Slim Encoder with Diameter of 50 mm

E6C3-A

Durable and Easy to Use

- Sealed bearings with IP65f drip and oil resistance.
- Superior shaft loading performance. Radial: 80 N, Thrust: 50 N
- High shock resistance through application of metal slit.
- Optimum angle control possible in combination with PLC or cam positioner.

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

Ordering Information

Encoder

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	Connector	**E6C3-AG5C-C**
			256, 360, 720, 1,024	Pre-wired (1 m) *1	**E6C3-AG5C**
		Binary	32, 40		**E6C3-AN5C**
		BCD	6, 8, 12		**E6C3-AB5C**
	Open-collector output (PNP)	Gray	256, 360, 720, 1,024		**E6C3-AG5B**
		Binary	32, 40		**E6C3-AN5B**
		BCD	6, 8, 12		**E6C3-AB5B**
5 VDC	Voltage output	Binary	256		**E6C3-AN1E**
12 VDC					**E6C3-AN2E**

Note: When ordering, specify the resolution in addition to the model number (example: E6C3-AG5C 360P/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)

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	Applicable to the E6C3-AG5C-C. Models are also available with 15-m and 98-m cables.
	E69-DF10	10 m	
	E69-DF20	20 m	

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 Sink current: 35 mA max. Residual voltage: 0.4 V max. (at sink current of 35 mA)	Output resistance: 8.2 kΩ
Rise and fall times of output	1 μs max. (Cable length: 2 m, Sink 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	None	
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								
Shaft loading 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 (JEM IP65f drip and oil resistance)*5								
Connection method	Connector Models *7	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								

*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:

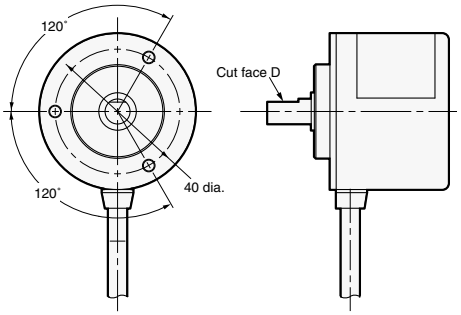
Output code	Resolution	Code No.
Binary	32	1 to 32
	40	1 to 40
	256	0 to 255
BCD	6	0 to 5
	8	0 to 7
	12	0 to 11
Gray	256	0 to 255
	360	76 to 435 (gray after 76)
	720	152 to 871 (gray after 152)
	1,024	0 to 1,023

*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 (2^0) of the code changes for the E6C3-AN1E or E6C3-AN2E.

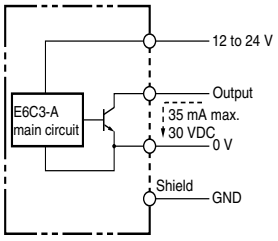
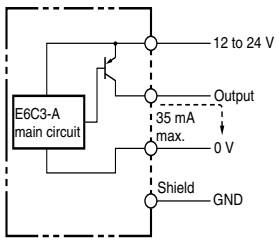
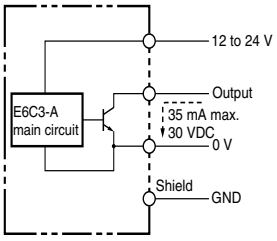
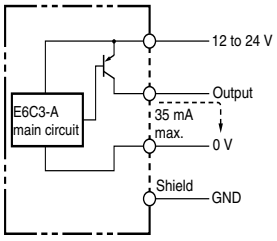
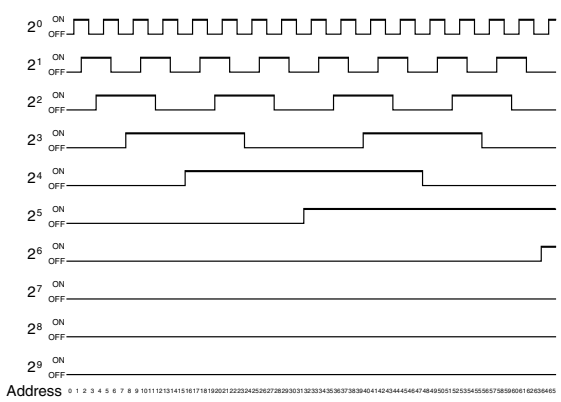
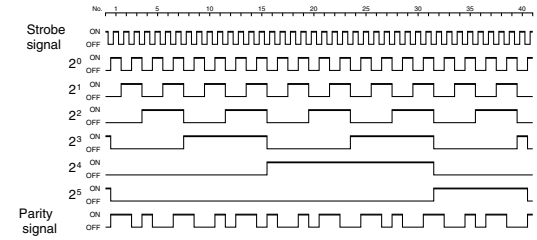
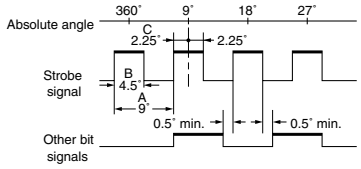


*5. JEM 1030: Applicable from 1991.

*6. 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°).

*7. 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	 Note: The circuit is the same for all bit outputs.	 Note: The circuit is the same for all bit outputs.	 Note: The circuit is the same for all bit outputs.	 Note: The circuit is the same for all bit outputs.
Output mode	Direction of rotation: CW (as viewed from the end of the shaft) 		Direction of rotation: CW (as viewed from the end of the shaft) Resolution/40  Resolution of 32 A = 11.25° B = 6° C = 3° 	

Connection Specifications

Connector Models

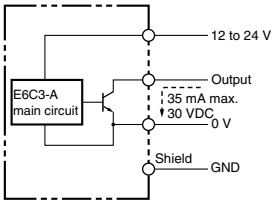
Model	E6C3-AG5C-C		
	Output signal		
Pin No.	8-bit (256)	9-bit (360)	10-bit (720)
1	} Connected internally	Not connected	2^9
2		2^8	2^8
3	2^5	2^5	2^5
4	2^1	2^1	2^1
5	2^0	2^0	2^0
6	2^7	2^7	2^7
7	2^4	2^4	2^4
8	2^2	2^2	2^2
9	2^3	2^3	2^3
10	2^6	2^6	2^6
11	Shield (ground)		
12	12 to 24 VDC		
13	0 V (common)		

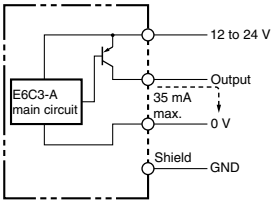
* Connector: RP13A-12PD-13SC (Hirose Electric Co., Ltd.)

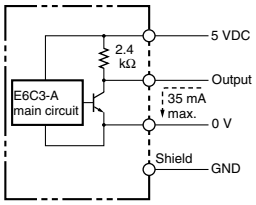
Pre-wired Models

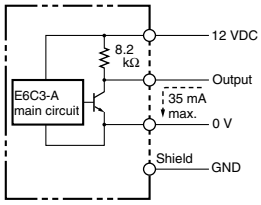
Model	E6C3-AG5C/E6C3-AG5B		
	Output signal		
Wire color	8-bit (256)	9-bit (360)	10-bit (720 or 1,024)
Brown	2^0	2^0	2^0
Orange	2^1	2^1	2^1
Yellow	2^2	2^2	2^2
Green	2^3	2^3	2^3
Blue	2^4	2^4	2^4
Purple	2^5	2^5	2^5
Gray	2^6	2^6	2^6
White	2^7	2^7	2^7
Pink	Not connected	2^8	2^8
Light blue	Not connected	Not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

I/O Circuit Diagrams

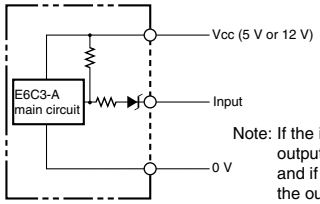
<table>
<tr><th>Model</th><th>E6C3-AB5C</th><th>E6C3-AB5B</th><th>E6C3-AN1E</th><th>E6C3-AN2E</th></tr>
<tr><td>Output circuits</td>
<td> 

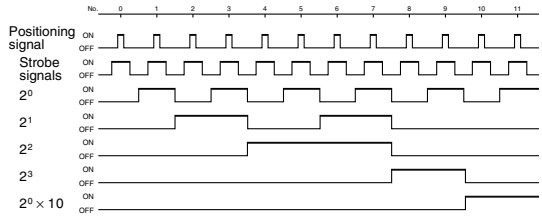
Note: The circuit is the same for all bit outputs.</td>
<td> 

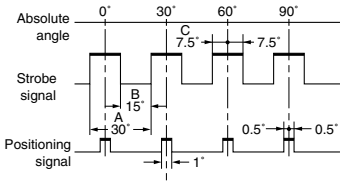
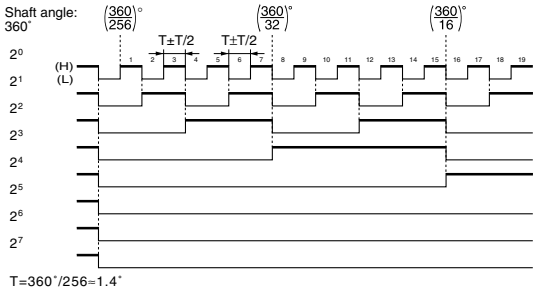
Note: The circuit is the same for all bit outputs.</td>
<td colspan="2"> 

Note: The circuit is the same for all bit outputs.


Note: The circuit is the same for all bit outputs.

Rotation Direction Input Circuit


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.</td></tr>
<tr><td>Output mode</td>
<td colspan="2">Direction of rotation: CW (as viewed from end of shaft)
Resolution/12


Resolution of 8
A = 45°, B = 22.5°
C = 11.25°
Resolution of 6
A = 60°, B = 30°
C = 15°

</td>
<td colspan="2">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.

</td></tr>
</table>

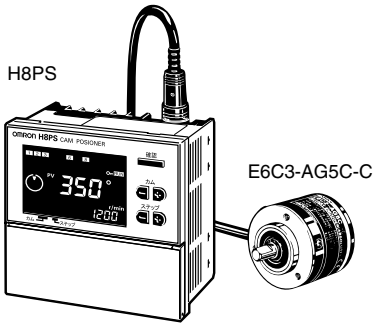
Connection Specifications

Pre-wired Models

Model	E6C3-AN5C/-AN5B	E6C3-AB5C/-AB5B		E6C3-AN1E/-AN2E
	Output signal	Output signal		Output signal
Wire color	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	$2^0 \times 10$	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)			

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

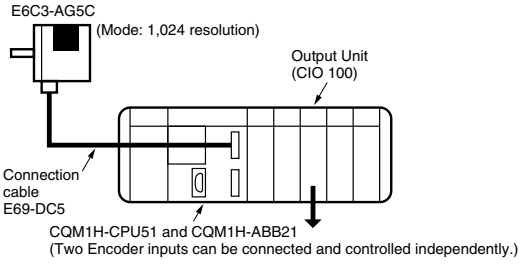
Rated voltage	24 VDC
Cam precision	0.5° (for 720 resolution), 1° (for 256/360 resolution)
No. of output points	8-point output type: 8 cam outputs, 1 RUN output, 1 pulse output 16-point output type: 16 cam outputs, 1 RUN output, 1 pulse output 32-point output type: 32 cam outputs, 1 RUN output, 1 pulse 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	● 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

Connections and System Configuration for E6C3-AG5C and the CQM1H (1,024 Resolution)

By combining the CQM1H-CPU51 and CQM1H-ABB21 with the E6C3-AG5C, output angle settings required to achieve 360° conversion, BCD conversion, and cam control can be easily made.

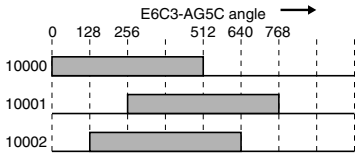


CQM1H-CPU51 Settings

Set port 1 to BCD mode and 10-bit resolution.

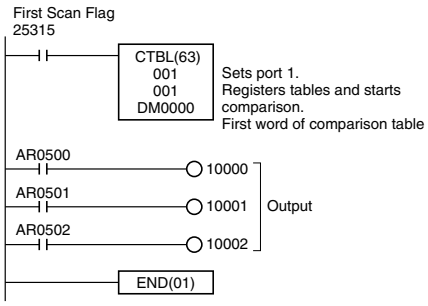
DM6643 | 0001

Output Timing



Ladder Program Example

The REGISTER COMPARISON TABLE (CTBL) instruction of the CQM1H-CPU51 is used to register a comparison table of output angle settings. Up to eight comparison can be registered.



DM Area Setting Example for Comparison Table

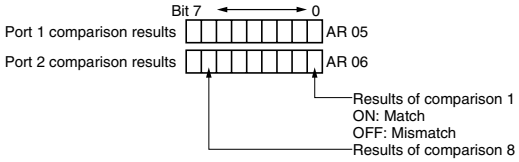
DM0000	0000	Lower limit 1	Bit AR 0500
0001	0512	Upper limit 1	
0002	0000	Subroutine 1	
0003	0256	Lower limit 2	Bit AR 0501
0004	0768	Upper limit 2	
0005	0000	Subroutine 2	
0006	0128	Lower limit 3	Bit AR 0502
0007	0640	Upper limit 3	
0008	0000	Subroutine 3	
0009	0000	Lower limit 4	Not used in this example.
0022	0000	Upper limit 8	
0023	0000		

Note: The upper and lower limits are set in increments of 1° in BCD mode and in increments of 5° in 360° mode. Subroutine numbers are set when interrupt processing is required.

CQM1H-CPU51 Memory Bits/Words

- **Range Comparison Results**

  When the angle of the E6C3-AG5C falls in one of the comparison ranges, the corresponding bit in word AR 05 or AR 06 of the CQM1H-CPU51 turns ON.
  The corresponding bit is OFF if there is no match.



- **Reading the PV**

  The grey code of the E6C3-AG5C is automatically converted to BCD or 360° and saved in words CIO 232 and CIO 234 in CQM1H-CPU51 memory.
  The present value can also be used elsewhere in the ladder program.

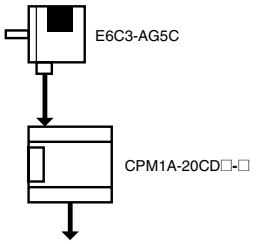
  Angle from port 1 | **** | CIO 232

  Angle from port 2 | **** | CIO 234

Refer to the *CQM1H User's Manual* (W363) for details on the CQM1H-CPU51 Programmable Controller.

Programmable Controller Connection Example

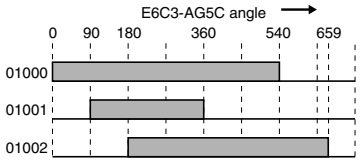
Connection to the CPM1A (720 Resolution)



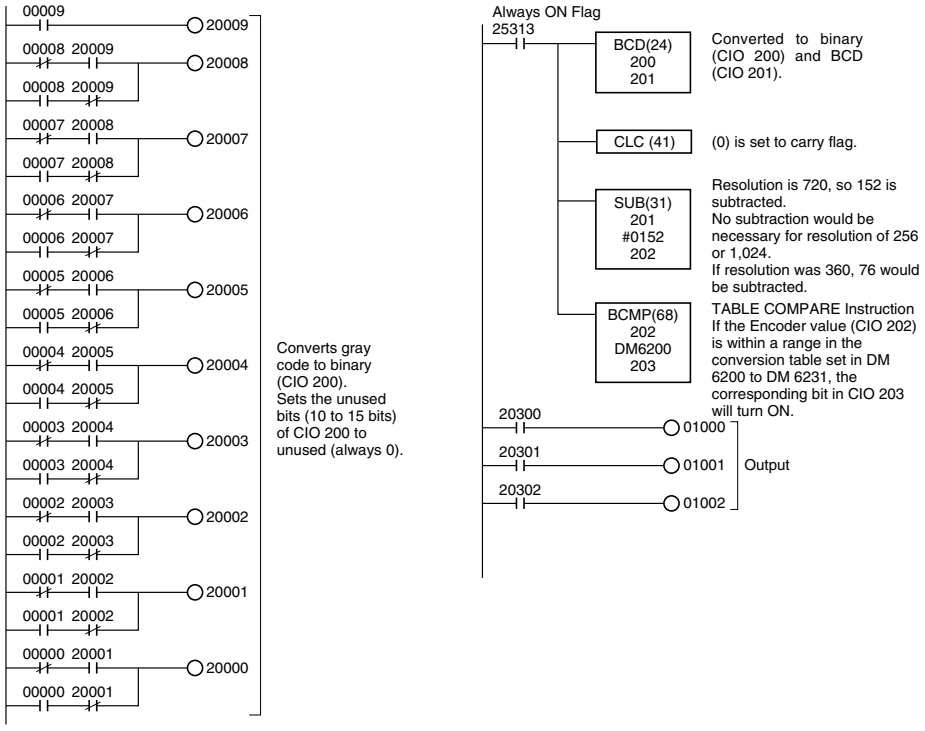
Wiring between the E6C3-AG5C and CPM1A

E6C3-AG5C output signal	CPM1A 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

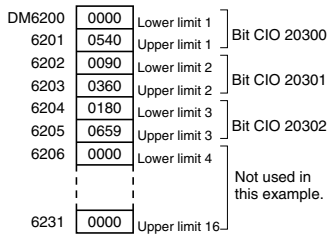
Output Timing



Ladder Programming Example



DM Area Setting Example for Comparison Table



CPM1A	For details, refer to the *SYSMAC C200HX/HG/HE/C200H/C200HS/CQM1/CPM1A/SRM1 Command Reference Manual* (SCCC-304).

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 mm^2
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

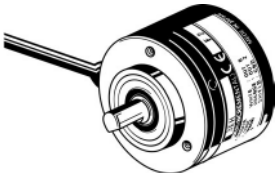
Spurious pulses may be generated when power is turned ON and OFF. Wait at least 0.1 s after turning ON the power to the Encoder before using the connected device, and stop using the connected device at least 0.1 s before turning OFF the power to the Encoder. Also, turn ON the power to the load only after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

Dimensions

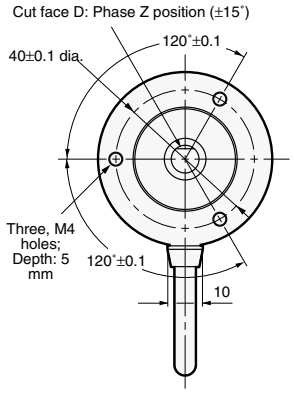
(Unit: mm)

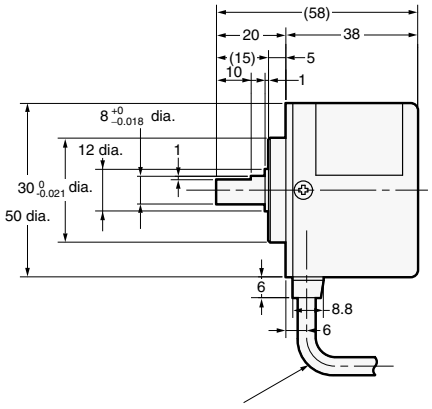
Encoder

E6C3-A□5□
E6C3-AN□E



Note: The E69-C08B Coupling is sold separately.

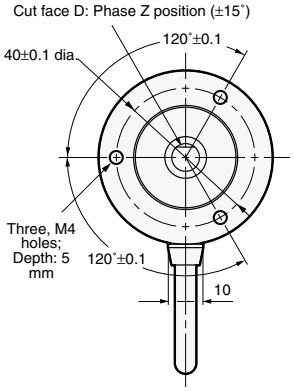


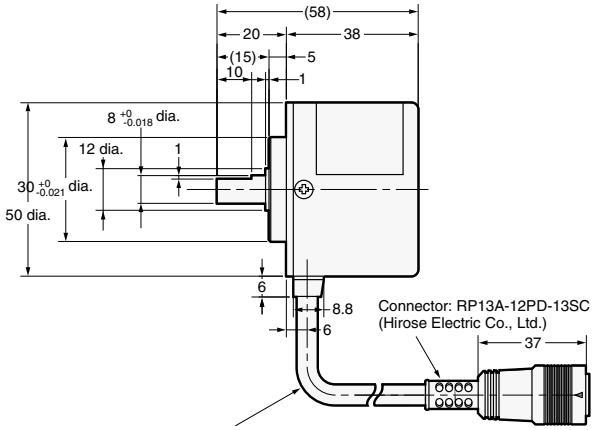


6-dia. oil-resistant PVC-insulated shielded cable with 12 conductors (Conductor cross section: 0.2 mm², Insulator diameter: 1.1 mm), Standard length: 1 m

E6C3-AG5C-C

Note: The E69-C08B Coupling is sold separately.



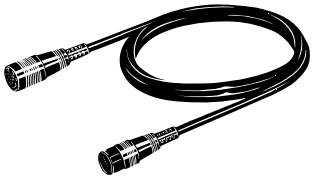


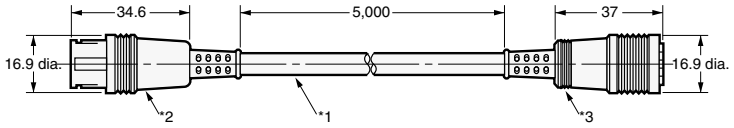
6-dia. oil-resistant PVC-insulated shielded cable with 12 conductors (Conductor cross section: 0.2 mm², Insulator diameter: 1.1 mm), Standard length: 1 m, Standard length for resolution of 360 or 720: 2 m

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

Couplings

E69-C08B
E69-C68B

Flanges

E69-FCA03
E69-FCA04

Servo Mounting Bracket

E69-2

General Precautions

For precautions on individual products, refer to *Safety Precautions* in individual product information.

⚠ WARNING

These products cannot be used in safety devices for presses or other safety devices used to protect human life. These products are designed for use in applications for sensing workpieces and workers that do not affect safety.

Precautions for Correct Use

- Do not use a voltage that exceeds the rated voltage range. Applying a voltage that is higher than the rated voltage range may cause explosion or burning.
- Be sure that the power supply polarity and other wiring is correct. Incorrect wiring may explosion or burning.
- Do not short-circuit the load. Doing so may cause explosion or burning.
- Make sure the power is OFF before performing wiring work. If the power is ON and an output wire contacts the power supply, the output circuit may be damaged.
- Wire high-voltage lines or power lines separately from Encoder wiring. If high-voltage lines are wired in parallel with Encoder wiring, induction may cause malfunction or damage.

Precautions for Correct Use

●**Mounting**

Mounting Procedure

1. Fit the coupling onto the shaft. — **Do not secure the coupling to the shaft with screws.**
2. Secure the Encoder.

Do not insert the shaft into the coupling beyond the value indicated at right.

Coupling	Amount of insertion
E69-C02B	3.2mm
E69-C04B	5.2mm
E69-C06B	5.5mm
E69-C08B	6.8mm
E69-C10B	7.1mm
E69-C68B	6.8mm
E69-C610B	7.1mm
E69-C06M	8.5mm
E69-C10M	10.5mm

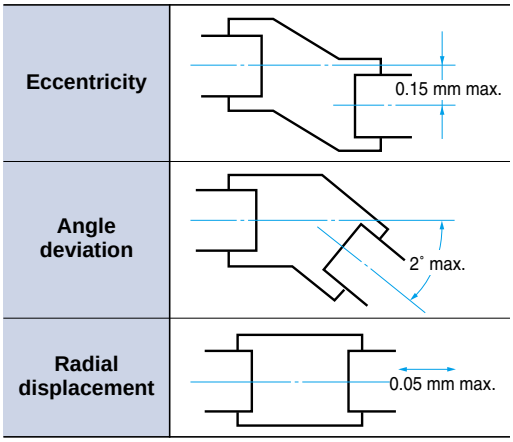
3. Secure the coupling.

Coupling	Tightening torque
E69-C02B	0.08N•m
E69-C04B	0.2N•m
E69-C06B	0.25N•m
E69-C08B	0.44N•m
E69-C10B	
E69-C68B	
E69-C610B	
E69-C06M	0.7N•m
E69-C10M	3.5N•m

4. Connect the power supply and I/O wires. — **Always turn OFF the power supply before wiring.**
5. Turn ON power and check output.

Mounting

- Do not allow water or oil to splash on the Encoder.
- The Rotary Encoder consists of high-precision components. Dropping the Encoder may damage it. Exercise sufficient caution when handling the Encoder.
- When using reverse rotation, check the Encoder mounting direction and the increment/decrement directions before mounting.
- When aligning phase Z of the Encoder with the origin of the machine in which the Encoder is installed, be sure to verify phase Z output while mounting the Encoder.
- Make sure that an excessive load is not placed on the shaft when the gears engage.
- When securing the Rotary Encoder with screws, tighten the screws to a torque of 0.49 N•m.
- When using a coupling, do not exceed the following permitted values.

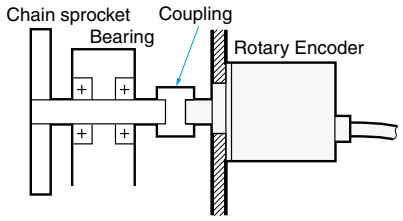


- If there are large mounting errors (eccentricity or angle deviation), an excessive load will be placed on the shaft, causing damage and an extremely shortened life.

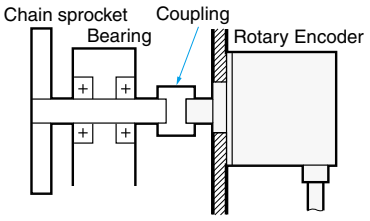
Mounting

- When connecting with a chain timing belt and gears, hold the shaft with a bearing and use a coupling to join to the Encoder.

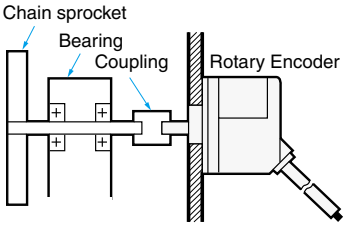
E6A2-C



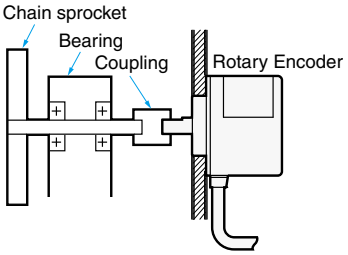
E6B2-C
E6D-C
E6C-N



E6C2-C



E6C3-C□H
E6C3-A

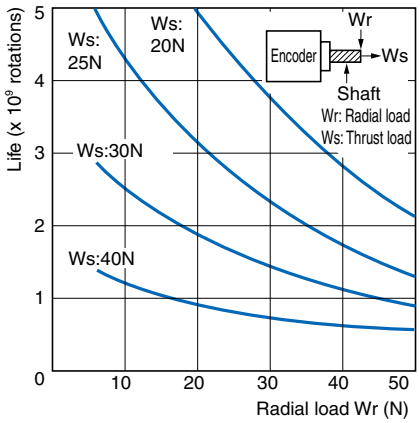


- When inserting the coupling into the shaft, do not tap it with a hammer or apply any other type of shock.
- When attaching or detaching the coupling, do not bend, compress, or pull excessively on the coupling.

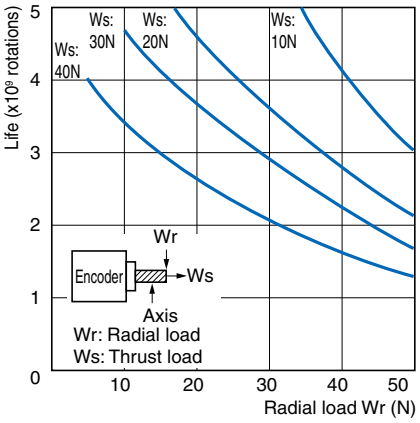
Life of Rotary Encoder Bearings

The life of bearings when a radial load and thrust load are applied are shown in the following graphs (theoretical value).

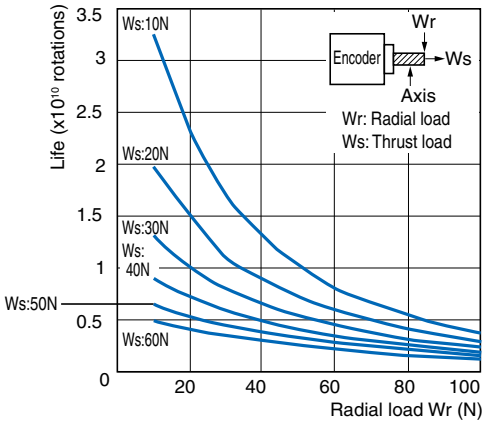
E6B2-C



E6C2-C□



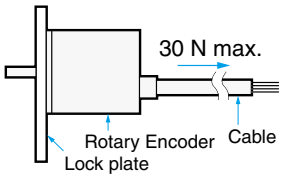
E6C3-C□H



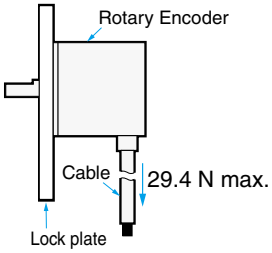
●Wiring

- If connecting the cable after securing the Encoder, do not pull on the cable with a force of 29.4 N or greater.

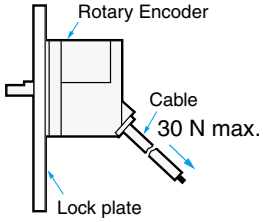
E6A2-C
E6J-A/C



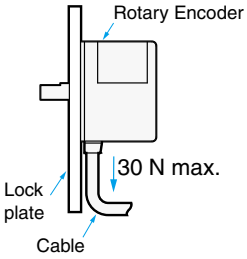
E6B2-C
E6D-C
E6C-N



E6C2-C



E6C3-C□H
E6C3-A



- If connecting the cable after securing the Encoder, do not pull on the cable. Also do not apply shock to the Encoder or shaft.

Connecting

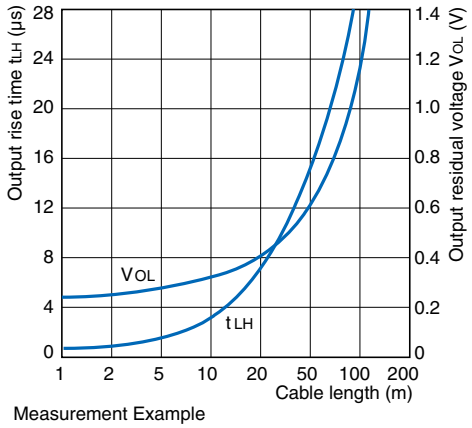
Connection

- When extending the cable, check the cable type and response frequency. Wire resistance and capacitance between wires may amplify residual voltage and cause waveform distortions. If the cable is extended, it is recommended to use a line-driver output. Regardless of the output type, only lengths of 30 m or less comply with the EMC Directive.
  To avoid inductive noise, keep the cabling as short as possible (particularly when inputting to an IC).
- If surges occur in the power supply, connect a surge absorber between the power supply and the Encoder. To reduce noise, keep the wiring as short as possible.
- Spurious pulses may be generated when the power is turned ON or OFF. Wait 0.1 s after turning ON the power before using the connected device, and stop using the connected device 0.1 s (1 s for E6CP-A) before turning OFF the power to the Encoder.
- Inrush current will flow when the power is turned ON. Take the value of the inrush current into consideration before using the power supply.

Cable Extension Characteristics

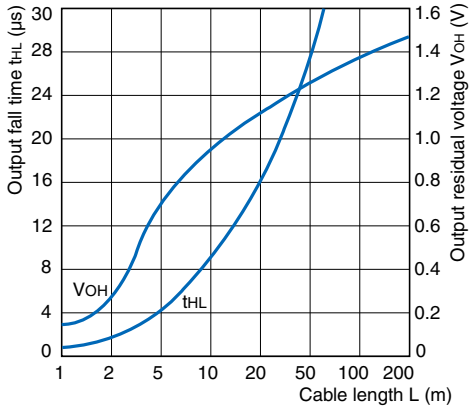
- When the cable length is extended, the output waveform startup time is lengthened and it affects the phase difference characteristics of phases A and B.
- The output waveform startup time changes not only according to the length of the cable, but also according to the load resistance and the cable type.
- Extending the cable length not only changes the startup time, but also increases the output residual voltage.

<E6B2-CWZ6C>



Measurement Example
Power supply voltage: 5 VDC
Load resistance: 1 kΩ (Output residual voltage is measured at a 35 mA load current.)
Cable: Special Cable

<E6C2-CWZ5B>



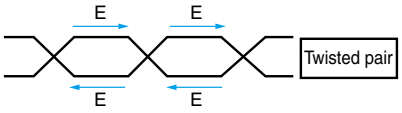
Measurement Example
Power supply voltage: 12 VDC
Load resistance: 5 mA (Output residual voltage is measured at a 35-mA load current.)
Cable: Special Cable

Preventing Counting Errors

Spurious pulses due to vibration may cause counting errors if the shaft is stationary near the rise or fall of the signal. Using an up/down counter can prevent the counting of error pulses.

Extending the Cable When Using a Line-driver Output

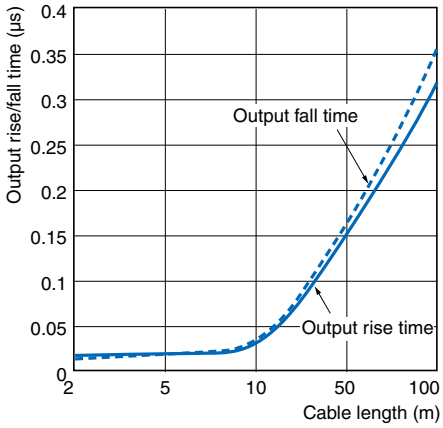
- Be sure to use shielded twisted-pair cable when extending the cable for a line-driver output. (Recommended Cable: TKVVBS4P-02A from Tachii Electric Wire Co.)
  Use an RS-422A Receiver for the receiver side.
- The structure of twisted-pair cable is suitable for RS-422A transmission. By twisting the two outputs as shown in the following diagram, electromotive force occurring in the wires is reciprocally canceled, and the noise element of normal mode is eliminated.



- When using a line-driver output, a power supply of 5 VDC is needed for the Encoder. The voltage will drop approximately 1 V per 100 m of cable.

<Using a Line Receiver IC>

Recommended IC: ICs from Texas Instruments Incorporated
AM26LS32, AM26C32

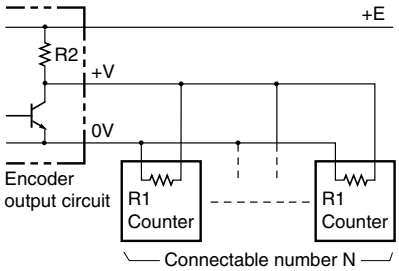


●Others

Input to More than One Counter from Encoder (with Voltage Output)

To connect multiple identical counters to one Encoder, use the following equation to determine the number of counters that can be connected.

$$\text{Number of connectable counters } N = \frac{R1(E - V)}{V \cdot R2}$$



E : Power supply voltage of Encoder
V : Input voltage of counter (min. value)
R1 : Input resistance of counter
R2 : Output resistance of Encoder

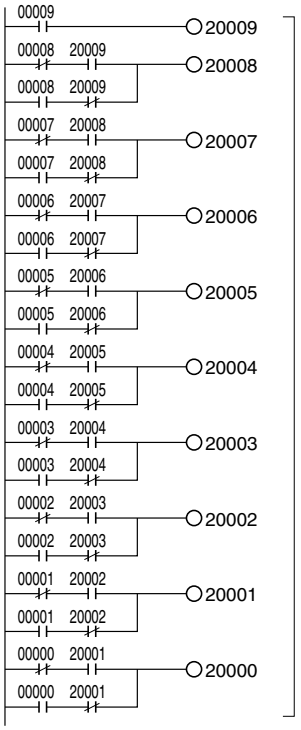
Gray Code → Binary Code Conversion

- This section explains how to convert gray code into binary values using PLC (Programmable Controller) ladder programming when the resolution is 720.

First, the following table shows a wiring example.

Encoder output signal	PLC input signal
Brown (2^0)	00000
Orange (2^1)	00001
Yellow (2^2)	00002
Green (2^3)	00003
Blue (2^4)	00004
Violet (2^5)	00005
Gray (2^6)	00006
White (2^7)	00007
Pink (2^8)	00008
Empty (2^9)	00009

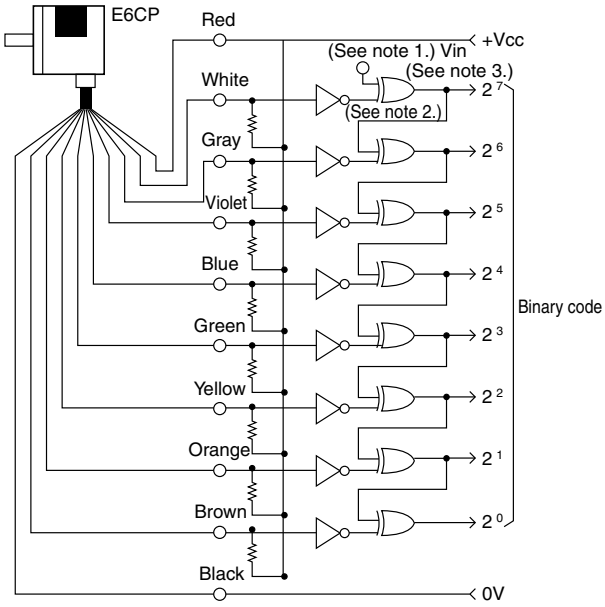
The following diagram shows converting gray code to binary using programming.
<Ladder Program Example>



The gray code is converted to binary and placed in IR 200. Bits 10 to 15 of IR200 are set to 0. (These bits are not used.)

Note: The ladder program example above is for a CPM1A or CQM1H PLC. Check the ladder programming with the model being considered for use.

- To convert gray code to binary code, refer to the circuits in the following diagram.



Note: 1. Vin can be connected to 0 V to convert to positive logic binary code.
2. Inverter
3. Exclusive OR

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