Incremental 40-mm-dia. Rotary Encoder

# E6B2-C

CSM_E6B2-C_DS_E_4_1

## 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.

## Ordering Information

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

| 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 | **E6B2-CWZ6C (resolution) 0.5M** 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 | **E6B2-CWZ5B (resolution) 0.5M** 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 | **E6B2-CWZ3E (resolution) 0.5M** 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 | **E6B2-CWZ1X (resolution) 0.5M** 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 | **E69-C06B** | Provided with the product. |
| | **E69-C68B** | Different end diameter |
| | **E69-C610B** | Different end diameter |
| | **E69-C06M** | Metal construction |
| Flanges | **E69-FBA** | --- |
| | **E69-FBA02** | E69-2 Servo Mounting Bracket provided. |
| Servo Mounting Bracket | **E69-2** | --- |

Refer to *Accessories* for details.

## 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** | | 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, 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, $\overline{A}$, B, $\overline{B}$, Z, and $\overline{Z}$ |
| **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$^{-6}$ kg·m$^2$ max.; 3 × 10$^{-7}$ kg·m$^2$ 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$^2$ or 2-mm double amplitude for 11 min 3 times each in X, Y, and Z directions | | | |
| **Shock resistance** | | Destruction: 1,000m/s$^2$ 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 | | | |

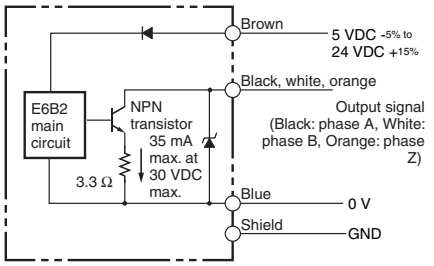
*1. An inrush current of approximately 9 A will flow for approximately 0.3 ms when the power is turned ON.
*2. The line driver output is a data transmission circuit compatible with RS-422A and long-distance transmission is possible with a twisted-pair cable. The quality is equivalent to AM26LS31.
*3. The maximum electrical response speed is determined by the resolution and maximum response frequency as follows:

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

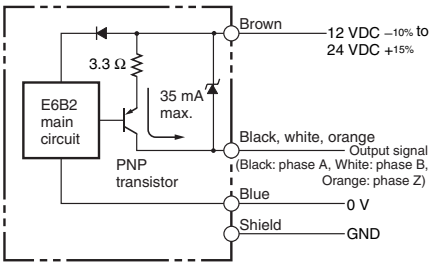
This means that the E6B2-C Rotary Encoder will not operate electrically if its speed exceeds the maximum electrical response speed.

## I/O Circuit Diagrams

### E6B2-CWZ6C



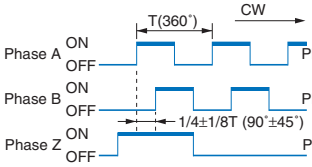

### E6B2-CWZ5B




**Output mode**

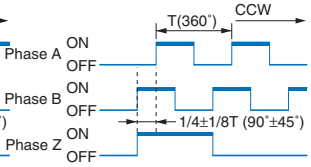
**E6B2-CWZ6C NPN Open-collector Output Model**
**E6B2-CWZ5B PNP Open-collector Output Model**

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




Note: Phase A is 1/4 T ± 1/8 T faster than phase B.
The ONs in the above timing chart mean that the output transistor is ON and the OFFs mean that the output transistor is OFF.

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

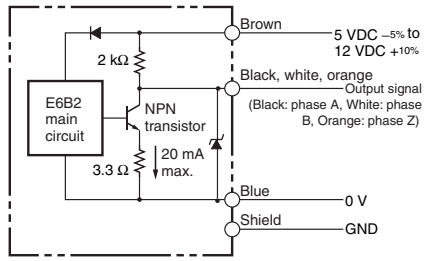



Note: Phase A is 1/4 T ± 1/8 T slower than phase B.

**Connection**

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

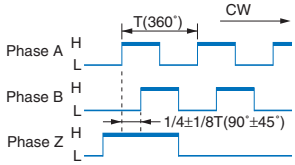
### E6B2-CWZ3E




**Output mode**

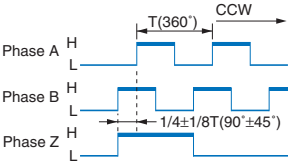
**E6B2-CWZ3E Voltage Output Model**

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



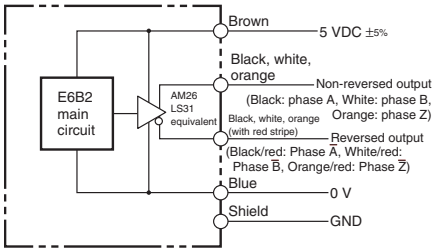

Note: Phase A is 1/4 T ± 1/8 T faster than phase B.

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




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

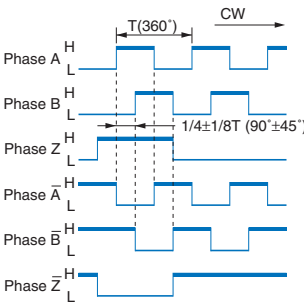
### E6B2-CWZ1X



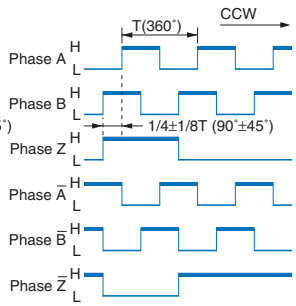

**Output mode**

**E6B2-CWZ1X Line Driver Output Model**

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




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




**Connection**

| Color | Terminal |
|---|---|
| Brown | Power supply (+Vcc) |
| Black | Output phase A |
| Black/red stripes | Output phase Ā |
| White | Output phase B |
| White/red stripes | Output phase B̄ |
| Orange | Output phase Z |
| Orange/red stripes | Output phase Z̄ |
| 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 Safe Use

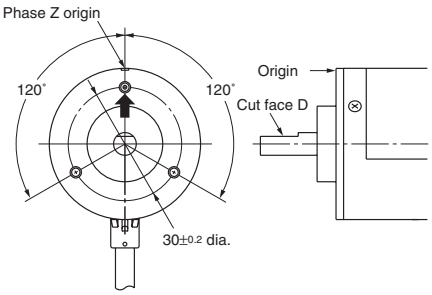
Incorrect wiring may damage internal circuits.

## Precautions for Correct Use

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

### ● 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.

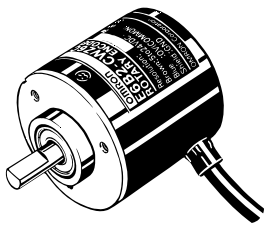
(Unit: mm)

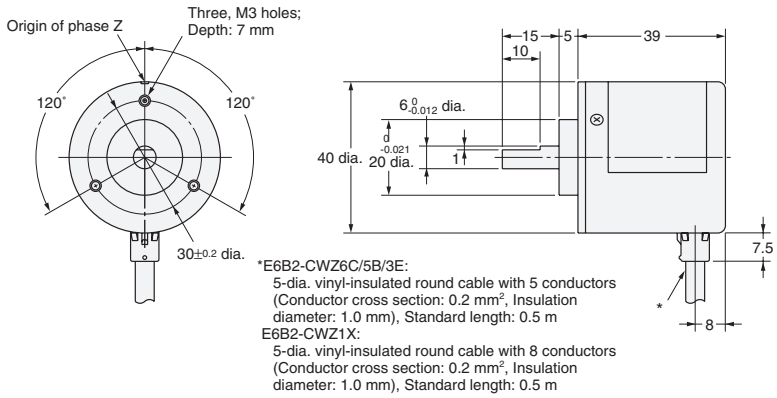
# Dimensions

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

## Encoder

**E6B2-C**






*E6B2-CWZ6C/5B/3E:
5-dia. vinyl-insulated round cable with 5 conductors (Conductor cross section: 0.2 mm², Insulation diameter: 1.0 mm), Standard length: 0.5 m
E6B2-CWZ1X:
5-dia. vinyl-insulated round cable with 8 conductors (Conductor cross section: 0.2 mm², Insulation diameter: 1.0 mm), Standard length: 0.5 m

## Accessories (Order Separately)

**Couplings**

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

**Flanges**

**E69-FBA**
**E69-FBA02**

**Servo Mounting Bracket**

**E69-2**

Refer to *Accessories* for details.

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Телефон: 8 (812) 309-75-97 (многоканальный)
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Web: http://oceanchips.ru/
Адрес: 198099, г. Санкт-Петербург, ул. Калинина, д. 2, корп. 4, лит. А