HT-98 closed-loop fiber optic gyroscope

1.Product introduction

1.1 The working principle, function and application scope of the product

This product is an inertial angular rate sensor based on Sagnac principle, which is used to measure the angular rate motion of the carrier around the sensitive axis of the product. This product takes the fiber ring as the angular rate sensitive unit and is based on the closed-loop detection circuit. The phase difference caused by the sensitive angular rate of the fiber ring is converted into an intensity signal by interference. The detection circuit converts the intensity signal into a voltage signal. The signal is detected by modulation and demodulation, and then fed back to the optical path as a feedback signal to achieve closed-loop control.

This product is an inertial sensor composed of an optical system and a corresponding power supply and data processing circuit, which can provide single-axis angle increment information.

This product is mainly used in inertial measurement components of high precision inertial navigation system and positioning and orientation system.

1.2 Composition

The product is mainly composed of the following components :

(a) Optical components : including optical fiber ring, Y waveguide, coupler, ASE light source, PIN-FET detector ;

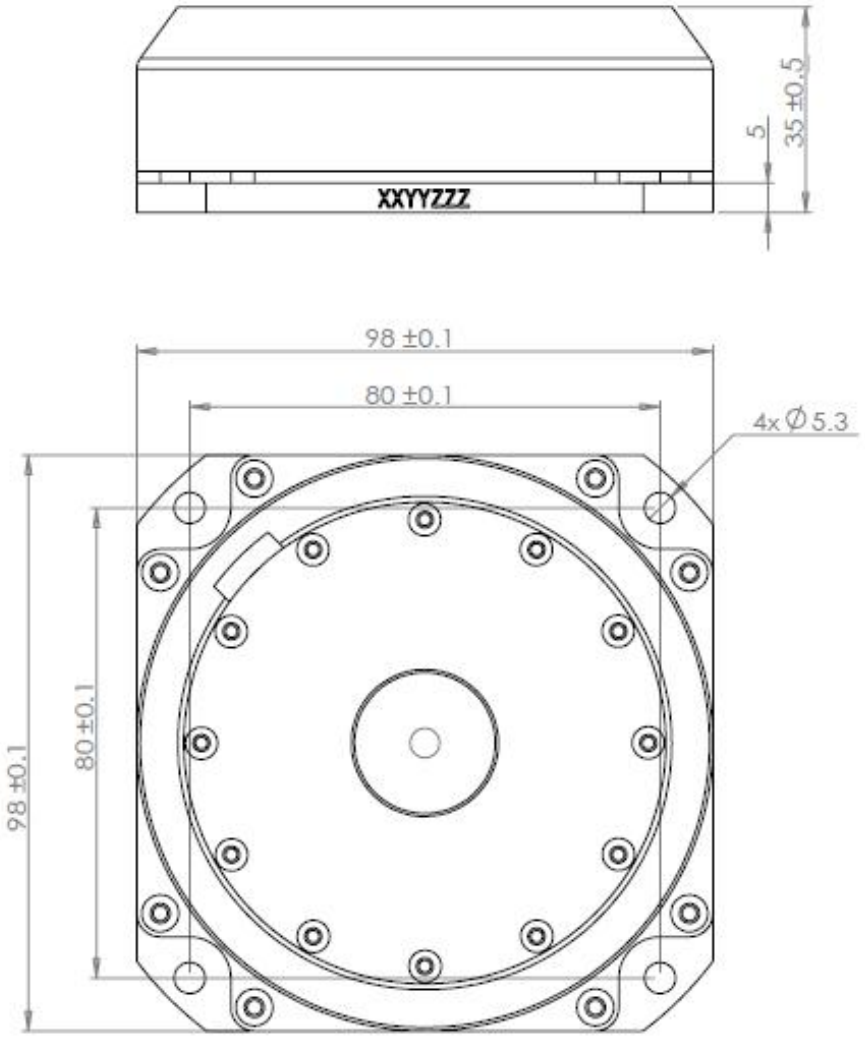
b) light source drive circuit, detection and control signal circuit board ;

c) fiber ring skeleton, cover, upper cover and bottom plate ;

1.3 Shape and installation size

The external dimension was (98 ± 0.1) mm ð (98 ± 0.1) mm ð (35 ± 0.5) mm.

The installation size is (80 ± 0.1) mm × (80 ± 0.1) mm, see Figure 1 :



1.4 Weight

540g ± 20g.

1.5 Working temperature

-40 ° C ~ + 70 ° C.

1.6 Storage temperature

-55 ° C ~ + 70 ° C.

1.7 Random vibration resistance

Random vibration magnitude : 5.3g, frequency range : 20Hz ~ 2000Hz.

1.8 Main performance parameters

Table 1 Main performance parameters

No.	Project	Performance index	Notes
1	Range (° / s)	±400	optional
2	Scale factor (LSB / ° / s)	2000000×（1±10%）	optional
3	Normal temperature scale factor nonlinearity, asymmetry (ppm)	≤20	
4	Normal temperature scale factor repeatability (ppm)	≤20	
5	Full temperature scale factor repeatability (ppm)	≤80	
6	Zero bias (° / h)	≤1	Deduct ground speed
7	Normal temperature bias stability (° / h)	≤0.01	
8	Normal temperature bias repeatability (° / h)	≤0.003	
9	Full temperature bias stability (° / h)	≤0.02	
10	Random walk (° / √ h)	≤0.001	
11	Vibration and vibration before and after the deviation value change (° / h)	≤0.03	
12	Deviation change before and after vibration (° / h)	≤0.03	
13	Low pressure height (m)	10000	
14	Magnetic field sensitivity (° / h / Gs)	≤0.01	

1.9 Mechanical and electrical interfaces

1.9.1 Mechanical interface

The product mounting surface constitutes a fixed surface for external installation, and the mounting screw is M5.

1.9.2 Power requirements

There are two external power supplies for the product, as shown in Table 2 :

Table 2 External power requirements

	+5V	-5V
Voltage	4.75V~5.25V	-4.75V~-5.25V
Ripple	20mV	20mV
Current	1.5A	0.6A

1.9.3 Electrical interface

HT-98 uses Guihang Electrical Appliance J30-21TJ (LN6.480.025, L = 300mm) -Q / Ln.J6-69A-2003 socket for electrical connection with the outside (the corresponding acquisition line uses J30-21ZK). The definition of the connector is shown in table 3.

Table 3 Definition of J30-21TJ connector

Pin No.	Signal name	Description
1，12，7，17	Mainboard + 5V	Gyroscope power supply
6，16，13，14	Mainboard ± 5V ground	
4，15	Mainboard - 5V	
2	NC	Reserve
3，5	NC	Reserve
8，18	T+	RS422 send
9，19	T-	
10，20	R+	RS422 receiving (differential synchronization signal)
11，21	R-	

Antistatic measures should be taken every time the plug terminal of the product is connected or contacted.

1.9.4 Communications protocol

The angular rate signal measured by the product is output in the RS422 serial port self-triggered mode, the baud rate is 460800bps, and the data update rate is 2ms.

Data format :

a) Each byte of data is 11 bits, including : the first bit is the starting bit (0), the second to the ninth bit is the data bit, the tenth bit is the parity bit, and the eleventh bit is the stop bit ;

b) A frame of data includes gyro output and temperature output, in which the gyro effective data is 32 bits and the temperature effective data is 12 bits (the highest bit is the symbol bit, 0 is positive, 1 is negative) ;

the specific format is :

	High							Low
Gyro frame header :	1	0	0	0	0	0	0	0
The first byte :	0	D6	D5	D4	D3	D2	D1	D0
The second byte :	0	D13	D12	D11	D10	D9	D8	D7
The third byte :	0	D20	D19	D18	D17	D16	D15	D14
The fourth byte :	0	D27	D26	D25	D24	D23	D22	D21
The fifth byte :	0	0	0	0	D31	D30	D29	D28
The sixth byte :	0	X	X	X	X	X	X	X

Note : The sixth byte is the check byte, which is the XOR value of the first byte to the fifth byte data in the packet.								
The seventh byte :	0	D6	D5	D4	D3	D2	D1	D0
The eighth byte :	0	D13	D12	D11	D10	D9	D8	D7
Ninth byte :	0	X	X	X	X	X	X	X
Note : The ninth byte is a check byte, which is the XOR value of the seventh to eighth bytes of data in the packet.								

2 Product installation

2.1 Installation requirements

The user is responsible for the installation and disassembly of the product. In this process, the product cannot be impacted and the outer surface of the product cannot be machined.

2.2 Inspection before installation

a) Check the appearance of the product with or without physical damage such as collision ;

b) At room temperature, the insulation resistance of all pins and shells of the product output interface is tested by using the insulation resistance meter, which is required to be $\geqslant$ 60MΩ ;

c) Check the electrical parameters of the product when necessary ;

d) the surface flatness of the fixed product is better than 0.05 mm ;

2.3 Inspection after installation

Check whether the mounting screws are firm.

3 Product maintenance, maintenance

Before the product is loaded into the carrier, it is required to energize the product at least once a year for 3600 s, and the electrical parameters of the product are not required to be tested when energized ;

b) After the product is loaded into the carrier, the product is required to be energized at least once a year, and the energization time is 3600 s.

c) Products should be re-calibrated every 8 years.

4 common fault phenomena and troubleshooting methods

This product is in a fully sealed state. It cannot be repaired on site after any failure occurs on the user, and it needs to be returned to the production unit for maintenance.

The following only lists some possible failure phenomena of the non-product itself, as shown in Table 5. If there are other technical problems in the use of the product, please contact the product manufacturer.

Table 5 Common faults and troubleshooting

No.	Fault phenomenon	Cause analysis	Exclusion method
1	The product is energized, and the current indication of + 5V and-5V ammeter is basically 0.	No power supply to the product or power supply current is too small	Check the power supply and power supply circuit, restore product power supply
2	The product is energized, + 5V, -5V ammeter current indicator is normal, but the computer acquisition program does not work. The product is energized, and the current indication of + 5V and-5V	Abnormal test equipment acquisition system	Check the connection cable, equipment power supply
		Software program conflict	Restart the test computer

	ammeter is basically 0.		
3	The product is energized, + 5V, -5V ammeter current indicator is normal, but the computer acquisition program does not work.	Short circuit may occur inside the test equipment	Check test equipment

5 Transportation and storage requirements of products

5.1 Transportation considerations

a) Place the product in the direction shown in the packing box ;

b) When the temperature range is − 40 °C ~ + 70 °C, it is allowed to be transported by road, railway, air and water ;

c) Ensure that the packaging box is fastened to the carrier and does not move during transportation.

5.2 Storage precautions

(a) Products placed in packaging boxes should be stored in an air-conditioned warehouse under standard atmospheric pressure at an ambient temperature of 15 °C ~ 35 °C ;

b) The storage period of the product is 15 years.

6 Physical photos