A-ROX
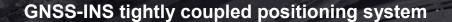
GNSS-INS tightly coupled positioning system

ANAVS

Advanced Navigation Solutions

Application

The A-ROX GNSS-INS tightly coupled positioning is the real-time **ground truth** measurement equipment for dynamic **automotive**, **railway** and **maritime** applications. It is used for ADAS and autonomous vehicle testing, endurance tests, fleet tests, survey and mapping from land, water and air, georeferencing of cameras, lidars and radar sensors, logging of parameters during vehicle tests and machine automation.

Technology

The patented **tightly coupled** sensor fusion algorithms integrate **survey-grade GNSS** raw measurement data (multi-constellation, multi-frequency), **RTK and PPP** (HAS and terrestrial) correction data, **inertial sensor** data (FOG-grade MEMS IMU) and **odometry** data for a highly accurate position, velocity and attitude solution, even in challenging GNSS environments. A smart handover from RTK to PPP technology, based on the reception of correction data, provides a unique positioning performance.

A powerful forward-backward post-processing engine is available to further enhance the accuracy of the position, velocity and attitude solution with all recorded raw sensor data.

System configuration

The A-ROX system is built on a new modular hardware platform, delivering improved processing capabilities and upgraded interfaces. The system can be configured with single, dual or triple GNSS antenna (s). The processing unit is part of the A-ROX system. A powerful configuration and visualization software is implemented as a **web app**, easily accessible from different kinds of devices, including laptops and tablets. It is directly hosted on the system with no need for installation of software on your device. On top of the local app, a cloud-based fleet management feature is available for controlling all your A-ROX devices and accessing all sensor data from anywhere.

Interfaces

The A-ROX system comes with an integrated **5G** module, providing access to RTK and PPP correction data and enabling remote view and system configuration user-friendly. Further interfaces are Wi-Fi, Gigabit Ethernet, USB-C and up to 4 CAN-FD channels. Trigger events, like wheel ticks, can be fed through the GPIOs into the sensor fusion framework.

There are several outputs available with a maximum rate of 200 Hz (1000 Hz optional): ROS 2, NMEA, ACOM and CAN.

Why choose the A-ROX system?

1 cm	**0.01 km/h**	**0.05°**	**0.02°**
Position	Velocity	Heading	Roll and Pitch

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

RTK-PPP Handover
Seamless handover between both technologies depending on available correction source.

HAS + OSNMA Technology
Uses Galileo High Accuracy Service (HAS) + OSNMA for Precise Point Positioning (PPP) and Integrity.

Web App
Web-based user interface for configuration, test-control, fleet management and post-processing.

Easy System Integration
Out-of-the-box working without the need for additional hardware thanks to integrated 5G modem and NTRIP client v2.

ROS 2
Solution output and all GNSS, IMU and vehicle sensor raw data are accessible with ROS 2.

ACOM Data Stream
Compatible with NCOM, fits directly to the OxTS toolchain. Your toolchain does not need to be changed.

Minimal Warm-up Time
1-2 min, no dynamic run-in procedure required.

Breakthrough Pricing
Best value for your money in its class.

Made in Germany
Development, production, support and repair service in Germany.

Technical Specifications

SENSOR FUSION PERFORMANCE

Accurate RTK Positioning* (1σ)
Horizontal accuracy	0.006 m ± 1 ppm
Vertical accuracy	0.010 m ± 1 ppm

Accurate PPP Positioning* (1σ)
Horizontal accuracy	0.20 m ± 1 ppm
Vertical accuracy	0.40 m ± 1 ppm

Accurate Attitude* (1σ)

Without dynamic pre-calibration
(2m antenna spacing)
Roll and Pitch	0.100°
True Heading	0.100°

With dynamic pre-calibration
Roll and Pitch	0.020°
True Heading	0.050°
Velocity Accuracy	0.03 m/s RMS
Time-Stamp Accuracy	1 µs 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°

GNSS FEATURES

Constellations
Galileo, GPS, Beidou, Glonass
SBAS (EGNOS, WAAS, GAGAN)
Concurrently used Constellations   All
Bands
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
Dual/Triple Antenna	Yes

FOG-GRADE MEMS IMU FEATURES

Accelerometer
Dynamic range	±10 G
Misalignment	0.01°
Bias Initial Error	2 mG
Bias Repeatability	2 mG
Bias Instability	12 µG
Bias Velocity Random Walk	0.023 (m/s)/√hr
Bais Noise Density (RMS)	60 µG/√Hz

Gyroscope
Dynamic range	±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 °/√hr
Bias Linear Acceleration Eff.	0.005 (°/s)/G
Bias Noise Density (RMS)	0.0013 (°/s)/√Hz

PERFORMANCE SPECIFICATION WITHOUT GNSS AFTER 60 sec

Real-time
Horizontal accuracy (RMS)	1.00 m
Vertical accuracy (RMS)	1.50 m
Roll & Pitch (1σ)	0.04°
True Heading (1σ)	0.20°
Velocity (RMS)	0.10 m/s

Postprocessing
Horizontal accuracy (RMS)	0.10 m
Vertical accuracy (RMS)	0.20 m
Roll & Pitch (1σ)	0.03°
True Heading (1σ)	0.10°
Velocity (RMS)	0.07 m/s

* Depends on environment and used GNSS-Antenna

Technical Specifications

INTERFACES

Output Format
    Standardized   NMEA format, ROS 2
    Proprietary   ANavS binary format, ACOM

Storage   32 GB, expandable up to 2 TB

Communication
    Gigabit Ethernet
    Wi-Fi
    4G or 5G 2x2 MIMO cellular network
    Up to 4 CAN-FD channels
    USB 3.1
    4 GPIO, PPS and Sync-in

PHYSICAL & ENVIRONMENTAL

Dimension   200 x 123 x 60 mm
Weight   1.2 kg

Power Connector
    LEMO connector
    USB-C Power Delivery (12-20V/3A)
Input voltage
    Absolute   9 - 36 V
    Nominal   12 - 24 V
Power Consumption
    Peak   20 W
    Average   13 W

ADDITIONAL HIGHLIGHTS

Highly adaptive and flexible for different needs due to its modular, M.2 card-based configuration structure
GNSS Sensors:
    Up to 3 Survey-Grade GNSS receivers for precise Attitude Determination
    Raw data available of all receivers (with up to 100 Hz)
    PPS Signal available
GPIOs
    4 configurable inputs or outputs to read in additional sensors, use event trigger or output status information
    Wheel tick input (odometry) for improved sensor fusion performance
Precision-Time-Protocol (PTP) PTP-Master time server to synchronize all your systems in your network
NTRIP Already included NTRIPv2 Client to stream RTK (RTCM 3, OSR) or PPP (RTCM3, SSR) correction data
DAkkS calibration Supplied with dynamic DAkkS calibration
No cable chaos One unit - all functions ready
ITAR-free Not export restricted by US ITAR regulations
Intuitive and simple handling No modems or other external devices required

ANAVS

Advanced Navigation Solutions