

Absolute Rotary Encoder

E6C2-A



Use the Tough E6C2-A (IP64 Enclosure Rating) Combined with a PLC or Cam Positioner for Optimum Control and Ease-of-Use

- Incorporates a sealed bearing, meeting IP64 for durability
- Compact: 50-mm diameter x 38-mm height
- 8 mm-dia. stainless steel shaft is twice as strong as conventional shafts
- Reliable bearing and metal slit plate ensure shock resistance of 1000 m/s²



Ordering Information

■ ABSOLUTE ROTARY ENCODERS

| Appearance | Connection method | Connecting device | Resolution (p/r) | Part number |
|---|-------------------|-------------------------|----------------------|---|
|  | Cable | Programmable Controller | 256, 360, 720, 1,024 | E6C2-AG5C 256 E6C2-AG5C 360 E6C2-AG5C 720 E6C2-AG5C 1024 |
|  | Connector | H8PS Cam Positioner | 256 | E6C2-AG5C-C 256 |

Note: The H8PS can be connected to the E6C2-AG5C-C but not to the E6C2-AG5C.

■ ACCESSORIES (ORDER SEPARATELY)

Refer to *Dimensions* section for details

| Item | Part number |
|-----------------|----------------------|
| Coupling | E69-C08B |
| Flange | E69-FCA-03 |
| | E69-FCA-04 |
| Extension cable | 5 m E69-DF5 |
| | 10 m E69-DF10 |
| | 15 m E69-DF15 |
| | 20 m E69-DF20 |

Specifications

■ RATINGS/CHARACTERISTICS

| | | |
|--------------------------------------|-------------------|---|
| Power supply voltage | | 12 VDC ^{-10%} to 24 VDC ^{+15%} , ripple (p-p) 5% max. |
| Current consumption | | 70 mA max. |
| Resolution (See Note 1) | | 256, 360, 720, 1,024 P/R |
| Output code (absolute) | | Gray code |
| Output configuration | | NPN open collector |
| Output capacity | Applied voltage | 30 VDC max. |
| | I _{sink} | 35 mA max. |
| | Residual voltage | 0.4 V max. |
| Max. response frequency (See Note 2) | | 20 kHz |
| Logic | | Negative logic output (H=0, L=1) |
| Rotational direction | | Clockwise, as viewed from the face of the shaft |
| Rise and fall times of output | | 1 μs max. (cable length: 2m; I _{sink} : 35 mA max.) |
| Starting torque | | 100 gf • cm (0.087 in • lbf) max. at room temperature 150 gf • cm (0.13 in • lbf) max. at low temperature |
| Moment of inertia | | 15 g • cm ² (1.5 x 10 ⁻⁶ kg • m ²) or 0.005 lb • in ² max. |
| Shaft loading | Radial | 8 kgf (78.4N) or 17.6 lbf |
| | Thrust | 5 kgf (49N) or 11.0 lbf |
| Maximum permissible rotation | | 5,000 rpm |
| Ambient temperature | Operating | -10°C to 70°C (14°F to 158°F) with no icing |
| | Storage | -25°C to 85°C (-13°F to 185°F) with no icing |
| Ambient humidity | Operating | 35% to 85% (with no condensation) |
| Insulation resistance | | 20 MΩ min. (at 100 VDC) between carry parts and case |
| Dielectric strength | | 500 VAC, 50/60 Hz for 1 min between carry parts and case |
| Vibration resistance | | Destruction: 10 to 500 Hz, 1.0-mm single amplitude or 150 m/s ² (approx. 15G) for 11 min. 3 times each in X, Y, and Z axes |
| Shock resistance | | Destruction: 1,000 m/s ² (approx. 100G) 3 times each in X, Y, and Z axes |
| Degree of protection | | IEC IP64 |
| Weight | | 300 g (0.66 lbs) with 2-m cable |

Note: 1. A gray code signal with a remainder of 76 is used for a resolution of 360 per rotation and a gray code signal with a remainder of 152 is used for a resolution of 720 per rotation. Therefore, the code signal for a resolution of 360 per rotation uses addresses 76 through 435 and that for a resolution of 720 per rotation uses addresses 152 through 871.

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

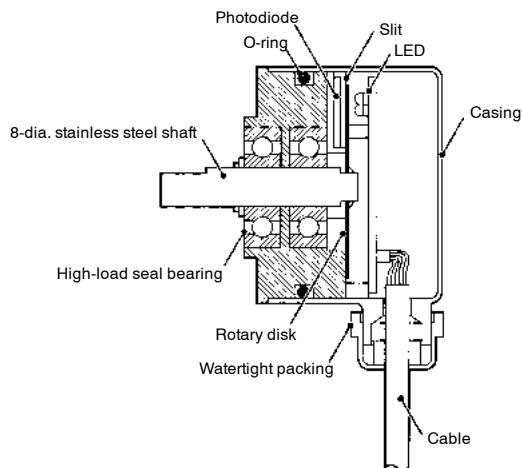
$$\text{Electrical maximum response rotation (rpm)} = \frac{\text{Maximum response frequency}}{\text{Resolution}} \times 60$$

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

Connections

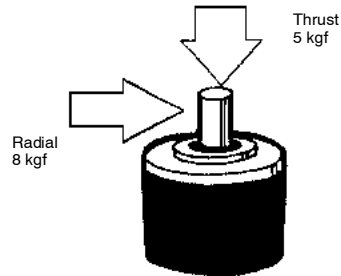
■ DURABLE DESIGN

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. The O-ring applied to the casing and a watertight packing applied to the cable connector enhance the watertight performance of the E6C2-A.



■ SHAFT STRENGTH

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, ensuring a shock resistance of 1,000 m/s².



Operation

■ CONNECTIONS

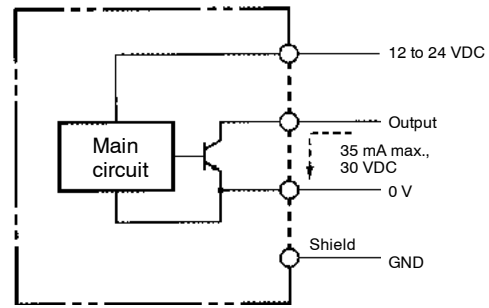
Cable Specifications

| Wire color | Output signal | | |
|------------|----------------|----------------|---------------------|
| | E6C2-AG5C | | |
| | 8-bit (256) | 9-bit (360) | 10-bit (720, 1,024) |
| Light blue | NC | NC | 2 ⁹ |
| Pink | NC | 2 ⁸ | 2 ⁸ |
| Purple | 2 ⁵ | 2 ⁵ | 2 ⁵ |
| Orange | 2 ¹ | 2 ¹ | 2 ¹ |
| Brown | 2 ⁰ | 2 ⁰ | 2 ⁰ |
| White | 2 ⁷ | 2 ⁷ | 2 ⁷ |
| Blue | 2 ⁴ | 2 ⁴ | 2 ⁴ |
| Yellow | 2 ² | 2 ² | 2 ² |
| Green | 2 ³ | 2 ³ | 2 ³ |
| Gray | 2 ⁶ | 2 ⁶ | 2 ⁶ |
| --- | Shield (GND) | | |
| Red | 12 to 24 VDC | | |
| Black | 0 V (Common) | | |

■ CONNECTOR SPECIFICATIONS

| | |
|------------|----------------|
| | Output signal |
| | E6C2-AG5C-C |
| Pin number | 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) |

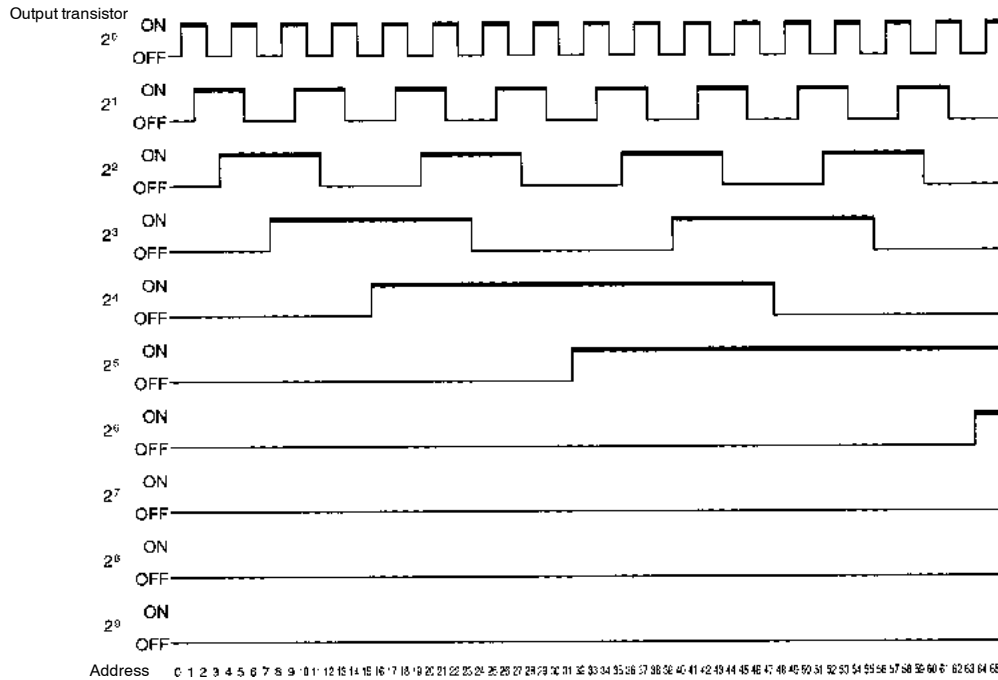
■ OUTPUT CIRCUIT DIAGRAM



Note: Each output bit uses the same circuit.

■ OUTPUT MODE

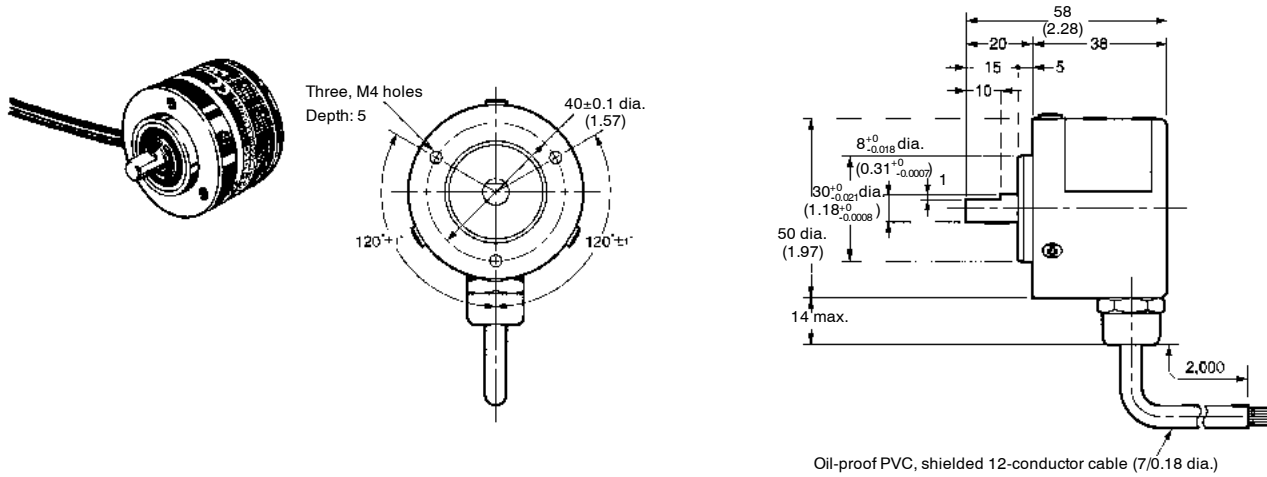
Rotating direction: CW, as viewed from the face of the shaft.



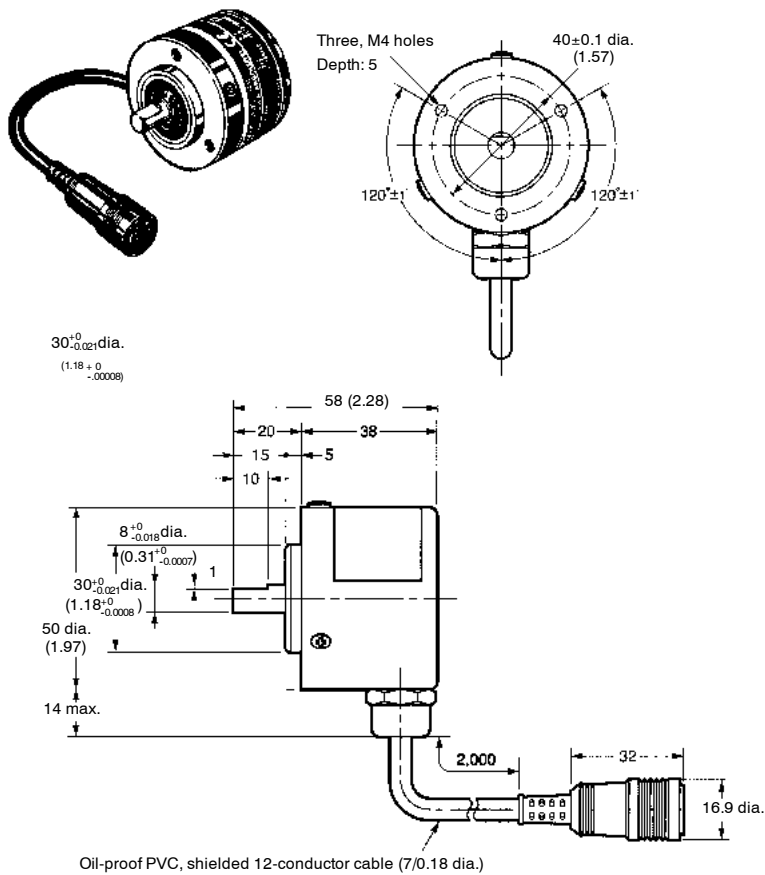
Dimensions

Unit: mm (inch)

■ E6C2-AG5C

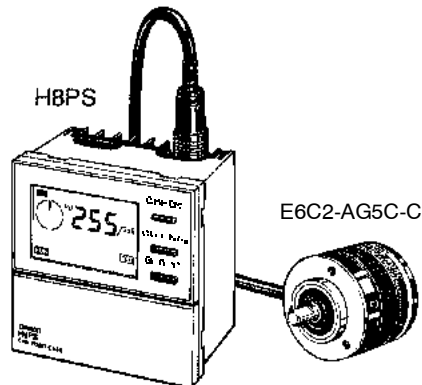


■ E6C2-AG5C-C



Installation

■ 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 |

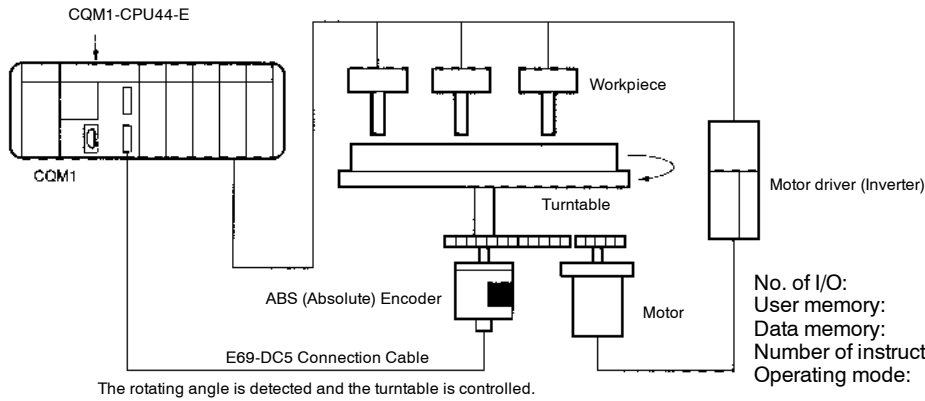
Specifications

| | |
|------------------|---|
| Rated voltage | 24 VDC |
| Cam resolution | 1.4° (a resolution of 256 per rotation) |
| Outputs | <p>Open-collector transistor output NPN: H8PS-8B(F) PNP: H8PS-8B(F)P</p> <p>Cam outputs: 8 lines (Output No. 1 to 8) 30 VDC max., 100 mA max. (residual voltage: 2 V max.)</p> <p>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.)</p> <p>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)</p> |
| 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.

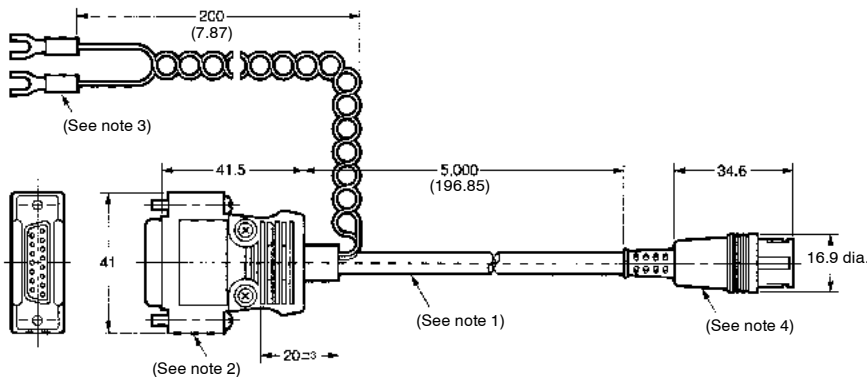


No. of I/O: 192 points max.
 User memory: 7.2 Kwords
 Data memory: 6 Kwords
 Number of instructions: 118
 Operating mode: BCD or 360° mode (selectable)

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) |

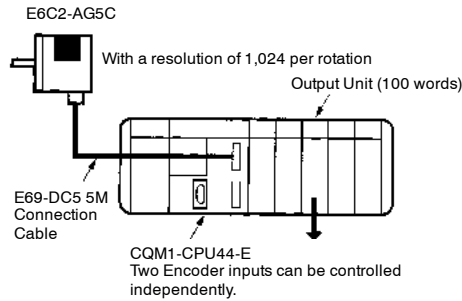
E69-DC5 5M Connection Cable for CQM1-CPU44-E (Order Separately)



- 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-CPU4-4E and E6C2-AG5C ensures easy output angle setting for cam control in 360° or BCD mode.

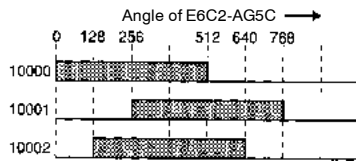


Mode Setting of CQM1-CPU44-E

Set port 1 to BCD mode and 10 bits

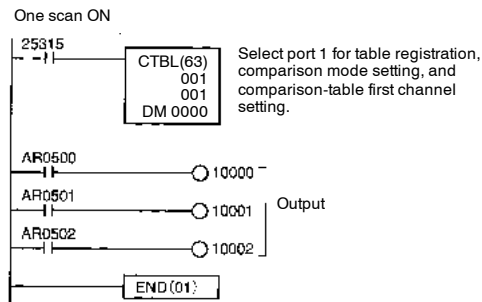
DM 6643 0001

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

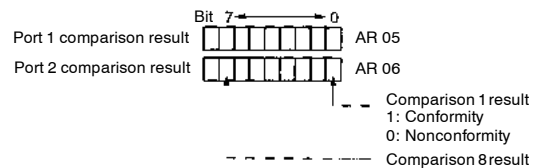
| | | | |
|--------|------|---------------------|---------------|
| DM0000 | 0000 | Lower limit 1 | } Bit AR 0500 |
| 0001 | 0512 | Upper limit 1 | |
| 0002 | 0000 | Subroutine number 1 | } Bit AR 0501 |
| 0003 | 0256 | Lower limit 2 | |
| 0004 | 0768 | Upper limit 2 | } Bit AR 0502 |
| 0005 | 0000 |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

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.

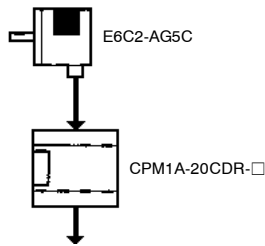


- Present Value Read

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

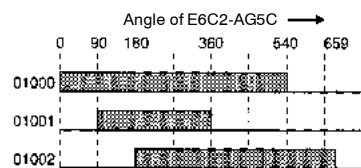
CONNECTING TO CPM1A USING A RESOLUTION OF 720 PER ROTATION



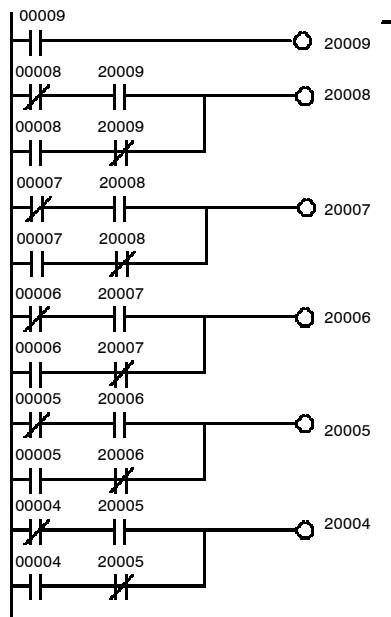
Wiring Between E6C2-AG5C and CPM1A

| 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 |

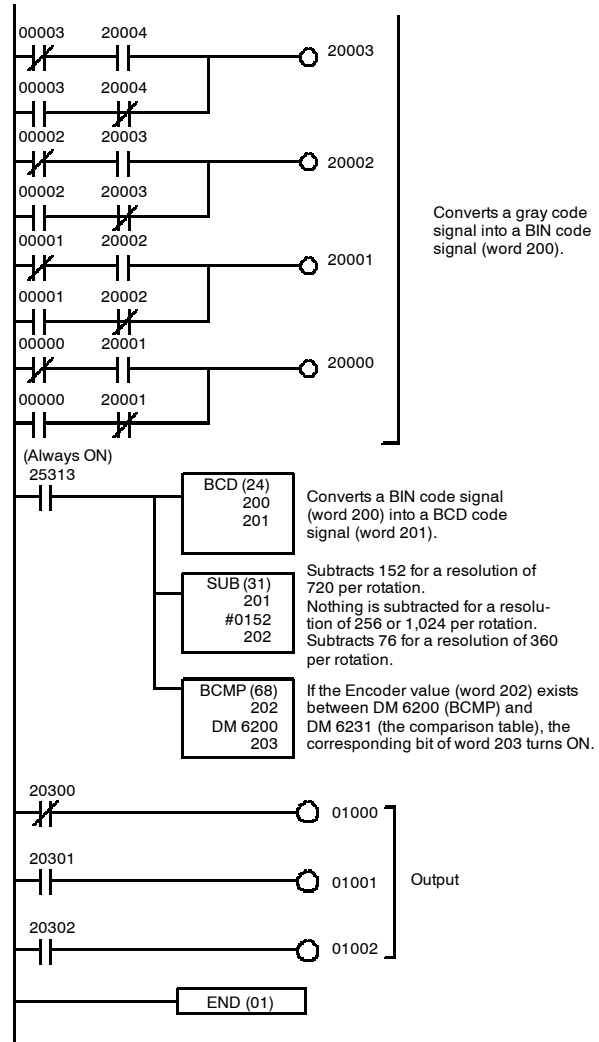
Output Timing



Ladder Program



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



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

Converts a BIN code signal (word 200) into a BCD code signal (word 201).

Subtracts 152 for a resolution of 720 per rotation. Nothing is subtracted for a resolution of 256 or 1,024 per rotation. Subtracts 76 for a resolution of 360 per rotation.

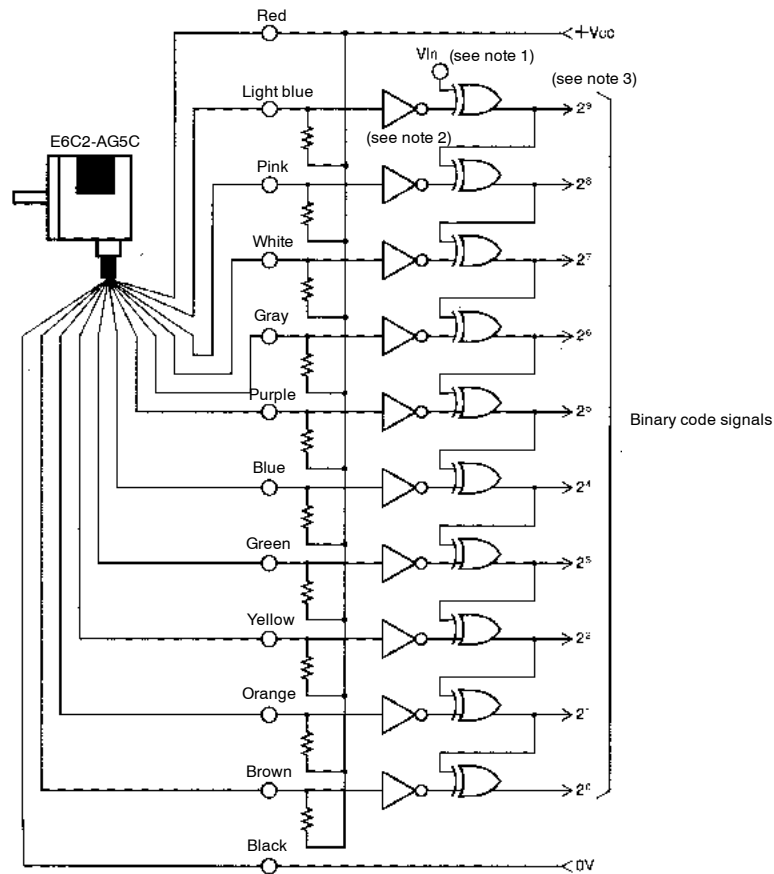
If the Encoder value (word 202) exists between DM 6200 (BCMP) and DM 6231 (the comparison table), the corresponding bit of word 203 turns ON.

Example of DM Setting for Comparison Table

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

■ GRAY-TO-BINARY CONVERSION CIRCUIT REFERENCE

Note: This circuit example is for 10-bit signals. For 9-bit signals, input V_{in} into the XOR of 2^8 , and for 8-bit signals, input V_{in} into the XOR of 2^7 .



Note: 1. Signal can be converted into positive-logic binary code signals if 0 V is connected to V_{in} .

2. Inverter
3. Exclusive OR (EOR)

NOTE: DIMENSIONS SHOWN ARE IN MILLIMETERS. To convert millimeters to inches divide by 25.4.

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