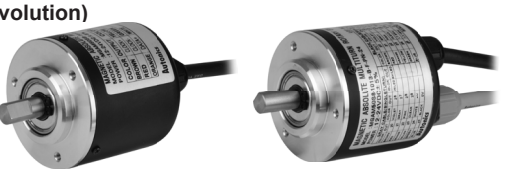
# Shaft Type Ø50mm Magnetic Multi-turn Absolute Rotary Encoder

## ■ Features

- **Higher resistant to vibration and impact by magnetic elements than optical encoder**
- **Total 23-bit resolution (8,388,608-division) of 10-bit single-turn (1,024-division) and 13-bit multi-turn (8,192-revolution)**
- Compact size of Ø50mm
- Parallel data/SSI data transmission type
- Maximizing users convenience with over flow alarm (OVF) function
- Power supply: 12-24VDC ±5%
- Protection structure IP50 (IEC standard)



## ■ Applications

- Precision machine tool, Fabric machinery, Robot, Parking system

**Please read "Safety Considerations" in the instruction manual before using.**

## ■ Ordering Information

| MGAM50S | 8 | – 10 | 13 | – B | – F | – PN | – 24 |
|---|---|---|---|---|---|---|---|

| Series | Shaft diameter | Single-turn | Multi-turn | Output code | Rotation direction | Control output | Power supply |
|---|---|---|---|---|---|---|---|
| Ø50mm Shaft type | Ø8mm | 10-bit (1024 -division) | 13-bit (8192 -revolution) | Binary Code | F: Output increases by CW rotation direction at the shaft<br>R: Output increases by CCW rotation direction at the shaft | PN: Parallel NPN open collector output<br>S: SSI Line driver output | 12-24VDC±5% |

## ■ Specifications

| Type | | | Shaft Type Ø50mm Magnetic Multi-turn Absolute Rotary Encoder | |
|---|---|---|---|---|
| Model | | | **MGAM50S8-1013-B-F-S-24** | **MGAM50S8-1013-B-F-PN-24** |
| Resolution | | Single-turn | 1024-division (10-bit) | |
| | | Multi-turn | 8192-revolution (13-bit) | |
| Rotation limit when power off ※1 | | | ±90° | |
| Electrical specification | Output | Hysteresis | ±0.1° | |
| | | Positioning error※2 | ±1-bit (LSB: Least Significant Bit) | |
| | | Output code | 24-bit, Binary code | Binary code |
| | | Control output | SSI (Synchronous Serial Interface)<br>Line driver output<br>[Low] - Sink current: max. 20mA,<br>Residual voltage: max. 0.5VDC⎓<br>[High] - Sink current: max. -20mA,<br>Output voltage: min. 2.5VDC⎓ | Parallel NPN open collector output<br>Sink current: max. 20mA,<br>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※4 | Input level | 0-1VDC⎓ | |
| | | Input logic | Low Active, Open for common use | |
| | | Input time | Over 100ms | |
| | SSI clock input | Input level | 5VDC⎓ ±5% | — |
| | | Input frequency | 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 megger between all terminals and case) | |
| | Dielectric strength | | 750VAC 50/60Hz for 1 minute (between all terminals and case) | |
| | Connection | | Axial cable type (cable gland) | |

※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 revolutions).
※4: Multi-turn count shall be initialized as 「0 revolution」 when multi-turn count reset is input.

## ■ Specifications

| Type | | Shaft Type Ø50mm Magnetic Multi-turn Absolute Rotary Encoder | |
|---|---|---|---|
| Model | | MGAM50S8-1013-B-F-S-24 | MGAM50S8-1013-B-F-PN-24 |
| 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: max. 10kgf, Thrust: max. 2.5kgf | |
| | Max. allowable 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 temp. | -10 to 70℃, storage: -25 to 85℃ | |
| | Ambient humid. | 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 out diameter: Ø0.8mm) | Ø6mm, 17-wire×2, 2m, Shield cable (AWG 28, core diameter: 0.08mm, number of cores: 17, insulator out diameter: Ø0.8mm) |
| Accessories | | Bracket, coupling | |
| Approval | | CE | |
| Weight※6 | | Approx. 391g (approx. 261g) | Approx. 523g (approx. 393g) |

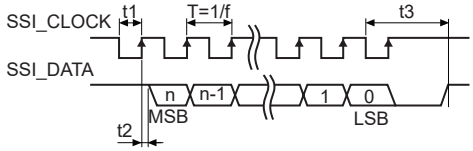
※5: In case of Parallel type model, Make sure that Max. response revolution should be lower than or equal to max. allowable revolution when selecting the resolution.

【Max. response revolution (rpm) = $\frac{\text{Max. response frequency}}{\text{Resolution}}$ × 60 sec】

※6: The weight includes packaging. The weight in parenthesis is for unit only.

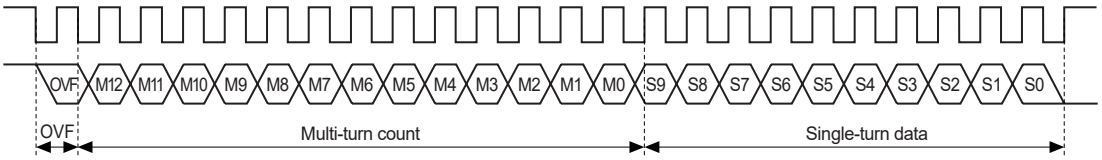
※Environment resistance is rated at no freezing or condensation.

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



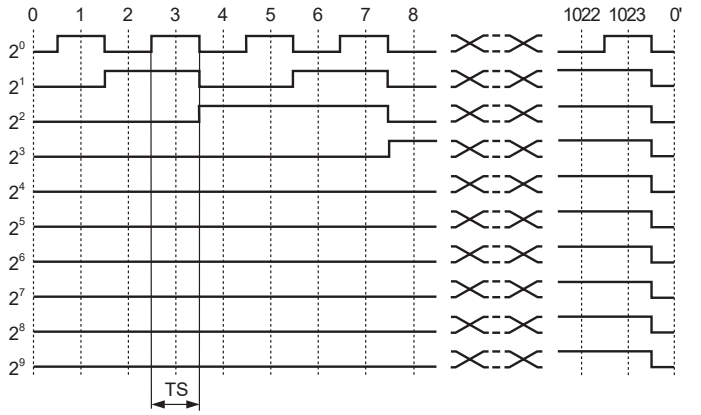

| | |
|---|---|
| **Clock Frequency f** | 100kHz to 1MHz |
| **T** | T: 1 to 10μs |
| | 0.5μs < t1 < 5μs |
| **Time lag t2** | t2 < 0.3μs |
| **Monoflop Time t3** | 15μs < t3 < 30μs |

## ■ Synchronous Serial Interface (SSI) Data Output



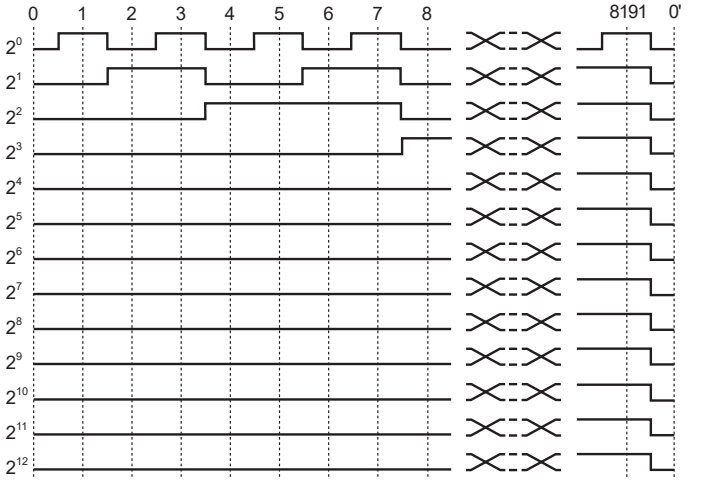

| Clock input bit | Data output name | Data output bit | Clock input bit | Data output name | Data output bit |
|---|---|---|---|---|---|
| 1 | Over flow alarm bit | 0-bit | 15 | Single-turn data | 9-bit (MSB) |
| 2 | Multi-turn count | 12-bit (MSB) | 16 | | 8-bit |
| 3 | | 11-bit | 17 | | 7-bit |
| 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'
※The above waveform is based on the positive logic. (The output waveform of negative logic is opposed.)

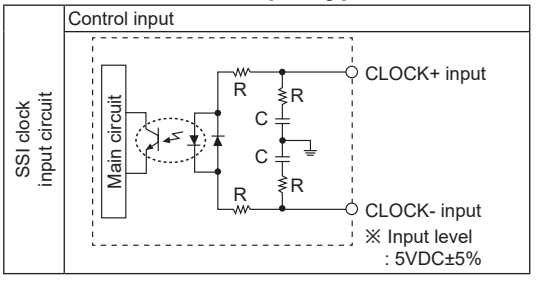
## ▣ Parallel Interface 8192-revolution Multi-turn Count Data Output Waveform

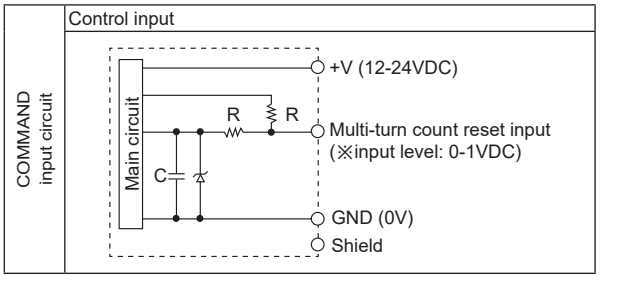



※The above waveform is based on the positive logic. (The output waveform of negative logic is opposed.)

## ▣ Control Output I/O Circuit

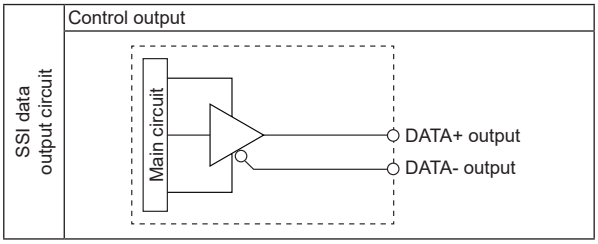
### ◎ SSI Line driver output type



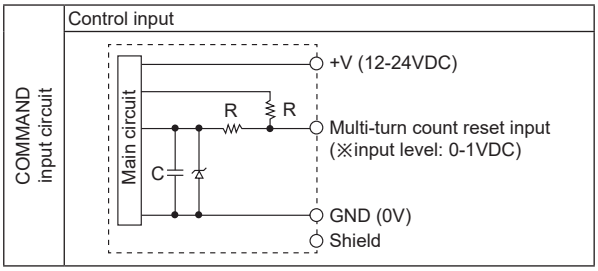



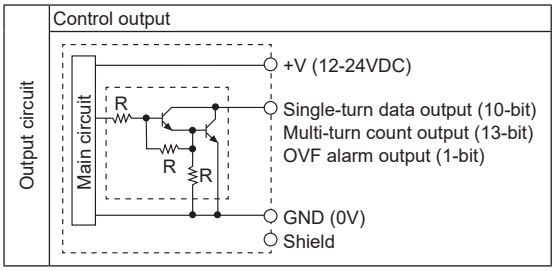
## ▣ Control Output I/O Circuit

### ◎ SSI Line driver output type




### ◎ Parallel NPN open collector output type




※Each bit of output has the same circuit.
※Please be aware of the fact that overload and short circuit may cause circuit break.

## ▣ Connections

### ◎ SSI Line driver output type

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

### ◎ Parallel NPN open collector output type

| Multi-turn count cable (sheath color: black) | | |
|---|---|---|
| Cable color | Description | |
| Brown | Multi-turn count | $2^0$ |
| Red | | $2^1$ |
| Orange | | $2^2$ |
| Yellow | | $2^3$ |
| Green | | $2^4$ |
| Blue | | $2^5$ |
| Purple | | $2^6$ |
| Gray | | $2^7$ |
| Pink | | $2^8$ |
| Clear | | $2^9$ |
| Light brown | | $2^{10}$ |
| Light yellow | | $2^{11}$ |
| Light green | | $2^{12}$ |
| Light blue | OVF | |
| Light purple | Multi-turn count reset | |
| White | N.C. | |
| Black | N.C. | |
| Shield | Signal shield cable (F.G.) | |

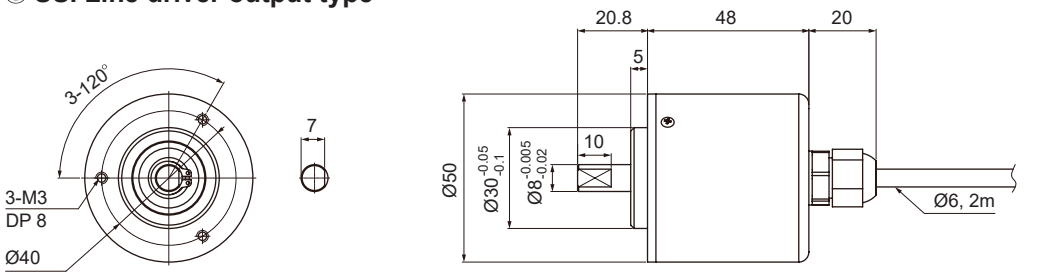
| Single-turn data cable (sheath color: gray) | | |
|---|---|---|
| Cable color | Description | |
| Brown | Single-turn data | $2^0$ |
| Red | | $2^1$ |
| Orange | | $2^2$ |
| Yellow | | $2^3$ |
| Green | | $2^4$ |
| Blue | | $2^5$ |
| Purple | | $2^6$ |
| Gray | | $2^7$ |
| Pink | | $2^8$ |
| Clear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

※Unused wires must be insulated.
※Do the wiring properly.
※Encoder metal case and shield cable must be grounded (F.G.).
※Please use caution to avoid short circuit when connecting output cables because I/O circuit uses the dedicated driver IC.
※Do not apply tensile strength over 30N to the cable.

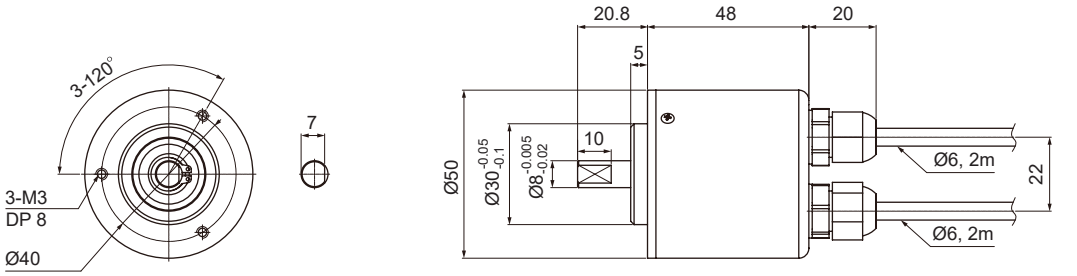
## ▣ Dimensions

(unit: mm)

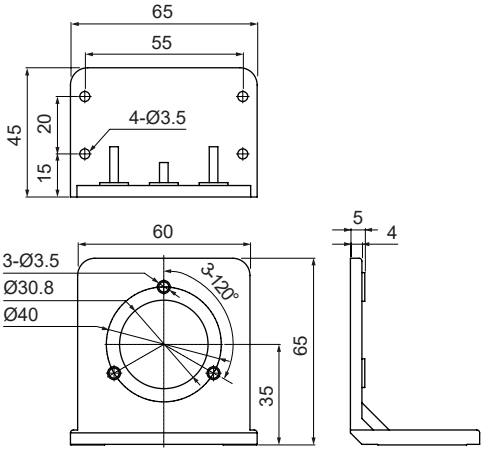
### ◎ SSI Line driver output type



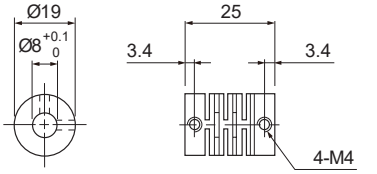

### ◎ Parallel NPN open collector output type




### ◎ Bracket




### ◎ Coupling




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

※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.
※Fix the unit or a coupling by a wrench under 0.15N·m of torque.
※When you install this unit, if eccentricity and deflection angle are larger, it may shorten the life cycle of this unit.
※For parallel misalignment, angular misalignment, end-play terms, refer to the "Glossary" section of Technical Description.
※For flexible coupling (ERB series) information, refer to the ERB series section.

## ▣ Functions

### ◎ Multi-turn count reset

Multi-turn data will be reset as 「0 revolution」 when multi-turn count reset cable (light purple) is inputted 0 to 1V (over 100ms).

### ◎ Over flow alarm (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.