

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 | E6F-AB3C 360P/R 2M *2 |
| | | | | Pre-wired Connector Model (2 m) | E6F-AB3C-C 360P/R 2M *2 |
| | | | | Pre-wired Model | E6F-AB5C 360P/R 2M |
| | | | | Pre-wired Connector Model (2 m) | E6F-AB5C-C 360P/R 2M |
| 12 to 24 VDC | PNP open collector | Gray code | 256, 360, 720 | Pre-wired Model | E6F-AB5B 360P/R 2M |
| | | | | Pre-wired Connector Model (2 m) | E6F-AG5C-C (resolution) 2M *1 Example: E6F-AG5C-C 256P/R 2M |
| | NPN open collector | | 256, 360, 720, 1,024 | Pre-wired Connector Model (2 m) | E6F-AG5C (resolution) 2M Example: E6F-AG5C 256P/R 2M |
| | | | | Pre-wired Model | E6F-AG5B (resolution) 2M 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 | E69-C10B | Provided with E6F Pre-wired Models. |
| | E69-C610B | Different end diameter |
| | E69-C10M | Metal construction |
| Servo Mounting Bracket | E69-2 | Provided with the product. (Three brackets in a set.) |
| Extension Cable | E69-DF5 | 5 m |
| | E69-DF10 | 10 m |
| | E69-DF20 | 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 | | 1.5×10^{-6} kg·m ² 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 ² 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:

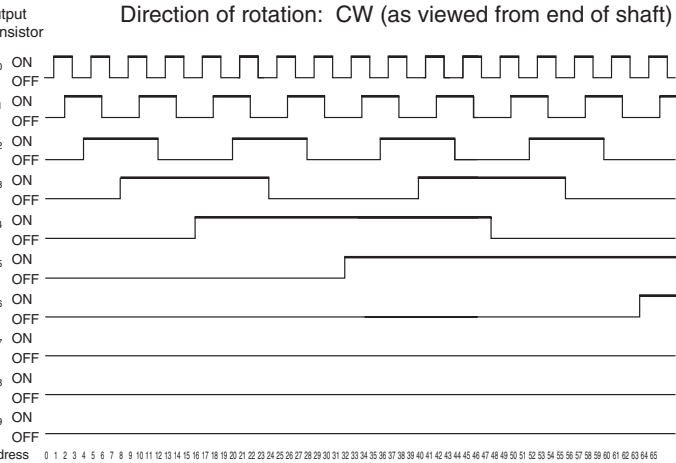
| Output code | Resolution | Code No. |
|-------------|------------|-----------------------------|
| BCD | 360 | 0 to 359 |
| | 256 | 0 to 255 |
| Gray code | 360 | 76 to 435 (gray after 76) |
| | 720 | 152 to 871 (gray after 152) |
| | 1024 | 0 to 1023 |

*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>E6F-AB3C E6F-AB3C-C</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>E6F-AB5C E6F-AB5C-C</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>E6F-AB5B</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>E6F-AG5C E6F-AG5C-C</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>E6F-AG5B</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 ⁰ | Connected internally | Not connected | 2 ⁹ |
| 2 | 2 ¹ | | 2 ⁸ | 2 ⁸ |
| 3 | 2 ² | 2 ⁵ | 2 ⁵ | 2 ⁵ |
| 4 | 2 ³ | 2 ¹ | 2 ¹ | 2 ¹ |
| 5 | 2 ⁰ × 10 | 2 ⁰ | 2 ⁰ | 2 ⁰ |
| 6 | 2 ¹ × 10 | 2 ⁷ | 2 ⁷ | 2 ⁷ |
| 7 | 2 ² × 10 | 2 ⁴ | 2 ⁴ | 2 ⁴ |
| 8 | 2 ³ × 10 | 2 ² | 2 ² | 2 ² |
| 9 | 2 ⁰ × 100 | 2 ³ | 2 ³ | 2 ³ |
| 10 | 2 ¹ × 100 | 2 ⁶ | 2 ⁶ | 2 ⁶ |
| 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 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 |
| Gray | 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: 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"> • Origin compensation (zeroing) • Rotation direction switching • Angle display switching • Teaching • Pulse output • Angle/number of rotations display switching • Puncture * • Angle advance • Number of rotations alarm output • Setting with support software (order separately) * |

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

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.

● Adjustment

Reading the Output Code

Read the code after the LSB (output 2⁰) 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.

(Unit: mm)

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 mm², 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.

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