

WITMOTION HWT901B-TTL

WITMOTION HWT901B-TTL 9-Axis Accelerometer and Inclinometer User Manual

Model: HWT901B-TTL

1. INTRODUCTION

This user manual provides detailed instructions for the setup, operation, calibration, and maintenance of the WITMOTION HWT901B-TTL 9-Axis Accelerometer and Inclinometer. This device is designed for precise motion sensing applications, integrating a gyroscope, accelerometer, digital compass, air pressure sensor, and altitude measurement capabilities. It features RM3100 magnetometer compensation and Kalman filtering for enhanced accuracy and stability.

2. SAFETY INFORMATION

Please read and understand all safety precautions before operating the device. Failure to follow these instructions may result in damage to the product or personal injury.

- **Power Supply:** Ensure the device is powered within its specified voltage range (e.g., 5V for TTL version). Incorrect voltage can cause permanent damage.
- **Connections:** Verify all wiring connections are correct before applying power. Incorrect wiring can lead to short circuits or component failure.
- **Environment:** Avoid exposing the device to extreme temperatures, humidity, or corrosive environments unless specifically rated for such conditions.
- **Handling:** Handle the sensor with care to prevent physical shock or damage to internal components.
- **Calibration:** Perform calibration procedures in a stable environment, free from strong magnetic interference, to ensure accurate readings.

3. PACKAGE CONTENTS

Upon opening the package, please verify that all items listed below are present and in good condition.

- 1 x HWT901B-TTL Sensor
- 1 x Connection Cable
- 1 x Instruction Card

- (Optional, depending on kit) USB-TTL Serial Converter
- (Optional, depending on kit) Type-C Adapter

PACKING





Figure 3.1: Contents of the WITMOTION HWT901B-TTL package, including the sensor, cable, and instruction card.

4. PRODUCT OVERVIEW

The WITMOTION HWT901B-TTL is an industrial-grade 9-axis sensor module designed for high-precision attitude measurement. It integrates a 32-bit processor, MPU9250 (accelerometer, gyroscope), RM3100 magnetometer, and a BMP280 air pressure sensor. The device utilizes advanced R&D dynamic fusion algorithms and Kalman filtering to provide stable and accurate data output for pitch, roll, yaw, acceleration, angular velocity, magnetic field, air pressure, and altitude.



Figure 4.1: Front view of the HWT901B-TTL sensor module, showing its compact design and labeling.

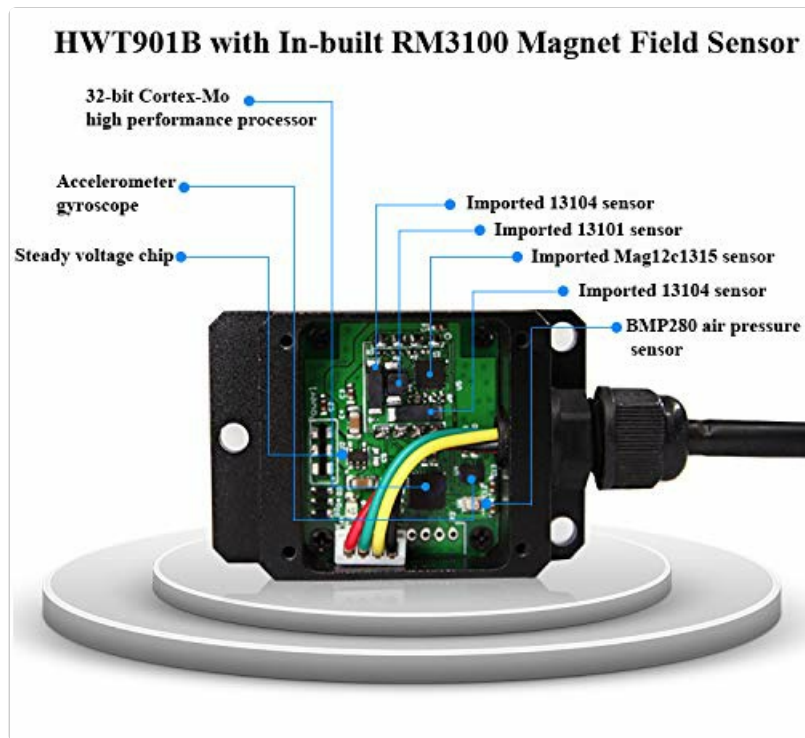


Figure 4.2: Internal view of the HWT901B-TTL, highlighting key components such as the 32-bit Cortex-M0 processor, accelerometer, gyroscope, RM3100 magnet field sensor, and BMP280 air pressure sensor.

Key Features:

- **10-Axis Measurement:** Pitch, Roll, Yaw (X, Y, Z axis), Accelerometer, Angular Velocity, Angle, Magnet Field, Air Pressure, Height.
- **High Accuracy:** Angle measurement accuracy up to 0.05 degrees (X, Y-axis) with low Z-axis drift.
- **Advanced Filtering:** Integrated Kalman Algorithm and RM3100 magnetometer compensation for stable and precise data.
- **Robust Design:** Equipped with a 32-bit processor and highly-integrated MEMS module for performance in challenging environments.
- **Selectable Output Rate:** Data output rate configurable from 0.2Hz to 200Hz.



Figure 4.3: Dimensional drawing of the HWT901B-TTL sensor, showing its length, width, and height in millimeters.

5. SETUP INSTRUCTIONS

5.1. PC Connection

1. **Install Serial Driver:** Download and install the appropriate serial driver (e.g., CH340) for your operating system.
2. **Connect Hardware:** Connect the HWT901B-TTL sensor to your PC using a USB-TTL serial converter.

Ensure VCC, TX, RX, and GND pins are correctly matched (VCC-VCC, TX-RX, RX-TX, GND-GND).

3. **Identify COM Port:** Open Device Manager on your PC and locate the assigned COM port for the serial converter.
4. **Launch Software:** Open the WITMOTION PC software (Minimu.exe).
5. **Select Port and Baud Rate:** In the software, select the identified COM port and the correct baud rate (default is typically 9600). Data should appear automatically. If not, manually select the COM port and baud rate.



Figure 5.1: The HWT901B-TTL connected to a PC via a serial converter, displaying real-time data on the WITMOTION software interface.

Video Guide: PC Connection and Basic Operation

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This video demonstrates the process of connecting the HWT901B-TTL sensor to a PC, installing necessary drivers, and viewing data using the WITMOTION software.

5.2. Android Smartphone Connection

1. **Install APP:** Install the WITMOTION APK file on your Android smartphone. Grant necessary permissions,

especially "Storage" and "Location".

2. **Prepare Hardware:** You will need the HWT901B-TTL sensor, a USB-TTL cable, and a Type-C OTG adapter (if your phone has a Type-C port, adapter may need to be purchased separately).
3. **Connect Hardware:** Connect the sensor to the USB-TTL cable, then connect the USB-TTL cable to your smartphone via the OTG adapter.
4. **Open APP:** Launch the WITMOTION APP.
5. **Select Module Type:** Choose "9-axis Series" from the module selection.
6. **Select Baud Rate:** Select the appropriate baud rate (default 9600). Connection should succeed, and data will be displayed.



*Type-C adapter is not included.

Figure 5.2: The HWT901B-TTL connected to an Android smartphone using a USB-TTL converter and a Type-C adapter.

Video Guide: Android Smartphone Connection

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This video illustrates the steps to connect the HWT901B-TTL sensor to an Android smartphone and view real-time data through the WITMOTION application.

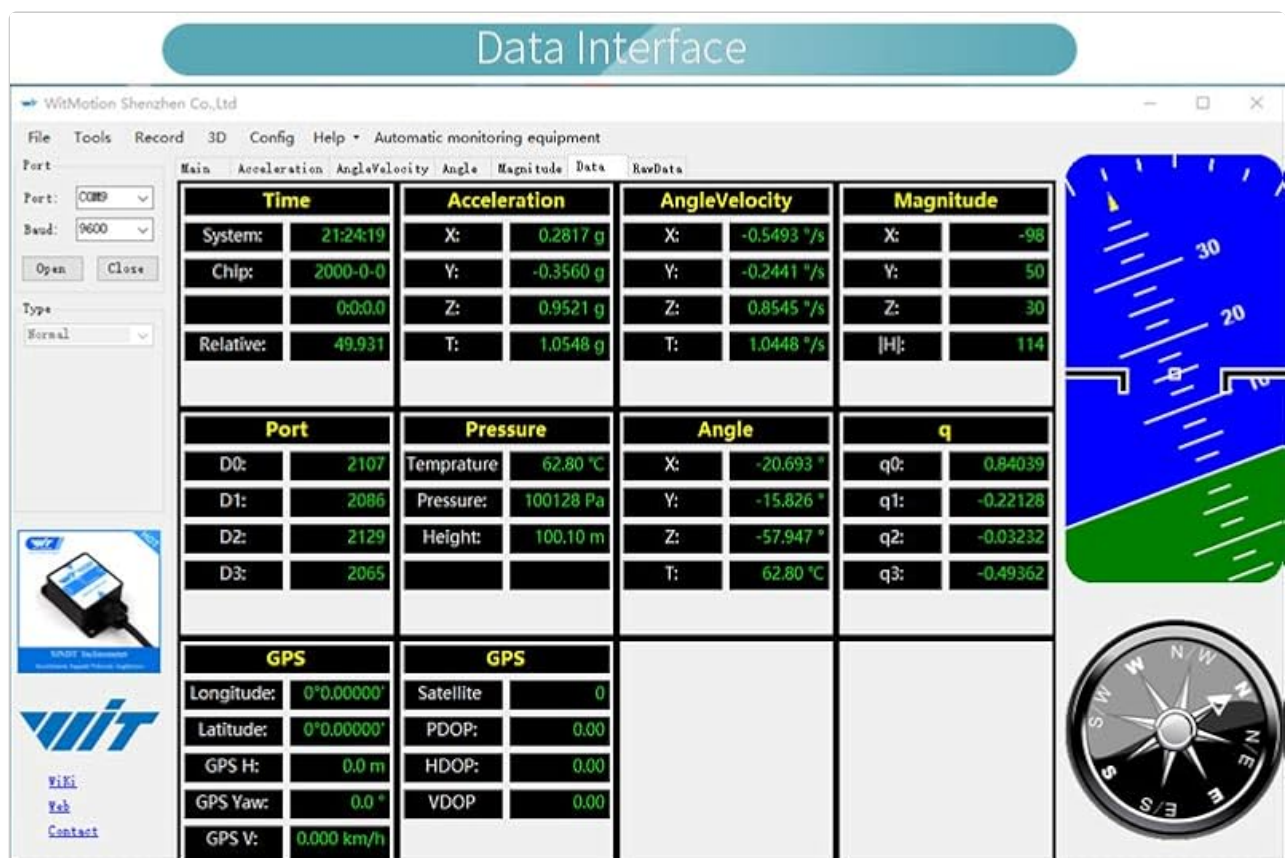
6. OPERATING INSTRUCTIONS

The WITMOTION software and Android app provide various interfaces for monitoring and configuring the HWT901B-TTL sensor.

6.1. Data Display

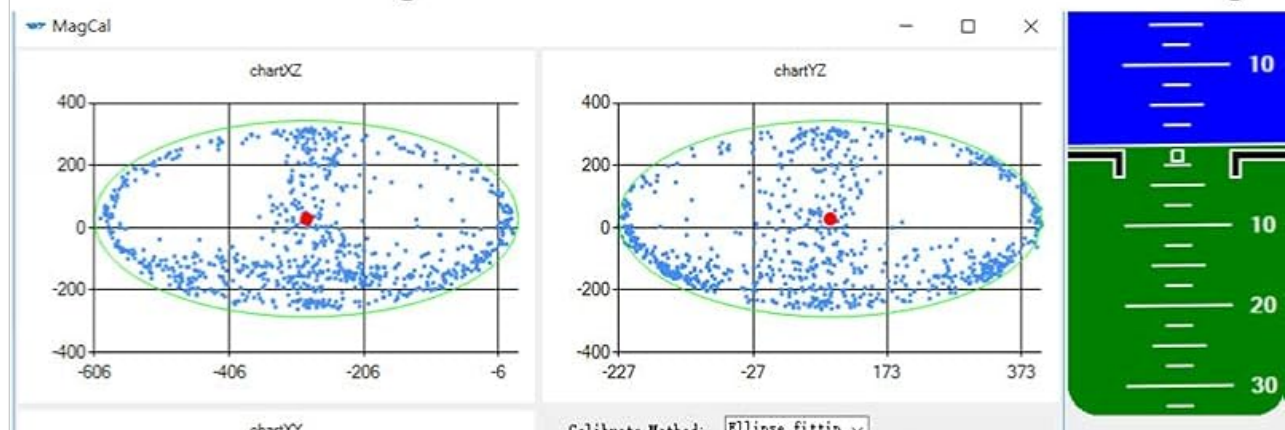
Once connected, the software/app will display real-time sensor data, including:

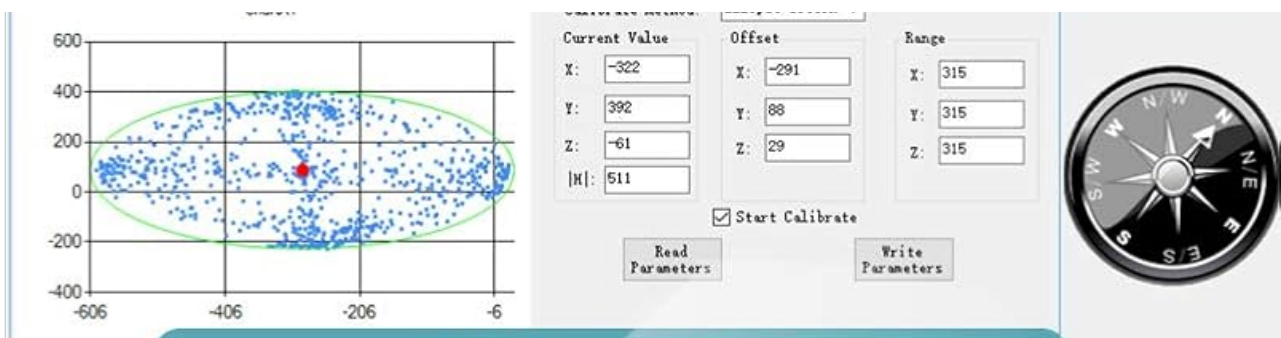
- **Main Interface:** Shows current Pitch, Roll, and Yaw angles.
- **Acceleration Graph:** Visualizes X, Y, Z axis acceleration over time.
- **Angular Velocity Graph:** Displays X, Y, Z axis angular velocity over time.
- **Angle Graph:** Plots Pitch, Roll, and Yaw angles over time.
- **Magnetic Field Graph:** Shows magnetic field strength along X, Y, Z axes.
- **Data Review:** Presents raw and processed data in tabular format.



Configuration

Magnetic&Acceleration Calibration before usage





3D Demostration

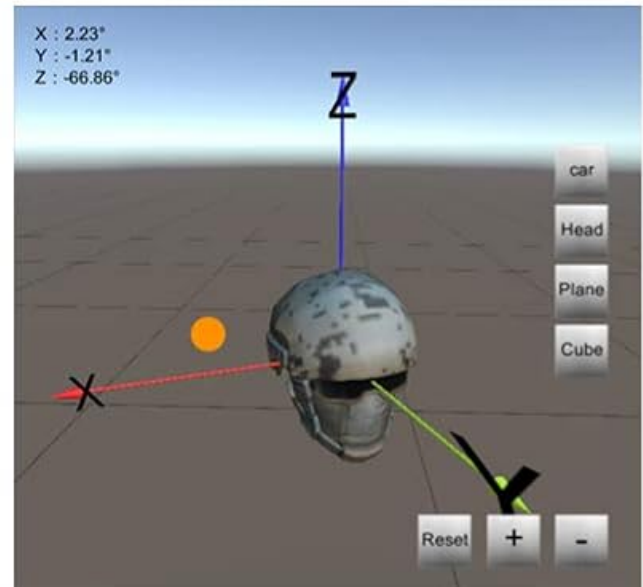
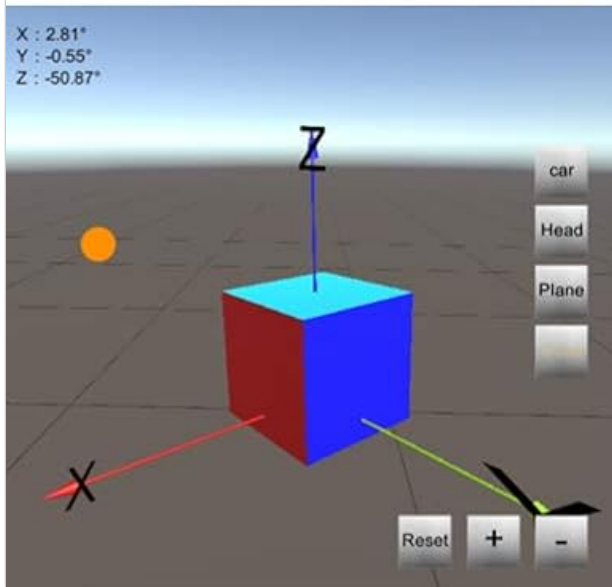


Figure 6.1: Overview of the PC software interface, showing data display, configuration options, and 3D demonstration capabilities.

Multifunctional Android APP

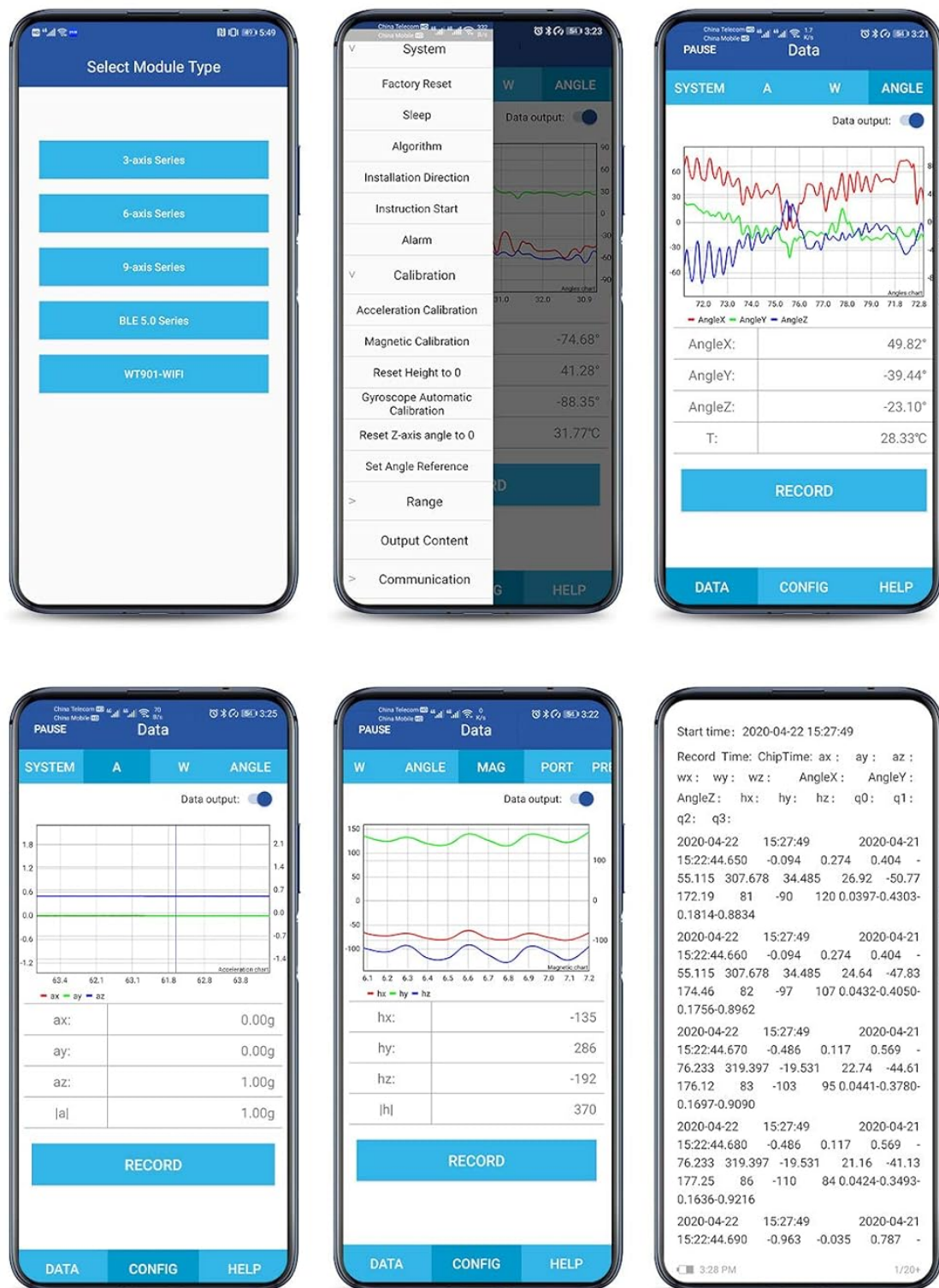


Figure 6.2: Various screens of the multifunctional Android application, illustrating data output, configuration settings, and different graph displays.

6.2. 3D Demonstration

The PC software includes a 3D visualization tool that allows you to observe the sensor's orientation in real-time. You can select different 3D models (car, head, plane, cube) to represent the sensor's movement. Before using the 3D demonstration, calibrate the direction of the 3D model using the arrow control keys to match the sensor's axial direction.

7. CALIBRATION

Regular calibration ensures the highest accuracy of the HWT901B-TTL sensor. Perform calibration in a stable environment, away from strong magnetic fields.

7.1. Acceleration Calibration

1. Place the module face up on a horizontal plane.
2. In the software/app, navigate to the calibration section and select "Acceleration Calibration".
3. Click "Start Calibration". The system will automatically calculate the calibration value. Keep the module still for 2-3 seconds.
4. Click "Complete Calibration" or "End Calibration".
5. Click "Write Parameter" or "Save Config" to save the parameters to the sensor.
6. To confirm successful writing, read the parameters again. After calibration, the Z-axis acceleration should read approximately 1g.

7.2. Magnetic Field Calibration

Magnetic field calibration compensates for local magnetic interference.

1. In the software/app, navigate to the calibration section and select "Magnetic Field Calibration".
2. Click "Start Calibration".
3. Rotate the sensor 360 degrees around its X, Y, and Z axes respectively. Ensure the sensor covers a full sphere of orientations during rotation.
4. Click "End Calibration" or "Magnetic Field Calibration Finish".
5. Click "Write Parameter" or "Save Config" to save the parameters to the sensor.

8. DATA LOGGING AND EXPORT

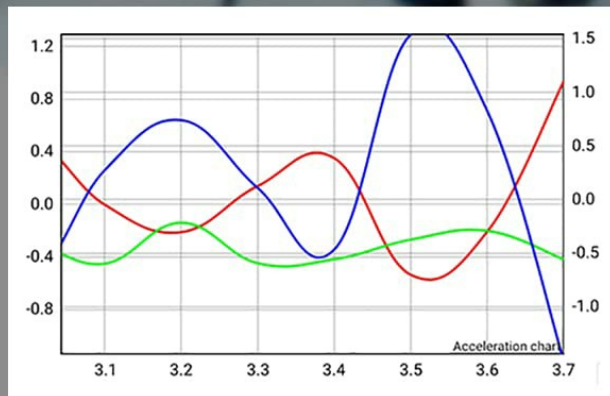
The WITMOTION software and app allow you to record and export sensor data for further analysis.

- **Recording:** In the software/app, navigate to the "Record" or "Data" tab and click the "Start" or "Record" button to begin logging data.
- **Stopping:** Click "Stop" to end the recording.
- **Export:** The recorded data can typically be extracted as a TXT file or other formats (e.g., CSV, BIN, PLAY) depending on the software version. For Android, recorded files are usually saved in the phone's root directory under a "Records" folder.

Powerful Data Storage & Export



Acceleration



Angle

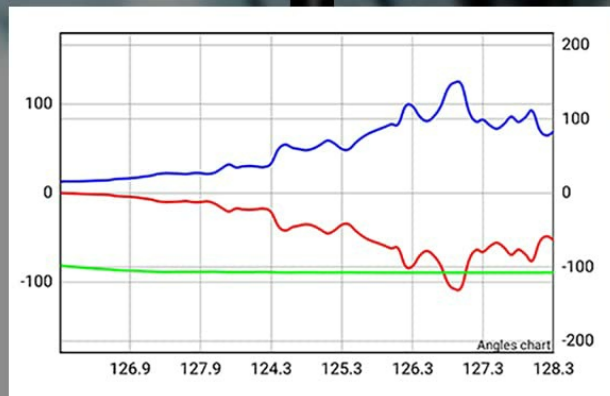


Figure 8.1: The sensor's capability for powerful data storage and export, showing acceleration and angle charts.

9. MAINTENANCE

To ensure the longevity and optimal performance of your HWT901B-TTL sensor, follow these maintenance guidelines:

- **Cleaning:** Keep the sensor clean and free from dust and debris. Use a soft, dry cloth for cleaning. Avoid using harsh chemicals or abrasive materials.
- **Storage:** Store the sensor in a dry, cool environment when not in use. Protect it from extreme

temperatures and humidity.

- **Cable Integrity:** Regularly inspect the connection cable for any signs of wear, cuts, or damage. Replace damaged cables immediately.
- **Firmware Updates:** Check the official WITMOTION website (wit-motion.com) for any available firmware updates to improve performance or add new features.

10. TROUBLESHOOTING

If you encounter issues with your HWT901B-TTL sensor, refer to the following common problems and solutions:

Problem	Possible Cause	Solution
No data output in software/app.	Incorrect serial driver installation. Wrong COM port selected. Incorrect baud rate. Loose wiring connection. Sensor not powered.	Reinstall serial driver. Verify COM port in Device Manager. Ensure baud rate (default 9600) matches. Check all wiring connections (VCC, TX, RX, GND). Confirm power supply is connected and active.
Inaccurate angle readings.	Sensor not calibrated. Strong magnetic interference. Sensor movement during calibration.	Perform Acceleration and Magnetic Field Calibration. Relocate sensor away from magnetic sources. Ensure sensor is perfectly still during acceleration calibration.
Android app not detecting sensor.	Missing app permissions (Storage, Location). Faulty OTG adapter or USB-TTL cable. Phone not compatible with CH340 driver.	Grant all required app permissions. Test with a different OTG adapter/cable. Ensure your phone supports CH340 drivers for USB-serial communication.

11. SPECIFICATIONS

Feature	Value
Model	HWT901B-TTL
Measurement Axes	9-axis (Accelerometer, Gyroscope, Magnetometer) + Air Pressure + Altitude
Accelerometer Range	±16g
Gyroscope Range	±2000°/s
Angle Accuracy (X, Y-axis)	0.05°
Magnetometer	RM3100 (compensated)

Feature	Value
Output Rate	0.2-200Hz (selectable)
Interface	TTL Serial
Processor	32-bit
Package Dimensions	6.1 x 6.02 x 2.05 inches
Weight	5.75 ounces

Video Guide: Temperature Aging Test

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This video demonstrates the temperature aging test process, ensuring stable accuracy across the sensor's operating temperature range.

Video Guide: High-Precision Turntable Calibration






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This video shows the high-precision turntable calibration process performed before packaging, ensuring the sensor's accuracy.

12. WARRANTY AND SUPPORT

WITMOTION provides comprehensive support for its products:

- **Warranty:** The HWT901B-TTL comes with a 12-month warranty.
- **Customer Service:** Lifetime friendly customer service is available from the WitMotion team.
- **Documentation:** For complete tutorials, software, and instructions, visit wit-motion.com and navigate to the support page or the WITMOTION Google Drive.
- **Video Resources:** Find instructional videos and project sharing on the official WITMOTION Youtube channel.
- **Contact:** For any assistance, contact support at support@wit-motion.com.

<div></div>	<p>WITMOTION WT901 Inclinator Sensor User Manual</p> <p>User manual for the WITMOTION WT901 Inclinator Sensor, detailing its features, applications, software introduction, and connection methods.</p>
<div></div>	<p>WT901B Inclinator Sensor User Manual</p> <p>User manual for the WT901B Inclinator Sensor, detailing its features, applications, software, and connection methods. Includes technical specifications and support information from WITMOTION.</p>
<div></div>	<p>WitMotion HWT901B AHRS IMU Sensor Datasheet</p> <p>Technical datasheet for the WitMotion HWT901B AHRS IMU sensor, detailing its features, specifications, parameters, and applications for industrial monitoring and predictive maintenance. Includes sensor capabilities, measurement ranges, accuracy, electrical parameters, and pin definitions.</p>
<div></div>	<p>WITMOTION BWT901CL User Manual: Bluetooth 2.0 Inclinator Sensor Guide</p> <p>Comprehensive user manual for the WITMOTION BWT901CL Bluetooth 2.0 Inclinator Sensor. Learn about installation, PC and Android app connection, calibration, and configuration for accurate attitude measurement.</p>
<div></div>	<p>WITMOTION WT901C(RS232) 9-Axis Inclinator Sensor User Manual MPU9250, Kalman Filtering</p> <p>User manual for the WITMOTION WT901C(RS232) RS232 9-axis vibration inclinometer sensor. Details features like high-stability acceleration, gyro, angle (XY 0.05° Accuracy), digital compass, MPU9250 sensor, and Kalman filtering. Covers applications, PC and MCU connection methods, and software for industrial control, robotics, and AGVs.</p>



USER MANUAL
HWT905(RS485)
IP68 Inclinometer



HWT905(RS485) Inclinometer (IP68) | WITMOTION | www.witmotion.com | 20230801 | 1.0

[WITMOTION HWT905\(RS485\) IP68 Inclinometer User Manual](#)

User manual for the WITMOTION HWT905(RS485) IP68 Inclinometer, detailing its features, applications, installation, and software usage. This AHRS IMU sensor provides high-precision angle, acceleration, and angular velocity measurements.