Autonics

Ø50mm Shaft Type Multi-turn Absolute Rotary Encoder
EPM50S SERIES
INSTRUCTION MANUAL

CE

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 instruction may result in fire, personal injury, or economic loss.
2. **Install on a device panel to use.**
Failure to follow this instruction may result in fire.
3. **Do not connect, repair, or inspect the unit while connected to a power source.**
Failure to follow this instruction may result in fire.
4. **Check 'Connections' before wiring.**
Failure to follow this instruction may result in fire.
5. **Do not disassemble or modify the unit.**
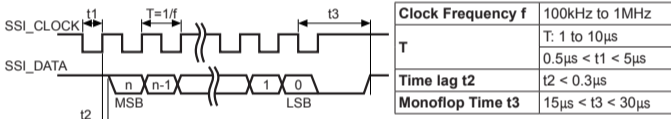Failure to follow this instruction may result in fire.

⚠ 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 product damage by fire.
3. **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 fire or explosion.
4. **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.**
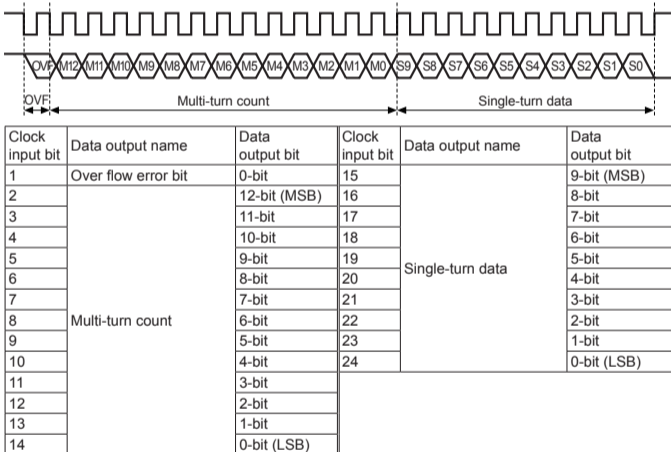Failure to follow this instruction may result in product damage.

■ Ordering Information

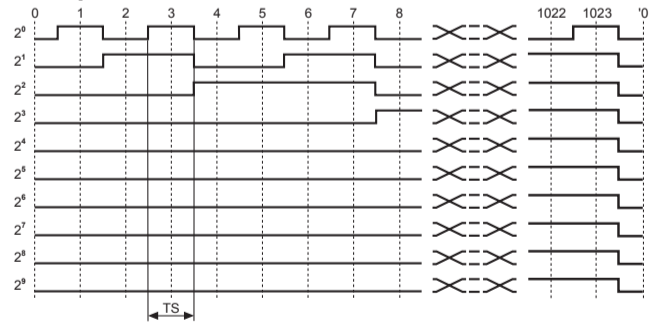| EPM50S	8	10	13	- B	- PN	- 24	-
Item	Shaft diameter	Single-turn	Multi-turn	Output code	Control output	Power supply	Cable
50mm Shaft type	Ø8mm	10-bit (1024 -division)	13-bit (8192 -revolution)	Binary Code	PN: Parallel NPN open collector output S: SSI line driver output	12-24VDC ±5%	No-mark: Axial cable type S: Radial cable type

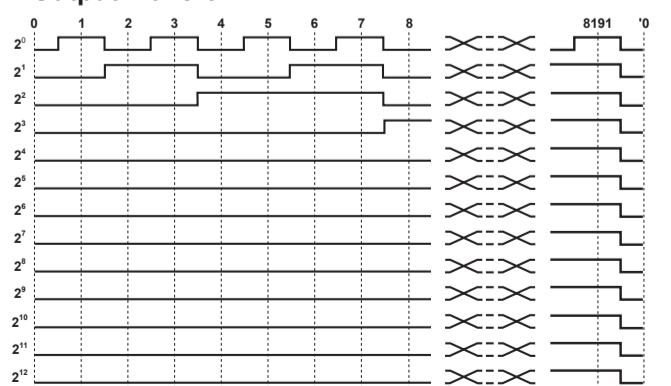## ■ Synchronous Serial Interface (SSI) Output Timing Diagram

Clock Frequency f	100kHz to 1MHz
T	T: 1 to 10µs
	0.5µs < t1 < 5µs
Time lag t2	t2 < 0.3µs
Monoflop Time t3	15µs < t3 < 30µs

■ Synchronous Serial Interface (SSI) Data Output

Clock input bit	Data output name	Data output bit	Clock input bit	Data output name	Data output bit
1	Over flow error bit	0-bit	15		9-bit (MSB)
2		12-bit (MSB)	16		8-bit
3		11-bit	17		7-bit
4		10-bit	18		6-bit
5		9-bit	19	Single-turn data	5-bit
6		8-bit	20		4-bit
7		7-bit	21		3-bit
8	Multi-turn count	6-bit	22		2-bit
9		5-bit	23		1-bit
10		4-bit	24		0-bit (LSB)
11		3-bit			
12		2-bit			
13		1-bit			
14		0-bit (LSB)			

■ Parallel Interface 1024-division Single-Turn Data Output Waveform

※TS=0.3515625°±15'
※Above waveform is based on the positive logic. (The output waveform of negative logic is in reverse.)

■ Parallel Interface 8192-revolution Multi-Turn Count Output Waveform
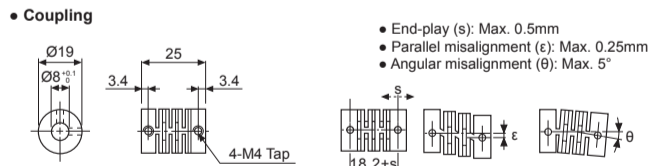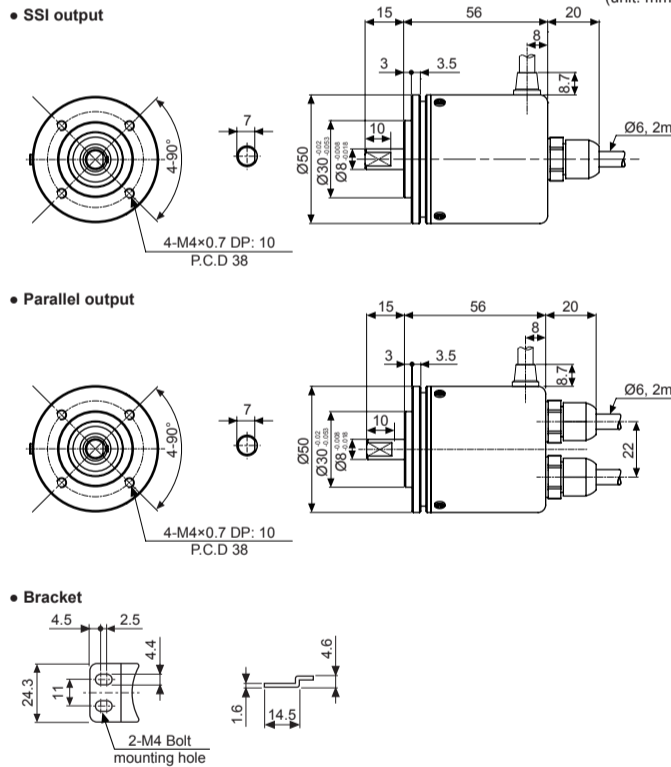

※Above waveform is based on the positive logic. (The output waveform of negative logic is in reverse.)

※**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

Type	Ø50mm shaft type multi-turn absolute rotary encoder	
Model	EPM50S8-1013-B-S-24	EPM50S8-1013-B-PN-24
Resolution Single-turn	1024-division (10-bit)	
Resolution Multi-turn	8192-revolution (13-bit)	
Rotation limit when power off※1	±90°	

			EPM50S8-1013-B-S-24	EPM50S8-1013-B-PN-24
Electrical specification	Output	Output code	24-bit, Binary 2 code	Binary 2 code
		Control output	SSI (Synchronous Serial Interface) Line driver • [Low]-Sink current: Max. 20mA, Residual voltage: Max. 0.5VDC⎓ • [High]-Sink current: Max. -20mA, Output voltage: Min. 2.5VDC⎓	Parallel NPN open collector output Sink current: Max. 32mA, Residual voltage: Max. 1VDC⎓
		Output signal	Single-turn data, Multi-turn count, OVF alarm※2	
		Output logic	—	Negative logic output
		Response time (rise/fall)	—	Max. 1µs (cable: 2m, I sink=32mA)
	Input	Input signal	Single-turn data reset※3, Multi-turn count reset※4, Direction, Clear	
			—	Latch
		Input level	0-1VDC⎓	
		Input logic	Low active, Open or High for common use	
		Input time	Single-turn data reset※3, Multi-turn count reset※4, Direction, Clear : Over 100ms	Latch: Over 500µs
	SSI clock input	Input level	5VDC⎓ ±5%	—
		Input frequency	100kHz to 1MHz	—
	Max. response frequency	—	50kHz	
	Power supply	12-24VDC⎓ ±5% (ripple P-P: max. 5%)	
	Current consumption	Max. 150mA (disconnection of the load)	Max. 100mA (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 terminals and case)	
	Connection	Axial/Radial cable type (cable gland)	
Mechanical specification	Starting torque	Max. 70gf·cm (0.0069N·m)	
	Moment of inertia	Max. 40g·cm² (4×10⁻⁶kg·m²)	
	Shaft loading	Radial: 10kgf, Thrust: 2.5kgf	
	Max. revolution※5	3,000rpm	
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 temperature	-10 to 70°C, storage: -25 to 85°C
	Ambient humidity	35 to 85%RH, storage: 35 to 90%RH
Protection structure	Axial cable type: IP64 (IEC standard), Radial cable type: IP50 (IEC standard)	
Cable	Ø6mm, 10-wire, 2m, Shield cable (AWG28, core diameter: 0.08mm, number of cores: 19, insulator diameter: Ø0.8mm)	Ø6mm, 17-wire×2, 2m, Shield cable (AWG28, core diameter: 0.08mm, number of cores: 17, insulator diameter: Ø0.8mm)
Accessories	Bracket, coupling	
Approval	CE	
Weight※6	Approx. 409g (approx. 324g)	Approx. 560g (approx. 475g)

※1: It calibrates the multi-turn counts by comparing single-turn data before/after power off without counting multi-turn counts when power is off. It shall be used on the condition that no overrated revolution occurred since proper multi-turn data may not be available if any revolutions occurred over ±90° from the position when power is off.
※2: OVF alarm is ON when multi-turn count is out of counting range (0 to 8191 revolution).
※3: Single-turn data will be reset as 「0」 when single-turn data reset is input.
※4: Multi-turn count will be reset as 「0 revolution」 when multi-turn count reset is input.
※5: In case of Parallel type model, Make sure that Max. response revolution should be lower than or equal to max. allowable revolution when selecting the resolution.

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

※6: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing or condensation.

■ Dimensions
(unit: mm)

● SSI output

● Parallel output

● Bracket

2-M4 Bolt mounting hole

● Coupling

4-M4 Tap

- End-play (s): Max. 0.5mm
- Parallel misalignment (ε): Max. 0.25mm
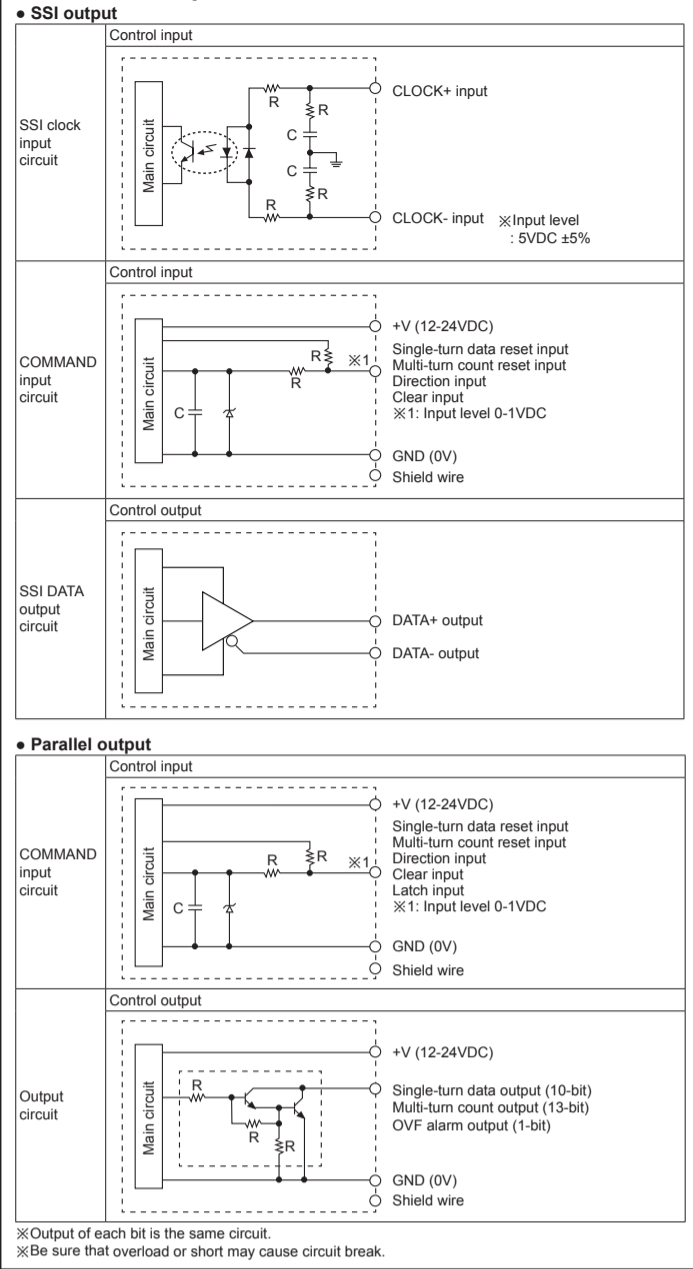- Angular misalignment (θ): Max. 5°

- Do not load overweight on the shaft.
- For more information about flexible coupling (ERB Series), please refer to the catalogue.
- 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.

■ Functions

○ Single-turn data reset
Single-turn data will be reset as 「0」 when single-turn data reset cable is inputted 0 to 1V (over 100ms). In case of not using single-turn data reset cable, connect the line to OPEN or + V.

○ Multi-turn count reset
Multi-turn data will be reset as 「0 revolution」 when multi-turn count reset cable is inputted 0 to 1V (over 100ms). In case of not using multi-turn count reset cable, connect the line to OPEN or + V.
OVF alarm will be reset with multi-turn count input.

○ Direction
Connect the direction cable to OPEN or +V and turn on the power. Output will increase when rotation direction is CW from shaft axis. In case of connecting 0 to 1 V (over 100ms), output will increase when rotation direction is CCW. If direction setting is reset, single-turn data, multi-turn count and OVF will be reset together since direction setting is initial setting which is set with Power ON.

○ Clear
Single-turn data will be reset as 「0」 and multi-count will be also reset as 「0 revolution」 when clear cable is inputted 0 to 1V (over 100ms). In case of not using clear cable, connect the cable to OPEN or + V. OVF alarm will be reset with clear input.

○ Latch (Parallel output model only)
When the latch cable is inputted 0 to 1V (over 500µs), outputs for single-turn data, multi-turn count and OVF at latch point will be remained. When latch cable is connected to OPEN or +V, output will be returned to operating mode output.

○ OVF
It is an alarm function when multi-turn count is out of rotation ranges (0 to 8191 revolutions). Over flow alarm is also reset with multi-turn count value when multi-turn count reset signal is inputted.

■ Control Output I/O Circuit

● SSI output

SSI clock input circuit — CLOCK+ input / CLOCK- input ※Input level : 5VDC ±5%

COMMAND input circuit — +V (12-24VDC) Single-turn data reset input Multi-turn count reset input Direction input Clear input ※1: Input level 0-1VDC / GND (0V) / Shield wire

SSI DATA output circuit — DATA+ output / DATA- output

● Parallel output

COMMAND input circuit — +V (12-24VDC) Single-turn data reset input Multi-turn count reset input Direction input Clear input Latch input ※1: Input level 0-1VDC / GND (0V) / Shield wire

Output circuit — +V (12-24VDC) Single-turn data output (10-bit) Multi-turn count output (13-bit) OVF alarm output (1-bit) / GND (0V) / Shield wire

※Output of each bit is the same circuit.
※Be sure that overload or short may cause circuit break.

■ Connections

● SSI output

Cable

Cable color	Description	Cable color	Description
Brown	CLOCK+	Gray	Single-turn data reset
Red	CLOCK-	Blue	Multi-turn count reset
Orange	DATA+	Purple	Clear
Yellow	DATA-	Green	Direction
White	+V (12-24VDC)		
Black	GND (0V)		
Shield wire	Signal shield cable (F.G.)		

● Parallel output

Multi-turn count cable (Sheath color: Black)		Single-turn data cable (Sheath color: Gray)	
Cable color	Description	Cable color	Description
Brown		Brown	2^0
Red		Red	2^1
Orange		Orange	2^2
Yellow		Yellow	2^3
Green		Green	2^4
Blue		Blue	Single-turn data 2^5
Purple	Multi-turn count	Purple	2^6
Gray		Gray	2^7
Pink		Pink	2^8
Clear		Clear	2^9
Light brown	2^{10}	Light brown	N.C.
Light yellow	2^{11}	Light yellow	Direction
Light green	2^{12}	Light green	Latch
Light blue	OVF	Light blue	Clear
Light purple	Multi-turn count reset	Light purple	Single-turn data reset
White	+V (12-24VDC)	White	+V (12-24VDC)
Black	GND (0V)	Black	GND (0V)
Shield wire	Signal shield cable (F.G.)	Shield wire	Signal shield cable (F.G.)

(Multi-turn count cable Brown to Clear = 2^0 to 2^9)

※Not used cables should be insulated.
※Do the wiring properly.
※Encoder's metal case and shield cable must be grounded (F.G.).
※Do the wiring with care for short since dedicated Driver IC is used for I/O circuit.
※As for Parallel output, it is recommended to connect +V and GND of both multi-turn count cable and single-turn data cable.
※Do not apply tensile strength over 30N to the cable.

■ Cautions during Use

1. Follow instructions in 'Cautions during Use'. Otherwise, It may cause unexpected accidents.
2. 12-24VDC power supply should be insulated and limited voltage/current or Class 2, SELV power supply device.
3. 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.
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. 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.
8. This unit may be used in the following environments.
   ①Indoors (in the 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, Co₂, 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

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