


Rugged Rotary Encoder



- Absolute model.
- External diameter of 50 mm.
- Resolution of up to 1,024 (10-bit).
- IP65 (improved oil-proof protection with sealed bearings)
- Optimum angle control possible in combination with PLC or Cam Positioner.



For the most recent information on models that have been certified for safety standards, refer to your OMRON website.

 Be sure to read *Safety Precautions* on page 7.

Ordering Information

Encoders [Refer to *Dimensions* on page 8.]

| Power supply voltage | Output configuration | Output code | Resolution (pulses/rotation) | Connection method | Model |
|----------------------|-----------------------------|-------------|--|---|--|
| 12 to 24 VDC | Open-collector output (NPN) | Gray | 256, 360, (720) *2 | Pre-wired Connector Model (1 m) | E6C3-AG5C-C (resolution) 1M Example: E6C3-AG5C-C 256P/R 1M |
| | | | 256, 360, 720, 1,024 | | E6C3-AG5C (resolution) 1M Example: E6C3-AG5C 256P/R 1M |
| | | Binary | 32, 40 | Pre-wired Model (1 m) *1 | E6C3-AN5C (resolution) 1M Example: E6C3-AN5C 32P/R 1M |
| | BCD | 6, 8, 12 | E6C3-AB5C (resolution) 1M Example: E6C3-AB5C 6P/R 1M | | |
| | Open-collector output (PNP) | Gray | 256, 360, 720, 1,024 | | E6C3-AG5B (resolution) 1M Example: E6C3-AG5B 256P/R 1M |
| | | Binary | 32, 40 | E6C3-AN5B (resolution) 1M Example: E6C3-AN5B 32P/R 1M | |
| BCD | | 6, 8, 12 | E6C3-AB5B (resolution) 1M Example: E6C3-AB5B 6P/R 1M | | |
| 5 VDC | Voltage output | Binary | 256 | E6C3-AN1E 256P/R 1M | |
| 12 VDC | | | | E6C3-AN2E 256P/R 1M | |

*1. Standard models are also available with 2-m cables. When ordering, specify the cable length at the end of the model number (example: E6C3-AG5C 360P/R 2M).

*2. When connecting to the H8PS, use the E6C3-AG5C-C 256, 360, 720P/R. (Only a 2-m cable is available for the 720P/R Model.)

For the 360/720 resolutions, 2-m cables are standard in-stock.

Accessories (Order Separately)

[Dimensions: Refer to *Accessories* on page 8 for Extension Cable dimensions and *Accessories* for the dimensions of other accessories.]

| Name | Model | Remarks |
|------------------------|------------------|---|
| Couplings | E69-C08B | --- |
| | E69-C68B | Different end diameter (6 to 8 mm) |
| Flanges | E69-FCA03 | --- |
| | E69-FCA04 | E69-2 Servo Mounting Bracket provided. |
| Servo Mounting Bracket | E69-2 | Provided with E69-FCA04 Flange. |
| Extension Cable | E69-DF5 | 5 m |
| | E69-DF10 | 10 m |
| | E69-DF20 | 20 m |
| | | Applicable to the E6C3-AG5C-C. Models are also available with 15-m and 98-m cables. |

Refer to *Accessories* for details.

Ratings and Specifications

| Item | Model | E6C3-AG5C-C | E6C3-AG5C | E6C3-AN5C | E6C3-AB5C | E6C3-AG5B | E6C3-AN5B | E6C3-AB5B | E6C3-AN1E | E6C3-AN2E |
|--------------------------------|--|----------------------|---|-----------|---|-----------|-----------|------------------|---|--------------------------------------|
| Power supply voltage | 12 VDC -10% to 24 VDC +15%, ripple (p-p): 5% max. | | | | | | | | 5 VDC ±5% | 12 VDC ±10% |
| Current consumption*1 | 70 mA max. | | | | | | | | | |
| Resolution*2 (pulses/rotation) | 256, 360, 720 | 256, 360, 720, 1,024 | 32, 40 | 6, 8, 12 | 256, 360, 720, 1,024 | 32, 40 | 6, 8, 12 | 256 | | |
| Output code | Gray code | | | Binary | BCD | Gray code | | Binary | BCD | |
| Output configuration | NPN open-collector output | | | | PNP open-collector output | | | | Voltage 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) | | | | Output resistance: 2.4 kΩ | Output resistance: 8.2 kΩ |
| | | | | | | | | | Sink current: 35 mA max. Residual voltage: 0.4 V max. (at sink current of 35 mA) | |
| Rise and fall times of output | 1 μs max. (Cable length: 1 m, Load current: 35 mA) | | | | | | | | Rise: 3 μs max., Fall: 1 μs max. | Rise: 10 μs max., Fall: 1 μs max. |
| Maximum response frequency*3 | 20 kHz | | | | | | | | 10 kHz | |
| Logic | Negative logic (high = 0, low = 1) | | | | Positive logic (high = 1, low = 0) | | | | | |
| Direction of rotation*4 | Output code increases for CW (as viewed from end of shaft). | | | | | | | | Switched using rotation direction input. | |
| Strobe signal | None | | Supported | | None | | Supported | | None | |
| Positioning signal | None | | | Supported | | None | | | Supported | |
| Parity signal | None | | Supported (even) | | None | | | Supported (even) | | None |
| Starting torque | 10 mN·m max. at room temperature, 30 mN·m max. at low temperature | | | | | | | | | |
| Moment of inertia | 2.3×10^{-6} kg·m ² | | | | | | | | | |
| Shaft loading | Radial | | 80 N | | | | | | | |
| | Thrust | | 50 N | | | | | | | |
| Maximum permissible speed | 5,000 r/min | | | | | | | | | |
| Ambient temperature range | Operating: -10 to 70°C (with no icing), Storage: -25 to 85°C (with no icing) | | | | | | | | | |
| Ambient humidity range | Operating/Storage: 35% to 85% (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 | Destruction: 10 to 500 Hz, 150 m/s ² or 2-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 *6 | | Pre-wired Models (Standard cable length: 1 m) | | | | | | | |
| Material | Case: Aluminum, Main unit: Aluminum, Shaft: SUS303 | | | | | | | | | |
| Weight (packed state) | Approx. 300 g | | | | | | | | | |
| Accessories | Instruction manual Note: Coupling, mounting bracket and hex-head spanner are sold separately. | | | | | | | | | |

*1. An inrush current of approximately 6 A will flow for approximately 0.8 ms when the power is turned ON.

*2. The code is as follows:

| Output code | Resolution | Code No. |
|-------------|------------|-----------------------------|
| Binary | 32 | 1 to 32 |
| | 40 | 1 to 40 |
| | 256 | 0 to 255 |
| BCD | 6 | 0 to 5 |
| | 8 | 0 to 7 |
| | 12 | 0 to 11 |
| Gray | 256 | 0 to 255 |
| | 360 | 76 to 435 (gray after 76) |
| | 720 | 152 to 871 (gray after 152) |
| | 1,024 | 0 to 1,023 |

*3. The maximum electrical response speed is determined by the resolution and maximum response frequency as follows:

$$\text{Maximum electrical response speed (rpm)} = \frac{\text{Maximum response frequency}}{\text{Resolution}} \times 60$$

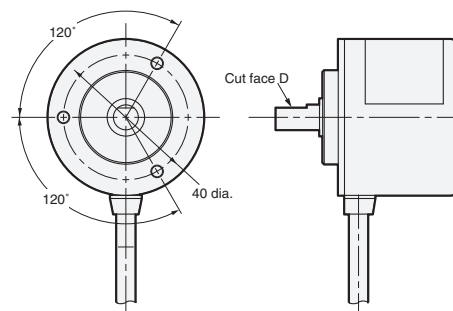
This means that the Rotary Encoder will not operate electrically if its speed exceeds the maximum electrical response speed.

*4. For the E6C3-AN1E and E6C3-AN2E, the rotation direction input (wire color: pink) can be connected to high (Vcc) to increase the output code for CW rotation and connected to low (0 V) to decrease the output code for CW rotation.
E6C3-AN1E: High = 1.5 to 5 V, Low = 0 to 0.8 V
E6C3-AN2E: High = 2.2 to 12 V, Low = 0 to 1.2 V

Read the code 10 μs or more after the LSB (2°) of the code changes for the E6C3-AN1E or E6C3-AN2E.

*5. The minimum address of the absolute code is output when cut face D on the shaft and the cable connection direction are as shown in the diagram at the right (output position range: ±15°).

*6. Resolution of 360 or 720: Standard cable length: 2 m
Resolution of 256: Standard cable length: 1 m



I/O Circuit Diagrams

| Model | E6C3-AG5C/-AG5C-C | E6C3-AG5B | E6C3-AN5C | E6C3-AN5B |
|------------------------|---|---|--|--|
| Output Circuits | <p>Note: The circuit is the same for all bit outputs. Each E6C3-A Rotary Encoder has one main circuit.</p> | <p>Note: The circuit is the same for all bit outputs. Each E6C3-A Rotary Encoder has one main circuit.</p> | <p>Note: The circuit is the same for all bit outputs. Each E6C3-A Rotary Encoder has one main circuit.</p> | <p>Note: The circuit is the same for all bit outputs. Each E6C3-A Rotary Encoder has one main circuit.</p> |
| Output mode | <p>Direction of rotation: CW (as viewed from the end of the shaft)</p> <p>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> | <p>Direction of rotation: CW (as viewed from the end of the shaft)</p> <p>Resolution/40</p> <p>Resolution of 32 $A = 11.25^\circ$ $B = 6^\circ$ $C = 3^\circ$</p> | | |

Connection Specifications

Connector Models

| Model | E6C3-AG5C-C | | |
|---------|------------------------|---------------|--------------|
| | Output signal | | |
| Pin No. | 8-bit (256) | 9-bit (360) | 10-bit (720) |
| 1 | } Connected internally | Not connected | 2^9 |
| 2 | | 2^8 | 2^8 |
| 3 | | 2^5 | 2^5 |
| 4 | 2^1 | 2^1 | 2^1 |
| 5 | 2^0 | 2^0 | 2^0 |
| 6 | 2^7 | 2^7 | 2^7 |
| 7 | 2^4 | 2^4 | 2^4 |
| 8 | 2^2 | 2^2 | 2^2 |
| 9 | 2^3 | 2^3 | 2^3 |
| 10 | 2^6 | 2^6 | 2^6 |
| 11 | Shield (ground) | | |
| 12 | 12 to 24 VDC | | |
| 13 | 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 Models

| Model | E6C3-AG5C/E6C3-AG5B | | |
|------------|---------------------|---------------|-----------------------|
| | Output signal | | |
| Wire color | 8-bit (256) | 9-bit (360) | 10-bit (720 or 1,024) |
| Brown | 2^0 | 2^0 | 2^0 |
| Orange | 2^1 | 2^1 | 2^1 |
| Yellow | 2^2 | 2^2 | 2^2 |
| Green | 2^3 | 2^3 | 2^3 |
| Blue | 2^4 | 2^4 | 2^4 |
| Purple | 2^5 | 2^5 | 2^5 |
| Gray | 2^6 | 2^6 | 2^6 |
| White | 2^7 | 2^7 | 2^7 |
| Pink | Not connected | 2^8 | 2^8 |
| Light blue | Not connected | Not connected | 2^9 |
| --- | Shield (ground) | | |
| Red | 12 to 24 VDC | | |
| Black | 0 V (common) | | |

I/O Circuit Diagrams

| Model | E6C3-AB5C | E6C3-AB5B | E6C3-AN1E | E6C3-AN2E |
|---|---|---|---|---|
| Output circuits | <p>Note: The circuit is the same for all bit outputs.</p> | <p>Note: The circuit is the same for all bit outputs.</p> | <p>Note: The circuit is the same for all bit outputs.</p> | <p>Note: The circuit is the same for all bit outputs.</p> |
| Rotation Direction Input Circuit | <p>Note: If the input is connected to Vcc, the output will increase for CW rotation and if the input is connected to 0 V, the output code will decrease for CW rotation.</p> | | | |
| Output mode | <p>Direction of rotation: CW (as viewed from end of shaft) Resolution/12</p> <p>Resolution of 8 A = 45°, B = 22.5° C = 11.25°</p> <p>Resolution of 6 A = 60°, B = 30° C = 15°</p> | | <p>Direction of rotation: CW (as viewed from end of shaft) if rotation direction input is high and CCW (as viewed from end of shaft) if rotation direction input is low.</p> <p>T = 360°/256 = 1.4°</p> | |

Connection Specifications

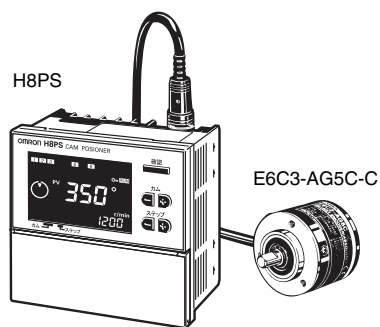
Pre-wired Models

| Wire color | Model | E6C3-AN5C/-AN5B | E6C3-AB5C/-AB5B | | E6C3-AN1E/-AN2E |
|------------|---------------|------------------|-----------------|---------------------|--------------------------|
| | Output signal | 6-bit (32 or 40) | 3-bit (6 or 8) | 5-bit (12) | 8-bit (256) |
| 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 | Not connected | 2 ³ | 2 ³ |
| Blue | | 2 ⁴ | Not connected | 2 ⁰ × 10 | 2 ⁴ |
| Purple | | 2 ⁵ | Not connected | Not connected | 2 ⁵ |
| Gray | | Parity | Positioning | Positioning | 2 ⁶ |
| White | | Strobe | Strobe | Strobe | 2 ⁷ |
| Pink | | Not connected | Not connected | Not connected | Rotation Direction Input |
| Light blue | | Not connected | Not connected | Not connected | Not connected |
| --- | | Shield (ground) | | | |
| Red | | 12 to 24 VDC | | | 5 or 12 VDC |
| Black | | 0 V (common) | | | |

Note: Normally connect GND to 0 V or to an external ground.

Connection Example

H8PS Cam Positioner Connection Example



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 |

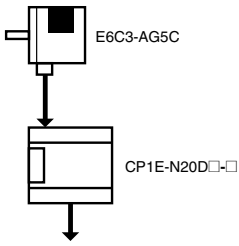
Specifications

| | |
|-----------------------------|--|
| 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) * |

* For 16-point and 32-point output types only

Programmable Controller Connection Example

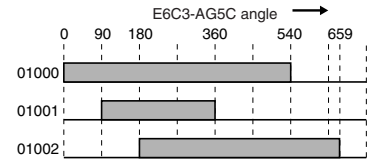
Connection to the CP1E
(720 Resolution)



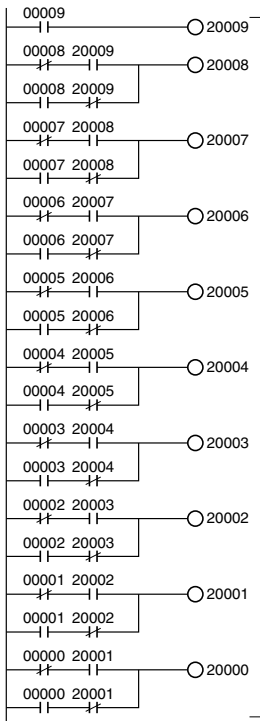
Wiring between the E6C3-AG5C and CP1E

| E6C3-AG5C out-put signal | CP1E input signal |
|------------------------------|-------------------|
| Brown (2 ⁰) | 00000 |
| Orange (2 ¹) | 00001 |
| Yellow (2 ²) | 00002 |
| Green (2 ³) | 00003 |
| Blue (2 ⁴) | 00004 |
| Purple (2 ⁵) | 00005 |
| Gray (2 ⁶) | 00006 |
| White (2 ⁷) | 00007 |
| Pink (2 ⁸) | 00008 |
| Light blue (2 ⁹) | 00009 |

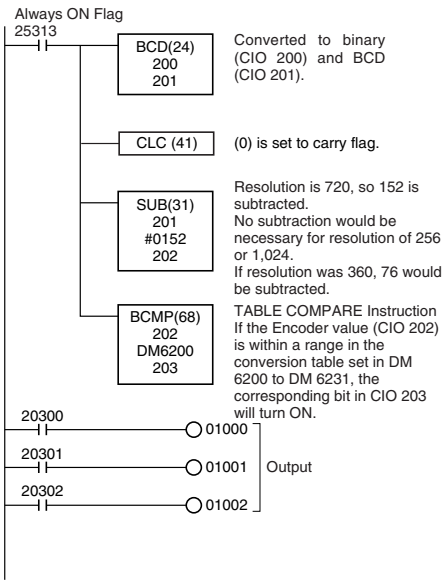
Output Timing



Ladder Programming Example



Converts gray code to binary (CIO 200).
Sets the unused bits (10 to 15 bits) of CIO 200 to unused (always 0).



Converted to binary (CIO 200) and BCD (CIO 201).
(0) is set to carry flag.
Resolution is 720, so 152 is subtracted. No subtraction would be necessary for resolution of 256 or 1,024.
If resolution was 360, 76 would be subtracted.
TABLE COMPARE Instruction
If the Encoder value (CIO 202) is within a range in the conversion table set in DM 6200 to DM 6231, the corresponding bit in CIO 203 will turn ON.

DM Area Setting Example for Comparison Table

| | | | |
|--------|------|----------------|-----------------------------|
| DM6200 | 0000 | Lower limit 1 | } Bit CIO 20300 |
| 6201 | 0540 | Upper limit 1 | |
| 6202 | 0090 | Lower limit 2 | } Bit CIO 20301 |
| 6203 | 0360 | Upper limit 2 | |
| 6204 | 0180 | Lower limit 3 | } Bit CIO 20302 |
| 6205 | 0659 | Upper limit 3 | |
| 6206 | 0000 | Lower limit 4 | } Not used in this example. |
| 6231 | 0000 | Upper limit 16 | |

CP1E

For details, refer to the following manual: CP1E-E□□SD□□/CP1E-N□□SD□□/CP1E-E□□D□□/CP1E-N□□D□□/CP1E-NA□□D□□-□ SYSMAC CP Series CP1E CPU Unit Instructions Reference Manual (Cat. No. W483).

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.

● Wiring

Connections

Cable Extension Characteristics

- Conditions will change according to frequency, noise, and other factors. As a guideline, use a cable length of 10 m* or less.

* Recommended Cable

Conductor cross section: 0.2 mm²

Spiral shield

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

Insulation resistance: 5 Ω/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.

● Connection

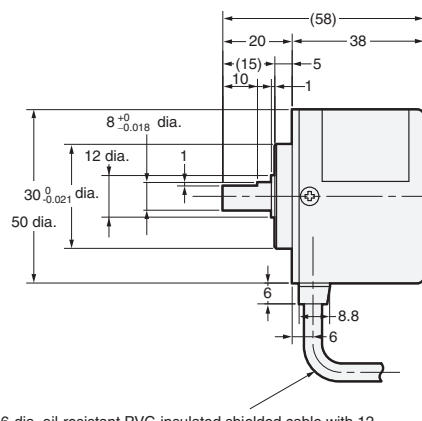
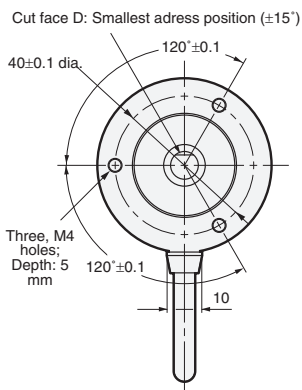
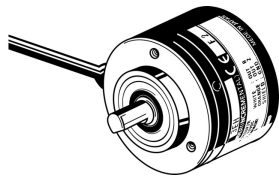
Spurious pulses may be generated when power is turned ON and OFF. Wait at least 0.1 s after turning ON the power to the Encoder before using the connected device, and stop using the connected device at least 0.1 s before turning OFF the power to the Encoder. Also, turn ON the power to the load only after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

Dimensions

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

Encoder

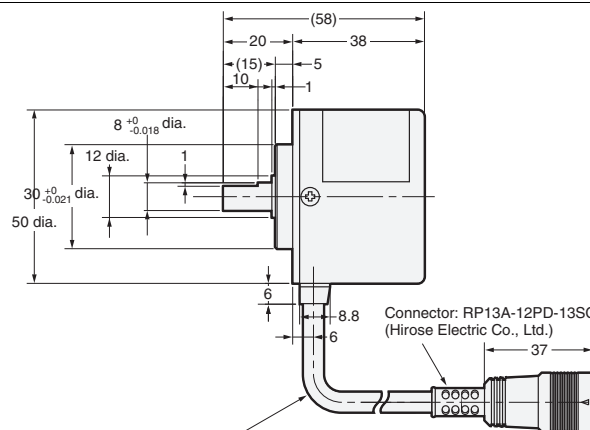
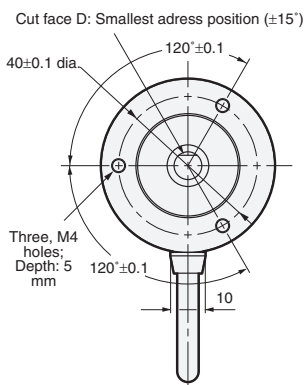
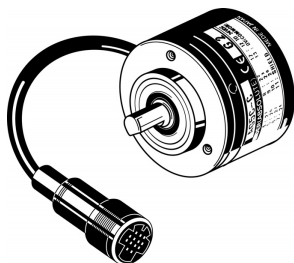
E6C3-A□5□
E6C3-AN□E



6-dia. oil-resistant PVC-insulated shielded cable with 12 conductors (Conductor cross section: 0.2 mm², Insulator diameter: 1.1 mm), Standard length: 1 m

Note: The E69-C08B Coupling is sold separately.

E6C3-AG5C-C



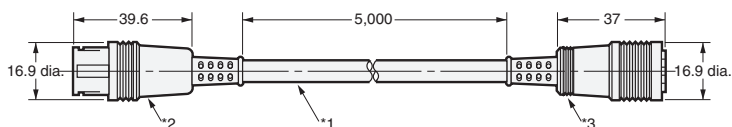
6-dia. oil-resistant PVC-insulated shielded cable with 12 conductors (Conductor cross section: 0.2 mm², Insulator diameter: 1.1 mm), Standard length for resolution of 360 or 720: 2 m

Note: The E69-C08B Coupling is sold separately.

Accessories (Order Separately)

Extension Cable

E69-DF5



*1. 6-dia. oil-resistant PVC-insulated 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 E6C3-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-C08B
E69-C68B

Refer to *Accessories* for details.

Flanges

E69-FCA03
E69-FCA04

Servo Mounting Bracket

E69-2

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Programmable Products.

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Change in Specifications.

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