LOCOSYS

GNSS Wireless & Communication

Datasheet of HAWK-Titan

AHRS/IMU/RTK/Heading Embedded Box

Version 1.0

2025/8/5

HYPER-TECH Systems

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Product name	Description	Version
HAWK-Titan	AHRS/IMU/RTK/Heading	1.0

1. Introduction

HAWK-Titan, developed by LOCOSYS Technology Inc., is a highly integrated navigation module designed for UAVs, autonomous vehicles, and surveying applications. It combines dual-frequency GNSS positioning, MEMS IMU, AHRS (Attitude and Heading Reference System), RTK (Real-Time Kinematic) correction, and dual-antenna heading solution. The module offers high-rate data output and robust interference resistance, making it ideal for embedded systems and dynamic environments where size, power, and accuracy are critical.

Key Technologies & Design Advantages

- Supports GPS/QZSS, GLONASS, Galileo, and BeiDou with dual-frequency reception (L1 + L5)
- Integrates high-precision MEMS gyroscope and accelerometer with low bias drift and wide dynamic range
- Built-in AHRS fuses data from IMU, magnetometer, barometer, and GNSS to deliver full attitude estimation (roll, pitch, yaw)
- RTK-enabled, compatible with RTCM 3.3 standard messages for centimeter-level positioning
- Dual-Antenna heading system achieves up to 0.1° heading accuracy, independent of magnetic interference
- Provides real-time output at up to 100 Hz, covering position, velocity, orientation, and heading

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2. Technical Highlights

AHRS (Attitude and Heading Reference System)

By fusing IMU, magnetometer, barometer, and GNSS data, the HAWK-Titan delivers accurate 3D orientation outputs (Roll, Pitch, Yaw), maintaining high stability even in magnetic interference or high-dynamic environments.

Inertial Measurement Unit (IMU)

- Equipped with high-grade MEMS gyroscopes and accelerometers
- Low bias instability and 0.1% full-scale non-linearity
- Supports 100Hz update rate, suitable for fast control feedback and dynamic tracking
- Compact, low-power design for seamless system integration

RTK (Real-Time Kinematic Positioning)

- Fully compatible with RTCM 3.3 message types (1005, 1074, 1084, etc.)
- Provides sub-meter to centimeter-level positioning in open-sky environments
- Ideal for precision agriculture, construction surveying, and robotic navigation

Heading (Dual-Antenna Solution)

- Delivers heading accuracy from 2.0° down to 0.1°, depending on baseline length
- Provides accurate heading even in static or low-speed scenarios
- Immune to magnetic distortion, outperforming traditional magnetometer-only solutions

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3. Application Scenarios

UAV Navigation

Supports mission-critical drone operations such as agricultural spraying, aerial mapping, and inspection. Enables smooth flight control and precise route tracking.

- ✓ High-frequency 100Hz output
- ✓ Centimeter-level RTK positioning
- ✓ Accurate heading without motion
- ✓ Stable flight performance in wind and vibration

Autonomous Ground Vehicles (AGV/UGV)

Delivers reliable navigation and heading solutions for industrial vehicles in logistics, agriculture, and mining.

- ✓ GNSS+IMU fusion for stability in multipath or GNSS-denied zones
- ✓ 0.1° heading precision with dual-antenna configuration
- ✓ MAVLink support for easy system integration
- ✓ Rugged design for all-weather, vibration-heavy environments

Precision Surveying and Mapping

Provides accurate positioning and orientation for geospatial professionals in mobile mapping and 3D reconstruction tasks.

- ✓ Multi-constellation GNSS (L1+L5)
- ✓ RTCM 3.X RTK compatibility for seamless base station integration
- ✓ Barometric sensor for accurate altitude referencing
- ✓ Suitable for static and dynamic data collection

By integrating advanced IMU, AHRS, RTK, GNSS, and dual-antenna heading technologies into one compact unit, HAWK-Titan delivers highly accurate, stable, and real-time navigation data. Whether airborne, on land, or in field survey applications, HAWK-Titan provides a dependable navigation core for next-generation autonomous and geospatial systems.

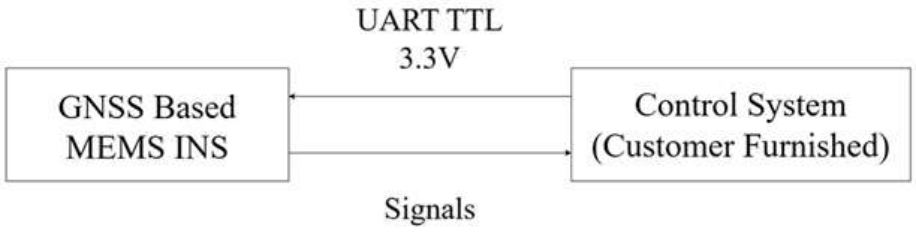
4. Electrical Specifications

Sensor Fusion Performance	
Roll & Pitch (RMS)	0.2 °
Heading (RMS)	0.8 °
Position (CEP)	1 m
Velocity (RMS)	0.05 m/s
Gyroscope Parameters	
Operating Range	± 2000 °/s
In-run Bias Instability	8 °/hr
Noise Density	0.42 °/$\sqrt{hr}$
Bandwidth (-3 dB)	520 Hz
Non-linearity	0.1 % FS (Full Scale)
Scale Factor Variation	0.5 % (typ.), 1.5 % (over life)
Accelerometer Parameters	
Operating Range	± 10 g
In-run Bias Instability	12 µg (x, y), 15 µg (z)
Noise Density	60 µg/$\sqrt{Hz}$
Bandwidth (-3 dB)	500 Hz
Non-linearity	0.1 % FS (Full Scale)
Magnetometer Parameters	
Operating Range	± 8 G
Total RMS Noise	1 mG
Non-linearity	0.2 %
Resolution	0.25 mG
Barometer Parameters	
Operating Range	300-1250 hPa
Total RMS Noise	1.2 hPa
Relative Accuracy	± 8 Pa

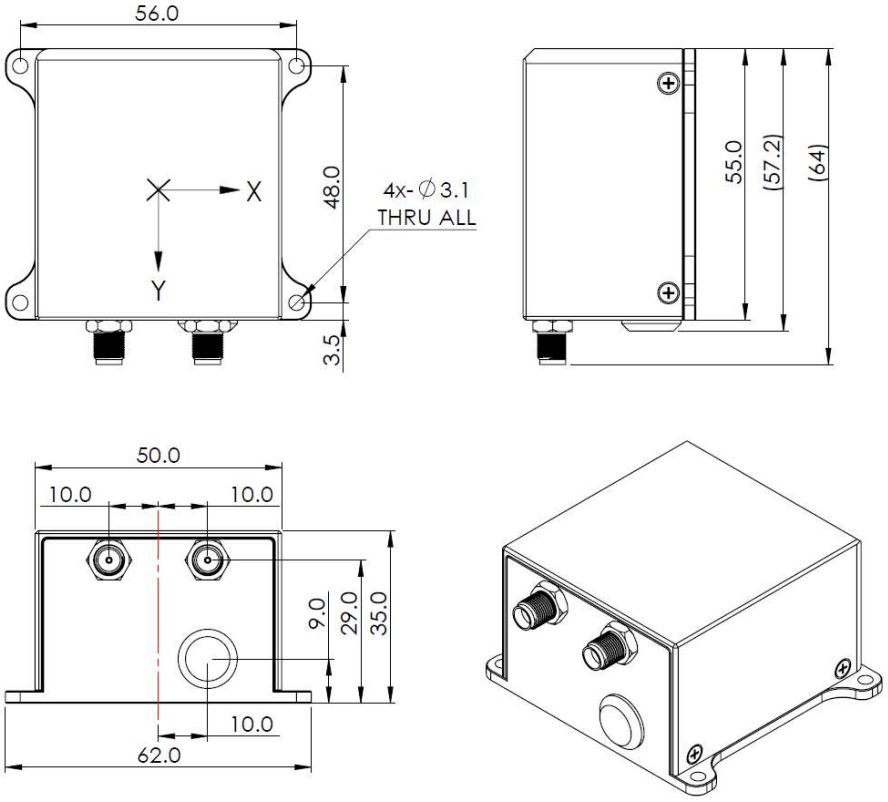
GNSS Receiver	
Frequency	GPS/QZSS: L1 C/A, L5C GLONASS: L1OF GALILEO: E1, E5a BEIDOU: B1I, B2a
Dual Antenna Heading Accuracy (RMS)	2.0° @ 0.1 m Baseline 0.4° @ 0.5 m Baseline 0.2° @ 1.0 m Baseline 0.1° @ 2.0 m Baseline
RTK Support(1)	RTCM V3.X Message type 1005, 1074, 1084, 1094, 1114, 1124
System Parameters	
Weight(2)	105 gram
Dimensions(3)	55 mm × 50 mm × 35 mm
Input Voltage	5 V
Power Consumption	1.3 W
Serial I/O	UART TTL
Output Data Rate(4)	100 Hz (50Hz for MAVLink format)
Operating Temperature Range	-25 ~ 85 ℃
Storage Temperature Range	-25 ~ 85 ℃

Note: All specifications of MEMS sensors are by design
(1) Factory setting does not support RTCM input
(2) 105g (main unit only), 147g (antenna)
(3) Dimensions exclude connector length
(4) With dual antenna heading output at 2 Hz

5. Block diagram



6. Antenna Dimensions



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Document change list

Revision 1.0

- First release on Aug. 05, 2025.