50 mm Diameter Absolute Single-Turn Rotary **Encoders (Optical)**

EP50 Series

INSTRUCTION MANUAL

TCD210034AC

Autonics

Thank you for choosing our Autonics product.

Read and understand the instruction manual and manual thoroughly before using the product.

For your safety, read and follow the below safety considerations before using. For your safety, read and follow the considerations written in the instruction manual, other manuals and Autonics website.

Keep this instruction manual in a place where you can find easily.

The specifications, dimensions, etc. are subject to change without notice for product improvement. Some models may be discontinued without notice.

Follow Autonics website for the latest information.

Safety Considerations

- Observe all 'Safety Considerations' for safe and proper operation to avoid hazards.
- ▲ symbol indicates caution due to special circumstances in which hazards may occur.

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

- 01. Fail-safe device must be installed when using the unit with machinery that may cause serious injury or substantial economic loss. (e.g. nuclear power control, medical equipment, ships, vehicles, railways, aircraft, combustion apparatus, safety equipment, crime / disaster prevention devices, etc.) ailure to follow this instruction may result in personal injury, economic loss or fire
- 02. Do not use the unit in the place where flammable / explosive / corrosive gas, high humidity, direct sunlight, radiant heat, vibration, impact or salinity may be present.

to follow this instruction may result in explosion or fire.

03. Install on a device panel to use. ailure to follow this instruction may result in fire.

- 04. Do not connect, repair, or inspect the unit while connected to a power source.
- Failure to follow this instruction may result in fire.
- 05. Check 'Connections' before wiring.
- ailure to follow this instruction may result in fire 06. Do not disassemble or modify the unit.

Failure to follow this instruction may result in fire

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

- 01. Use the unit within the rated specifications.
- ailure to follow this instruction may result in fire or product damage.
- 02. Do not short the load. ailure to follow this instruction may result in fire
- 03. Do not use the unit near the place where there is the equipment which
- generates strong magnetic force or high frequency noise and strong alkaline, strong acidic exists.

Failure to follow this instruction may result in product damage

Cautions during Use

- Follow instructions in 'Cautions during Use'.
- Otherwise, It may cause unexpected accidents
- 5 VDC==, 12 24 VDC== power supply should be insulated and limited voltage / current or Class 2, SELV power supply device.
- · For using the unit with the equipment which generates noise (switching regulator, inverter, servo motor, etc.), ground the shield wire to the F.G. terminal.
- · Ground the shield wire to the F.G. terminal.
- When supplying power with SMPS, ground the F.G. terminal and connect the noise canceling capacitor between the 0 V and F.G. terminals.
- Wire as short as possible and keep away from high voltage lines or power lines, to
- prevent inductive noise. • Check the wire type and response frequency when extending wire because of distortion of waveform or residual voltage increment etc. by line resistance or capacity
- hetween lines. • This unit may be used in the following environments.
- Indoors (in the environment condition rated in 'Specifications')
- Altitude max 2 000 m
- Pollution degree 2
- Installation category II

Cautions during Installation

- Install the unit correctly with the usage environment, location, and the designated specifications.
- · Do not load overweight on the shaft.
- Do not put strong impact when insert a coupling into shaft.
- Failure to follow this instruction may result in product damage
- When fixing the product or coupling with a wrench, tighten under 0.15 N m. • If the coupling error (parallel misalignment, angular misalignment) between the shaft
- increases while installation, the life cycle of the coupling and the encoder can be
- Do not apply tensile strength over 30 N to the cable.

Ordering Information

This is only for reference, the actual product does not support all combinations. For selecting the specified model, follow the Autonics website

EP50 **0 2** - **3** - **4 5** - **6** -

Shaft type

S: Shaft type

Shaft outer diameter

8: Ø 8 mm

Resolution

Output code

Rotating direction

- F: Increase output when the rotating direction is clockwise base on facing the shaft
- R: Increase output when the rotating direction is counter-clockwise base on facing the shaft

6 Control output

N: NPN open collector output P: PNP open collector output

Power supply 5.5 VDC== +5%

1 · BCD code 2: Binary code

Number: Refer to resolution in 'Output

Phase / Output Angle

24: 12 - 24 VDC== ±5%

Product Components

Product

3: Grav code

- Bolt \times 8
- Instruction manual
- Coupling × 1
- Bracket \times 2

Connections

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

Function Refer

• Since exclusive driver IC is used for output circuit, be aware of short circuits when wiring each output wires.

Color

• N · C: not connected

■ BCD code

■ Binary / Gray code

Function Refer

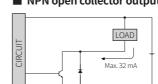
White	+V	Power	White	+V	Power
Black	GND		Black	GND	
Brown	2 ⁰		Brown	2°	
Red	2 ¹		Red	2 ¹	
Orange	2 ²		Orange	2 ²	
Yellow	2 ³		Yellow	2 ³	
Blue	$2^{0} \times 10$		Blue	2 ⁴	
Purple	$2^{1} \times 10$		Purple	2 ⁵	
Gray	$2^2 \times 10$		Gray	2 ⁶	
White / Brown	$2^3 \times 10$	TP1 (≤ 40 division)	White / Brown	27	TP1 (≤ 40 division)
White / Red	$2^0 \times 10^2$	TP2 (≤ 40 division)	White / Red	28	TP2 (≤ 40 division)
White / Orange	$2^1 \times 10^2$	EP (≤ 40 division)	White / Orange	29	EP (≤ 40 division)
White / Yellow	$2^2 \times 10^2$		White / Yellow	N·C	
White / Blue	$2^3 \times 10^2$		White / Blue	N·C	
White / Purple	$2^{0} \times 10^{3}$		White / Purple	N·C	
Shield	F.G.	Signal shield	Shield	F.G.	Signal shield

Inner Circuit

- The output circuit is identical for each output bit.
- Be aware of circuit break in case of overload or short beyond the specifications.

■ PNP open collector output ■ NPN open collector output

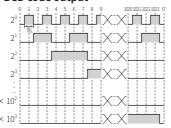




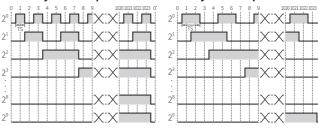
Output Waveform

· Following waveform is based on the positive logic. (In case of negative logic, the waveform is opposite to corresponding waveform.)

■ BCD code output



■ Binary code output ■ Gray code output



Specifications

Model	LI 3030	L. 3030	
Resolution 01)	≤ 1024 division		
Output code	BCD / Binary / Gray code model		
Control output	NPN open collector output	PNP open collector output	
Inflow current	≤ 32 mA	-	
Residual voltage	≤ 1 VDC==	-	
Outflow current	-	≤ 32 mA	
Output voltage	-	≥ (power supply -1.5) VDC==	
Response speed 02)	$T_{on} \le 800$ nsec, $T_{off} \le 800$ nsec		
Max. response freq.	35 kHz		
Max. allowable revolution (33)	3,000 rpm		
Starting torque	≤ 0.0069 N m		
Inertia moment	$\leq 40 \mathrm{g} \cdot \mathrm{cm}^2 (4 \times 10^{-6} \mathrm{kg} \cdot \mathrm{m}^2)$		
Allowable shaft load	Radial: 10 kgf, Thrust: 2.5 kgf		
Unit weight (packaged)	≈ 398 g (≈ 482 g)		
Approval	C € FR EHI		

- 01) Refer to resolution in 'Output Phase / Output Angle
- 02) Based on cable length: 2 m, I sink = 32 mA
- 03) Select resolution to satisfy Max. allowable revolution ≥ Max. response revolution $[max. response revolution (rpm) = \frac{max. response frequency}{resolution} \times 60 sec]$

Power supply	5 VDC== \pm 5% (ripple P-P: \leq 5%) / 12 - 24 VDC== \pm 5% (ripple P-P: \leq 5%) model
Current consumption	\leq 100 mA (no load)
Insulation resistance	\geq 100 M Ω (500 VDC== megger)
Dielectric strength	Between the charging part and the case: 750 VAC ~ 50 / 60 Hz for 1 min
Vibration	1mm double amplitude at frequency 10 to 55 Hz in each X, Y, Z direction for 2 hours
Shock	≲ 50 G
Ambient temp.	-10 to 70 °C, storage: -25 to 85 °C (no freezing or condensation)
Ambient humi.	35 to 85%RH, storage: 35 to 90%RH (no freezing or condensation)
Protection rating	IP65 (IEC standard)
Connection	Axial cable type (cable gland)
Cable spec. 01)	Ø 7 mm, 15-wire, 2m, shield cable
Wire spec.	AWG28 (0.08 mm, 40-core), insulator diameter: Ø 0.8 mm

01) Oil-resistant PVC shield cable option is also available to order

Output Phase / Output Angle

- TP = Timing Pulse
- TS = Signal Pulse
- EP = Even Parity

1024

720

- Resolution BCD code Binary code Gray code 'S: 0.3515° ±15' (13 bit) S: 0.3515° ±15' (10 bit) TS: 0.703° ±15' (10 bit) TS: 0.5° ±25' (11 bit) TS: 0.703° ±15' (11 bit) TS: 0.703° ±15' (9 bit) TS: 1.406° ±15' (9 bit) TS: 1° ±25' (10 bit) TS: 1° ±25' (9 bit) TS: 2° ±25' (9 bit) TS: $1.406^{\circ} \pm 15'$ (10 bit) TS: 1.406° ± 15' (8 bit) TS: 2° ±25' (9 bit) TS: 2° ±25' (8 bit) TS: 2.8125° ±15' (9 bit) TS: 2.8125° ±15' (7 bit)
- 512 360 256 TS: 2.8125° ± 15′ (8 bit) 180 128 TS: 5.625° ±15' (7 bit) 90 TS: 4° ±25' (8 bit) TS: 4° ±25' (7 bit) TS: 8° ±25' (7 bit) 64 TS: 5.625° ±15' (7 bit) TS: 5.625° ±15' (6 bit) TS: 11.25° ±15' (6 bit) 48 TS: 7.5° ±25' (7 bit) TS: 7.5° ±25' (6 bit) TS: 15° ±25′ (6 bit) 45 TS: 8° ±25' (7 bit) TS: 8° ±25' (6 bit) TP1: 5° ±60' (1 bit) TP1: 5° ±60′ (1 bit) TP1: 5° ±60' (1 bit) TP2: 2° ±60' (1 bit) 40 TS: 9° ±60' (6 bit) TS: 9° ±60' (6 bit) TS: $18^{\circ} \pm 60'$ (6 bit) EP: 9° ±60' (1 bit) EP: 9° ±60' (1 bit) EP: 9° ±60' (1 bit) $TP1 \cdot 7^{\circ} + 60' (1 \text{ bit})$ TP1: 7° ±60' (1 bit) $TP1 \cdot 7^{\circ} + 60' (1 \text{ hit})$ ΓP2: 2° ±60′ (1 bit)
- 32 TS: 11.25° ±60' (6 bit) TS: 11.25° ±60′ (5 bit rs· 22 5° +60° (5 hit EP: 11.25° ±60' (1 bit) EP: 11.25° ±60′ (1 bit) EP: 11.25° ±60′ (1 bit) TP1.8° +60' (1 hit) TP1: 8° ±60' (1 bit) TP1: 8° ±60' (1 bit) TP2: 3° ±60' (1 bit) TP2: $3^{\circ} \pm 60'$ (1 bit) TP2: $3^{\circ} \pm 60'$ (1 bit) 24 EP: 15° ±60' (1 bit) FP: 15° ±60' (1 bit) FP: 15° ±60' (1 bit) TP1: 12° ±60′ (1 bit) TP1: 12° ±60′ (1 bit) TP1: 12° ±60′ (1 bit) TP2: $2^{\circ} \pm 60'$ (1 bit) TP2: $2^{\circ} \pm 60'$ (1 bit) TP2: 2° ±60' (1 bit) 20

EP: $18^{\circ} \pm 60' (1 \text{ bit})$

EP: 36° ±60' (1 bit)

TP1: 39° ±60′ (1 bit)

TP2: 15° +60' (1 bit)

TS: 45° ±60′ (3 bit)

EP: 45° ±60' (1 bit)

TP1: 53° ±60' (1 bit)

TP2· 15° +60' (1 hit)

TS: 60° ±60' (3 bit)

TP1: 15° ±60' (1 bit) TP2: 2° ±60′ (1 bit) TP2: 2° ±60′ (1 bit) TP2: 2° ±60′ (1 bit) 16 TS: $22.5^{\circ} \pm 60' (5 \text{ bit})$ TS: $22.5^{\circ} \pm 60'$ (4 bit) TS: $45^{\circ} \pm 60'$ (4 bit) EP: 22.5° ±60' (1 bit) EP: 22.5° ±60' (1 bit) EP: 22.5° ±60' (1 bit) TP1: 15° ±60' (1 bit) TP1: 15° ±60′ (1 bit) TP1: 15° ±60' (1 bit) TP2: 3° ±60′ (1 bit) TP2: 3° ±60′ (1 bit) 12 TS: 30° ±60' (5 bit) TS: 30° +60' (4 hit) TS: $60^{\circ} \pm 60'$ (4 bit) EP: 30° ±60' (1 bit) EP: 30° ±60' (1 bit) EP: 30° ±60' (1 bit) TP1: 30° ±60' (1 bit) TP2: 12° ±60' (1 bit) TP1: 30° ±60' (1 bit) TP2: 12° ±60' (1 bit) TP1: 30° ±60′ (1 bit)

EP: 18° ±60′ (1 bit)

TP1: 15° ±60' (1 bit

EP: 36° ±60' (1 bit)

TP2: 15° +60' (1 bit)

TS: 45° ±60' (3 bit)

EP: 45° ±60' (1 bit)

TP1: 53° ±60' (1 bit)

TP2· 15° +60' (1 hit)

TS: 60° ±60' (3 bit)

EP: 60° ±60' (1 bit)

EP: 18° ±60' (1 bit)

TP1: 15° ±60′ (1 bit)

TP2: 12° ±60' (1 bit)

EP: 36° ±60′ (1 bit)

TP2: 15° +60' (1 hit)

S: 90° ±60' (3 bit)

P: 45° ±60' (1 bit)

TP1: 53° ±60′ (1 bit)

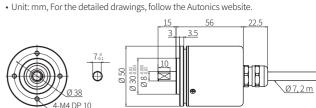
ΓP2: 15° ±60' (1 bit)

TS: 120° ±60′ (3 bit)

EP: 60° ±60' (1 bit)

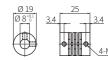
Dimensions

10



Bracket





■ Coupling

- Parallel misalignment: ≤ 0.25 mm
- End-play: ≤ 0.5 mm