40 mm Diameter Incremental Rotary Encoders

E40 Series

INSTRUCTION MANUAL

TCD210019AD

Autonics

Thank you for choosing our Autonics product.
Be sure to read and fully understand the instruction manual and other manuals before using the product.
For your safety, read and follow the safety precautions, warnings, cautions, and handling instructions listed in the instruction manual, other manuals, and the Autonics website.
Keep this document in a location where it can be easily accessed.

Visit the Autonics website (www.autonics.com or QR code) for the latest information. Manuals, CAD files, certifications, software, etc. are available. The dimensions, specifications, certifications, etc. are subject to change without notice for product improvement. Certain models may be discontinued without notice.

Safety Precautions

- 'Safety Precautions' are provided to ensure safe and proper use of the product and to prevent accidents or hazards. Please make sure to follow them carefully.
- ⚠ symbol indicates a caution, warning of potential hazards under certain conditions.

⚠ Warning Failure to follow instructions may result in serious injury or death.

01. Fail-safe device must be installed when using the product in applications that may cause serious injuries or property loss. (E.g. nuclear control systems, medical equipment, ships, vehicles, railroads, aircraft, combustion devices, safety devices, security systems, disaster prevention devices, etc.)
Failure to do so may result in personal injury, property loss or fire.
02. Do not use or store the product in environments containing flammable, explosive, or corrosive gases, or in places exposed to high humidity, direct sunlight, radiant heat, vibration, shock, or salt.
Failure to do so may result in explosion or fire.
03. Install the product on a device panel before use.
Failure to do so may result in fire.
04. Do not connect, repair, or inspect the product while connected to a power source.
Failure to do so may result in fire.
05. Check the connection diagram before wiring.
Failure to do so may result in fire.
06. Do not make any unauthorized modifications to the product.
Failure to do so may result in fire.

⚠ Caution Failure to follow instructions may result in injury or product damage.

01. Use the product within its rated specifications and performance limits.
Failure to do so may result in fire or product damage.
02. Do not short-circuit the load.
Failure to do so may result in fire.
03. Do not use the product near devices that generate strong magnetic fields or electrical noise, or in environments with strong alkaline or acidic substances.
Failure to do so may result in product damage.

Cautions During Use

- Make sure to follow the instructions in 'Cautions During Use'.
  Failure to do so may result in unexpected accidents.
- Power input should be supplied from an isolated and limited voltage/current source, or from a Class 2 or SELV power supply..
- When using noise-generating devices (e.g. switching regulators, inverters, servo motors, etc.), ground the shielded wire to F.G.
- Ground the shielded wire to F.G.
- When supplying power with an SMPS, ground the F.G. terminal and connect a noise suppression capacitor between the 0 V and F.G. terminals.
- To prevent surges and inductive noise, separate the wiring from high-voltage and power lines, and keep wiring lengths as short as possible.
- For line driver models, always use twisted-pair cables with sealing, and use receivers suitable for RS-422A communication on the receiver side.
- When extending wiring, check the cable type and response frequency, as line resistance and line-to-line capacitance may cause increased residual voltage or waveform distortion.
- This product may be used in the following environmental conditions.
  - Indoors (within rated environmental performance specifications)
  - Altitude: up to 2,000 m
  - Pollution Degree 2
  - Installation Category II

Cautions During Installation

- Install the product within the rated specifications in recommended usage environments.
- Do not apply excessive load to the rotating shaft.
- When connecting a coupling to the shaft, do not apply impact force such as hammering. There is a risk of product damage..
- When using a wrench to secure the product or coupling, tighten with a torque less than 0.15 N•m.
- If the misalignment between rotating shafts (parallel misalignment, angular misalignment) is excessive during coupling, the lifespan of both the coupling and encoder may be reduced.
- If a coupling is not used, impact or load may be applied directly to the encoder shaft, and the lifespan of the encoder may be reduced.
- After securing the product and cable, do not pull with a force exceeding 30N.

Ordering Information

For reference only. The actual product does not support all combinations.
To check all supported models, please refer to the Autonics website.

E40 ❶ ❷ - ❸ - ❹ - ❺ - ❻ - ❼

❶ Shaft type
S: Shaft type
H: Hollow type
HB: Hollow Built-in type

❷ Shaft outer diameter / Shaft inner diameter
6: Ø 6 mm
8: Ø 8 mm
10: Ø 10 mm
12: Ø 12 mm

❸ Resolution
Number: Refer to resolution in 'Specifications'

❹ Output phase
2: A, B
3: A, B, Z
4: A, $\overline{A}$, B, $\overline{B}$
6: A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$

❺ Control output
T: Totem-pole output
N: NPN open collector output
V: Voltage output
L: Line driver output

❻ Power supply
5: 5 VDC ±5%
24: 12 - 24 VDC ±5%

❼ Connection
No mark: Radial cable type
C: Radial cable connector type

Product Components

Shaft type	Shaft type	Hollow type	Hollow Built-in type
Product components	Product, Instruction manual	Product (+ bracket), Instruction manual	
Bolt	× 4	× 2	× 2
Coupling	× 1	-	-

Sold Separately

- M17 connector cable: CID6S-□, CID9S-□

Connections

- Unused wires must be insulated.
- The metal case and shielded wire of encoders must be grounded (F.G.).
- F.G. (Frame Ground) must be grounded separately.

■ Totem-Pole / NPN Open Collector / Voltage Output

Pin	Color	Function	Pin	Color	Function
1	Black	OUT A	4	Brown	+V
2	White	OUT B	5	Blue	GND
3	Orange	OUT Z	6	Shield	F.G.

● M17 6-pin layout

■ Line Driver Output

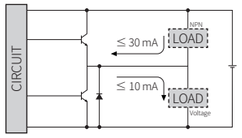
Pin	Color	Function	Pin	Color	Function
1	Black	OUT A	5	White	OUT B
2	Red	OUT $\overline{A}$	6	Gray	OUT $\overline{B}$
3	Brown	+V	7	Orange	OUT Z
4	Blue	GND	8	Yellow	OUT $\overline{Z}$
—			9	Shield	F.G.

● M17 9-pin layout

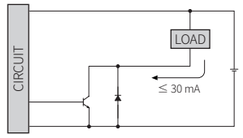
Circuit Diagram

- Output circuits are identical for all output phases.

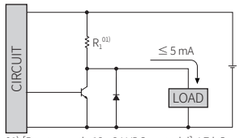
■ Totem-Pole Output



■ NPN Open Collector Output

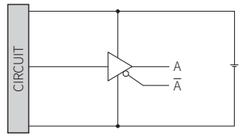


■ Voltage Output



01) [Power supply 12 - 24 VDC⎓ model] 4.7 kΩ
[Power supply 5 VDC⎓ model] 820 Ω

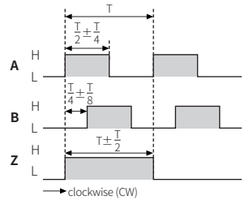
■ Line Driver Output



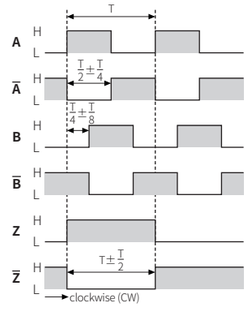
Output Waveform

- The rotation direction is based on facing the shaft, and it is clockwise (CW) when rotating to the right.
- Phase difference between A and B: $\frac{T}{4} \pm \frac{T}{8}$ (T = 1 cycle of A)

■ Totem-Pole / NPN Open Collector / Voltage Output



■ Line Driver Output



Specifications

Model	E40□□-□-□-T-□-□	E40□□-□-□-N-□-□	E40□□-□-□-V-□-□	E40□□-□-□-L-□-□
Resolution	1 / 2 / 5 / 12 PPR 01) 10 to 5,000 PPR model			
Control output	Totem-pole output	NPN open collector output	Voltage output	Line driver output
Output phase	A, B, Z	A, B, Z	A, B, Z	A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$
Sink current	≤ 30 mA	≤ 30 mA	-	≤ 20 mA
Residual voltage	≤ 0.4 VDC⎓	≤ 0.4 VDC⎓	≤ 0.4 VDC⎓	≤ 0.5 VDC⎓
Source current	≤ 10 mA	-	≤ 5 mA	≤ -20 mA
Output voltage (5 VDC⎓)	≥ (V_{CC} - 2.0) VDC⎓	-	≤ ($\frac{R_L}{R_L + R_1} \times V_{CC}$) VDC⎓ 02)	≥ 2.5 VDC⎓
Output voltage (12 - 24 VDC⎓)	≥ (V_{CC} - 3.0) VDC⎓	-		≥ (V_{CC} - 3.0) VDC⎓
Response speed 03)	≤ 1 μs			≤ 0.5 μs
Max. response freq.	300 kHz			
Max. allowable revolution 04)	5,000 rpm			
Starting torque	E40S: ≤ 0.004 N·m E40H, E40HB: ≤ 0.005 N·m			
Inertia moment	≤ 40 g·cm² (4 × 10⁻⁶ kg·m²)			
Allowable shaft load	Radial: ≤ 2 kgf, Thrust: ≤ 1 kgf			
Unit weight	≈ 120 g			
Certification	CE UK EAC			

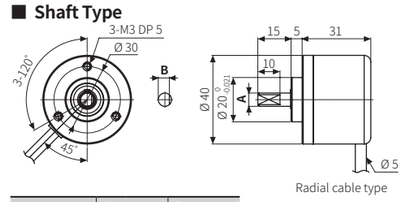
01) Depending on the control output, only A, B or A, $\overline{A}$, B, $\overline{B}$ are output.
02) The output voltage varies depending on load resistance (R_L = load resistance).
03) Based on cable length: 2 m, I sink: 20 mA
04) Select resolution to satisfy Max. allowable revolution ≥ Max. response revolution
[max. response revolution (rpm) = $\frac{\text{max. response frequency}}{\text{resolution}} \times 60$ sec]

Power supply	5 VDC⎓ ± 5% (ripple P-P: ≤ 5%) / 12 - 24 VDC⎓ ± 5% (ripple P-P: ≤ 5%) model
Current consumption	Totem-pole, NPN open collector, Voltage output: ≤ 80 mA (no load) Line driver output: ≤ 50 mA (no load)
Insulation resistance	≥ 100 MΩ (500 VDC⎓ megger)
Dielectric strength	Between charging part and case: 750 VAC~ 50 / 60 Hz for 1 minute
Vibration resistance	1 mm double amplitude at frequency 10 to 55 Hz in each X, Y, Z direction for 2 hours
Shock resistance	≤ 50 G
Ambient temp.	-10 to 70 °C, storage: -25 to 85 °C (no freezing or condensation)
Ambient humidity	35 to 85% RH, storage: 35 to 90% RH (no freezing or condensation)
Protection rating	IP50 (IEC standard)
Connection	Radial cable type / cable connector type model
Cable specifications	Ø 5 mm, 5-wire (Line driver output: 8-wire), shielded cable cable type: 2 m, cable connector type: 250 mm
Wire specifications	AWG24 (0.08 mm, 40-core), insulator diameter: Ø 1 mm
Connector specifications	Totem-pole, NPN open collector, Voltage output: M17 6-pin plug type Line driver output: M17 9-pin plug type

Dimensions

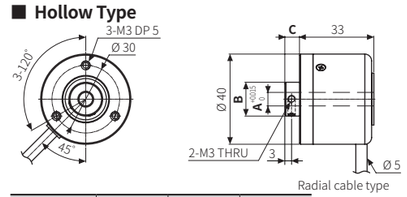
- Unit: mm (Refer to the CAD files from the Autonics website for exact dimensions)
- Cable type shown as reference.
  Refer to 'Specifications' for detailed specifications of cable, wire and connector.

■ Shaft Type



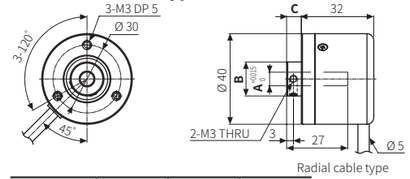
	A	B
E40S6	Ø 6 -0.004 -0.016	5
E40S8	Ø 8 -0.005 -0.02	7

■ Hollow Type



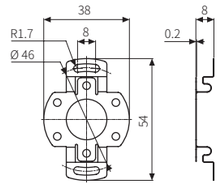
	A	B	C
E40H6	Ø 6	Ø 15	6.5
E40H8	Ø 8	Ø 15	6.5
E40H10	Ø 10	Ø 17	6.3
E40H12	Ø 12	Ø 17	6.3

■ Hollow Built-in Type

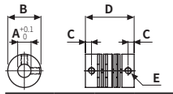


	A	B	C
E40HB6	Ø 6	Ø 15	6.5
E40HB8	Ø 8	Ø 15	6.5
E40HB10	Ø 10	Ø 17	6.3
E40HB12	Ø 12	Ø 17	6.3

■ Bracket



■ Coupling



	A	B	C	D	E
E40S6	Ø 6	Ø 15	2.8	22	4-M3
E40S8	Ø 8	Ø 19	3.4	25	4-M4

- Parallel misalignment: ≤ 0.25 mm
- Angular misalignment: ≤ 5°
- End-play: ≤ 0.5 mm

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