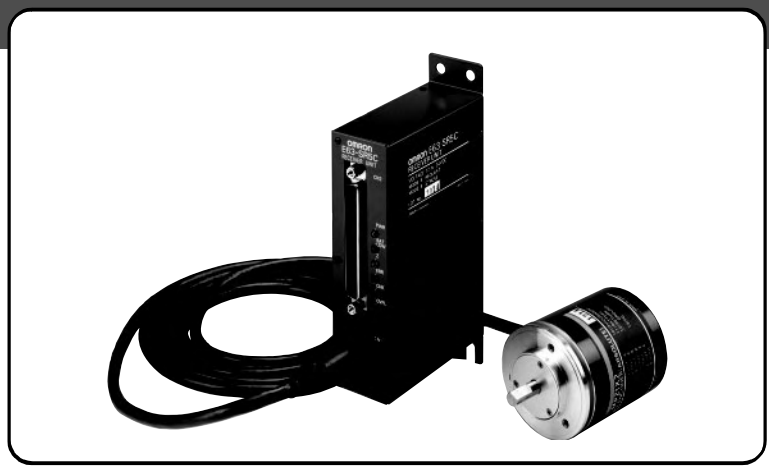
OMRON

Multi-turn Absolute Encoder
E6C-M



Compact, Multi-turn Absolute Rotary Encoder Reducing the Size of Required Equipment

- Data is retained and rotational measurement continues even after power is interrupted.
- High-resolution 23-bit sensing in a compact package (60 mm long × 50 mm in diameter).
- Drip-proof, oil-proof construction meets IP64F standards.
- Wiring is reduced through serial transfer of position signals.
- Receiver Unit converts the serial signal to a parallel signal.

<READ AND UNDERSTAND THIS CATALOG>

Please read and understand this catalog before purchasing the products. Please consult your OMRON representative if you have any questions or comments.

Ordering Information

Name	Model
Multi-turn Absolute Encoder	E6C-MPZ1X2
Receiver Unit	E63-SR5C

■ Accessories (Order Separately)

Name	Model	Remarks
Coupling	E69-C06B	---
	E69-C68B	Different end diameter
	E69-C610B	Different end diameter
	E69-C06M	Metal construction
Servo Mounting Bracket	E69-2	Three brackets in a set, provided with the Encoder
Extension Cable	E69-DM5	5 m (See note.)
D-sub Connector	XM2A-3701	Plug
	XM2S-3711	Hood

Note: The total extended length is 30 m max. (including the 2-m cable attached to the Absolute Encoder).

Specifications

■ Ratings/Characteristics

Item		E6C-MPZ1X2	E63-SR5C
Power supply voltage		---	12 VDC$^{-10\%}$ to 24 VDC$^{+15\%}$
Current consumption		150 mA max. (See note 1.)	200 mA max.
Resolution	Absolute	Single-turn: 2,048/rotation (11 bits) Multi-turn: 4,096 rotations (12 bits)	---
	Incremental	2048 pulses/rotation	---
Output code (absolute)		---	Pure binary
Output phases (incremental)		---	A, B, and Z
Phase difference on output (incremental)		---	90°±45° between A and B (1/4T±1/8T)
Output configuration		---	NPN open collector
Output capacity		---	Applied voltage: 30 VDC max. Sink current: 20 mA max. Residual voltage: 0.4 V max. (at sink current of 20 mA)
Max. response speed		150 kHz (incremental signal)	---
Max. rotational speed response		4,500 r/min (1,000 r/min from 1 s after a power interruption) (See note 2.)	---
Condenser backup time		20 h (typical)	---
Battery backup time		---	5 years min. Internal ER17/33 lithium battery (1500 mAH Hitachi Maxell battery)
Rotational direction		Output code incremented by CW (as viewed from the end of the shaft)	---
Starting torque		9.8 mN·m max.	---
Moment of inertia		1×10^{-6} kg·m^2 max.	---
Shaft loading	Radial	50 N	---
	Thrust	30 N	---
Ambient temperature		Operating: –10°C to 70°C (with no icing) Storage: –25°C to 70°C (with no icing)	Operating: –10°C to 55°C (with no icing) Storage: –25°C to 65°C (with no icing)
Ambient humidity		Operating/storage: 35% to 85% (with no condensation)	
Insulation resistance		20 MΩ min. (at 100 VDC) between current-carrying parts and case	
Dielectric strength		1,000 VAC, 50/60 Hz for 1 min. between current-carrying parts and case	
Vibration resistance		10 to 500 Hz, 2-mm double amplitude or 150 m/s^2 for 11 min, 3 times each in X, Y, and Z directions	10 to 150 Hz, 1.5-mm double amplitude or 100 m/s^2 for 8 min, 4 times each in X, Y, and Z directions
Shock resistance		1,000 m/s^2 3 times each in X, Y, and Z directions	300 m/s^2 3 times each in X, Y, and Z directions
Degree of protection		IEC 60529: IP64 watertight (JEC IP64F oil resistive)	---
Connection method		Pre-wired connector with connector (standard length: 2 m) (See note 3.)	Connector
Weight (packed state)		Approx. 350 g	Approx. 350 g
Accessories		Servo Mounting Bracket, Instruction manual	Instruction manual

Note 1. When the Encoder's internal condenser is completely discharged, there will be an inrush current of 300 mA max. for about 2 s. Also, the battery alarm might go ON if the condenser is discharged; in this case, reset the Encoder with the ERS (Encoder Reset Input) before operation.

2. If the main power supply is interrupted, the Encoder's internal condenser and Receiver Unit's internal battery will supply power to retain rotational speed data and continue rotational measurement. The Encoder can continue to respond to 4,500 rpm rotation for 1 second after the main power is interrupted, but thereafter the maximum rotational speed response drops to 1,000 rpm. This feature allows the Encoder to keep up with the rotational speed of devices which continue to rotate due to inertia after a power interruption.

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

Operation

■ E63-SR5C Specifications

Connections

Pin no.	Symbol	Signal		Function
		Single-turn absolute data	Multi-turn absolute data	
1	ABS0	---	2^0	---
2	ABS1	---	2^1	---
3	ABS2	2^0	2^2	---
4	ABS3	2^1	2^3	---
5	ABS4	2^2	2^4	---
6	ABS5	2^3	2^5	---
7	ABS6	2^4	2^6	---
8	ABS7	2^5	2^7	---
9	ABS8	2^6	2^8	---
10	ABS9	2^7	2^9	---
11	ABS10	2^8	2^{10}	---
12	ABS11	2^9	2^{11}	---
13	ABS12	2^{10}	---	---
14	ABS13	---	---	---
15	ABS14	---	---	---
16	ABS15	---	---	---
17	STR0	Strobe 0 output		Strobe output for single-turn absolute data
18	STR1	Strobe 1 output		Strobe output for multi-turn absolute data
19	GND	0 V		0 V for outputs
20	BAL	Battery alarm output		Output when the internal battery's voltage drops (See note 1.)
21	OFW	Overflow alarm output		See note 2.
22	CHK	Open-circuit detection alarm output		Output when a broken circuit is detected in the connection to the Encoder.
23	ERR	Communication error output		Output when a communication error from the Encoder is detected.
24	VCC	Power supply 12 to 24 VDC		---
25	VCC	Power supply 12 to 24 VDC		---
26	GND	Power supply 0 V		---
27	GND	Power supply 0 V		---
28	ERS	Encoder reset input		High: Active (2 s min.) (See note 3.)
29	RST	Reset input		Low: Active (See note 4.)
30	RQ0	Request 0 input		High: Active (See note 5.)
31	RQ1	Request 1 input		High: Active (See note 6.)
32	GND	0 V		---
33	A	Incremental phase-A output		---
34	GND	0 V		---
35	B	Incremental phase-B output		---
36	GND	0 V		---
37	Z	Incremental phase-Z output		---

Note 1. This signal is output when the battery voltage drops below 3.0 V. Set the encoder reset input to high to cancel the output.

2. This signal is output if the Encoder's multi-turn value exceeds 4,096 during clockwise rotation or falls below 0 during counter-clockwise rotation.

3. This input resets the multi-turn value, overflow alarm, and BAL (battery alarm output). This is a high-active signal, so input a high signal (12 to 24 V) for 2 s or more.

4. Resets the open-circuit detection alarm and communications error. The RST input signal is the only low-active signal (2 V or less).

5. The single-turn absolute data is output when this signal is input.

6. The multi-turn absolute data is output when this signal is input.

7. When the RST (reset input) is being input, absolute data outputs and alarm outputs cannot be read and input signals (e.g., ERS, RQ0, RQ1) cannot be received.

8. The ABS13, ABS14, and ABS15 single-turn absolute data signals might go ON occasionally, but these signals cannot be used as data.

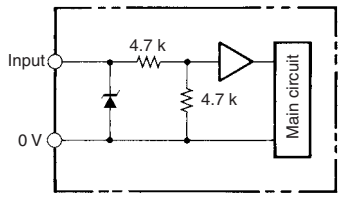
I/O Specifications

Input

Input voltage	12 to 24 VDC
Input current	1 to 3 mA

Note: When connecting PC outputs to E63-SR5C inputs, use positive-common PLC outputs such as those in the C200H-OD217.

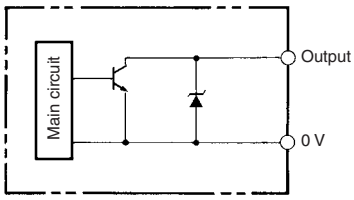
Circuits



Output

Output configuration	NPN open collector
Output capacity	Applied voltage: 30 VDC max. I_{sink} current: 20 mA max. Residual voltage: 0.4 V max.

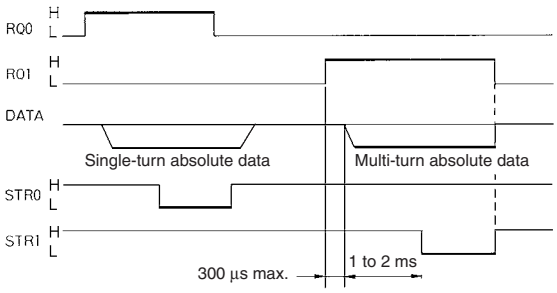
Circuits



Data Output Timing

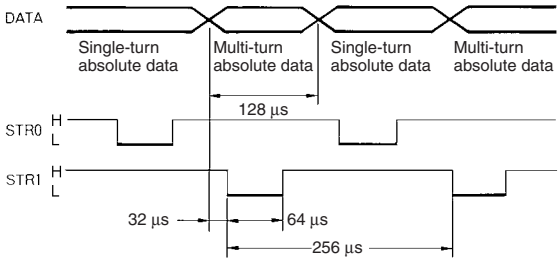
(A) Request Mode

When the request signal is input, data is output along with the strobe signal.



(B) Strobe Mode

Data is output in order along with the strobe signal.



Note 1. Switch between strobe mode and request mode with the mode switch.

2. In request mode, RQ0 (request input 0) has priority over RQ1 (request input 1), so RQ1 cannot be received while RQ0 is ON. Input RQ0 and RQ1 separately.

3. Since absolute data is transmitted serially between the Encoder and Receiver Unit, there is a 256-µs delay in data transfer. This delay causes real-time data response to be lost at a rotational speed of more than 100 rpm.

Display

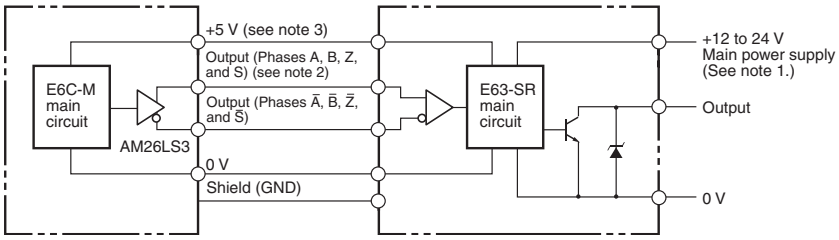
Name	Color	Function
POWER	Green	Lights when the power supply is ON.
CHK	Red	Lights when there is an open circuit in the signal line.
OFW	Red	Lights when there is an overflow error.
ERR	Red	Lights when there is a communications error.
BAL	Red	Lights when battery voltage drops.
Z	Orange	Phase-Z origin indicator

Data Output Mode Switch

Mode	Name	Function
A	Request mode	Data is output when the request signal is input.
B	Strobe mode	Data is always output in order.

Output Circuit Diagram

E6C-MPZ1X2 **E63-SR5C (Receiver Unit)**



Note 1. The Encoder's data communication will stop when the main power supply goes OFF, but the Encoder's internal condenser and Receiver Unit's internal battery will supply power to retain multi-turn absolute data and measure rotational speed.

2. Phase S: Absolute serial data output
Phase A: Incremental phase-A output
Phase B: Incremental phase-B output
Phase Z: Incremental phase-Z output
Refer to the separate specifications for each model for details on data transfer formats.

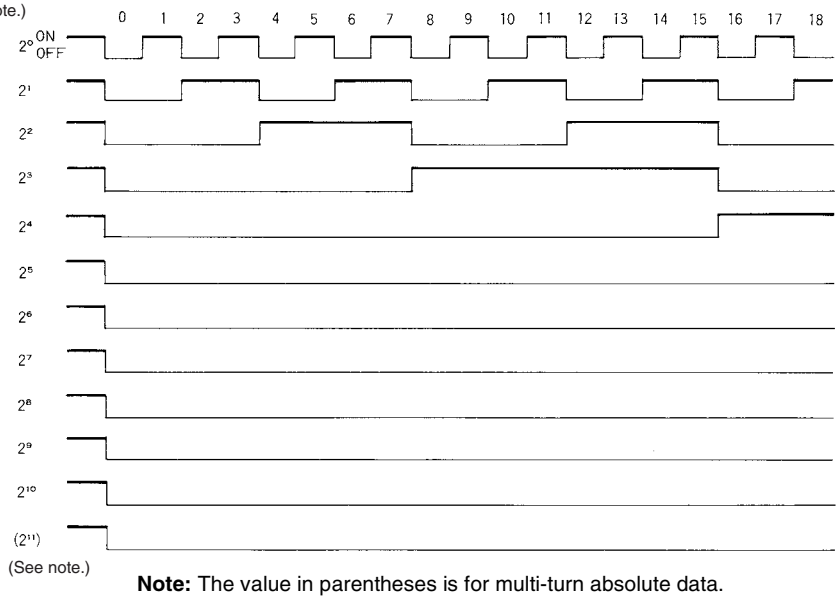
3. There is a voltage feedback function that adjusts for the drops in the voltage supplied to the Encoder due to the length of the encoder cable, which maintains a steady voltage level.

Timing Charts

E63-SR5C
Absolute Signal

Direction of resolution: CW
(As viewed from the end of the shaft)

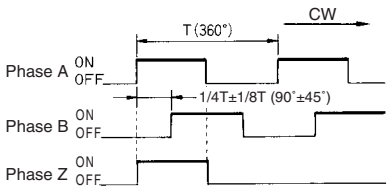
Single-turn absolute data: 2047
Multi-turn absolute data: (4095)
(See note.)



Note: The value in parentheses is for multi-turn absolute data.

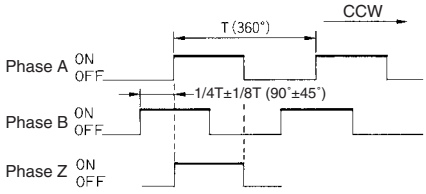
Incremental Signal

Direction of resolution: CW
(As viewed from the end of the shaft)



Note: Phase A is 1/4±1/8T (90°+45°) faster than phase B.

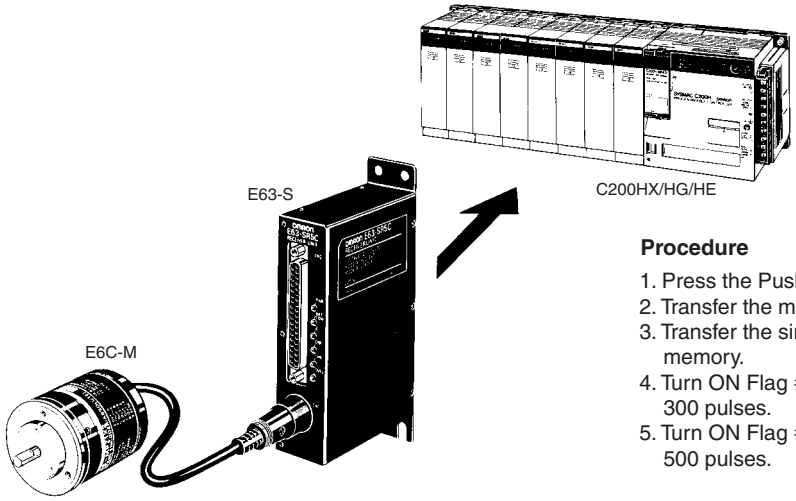
Direction of resolution: CCW
(As viewed from the end of the shaft)



Note: Phase A is 1/4±1/8T (90°+45°) slower than phase B.

Installation

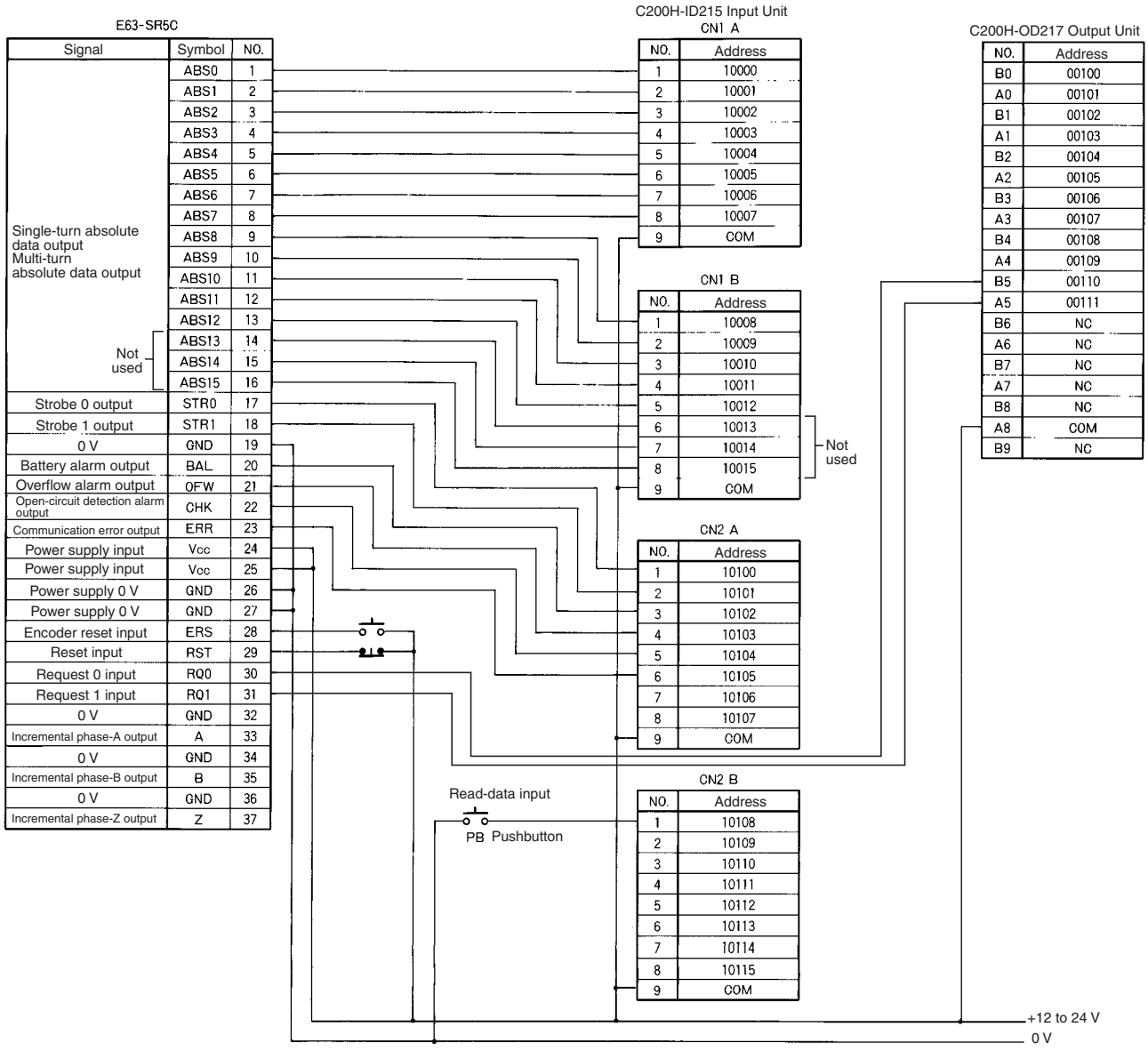
■ Connection to PLC (Request Mode)



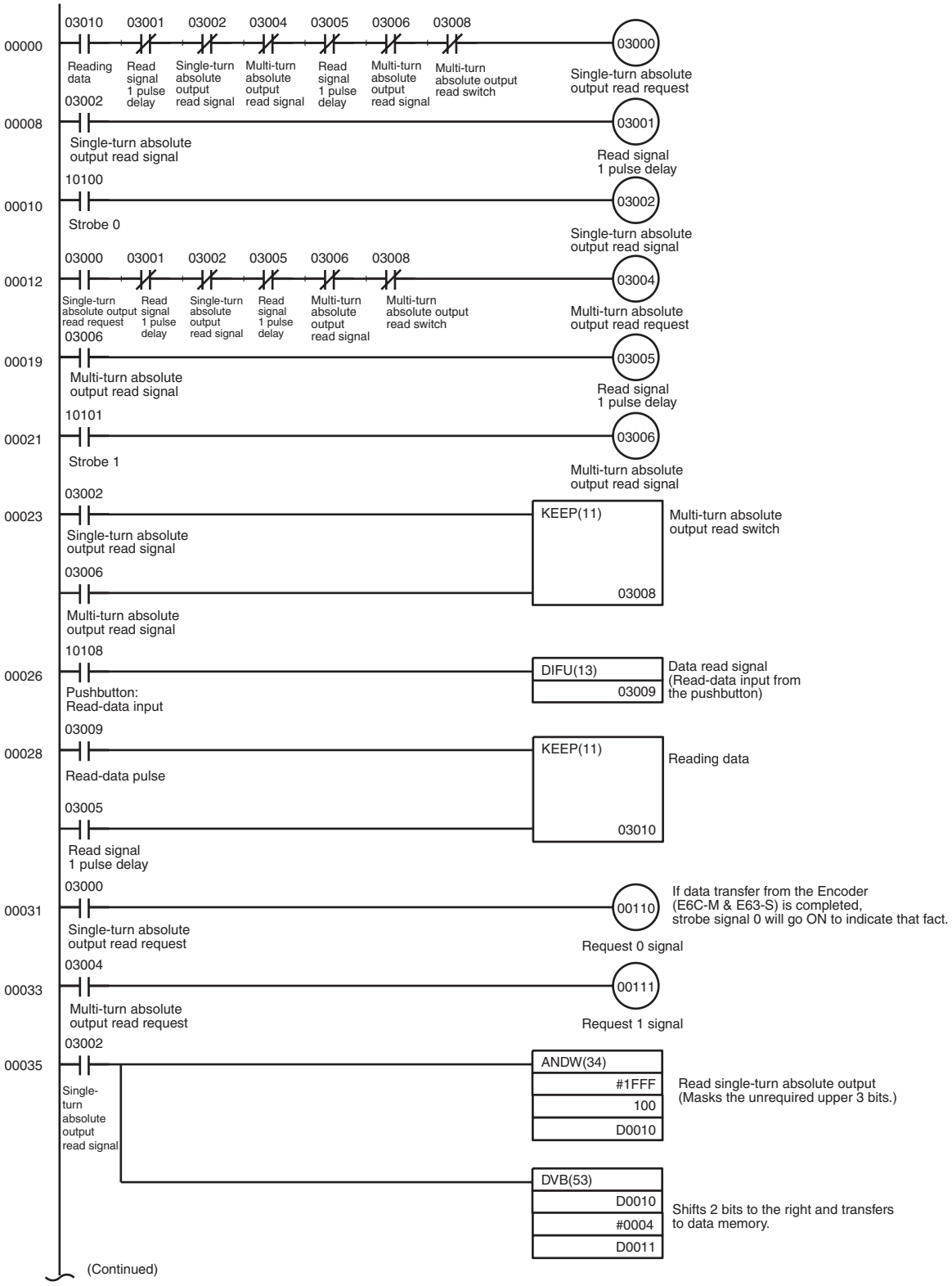
Procedure

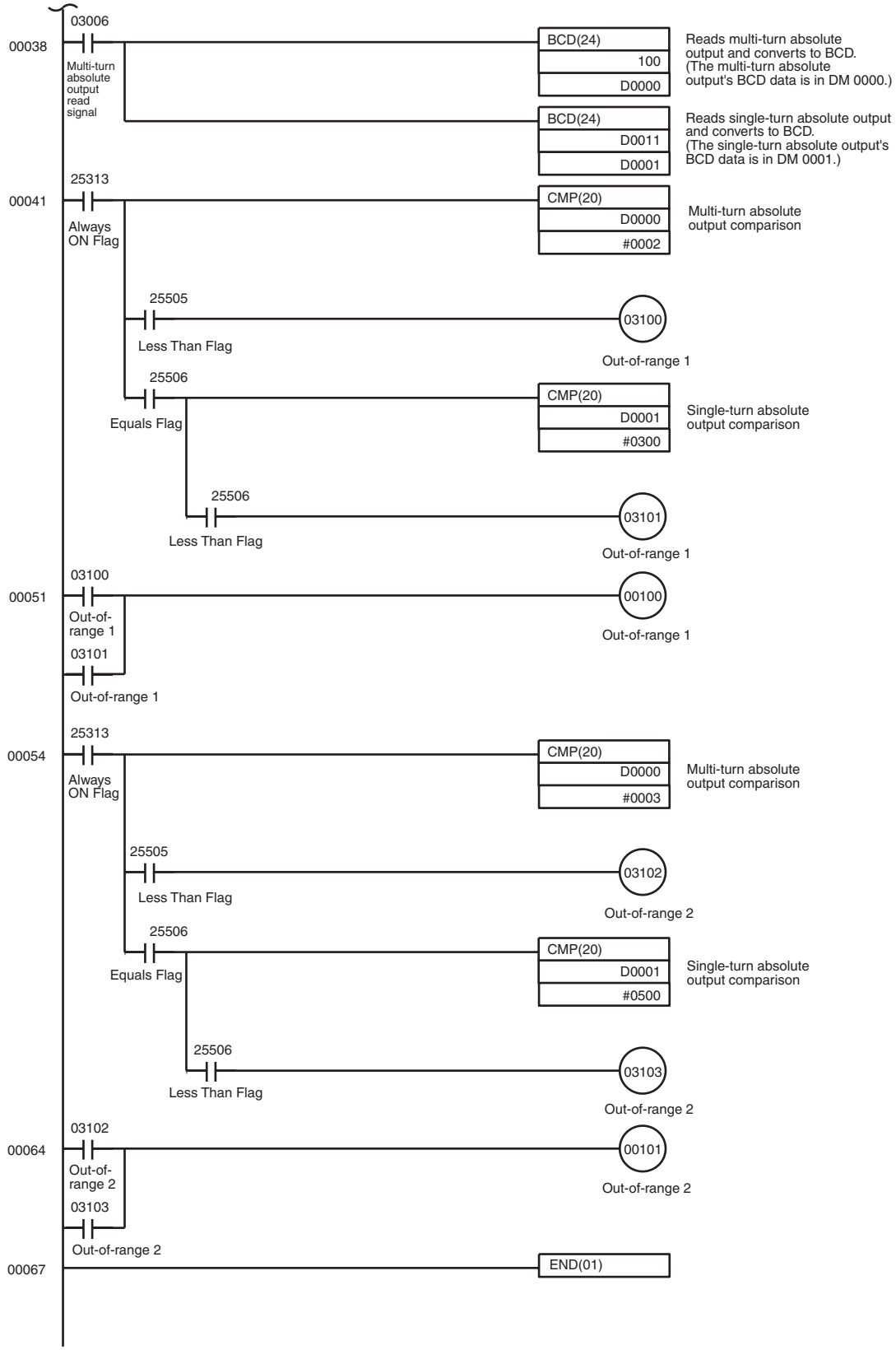
1. Press the Push (PB) Button.
2. Transfer the multi-turn absolute data to the PC's data memory.
3. Transfer the single-turn absolute data to the PC's data memory.
4. Turn ON Flag #1 if the above data exceeds 2 rotations and 300 pulses.
5. Turn ON Flag #2 if the above data exceeds 3 rotations and 500 pulses.

Connections

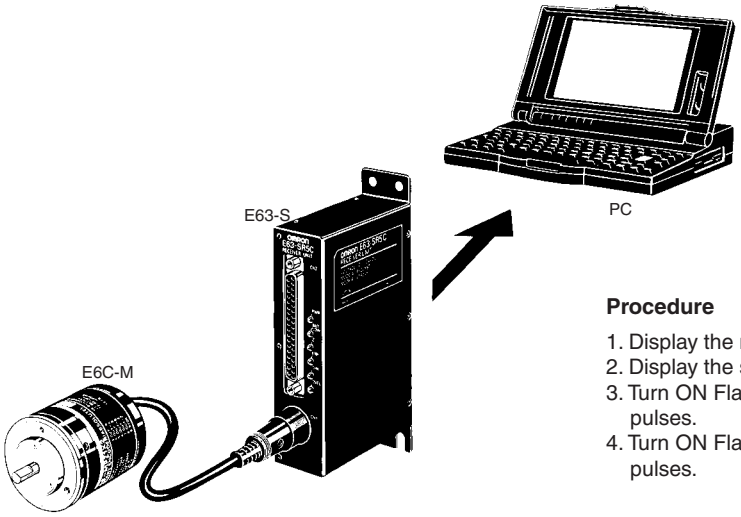


Sample Program




00038
03006
Multi-turn absolute output read signal
BCD(24)
100
D0000
Reads multi-turn absolute output and converts to BCD. (The multi-turn absolute output's BCD data is in DM 0000.)
BCD(24)
D0011
D0001
Reads single-turn absolute output and converts to BCD. (The single-turn absolute output's BCD data is in DM 0001.)
00041
25313
Always ON Flag
CMP(20)
D0000
#0002
Multi-turn absolute output comparison
25505
Less Than Flag
03100
Out-of-range 1
25506
Equals Flag
CMP(20)
D0001
#0300
Single-turn absolute output comparison
25506
Less Than Flag
03101
Out-of-range 1
00051
03100
Out-of-range 1
00100
Out-of-range 1
03101
Out-of-range 1
00054
25313
Always ON Flag
CMP(20)
D0000
#0003
Multi-turn absolute output comparison
25505
Less Than Flag
03102
Out-of-range 2
25506
Equals Flag
CMP(20)
D0001
#0500
Single-turn absolute output comparison
25506
Less Than Flag
03103
Out-of-range 2
00064
03102
Out-of-range 2
00101
Out-of-range 2
03103
Out-of-range 2
00067
END(01)

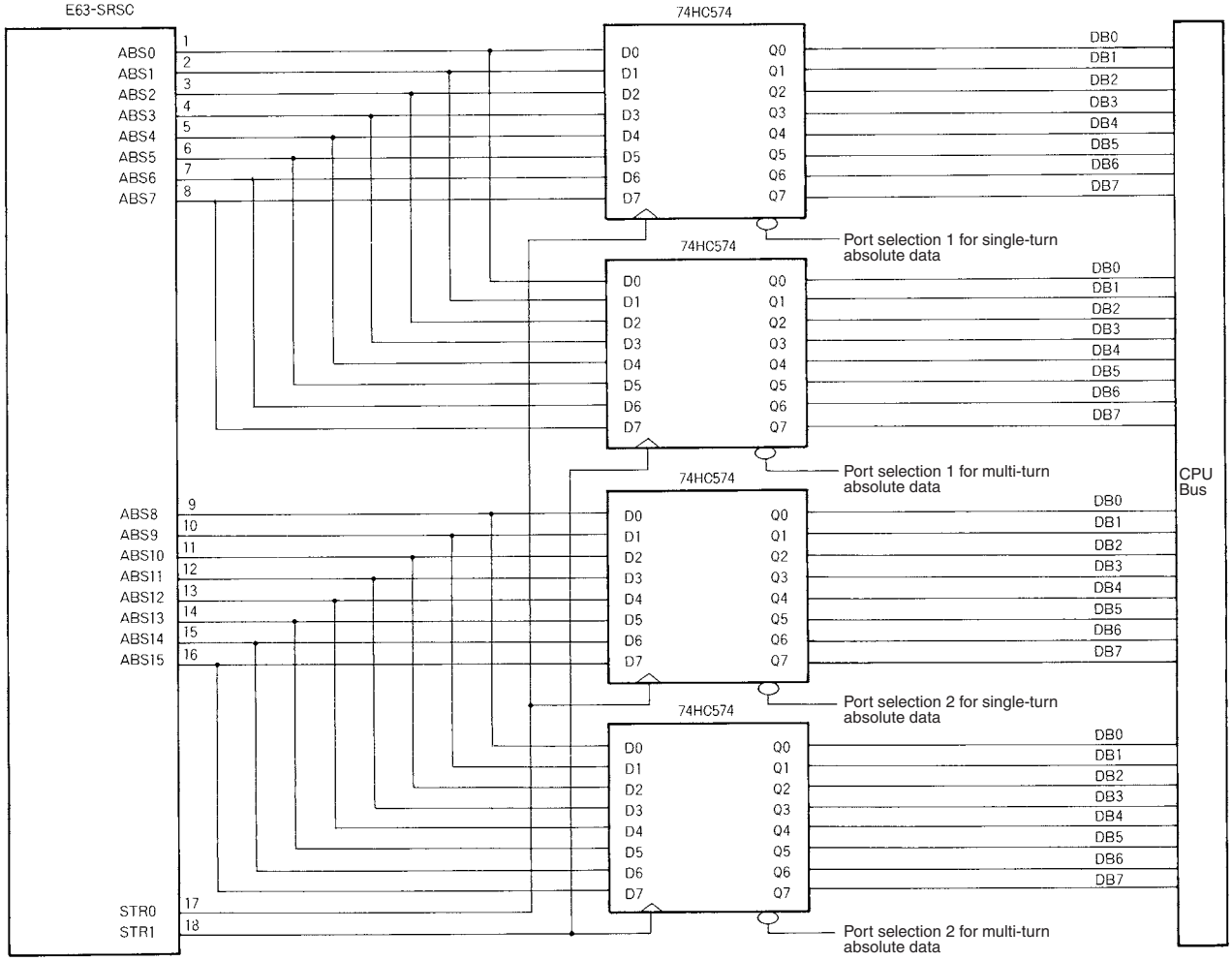
■ Connection to PC (Strobe Mode)



Procedure

1. Display the multi-turn absolute data at the personal computer.
2. Display the single-turn absolute data at the personal computer.
3. Turn ON Flag #1 if the above data exceeds 2 rotations and 300 pulses.
4. Turn ON Flag #2 if the above data exceeds 3 rotations and 500 pulses.

Connections



Note: The following port selections are used in the sample program on the next page:
Port selection 1 for single-turn absolute data: ABS_SEL1(&H00D0)
Port selection 2 for single-turn absolute data: ABS_SEL2(&H00D2)
Port selection 1 for multi-turn absolute data: TAKAITEN_SEL1(&H00D4)
Port selection 2 for multi-turn absolute data: TAKAITEN_SEL2(&H00D6)

Sample Program

```
100 REM ************************************************
110 REM  Displays the single-turn absolute data.
120 REM
130 REM ************************************************

200 ABS_SEL1  =&H00D0                          Single-turn absolute data (lower byte) input latch port address
210 ABS_SEL2  =&H00D2                          Single-turn absolute data (higher byte) input latch port address

220 KAITENRYO_LOW=INP(ABS_SEL1)                Reads the single-turn absolute data (lower byte).
230 KAITENRYO_HI =INP(ABS_SEL2)                Reads the single-turn absolute data (higher byte).
240 KAITENRYO=KAITENRYO_LOW+(KAITENRYO_HI*256) Converts the single-turn absolute data to 16-bit data.
250 KAITENRYO=KAITENRYO AND &H1FFC             Masks the unneeded bits.
260 KAITENRYO=KAITENRYO /4                     Shifts 2 bits right.
270 PRINT KAITENRYO                            Displays the single-turn absolute data.
280 END
```

```
100 REM ************************************************
110 REM  Prints the multi-turn absolute data.
120 REM
130 REM ************************************************

200 TAKAITEN_SEL1=&H00D4                       Multi-turn absolute data (lower byte) input latch port address
210 TAKAITEN_SEL2=&H00D6                       Multi-turn absolute data (higher byte) input latch port address

220 KAITENSUU_LOW=INP(TAKAITEN_SEL1)           Reads the multi-turn absolute data (lower byte).
230 KAITENSUU_HI =INP(TAKAITEN_SEL2)           Reads the multi-turn absolute data (higher byte).
240 KAITENSUU=KAITENSUU_LOW+(KAITENSUU*256)    Converts the multi-turn absolute data to 16-bit data.
250 KAITENSUU=KAITENSUU AND &HFFF              Masks the unneeded bits.
260 PRINT KAITENSUU                            Prints the multi-turn absolute data.
270 END
```

```
100 REM ************************************************
110 REM  Turns ON flags if the set values are exceeded.
120 REM
130 REM ************************************************

200 ABS_SEL1        =&H00D0                    Single-turn absolute data (lower byte) input latch port address
210 ABS_SEL2        =&H00D2                    Single-turn absolute data (higher byte) input latch port address
220 TAKAITEN_SEL1   =&H00D4                    Multi-turn absolute data (lower byte) input latch port address
230 TAKAITEN_SEL2   =&H00D6                    Multi-turn absolute data (higher byte) input latch port address
240 SETTEI_KAITENRYO1     =300                 Single-turn absolute data #1 set value (300 pulses)

250 SETTEI_KAITENSUU1 =2                       Multi-turn absolute data #1 set value (2 rotations)
260 SETTEI_KAITENRYO2     =500                 Single-turn absolute data #2 set value (500 pulses)
270 SETTEI_KAITENSUU2 =3                       Multi-turn absolute data #2 set value (3 rotations)
280 OVER_FLG1         =0                       Over #1 set value flag
290 OVER_FLG2         =0                       Over #2 set value flag

300 KAITENRYO_LOW=INP(ABS_SEL1)                Reads the single-turn absolute data (lower byte).
310 KAITENRYO_HI =INP(ABS_SEL2)                Reads the single-turn absolute data (higher byte).
320 KAITENRYO=KAITENRYO_LOW+(KAITENRYO_HI*256) Converts the single-turn absolute data to 16-bit data.
330 KAITENRYO=KAITENRYO AND &H1FFC             Masks the unneeded bits.
340 KAITENRYO=KAITENRYO /4                     Shifts 2 bits right.

400 KAITENSUU_LOW=INP(TAKAITEN_SEL1)           Reads the multi-turn absolute data (lower byte).
410 KAITENSUU_HI =INP(TAKAITEN_SEL2)           Reads the multi-turn absolute data (higher byte).
420 KAITENSUU=KAITENSUU_LOW+(KAITENSUU*256)    Converts the multi-turn absolute data to 16-bit data.
430 KAITENSUU=KAITENSUU AND &HFFF              Masks the unneeded bits .

500 *CHECK1
510 IF KAITENSUU=SETTEI_KAITENSUU1 ELSE GOTO*CHECK2   If the multi-turn absolute data equals its #1 set value and
520  IF KAITENRYO>=SETTEI_KAITENRYO1 THEN OVER_FLG1=1 the single-turn absolute data exceeds its #1 set value, the
                                                      “over #1 set value flag” is turned ON.
600 *CHECK2
610 IF KAITENSUU>SETTEI_KAITENSUU1 ELSE GOTO *CHECK3  If the multi-turn absolute data exceeds its #1 set value,
                                                      the “over #1 set value flag” is turned ON.
620 OVER_FLG1=1

700 *CHECK3
710 IF KAITENSUU=SETTEI_KAITENSUU2 ELSE GOTO *CHECK4  If the multi-turn absolute data equals its #2 set value and
720  IF KAITENRYO>=SETTEI_KAITENRYO2 THEN OVER_FLG2=1 the single-turn absolute data exceeds its #2 set value, the
                                                      “over #2 set value flag” is turned ON.
800 *CHECK4
810 IF KAITENSUU>SETTEI_KAITENSUU2 ELSE GOTO *EXIT    If the multi-turn absolute data exceeds its #2 set value,
                                                      the “over #2 set value flag” is turned ON.
820 OVER_FLG2=1

900 *EXIT
910 END
```

Note: The KAITENRYO variable is the single-turn absolute data and the KAITENSUU variable is the multi-turn absolute data.

Precautions

⚠ WARNING

This product is not designed or rated for ensuring safety of persons. Do not use it for such purposes.

■ Precautions for Correct Use

Storage Conditions

Store the E6C-M within the temperature and humidity ranges given in the specifications and observe the following precautions.

1. Store the Unit and packaging where they won't be subjected to salt air or corrosive gases such as hydrogen sulfide.
2. Store the Unit in a dust-free area where it can be inspected visually.
3. Do not store the Unit in direct sunlight.

Also, never place a load on the Unit that could deform or damage it.

Operating Conditions

Operate the E6C-M within the temperature and humidity ranges given in the specifications and observe the following precautions.

1. Install the Unit in a low-dust location free of corrosive gases.
2. Install the Unit in a location free of water and oil where the effects of vibration and shock are insignificant.
3. Avoid locations with sudden temperature changes, even if the temperature range is within the recommended limits.

Also, never place a load on the Unit that could deform or damage it.

Mounting

The Rotary Encoder consists of high-precision components. Handle with utmost care and do not drop the Rotary Encoder, otherwise malfunctioning may result.

When installing the Encoder, be sure not to apply excessive force or shock to the rotational shaft.

Use a coupling on the rotational shaft and be sure to avoid excessive shock or vibration during operation.

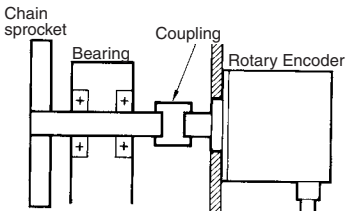
When inserting the shaft in the coupling, do not use excessive force (by striking it with a hammer, for example).

If the E6C-M is mounted and wired with a cable, do not pull the cable.

When using a gear linkage, be sure not to apply a large load on the shaft.

If a significant installation error is made (misalignment), the shaft will be subjected to excessive force which will damage it or shorten the life of the Unit.

When linking with a chain timing belt or toothed gear, connect a separate bearing before the coupling to the encoder.



Wiring

Insert a surge absorber between the power supply terminals if there is any surge.

Turn OFF the Rotary Encoder when wiring. The output circuit may be damaged if the output line contacts with the power source while the Rotary Encoder is turned ON.

Never disconnect or connect the circuit when current is flowing. This might damage the Unit.

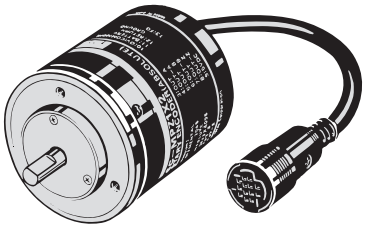
Avoid wiring the E6C-M and E63-SRC's cables parallel to power lines or high-voltage lines. Use a separate conduit.

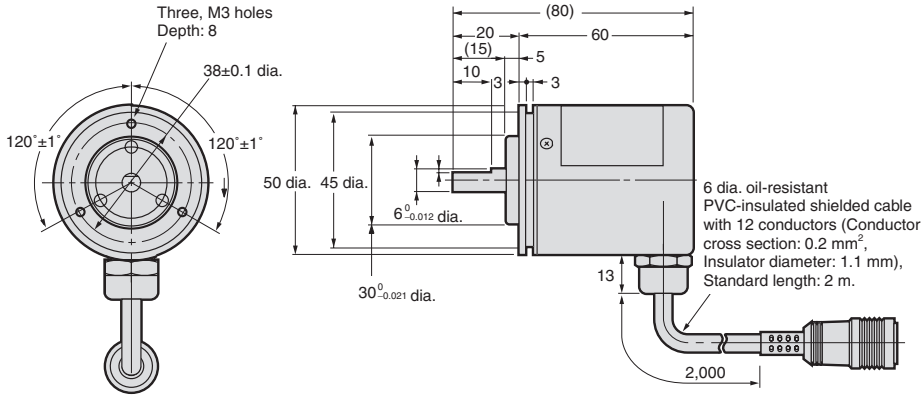
Spurious pulses might be generated when power is turned ON, so wait at least 0.3 s after the last Unit is turned ON before using the Units.

Dimensions

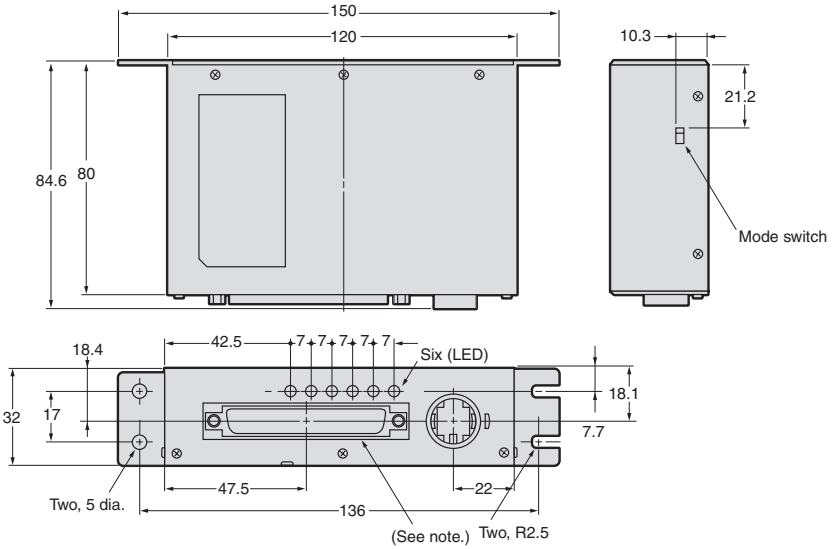
Note: All units are in millimeters unless otherwise indicated.

E6C-MPZ1X2



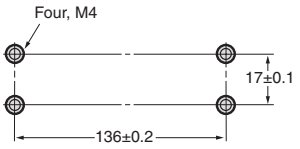


E63-SR5C Receiver Unit



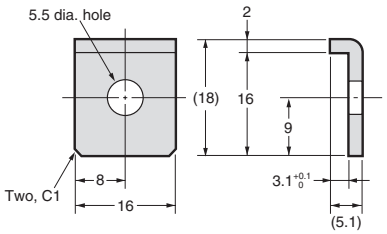
Note: OMRON 37-pin D-sub Connector
XM2A-3701 (plug) (Order separately.)
XM2S-3711 (hood) (Order separately.)

Mounting Holes



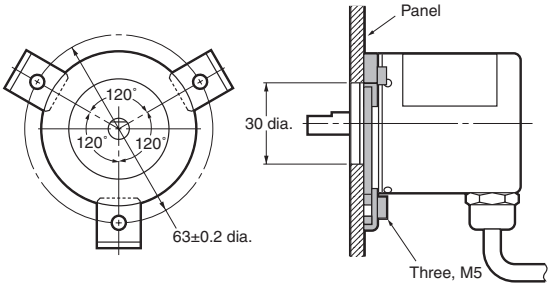
Accessories

Mounting Bracket (Provided)

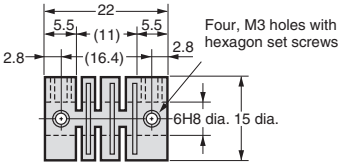


Note: Provided with the E6C-MPZ1X2.

Mounting Bracket Installation

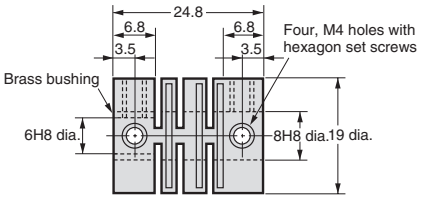


E69-C06B Coupling (Order Separately)



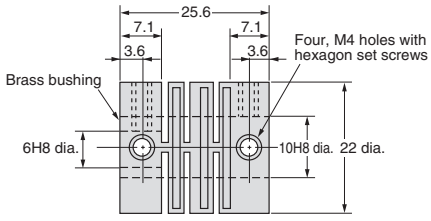
Note: Material: Glass-reinforced PBT

E69-C68B Different Diameter



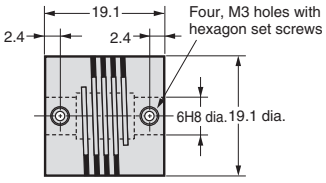
Note: Material: Glass-reinforced PBT

E69-C610B Different Diameter



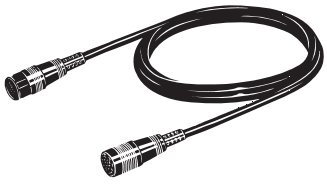
Note: Material: Glass-reinforced PBT

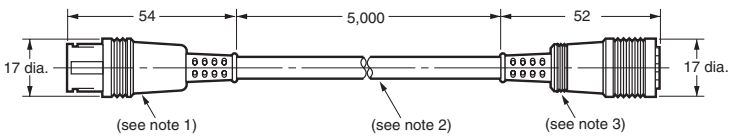
E69-C06M



Note: Material: Extra super duralumin

Extension Cable E69-DM5





Note 1. Connects to the E63-SR5C Receiver Unit.

2. Oil-resistant PVC insulated shielded cable with 6 dia. and 12 conductors (Conductor cross section: 0.2 mm^2, Insulator diameter: 1.1 mm), Standard length: 5 m

3. Connects to the E6C-MPZ1X2 Absolute Encoder.

Note: The cable length between the E6C-M and E63-SR5C can be extended to a maximum of 30 m including the length of the cable provided with the Absolute Encoder.

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To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Cat. No. E242-E1-02

In the interest of product improvement, specifications are subject to change without notice.

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