Rugged Incremental 50-mm-dia. Rotary Encoder

# E6C3-C

CSM_E6C3-C_DS_E_7_1

## Rugged Rotary Encoder

- Incremental model
- External diameter of 50 mm.
- Resolution of up to 3,600 ppr.
- IP65 (improved oil-proof construction with sealed bearings)
- Superior shaft loading performance (radial: 80 N, thrust: 50 N)

CE

⚠ 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) | Connection method | Model |
|---|---|---|---|---|
| 12 to 24 VDC | Complementary output | 100, 200, 300, 360, 500, 600, 720, 800, 1,000, 1,024, 1,200, 1,500, 1,800, 2,000, 2,048, 2,500, 3,600 | Pre-wired (1 m) (See note.) | **E6C3-CWZ5GH (resolution) 1M** Example: E6C3-CWZ5GH 100P/R 1M |
| 5 to 12 VDC | Voltage output | 100, 200, 300, 360, 500, 600, 720, 800, 1,000, 1,024, 1,200, 1,500, 1,800, 2,000, 2,048, 2,500, 3,600 | | **E6C3-CWZ3EH (resolution) 1M** Example: E6C3-CWZ3EH 100P/R 1M |
| 5 to 12 VDC | Line-driver output | 100, 200, 300, 360, 500, 600, 720, 800, 1,000, 1,024, 1,200, 1,500, 1,800, 2,000, 2,048, 2,500, 3,600 | | **E6C3-CWZ3XH (resolution) 1M** Example: E6C3-CWZ3XH 100P/R 1M |

Note: Models with 2-m cable are also available. When ordering, specify the cable length at the end of the model number (example: E6C3-CWZ5GH 300P/R 2M).

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

| Name | Model | Remarks |
|---|---|---|
| Couplings | **E69-C08B** | --- |
| | **E69-C68B** | Different end diameter (6 to 8 mm) |
| Flanges | **E69-FCA03** | --- |
| | **E69-FCA04** | E69-2 Servo Mounting Bracket provided. |
| Servo Mounting Bracket | **E69-2** | Provided with E69-FCA04 Flange. |

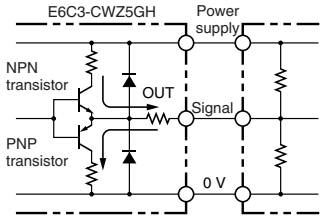
Refer to *Accessories* for details.

## Ratings and Specifications

| Item / Model | | E6C3-CWZ5GH | E6C3-CWZ3EH | E6C3-CWZ3XH |
|---|---|---|---|---|
| Power supply voltage | | 12 VDC −10% to 24 VDC +15%, ripple (p-p): 5% max. | 5 VDC −5% to 12 VDC +10%, ripple (p-p): 5% max. | |
| Current consumption*1 | | 100 mA max. | | |
| Resolution (pulses/rotation) | | 100, 200, 300, 360, 500, 600, 720, 800, 1,000, 1,024, 1,200, 1,500, 1,800, 2,000, 2,048, 2,500, 3,600 | | |
| Output phases | | Phases A, B, and Z*5 | | Phases A, $\overline{A}$, B, $\overline{B}$, Z, and $\overline{Z}$ |
| Output configuration | | Complementary outputs*2 | Voltage output (NPN output) | Line driver output*3 |
| Output capacity | | Output voltage: VH = Vcc = 3 V min. (IO = 30 mA)<br>VL = 2 V max. (IO = −30 mA)<br>Output current: ±30 mA | Output resistance: 2 kΩ<br>Output current: 35 mA max.<br>Residual voltage: 0.7 V max. | AM26LS31 equivalent<br>Output current: High level: IO = −10 mA<br>Low level: IS = 10 mA<br>Output voltage: VO = 2.5 V min.<br>VS = 0.5 V max. |
| Maximum response frequency*4 | | 125 kHz (65 kHz when using phase Z reset) | | |
| Phase difference between outputs | | 90°±45° between A and B (1/4 T ± 1/8 T) | | |
| Rise and fall times of output | | 1 μs max. (Cable length: 2 m, Output current: 30 mA) | 1 μs max. (Cable length: 2 m, Output current: 35 mA) | 1 μs max. (Cable length: 2 m, IO: −10 mA, IS: 10 mA) |
| Starting torque | | 10 mN·m max. at room temperature, 30 mN·m max. at low temperature | | |
| Moment of inertia | | $2.0 \times 10^{-6}$ kg·m² max.; $1.9 \times 10^{-6}$ kg·m² max. at 500 P/R max. | | |
| Shaft loading | Radial | 80 N | | |
| | Thrust | 50 N | | |
| Maximum permissible speed | | 5,000 r/min | | |
| Protection circuits | | Power supply reverse polarity protection, Output 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/s² or 2-mm double amplitude for 11 min 3 times each in X, Y, and Z directions | | |
| Shock resistance | | Destruction: 1,000 m/s² 3 times each in X, Y, and Z directions | | |
| Degree of protection | | IEC 60529 IP65, in-house standards: oilproof | | |
| Connection method | | Pre-wired Models (Standard cable length: 1 m) | | |
| Material | | Case: Aluminum, Main unit: Aluminum, Shaft: SUS303 | | |
| Weight (packed state) | | Approx. 300 g | | |
| Accessories | | Instruction manual Note: Coupling, mounting bracket and hex-head spanner are sold separately. | | |

*1. An inrush current of approximately 9 A will flow for approximately 0.1 ms when the power is turned ON.

*2. Complementary Output
The complementary output has two output transistors (NPN and PNP) as shown below. 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).



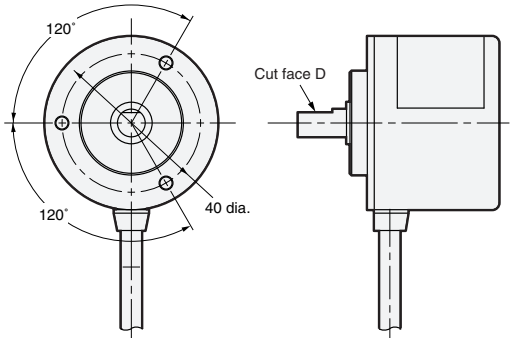

*3. The line driver output is a data transmission circuit compatible with RS-422A and long-distance transmission is possible with a twisted-pair cable. (AM26LS31 equivalent)

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

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

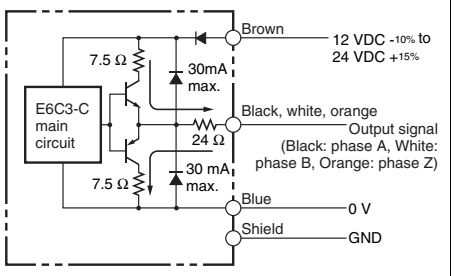
This means that the Rotary Encoder will not operate electrically if its speed exceeds the maximum electrical response speed.

*5. The phase Z signal is output when cut face D on the shaft and the cable connection direction are as shown in the following diagram (output position range: ±15°).

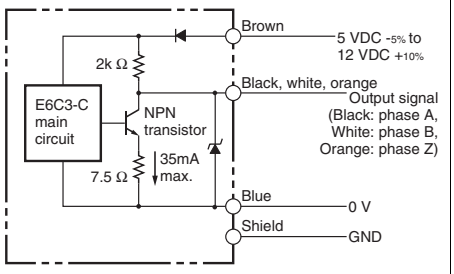


## I/O Circuit Diagrams

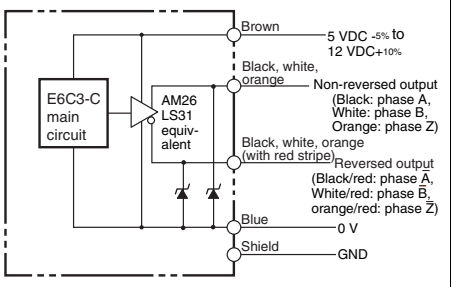
### E6C3-CWZ5GH




### E6C3-CWZ3EH

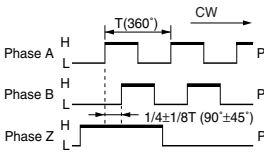



### E6C3-CWZ3XH



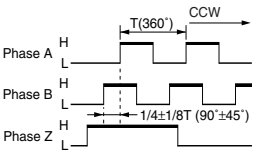

### E6C3-CWZ3EH Voltage Output Model
### E6C3-CWZ5GH Complementary Output Model

Direction of rotation: CW (as viewed from end of shaft)




Note: Phase A is 1/4 T ± 1/8 T faster than phase B.

Direction of rotation: CCW (as viewed from end of shaft)



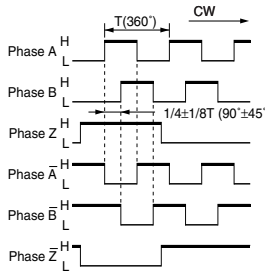

Note: Phase A is 1/4 T ± 1/8 T slower than phase B.

("H" and "L" in the diagrams are the output voltage levels of phases A, B, and Z.)

| Color | Terminal |
|---|---|
| Brown | Power supply (+Vcc) |
| Black | Output phase A |
| White | Output phase B |
| Orange | Output phase Z |
| Blue | 0 V (common) |

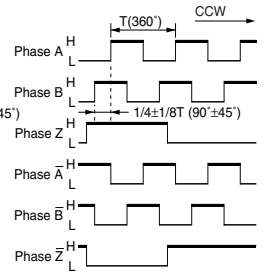
### E6C3-CWZ3XH Line Driver Output Model

Direction of rotation: CW (as viewed from end of shaft)




Note: Phase A is 1/4 T ± 1/8 T faster than phase B.

Direction of rotation: CCW (as viewed from end of shaft)




Note: Phase A is 1/4 T ± 1/8 T slower than phase B.

("H" and "L" in the diagrams are the output voltage levels of phases A, B, and Z.)

| Color | Terminal |
|---|---|
| Brown | Power supply (+Vcc) |
| Black | Output phase A |
| White | Output phase B |
| Orange | Output phase Z |
| Black/red stripes | Output phase $\overline{A}$ |
| White/red stripes | Output phase $\overline{B}$ |
| Orange/red stripes | Output phase $\overline{Z}$ |
| Blue | 0 V (common) |

Note: Receiver: AM26LS32 equivalent

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

#### Connections

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 10 m, use a Model with a Line-driver Output or Complementary Output.
  (max. length for line-driver output: 100 m,
  max. length for complementary output: 30 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.

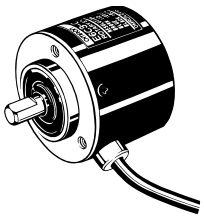
(Unit: mm)

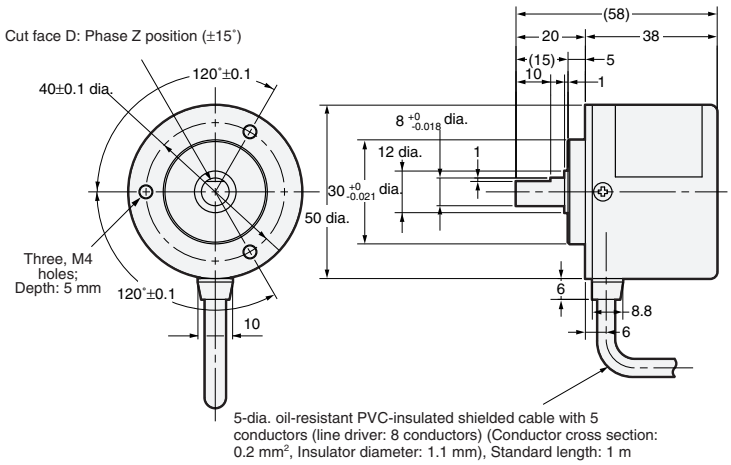
# Dimensions

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

## Encoder

**E6C3-CWZ□□H**






The E69-C08B Coupling is sold separately.

## Accessories (Order Separately)

### Couplings

**E69-C08B**
**E69-C68B**

### Flanges

**E69-FCA03**
**E69-FCA04**

### Servo Mounting Bracket

**E69-2**

Refer to *Accessories* for details.

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