

Fiber Optic Gyroscope Assembly

Abstract:

This instruction describes the appearance features, technical specifications, and the interface definitions and communication protocols of gyroscope of YH-135 Miniaturized Fiber Optic Gyroscope Assembly for satellite applications.

Key Words: Satellite, Fiber Optic Gyroscope, Outline Size, Integrated Connection, Operating Specification

1. Appearance

The appearance of Fiber Optic Gyroscope is shown as figure1.



Fig.1 Fiber Optic Gyroscope

2. Specifications

Table1 Specifications

Item	Parameter	Remark
Bias stability	<0.15°/hr	(100s,1σ)
Warm-up Time	< 5s	
Threshold	< 0.5°/hr	
Resolution	< 0.5°/hr	
Scale factor nonlinearity	< 100 ppm (1 σ)	
Scale factor repeatability	< 100 ppm (1 σ)	Fixed point temperature
Dynamic range	±200 %/s	adjustable
Operating temperature	-40°C to +60 °C	
Storage temperature	15°C to +35°C	

3. Mechanical Interfaces

Table2 Specifications

Item	Parameter	Remark
Outline size	80mm×80mm×50mm	
Body size		
Weight	450±15g	
Mounting bolt	Φ3.5±0.1	
Mounting aperture	79.5mm×79.5mm	
Mounting surface accuracy	0.008(mm/80mm)	

4. Power Requirements

+5 V DC power supply.

Table3 Power Requirements

Items	Parameter	Remark
Power supply accuracy	±5%	
Power supply ripple	50mV	
Steady power consumption	<5.5 W	
Peak power consumption	<8 W	

5. Interface Definitions and Communication Protocols

The electrical interface between Fiber Optic Gyroscope Assembly and the satellite attitude and orbit control system adopts the form of connector. The specific type of connector is shown as Table4.

Table4 Connector

Number	Type	Purpose
X1	J30J-25ZK	Power and communication for Fiber Optic Gyroscope Assembly

The pin allocation and number of the connector are shown as Table5.

Table5 Connector Pin Allocation

Pin Number	Function	Voltage	Signal Type
1, 14	+5V power supply	+5V	+5V bus power supply
3, 16	primary power supply return line	0V	5, 18
5, 18	receive negative RX-		RS422 receive negative
6, 19	receive positive RX+		RS422 receive positive
7, 20	send negative TX-		RS422 send negative
8, 21	send positive TX+		RS422 send positive
12, 24	secondary ground return line	0V	
13, 25	to shell		
2, 4, 15, 17	reserved		not used
9, 10, 11, 22, 23	void		

5.1 communication interface

The communication interface between Gyroscope and the satellite adopts RS422 with the form of “double pins and double wires” to improve reliability, as shown in figure2.

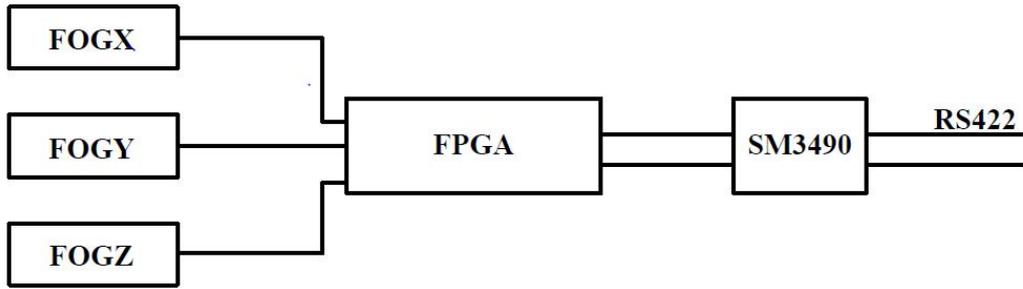
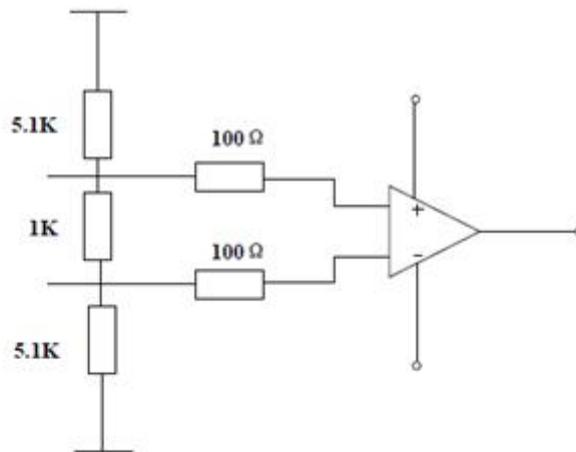
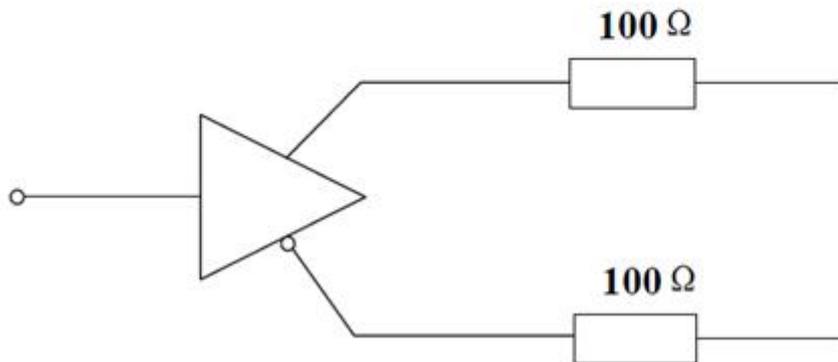


Fig.2 Interface between Gyroscope and Satellite

Each axis of gyroscope adopts SM3490 to connect with satellite, and three axes of gyroscope adopt the same interface, as shown in figure3.



(a) RS422 receive schematic



(b) RS422 send schematic

Fig.3 RS422 Schematic

5.2 communication protocols

RS422 communication sending data baud rate is 115200bps, and the byte sending format are 1 start bit, 8 data bits, 1 odd parity bit, and 1 stop bit. The frame format is shown as figure4.

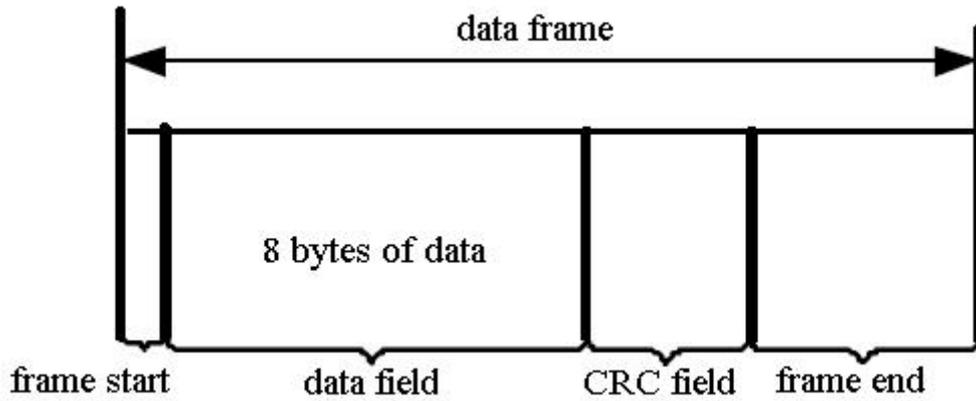


Figure4 RS422 Data Frame Format

1) instruction frame format

Table6 measurement data instruction frame format

No.	data content	data format	remark
byte1	ID code	EBH	a. After the house-keeping computer sends any instruction, Inertial Measurement Unit shall return acknowledge frame first, then execute related instruction, and respond the query instruction from the house-keeping computer during the next cycle. b. After the house-keeping computer receives a normal acknowledge frame, instruction code restores the initial value.
byte2-3	instruction code	0000H, query data E55EH, software reset	
byte4	CHK	checksum of byte2-3	

2) acknowledge format

After the gyroscope unit receives an instruction frame from the house-keeping computer, it returns immediately to the house-keeping computer the current status of Inertial Measurement Unit, as shown in Table7.

Table7 measurement data acknowledge frame format

No.	data content	data format
byte1	ID code	14H
byte2	data valid flag	00H gyroscope data invalid
		0FH gyroscope data valid
		B0H, ground test overtime
byte3	instruction code received by the frame	00: default state received
byte4-5	frame number (instruction counter accumulation, start from first frame: start from	unsigned integer

No.	data content	data format
	0, cleared after full to start from 0 again)	
byte6-8	X axis angular velocity	binary complementary code
byte9-11	X axis angular velocity	binary complementary code
byte12-14	X axis angular velocity	binary complementary code
byte15-16	X axis gyroscope temperature signal	binary complementary code
byte17-18	Y axis gyroscope temperature signal	binary complementary code
byte19-20	Z axis gyroscope temperature signal	binary complementary code
byte21	fixed	unsigned integer
byte22	CHK (lower 8 bits of checksum of 2-21 bytes)	checksum of byte2-3

6. Fault Identification

If the following phenomena happen in the process of installation testing, it indicates that Fiber Optic Gyroscope has faults. Please contact supplier to solve the problems:

- There are obvious damage signs on the appearance, including serious scratch, knock mark, component loss, etc.
- The failure of mounting gyroscope to satellite or the mounting accuracy failing to meet requirements.
- There are damages to electrical interface. The isolation impedance is less than 5MΩ when conducting electrical test.
- The static operating current is greater than 0.9A after power-on under normal temperature and pressure.
- Data bus can't receive (send) data or receive (send) error data.
- The bias stability exceeds specification significantly when testing gyroscope output data.
- When there is overflow flag, it indicates that gyroscope data exceeds limit. The overflow flag can be cleared only after power-on again.

7. Maintenance

Dedicated person should be designated for routine maintenance of Fiber Optic Gyroscope.

- The input power supply of Fiber Optic Gyroscope is +5VDC. No one

shall be allowed to change that.

- The type, specification, and parameter of components in circuits and the optical channel shall not be changed in the process of usage or maintenance. If faults happen, please contact supplier.
- Installations must be firm without breaking off.
- Transportation shall comply with waterway, land route transportation and loading requirements, avoiding collision, water, and corrosion.