

AI-ROX

The extended A-ROX system with computer vision sensors including AI algorithms



Advanced Navigation Solutions

Application

The AI-ROX is based on the A-ROX system and extends its capabilities with a high-performance LiDAR sensor and a stereo camera, enabling SLAM-based localization in GNSS-denied and indoor environments. Four additional cameras provide a 360° surround view, complementing the LiDAR perception system

The AI-ROX is designed for ADAS and autonomous vehicle testing, surveying and mapping, georeferencing of camera and LiDAR data, vehicle test data logging, and machine automation applications.

Technology

Patented **tightly coupled** sensor fusion algorithms combine **survey-grade GNSS** raw measurements (multi-constellation, multi-frequency), **RTK and PPP** correction services (including HAS and terrestrial corrections), **inertial measurements** from a FOG-grade MEMS IMU, **odometry, LiDAR**, and **camera** data to provide a highly accurate position, velocity, and attitude solution, even in GNSS-challenged environments.

AI-assisted localization algorithms further enhance positioning robustness and availability. Integrated A-Shield technology provides trusted navigation and interference resilience under challenging operating conditions.

For applications requiring maximum accuracy, a powerful **forward-backward post-processing** engine utilizes all recorded raw sensor data to generate highly accurate reference trajectories and ground-truth solutions.



System configuration

The AI-ROX is built on a new modular hardware platform featuring enhanced processing performance and upgraded interfaces. The system is configured with dual GNSS antennas and includes all required processing units, including an integrated GPU.

Configuration, monitoring, and visualization are provided through the browser-based **Command Center**, hosted directly on the device and accessible from laptops, tablets, and other network-enabled devices without software installation.

In addition, the cloud-based **A-Hub** platform enables centralized fleet management, remote device control, and access to recorded sensor data from any location.

Interfaces

The AI-ROX includes an integrated 5G modem for RTK and PPP correction services, remote monitoring, and system configuration. Additional interfaces include Wi-Fi, Gigabit Ethernet, USB-C, up to four CAN-FD channels, and GPIOs for external trigger events and wheel-tick inputs.

The system supports ROS 2, NMEA, ACOM, and CAN output formats.

Why choose the AI-ROX system?

1 cm

Position

0.01 km/h

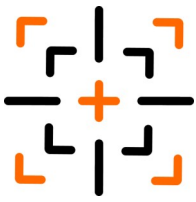
Velocity

0.05°

Heading

0.02°

Roll and Pitch



Highly Accurate Navigation

Highly accurate position, velocity and attitude information for ground truth data generation.



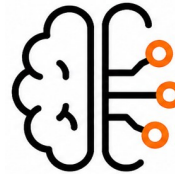
HAS + OSNMA Technology

Use of Galileo High Accuracy Service (HAS) + OSNMA for Precise Point Positioning (PPP) and authentication.



LiDAR and Visual SLAM

Robust LiDAR and camera-based SLAM for precise localization and navigation in GNSS-denied or degraded environments.



AI Inside

AI-based sensor fusion and perception algorithms for enhanced accuracy, robustness and environment understanding



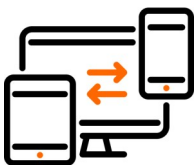
Environment Perception

Real-time detection, semantic segmentation and classification of surrounding objects, traffic lights and road infrastructure for ADAS applications.



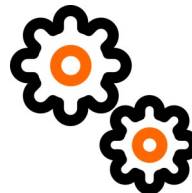
High Definition Mapping

Generation of geo-referenced 3D point-cloud maps and high definition lane-level 2D maps



Web App

Local and cloud based user interface for configuration, test-control, fleet management and post-processing.



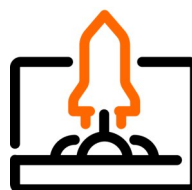
ROS 2

Solution output and interfaces to all GNSS receivers, IMU, vehicle, LiDAR and camera data with ROS 2.



Minimal Warm-up Time

1-2 min, no dynamic run-in procedure required.



Easy System Integration

Out-of-the-box working, without measuring lever arms of the system or additional hardware.

Technical Specifications

SENSOR FUSION PERFORMANCE

Accurate RTK Positioning* (1σ)

Horizontal accuracy	0.006 m \pm 1 ppm
Vertical accuracy	0.010 m \pm 1 ppm

Accurate PPP Positioning* (1σ)

Horizontal accuracy	0.20 m \pm 1 ppm
Vertical accuracy	0.40 m \pm 1 ppm

Accurate Attitude* (1σ)

Without dynamic pre-calibration	
Roll and Pitch	0.150°
True Heading	0.150°

With dynamic pre-calibration	
Roll and Pitch	0.020°
True Heading	0.050°

Velocity Accuracy 0.03 m/s RMS

Time-Stamp Accuracy 1 μ s RMS

Solution Output-Rate up to 200 Hz
(1000 Hz optional)

RTK Initialization*

Initialization Time < 7 s

PPP Initialization*

Initialization Time < 4 min

Slip angle accuracy* 0.15°

* Depends on environment and used GNSS-Antenna

FOG-GRADE MEMS IMU FEATURES

Accelerometer

Dynamic range	\pm 10 G
Misalignment	0.01°
Bias Initial Error	2 mG
Bias Repeatability	2 mG
Bias Instability	12 μ G
Bias Velocity Random Walk	0.023 (m/s)/ \sqrt hr
Bias Noise Density (RMS)	60 μ G/ \sqrt Hz

Gyroscope

Dynamic range	\pm 450 °/s
Misalignment	0.01°
Bias Initial Error	0.1 °/s
Bias Repeatability	0.01°
Bias Instability	0.8 °/h
Bias Angular Random Walk	0.06 °/ \sqrt hr
Bias Linear Acceleration Eff.	0.005 (°/s)/G
Bias Noise Density (RMS)	0.0013 (°/s)/ \sqrt Hz

GNSS FEATURES

Constellations

Galileo, GPS, Beidou, Glonass
SBAS (EGNOS, WAAS, GAGAN)

Concurrently used Constellations All

Signals

GPS: L1C/A, L1C, L1PY, L2C, L2P, L5
GAL: E1, E5a, E5b, E5 AltBoc, E6
BDS: B1I, B1C, B2a, B2I, B3
GLO: L1CA, L2CA, L2P, L3
QZSS: L1C/A, L1C, L2C, L5, L6

Channels 448

GNSS data rate up to 100 Hz

Jamming detection Yes

LIDAR FEATURES

Type	Ouster LiDAR
Model	OS1-128, REV7
Measurement Range	Mid-range (max. 200 m)
Vertical Resolution	128 channels
Horizontal Resolution	512, 1024, or 2048
Rotation rate	10 or 20 Hz
Field of View (Vertical)	45° (+22.5° to -22.5°)
Field of View (Horizontal)	360°
Angular Sampling Accuracy	Vertical: \pm 0.01° / Horizontal: \pm 0.01°
Range Resolution	0.1 cm
Operating Temperature	-40°C to 60°C
Ingress Protection	IP68 & IP69K

Technical Specifications

CAMERA FEATURES

Type (Model)	Basler ace GigE (acA1920-40gc)
Description	Compact GigE Vision color machine-vision camera featuring a 2.3 MP Sony IMX249 CMOS global-shutter sensor (1/1.2", 5.86 µm pixels) with C-mount high-quality optics.
Resolution	1920 px x 1200 px (2.3 MP)
Sensor Type	Sony IMX249, Global Shutter
Frame Rate	42 fps
Operating Temp.	0°C to 50°C
Other Features	PoE, PTP
Lenses	4.7 mm (4x surround), 6 mm/16 mm (2x stereo front)
Stereo Baseline	530 mm

COMPUTE PLATFORM

Used to interface camera and LiDAR sensors and as high-throughput compute platform and data storage. Enables real-time processing, for object detection, semantic segmentation, and SLAM.

Industrial Edge AI Computer (external, e.g. vehicle trunk) for high performance and most flexibility.

Such as: Nuvo-10108GC Series (Supports single NVIDIA® 350W GPU, Intel® 14th/13th/12th-Gen Core™ 35W/ 65W CPU, Up to 128GB DDR5 RAM, Three x8 PCIe slots, rugged, -25°C to 60°C operation)

Compact Embedded Mini PC (internal, or external) allows for a fully integrated hardware solution.

Such as: NVIDIA® Jetson Orin AGX, or Intel® CPU based platforms.

INTERFACES

Output Format	
Standardized	ROS 2, NMEA format
Proprietary	ACOM
Storage	32GB on A-ROX, additional storage on the compute platform
Communication	
Gigabit Ethernet	
Wi-Fi	
4G or 5G 4x4 MIMO cellular network	
Up to 4 CAN-FD channels	
USB 3.1	
Powering	
Variable input voltage	

PHYSICAL & ENVIRONMENTAL

Dimension	1070x380x355 mm
Weight	20 kg
Input voltage	
Nominal	12 - 24 V
Power Consumption (with Nvidia Jetson Orin AGX)	
Peak	200 W
Average	100 W
Operating Temperature	-20 to 65°C
Weatherproof enclosure	Yes

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