Hollow-shaft Encoder with Diameter of 40 mm

**E6H-C**

**Hollow-shaft Encoder**

- Incremental model.
- External diameter of 40 mm.
- Resolution of up to 3,600 ppr.
- Slim design at only 26 mm thick.

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 4.]

<table>
<thead>
<tr>
<th>Power supply voltage</th>
<th>Output configuration</th>
<th>Resolution (pulses/rotation)</th>
<th>Model</th>
</tr>
</thead>
</table>
| 5 to 24 VDC          | Open-collector output| 300, 360, 500, 600, 720, 800, 1,000, 1,024, 1,200, 1,500, 1,800, 2,000, 2,048, 2,500, 3,600 | E6H-CWZ6C (resolution) 0.5M  
Example: E6H-CWZ6C 300P/R 0.5M |
| 5 to 12 VDC          | Voltage output       | 300, 360, 500, 600, 720, 800, 1,000, 1,024, 1,200, 1,500, 1,800, 2,000, 2,048, 2,500, 3,600 | E6H-CWZ3E (resolution) 0.5M  
Example: E6H-CWZ3E 300P/R 0.5M |
| 5 to 12 VDC          | Line-driver output   | 300, 360, 500, 600, 720, 800, 1,000, 1,024, 1,200, 1,500, 1,800, 2,000, 2,048, 2,500, 3,600 | E6H-CWZ3X (resolution) 0.5M  
Example: E6H-CWZ3X 300P/R 0.5M |
### Ratings and Specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Model</th>
<th>E6H-CWZ6C</th>
<th>E6H-CWZ3E</th>
<th>E6H-CWZ3X</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply voltage</td>
<td></td>
<td>5 VDC −5% to 24 VDC +15%, ripple (p-p): 5% max.</td>
<td>5 VDC −5% to 12 VDC +10%, ripple (p-p): 5% max.</td>
<td></td>
</tr>
<tr>
<td>Current consumption*1</td>
<td></td>
<td>100 mA max.</td>
<td></td>
<td>150 mA max.</td>
</tr>
<tr>
<td>Resolution (pulses/rotation)</td>
<td></td>
<td>300, 360, 500, 600, 720, 800, 1,004, 1,200, 1,500, 1,800, 2,000, 2,048, 2,500, 3,600</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output phases</td>
<td></td>
<td>Phases A, B, and Z</td>
<td></td>
<td>Phases A, X, B, Z, and Z</td>
</tr>
<tr>
<td>Output configuration</td>
<td></td>
<td>Open-collector output</td>
<td>Voltage output</td>
<td>Line-driver output*4</td>
</tr>
<tr>
<td>Output capacity</td>
<td></td>
<td>Applied voltage: 35 VDC max.</td>
<td>Output resistance: 1 kΩ</td>
<td>Output current: High level: I0 = −10 mA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sink current: 35 mA max.</td>
<td>Residual voltage: 0.7 V max. (at sink current of 35 mA)</td>
<td>Low level: I0 = 10 mA</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Voltage output: V0 = 2.5 V min.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>V0 = 0.5 V</td>
</tr>
<tr>
<td>Maximum response frequency*2</td>
<td></td>
<td>100 kHz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phase difference between outputs</td>
<td></td>
<td>90° ±45° between A and B (1/4 T ± 1/8 T)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rise and fall times of output</td>
<td></td>
<td>1 μs max. (Control output voltage: 5 V, Load resistance: 1 kΩ, Output cable: 500 mm)</td>
<td></td>
<td>1 μs max. (I0 = −10 mA, I0 = 10 mA, Output cable: 500 mm)</td>
</tr>
<tr>
<td>Starting torque</td>
<td></td>
<td>1.5 mN·m max.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moment of inertia</td>
<td></td>
<td>2×10⁻⁶ kg·m² max.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shaft loading</td>
<td>Radial</td>
<td>29.4 N</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Thrust</td>
<td>4.9 N</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum permissible speed</td>
<td></td>
<td>10,000 r/min</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambient temperature range</td>
<td></td>
<td>Operating: −10 to 70°C (at 90% humidity max.), Storage: −30 to 85°C (with no icing)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambient humidity range</td>
<td></td>
<td>Operating/Storage: 90% max. (with no condensation)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insulation resistance</td>
<td></td>
<td>Excluded because of capacitor ground.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dielectric strength</td>
<td></td>
<td>Excluded because of capacitor ground.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vibration resistance</td>
<td></td>
<td>Destruction: 10 to 500 Hz, 100 m/s² or 1.5-mm double amplitude for 2 hours each in X, Y, and Z directions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shock resistance</td>
<td></td>
<td>300 m/s² for 11 ms 3 times each in X, Y, and Z directions (excluding shock to the shaft)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Degree of protection*3</td>
<td></td>
<td>IEC 60529 IP50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Connection method</td>
<td></td>
<td>Pre-wired Models (Standard cable length: 0.5 m)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Material</td>
<td></td>
<td>Case: Iron, Main unit: Aluminum, Pressboard panel: SUS304</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight (packed state)</td>
<td></td>
<td>Approx. 120 g</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accessories</td>
<td></td>
<td>Instruction manual</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*1. An inrush current of approximately 6 A will flow for approximately 0.3 ms when the power is turned ON.

*2. 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.

*3. No protection is provided against water or oil.

*4. 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.
## I/O Circuit Diagrams

### E6H-CWZ6C

#### Open-collector output

- **Direction of rotation:** CW (as viewed from end of shaft)  
  - Phase A: OFF  
  - Phase B: OFF  
  - Phase Z: OFF

- **Direction of rotation:** CCW (as viewed from end of shaft)  
  - Phase A: ON  
  - Phase B: ON  
  - Phase Z: ON

**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.**

### E6H-CWZ3E

#### Voltage output

- **Direction of rotation:** CW (as viewed from end of shaft)  
  - Phase A: H  
  - Phase B: L  
  - Phase Z: L

- **Direction of rotation:** CCW (as viewed from end of shaft)  
  - Phase A: L  
  - Phase B: H  
  - Phase Z: H

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

### E6H-CWZ3X

#### Line-driver output

- **Direction of rotation:** CW (as viewed from end of shaft)  
  - Phase A: H  
  - Phase B: L  
  - Phase Z: L

- **Direction of rotation:** CCW (as viewed from end of shaft)  
  - Phase A: L  
  - Phase B: H  
  - Phase Z: H

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

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

**Note:**  
1. Receiver: AM26LS32 equivalent  
2. "Black/red" indicates a red strip.

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**Note:** 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.

**Mounting**

- The diameter of the mating shaft must be 8.012 to 8.004 mm and 8 to 11 mm long from the mounting surface.
- The allowable displacement in the mating shaft must 0.05 mm in the radial direction and 0.3 mm in the thrust direction.
- The mounting surface and shaft must be perpendicular to within 0.03 mm.
- When securing the Encoder, do not allow force to be applied to the leaf spring (*).

![Image of Encoder with leaf spring notation]

- When securing the Encoder, use two M3 screws to secure the leaf spring to the mounting surface.
- Use the Allen set screw provided with the hollow shaft to secure the shaft. Use a tightening torque of 0.4 N·m and apply screw lock glue to the screw to prevent it from becoming loose.
- If wiring after securing the Encoder, do not pull on the cable. Also, do not apply shock to the Encoder or hollow shaft.
- If the Encoder phase Z must be aligned with the origin of the installation device, mount the Encoder while checking the phase Z output.

**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.

**Rotary Encoder Recommended Power Supplies:** Consult your OMRON representative for details.

**Dimensions**

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

E6H-C

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>(Unit: mm)</th>
<th>Allen set screws</th>
<th>Hollow shaft (Hollow shaft interior dia.: 8 mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>E6H-CW25C, E6H-CW23E</td>
<td>4.2-dia. shielded cable with 5 conductors (Conductor cross section: 0.1 mm², Insulator diameter: 0.88 mm), Standard length: 500 mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E6H-CW23X</td>
<td>5.5-dia. shielded cable with 8 conductors (Conductor cross section: 0.1 mm², Insulator diameter: 1.0 mm), Standard length: 500 mm</td>
<td>8 ( \pm \frac{1}{32} ) dia.</td>
<td></td>
</tr>
</tbody>
</table>

![Diagram of E6H-C dimensions]
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