


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.



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 6.

Ordering Information

Encoders [Refer to *Dimensions* on page 7.]

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 7 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	Binary	
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:

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

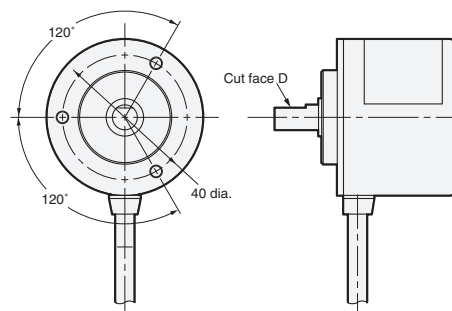
This means that the Rotary Encoder will not operate electrically if its speed exceeds the maximum electrical response speed.

*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 (2⁰) 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</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> <p>Absolute angle 360° 9° 18° 27° 2.25° 4.5° 0.5° min. 0.5° min.</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>
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° 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>Shaft angle: $\frac{360^\circ}{256}$</p> <p>$T \pm T/2$</p> <p>$T = 360^\circ / 256 = 1.4^\circ$</p>		

Connection Specifications

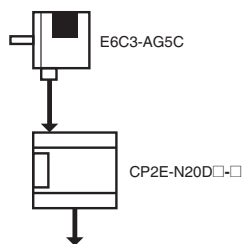
Pre-wired Models

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.

Programmable Controller Connection Example

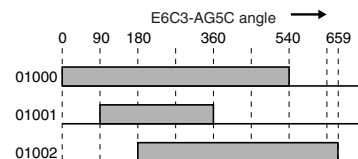
Connection to the CP2E (720 Resolution)



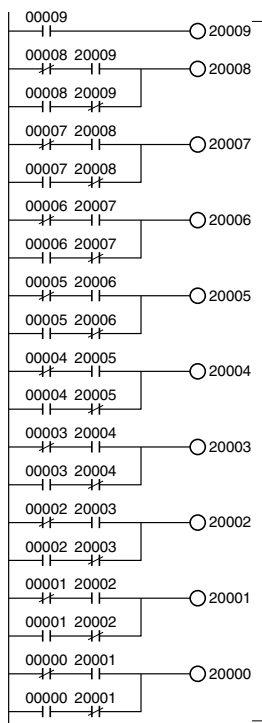
Wiring between the E6C3-AG5C and CP2E

E6C3-AG5C out-put signal	CP2E 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

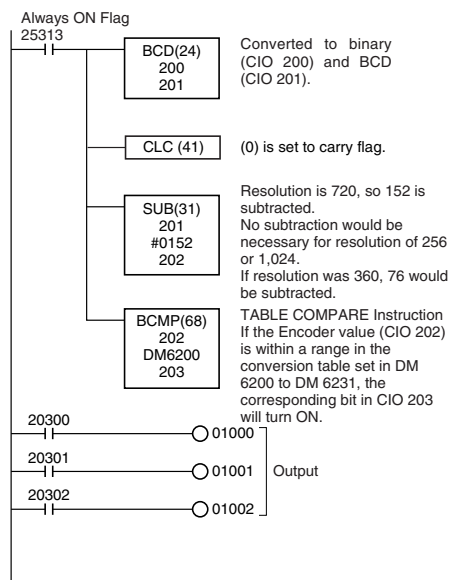
Output Timing



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).



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	

CP2E For details, refer to the following manual: SYSMAC CP Series CP1E/CP2E 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**

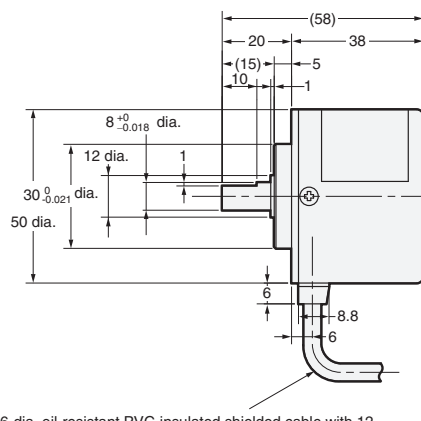
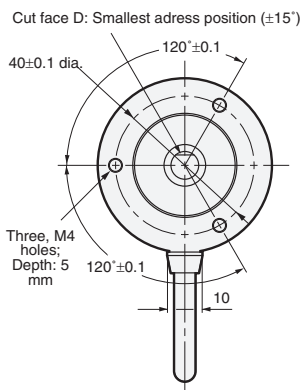
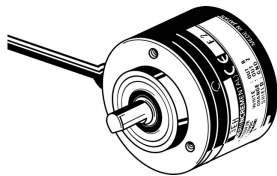
Spurious pulses may be generated when power is turned ON and OFF. Wait at least 0.1 s after turning ON the power to the Encoder before using the connected device, and stop using the connected device at least 0.1 s before turning OFF the power to the Encoder. Also, turn ON the power to the load only after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

Dimensions

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

Encoder

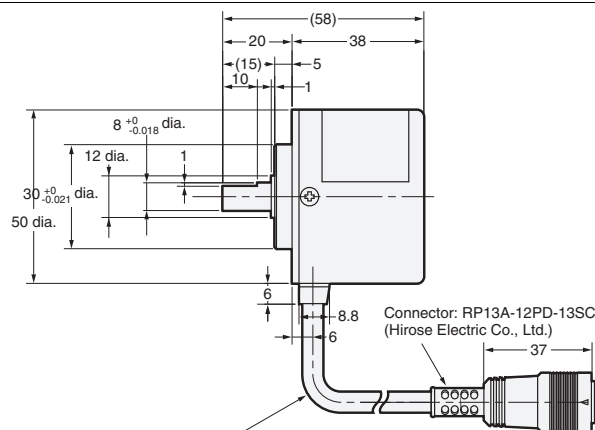
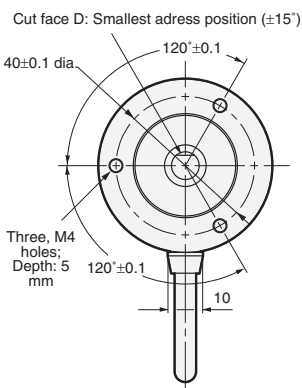
E6C3-A□5□
E6C3-AN□E



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



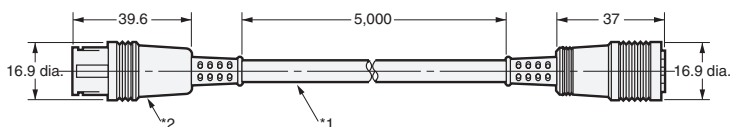
6-dia. oil-resistant PVC-insulated shielded cable with 12 conductors (Conductor cross section: 0.2 mm², Insulator diameter: 1.1 mm, Standard length: 1 m, Standard length for resolution of 360 or 720: 2 m

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.

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

Couplings

E69-C08B
E69-C68B

Refer to *Accessories* for details.

Flanges

E69-FCA03
E69-FCA04

Servo Mounting Bracket

E69-2

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