

USER MANUAL BWT901CL

Bluetooth 2.0 Inclinometer Sensor





Tutorial Link

[Google Drive](#)

Link to instructions DEMO:

[WITMOTION Youtube Channel](#)

[BWT901CL 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

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1 Introduction

The BWT901CL is a multi-sensor device detecting acceleration, angular velocity, angle as well as magnetic field. The robust housing and 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.

BWT901CL'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.

BWT901CL is an CE standard accelerometer. It is employed where the highest measurement accuracy is required. BWT901CL 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
- 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.
- For proper instrument grounding: use WITMOTION with its original factory-made cable or accessories.
- Do not access the I2C interface.
- Do not change the baud rate because WITMOTION BLUETOOTH sensor's baud rate is fixed.

1.2 LED Status

LED	Status	Remark
Red	Flashing	Charging
Blue	Flashing	Pairing process
	Keeping still	Successful pairing

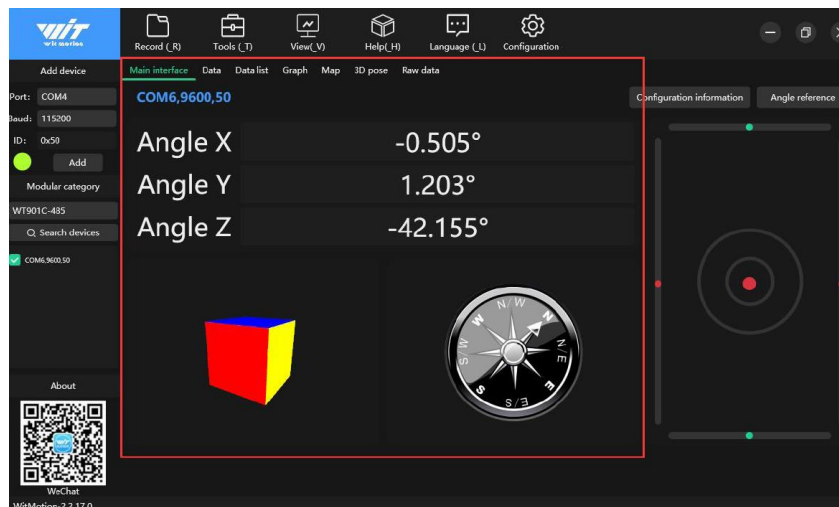
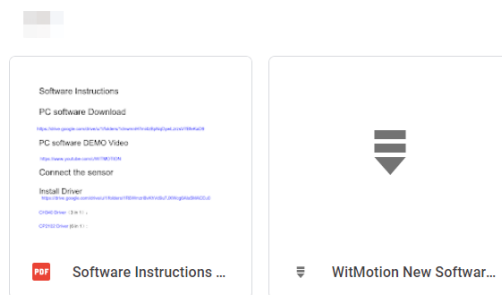
2 Instructions of 2023 New Software

In order to improve the user experience and our customer service, we develop a new version PC software.

Below is the new software and universal instruction download link.

https://drive.google.com/drive/folders/1dnwmnH7mi4zBpNqDywLzrzsV7BfeKaD9?usp=share_link

WITMOTION New Software(Universal)



Note:

The 2022 old version software will be reserved for use. You can check "Chapter 3 Use Instructions with PC" for more details. ↓ ↓ ↓

3 Use Instructions with PC

3.1 Connection Method

PC software is only compatible with Windows system.

[BWT901CL Playlist](#)

3.1.1 Serial Connection

Step 1. Connect the sensor with offered Type-C wire.

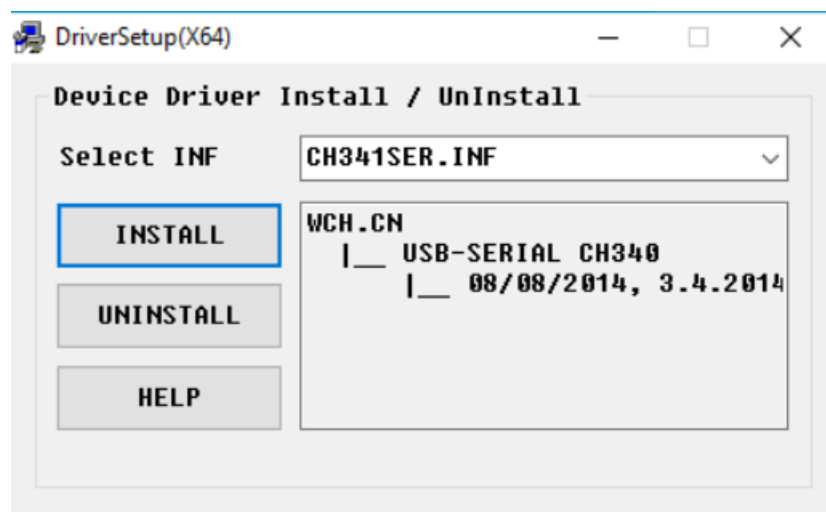
(Warm Reminder: If you wanna use a longer cable, it should be a standard Type-C data cable)

Step 2. Unzip the software and install the driver CH340


<https://drive.google.com/file/d/1I3hI9Thsj9aXfG6U-cQLpV9hC3bVEH2V/view?usp=sharing>

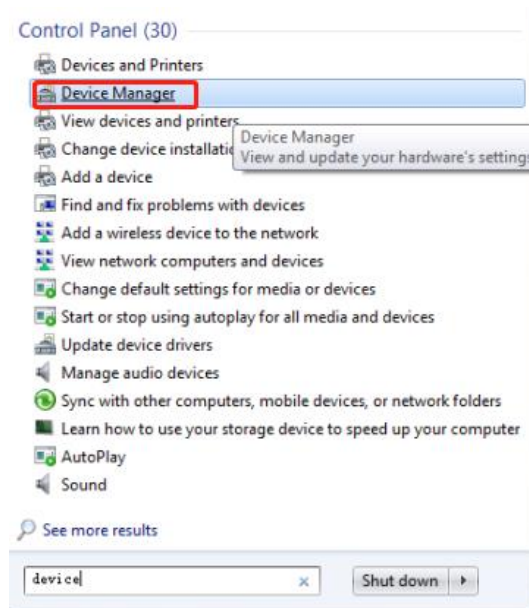
*How to Install and update the CH340 driver

Click the "Uninstall" button first. Then click on the "Install" button.



*How to verify your driver is working

1) To check that the CH340 enumerates to a COM port, you can open the device manager. You can click the **Start** or  (Windows) button and type "*device manager*" to quickly search for the application.



2) After opening the device manager, you will need to open the **Ports (COM & LPT)** tree. The CH340 should show up as **USB-SERIAL CH340 (COM#)**. Depending on your computer, the COM port may show up as a different number.



(Old version software instruction)

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 115200, data will be shown on the software.

3.1.2 USB-HID Connection

Step 1. Open the software, Minimu.exe



Step 2. Insert the USB-HID adapter into the USB slot of the computer (the blue light of HID adapter flashes)





Step 3. Install the driver CH340 and confirm the "com port" in device manager

<https://drive.google.com/file/d/1I3hI9Thsj9aXfG6U-cQLpV9hC3bVEH2V/view?usp=sharing>

*How to Install and update the CH340 driver

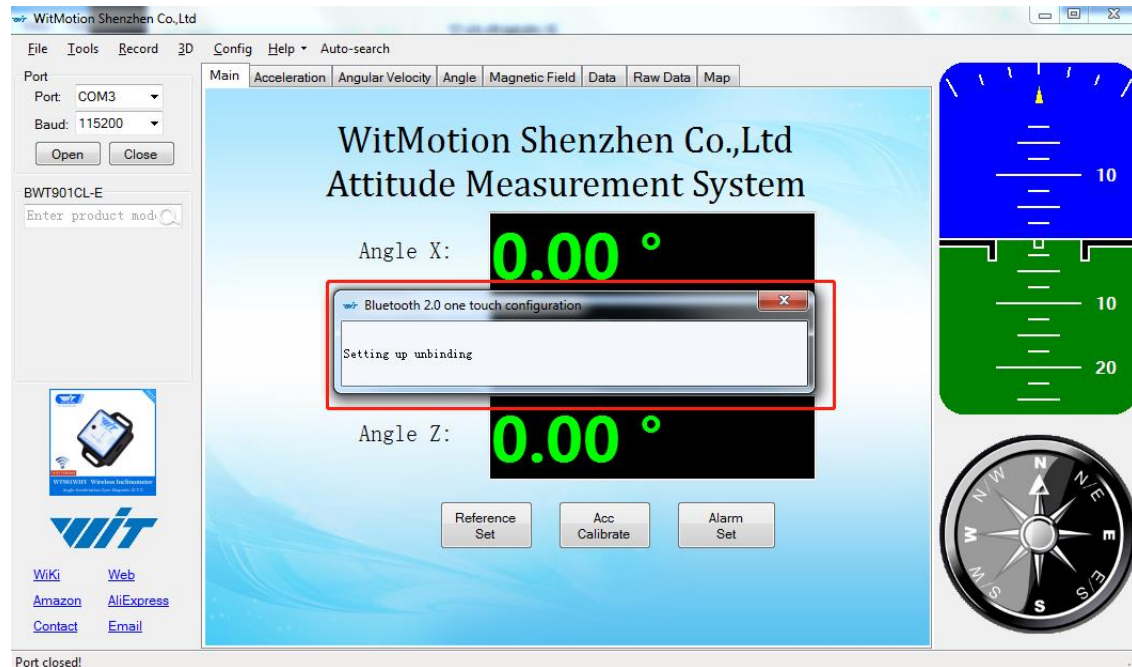
Please kindly refer to Chapter 2.1.1 Serial Connection, content of installing or updating CH340 driver

Step 3. Turn on the sensor and the blue light of the sensor flashes

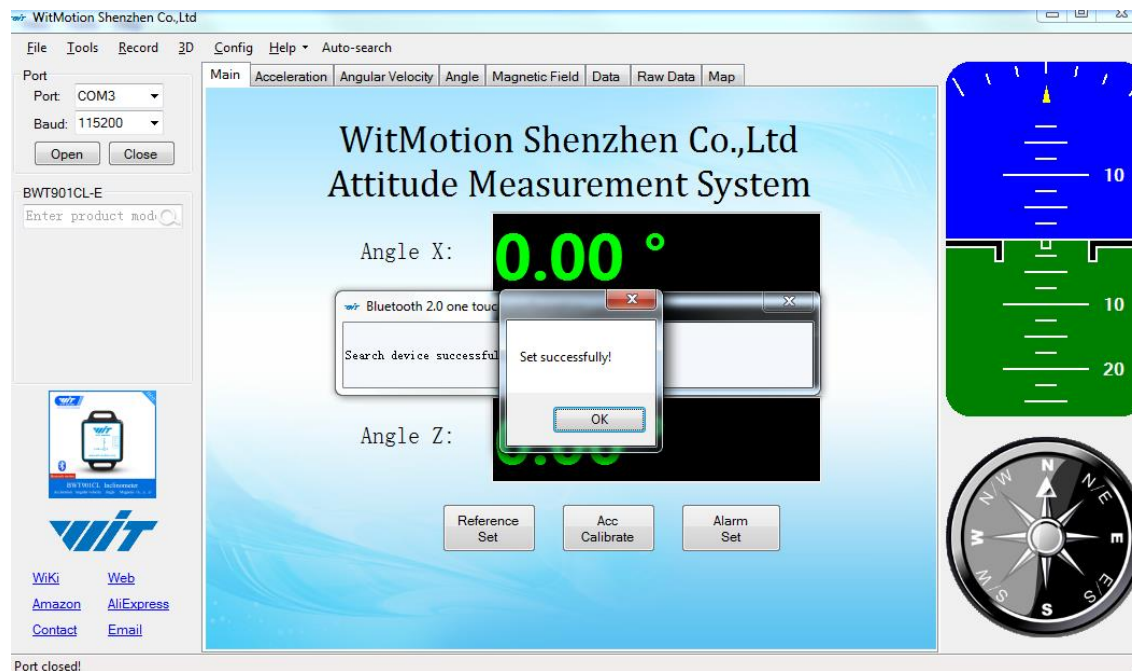
Step 4. Close the pop-up window



Step 5. the software will be set up unbinding automatically and search devices successfully (Bluetooth Pairing process)



Step 6. Set successfully, click "ok"



Step 7. Wait till the sensor's blue LED light remains on--means pairing succeeded



Step 8. Data will appear once the auto-search finishes

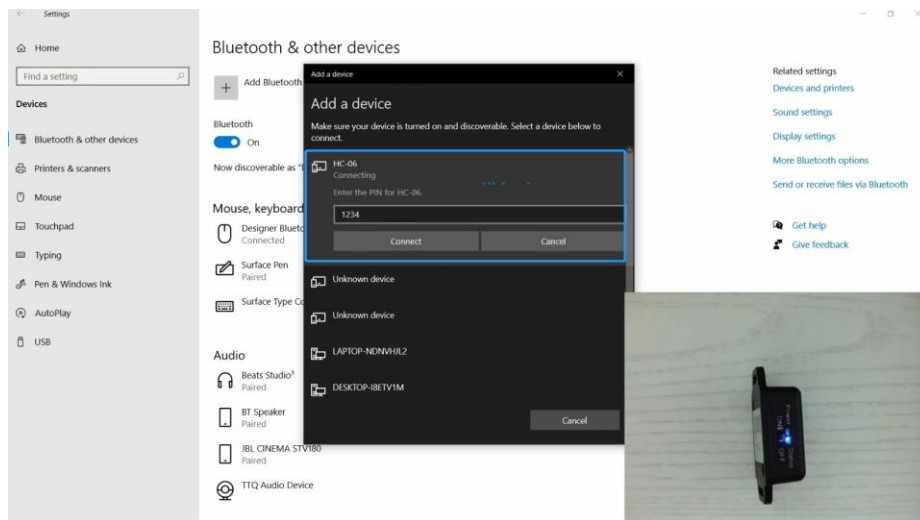


3.1.3 PC's Bluetooth Connection

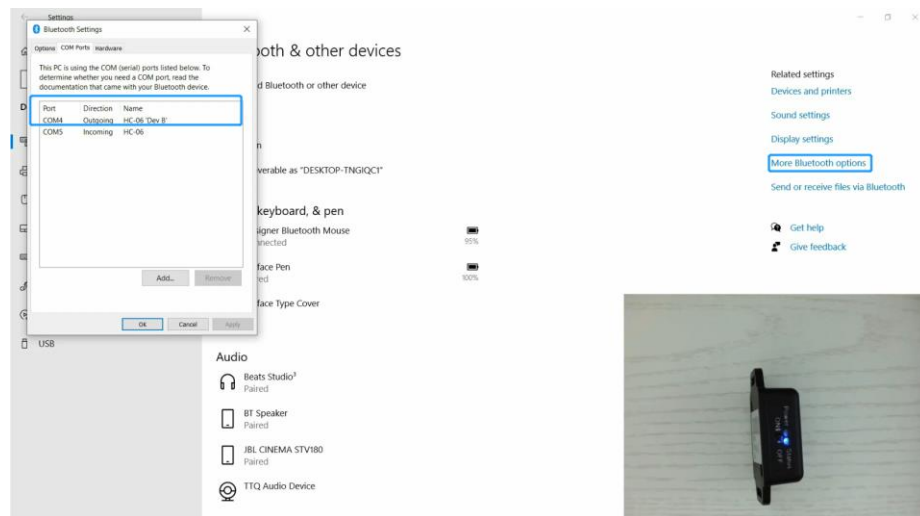
Step 1. Turn on the computer's Bluetooth

Step 2. Turn on the sensor

Step 3. Search HC-06 device and input pairing password, 1234



Step 4. Confirm the "outgoing com port" on "More Bluetooth Options" page



Step 5. Open software (Minimu.exe) and choose the correct com port

Step 6. Data will appear once the automatic search finishes.

3.2 Software Introduction

[Link to download software](#)

3.2.1 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 BWT901CL	
Open	Open com port	
Close	Close com port	

3.2.2 Menu of Configuration

Normal - Config ×

System

Algrithm:
 Install Direction:
 Instruction Startup

Calibrate

Gyro Auto Calibrate

Range

Acceleration:
 Gyro:
 Band Width:
 GPS Time Zone:

Communication

Baud Rate:
 Output Rate:
 Device Address:

Content

Time
 Acceleration
 Velocity
 Angle
 Magnetism
 Port

Pressure
 Location
 PDOP
 Quaternion
 Positioning Accuracy
 GPS Original

Port

D0 model: pulse width: cycle:

D1 model: pulse width: cycle:

D2 model: pulse width: cycle:

D3 model: pulse width: cycle:

Online

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:
 Instruction Startup

Menu of System	
Button	Function
Reset	Reset to factory setting
Sleep	Sleep function, not available for Bluetooth sensor series
Alarm	Alarm function, not available for Bluetooth sensor series
Algorithm	6-axis algorithm or 9-axis
Installation Direction	Vertical or horizontal installation
Instruction Start-up	Instructions sending to start-up the sensor

Calibrate

Gyro Auto Calibrate

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, WTGAHRS1, HWT901B)
Reset Z-axis Angle	Reset Z-axis angle to 0 degree, not available for BWT901CL in 9-axis algorithm
Angle Reference	Setting current angle as 0 degree
Gyro Auto Calibrate	Auto-calibration of gyroscope

Range

Acceleration:
 Gyro:
 Band Width:
 GPS Time Zone:

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: Output Rate: Device Address:

Menu of Communication	
Button	Function
Baud Rate	Baud rate selection, not available for Bluetooth sensor series
Output Rate	Return rate selection
Device Address	Not available for Bluetooth sensor series


Content


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


Menu of Content	
Button	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, not available for Bluetooth sensor series
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
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	Not available for Bluetooth sensor series
D1 Model	Not available for Bluetooth sensor series


D2 Model	Not available for Bluetooth sensor series
D3 Model	Not available for Bluetooth sensor series
Pulse width	Not available for Bluetooth sensor series
Cycle	Not available for Bluetooth sensor series

Port

D0 model: pulse width:  cycle:

D1 model: pulse width:  cycle:

D2 model: pulse width:  cycle:

D3 model: pulse width:  cycle:

3.3 Calibration

Preparation:

Make sure the sensor is "Online".

Calibration on PC software:

It is required to calibrate for the first time usage.

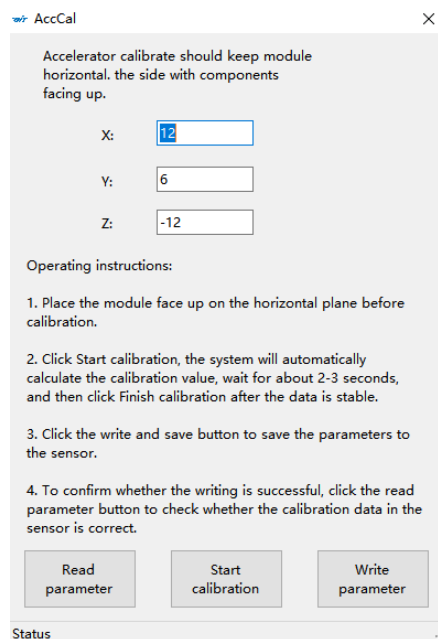
3.3.1 Accelerometer Calibration

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



AccCal

Accelerator calibrate should keep module horizontal, the side with components facing up.

X:

Y:

Z:

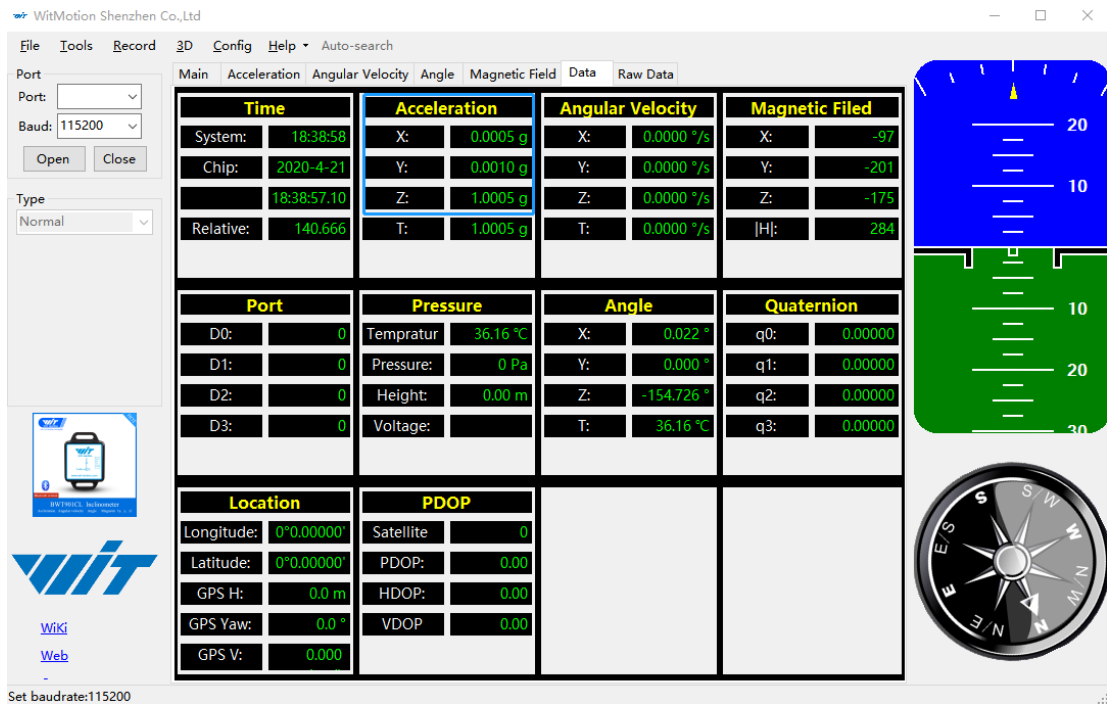
Operating instructions:

1. Place the module face up on the horizontal plane before calibration.
2. Click Start calibration, the system will automatically calculate the calibration value, wait for about 2-3 seconds, and then click Finish calibration after the data is stable.
3. Click the write and save button to save the parameters to the sensor.
4. To confirm whether the writing is successful, click the read parameter button to check whether the calibration data in the sensor is correct.

Status

Step 4. Click "Complete Calibration"

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



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File Tools Record 3D Config Help Auto-search

Port: []
Baud: 115200
Open Close

Type: Normal

Time		Acceleration		Angular Velocity		Magnetic Field	
System:	18:38:58	X:	0.0005 g	X:	0.0000 %/s	X:	-97
Chip:	2020-4-21	Y:	0.0010 g	Y:	0.0000 %/s	Y:	-201
	18:38:57.10	Z:	1.0005 g	Z:	0.0000 %/s	Z:	-175
Relative:	140.666	T:	1.0005 g	T:	0.0000 %/s	H :	284

Port		Pressure		Angle		Quaternion	
D0:	0	Tempratur	36.16 °C	X:	0.022 °	q0:	0.00000
D1:	0	Pressure:	0 Pa	Y:	0.000 °	q1:	0.00000
D2:	0	Height:	0.00 m	Z:	-154.726 °	q2:	0.00000
D3:	0	Voltage:		T:	36.16 °C	q3:	0.00000

Location		PDOP	
Longitude:	0°0.00000'	Satellite	0
Latitude:	0°0.00000'	PDOP:	0.00
GPS H:	0.0 m	HDOP:	0.00
GPS Yaw:	0.0 °	VDOP:	0.00
GPS V:	0.000		

Set baudrate:115200

1. 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.

3.3.2 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.

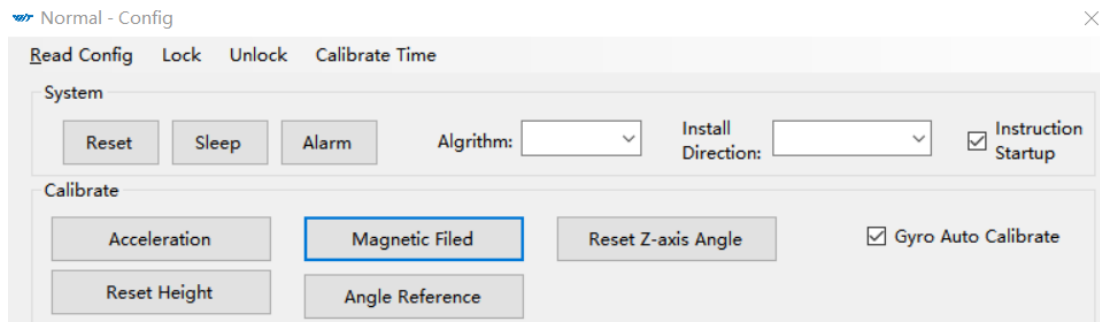
Preparation:

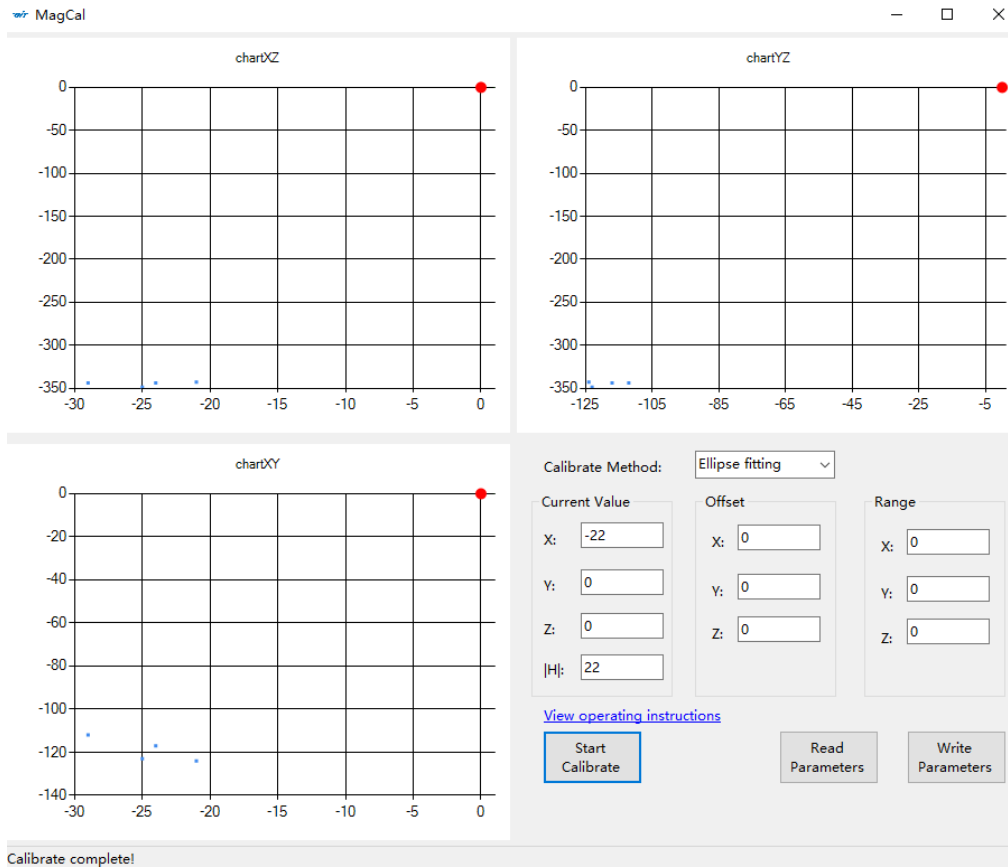
Sensors should be 20CM away from magnetic and iron and other materials

Methods:

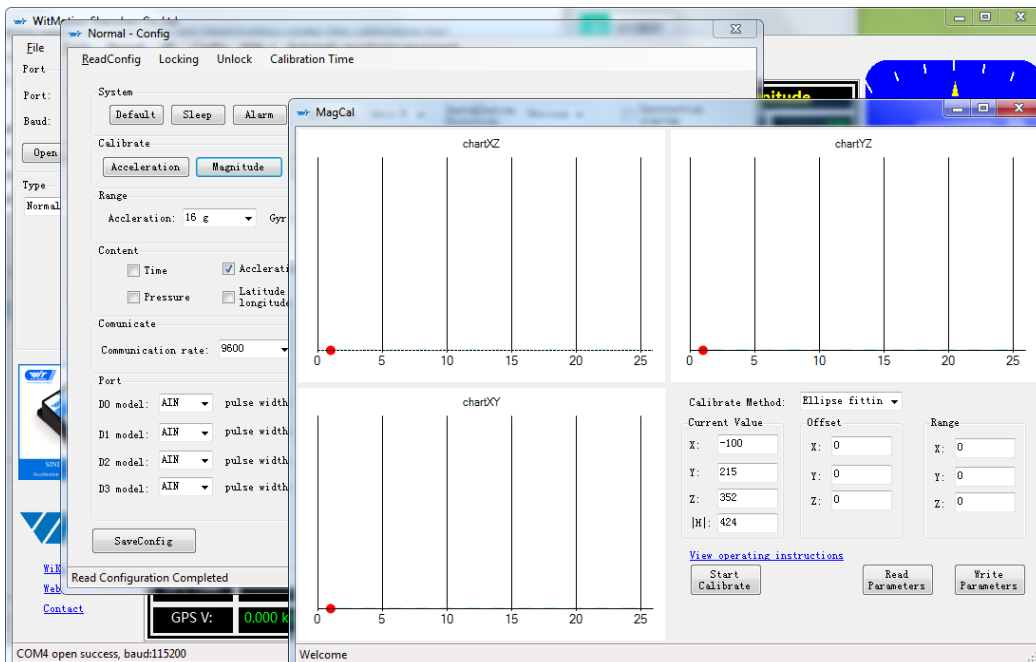
Step 1. Open the Config menu

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

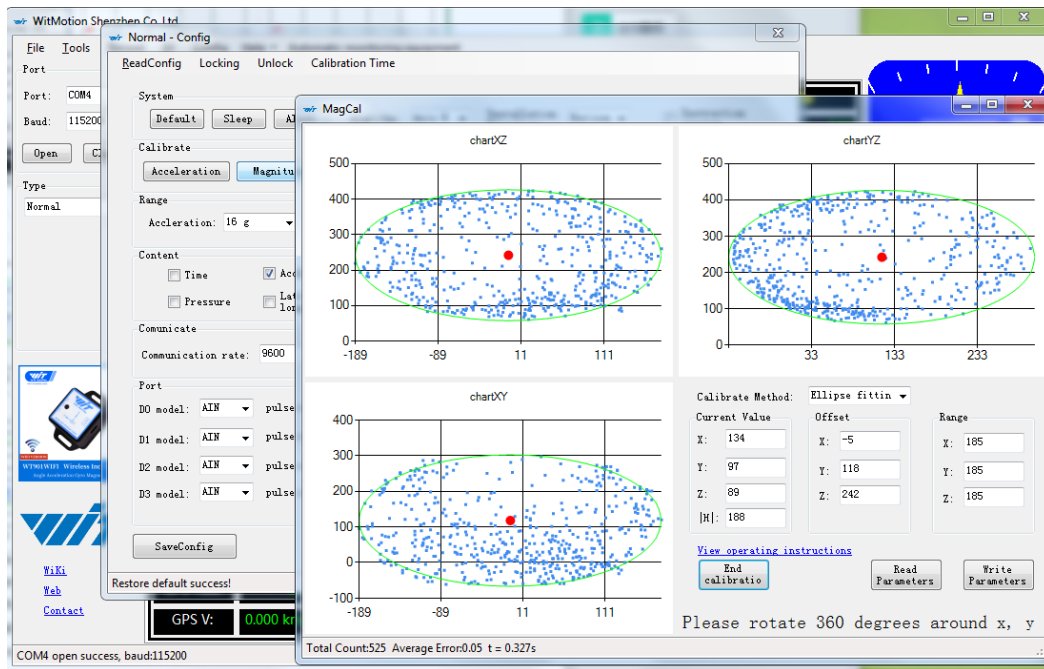




Step 3. Slowly rotate the module 360° around X, Y, Z, 3-axis accordingly



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.

3.3.3 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.

3.3.4 Reset Z-axis Angle

Note: If you want to avoid magnetic interference, you can change the algorithm to 6-axis, function of resetting Z-axis angle can be used.

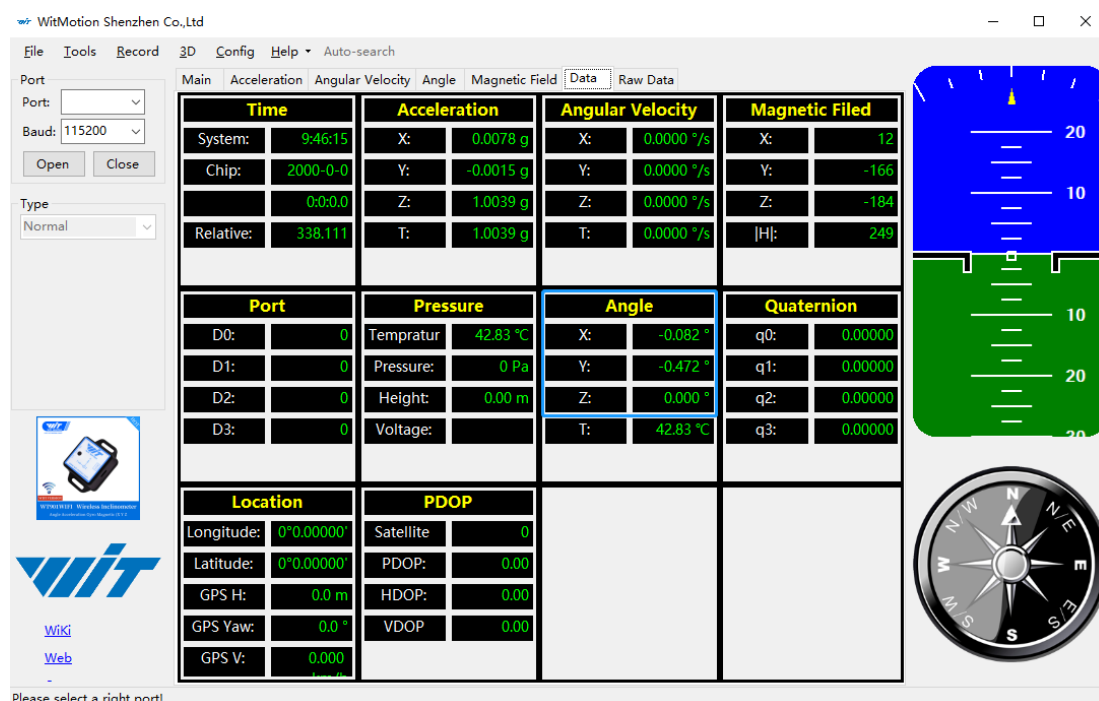
The z-axis angle is an absolute angle, and it takes the northeast sky as the coordinate system can not be relative to 0 degree.

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:

Step 1: Keep the module static.

Step 2: Open the "Config" and then click the "Reset Z-axis Angle" option, you will see the angle of the Z-axis backs to 0 degree in the "Data".



The screenshot shows the WitMotion software interface with the following data:

Time		Acceleration		Angular Velocity		Magnetic Filed	
System:	9:46:15	X:	0.0078 g	X:	0.0000 °/s	X:	12
Chip:	2000-0-0	Y:	-0.0015 g	Y:	0.0000 °/s	Y:	-166
	0:0:0.0	Z:	1.0039 g	Z:	0.0000 °/s	Z:	-184
Relative:	338.111	T:	1.0039 g	T:	0.0000 °/s	H :	249

Port		Pressure		Angle		Quaternion	
D0:	0	Tempratur	42.83 °C	X:	-0.082 °	q0:	0.00000
D1:	0	Pressure:	0 Pa	Y:	-0.472 °	q1:	0.00000
D2:	0	Height:	0.00 m	Z:	0.000 °	q2:	0.00000
D3:	0	Voltage:		T:	42.83 °C	q3:	0.00000

Location		PDOP	
Longitude:	0°0.00000'	Satellite	0
Latitude:	0°0.00000'	PDOP:	0.00
GPS H:	0.0 m	HDOP:	0.00
GPS Yaw:	0.0 °	VDOP:	0.00
GPS V:	0.000		

3.3.5 Reset Height to 0

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

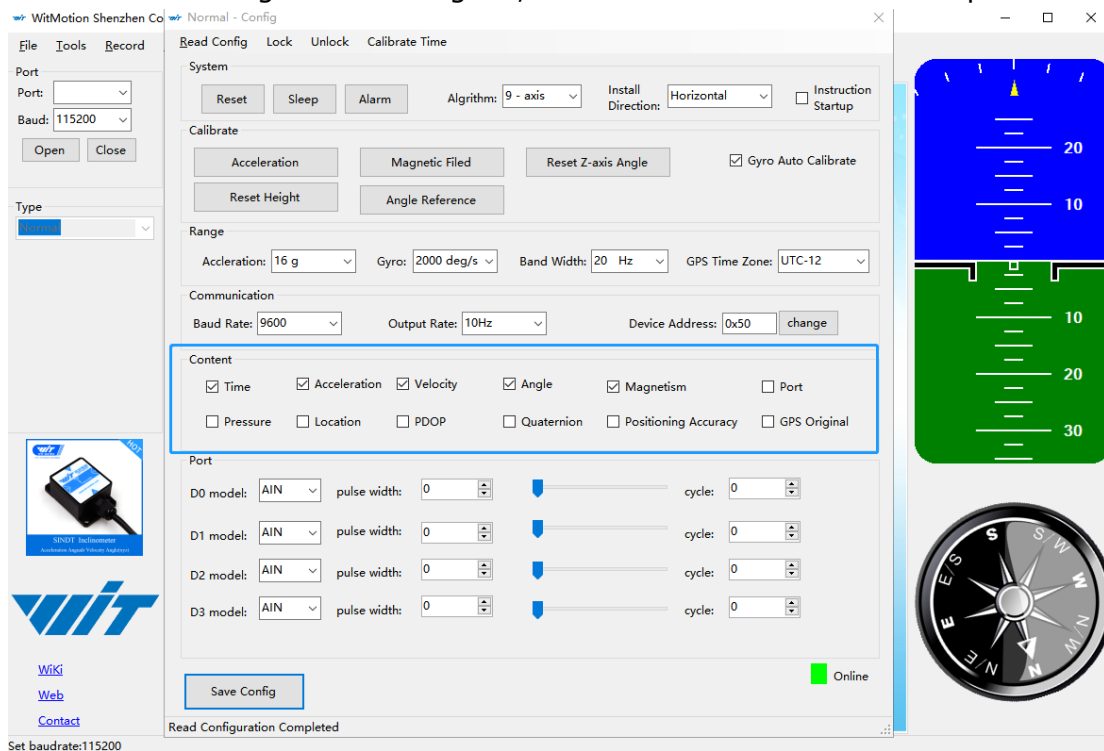
3.4 Configuration

3.4.1 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.

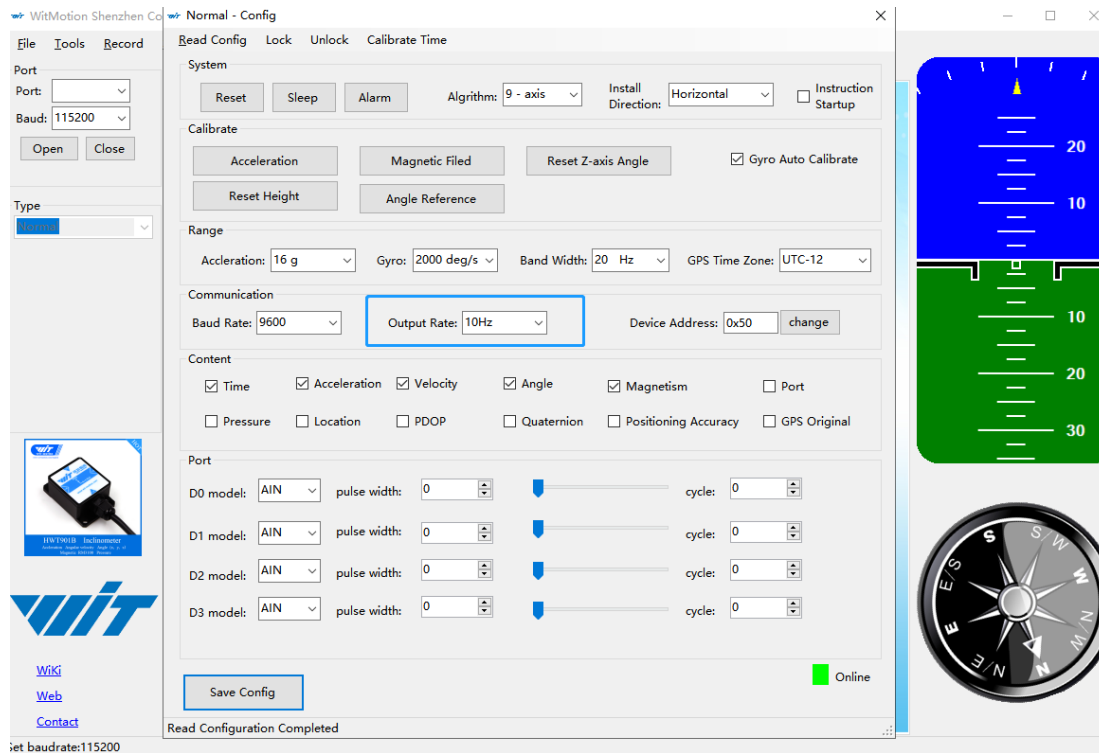
Taking BWT901CL as an example, the default output of the module is acceleration, angular velocity, angle, and magnetic field.

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



The screenshot shows the 'Normal - Config' window of the WitMotion software. The 'Content' section is highlighted with a blue box, indicating the selected data output options: Time, Acceleration, Velocity, Angle, Magnetism, Port, Pressure, Location, PDOP, Quaternion, Positioning Accuracy, and GPS Original. The 'Port' section shows four channels (D0, D1, D2, D3) all set to 'AIN' model. The 'System' section includes buttons for 'Reset', 'Sleep', and 'Alarm', and a dropdown for 'Algorithm' set to '9-axis'. The 'Communication' section shows 'Baud Rate' at 9600 and 'Output Rate' at 10Hz. On the right side, there are two vertical scale indicators (one blue, one green) and a compass rose.

3.4.2 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 33bytes in a 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 115200.

3.4.3 Baud Rate

Not available for Bluetooth sensor series.

3.4.4 Data Recording

Method are as follows:

Step 1: Click "Record" and "Begin"

Step 2: Click "Stop"

The screenshot shows the WitMotion software interface. A menu is open with 'Record', 'Begin', and 'Stop' options. The main display is a grid of sensor data:

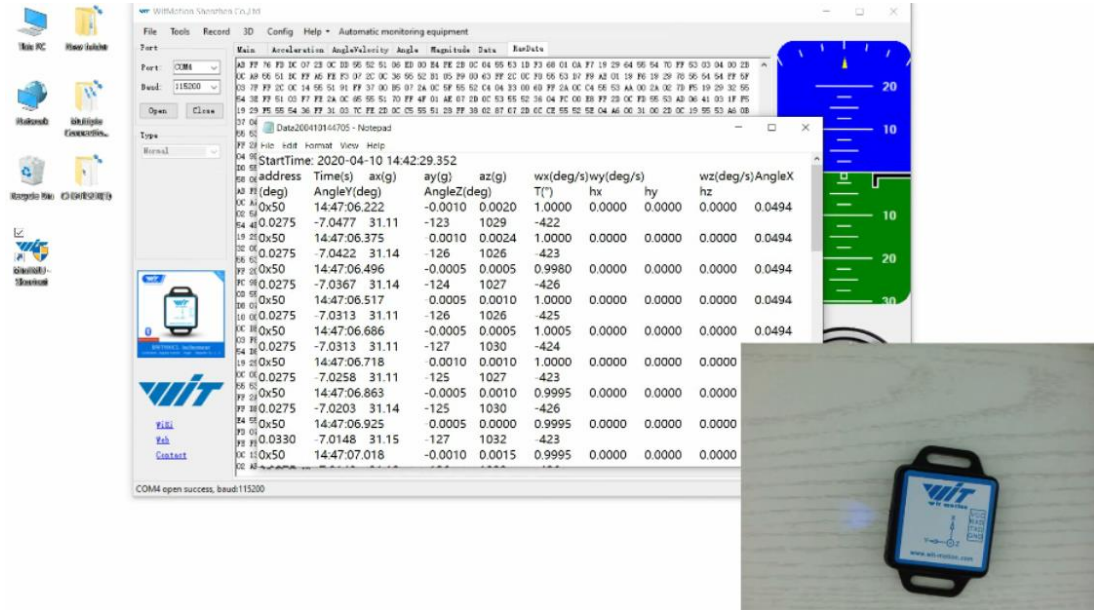
Time		Acceleration		Angular Velocity		Magnetic Filed	
System:	19:05:34	X:	-0.0029 g	X:	0.0000 °/s	X:	-84
Chip:	2020-4-21	Y:	0.0044 g	Y:	0.0000 °/s	Y:	-213
	19:5:33.290	Z:	1.0005 g	Z:	0.0000 °/s	Z:	-211
Relative:	1736.287	T:	1.0005 g	T:	0.0000 °/s	H :	311

Port		Pressure		Angle		Quaternion	
D0:	0	Temperature:	36.31 °C	X:	0.253 °	q0:	0.00000
D1:	0	Pressure:	0 Pa	Y:	0.170 °	q1:	0.00000
D2:	0	Height:	0.00 m	Z:	-157.731 °	q2:	0.00000
D3:	0	Voltage:		T:	36.31 °C	q3:	0.00000

Location		PDOP	
Longitude:	0°0.00000'	Satellite	0
Latitude:	0°0.00000'	PDOP:	0.00
GPS H:	0.0 m	HDOP:	0.00
GPS Yaw:	0.0 °	VDOP:	0.00
GPS V:	0.000 km/h		

On the right side, there are two vertical scale indicators (one blue, one green) and a compass rose.

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 a Excel file. In this way, all data will be shown in order.

StartTime: 2020-04-11 16:54:24.437															
address	Time(s)	ChipTimeax(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	-0.7711	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	-0.0059	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	145.3656	-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

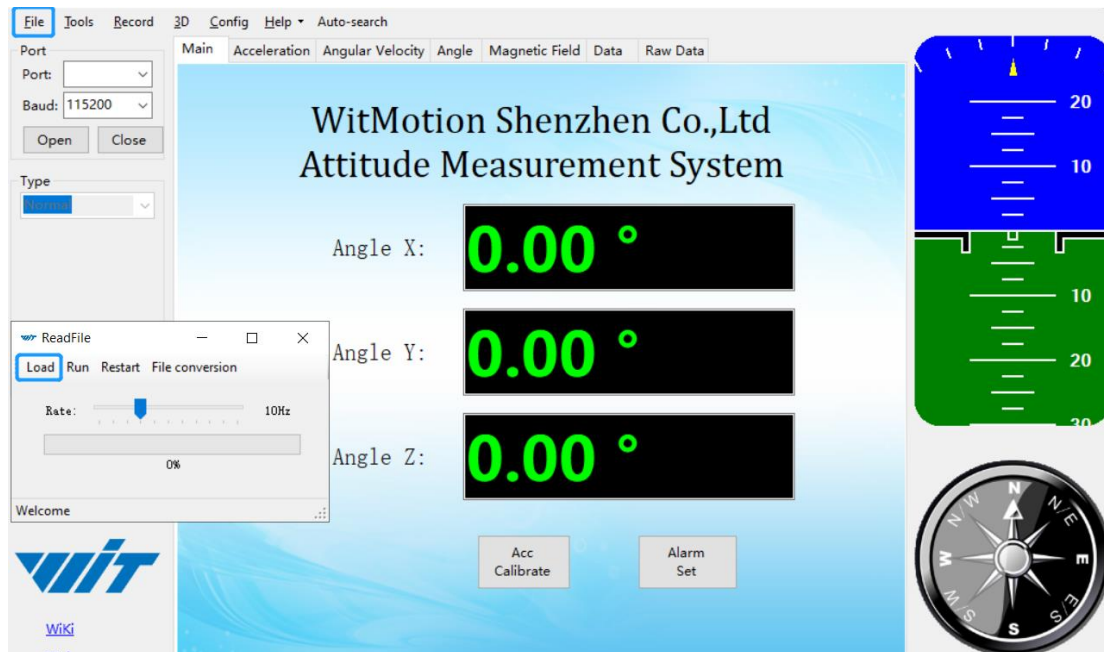
3.4.5 Data Playback

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.

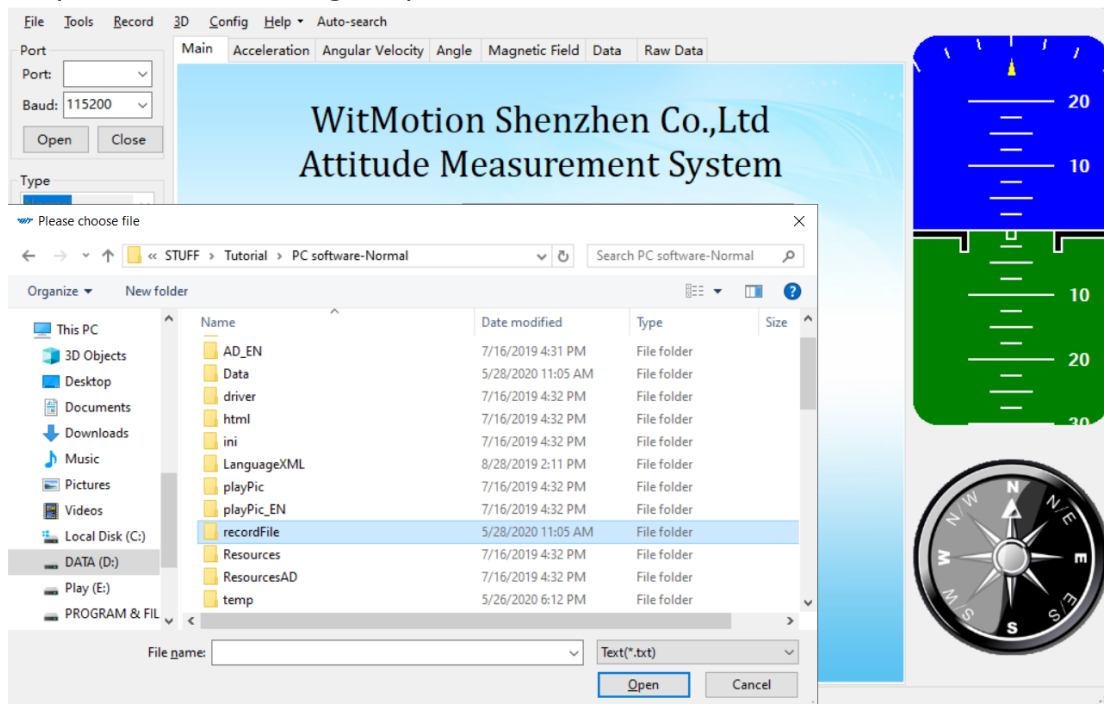
Recorded data playback method:

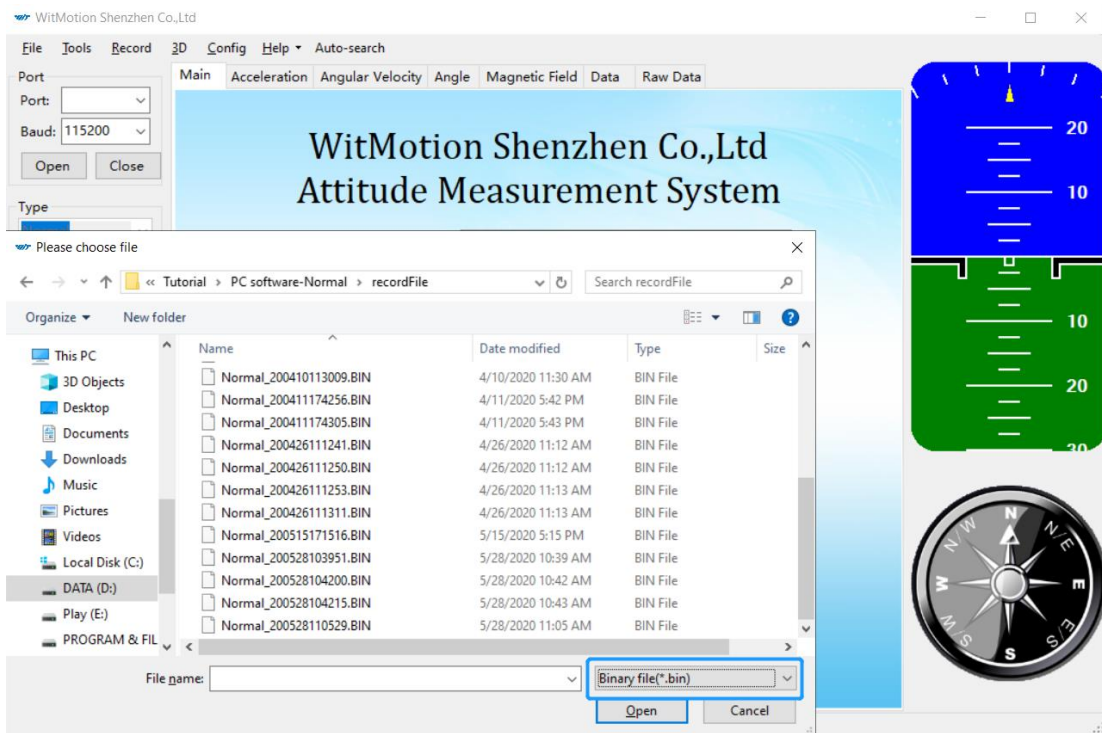
Step 1: Disconnect the sensor

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.



3.4.6 Standby and Wake Up

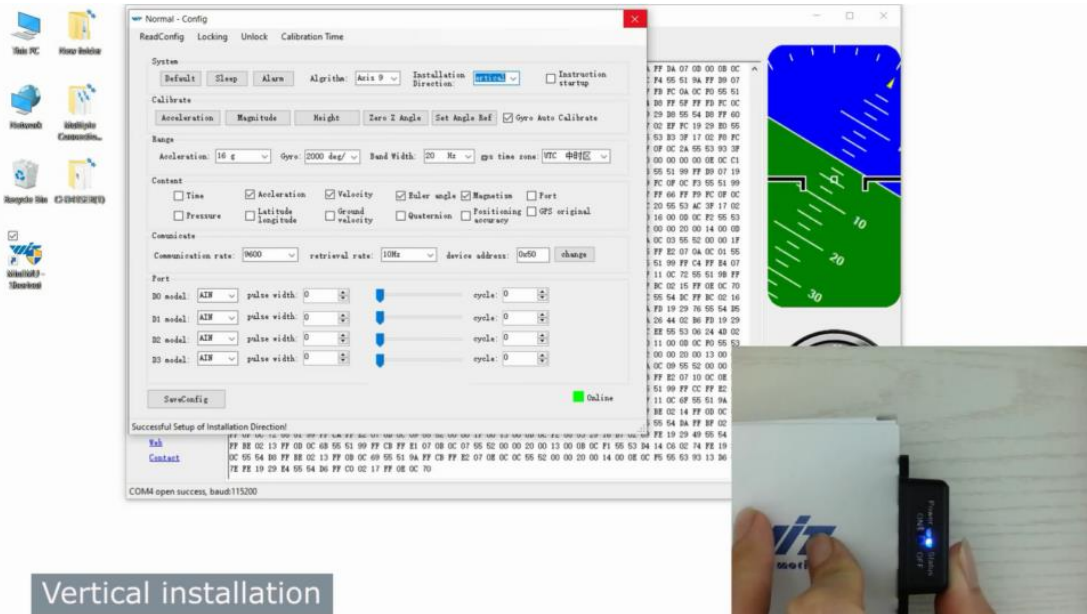
Not available for Bluetooth sensor series.

3.4.7 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.

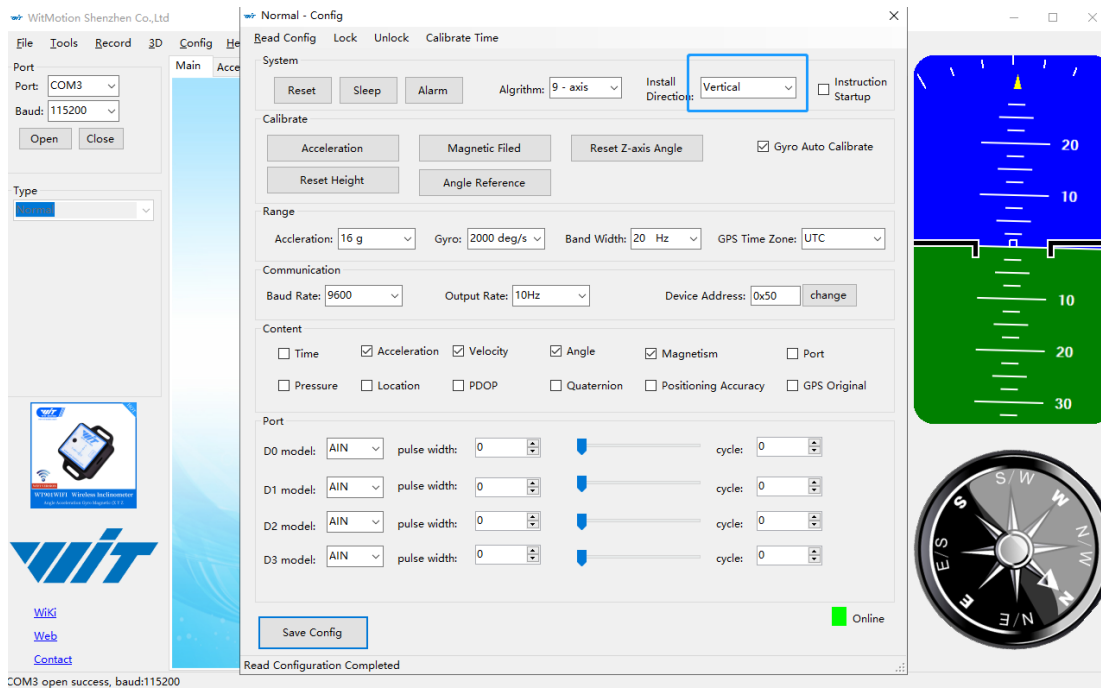
Step 1: Rotate the module 90 degrees around the X-axis

Step 2: Place the sensor 90 degrees vertically



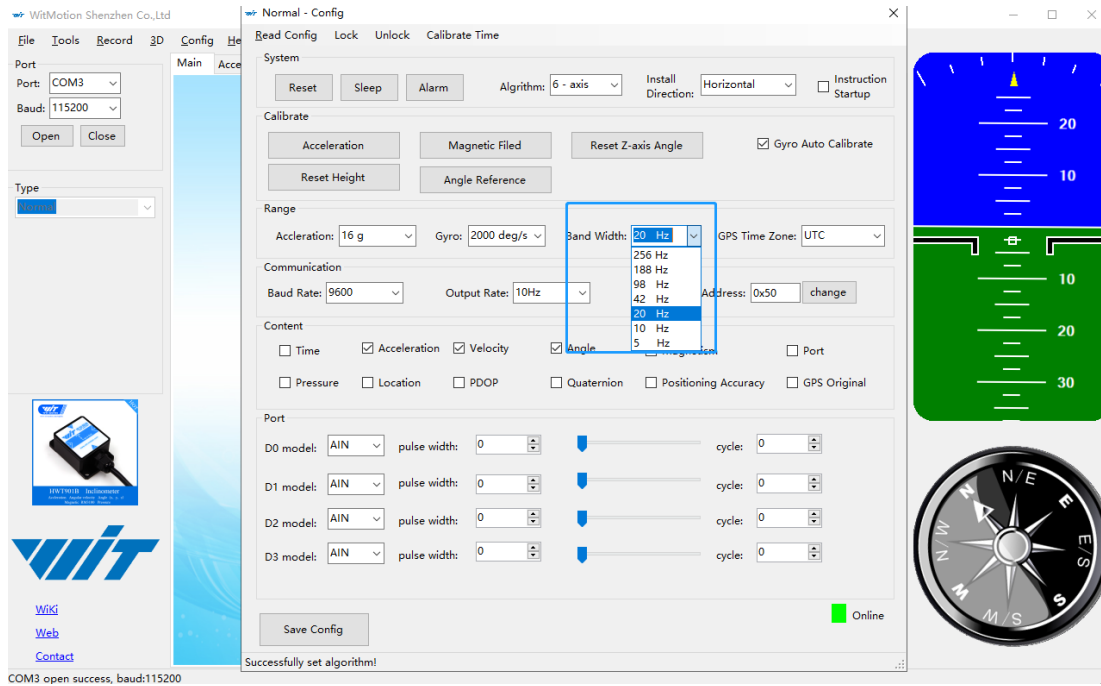
Vertical installation

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



3.4.8 Bandwidth

Default bandwidth is 20Hz.

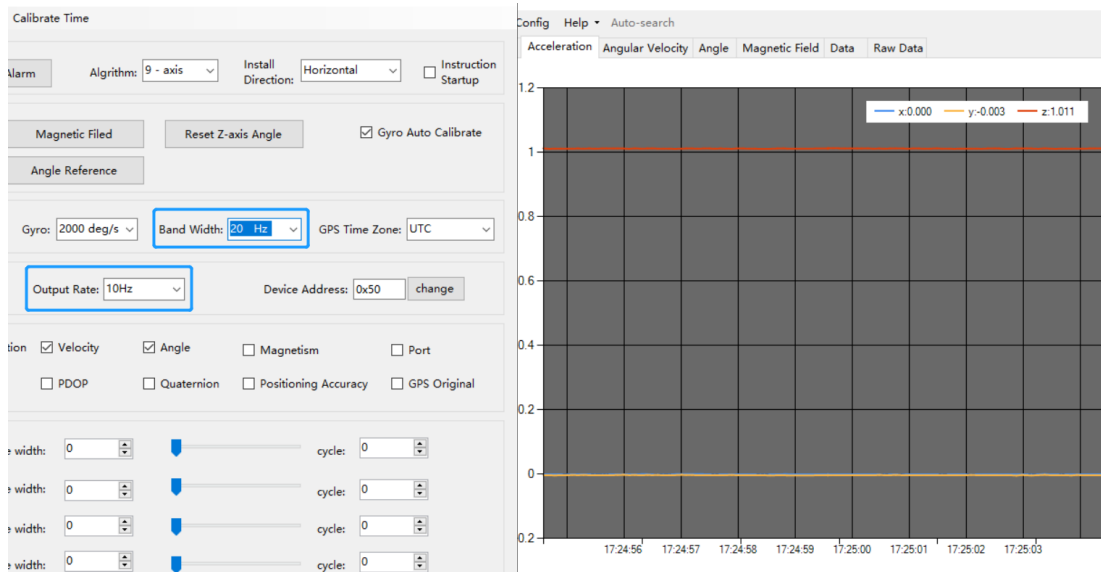


Function:

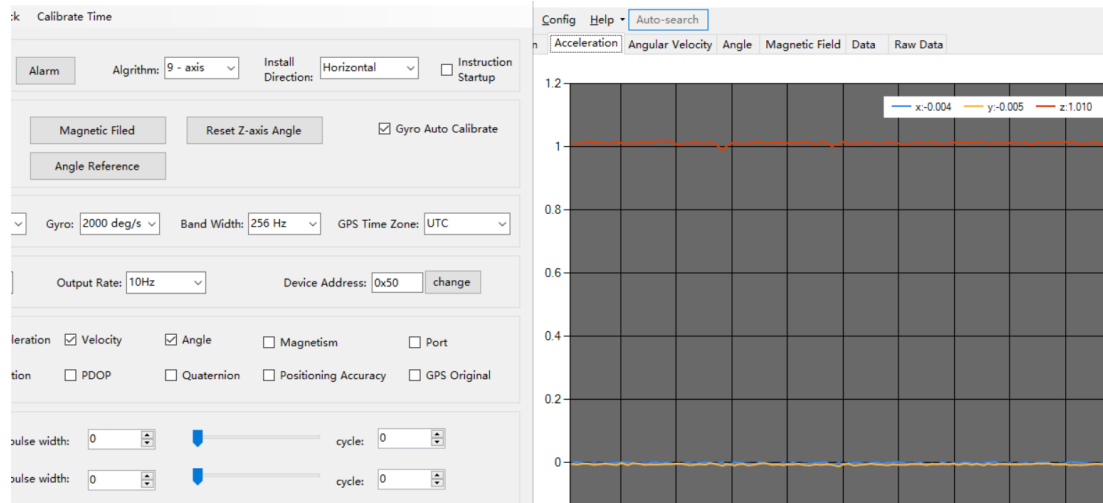
1. The higher rate of bandwidth setting will lead to the higher fluctuation in data waveform. Conversely, the lower rate of bandwidth, data will become more fluent.

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.

3.4.9 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.

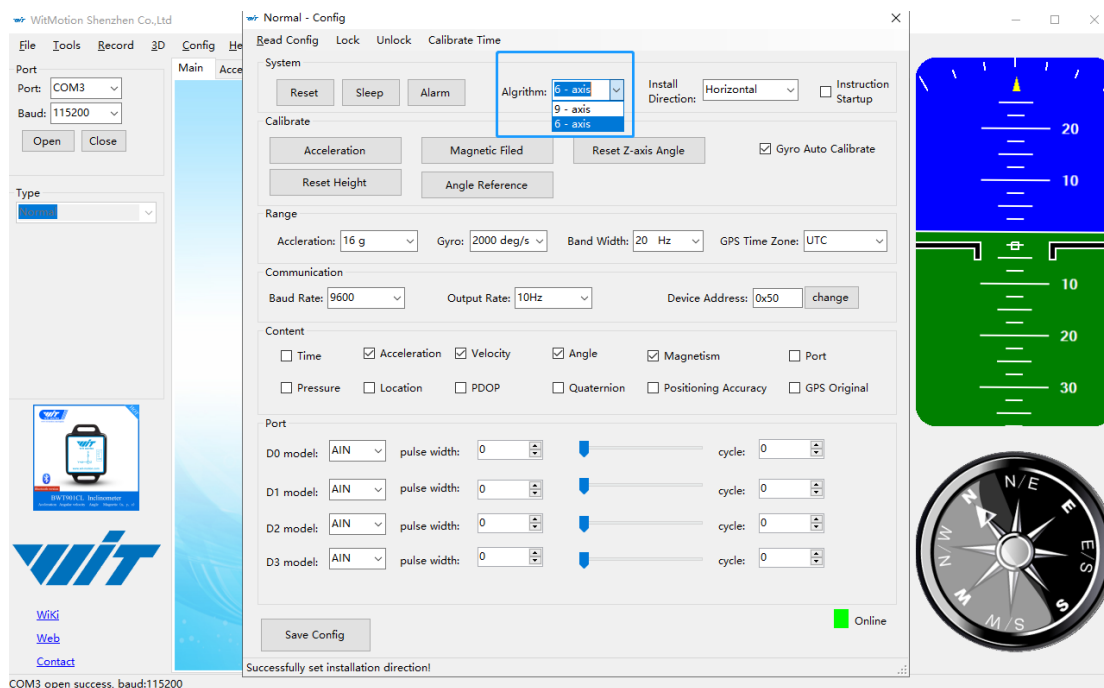
The default algorithm of BWT901CL is 9-axis. If there is magnetic field interference around installed environment, it is recommended to switch to 6-axis algorithm to detect the angle.

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.

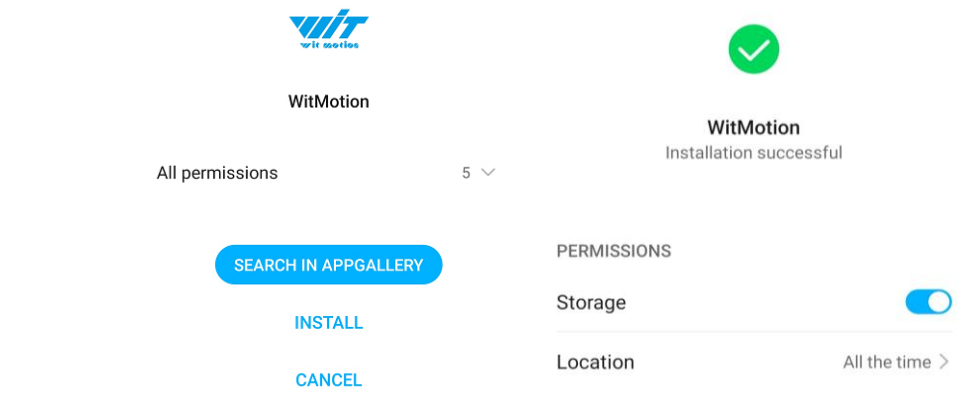


4 Use Instructions with Android Phone

For APP configuration introduction, please referring to the Chapter 2.2

4.1 APP Installation

Install the APK file, give permission of Location and Storage



[Link to download Android APP](#)

[WITMOTION 2023v New Android APP](#)

My Drive > WITMOTION Document Center > BWT901CL

Name	Owner	Last modified	File size
Instruction Videos (search Witmotion on Youtube)	me	Sep 22, 2021	—
Document (manual & datasheet)	me	Sep 22, 2021	—
WITMOTION Android APP.zip	me	Oct 10, 2021	6.3 MB
Standard Software for Windows PC.zip	me	Jun 6, 2020	26.4 MB
Sample Code.zip	me	May 9, 2020	27.6 MB
multiple USB-HID.zip	me	Mar 10, 2022	18.5 MB
Multi-connection Software(USB-HID adapter required)	me	Jan 18, 2022	26.4 MB
CH340& CP2102 Driver.zip	me	Jun 24, 2021	9.3 MB

About Android APP:

1. Note: Paired devices can be searched without turning on positioning. According to Google's requirements, if APP installed on a higher version of Android (6.0) mobile phone, pairing with a Bluetooth device, Location must be allowed when using Bluetooth at the same time.

2. It is recommended to use method shown in the Chapter 3.3.1

If Bluetooth device cannot be shown on search result, it is recommended to try

BWT901CL | manual V23-0211 | www.wit-motion.com

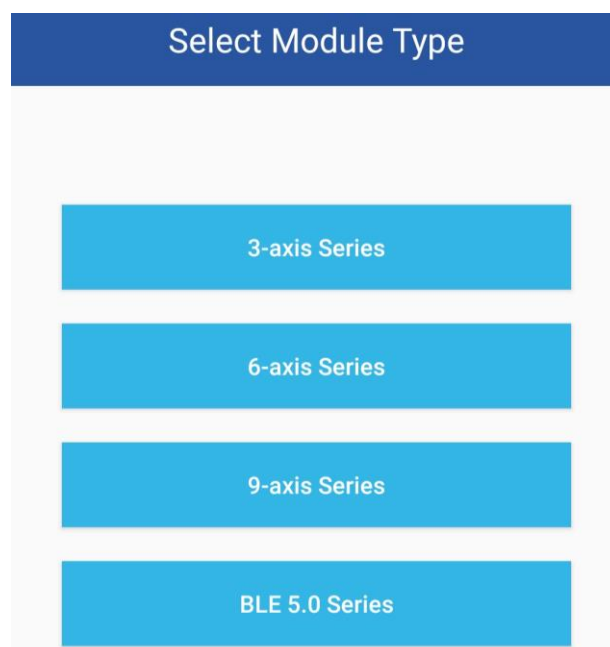
another method in the Chapter 3.3.2

4.2 Connection

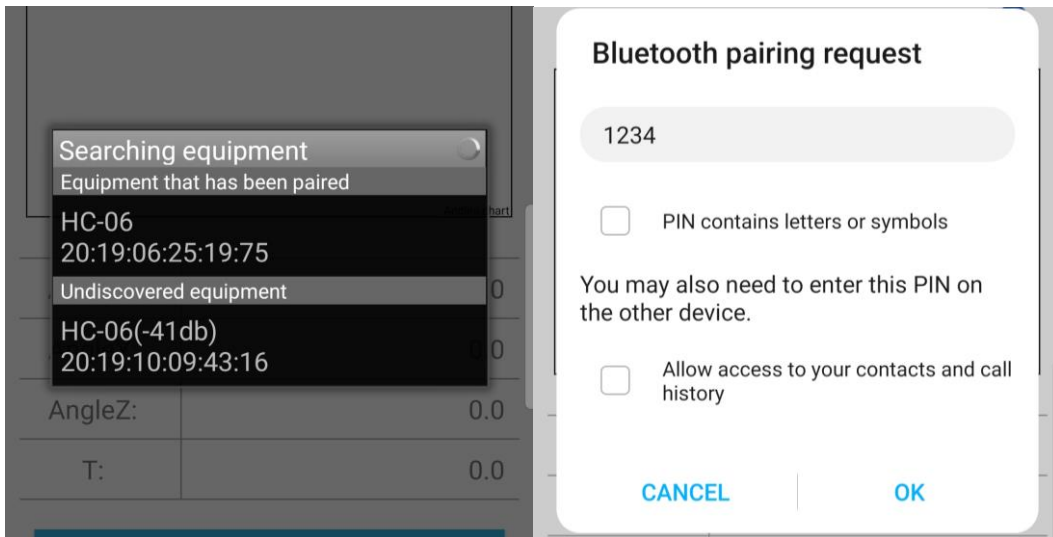
4.2.1 APP Pairing

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

Step 2. Open APP and choose "9-axis Series"



Step 3. Turn on the sensor and search "HC-06", input password "1234".



Step 4. When pairing is done, the blue LED light of sensor will remain still. After a few seconds, the data will show automatically.



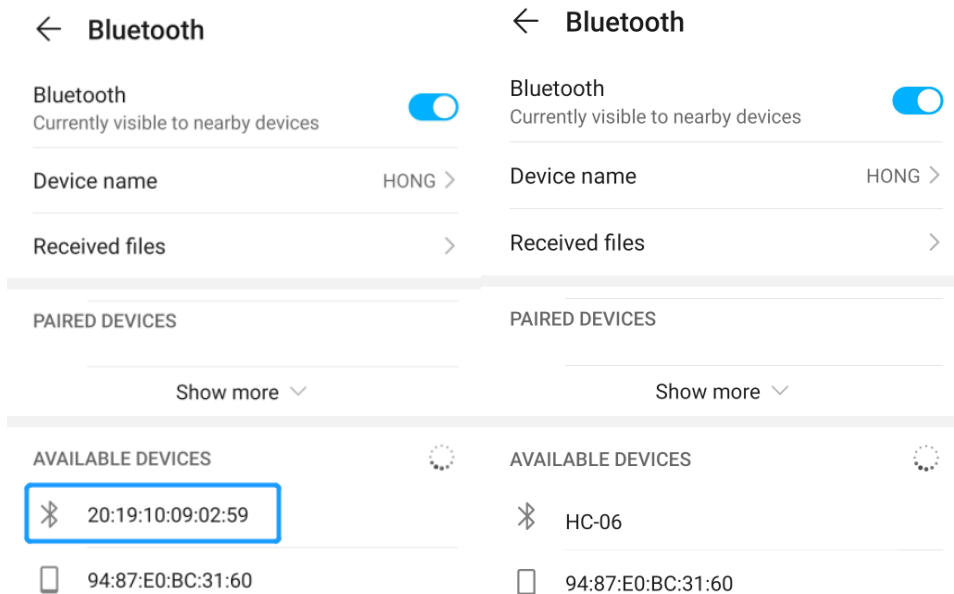
4.2.2 Phone's Bluetooth Pairing

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

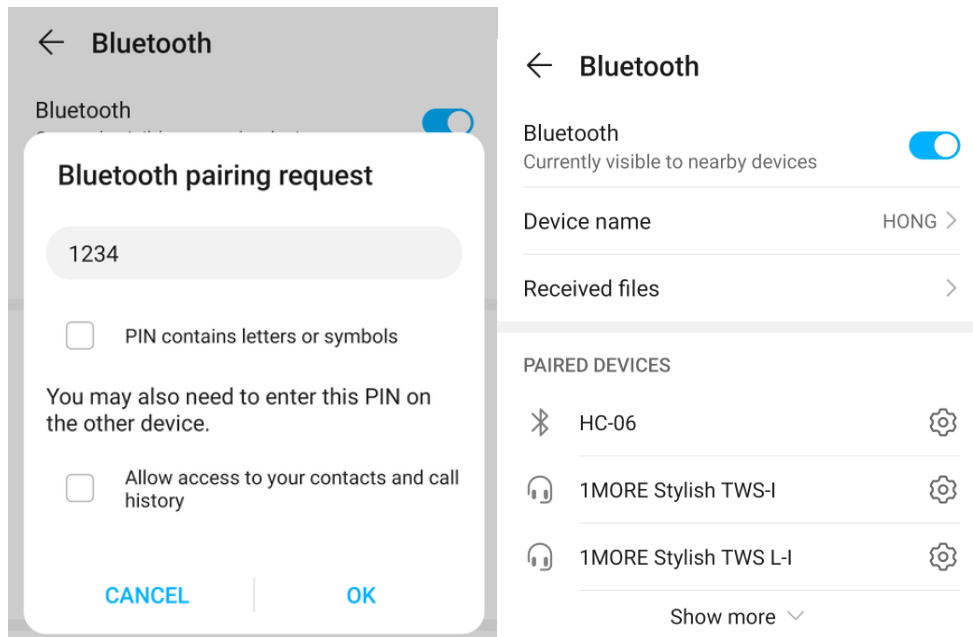
Step 2. Turn on the Bluetooth in the setting menu of smartphone

Step 3. Search the Bluetooth sensor

(First pairing the device will be recognize as mac address and will be shown as HC-06 after successful pairing.)



Step 4. Click the "MAC address" device and input the password "1234"



Step 5. Open the WITMOTION APP, and choose "9-axis Series"

Step 6. Click "Scan" and select the paired Bluetooth device "HC-06"
(No need to input password)

Step 7. The Blue LED light of sensor will keep on. Connection with APP is successful.



4.3 Calibration

[BWT901CL Playlist](#)

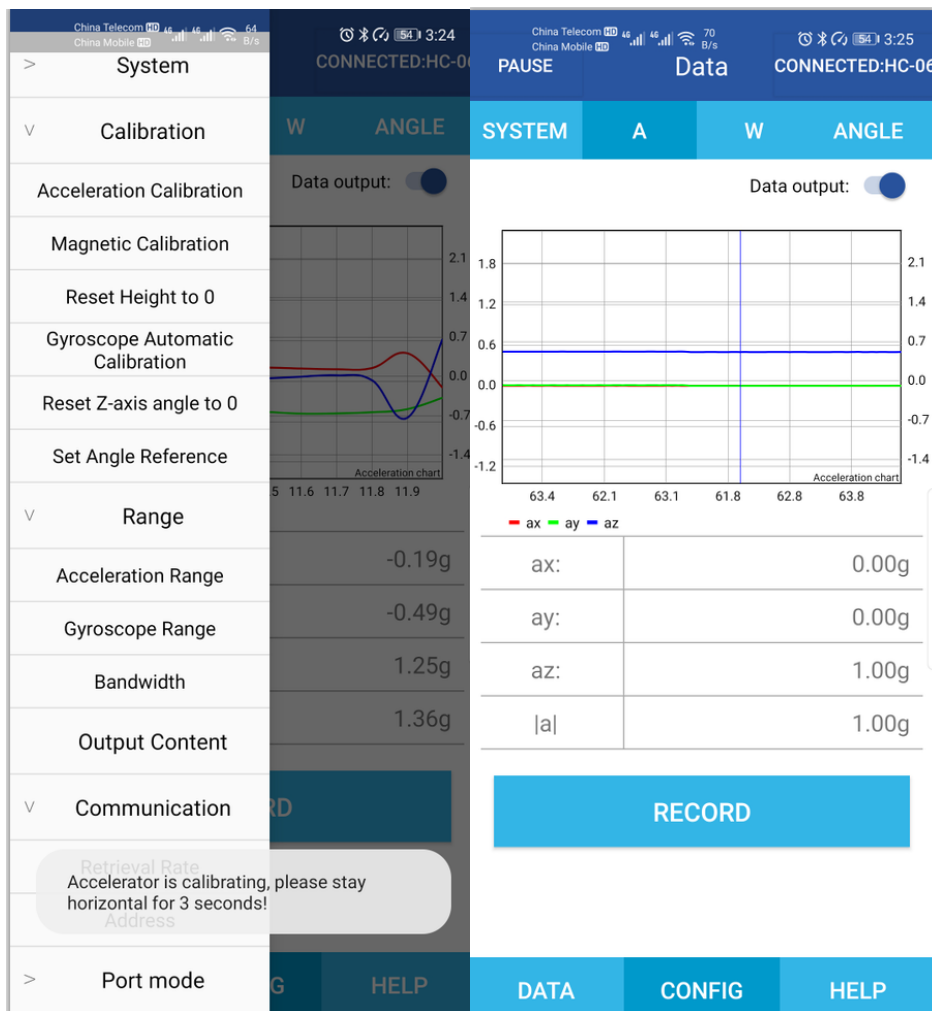
4.3.1 Acceleration Calibration

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



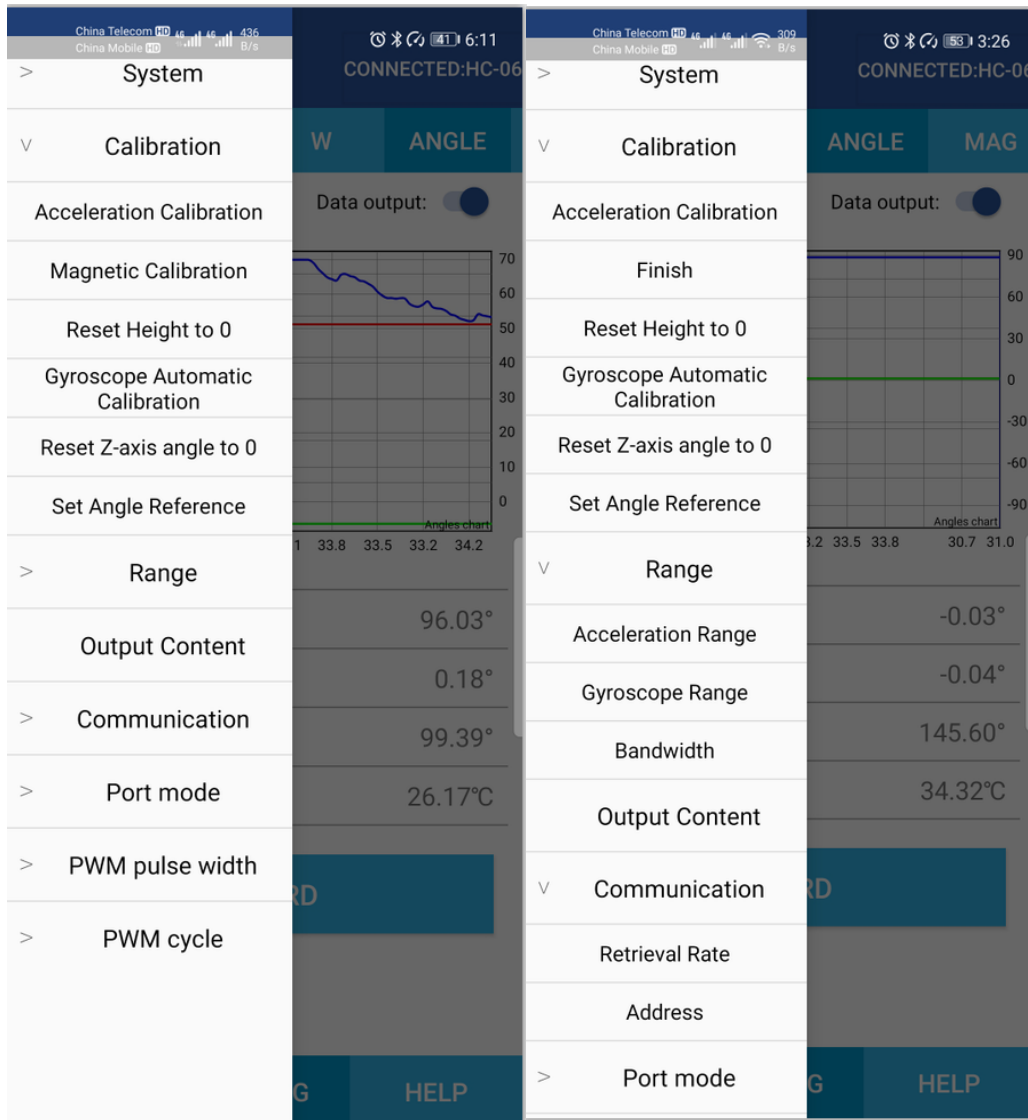
4.3.2 Magnetic field calibration

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 "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.

5 Multiple Connection

For software introduction, please referring to the Chapter 2.2.

5.1 Download Link

For multi-connection, please download the multi-connection HID software.

[Download link](#)

5.2 Connection Instructions

[DEMO Link](#)

Instructions:

Step 1. Open the multiple-connection PC software

Step 2: Plugin the USB-HID adapter in the beginning

Step 3. Turn on the sensor after the red light of USB-HID adapter begins flashing

Step 4. Wait till sensor's blue LED light keeps on--means pairing succeeds

Step 5. For multiple-connection, repeat Step 2-4

Step 6. Click the HID device accordingly and the data will show

Notice:

1. The multiple connection will require the USB-HID 2.0 adapter (need to install CH340 driver)
2. Each BWT901CL Bluetooth 2.0 sensor can only pair with 1 USB-HID adapter.