



USER MANUAL WT901

Inclinometer Sensor





Tutorial link

[Google Drive](#)

Link to instructions DEMO:

[WITMOTION Youtube Channel](#)

[WT901 Playlist](#)

If you have technical problems or cannot find the information that you need in the provided documents, please contact our support team. Our engineering team is committed to providing the required support necessary to ensure that you are successful with the operation of our AHRS sensors.

Contact

[Technical Support Contact Info](#)

Application

- AGV Truck
- Platform Stability
- Auto Safety System
- 3D Virtual Reality
- Industrial Control
- Robot
- Car Navigation
- UAV
- Truck-mounted Satellite Antenna Equipment



Contents

Tutorial link.....	- 2 -
Contact.....	- 2 -
Application.....	- 2 -
Contents.....	- 3 -
1 Introduction.....	- 5 -
1.1 Warning Statement.....	- 6 -
2 Use Instructions with PC.....	- 7 -
2.1 Connection Method.....	- 7 -
2.1.1 Serial Connection.....	- 7 -
2.2 Software Introduction.....	- 9 -
2.2.1 Main Menu.....	- 9 -
2.2.2 Menu of Configuration.....	- 10 -
2.3 Calibration.....	- 14 -
2.3.1 Accelerometer Calibration.....	- 14 -
2.3.2 Magnetic Field Calibration.....	- 16 -
2.3.3 Gyroscope Automatic Calibration.....	- 18 -
2.3.4 Reset Z-axis Angle.....	- 19 -
2.3.5 Reset Height to 0.....	- 19 -
2.4 Configuration.....	- 20 -
2.4.1 Return Content.....	- 20 -
2.4.2 Output Rate.....	- 21 -
2.4.3 Baud Rate.....	- 22 -
2.4.4 Data Recording.....	- 23 -
2.4.5 Data Playback.....	- 25 -
2.4.6 Standby and Wake Up.....	- 27 -
2.4.7 Placement Direction.....	- 28 -



2.4.8 Bandwidth.....	- 29 -
2.4.9 Restore Factory Setting.....	- 31 -
2.4.10 Set IIC Address.....	- 32 -
2.4.11 Set Extended Port.....	- 33 -
2.4.12 6-axis/ 9-axis Algorithm.....	- 34 -
2.4.13 Set Alarm Status.....	- 35 -
3 Use Instructions with Android Phone.....	- 36 -
3.1 APP Installation.....	- 36 -
3.2 Hardware Preparation.....	- 37 -
3.3 Connection.....	- 38 -
3.4 Calibration.....	- 42 -
3.4.1 Acceleration Calibration.....	- 42 -
3.4.2 Magnetic Field Calibration.....	- 43 -
4 MCU Connection.....	- 44 -
4.1 Arduino.....	- 44 -
4.2 STM32.....	- 44 -
4.3 Raspberry pi.....	- 44 -
4.4 C#.....	- 44 -
4.5 C++.....	- 45 -
4.6 Matlab.....	- 45 -
5 IIC Connection.....	- 46 -



1 Introduction

The WT901 is a multi-sensor device detecting acceleration, angular velocity, angle as well as magnetic field. The small outline makes it perfectly suitable for industrial retrofit applications such as condition monitoring and predictive maintenance. Configuring the device enables the customer to address a broad variety of use cases by interpreting the sensor data by smart algorithms.

WT901's scientific name is AHRS IMU sensor. A sensor measures 3-axis angle, angular velocity, acceleration, magnetic field. Its strength lies in the algorithm which can calculate three-axis angle accurately.

WT901 is employed where the highest measurement accuracy is required. It offers several advantages over competing sensor:

- Heated for best data availability: new WITMOTION patented zero-bias automatic detection calibration algorithm outperforms traditional accelerometer sensor
- High precision Roll Pitch Yaw (X Y Z axis) Acceleration + Angular Velocity + Angle + Magnetic Field output
- Low cost of ownership: remote diagnostics and lifetime technical support by WITMOTION service team
- Developed tutorial: providing manual, datasheet, Demo video, free software for Windows computer, APP for Android smartphones , and sample code for MCU integration including 51 serial, STM32, Arduino, Matlab, Raspberry Pi, communication protocol for project development
- WITMOTION sensors have been praised by thousands of engineers as a recommended attitude measurement solution



1.1 Warning Statement

- Putting more than 5 Volt across the sensor wiring of the main power supply can lead to permanent damage to the sensor.
- VCC cannot connect with GND directly, otherwise it will lead to the burning of the circuit board.
- For proper instrument grounding: use WITMOTION with its original factory-made cable or accessories.
- For secondary developing project or integration: use WITMOTION with its compiled sample code.

2 Use Instructions with PC

2.1 Connection Method

PC software is only compatible with Windows system.

[Link to WT901's demo video](#)

2.1.1 Serial Connection

Step 1. Connect the sensor with a serial converter

PIN Connection:

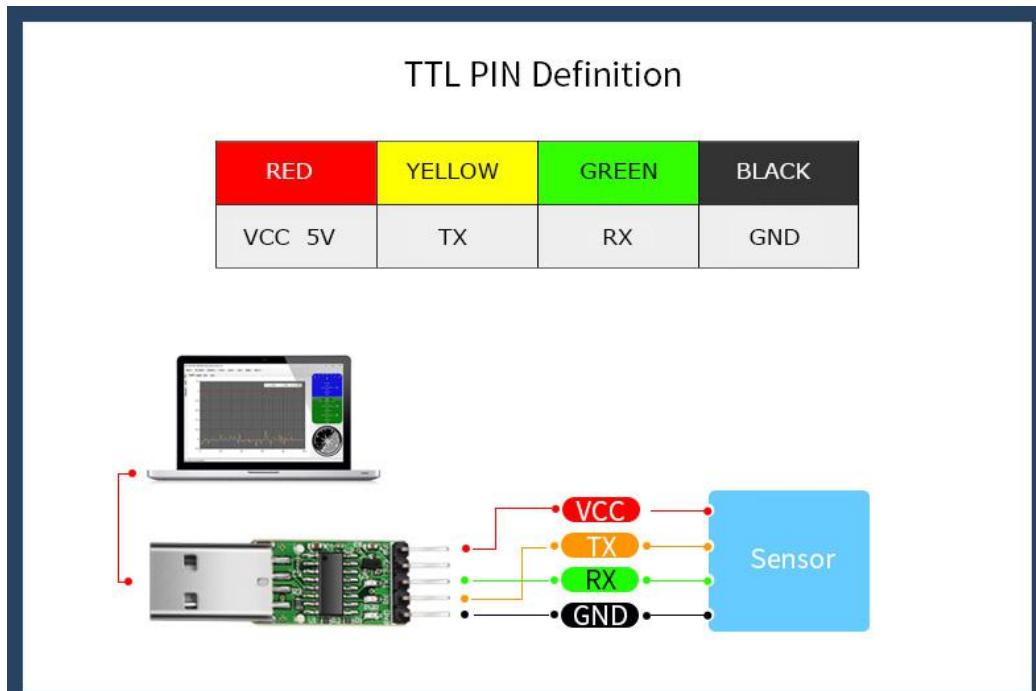
VCC - 5V

TX - RX

RX - TX

GND - GND

(When connecting with computer, VCC-5V is recommended.)





Recommended tools:



3 in-1 converter



6-in-1 converter



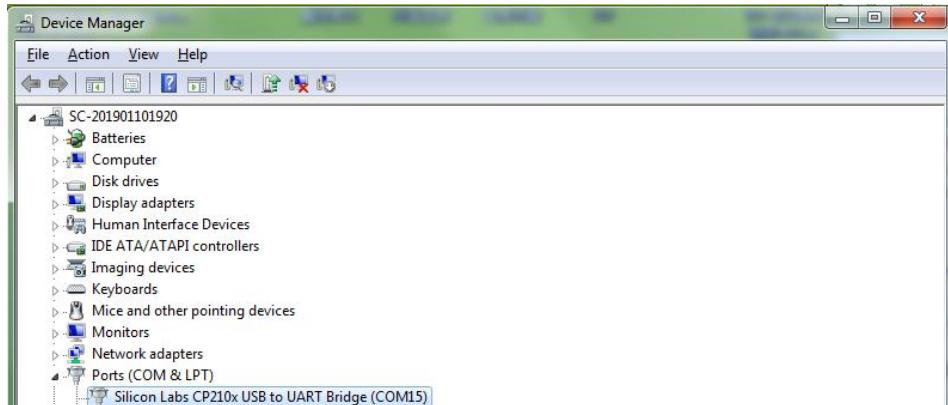
TTL serial cable

Step 2. Unzip the software and install the driver CH340 or CP2102
(Depending on which accessory for usage.)

[Link to tutorial of 3-in-1 serial converter/ TTL serial cable \(CH340 driver\)](#)

[Link to tutorial of 6-in-1 serial converter \(CP2102 driver\)](#)

Step 3. Plugin the converter to computer and confirm the “com port” in device manager



Step 4. Open the software(Minimu.exe)
Data will appear after auto-search finishes

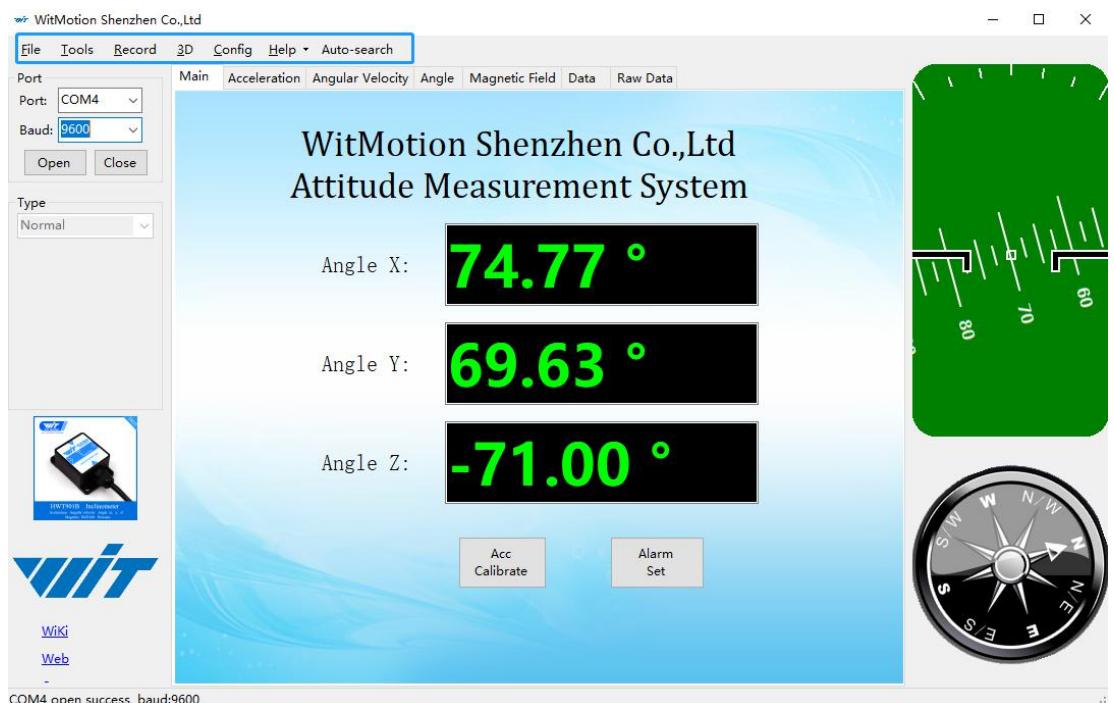
Notice: If not successful, please operate manually
Choose the com port and baud rate 9600, data will be shown on the software.



2.2 Software Introduction

[Link to download software](#)

2.2.1 Main Menu



Main Menu of software		
Button	Function	
File	Launch recorded HEX file (Bin format)	
Tools	Hide or display tools box on left side	
Record	Record function	
3D	3D DEMO	
Config	Configuration setting	
Help	Language	English or Chinese
	Bluetooth Set	Binding device or unbind
	Firmware update	Option for firmware update
	About Minimu	Info about Minimu.exe
	Factory test	For manufacturer internal test only
Auto-search	Auto searching the sensor	
Port	Com port selection	
Baud	Baud rate selection	
Type	Fixed setting as Normal for WT901	
Open	Open com port	
Close	Close com port	

2.2.2 Menu of Configuration

Normal - Config

[Read Config](#) [Lock](#) [Unlock](#) [Calibrate Time](#)

System

Reset Sleep Alarm Algorithm: 9 - axis Install Direction: Horizontal Instruction Startup

Calibrate

Acceleration Magnetic Filed Reset Z-axis Angle Gyro Auto Calibrate
Reset Height Angle Reference

Range

Acceleration: 16 g Gyro: 2000 deg/s Band Width: 20 Hz GPS Time Zone: UTC-12

Communication

Baud Rate: 9600 Output Rate: 10Hz Device Address: 0x50 [change](#)

Content

Time Acceleration Velocity Angle Magnetism Port
 Pressure Location PDOP Quaternion Positioning Accuracy GPS Original

Port

D0 model:	AIN	pulse width:	0		cycle:	0	
D1 model:	AIN	pulse width:	0		cycle:	0	
D2 model:	AIN	pulse width:	0		cycle:	0	
D3 model:	AIN	pulse width:	0		cycle:	0	

[Save Config](#)

Read Configuration Completed

Menu of Configuration	
Button	Function
Read Config	Reading the current configuration
Lock	Lock the sensor
Unlock	Unlock the sensor
Calibrate Time	Calibration time of chip
Save Config	Save configuration

System		Algorithm:	Install Direction:	<input type="checkbox"/> Instruction Startup
<input type="button"/> Reset	<input type="button"/> Sleep	<input type="button"/> Alarm	9 - axis	Horizontal
Menu of System				
Button		Function		
Reset		Reset to factory setting		
Sleep		Sleep function		
Alarm		Alarm function		
Algorithm		6-axis algorithm or 9-axis		
Installation Direction		Vertical or horizontal installation		
Instruction Start-up		Instructions sending to start-up the sensor		

Instruction Start-up:

This function is used to prevent the data sent by the module after connecting to the computer to conflict with the mouse, causing the mouse to jump. After checking this function, the function will take effect the next time the module is used, or it can take effect when the module is powered on again.

Calibrate		<input type="checkbox"/> Gyro Auto Calibrate
<input type="button"/> Acceleration	<input type="button"/> Magnetic Filed	<input type="button"/> Reset Z-axis Angle
<input type="button"/> Reset Height	<input type="button"/> Angle Reference	
Menu of Calibrate		
Button		Function
Acceleration		Accelerometer calibration
Magnetic Field		Magnetometer calibration
Reset Height		Reset height data to 0 (only for sensor built-in barometer, including WT901B, WTGAHRS2, WTHARS1, HWT901B)
Reset Z-axis Angle		Reset Z-axis angle to 0 degree, only available for WT901 in 6-axis algorithm
Angle Reference		Setting current angle as 0 degree
<input type="checkbox"/> Gyro Auto Calibrate		Auto-calibration of gyroscope



Range			
Acceleration:	16 g	Gyro:	2000 deg/s
Band Width:	20 Hz	GPS Time Zone:	UTC-12

Menu of Range	
Button	Function
Acceleration	Acceleration measurement range
Gyro	Gyroscope measurement range
Band Width	Bandwidth range
GPS Time Zone	GPS positioning of time zone

Communication			
Baud Rate:	9600	Output Rate:	10Hz
Device Address:	0x50	change	

Menu of Communication	
Button	Function
Baud Rate	Baud rate selection
Output Rate	Return rate selection
Device Address	IIC address

Content							
<input checked="" type="checkbox"/> Time	<input checked="" type="checkbox"/> Acceleration	<input checked="" type="checkbox"/> Velocity	<input checked="" type="checkbox"/> Angle	<input checked="" type="checkbox"/> Magnetism	<input type="checkbox"/> Port		
<input type="checkbox"/> Pressure	<input type="checkbox"/> Location	<input type="checkbox"/> PDOP	<input type="checkbox"/> Quaternion	<input type="checkbox"/> Positioning Accuracy	<input type="checkbox"/> GPS Original		

Menu of Content	
Option	Function
Time	Time data output
Acceleration	Acceleration data output
Velocity	Angular velocity data output
Angle	Angle data output
Magnetism	Magnetic field data output
Port	Port data output
Pressure	Pressure output, only available with the sensor built-in barometer like HWT901B, WTGAHRS2, WT901B, etc
Location	Latitude&Longitude data output, only for GPS IMU series, such as WTGAHRS1, WTGAHRS2
PDOP	Ground velocity data output, only for GPS IMU series, such as WTGAHRS1, WTGAHRS2 GPS IMU

Quaternion	Quaternion data output
Positioning Accuracy	Option for GPS positioning accuracy output, including Satellite quantity, PDOP, HDOP, VDOP data, only for GPS IMU series, such as WTGAHRS1, WTGAHRS2
GPS Original	Only output GPS raw data, only for GPS IMU series, such as WTGAHRS1, WTGAHRS2
Menu of Port	
D0 Model	Extended port D0
D1 Model	Extended port D1
D2 Model	Extended port D2
D3 Model	Extended port D3
Pulse width	Pulse width of PWM
Cycle	Cycle of PWM

Port

D0 model:	AIN	pulse width:	0	<input type="button" value="▼"/>	cycle:	0	<input type="button" value="▲"/>
D1 model:	AIN	pulse width:	0	<input type="button" value="▼"/>	cycle:	0	<input type="button" value="▲"/>
D2 model:	AIN	pulse width:	0	<input type="button" value="▼"/>	cycle:	0	<input type="button" value="▲"/>
D3 model:	AIN	pulse width:	0	<input type="button" value="▼"/>	cycle:	0	<input type="button" value="▲"/>

2.3 Calibration

Preparation:

Make sure the sensor is "Online".

Calibration on PC software:

It is required to calibrate for the first time usage.

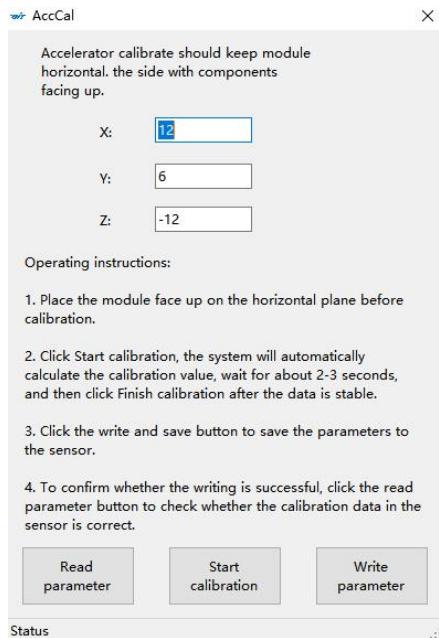
2.3.1 Accelerometer Calibration

Purpose:

The accelerometer calibration is used to remove the zero bias of the accelerometer. Before calibration, there will be different degrees of bias error. After calibration, the measurement will be accurate.

Methods:

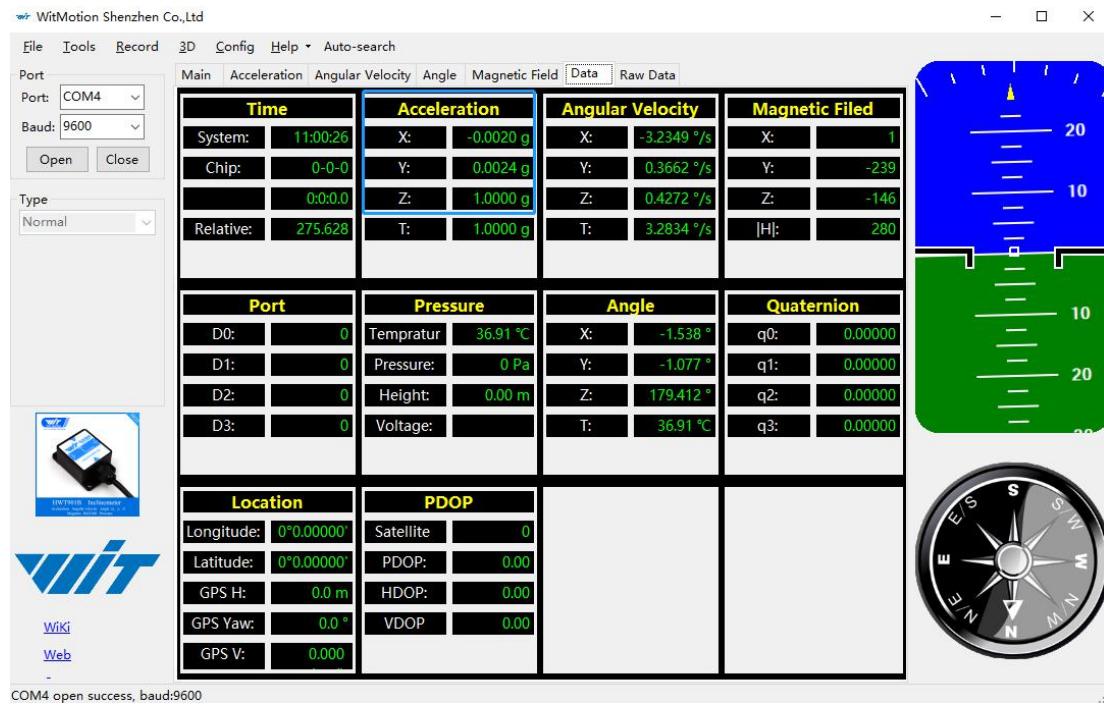
- Step 1. Keep the module horizontally stationary
- Step 2. Click the accelerometer calibration
- Step 3. Click the "Start calibration" and wait for 3 seconds





Step 4. Click "Complete Calibration"

Step 5. Judge the result--confirm if there is 1g on Z-axis acceleration



After 1 ~ 2 seconds, the three axial acceleration value of the module is about 0, 0, 1, the X and Y axis Angle is around 0°. After calibration, the x-y axis Angle is accurate.

Note: When putting the module horizontal, there is 1g of gravitational acceleration on the Z-axis.

2.3.2 Magnetic Field Calibration

Purpose:

Magnetic calibration is used to remove the zero bias of the magnetic field sensor. Usually, the magnetic field sensor will have a large zero error when it is manufactured. If it is not calibrated, it will bring a large measurement error, which will affect the accuracy of the measurement of the z-axis Angle of the heading Angle.

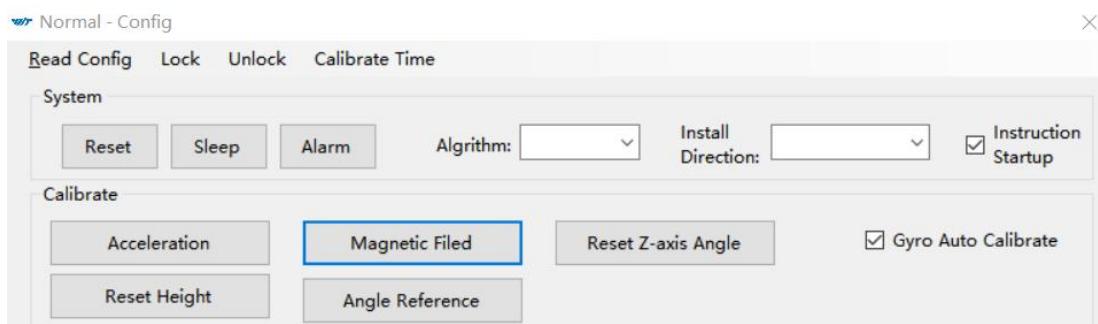
Preparation:

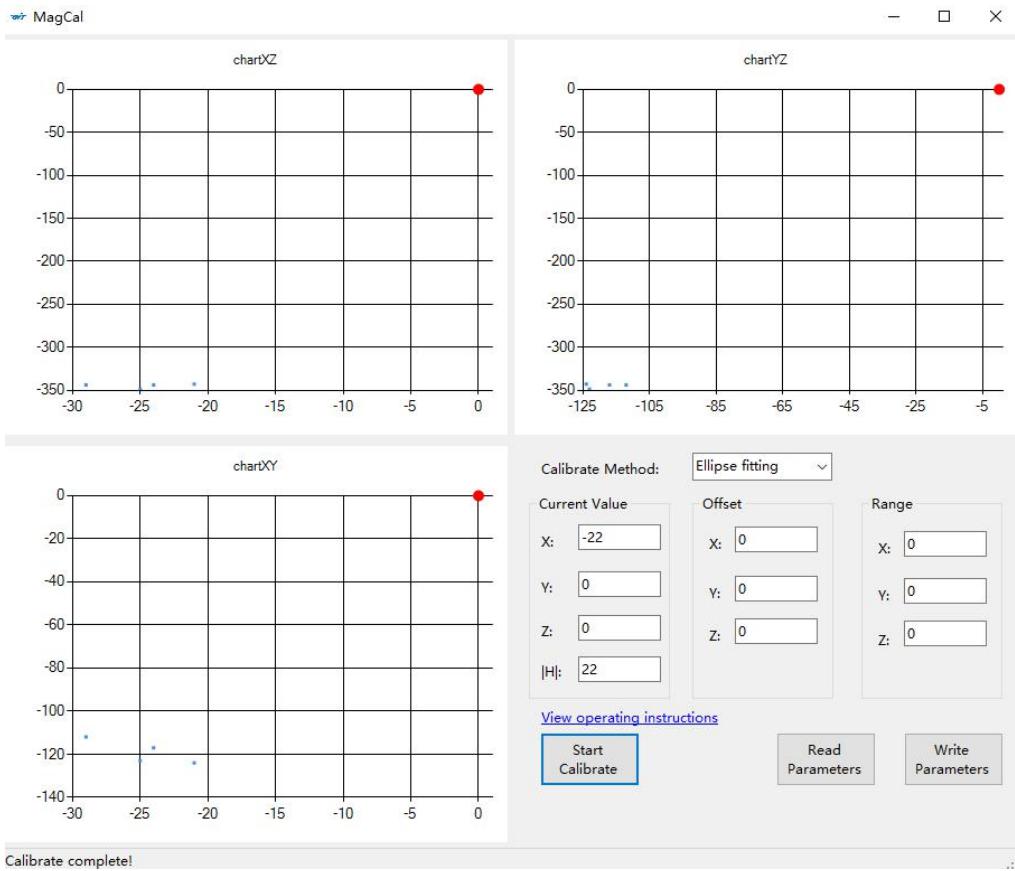
If you wanna measure the Z-axis, it is required to keep the sensor stay 20CM away from magnetic and iron and other materials

Methods:

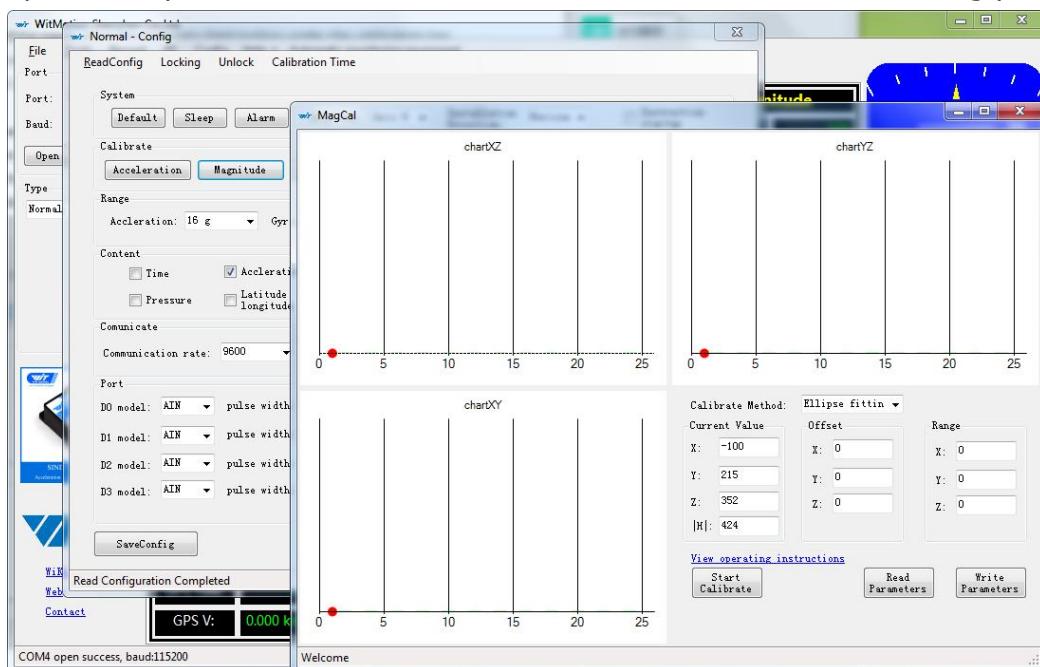
Step 1. Open the Config menu

Step 2. Click the magnetic field calibration button. click the "Start calibration"

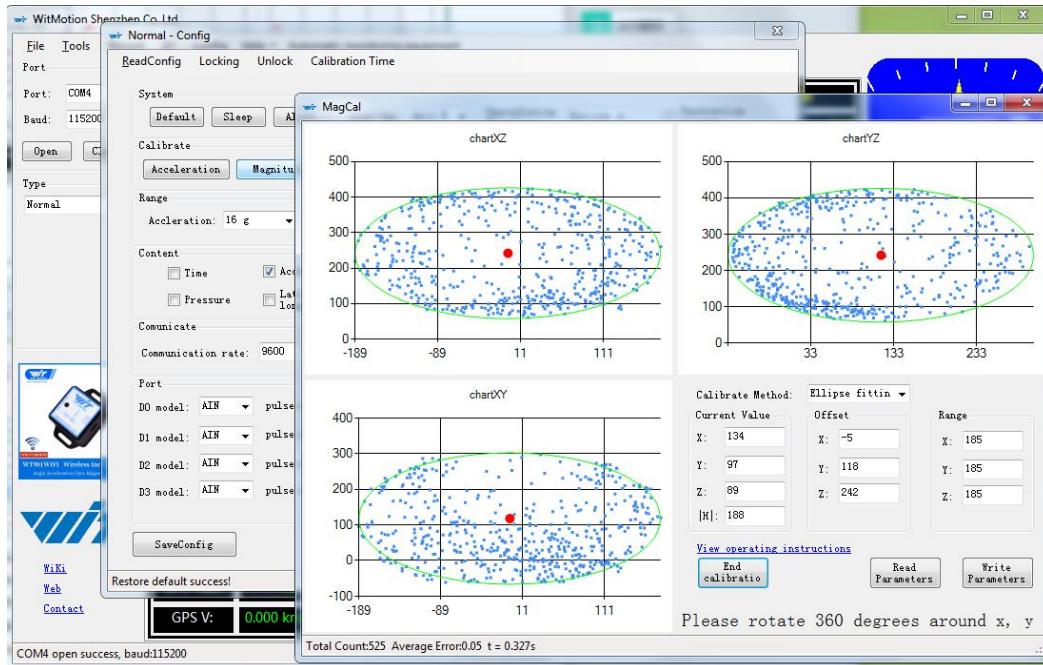




Step 3. Slowly rotate the module 360° around X, Y, Z, 3-axis accordingly



Step 4. After rotation, click "End calibration"



Successful result:

Most of data dots will be within the ellipse.

If not successful, please stay away from the objective that can create magnetic field interference.

2.3.3 Gyroscope Automatic Calibration

The gyroscope calibration is to calibrate the angular velocity, and the sensor will calibrate automatically.

It is recommended that the automatic calibration of gyroscopes can be inactivated only if the module rotates at a constant speed.



2.3.4 Reset Z-axis Angle

Note: If you want to avoid magnetic interference, you can change the algorithm to Axis 6, then you can use reset function of "Reset Z-axis angle".

The z-axis angle is an absolute angle, and it takes the northeast sky as the coordinate system can not be relative to 0 degree.

Z axis to 0 is to make the initial angle of the z axis angle is relative 0 degree. When the module is used before and z - axis drift is large, the z - axis can be calibrated, When the module is powered on, the Z axis will automatically return to 0.

Calibration methods as follow: firstly keep the module static, click the "Config" open the configuration bar and then click "Reset Z-axis Angle" option, you will see the the angle of the Z axis backs to 0 degree in the module data bar.

2.3.5 Reset Height to 0

Only available for the module built-in barometer like WT901B, HWT901B, WTGAHRS1, WTGAHRS2.

2.4 Configuration

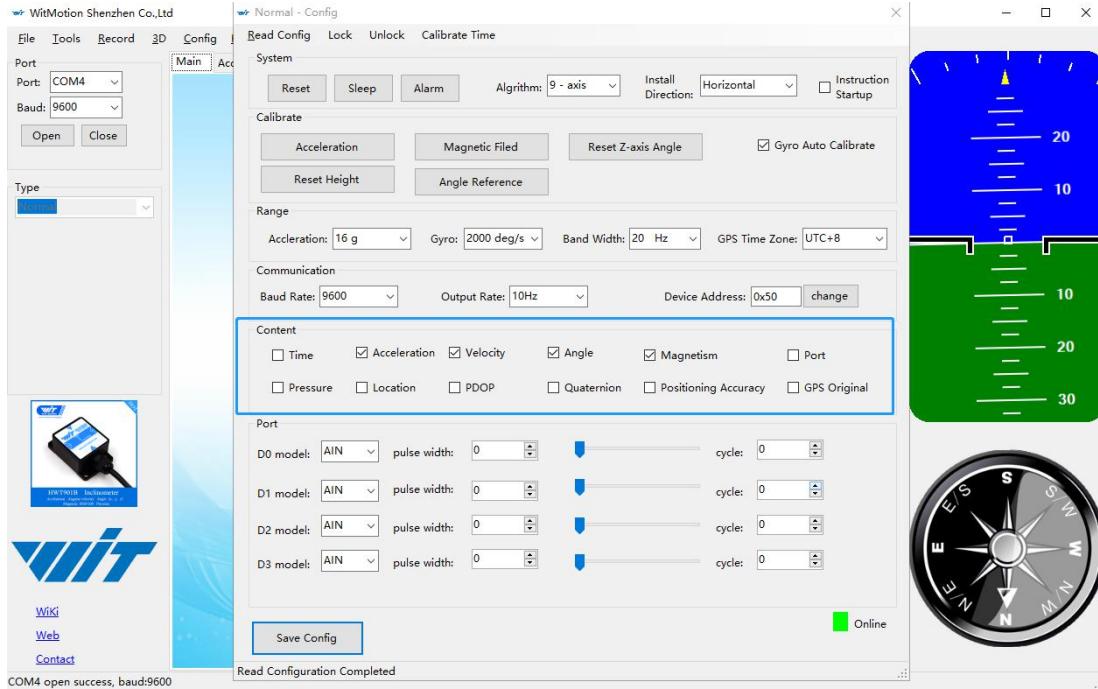
It is required to click "Unlock" before setting configurations.

2.4.1 Return Content

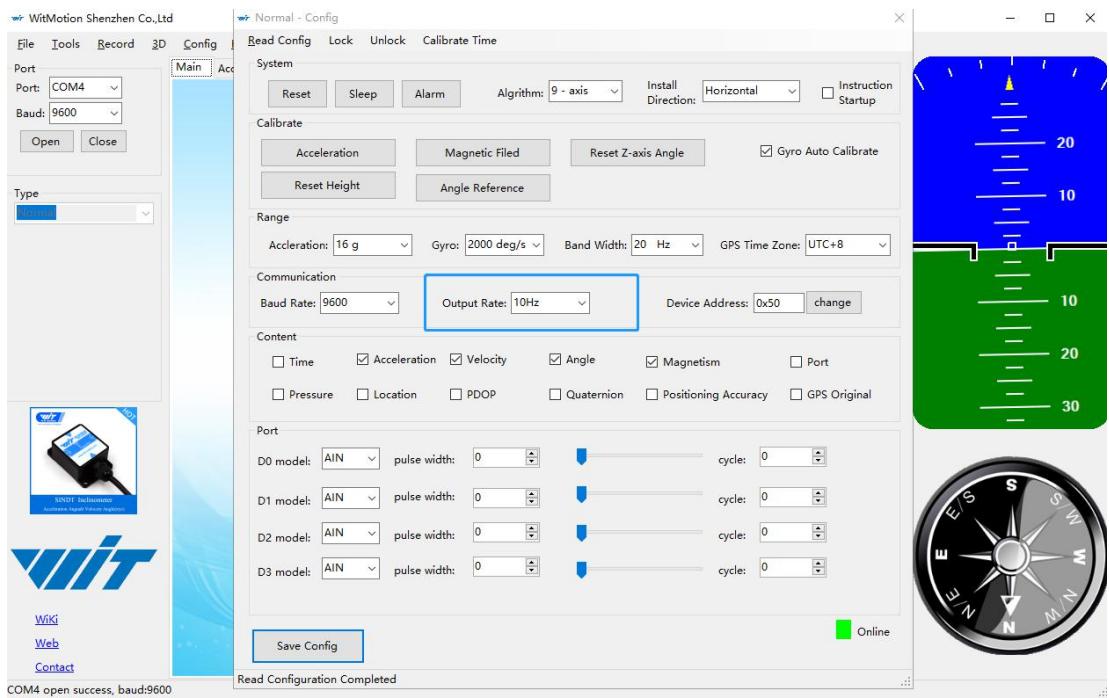
Setting method: The content of the data return can be set according to user needs, click the configuration option bar, and check the data content to be output.

Taking WT901 as an example, the default output of the module is acceleration, angular velocity, angle, and magnetic field.

Notice: If choosing the GPS Original, there will be no other data output.



2.4.2 Output Rate



The default return rate of the module is 10Hz, the highest return rate supports 200Hz.

10Hz refers to 10 packets returned every second. There contain 44bytes in a data packet in default.

Byte Calculation:

11bytes * types of return content

Default return content includes acceleration, gyro, angle, mag.

That is, 4*11, 44bytes in data packet in default.

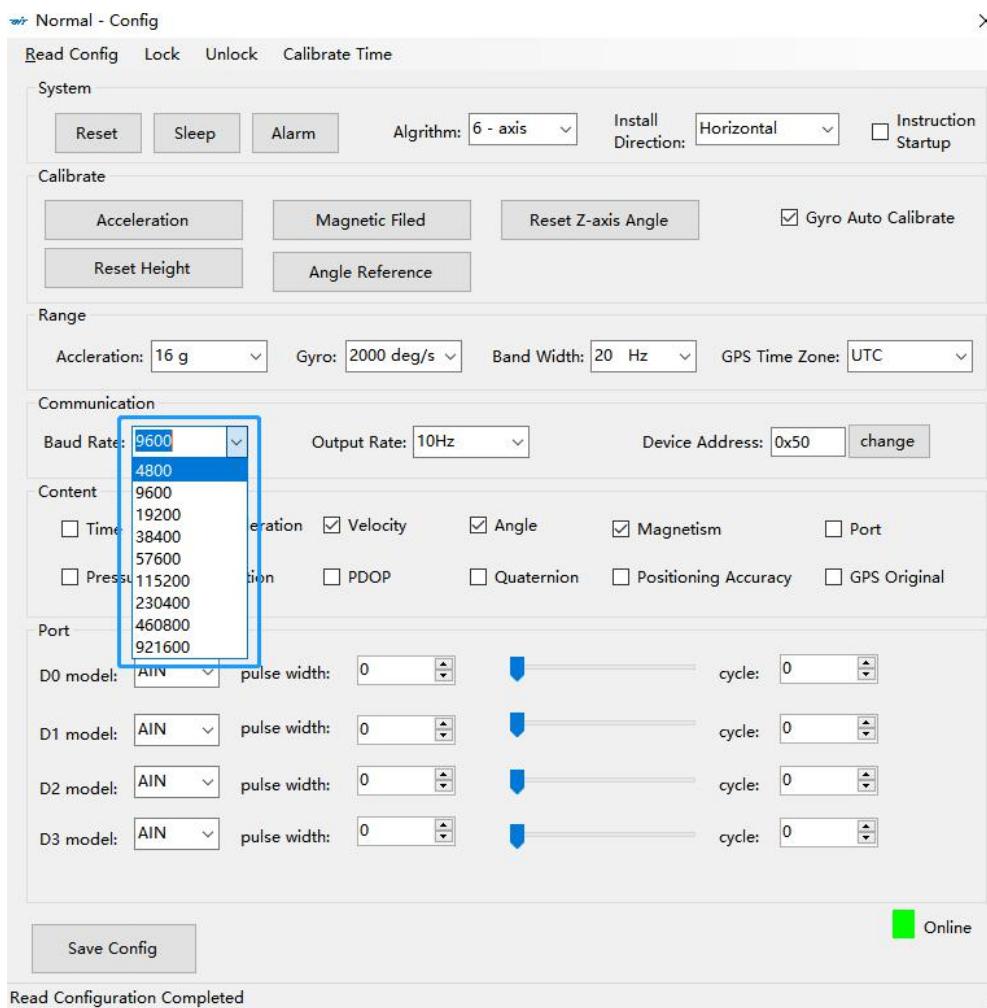
Reminder: If there being many types of return data and low baud rate of communication, the module will automatically reduce the frequency and output at a maximum allowable output rate. The default baud rate is 9600.

2.4.3 Baud Rate

The module supports multiple baud rates, and the default baud rate is 9600.

To set the baud rate of the module, you need to select the baud rate to be changed in the communication rate drop-down box in the configuration bar based on the correct connection between the software and the module.

Note: After the change, the module will no longer output data at the original baud rate. The data will be output only when the baud rate that has been changed is selected on the PC software again.

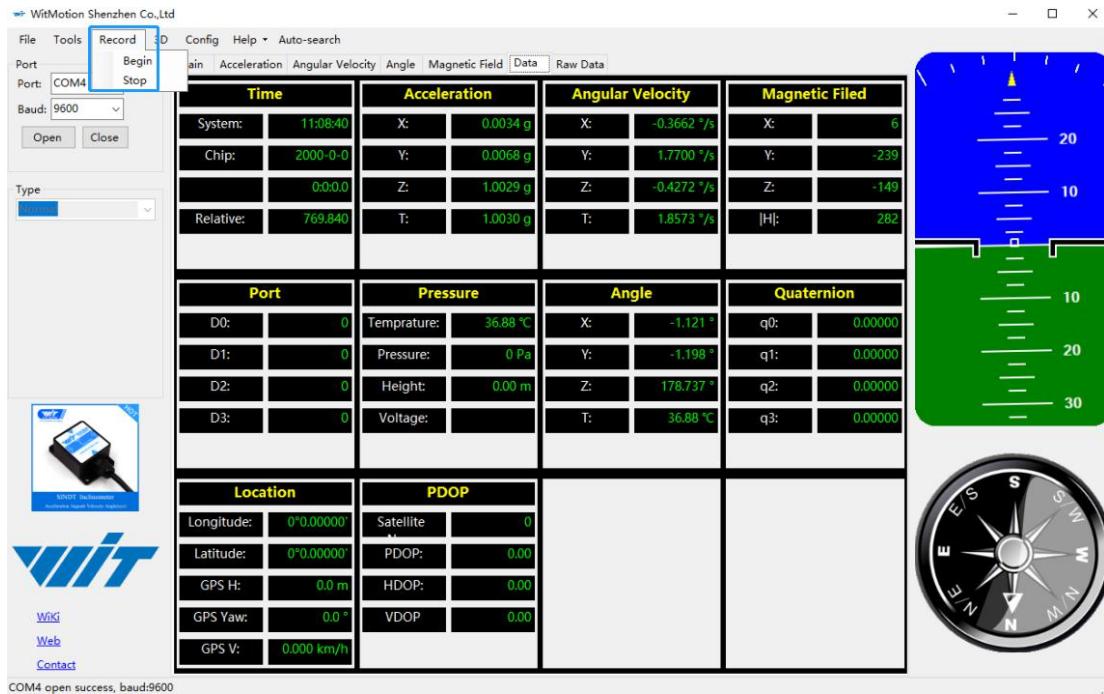


2.4.4 Data Recording

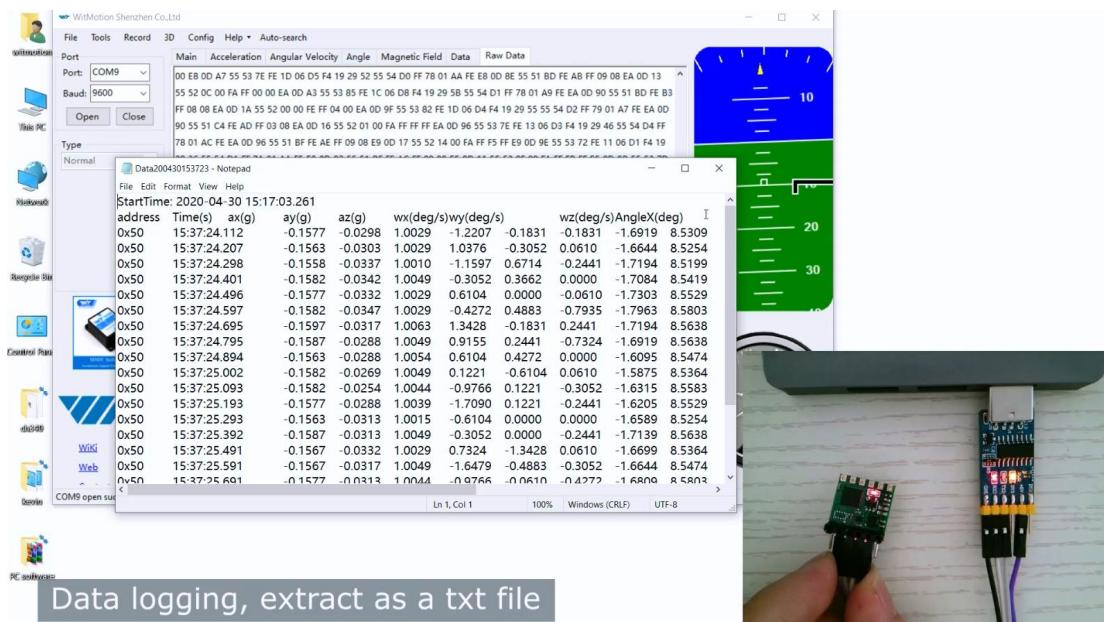
Method are as follows:

Step 1: Click "Record" and "Begin"

Step 2: Click "Stop"



Step 3: Extract the data as "txt" file



Notice: If there is repeated "TIME" of data, that's caused by low-resolution of the Windows system's time. The changes in other data is correct.

It is highly recommended that data can be pasted to an Excel file. In this way, all data will be shown in order.

StartTime: 2020-04-11 16:54:24.437	address	Time(s)	ChipTime	ax(g)	ay(g)	az(g)	wx(deg/s)	wy(deg/s)	wz(deg/s)	AngleX(deg)	AngleY(deg)	AngleZ(deg)	T(°)	hx	hy	hz
0x50	43:06.4	02:40:4	0.4443	0.1777	-0.8696	3.1738	-0.3662	-29.541	166.0364	-29.2072	120.6299	29.97	0	50	313	
0x50	43:06.5	02:40:5	0.02	0.5796	-0.7739	-192.0166	283.9355	-700.2563	142.0532	-24.884	154.8907	30	-29	7	312	
0x50	43:06.6	02:40:6	-0.2896	0.8599	-0.5571	-8.2397	-3.7842	-264.5264	124.0741	20.0171	-158.2196	30	-7	-85	291	
0x50	43:06.7	02:40:7	-0.771	0.5322	-0.4761	36.0718	43.8232	-226.8677	132.984	41.4514	-138.0872	30	38	-93	289	
0x50	43:06.8	02:40:8	-0.5601	0.4233	-0.5562	55.7861	101.9897	274.1699	144.5087	35.5792	-132.4292	30	22	-58	301	
0x50	43:06.9	02:40:9	-0.0058	0.5503	-1.0103	139.0991	-32.7759	432.251	141.4929	1.8073	-174.1113	30	-22	-9	308	
0x50	43:07.0	02:41:0	0.2656	0.3887	-0.8594	124.3896	7.8735	341.1865	154.6985	-15.5896	157.3077	30.01	-14	46	307	
0x50	43:07.1	02:41:1	0.3911	0.1104	-0.8467	40.7715	11.9019	257.1411	177.3303	-25.7684	127.7325	30	0	104	294	
0x50	43:07.2	02:41:2	0.3896	0.3022	-0.8994	-90.0879	135.3149	-268.9819	163.4601	-31.9867	128.6829	30.03	-2	67	308	
0x50	43:07.3	02:41:3	0.2939	0.9531	-0.2837	-251.5259	48.645	-750.4272	119.0149	-0.3625	-174.1608	30.03	-30	-56	295	
0x50	43:07.4	02:41:4	-0.4614	0.7075	-0.3384	-27.3438	-19.4702	-226.9287	112.8021	30.6519	-161.4001	30	33	-122	272	
0x50	43:07.5	02:41:5	-0.7988	0.6279	-0.5044	28.0762	81.7261	122.1924	122.0087	39.8035	-151.1389	30	63	-110	275	
0x50	43:07.6	02:41:6	-0.2495	0.8135	-0.5327	36.377	5.6763	93.0176	121.8494	15.7214	-161.109	30	12	-108	288	
0x50	43:07.7	02:41:7	0.3057	0.7432	-0.5996	74.0356	-0.061	379.7607	126.7603	-11.4478	-176.6711	30.03	-51	-68	295	
0x50	43:07.8	02:41:8	0.4922	0.4653	-0.7129	134.7656	24.231	268.9819	145.3556	-32.4756	163.3832	30.02	-83	10	295	
0x50	43:07.9	02:41:9	0.4507	0.4272	-0.7871	-186.5234	-36.3159	420.6543	166.2616	-49.1583	130.2924	30.02	-86	71	292	
0x50	43:08.0	02:42:0	0.6045	-0.062	-0.8027	37.9028	7.6294	-138.0005	173.4357	-45.8514	118.0206	30.03	-66	75	298	
0x50	43:08.1	02:42:1	0.4712	0.6011	-0.5688	-172.6685	-7.1411	-537.6587	137.6312	-31.2396	163.8171	30.03	-78	20	300	
0x50	43:08.2	02:42:2	-0.0649	0.873	-0.4028	-115.6616	2.3193	-276.2451	113.6481	4.6417	-169.8761	29.98	-37	-101	283	
0x50	43:08.3	02:42:3	-0.4092	0.856	-0.1816	-134.8877	-38.208	-155.7007	99.8822	26.933	-165.943	30.03	32	-166	244	
0x50	43:08.4	02:42:4	-0.5171	0.8809	-0.1152	84.1064	0.9155	86.2427	94.8285	33.2666	-167.5415	30.06	72	-186	218	
0x50	43:08.5	02:42:5	-0.1782	0.9595	-0.2793	243.2861	29.3579	406.8604	110.7367	13.3429	-169.0686	30.03	29	-156	254	

Time represents time, ax ay az represents the acceleration in the three axes of x y z, wx wy wz represents the angular velocity in the three axes of x y z. Anglex Angley Anglez represents the angles of the three axial directions of x y z, T represents the temperature, and hx hy hz represents the magnetic fields of the three axial directions of x y z respectively.



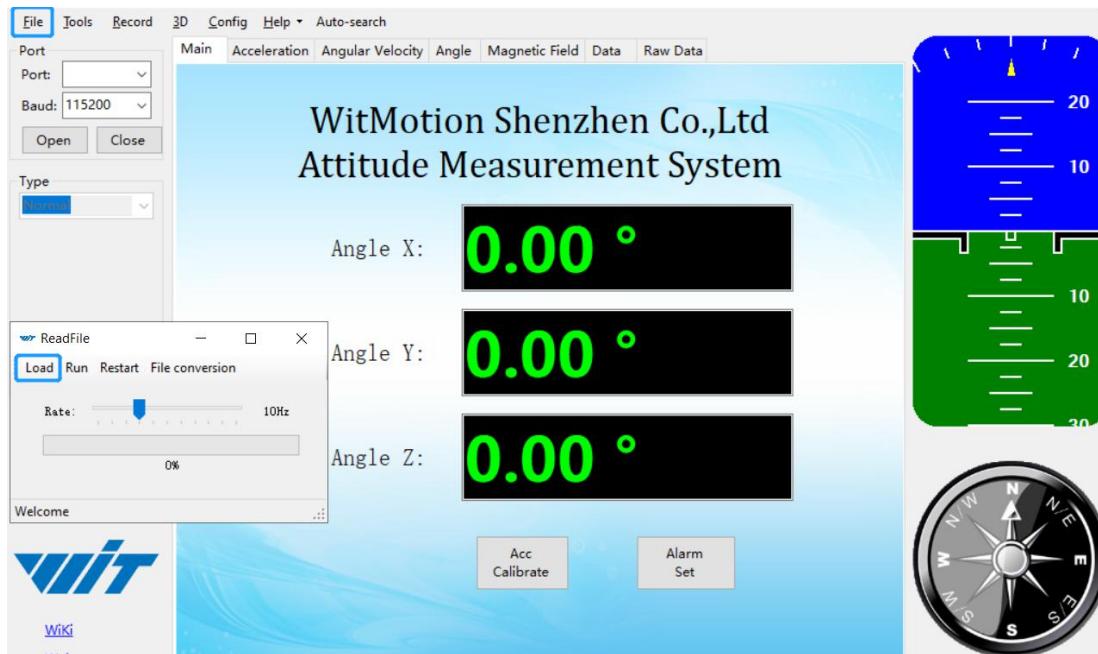
2.4.5 Data Playback

New function: When creating recorded file each time, there will a BIN file created in the folder of record file in path of installed software meanwhile.

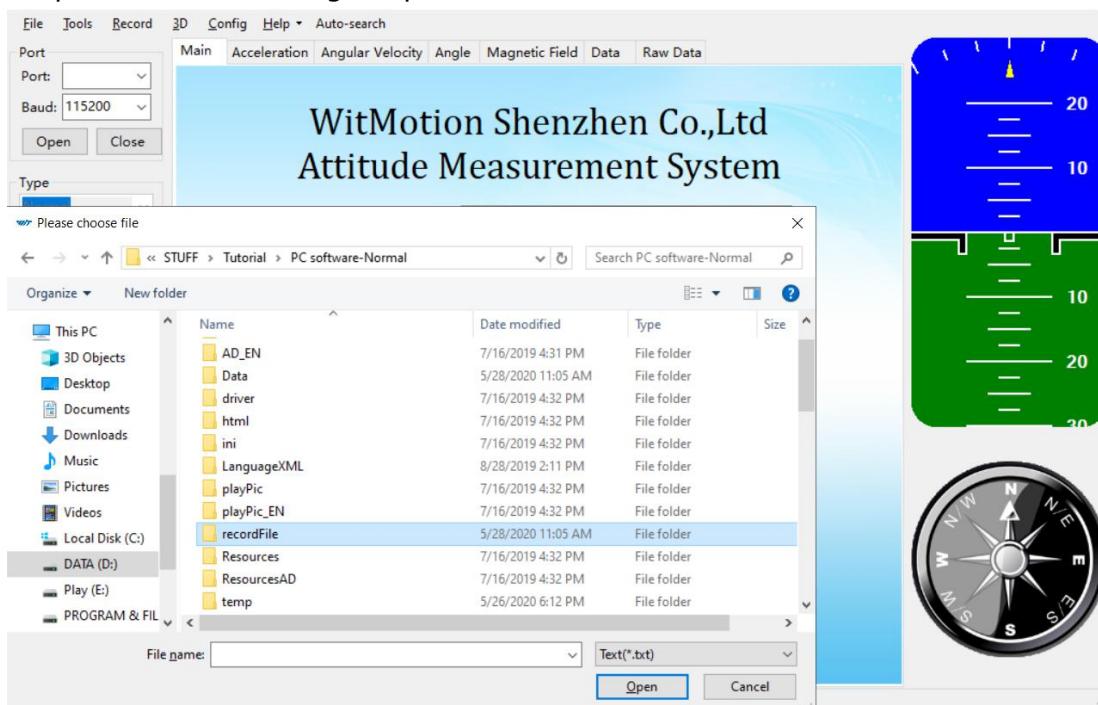
Recorded data playback method:

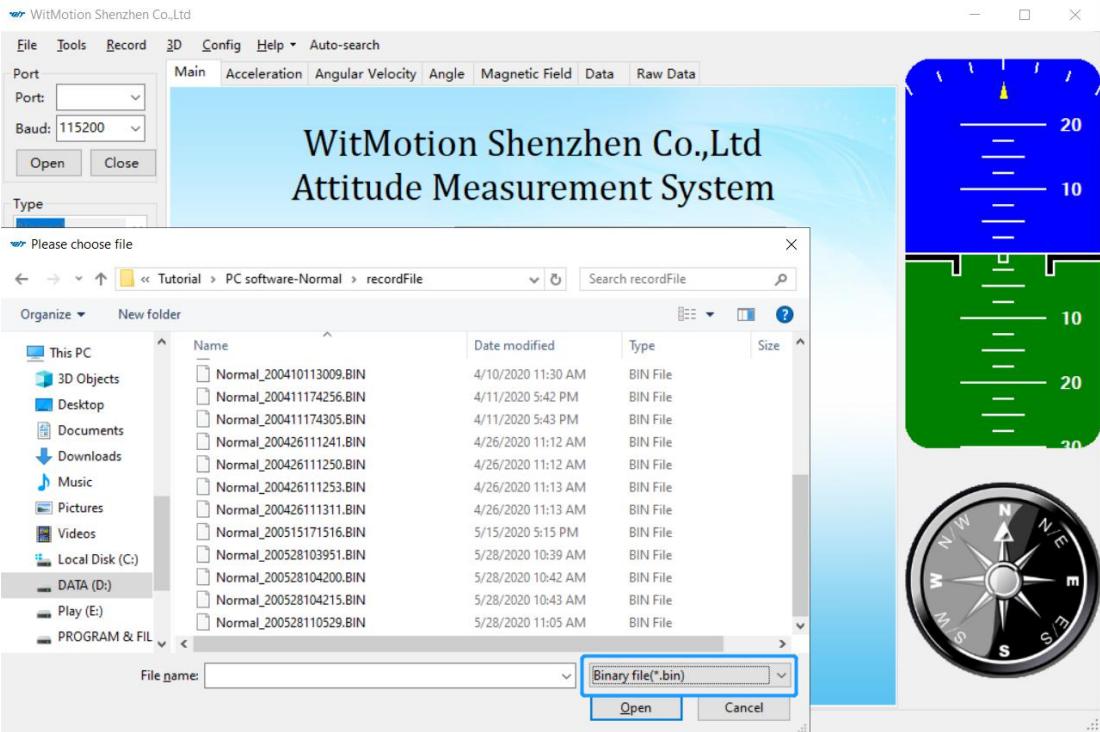
Step 1: Disconnect the sensor

Step 2: Click "File" Button and then click "Load"



Step 3: Choose the original path of software installation and load the Bin file





Step 4: Click "Run" and the Binary file will be playback
When playback, the rate can be editable.



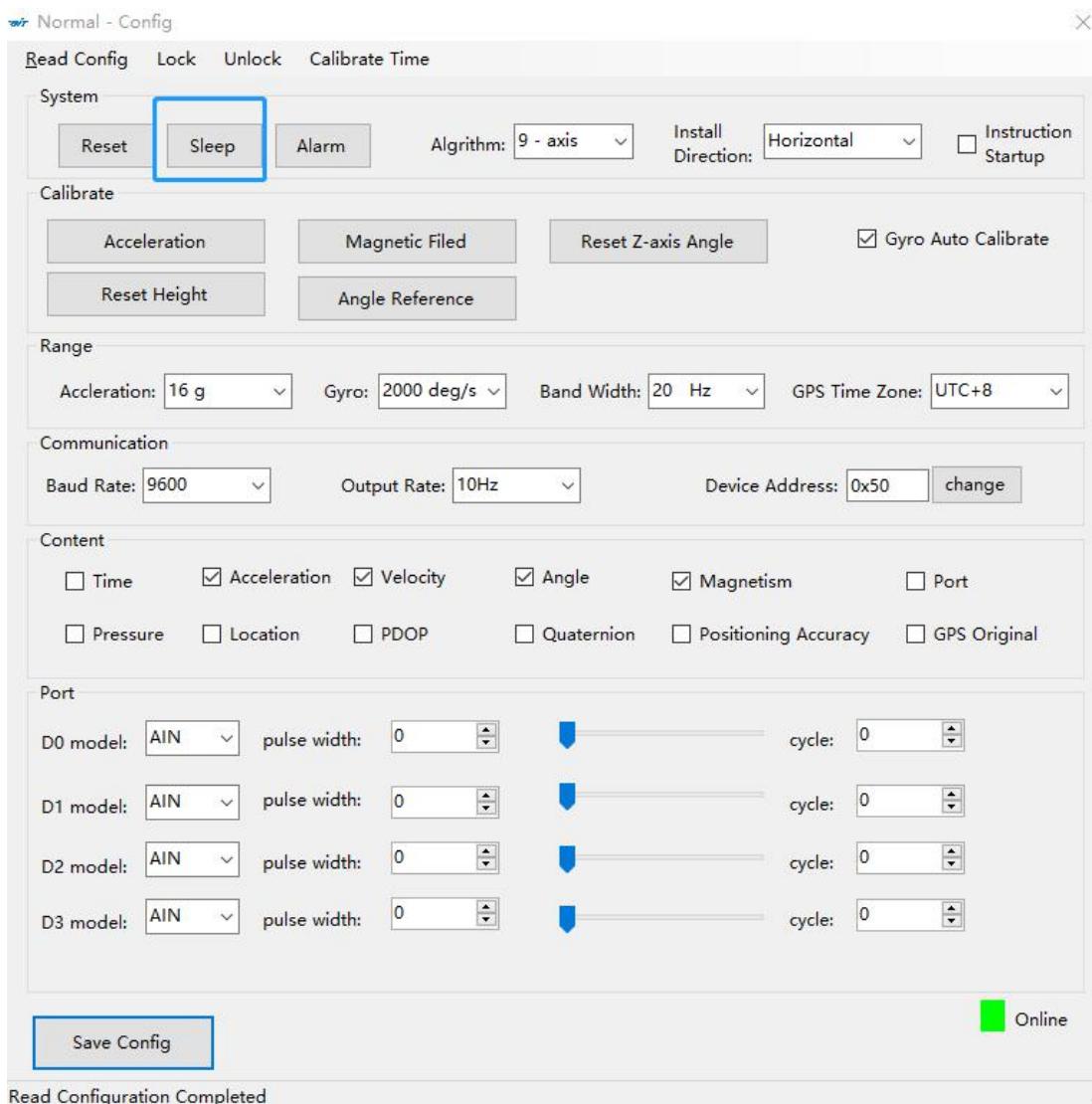
2.4.6 Standby and Wake Up

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 the 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.



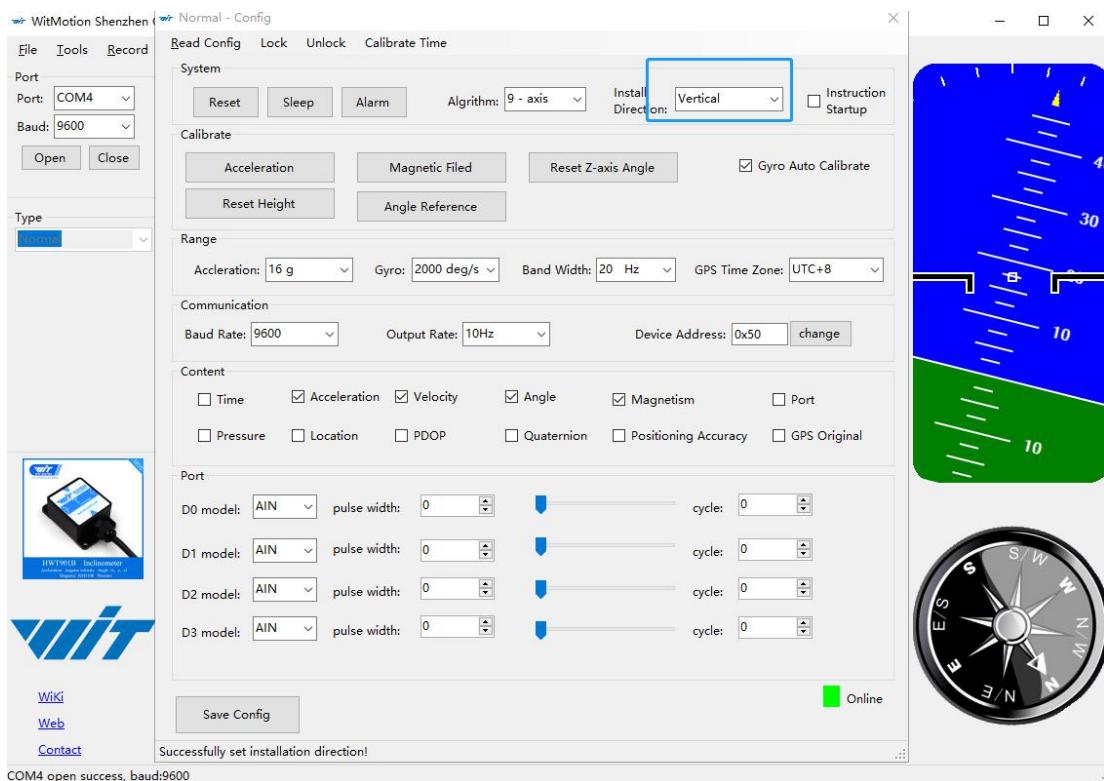
2.4.7 Placement Direction

The default installation direction of the module is horizontal. When the module needs to be installed vertically, the vertical installation can be set.

Step 1: Rotate the module 90 degrees around the X-axis

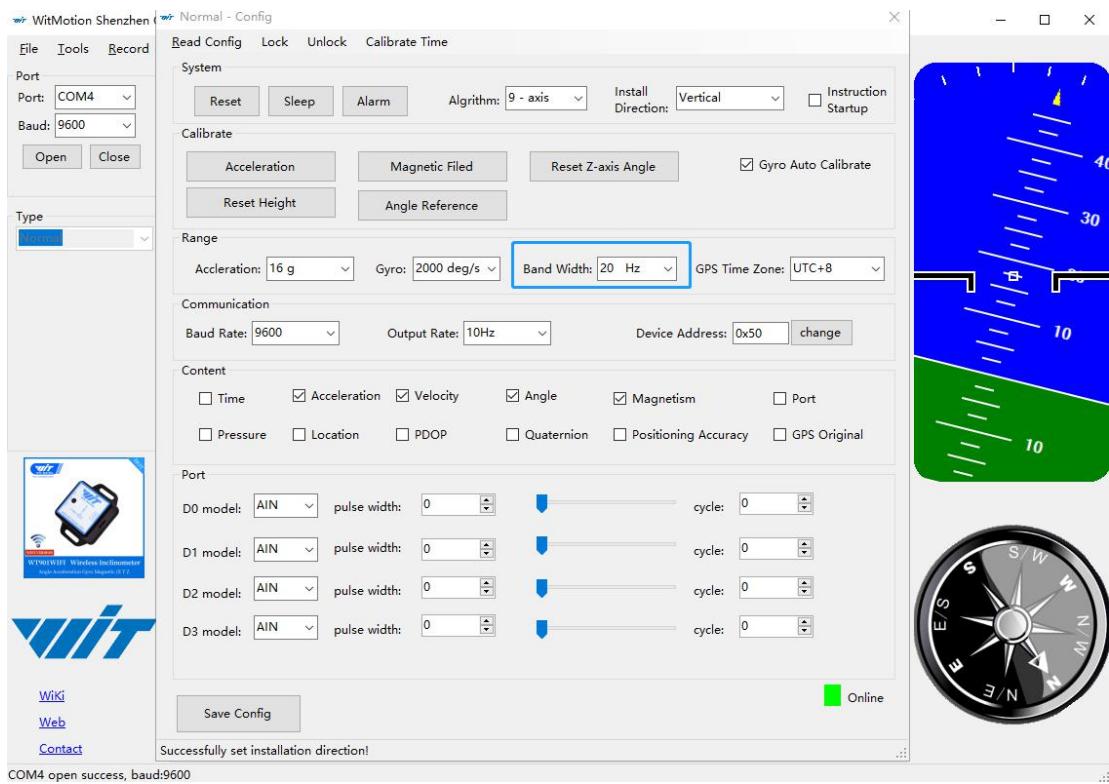
Step 2: Place the sensor 90 degrees vertically

Step 3: Click "Vertical" as install directions on "Config" menu



2.4.8 Bandwidth

Default bandwidth is 20Hz.

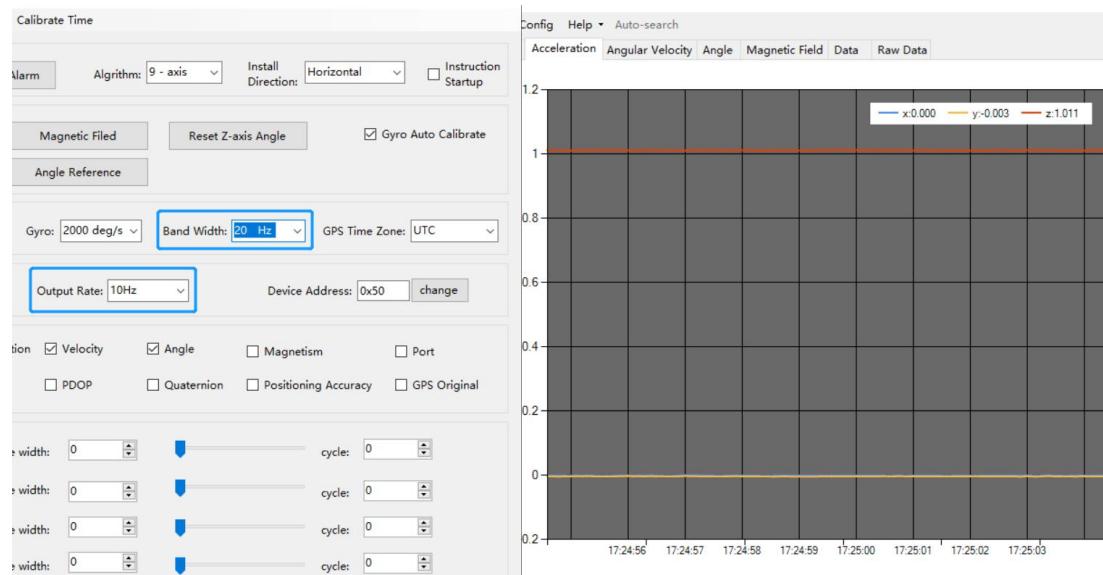


Function:

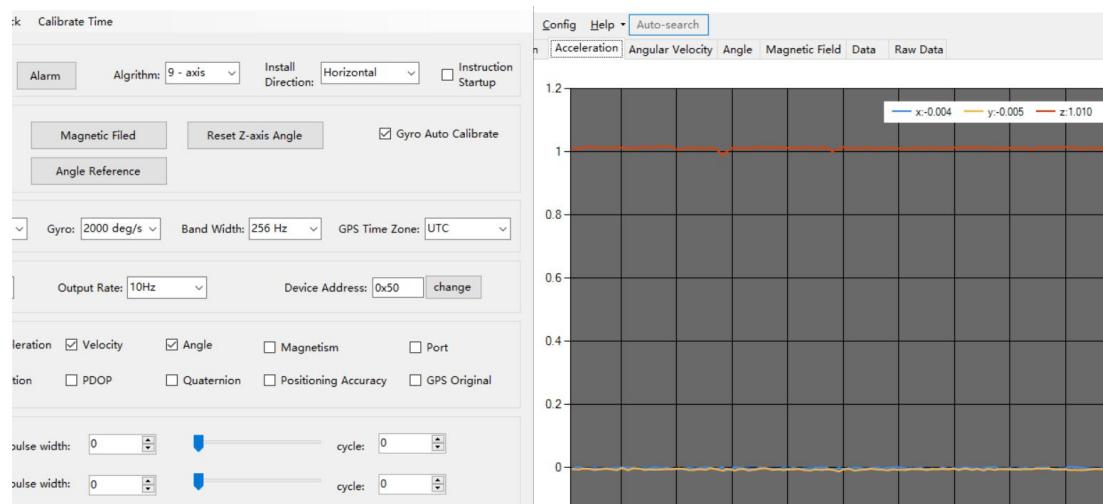
1. The higher rate of bandwidth setting will lead to the higher fluctuation in data waveform. Conversely, the lower rate of bandwidth, data will become more fluent.

For example:

Bandwidth as 20Hz, Output rate as 10Hz. The waveform is very steady.



Bandwidth as 256Hz, Output rate as 10Hz. The waveform will show more fluctuation.



2. The higher rate of bandwidth will solve the data-repeating problem.

For example, if the bandwidth setting is 20Hz, retrieval rate as 100Hz, there will be 5 repeating data.

If you prefer there is no repeating data, it is required to increase the bandwidth more than 100Hz.



2.4.9 Restore Factory Setting

There are two ways to restore the factory settings, the short circuit method and the command method.

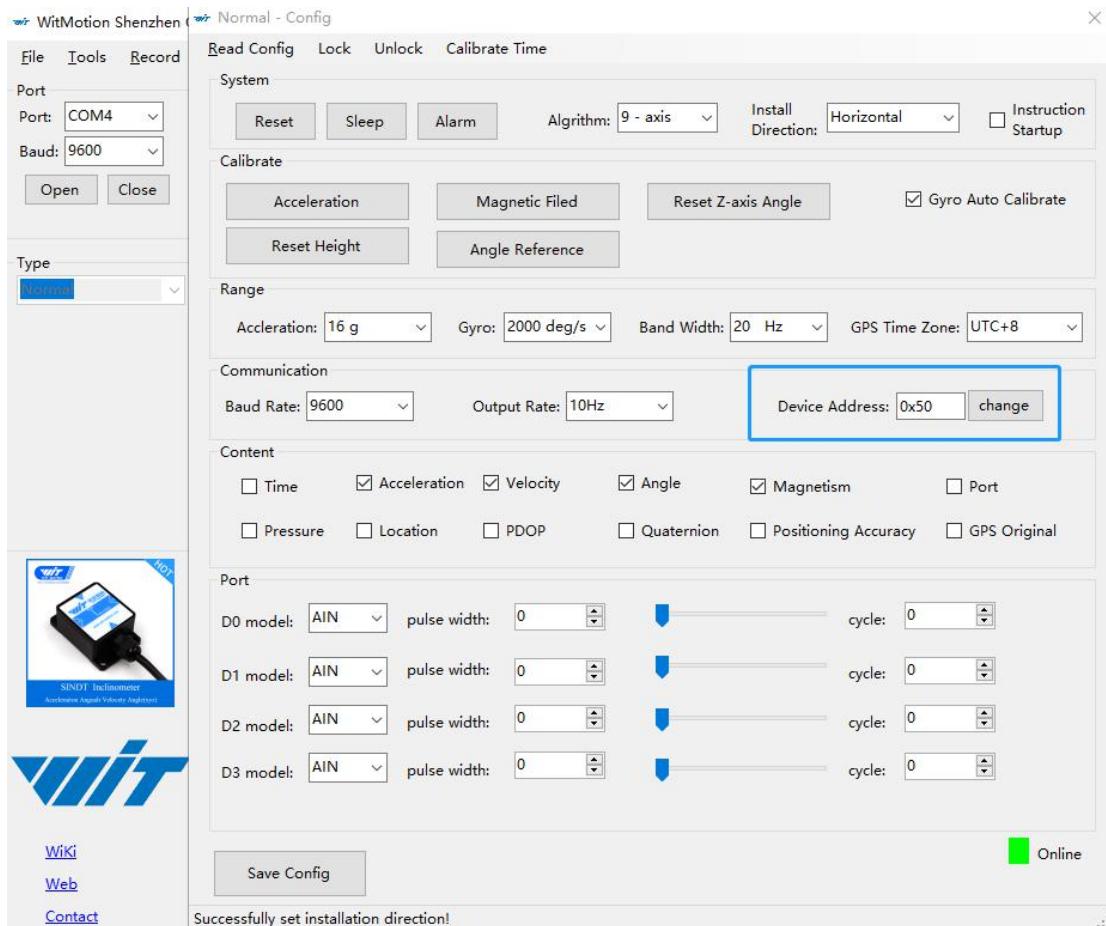
Short-circuit method: short-circuit the D2 pin and VCC pin of the module with wires, and then power on the module. The LED of the module is on continuously for about 2 seconds. The LED is off, and the factory reset operation is completed.

Command method: connect the WT901 module and the computer through the USB-TTL module, click the setting tab, and click to restore the default. After restoring the factory settings, power on the module again. (This method needs to know the baud rate of the module in advance, if the baud rate does not match the instruction will not take effect, please try to use the short circuit method to recover)

2.4.10 Set IIC Address

The module's default IIC address is 0x50, which can be changed by software. Change the IIC address only when the module connect to PC program successfully, and enter the new 16 hexadecimal IIC address and click the "change" button.

Reminder: The IIC address of the module will not be changed immediately, and it will take effect when the module restart.



2.4.11 Set Extended Port

The WT901 module has 4 multiple function extended ports, which can be set to different functions according to the need. Set extended port only when the module connects to the PC software successfully.

The extended port supports analog input mode, digital input mode, digital output mode, PWM output mode. D1 port also supports GPSRX mode, port state by default is analog input mode.

The port status packet in which the module exports contains the status information of the extended port. In different modes, the port state data DxStatus has the following meanings:

Mode	Implication
Analog input mode	Analog voltage
Digital input mode	Port high and low level state
Digital high level output mode	Port output state
Digital low level output mode	Port output state
PWM output mode	PWM high level width
CLR (D1)	The XY relative attitude 0

Analog input mode is used to measure the analog voltage on the port, such as a potentiometer or a sensor, etc.

The formula is as follows:

$$U=DxStatus/4096*U_{VCC}$$

U_{VCC} is the power supply voltage of the module, because the module has LDO if the module power supply voltage is greater than 3.5V, U_{VCC} is 3.3V. If the module supply voltage is less than 3.5V, U_{VCC} equal to the supply voltage minus 0.2V.

For digital input mode, if the voltage is high, $DxStatus=1$, else, $DxStatus=0$.

For digital output mode:

Voltage is high, $DxStatus=1$.

Voltage is low, $DxStatus=0$.

PWM output mode is used for the output of the PWM wave, the cycle and the high level width can be adjusted, the unit is us. In the PWM output mode, the port state data is used to indicate the high level of the PWM, the unit us.

2.4.12 6-axis/ 9-axis Algorithm

6-axis algorithm: Z-axis angle is mainly calculated based on angular velocity integral. There will be calculated error on Z-axis angle.

9-axis algorithm: Z-axis angle is mainly calculated and analyzed based on the magnetic field. Z-axis angle will have few drift.

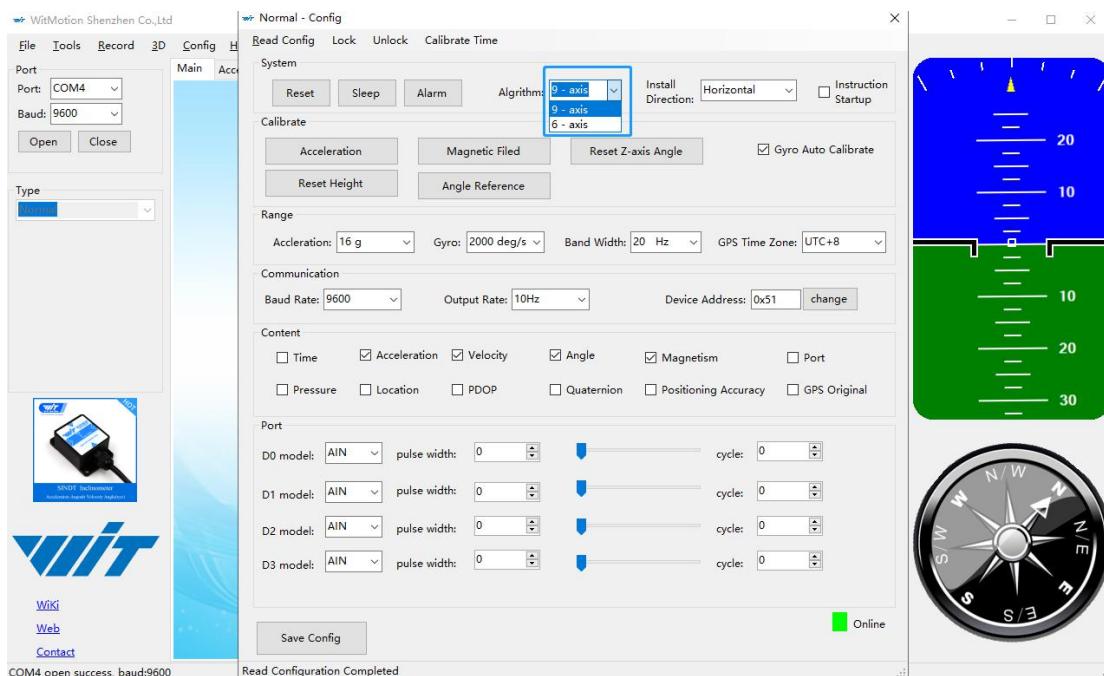
The default algorithm of WT901 is 9-axis. If there is magnetic field interference around installed environment, it is recommended to switch to 6-axis algorithm to detect the angle.

Method:

Step 1: Switch to the "6-axis" algorithm on "Config" menu

Step 2: Proceed the "Accelerometer calibration" and "Reset Z-axis angle" calibration.

After the calibration is completed, it can be used normally.

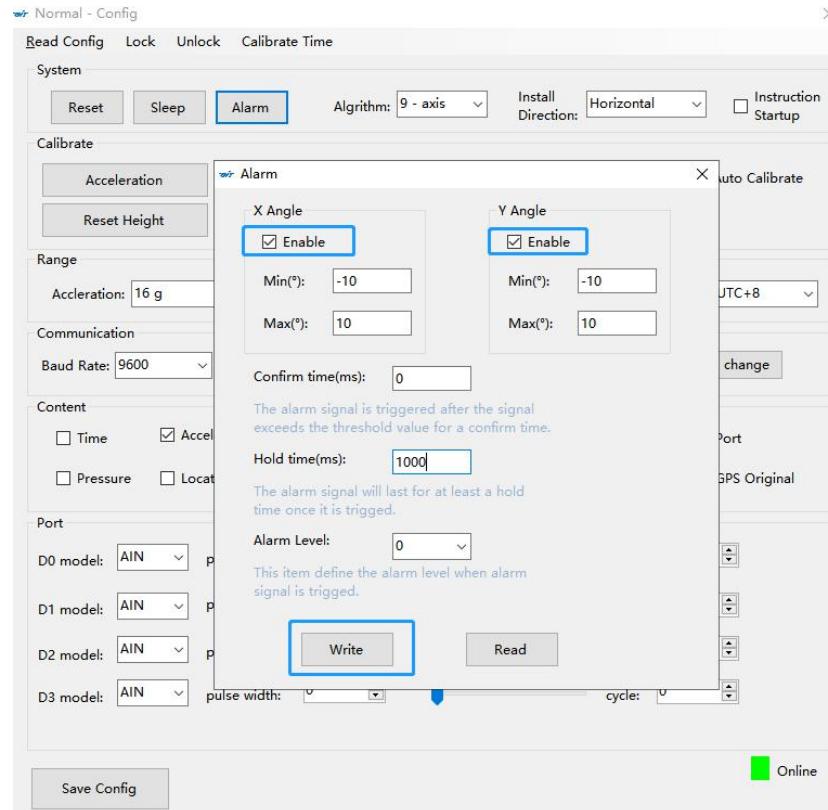


2.4.13 Set Alarm Status

Through the alarm setting of the PC software, the following pins can be set as the alarm status output port. Take the following settings as an example.

Normally, the four ports output low level (0V), and when the X-axis angle value is greater than 10 ° or less than -10 °, the corresponding port will output high level (3.3V).

Name	Function
D2	Output X + alarm status
D3	Output X- alarm status
SCL	Output Y + alarm status
SDA	Output Y- alarm status



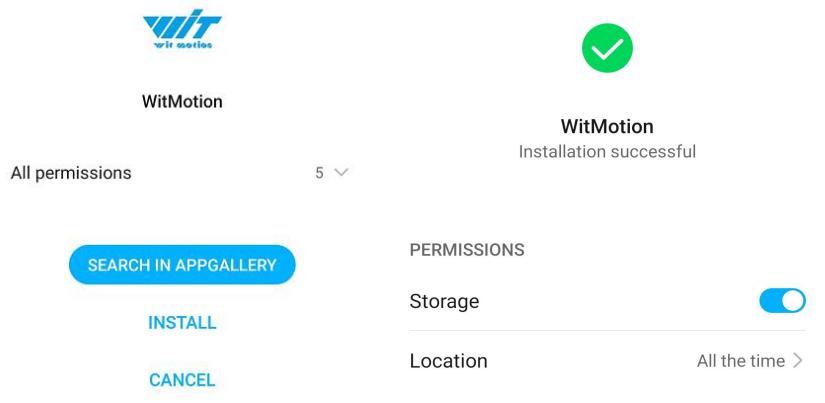


3 Use Instructions with Android Phone

For APP configuration introduction, please referring to the Chapter 2.2

3.1 APP Installation

Install the APK file, give permission of Location and Storage



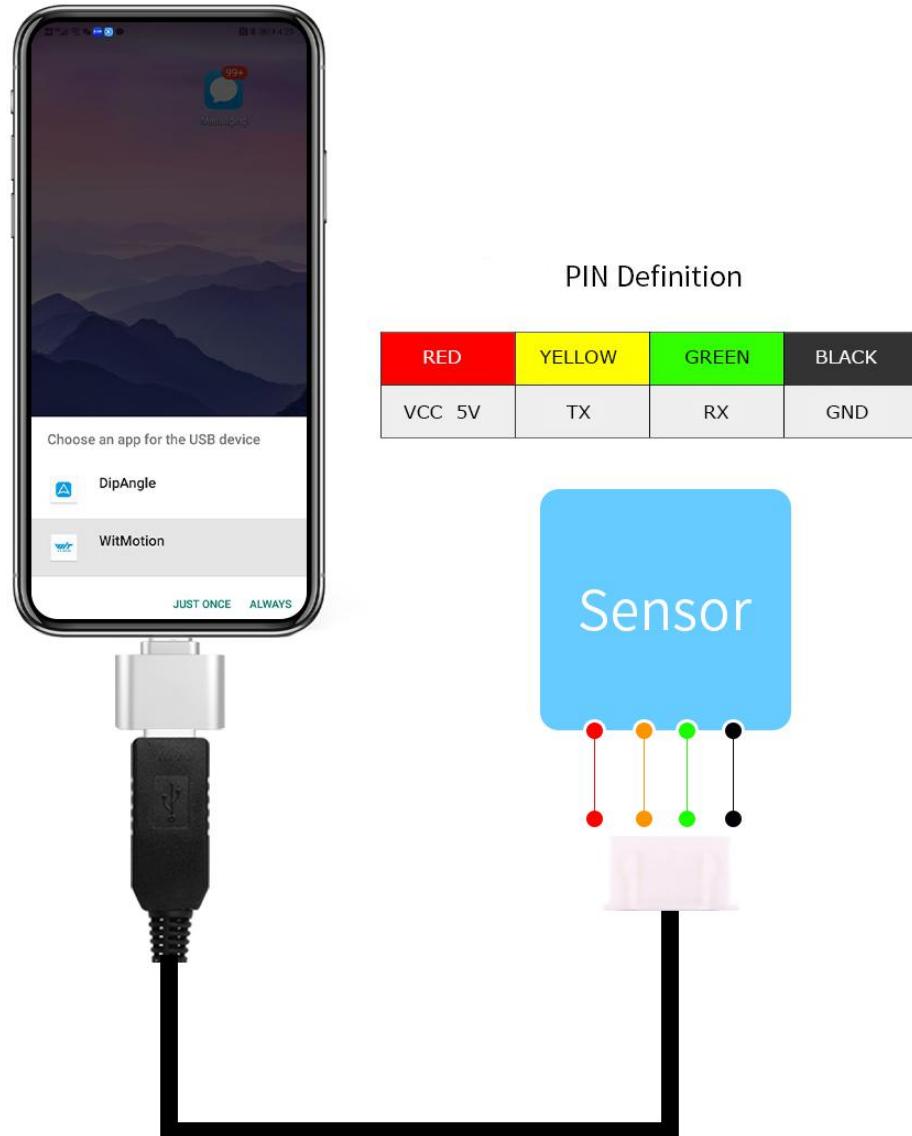
[Link to download Android APP](#)

My Drive > WITMOTION Document Center > WT901 >

Name ↑
CH340& CP2102 Driver.zip
Sample Code.zip
Standard Software for Windows PC.zip
WITMOTION Android APP.zip
WT901_V1.1.pdf
WT901.mp4

3.2 Hardware Preparation

Connecting with Android smartphone requires a serial cable and a Type-C converter or OTG converter according to phone's interface.





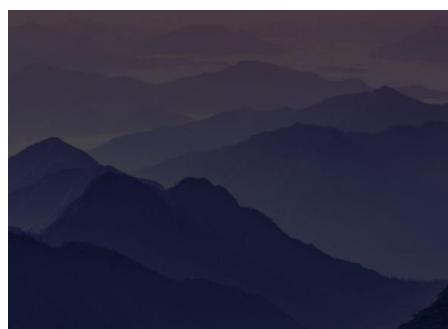
3.3 Connection

Step 1. Install the APK file, give permission of Storage.

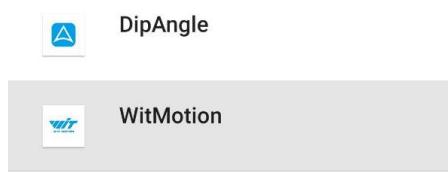
Step 2: Connect the sensor with TTL cable. Then connect the cable with type-c converter. Plug in the device "type-c converter" to the phone.

Notice:

1. After successful connection, there will be a notification reminding that "Choose an APP for the USB device", which means that the device has been detected. Choose "WitMotion", "JUST ONCE" or "ALWAYS" is optional.
2. Only CH340 driver can be detected via WitMotion APP.



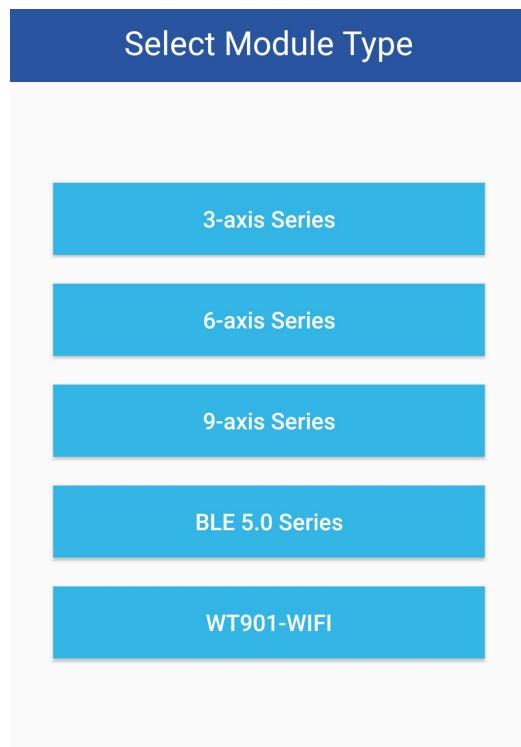
Choose an app for the USB device



JUST ONCE ALWAYS

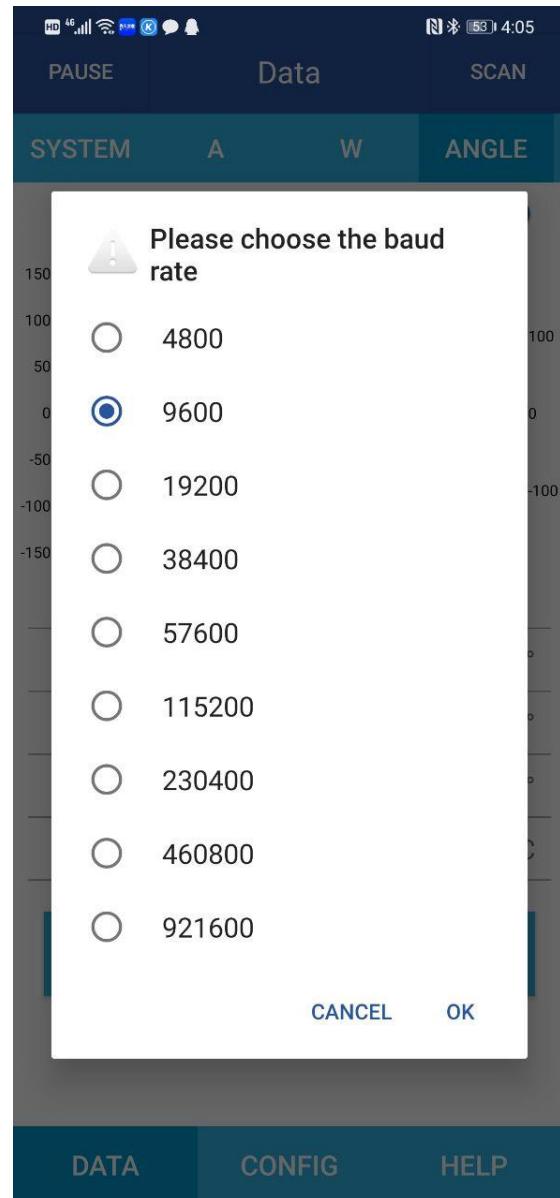


Step 3. Open APP and choose "9-axis Series" as sensor series





Step 4. Select the baud rate- 9600.





After selection and wait for a few seconds, the data will show automatically.



3.4 Calibration

[WT901 Playlist](#)

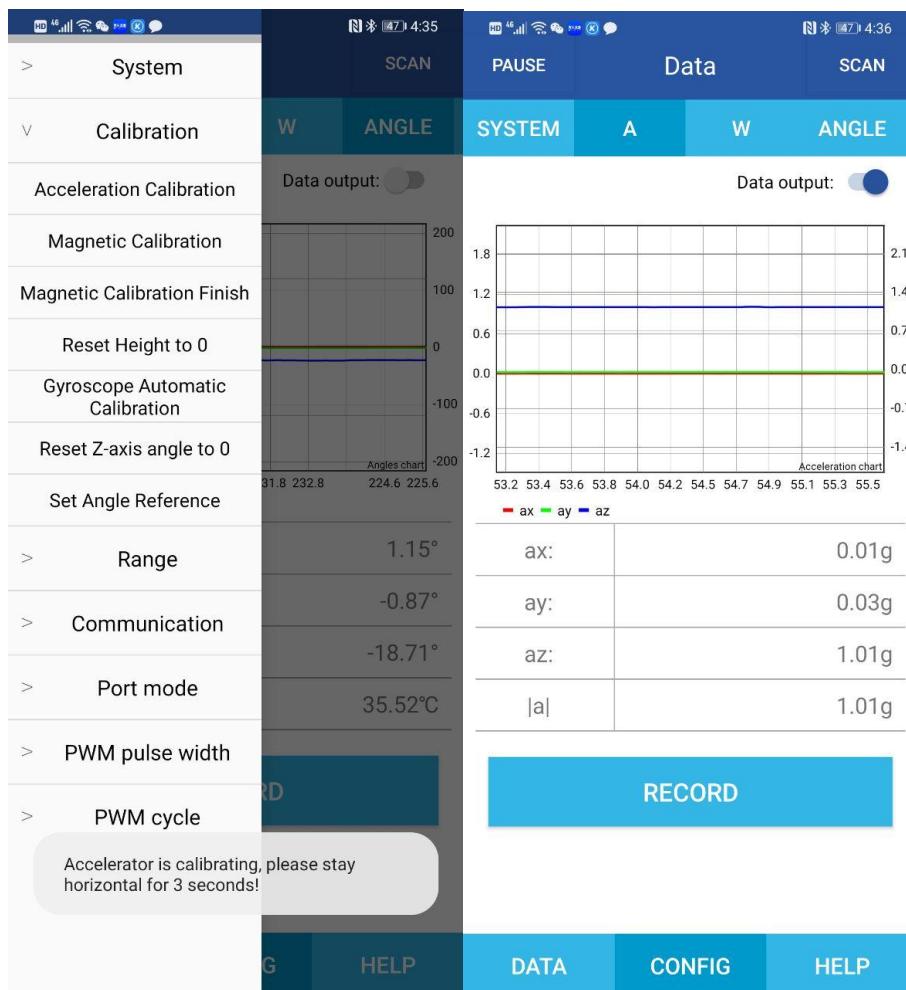
3.4.1 Acceleration Calibration

Step 1. Keep the module horizontally stationary

Step 2. Click the "Calibration" menu

Step 3. Click the "Acceleration Calibration" and wait for 3 seconds

Step 5. Judge the result--confirm if there is 1g on Z-axis acceleration



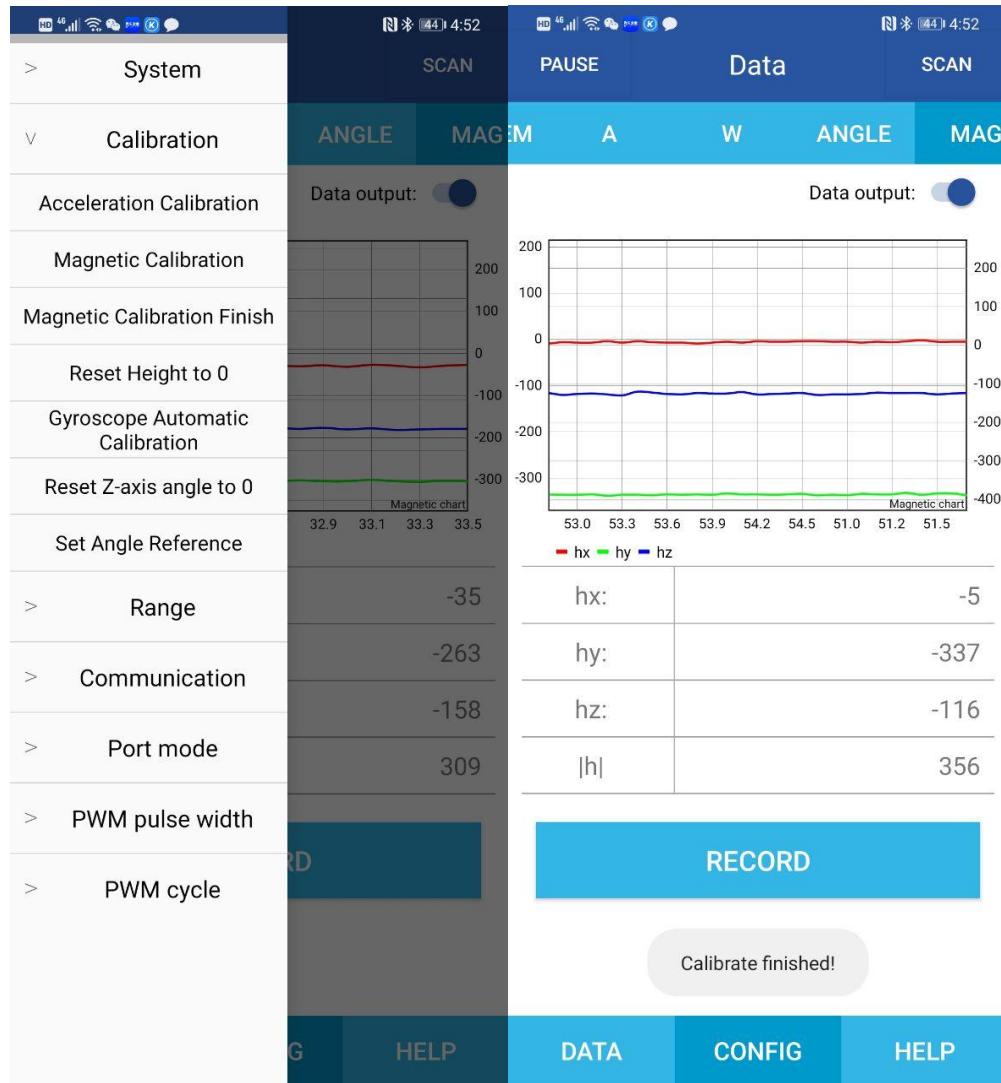
3.4.2 Magnetic Field Calibration

Step 1. Click "Calibration" menu

Step 2. Click the "Magnetic calibration" button

Step 3. Slowly rotate the module 360° around X, Y, Z, 3-axis accordingly

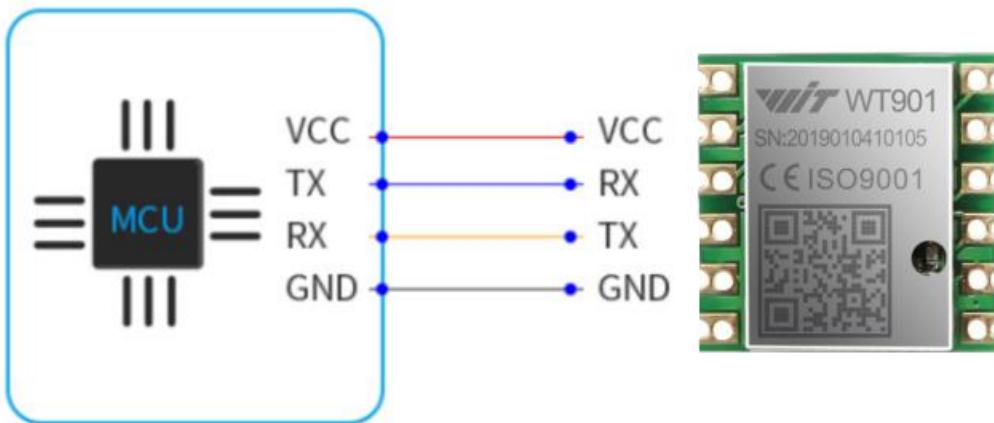
Step 4. After rotation, click "Magnetic Calibration Finish"



Check the result: The Z-axis angle will have fewer drift than before.

Notice: If not successful, please stay away from the objective that can create magnetic field interference.

4 MCU Connection



[Link to download all sample code](#)

[Link to sample code instructions demo](#)

Notice: There is no sample code provided for Linux or Python system at present.

4.1 Arduino

[Download link](#)

[Arduino UNO3 Demo Link](#)

4.2 STM32

[Download link](#)

4.3 Raspberry pi

[Tutorial link](#)

4.4 C#

[DEMO link](#)



4.5 C++

[DEMO link](#)

4.6 Matlab

[Receive Sample Code](#)

[Dataplot DEMO](#)

5 IIC Connection

The WT901 module can be connected to the MCU through the IIC interface. The connection method is shown in the figure below.

Note:

1. In order to connect multiple modules on the IIC bus, the IIC bus of the module is an open-drain output. When the MCU is connected to the module, the IIC bus needs to be pulled up to VCC through a 4.7K resistor.
2. VCC is 3.3V, it must be connected to the power supply. Directly using the power supply on the module may cause a voltage drop, so that the actual voltage of the module is not 3.3 ~ 5V.
1. The internal pull-up of the MCU is a weak pull-up, the driving capacity is limited, and an external pull-up on the hardware is required.

