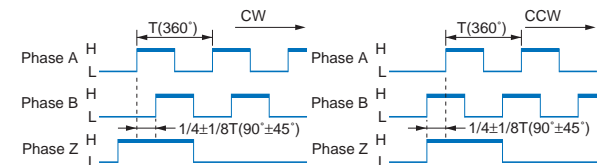
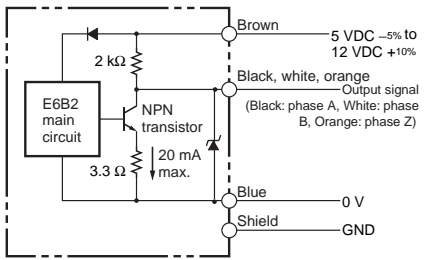
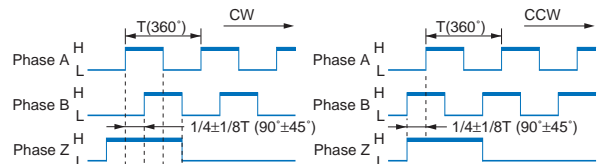
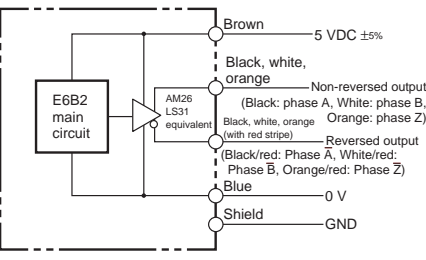
\*2. The line driver output is a data transmission circuit compatible with RS-422A and long-distance transmission is possible with a twisted-pair cable. The quality is equivalent to AM26LS31.

\*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 E6B2-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   |       |          |       |                     |       |                |                   |                |        |                |                   |                |        |                |                    |                |      |              |
|--|--|--|-------|----------|-------|---------------------|-------|----------------|-------------------|----------------|--------|----------------|-------------------|----------------|--------|----------------|--------------------|----------------|------|--------------|
| <p><b>E6B2-CWZ6C</b></p>  <p>5 VDC <math>-5\%</math> to <math>24\text{ VDC } +15\%</math></p> <p>Black, white, orange<br/>Output signal<br/>(Black: phase A, White: phase B, Orange: phase Z)</p> <p>Blue 0 V</p> <p>Shield GND</p>   | <p><b>E6B2-CWZ6C NPN Open-collector Output Model</b><br/><b>E6B2-CWZ5B PNP Open-collector Output Model</b></p> <p>Direction of rotation: CW (as viewed from end of shaft)      Direction of rotation: CCW (as viewed from end of shaft)</p>  <p>Note: Phase A is <math>1/4 T \pm 1/8 T</math> faster than phase B.      Note: Phase A is <math>1/4 T \pm 1/8 T</math> slower than phase B.</p> <p>(The ONs in the above timing chart mean that the output transistor is ON and the OFFs mean that the output transistor is OFF.)</p> |  |       |          |       |                     |       |                |                   |                |        |                |                   |                |        |                |                    |                |      |              |
| <p><b>E6B2-CWZ5B</b></p>  <p>12 VDC <math>-10\%</math> to <math>24\text{ VDC } +15\%</math></p> <p>Black, white, orange<br/>Output signal<br/>(Black: phase A, White: phase B, Orange: phase Z)</p> <p>Blue 0 V</p> <p>Shield GND</p>   | <p><b>E6B2-CWZ3E Voltage Output Model</b></p> <p>Direction of rotation: CW (as viewed from end of shaft)      Direction of rotation: CCW (as viewed from end of shaft)</p>  <p>Note: Phase A is <math>1/4 T \pm 1/8 T</math> faster than phase B.      Note: Phase A is <math>1/4 T \pm 1/8 T</math> slower than phase B.</p> <p>(“H” and “L” in the diagrams are the output voltage levels of phases A, B, and Z.)</p>  | <table border="1"> <thead> <tr> <th>Color</th> <th>Terminal</th> </tr> </thead> <tbody> <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> </tbody> </table>   | Color | Terminal | Brown | Power supply (+Vcc) | Black | Output phase A | White             | Output phase B | Orange | Output phase Z | Blue              | 0 V (common)   |        |                |                    |                |      |              |
| Color  | Terminal   |  |       |          |       |                     |       |                |                   |                |        |                |                   |                |        |                |                    |                |      |              |
| Brown  | Power supply (+Vcc)  |  |       |          |       |                     |       |                |                   |                |        |                |                   |                |        |                |                    |                |      |              |
| Black  | Output phase A   |  |       |          |       |                     |       |                |                   |                |        |                |                   |                |        |                |                    |                |      |              |
| White  | Output phase B   |  |       |          |       |                     |       |                |                   |                |        |                |                   |                |        |                |                    |                |      |              |
| Orange   | Output phase Z   |  |       |          |       |                     |       |                |                   |                |        |                |                   |                |        |                |                    |                |      |              |
| Blue   | 0 V (common)   |  |       |          |       |                     |       |                |                   |                |        |                |                   |                |        |                |                    |                |      |              |
| <p><b>E6B2-CWZ3E</b></p>  <p>5 VDC <math>-5\%</math> to <math>12\text{ VDC } +10\%</math></p> <p>Black, white, orange<br/>Output signal<br/>(Black: phase A, White: phase B, Orange: phase Z)</p> <p>Blue 0 V</p> <p>Shield GND</p>  | <p><b>E6B2-CWZ1X Line Driver Output Model</b></p> <p>Direction of rotation: CW (as viewed from end of shaft)      Direction of rotation: CCW (as viewed from end of shaft)</p>  <p>Note: Phase A is <math>1/4 T \pm 1/8 T</math> faster than phase B.      Note: Phase A is <math>1/4 T \pm 1/8 T</math> slower than phase B.</p> <p>(“H” and “L” in the diagrams are the output voltage levels of phases A, B, and Z.)</p>  | <table border="1"> <thead> <tr> <th>Color</th> <th>Terminal</th> </tr> </thead> <tbody> <tr> <td>Brown</td> <td>Power supply (+Vcc)</td> </tr> <tr> <td>Black</td> <td>Output phase A</td> </tr> <tr> <td>Black/red stripes</td> <td>Output phase A</td> </tr> <tr> <td>White</td> <td>Output phase B</td> </tr> <tr> <td>White/red stripes</td> <td>Output phase B</td> </tr> <tr> <td>Orange</td> <td>Output phase Z</td> </tr> <tr> <td>Orange/red stripes</td> <td>Output phase Z</td> </tr> <tr> <td>Blue</td> <td>0 V (common)</td> </tr> </tbody> </table> <p>Note: Receiver: AM26LS32 equivalent</p> | Color | Terminal | Brown | Power supply (+Vcc) | Black | Output phase A | Black/red stripes | Output phase A | White  | Output phase B | White/red stripes | Output phase B | Orange | Output phase Z | Orange/red stripes | Output phase Z | Blue | 0 V (common) |
| Color  | Terminal   |  |       |          |       |                     |       |                |                   |                |        |                |                   |                |        |                |                    |                |      |              |
| Brown  | Power supply (+Vcc)  |  |       |          |       |                     |       |                |                   |                |        |                |                   |                |        |                |                    |                |      |              |
| Black  | Output phase A   |  |       |          |       |                     |       |                |                   |                |        |                |                   |                |        |                |                    |                |      |              |
| Black/red stripes  | Output phase A   |  |       |          |       |                     |       |                |                   |                |        |                |                   |                |        |                |                    |                |      |              |
| White  | Output phase B   |  |       |          |       |                     |       |                |                   |                |        |                |                   |                |        |                |                    |                |      |              |
| White/red stripes  | Output phase B   |  |       |          |       |                     |       |                |                   |                |        |                |                   |                |        |                |                    |                |      |              |
| Orange   | Output phase Z   |  |       |          |       |                     |       |                |                   |                |        |                |                   |                |        |                |                    |                |      |              |
| Orange/red stripes   | Output phase Z   |  |       |          |       |                     |       |                |                   |                |        |                |                   |                |        |                |                    |                |      |              |
| Blue   | 0 V (common)   |  |       |          |       |                     |       |                |                   |                |        |                |                   |                |        |                |                    |                |      |              |
| <p><b>E6B2-CWZ1X</b></p>  <p>5 VDC <math>\pm 5\%</math></p> <p>Black, white, orange<br/>Non-reversed output<br/>(Black: phase A, White: phase B, Orange: phase Z)</p> <p>Black/red (with red stripe), white/red (with red stripe), orange/red<br/>Reversed output<br/>(Black/red: Phase A, White/red: Phase B, Orange/red: Phase Z)</p> <p>Blue 0 V</p> <p>Shield GND</p> | <p>Note: 1. The shielded cable outer core (shield) is not connected to the inner area or to the case.<br/>2. The phase A, phase B, and phase Z circuits are all identical.<br/>3. Normally, connect GND to 0 V or to an external ground.</p>   |  |       |          |       |                     |       |                |                   |                |        |                |                   |                |        |                |                    |                |      |              |

## Safety Precautions

Be sure to read the precautions for all models in the website at: <http://www.ia.omron.com/>.

### 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.
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 0.1 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 E6B2-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.

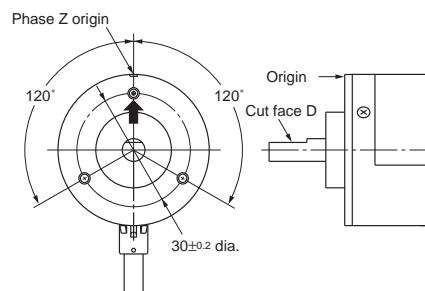
### Precautions for Correct Use

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. 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.
6. 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.
7. When inserting the shaft in the coupling, do not use excessive force (by striking it with hammer, for example).
8. When installing or removing the coupling, do not apply an excessive being, compressing, or tensile force.

### ● Mounting

#### ● Origin Indication

It is easy to adjust the position of phase Z with the origin indication function. 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.



- Do not extend the length of the cable to more than 2 m. If the cable must be more than 2 m, use a Model with a Line-driver Output (max. length: 100 m).

### ● Wiring

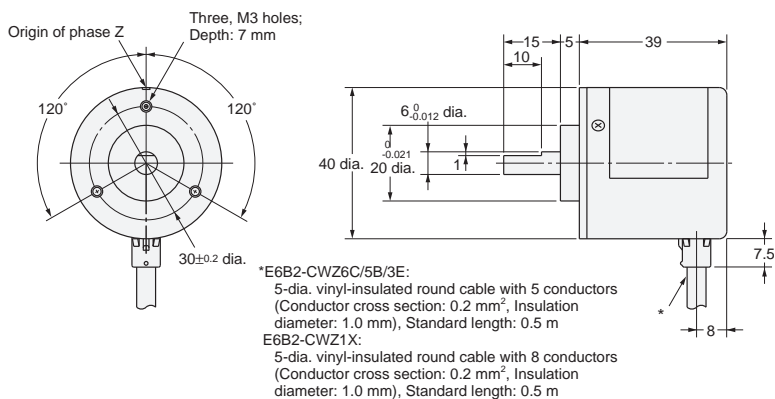
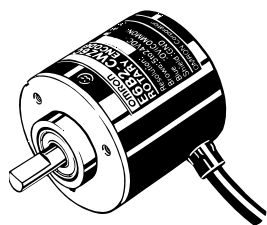
Spurious pulses may be generated when power is turned ON and OFF. Wait at least 0.1 s after turning ON the power to the Encoder before using the connected device, and stop using the connected device at least 0.1 s before turning OFF the power to the Encoder. Also, turn ON the power to the load only after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

## Dimensions

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

### Encoder

#### E6B2-C



### Accessories (Order Separately)

#### Couplings

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

#### Flanges

E69-FBA  
E69-FBA02

#### Servo Mounting Bracket

E69-2

Refer to *Rotary Encoders Accessories* on your OMRON website for details.

## Terms and Conditions Agreement

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Product specifications and accessories may be changed at any time based on improvements and other reasons. It is our practice to change part numbers when published ratings or features are changed, or when significant construction changes are made. However, some specifications of the Product may be changed without any notice. When in doubt, special part numbers may be assigned to fix or establish key specifications for your application. Please consult with your Omron's representative at any time to confirm actual specifications of purchased Product.

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