# Body Type Front Wheel Angle Sensor

## FSS-G200PN Product Manual

## Characteristic

### Tactical MEMS Gyroscope

- 4.0°/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

- Support RS232, CAN mainstream agricultural machinery controller interface
- Size of45*45*22.8mm and weighs only 50g



## Product Description

FSS-G200PN is an inertial sensor module 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, input agricultural machinery parameters and motor angle value, and then 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

- Rice transplanter
- Tractor

On the basis of standard performance and output parameters, Forsence 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 | | 4.0 | | °/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 | | 0.1 | | °/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. Try to install the module horizontally on the horizontal rigid plane in the center of the car body, and fix it securely.

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

4. Ensure that parameters such as vehicle wheelbase, RTK antenna installation method, motor angle, drive ratio are imported normally through the protocol described in Chapter 5.

5. When the vehicle starts, the front wheel angle is positioned as a valid indicator, and the front wheel angle is available.

# 3. Configuration

**Figure 1 Outline Structure And Dimensions（Unit：mm）**
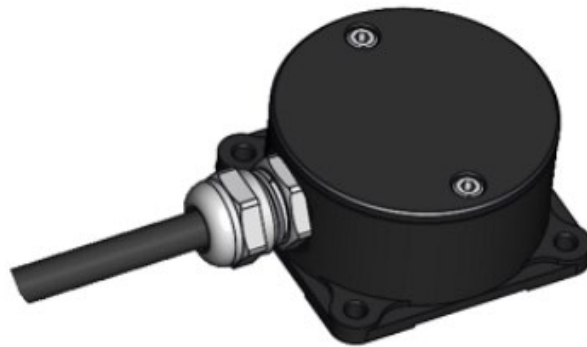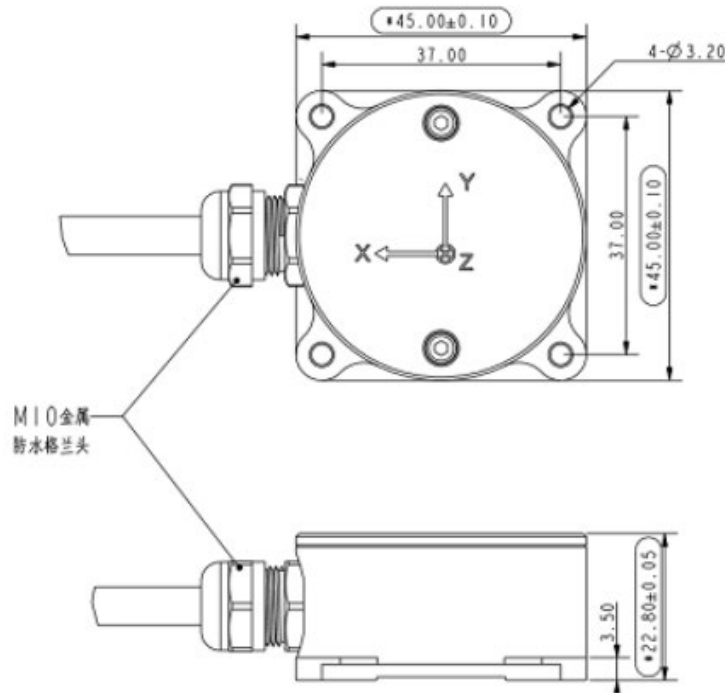
## 4.    Electrical Characteristics

**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 | °C |

Remarks: Standard RS232 and CAN bus interface, also can choose double RS232 interface.

**Table 3 Pin Definition-CAN Edition**

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

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

# 5. Software Configuration Usage - CAN Interface

## 5.1 Input Configuration

### 5.1.1 Input Farm Machine Parameters

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.

● The wheelbase is uint16 data type, and the unit is mm.

● The installation mode of RTK dual antenna has four options: 0, 1, 2 and 3. The data type is uint8. The description is as follows:

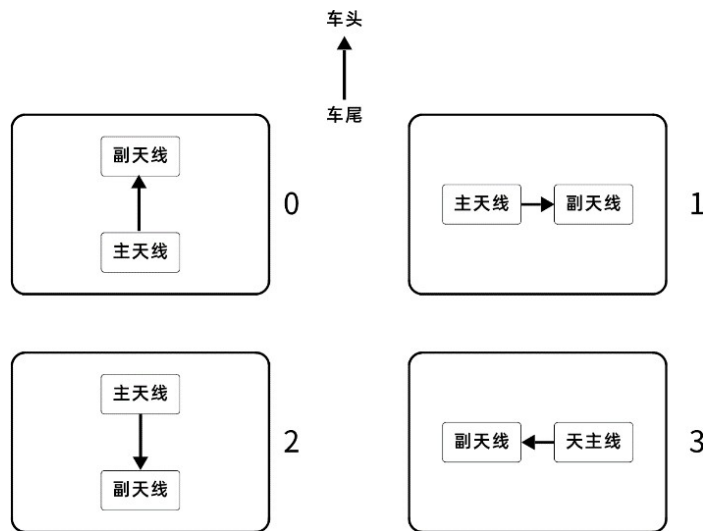**Figure 2 Schematic diagram of double antenna installation mode setting**



**Table 4 Frame Format of Agricultural Machinery Parameters**

| 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 |

### 5.1.2 Input Motor Parameters

The controller sends the steering wheel motor angle value and steering wheel to front wheel angle transmission ratio to G200PN through CAN bus. It is recommended to send at least 20 Hz.

● The motor angle is int32 data type, and the unit is 0.01 degree. For example, if the motor angle is -12.31 degrees, - 1231 should be sent.

(Note: there is no interval range for the angle value of the steering wheel motor, the left angle decreases continuously, and the right angle increases continuously)

● The steering wheel to front wheel angle transmission ratio is uint16 data type. Indicates the degree of change of steering wheel angle corresponding to 1 degree of front wheel rotation. Generally, the transmission ratio of rice transplanter is 11, which means that the steering wheel rotates 11 degreesand the front wheel angle rotates 1 degree.

**Table 5 Motor Parameter Frame Format**

| CAN-ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
|---|---|---|---|---|---|---|---|---|
| 0x104 Standard frame | Motor angle, int32 type 0-7 data bits | Motor angle, int32 type 8-15 data bits | Motor angle, int32 type 16-23 data bits | Motor angle, int32 type 24-31 data bits | Reserved, set to 0 | Reserved, set to 0 | 8-bit lower transmission ratio | 8-bit higher transmission ratio |

## 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. Update rate 50 Hz

**Table 6 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 fixed solution of double antenna RTK Positioning, vehicle wheelbase, motor angle, transmission ratio and other parameters are 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 7 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 | Transmission ratio |