


# E6F-A

## Rugged Rotary Encoder

- Absolute model.
- External diameter of 60 mm.
- Resolution of up to 1,024 (10-bit).
- IP65 oil-proof protection.
- Strong shaft.  
Radial: 120 N, Thrust: 50 N



 Be sure to read *Safety Precautions* on page 5.

## Ordering Information

**Encoders** [Refer to *Dimensions* on page 6.]

Power supply voltage	Output configuration	Output code	Resolution (divisions)	Connection method	Model
5 to 12 VDC	NPN open collector	BCD	360	Pre-wired Model	<b>E6F-AB3C 360P/R 2M *2</b>
				Pre-wired Connector Model (2 m)	<b>E6F-AB3C-C 360P/R 2M *2</b>
				Pre-wired Model	<b>E6F-AB5C 360P/R 2M</b>
				Pre-wired Connector Model (2 m)	<b>E6F-AB5C-C 360P/R 2M</b>
12 to 24 VDC	PNP open collector	Gray code	256, 360, 720	Pre-wired Model	<b>E6F-AB5B 360P/R 2M</b>
				Pre-wired Connector Model (2 m)	<b>E6F-AG5C-C (resolution) 2M *1</b> Example: E6F-AG5C-C 256P/R 2M
	NPN open collector		256, 360, 720, 1,024	Pre-wired Connector Model (2 m)	<b>E6F-AG5C (resolution) 2M</b> Example: E6F-AG5C 256P/R 2M
				Pre-wired Model	<b>E6F-AG5B (resolution) 2M</b> Example: E6F-AG5B 256P/R 2M
	PNP open collector				

\*1. The E6F-AG5C-C is designed for connection to Cam Positioners (H8PS).

\*2. Models are also available with 5-m and 10-m cables.

## Accessories (Order Separately)

[Dimensions: Refer to *Accessories* for coupling dimensions and to page 6 for the dimensions of other accessories.]

Name	Model	Remarks
Couplings	<b>E69-C10B</b>	Provided with E6F Pre-wired Models.
	<b>E69-C610B</b>	Different end diameter
	<b>E69-C10M</b>	Metal construction
Servo Mounting Bracket	<b>E69-2</b>	Provided with the product. (Three brackets in a set.)
Extension Cable	<b>E69-DF5</b>	5 m
	<b>E69-DF10</b>	10 m
	<b>E69-DF20</b>	20 m
Models are also available with 15-m and 98-m cables.		

Refer to *Accessories* for details.

## Ratings and Specifications

Item	Model	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*1		60 mA max.								
Resolution (pulses/rotation)*2		360					256, 360, 720	256, 360, 720, 1024		
Output code		BCD					Gray code			
Output configuration		NPN open-collector output				PNP open-collector output	NPN open-collector output		PNP open-collector output	
Output capacity		Applied voltage: 30 VDC max. Sink current: 35 mA max. Residual voltage: 0.4 V max. (at sink current of 35 mA)				Source current: 35 mA max. Residual voltage: 0.4 V max. (at source current of 35 mA)	Applied voltage: 30 VDC max. Sink current: 35 mA max. Residual voltage: 0.4 V max. (at sink current of 35 mA)		Source current: 35 mA max. Residual voltage: 0.4 V max. (at source current of 35 mA)	
Maximum response frequency*3		10 kHz					20 kHz			
Logic		Negative logic (high = 0, low = 1)				Positive logic (high = 1, low = 0)	Negative logic (high = 0, low = 1)		Positive logic (high = 1, low = 0)	
Direction of rotation		Output code incremented by CW (as viewed from the end of the shaft)								
Rise and fall times of output		1 μs max. (E6F-AB3C, A□5C: Load voltage: 5 V, Load resistance: 1 kΩ, Output cable: 2 m max.; E6F-A□5B: Power supply voltage: 12 V, Load resistance: 1 kΩ, Output cable: 2 m max.)								
Starting torque		9.8 mN·m max. at room temperature, 14.7 mN·m max. at low temperature								
Moment of inertia		$1.5 \times 10^{-6}$ kg·m <sup>2</sup> max.								
Shaft loading	Radial	120 N								
	Thrust	50 N								
Maximum permissible speed		5000 r/min								
Ambient temperature range		Operating: -10 to 70°C (with no icing), Storage: -25 to 80°C (with no icing)								
Ambient humidity range		Operating: 35% to 85% (with no condensation), Storage: 35% to 95% (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		10 to 500 Hz, 1.5-mm double amplitude for 11 min 3 times each in X, Y, and Z directions								
Shock resistance		Destruction: 1,000 m/s <sup>2</sup> 3 times each in X, Y, and Z directions								
Degree of protection		IEC 60529 IP65, in-house standards: oilproof								
Connection method		Connector Models (Standard cable length: 2 m)	Pre-wired Models (Standard cable length: 2 m)	Connector Models (Standard cable length: 2 m)	Pre-wired Models (Standard cable length: 2 m)		Connector Models (Standard cable length: 2 m)	Pre-wired Models (Standard cable length: 2 m)		
Material		Case: Zinc alloy, Main unit: Aluminum, Shaft: SUS420J2, Mounting Bracket: Galvanized iron								
Weight (packed state)		Approx. 500 g								
Accessories		Servo Mounting Bracket, Coupling (provided with Pre-wired Models only), Hexagonal wrench (provided with Pre-wired Models only), Instruction manual								

\*1. An inrush current of approximately 9 A will flow for approximately 5 μs when the power is turned ON.

\*2. The code is as follows:

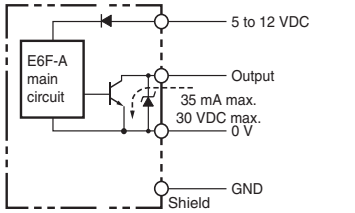
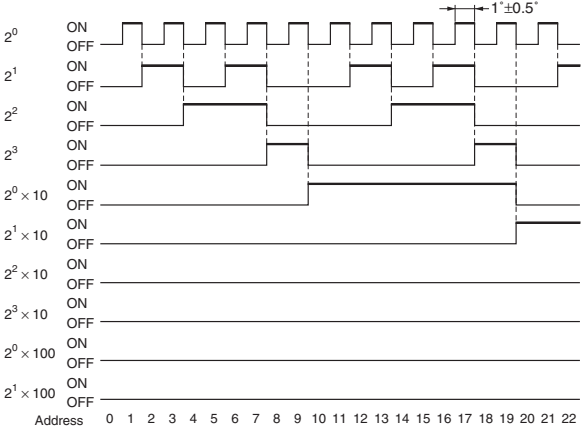
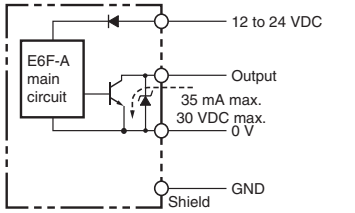
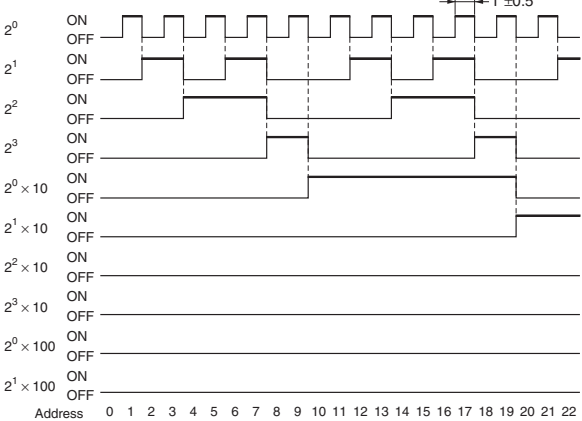
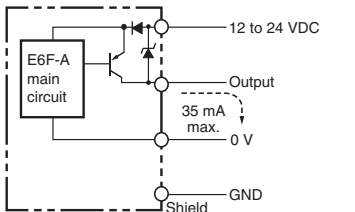
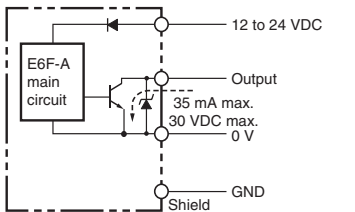
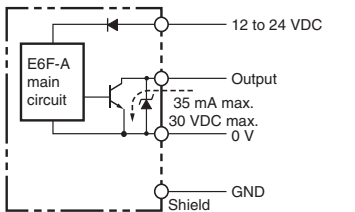
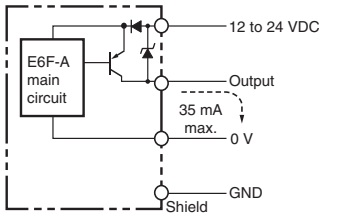
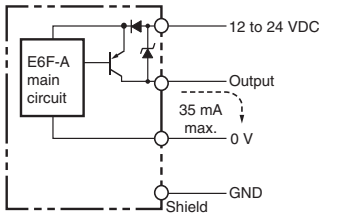
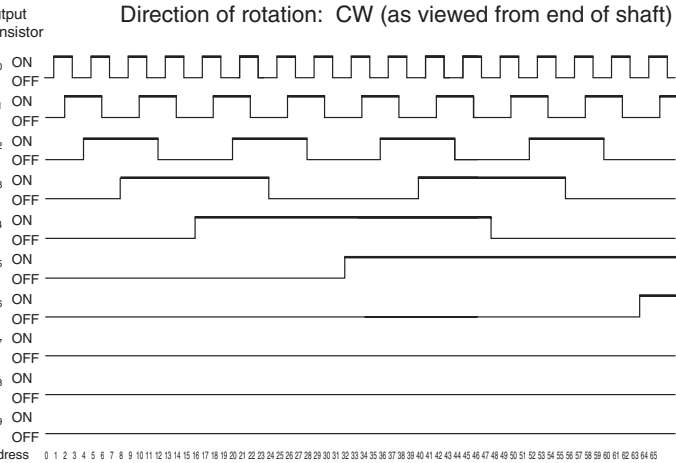
Output code	Resolution	Code No.
BCD	360	0 to 359
	256	0 to 255
Gray code	360	76 to 435 (gray after 76)
	720	152 to 871 (gray after 152)
	1024	0 to 1023

\*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 Rotary Encoder will not operate electrically if its speed exceeds the maximum electrical response speed.

I/O Circuit Diagrams

Model	Output Circuits	Output mode
<p><b>E6F-AB3C</b> <b>E6F-AB3C-C</b></p>	 <p>Note: The circuit is the same for all bit outputs. Each E6F-A Rotary Encoder has one main circuit.</p>	<p>Direction of rotation: CW (as viewed from end of shaft)</p> 
<p><b>E6F-AB5C</b> <b>E6F-AB5C-C</b></p>	 <p>Note: The circuit is the same for all bit outputs. Each E6F-A Rotary Encoder has one main circuit.</p>	<p>Direction of rotation: CW (as viewed from end of shaft)</p> 
<p><b>E6F-AB5B</b></p>	 <p>Note: The circuit is the same for all bit outputs. Each E6F-A Rotary Encoder has one main circuit.</p>	<p>Direction of rotation: CW (as viewed from end of shaft)</p> 
<p><b>E6F-AG5C</b> <b>E6F-AG5C-C</b></p>	 <p>Note: The circuit is the same for all bit outputs. Each E6F-A Rotary Encoder has one main circuit.</p>	<p>Direction of rotation: CW (as viewed from end of shaft)</p> 
<p><b>E6F-AG5B</b></p>	 <p>Note: The circuit is the same for all bit outputs. Each E6F-A Rotary Encoder has one main circuit.</p>	<p>Direction of rotation: CW (as viewed from end of shaft)</p> 

## Connection Specifications

### Connector Models\*

Model	E6F-AB3C-C/ -AB5C-C	E6F-AG5C-C		
	Output signal	Output signal		
Pin No.	10-bit (360)	8-bit (256)	9-bit (360)	10-bit (720)
1	2 <sup>0</sup>	Connected internally	Not connected	2 <sup>9</sup>
2	2 <sup>1</sup>		2 <sup>8</sup>	2 <sup>8</sup>
3	2 <sup>2</sup>	2 <sup>5</sup>	2 <sup>5</sup>	2 <sup>5</sup>
4	2 <sup>3</sup>	2 <sup>1</sup>	2 <sup>1</sup>	2 <sup>1</sup>
5	2 <sup>0</sup> × 10	2 <sup>0</sup>	2 <sup>0</sup>	2 <sup>0</sup>
6	2 <sup>1</sup> × 10	2 <sup>7</sup>	2 <sup>7</sup>	2 <sup>7</sup>
7	2 <sup>2</sup> × 10	2 <sup>4</sup>	2 <sup>4</sup>	2 <sup>4</sup>
8	2 <sup>3</sup> × 10	2 <sup>2</sup>	2 <sup>2</sup>	2 <sup>2</sup>
9	2 <sup>0</sup> × 100	2 <sup>3</sup>	2 <sup>3</sup>	2 <sup>3</sup>
10	2 <sup>1</sup> × 100	2 <sup>6</sup>	2 <sup>6</sup>	2 <sup>6</sup>
11	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)		

\* Connector: RP13A-12PD-13SC (Hirose Electric Co., Ltd.)  
Note: Normally connect GND to 0 V or to an external ground.

### Pre-wired Model

Model	E6F-AB3C/ -AB5C/-AB5B	E6F-AG5C/-AG5B		
	Output signal	Output signal		
Wire color	10-bit (360)	8-bit (256)	9-bit (360)	10-bit (720,1024)
Brown	2 <sup>0</sup>	2 <sup>0</sup>	2 <sup>0</sup>	2 <sup>0</sup>
Orange	2 <sup>1</sup>	2 <sup>1</sup>	2 <sup>1</sup>	2 <sup>1</sup>
Yellow	2 <sup>2</sup>	2 <sup>2</sup>	2 <sup>2</sup>	2 <sup>2</sup>
Green	2 <sup>3</sup>	2 <sup>3</sup>	2 <sup>3</sup>	2 <sup>3</sup>
Blue	2 <sup>0</sup> × 10	2 <sup>4</sup>	2 <sup>4</sup>	2 <sup>4</sup>
Purple	2 <sup>1</sup> × 10	2 <sup>5</sup>	2 <sup>5</sup>	2 <sup>5</sup>
Gray	2 <sup>2</sup> × 10	2 <sup>6</sup>	2 <sup>6</sup>	2 <sup>6</sup>
White	2 <sup>3</sup> × 10	2 <sup>7</sup>	2 <sup>7</sup>	2 <sup>7</sup>
Pink	2 <sup>0</sup> × 100	Not connected	2 <sup>8</sup>	2 <sup>8</sup>
Light blue	2 <sup>1</sup> × 100	Not connected	Not connected	2 <sup>9</sup>
---	Shield (ground)	Shield (ground)		
Red	-AB3C: 5 to 12 VDC, -AB5C: 12 to 24 VDC	12 to 24 VDC		
Black	0 V (common)	0 V (common)		

## Connection Example

### H8PS Cam Positioner Connection



### Ordering Information

Model
H8PS-8A
H8PS-8AP
H8PS-8AF
H8PS-8AFP
H8PS-16A
H8PS-16AP
H8PS-16AF
H8PS-16AFP
H8PS-32A
H8PS-32AP
H8PS-32AF
H8PS-32AFP

### Specifications

Rated voltage	24 VDC
Cam precision	0.5° (for 720 resolution), 1° (for 256/360 resolution)
No. of output points	8-point output type: 8 cam outputs, 1 RUN output, 1 pulse output 16-point output type: 16 cam outputs, 1 RUN output, 1 pulse output 32-point output type: 32 cam outputs, 1 RUN output, 1 pulse output
Encoder response	RUN mode, test mode: 256/360 resolution ... 1,600 r/min max. (1,200 r/min when advance compensation is set for four cams or more) 720 resolution ..... 800 r/min max. (600 r/min when advance compensation is set for four cams or more)
Additional functions	<ul style="list-style-type: none"> <li>• Origin compensation (zeroing)</li> <li>• Rotation direction switching</li> <li>• Angle display switching</li> <li>• Teaching</li> <li>• Pulse output</li> <li>• Angle/number of rotations display switching</li> <li>• Puncture *</li> <li>• Angle advance</li> <li>• Number of rotations alarm output</li> <li>• Setting with support software (order separately) *</li> </ul>

Note: For 16-point and 32-point output types only

## Safety Precautions

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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.



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**Precautions for Correct Use**

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

● **Adjustment**

**Reading the Output Code**

Read the code after the LSB (output 2<sup>0</sup>) of the code changes for the E6F-AB3C and E6F-AB3C-C.

● **Wiring**

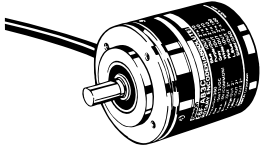
Spurious pulses may be generated when power is turned ON and OFF. Wait at least 0.1 s after turning ON the power to the Encoder before using the connected device, and stop using the connected device at least 0.1 s before turning OFF the power to the Encoder. Also, turn ON the power to the load only after turning ON the power to the Encoder.

## Dimensions

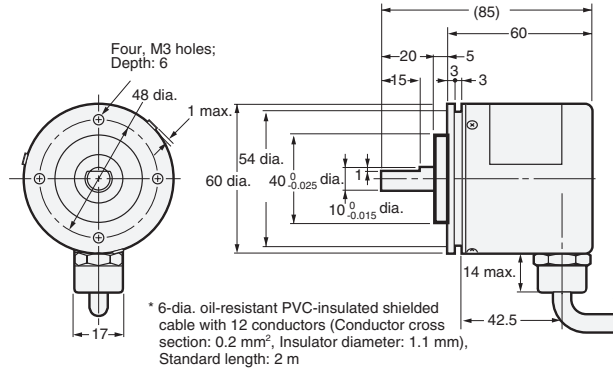
Tolerance class IT16 applies to dimensions in this datasheet unless otherwise specified.

### Encoder

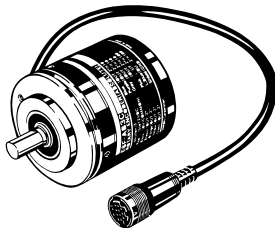
E6F-AB3C  
E6F-AB5C  
E6F-AG5C  
E6F-AG5B  
E6F-AB5B



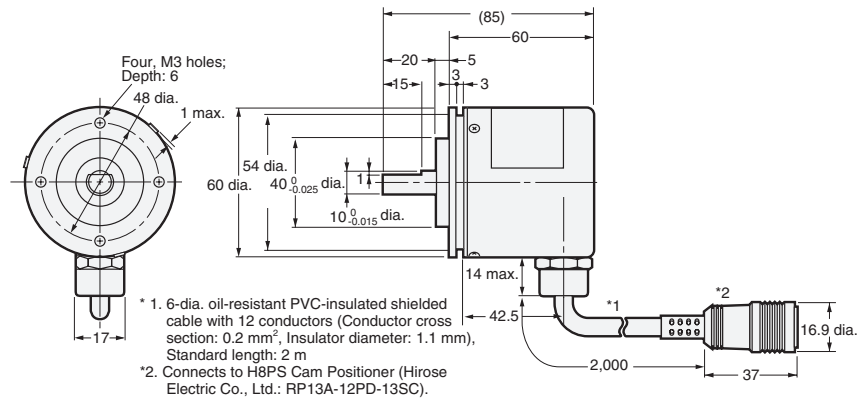
The E69-C10B Coupling is provided.



E6F-AB3C-C  
E6F-AB5C-C  
E6F-AG5C-C



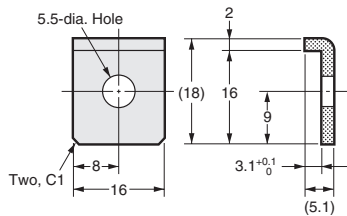
The E69-C10B Coupling is sold separately.



## Accessories (Order Separately)

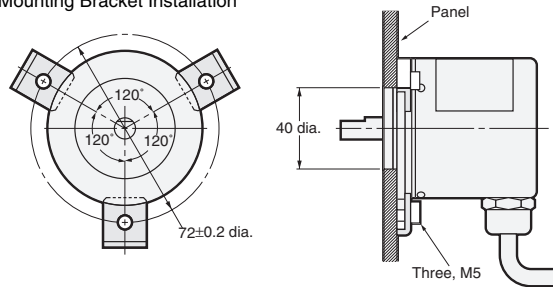
### Servo Mounting Bracket

E69-2



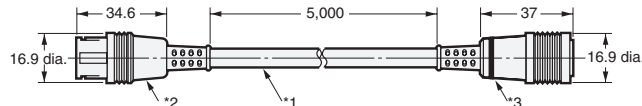
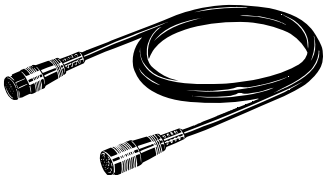
Note: Provided with the product.

### Mounting Bracket Installation



### Extension Cable

E69-DF5



\*1. 6-dia. shielded cable with 12 conductors (Conductor cross section: 0.2 mm<sup>2</sup>, Insulator diameter: 1.1 mm), Standard length: 5 m

\*2. Connects to connector on E6F-AB3C-C or E6F-AG5C-C.

\*3. Connects to H8PS Cam Positioner.

Note: 1. The E69-DF5 (5 m) is also available with the following cable lengths: 10 m, 15 m, 20 m, and 98 m.

2. Cable can be extended to 100 m when the H8PS Cam Positioner is connected.

### Couplings

E69-C10B  
E69-C610B  
E69-C10M

Refer to *Accessories* for details.

## Read and Understand This Catalog

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