

GE Series

High Sensitivity, High Speed, High Accuracy TMR Geartooth Encoders

Description

The GE series geartooth encoders are non-contact incremental encoders measuring rotary speed and position in spindles and motors. Based on MultiDimension Technology (MDT)'s unique tunneling magnetoresistance (TMR) sensor technology, they detect changes in the magnetic field due to gear movement to achieve high sensitivity, fast response, high accuracy, and high reliability.



Applications

- Spindles and motors
- CNC machine tools
- Energy and power generation systems
- Elevators

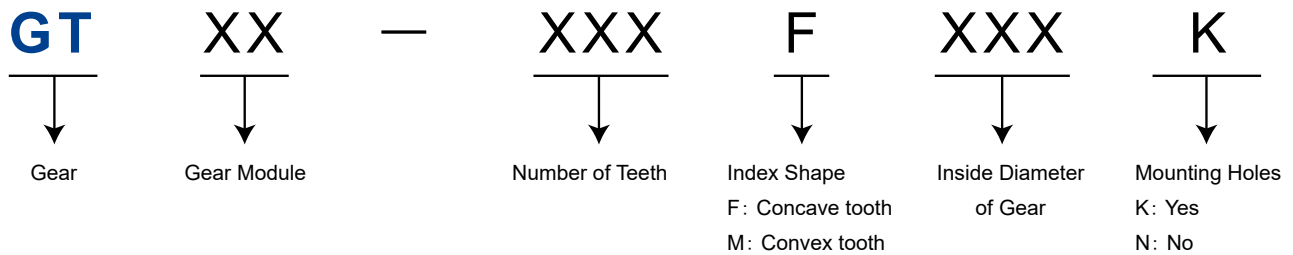
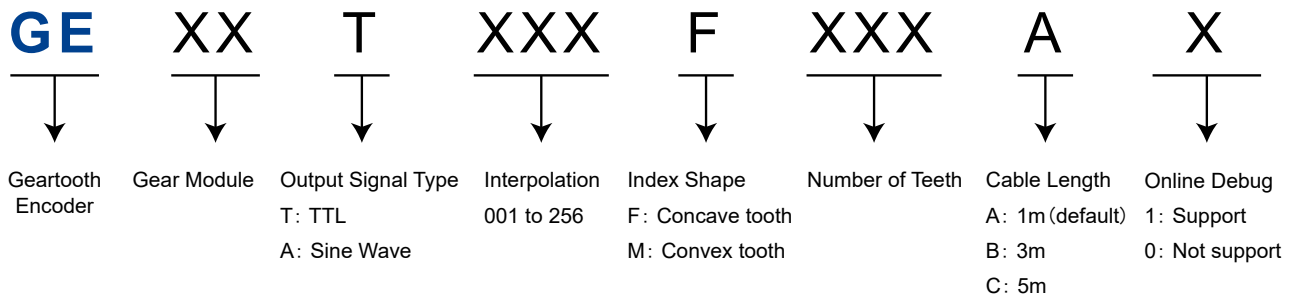


Features and Benefits

- **Compatible:** Incremental ABZ Signal
Designed for 0.2 to 0.8 module gears with different teeth numbers. Outputs in TTL or 1 V_{pp} sinusoidal signal (phase A and B), reference mark signal (Z), and corresponding differential signals (A-, B-, Z-). Compatible with most drivers and systems.
- **Quick:** High response frequencies, suitable for high-speed spindle
Up to 10 MHz output frequency and up to 500 kHz input frequency. Adapt to spindles with a speed of more than 30,000 RPM.
- **Precision:** High accuracy and high resolution
TTL encoder provides up to 256-fold integrated interpolation. Analog encoder accuracy of graduation as low as 30" (in specific systems).
- **Reliable:** Designed for harsh environment
Fully sealed metal housing with surface treatment provides IP68 protection against water, oil, or dust. With the internal protection circuit, it can effectively improve the anti-interference and anti-static performance of the encoder. Operating temperature range is -20 °C to 100 °C.
- **Flexible:** Customizable on demand
Non-standard resolutions available on demand. Reference signal width, wave form, cable length, and gear can also be customized. Enhanced versions support parameter burning, real-time calibration after installation. Easy integration with optional diagnostic tool. It can significantly improve the installation efficiency and reliability of the encoder when the encoder is deployed with the diagnostic tool.

Selection Guide

Model	Description	Output Signal	Supply Voltage	Gear Module	Diagnostic tool Model	Calibration After Installation
GE-T	Incremental TTL	RS422(TTL)	5 VDC±10%	0.3 to 1	GF-T, GF-A/T	Support
GE-A	Incremental Sine Wave	Sin/Cos(1V _{pp})	5 VDC±10%	0.3 to 1	GF-A/T	Support



Catalogue

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1. Electrical Parameters

Parameter	GE-T (TTL)	GE-A (Sine wave)
Supply voltage	5 VDC±10%	5 VDC±10%
Output current	≤ 27 mA (no load)	≤ 20 mA (no load)
Output terminals	A, A-, B, B-, Z, Z-	A, A-, B, B-, Z, Z-
Output signal	RS422 (TTL)	Sin/Cos
Amplitude accuracy	50%±10%	1V _{pp} ±20%
Phase angle	90°±10%	90°±5%
Switching time	20 ns	-
Input frequency	≤ 700 kHz	≤ 500 kHz
Output frequency	≤ 10 MHz	≤ 500 kHz
Integrated interpolation	2-fold...256-fold (step 0.25)	-
Calibration	Auto	Manual
Real-time diagnosis	Support	Support / No support
Insulation resistance	10 MΩ (DC 500 V)	
Withstand voltage	AC 500 V (1 min)	
EMC pulse	4000 V	

2. Mechanical Parameters

Parameter	Value
Gear module	0.2 module to 0.8 module
Index tooth	Concave (default), convex
Mounting air gap	0.2 mm (0.4 module), 0.3 mm (0.5 module), 0.5 mm (0.8 module)
Mounting tolerance	±0.05 mm
Distance between mounting holes	27 mm
Mounting screws	M4 (2 pcs)
Housing material	Zinc alloy, fully potted
Recommended gear material	Ferromagnetic: 45 steel, 40Cr steel, 430 stainless steel
Recommended gear accuracy	Level 7 or above
Operating ambient temperature	-20 °C to 100 °C
Storage ambient temperature	-30 °C to 110 °C
Protection grade	IP68

3. TTL/RS422 Output

The GE-T series encoder outputs TTL A/B differential square wave signals and index signals with A+/A-/B+/B-/Z+/Z- six output terminals. A and B are differential square wave signals phase-shifted by 90°, and the Z signal is the index signal with half pulse width of A/B.

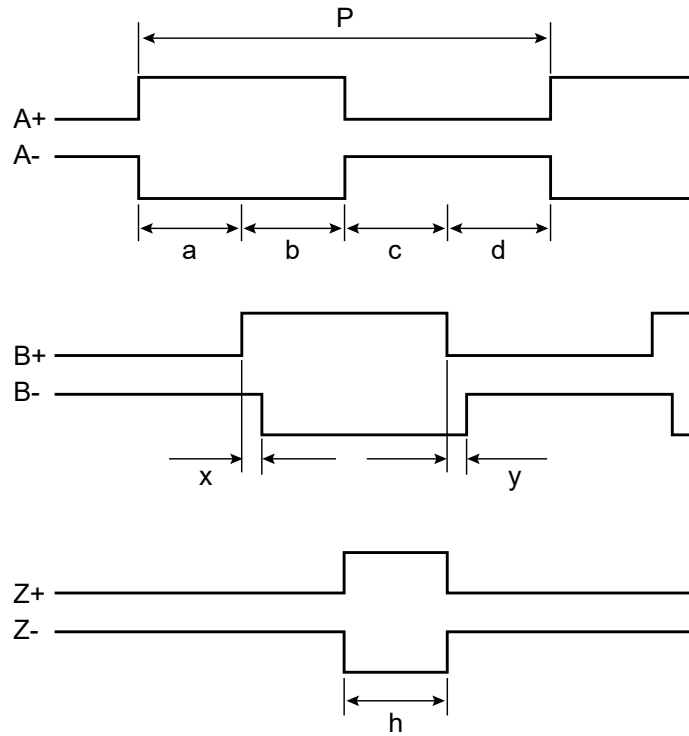


Figure 1. TTL differential square wave signals

Parameter	Value
A/B pulse period (P)	$360^\circ / (\text{number of teeth} \times \text{interpolation} \pm 20\%)$
A/B half pulse width (a, b, c, d)	$0.25P \pm 20\%$
A/B single pulse width (a+b, b+c)	$0.5P \pm 20\%$
Z index signal pulse width (h)	$0.25P \pm 20\%$
Delay time (x, y)	$\leq 100 \text{ ns}$
Output frequency	$\text{Number of teeth} \times \text{interpolation} \times \text{RPM}/60$

4. Sinusoidal Output

The GE-A series encoder outputs differential sinusoidal signals with $1V_{pp}$ amplitude and index signals with A+/A-/B+/B-/Z+/Z- six output terminals. A and B are differential sinusoidal signals phase-shifted by 90° , and the Z signal is the index signal.

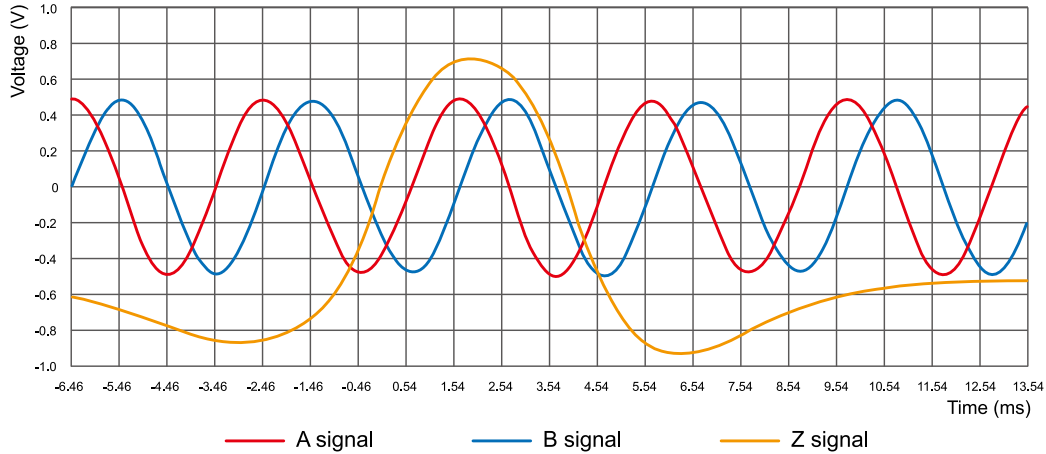


Figure 2. A/B/Z differential signals

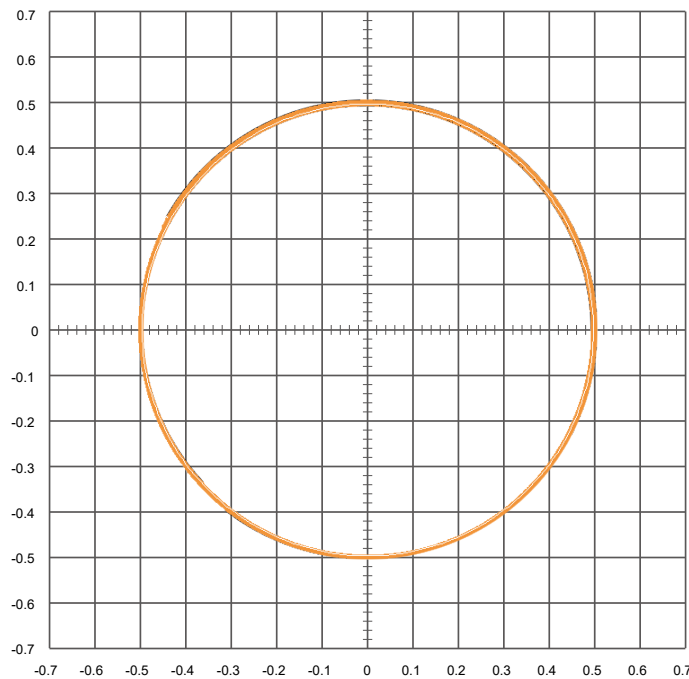


Figure 3. Lissajous curve of the measured X-Y signals

5. Diagnostic tool

MDT provide optional diagnostic tools for real-time diagnosis of GE-T and enhanced version GE-A encoder.

The main functions of diagnostic tool (GF-T, GF-A/T) for GE-T are:

1. Monitoring mode: It is capable of monitoring encoder's output signal pulse, gear rotation direction, and number of rotations in real time.
2. Calibration mode: It can calibrate the output signal offset and phase of GE-T encoder and monitor interpolation and stability in real time.

The diagnostic tool GF-A/T can calibrate output signal amplitude, offset, and phase of GE-A encoder in real time.



Figure 4. Diagnostic tool GF-T for GE-T encoder only



Figure 5. Diagnostic tool GF-A/T for GE-A and GE-T encoder

6. Connector Configuration

Standard D-Sub 15-pin connector

- The connector housing is a zinc alloy metal with gold-plated solid burs pins.
- Cable lengths available are in 1 meter (default), 3 meters, and 5 meters.

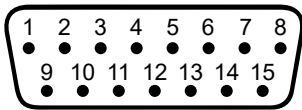
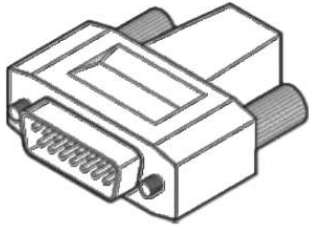
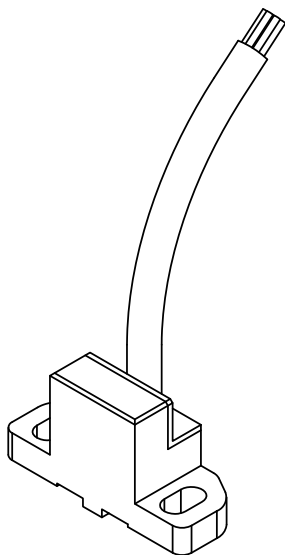


Figure 6. Pin definition

Pin Number	Color	Function
1	Brown	5 V
2	White	0 V
3	Green	A (sin)
4	Yellow	A- (sin-)
5	-	-
6	Blue	B (cos)
7	Red	B- (cos-)
8	-	-
9	-	-
10	Black	Z
11	-	-
12	Pink	Z-
13	-	-
14	Grey	CY
15	Orange	QM

Note: Pin 14 and 15 are for GE-A only.



7. Dimensions

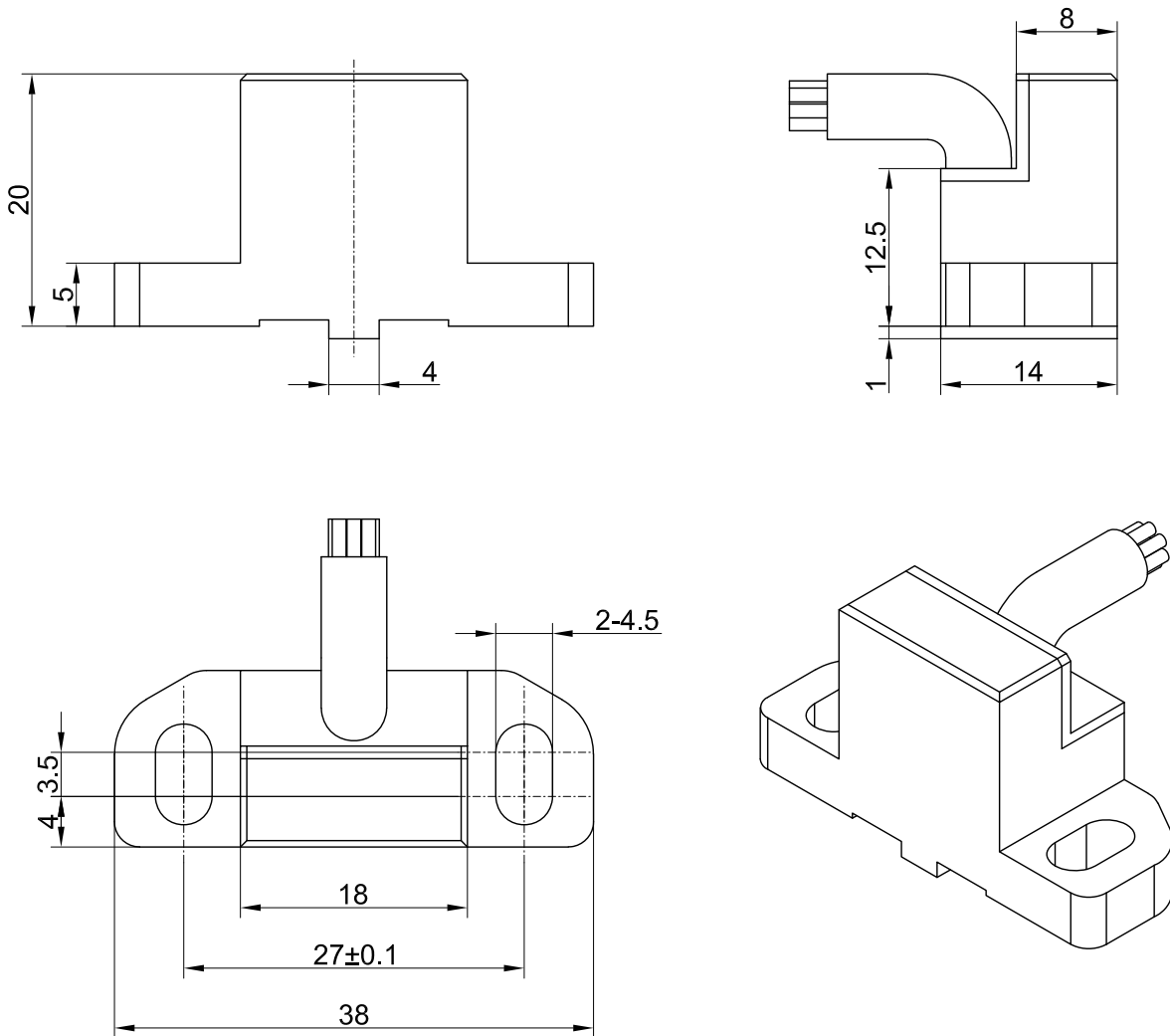


Figure 7. Outline of GE series encoder (unit: mm)

8. Mounting Position

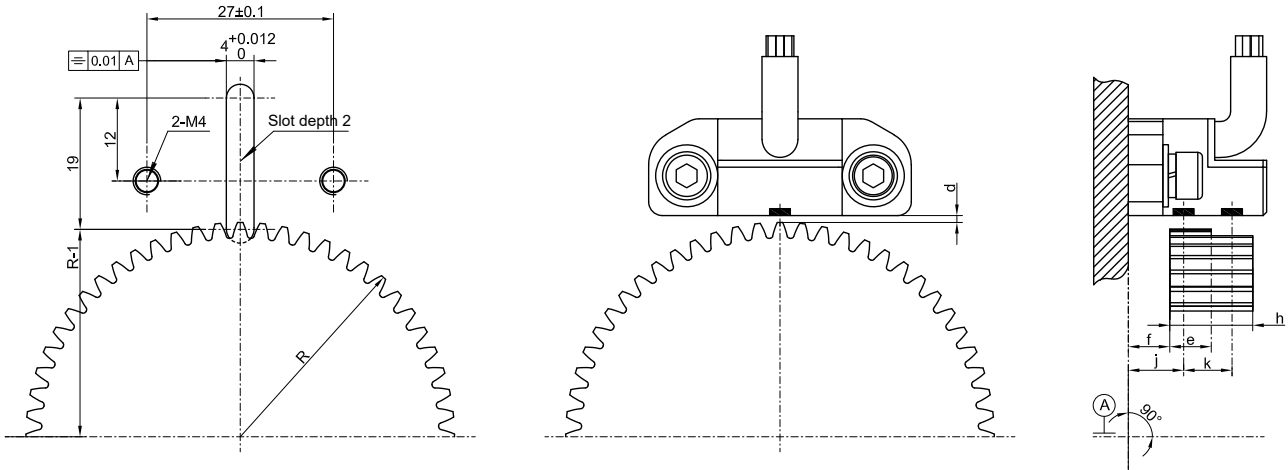


Figure 8. Mounting schematics (unit: mm)

Note:

- e Gear width measured by primary sensor ≥ 3 mm
- f Distance from gear wheel: 6 mm (when gear width is 12 mm)
- j Distance from primary sensor: 8 mm
- k Distance between primary and secondary sensors: 7 mm
- h Gear width: ≥ 8 mm (12 mm recommended)
- d Mounting air gap: Please refer to mechanical parameters

9. Caution for Use

- Please use the feeler gauge included in the package when installing the encoder. Other materials may damage the encoder surface.
- Do not touch the sensing surface with sharp objects.
- That the motor is properly grounded. Insufficient grounding may cause external interference to nullify signals.
- Keep encoder and gear from strong magnetic interference.
- Beware of supply voltage drops.

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