FG-120C High Precision Single-Axis Fiber Optic Gyroscope

1 Overview

This document specifies the requirements and methods for the use and maintenance of the FG-120C high-precision single-axis fiber optic gyroscope (hereinafter referred to as the product).

2 Product Introduction

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

2.1.1 How it works

inertial angular rate sensor based on the optical Sagnac effect, used to measure the angular velocity of the carrier along the sensitive axis of the product . The angular velocity sensing unit of this product is an optical fiber ring, which uses a digital closed-loop detection circuit to extract the optical path difference of clockwise and counterclockwise propagating light caused by the external physical angular velocity that the optical fiber ring is sensitive to, and at the same time, the voltage signal converted from the optical path difference signal is closed-loop feedback and control to achieve signal modulation and demodulation, so as to achieve the purpose of high-precision angular velocity signal detection.

2.1.2 Function

This product consists of two parts: an optical angular velocity sensitive unit and a signal detection unit, providing single-axis angular increment information and internal temperature information.

2.1.3 Scope of application

The products are mainly suitable for medium and high precision inertial navigation systems, positioning and orientation systems, servo stabilization systems and other applications.

2.2 composition

The main components of the product are as follows:

a) Optical path unit: including erbium-doped light source, optical fiber ring, integrated optical phase modulator, optical fiber coupler, and optical detector;

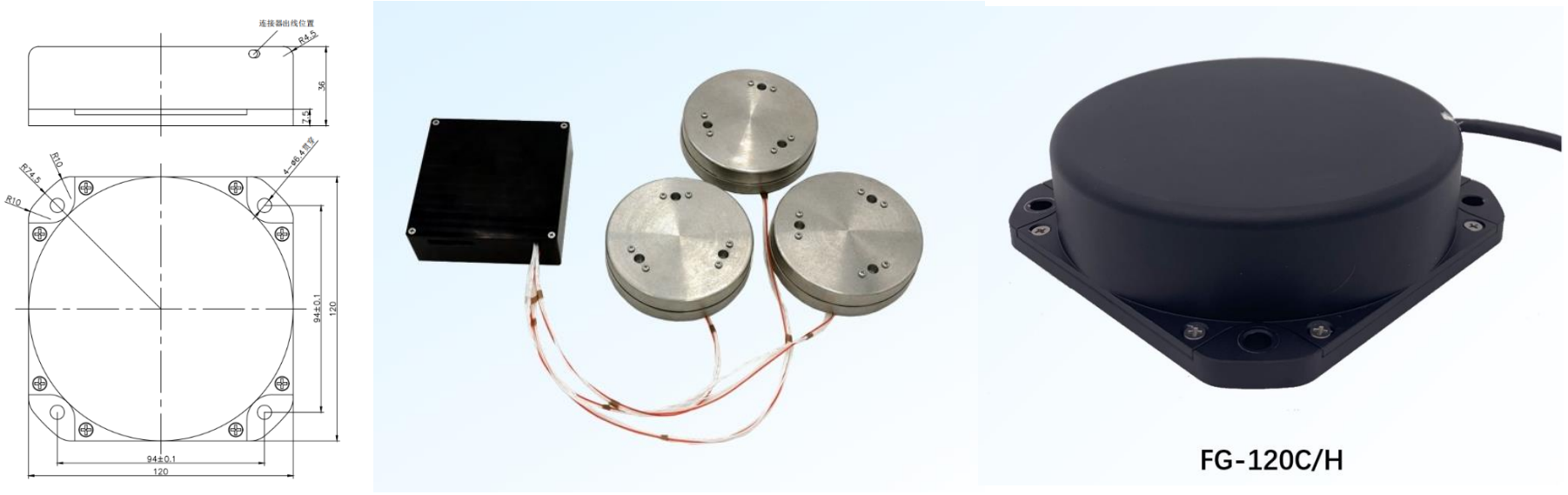
b) Circuit unit: light source driving circuit, signal detection and control circuit;

c) Gyro structure.

2.3 Appearance and installation dimensions

Dimensions (mm): 120 ± 0.1 × 120 ± 0.1 × 36 ± 0.1 (length × width × height);

Installation dimensions (mm): 94 ± 0.1 × 94 ± 0.1 (length × width), hole position 4 × Φ6.4 , as shown in Figure



picture 1.

picture 1 FG-120C fiber optic gyroscope appearance and installation diagram

2.4 Weight Total product weight: 890g±20g.

2.5 Main performance parameters (Table 1)

NO.	Test items	unit	Technical requirements
1	Dimensions	mm	120×120×36
2	Startup time	s	3
3	Bias	(°)/h	≤0.25
4	Zero bias stability at room temperature (constant temperature)	(°)/h	≤0.005 (10s smoothing) ≤0.002 (100s smoothing)
5	Constant temperature bias repeatability	(°)/h	≤0.0 01 Constant temperature (-40℃~70℃)
6	Bias repeatability in different temperature ranges	(°)/h	Range < 0.02 (maximum value minus minimum value)
7	At constant temperature (-40°C~70°C) Normal temperature: Select 7 groups for measurement -40℃: Select 7 groups for measurement 70℃: Select 7 groups for measurement	(°)/h	Take the variance value, data <1‰ The highest accuracy can reach 0.0005
8	Update rate	Hz	>2000
9	Zero bias sensitivity	(°)/h/ Gs	≤0.003
10	Random walk coefficient	(º)/h1/2	≤0.0003
11	Scale factor nonlinearity	ppm	≤2
12	Scale factor asymmetry	ppm	≤2
13	Scale factor repeatability	ppm	≤5
14	Threshold	(°)/h	≤0.002
15	Resolution	(°)/h	≤0.002
16	bandwidth	Hz	≥200
17	Operating temperature	℃	-45 ~ +70
18	Storage temperature	℃	-55 ~ +85
19	Dynamic Range	(°)/s	±300
20	Supply voltage	V	+5
21	Steady-state power consumption at room temperature	W	≤2.5
22	power consumption at full temperature	W	≤4

23	Starting instantaneous current	A	<1.5

2.6 Mechanical and electrical interface relationship

2.6.1 Power Requirements

The product is powered by a +5V DC power supply. The power supply requirements are shown in Table 2:

Table 2 Power supply requirements for FG-120C fiber optic gyroscope

Serial number	name	Require
1	Power supply accuracy	±5%
2	Power supply ripple (Vpp)	≤50mV
3	Supply current	>1.5A

2.6.2 Electrical connection interface

of the gyro-end connector is: J30JZLN9ZKCA000, and the matching connector (model: J30JZ/XN9TJCAL01) is provided . The reserved wire length is: 200mm±20mm (calculated from the outlet position, excluding the metal part of the connector), as defined in Table 3.

Table 3 J30JZLN9ZKCA000 gyro connector and test line point definition

Core point number	definition	Notes
1	+5V	Power Input
2	GND	Power Ground
3	reserve	--
4	RXD+	Gyro differential gate positive
5	TXD+	Gyro RS422 output positive
6	+5V	Power Input
7	GND	Power Ground
8	RXD-	Gyro differential gate negative
9	TXD-	Gyro RS422 output negative

Note: When connecting or touching this product, anti-static measures should be taken in accordance with the provisions of GJB 1649-1993 .

2.6.3 Communication Protocol

Communication interface: RXD and TXD are both RS422/485 differential communication interfaces. RXD is used to receive differential pulse (or square wave) synchronous selection signals, and TXD is used for serial data signal output.

Communication protocol: After receiving the falling of the selection signal, the gyro latches the internal angle increment data and starts to output the gyro data packet through TXD within 1μs. The transmission baud rate is 921.6 kbps. The data packet contains 11 bytes, each byte has 1 start bit, 8 data bits, 1 stop bit, and no parity bit.

The angular increment information is the angular increment value of the gyroscope during the time between two selection signals. The accumulated angular increment value during a period of time divided by the interval time is the average angular velocity of the gyroscope during this period of time.

The data packet format is as follows:

Table 4 Gyro data packet format

Byte sequence number	content
1	99 (hexadecimal)
2	66 (hexadecimal)
3	Status word, normal value is FF (hexadecimal)
4	Gyro angle increment 1, LSB
5	Gyro angle increment 2
6	Gyro angle increment 3
7	Gyro angle increment 4, MSB
8	Temperature data, LSB
9	Temperature data, MSB
10	Frame number, incremented each time it is sent, cyclic count
11	Checksum, the sum of bytes 3 to 10

Note: The temperature dimension is 16.

The meaning of the status word is as follows:

bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
reserve	reserve	reserve	Circuit control status	reserve	reserve	reserve	Optical path status

Among them: "Reserved" bit is always 1;

When the "circuit control status" bit is 1, it means that the gyro circuit control status is normal, and when it is 0, it means that the control status is abnormal;

When the "optical path status" bit is 1, it means that the gyro optical path is working normally. When it is 0, it means that the gyro optical path status is abnormal.

If any of the above two status bits is always 0 during the use of the gyroscope, and is accompanied by abnormal gyroscope data, the gyroscope should be returned for repair.

3 Product installation and removal

3.1 Require

The user is responsible for installing and disassembling the product. During this process, the product must not be hit, knocked or bumped, and the outer surface of the product must not be machined.

a) The surface used to fix the product requires a flatness better than 0.02mm;

b) It is recommended that the heat dissipation of the product mounting base be fully considered during product testing.

3.2 Post-installation inspection

Check whether each mounting screw meets the size of the mounting hole and is firm.

4 Operating Procedure

4.1 Inspection before use

Check the appearance of the product for any physical damage such as collision.

4.2 Instructions for use of the product

a) Install the product on the carrier and connect the cables correctly according to the requirements in Table 3;

b) Perform data connection according to the communication protocol in 2.6.3.

4.3 Precautions

a) The gyroscope should not be frequently powered on and off during use to avoid damaging the gyroscope's performance and reducing its service life;

Before the gyroscope is powered on , the power supply system should be checked to ensure that there is no short circuit between the power supply voltage and the electrical points, and between the gyroscope housing and the electrical points;

c) If this product malfunctions, please consult the manufacturer. Do not disassemble or repair it without authorization.

d) The fiber optic gyroscope is a precision instrument and should be handled with care during use and transportation;

e) Correct connection of product input and output signal lines and power supply lines must be ensured;

f) Anti-static measures are required when contacting the product;

g) The magnetic field strength around the product location is required to be less than 10 Gauss.

5 Maintenance and care

a) Before the product is loaded into the carrier, it is required to be powered on at least once every 6 months, and the power-on time is 3600s. The power-on time does not require the testing of the product's electrical parameters;

b) After the product is loaded into the carrier, it is required to be powered on at least once a year for 3600s. It is not required to test the electrical parameters of the product when powered on.

6 Transportation and storage requirements

6.1 Transportation Notes

a) Place the product in the direction indicated in the packaging box;

b) Transport by road, rail, air and water is permitted;

c) During transportation, ensure that the packaging box is firmly secured to the carrier and does not move.

6.2 Storage conditions, shelf life and precautions

a) Products placed in packaging boxes should be stored under standard atmospheric pressure, with an ambient temperature of 25°C ± 10°C, a relative humidity of 30% to 50%, and an ambient magnetic field strength of less than 10 Gauss;

b) The product shelf life is 15 years.

7 Unpacking Notes

a) Check the appearance of the outer packaging for any physical damage such as collision;

b) Check whether the product and supporting accessories are complete, see Table 7 for details.

c) When taking out the product, electrostatic protection should be performed.

Table 7 Product delivery list

Serial number	name	quantity
1	FG- 120C Fiber Optic Gyroscope	1
2	Gyroscope packaging box	1
3	Gyroscope test report	1
4	J30JZ/XN9TJCAL01 Connector	1
5	Certificate	1