

HARDWARE MANUAL

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Q.MAX5

Multi-Band RTK GNSS Module with IMU

Multi-Band RTK GNSS + 6-DOF IMU Precision Positioning Module

GNSS CORE

Septentrio Mosaic-X5

RTK ACCURACY

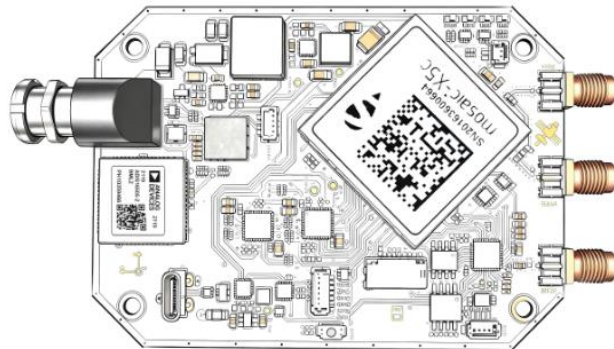
0.6 cm + 0.5 ppm

INERTIAL

ADI ADIS16505-1 6-DOF

UPDATE RATE

up to 100 Hz



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About This Manual

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Safety and Warning Instructions

This manual outlines the commissioning, installation, and operation of the Q.MAX5 Multi-Band RTK GNSS Module with integrated IMU.

- This equipment may only be used for the purpose specified by the manufacturer.
- This manual should be kept accessible.
- Illegal changes and the use of spare parts as well as accessories that have not been sold or recommended by the manufacturer of this unit can cause operational failures or hazards. Such measures lead to an exclusion of liability, and the manufacturer accepts no responsibility.
- Repairs may only be carried out by the manufacturer or accredited distributor/re-seller.
- Basis for the guarantee of the manufacturer is the version of the warranty policy for the unit at the time of purchase. No liability is accepted for inappropriate, incorrect manual or automatic setting of parameters, or improper use.
- The distributor/re-seller is responsible for ensuring that the device is assembled and integrated according to recognised technical guidelines as well as valid regulations in the country of use.

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1. Introduction Summary

This manual outlines the technical characteristics, specifications, and integration guidelines for the Q.MAX5 Multi-Band RTK GNSS Module with Integrated 6-DOF IMU.

2. Product Overview & Technology

The Technology

The Q.MAX5 is a complete, high-precision positioning receiver, pairing a multi-band Septentrio Mosaic-X5 engine with an industrial-grade ADI ADIS16505 6-DOF IMU. It is engineered to maintain continuous position and heading updates in difficult RF and satellite-denied environments—such as under orchard canopies, inside urban canyons/tunnels, and through heavy EMI or water-surface multipath.

Around the Septentrio Mosaic-X5 core (tracking GPS, GLONASS, Galileo, BeiDou, QZSS, and NavIC on L1/L2/L5), on-module sensor fusion with the 6-DOF IMU supplies continuous Dead Reckoning when the sky is blocked. RTK holds 0.6 cm + 0.5 ppm accuracy and PPK holds 0.5 cm + 0.5 ppm at update rates up to 100 Hz.

Flexibility & System Concept

Integration is open:

- **Protocols:** NMEA 0183 v4.10, SBF (Septentrio Binary Format), RTCM 2.x/3.x, UBX pass-through, and NTRIP client/server.
- **Hardware Interfaces:** Dual 3.3V TTL UARTs, USB 2.0 High-Speed, CAN 2.0B / CAN-FD, and 1PPS output (< 20 ns).
- **Storage & Logging:** MicroSD card slot over SDIO for gapless raw PPK data logging, buffered by 4 MB PSRAM cache.

3. Technical Data & Specifications

01 GNSS & Positioning Performance

Parameter	Value
GNSS Core	Septentrio Mosaic-X5 multi-frequency, full-constellation receiver
Constellations	GPS (L1C/A, L1C, L2C, L2P, L5), GLONASS (L1CA, L2CA, L3), Galileo (E1, E5a, E5b, AltBOC), BeiDou (B1I, B1C, B2I, B2a, B3I), QZSS (L1C/A, L1C, L2C, L5), NavIC (L5)
Standalone Accuracy	Horizontal 1.2 m · Vertical 1.9 m
RTK Accuracy	Horizontal 0.6 cm + 0.5 ppm · Vertical 1.0 cm + 1 ppm
PPK Accuracy	Horizontal 0.5 cm + 0.5 ppm · Vertical 0.8 cm + 1 ppm
TTFF	Cold start < 45 s · Hot start < 2 s
Velocity Accuracy	0.03 m/s
Anti-Interference	Septentrio AIM+ dynamic notch filtering with spoofing detection

02 Inertial Sensor (ADI ADIS16505-1)

Parameter	Value
Sensor Type	Industrial 6-DOF MEMS combo (3-axis gyroscope + 3-axis accelerometer)
Gyroscope (Triaxial)	Range ± 125 / ± 500 / ± 2000 °/s · In-run bias stability 2.3 °/hr · ARW 0.13 °/√hr
Accelerometer (Triaxial)	Range ± 78.4 m/s ² (± 8 g) · In-run bias stability 26.5 μ m/s ² (X/Y) · VRW 0.035 m/s/√hr
Sampling & Output	Up to 2000 Hz internal sampling · Filtered output at 100 / 200 Hz

03 Processing, Memory & Storage

Parameter	Value
MCU	STM32H743VIHx · Arm Cortex-M7 @ 480 MHz · 1027 DMIPS · Double-precision FPU · 1 MB SRAM
System RAM	ESP-PSRAM32 · 4 MB external PSRAM cache (zero packet loss on high-frequency streams)
Firmware Storage	W25Q128JVS · 128 Mbit (16 MB) NOR Flash with XIP (execute-in-place)
Data Logging	MicroSD card slot over SDIO for long-term raw PPK logging

04 Protocols & Interfaces

Parameter	Value
Protocols	NMEA 0183 v4.10, SBF, RTCM 2.x/3.x, UBX pass-through, NTRIP client/server
UART	2× UART (3.3 V TTL, up to 921,600 bps)
USB	1× USB 2.0 High-Speed (Type-C / header) for local web GUI & streaming
CAN Bus	1× CAN 2.0B / CAN-FD (optional onboard transceiver)
PPS Output	1× PPS time pulse (< 20 ns accuracy)
Antenna Inputs	Main GNSS + Aux GNSS (dual-antenna heading) + 2.4 GHz WiFi antenna

05 Electrical & Physical

Parameter	Value
Input Supply (VIN)	3.5 V min · 12 / 24 V typical · 60 V max (reverse-voltage protected)
Power Management	TI TPS54260DRCR step-down · 2.5 A continuous output · Eco-mode
Power Consumption	1.8 W typical · 2.5 W max (RTK active + IMU streaming + SD logging)
Operating Temperature	−40 °C to +85 °C (Industrial grade)
Dimensions & Weight	45 × 35 × 12 mm (PCB mainboard) · Weight: 32 g

4. What's Included & Key Components

- Q.MAX5 RTK GNSS Carrier Mainboard
- Onboard Septentrio Mosaic-X5 Receiver Core
- Onboard ADI ADIS16505-1 6-DOF IMU Sensor
- Onboard MicroSD Card Slot
- 2.4 GHz WiFi Antenna Input for Local Web Configuration

5. Target Applications

1. **Autonomous Agriculture & Ag-Robotics:** Tractor auto-steer, precision spraying, and robotic harvesting under heavy orchard canopy.
2. **Surveying & Construction Machinery:** Excavator grade control and drone LiDAR/photogrammetry mapping with zero-loss PPK logging.
3. **UGVs & Autonomous Driving:** Centimeter-level Dead Reckoning in urban canyons, tunnels, and high-EMI industrial complexes.
4. **Autonomous Marine & Yacht Navigation:** Centimeter positioning and attitude tracking for autonomous yachts and USVs through water multipath and wave motion.

6. Quick Web Configuration

The module supports local browser configuration via its 2.4 GHz WiFi connection. Users can configure baud rates, network streams, and output protocols without installing specialized software or setting up cloud accounts.

The detailed configuration guides will follow the official documents of Septentrio Mosaic-X5.

7. Power & Protection Management

Powered by a TI TPS54260 step-down converter (3.5 V ~ 60 V input range), the board operates directly off 12 V, 24 V, or 48 V vehicle buses. Built-in protection includes reverse-voltage protection, over-current protection with frequency foldback, and thermal shutdown.

8. Care, Maintenance & Warranty

- **Maintenance:** The Q.MAX5 module is maintenance-free.
- **Warranty:** 2-year manufacturer warranty. Product defects are repaired or replaced free of charge.
- **Component Availability:** Mechanical/hardware components guaranteed available for 15 years.



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