WITMOTION WTGPS-300P

WitMotion WTGPS-300P User Manual

Inertial Navigation Satellite Positioning Module

Brand: WITMOTION | Model: WTGPS-300P

1. INTRODUCTION

The WitMotion WTGPS-300P is an advanced inertial navigation satellite positioning module designed for high-precision positioning and navigation applications. It integrates satellite positioning (GPS/GNSS/BDS/GLONASS) with inertial navigation capabilities, providing robust performance even in environments with poor satellite signal reception. This module is suitable for vehicle-mounted applications, offering features like driving behavior monitoring and automatic switching between GPS and inertial navigation. This manual provides essential information for the proper setup, operation, and maintenance of your WTGPS-300P module.

2. PRODUCT FEATURES

- **Flexible Installation:** Designed for versatile installation in various positions and postures, particularly in automotive environments.

- **Driving Behavior Monitoring:** Capable of analyzing driving behaviors such as hard braking, harsh turns, sudden acceleration, and deceleration.

- **Automatic Navigation Switching:** Seamlessly switches between GPS navigation and inertial navigation for continuous positioning.

- **Multi-Satellite System Support:** Compatible with BDS, GPS, and GLONASS satellite systems.

- **PC Software & Customization:** Includes PC software for data review and offers customization options.

- **High Precision INS:** Integrates satellite positioning and inertial navigation to overcome challenges of poor satellite signals and inaccurate positioning.

- **Built-in IPX Interface:** Supports connection to various external active antennas for enhanced adaptability.

- **Type-C Interface:** Provides plug-and-play connectivity for easy data review on a PC.

- **Farah Capacitance:** Offers power storage to save data for 60 seconds after power loss.

- **GPS-IMU Integration:** Receives GPS signals and fuses them with an integrated navigation algorithm.

- **Serial Connection:** Reserved serial port on the module for communication.

- **Sub-meter Navigation:** Supports RTCM2.3 protocol for sub-meter navigation accuracy.
- **Firmware Algorithm:** Utilizes an Adaptive Kalman Filter algorithm for improved performance.

3. Setup Guide

3.1 Unpacking and Inspection

Upon receiving your WTGPS-300P module, carefully unpack it and inspect for any visible damage. Ensure all components are present.

3.2 Hardware Connection

1. **Power Supply:** Connect the module to a stable 3.3V power source via the VCC and GND pins.
2. **Antenna Connection:** Connect a compatible external active antenna to the IPX interface. Ensure the connection is secure.
3. **Data Connection:** For data communication, connect the module to your host device (e.g., PC, microcontroller) using the TXD and RXD pins for serial communication, or the Type-C USB port for PC connection.
4. **PPS Output:** The PPS pin provides a Pulse Per Second output for precise timing synchronization.

3.3 Initial Installation

Before powering on the module, ensure it is fixed in its intended installation location. The module requires a stable, non-moving state during power-on for proper initialization of its inertial sensors. Avoid any movement during the initial power-up sequence.

Figure 1: WitMotion WTGPS-300P Module. This image shows the compact design of the module, highlighting the Type-C USB port, IPX antenna connector, and various pins for power and data.

Multiple Antenna Options

External Antenna
•••
Built-in magnet, strong signal, high-stability 27dB high-gain omnidirectional active antenna wider working coverage, easy-absorption

Ceramic Antenna
•••
Network risk reduction, Robust rigidity with excellent mechanical properties longer lifetime. Highly integrated,performance-ensured Antennas are highly integrated to ensure equipment operation.

Figure 2: Hardware Analysis of WTGPS-300P. This diagram illustrates key components and interfaces of the module, including the IPX interface for external antennas, Type-C port for PC connection, Farah Capacitance for power backup, GPS-IMU for integrated navigation, and the serial connection points.

4. OPERATING INSTRUCTIONS

4.1 Power On and Initialization

Once connected, apply power to the module. The module will begin its initialization sequence. Ensure the module remains stationary during this phase to allow the inertial sensors to calibrate correctly.

4.2 Data Acquisition

The WTGPS-300P outputs positioning and navigation data through its serial port or Type-C USB interface. Use the provided PC software or a custom application to read and interpret the data stream. The data includes 3D position, 3D velocity, 3D attitude (Pitch, Roll, Heading), 3D acceleration, and 3D angular velocity.

Combined Multiple Systems

High sensitivity | 135 channels
Support BDS/GPS/GLONASS,
single system of satellite navigation,
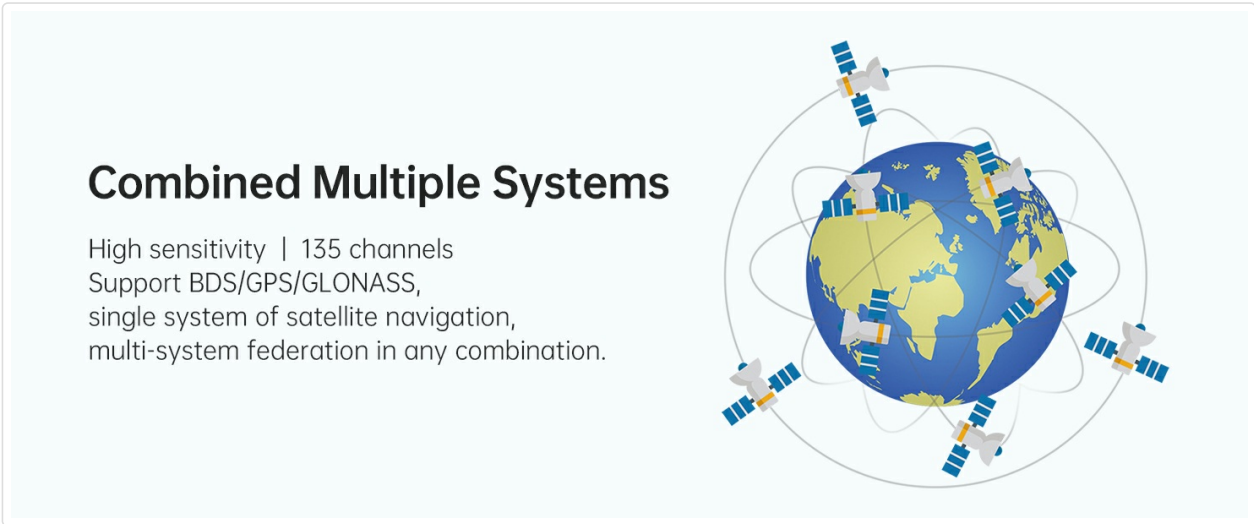multi-system federation in any combination.

Figure 3: Powerful Satellite Search. This image shows the PC software interface displaying satellite search results, including a sky plot of visible satellites and a bar graph indicating signal strength for various satellite systems.

4.3 Inertial Navigation and GPS Integration

The module automatically integrates GPS and inertial navigation data. In environments where GPS signals are weak or unavailable (e.g., tunnels, underground garages), the inertial navigation system provides continuous positioning data. When GPS signals are restored, the system seamlessly switches back to GPS-aided navigation.

Precise Driving Behavior Analysis

The WTGPS-300 allows for precise driving behavior analysis like rapid acceleration, deceleration, lane changes, turns, rollovers, abnormal attitudes, and collisions using high-precision vehicle data from the integrated navigation system.

Satellite navigation 3D position → Inertial navigation 3D position

Satellite navigation 3D velocity → Inertial navigation 3D velocity

3D Attitude (Pitch+Roll+Heading)

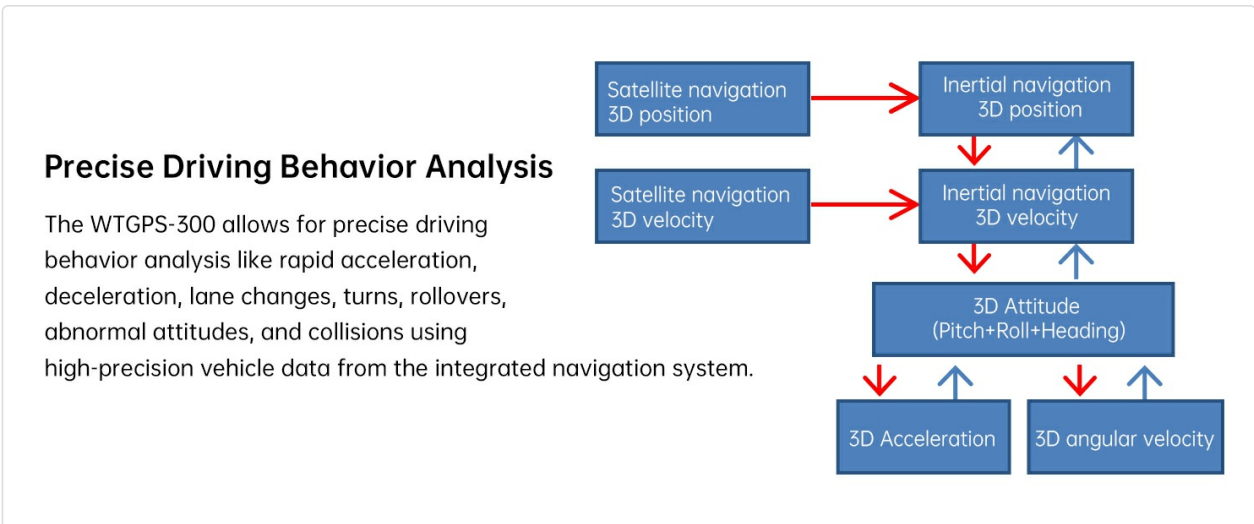3D Acceleration

3D angular velocity

Figure 4: High Precision INS - Precise Positioning. This image displays a map with vehicle trajectories in Shanghai, demonstrating how the WTGPS-300P maintains accurate positioning through tunnels and garages by integrating satellite and inertial navigation.

Figure 5: Signal Reception in Weak Signal Areas. This illustration shows the module's ability to maintain signal reception for up to 30 minutes even in areas with weak satellite signals, crucial for continuous navigation.
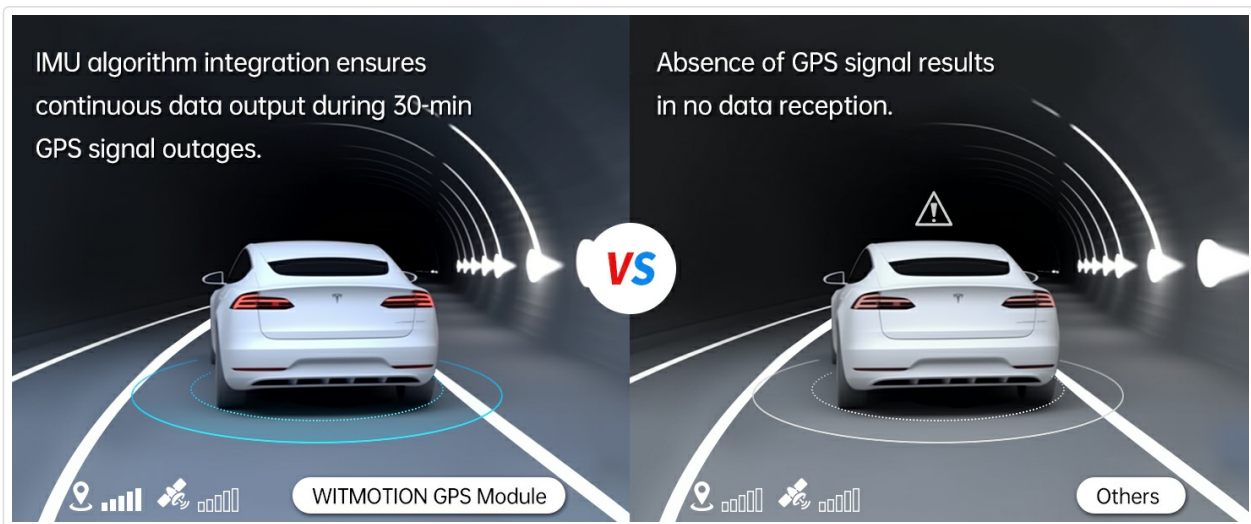

Figure 6: IMU Algorithm Integration. This comparison highlights the advantage of the WitMotion GPS module, demonstrating continuous data output during GPS signal outages in a tunnel, unlike other systems that may lose data.

4.4 Driving Behavior Analysis

The module's integrated navigation system provides high-precision vehicle attitude, acceleration, and angular velocity data. This data is used to perform accurate driving behavior analysis, identifying events such as rapid acceleration, rapid deceleration, sudden lane changes, sharp turns, vehicle rollovers, abnormal attitudes, and potential collisions.
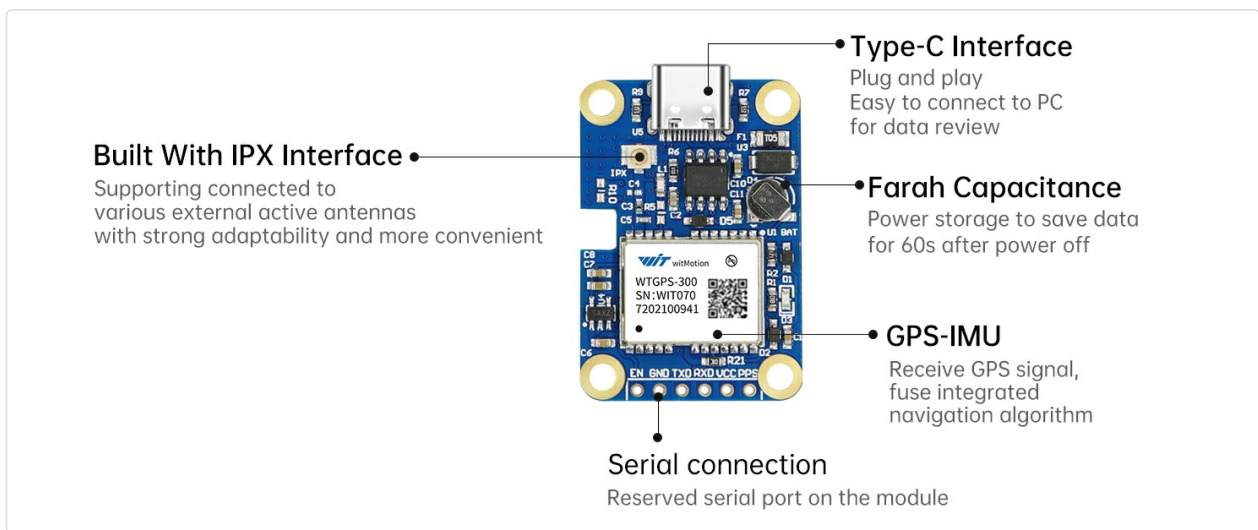
Figure 7: Driving Behavior Analysis Algorithm. This flowchart details the process of how satellite navigation and inertial navigation data are combined to derive 3D attitude, acceleration, and angular velocity for precise driving behavior analysis.

5. MAINTENANCE

The WTGPS-300P module is designed for durability and reliability. Minimal maintenance is required.

- **Keep Clean:** Ensure the module and its connectors are free from dust, dirt, and moisture.
- **Secure Connections:** Periodically check that all cable connections (power, antenna, data) are secure and free from damage.
- **Environmental Conditions:** Operate the module within its specified temperature and humidity ranges to ensure optimal performance and longevity.
- **Firmware Updates:** Check the official WitMotion website for any available firmware updates to ensure your module has the latest features and performance enhancements.

6. TROUBLESHOOTING

6.1 No Data Output

- **Check Power:** Verify that the module is receiving the correct 3.3V power supply.
- **Check Connections:** Ensure the serial or Type-C USB data connections are correctly wired and secure.
- **Software Configuration:** Confirm that your PC software or host application is configured with the correct serial port settings (baud rate, parity, stop bits).

6.2 Inaccurate Positioning

- **Antenna Placement:** Ensure the external antenna has a clear, unobstructed view of the sky. Avoid placing it near metallic objects that could interfere with signal reception.
- **Antenna Connection:** Verify the IPX antenna connection is tight and undamaged.
- **Initialization:** Confirm the module was stationary during power-on for proper inertial sensor calibration. If moved, power cycle the module while stationary.
- **Signal Environment:** In areas with very weak or no satellite signals, the accuracy will rely solely on inertial navigation, which may drift over extended periods without GPS correction.

6.3 Module Not Recognized by PC

- **USB Cable:** Try a different Type-C USB cable.
- **Drivers:** Ensure necessary USB drivers are installed on your PC. Refer to WitMotion support resources for driver information.
- **Port Conflict:** Check Device Manager for any conflicts or unrecognized devices.

7. SPECIFICATIONS

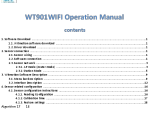| Parameter	Value
Item Weight	0.02 Kilograms (0.704 ounces)
Package Dimensions	2.91 x 2.91 x 0.87 inches
Voltage	3.3V
Working Temperature	-30°C to 85°C
Storage Temperature	-40°C to 125°C
Timing Precision (SBAS)	1.0m
Positioning Precision (RMS)	30ns
Speed Precision (99%)	60ns
Heading Precision	0.05m/s
Operating Limit (Angle)	0.3 degrees
Operating Limit (Dynamic)	<= 4g
Operating Limit (Height)	<= 50,000m
Operating Limit (Velocity)	<= 500m/s
Mounting Type	Dashboard Mount, Panel Mount
Supported Satellite Systems	BDS/GPS/GLONASS

Figure 8: WTGPS-300P Technical Specifications. This table provides detailed technical parameters for the module, including physical dimensions, electrical requirements, environmental limits, and performance metrics for timing, positioning, speed, and heading precision.

8. WARRANTY AND SUPPORT

For warranty information, technical support, and additional resources, please visit the official WitMotion website or contact their customer service. Keep your purchase receipt for warranty claims.
WitMotion Official Website: Visit the WITMOTION Store on Amazon

Related Documents - WTGPS-300P

	WITMOTION WTGAHRS1 GPS IMU User Manual User manual for the WITMOTION WTGAHRS1 GPS IMU sensor. Learn about its features, industrial applications, PC/Android integration, calibration, and MCU connectivity.
	WitMotion Sensor Product Catalog and Document Center Explore the comprehensive range of WitMotion sensors, including Bluetooth Accelerometers, Digital Inclinometers, GPS IMUs, RTK Positioning Sensors, and more. Access tutorials, datasheets, and support information for WitMotion products.
	WITMOTION WTGAHRS2 GPS IMU User Manual and Technical Guide Comprehensive user manual for the WITMOTION WTGAHRS2 GPS IMU sensor. Learn about its features, applications, connection methods, software, and technical specifications.
	WT901WIFI Operation Manual This manual provides detailed instructions for the operation, connection, configuration, and calibration of the WT901WIFI Inertial Measurement Unit (IMU) from WitMotion. It covers software setup, sensor network configuration (AP and Station modes), data communication protocols (UDP and TCP), and various calibration procedures.
	WT901C Digital Attitude Sensor: Specification, Features, and User Guide Comprehensive guide to the WitMotion WT901C Digital Attitude Sensor, covering its specifications, features, hardware and software connections, calibration procedures, serial communication protocols, and application areas.
	WITMOTION WTGAHRS2 GPS IMU User Manual User manual for the WITMOTION WTGAHRS2 GPS IMU sensor, detailing its features, installation, configuration, and usage for accurate attitude and position measurement in industrial applications.