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BS-GC20-400-D3EC

Operation Instruction of Micro Gyroscope Assembly

EX2.900.001SM

Compilation

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This instruction manual is the main reference document for the use and operation of BS-GC20-400-D3EC micro gyroscope combination.

The micro-gyroscope assembly can be configured into biaxial or triaxial according to the customer's requirements. This manual describes the three-axis gyroscope assembly, and the biaxial product also meets the requirements of this manual.

This instruction manual is mainly prepared in accordance with the Technical Agreement of BS-GC20-400-D3EC Micro Gyroscope Assembly and the Technical Conditions of Inertial Measurement Unit and Triaxial Gyroscope Assembly.

1 Product features and technical parameters

1.1 Composition and function

The micro gyroscope assembly is composed of a three-axis gyroscope, a temperature sensor, a signal processing board, a structure and necessary software, and is used for measuring the three-axis/two-axis angular rate of a carrier, and outputting three angular rate data subjected to error compensation (including temperature compensation, installation misalignment angle compensation, nonlinear compensation and the like) through an RS-422 serial port according to an agreed communication protocol.

1.2 Main technical parameters

1.2.1 Gyroscope specifications

a) Measuring range: ± 400 °/s

b) Zero-bias stability (@ Allan variance): ≤ 1 °/H

c) Zero-bias stability (1s smooth, 1σ, room temperature): ≤ 10 °/H

d) Zero bias error within full temperature range: ≤ 20 °/H

e) Random walk: ≤ 0.2 °/√ H

f) Zero-bias repeatability: ≤10°/h

g) Zero bias acceleration sensitivity: ≤ 1 °/H/G

h) Resolution: ≤ 0.001 °/s

i) Scale factor nonlinearity: ≤ 100ppm

j) Repeatability of scale factor: ≤ 100ppm

k) Cross coupling: ≤ 0.1%

l) Bandwidth: ≤250Hz

m) Weight: (52 ± 5) G

1.2.2 Power supply requirements

a) Supply voltage: (+ 5 ± 0.5) V (DC);

b) Power supply current: working current < 0.3A;

1.2.3 Environmental adaptability

a) Working temperature: (-45 ~ 85) ℃

b) Storage temperature: (-55 ~ 105) ℃

c) Vibration: 10 ~ 2000Hz, 6.06g

d) Impact: 5000 G, 0.1ms

2 Space coordinate system

2.1 Right Hand Rule Principle 1

The three-degree-of-freedom gyroscope contained in the micro-gyroscope assembly represents the spatial coordinate system of three axes, namely X, Y and Z. The X axis points to the direction of the electrical connection interface, the Y axis points to the left side of the micro-gyroscope assembly, and the Z axis refers to the top surface of the micro-gyro assembly, as shown in Figure 2-1.

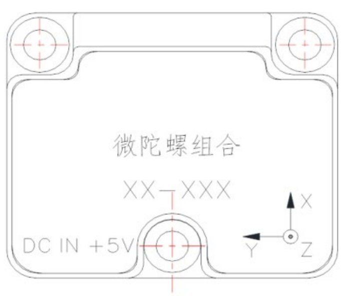

Figure 2-1 Space Coordinate System of Micro Gyroscope Combination

The installation of the micro-gyroscope assembly should match the axial direction of the coordinate system, otherwise the measured angular velocity data is not accurate. Following the "right hand rule principle 1", you can quickly assign and determine the axis of the coordinate system. Stretch out the right hand and spread out the thumb, index finger and middle finger respectively. The direction of the thumb is the X axis, the direction of the index finger is the Y axis, and the direction of the middle finger is the Z axis, as shown in Figure 2-2.

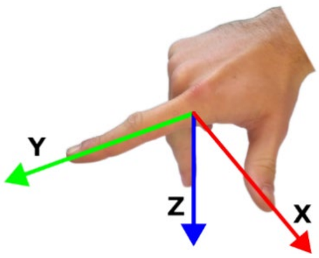

Figure 2-2 Right Hand Rule Principle 1

2.2 Right hand rule principle two

The angular velocity in three directions can be measured by a three-degree-of-freedom gyroscope combined with a micro-gyroscope. The direction of the angular velocity of the axial rotation of the coordinate axis can be quickly determined by following the "right-hand rule principle 2". Stretch out the right hand and unfold the thumb. The direction of the thumb is the axial direction. The direction of the other four fingers is the positive direction of angular velocity of the axial rotation of the thumb. The opposite direction of bending the four fingers is the negative direction of angular velocity, as shown in Figure 2-3.

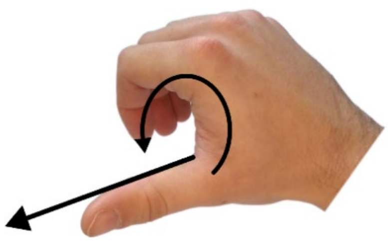

Figure 2-3 Right Hand Rule Principle 2

3 Structural installation

See Figure 3-1 for the outline drawing of BS-GC20-400-D3EC micro gyroscope assembly.

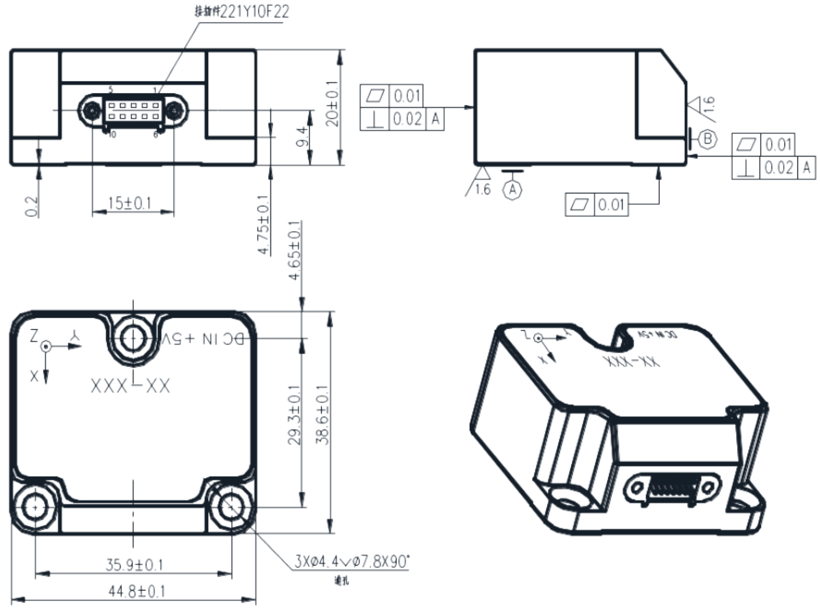

Figure 3-1 Outline drawing of micro gyroscope assembly

It is recommended that the flatness of the mounting surface opposite to the reference surface shall not be greater than 0.01 mm, the verticality shall not be greater than 0.02 mm, and the surface roughness shall not exceed 0.8 μm.

4 Electrical characteristics

4.1 Electrical interface

The model of electrical connector of BS-GC20-400-D3EC micro gyroscope assembly is 221Y10F22, the manufacturer is NICOMATIC, and the connector matched with the product is H222S10M11D6A150B. See Table 4-1 and Figure 4-1 for the specific distribution of contacts.

Table 4-1 Contact Distribution Table

Node number	Node definition	Type	Explain
1	GND	SUPPLY	Power ground(4)
2	ExtTrig	INPUT	External Trigger Source(3)
3	VSUP	SUPPLY	Positive end of product power supply, DC regulated power supply + 5V
4	TxD+	OUTPUT	Product RS422 output interface positive terminal
5	TxD-	OUTPUT	Product RS422 output interface negative terminal
6	CHASSIS	CHASSIS	Product mechanically isolated from power ground
7	GND	INPUT	Signal Ground(4)
8	NRST	INPUT	Reset signal(2)
9	RxD-	INPUT	Product RS422 receiving interface negative terminal
10	RxD+	INPUT	Product RS422 receiving interface positive terminal

Note:

(1) The reference object of the sending and receiving function of RS422 communication in the table is the micro-gyroscope combination.

(2) The reset signal needs to be specially configured according to the requirements. The default micro-gyroscope combination does not have this configuration. The internal configuration is a 3.3 V pull-up resistor, which can be suspended or connected to VSUP.

(3) The external trigger source needs to be specially configured according to the requirements. The default micro-gyroscope combination does not have this configuration. The internal configuration is a 3.3 V pull-up resistor, which can be suspended or grounded.

(4) The signal ground and the power ground are connected together by magnetic beads, which can be considered to be electrically connected.

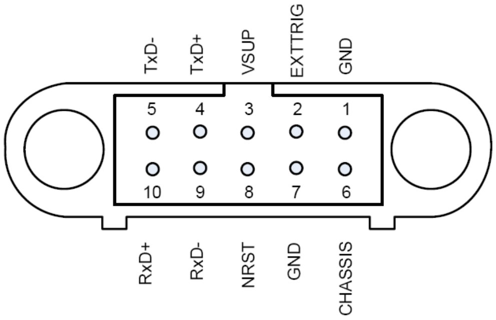

Fig. 4-1 Configuration Diagram of Connector Node (Seen from the Outside of the Product)

4.2 Electrical interface connections

The use of the BS-GC20-400-D3EC micro-gyro combination is very simple. If no special additional functions are required, data will be sent through the RS422 communication interface protocol about 2S after the micro-gyroscope assembly is powered on. Figure 4-2 is a simple interconnection diagram of the BS-GC20-400-D3EC micro gyroscope assembly.

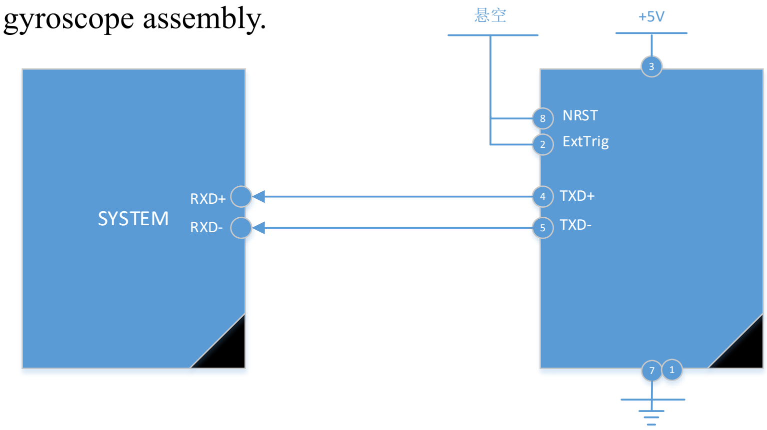

Fig. 4-2 Electrical connection 1

If all functions of the BS-GC20-400-D3EC micro-gyroscope assembly are to be used, it is necessary to interconnect with the micro-gyroscope assembly as shown in Figure 4-3.

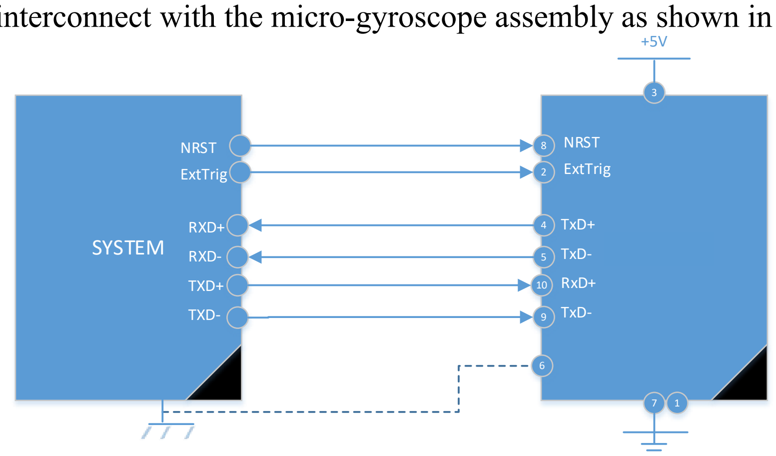

Figure 4-3 Electrical connection 2

4.3 Additional Function 1: Reset

The BS-GC20-400-D3EC microgyroscope assembly has a separate digital input pin (NRST) that allows the BS-GC20-400-D3EC to be reset without re-powering up if the microgyroscope assembly has completed a specific configuration. The trigger mode of the NRST signal can be specially defined according to the requirements.

4.4 Additional function 2: external trigger

The BS-GC20-400-D3EC micro gyroscope assembly has an independent digital input pin (ExtTrig). If the micro gyroscope assembly completes a specific configuration, it can send data through the RS422 communication interface protocol when it receives an external trigger source signal and generates an interrupt. The frequency of the sent data is synchronized with the frequency of the ExtTrig signal. However, there are two special cases where sending data is not affected by an external trigger source:

a) In the normal mode, send the command 'C' to the micro-gyroscope assembly, test the RS422 interface, and the micro-gyroscope assembly will transmit the configuration data stream without being affected by the external trigger source.

b) In the power-on initialization state, the micro-gyroscope assembly sends the initialization state data without being affected by the external trigger source.

Figure 4-4 is the timing diagram of sending data by the external trigger source. The sampling frequency of the micro gyroscope group is 2000 Hz. The external trigger source shall not be higher than the sampling frequency. Latency is the delay of sending trigge[illegible]

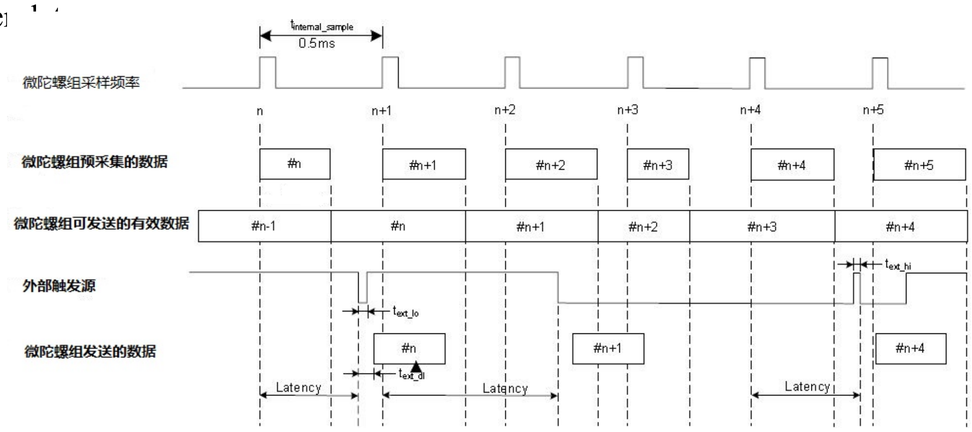

Figure 4-4 External Trigger Timing Diagram

5 Communication interface

5.1 Configurable parameters

The product communication protocol can be configured through the upper computer software, and the configurable parameters are shown in Table 5-1 below.

Table 5-1 Product Configurable Parameters

Parameter	Configuration value		Explain
Data frame	Standard data frame (ID = 0x90) Extended Data Frame (ID = 0x92) 'Angular Velocity + gyro temperature 'data frame (ID = 0 xA0) 'Angular Velocity + counter 'data frame (ID = 0xA2) 'Angular Velocity + time delay 'data frame (ID = 0 xA4) 'Angular Velocity + counter + delay 'data frame (ID = 0 xA5) 'Angular Velocity + gyro temperature + counter 'data frame (ID = 0x99) 'Angular Velocity + gyro temperature + time delay 'data frame (ID = 0 xA6) 'Angular Velocity + gyro temperature + delay + counter 'data frame (ID = 0xA8)		See Section 5.3 for the specific data frame format, and you can choose one of them to send. See Table 5-2 for the relationship between data frame, baud rate and update rate.
RS422 baud rate	460800bps 921600bps		Refer to Table 5-2 for baud rate limit conditions.
RS422 check digit	NONE (no check) ODD (odd parity) EVEN (even parity)		
RS422 stop bit	1 bit 2 bits		
Low-pass filter bandwidth	-3dB frequency	Group Delay (ms)	The filter setting is independent of the data update rate. The low-pass filter is a second-order IIR.
	16Hz 33Hz 66Hz 131Hz 262Hz	23.4 11.7 5.9 3.0 1.6	
Data update rate	125Hz 250Hz 500Hz 1000Hz 2000Hz		Refer to Table 5-2 for data update rate restrictions.
Restore factory settings	Restore factory settings Restore factory settings and save		

Note: In this manual, 0x 90 and 90H both represent the hexadecimal number 90, and the corresponding decimal number is 144. Others are similar.

5.2 Communication interface

By using RS-422 standard communication interface to communicate with the product, the transmission baud rate and data update rate can be configured by the upper computer software. Table 5-2 shows the maximum data update rate corresponding to the transmission baud rate.

Table 5-2 Data Frame, Baud Rate and Maximum Data Update Rate

Communication baud rate / A data frame is sent	460800 bit/s	921600 bit/s
Standard data frame (ID = 0x90)	2000Hz	2000 Hz
Extended Data Frame (ID = 0x92)	2000 Hz	2000 Hz
'Angular Velocity + gyro temperature 'data frame (ID = 0 xA0)	1000 Hz	2000 Hz
'Angular Velocity + counter 'data frame (ID = 0xA2)	2000 Hz	2000 Hz
'Angular Velocity + time delay 'data frame (ID = 0 xA4)	2000 Hz	2000 Hz
'Angular Velocity + counter + delay 'data frame (ID = 0 xA5)	2000 Hz	2000 Hz
'Angular Velocity + gyro temperature + counter 'data frame (ID = 0x99)	1000 Hz	2000 Hz
'Angular Velocity + gyro temperature + time delay 'data frame (ID = 0 xA6)	1000 Hz	2000 Hz
'Angular Velocity + gyro temperature + delay + counter 'data frame (ID = 0xA8)	1000 Hz	2000 Hz

5.3 Data frame format

For the data sent by the micro-gyroscope combination in each cycle, the data format can refer to the corresponding data frame format configured in the operating instructions of the supporting upper computer, and all formats are shown in the following table.

Table 5-3 Standard data frame format of micro gyroscope combination

Parameter name	Valid range	Byte	Scale	Remark
Frame header	90H	1	——	——
X-axis angular velocity	[-410，410]	3	2^{-14}	Unit: (/s, from high to low, the most significant bit of the first byte is the sign bit. See Note 1 for the specific algorithm.
Y-axis angular velocity	[-410，410]	3	2^{-14}	Unit: (/s, from high to low, the most significant bit of the first byte is the sign bit. See Note 1 for the specific algorithm.

Z-axis angular velocity	[-410，410]	3	2^{-14}	Unit: (/s, from high to low, the most significant bit of the first byte is the sign bit. See Note 1 for the specific algorithm.
Gyro status	——	1	——	All zeros are normal. See 5.4
Checksum	——	1	——	CRC check, see note 4

Table 5-4 Extended Data Frame Format of Micro Gyro Assembly

Parameter name	Valid range	Byte	Scale	Remark
Frame header	92H	1	——	——
X-axis angular velocity	[-410，410]	3	2^{-14}	Unit: (/s, from high to low, the most significant bit of the first byte is the sign bit. See Note 1 for the specific algorithm.
Y-axis angular velocity	[-410，410]	3	2^{-14}	Unit: (/s, from high to low, the most significant bit of the first byte is the sign bit. See Note 1 for the specific algorithm.
Z-axis angular velocity	[-410，410]	3	2^{-14}	Unit: (/s, from high to low, the most significant bit of the first byte is the sign bit. See Note 1 for the specific algorithm.
Gyro status	——	1	——	All zeros are normal. See 5.4
Reserved	——	1	——	Customized
Reserved	——	1	——	Customized
Reserved	——	1	——	Customized
Checksum	——	1	——	CRC check, see note 4

Table 5-5 Data Frame Format of "Angular Velocity + Gyro Temperature" of Micro Gyro Assembly

Parameter name	Valid range	Byte	Scale	Remark
Frame header	A0H	1	——	——

X-axis angular velocity	[-410，410]	3	2^{-14}	Unit: (/s, from high to low, the most significant bit of the first byte is the sign bit. See Note 1 for the specific algorithm.
Y-axis angular velocity	[-410，410]	3	2^{-14}	Unit: (/s, from high to low, the most significant bit of the first byte is the sign bit. See Note 1 for the specific algorithm.
Z-axis angular velocity	[-410，410]	3	2^{-14}	Unit: (/s, from high to low, the most significant bit of the first byte is the sign bit. See Note 1 for the specific algorithm.
Gyro status	——	1	——	All zeros are normal. See 5.4
X-axis gyro temperature	[-128，128]	2	2^{-8}	Unit: ℃, from high to low, the most significant bit of the first byte is the sign bit. See Note 2 for the specific algorithm.
Y-axis gyro temperature	[-128，128]	2	2^{-8}	Unit: ℃, from high to low, the most significant bit of the first byte is the sign bit. See Note 2 for the specific algorithm.
Temperature of Z-axis gyroscope	[-128，128]	2	2^{-8}	Unit: ℃, from high to low, the most significant bit of the first byte is the sign bit. See Note 2 for the specific algorithm.
Checksum	——	1	——	CRC check, see note 4

Table 5-6 Data Frame Format of "Angular Velocity + Counter" of Micro Gyro Assembly

Parameter name	Valid range	Byte	Scale	Remark
Frame header	A2H	1	——	——

X-axis angular velocity	[-410，410]	3	2^{-14}	Unit: (/s, from high to low, the most significant bit of the first byte is the sign bit. See Note 1 for the specific algorithm.
Y-axis angular velocity	[-410，410]	3	2^{-14}	Unit: (/s, from high to low, the most significant bit of the first byte is the sign bit. See Note 1 for the specific algorithm.
Z-axis angular velocity	[-410，410]	3	2^{-14}	Unit: (/s, from high to low, the most significant bit of the first byte is the sign bit. See Note 1 for the specific algorithm.
Gyro status	——	1	——	All zeros are normal. See 5.4
Counter	——	1	——	Output value range: [0,255]
Checksum	——	1	——	CRC check, see note 4

Table 5-7 Data Frame Format of "Angular Velocity + Delay" of Micro Gyro Assembly

Parameter name	Valid range	Byte	Scale	Remark
Frame header	A4H	1	——	——
X-axis angular velocity	[-410，410]	3	2^{-14}	Unit: (/s, from high to low, the most significant bit of the first byte is the sign bit. See Note 1 for the specific algorithm.
Y-axis angular velocity	[-410，410]	3	2^{-14}	Unit: (/s, from high to low, the most significant bit of the first byte is the sign bit. See Note 1 for the specific algorithm.
Z-axis angular velocity	[-410，410]	3	2^{-14}	Unit: (/s, from high to low, the most significant bit of the first byte is the sign bit. See Note 1 for the specific algorithm.
Gyro status	——	1	——	All zeros are normal. See 5.4

Delay	——	2	——	Unit: us, first high and then low, the most significant bit of the first byte is the sign bit. See Note 3 for the specific algorithm.
Checksum	——	1	——	CRC check, see note 4

Table 5-8 Data frame format of "angular velocity + counter + delay" of micro gyroscope combination

Parameter name	Valid range	Byte	Scale	Remark
Frame header	A5H	1	——	——
X-axis angular velocity	[-410，410]	3	2^{-14}	Unit: (/s, from high to low, the most significant bit of the first byte is the sign bit. See Note 1 for the specific algorithm.
Y-axis angular velocity	[-410，410]	3	2^{-14}	Unit: (/s, from high to low, the most significant bit of the first byte is the sign bit. See Note 1 for the specific algorithm.
Z-axis angular velocity	[-410，410]	3	2^{-14}	Unit: (/s, from high to low, the most significant bit of the first byte is the sign bit. See Note 1 for the specific algorithm.
Gyro status	——	1	——	All zeros are normal. See 5.4
Counter	——	1	——	Output value range: [0,255]
Delay	——	2	——	Unit: us, first high and then low, the most significant bit of the first byte is the sign bit. See Note 3 for the specific algorithm.
Checksum	——	1	——	CRC check, see note 4

Table 5-9 Data frame format of "angular velocity + gyro temperature + counter" of micro gyro combination

Parameter name	Valid range	Byte	Scale	Remark
Frame header	99H	1	——	——

X-axis angular velocity	[-410，410]	3	2^{-14}	Unit: (/s, from high to low, the most significant bit of the first byte is the sign bit. See Note 1 for the specific algorithm.
Y-axis angular velocity	[-410，410]	3	2^{-14}	Unit: (/s, from high to low, the most significant bit of the first byte is the sign bit. See Note 1 for the specific algorithm.
Z-axis angular velocity	[-410，410]	3	2^{-14}	Unit: (/s, from high to low, the most significant bit of the first byte is the sign bit. See Note 1 for the specific algorithm.
Gyro status	——	1	——	All zeros are normal. See 5.4
X-axis gyro temperature	[-128，128]	2	2^{-8}	Unit: °C, from high to low, the most significant bit of the first byte is the sign bit. See Note 2 for the specific algorithm.
Y-axis gyro temperature	[-128，128]	2	2^{-8}	Unit: °C, from high to low, the most significant bit of the first byte is the sign bit. See Note 2 for the specific algorithm.
Temperature of Z-axis gyroscope	[-128，128]	2	2^{-8}	Unit: °C, from high to low, the most significant bit of the first byte is the sign bit. See Note 2 for the specific algorithm.
Counter	——	1	——	Output value range: [0,255]
Checksum	——	1	——	CRC check, see note 4

Table 5-10 Data frame format of "angular velocity + gyro temperature + time delay" of micro gyro combination

Parameter name	Valid range	Byte	Scale	Remark
Frame header	A6H	1	——	——
X-axis angular velocity	[-410，410]	3	2^{-14}	Unit: (/s, from high to low, the most significant bit of the first byte is the sign bit. See Note 1 for the specific algorithm.

Y-axis angular velocity	[-410，410]	3	2^{-14}	Unit: (/s, from high to low, the most significant bit of the first byte is the sign bit. See Note 1 for the specific algorithm.
Z-axis angular velocity	[-410，410]	3	2^{-14}	Unit: (/s, from high to low, the most significant bit of the first byte is the sign bit. See Note 1 for the specific algorithm.
Gyro status	——	1	——	All zeros are normal. See 5.4
X-axis gyro temperature	[-128，128]	2	2^{-8}	Unit: ℃, from high to low, the most significant bit of the first byte is the sign bit. See Note 2 for the specific algorithm.
Y-axis gyro temperature	[-128，128]	2	2^{-8}	Unit: ℃, from high to low, the most significant bit of the first byte is the sign bit. See Note 2 for the specific algorithm.
Temperature of Z-axis gyroscope	[-128，128]	2	2^{-8}	Unit: ℃, from high to low, the most significant bit of the first byte is the sign bit. See Note 2 for the specific algorithm.
Delay	——	2	——	Unit: us, first high and then low, the most significant bit of the first byte is the sign bit. See Note 3 for the specific algorithm.
Checksum	——	1	——	CRC check, see note 4

Table 5-11 Data frame format of "angular velocity + gyro temperature + delay + counter" of micro gyro combination

Parameter name	Valid range	Byte	Scale	Remark
Frame header	A8H	1	——	——
X-axis angular velocity	[-410，410]	3	2^{-14}	Unit: (/s, from high to low, the most significant bit of the first byte is the sign bit. See Note 1 for the specific algorithm.

Y-axis angular velocity	[-410，410]	3	2^{-14}	Unit: (/s, from high to low, the most significant bit of the first byte is the sign bit. See Note 1 for the specific algorithm.
Z-axis angular velocity	[-410，410]	3	2^{-14}	Unit: (/s, from high to low, the most significant bit of the first byte is the sign bit. See Note 1 for the specific algorithm.
Gyro status	——	1	——	All zeros are normal. See 5.4
X-axis gyro temperature	[-128，128]	2	2^{-8}	Unit: °C, from high to low, the most significant bit of the first byte is the sign bit. See Note 2 for the specific algorithm.
Y-axis gyro temperature	[-128，128]	2	2^{-8}	Unit: °C, from high to low, the most significant bit of the first byte is the sign bit. See Note 2 for the specific algorithm.
Temperature of Z-axis gyroscope	[-128，128]	2	2^{-8}	Unit: °C, from high to low, the most significant bit of the first byte is the sign bit. See Note 2 for the specific algorithm.
Delay	——	2	——	Unit: us, first high and then low, the most significant bit of the first byte is the sign bit. See Note 3 for the specific algorithm.
Counter	——	1	——	Output value range: [0,255]
Checksum	——	1	——	CRC check, see note 4

Explain

1) Gyro angular velocity output [°/s] $=\dfrac{AR_1\cdot 2^{16}+AR_2\cdot 2^{8}+AR_3}{2^{14}}$ See Figure 5-1 for data bit format;

Among AR_1 Outputting the high eight bits of the three bytes for the angular velocity of each axis of the gyroscope;

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AR_2 Outputting the middle eight bits of the three bytes for the angular velocity of each axis of the gyroscope;

AR_3 Outputs the lower eight bits of the three bytes for the angular velocity of each axis of the gyro.

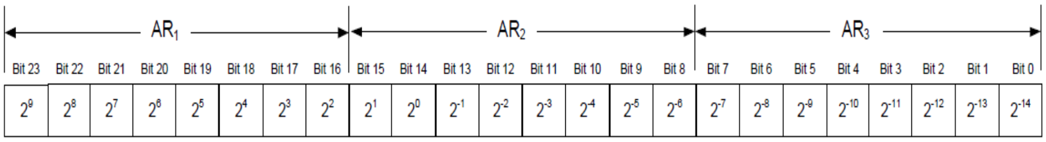

Figure 5-1 Converting the Gyro Angular Velocity Output to [°/s]

2) Temperature output [°C] $=\frac{T_1 \cdot 2^8 + T_2}{2^8}$? See Figure 5-2 for data bit format.

Among T_1 Outputs the upper eight bits of the two bytes for each axis temperature;

T_2 Outputs the lower eight bits of the two bytes for each axis temperature.

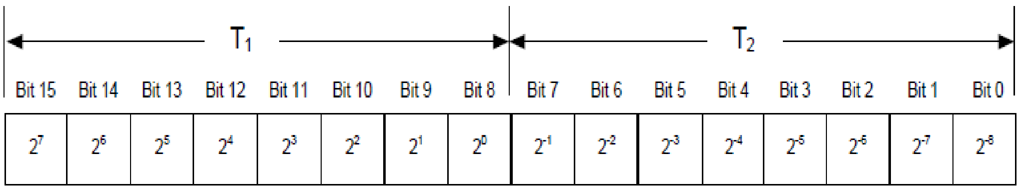

Figure 5-2 Converting Temperature Output to [°C]

3) Delay time output [us] = $T_1 \cdot 2^8 + T_2$

Where, T_1 is the high eight bits in the two bytes of the delay time output;

T_2 outputs the lower eight bits of the two bytes for the delay time.

4) CRC check method

The CRC uses a standard CRC-8 polynomial, $x^8 + x^2 + x + 1$ See Appendix B for the list of data tables and lookup function codes generated from the polynomial.

5.4 Self-check function and real-time output function of working status

The product has the functions of self-checking and real-time output of working status. The data frame contains a byte indicating the status, and the real-time output of product working status information begins after the power-on start is completed. The status bits are defined in Table 5-12.

Table 5-12 Product Status Bit Definitions

Bit	Definition

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7	0 = normal, standby
6	0 = normal, standby
5	0 = normal, 1 = abnormal external environment
4	0 = normal, 1 = three axes out of service condition
3	0 = normal, standby
2	0 = OK, 1 = Z axis out of use condition or error
1	0 = OK, 1 = Y axis out of use condition or error
0	0 = OK, 1 = X axis out of use condition or error

6 Functional testing

6.1 Test equipment and instrumentation required

The equipment and instruments required in the test include: DC regulated power supply, computer, turntable, test tooling and test cable.

6.2 Functional testing

The product is in a static state, and the DC regulated power supply is used to supply power to the product. The power supply requirements meet the requirements of 1.2.2. The specific connection mode of the product is shown in Figure 6-1. Data is received according to the communication protocol, and the angular velocity output of the product is received and displayed by the upper computer receiving software.

Rotate the gyroscope assembly in the positive direction around X, Y and Z respectively (if conditions permit, the turntable can be used for input, and if conditions do not permit, it can be rotated by hand), and the angular velocity output of the corresponding axis can be monitored as the positive angular rate. Rotate the product reversely around X, Y and Z respectively, and the angular velocity output of the corresponding axis can be monitored to be a negative angular velocity. It indicates that the angular velocity output polarity of the product is correct. The two angular rate values at the output of the product shall be in the vicinity of 0 deg/s under stationary conditions.

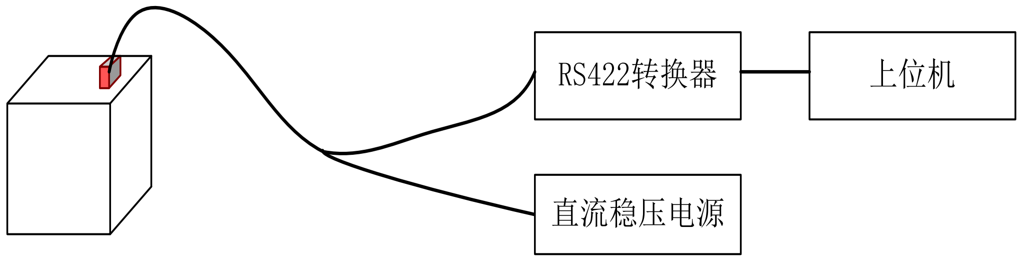

Figure 6-1 Schematic diagram of gyro combination test connection

7 Use and maintenance requirements

Before use, the installation position of the system must be checked to ensure correct installation. Carefully check the connection of each signal line to ensure that the connection is correct.

Before power-on, check the cable network contact and power supply value, and the power supply polarity shall not be reversed.

In use, the mechanical grounding of the system shall be well grounded.

This product contains precision instruments. Knocking and falling are prohibited.

This product should be stored in a well-ventilated warehouse with a temperature of (15 ~ 35) ℃, a relative humidity of not more than 75%, and free of acid, alkali and corrosive gases.

Appendix A Packing List

BS-GC20-400-D3EC Micro Gyroscope Combination Product Matching Table

Serial number	Name	Quantity	Unit	Remark
1	BS-GC20-400-D3EC Products	1	Taiwan	
2	Product certificate	1	Share	
3	Product CD (including user	1	Zhang	

	software View, product instruction manual, software manual, etc.)			
4	Packing list	1	Share	
5	Product packing box	1	A	

Appendix B CRC Lookup Table and Lookup Function

Query table for B1 CRC8

```
static uint8_t crc8_table[256] = {
0x00,0x07,0x0E,0x09,0x1C,0x1B,0x12,0x15,0x38,0x3F,0x36,0x31,0x24,0x23,0x2A,0x2D,
0x70,0x77,0x7E,0x79,0x6C,0x6B,0x62,0x65,0x48,0x4F,0x46,0x41,0x54,0x53,0x5A,0x5D,
0xE0,0xE7,0xEE,0xE9,0xFC,0xFB,0xF2,0xF5,0xD8,0xDF,0xD6,0xD1,0xC4,0xC3,0xCA,0xCD,
```

```
0x90,0x97,0x9E,0x99,0x8C,0x8B,0x82,0x85,0xA8,0xAF,0xA6,0xA1,0xB4,0xB3,0xBA,0xBD,
0xC7,0xC0,0xC9,0xCE,0xDB,0xDC,0xD5,0xD2,0xFF,0xF8,0xF1,0xF6,0xE3,0xE4,0xED,0xEA,
0xB7,0xB0,0xB9,0xBE,0xAB,0xAC,0xA5,0xA2,0x8F,0x88,0x81,0x86,0x93,0x94,0x9D,0x9A,
0x27,0x20,0x29,0x2E,0x3B,0x3C,0x35,0x32,0x1F,0x18,0x11,0x16,0x03,0x04,0x0D,0x0A,
0x57,0x50,0x59,0x5E,0x4B,0x4C,0x45,0x42,0x6F,0x68,0x61,0x66,0x73,0x74,0x7D,0x7A,
0x89,0x8E,0x87,0x80,0x95,0x92,0x9B,0x9C,0xB1,0xB6,0xBF,0xB8,0xAD,0xAA,0xA3,0xA4,
0xF9,0xFE,0xF7,0xF0,0xE5,0xE2,0xEB,0xEC,0xC1,0xC6,0xCF,0xC8,0xDD,0xDA,0xD3,0xD4,
0x69,0x6E,0x67,0x60,0x75,0x72,0x7B,0x7C,0x51,0x56,0x5F,0x58,0x4D,0x4A,0x43,0x44,
0x19,0x1E,0x17,0x10,0x05,0x02,0x0B,0x0C,0x21,0x26,0x2F,0x28,0x3D,0x3A,0x33,0x34,
0x4E,0x49,0x40,0x47,0x52,0x55,0x5C,0x5B,0x76,0x71,0x78,0x7F,0x6A,0x6D,0x64,0x63,
0x3E,0x39,0x30,0x37,0x22,0x25,0x2C,0x2B,0x06,0x01,0x08,0x0F,0x1A,0x1D,0x14,0x13,
0xAE,0xA9,0xA0,0xA7,0xB2,0xB5,0xBC,0xBB,0x96,0x91,0x98,0x9F,0x8A,0x8D,0x84,0x83,
0xDE,0xD9,0xD0,0xD7,0xC2,0xC5,0xCC,0xCB,0xE6,0xE1,0xE8,0xEF,0xFA,0xFD,0xF4,0xF3
};
```

B2 is a table lookup function that returns the calculated CRC value

```
uint8_t CRC8(uint8_t *ptr, uint8_t len)
{
    uint8_t crc = 0x00;
    while (len--)
    {
        crc = crc8_table[crc ^ *ptr++];
    }
    return (crc);
}
```

Uint8 _ t is of type byte.