

Autonics

Ø50mm Shaft type Magnetic Multi-turn Absolute Rotary Encoder
MGAM50S SERIES

INSTRUCTION MANUAL

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, 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

MGAM50S	8	10	13	B	F	PN	24
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Item	Shaft diameter	Single-turn	Multi-turn	Output code	Rotation direction	Control output	Power supply
50mm Shaft type	Ø8mm	10-bit (1024 -division)	13-bit (8192 -revolution)	Binary Code	F: Output increases by CW rotation direction at the shaft R: Output increases by CCW rotation direction at the shaft	PN: Parallel NPN open collector S: SSI Line driver output	12-24VDC ±5%

Synchronous Serial Interface (SSI) Output Timing Diagram

Clock Frequency f	100kHz to 1MHz
T : 1 to 10µs	
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	Single-turn data	9-bit (MSB)
2	Multi-turn count	12-bit (MSB)	16		8-bit
3		11-bit	17		7-bit
4		10 bit	18		6-bit
5		9-bit	19		5-bit
6		8-bit	20		4-bit
7		7-bit	21		3-bit
8		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'
※Left 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

※Left 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 magnetic multi-turn absolute rotary encoder		
Model	MGAM50S8-1013-B-F-S-24	MGAM50S8-1013-B-F-PN-24	
Resolution	Single-turn Multi-turn	1024-division (10-bit) 8192-revolution (13-bit)	
Rotation limit when power off	※1 ±90°		
Electrical specification	Hysteresis	±0.1°	
	Positioning error	※2 ±1-bit (LSB: Least Significant -bit)	
	Output code	24-bit, 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	Binary 2 code Parallel NPN open collector output Sink current: Max. 20mA, Residual voltage: Max. 1VDC
		Output signal	Single-turn data, Multi-turn count, over flow alarm (OVF)※3
		Output logic	— Negative logic output
	Response time (rise/fall)	— Max. 1µs (cable: 2m, I sink = 20mA)	
	Multi-turn count reset input	Input level Input logic Input time	0-1VDC Low Active, OPEN for common use Over 100ms
	SSI Clock input	Input level Input frequency	5VDC ±5% 100kHz to 1MHz
	Max. response frequency	—	30kHz
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 between all terminals and case)		
Dielectric strength	750VAC 50/60Hz for 1 minute (between all terminals and case)		
Connection	Axial cable type (cable gland)		
Mechanical specification	Starting torque	Max. 70gf·cm (0.0069N·m)	
	Moment of inertia	Max. 80g·cm ² (8×10 ⁻⁶ kg·m ²)	
	Shaft loading	Radial: 10kgf, Thrust: 2.5kgf	
	Max. revolution	3000rpm	
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°C, storage: -25 to 85°C	
Ambient humi.	35 to 85%RH, storage: 35 to 90%RH		
Protection structure	IP50 (IEC standard)		
Cable	Ø6mm 10-wire, 2m, Shield cable (AWG 28, core diameter: 0.08mm, number of cores: 19, insulator diameter: Ø0.8mm)	Ø6mm 17-wire×2, 2m, Shield cable (AWG 28, core diameter: 0.08mm, number of cores: 17, insulator diameter: Ø0.8mm)	
Accessories	Mounting bracket, coupling		
Approval	CE		
Weight	Approx. 391g (approx. 261g)	Approx. 523g (approx. 393g)	

※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 counts may not be available if any revolutions occurred over ±90° from the position when power is off.

※2: When turning ON/OFF the unit, there may be ±1-bit (LSB) error at present position by hysteresis.

※3: OVF alarm is ON when multi-turn count is out of counting range (0 to 8191 revolution).

※4: Multi-turn count shall be initialized 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.

【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

Coupling

Control Output I/O Circuit

SSI output

Control input

SSI CLK input circuit

CLOCK+ input

CLOCK- input ※Input level : 5VDC ±5%

COMMAND input circuit

Control input

COMMAND input circuit

+V (12-24VDC)

Multi-turn count reset input (※Input level: 0-1VDC)

GND (0V)

Shield wire

SSI DATA output circuit

Control output

SSI DATA output circuit

DATA+ output

DATA- output

Parallel output

Control input

COMMAND input circuit

+V (12-24VDC)

Multi-turn count reset input (※Input level: 0-1VDC)

GND (0V)

Shield wire

Output circuit

Control output

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.
※Overload or short may cause circuit break.

Connections

SSI output

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

Parallel output

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

※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.
※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, Co., 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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