FIXPOSITION

Version 2024.04

QUICK START GUIDE
Vision-RTK 2

Content

Technical data 1

Setup overview 2

Step 1 - Power on the Vision-RTK 2 3

Step 2 - Connect to the Web-interface 4

Step 3 - Configure network 5

Step 4 - Configure GNSS corrections 6

Step 5 - Configure the Fusion engine 7

Step 6 - Configure output 8

Step 7 - Check GNSS Status 9

Step 8 - Check camera view 10

Step 9 - Start the Fusion engine 11

Step 10 - Calibrate the IMU 12

Data logging and customer support 13

Software update 14

Technical data

Technical details

Maximum output rate	100Hz
Positioning accuracy (RTK Fix only)	1.0 cm + 1 ppm R50
Heading accuracy	0.4° (1 m baseline)
Velocity accuracy	0.1 m/s
Maximum velocity	22 m/s
Position error as % if distance traveled in GNSS outages	0.75 %[1]
Acquisition time	25 s (cold start)

[1] *Automotive mode with wheel odometry input*

Communication and configuration

Data formats	NMEA, ROS1, ROS2, Fixposition messages, others
Operation modes	Automotive, Generic, Lawnmower, Ground robot
RTK correction format	RTCM3
Data interfaces (input/output)	UART, TCP, CAN
Time synchronization	PPS, PTP, NTP

Hardware

Dual RTK receivers	Supported GNSS constellations · GPS/QZSS (L1C/A, L2C) · Galileo (E1B/C, E5B) · Beidou (B1I, B2I) · GLONASS (L1OF, L2OF)
Camera	CMOS with global shutter, 120° DFOV
IMU	Accelerometer and gyroscope
Internal storage	16 GB flash memory
Time synchronization	PPS, PTP, NTP

Interfaces

Wired inputs/outputs	2x UART, CAN, Ethernet, USB-C
Wireless	Wi-Fi 802.11 ac/a/b/g/n
GNSS antenna connector	2x SMA
Camera inputs	2x MIPI CSI-2

Electrical specifications

Supply voltage range	5-36 V DC
Typical power consumption	10 W

Mechanical specifications

Dimensions (L × W × H)	114 × 129 × 30 mm
Weight	420g

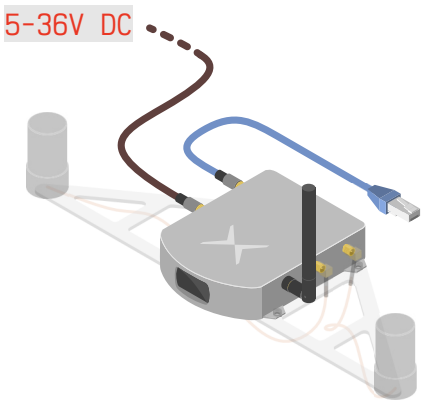
Environmental specifications

Operating temperature	-30°C to +85°C
Certifications	IP66 - water and dust resistance

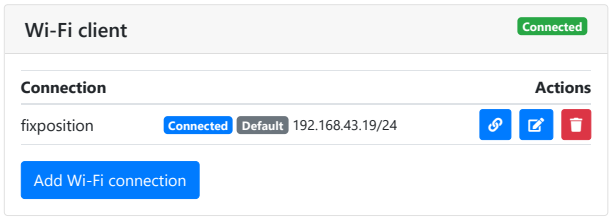
Setup overview

1. Power on the Vision-RTK 2 (Step 1) and connect to the sensor over Ethernet or Wi-Fi (Step 2)

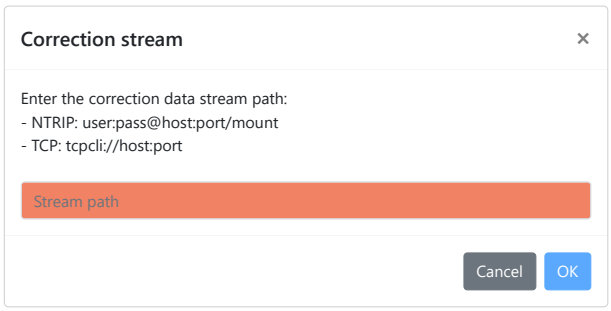
Ethernet	10.0.2.1
Wi-Fi	10.0.1.1
SSID	fp-xxxxxx
password	1234567890



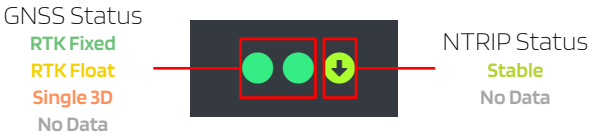
2. Provide internet access to the Vision-RTK 2 (Step 3)



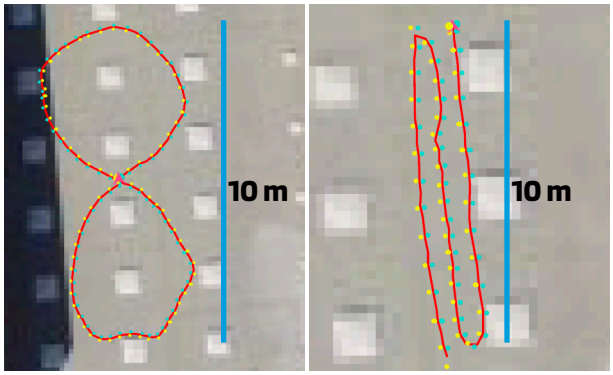
3. Provide RTK corrections via NTRIP (Step 4)



4. Head into an open area with a clear view of the sky to achieve an RTK fixed on both GNSS receivers (Step 7)

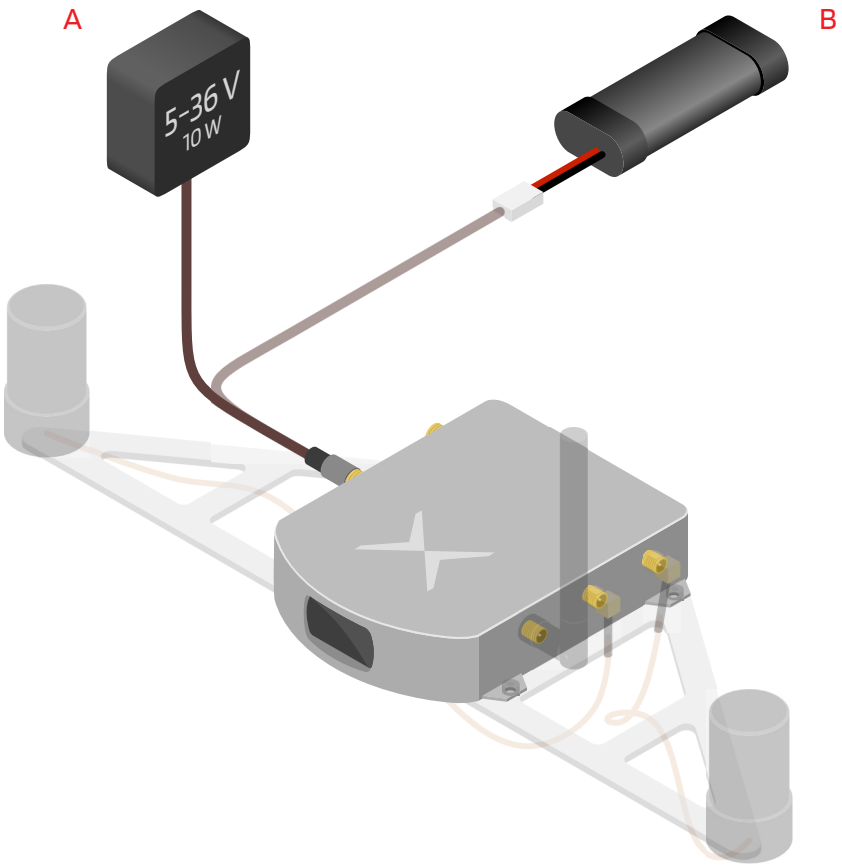


5. Start the Fusion engine (Step 9) and perform IMU calibration (Step 10)



Step 1: Power on the Vision-RTK 2

1. To power on the Vision-RTK 2, either:
   A. Connect the Vision-RTK 2 to an external power supply
   B. Connect the battery provided with the starter kit



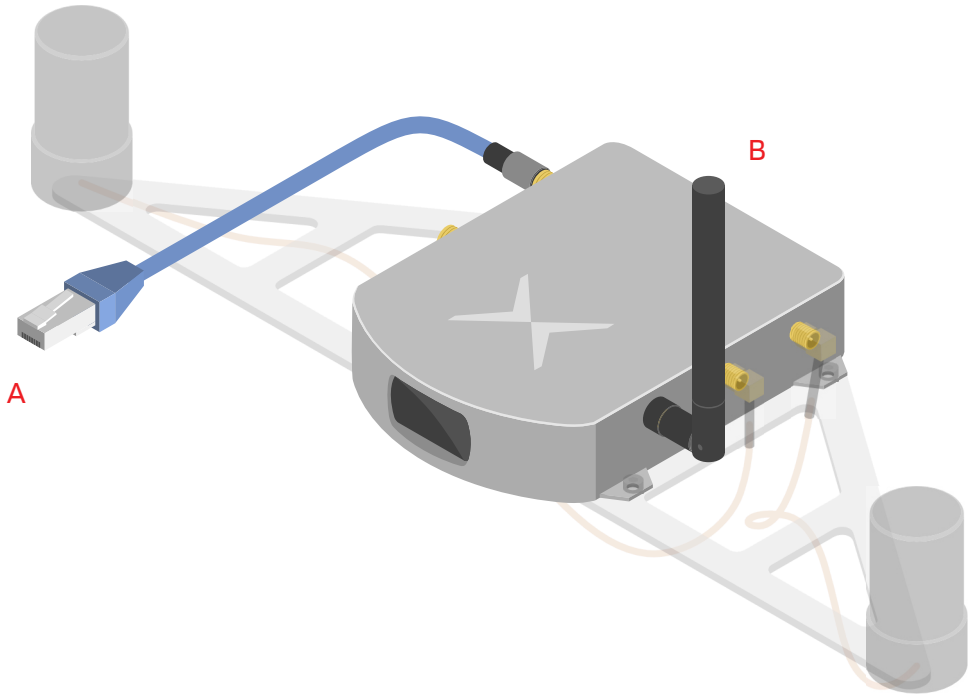
2. To power off the Vision-RTK 2, simply disconnect the power supply

⊕ Additional information

- Ensure the power cable is securely fastened to the Vision-RTK 2.
- The power supply must be able to deliver 10 W at a 5-36 V voltage. The absolute maximum ratings are -14 V to 40 V, and operating conditions are 4.5 V to 36 V.
- Do not disconnect the power while recording, as information might be lost. After stopping a recording, wait at least 15 seconds before powering down.
- While it is possible to power the Vision-RTK 2 via the USB-C port, it is not recommended to do so during operation.

Step 2: Connect to the Web-interface

1. Connect the Vision-RTK 2 either via:
   A. Ethernet (recommended)
      - Connect the provided Ethernet cable to your network
      - Open the browser and visit `http://10.0.2.1/` or `http://fp-xxxxxx.local/`
   B. Wi-Fi
      - Plug the provided Wi-Fi antenna to the Vision-RTK 2
      - Connect to the Wi-Fi SSID `fp-xxxxxx` using the default password `1234567890`
      - Open the browser and visit `http://10.0.1.1/` or `http://fp-xxxxxx.local/`



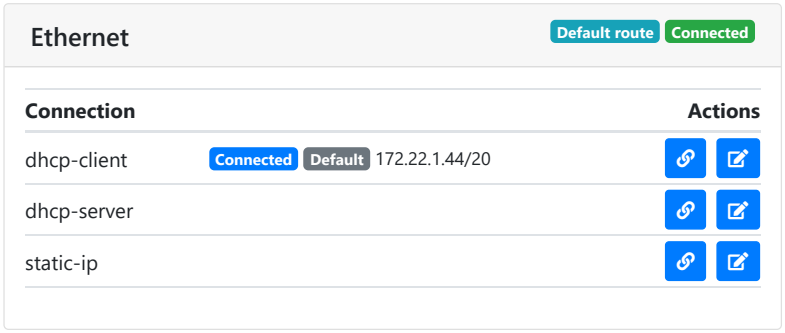
⊕ Additional information

- Wi-Fi is only suitable as a service interface. Use Ethernet for regular operation
- Connect the Wi-Fi antenna as the range without it is limited to only half a meter
- To change the Wi-Fi access point password, refer to ***Section 5.2.6*** of the Integration manual. To set up a password for the web interface, refer to ***Section 5.14***
- When employing an intermediary device, such as a router, configure the sensor as a DHCP client. The network's DHCP server will assign a dynamic IP to the sensor. Thus, the 10.0.1.1 and 10.0.2.1 IPs do not apply anymore
- To configure a static IP, please refer to ***Section 5.2.7*** of the Integration manual

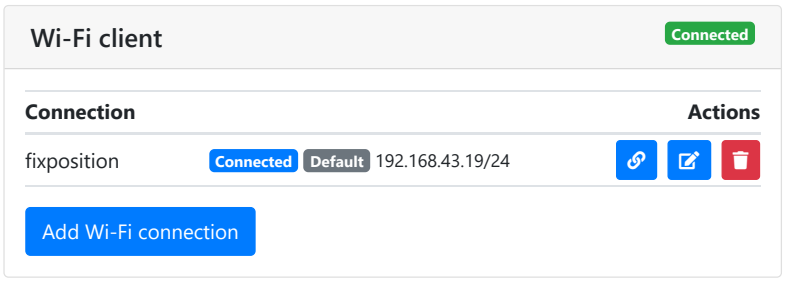
Step 3: Configure network

GNSS corrections for the Vision-RTK 2 are typically delivered over the internet, which necessitates connectivity to a network with internet access.

1. Navigate to `Configuration ↪ Network`
2. Establish a network connection over:
   A. Ethernet (recommended)
      - Connect the Vision-RTK 2 to the desired network
      - Set the Vision-RTK 2 as ***DHCP client*** or ***DHCP server*** depending on the network topology



   B. Wi-Fi
      - Select the active Wi-Fi band (2.4 or 5 GHz)
      - On the Wi-Fi client tab, click ***Add Wi-Fi connection***
      - Search for available networks, select one, and type in the password to connect
      - Wait until the connection is established (the label ***"Connected"*** will appear)

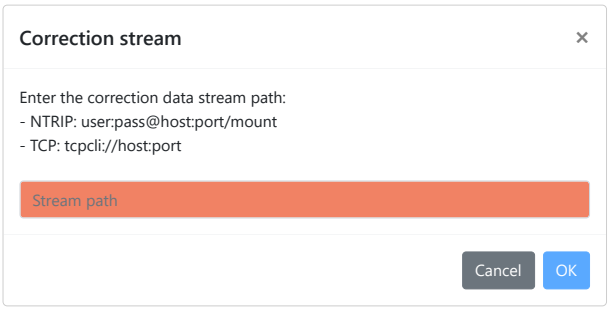


⊕ Additional information

- The Vision-RTK 2 can only access the Internet if set as a DHCP client or with an static IP
- An Ethernet connection is always prioritized over Wi-Fi for Internet access
- Set the network as default to automatically reconnect to it after a disconnection or reboot
- 2.4 GHz is preferred over 5 GHz for Wi-Fi connections due to its range and reliability
- The only supported Wi-Fi security configuration is *wpa-psk* (WPA2)
- The network SSID must be alphanumeric
- Most Wi-Fi 6E access points use 802.11ax by default, which is not supported. It must be configured to one of the supported bands

Step 4: Configure GNSS corrections

1. Navigate to `Configuration ↪ GNSS`
2. Select a source for corrections among:
   A. NTRIP client (recommended)
      - Fill in the required configuration fields (optionally, can also be filled using a path)



   B. I/O port
      - Send appropriate RTCM3 messages to any I/O port. In this configuration, the built-in NTRIP client is disabled, and the sensor does not need an Internet connection
   C. TCP client
      - Connect to any TCP/IP host that provides the appropriate RTCM3 messages. In this configuration, the sensor does not need an Internet connection

⊕ Additional information

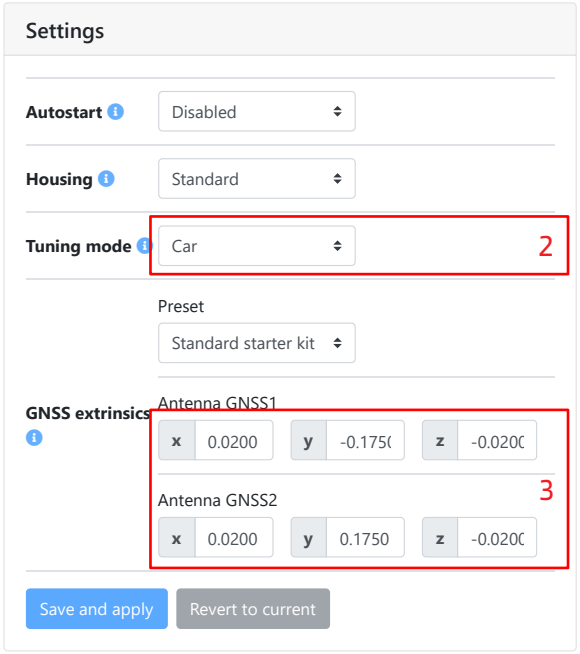
- The geodetic coordinate system is defined by the correction service provider
- Ensure that your selected correction stream has a base-station nearby (ideally closer than 15km) or good VRS coverage
- For more information, refer to ***Section 5.5*** of the Integration manual

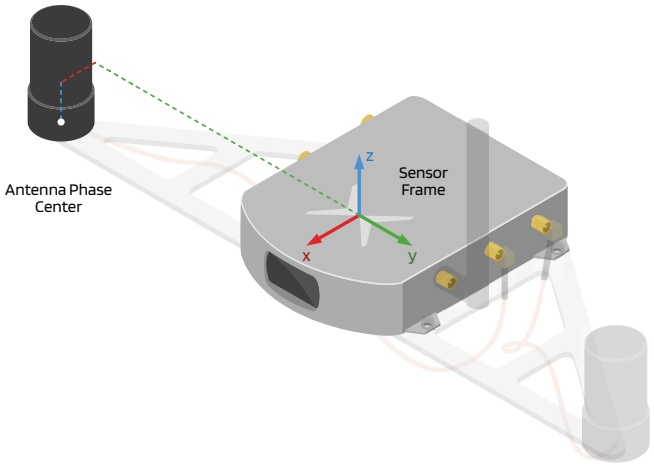
Step 5: Configure the Fusion engine

1. Navigate to `Configuration ↪ Fusion`
2. Select the tuning mode based on the following table

Mode	Application	v range	ω Range
Generic	Default mode that covers most platforms' dynamics	± 3 m/s	± 1.5 rad/s
Slow robot	Dynamics similar to that of a slow-moving robot	± 3 m/s	± 0.5 rad/s
Lawnmower	Dynamics similar to that of a lawnmower	± 3 m/s	± 1.0 rad/s
Car	Dynamics similar to that of a passenger car	± 22 m/s	± 0.5 rad/s

3. Set the GNSS antenna extrinsics within millimeter accuracy



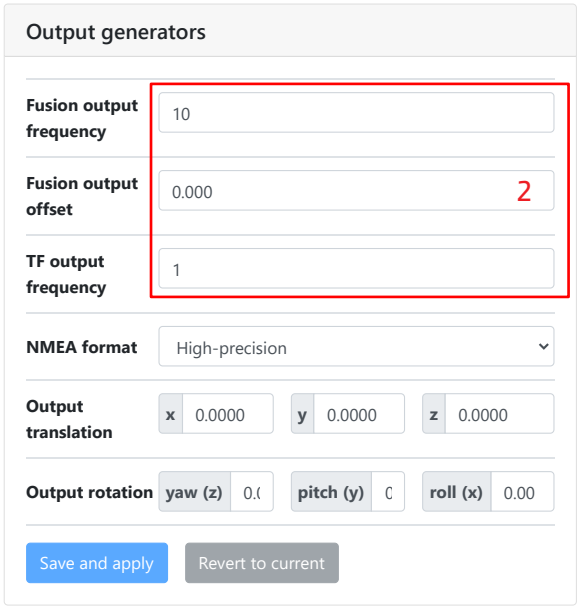


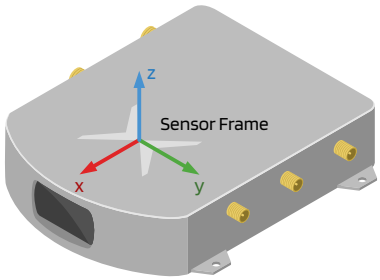
Additional information

- Providing wheelspeed measurements is recommended for optimal performance
- If using the Starter Kit, select the ***Standard Starter Kit*** preset to retrieve the extrinsics
- The ***Autostart*** option enables the Fusion Engine to initialize automatically on system boot-up
- If the baseline check error pop-up appears, please verify your GNSS extrinsics and check that the selected base-station is closer than 25km (refer to ***Section 5.13*** of the Integration manual)
- The GNSS extrinsics are set relative to the 'X' on the sensor
- The antenna reference point refers to its phase center (see antenna datasheet)

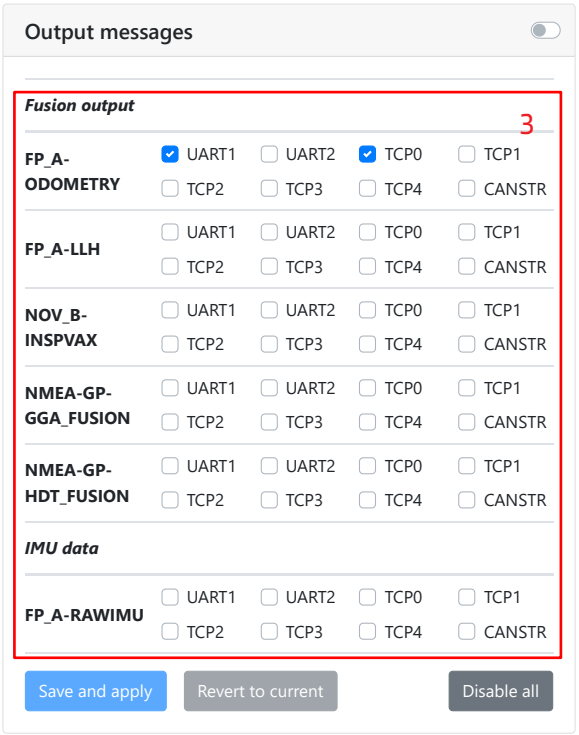
Step 6: Configure output

1. Navigate to `Configuration ↬ I/O` to the ***Output generators*** section
2. Set the ***Output frequency*** (Hz), ***Output translation*** (m), and ***Output rotation*** (degrees)





3. Navigate to ***Output messages*** section and select the desired messages and output channels

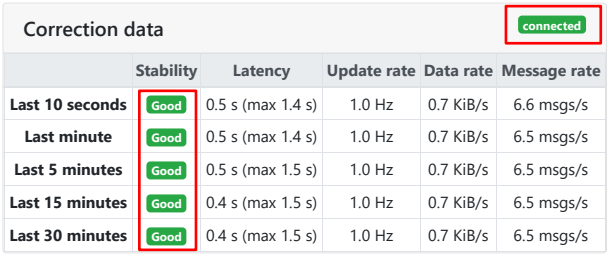


Additional information

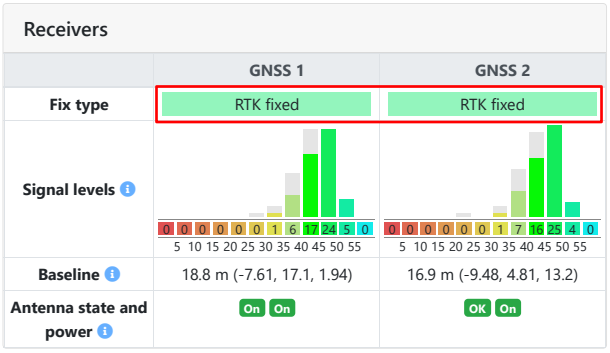
- The output translation is set relative to the 'X' on the sensor
- The high-precision NMEA format contains non-standard fields which allow higher precision in the timing, position, and heading values
- A higher output frequency requires a higher I/O bandwidth. For example, IMU messages require significant bandwidth and should be enabled with discretion
- All available messages are documented at https://docs.fixposition.com/fd/i-o-messages
- For the LLH output, the sensor assumes that the correction data employs the WGS84 geodetic datum
- Enabling more messages will consume more CPU resources and might impact the sensor's performance. Only enable them when necessary, preferably on one port only

Step 7: Check GNSS status

1. Navigate to `Status ↬ GNSS`
2. Ensure the correction data is connected and stable



3. Ensure both of the GNSS receivers to be of ***"RTK Fixed"*** status

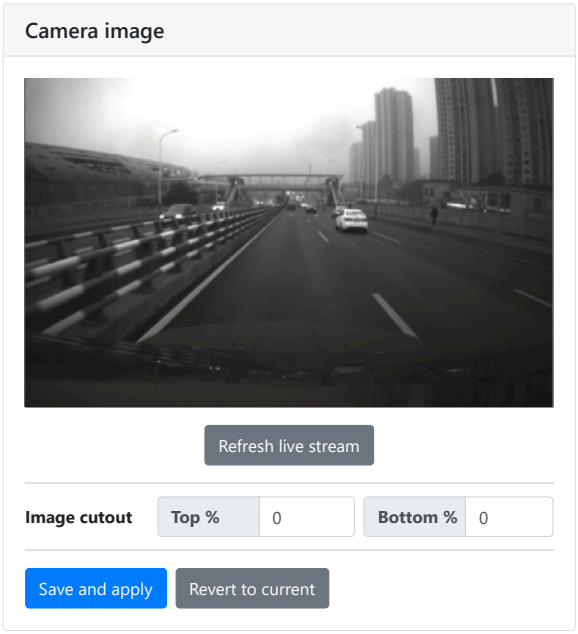


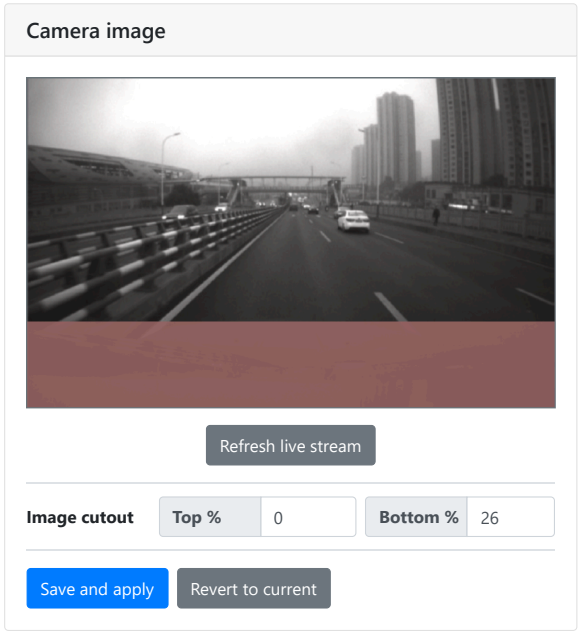
⊕ Additional information

- Initialize outdoors, as some casters require an initial position estimate to provide corrections
- Most signals should ideally be above 42 dBHz
- Antenna state and power should be *OK* and *On*
- If an RTK fixed is not achieved in less than two minutes, move away from obstructions, ensure no USB3 devices or unshielded cables are near the GNSS antennas, and verify that your selected base-station is closer than 25km

Step 8: Check camera view

1. Navigate to `Configuration ↪ Camera`
2. Ensure that feature-sparse regions and static objects (e.g., vehicle's structure) are cropped from the image





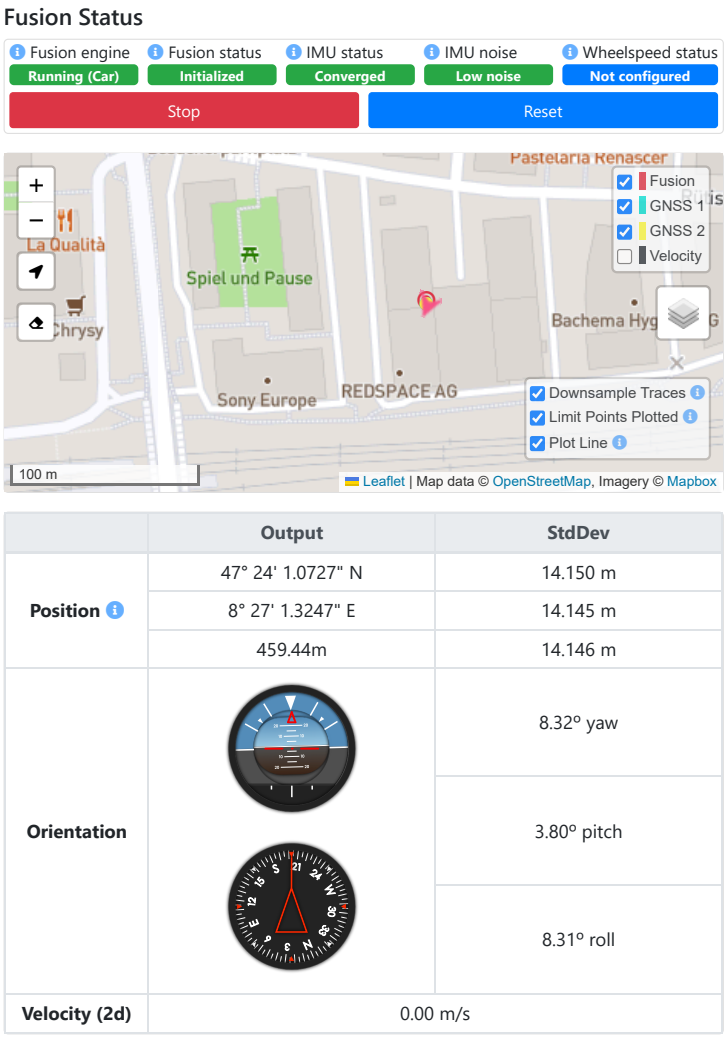
⊕ Additional information

- The auto-exposure of the camera is affected by the crop mask
- The sensor can look forwards or backwards
- Employ an external lighting source if working in low-lighting conditions

Step 9: Start the Fusion engine

1. Navigate to `Status ↬ Fusion`
2. Click the ***Start*** button and head into an open area with a clear view of the sky to achieve an ***"RTK fixed"*** on both GNSS receivers. This process should take less than 2 minutes

3. Ensure that all message outputs on the status page are activated and the arrow in the map is accurately indicating the heading of the sensor

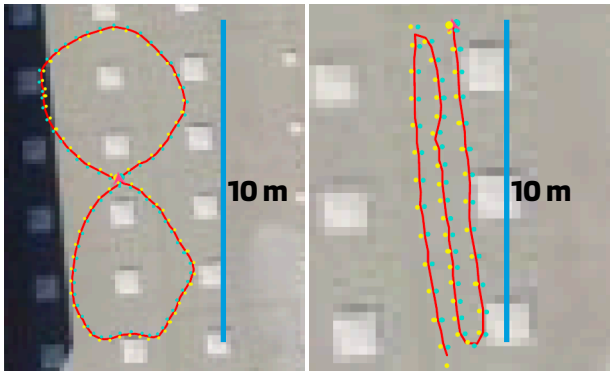


	Output	StdDev
Position	47° 24' 1.0727" N	14.150 m
	8° 27' 1.3247" E	14.145 m
	459.44m	14.146 m
Orientation		8.32° yaw
		3.80° pitch
		8.31° roll
Velocity (2d)	0.00 m/s	

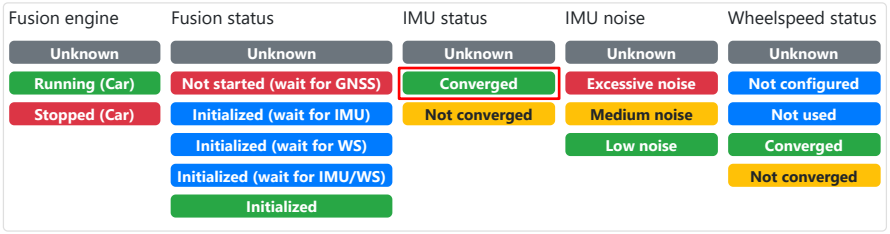
Step 10: Calibrate the IMU

The Vision-RTK 2 requires a start-up procedure before being fully operational. The user must ensure the following requirements are fulfilled to start the calibration procedure:

1. Ensure both receivers obtain RTK fixed status
2. Start the Fusion engine, and ensure extrinsics are correct
3. Move the sensor under RTK fixed status with some dynamic motion
   - Move in the shape of eight roughly sized at 10m
   - Move back-and-forth a few times over a stretch of 10m



4. Calibrate until IMU biases are converged (***IMU status*** must show ***"Converged"***)

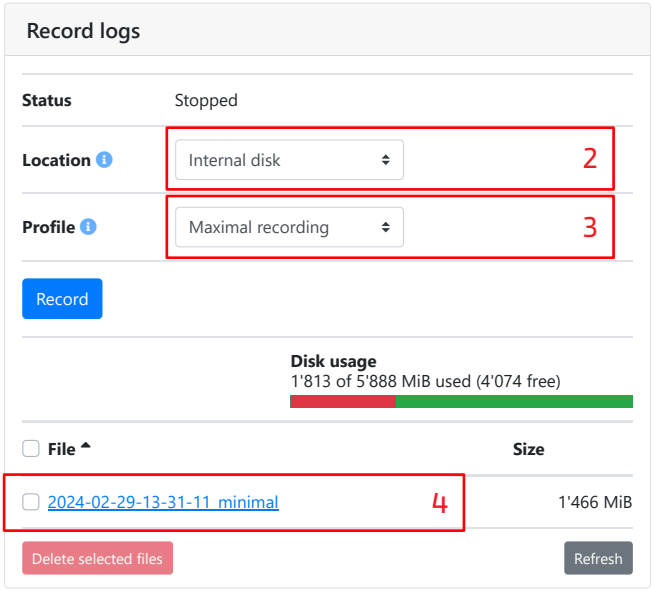


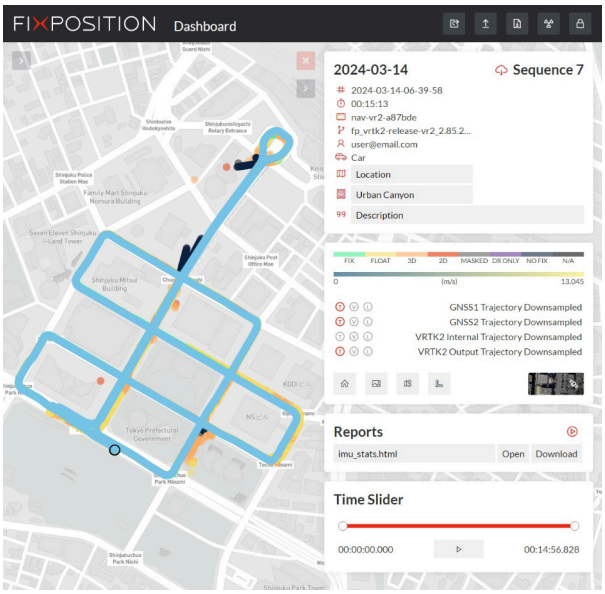
⊕ Additional information

- After converging, the IMU biases will be saved to be used on the next initialization procedure. Thus, the calibration will be significantly faster
- The IMU biases will continue to be estimated any time the sensor is under *"RTK fixed"*
- IMU's ***"Excessive noise"*** only indicates that the measurements present significant mechanical vibrations; however, this is not necessarily noise (e.g., moving on rocky terrain)

Data logging and customer support

1. Navigate to `System ↪ Logs`
2. Choose the logging location
   A. Internal disk: Embedded memory, max. around 6 GB (up to ~20min of "Maximal" recording)
   B. External USB: Storage connected to USB-C port. May consume additional CPU resources
   C. Download: Stream the log file in real-time using standard HTTP. This is the preferred method, but needs a stable and reliable Ethernet connection (available since 2.85.3)
3. Choose the logging level
   A. Minimal: Smallest file, only minimal data (e.g., no camera). Limited reprocessing capabilities
   B. Medium: Larger file, does not record all data (e.g., camera only at 2 Hz). Most reprocessing capabilities are available, but only limited fine-tuning is possible
   C. Maximal: Largest file, contains all data. Allows to fully reprocess the trajectory
   D. Debug logs: System log used to identify issues when a recording is unavailable
4. Retrieve the logs from the web-interface by clicking on the log name



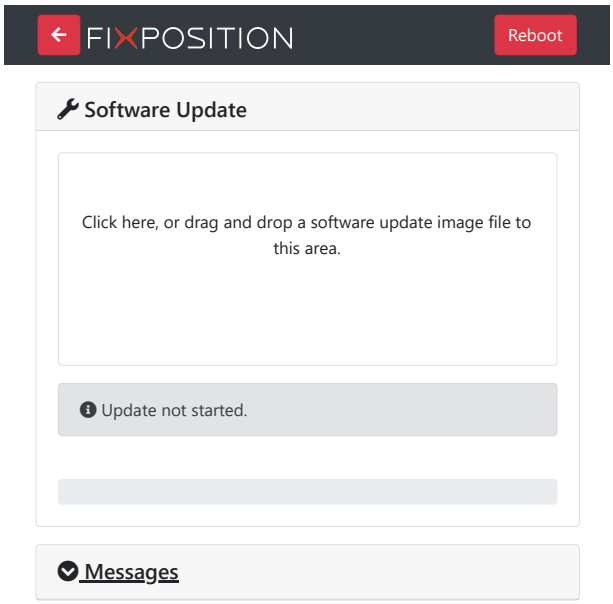


5. Get support
   A. Browse the Vision-RTK 2 Documentation for rich description of all features
   B. Email support@fixposition.com to get access to the Fixposition Dashboard, and upload the log files to the Fixposition Data Uploader[1] to accelerate debugging and analyze the sequence
   C. Report other technical issues at Fixposition JIRA platform
   D. Request customer support at support@fixposition.com

[1] *All shared data is visible only to the uploader, the uploader's company domain (if explicitly asked to do so), and selected Fixposition employees.*

Software update

1. Navigate to `System ↪ Update`
2. Drag/drop the corresponding SWU file inside the marked area.
3. Wait for a few minutes for the update to process. The sensor will automatically restart after the update is completed



Additional information

- Software updates are released at Current Software Version
- Software updates are released every 6-10 weeks. Please email support@fixposition.com to be added to the distribution list