

# BS-FU35B-1-D1EC Fiber Optic Gyroscope Operation Manual

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# 1 Overview

This document specifies the requirements and methods for the use and maintenance of BS-FU35B-1-D1EC fiber optic gyroscope (product for short).

## 2 Product introduction

### 2.1 Working principle, function and scope of application of the product

#### 2.1.1 How it works

This product is an inertial angular rate sensor based on the optical Sagnac effect, which is used to measure the angular rate of the carrier along the sensitive axis of the product. The angular rate sensing unit of the product is an optical fiber ring, a digital closed-loop detection circuit is adopted to extract the optical path difference of clockwise and counterclockwise propagation light caused by the external physical angular rate, which is sensed by the optical fiber ring, and meanwhile, the optical path difference signal is converted into a voltage signal for closed-loop feedback and control, so as to realize the modulation and demodulation of the signal and achieve the purpose of angular rate signal detection.

#### 2.1.2 Function

This product is composed of an optical angular velocity sensing 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 applications such as medium-precision inertial navigation systems, positioning and orientation systems, and servo stabilization systems.

## 2.2 Composition

The main components of the product are as follows:

- a) The optical path unit comprise an SLD light source, an optical fiber re, an integrated optical phase modulator, an optical fiber coupler and an optical detector;
- b) The circuit unit comprises a light source driving circuit and a detection and control signal circuit board;
- c) Gyroscope structural parts.

## 2.3 Appearance and installation dimension

Overall dimension (mm):  $(60 \pm 0.1) \times (60 \pm 0.1) \times (31 \pm 0.1)$  (L × W × H);

Installation dimension (mm):  $(50 \pm 0.1) \times (50 \pm 0.1)$  (L × W),  $\Phi 3.2 \text{ mm} \times 4$ , such as Figure As shown.

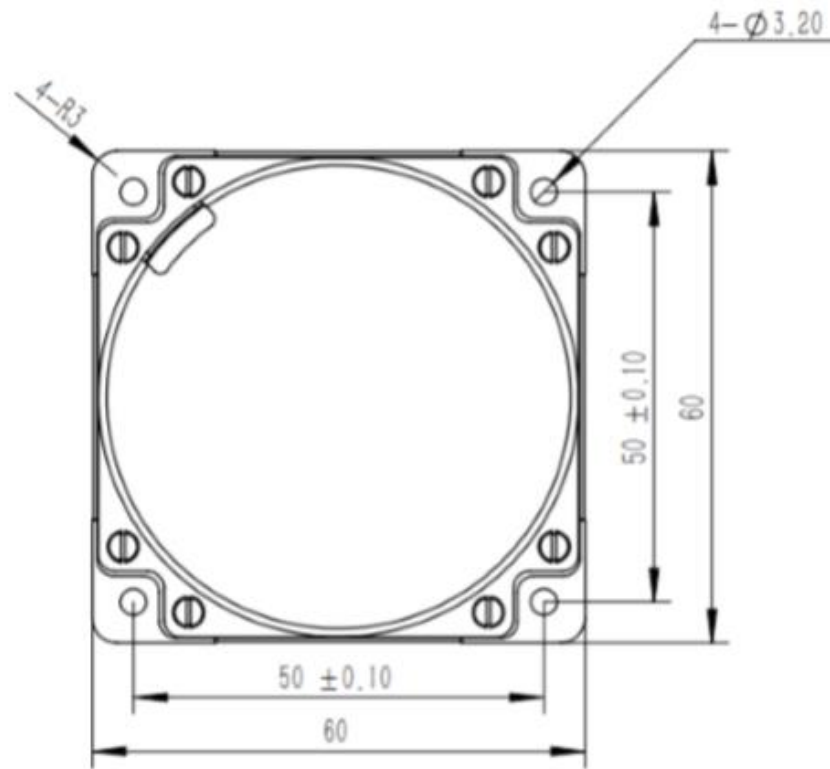


Figure 1 Outline and Installation Diagram of BS-FU35B-1-D1EC Fiber Optic Gyroscope

## 2.4 Weight

The total weight of the product is less than 200 G.

## 2.5 Main performance parameters

See the main performance parameters of the product for details.

Table 1 Main performance parameters

Serial number	Test item	Unit	Technical requirements
1	Overall dimensions	mm	60×60×31
2	Start time	s	5
3	Zero bias stability (10 s smoothing, 1σ)	°/h	≤0.1
4	Zero-bias repeatability	°/h	≤0.1
5	Random walk coefficient	°/h <sup>1/2</sup>	≤0.01

6	Scale factor nonlinearity	ppm	≤50
7	Scale factor repeatability	ppm	≤50
8	Operating temperature	°C	-40~+70
9	Storage temperature	°C	-50~+70
10	Dynamic range	(°)/s	±1000
11	Supply voltage	V	+5
12	Steady-state power consumption	W	<4
13	Weight	g	<190g

## 2.6 Mechanical and electrical interface relation

### 2.6.1 Power requirements

The product is powered by +5V DC. Its power supply requirements are as follows:

Table 2 BS-FU35B-1-D1EC Fiber Optic Gyroscope Power Requirements

Serial number	Name	Request
1	Power supply accuracy	±5%
2	Power ripple (Vpp)	20mV
3	Supply current	>1.5A

### 2.6.2 Electrical connection interface

The connector connecting the product to the outside is J30JZLN9ZKCA000. See Table 3 for the definition.

Table 3 Definition of J30JZLN9ZKCA000 Gyroscope Connector and Test Line Point

Core point number	Definition	Comment
1	+5V	Power supply input
2	GND	Power ground
3	--	Reserved
4	RXD+	Gyro differential sorting and correcting
5	TXD+	Gyro RS422 output positive
6	+5V	Power supply input

Core point number	Definition	Comment
7	GND	Power ground
8	RXD-	Gyro differential gating negative
9	TXD-	Gyro RS422 output negative

Note: When connecting or contacting the product, anti-static measures shall be taken in accordance with GJB 1649-1993.

### 2.6.3 Communication protocol

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

Communication protocol: The frequency of the gating signal is not more than 1 kHz. The gyro latches the internal incremental angle data after receiving the falling gating signal, and starts to output the gyro data packet through TXD within 5  $\mu$ s. The transmission baud rate is 460.8 kbps. The data packet contains 11 bytes, and each byte has 1 start bit, 8 data bits, and 1 stop bit. There is no parity bit.

The angle increment information is the angle increment value of the gyroscope in the time between two gating signals, and the average value of the angular velocity of the gyroscope in a period of time is obtained by dividing the angle increment accumulated value in the period of time by the interval time.

The packet format is as follows:

Table 4 Format of Gyro Data Packet

Byte sequence number	Content
1	99 (hexadecimal)
2	66 (hexadecimal)
3	Status word, normal value is FF (hexadecimal)
4	Gyro delta 1, LSB
5	Gyro delta 2
6	Gyro delta 3
7	Gyro delta 4, MSB
8	Temperature data, LSB
9	Temperature data, MSB

10	Frame number, plus one for each transmission, cycle count
11	Checksum, cumulative sum of bytes 3 to 10

### **3 Product installation and removal**

#### **3.1 Request**

The user shall be responsible for the installation and disassembly of the product. During this process, the product shall not be impacted, and the outer surface of the product shall not be machined.

#### **3.2 Methods and procedures**

The method and steps are as follows:

The flatness of the surface of the a) used for fixing the product is required to be superior to the 0.02 mm;

The b) recommends that a layer of heat-conducting silica gel with a thickness of 0.2 to 0.5 mm should be evenly coated on the bottom of the product when installing the product.

The c) recommends that an aluminum plate (larger than the product) be placed under the product mounting surface during product testing;

The magnetic field intensity at the installation position of the d) product shall not be greater than 1G/s.

#### **3.3 Inspection after installation**

Check whether each mounting screw conforms to the size of the mounting hole and whether it is firm.

### **4 Operating procedures**

#### **4.1 Inspection before use**

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

#### **4.2 Instructions for the use of the product**

Instructions for use are as follows:

- a) The product is installed on the carrier, and the cable is correctly connected according to the requirements of Table 3;
- b) Carry out data connection according to the communication protocol of 2.6. 3.

#### **4.3 Precautions**

The relevant notes are as follows:

- a) In order to avoid damaging the performance of the gyroscope and reducing the service life of the gyroscope, frequent power-on and power-off operations should not be carried out during the use of the gyroscope.
- b) Before the gyroscope is powered on, the power supply system shall be checked to ensure that there is no short circuit between the electrical points of the power supply and between the gyroscope shell and the electrical points;
- c) In case of abnormal operation of this product, the manufacturer shall be consulted. It is forbidden to disassemble and repair the product without authorization.
- d) The fiber optic gyroscope is a precision instrument, so it should be handled with care during use and transportation.
- e) The correct product input and output signal lines and power supply lines must be ensured;
- f) It is required to take anti-static measures in the process of contacting the product;
- g) The magnetic field intensity around the product location shall be less than 1Gs.

## **5 Maintenance and care**

Relevant maintenance and service instructions:

- a) Before the product is loaded into the carrier, it is required to electrify the product at least once every 6 months, and the one-time electrification time is 3600 s. The electrification time is not required to detect the electrical parameters of the product;
- b) After the product is loaded into the carrier, it is required to be powered on at least once a year for 3600s, and the electrical parameters of the product are not required to be detected when the product is powered on.

## **6 Common Faults and Troubleshooting**

This product is in a sealed state and cannot be repaired on site after any failure of the user, and needs to be returned to the production unit for repair.

The following can only list some possible faults that are not related to the product itself, as shown in Table 5. If the user has other technical problems, please contact the product manufacturer.

Table 5 Common Faults and Troubleshooting



Serial number	Fault symptom	Cause analysis	Exclusion method
1	When the product is energized, the indication of + 5V ammeter is basically zero.	The product is not being powered or is providing too little current.	Check the power supply and power supply circuit, and restore the power supply of the product.
2	When the product is powered on, the + 5V ammeter indicates normally, but the computer acquisition program does not work.	The acquisition system of the test equipment is abnormal.	Check the connection cable and the power supply of the equipment.
		Software program conflict	Restart the computer

## 7 Transportation and storage requirements

### 7.1 Shipping considerations

Transportation precautions are as follows:

- a) Place the product in the direction shown in the packing box;
- b) Transportation by road, rail, air and water is permitted;
- c) During transportation, ensure that the packing box is fastened to the carrier and will not move.

### 7.2 Storage conditions and storage period

Precautions for storage conditions and duration are as follows:

- a) The products placed in the packing box shall be stored in an air-conditioned warehouse under the standard atmospheric pressure, with the ambient temperature of  $25\text{ }^{\circ}\text{C} \pm 10\text{ }^{\circ}\text{C}$ , the relative humidity of 30% ~ 70%, and the surrounding magnetic field intensity of less than 1Gs;
- b) The storage life of the product is 15 years.

## 8 Unpacking notes

- a) Check the appearance of the outer package for physical damage such as collision;
- b) Check whether the product and supporting accessories are complete. See 6 for details.
- c) Electrostatic protection shall be carried out when the product is taken out.

Table 6 List of Supporting Products to be Delivered

Serial number	Name	Quantity
1	BS-FU35B-1-D1EC fiber optic gyroscope	1
2	Gyroscope packing box	1
3	Gyroscope test report (including certificate of conformity)	1
4	J30JZ/XN9TJCAL01 Connector	1