

# USER MANUAL

**WT9011DCL**

**Bluetooth 5.0 Inclinator Sensor**



## Tutorial Link

[Google Drive](#)

**Link to instructions DEMO:**

[WITMOTION Youtube Channel](#)

[WT9011DCL 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

- Unmanned/Assisted Driving
- Large-scale farming automated farming
- Safety monitoring for working at heights
- Unmanned aerial vehicle
- Industrial attitude monitoring
- Human motion tracking/capture
- Robot, Automated Guided Transporter
- Pedestrian Navigation
- Truck-mounted Satellite Antenna Equipment

## Contents

Tutorial Link .....	- 2 -
Contact .....	- 2 -
Application .....	- 2 -
Contents .....	- 3 -
1 Introduction .....	- 5 -
1.1 Warning Statement .....	- 6 -
1.2 LED Status .....	- 7 -
2 Use Instructions with Android Phone .....	- 8 -
2.1 APP Installation .....	- 8 -
2.2 Connection .....	- 9 -
2.3 Calibration .....	- 12 -
2.3.1 Acceleration Calibration .....	- 12 -
2.3.2 Magnetic Field Calibration .....	- 13 -
2.4 Multi-connection .....	- 14 -
3 Use Instructions with iPhone .....	- 15 -
3.1 How to install .....	- 15 -
3.2 How to setup .....	- 16 -
3.3 How to configure .....	- 17 -
3.3.1 Rename .....	- 18 -
3.4 Data Recording .....	- 19 -
4 Use Instructions with PC .....	- 22 -
4.1 PC Connection .....	- 22 -
4.1.1 Serial Connection .....	- 22 -
4.1.2 BLE 5.0 Adapter Connection .....	- 25 -
4.2 Software Introduction .....	- 26 -
4.2.1 Main Menu .....	- 26 -

4.2.2	Menu of Configuration .....	27 -
4.3	Calibration .....	29 -
4.3.1	Accelerometer Calibration .....	29 -
4.3.2	Magnetic Field Calibration .....	31 -
4.3.3	Gyroscope Automatic Calibration .....	33 -
4.3.4	Reset Z-axis Angle .....	33 -
4.3.5	Reset Height to 0 .....	33 -
4.4	Configuration .....	34 -
4.4.1	Data Recording .....	34 -
4.4.2	Data Playback .....	36 -
4.4.3	Placement Direction .....	38 -
4.4.4	Bandwidth .....	39 -
4.4.5	6-axis/ 9-axis Algorithm .....	41 -
5	Instructions of 2023 New Software .....	42 -
6	Multiple-Connection Instructions .....	43 -
6.1	Connection Instructions .....	44 -
6.1	Software Setting .....	46 -
6.1.1	Data Configuration .....	46 -
6.1.2	Calibrate .....	48 -
6.1.3	Device name Edition .....	49 -
6.1.4	Curve Display .....	50 -
6.1.5	Data Recording .....	51 -

## 1 Introduction

The WT9011DCL-BLE5.0 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. Configuration using the device enables the customer to address a broad variety of use cases by interpreting the sensor data by smart algorithms.

WT9011DCL-BLE5.0'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 the three-axis angle accurately.

It is employed where the highest measurement accuracy is required.

WT9011DCL 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.
- Working temperature environment range: -20 °C -60 °C , storage temperature environment range: -40°C-85°C
- Working and storage humidity environment range: 10%-90%
- Radiation warning

Any Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user

is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment.

## 1.2 LED Status

LED	Status	Remark
Red	Keeping on	Charging (powered by offered Type-C wire)
Green	Always on	Standby
	Flashing once every two seconds	Pairing succeeds
No light	Power off	short press of 1 sec to turn on (as it is in the original design), long press of 5 seconds to turn off. Besides the connection state, during the other time the sensor remains in standby and broadcast mode.

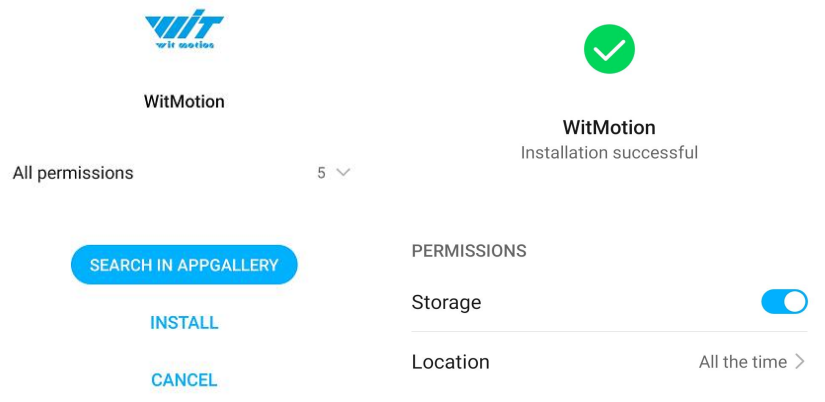
## 2 Use Instructions with Android Phone

For APP configuration introduction, please referring to the link.

[https://drive.google.com/file/d/122Es4QPLi5R-O4TjN43FMFRcaNK9eSY8/view?usp=share\\_link](https://drive.google.com/file/d/122Es4QPLi5R-O4TjN43FMFRcaNK9eSY8/view?usp=share_link)

### 2.1 APP Installation

Install the APK file, give permission of Location and Storage



[WITMOTION 2023v New Android APP](#)

Link to check the tutorial video.

[https://youtube.com/playlist?list=PL43tdDrVL\\_VBMU2CrEZfC0MxA0aRz-EY1](https://youtube.com/playlist?list=PL43tdDrVL_VBMU2CrEZfC0MxA0aRz-EY1)

My Drive > WITMOTION Document Center > Software, APP, Protocol,...				
Name	Owner	Last modified	File size	
WITMOTION PROTOCOL	me	Dec 22, 2022 me	—	
Software	me	Apr 19, 2023 me	—	
Sample Codes (SDK)	me	Apr 19, 2023 me	—	
Android APP(for WT901BLECL,WT901DCL,BWT6ICL,BWT90ICL only)	me	Apr 20, 2023 me	—	

#### About Android APP:

1. It is required to allow for application positioning (Always allowed), and turn on the positioning function and Bluetooth.

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

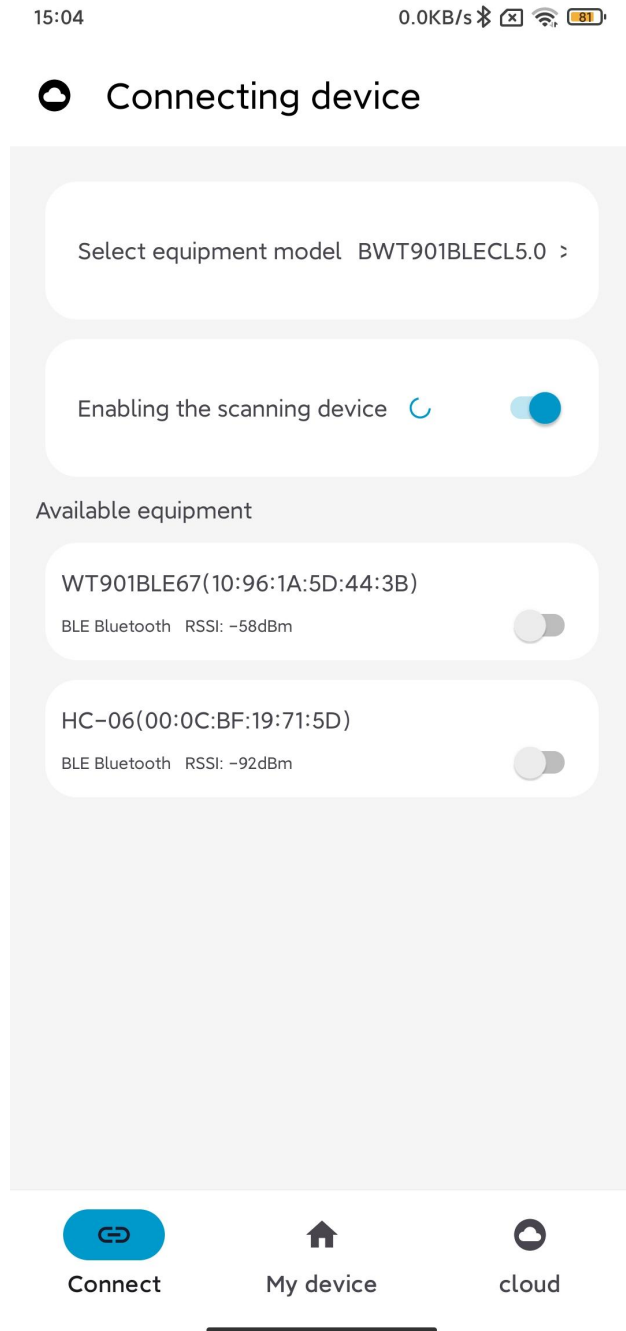
2. After turning on Bluetooth, it takes about one minute to search for authorization to find Bluetooth.



## 2.2 Connection

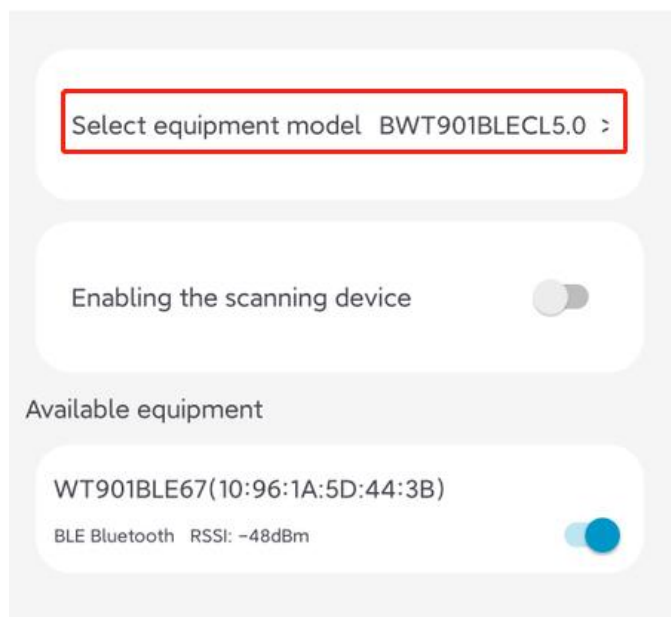
Step 1. Install the APK file, give permission of Location and Storage

Step 2. Open APP and click "Connect"

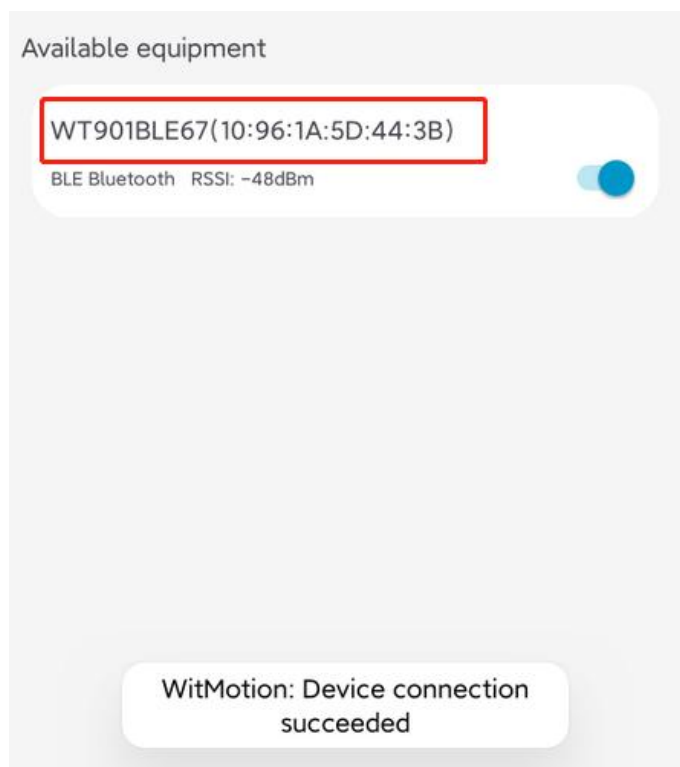


Step 3: Turn on the sensor, select “BWT901BLCL5.0” or “WT901BLECL” and then scan the device

### Connecting device

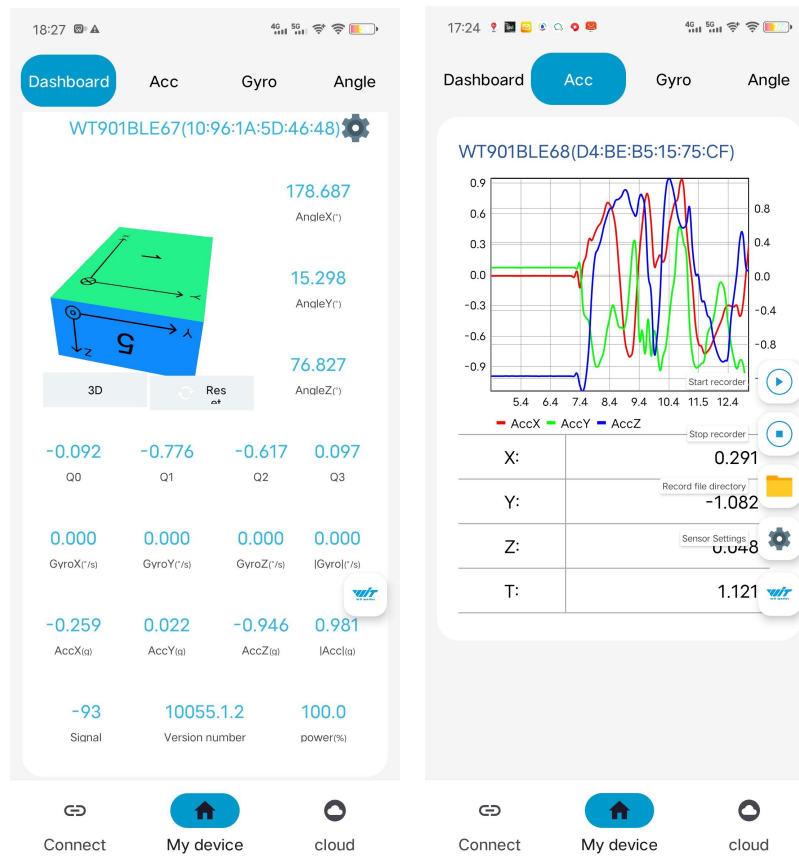


Note: The device will show as “WT901BLE”+“MAC address”



Step 4. When pairing is done, the blue LED light of the sensor will flash and keep about one second

After a few seconds, the data will show automatically



## 2.3 Calibration

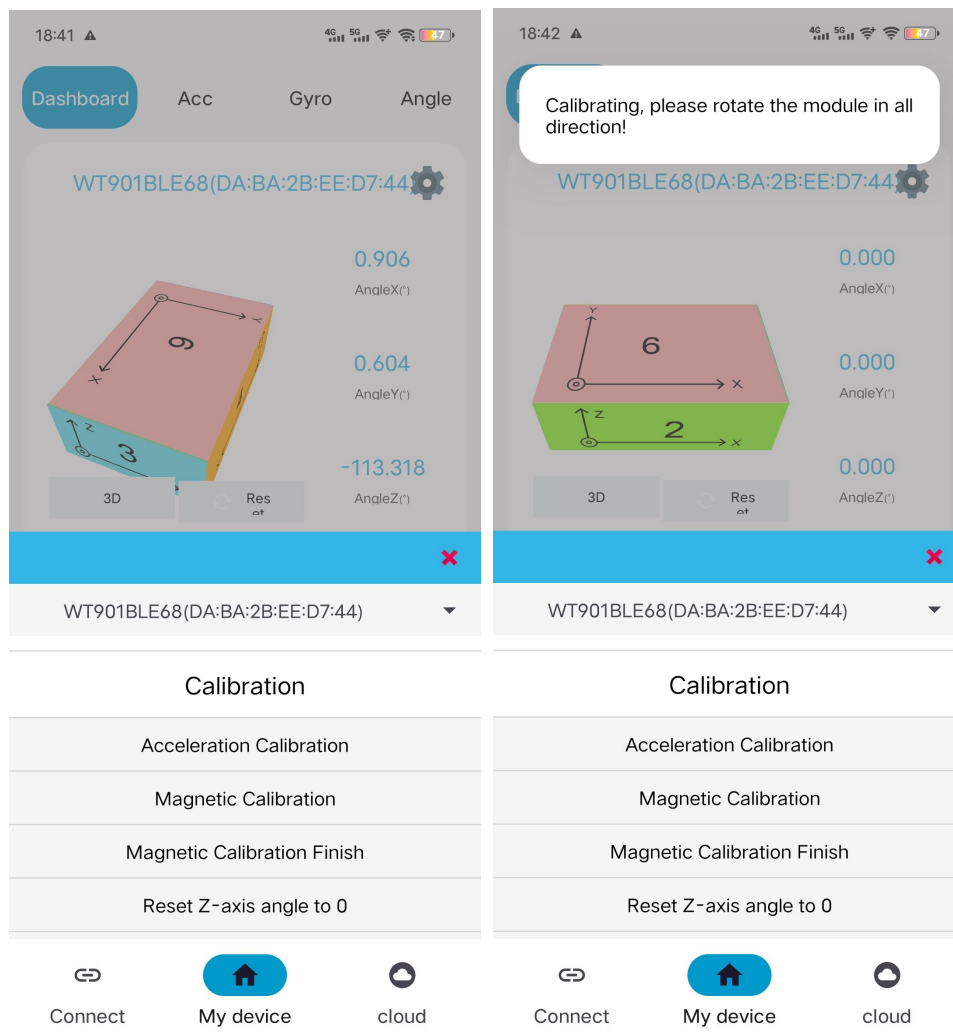
### 2.3.1 Acceleration Calibration

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. Check the result--confirm if there is 1g on Z-axis acceleration



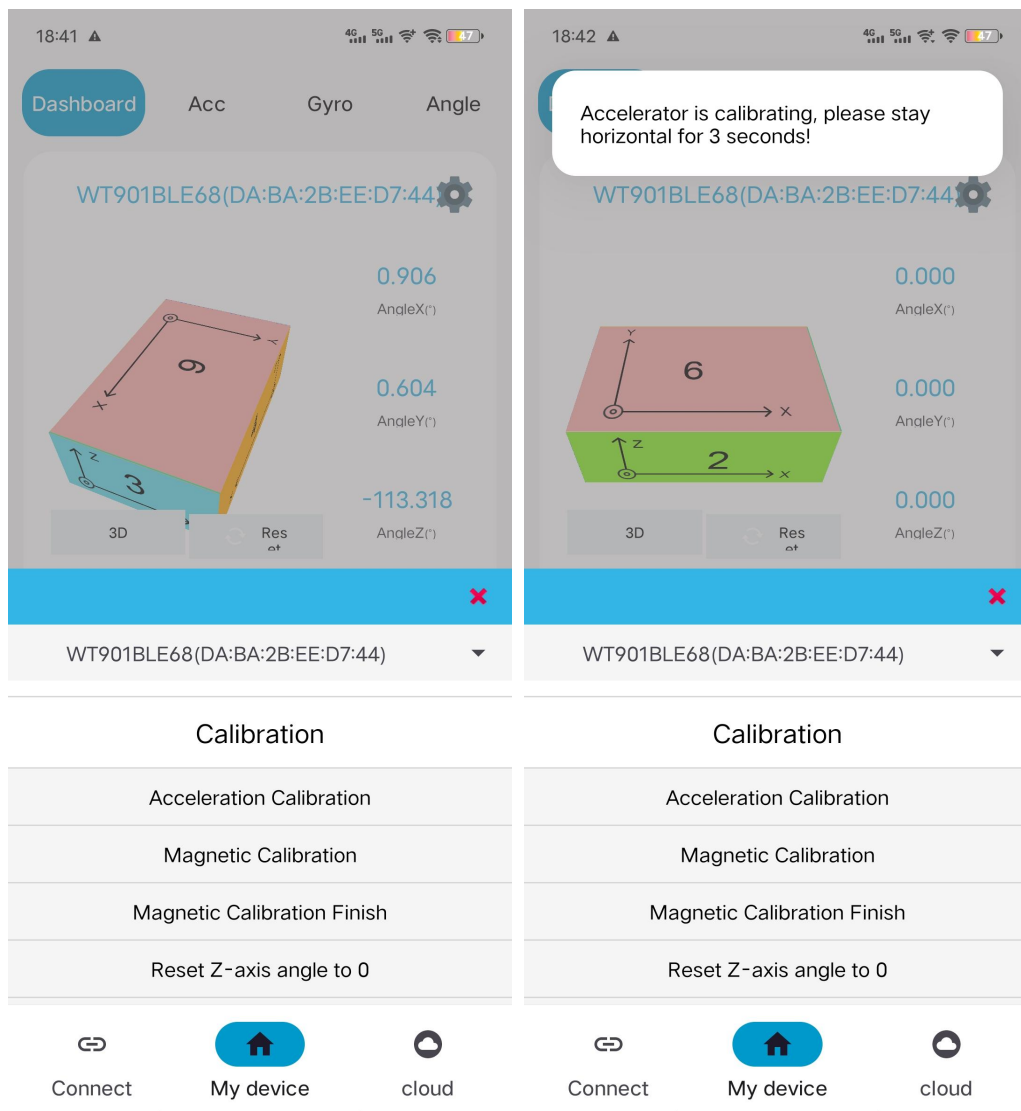
## 2.3.2 Magnetic Field Calibration

Step 1. Click the "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 less drift than before.

Notice: If there is drift of Z-axis, please stay away from the objective that can create magnetic field interference.

## 2.4 Multi-connection

Link to the multi-connection video demo.

<https://youtu.be/7M6R5Tjr8U>

As with PC software, we recommend up to 4 devices multi-connection.

Below is the different phones' actual measure distance.

BD= Best distance; MD=Max distance

	WT9011DCL	Single device		Two devices		Three devices		Four devices	
Phone		BD/m	MD/m	BD/m	MD/m	BD/m	MD/m	BD/m	MD/m
Samsung	Android 13	56m	108m						
Honor	Android 12	49m	90m						
Redmi	Android 10	18.5m	33m						
Vivo	Android 12	56m	76m						
Oppo	Android 13	35m	64m						
Xiaomi	Android 11	30m	50m						
iPhone	Ios16.4.1	14m	34m						
Lenovo	Android 11	38m	58m						

### 3 Use Instructions with iPhone

The new version of iOS APP has been launched. There will be many function coming out soon in future.

NOTICE:

The existing function of history recording is in instructions at present.  
Your understanding would be highly appreciated.

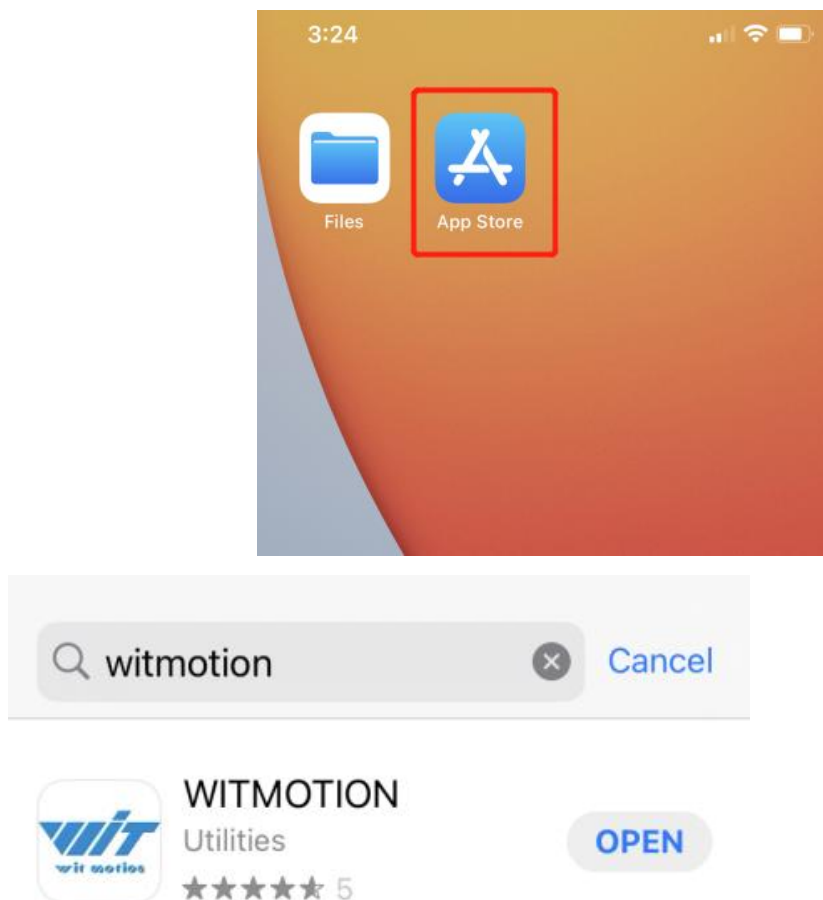
If you phone comes with txt reader, the recorded file can be easily opened.

A txt recorder like Micro Software.

[https://www.youtube.com/playlist?list=PL43tdDrVL\\_VCgrQJTaODOhkkbmTkS1kMs](https://www.youtube.com/playlist?list=PL43tdDrVL_VCgrQJTaODOhkkbmTkS1kMs)

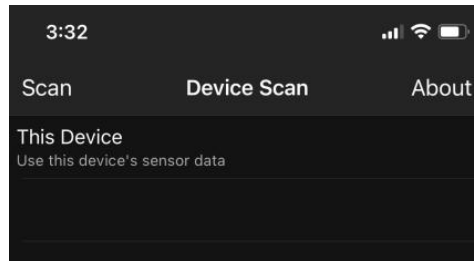
#### 3.1 How to install

Step 1. Search "WITMOTION" on iOS App Store, and install the APP

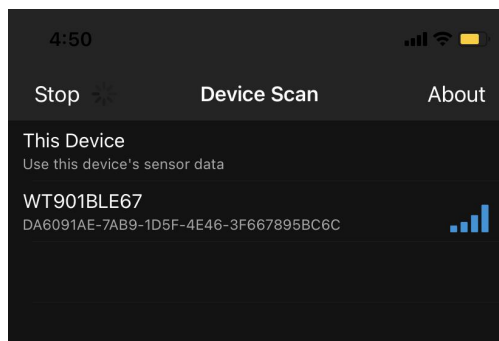


## 3.2 How to setup

Step 1. Turn on the sensor and then click "Scan"

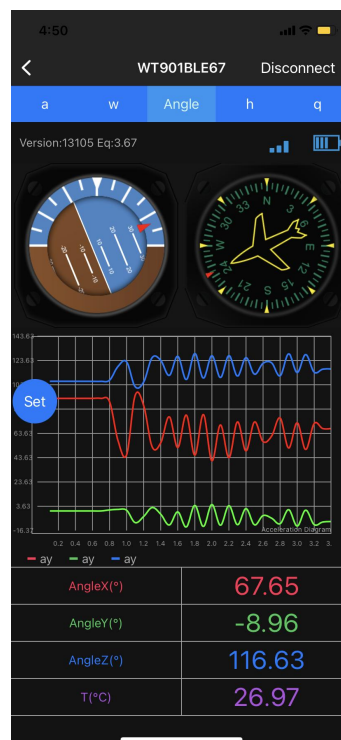


Sensor device ID will be recognized as WT901BLE+number  
The second column is its SSID number.



Step 2. Select the device and the data will be online

Demo: Angle data curve

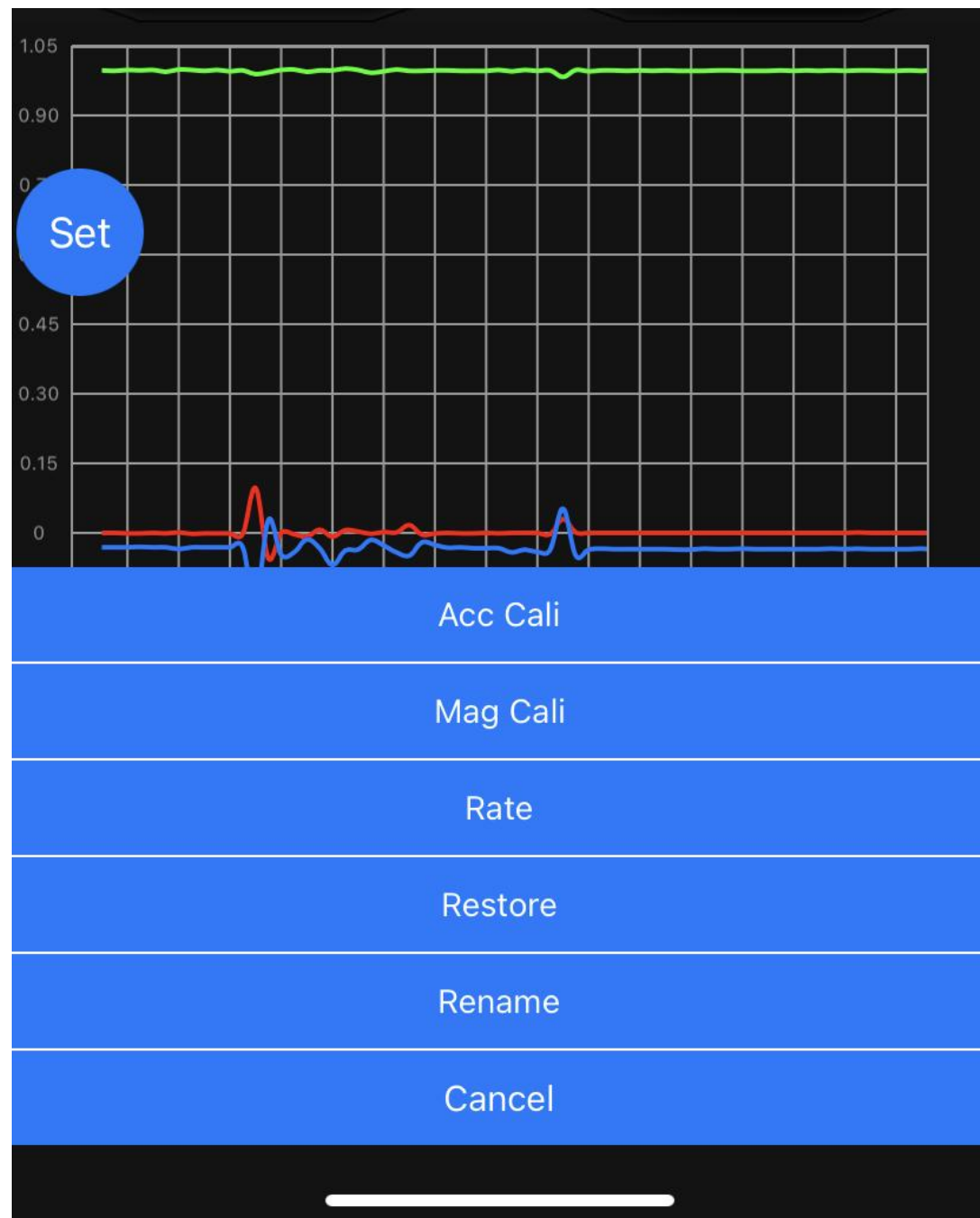




### 3.3 How to configure

For menu setting and its introduction including button and functions setting, please referring to the Chapter 4.2.

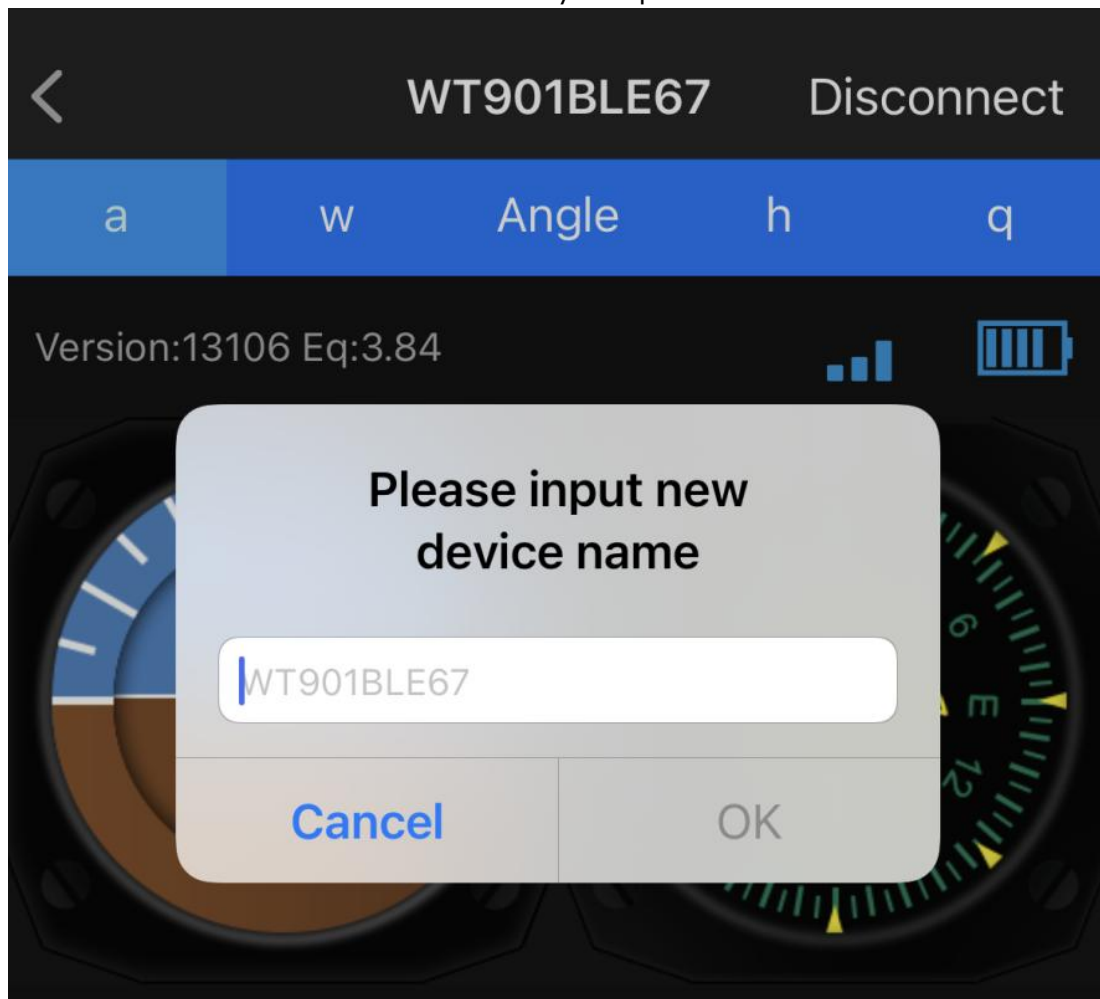
Click the button of "SET", the menu will jump out automatically.



### 3.3.1 Rename

Click rename and you can edit its name.

The name will be fixed with WT + Name you input.



### 3.4 Data Recording

The data can be easily recorded by simply press the button of record.

The recorded file can be txt format at present. You can send the record file to the computer and then paste the data to an excel file for intuitive reviewing.

P.S If you meet any problem, please reach our team at [support@wit-motion.com](mailto:support@wit-motion.com)

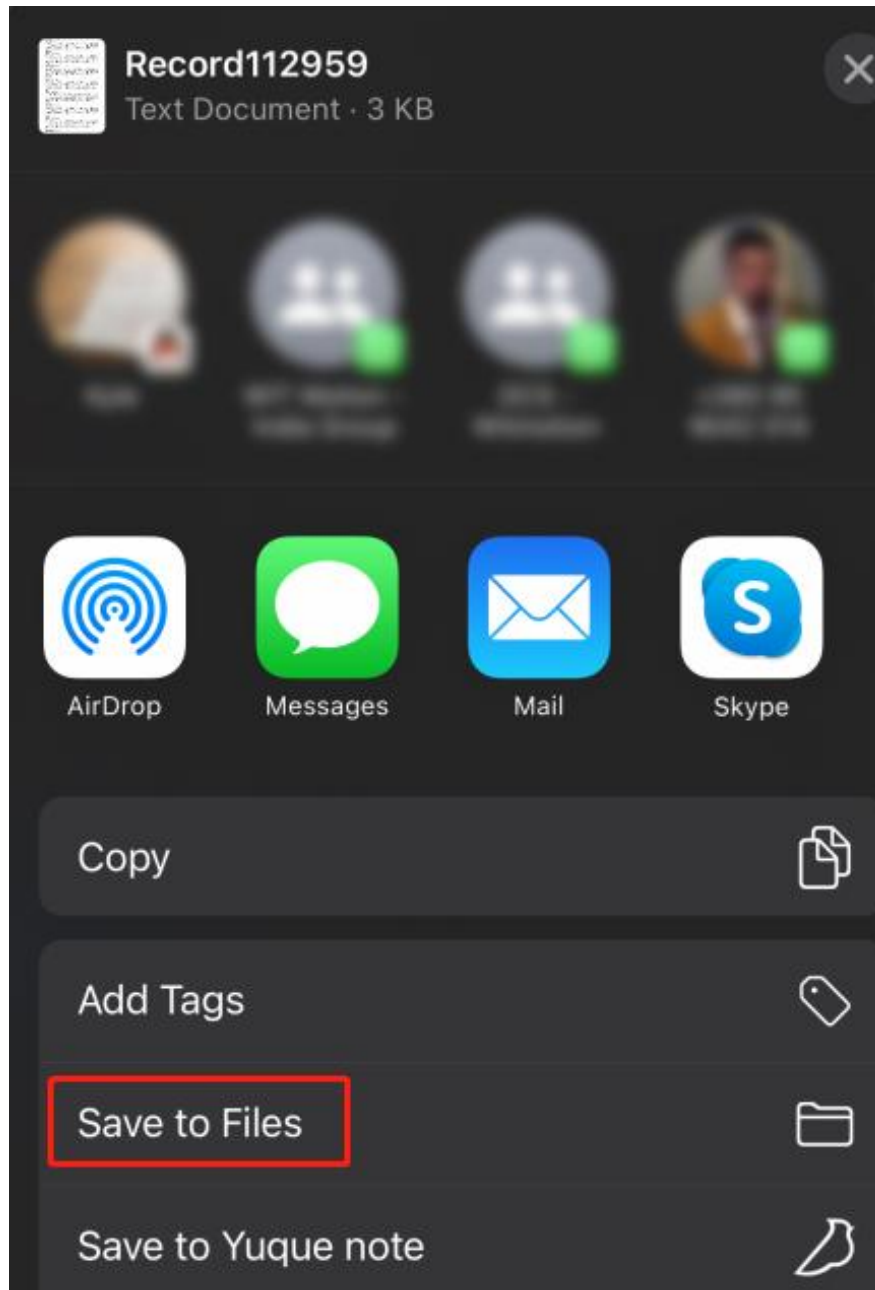
Step1. Click "Record"

Step2. When you finish the record, click "End".

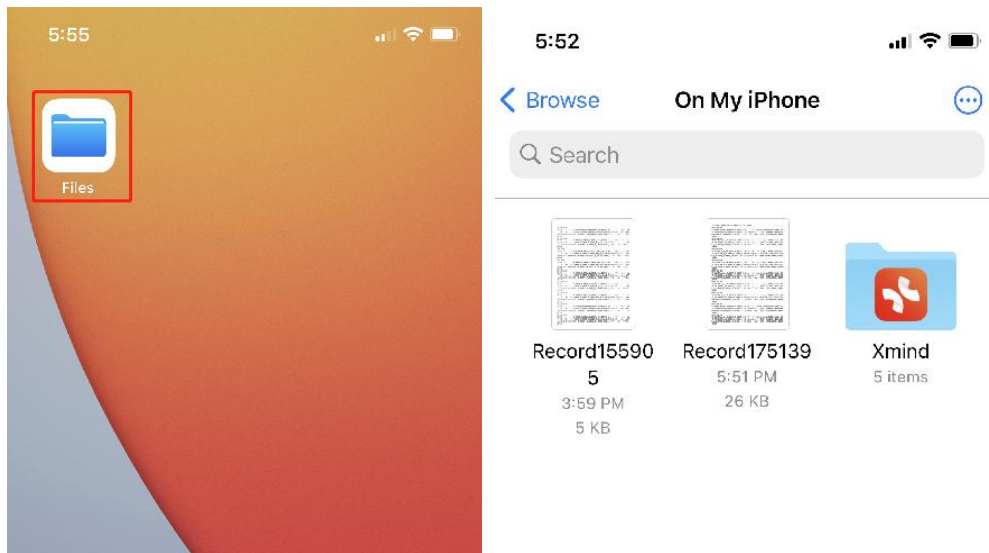


Step3. Once you finished the record, you need to save the file. We recommend you choose the button "Save to Files", the file will save the on your mobile desktop folder.

PS: We tried all saving methods and found this method to be convenient.



Step4. Come back to your mobile desktop, click the "Files", then you can check the records files.



Step 5. The file will show this format.

5:52

Done Record175139 (2 of 2)

```
,h,-4632.0000,-6725.0000,-1620.0000
2023-04-20
17:51:39.2,a,-0.0063,0.0015,1.0073,ver,18414,eq,4.0600,rs
si,-61,T,30.0700,w,0.0000,0.0000,0.0000,Angle,0.5768,-0.
1208,-145.4755,q,0.2967,0.0005,-0.0051,-0.9549,h,-4648
.0000,-6703.0000,-1601.0000
2023-04-20
17:51:39.2,a,-0.0068,0.0020,1.0088,ver,18414,eq,4.0600,r
ssi,-61,T,30.0700,w,0.0000,0.0000,0.0000,Angle,0.5823,-
0.1208,-145.4700,q,0.2968,0.0005,-0.0052,-0.9549,h,-46
44.0000,-6714.0000,-1587.0000
2023-04-20
17:51:39.3,a,-0.0054,0.0015,1.0088,ver,18414,eq,4.0600,rs
si,-61,T,30.0300,w,0.0000,0.0000,0.0000,Angle,0.5823,-0
.1208,-145.4590,q,0.2969,0.0005,-0.0052,-0.9549,h,-463
2.0000,-6706.0000,-1565.0000
2023-04-20
17:51:39.4,a,-0.0059,0.0024,1.0078,ver,18414,eq,4.0600,rs
si,-61,T,30.0700,w,0.0000,0.0000,0.0000,Angle,0.5823,-0.
1208,-145.4535,q,0.2969,0.0005,-0.0052,-0.9549,h,-463
7.0000,-6709.0000,-1566.0000
2023-04-20
```

## 4 Use Instructions with PC

### 4.1 PC Connection

PC software is only compatible with Windows system.

[Link to download software](#)

[Instructions Video link](#)

#### 4.1.1 Serial Connection

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

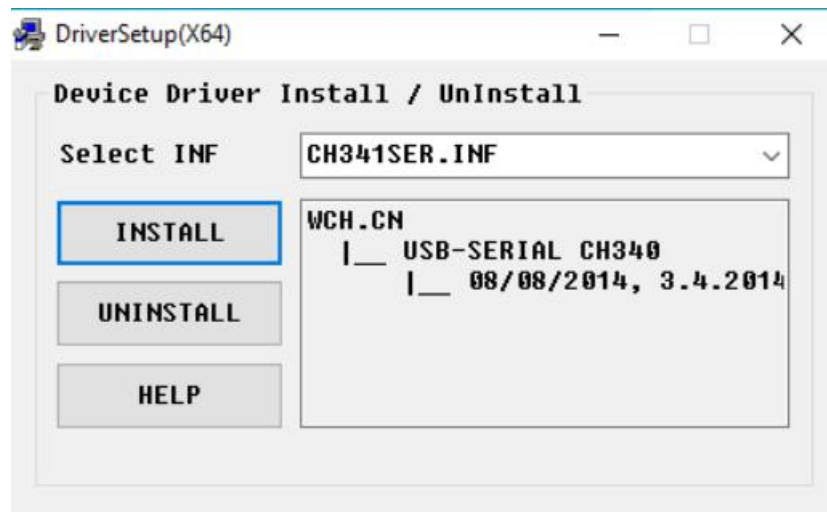
(Warm Reminder: If you wanna use a longer cable, it should be a standard Type-C data cable)

**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.







#### **4.1.2 BLE 5.0 Adapter Connection**

**4.1.3 Note: If you use the Windows 10 OS computer, there is no need to install the driver.**

Step 1. Insert adapter into the USB port in the beginning and confirm if there is a port generated in the device manager.

Step 2. Turn on the switch of the sensor after blue light of adapter flashes  
P.S The sensor's LED light will flash quickly. (once per second )

Step 3. Run the MiniIMU.exe application  
click search button and wait for 30 seconds.

Step 4. Data will appear once the auto-search finished  
LED status: The LED light of sensor will flash slowly. (once two seconds.)  
The adapter's LED light will remain still.

## 4.2 Software Introduction

### 4.2.1 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 Bluetooth 5.0 for WT9011DCL BLE5.0
Open		Open com port
Close		Close com port