FORSENSE 原极科技

Tactical single axis MEMS Gyroscope sensor

FSS-G200P Product Manual

Characteristic

Tactical MEMS gyroscope

- 5.0°/h Bias stability
- Better than 1.0°/s bias repeatability
- 0.08°/s Ultra low output noise

High reliability

- Shock resistance:2000g（0.5ms,half sine,3-axis）
- Shock vibration:10g（10~2KHz,3-axis）
- Stable operation at full temperature: -40 ℃~85℃
- 100% Magnetic shielding
- IP67 Waterproof
- Special bending resistant cable

Flexible digital interface, small size

- Configurable output sampling rate up to 400Hz
- Support RS232, CAN mainstream agricultural machinery controller interface
- Size of 45*45*22.8mm and weighs only 50g

Product Description

FSS-G200P is a single degree of freedom MEMS gyroscope module, which was originally designed for measuring the front wheel angle of automatic driving of agricultural machinery. The module has its own front wheel angle estimation algorithm. Customers only need to access a serial port of RTK board to output high-precision and drift free front wheel angle value.

The module has the characteristics of high repeatability, good stability, good vibration and shock resistance. Large wheel angle can be measured under vibration environment, so that each module can play stably under various limit conditions, and ensure the high consistency of all product performance.

Application Area

- Automatic driving of agricultural machinery
- Engineering vehicle

On the basis of standard performance and output parameters, Forsense also provides customized software and logo services for your special needs.

1. Performance Parameter

1.1 Key specification of Gyroscope

Table 1 Key specification of Gyroscope

Parameter	Test Conditions /Remarks	Min	Typ	Max	Units
Measuring range			±500		°/s
Bias stability[1]	@25℃, 1σ		5.0		°/hr
Bias repeatability	@25℃, 1σ		1.0		°/s
Internal low pass cutoff frequency	Software adjustable	1.0	15	47	Hz
ODR[2]		1	100	400	Hz
Measurement delay				5.0	ms
Random walk	Allan variance@25℃, 1σ		0.8		$°/\sqrt{hr}$
Output noise[3]	rms@30Hz cf		0.08		°/s

[1] According to IEEE standard, Allan variance curve is given under static 25 ℃

[2] The maximum output update rate is not greater than 200Hz@115200bps

[3] RMS index under static 25 ℃ environment and cut-off frequency of 15Hz

2. Usage Method

1. The serial port of the module is directly connected to a separate serial port of the dual antenna RTK board.

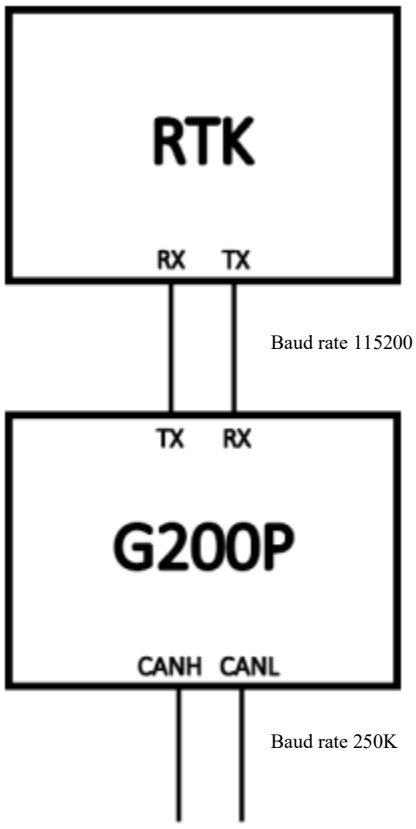
2. Install the module horizontally at the front axle of the front wheel and fix it firmly.

3. Make sure that the dual antenna RTK board is positioned and fixed.

4. Ensure that the wheelbase of the vehicle and the installation mode of RTK antenna are normal through the protocol described in Chapter

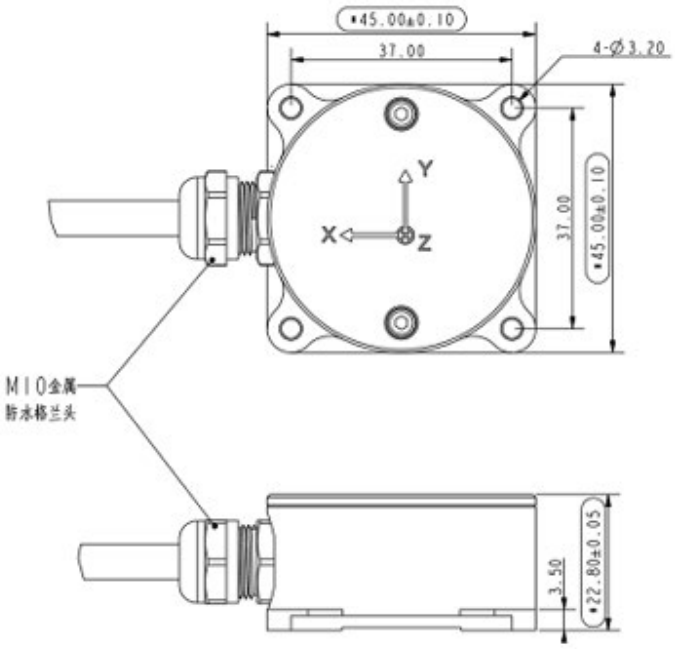
5.After the vehicle starts, the effective sign of front wheel angle is set, and the front wheel angle is available.

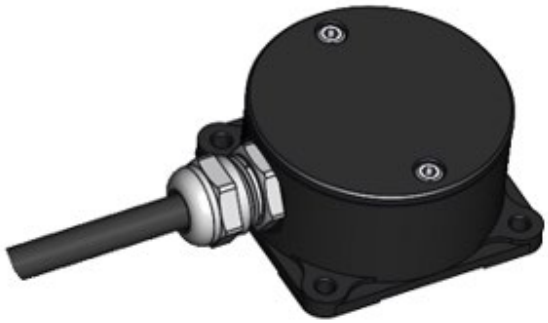
Figure 1 System connection diagram



3. Configuration

Figure 2 Outline structure and dimensions（Unit：mm）





4. Electrical Characteristics

Table 2 Electrical characteristics

Parameter	Symbol	Interface Type	Min	Max	Units
Power input	VCC		4.5	5.5	V
Power ground	GND				
Electric current	I		60	80	mA
Temperature	T		-40	85	℃

Note: Standard RS232 and CAN bus interface

Table 3 Pin definition

Parameter	Line Color	Remarks
Power input	Red	4.5-5.5Vinput
Power ground	Black	
RS232_TX	Yellow	RS232 Level
RS232_RX	White	
CAN_L	Brown	
CAN_H	Green	

Note: The baud rate of CAN communication is 250k, and the built-in matching resistance is 120 Ω

5. Software Configuration Method

5.1 Input configuration

The controller sends the vehicle wheelbase and RTK double antenna installation mode to G200 through CAN bus. It is recommended to send it at 1 Hz.

- Axle pitch is uint16 data type in mm.
- RTK dual antenna installation has four options: 0, 1, 2, 3.The data type is uint8.Describe as follows:

Figure 2 Diagram of dual antenna installation mode setup

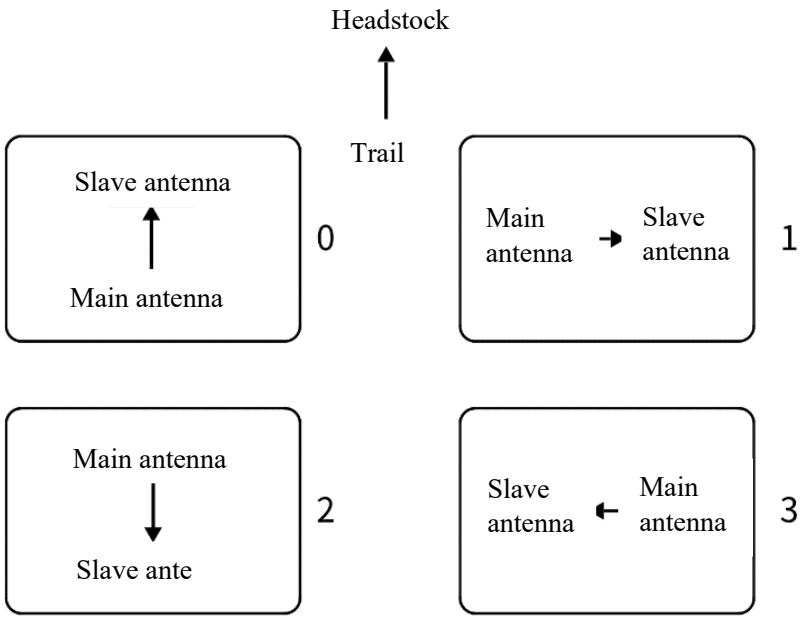


Table 4 Input Configuration Frame Format

CAN-ID	Data[0]	Data[1]	Data[2]	Data[3]	Data[4]	Data[5]	Data[6]	Data[7]
0x101 Standard frame	High 8-bit wheelbase	Low 8-bit wheelbase	RTK double antenna installation	Reserved, set to 0	Reserved, set to 0	Reserved, set to 0	Reserved, set to 0	Reserved, set to 0

5.2 Output data format

The controller obtains the front wheel angle value through CAN bus. The unit of angle value is degree, the left wheel is positive, the right wheel is negative, and the update rate is 50 Hz.

Table 5 Output data frame format

CAN-ID	Data[0]	Data[1]	Data[2]	Data[3]	Data[4]	Data[5]	Data[6]	Data[7]
0x110 Standard frame	Front wheel angle, 0-7 data bits of float type	Front wheel angle, 8-15 data bits of float type	Front wheel angle, 16-23 data bits of float type	Front wheel angle, 24-31 data bits of float type	Frame count	Reserve	Reserve	Front wheel valid flag bit, uint8 type. 1 is valid and 0 is invalid

Note: only when the double antenna RTK Positioning fixed solution and directional fixed solution, the wheelbase of the vehicle is sent correctly, and the vehicle starts, the front wheel angle sign will be effective.

5.3 Test and status data

The module sends status information at 1 Hz update rate, which is used to indicate the connection status of RTK data, as well as the vehicle wheelbase, antenna installation type and other data obtained from the controller.

Table 6 State data frame format

CAN-ID	Data[0]	Data[1]	Data[2]	Data[3]	Data[4]	Data[5]	Data[6]	Data[7]
0x116 Standard frame	RTK Positioning status 0-no gps,1-single,5-float,4-fix	Fixed state of dual antenna heading angle (RTK is true only when the heading is fixed and the antenna type sent to the controller is taken)	Is the wheelbase and antenna type sent by the controller available	Installation type of RTK antenna	The wheelbase is 8 bits lower in mm	The wheelbase is 8 bits higher in mm	Frame count	Reserve

5.4 Only used the CAN interface

If the user cannot connect the serial port of the RTK board card directly to the serial port of G200, the RTK data needs to be forwarded to G200 through the CAN bus through the user's controller. Take THE RTK board card and the 482 board card of Sincom as examples to illustrate that the data in the KSXT frame needs to be forwarded. After the data is parsed to the frame, the forwarding delay is less than 20ms and the update rate is not less than 10Hz.

5.4.1 Angle information frame

The azimuth is 0.01 degrees of pitch. That is, 10.12 degrees requires 1012.

The directional state is field 12 in the KSXT frame.

The positioning status is field 11 in the KSXT frame.

The number of main satellites is the 14 field in KSXT frame.

The number of sub-satellites is field 13 in THE KSXT frame.

Table 7 Angle information frame format

CAN-ID	Data[0]	Data[1]	Data[2]	Data[3]	Data[4]	Data[5]	Data[6]	Data[7]
0x06 Standard frame 250K	azimuth, 0-7 data bits of uint16 type	azimuth, 8-15 data bits of uint16 type	Pitching angle, 0-7 data bits of uint16 type	Pitching angle, 8-15 data bits of uint16 type	Directional state uint8 type	Positioning state uint8 type	Number of main satellites uint8 type	Number of sub-satellites uint8 type

Figure 4 KSXT data structure

ID	字段	数据描述	符号	示例
1	$KSXT	帧头	$KSXT	$KSXT
2	utc	位置对应的 UTC 时间，yyyy/mm/dd/hh/mm/ss.ss	yyyymmddhhmmss.ss	20170616093520.00
3	lon	经度（单位：度），保留小数点后 8 位有效数字	DDD.DDDDDDDD	
4	lat	纬度（单位：度），保留小数点后 8 位有效数字	DD.DDDDDDDD	
5	Height	海拔高（单位：米），保留小数点后 4 位有效数字		
6	Heading	方位角	a	E
7	pitch	俯仰角		
8	track true	速度角		
9	Vel	水平速度		
10	Roll	横滚		
11	POS	GNSS 定位质量指示符	x	1

Figure 5 Instruction information reference

ID	字段	数据描述	符号	示例
	qual	0 = 定位不可用或无效 1 = 单点定位 2 = RTK 浮点解 3 = RTK 固定解		
12	HEADING qual	GNSS 定向质量指示符 0 = 定位不可用或无效 1 = 单点定位 2 = RTK 浮点解 3 = RTK 固定解		
13	#solnSVs	前天线使用卫星数 前天线当前参与解算的卫星数量		
14	#solnSVs	后天线使用卫星数 后天线当前参与解算的卫星数量		
15	East	东向位置坐标：以基站为原点的地理坐标系下的东向位置，单位：米，小数点后 3 位		
16	north	北向位置坐标：以基站为原点的地理坐标系下的北向位置，单位：米，小数点后 3 位		
17	up	天向位置坐标：以基站为原点的地理坐标系下的天顶向位置，单位：米，小数点后 3 位		
18	EastVel	东向速度：地理坐标系下的东向速度，小数点后 3 位，单位：Km/h(如无为空)		
19	northVel	北向速度：地理坐标系下的北向速度，小数点后 3		

5.5 Speed information frame

The unit of east, north and ground velocity is 0.01m/s. For 1.23m/s, enter 123.

The unit of velocity Angle is 0.01 degree. That is, 10.12 degrees requires the input of 1012, which is the 8 field in KSXT frame.

Table 8 Speed information frame format

CAN-ID	Data[0]	Data[1]	Data[2]	Data[3]	Data[4]	Data[5]	Data[6]	Data[7]
0x07 Standard frame 250K	East to speed, 0-7 data bits of uint16 type	East to speed, 8-15 data bits of uint16 type	North to speed, 0-7 data bits of uint16 type	North to speed, 8-15 data bits of uint16 type	Sky to speed, 0-7 data bits of uint16 type	Sky to speed, 8-15 data bits of uint16 type	Velocity angle, 0-7 data bits of uint16 type	Velocity angle, 8-15 data bits of uint16 type