Autonics

ROTARY ENCODER (INCREMENTAL TYPE)
E40 SERIES

INSTRUCTION MANUAL

CE

E40S **E40H** **E40HB**

Thank you for choosing our Autonics product.
Please read the following safety considerations before use.

▣ Safety Considerations

※Please observe all safety considerations for safe and proper product operation to avoid hazards.
※⚠ symbol represents caution due to special circumstances in which hazards may occur.

⚠ Warning Failure to follow these instructions may result in serious injury or death.
⚠ Caution Failure to follow these instructions may result in personal injury or product damage.

⚠ Warning

1. **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.)**
   Failure to follow this instruc ion may result in personal injury, economic loss or fire.
2. **Do not use the unit in the place where flammable/explosive/corrosive gas, humidity, direct sunlight, radiant heat, vibration, impact, or salinity may be present.**
   Failure to follow this instruction may result in explosion or fire.
3. **Install on a device panel to use.**
   Failure to follow this instruc ion may result in fire.
4. **Do not connect, repair, or inspect the unit while connected to a power source.**
   Failure to follow this instruc ion may result in fire.
5. **Check 'Connections' before wiring.**
   Failure to follow this instruc ion may result in fire.
6. **Do not disassemble or modify the unit.**
   Failure to follow this instruc ion may result in fire.

⚠ Caution

1. **Use the unit within the rated specifications.**
   Failure to follow this instruction may result in fire or product damage.
2. **Do not short the load.**
   Failure to follow this instruction may result in fire.
3. **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.

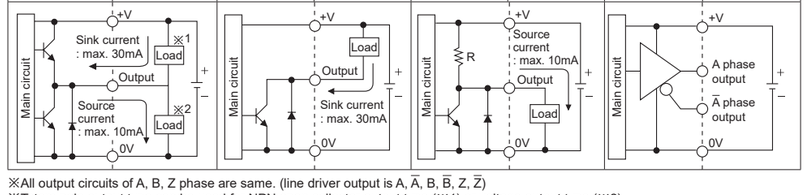
▣ Ordering Information

E40S	6	–	5000	–	3	–	N	–	24	–	

Series	Shaft diameter		Pulses / revolution	Output phase	Control output	Power supply	Cable
Ø40mm Shaft type	External	6: Ø6mm 8: Ø8mm	Refer to resolution	2: A, B 3: A, B, Z 4: A, $\overline{A}$, B, $\overline{B}$ 6: A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$	T: Totem pole output N: NPN open collector output V: Voltage output L: Line driver output	5: 5VDC ±5% 24: 12-24VDC ±5%	No mark : Radial cable type C : Radial cable connector type
Ø40mm Hollow shaft type, Hollow built-in type	Inside	6: Ø6mm 8: Ø8mm 10: Ø10mm 12: Ø12mm					

▣ Control Output Diagram

Totem pole output		NPN open collector output		Voltage output		Line driver output	
Rotary encoder circuit	Load connection	Rotary encoder circuit	Load connection	Rotary encoder circuit	Load connection	Rotary encoder circuit	Load connection



※All output circuits of A, B, Z phase are same. (line driver output is A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$)
※Totem pole output type can be used for NPN open collector output type (※1) or voltage output type (※2).

※The above specifications are subject to change and some models may be discontinued without notice.
※Be sure to follow cautions written in the instruction manual, and the technical descriptions (catalog, homepage).

▣ Specifications

Item			Diameter Ø40mm shaft type/hollow shaft type/hollow built-in type of incremental rotary encoder		
Model	Totem pole output		E40S□-□-□-T-□-□	E40H□-□-□-T-□-□	E40HB□-□-□-T-□-□
	NPN open collector output		E40S□-□-□-N-□-□	E40H□-□-□-N-□-□	E40HB□-□-□-N-□-□
	Voltage output		E40S□-□-□-V-□-□	E40H□-□-□-V-□-□	E40HB□-□-□-V-□-□
	Line driver output		E40S□-□-□-L-□-□	E40H□-□-□-L-□-□	E40HB□-□-□-L-□-□
Resolution (PPR)※1			*1, *2, *5, 10, *12, 15, 20, 23, 25, 30, 35, 40, 45, 50, 60, 75, 100, 120, 125, 150, 192, 200, 240, 250, 256, 300, 360, 400, 500, 512, 600, 800, 1000, 1024, 1200, 1500, 1800, 2000, 2048, 2500, 3000, 3600, 5000		
Output phase※2			A, B, Z phase (line driver output: A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$ phase)		
Electrical specification	Phase difference between output		Output between A and B phase: $\frac{T}{4}\pm\frac{T}{8}$ (T= 1cycle of A phase)		
	Control output	Totem pole output	•[Low] - Load current: max. 30mA, residual voltage: max. 0.4VDC⎓ •[High] - Load current: max. 10mA, Output voltage (power voltage 5VDC⎓): min. (power voltage-2 0)VDC⎓, Output voltage (power voltage 12-24VDC⎓): min. (power voltage-3 0)VDC⎓		
		NPN open collector output	Load current: max. 30mA, residual voltage: max. 0.4VDC⎓		
		Voltage output	Load current: max. 10mA, residual voltage: max. 0.4VDC⎓		
		Line driver output	•[Low] - Load current: max. 20mA, residual voltage: max. 0.5VDC⎓ •[High] - Load current: max. -20mA, Output voltage (power voltage 5VDC⎓): min. 2.5VDC⎓, Output voltage (power voltage 12-24VDC⎓): min. (power voltage-3 0)VDC⎓		
	Response time (rise/fall)	Totem pole output	Max. 1μs (cable length: 2m, I sink=20mA)		
		NPN open collector output			
		Voltage output			
		Line driver output	Max. 0.5μs (cable length: 2m, I sink=20mA)		
	Max. response frequency		300kHz		
	Power supply		•5VDC⎓ ±5% (ripple P-P: max. 5%) •12-24VDC⎓ ±5% (ripple P-P: max. 5%)		
	Current consumption		Max. 80mA (disconnection of the load), Line driver output: max. 50mA (disconnection of the load)		
	Insulation resistance		Over 100MΩ (at 500VDC megger between all terminals and case)		
	Dielectric strength		750VAC 50/60Hz for 1 minute (between all termials and case)		
	Connection		Radial cable type, radial cable connector type		
Mechanical specification	Starting torque		Shaft type: max. 40gf·cm (0.004N·m), hollow shaft/hollow built-in type: max. 50gf·cm (0.005N·m)		
	Moment of inertia		Max. 40g·cm² (4×10⁻⁶ kg·m²)		
	Shaft loading		Radial: 2kgf, Thrust: 1kgf		
	Max. allowable revolution※3		5,000rpm		
Vibration			1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours		
Shock			Approx. max. 50G		
Environment	Ambient temp.		-10 to 70℃, storage: -25 to 85℃		
	Ambient humi.		35 to 85%RH, storage: 35 to 90%RH		
Protection structure			IP50 (IEC standard)		
Cable			Ø5mm, 5-wire (line driver output: 8-wire), 2m, Shield cable (AWG 24, core diameter: 0.08mm, number of cores: 40, insulator out diameter: Ø1mm)		
Accessory			Ø6mm coupling, Ø8mm coupling	Bracket	
Approval			CE (except for line driver output)		
Unit weight			Approx. 120g		

※1: Not indicated resolutions are customizable. ※2: '*' pulse is only for A, B phase. (line driver output is for A, $\overline{A}$, B, $\overline{B}$ phase)
※3: Make sure that Max. response revolution should be lower than or equal to max. allowable revolution when selecting the resolution.

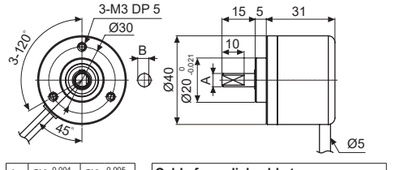
$$[\text{Max. response revolution (rpm)} = \frac{\text{Max. response frequency}}{\text{Resolution}} \times 60\ \text{sec}\ ]$$

※Environment resistance is rated at no freezing or condensation.

▣ Dimensions

(unit: mm)

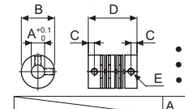
◎ **Shaft type**



A	Ø6 -0.004 -0.016	Ø8 -0.005 -0.02
B	5	7

Cable for radial cable type
Ø5, 5-wire (Line driver output: 8-wire), Length: 2m, Shield cable
Cable for radial cable connector type
Ø5, 5-wire (Line driver output: 8-wire), Length: 250mm, Shield cable

◎ **Coupling (shaft type)**

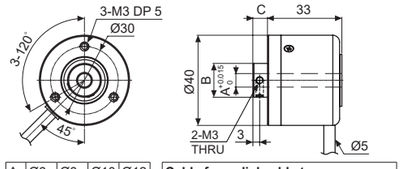


- Parallel misalignment: max. 0.25mm
- Angular misalignment: max. 5°
- End-play: max. 0 5mm

	A	B	C	D	E
E40S6 Ø6mm coupling	Ø6	Ø15	2.8	22	4-M3
E40S8 Ø8mm coupling	Ø8	Ø19	3.4	25	4-M4

※ t must not use larger shaft loading than specification.
※Do not put strong impact when insert a coupling into shaft. Failure to follow this instruction may result in product damage.
※Fix the unit or a coupling by a wrench under 0.15 N m of torque.
※When you install this unit, if eccentricity and deflection angle are larger, it may shorten the life cycle of this unit.

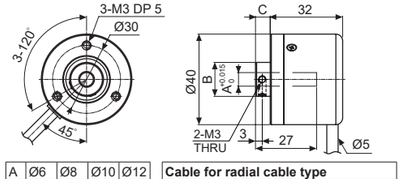
◎ **Hollow shaft type**



A	Ø6	Ø8	Ø10	Ø12
B	Ø15		Ø17	
C	6.5		6.3	

Cable for radial cable type
Ø5, 5-wire (Line driver output: 8-wire), Length: 2m, Shield cable
Cable for radial cable connector type
Ø5, 5-wire (Line driver output: 8-wire), Length: 250mm, Shield cable

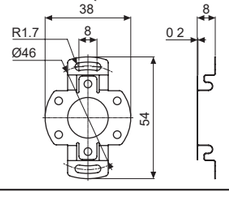
◎ **Hollow built-in type**



A	Ø6	Ø8	Ø10	Ø12
B	Ø15		Ø17	
C	6.5		6.3	

Cable for radial cable type
Ø5, 5-wire (Line driver output: 8-wire), Length: 2m, Shield cable
Cable for radial cable connector type
Ø5, 5-wire (Line driver output: 8-wire), Length: 250mm, Shield cable

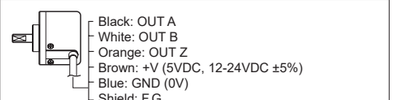
◎ **Bracket (hollow shaft/hollow built-in type)**



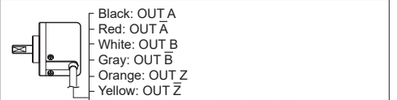
▣ Connections

◎ **Radial cable type**

• Totem pole output • NPN open collector output • Voltage output



• Line driver output



※Non-using wires must be insulated.
※The shield cable and metal case of encoder must be grounded(F.G.).
※Do not apply tensile strength over 30N to the cable.

◎ **Radial cable connector type**

• Totem pole output • NPN open collector output • Voltage output

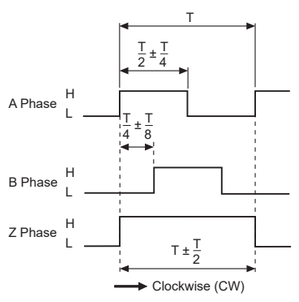
Pin No.	Cable color	Function
1	Black	OUT A
2	White	OUT B
3	Orange	OUT Z
4	Brown	+V
5	Blue	GND
6	Shield	F.G.

• Line driver output

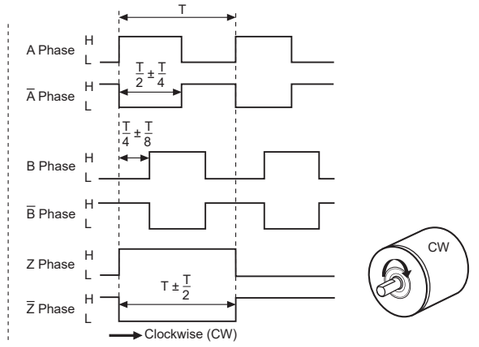
Pin No.	Cable color	Function
1	Black	OUT A
2	Red	OUT Ā
3	Brown	+V
4	Blue	GND
5	White	OUT B
6	Gray	OUT B̄
7	Orange	OUT Z
8	Yellow	OUT Z̄
9	Shield	F.G.

▣ Output Waveforms

◎ **Totem pole output / NPN open collector output / Voltage output**



◎ **Line driver output**



▣ Cautions during Use

1. Follow instructions in 'Cautions during Use'. Otherwise, It may cause unexpected accidents.
2. 5VDC, 12-24VDC power supply should be insulated and limited voltage/current or Class 2, SELV power supply device.
3. For using he unit with the equipment which generates noise (switching regulator, inverter, servo motor, etc.), ground the shield wire to the F.G. terminal.
4. Ground the shield wire to the F.G. terminal.
5. When using switching mode power supply, frame ground (F.G.) terminal of power supply should be grounded.
6. Wire as short as possible and keep away from high voltage lines or power lines, to prevent inductive noise.
7. For Line driver unit, use the twisted pair wire which is attached seal and use the receiver for RS-422A communication.
8. 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 between lines.
9. This unit may be used in the following environments.
   ①Indoors (in he environment condition rated in 'Specifications')
   ②Altitude max. 2,000m
   ③Pollution degree 2
   ④Installation category II

▣ Major Products

- Photoelectric Sensors
- Fiber Optic Sensors
- Door Sensors
- Door Side Sensors
- Area Sensors
- Proximity Sensors
- Pressure Sensors
- Rotary Encoders
- Connector/Sockets
- Switching Mode Power Supplies
- Control Switches/Lamps/Buzzers
- I/O Terminal Blocks & Cables
- Stepper Motors/Drivers/Motion Controllers
- Graphic/Logic Panels
- Field Network Devices
- Laser Marking System (Fiber, Co_2, Nd: YAG)
- Laser Welding/Cutting System
- Temperature Controllers
- Temperature/Humidity Transducers
- SSR/Power Controllers
- Counters
- Timers
- Panel Meters
- Tachometer/Pulse (Rate) Meters
- Display Units
- Sensor Controllers