

GE-A GEARTOOTH ENCODER

High-precision Speed and Position Sensor with Sine/Cosine Output, Support online debug function

General Description

The GE-A Geartooth Encoders (including Normal Version and Enhanced Version) of MultiDimension Technology (MDT) are non-contact incremental encoders for rotary speed and position measurement. Based on MDT's unique Tunneling Magnetoresistance (TMR) sensor technology, they provide orthogonal differential sin/cos signals with high quality, along with an index signal and their inverse signals. The GE-A series are designed for 0.3~1.0-module gears with different teeth numbers. (Gear is the optional product).

Features

- Output signal amplitude in 1Vpp with high quality
- High frequency response up to 1MHz
- Operating temperature range from -40°C to 100°C
- IP68 protection grade

Advantages

- Fully sealed housing with metal case to ensure the highest protection level
- Non-contact measurement, abrasion and vibration free, can work in harsh environments such as water, oil or dust
- Weak magnetic induction prevents the gear from being magnetized, and the surface of the encoder is not easy to adsorb iron filings
- Large tolerance to air-gap and installation position with high-sensitivity TMR sensors
- Both convex and concave type are allowed for the index teeth
- Enhanced Version can support online debug function: With GF-A Debug Board, the encoder can be debugged online in real time. It can simplify installation and improve encoder accuracy

(GF-A Debug Board is the optional product)



Applications

- Rotary position and speed sensing in CNC machines
- Energy and power generation systems
- Railway equipment
- Elevators

Electrical Parameters

SYMBOL	PARAMETER NAME	VALUE	UNIT	NOTE
Vcc	Supply Voltage	5±10%	V	DC
Iout	Output Current	≤20	mA	No load
Vout	Output Signal	sin/cos (1Vpp±10%)	V	
Fin	Input Frequency	≤1M	Hz	
Fout	Output Frequency	≤1M	Hz	
	Phase	90±5%	°	
	Calibration Method	manual		
	Online Debug	support (Enhanced Version)		With GF-A Debug Board
	Insulation Resistance	10M	Ω	DC500V
	Withstand Voltage	AC500	V	1 min
	EMC Group Pulse	4000	V	

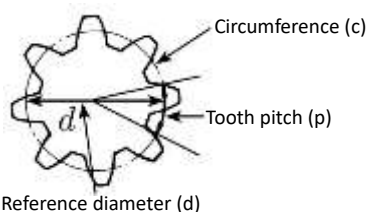
Mechanical Parameters

SYMBOL	PARAMETER NAME	VALUE	UNIT	NOTE
D	Distance between Mounting Holes	27	mm	Using two M4 screws
Gap	Mounting Air-gap	0.2/0.3/0.5	mm	Corresponding to 0.4/0.5/0.8-module respectively
Tol	Mounting Tolerance	±0.05	mm	
To	Operating Temperature	-40~100	°C	
Ts	Storage Temperature	-40~100	°C	
P	Protection Grade	IP68		Zinc alloy housing, Fully potted

Recommended Gear Parameters

SYMBOL	PARAMETER NAME	VALUE	UNIT	NOTE
M	Gear Module	0.3~1.0	mm	
Z	Number of Teeth	no limit		
δ	Width	Min.10	mm	Recommend 12mm
	Material	ferromagnetic steel		Recommend 45#steel
	Index Tooth Shape	convex /concave tooth		Recommend concave tooth
	Tooth Width Ratio between Two Layers	1:1		Width of the index tooth is 6mm
	Gear Accuracy	above level ISO8		Corresponding to level JIS4

Calculation method of gear parameters:



$$d=mz \quad (\text{Reference diameter} = \text{Module} \times \text{Number of teeth})$$

$$z=d/m \quad (\text{Number of teeth} = \text{Reference diameter} / \text{Module})$$

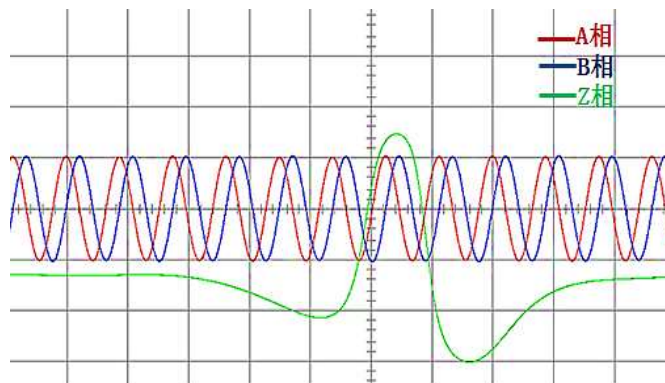
$$p= \pi m \quad (\text{Tooth pitch} = \pi \times \text{Module})$$

$$m=d/z \quad (\text{Module} = \text{Reference diameter} / \text{Number of teeth})$$

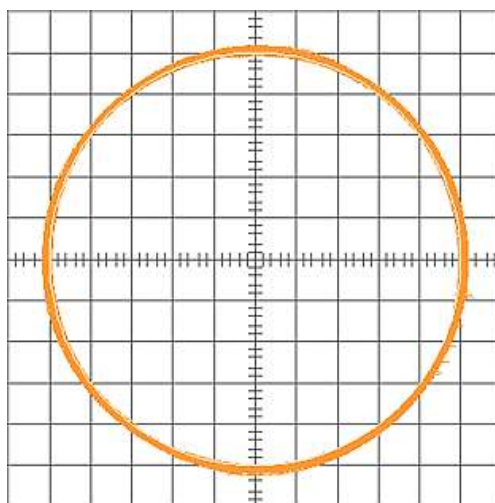
Output Signals

The encoder's output signals are differential sine/cosine signals with 1Vpp amplitude along with the index signal. There are six output terminals including A+/A-/B+/B-/Z+/Z-. A/B signals are two orthogonal differential sine/cosine signals, and the Z signal is the index signal.

The following chart is the measured A/B/Z differential X-T signals.



The following chart is the Lissajous-Figure of the measured X-Y signals.



Gear Module

The GE-A product series is designed for gears with 0.3~1.0-module, and the number of teeth may vary.

The following table shows the recommended mounting air-gap under 0.4/0.5/0.8-module.

Gear Module	Mounting Air-gap	Mounting Tolerance
0.4	0.2mm	±0.05mm
0.5	0.3mm	±0.05mm
0.8	0.5mm	±0.05mm

Number of Teeth

The encoder should match gears with proper number of teeth for optimal results. The recommended number of teeth is 128, 256, or 512. The minor difference in teeth number is acceptable without affecting the quality of the output signals.

Installation Procedure

The encoder features a compact design with the distance between two mounting holes at 27mm, making it compatible with most of the similar products on the market. The installation procedure is as follows.

1. Mount the encoder using two M4 screws. The screws should not be firmly tightened yet to allow adjustment for the mounting air-gap.
2. Insert a feeler gauge with desired thickness in the middle of the encoder and the gear. Move the encoder toward the gear until there is no space between the encoder, the feeler gauge and the gear, and the feeler can be removed smoothly without apply extra force.
3. Firmly tighten the two M4 screws and pull out the feeler gauge.

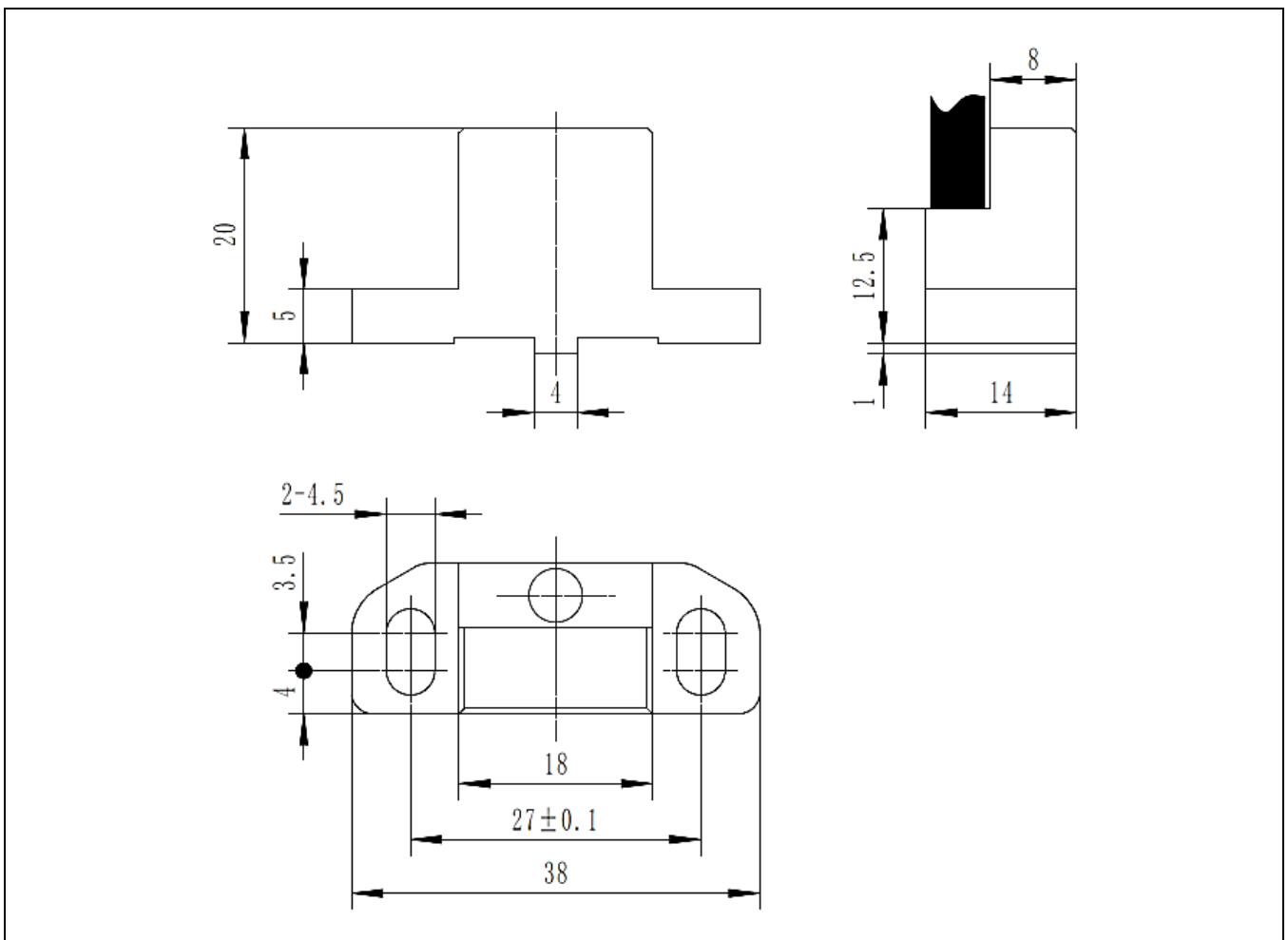
Due to the encoder's built-in self-calibration capability, it will produce desired output signal as long as the proper mounting air-gap is ensured by the above procedure within tolerance.

Cable

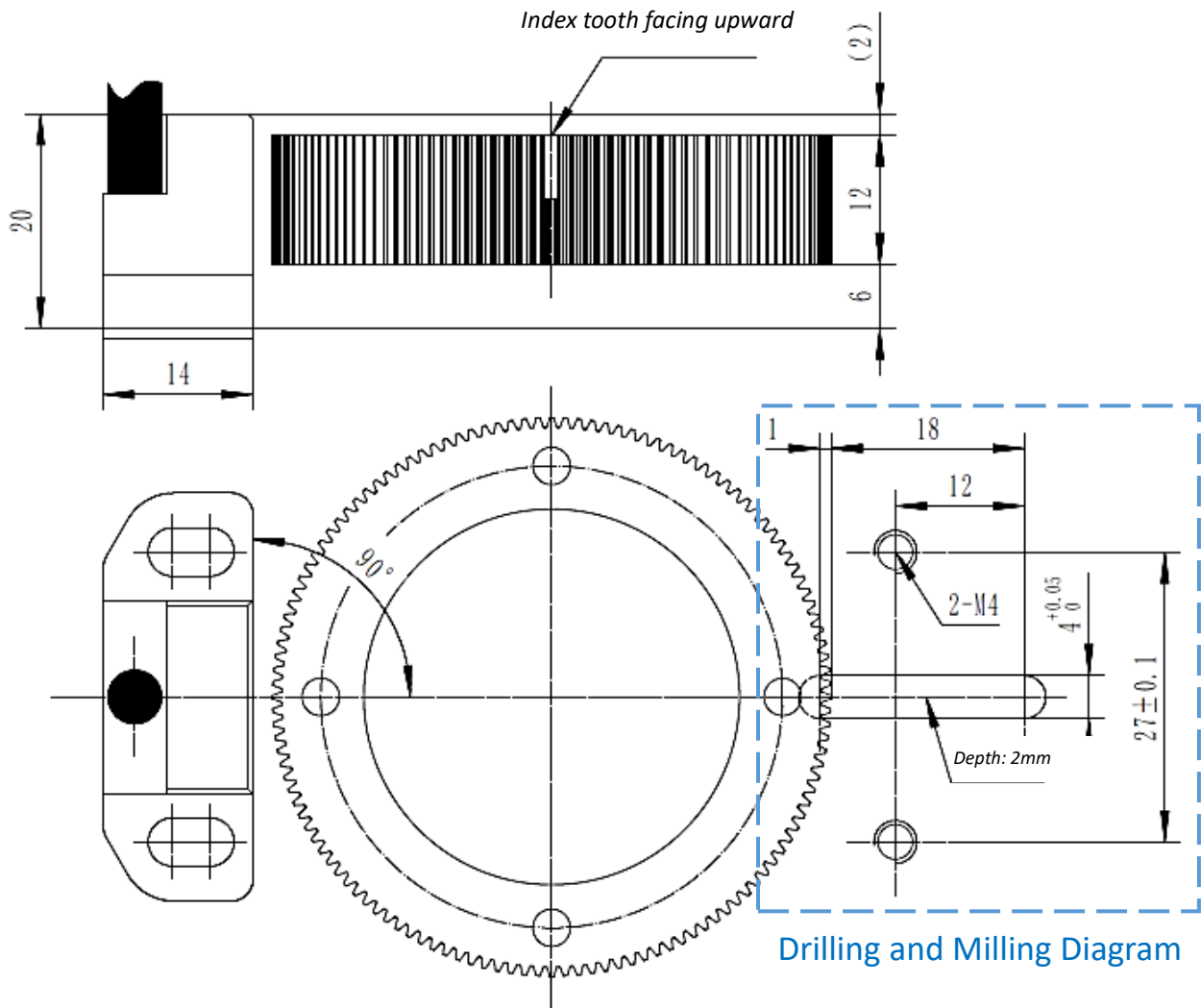
Normal Version encoder cable consists of eight twisted-pair shielded wires. The cross section of the cable core is 0.14mm^2 , and the outer diameter is $5.0\pm 0.2\text{mm}$. The cable length is 1m、3m、5m by default.

Enhanced Version encoder cable consists of ten twisted-pair shielded wires. The cross section of the cable core is 0.14mm^2 , and the outer diameter is $5.0\pm 0.2\text{mm}$. The cable length is 1m、3m、5m by default.

Dimensions



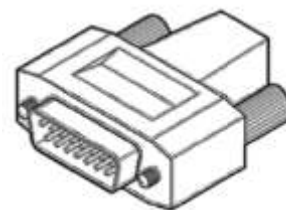
Mounting Position



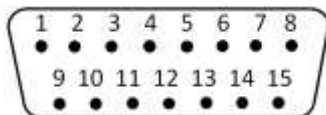
Connector Type

Using standard D-Sub 15-pin connector

- The connector housing is a zinc alloy metal housing, and the pins are gold-plated solid burs.
- Cable lengths are available in 1m (standard), 3m, and 5m.



Interface Definition



1	Brown	5V
2	White	0V
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

*Pin 14 and 15 are only Enhanced Version communication interfaces

Order Code

GE - - A - 001 - F - - A -

1 2 3 4 5 6 7 8

1 Series	2 Gear Module	3 Output Signal Type	4 Interpolation	5 Index Shape	6 Number of Teeth	7 Cable Length	8 Online Debug
Gear tooth Encoder	04: 0:4- module	A: Sin/Cos signals	1 (default)	F: concave tooth	128	A: 1m (standard)	1: support
	05: 0:5- module			M: convex tooth	256	B: 3m	0: not support
	C: 5m	

Gear Code (Optional)



1	2	3	4	5	6
Series	Gear Module	Number of Teeth	Index Shape	Inside Diameter of Gear	Mounting Holes
Gear	04: 0:4- module	128	F: concave tooth	082: 82mm	K: yes
	05: 0:5- module	256	M: convex tooth	108: 108mm	N: no
	

GF-A Debug Board (Optional)

The GE-A Debug Board of MultiDimension Technology (MDT) can be used for real-time automatic debugging for GE-A (Enhanced Version) Geartooth Encoder. It is a multifunctional debug board with digital display and can debug the GE-A Gear Encoder's output signal amplitude, offset and phase in real time.

* For detailed parameters and instructions, please refer to the official website specification.



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