User Guide: simpleRTK3B Heading

Product overview

You can use simpleRTK3B Heading as a standalone board by connecting it to your PC or tablet. Additionally, it can be used as an add-on board for your projects, such as an Arduino shield.
The main component of simpleRTK3B Heading is Mosaic-H multi band (L1, L2 and E5b) RTK GNSS module.

Important before use:

This is a traditional RTK module, it only finds satellites outdoors. If you try to use it next to the Window it will not find any satellites.

The module needs 10 seconds to boot, be patient after connecting to the PC ?

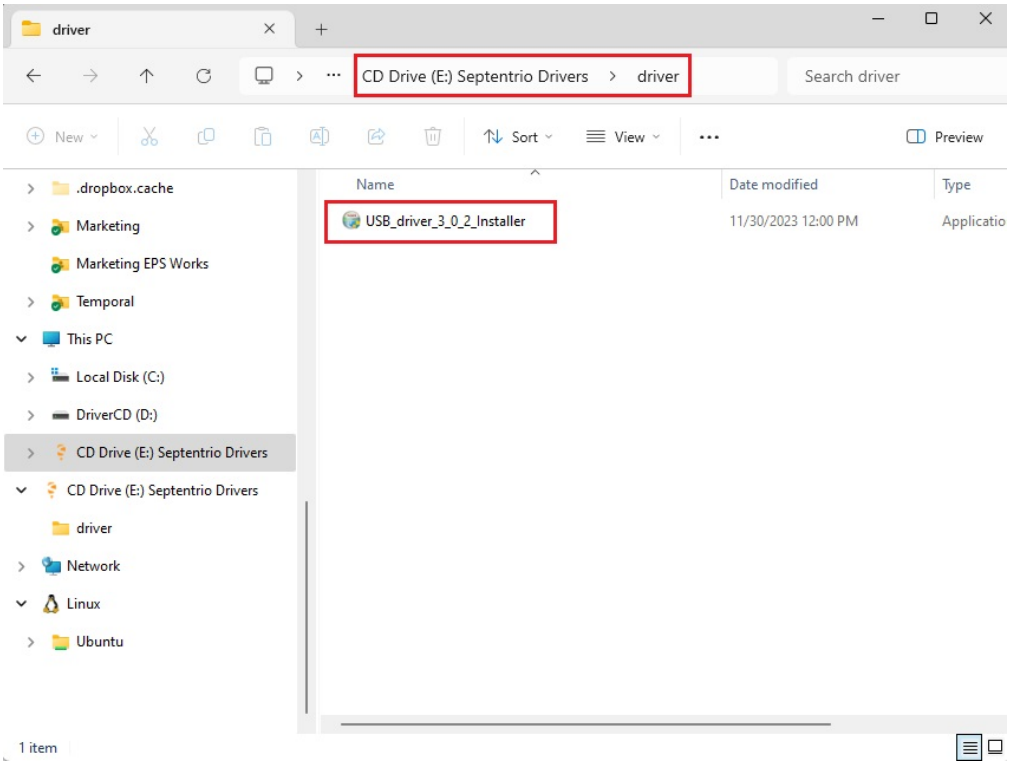
Get started

Before start: We recommend not changing any configuration or updating the firmware. Your receiver comes pre-configured as a Rover.

Step A: Assembly and driver installation

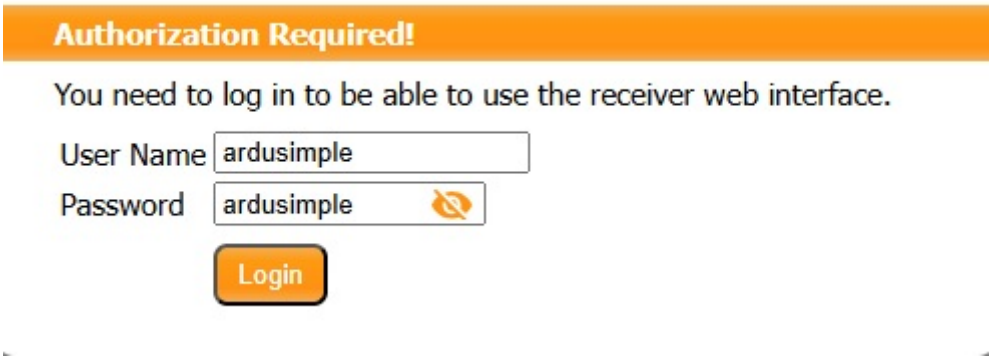
Important: This is a traditional RTK module, so it is designed to work outdoors only. If you try to use it next to a window it will not work properly. Additionally, the module needs at least 10 seconds to initialize, so be patient.?

1. Screw the GNSS antenna by hand to your receiver module antenna connector, do not use any tools.
2. Connect the receiver to your PC via the USB port labelled as **POWER+GPS**.
3. When you connect this product to a PC for the first time, the PC may not recognize it. You will only see a new Hard Disk in your computer. Open it and install the Septentrio driver.
4. After installation is completed, disconnect and reconnect again, your PC will recognize the receiver. This only needs to be done once.

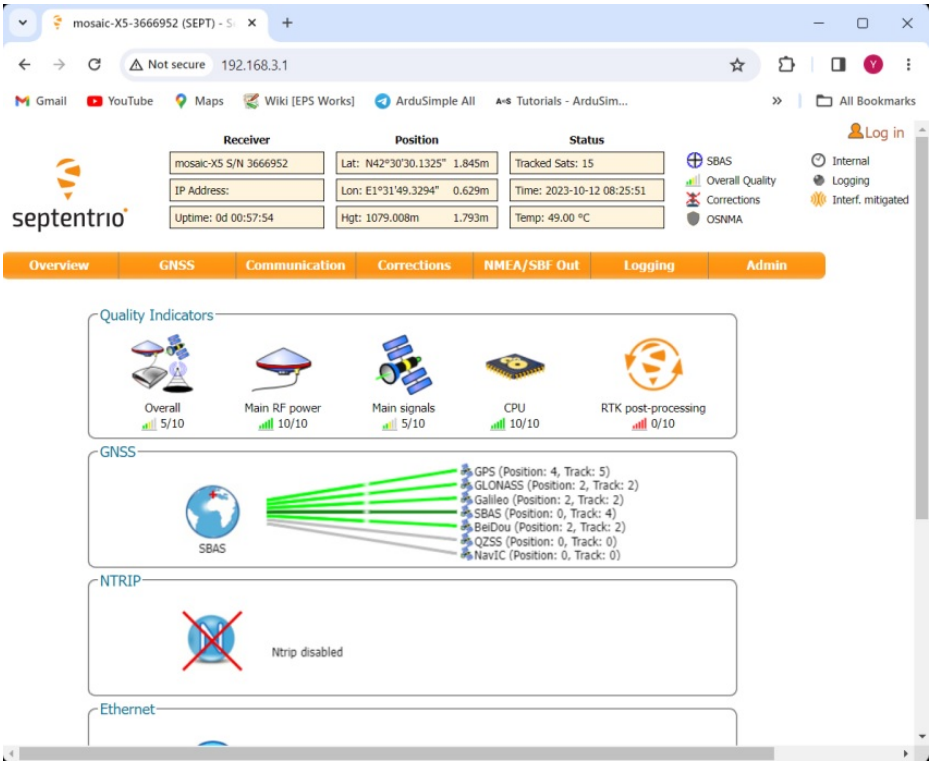


Step B: Connect to Septentrio web interface

5. Open a web browser and type in **http://192.168.3.1** to access the **Septentrio web interface**.
6. The first time you connect you might be asked to login. All our Septentrio receiver boards come with an ArduSimple user from the factory, use **ardusimple** (lowercase) for both **User Name** and **Password** fields and press **Login**.



7. The web interface will open and show the general status of your Septentrio receiver module.



Step C: RTK corrections

In order to achieve centimeter level accuracy in your GNSS receivers, you have to get RTK corrections. So if you don’t have your own base station providing corrections,

the easiest way to get RTK corrections are the available RTK Correction Services in your Country.

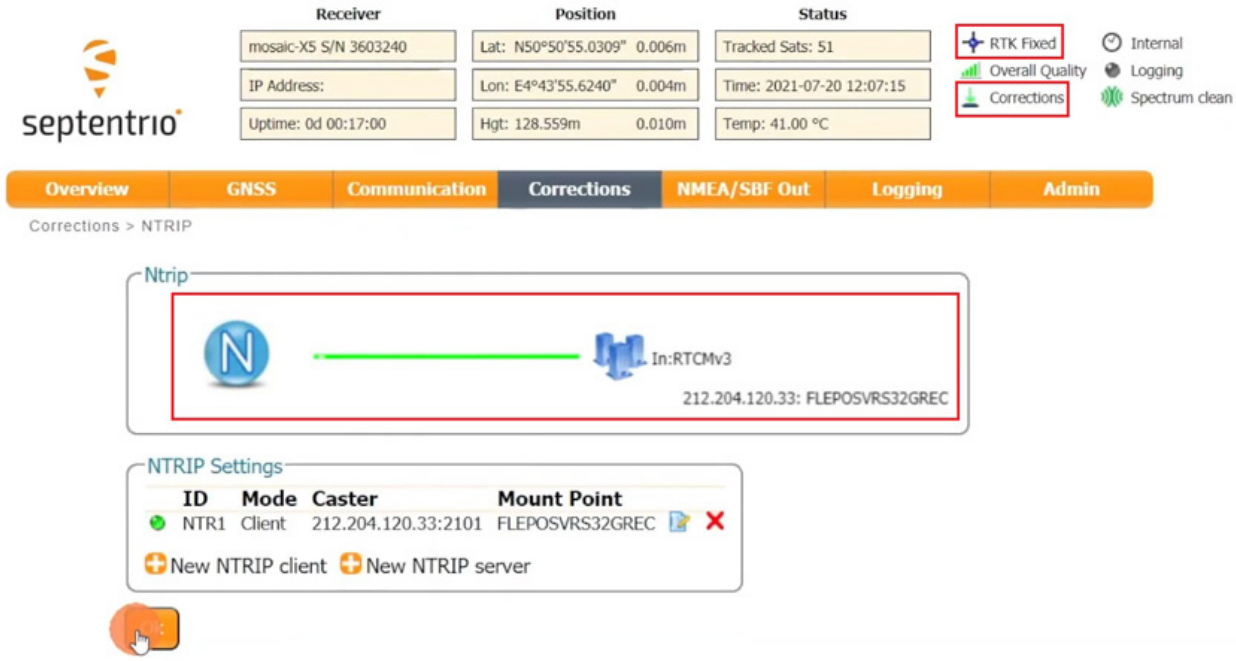
You just need to register into the service to get your NTRIP credentials such as server, port, username, password and mount point.

8. Share your internet connection with the receiver via USB and receive RTK corrections by following this video tutorial.

To view the video, visit the page

9. You will find incoming NTRIP corrections after waiting for a few minutes, and RTK Float or Fixed status.

Note: After restarting your receiver you will find that its IP address has changed, so you will have to check the new address and reconnect to it.



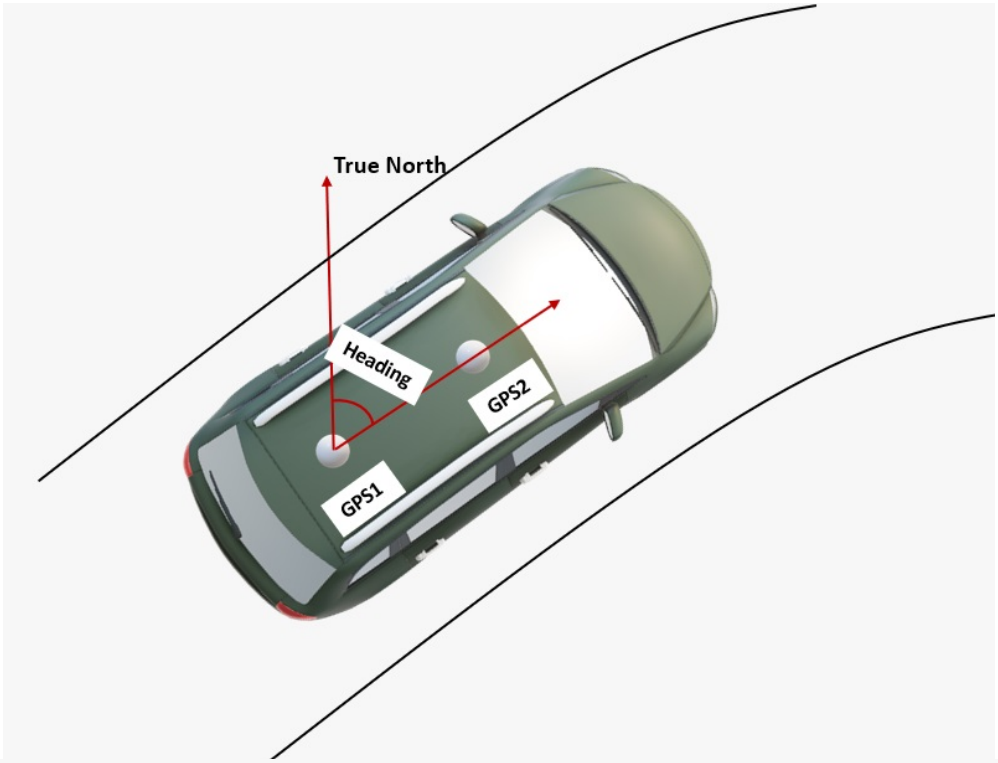
Step D: Heading configuration

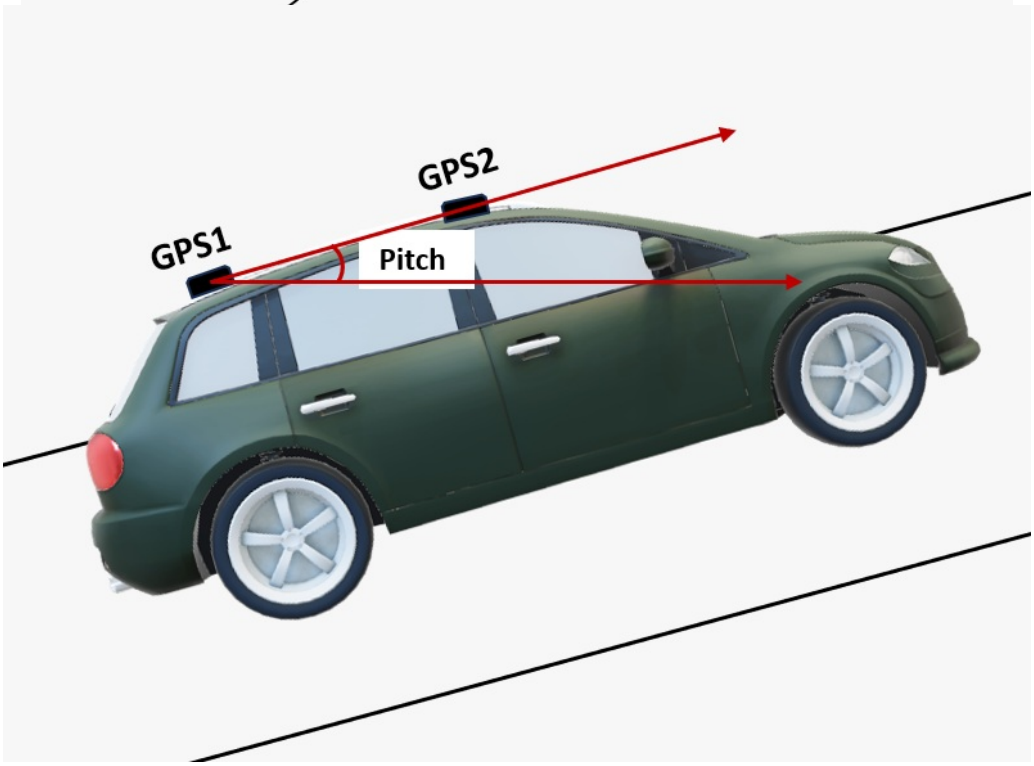
Follow this dual-antenna installation manual to obtain correct heading data from the mosaic?H module.

10. The heading result is the angle from True North to the Baseline of the master antenna (labelled as GPS1 on board) to the slave antenna (labeled as GPS2) in a clockwise direction.Pitch angle refers to the angle of the car or drone relative to the

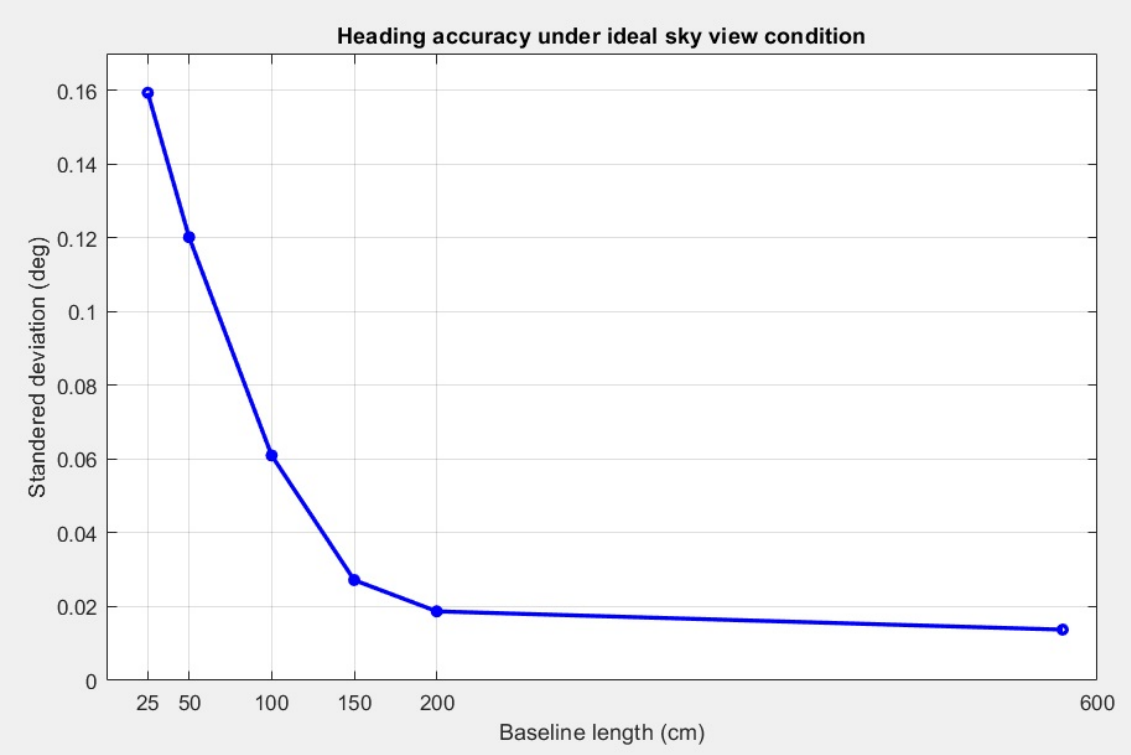
horizontal plane.

11. In the default configuration, the antennas should be placed longitudinally along the vehicle, with the master antenna (GPS1) positioned at the back.

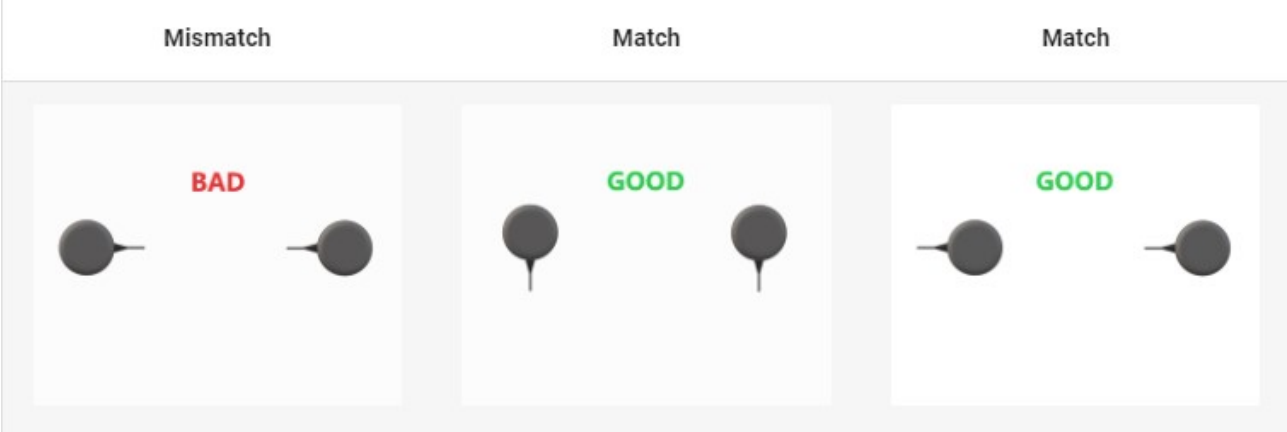




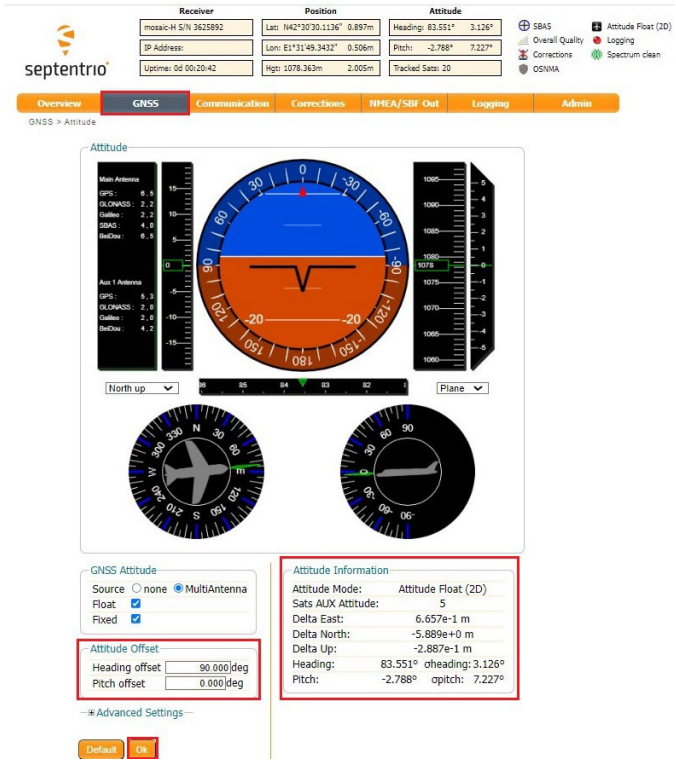
12. There is a minimum distance required between 2 antennas for an accurate heading to be generated. Heading accuracy can be improved by increasing the baseline length (distance between the 2 antennas). In general minimum 1 meter distance (baseline length) is required to achieve satisfactory sub-degree precision under non-ideal condition. In practical, this is not possible for many vehicles. With a good installation with 0.5 meters, you can get decent results. With 0.3 meters it's possible to get heading, but it's output sometimes will be a bit noisy. But it might be good enough for some applications.



13. It is recommended that both GNSS antennas be identical and have the same physical orientation relative to each other (i.e. the antenna cable should exit in the same direction on both antennas). This will ensure best RF phase center alignment and heading accuracy. The actual RF phase center is often offset from the physical center of the antenna case.For optimal results, ensure that the RF cable lengths for both antennas are identical.

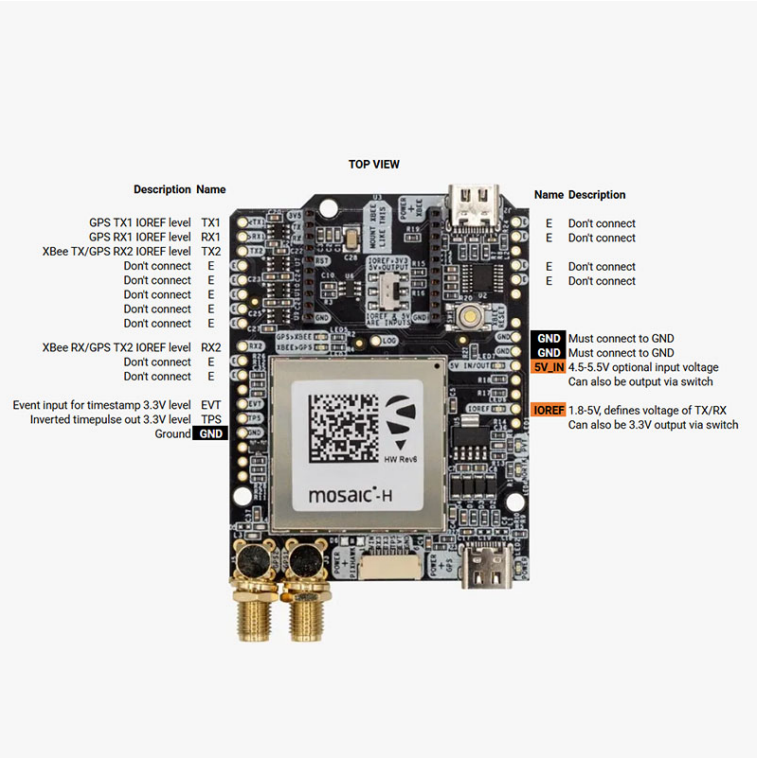


14. Open Septentrio web interface. If you can not install the antennas with default setup, go to **GNSS–> Attitude**. At Attitude Offset to set the Heading and Pitch offset.
15. At Attitude Information you can check the heading information of your vehicle.

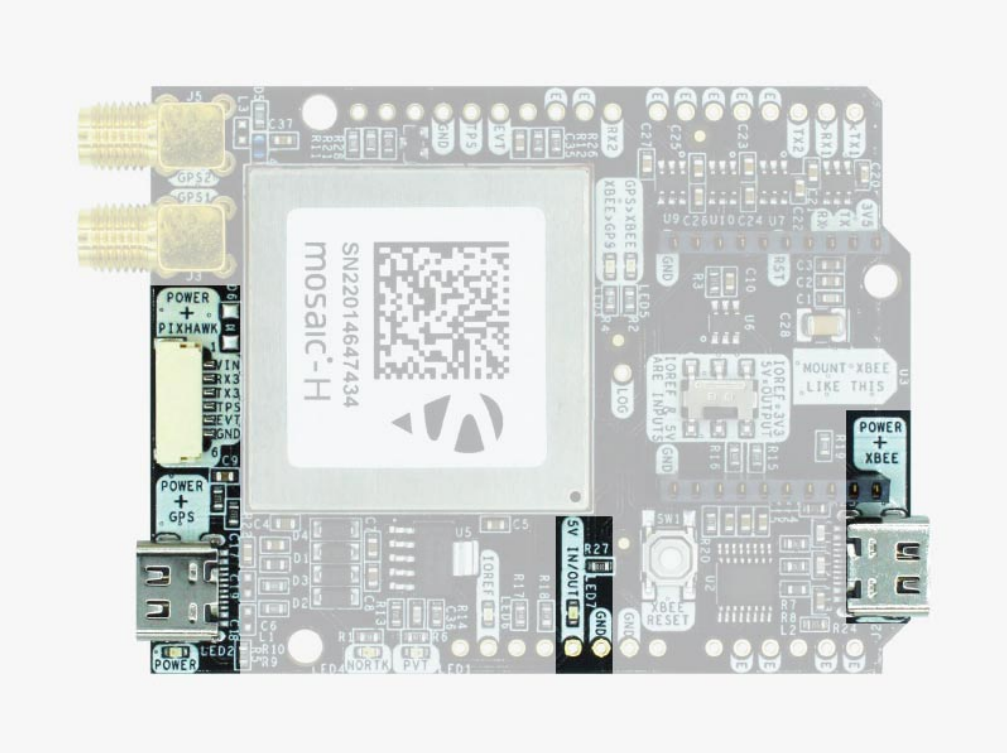


Hardware

Pinout



Power



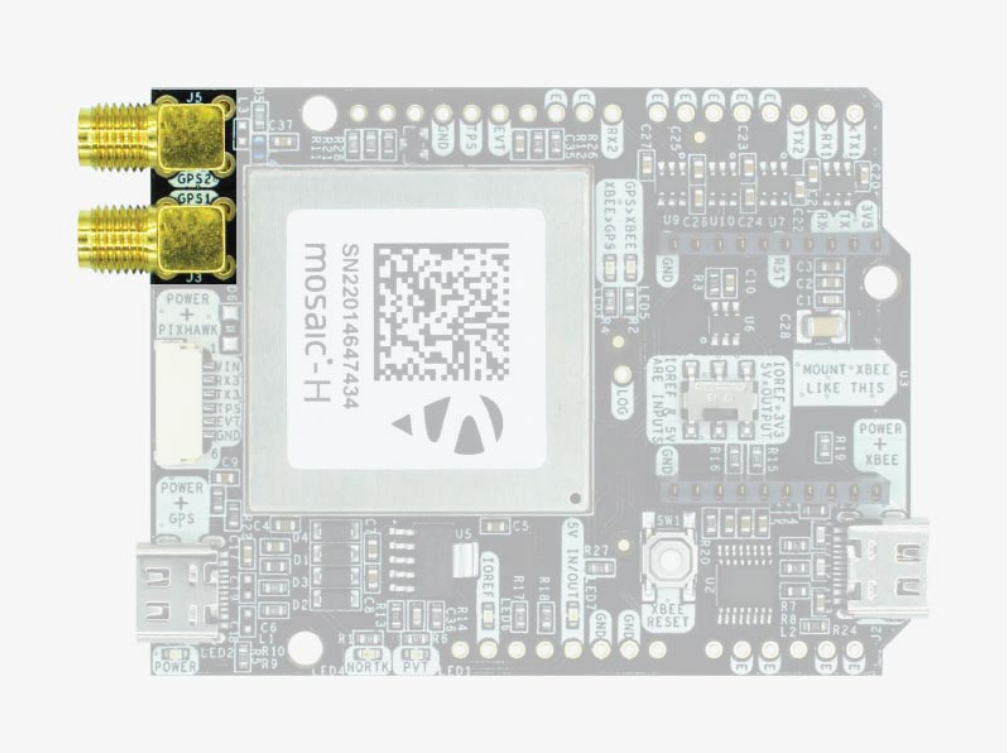
The simpleRTK3B Heading can be powered from 4 different sources:

- GPS USB port
- XBEE USB port
- Pixhawk connector
- Arduino rail

Only 1 of them is needed to use the board, but you can also connect the 4 at the same time, there's no risk.
The simpleRTK3B Heading has a High Power (HP) XBee socket. You can connect any XBee accessory to it. If you connect a device that requires high power to the XBee socket, you will have to make sure your power supply can provide this power.

- Use only high quality USB-C cables, not longer than 1 meter.
- If you connect simpleRTK3B Heading through a USB hub to your PC/Tablet or your PC has low power USB ports, you will have to connect the second USB port directly to a wall plug or high power USB port.

GNSS Antenna



simpleRTK3B Heading does not include, but requires a good quality GPS/GNSS antenna.

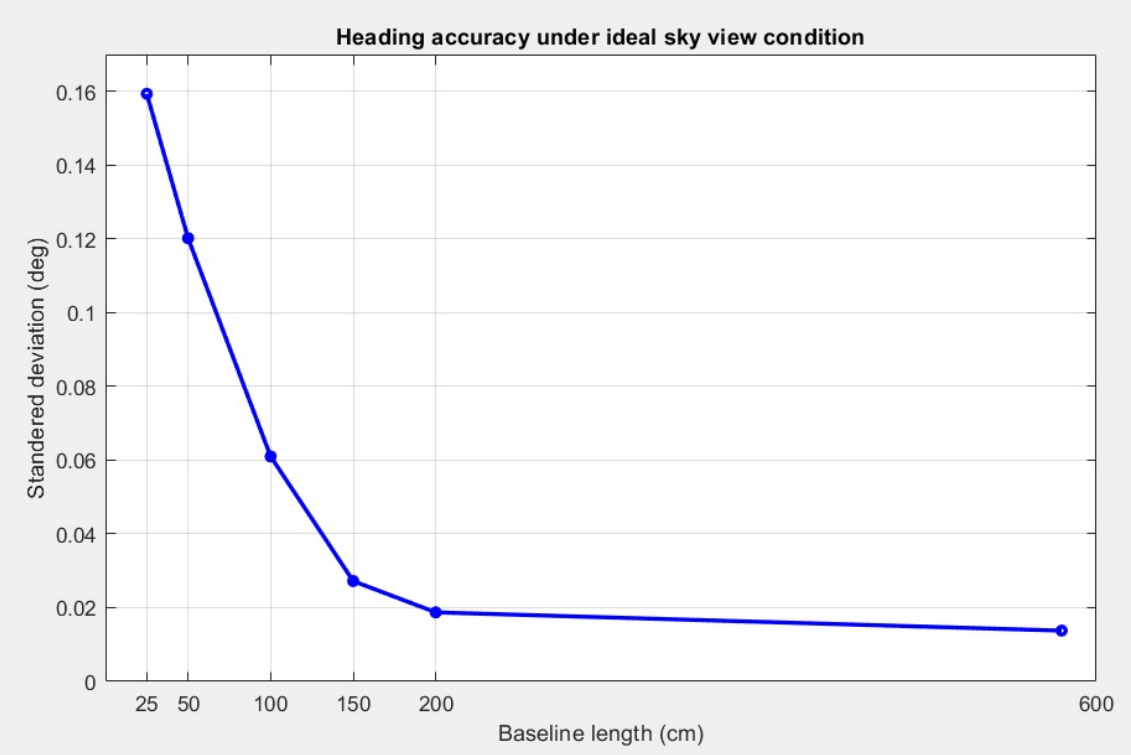
simpleRTK3B Heading supports L1/L2/Eb5 bands. If you want to get the most out of this module, we recommend a Budget Survey GNSS Multiband antenna.

The board is compatible with both active antennas supporting 3.3V supply and passive antennas. The maximum output current is 150mA @ 3.3V.

If you use it with the traditional cheap GPS antennas widely available, you will not achieve the expected performance.

IMPORTANT: The installation of the antenna is also a key point to achieve the best results.

- It is mandatory to connect the antenna **before** powering the board.
- The GPS/GNSS antenna should always be installed with the maximum possible view of the sky.
- In the default configuration, the antennas should be placed longitudinally along the vehicle, with the master antenna (GPS1) positioned at the back.
- In addition, if possible, it should be installed with a metallic plane behind, e.g. rooftop of the car, on a metal plate bigger than 20cm, etc.
- The heading accuracy will depend on antenna distance, check image below. With a good installation with 0.5 meters, you can get decent results.

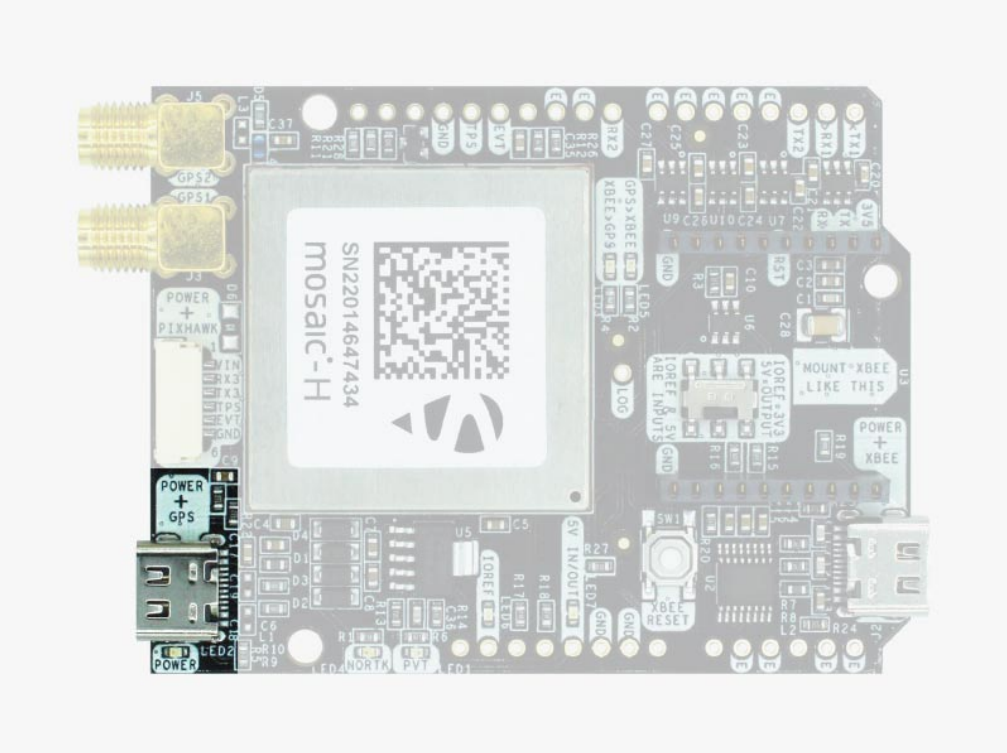


If you want to learn how installation impacts performance, please have a look at our GPS/GNSS antenna installation guide or look this video.

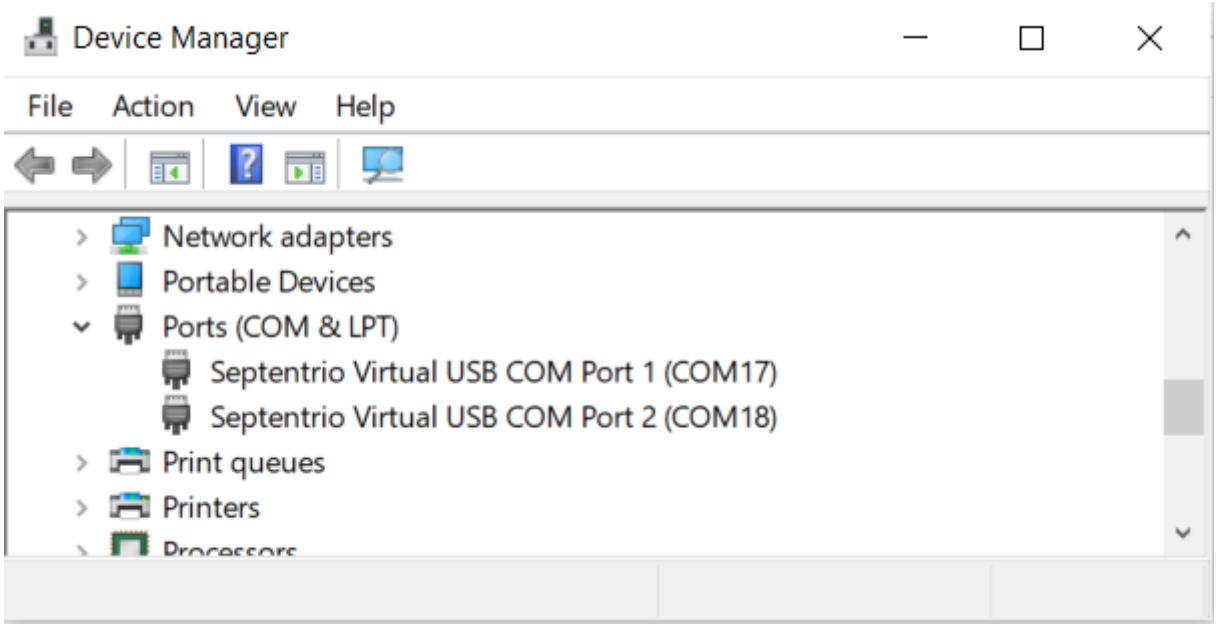
Interfaces

simpleRTK3B Heading board has a few interfaces that we will now explain in detail.

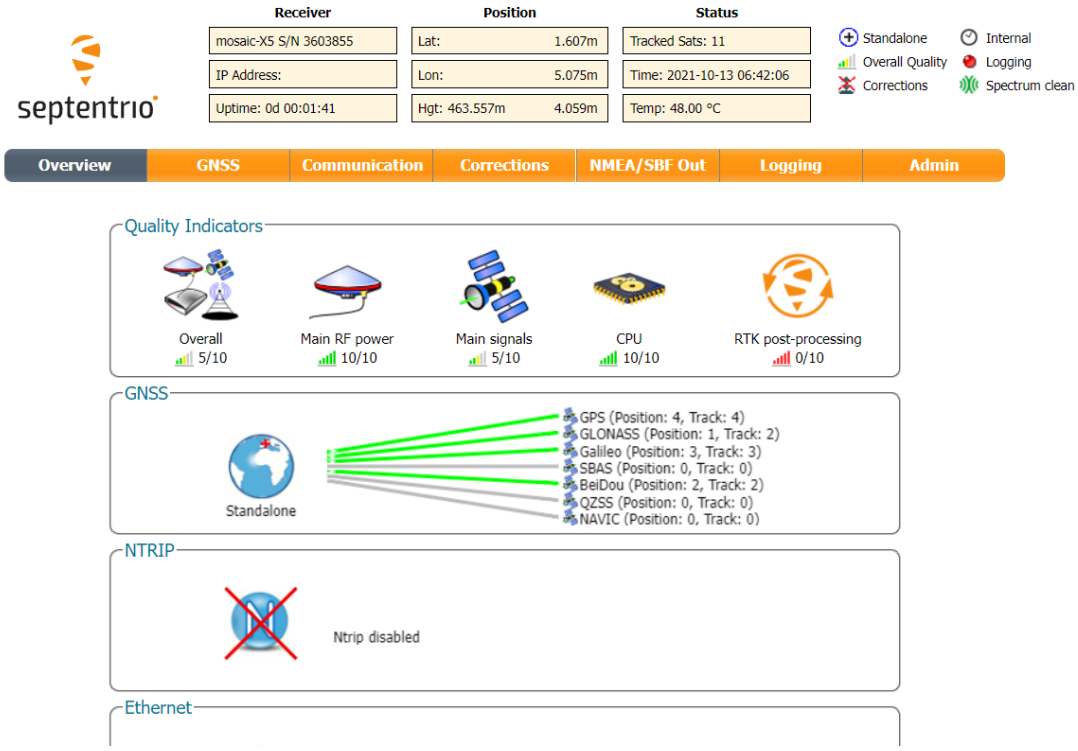
USB GPS



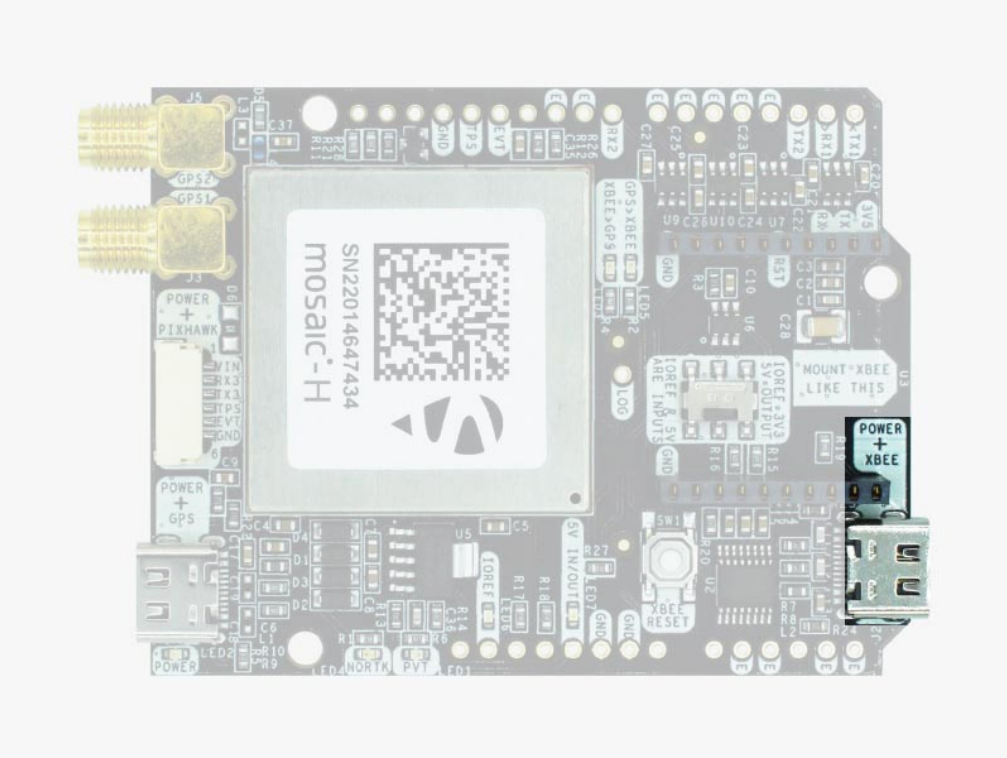
This USB-C connector gives you access to the native USB from the Mosaic module. When you connect to the PC for the first time, you will only see a new Hard Disk in your computer. Open it and install the Septentrio drivers.
After installation, when you connect the receiver to the PC, you will see 2 new COM ports, that you can use with your favourite terminal tool to read NMEA or have full access to the Mosaic using RxTools.



But the nicest thing of this receiver is that if you go to the web browser and write 192.168.3.1, the Septentrio web interface appears, that you can both to configure and monitor the receiver:

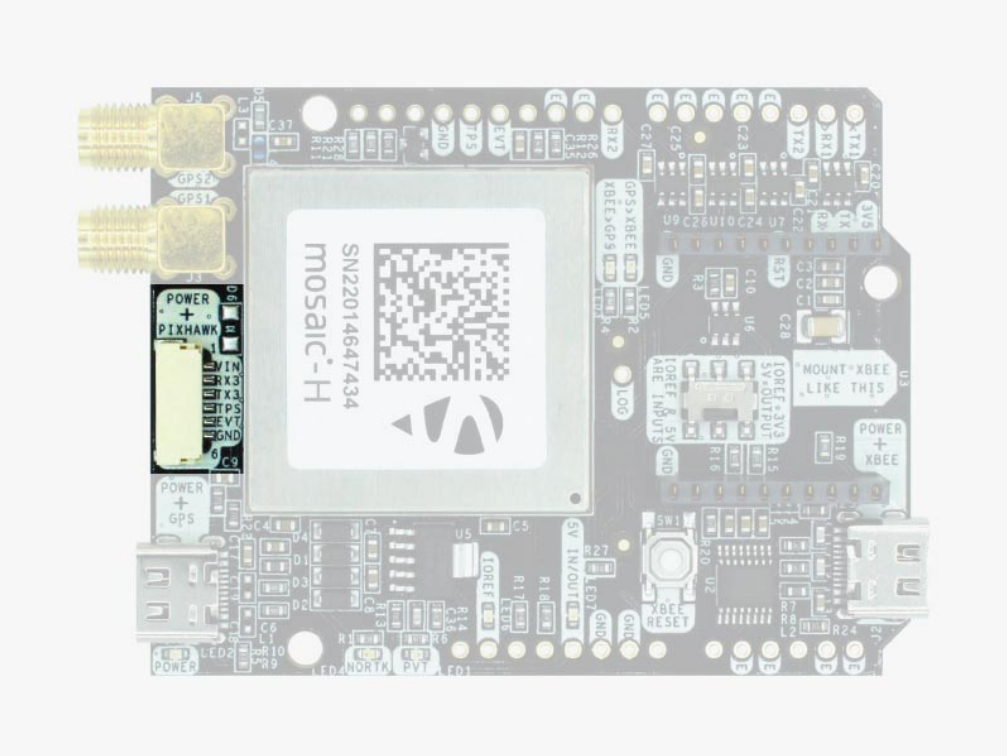


USB XBee



This USB-C connector gives you access to the UART of the XBEE radio (if you mount one), via an FTDI USB-to-UART converter. We find very practical to use this connector to power the board, so you can then connect and disconnect the GPS USB as your wish, without removing the power to the board. You can use any USB wall plug adapter you find at home.
To use this connector only as a power source, you don't need any driver. You can use your PC, or connect to your USB wall adapter.
To use this connector to configure an XBee radio, you will need the VCP driver from FTDI: https://ftdichip.com/drivers/vcp-drivers/

Pixhawk connector

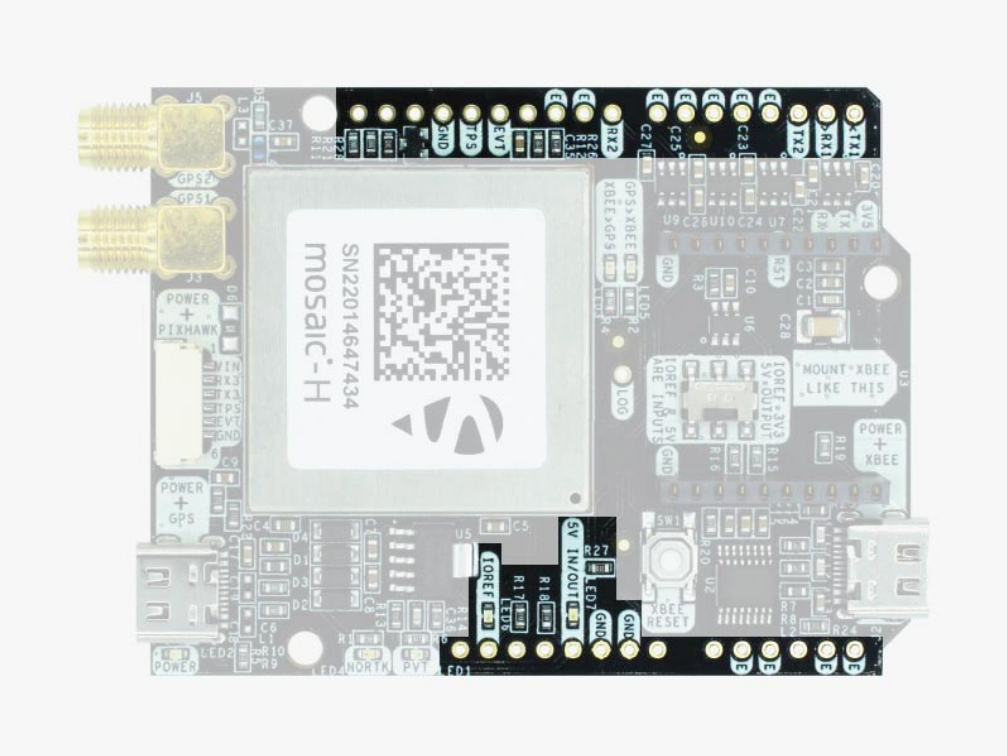


This connector is a standard JST GH that can be used to connect the simpleRTK3B Heading to a Pixhawk autopilot. You can also use this connector to power the board. The Pixhawk JST-GH connector is following the Pixhawk standard:

- 1: 5V_IN
- 2: Mosaic COM3 RX (3.3V level)
- 3: Mosaic COM3 TX (3.3V level)
- 4: Timepulse output (3.3V level)
- 5: Event input (3.3V level)
- 6: GND

Please note that the board only includes GPS and doesn't include magnetometer.

Arduino rails

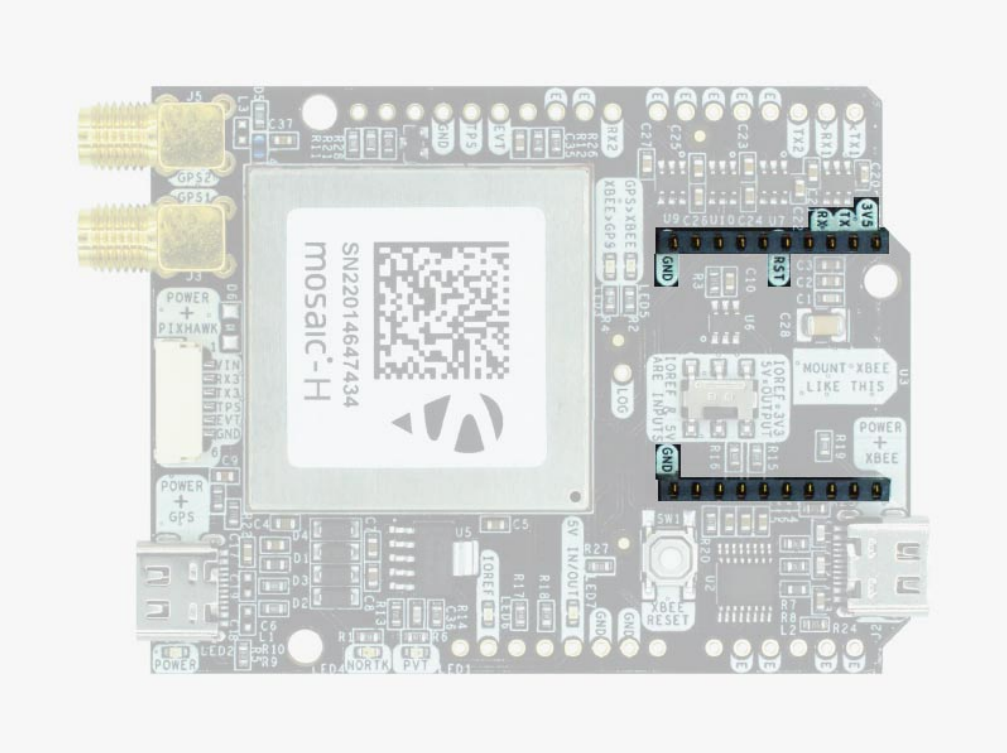


simpleRTK3B Heading has optional rails to connect to other arduino UNO compatible devices.

- **GND:** ground is available in the standard Arduino pins. You should always connect this line to your other board.
- **5V IN/OUT:**
  - When the LED next to this pin is OFF, you can power simpleRTK3B Heading from this pin. For example, just plug it on top of an Arduino UNO board, and simpleRTK3B Heading will turn ON. (Check if your Arduino can power 300mA @ 5V shields).
  - Alternatively, you can now use simpleRTK3B Heading to power other shields. Just turn ON the switch “5V=OUTPUT” and simpleRTK3B Heading board will output 5V at this pin.
- **IOREF:** This pin affects the functionality of TX1, RX1, TX2, RX2 pins.
  - When plugging the simpleRTK3B Heading board on top of an Arduino UNO or Raspberry Pi, this pin is used to automatically define the voltage level of the communication pins (TX1, RX1, TX2, RX2).
  - When wiring your own cables to the board, this is an input that will define the voltage levels of the pins. If you input 1.8V, the next pins will be 1.8V level. It supports from 1.2V to 5.5V.
  - If you want to connect wires to the listed pins and 3.3V is OK for you, you just need to enable the switch “IOREF=3.3V.”
- **TX1, RX1, TX2, RX2:** These pins work with the voltage level defined by IOREF.
  - TX1: Mosaic COM1 TX
  - RX1: Mosaic COM1 RX

- TX2: XBee UART TX (this pin is also connected to Mosaic COM2 RX).
- RX2: XBee UART RX (this pin is also connected to Mosaic COM2 TX).

High Power (HP) XBee socket

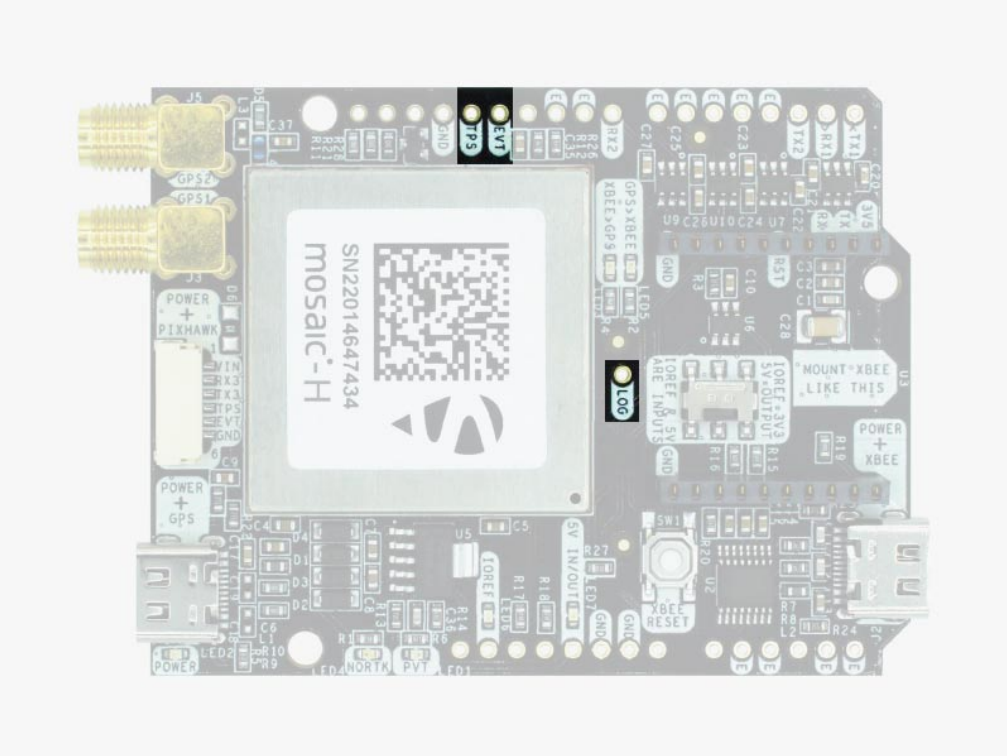


The simpleRTK3B Heading has a High Power (HP) XBee socket. You can use this socket to connect an XBee compatible radio. The following pins are available:

- VCC, which is a 3.3V output with a maximum current of 1A constant and peak 1.5A.
- XBee UART RX, at 3.3V level
- XBee UART TX, at 3.3V level
- GND

The XBee socket is connected to Mosaic COM2.

Special function pins

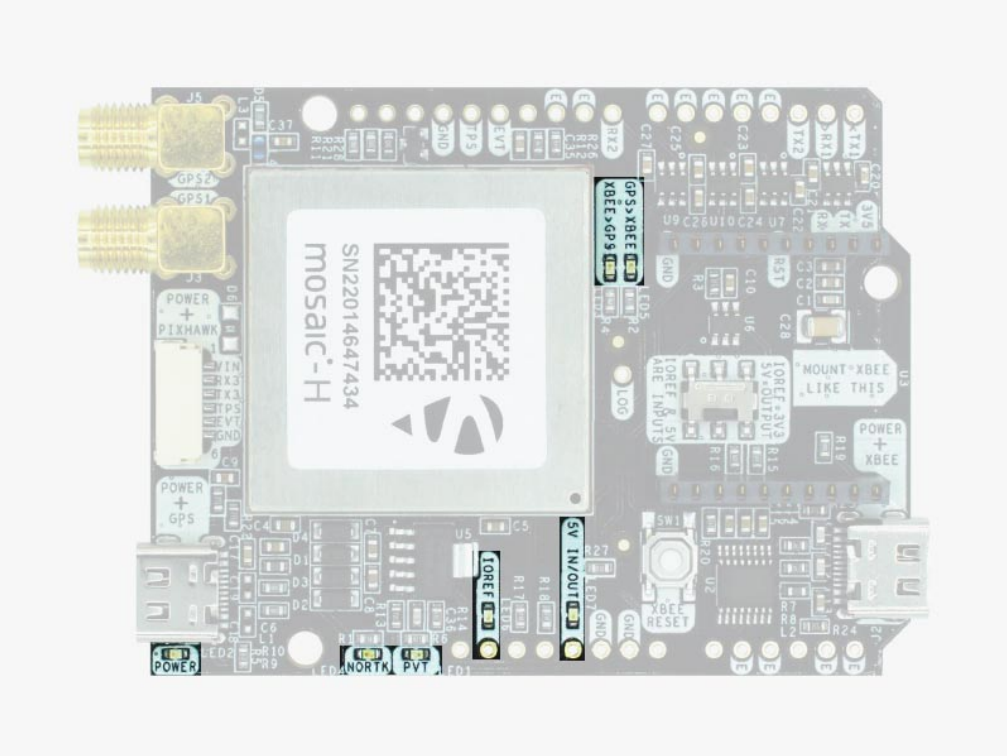


In addition to above, there's also a few additional pins available for the most advanced users. If you are going to use simpleRTK3B Heading connected on top of an Arduino or Raspberry Pi and you don't use any of these pins, it's recommended to not connect the pins: you can cut the header in this pins to avoid the connection, and prevent unexpected behaviours.

- Timepulse (TPS): 3.3V configuration time pulse output. The logic of this pin is inverted with the web interface. If the web interface you select HIGH, the pin will output LOW.
- External Event (EVT): time synchronization input, maximum voltage 3.6V. This input is filtered to avoid glitches.
- Logging Button (LOG): the logging feature can be controlled via web interface, but in case you want to add a button to control this feature.
    - Driving the LOGBUTTON pin low for 100 ms to 5 seconds toggles logging on and off.
    - Driving the LOGBUTTON pin low for more than 5 seconds and then releasing it unmounts the SD card if it was mounted, or mounts it if it was unmounted.

Remember that you can add a second XBee socket to your board with the Shield for Second XBee socket.

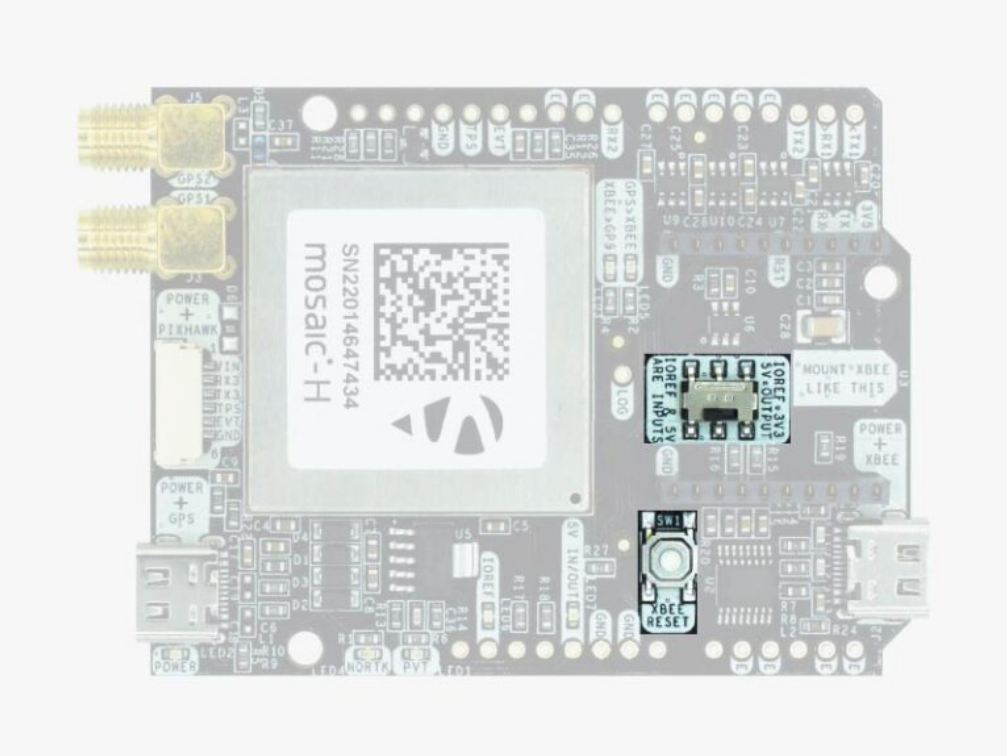
LEDs



The board includes 7 status LEDs, which indicate that:

- **POWER**: the simpleRTK3B Heading board has power.
- **PVT**: LED lights when it was possible to calculate a position from the available satellite visibility.
- **NORTK**: ON when no RTK, blinking when receiving correction data, OFF when the device is in RTK FIXED mode.
- **XBEE>GPS**: The XBEE radio is receiving data over the air and sending it to the Mosaic.
- **GPS>XBEE**: The Mosaic is outputting data to the XBee radio.
- **5V IN/OUT**: Indicates if there is voltage on that pin.
- **IOREF**: Indicates if there is voltage on that pin. If the IOREF pin is enabled, the UARTs on Arduino rails are activated.

Buttons and switches

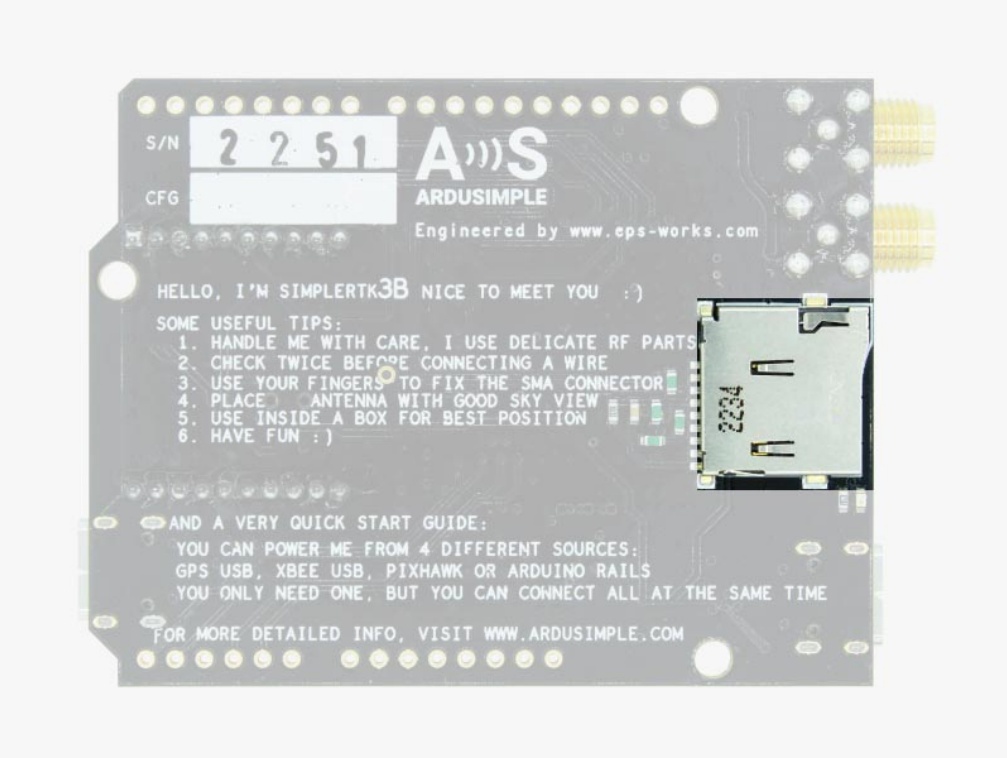


There’s only one button: XBee Reset, and the good news is that you probably will not have to use it. This button is used to program the XBee radio if you want to update firmware, etc.

You will find also 1 switch under the XBee socket: it let you enable IOREF with 3.3V and 5V arduino pin as output so the board can power accessories like Shield for Second XBee socket.

At the same time this switch will also enable the arduino rail signals at 3.3V. Check the “Arduino Rails” section above to read more details about this.

Onboard datalogging (MicroSD card)



simpleRTK3B Heading incorporates a microSD card reader for data logging. You can configure the datalogging details from Septentrio's web interface.

A peculiarity of Septentrio datalogging is that storage inside microSD card is done in batches. For example, if you only enable GGA message for storage 1 time per second and you only leave the system up for 10 seconds, there will be no data inside the memory card, because you didn't reach the minimum data size for storage. We recommend enabling a few messages per second to make sure when powering down a minimum number of last messages are lost.

In case you want to control logging with a button, there's a pin labelled **LOG** that is connected to the **LOGBUTTON** function of the Mosaic module: if you connect this pin to **GND** you can trigger externally start / stop of recording. Otherwise you can simply do it from the web interface or leave it always O.

Accessories

You can add any of these features (and more) with our XBee plugins:

Plugins
Radio module 450MHz

Plugins
WiFi NTRIP Master

Plugins
WiFi NTRIP Master (external antenna version)

Plugins
Radio module Long Range (LR)

Plugins
Radio module eXtra Long Range (XLR)

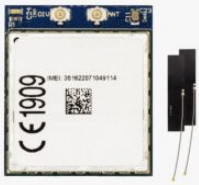
Plugins
Radio Module Medium Range (MR)

Plugins
Bluetooth module

Sale!

Made in Europe
Plugins
Ethernet NTRIP Master

Sale!



Plugins
4G NTRIP Master

Plugins
BT+BLE Bridge

Sale!

Plugins
CANBus GNSS Master

Plugins
RS232 plugin

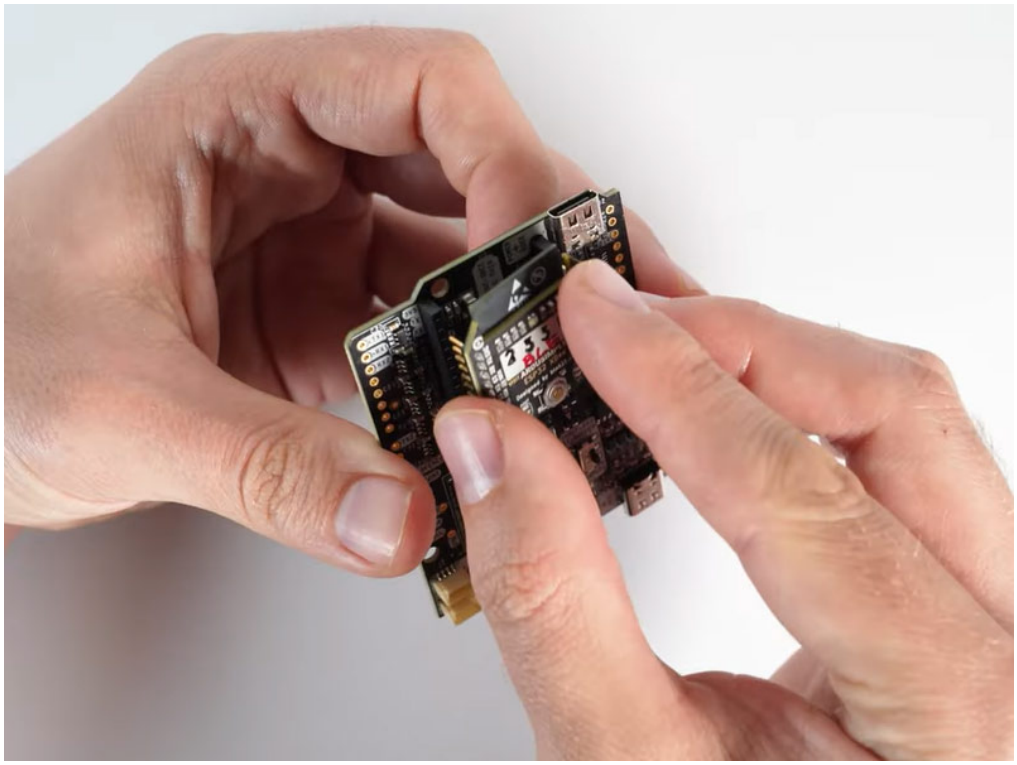
Sale!

Made in Europe
Plugins
PointPerfect L-Band Corrections Receiver NEO-D9S

Plugins
Shield for Septentrio Native Ethernet

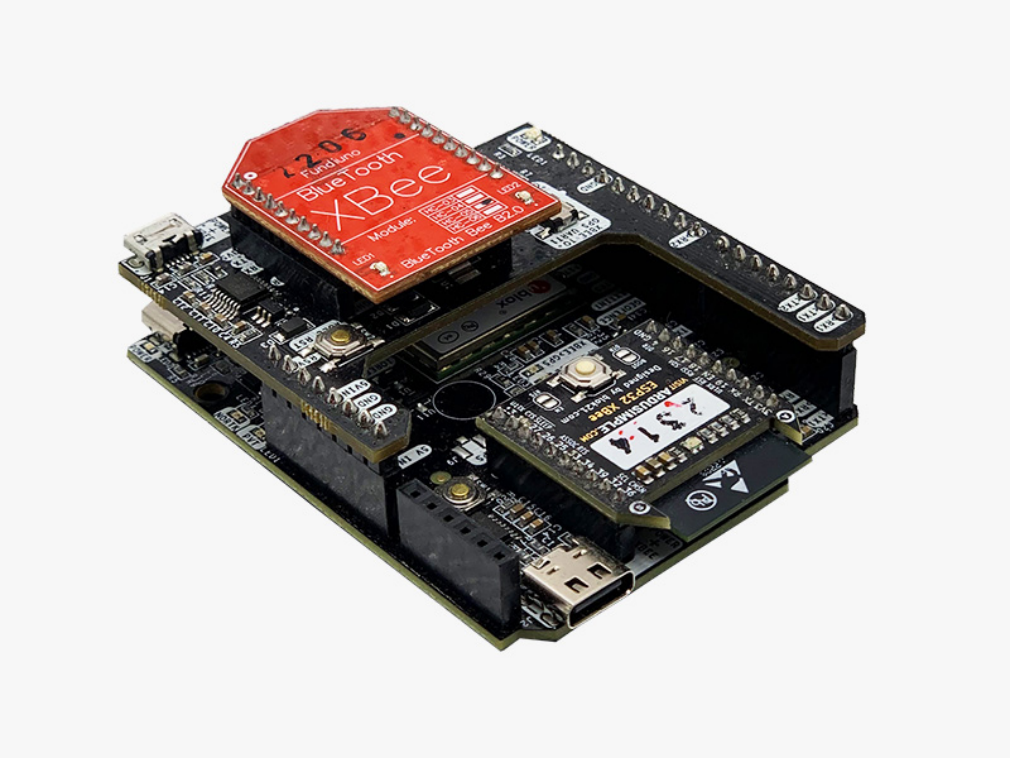
How to add plugin

1. To connect the communication plugin to the XBee socket, simply insert it into the XBee connector on the board.



2. To use the plugin, go to the Septentrio Mosaic-X5 and Mosaic-H configuration page and load the configuration file **Send 1Hz full NMEA to Plugin** onto your receiver following the instructions.

3. The board supports a second XBee plugin. You can use two communication plugins at the same time by adding a Shield for Second Plugin Socket. To attach it, you will need the Expansion Headers Kit (not soldered) on the receiver, or order Expansion Headers Kit (soldered) if you want us to solder it for you.



Related tutorials

If you’re looking for more detailed guidance, explore the following resources and tutorials:

- Mosaic-H reference guide
- How to enable the latest anti-spoofing OSNMA service on your Septentrio receiver
- How to share your Septentrio base station with RTK2go via Septentrio Native Ethernet
- How to configure Septentrio receiver and connect it to ArduPilot
- How to use PointPerfect with Septentrio receivers
- How to generate RINEX files with simpleRTK3B Pro
- How to load antenna calibration files to Septentrio receivers

For additional configuration information, such as upgrading firmware or configuring the receiver as a base or rover, refer to the Septentrio Configuration Page.