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> [Industry-Grade Beidou+GPS AHRS IMU] WTGAHRS2 MPU9250 10-axis Accelerometer+Gyroscope+Angle(XY 0.05° Accuracy)+Magnetometer+Air Pressure+Latitude+Longitude+Ground Speed, Navigation System

WITMOTION WTGAHRS2

WTGAHRS2 MPU9250 10-axis AHRS IMU User Manual

Model: WTGAHRS2 | Brand: WITMOTION

1. INTRODUCTION

The WITMOTION WTGAHRS2 is an industry-grade 10-axis Attitude and Heading Reference System (AHRS) Inertial Measurement Unit (IMU). It integrates a 3-axis gyroscope, 3-axis accelerometer, 3-axis magnetometer, and includes capabilities for air pressure, height, GPS, latitude, longitude, and ground speed measurements. Designed for high precision, it utilizes a Kalman filter for stable data output and features a 32-bit high-performance core processor. This module is suitable for applications requiring accurate attitude measurement in dynamic environments, such as flight control systems, self-balancing robots, and navigation.



Figure 1: WTGAHRS2 IMU Sensor with connection labels.

AHRS

WTGAHRS2

is a focus on inclinometer and attitude sensor, the rotary controller is a focus on inclinometer and attitude sensor, the RC measurement sensors, deep loosening sensors loosening measurement sensors, deep lo

AHRS+GPS+BDS



Acceleration



Angular Rate



Angle



Magnet



Air Pressure



Longitude



Latitude



Ground Speed

Figure 2: Overview of WTGAHRS2 capabilities including acceleration, angular rate, angle, magnet, air pressure, longitude, latitude, and ground speed.

Product Overview Video

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Video 1: Demonstrates the WitMotion WTAHRS2 High-Stability 10-axis IMU AHRS Inclinometer and its high-precision capabilities.

2. PACKAGE CONTENTS

The following items are included in your product package:

- 1 x WitMotion WTGAHRS2 BeiDou GPS IMU Sensor (In-built GPS antenna)
- 1 x 3-in-1 USB-TTL converter
- 1 x Welcome guide (instructions card with tutorial website)



Figure 3: Contents of the WTGAHRS2 package, including the sensor, USB-TTL converter, and welcome guide.

3. TECHNICAL SPECIFICATIONS

Feature	Description/Value
Voltage	3.3V ~ 5V

Feature	Description/Value
Current	Typical 20mA
Dimensions	45mm X 62mm X 27mm (1.77 x 2.44 x 1.06 inches)
Measuring Parameters	3-axis Acceleration, Electronic Gyroscope, Angle, Magnet, Air Pressure, Height, GPS, Altitude, Longitude, Ground Speed (digital data output)
Acceleration Range	± 16g
Angular Velocity Range	± 2000 °/s
Angle Range	X (-180,180), Y(-90,90), Z(-180,180)
Attitude Measurement Precision	0.05 degrees
GPS Module	UBLOX 6M (NMEA-0183 standard compatible)
Height Precision	0.1m (Atmospheric pressure based)
Data Output Frequency	Up to 200Hz
Data Interface	Serial port UART (TTL level)
Baud Rate	4800-230400 kps (Default: 9600 kps)

GPS Parameters



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

Figure 4: Detailed GPS parameters for the WTGAHRS2 module.

4. SETUP AND CONNECTION

4.1. PC Setup

To connect and use the WTGAHRS2 with a Windows PC, follow these steps:

1. **Install the Serial Driver:** Before connecting the sensor, install the necessary serial driver (e.g., CH340 driver) for the USB-TTL converter. This driver ensures your PC recognizes the converter as a COM port.
2. **Connect the Sensor:** Connect the WTGAHRS2 sensor to the 3-in-1 USB-TTL converter using the provided cable. Ensure correct pin connections: VCC to VCC (5V), TX to RX, RX to TX, and GND to GND.

3. **Connect to PC:** Plug the USB-TTL converter into an available USB port on your Windows PC.
4. **Confirm COM Port:** Open Device Manager on your PC and verify that a new COM port (e.g., USB-SERIAL CH340) is listed under "Ports (COM & LPT)". Note the assigned COM port number.
5. **Open Software:** Launch the WitMotion PC software (Minimu.exe). The software should automatically detect the sensor and display data. If not, manually select the correct COM port and baud rate (default 9600) in the software settings.

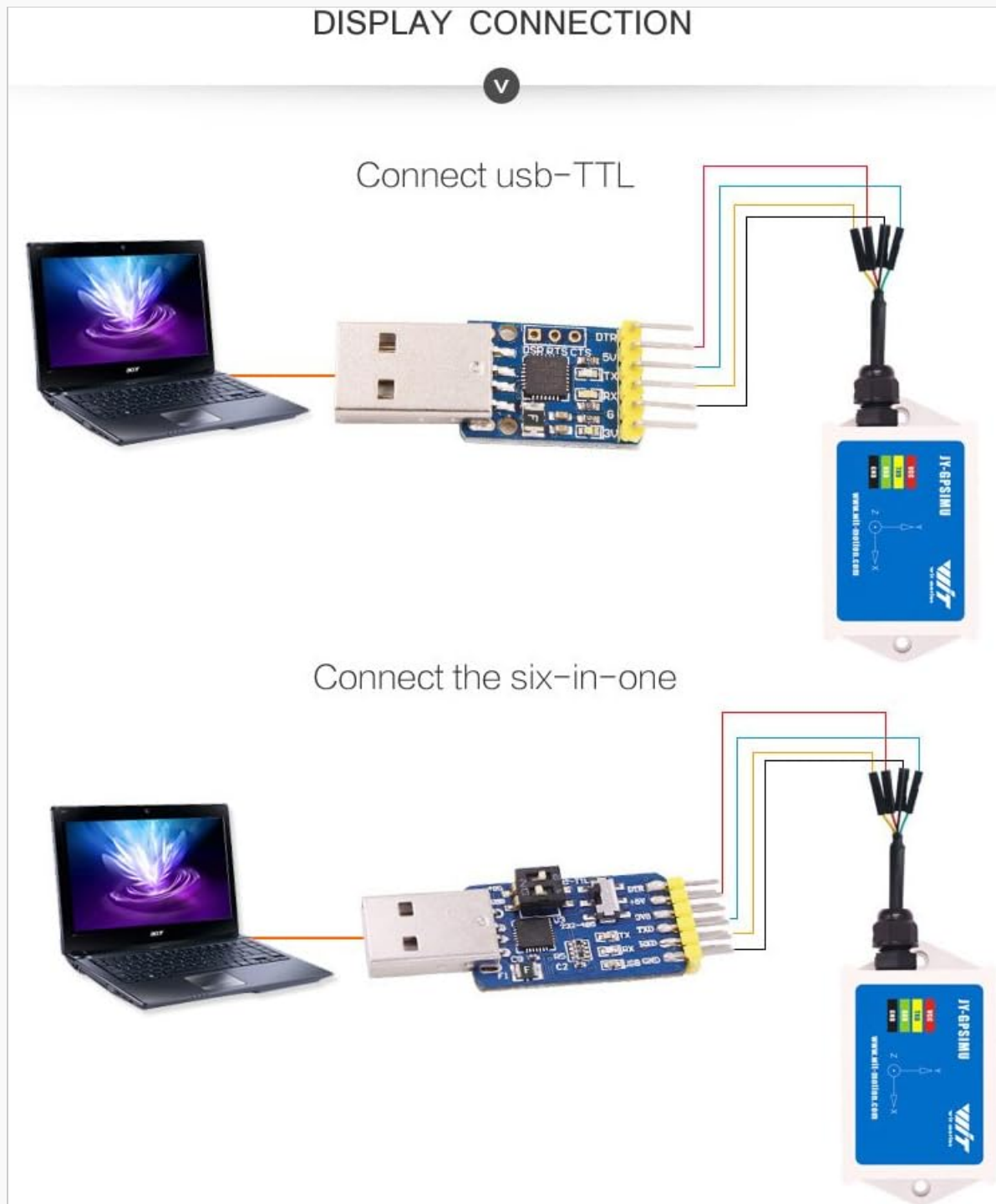


Figure 5: Diagram illustrating the connection of the WTGAHRS2 sensor to a PC via the USB-TTL converter.

PC Setup and Usage Video

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Video 2: Step-by-step instructions for setting up and using the WTGAHRS2 with a PC, including driver installation and software operation.

4.2. Android Smartphone Setup

To connect and use the WTGAHRS2 with an Android smartphone, follow these steps:

1. **Install the APP:** Download and install the WitMotion APP (APK file) on your Android smartphone. Ensure you grant necessary permissions, especially "Storage" and "Location," when prompted during installation.
2. **Prepare Connections:** Connect the WTGAHRS2 sensor to the USB-TTL converter. If your smartphone uses a Type-C port, you will need a Type-C OTG converter to connect the USB-TTL cable to your phone.
3. **Connect to Smartphone:** Plug the USB-TTL converter (with the sensor attached) into your smartphone's USB port via the OTG converter if needed.
4. **Open APP and Select Module:** Open the WitMotion APP. Power the module by connecting the serial converter. Select "9-axis Series" from the module type options.
5. **Select Baud Rate:** Choose the appropriate baud rate (default 9600) in the app settings.
6. **Confirm Connection:** Once connected successfully, data from the sensor will begin to display in the app.



Figure 6: WTGAHRS2 sensor connected to an Android smartphone via a USB-TTL converter.

Android Setup and Usage Video

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Video 3: Demonstrates the setup and use of the WTGAHRS2 with an Android smartphone, including app installation and data display.

5. OPERATING INSTRUCTIONS

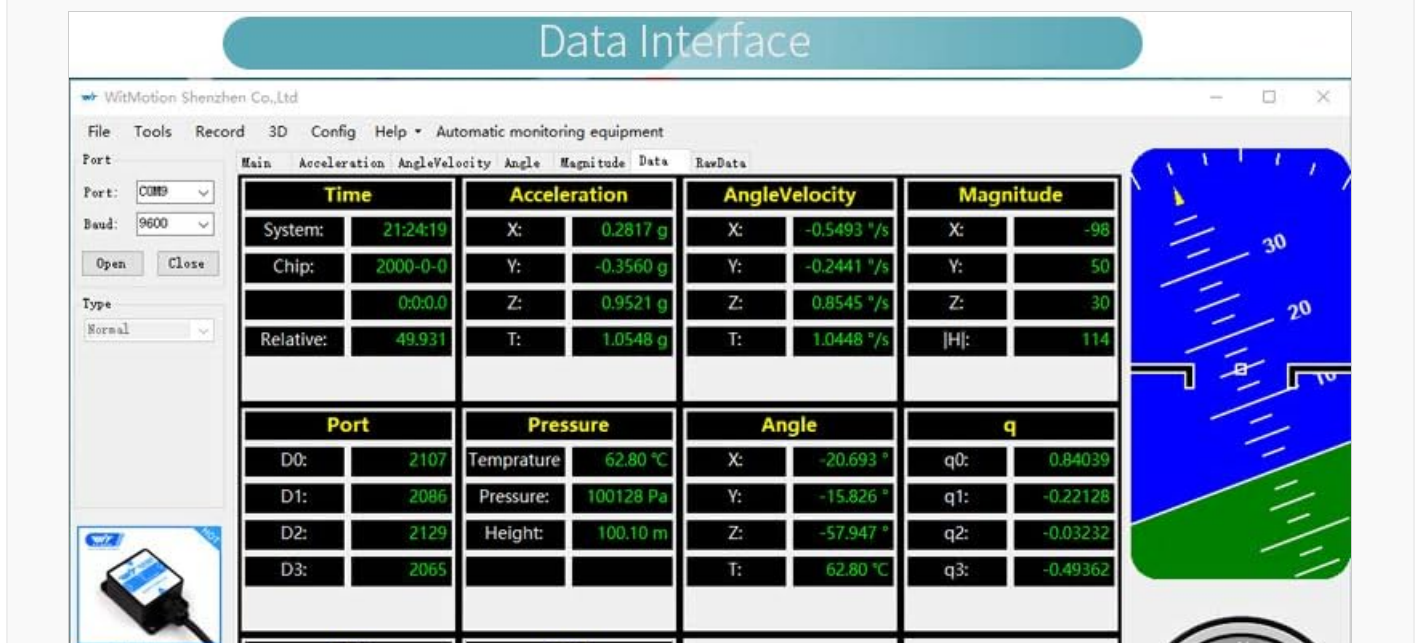
5.1. PC Software Operation

The WitMotion PC software provides a comprehensive interface for monitoring, configuring, and calibrating the WTGAHRS2 sensor. Key functionalities include:

- **Real-time Data Display:** View live data for acceleration, angular velocity, angle (pitch, roll, yaw), magnetic field, and raw data.
- **Data Chart Interface:** Visualize sensor data over time with graphs for acceleration, gyroscope, angle, and magnetic field, facilitating easy review and recording.
- **3D Demonstration:** Observe the sensor's attitude in a 3D model simulation, which can be calibrated to match the sensor's orientation. Multiple simulation models (car, head, plane, cube) are available.
- **Data Logging:** Record sensor data to a text file for later analysis.
- **Configuration:** Adjust various parameters such as baud rate, output rate, and content of the output data.



Figure 7: The WTGAHRS2 PC software interface showing real-time data and 3D demonstration.



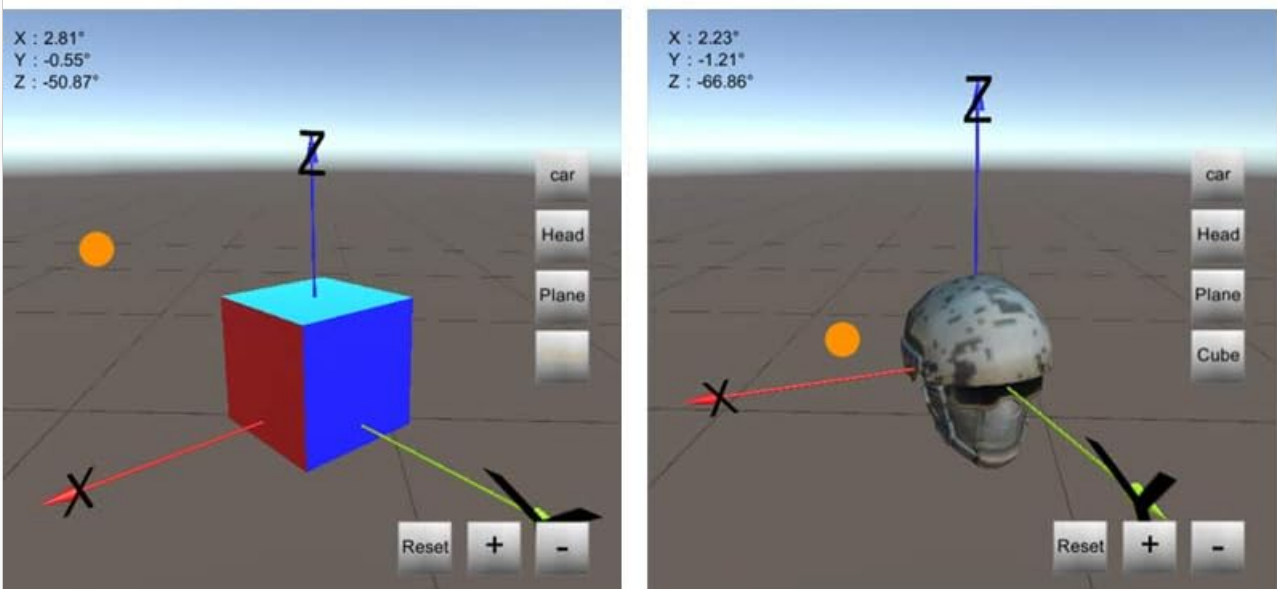
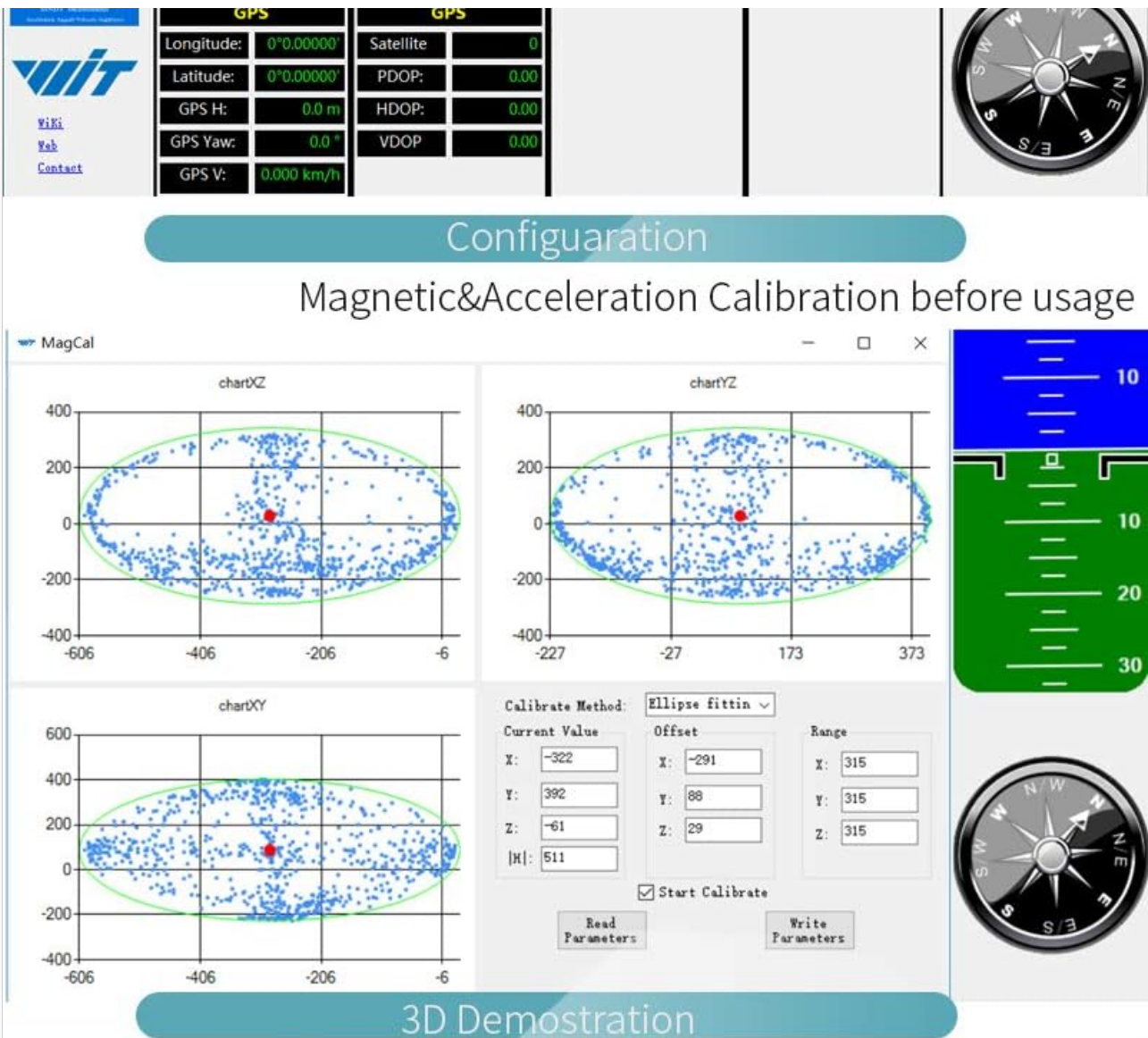


Figure 8: Detailed view of the PC software's data interface, configuration options, and magnetic/acceleration calibration sections.

5.2. Android App Operation

The WitMotion Android APP offers similar functionalities for mobile use:

- **Data Display:** View real-time acceleration, gyroscope, angle, and magnetic field data.
- **Graph Display:** Visual representation of sensor data over time for easy monitoring.
- **Data Logging:** Record data directly on your smartphone and extract it as a TXT file.

- **Calibration:** Perform acceleration and magnetic field calibrations directly from the app.
- **Configuration:** Access system settings, calibration options, range settings, and communication parameters.

Multifunctional Android APP

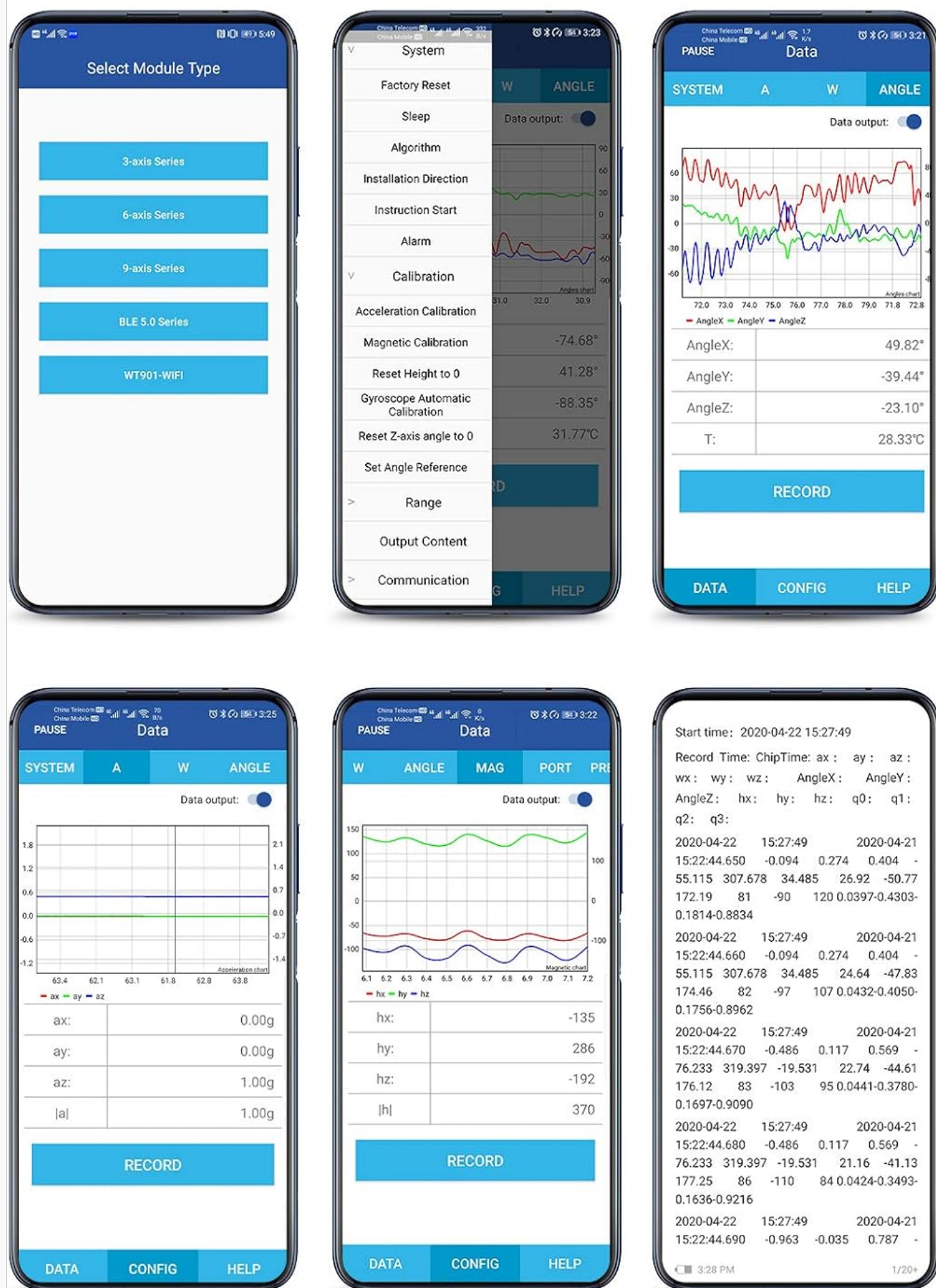


Figure 9: Screenshots of the multifunctional Android APP interface, showing various data displays and configuration options.

6. CALIBRATION

Proper calibration is crucial for accurate sensor readings. The WTGAHRS2 supports both acceleration and magnetic field calibration.

6.1. Acceleration Calibration

To calibrate the accelerometer, ensure the module is placed horizontally and remains still for approximately 3 seconds. The software/app will automatically detect and calibrate the acceleration, setting the Z-axis acceleration to 1g (gravity).

6.2. Magnetic Field Calibration

Magnetic field calibration compensates for environmental magnetic interference. During calibration, you will be instructed to rotate the module 360 degrees around its X, Y, and Z axes respectively. Follow the on-screen instructions in the software/app to complete this process. This ensures accurate heading data.

7. TROUBLESHOOTING

• No Data Output / Connection Issues:

- Ensure the serial driver for the USB-TTL converter is correctly installed on your PC.
- Verify all wiring connections (VCC, TX, RX, GND) are correct and secure.
- Check the COM port number in Device Manager and ensure it matches the selection in the software/app.
- Confirm the baud rate setting in the software/app matches the sensor's default (9600) or configured rate.
- For Android, ensure the APP has "Storage" and "Location" permissions granted.

• Inaccurate Angle/Heading Data:

- Perform both Acceleration and Magnetic Field calibrations as described in Section 6. Magnetic calibration is especially important for accurate heading.
- Ensure the sensor is not near strong magnetic fields or large metal objects during operation, as this can interfere with magnetometer readings.

• GPS Data Not Appearing:

- GPS positioning requires operation outdoors with a clear view of the sky to acquire satellite signals.
- In the PC software's configuration, ensure "GPS Original" is unchecked if you want other data (acceleration, angle, etc.) to be outputted alongside GPS. If "GPS Original" is checked, only raw GPS data will be output.

• Software/App Crashes or Freezes:

- Ensure your operating system (Windows/Android) is up to date.
- Try reinstalling the software/app.
- Close other demanding applications that might be consuming system resources.

8. MAINTENANCE

The WTGAHRS2 IMU is designed for robust performance and requires minimal maintenance. To ensure its longevity and optimal operation:

- Keep the device clean and free from dust and debris. Use a soft, dry cloth for cleaning.
- Avoid exposing the device to extreme temperatures, humidity, or direct sunlight for prolonged periods.
- Handle the sensor with care to prevent physical damage from drops or impacts.
- Store the device in a cool, dry place when not in use.

9. WARRANTY AND SUPPORT

WITMOTION is committed to providing high-quality products and excellent customer service.

- **Warranty:** Your WTGAHRS2 sensor comes with a 12-month warranty from the date of purchase. This warranty covers manufacturing defects and ensures product reliability.
- **Customer Service:** WITMOTION offers lifetime friendly customer service. If you encounter any issues or have questions, please do not hesitate to contact our support team.
- **Online Resources:**
 - Visit the official WIT-MOTION website (wit-motion.com) for comprehensive documentation, software downloads, and detailed instructions. Look for the "Support" page.
 - Access additional tutorials and resources via the WITMOTION Google Drive, as indicated on the welcome guide included in your package.
 - Subscribe to the official WITMOTION YouTube channel for instructional videos, project experiences, and product demonstrations.
- **Contact Support:** For direct assistance, you can reach our support team at atsupport@wit-motion.com.

ASK A QUESTION ABOUT THIS MANUAL

Ask about setup, troubleshooting, compatibility, parts, safety, or missing instructions. Manuals+ will review the question and use this page’s manual context to help answer it.

Name

Anonymous

Email

you@example.com

After a successful submission, we securely hash the supplied account or form email before sending it to Microsoft Advertising for conversion attribution. [Privacy details](#).

Question

Example: How do I reset this device or fix this error?

Details

Model number, symptoms, what you tried, or the section of the manual you are using.

Submit question