OMRON

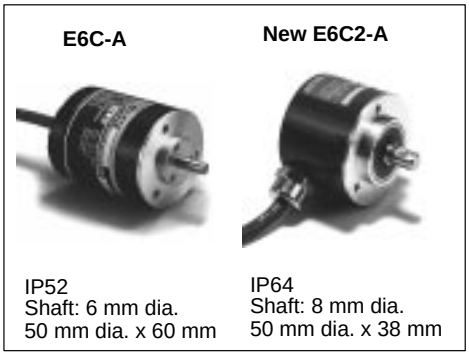
Absolute Rotary Encoder

E6C2-A

The Tough E6C2-A Absolute Rotary Encoder Provides IP64 Degree of Protection and Ensures Ease of Use in Combination with the Programmable Controller or Cam Positioner.

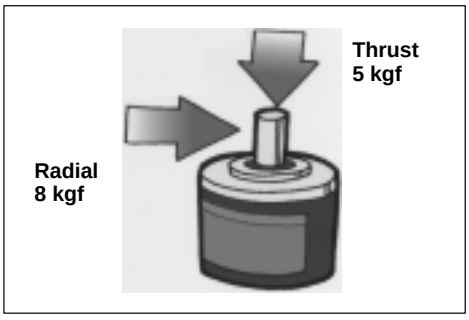
■ IP64 (IEC529) for Durability

The E6C2-A is a compact model that is 38 mm in length and 50 mm in diameter. It also incorporates a seal bearing, thus meeting IP64.



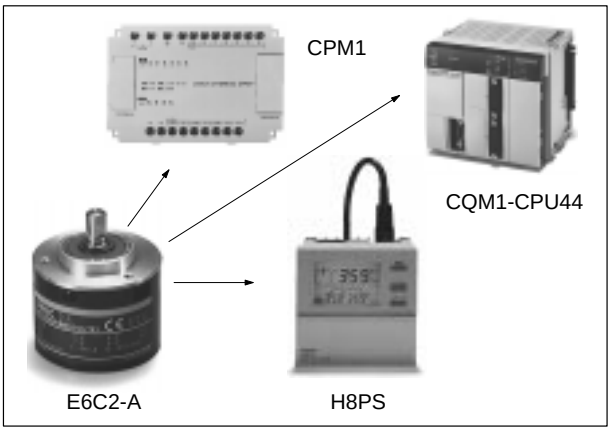
■ Shaft is Approximately Twice as Strong as Conventional Shafts

The E6C2-A has a stainless steel shaft that is 8 mm in diameter and approximately twice as strong as OMRON's conventional Rotary Encoder shaft. The E6C2-A also has a reliable bearing and metal slit plate, thus ensuring a shock resistance of 1,000 m/s^2.



■ Combines with the Programmable Controller or Cam Positioner for Ideal Angle Control

The E6C2-A resolution per rotation is as high as 256 (8 bits) to 1,024 (10 bits). The E6C2-A used in combination with the CQM1 Programmable Controller or H8PS Cam Positioner ensures ideal and easy angle control.



Ordering Information

Absolute Rotary Encoders

Supply voltage	Output configuration	Output code	Resolution (p/r)	Connection method	Model
12 to 24 VDC	NPN open collector output	Gray code	256	Connector	E6C2-AG5C-C
			256, 360, 720, 1,024	Pre-wired	E6C2-AG5C
		Binary	32, 40		E6C2-AN5C
		BCD	6, 8, 12		E6C2-AB5C
	PNP open collector output	Gray code	256, 360, 720, 1,024		E6C2-AG5B
		Binary	32, 40		E6C2-AN5B
		BCD	6, 8, 12		E6C2-AB5B
5 VDC	Voltage output	Binary	256		E6C2-AN1E
12 VDC					E6C2-AN2E

Note: 1. When ordering, specify the model number and resolution.
2. The H8PS can be connected to the E6C2-AG5C-C but not to the E6C2-AG5C.

■ Accessories (Order Separately)

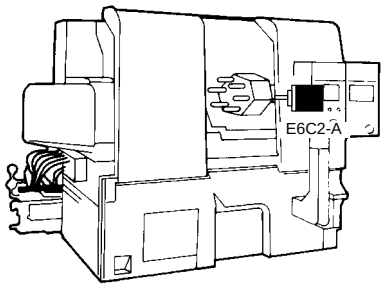
Refer to page 15 for details.

Item	Model
Coupling	E69-C08B
Flange	E69-FCA03
	E69-FCA04
Extension Cable (see note)	E69-DF5

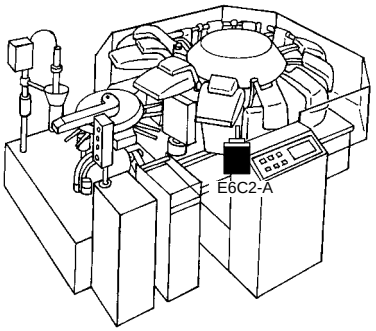
Note: In addition to the above Extension Cable, 10-, 15- 20-, and 98-m-long Extension Cables are available.

Application Examples

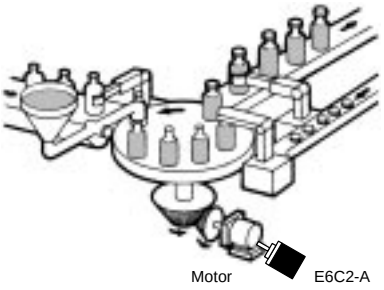
NC Machine Tool for Cutter Position Detection



Vacuum Packaging Machine



Bottling Machine for Table Position Detection



Specifications

■ Ratings/Characteristics

Item	E6C2-AG5C-C	E6C2-AG5C	E6C2-AN5C	E6C2-AB5C	E6C2-AG5B	E6C2-AN5B	E6C2-AB5B	E6C2-AN1E	E6C2-AN2E
Output configuration	NPN				PNP			Voltage output	
Power supply voltage	12 VDC$^{-10\%}$ to 24 VDC$^{+15\%}$, ripple (p-p) 5% max.							5 VDC ±5%	12 VDC ±10%
Current consumption	70 mA max.								80 mA max.
Resolution (see note 1) (pulses/rotation)	256	256, 360, 720, 1,024	32, 40	6, 8, 12	256, 360, 720, 1,024	32, 40	6, 8, 12	256	
Output code (absolute)	Gray code		Binary	BCD	Gray code	Binary	BCD	Binary	
Output capacity	Applied voltage: 30 VDC max. I_{sink}: 35 mA max. Residual voltage: 0.4 V max. (at sink current of 35 mA)				I_{sink}: 35 mA max. Residual voltage: 0.4 V max. (at sink current of 35 mA)			Output resistance: 2.4 kΩ	Output resistance: 8.2 kΩ
								I_{sink}: 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: 2m; I_{sink}: 35 mA max.)							Rise: 3 μs max. Fall: 1 μs max.	Rise: 10 μs max. Fall: 1 μs max.
Max. response frequency (see note 2)	20 kHz							10 kHz	
Logic	Negative logic output (H=0, L=1)				Positive logic output (H=1, L=0)				
Rotational direction (see note 3)	Output code incremented by clockwise rotation (as viewed from the face of the shaft.)							Changed using the rotational direction designation input.	
Strobe signal	Not available		Available		Not available	Available		Not available	
Positioning signal	Not available			Available	Not available		Available	Not available	
Parity signal	Not available		Available (even number)	Not available		Available (even number)	Not available		
Starting torque	9.8 mN • m max. at room temperature 14.7 mN • m max. at low temperature								
Moment of inertia	1.5 x 10^{-6} kg • m^2								
Shaft loading	Radial: 78.4 N Thrust: 49 N								
Maximum permissible rotation	5,000 rpm								
Ambient temperature	Operating: –10°C to 70°C (with no icing) Storage: –25°C to 85°C (with no icing)								
Ambient humidity	35% to 85% (with no condensation)								
Insulation resistance	1,000 MΩ min. (at 500 VDC) between current-carry parts and case								
Dielectric strength	500 VAC, 50/60 Hz for 1 min between current-carry parts and case								
Vibration resistance	Destruction: 10 to 500 Hz, 1.0-mm single amplitude or 150 m/s^2 for 11 min. 3 times each in X, Y, and Z directions.								
Shock resistance	Destruction: 1,000 m/s^2, 6 times each in X, Y, and Z directions								

Item	E6C2-AG5C-C	E6C2-AG5C	E6C2-AN5C	E6C2-AB5C	E6C2-AG5B	E6C2-AN5B	E6C2-AB5B	E6C2-AN1E	E6C2-AN2E
Degree of protection	IEC60529 IP64 (see note 4)								
Connection method	Connector (standard length: 2 m)	Pre-wired (standard length: 2m)							
Weight (packed state)	Approx. 300 g								
Others	Instruction manual								

Note: 1. The codes are classified as shown in the following table.

Output code	Resolution	Code number
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 code	256	0 to 255
	360	76 to 435 (Remainder of 76)
	720	152 to 871 (Remainder of 152)
	1,024	0 to 1,023

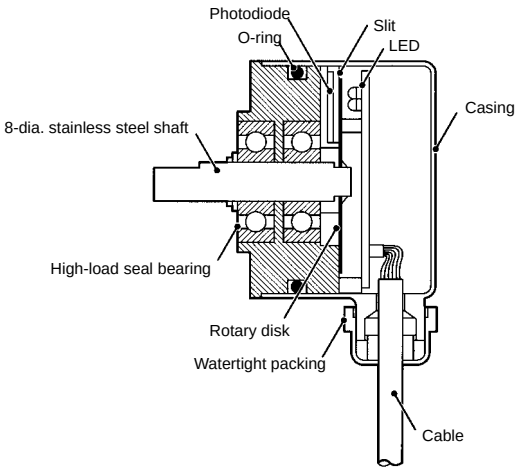
2. The electrical maximum response rotation is determined by using the resolution and maximum response frequency in the following formula.

$$\text{Electrical maximum response rotation (rpm)} = \frac{\text{Maximum response frequency}}{\text{Resolution}} \times 60$$

Therefore, a signal cannot follow electrically if the actual rotation exceeds the maximum response rotation.

3. With the E6C2-AN1E and E6C2-AN2E models, the output code can be increased in the clockwise direction by connecting the rotational direction designation input (wire color: pink) to H (Vcc), and the output code can be decreased in the clockwise direction by connecting the input to L (0 V).
   E6C2-AN1E: H=1.5 to 5 V, L=0 to 0.8 V
   E6C2-AN2E: H=2.2 to 12 V, L=0 to 1.2 V
   With the E6C2-AN1E and E6C2-AN2E models, read the code at least 10 μs after the LSB (2^0) code has changed.
4. JEM1030: applicable since 1991.

■ Construction



The E6C2-A incorporates a high-performance LED, custom-made diode array, high-density printed circuit board, and a compact, watertight, seal bearing that withstands heavy loads, thus ensuring high mechanical durability, watertight performance, and compactness. Furthermore, the O-ring applied to the casing and a watertight packing applied to the cable connector enhance the watertight performance of the E6C2-A.

Operation

■ Connections

Connector Specifications

Pin number	E6C2-AG5C-C
	Output signal
	8-bit (256)
1	NC
2	NC
3	2^5
4	2^1
5	2^0
6	2^7
7	2^4
8	2^2
9	2^3
10	2^6
11	Shield (GND)
12	12 to 24 VDC
13	0 V (Common)

Note: Connector type: RP13A-12PD-13SC (Hirose Electric)

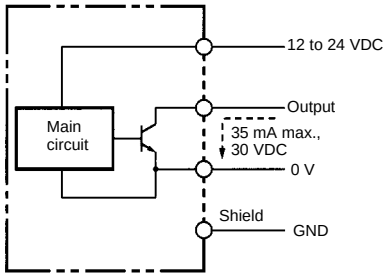
Cable Specifications

Wire color	E6C2-AG5C/E6C2-AG5B			E6C2-AN5C/ -AN5B	E6C2-AB5C/AB5B		E6C2-AN1E/ AN2E
	Output signal			Output signal	Output signal		Output signal
	8-bit (256)	9-bit (360)	10-bit (720, 1,024)	6-bit (32, 40)	3-bit (6, 8)	5-bit (12)	8-bit (256)
Brown	2^0	2^0	2^0	2^0	2^0	2^0	2^0
Orange	2^1	2^1	2^1	2^1	2^1	2^1	2^1
Yellow	2^2	2^2	2^2	2^2	2^2	2^2	2^2
Green	2^3	2^3	2^3	2^3	NC	2^3	2^3
Blue	2^4	2^4	2^4	2^4	NC	$2^0 \times 10$	2^4
Purple	2^5	2^5	2^5	2^5	NC	NC	2^5
Gray	2^6	2^6	2^6	Parity	Positioning	Positioning	2^6
White	2^7	2^7	2^7	Strobe	Strobe	Strobe	2^7
Pink	NC	2^8	2^8	NC	NC	NC	Rotational direction designation input
Light blue	NC	NC	2^9	NC	NC	NC	NC
---	Shield (GND)						
Red	12 to 24 VDC						5, 12 VDC
Black	0 V (Common)						

■ Output Circuit Diagrams

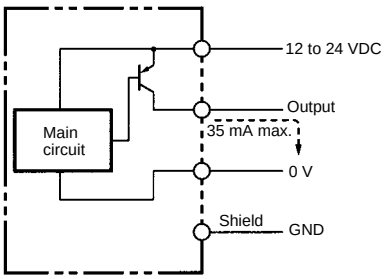
E6C2-AG5C/-AG5C-C and E6C2-AG5B Output Circuits

E6C2-AG5C/-AG5C-C



Note: Each output bit uses the same circuit.

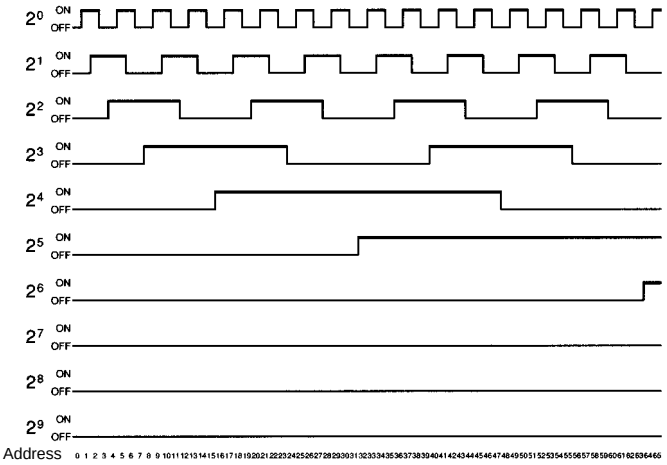
E6C2-AG5B



Note: Each output bit uses the same circuit.

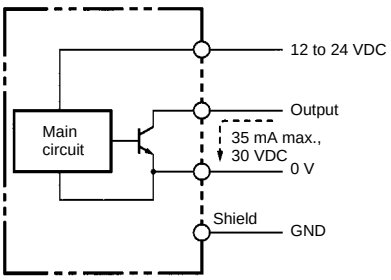
E6C2-AG5C/-AG5C-C and E6C2-AG5B Output Modes

Rotating direction: CW, as viewed from the face of the shaft.



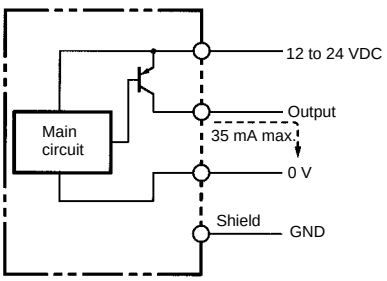
E6C2-AN5C and E6C2-AN5B Output Circuits

E6C2-AN5C



Note: Each output bit uses the same circuit.

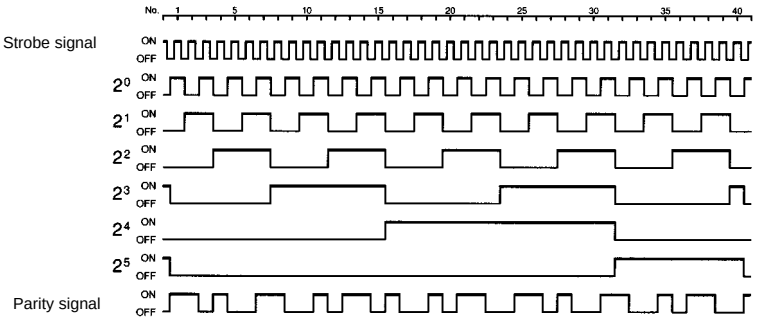
E6C2-AN5B

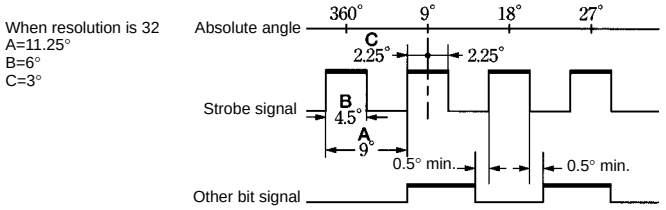


Note: Each output bit uses the same circuit.

E6C2-AN5C and E6C2-AN5B Output Modes

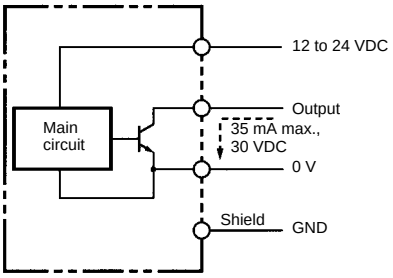
Rotating direction: CW, as viewed from the face of the shaft.
Resolution: 40





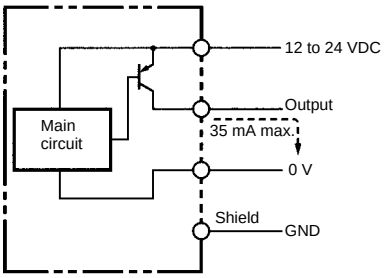
E6C2-AB5C and E6C2-AB5B Output Circuits

E6C2-AB5C



Note: Each output bit uses the same circuit.

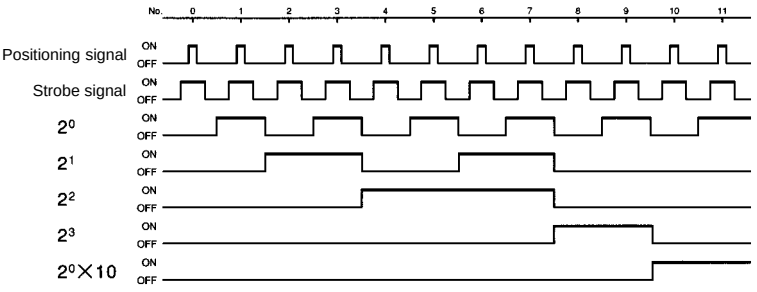
E6C2-AB5B

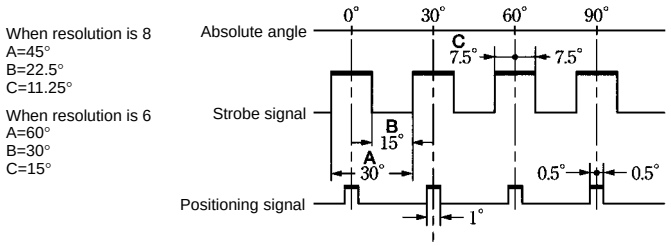


Note: Each output bit uses the same circuit.

E6C2-AB5C and E6C2-AB5B Output Modes

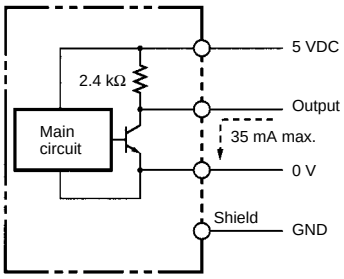
Rotating direction: CW, as viewed from the face of the shaft.
Resolution: 12





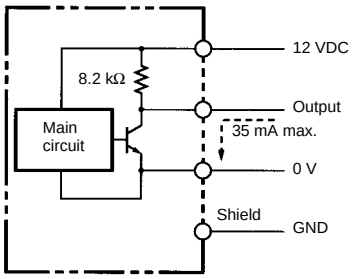
E6C2-AN1E and E6C2-AN2E Output Circuits

E6C2-AN1E



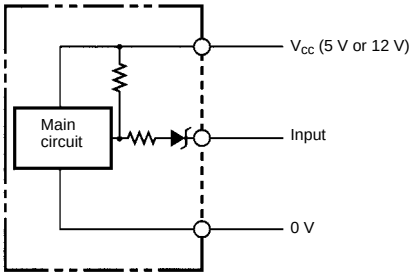
Note: Each output bit uses the same circuit.

E6C2-AN2E



Note: Each output bit uses the same circuit.

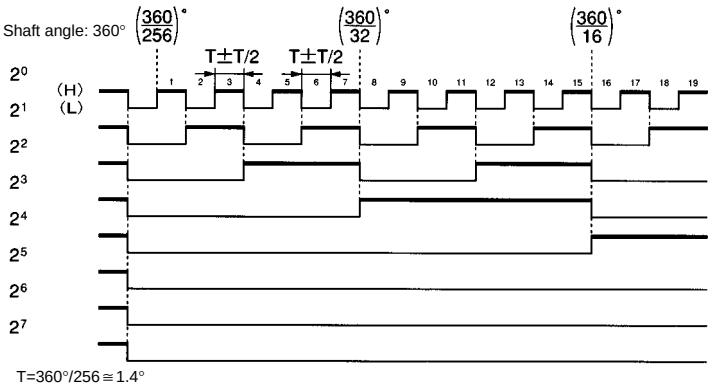
Rotational Direction Designation Input Circuit



Note: Output code increases in the clockwise direction when the input is connected to Vcc and decreases in the clockwise direction when the input is connected to 0 V.

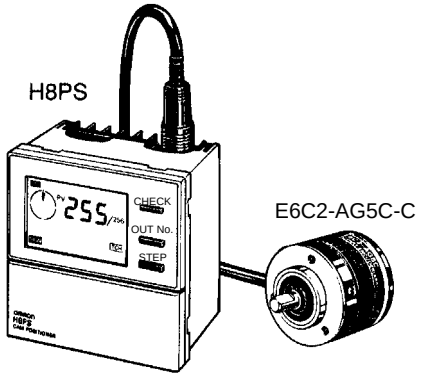
E6C2-AN1E and E6C2-AN2E Output Modes

Rotating direction: CW, as viewed from the face of the shaft, when rotational direction designation input is at “H.”
CCW, as viewed from the face of the shaft, when rotational direction designation input is at “L.”



■ Connection Examples

Connecting E6C2-AG5C-C to H8PS Cam Positioner



Model	Mounting method	Output configuration
H8PS-8B	Flush	NPN transistor output
H8PS-8BP		PNP transistor output
H8PS-8BF	Surface/Track	NPN transistor output
H8PS-8BFP		PNP transistor output

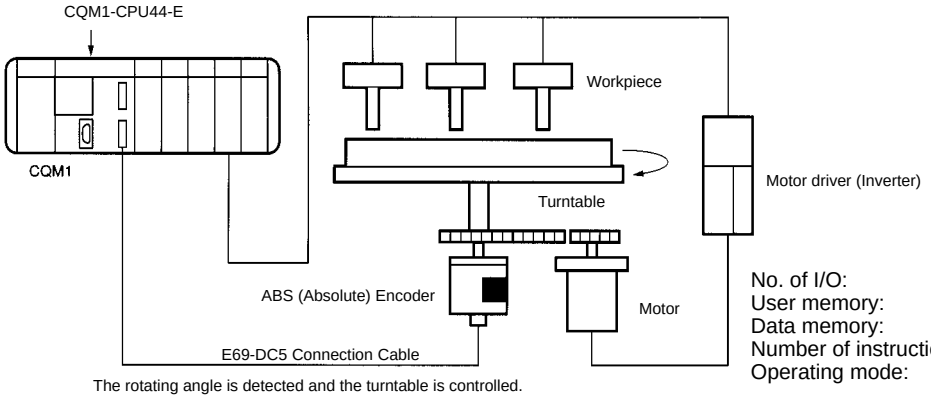
Specifications

Rated voltage	24 VDC
Cam resolution	1.4° (a resolution of 256 per rotation)
Outputs	Open-collector transistor output NPN: H8PS-8B(F) PNP: H8PS-8B(F)P Cam outputs: 8 lines (Output No. 1 to 8) 30 VDC max., 100 mA max. (residual voltage: 2 V max.) RUN OUT: Turns ON in Run and Test modes, OFF in Program mode in case of error 30 VDC max., 100 mA max. (residual voltage: 2 V max.) TACHOMETER: 60-ppr signal output for rpm meter 30 VDC max., 30 mA max. (residual voltage: 0.5 V max. for NPN models, 2 V max. for PNP models)
Encoder response	330 rpm
Functions	Origin compensation (zero shift) Rotating direction selection Angle display selection Teaching

■ Connecting E6C2-AG5C to Programmable Controller

Example of Connection to CQM1-CPU44-E High-capacity CPU Unit with Absolute Interface and RS-232C Port

Position data can be directly input as 8, 10, or 12-bit gray code signals from Absolute Encoders to the CQM1-CPU44-E. The position data input is backed up during power failures. Therefore, the origin return operation is not required after the power supply resumes. Furthermore, the origin compensation function of the E6C2-AG5C makes it possible to use any position for the origin.



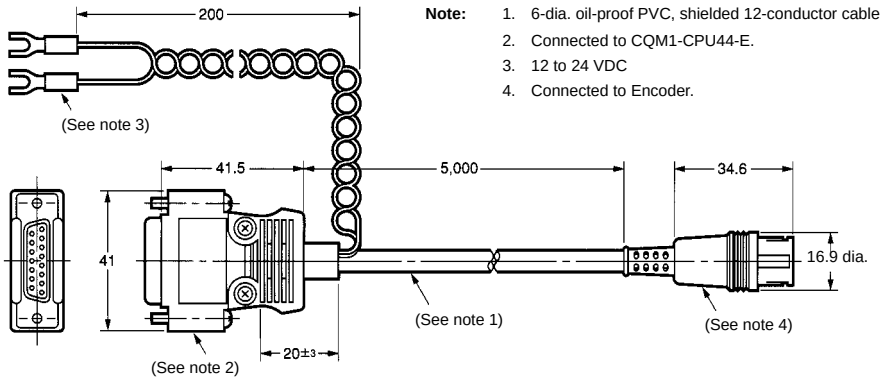
The rotating angle is detected and the turntable is controlled.

No. of I/O:	192 points max.
User memory:	7.2 Kwords
Data memory:	6 Kwords
Number of instructions:	118
Operating mode:	BCD or 360° mode (selectable)

Input Specifications

Input voltage	24 VDC$^{+10\%}_{-15\%}$
Input impedance	5.4 kΩ
Input current	4 mA (TYP.)
ON voltage	16.8 VDC min.
OFF voltage	3.0 VDC max.
Counting speed	4 kHz max.
Input code	Gray code (8, 10, or 12 bits)

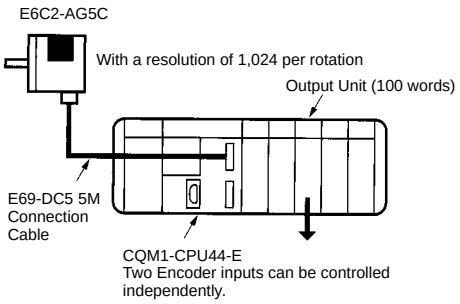
E69-DC5 5M Connection Cable for CQM1-CPU44-E (Order Separately)



Note:
1. 6-dia. oil-proof PVC, shielded 12-conductor cable (7/0.18 dia.); standard length: 5 m
2. Connected to CQM1-CPU44-E.
3. 12 to 24 VDC
4. Connected to Encoder.

System Configuration Using a Resolution of 1,024 per Rotation

A combination of the CQM1-CPU44E and E6C2-AG5C ensures easy output angle setting for cam control in 360° or BCD mode.

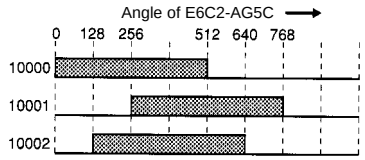


Mode Setting of CQM1-CPU44-E

Set port 1 to BCD mode and 10 bits

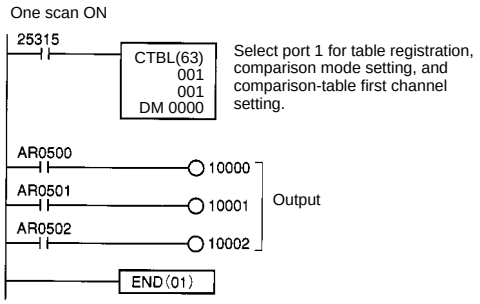
DM 6643 | 0001 |

Output Timing

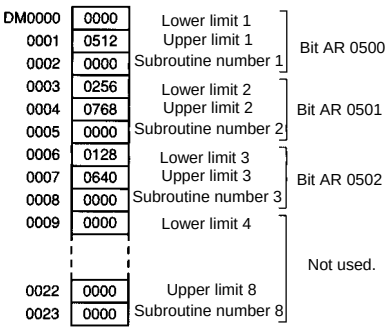


Ladder Program Example

Use the CTBL instruction of the CQM1-CPU44-E to register a maximum of eight comparison tables for output angle setting.



Example of DM Setting for Comparison Table

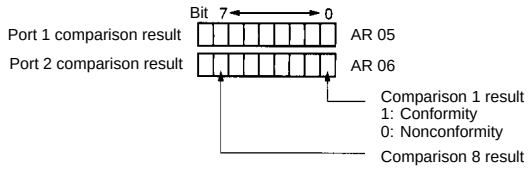


Note: An upper or lower limit can be set with integers in BCD mode and 5° increments in 360° mode. Subroutine numbers are set for interrupt processing.

Internal Bits of CQM1-CPU44-E

- Range Comparison Result

Each bit of the CQM1-CPU44-E CPU Unit's words AR 05 and AR 06 turns ON only when the comparison range coincides with the angle of E6C2-AG5C.

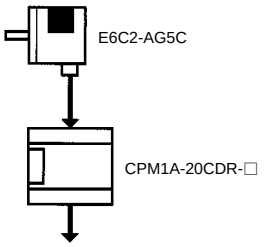


- Present Value Read

The gray code signals of the E6C2-AG5C are automatically converted into BCD or 360° code signals and read through the CQM1-CPU44-E CPU Unit's words AR 232 and AR 234. The present value can be used for ladder programs.

Port 1 angle	＊＊＊＊	Word 232
Port 2 angle	＊＊＊＊	Word 234

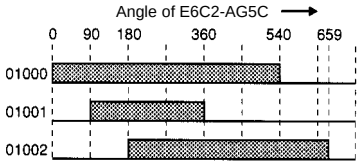
Connecting to CPM1A Using a Resolution of 720 per Rotation



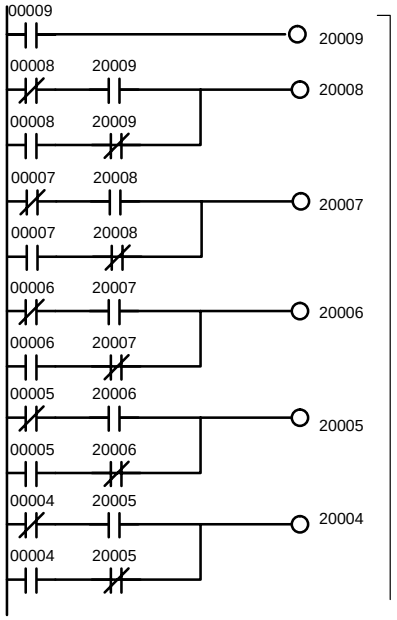
Wiring Between E6C2-AG5C and CPM1A

Output signal from E6C2-AG5C	Input signal to CPM1A
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

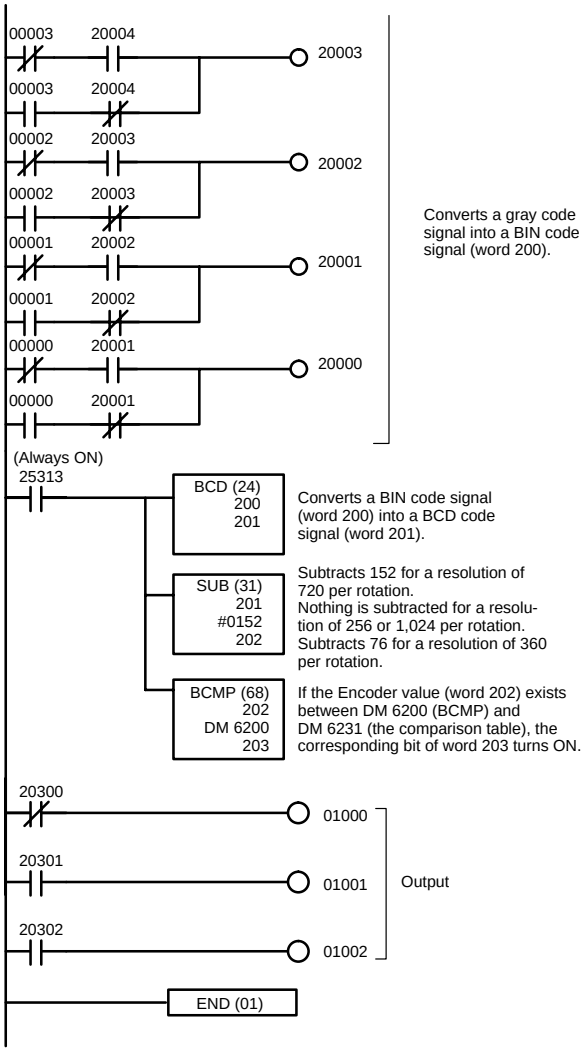
Output Timing



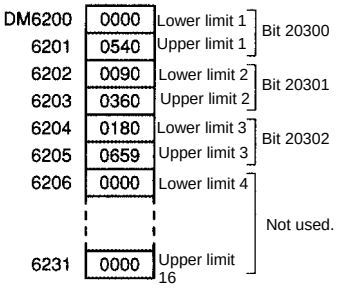
Ladder Program



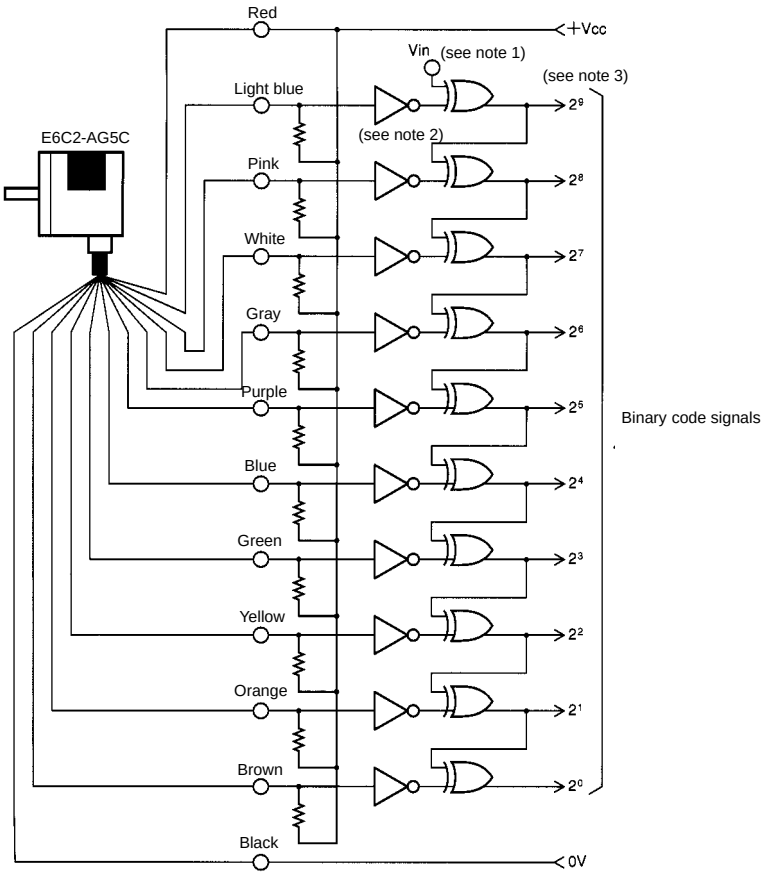
Converts a gray code signal into a BIN code signal (word 200).



Example of DM Setting for Comparison Table



■ Gray-to-Binary Conversion Circuit Reference



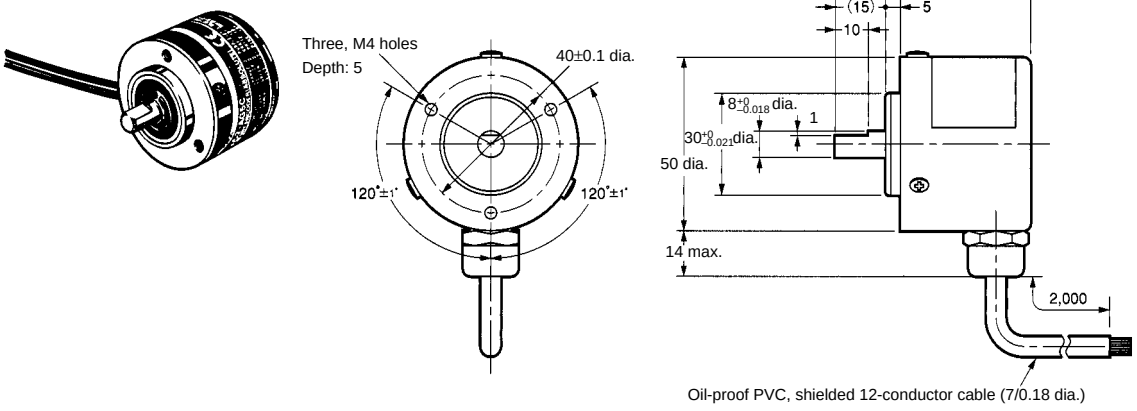
Note: 1. Signal can be converted into positive-logic binary code signals if 0 V is connected to Vin.
2. Inverter
3. Exclusive OR (EOR)

Note: The above circuit example is for 10-bit signals. For 9-bit signals, input Vin into the EOR of 2^8, and for 8-bit signals, input Vin into the EOR of 2^7.

Dimensions

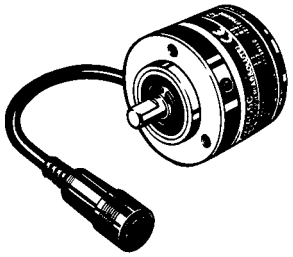
Note: All units are in millimeters unless otherwise indicated.

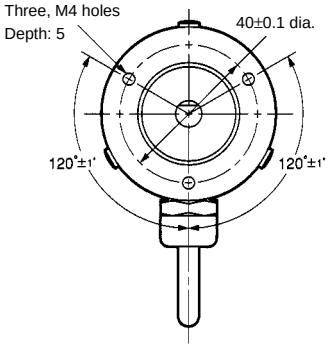
E6C2-A□5□
E6C2-AN□E

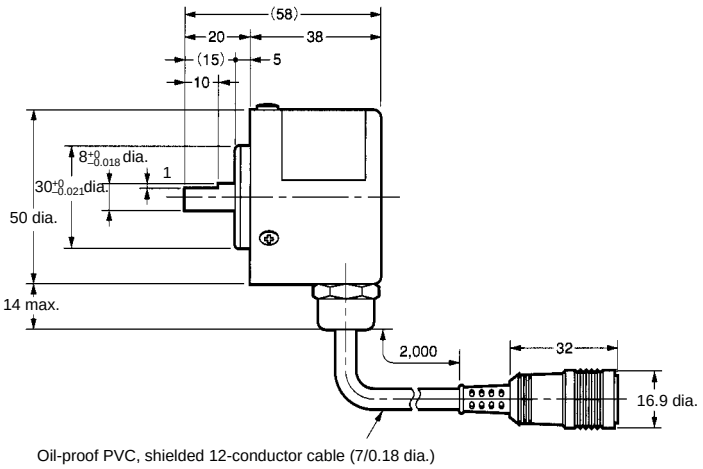


Note: E69-C08B Coupling is sold separately.

E6C2-AG5C-C







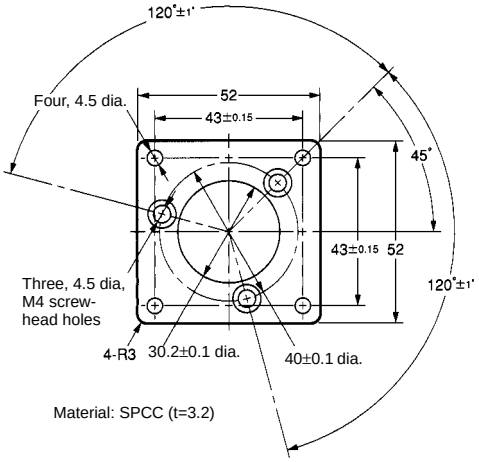
Oil-proof PVC, shielded 12-conductor cable (7/0.18 dia.)

Note: E69-C08B is sold separately.

■ Accessories (Order Separately)

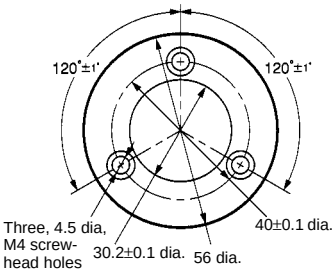
Flanges

E69-FCA03

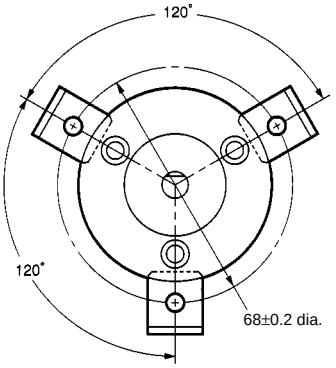


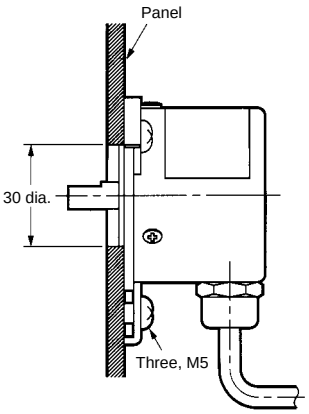
Material: SPCC (t=3.2)

E69-FCA04

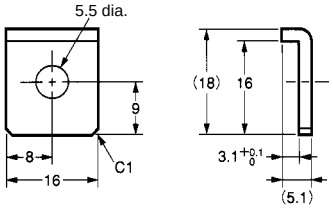


Mounting Bracket Installation





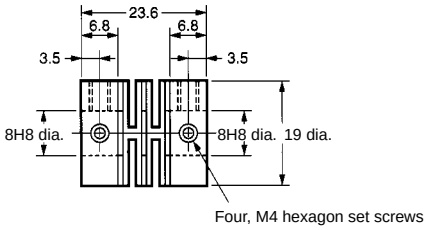
Mounting Brackets
(Three Mounting Brackets Attached)



Material: SPCC (t=3.2)

Coupling

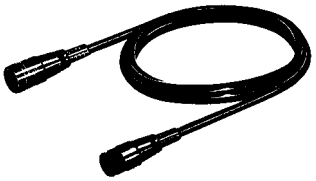
E69-C08B



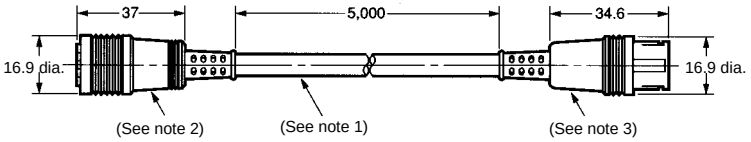
Note: Material: Glass-reinforced PBT

Extension Cable

E69-DF5



Note: The Cable can be extended up to 100 m for connecting the H8PS.



Note:
1. 6-dia. oil-proof PVC, shielded 12-conductor cable (7/0.18 dia.); standard length: 5 m
2. Connects to the H8PR Rotary Positioner and H8PS Cam Positioner.
3. Connects to the connector of the E6C2-AG5C-C.

Precautions

1. The following actions may damage the E6C2-A.
   - Imposing a voltage which exceeds the rated voltage range.
   - Mistakes in wiring such as an error in power supply polarity.
   - Wiring while the E6C2-A is turned ON.
   - Load short-circuiting.
2. Do not wire power lines or high-tension lines alongside the lines of the E6C2-A, otherwise the E6C2-A may be damaged or malfunction due to induction. Be sure to wire the lines of the E6C2-A separately from power lines or high-tension lines.

Correct Use

1. If the power supply has surge voltage, connect a surge supressor between the positive and negative terminals of the power supply to absorb the surge voltage. Also, in order to protect the E6C2-A from noise as much as possible, shorten the wires connected to the E6C2-A as much as possible.
2. Unnecessary pulses are output at the time the E6C2-A is turned ON or OFF. After turning ON the E6C2-A, be sure to wait 1 s before turning ON the peripheral devices connected to the E6C2-A 1 s and turn OFF the peripheral devices 0.1 s before turning OFF the E6C2-A.
3. The E6C2-A consists of high-precision components and must be handled with utmost care.
   - Be sure that the E6C2-A is free of water or oil drops.
   - If the E6C2-A is mounted and wired with a cable, do not pull the cable with a force exceeding 29.4 N {3 kgf}.
   - The E6C2-A can be mounted with screws, in which case, be sure that the tightening torque applied to each screw does not exceed 0.49 N • m {5 kgf • cm}.
   - Do not impose excessive loads on the shaft, otherwise the shaft may break. The shaft may be coupled with a chain timing belt and gear only through a coupling and bearing.
   - If a significant installation error is made (misalignment), the shaft will be subjected to an excessive force that will damage the shaft.
   - When inserting the shaft into the coupling, do not use excessive force (by striking the coupling or shaft with a hammer, for example).
   - Do not impose excessive bending, pressure, or pulling force on the E6C2-A when inserting the shaft into the coupling or separating the coupling from the shaft.

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Cat. No. Q107-E1-2 **In the interest of product improvement, specifications are subject to change without notice.**

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