

# Incremental 60-mm-dia. Rotary Encoder E6F-C

## The Strongest Shaft for Tough Jobs

- The strongest shaft of any OMRON Incremental Encoder (120 N in the radial direction and 50 N in the thrust direction).
- Water- and oil-proof structure (IP65f) for a greater degree of protection against water, oil, and other substances.
- CE marking.
- Output short-circuit protection circuit to reduce risks from incorrect wiring.
- Complementary outputs for long-distance cable extension.



## Ordering Information

### ■ Rotary Encoder

Supply voltage	Output configuration	Resolution (P/R)	Model
12 to 24 VDC	Complementary output	100, 200, 360, 500, or 600 1,000	E6F-CWZ5G

### ■ Accessories (Order Separately)

Name	Remarks	Remarks
Coupling	E69-C10B	---
	E69-C610B	Different end diameter
	E69-C10M	Metal construction
Servo Mounting Brackets	E69-2	Three brackets in a set; included with the Encoder.

# Specifications

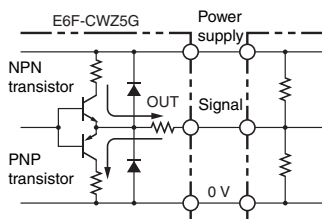
## ■ Ratings/Characteristics

Item	E6F-CWZ5G
Rated power supply voltage	12 VDC -10% to 24 VDC +15%
Current consumption (See note 1.)	100 mA max.
Resolution (P/R)	100, 200, 360, 500, 600, or 1,000
Output configuration	Complementary outputs (See note 2.)
Output capacity	Output voltage: $V_H = V_{CC} - 3 \text{ V min.}$ ( $I_O = 30 \text{ mA}$ ), $V_L = 2 \text{ V max.}$ ( $I_O = -30 \text{ mA}$ ) Output current: $\pm 30 \text{ mA}$
Max. response frequency	83 kHz
Phase difference	Phases A and B: $90 \pm 45^\circ$ ( $1/4 T \pm 1/8 T$ )
Rise and fall times of output	1 $\mu\text{s}$ max. (cable length: 2 m; output current: 30 mA)
Starting torque	10 mN·m max. (at room temperature), 15 mN·m max. (at low temperature)
Moment of inertia	$3 \times 10^{-6} \text{ kg}\cdot\text{m}^2$ max. (at 600 max. P/R: $1.5 \times 10^{-6} \text{ kg}\cdot\text{m}^2$ max.)
Shaft loading	Radial
	Thrust
Max. permissible revolution	5,000 r/min
Protection circuit	Power supply reverse connection protection, output load short-circuit protection
Ambient temperature	Operating: $-10$ to $70^\circ\text{C}$ (with no icing) Storage: $-25$ to $85^\circ\text{C}$ (with no icing)
Ambient humidity	Operating and storage: 35% to 85% (with no condensation)
Insulation resistance	20 M $\Omega$ min. (at 500 VDC) between carry parts and case
Dielectric strength	500 VAC, 50/60 Hz for 1 min between carry parts and case
Vibration resistance	Destruction: 10 to 500 Hz, 2-mm double amplitude or 150 m/s <sup>2</sup> in X, Y, and Z directions for 11 min per sweep, 3 sweeps
Shock resistance	Destruction: 1,000 m/s <sup>2</sup> 3 times each in X, Y, and Z directions
Degree of protection	IEC IP65 (JEM water/oil-proof IP65f) (See note 3.)
Connection method	Prewired (standard cable length: 2 m)
Weight (packed)	Approx. 500 g
Accessories	E69-2 Servo Mounting Brackets and instruction sheet

**Note 1.** An inrush current of approximately 9 A will flow for approximately 0.5  $\mu\text{s}$  right after the E6F-C is turned ON.

**2.** Complementary outputs:

As shown in the following diagram, there are two complementary transistor outputs in the output circuit: NPN and PNP. These correspond to the high and low output signals, and alternately turn ON and OFF. In application, pull the voltage up to the positive power supply level or pull it down to 0 V. The complementary output circuit controls both the outgoing and incoming current, and is characterized by a high-speed signal rise and fall, enabling longer cable extensions. It can be connected to open collector input devices (NPN and PNP).



**3.** JEM1030: Applicable from 1991.

# Output Circuits

Output circuit	Output mode	Connection												
<p>Brown 12 VDC -10% to 24 VDC +15%</p> <p>Black, white, orange Output signal</p> <p>Black: Phase A; White: Phase B; Orange: Phase Z</p> <p>Blue (Shield) 0 V (GND)</p>	<p>Rotation direction: CW (as viewed from end of shaft)      Rotation direction: CCW (as viewed from end of shaft)</p> <p>CW direction      CCW direction</p> <p><b>Note:</b> Phase A is <math>1/4 T \pm 1/8 T</math> ahead of phase B      <b>Note:</b> Phase A is <math>1/4 T \pm 1/8 T</math> behind Phase B</p>	<table border="1"> <thead> <tr> <th>Cable color</th> <th>Terminal name</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>	Cable color	Terminal name	Brown	Power supply (+ Vcc)	Black	Output phase A	White	Output phase B	Orange	Output phase Z	Blue	0 V (common)
Cable color	Terminal name													
Brown	Power supply (+ Vcc)													
Black	Output phase A													
White	Output phase B													
Orange	Output phase Z													
Blue	0 V (common)													

**Note 1.** The shielded cable outer core is not connected to the inner area or to the case.

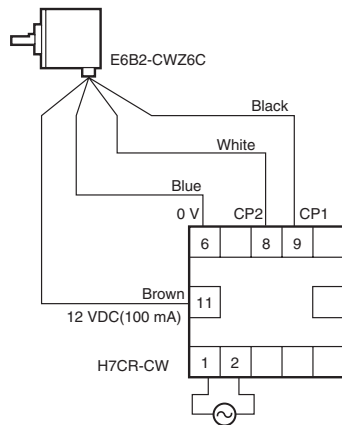
**2.** The phase-A, phase-B, and phase-Z circuits are all identical.

**3.** Normally, connect GND to 0 V or to an external ground.

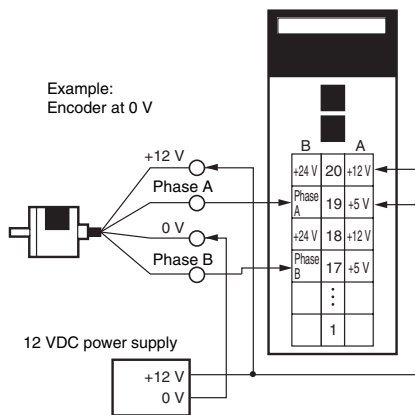
# Connection with Peripheral Devices

## ■ Connection Examples

### Connection to a H7CR-CW Counter

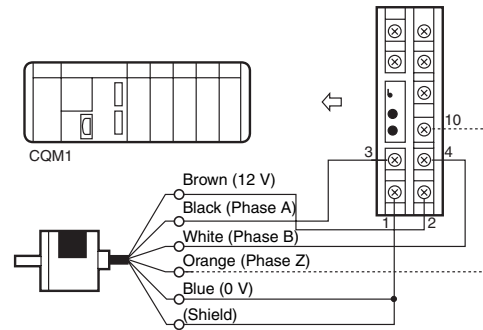


### Connection to a Programmable Controller C200H-CT□□ High-speed Counter Unit (Typical Example: C200H-CT001-V1)



**Note:** When the encoder power supply is either 5 V or 24 V:  
 Phase A + 5 V power supply → A19;  
 Phase A + 24 V power supply → B20;  
 Phase B + 5 V power supply → A17;  
 Phase B + 24 V power supply → B18.

### Connection to a CQM1 Programmable Controller



- The CPU Unit's three input points (IN04, IN05, and IN06) may directly receive the E6F-C's pulse input and use it for an internal high-speed counter.
- Response speeds of 5 kHz during single phase and 2.5 kHz during two phase, and pulse count values of 0 to 65535 (in Increment mode) and ±32767 (in Up/Down mode) may be counted.
- The high-speed counter operation mode is set in the PC Setup in the DM Area.

### Count Mode

<b>Up/Down mode</b>	Increments and decrements are counted in phase A and phase B.
<b>Increment mode</b>	Increments are counted in phase A only.
<b>Standard mode</b>	IN04 to IN06 are used as standard inputs.

### Reset Mode

One of two resetting methods may be selected:

- Resetting the present counter value using only the soft reset.
- Resetting the present counter value using the soft reset and an AND of the phase-Z input.

### Output Mode

<b>Target value match</b>	Up to 16 target values may be set. When the count value reaches a target value, the specified subroutine process will run.
<b>Zone comparison</b>	Up to 8 zones (upper and lower limits) may be set. When the count value enters a zone, the specified subroutine process will run.

# Operation and Installation

## ■ Precautions

- Do not impose voltages exceeding the rated voltage on the E6F-C, otherwise the E6F-C may be damaged.
- Be sure that the wiring of the E6F-C, including the polarity, is correct. The E6F-C may be damaged if wired incorrectly.
- Do not short the load of the E6F-C, otherwise the E6F-C may be damaged.
- Turn OFF the E6F-C while wiring. Wiring while the power supply is turned ON could damage the output circuit if the output cable touches the power supply.
- Do not wire power lines or high-tension lines along with the power supply lines of the E6F-C, otherwise the E6F-C may be damaged or malfunction.

## ■ Application

### Mounting

#### Mounting Procedure

1. Insert the shaft into the Coupling.  
Do not secure the Coupling and the shaft with screws at this stage.
2. Secure the E6F-C.  
Refer to the following table for the maximum insertion lengths of the shaft into the Coupling.

Coupling	Insertion length
E69-C10B	7.1 mm
E69-C610B	
E69-C10M	10.5 mm

3. Secure the Coupling.

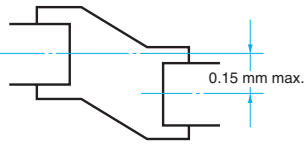
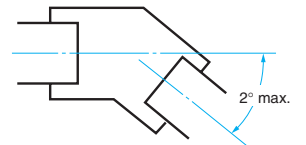
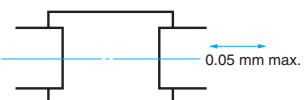
Coupling	Tightening torque
E69-C10B	0.44 N·m
E69-C610B	
E69-C10M	3.5 N·m

4. Connect the power and I/O lines.  
Turn OFF the E6F-C when connecting the lines.
5. Turn ON the E6F-C and check the output.

#### Mounting Information

- Be careful not to allow water, oil, or other substances to be sprayed on the E6F-C.
- The E6F-C consists of high-precision components. Handle the E6F-C with utmost care and do not drop it, otherwise malfunctioning may result.
- When the E6F-C is to be used in reversing, pay utmost attention to the mounting direction of the E6F-C, and to the direction of increment and decrement rotation.
- To match phase Z of the E6F-C to the origin of the device to be connected to the E6F-C, confirm the phase-Z output when connecting the device.
- Do not impose an excessive load on the shaft when the shaft is connected to a gear.
- If the E6F-C is mounted with screws, the tightening torque must not exceed 0.49 N·m.

- When using a Coupling, mount within the following tolerances.

<b>Eccentricity tolerance</b>	
<b>Declination tolerance</b>	
<b>Displacement tolerance in the shaft direction</b>	

- If the eccentricity or declination value exceeds the tolerance, an excessive load on the shaft may damage the E6F-C or shorten the life of the E6F-C.

### 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 extending the cable length beyond 10 m, use the line driver output or complementary output.  
(Line driver output length: 100 m max; complementary output length: 30 m max.)

Recommended Cable:

Conductor cross-sectional area: 0.2 mm<sup>2</sup>

Spiral shield

Conductor resistance: 92 Ω/km max. (20°C)

Insulation resistance: 5 MΩ/km min. (20°C)

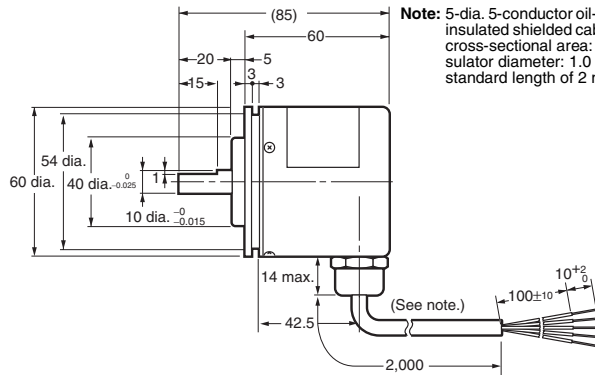
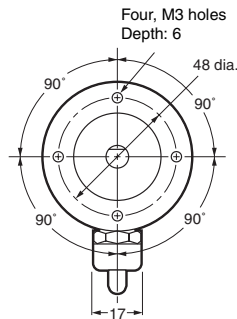
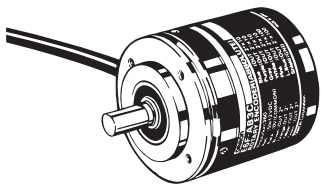
- The output waveform startup time changes not only according to the length of the cable, but also according to the load resistance and the cable type.
- Extending the cable length not only changes the startup time, but also increases the output residual voltage.

# Dimensions

(Unit: mm)

## Rotary Encoder

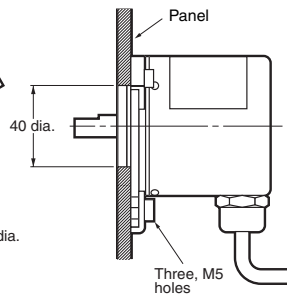
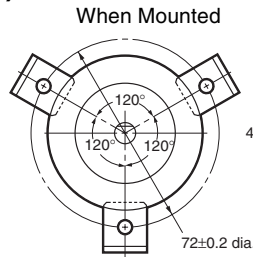
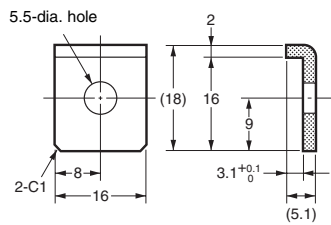
### E6F-CWZ5G



## Accessories (Order Separately)

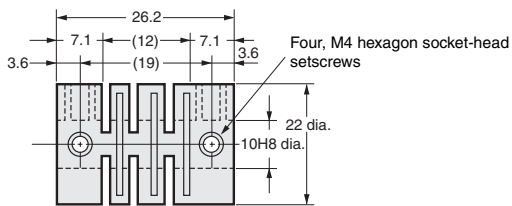
### Servo Mounting Brackets

#### E69-2 (Included with Encoder)



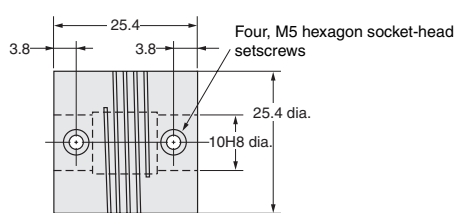
### Couplings

#### E69-C10B



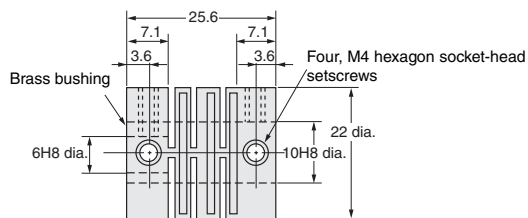
Material: Glass-reinforced PBT

#### E69-C10M



Material: Extra-super duralumin

#### E69-C610B (Different End Diameter)



Material: Glass-reinforced PBT



**ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.**

To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Cat. No. E284-E1-01

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

---

**OMRON Corporation**

Industrial Automation Company

Industrial Sensors Division  
Sensing Devices and Components Division H.Q.  
Shiokoji Horikawa, Shimogyo-ku  
Kyoto, 600-8530 Japan  
Tel: (81)75-344-7068/Fax: (81)75-344-7107

Printed in Japan  
0901-1M (0901) (B)