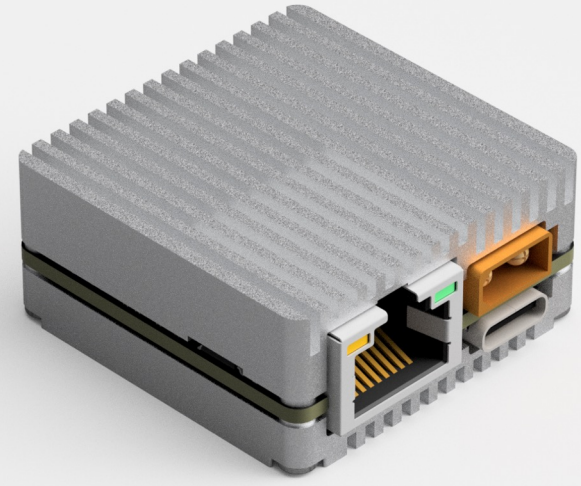
olive

olixSense™ X1 Ultra IMU / AHRS Sensor

Embedded AI Fusion | Penta Redundant | Gigabit POE+ Ethernet | ROS2 Native



ROS

olixAI™ Embedded AI Sensor Fusion

Gigabit POE Ethernet

Penta 3-Axis Gyroscope

Penta 3-Axis Accelerometer

Technical Document No. 1765556141 | SKU# OLVX-X1-PIMU-ETH-POE | Revision V0.4 - Dec 2025

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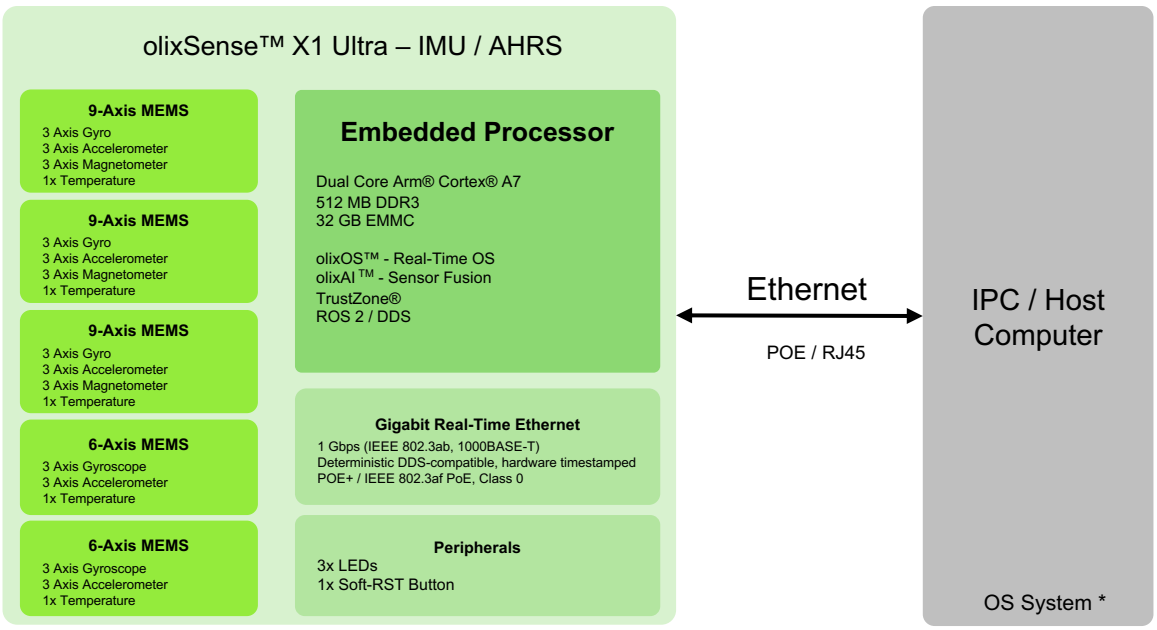
1. Product Overview

The olixSense™ IMU X1 Ultra is a high-performance inertial measurement unit designed for advanced mobile robotics, industrial automation, and autonomous systems. Built with a dual-core embedded processor, real-time Linux kernel (olixOS™), and native ROS 2 integration, it delivers AI-enhanced sensor fusion, robust timing, and low-latency inertial data ideal for high-frequency control and SLAM pipelines.

2. Key Features

- 39-DoF Inertial Sensing: Penta 3-axis gyroscopes, accelerometers, and triple magnetometer
- Real-Time Embedded AI Fusion: Deep fusion with redundancy and failover
- ROS 2 Native: Direct DDS communication, plug-and-play for robotic middleware
- High-Frequency Output (ODR) : Up to 1000 Hz raw & fused
- Low-Latency Gigabit Ethernet: Deterministic, real-time data transport
- Onboard Processing: Dual-core Cortex-A7 + 512MB DDR3 RAM
- Industrial-Grade: Vibration and temperature calibrated, 42g, 38x38x18 mm

3. System Architecture



IP Address: **192.168.7.100**

IP Address: **192.168.7.XXX**

* This device does not require any additional driver installation.

4. Applications

- Mobile Robots (AMR, AGV, UAV)
- Industrial Arms & Hands
- Research and SLAM Systems
- Sensor Fusion Systems
- Predictive Maintenance and Vibration Analysis

5. Sensor Specifications

- Sensor Fusion Performance

Parameter / Metric	Value
Roll, Pitch (Stationary, AHRS Mode, ODR 100 Hz)	< 0.1° RMSE
Roll, Pitch (Dynamic, AHRS Mode, ODR 100 Hz)	< 0.5° RMSE
Roll, Pitch (Stationary, IMU Mode, ODR 1 KHz)	< 0.25° RMSE
Roll, Pitch (Dynamic, IMU Mode, ODR 1 KHz)	< 0.5° RMSE
Yaw (Stationary, AHRS Mode, ODR 100 Hz) *	< 0.1° /hr
Yaw (Dynamic, AHRS Mode, ODR 100 Hz) *	< 0.003° /s
Yaw (Stationary, IMU Mode, ODR 1 KHz) *	< 0.3° /hr
Yaw (Dynamic, IMU Mode, ODR 1 KHz) *	< 0.005° /s

- Physical and Electrical

Weight	42g
Size	38.0 mm x 38.0 mm x 18.0 mm
Power Consumption	1.2 W (Typical), 1.8 W (Max)
Operating Voltage	6.0 to 56.0 VDC (POE+ Standard)
Operating Temperature	-10°C to 55°C
Interface LEDs	3x (Heartbeat, User, System)

- System Performance

Metric	Value
Attitude Accuracy (AHRS)	< 2° RMSE (yaw), < 0.5° RMSE (roll / pitch)
Latency (m2d) / (motion to dds message)	< 1 ms (AI fused output)
Time Sync Error (DDS)	< 200 µs (DDS – ROS 2)
Allan Variance	VRW 0.06 m/s/√hr, ARW 0.43 °/√hr
AGV Rotation Test	Yaw RMSE: 1.0°, Std Dev: 0.5°
OptiTrack Ref	Used 8x PrimeX 22 for GT validation
Ingress Rating	IP51
Vibration Resistance	5g RMS, 20-2000 Hz

* The heading accuracy depends on sensor configuration and calibration. A fully calibrated sensor and ideal tilt compensation are assumed.

- MEMS Sensor Performance

Specification	Accelerometer	Gyroscope	Magnetometer
Range	± 4g, 8g, 16g	± 250 °/s, 500 °/s, 2000 °/s	± 1300 µT
Resolution	16-bit or 0.06 mg/LSB	16-bit or 0.004 dps/LSB	16-bit
Sensitivity	2048 LSB/g @ ±16 g	262.1 LSB/dps @ ±125 deg/sec	± 0.3 µT
Sensitivity Tolerance	±4 % @Ta=25°C, gFS2g	±3 % @ Ta=25°C, RFS2000	±0.03% @ After API compensation -40°C ≤ TA ≤ +85°C Nominal VDD supplies
Zero-rate Offset	±20 mg	±0.5 dps	-
Output Noise Density	160 µg/√Hz	0.008 dps/√Hz	-
Zero-g Offset (x,y.z)	±150 mg @ gFS2g, TA=25°C, nominal VDD supplies, over life-time	+3 dps @ Nominal VDD supplies T A =25°C, Slow and fast offset cancellation off	-
Nonlinearity	0.5 %FS @ TA=25°C, nominal VDD, best fit straight line gFS2g	0.01 %FS @ TA=25°C, nominal VDD, best fit straight line RFS250, RFS2000	1.2 %FS @ best fit straight line

- Communication Interface / ODR

Interface Connector	Ethernet RJ45 / LAN
Communications Protocol	1 Gbps (IEEE 802.3ab, 1000BASE-T)
Output Data Rate (Raw and Fused Data)	1-1000 Hz
Middleware / Protocols (DDS)	- rmw_fastrtps_cpp - rmw_cyclonedds_cpp - rmw_connext_cpp - rmw_zenoh
ROS 2 Distribution	- Humble - Jazzy

- ROS 2 Native Messages

Topic/Service Name	Type	Description
/imu	sensor_msgs/Imu	Acc, Gyro, Quaternion
/acceleration	geometry_msgs/msg/AccelStamped	Gravity Compensated Accel
/magneticfield	sensor_msgs/MagneticField	Magnetic Field
/velocity	geometry_msgs/msg/TwistStamped	Relative Velocity
/temperature	sensor_msgs/msg/Temperature	Sensor Temperature
/status	diagnostic_msgs/msg/DiagnosticStatus	Sensor Status

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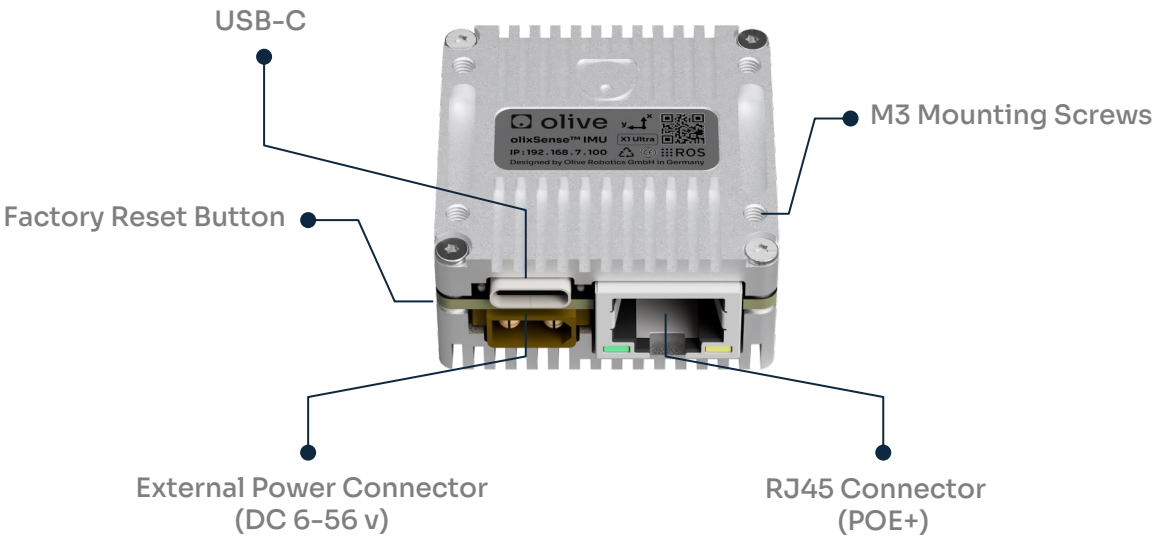
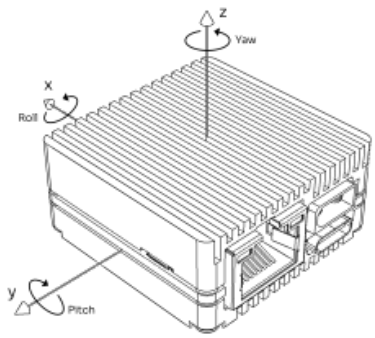
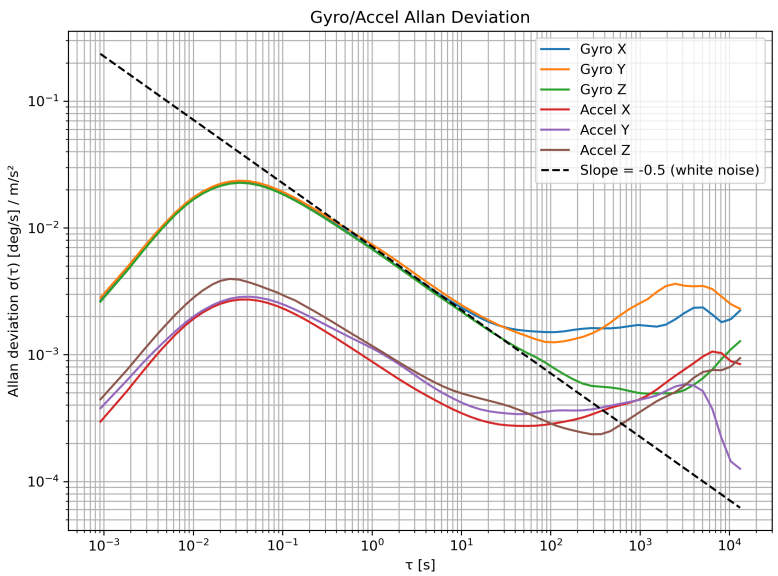
- **Sensor Interface / Peripherals**



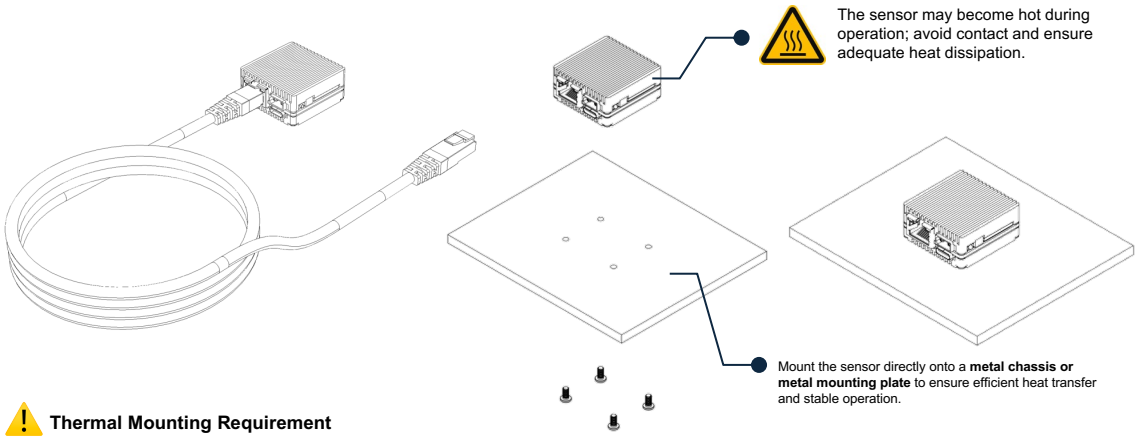
- **Coordinate Frame / Axis**



- **Performance Test / Allan Deviation Plot**



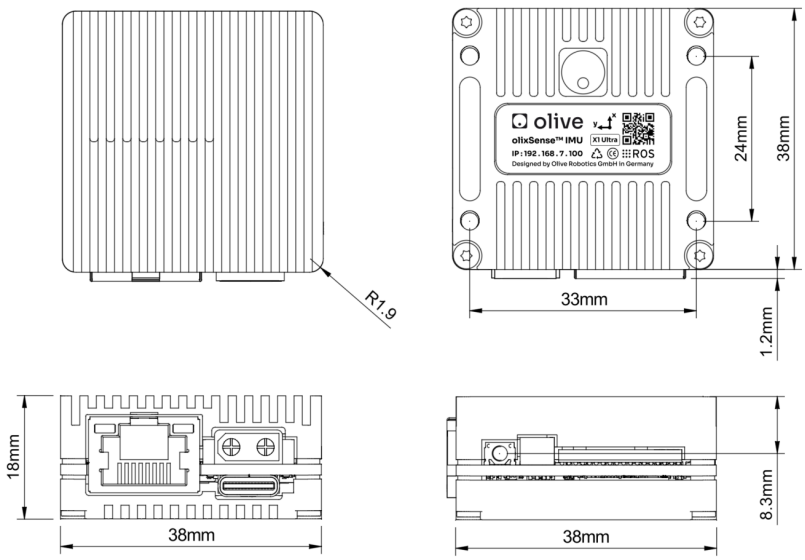
- Mechanical Installation Overview



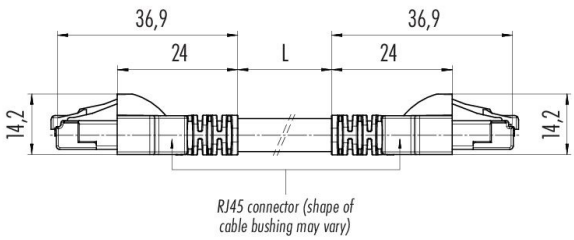
Thermal Mounting Requirement

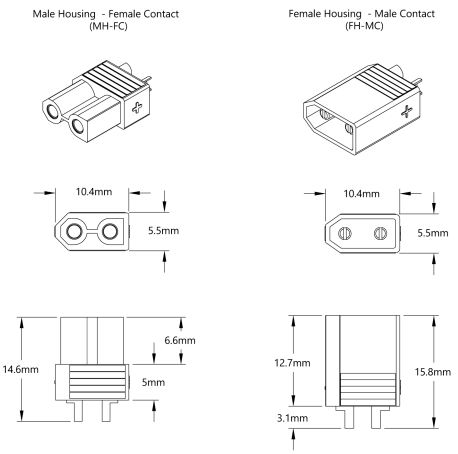
For proper operation and long-term reliability, the sensor **must be mounted on a metal surface** of the system or robot to allow effective heat dissipation. Operating the sensor **without adequate thermal coupling**, or in **warm or poorly ventilated environments**, can lead to elevated internal temperatures. Prolonged exposure to excessive heat **may degrade performance and cause permanent damage** to the sensor over time.

- Physical Dimensions



- Connector Specification





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