olixSense™

X2 Pro

Inertial measurement. Relative and magnetometer-aided orientation.



olixAI™
Sensor fusion

olixOS™
Embedded platform

USB-C
Power + IP data

Multi-Redundant MEMS with Advanced Skew-Redundant Geometry Mounting. Fused orientation, angular velocity and acceleration in one virtual measurement frame.

IMU + AHRS

Relative or magnetometer-aided orientation

ROS 2 native

DDS topics · TCP / UDP JSON
Browser configuration

1,000 Hz

Maximum publish-rate setting[1]
100 Hz default

NETWORK / POWER

Ethernet-over-USB · USB-C power

NOMINAL ENVELOPE[2]

66 × 48 × 16 mm

[1] Effective throughput depends on configuration and host. [2] Includes mounting tabs; excludes cable and mating plug. Performance figures and their status are specified on page 3.

02 Architecture 03 Performance 06 Connection 10 Mechanical 12 Disclaimer

01 / SENSING AND OPERATING MODES

Architecture and operating modes

A unified sensing pipeline delivers fused and filtered motion data in a common virtual measurement frame.

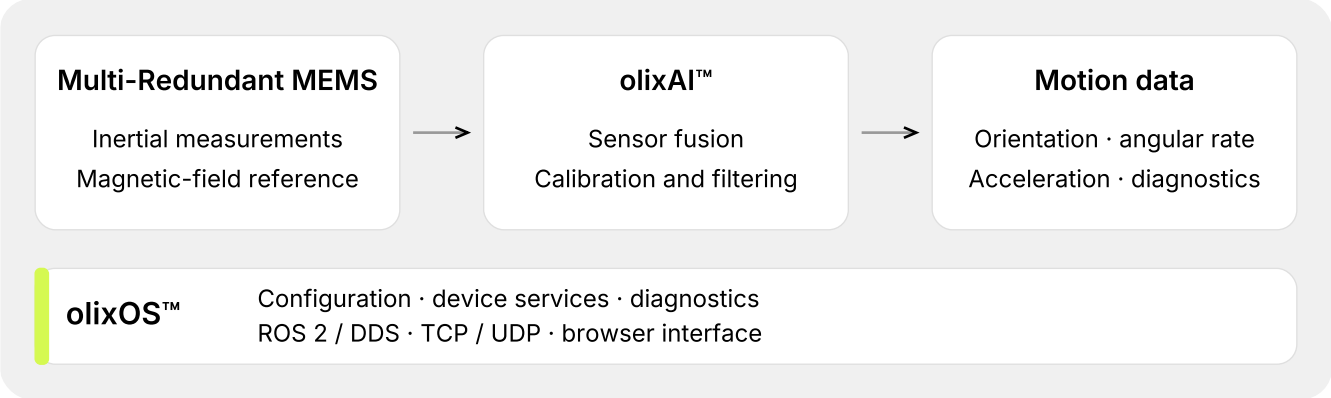


Figure 1. Product-level sensing and software architecture.

Function	Description
Sensing technology	Multi-Redundant MEMS with Advanced Skew-Redundant Geometry Mounting
Sensor fusion	olixAI™ combines inertial measurements, calibration and filtering into a unified output
Operating system	olixOS™ manages sensor services, configuration, diagnostics and network access
Measurement reference	Virtual origin at the board centre, aligned with the central inertial reference frame
Published data	Orientation quaternion, angular velocity, acceleration and auxiliary diagnostic streams

IMU and AHRS modes

Characteristic	IMU mode	AHRS mode
Orientation reference	Relative to the initialized or user-defined orientation	Orientation with magnetic heading aiding; local zero is configurable
Fusion inputs	Inertial acceleration and angular-rate measurements	Inertial measurements with magnetometer data
Magnetometer role	Excluded from the orientation solution	Included in the orientation solution
Typical application	Relative motion tracking and externally aided estimation	Attitude estimation with magnetic heading reference

For AHRS operation, perform magnetic calibration in the installed configuration and maintain suitable separation from magnets, high-current wiring and ferromagnetic structures. Local orientation zero and magnetic heading reference serve different purposes.

02 / FUSED DATA

Fused-output performance

Relative orientation, noise and stability at the olixAI™ fused output.

Settled relative orientation · RMSE[1]

Operating mode	Roll	Pitch	Yaw
AHRS	< 0.4°	< 0.6°	< 0.5°
IMU	< 0.4°	< 0.4°	< 0.2°

Estimated aggregate RMSE for settled single-axis rotations. The metric describes relative angular displacement after motion has stopped.

Moving-platform settled-angle RMSE[1]

Operating mode	Roll	Pitch	Yaw
AHRS	< 1.1°	< 1.2°	< 1.7°
IMU	< 1.1°	< 1.2°	< 1.3°

Estimated relative-angle error between settled poses on a moving platform. This metric does not specify continuous tracking or absolute magnetic-heading accuracy.

Fused inertial noise and stability[1]

Parameter	Estimated bound	Unit
Gyroscope noise density	< 0.01	°/s/√Hz
Angle random walk	< 0.6	°/√h
Gyroscope bias instability	< 7	°/h
Accelerometer noise density	< 200	µg/√Hz
Velocity random walk	< 0.11	m/s/√h
Accelerometer bias instability	< 0.001	m/s^2

Noise and stability estimates represent three-axis means for stationary operation at room temperature. Allan-derived white-noise coefficients and bias instability are distinct from absolute bias and thermal drift.

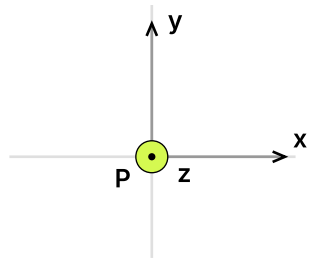
[1] **Specification basis.** Engineering estimates, rounded conservatively toward larger error or noise. The < notation denotes an estimated aggregate bound; it is not a measured X2 acceptance limit, a maximum sample error or a production guarantee. Model-specific performance validation remains pending.

Performance depends on operating mode, calibration, temperature, measurement range, output bandwidth and installation. Compare results using matching filter and publication settings.

03 / MEASUREMENT REFERENCE

Virtual measurement frame

Fused and filtered data is published at a virtual measurement origin located at the board centre.



Virtual measurement origin

One reference for the fused output

Position: board centre

Pose: central inertial reference frame

Orientation · angular velocity · acceleration
Fused and filtered by olixAI™

Right-handed schematic; output convention set in olixOS™.

Figure 2. Virtual origin P in a simplified board view. Axis arrows illustrate a right-handed reference frame; physical installation orientation follows the selected output convention.

Reference	Definition
Measurement origin P	Board centre; a virtual reference point for the fused output
Reference orientation	Aligned with the central inertial reference coordinate frame
Published quantities	Orientation, angular velocity and acceleration expressed in the configured output frame
Robot integration	Apply the installation transform from the sensor output frame to the robot frame

Measurement ranges

Parameter	Range / specification	Condition
Acceleration	±2, ±4, ±8, ±16 g	Selectable in IMU mode; ±4 g in AHRS mode
Angular-rate front end	±125, ±250, ±500, ±1,000, ±2,000 °/s	Hardware full-scale options; selectable settings depend on the software configuration
Magnetic field	±1,300 µT (x/y); ±2,500 µT (z), typical	Native magnetic sensing axes
Temperature	Internal temperature data	Diagnostic output



Installation reference

Use one output convention and installation transform consistently in olixOS™, the robot model and the state estimator.

04 / ELECTRICAL AND PROCESSING

Power, USB and processing

Power and IP data share a USB-C connection to the host computer.

Interface / power	Specification	Integration detail
Physical connector	USB Type-C	Recessed connector with dual cable-retention positions
Data interface	Ethernet-over-USB 2.0	USB virtual network interface
USB network profiles	ECM / RNDIS	Profile availability follows device configuration and host support
Supply voltage	5 V DC, nominal	USB power input
Power source	USB host or powered hub	Select a source with sufficient current capacity for the ordered unit
Host connection	Data-capable USB port and cable	Verify USB networking support on the host operating system
Cable retention	Approved locking USB cable	Use matching screw hardware and provide strain relief

Embedded Physical AI for Sensors & Robots.

Processing and software platform

olixAI™ sensor fusion
olixOS™ device services

Resource	Specification
Operating system	olixOS™
Sensor fusion	olixAI™
Processor	8-core, 64-bit CPU; up to 2.2 GHz[1]
AI acceleration	Up to 6 TOPS peak[1]
Memory	4 GB
Storage	64 GB eMMC, nominal
Configuration	Integrated browser interface
Device services	Sensor streaming, calibration, diagnostics and software maintenance

[1] Peak platform capability. Sustained processing performance depends on workload and thermal conditions. USB bus speed and publication rate are distinct from sustained application throughput.

Use an approved data cable and a host port or hub rated for the ordered unit's USB supply-current requirement.

05 / CONNECTION

Ethernet-over-USB connection

A single USB connection provides power and network access.



Figure 3. X2 Pro with a USB data cable. Host connector and cable length follow the ordered configuration.



USB-C connector panel

Connection overview

Interface	Function
USB-C on sensor	Power input and Ethernet-over-USB data
Retention positions	Dual screw retention for the approved locking cable
USB host end	Connect to a data-capable host port or powered hub
Diagnostics	Network access to olixOS™ configuration and status

Installation sequence

Step	Action
01 · Mount	Secure the base to a rigid surface and establish the installed pose.
02 · Connect	Attach the approved USB data cable; secure the cable and connect it to the host.
03 · Configure network	Allow the USB network interface to enumerate. Set the host adapter to the sensor subnet.
04 · Integrate	Open olixOS™ at the device IP address; verify output mode, frame, timestamp and data stream.

Example setup: sensor `192.168.7.100` and host USB adapter `192.168.7.1/24`. Use the configured address on a commissioned unit. A USB data connection is required for network communication.

06 / CONNECTIVITY

Data interfaces and protocols

Native ROS 2 integration and timestamped JSON streaming operate over the USB network interface.

ROS 2 topic suffix[1]	Message type	Output
`imu`	sensor_msgs/msg/Imu	Quaternion, angular velocity, acceleration and covariance
`acceleration`	geometry_msgs/msg/AccelStamped	Gravity-compensated acceleration
`velocity`	geometry_msgs/msg/TwistStamped	Integrated velocity estimate[2]
`magneticfield`	sensor_msgs/msg/MagneticField	Magnetic field in tesla; auxiliary stream in IMU mode
`temperature`	sensor_msgs/msg/Temperature	Internal temperature
`status`	diagnostic_msgs/msg/DiagnosticStatus	System diagnostics
`/tf`	tf2_msgs/msg/TFMessage	Optional transform publication

[1] Example namespace: `/olive/olixSense/x2/id001/`. Device identifier and namespace are configurable. Topic availability follows the selected operating mode. [2] Use external aiding for sustained velocity estimation.

TCP / UDP data export

Setting	Specification
Transport	TCP or UDP server; configurable port, default **5600**
Data format	JSON; schema `olive_imu.v1`; TCP uses one newline-delimited object per sample
Timestamp and frame	`stamp.sec`, `stamp.nanosec`, `frame_id`
Orientation	Quaternion `x, y, z, w`
Motion units	Angular velocity: rad/s · acceleration: m/s²
Covariance	3 × 3 arrays for orientation, angular velocity and acceleration
UDP registration	An initial client packet registers the stream destination

Native ROS 2 integration

olixOS™ provides browser access to operating modes, parameters, calibration and diagnostics. ROS 2 services support bias setting, orientation zero, standby and restart. ROS 1 systems can integrate through a compatible bridge.

07 / HOST INTEGRATION

Network and host integration

Connect ROS 2, data loggers and custom applications through the USB network interface.

Access and addressing

Item	Integration detail
Sensor address	Default: `192.168.7.100`. Use the configured address after commissioning.
Host USB adapter	Example: `192.168.7.1/24`; keep host and sensor in the same subnet.
Browser access	Open `http://192.168.7.100` after the USB network interface is available.
Multiple sensors	Use unique addresses and ROS namespaces; configure USB subnets and host routes to avoid conflicts.
Host environment	ROS 2 Humble; match topic names and QoS. Verify host support for the selected ECM / RNDIS profile.

Select the data interface

Interface	Typical use	Connection behavior
ROS 2 / DDS	Robot state estimation	Topics, services, frame IDs and covariance
UDP / JSON	Live data and visualization	Initial client registration packet; receiver handles sample loss
TCP / JSON	Data logging and custom apps	Client opens a connection; newline-delimited samples; buffering possible

Read the main ROS 2 stream

```
ros2 topic echo /olive/olixSense/x2/id001/imu \
  --qos-reliability best_effort
```

Replace `id001` with the configured namespace. Match the subscriber reliability policy to the selected publisher QoS.

Time and estimator integration

Data item	Integration guidance
Timestamps	`stamp.sec` and `stamp.nanosec` encode message time. Use a shared time reference to correlate devices.
Frames and gravity	Use the configured `frame_id`; select the gravity-compensated `acceleration` stream when required by the estimator.
Covariance	Check the orientation, angular-velocity and acceleration covariance fields for the selected configuration.

The X2 acts as the TCP/UDP server. Enable the desired export in olixOS™ and apply any requested service restart before connecting the client.

08 / CONFIGURATION

Output configuration and calibration

Configure the sensor response and output convention for the application.

Control	Range / options	Default / behavior
Main IMU publish-rate setting	0–1,000 Hz	100 Hz
Auxiliary publish rate	1–200 Hz	100 Hz
System status rate	0–10 Hz	1 Hz
Acceleration / gyro low-pass	0–500 Hz setting	8 Hz; 0 disables the cutoff filter
Acceleration / gyro EMA gain	0–1	0.92
Publisher QoS	Best effort / reliable	Best effort
Operating modes	IMU / AHRS	Select inertial-relative or magnetometer-aided fusion
Application profiles	Drone / Mobile Robot / Humanoid / Raw	Profile-based configuration
Orientation zero	At startup / service command	Defines the local orientation reference

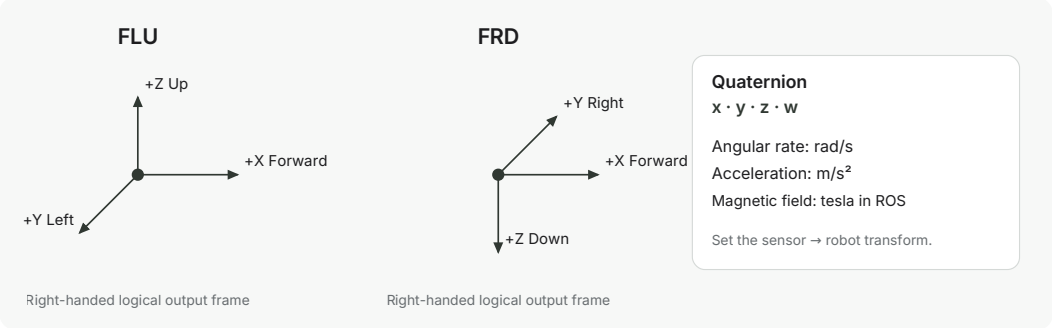


Figure 4. Logical FLU and FRD output conventions. Apply the sensor-to-robot transform for the installed pose.

Publication rate and measurement bandwidth are configured separately. Select filter settings compatible with the actual sampling rate, and verify gravity treatment and covariance conventions when integrating an estimator.

Calibration and reference setup

Operation	Purpose / method
Bias calibration	Keep the device stationary in its normal mounting pose; run the olixOS™ bias action or `setBias` service.
Orientation zero	Use `setZeroQuaternion` to define the present orientation as the local reference. This operation is separate from bias calibration.
Magnetic calibration	For AHRS operation, calibrate in the installed environment and check for magnetic disturbances.

Mode, profile and range changes may request a service restart. Confirm the active settings after applying the configuration.

09 / MECHANICAL

Dimensions and installation

Low-profile metal housing with an integrated mounting base and recessed USB-C connector.

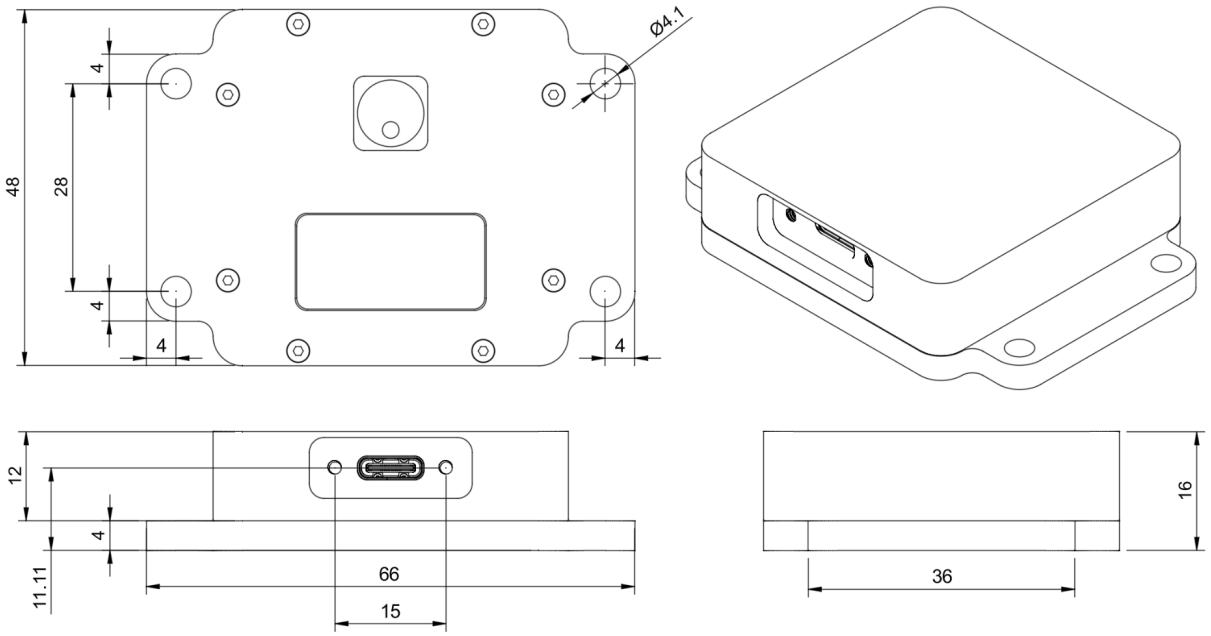


Figure 5. Supplied enclosure drawing. Dimensions in mm; use the controlled drawing for production tolerances.

Mechanical parameter	Nominal value
Overall envelope (W × D × H)	66 × 48 × 16 mm, including mounting tabs
Housing footprint	48 × 48 mm
Mounting base	66 × 48 × 4 mm
Mounting holes	4 × Ø4.1 mm
Mounting-hole centres	58 × 28 mm
Cable-retention centres	15 mm between retention positions
Housing	Metal enclosure; finish according to ordered configuration
Interface	USB Type-C; use the approved locking data cable

Mount to a rigid surface and apply the sensor-to-robot transform from the virtual measurement origin. Dimensions exclude the cable and mating plug. Provide connector access, cable bend clearance and strain relief; use the controlled drawing for production tolerances.

10 / CONDITIONS AND ORDERING

Environment, accessories and ordering

Define the sensor configuration and installation accessories for your application.

Environmental design envelope[1]

Parameter	Value
Ambient operating temperature	−20 to +60 °C[1]
Storage temperature	−20 to +70 °C[1]
Relative humidity	10–90% RH, non-condensing[1]

[1] Subsystem-based design envelope; complete-assembly environmental qualification remains pending. Thermal behavior depends on processing load, enclosure conditions and mounting.



Locking USB data cable

Specify cable length, host connector and retention hardware. One approved USB cable carries power and Ethernet-over-USB data.

Illustrated cable is a reference accessory; supplied appearance and configuration follow the quotation.

Ordering information

Item	Specify / confirm with the order
Product	olixSense™ X2 Pro - Ethernet-over-USB
Processing configuration	olixOS™ with olixAI™; 4 GB memory / 64 GB eMMC, nominal
Cable and USB host	Cable length, host connector, retention hardware and USB power capacity
Integration configuration	IMU or AHRS mode, output frame, namespace and publication rate
Installation	Mounting location, available clearance and environmental requirements
Delivery contents	Sensor and accessories as itemized in the quotation
Integration documents	Product documentation; order-specific mechanical and USB connection details

For application-specific confirmation, request the assembled mass, measured power, USB supply-current requirement and applicable environmental or conformity documentation with the quotation.

Olive Robotics GmbH

Daimlerstraße 7 · 85521 Ottobrunn · Germany
contact@olive-robotics.com · olive-robotics.com
Product documentation



Olive Robotics GmbH
Daimlerstraße 7, 85521 Ottobrunn, Germany
www.olive-robotics.com
contact@olive-robotics.com

Technical Document No. OLV-X2P-DS-0001 · olixSense™ X2 Pro
Revision 1.2 · 19 October 2026

Disclaimer

This document and the information contained herein are provided by Olive Robotics GmbH (“Olive Robotics”) for informational purposes only. While every effort has been made to ensure the accuracy and reliability of the content at the time of publication, all information is provided “as is”, without warranties of any kind, either express or implied, including but not limited to warranties of merchantability, fitness for a particular purpose, non-infringement, or accuracy. No representation is made, and no liability is assumed, for the completeness, accuracy, or reliability of the information, specifications, figures, or performance characteristics described herein. Users are solely responsible for evaluating the suitability of the information and the products described for their intended use. Olive Robotics reserves the right to modify, correct, enhance, or otherwise amend its products, specifications, documentation, and this publication at any time and without prior notice. This document supersedes all prior documentation relating to the subject matter contained herein. Use of any Olive Robotics product must comply with all applicable laws, standards, and regulations, and is subject to the terms and conditions of sale and/or licensing in effect at the time of purchase or use. For the latest version of this document or for additional product support, please visit www.olive-robotics.com or contact an authorized representative of Olive Robotics GmbH.

© 2026 Olive Robotics GmbH - All rights reserved.