Version 2026.04

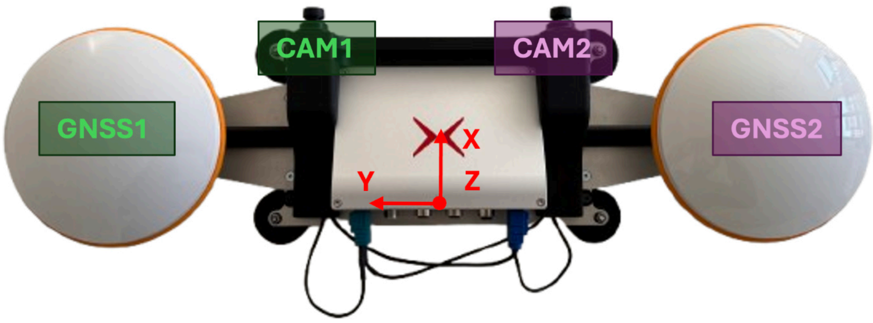
QUICK START GUIDE
PBx-A1

Content

Step 1: Mount the PBx-A1

Before mounting the PBx-A1, prepare the EVK

- ▷ The PBx-A1 comes calibrated to the EVK mount, But it needs to be reassembled.
- ▷ Screw the antennas to the mounts.
- ▷ Connect the cables from the PBx -A1 connectors to the **corresponding** cameras and GNSS antennas
- ▷ **Note:** Each camera has their own calibrated intrinsics values and thus the camera mounted on the left side (positive Y direction) has to be connected to the camera 1 port on the PBx-A1 and vice versa for camera 2.



It is important to fixate the PBx-A1 and all its accessories properly to the same rigid body of the platform.

1. The PBx-A1 EVK can be mounted with the magnets on a metallic surface for first testings.
2. A more proper setup involves a mount with screws. For that, please find measurements of the eyeholes on the datasheet. A STEP file of the complete EVK can be requested from support@fixposition.com.
3. At first, it is strongly recommended to use the EVK setup as it is delivered. The Evaluation Kit is calibrated and ready to use.

Where to place the PBx-A1 EVK with the pre-calibrated stereo camera setup?

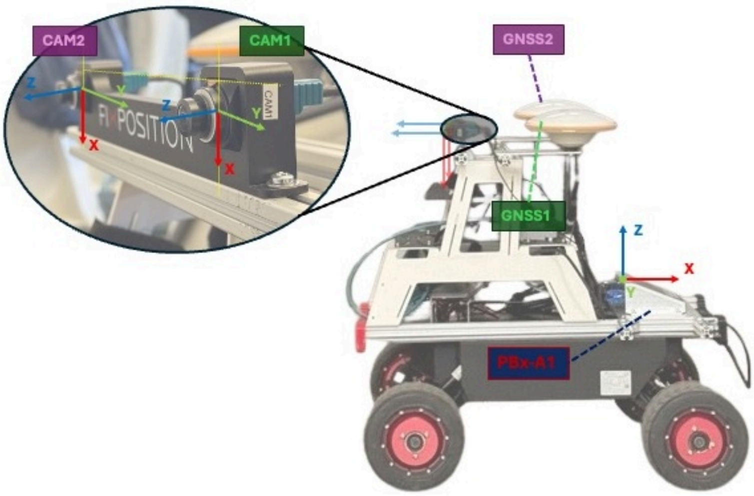
- ▷ On a surface with low vibration
- ▷ On a surface from where the camera has clear FOV.

⊕ Additional information

- ○ Once you are familiar with the device, the stereo camera bar can be detached from the EVK and placed at a new distance to the PBx-A1 box.
- ○ **Note:** This requires exact measurement (millimeter resolution) of the new camera bar position and configuration of the calibration file.
- ○ Expanded future camera support options is subject to upcoming developments.

Step 1: Mount the PBx-A1

1. The two cameras **have** to stay in the delivered bar.
2. The stereo bar has eyeholes for mounting. Fixate the stereo camera bar **within a 1 meter radius** from the PBx-A1.
3. It is recommended to introduce **one change at a time.** Do not change the camera and antenna positions all in one step. Leave the GNSS positions on the EVK for now.
4. Create a **duplicate copy** of the original camera calibration file as backup. The calibration file can be requested from support@fixposition.com. Share your device's UID "xf-abc213" to facilitate the support.
5. Measure the exact translation in meters **with sub-centimeter** precision and rotation in radians **from the reference frame origin of the PBx-A1 to the center of each camera lens**, i.e., in XYZ directions. The reference frame of the camera sits in the center point of the cyllindrical lens as marked in the image below.



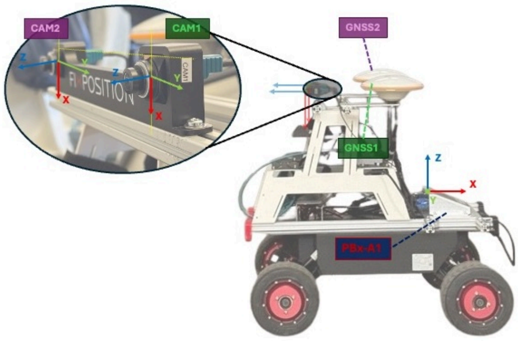
6. Now **add** the translation and rotation from reference frame to the IMU position to your measured values.
   Find this information on the calibration file under `tfs > IMU1__VRTK > se3`.
7. For **camera 1** (left / in positive Y direction), under `tfs > IMU1__CAM1 > se3`.
8. For **camera 2** (right / in negative Y direction), under `tfs > IMU1__CAM2 > se3`.
9. **Save** the modified calibration file and **reupload** it to the PBx-A1 on the Configuration > Camera page.
10. **Reset the bias data**: `System ↪ Tools ↪ Reset data`.
11. **Reboot the device** via web interface: `System ↪ Reboot`.

⊕ Additional information

- Carefully edit the calibration file. Modifying wrong sections can break xFusion's functionality.
- Fusion will refine the rotation. Converge the IMU to to "Fine converged".
- Fusion can not refine the translation input; Therefore it depends on very precise and correct input.
- UI and calibration workflows are subject to ongoing development for improved user experience.

Step 1: Mount the PBx-A1

Example:



1. Find initial calibration values for the PBx-A1 in the calib.yaml. The calibration is only valid for the EVK mount.

```
IMU1__CAM1:
    ref: IMU1
    obj: CAM1
    dt: -0.00586291
    se3:
        phi:
            - -1.20457347
            - 1.21078992
            - -1.19649843
        pos:
            - 0.11814427
            - 0.14008118
            - 0.01444915
IMU1__CAM2:
    ref: IMU1
    obj: CAM2
    dt: -0.00578629
    se3:
        phi:
            - -1.20997684
            - 1.20789558
            - -1.19893356
        pos:
            - 0.11960791
            - -0.03952801
            - 0.013571041
```

2. Measure distance and rotation from the PBx-A1's reference frame to each camera.
3. **Do a sanity check:**
   The absolute distance between `IMU1__CAM1` and `IMU1__CAM2` is the distance between the two cameras (18cm).

```
IMU1__CAM1:
    ref: IMU1
    obj: CAM1
    dt: -0.00586291
    se3:
        phi:
            - -1.20
            - 1.21
            - -1.20
        pos:
            - -0.288
            - -0.075
            - 0.254
IMU1__CAM2:
    ref: IMU1
    obj: CAM2
    dt: -0.00578629
    se3:
        phi:
            - -1.20
            - 1.21
            - -1.20
        pos:
            - -0.288
            - 0.105
            - 0.254
```

4. Add the translation from the reference frame to IMU. In our example, we find these values [-0.0124, 0.0438, 0.0355] in the calib.yaml `tfs ↪ IMU1__VRTK ↪ se3`
5. Enter these values to the calibration file to `tfs ↪ IMU1__CAM1 ↪ se3` and `tfs ↪ IMU1__CAM2 ↪ se3`
6. Upload this file to the PBx-A1's web interface: `Configuration ↪ Camera ↪ Camera Calibration`
7. Reset IMU bias data and reboot.

```
IMU1__CAM1:
    ref: IMU1
    obj: CAM1
    dt: -0.00586291
    se3:
        phi:
            - -1.20
            - 1.21
            - -1.20
        pos:
            - -0.3004
            - -0.0312
            - 0.2895
IMU1__CAM2:
    ref: IMU1
    obj: CAM2
    dt: -0.00578629
    se3:
        phi:
            - -1.20
            - 1.21
            - -1.20
        pos:
            - -0.3004
            - 0.1488
            - 0.2895
```

Step 2: Power on the PBx-A1

1. To power on the PBx-A1, connect a 9-36V power supply.
   A. This can be a power bank or a battery.
   B. Ideally, use a DC output from your platform.
   C. For more information on electrical specs, see the datasheet.
2. You will see a blue LED light up below and left to the Power connector on the PBx-A1. The start-up will take a few seconds.

⊕ Additional information

- Ensure the power cable is securely fastened to the PBx-A1.
- Do not disconnect the power while recording, as information might be lost. After stopping a recording, wait at least 15 seconds before powering down.

Step 3: Establish network connection to access PBx-A1

A network connection is required for:

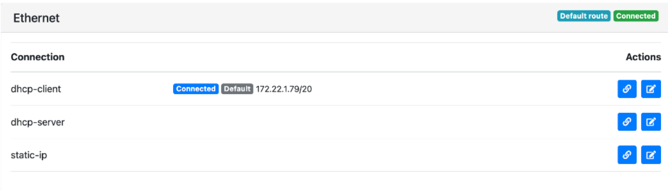
- ▷ Interacting with the device via web interface and API.
- ▷ Receiving data via TCP.
- ▷ Providing an internet connection for NTRIP client. Alternatively, the RTCM correction data messages can be streamed to the device from an external source.

CAUTION

- ○ Be attentive when changing the default of the ethernet configuration.
- ○ There is currently no recovery route for the PBx-A1. Troubleshoot access is reserved to Fixposition.
- ○ Forgetting your configured static-ip will lock you out and might require a RMA process with Fixposition for fixing.

How to access the web interface?

1. Use the provided Ethernet cable to connect the PBx-A1 to your network. The PBx-A1 is configured as DHCP Client as default.
2. If your computer is connected to the same network as the PBx-A1:
3. Open the browser and use your device's UID to visit `http://xf-abc123.local/`
4. Go to Configuration > Network > Ethernet to find the assigned IP for further use, i.e., API or ROS Driver.



Troubleshooting

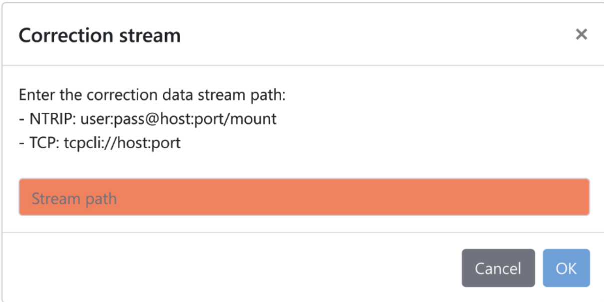
- If you can not access the device using your UID, make sure that the used network is able to assign an IP to the PBx-A1. For that, the network needs to be a DHCP Server. You can reconfigure your computer to be a DHCP Server too, if you want to connect the device your computer.
- Try to find the device by scanning all available IP addresses using ifconfig or ipconfig. Repeat the command after connecting the PBx-A1 via Ethernet to find the new IP address.
- Contact support@fixposition.com for further support.

⊕ Additional information

- ○ 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.
- ○ To configure a static IP, please refer to of the Integration Manual for best practices and limitations.
- ○ Upon factory resetting the config, the ethernet config defaults to DHCP Server. The PBx-A1 will be reachable under 10.0.2.1

Step 4: Configure GNSS corrections

1. Navigate to `Configuration ↪ GNSS`
2. Select a source for corrections among:
   A. NTRIP client (requires internet connection on PBx-A1)
      - Fill in the required configuration fields (optionally, can also be filled using a path)



   B. I/O port (no internet connection required)
      - Stream appropriate RTCM3 messages through any I/O port

   C. TCP client (no internet connection required)
      - Connect to any TCP/IP host that provides the appropriate RTCM3 messages

⊕ Additional information

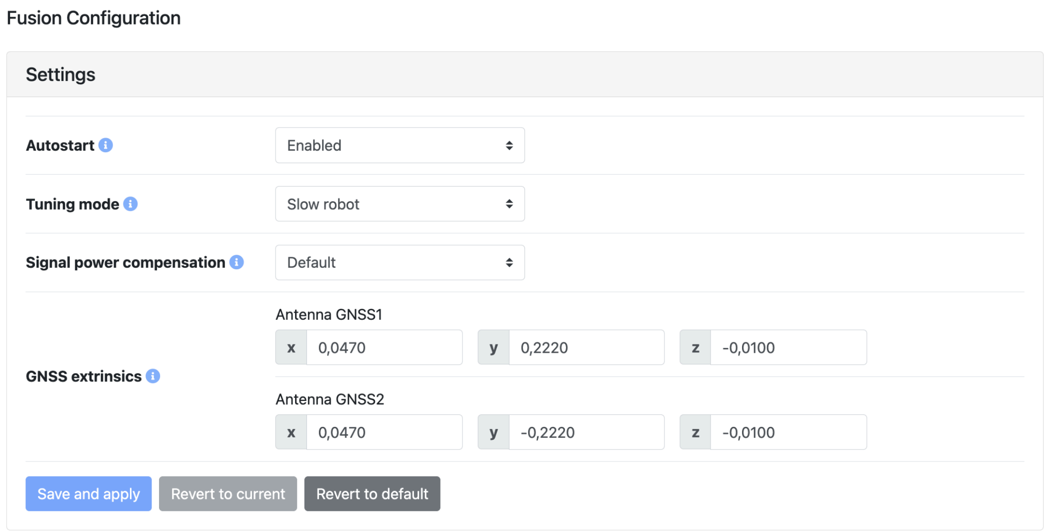
- The geodetic coordinate system is defined by the correction service provider.
- Ensure that your selected correction stream has a base-station nearby (ideally closer than 15km) or good VRS coverage.

Step 5: Configure xFusion

1. Navigate to `Configuration ↪ Fusion`

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

1. Select the tuning mode based on the table above
2. Set the GNSS antenna extrinsics within millimeter accuracy. Find the default extrinsics of the EVK here:

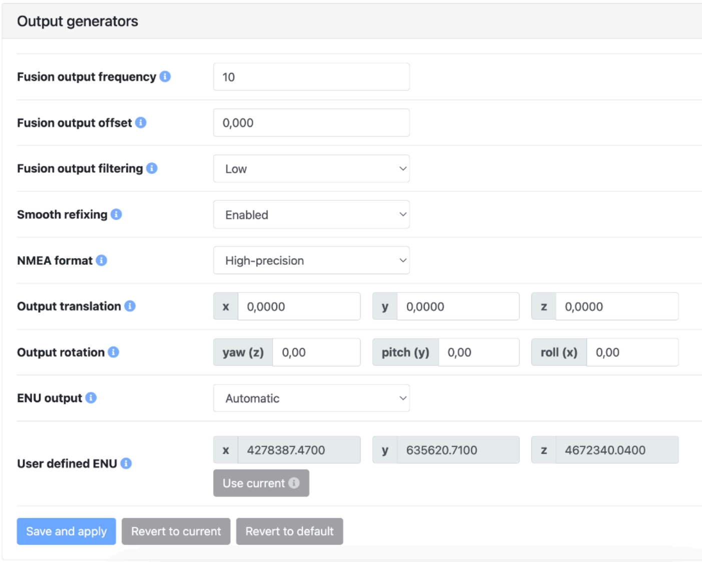


⊕ Additional information

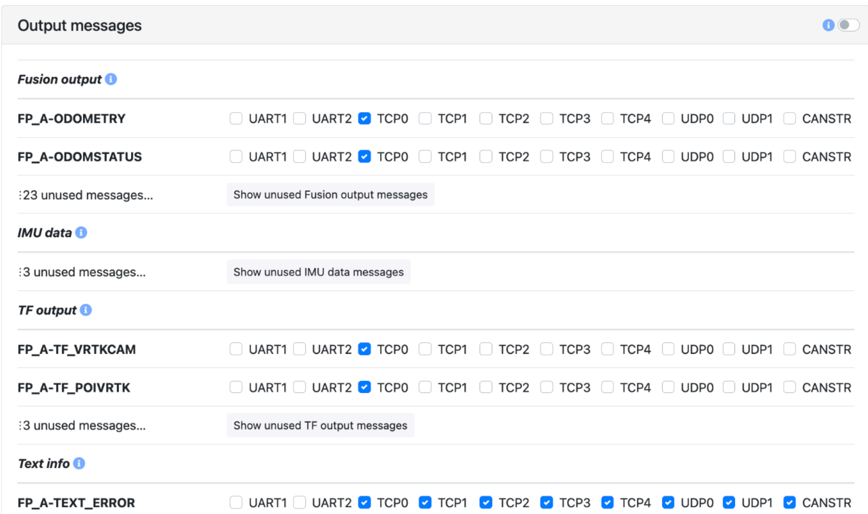
- Currently, pressing the “Revert to Default Button” will reset to wrong values. The default EVK GNSS extrinsics are shown above.
- The *Autostart* option enables the Fusion Engine to initialize automatically on system boot-up.
- The GNSS extrinsics are set relative to the marked reference frame on the sensor. A tilted mounting of the PBx-A1 leads to a tilted reference frame that needs to be considered when measuring the antenna positions.
- 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

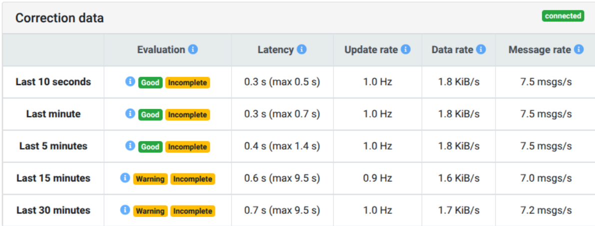


⊕ Additional information

- The output translation is set relative to the marked reference frame on the sensor.
- A higher output frequency requires a higher I/O bandwidth. For example, IMU messages require significant bandwidth and should be enabled with discretion. An overload on the output can lead to inconsistent output stream.
- 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.

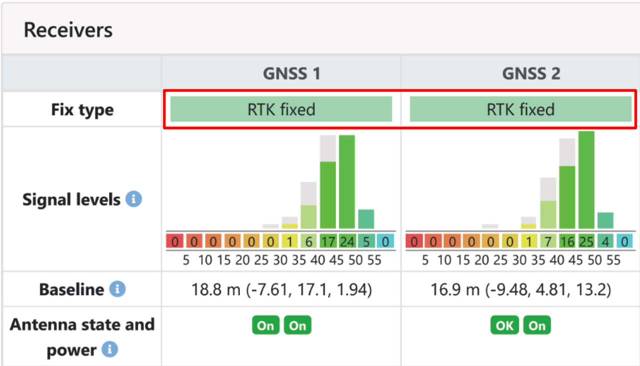
Step 7: Check GNSS status

1. Navigate to `Status ↪ GNSS`


Correction data — connected

	Evaluation	Latency	Update rate	Data rate	Message rate
Last 10 seconds	Good Incomplete	0.3 s (max 0.5 s)	1.0 Hz	1.8 KiB/s	7.5 msgs/s
Last minute	Good Incomplete	0.3 s (max 0.7 s)	1.0 Hz	1.8 KiB/s	7.5 msgs/s
Last 5 minutes	Good Incomplete	0.4 s (max 1.4 s)	1.0 Hz	1.8 KiB/s	7.5 msgs/s
Last 15 minutes	Warning Incomplete	0.6 s (max 9.5 s)	0.9 Hz	1.6 KiB/s	7.0 msgs/s
Last 30 minutes	Warning Incomplete	0.7 s (max 9.5 s)	1.0 Hz	1.7 KiB/s	7.2 msgs/s

2. Ensure the correction data is connected and stable
3. Ensure both of the GNSS receivers show the fix type ***"RTK Fixed"*** on the `Status ↪ GNSS` page and on the `Status ↪ Fusion` page.
4. Most signals should have signal levels above 42 dbHz

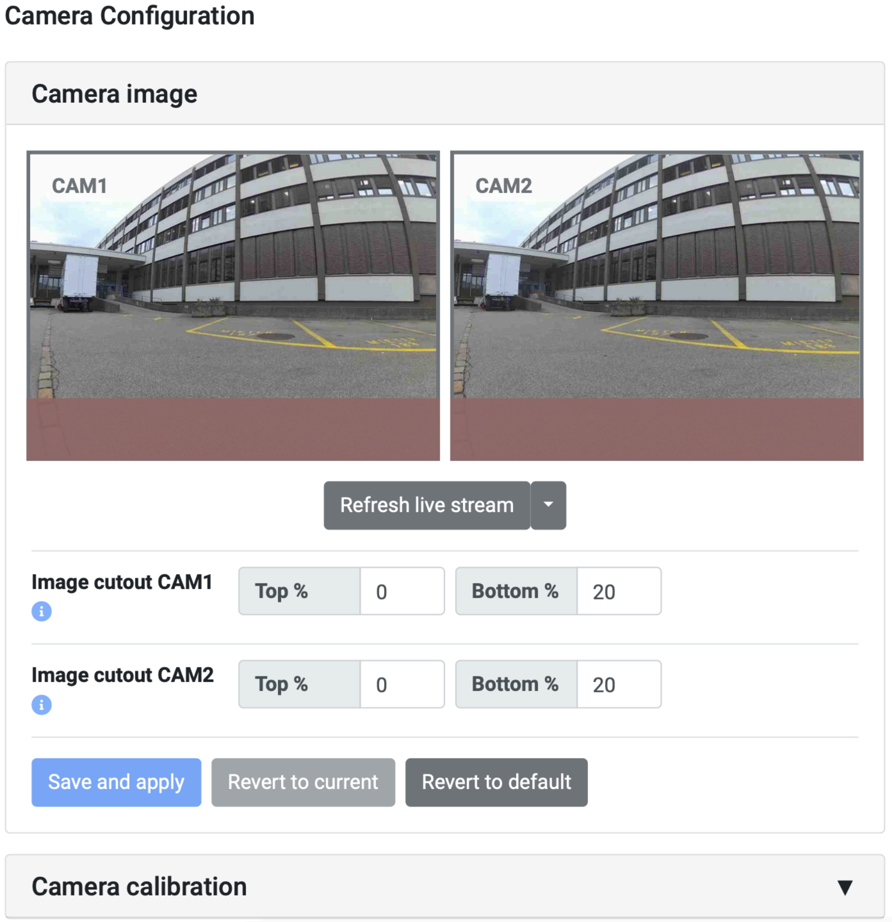


⊕ Additional information

-
- GNSS2 antenna state and power and the GNSS1 antenna state and power should be *OK* and *On.*
- If RTK Fix is not achieved in less than two minutes, move away from obstructions. Ensure no USB3 connectors, lidars, or unshielded cables are near the GNSS antennas. Also, 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
3. Apply this for both cameras.

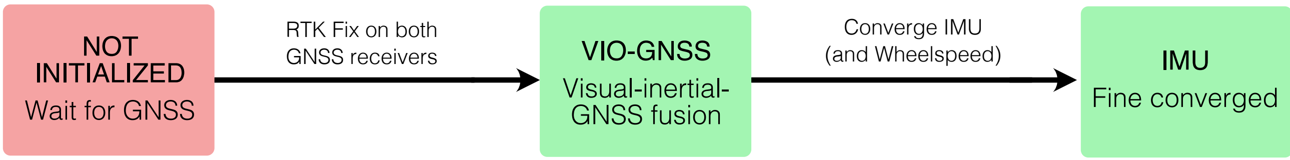


⊕ Additional information

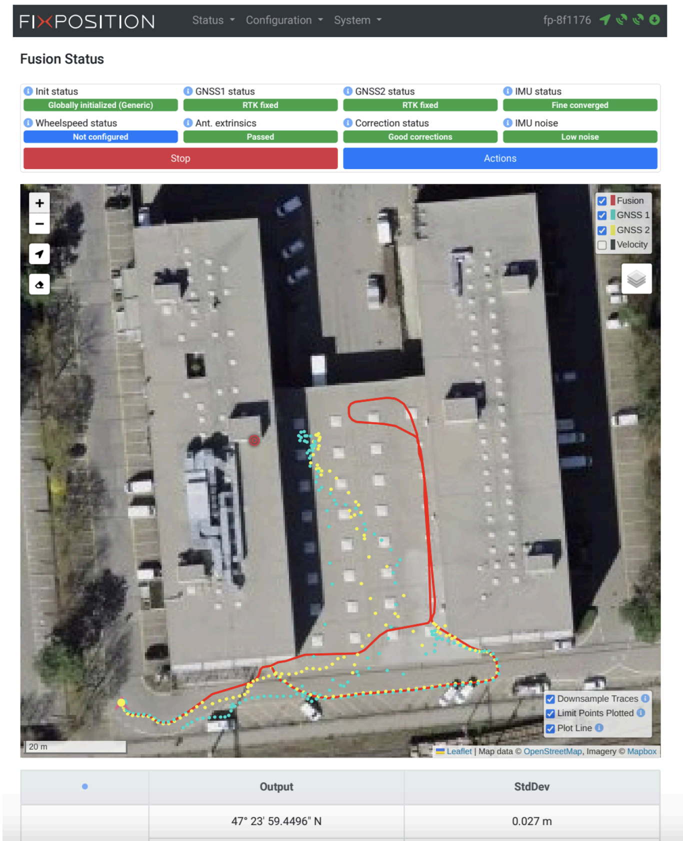
- Try to keep the cropping minimal by optimizing the camera mounting point.
- The sensor can look forwards or backwards

Step 9: Start xFusion

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"*** status on both GNSS receivers. This process should take less than 2 minutes.



3. Move the platform around while receiving RTK Fix signals to converge the IMU and the wheelspeed biases.
4. For more information on the Fusion initialization, see Section 6 of the Integration Manual.



⊕ Additional information

- The GNSS status fields on the Status > GNSS page can indicate a different status than the status fields on the Status > Fusion page. For more informtaion, see Section 6.1 of the Integration Manual.
- If the GNSS extrinsics are configured incorrectly, the status field "Ant. extrinsics" will continue to say "failed". This will block the Fusion initialization.the a
- Move in figure-8 shape, circles, and straight lines back and forth to converge the IMU faster.

Data logging and customer support

1. Navigate to `System ↪ Logs`
2. Choose the logging location
    A. Internal disk: Embedded memory, around 20 GB (up to ~60min of “Maximal“ recording)
    B. Download: Stream the log file in real-time using standard HTTP. This is the preferred method, but needs a stable and reliable Ethernet connection
3. Choose the logging level
    A. Minimal: Smallest logging rate, only minimal data (e.g., no camera).
    B. Maximal: Largest logging rate. Allows Fixposition to fully reprocess the trajectory.
    C. Debug logs: Choose to capture retrospective error log up to recent 12h
4. Download the file by clicking on the file
5. Upload to the Customer Dashboard and send an email to support@fixposition.com