

Tough and Easy

- Sealed bearings with IP64 oilproof construction.
- Improved shaft loading performance.
Radial: 50 N, Thrust: 30 N
- Pre-wired Models with cable connected at an angle.
Side or back cable connections also possible.
- Improved reliability with reverse connection and load short-circuit protection (except for line-driver outputs).



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

Ordering Information

Encoders [Refer to *Dimensions* on page 4.]

| 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 | E6C2-CWZ6C (resolution) 2M 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 | E6C2-CWZ5B (resolution) 2M 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 | E6C2-CWZ3E (resolution) 2M 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 | E6C2-CWZ1X (resolution) 2M 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. |

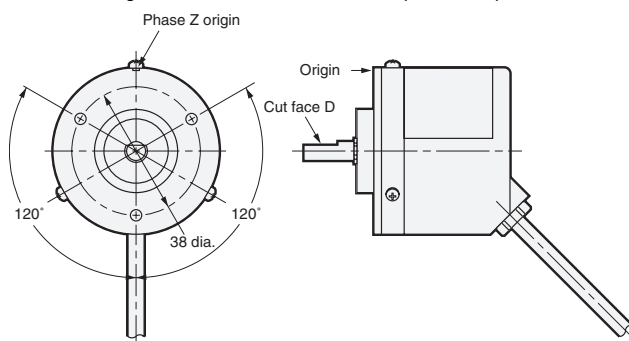
Refer to *Accessories* for details.

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 | | 80 mA 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 Ω 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 μ s max. (Control output voltage: 5 V, Load resistance: 1 k Ω , Cable length: 2 m) | 1 μ s max. (Cable length: 2 m, Sink current: 10 mA) | | 0.1 μ 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 ⁻⁶ kg·m ² max.; 3 × 10 ⁻⁷ kg·m ² 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 | | 20 M Ω 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 ² or 2-mm double amplitude for 11 min 3 times each in X, Y, and Z directions | | | |
| Shock resistance | | Destruction: 1,000 m/s ² 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: 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 | | | | | | | | | | | | | | | | | | |
|---|--|---|-------|----------|-------|---------------------|-------|----------------|-------|----------------|--------|----------------|-------------------|------------------------|-------------------|------------------------|--------------------|------------------------|------|--------------|
| <p>E6C2-CWZ6C</p> <p>E6C2-CWZ5B</p> | <p>E6C2-CWZ6C NPN Open-collector Output Model E6C2-CWZ5B PNP Open-collector Output Model</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 $1/4 T \pm 1/8 T$ faster than phase B. Note: Phase A is $1/4 T \pm 1/8 T$ 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> | <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>E6C2-CWZ3E</p> | <p>E6C2-CWZ3E Voltage Output Model</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 $1/4 T \pm 1/8 T$ faster than phase B. Note: Phase A is $1/4 T \pm 1/8 T$ slower than phase B.</p> | | | | | | | | | | | | | | | | | | | |
| <p>E6C2-CWZ1X</p> | <p>E6C2-CWZ1X Line Driver Output Model</p> <p>Direction of rotation: CW (as viewed from end of shaft) Direction of rotation: CCW (as viewed from end of shaft)</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>Black/red stripes</td> <td>Output phase \bar{A}</td> </tr> <tr> <td>White/red stripes</td> <td>Output phase \bar{B}</td> </tr> <tr> <td>Orange/red stripes</td> <td>Output phase \bar{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 | White | Output phase B | Orange | Output phase Z | Black/red stripes | Output phase \bar{A} | White/red stripes | Output phase \bar{B} | Orange/red stripes | Output phase \bar{Z} | Blue | 0 V (common) |
| Color | Terminal | | | | | | | | | | | | | | | | | | | |
| Brown | Power supply (+Vcc) | | | | | | | | | | | | | | | | | | | |
| Black | Output phase A | | | | | | | | | | | | | | | | | | | |
| White | Output phase B | | | | | | | | | | | | | | | | | | | |
| Orange | Output phase Z | | | | | | | | | | | | | | | | | | | |
| Black/red stripes | Output phase \bar{A} | | | | | | | | | | | | | | | | | | | |
| White/red stripes | Output phase \bar{B} | | | | | | | | | | | | | | | | | | | |
| Orange/red stripes | Output phase \bar{Z} | | | | | | | | | | | | | | | | | | | |
| Blue | 0 V (common) | | | | | | | | | | | | | | | | | | | |

- 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 Correct Use

Do not use the Encoder under ambient conditions that exceed the ratings.

● **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 mm²
 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.

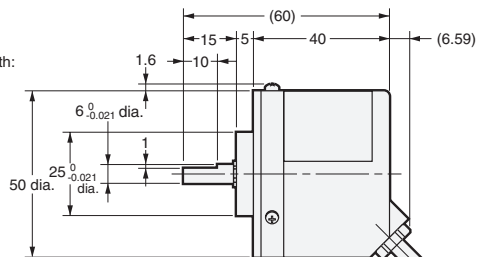
(Unit: mm)

Dimensions

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

Encoder

E6C2-CWZ□□



5-dia. oil-resistant PVC-insulated shielded cable with 5 conductors (line driver: 8 conductors)
 (Conductor cross section: 0.2 mm², Insulator diameter: 1.0 mm),
 Standard length: 2 m

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.

Read and Understand This Catalog

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In the interest of product improvement, specifications are subject to change without notice.

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JONHON

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