

Absolute 60-mm-dia. Rotary Encoder E6F-A

High Accuracy and Durability for Automatic Equipment

- Stronger shaft and greater durability (120 N in the radial direction and 50 N in the thrust direction) than previous E6F Encoders.
- Water- and oil-proof structure (IP65f) for a greater degree of protection against water, oil, and other substances.
- Wider range of resolutions for even more applications (series includes models with resolutions up to 1,024).
- Faster response for high-speed control applications (grey code: 20 kHz).



Ordering Information

■ Rotary Encoders

Supply voltage	Output configuration	Output code	Resolution (P/R)	Connection	Model
5 to 12 VDC	NPN open collector	BCD	360	Prewired	E6F-AB3C
				Connector	E6F-AB3C-C
12 to 24 VDC	NPN open collector	Grey binary	256	Prewired	E6F-AB5C C€
				Connector	E6F-AB5C-C C€
	PNP open collector	256, 360, 720, or 1,024	Prewired	E6F-AB5B C€	
			Connector	E6F-AG5C-C	
	NPN open collector	256, 360, 720, or 1,024	Prewired	E6F-AG5C	
			Connector	E6F-AG5B C€	
PNP open collector					

Note 1. When ordering, specify the resolution together with the model number (e.g., F6F-AG5C 256).

2. The E6F-AB3C-C connects to the H8PR-8, H8PR-16, or H8PR-24 Rotary Positioner.

3. The E6F-AG5C-C connects to the H8PS-8A or H8PS-8AF Cam Positioner.

■ Accessories (Order Separately)

Name	Model	Remarks
Coupling	E69-C10B	Included with the E6F-AB3C.
	E69-C610B	Different end diameter
	E69-C10M	Metal construction
Servo Mounting Brackets	E69-2	Three brackets in a set; included with the Encoder.
Extension Cable	E69-DF5	5 m (10-, 15-, 20-, and 98-m cables are also available.)

Specifications

■ Ratings/Characteristics

Item	E6F-AB3C-C	E6F-AB3C	E6F-AB5C-C	E6F-AB5C	E6F-AB5B	E6F-AG5C-C	E6F-AG5C	E6F-AG5B
Power supply voltage	5 VDC -5% to 12 VDC +10%, ripple (p-p): 5% max.		12 VDC -10% to 24 VDC +15%, ripple (p-p): 5% max.					
Current consumption (See note 1.)	60 mA max.							
Resolution (P/R) (See note 2.)	360					256	256, 360, 720, or 1,024	
Output code	BCD					Grey binary		
Output configuration	NPN open collector				PNP open collector	NPN open collector		PNP open collector
Output capacity	Applied voltage: 30 VDC max. Sink current: 35 mA max. Residual voltage: 0.4 V max. (when sink current is 35 mA)				Source current: 35 mA max. Residual voltage: 0.4 V max. (when source current is 35 mA)	Applied voltage: 30 VDC max. Sink current: 35 mA max. Residual voltage: 0.4 V max. (when sink current is 35 mA)		Source current: 35 mA max. Residual voltage: 0.4 V max. (when source current is 35 mA)
Max. response frequency (See note 3.)	10 kHz					20 kHz		
Logic	Negative logic (H = OFF; L = ON)				Positive logic (H = ON; L = OFF)	Negative logic (H = OFF; L = ON)		Positive logic (H = ON; L = OFF)
Rotation direction	Output codes increase CW (as seen from the shaft)							
Rise and fall times of output	1 μs max. (For E6F-AB3C and A□5C, load voltage: 5 V; load resistance: 1 kΩ; cable length: 2 m max.) (For E6F-A□5B, power supply voltage: 12 V; load resistance: 1 kΩ; cable length: 2 m max.)							
Starting torque	9.8 mN·m max. (at room temperature), 14.7 mN·m max. (at low temperature)							
Moment of inertia	1.5 × 10 ⁻⁶ kg·m ² max.							
Shaft loading	Radial	120 N						
	Thrust	50 N						
Max. permissible revolution	5,000 r/min							
Ambient temperature	Operating: -10 to 70°C (with no icing) Storage: -25 to 80°C (with no icing)							
Ambient humidity	Operating: 35% to 85% (with no condensation) Storage: 35% to 95% (with no condensation)							
Insulation resistance	10 MΩ 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 55 Hz, 1.5-mm double amplitude for 2 hrs 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 IP65 (JEM water-/oil-proof IP65f) (See note 4.)							
Connection method	Connector (standard cable length: 2 m)	Prewired (standard cable length: 2 m)	Connector (standard cable length: 2 m)	Prewired (standard cable length: 2 m)	Connector (standard cable length: 2 m)	Prewired (standard cable length: 2 m)	Connector (standard cable length: 2 m)	Prewired (standard cable length: 2 m)
Weight (packed)	Approx. 500 g							
Accessories	Servo Mounting Brackets and instruction sheet							

Note 1. An inrush current of approximately 9 A flows for approximately 0.5 μs right after the E6F-A is turned ON.

2. Codes are shown in the following table.

Output code	Resolution	Code No.
BCD	360	0 to 359
Grey binary	256	0 to 255
	360	76 to 435 (grey after 76)
	720	152 to 871 (grey after 152)
	1,024	0 to 1,023

3. The maximum electrical response revolution is determined by the resolution and maximum response frequency as follows:
Maximum electrical response frequency (r/min) = Maximum response frequency/resolution × 60
This means that the E6F-A will not operate electrically if its revolution exceeds the maximum electrical response revolution.

4. JEM1030: Applicable from 1991.

Output Circuits

Model	Output circuits	Output mode
E6F-AB3C E6F-AB3C-C	<p>Note: The circuit is the same for all bit outputs.</p>	<p>Rotation direction: CW (as viewed from end of shaft)</p> <p>2⁰ ON OFF 2¹ ON OFF 2² ON OFF 2³ ON OFF 2⁰X10 ON OFF 2¹X10 ON OFF 2²X10 ON OFF 2³X10 ON OFF 2⁰X100 ON OFF 2¹X100 ON OFF Address 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22</p>
E6F-AB5C E6F-AB5C-C	<p>Note: The circuit is the same for all bit outputs.</p>	
E6F-AB5B	<p>Note: The circuit is the same for all bit outputs.</p>	
E6F-AG5C E6F-AG5C-C	<p>Note: The circuit is the same for all bit outputs.</p>	<p>Rotation direction: CW (as viewed from end of shaft)</p> <p>Output transistor</p> <p>2⁰ ON OFF 2¹ ON OFF 2² ON OFF 2³ ON OFF 2⁴ ON OFF 2⁵ ON OFF 2⁶ ON OFF 2⁷ ON OFF 2⁸ ON OFF 2⁹ ON OFF Address 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65</p>
E6F-AG5B	<p>Note: The circuit is the same for all bit outputs.</p>	

Connection Specifications

■ Connector Encoders

Pin No.	E6F-AB3C-C/-AB5C-C	E6F-AG5C-C
	Output signal: 10-bit (360)	Output signal: 8-bit (256)
1	2 ⁰	Connected internally.
2	2 ¹	
3	2 ²	2 ⁵
4	2 ³	2 ¹
5	2 ⁰ × 10	2 ⁰
6	2 ¹ × 10	2 ⁷
7	2 ² × 10	2 ⁴
8	2 ³ × 10	2 ²
9	2 ⁰ × 100	2 ³
10	2 ¹ × 100	2 ⁶
11	Shield (ground)	Shield (ground)
12	-AB3C-C: 5 to 12 VDC, -AB5C-C: 12 to 24 VDC	12 to 24 VDC
13	0 V (common)	0 V (common)

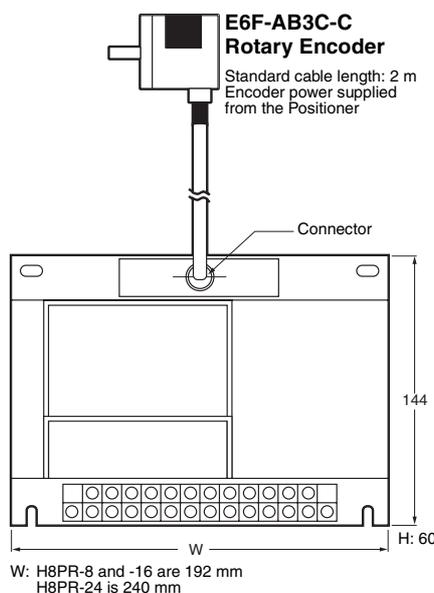
Note: Connector: PR13A-12PD-13SC (Hirose Electric Co., Ltd.)

■ Prewired Encoders

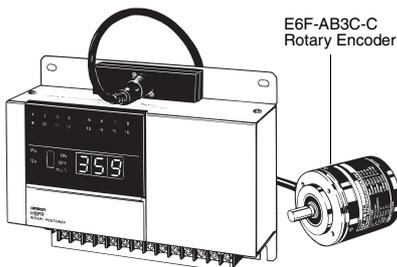
Cable color	E6F-AB3C/-AB5C/-AB5B	E6F-AG5C/-AG5B		
	Output signal: 10-bit (360)	Output signal: 8-bit (256)	Output signal: 9-bit (360)	Output signal: 10-bit (720 and 1,024)
Brown	2 ⁰	2 ⁰	2 ⁰	2 ⁰
Orange	2 ¹	2 ¹	2 ¹	2 ¹
Yellow	2 ²	2 ²	2 ²	2 ²
Green	2 ³	2 ³	2 ³	2 ³
Blue	2 ⁰ × 10	2 ⁴	2 ⁴	2 ⁴
Purple	2 ¹ × 10	2 ⁵	2 ⁵	2 ⁵
Grey	2 ² × 10	2 ⁶	2 ⁶	2 ⁶
White	2 ³ × 10	2 ⁷	2 ⁷	2 ⁷
Pink	2 ⁰ × 100	Not connected	2 ⁸	2 ⁸
Light blue	2 ¹ × 100	Not connected	Not connected	2 ⁹
--	Shield (ground)	Shield (ground)		
Red	-AB3C: 5 to 12 VDC, -AB5C and -AB5B: 12 to 24 VDC	12 to 24 VDC		
Black	0 V (common)	0 V (common)		

Connection Examples

■ Connection to H8PR Rotary Positioners



**Simplified Key Switch
H8PR-8, -16, and -24
Rotary Positioners**



Note: The distance between H8PR and E6F-AB3C-C may be extended to 30 m (including accessory cable).

Models

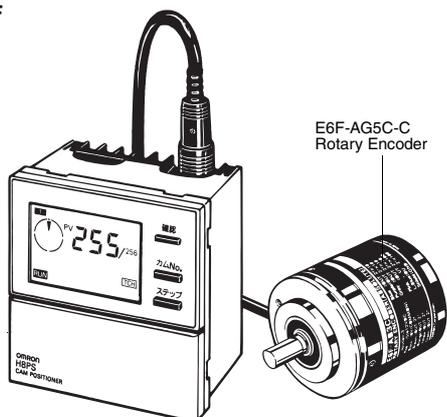
Model	Applicable model
H8PR-8	E6F-AB3C-C
H8PR-16	
H8PR-24	

Specifications

Rated voltage	100 to 240 VAC
Cam precision	1° (360 divisions per revolution)
No. of output points	H8PR-8: 8 H8PR-16: 16 H8PR-24: 24
Encoder response	833 r/min
Additional functions	<ul style="list-style-type: none"> • Origin compensation (zeroing) • Rotation direction switching • Initial angle specification • Angle Teaching • Retentive memory for power interruptions (10 years min.)

■ Connection to H8PS Cam Positioners

**H8PS-8A and -8AF
Cam Positioners**



Note: The distance between H8PS and E6F-AG5C-C may be extended to 100 m (including accessory cable).

Models

Model	Applicable model
H8PS-8A	E6F-AG5C-C
H8PS-8AF	

Specifications

Rated voltage	24 VDC
Cam precision	1.4° (256 divisions per revolution)
No. of output points	Cam output: 8 Output during RUN: 1 Rotary output: 1
Encoder response	330 r/min
Additional functions	<ul style="list-style-type: none"> • Origin compensation (zeroing) • Rotation direction switching • Angle display switching • Teaching

■ Connection to Programmable Controllers

The E6F-A can be connected to the CQM1-CPU44-E.

Operation and Installation

■ Precautions

- Do not impose voltages exceeding the rated voltage on the E6F-A, otherwise the E6F-A may be damaged.
- Be sure that the wiring of the E6F-A, including the polarity, is correct. The E6F-A may be damaged if wired incorrectly.
- Do not short the load of the E6F-A, otherwise the E6F-A may be damaged.
- Turn OFF the E6F-A while wiring. Wiring while the power supply is turned ON could result in burning of 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-A, otherwise the E6F-A 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-A.
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

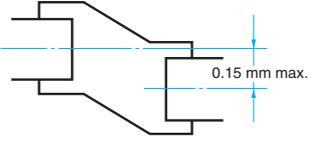
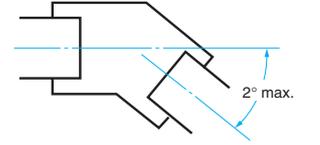
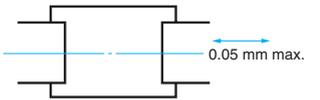
3. Secure the Coupling.

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-A when connecting the lines.
5. Turn ON the E6F-A and check the output.

Mounting Information

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

Eccentricity tolerance	
Declination tolerance	
Displacement tolerance in the shaft direction	

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

Adjustments: Reading Output Codes

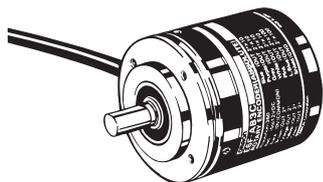
- When reading the output code of the E6F-AB3C or E6F-AB3C-C, read the code only after the LSB (2° output) has changed.

Dimensions

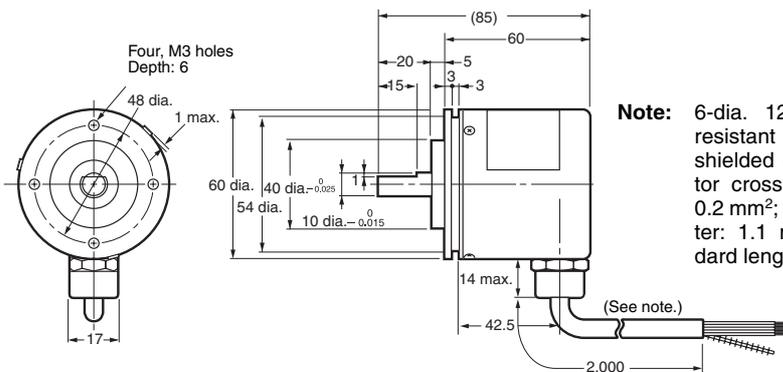
(Unit: mm)

Rotary Encoders

E6F-AB3C
E6F-AB5C
E6F-AG5C
E6F-AG5B
E6F-AB5B

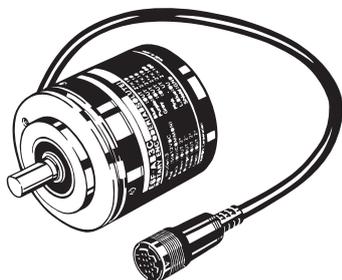


E69-C10B Coupling is included.

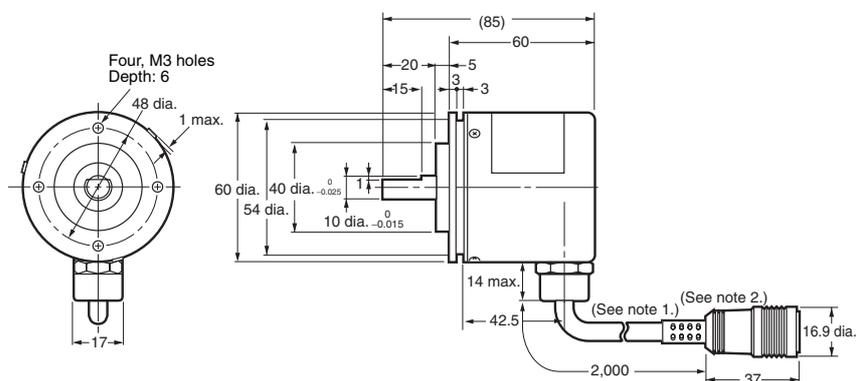


Note: 6-dia. 12-conductor oil-resistant PVC insulated shielded cable, (conductor cross-sectional area: 0.2 mm²; insulator diameter: 1.1 mm dia.), standard length of 2 m

E6F-AB3C-C
E6F-AG5C-C



E69-C10B Coupling is sold separately.



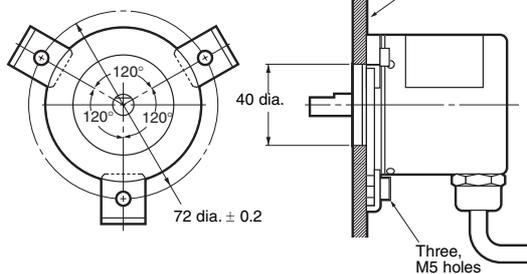
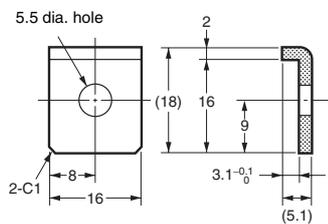
Note 1. 6-dia. 12-conductor oil-resistant PVC insulated shielded cable, (conductor cross-sectional area: 0.2 mm²; insulator diameter: 1.1 mm dia.), standard length of 2 m
2. Connector for H8PR Rotary Positioner and H8PS Cam Positioner.

Accessories (Order Separately)

Servo Mounting Bracket

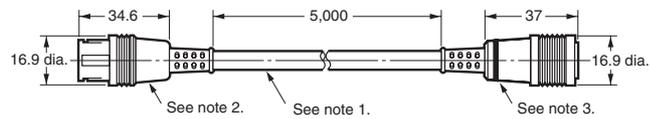
E69-2 (Included with Encoder)

When Mounted



Extension Cable

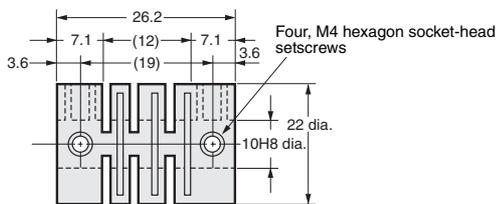
E69-DF5



- Note:**
1. 6-dia. 12-conductor shielded cable (cross-sectional area: 0.2 mm²; insulator diameter: 1.1 mm dia.), standard length of 5 m
 2. Connect to the E6F-AB3C-C or E6F-AG5C-C Connector.
 3. Connect to the H8PR Rotary Positioner or H8PS Cam Positioner.
 4. The cable length can be extended to up to 30 m between the H8PR and E6F-AB3C-C and up to 100 m between the H8PS and E6F-AG5C-C (including accessory cable). Cables of 10 m, 15 m, 20 m, and 98 m are also available in addition to the E69-DF5 (5 m).

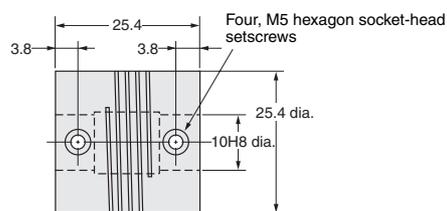
Couplings

E69-C10B



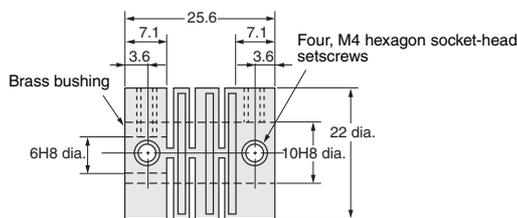
Material: Glass-reinforced PBT

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. E283-E1-01

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

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