

# WTGAHRS2

## High Precision Inertial Navigation

### SPECIFICATION



Model : WTGAHRS2

Description : 10 Axis High Precision Inertial Navigation

Enterprise quality system standard : ISO9001:2016

Tilt switch production standard : GB/T191SJ 20873-2016

Criterion of detection : GB/T191SJ 20873-2016

Revision date : 2019.07.20

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## 1 Description

**This product is built-in JY901B and GPS module, the communication protocol and specific parameters please refer to the information.**

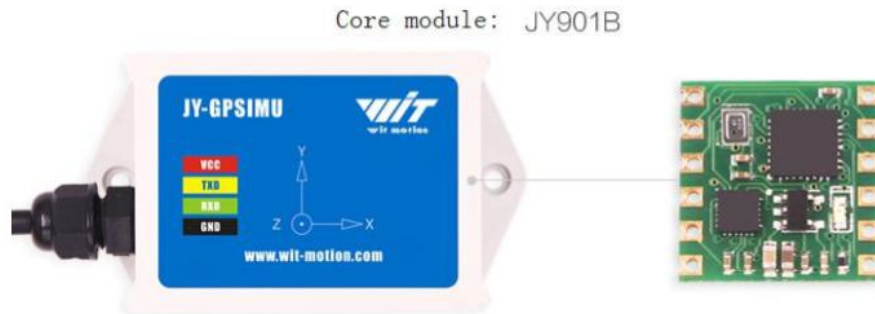
[https://wiki.wit-motion.com/english/doku.php?id=professional\\_application\\_inclinometer](https://wiki.wit-motion.com/english/doku.php?id=professional_application_inclinometer)

WTGAHRS2	High-precision	0.05°	TTL	3.3-5V	±16g	±2000°/s	X(-180, 180) Y(-90, 90)	yes	yes
<a href="https://drive.google.com/open?id=12NKa8haWFUjIPuee7YOTyHkqb11FVK7">https://drive.google.com/open?id=12NKa8haWFUjIPuee7YOTyHkqb11FVK7</a>									
angle, heading angle and GPS positioning information									

◆ Module integrates high-precision gyroscopes, accelerometer, geomagnetic sensor, GPS module, high-performance microprocessors and advanced dynamics solves dynamic

Kalman filter algorithm to quickly solve the current real-time movement of the module attitude .

- ◆ The use of advanced digital filtering technology, can effectively reduce the measurement noise and improve measurement accuracy.
- ◆ Integrates gesture solver, with dynamic Kalman filter algorithm, can get the accurate attitude in dynamic environment, attitude measurement precision is static: 0.05 degrees, dynamic: 0.1 degrees with high stability, performance is even better than some professional Inclinometer!
- ◆ Integrate voltage stabilization circuit, working voltage is 3.3v ~ 5v(TTL)  
Supports serial port TTL digital interface, Serial port rate is adjustable from 2400kbps ~ 921600 kbps (9600 default)
- ◆ Highest 200Hz output data rate. The output data and rate can be adjusted.
- ◆ 4layer PCB technology, thinner, smaller, and more reliable.



## 2 Features

### 2.1 Attitude Sensor Parameters

- 1、 Input voltage: 3.3V~5V
- 2、 Consumption current: <40mA
- 3、 Volume: 61.2mm X 45.2mm X 27.8mm
- 4、 Measuring dimensions:  
Acceleration: X Y Z  
Angular Velocity: X Y Z  
Angle: X Y Z  
Magnetic field: X Y Z  
Atmospheric pressure: YES

GPS: X Y Z

5、 Range: Acceleration:  $\pm 2/4/8/16g$ (optional)

Angular Velocity:  $\pm 250/500/1000/2000$  °/s.(optional), Angle:  $\pm 180$ ° .

6、 Stability: Acceleration: 0.01g, angular speed 0.05 °/s.

7、 Attitude measurement stability: 0.01°

8、 Angle Accuracy: Static 0.05 ° Dynamic 0.1°

9、 Data output: time, acceleration, angular velocity, angle, magnetic field, pressure (JY-901B) , height (JY-901B) ,

longitude, latitude (need to connect GPS), Groundspeed (need to connect GPS)

10、 The data output frequency 0.1Hz to 200Hz

11、 Data Interface:

UART (TTL

level, baud rate support 2400, 4800, 9600, 19200, 38400, 57600, 115200, 230400, 460800, 921600)

12、 GPS: YES+ Beidou signal (satellite)

13、 Environment: Static, Dynamic

14、 Antenna: Built-in

## 2.2 GPS Parameters

Content	Description		
C / A code	1.023mhz stream		
Receive band	BDS/GPS/GLONASS/GALILEO/QZSS/SBAS		
Receive channel	Three-channel RF, support for the whole constellation bds, GPS and glonass at the same time to receive		
S11SWR	≤1.3	S22SWR	≤1.3
S21Log Mag	≥20.0dB	S11Smith	50Ω ±5%
Positioning performance			
Horizontal position accuracy	<2.5m[autonomous][50%] <2m[sbas] (cep,50%,24 when the static, signal strength, -130dbm, about 6 available satellites available )		
Rate	<0.1m/s	Direction	<0.5Degrees
Timing accuracy	30ns	Reference coordinate system	WGS-84
Maximum altitude	50000m	Maximum speed	50000m/s
Acceleration	≤4g		
Electrical performance			
Tracking Sensitivity	-162dbm	Capture sensitivity	-148dbm
Cold start Sensitivity	-148dbm	Hot start sensitivity	-156dbm
Cold start time	35S	Warm start time	32S
Hot start time	1S		
Other parameters			
Standard clock pulse	0.25HZ~1KHZ		
Positioning update rate	1HZ~110HZ(Default 1Hz)		UART / TTL Port Interface (Default)

## 3 Axial Direction

As shown in the figure above, the coordinates of the module are indicated, and the right is the X-axis, the upper is Y axis, the Z axis is perpendicular to the surface of the paper to yourself. The direction of rotation is defined by the right hand rule. that is, the thumb of the right hand is pointed to the axial direction, and the four is the direction of the bending of the right hand.

## 4 Hardware Connection

### 4.1 Serial Connection

Module 3 in 1 Convert:

<https://www.aliexpress.com/item/32873159970.html>



Driver installation:

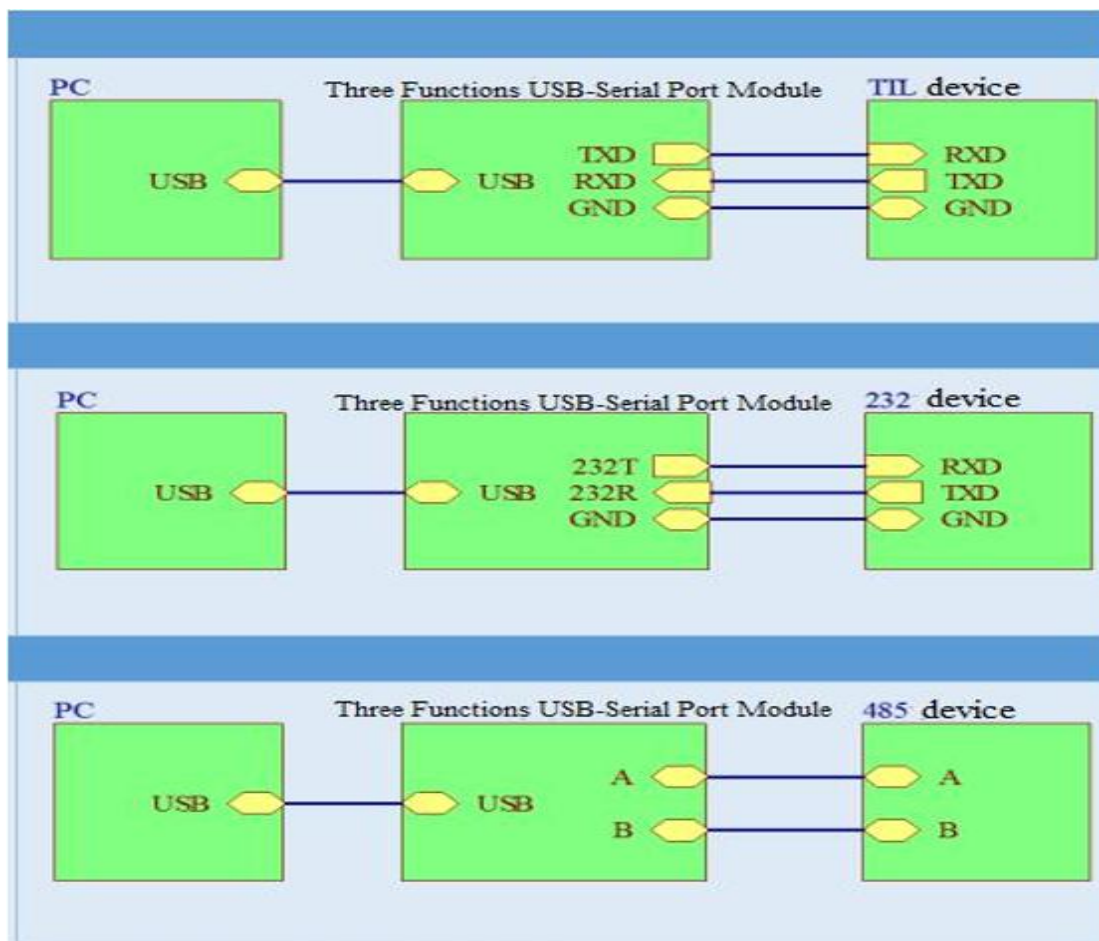
First, install the driver CH340 when we used the USB serial module ,after installed the driver. then get the corresponding Com number in the device manager. Driver as followed:

[https://wiki.wit-motion.com/english/doku.php?id=communication\\_module](https://wiki.wit-motion.com/english/doku.php?id=communication_module)

#### Resource Summary

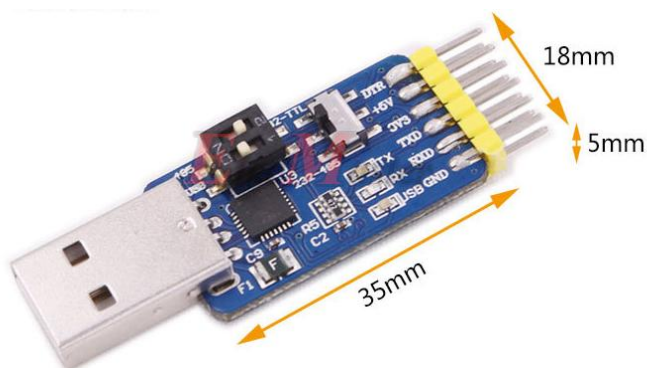
User Manual and Development Documents : [communication\\_module document center](#)  
Device driver: [serial\\_port\\_debugging\\_assistan](#) [CH340](#) [CP2102](#)

Contact us



Module 6 in 1 Convert:

<https://www.aliexpress.com/item/32607767675.html>



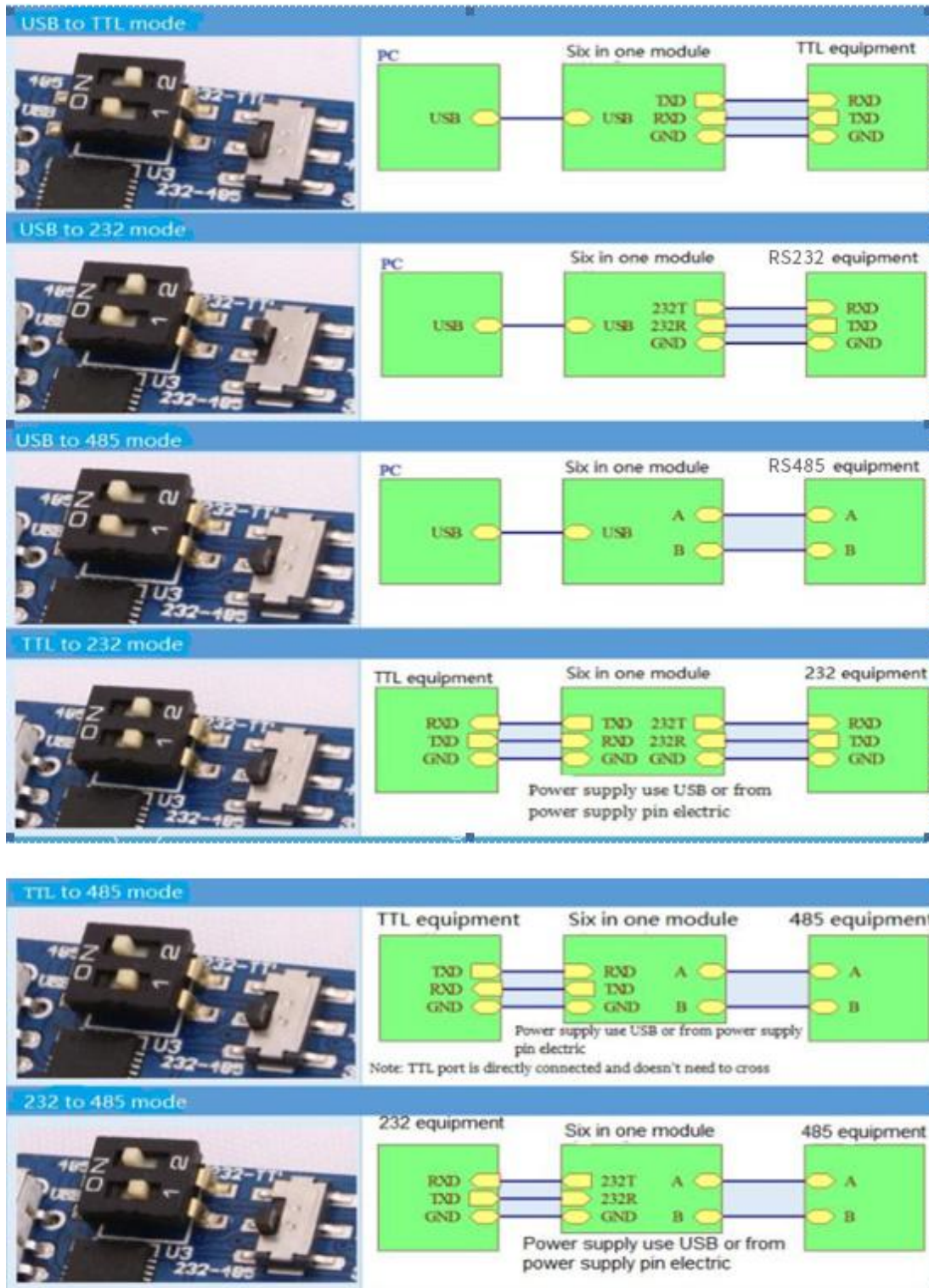
Driver installation:

First, install the driver CP210X when we used the USB serial module ,after installed the driver. then get the corresponding Com number in the device manager. Driver as followed:

[https://wiki.wit-motion.com/english/doku.php?id=communication\\_module](https://wiki.wit-motion.com/english/doku.php?id=communication_module)

### Resource Summary

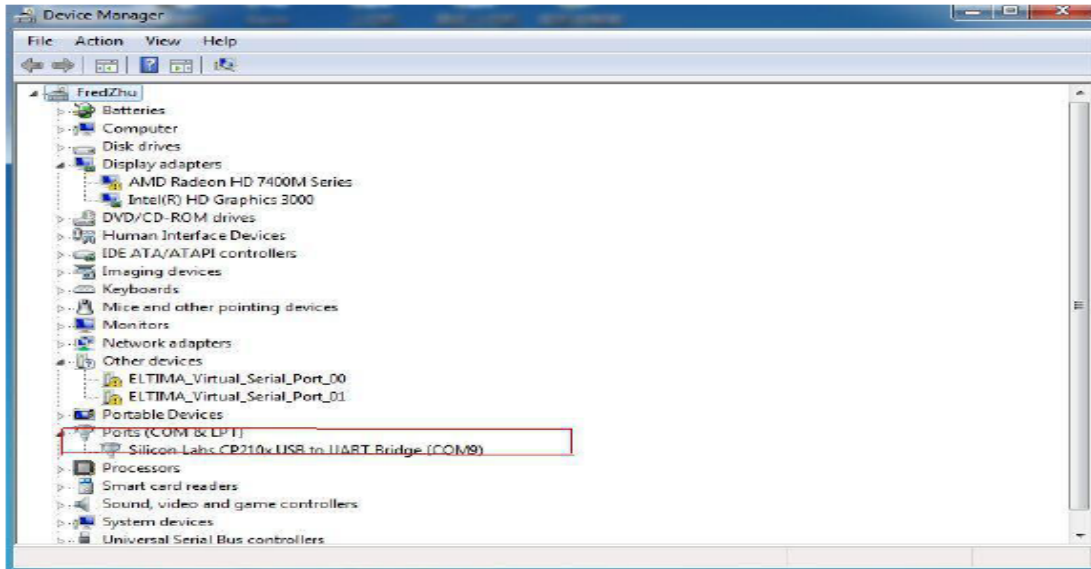
 User Manual and Development Documents : [communication\\_module](#) document center

 Device driver: [serial\\_port\\_debugging\\_assistant](#) [CH340](#) [CP2102](#)


After installing the module driver, and then Device Manager can query corresponding

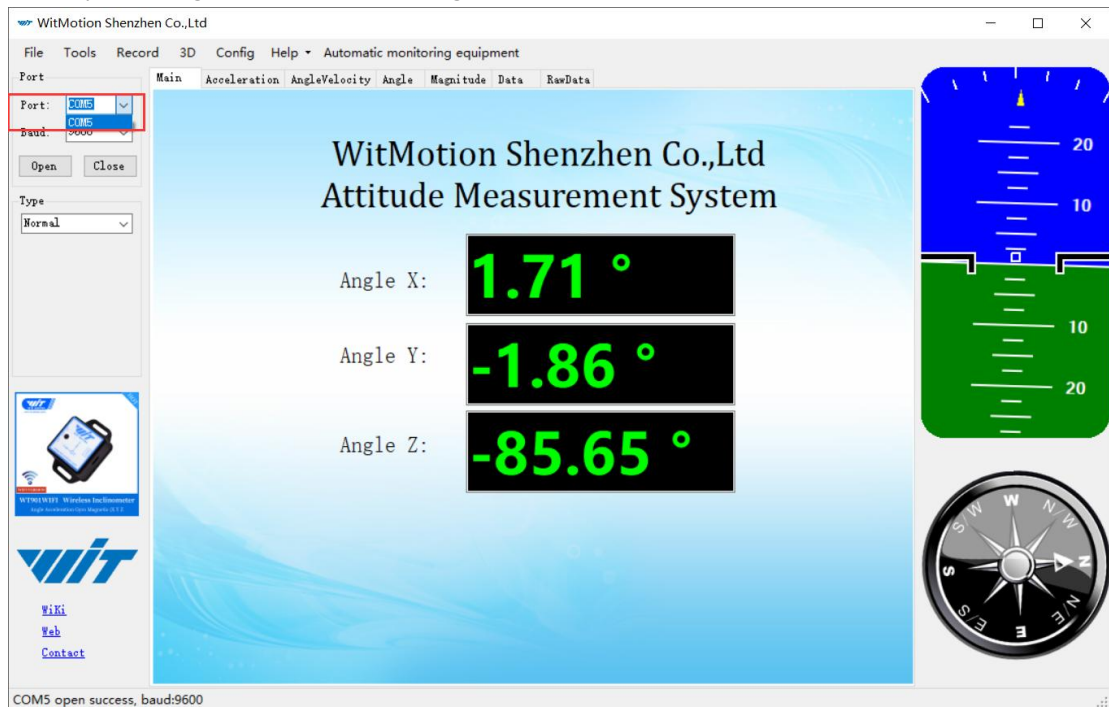


serial number, as below figure shows:



#### 4.1.1 Connection with PC software

Open the software “MiniIMU.exe” and select the Com number which you have got in the device manager before.

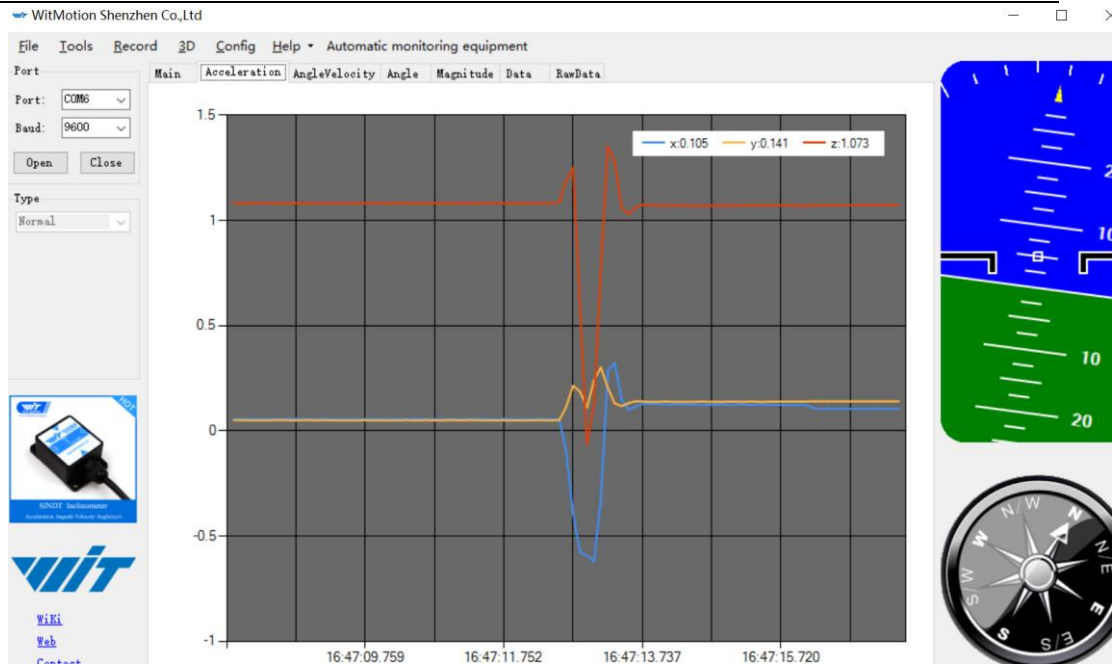




Click the “Type” and select model “Normal”.

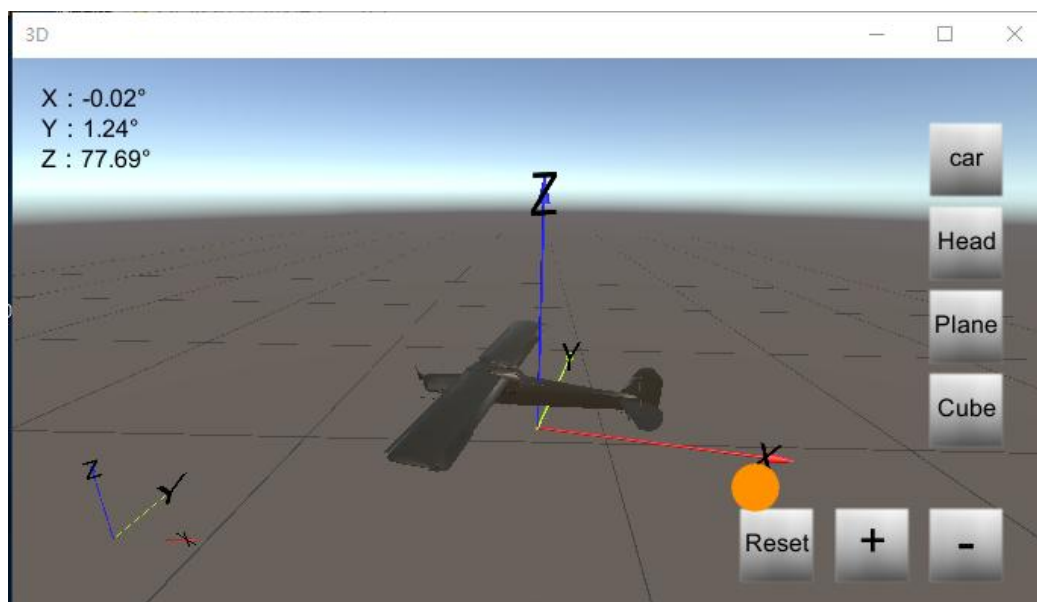
Click the “Baud” and select “9600”, after all those selections are completed, the software can display data.





When the time interval between the current acquisition data and the previous acquisition data is long, the chart update will be slow. At this time, you can right-click the image and pop up the clear diagram bar. Click the clear diagram option to speed up the data refresh rate.

Click the “3D” and you can bring up the three-dimensional display interface, which displays the three-dimensional posture of the module.



## 4.2 Module Calibration

Reminder: The module calibration and configuration should be carried out under the online state which displayed in the low right corner of the software configuration bar.

The module need to be calibrated before the module is used. The calibration of HWT901B includes accelerometer calibration and magnetic calibration.

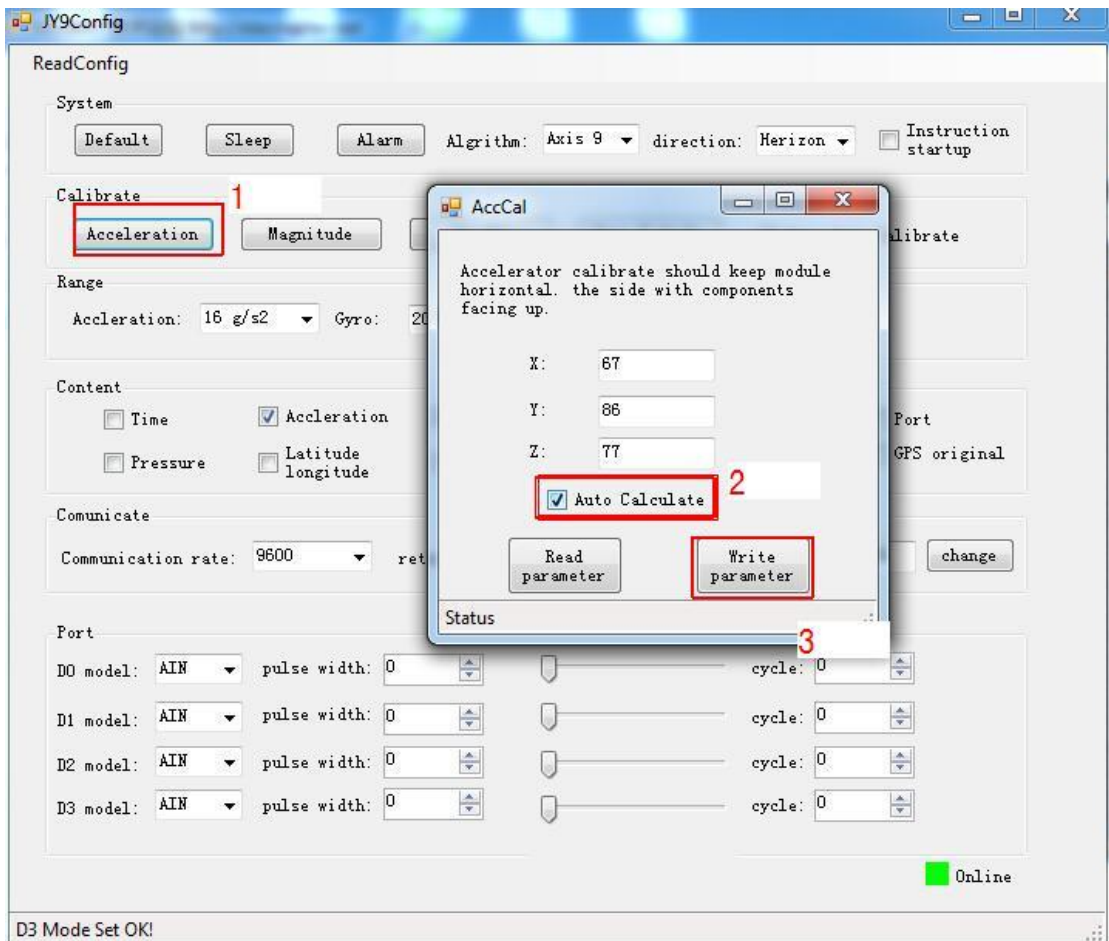
Ps: All the calibration must be maintained at a level, unless you want to Vertical Installation, and the upper computer sets the vertical position of the vertical installation.

### 4.2.1 Accelerometer Calibration

The accelerometer calibration is used to remove the zero bias of the accelerometer. When the sensor is out of the factory, there will be different degrees of bias error. After manual calibration, the measurement will be accurate.

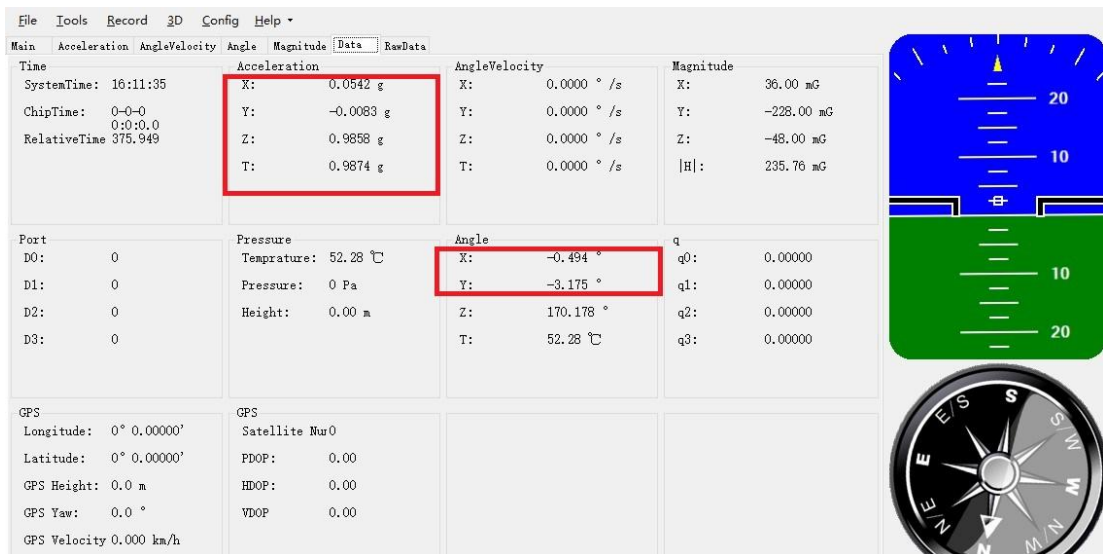
Methods as follow:

1. Firstly keep the module horizontally stationary, in the “Config” of the software click “Acceleration” and a calibration interface will pop up.
2. Check the “Auto Calculate” option, the software will automatically calculates the zero bias value and then click “Write parameter”



3. After 1 to 2 seconds, the three axes of the module acceleration will be around 0.01 and the X and Y axes will be around 0°. The X-axis angle after calibration is exactly the same.

Note: When the Z-axis is horizontally stationary, there is 1 G of gravitational acceleration.



## 4.2.2 Magnetic Calibration

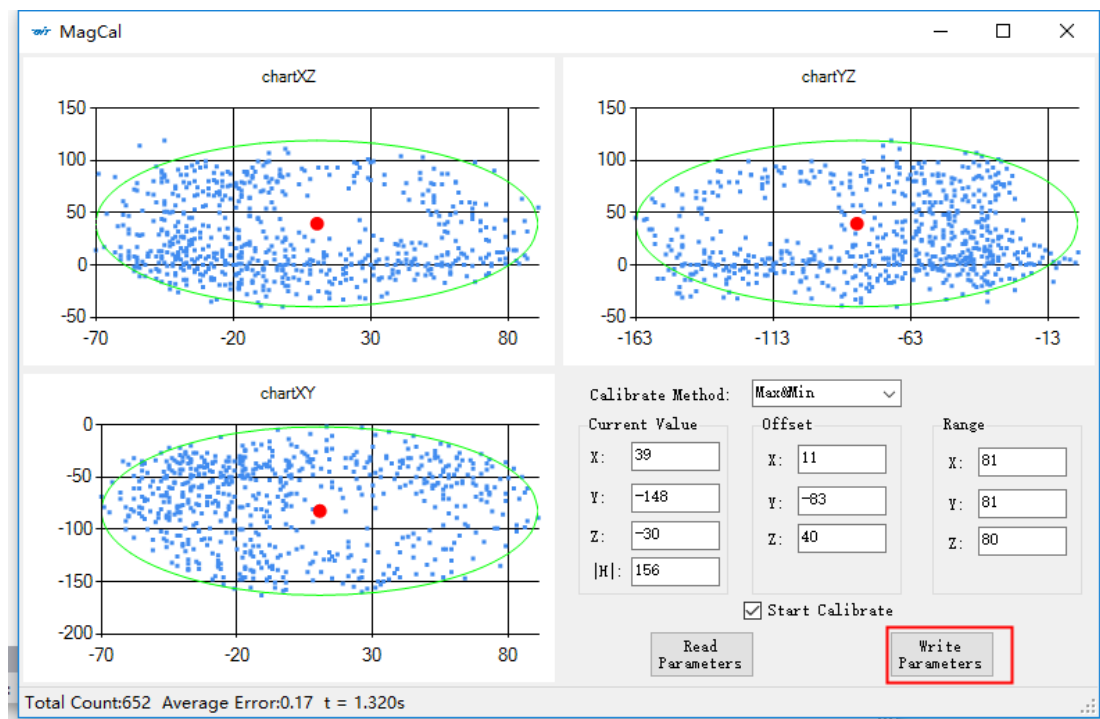
Magnetic field calibration is used to remove the magnetic field sensor's zero offset. Usually, the magnetic field sensor will have a large zero error when it is manufactured. If it is not calibrated, it will bring about a large measurement error and affect the accuracy of the Z-axis angle measurement of the heading angle.

Calibration methods as follow:

1. When calibrating, first connect the module and the computer, and place the module in a place far away from the disturbing magnetic field (ie, more than 20 CM away from magnets and iron, etc.), and then open the upper computer software.

2. In the settings page, click on the magnetic field button under the calibration bar to enter the magnetic field calibration mode. At this time, the MagCal window pops up. Click on the calibration button in this window.

3. Then slowly rotate the module around the three axes, let the data points draw points in the three planes, you can rotate a few more times, and after you draw a more regular ellipse, you can stop the calibration. After the calibration is completed, click Write Parameters.



Note: The data points should be within the ellipse but not outside the ellipse. If you cannot draw the ellipse, please keep away from the magnetic field interference. Then refer to the calibration video and place the module on the north-south axis of the Earth's magnetic field.

Calibration video: <https://www.youtube.com/channel/UCxBLgvYQNk-sGVDp42ch-Ug>

### Height Setting 0

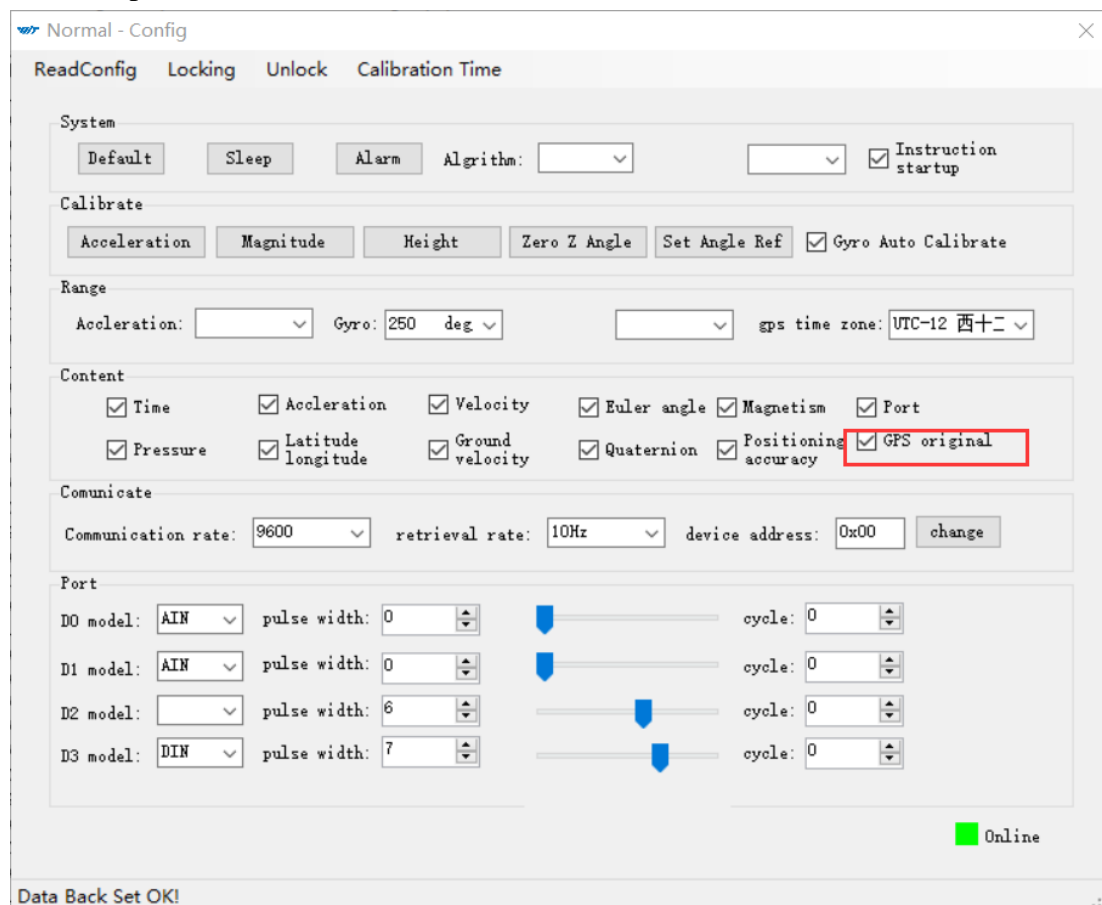
The height setting 0 is an operation to make the height of the module returns to 0,

the height output of the module is calculated on the basic of the air pressure. .

The altitude return to zero operation is to calculate the current barometric pressure as zero height position. To do this, click on the "Height" option in the configuration bar.

### 4.3 GPP Raw Data

Before using the module, you need to check whether the GPS has original data output. The method is as follows: Open the configuration bar and check the “GPS original” in the output content. The original data of the GPS will be displayed in the original data of the computer



Note: After the check is completed, the GPS original should be removed. Otherwise, the module only out puts the GPS raw data and does not out put other data.

### 4.4 Set Return Content

Method: The content can be returned what users need. Click “Config” and select the content what you need. The module default content is Angle, Angular

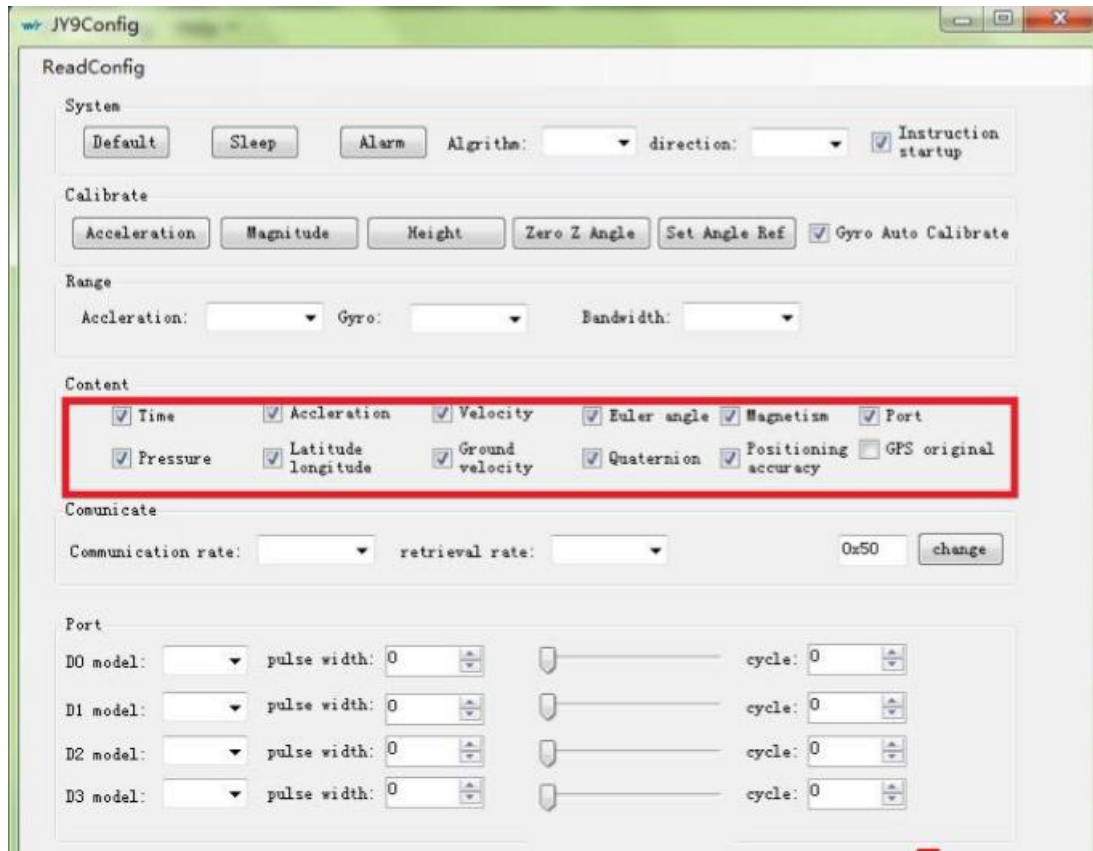
velocity, Acceleration, Magnetic field.

Time is the module internal time. Default: 0:0:0 January 1, 2015

If the GPS module is connected, the time received by the GPS is taken as the time of the module.

The latitude and longitude and ground speed information is valid only after the module is connected to the GPS module. To get the correct data, you also need to check the "latitude and longitude", "groundspeed" and "positioning accuracy" in the settings.

Note: After checking "GPS Original", the module only outputs the original GPS information, and other data will not be output.



After completing the above settings, after waiting for a few minutes of GPS positioning, you can see the GPS information

## 4.5 Set Return Rate

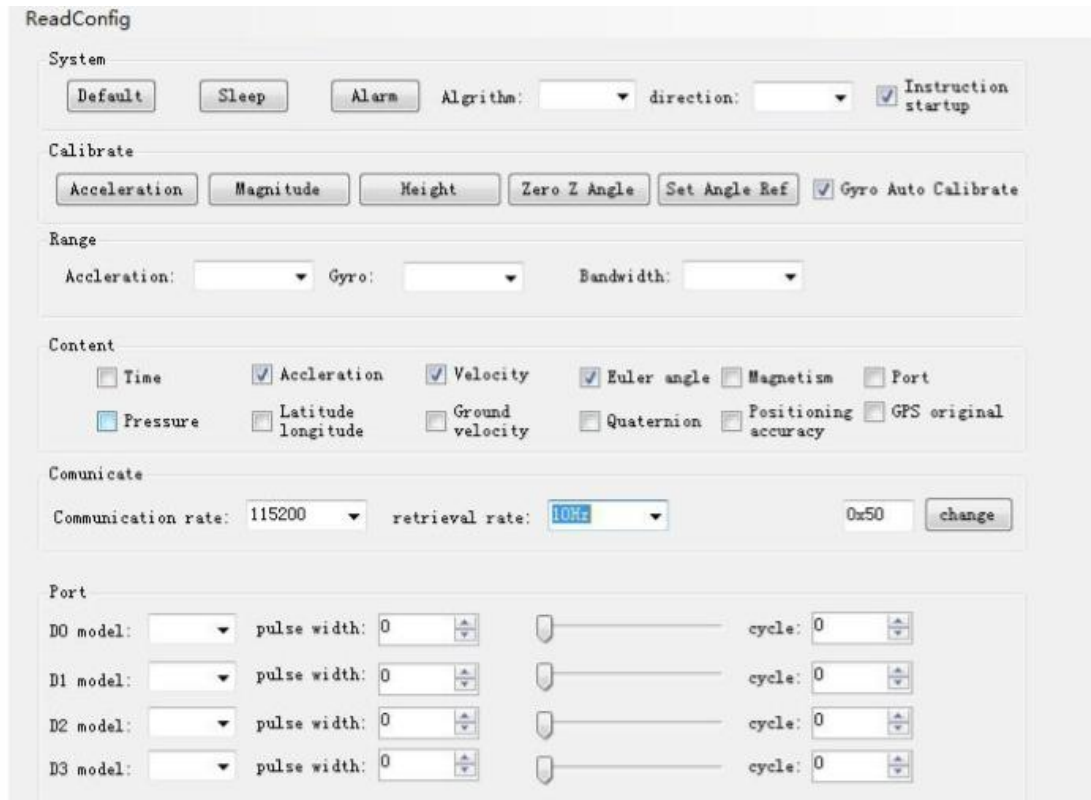
Setting methods: click "Config" to open configuration bar and then set the "returnrate" is 0.1HZ-200HZ optional.

The default return rate of the module is 10HZ, the highest return rate supports 200HZ. GPS module return rate is 1HZ, cannot change.

Note: If there being a lot of return content and low baud rate of communication,



the module will automatically reduce the frequency and output at a maximum allowable output rate. The baud rate is 115200 as normal



The screenshot shows the 'ReadConfig' software interface with the following sections:

- System:** Includes buttons for 'Default', 'Sleep', and 'Alarm'. It also features dropdown menus for 'Algorithm' and 'direction', and a checked checkbox for 'Instruction startup'.
- Calibrate:** Includes buttons for 'Acceleration', 'Magnitude', 'Height', 'Zero Z Angle', and 'Set Angle Ref'. A checked checkbox for 'Gyro Auto Calibrate' is also present.
- Range:** Features dropdown menus for 'Acceleration', 'Gyro', and 'Bandwidth'.
- Content:** A grid of checkboxes for various data outputs: Time, Acceleration (checked), Velocity (checked), Euler angle (checked), Magnetism, Port, Pressure, Latitude longitude, Ground velocity, Quaternion, Positioning accuracy, and GPS original accuracy.
- Communicate:** Includes dropdown menus for 'Communication rate' (set to 115200) and 'retrieval rate' (set to 10Hz), along with a '0x50' field and a 'change' button.
- Port:** A table for configuring four digital pins (D0-D3). Each row includes a 'model' dropdown, a 'pulse width' input (set to 0), a shield icon, and a 'cycle' input (set to 0).

## 4.6 Sleep/ Wake up

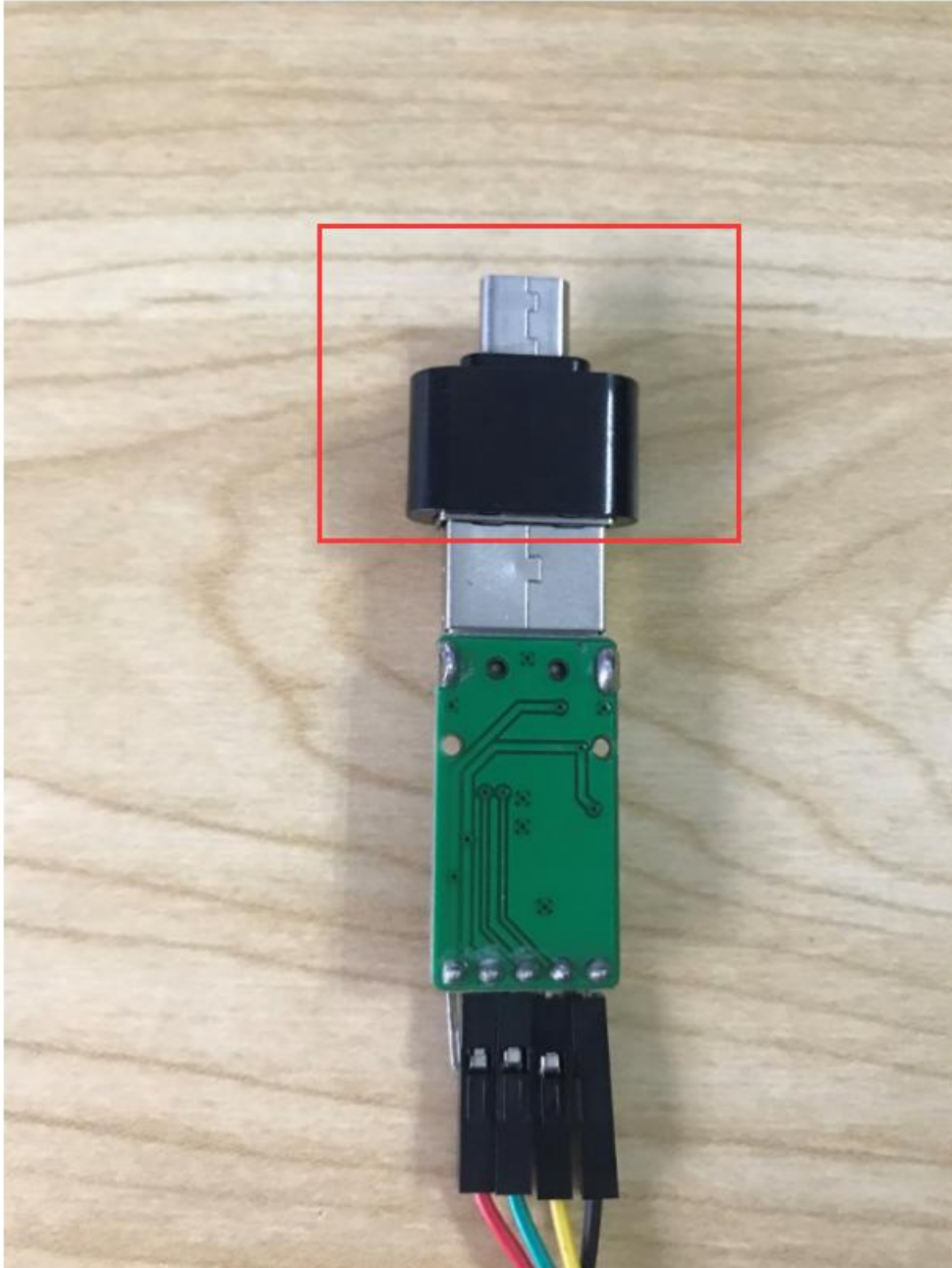
**Sleep:** The module paused working and entered the standby mode. Power consumption is reduced after sleeping.

**Wake up:** The module enters the working state from standby state.

The module defaults to a working state, in the “Config” of the software, click “Sleep” option to enter the sleep state, click “Sleep” again to release sleep.

## 5 Connect to phone

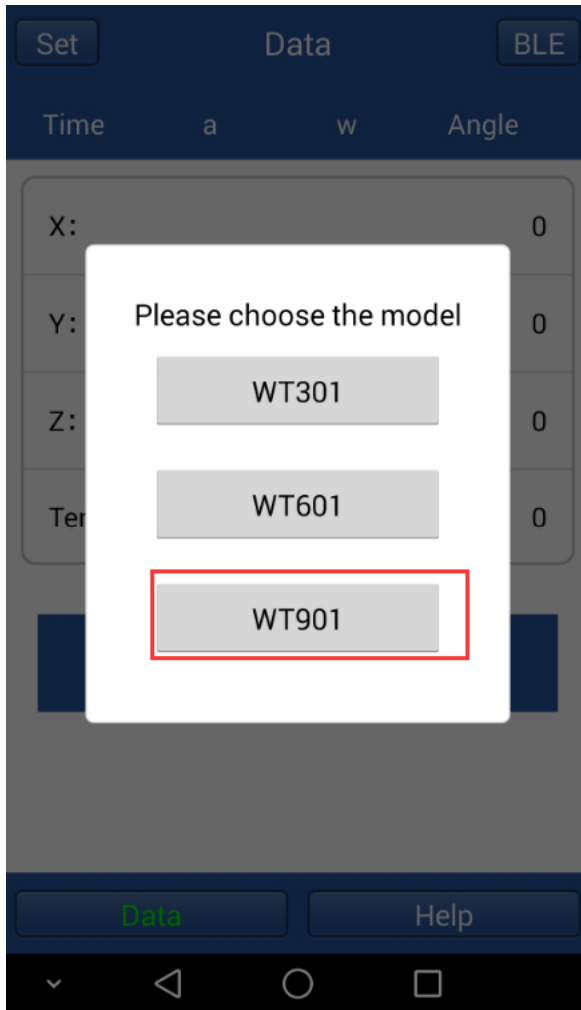
- 1) we need a OTG Adapter to join phone (Android)




2) Install the app in the Phone, open the app ,then choice WT901,and choice 9600

App address:

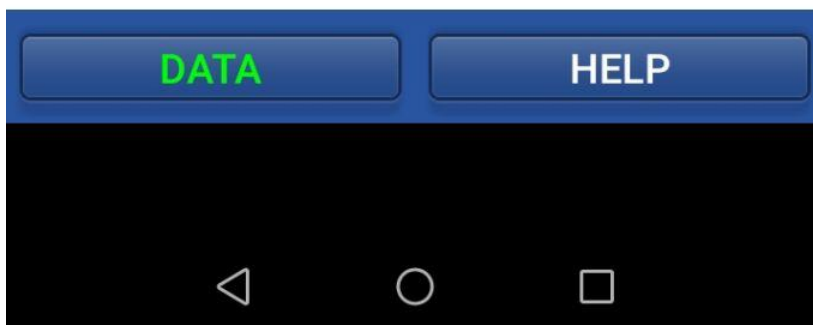
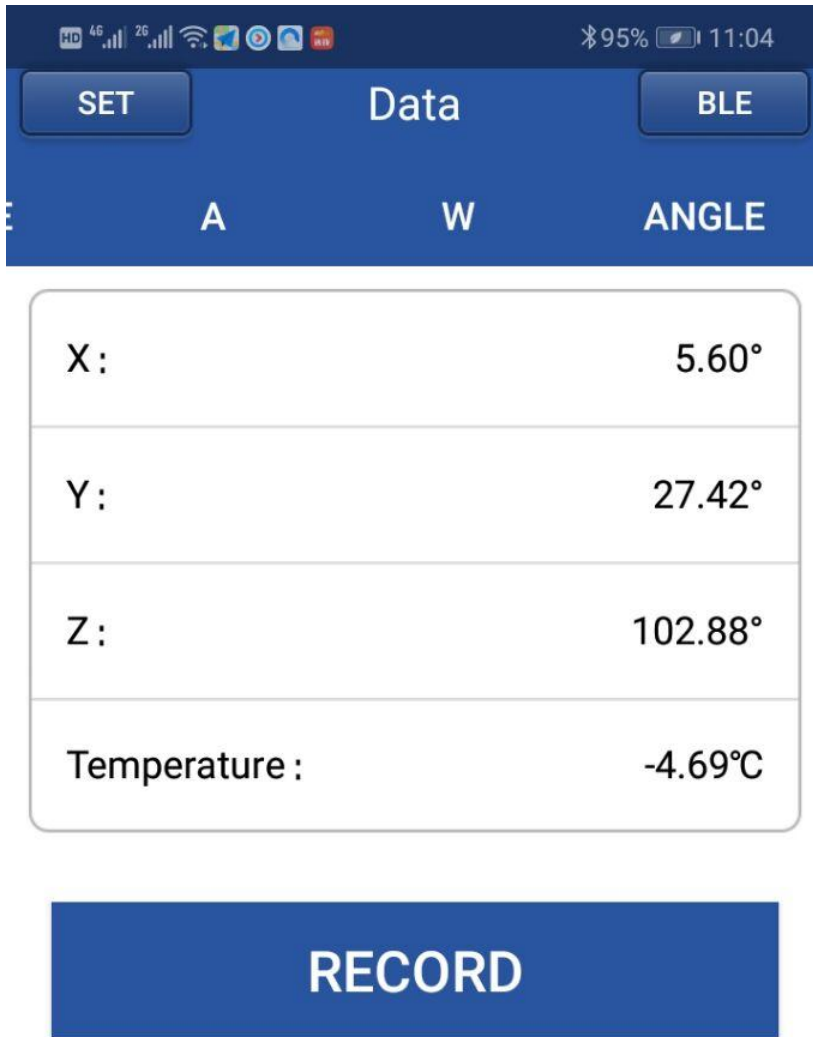
<https://drive.google.com/open?id=1FCn1HZFiviTRyodnLyNrBu9Upxr4hz-O>



 Please choose the baud rate

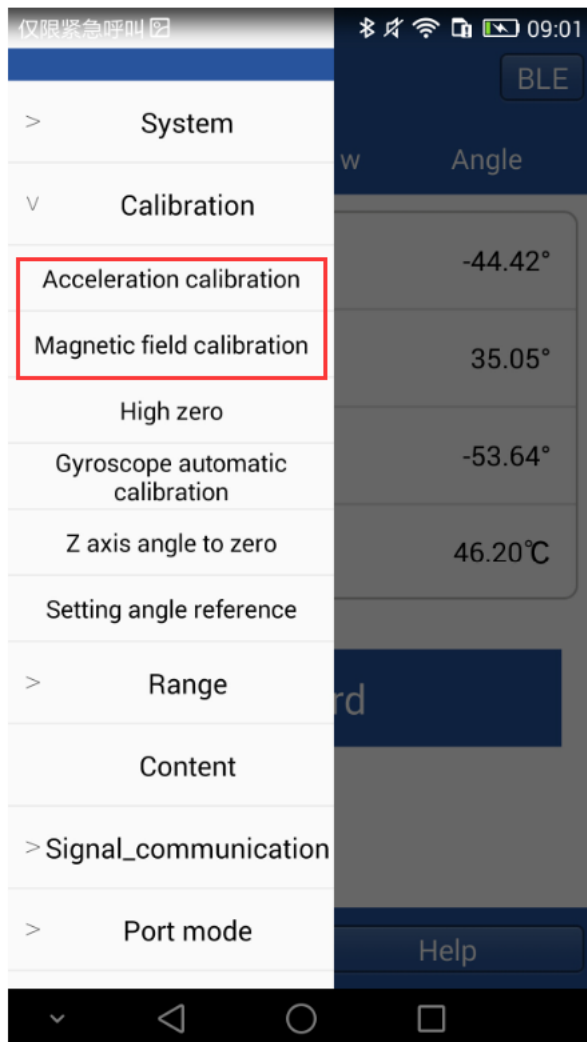
4800	<input type="radio"/>
9600	<input checked="" type="radio"/>
19200	<input type="radio"/>
38400	<input type="radio"/>
57600	<input type="radio"/>
115200	<input type="radio"/>
230400	<input type="radio"/>
460800	<input type="radio"/>
921600	<input type="radio"/>

cancel      OK



## 5.1 Calibration (calibration on app)

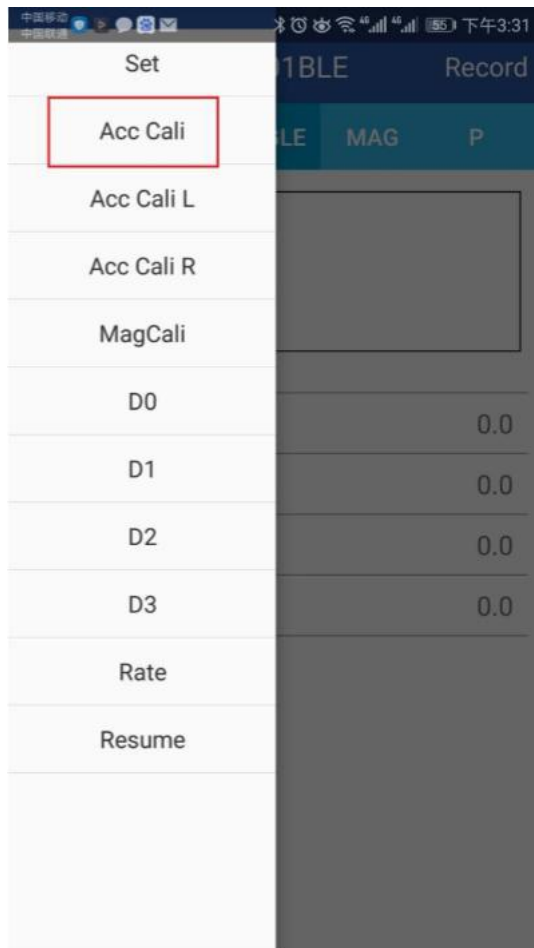
Please keep the WTGAHRS2 on the horizontal level and make the “acceleration calibration” and “Magnetic field calibration” as below:



### 1) Accelerometer Calibration

The accelerometer calibration is used to remove the zero bias of the accelerometer. When the sensor is out of the factory, there will be different degrees of bias error. After manual calibration, the measurement will be accurate.

- 1、Methods as below: Firstly keep the module horizontally stationary, click "Acceleration", after 1~2s the acceleration X Y Z value will at 0 0 1. X Y angle: 0°.After calibration the value will be accurate.



- 2、Accelerometer Calibration L, Accelerometer Calibration R In the case that the surface is not very flat, and the data is still in error after the calibration, the calibration L and R can be used for re-calibration. Methods as below : The module is still at left, click on the calibration L, 2S after and then put the module to the right and click on the calibration R, so that the X Y-axis angle is accurate when used after two calibrations.

## 2)Magnetic Calibration

Magnetic field calibration is used to remove the magnetic field sensor's zero offset. Usually, the magnetic field sensor will have a large zero error when it is manufactured. If it is not calibrated, it will bring about a large measurement error and affect the accuracy of the Z-axis angle measurement of the heading angle.

Calibration methods as follow:

1. When calibrating, first connect the module and the computer, and place the module in a place far away from the disturbing magnetic field (ie, more than 20 CM away from magnets and iron, etc.), and then open the upper computer software.

2. Click the "Magnetic Field Calibration" and rotate 360° around the X axis of the module ( you can rotate around the Y axis or the Z axis first). Rotate a few turns, then turn 360° around the Y axis. Then turn 360° around the Z axis, then turn a few turns at random, then click the "Finish" to complete the calibration.



## 6 Application area

Agricultural machinery



Internet of things



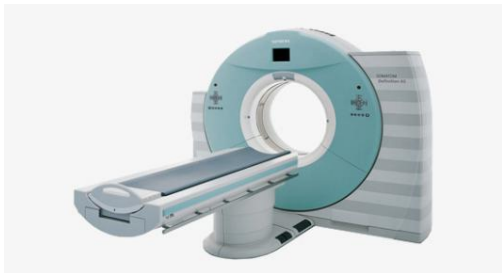
Solar energy



Power monitoring



Medical instruments



Construction machinery



Geological monitoring





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