User Guide: simpleRTK3B Compass

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Product Overview

You can use the simpleRTK3B Compass 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 Compass is Unicore UM982 module. It is designed to perform on-chip RTK positioning and dual-antenna heading.

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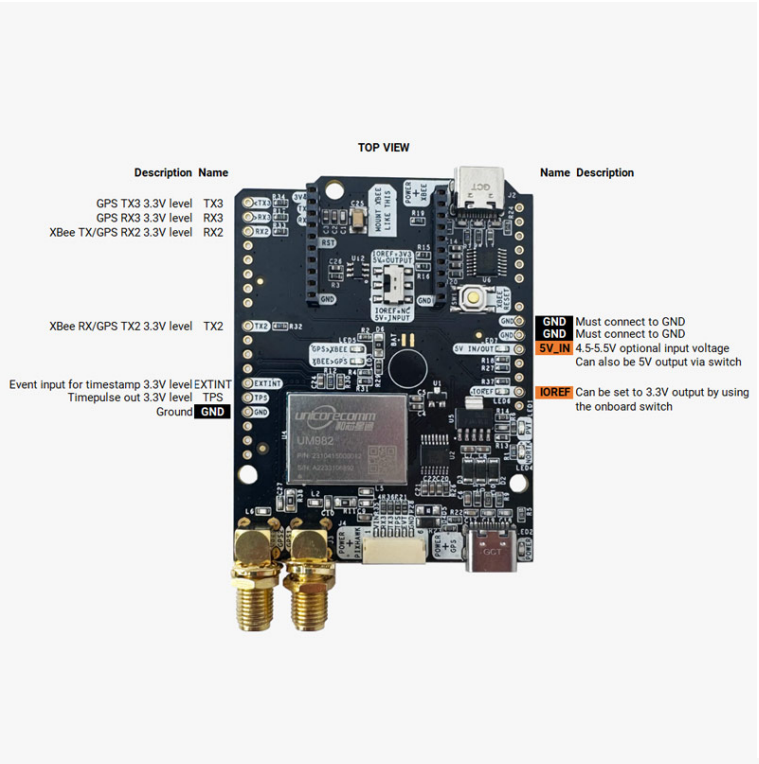
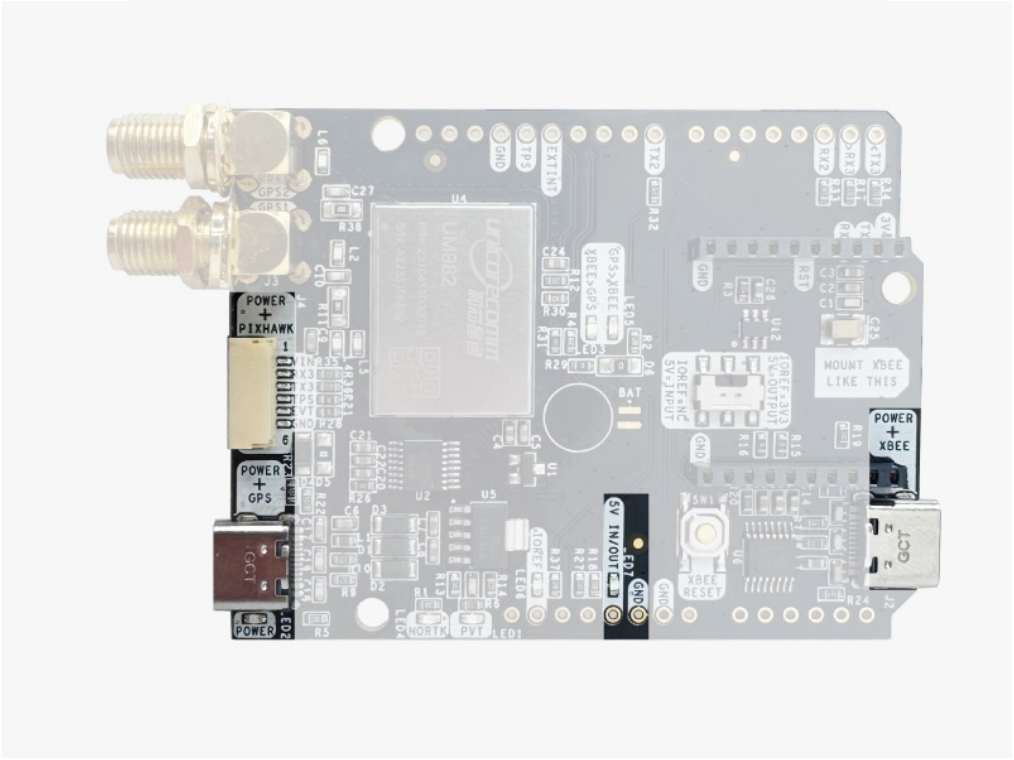
Hardware

Pinout definition

Power





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The simpleRTK3B Compass can be powered from 4 different sources:

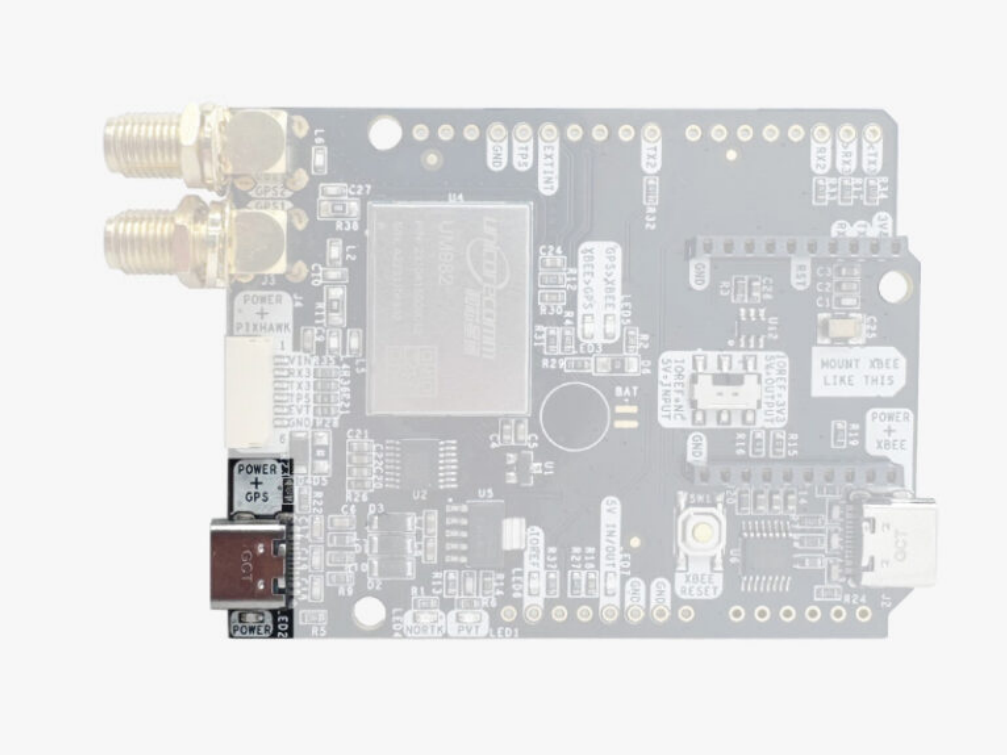
- GPS USB port
- XBEE USB port
- Pixhawk connector
- Arduino rail

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.

Communication ports

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

USB GPS



This USB-C connector gives you access via FTDI USB-to-UART converter, to COM1 of the UM982 module.
You can connect this interface to your preferred mobile phone, tablet, or PC and start receiving NMEA data.
After connecting the receiver to the PC, you will see 1 new COM ports, that you can use

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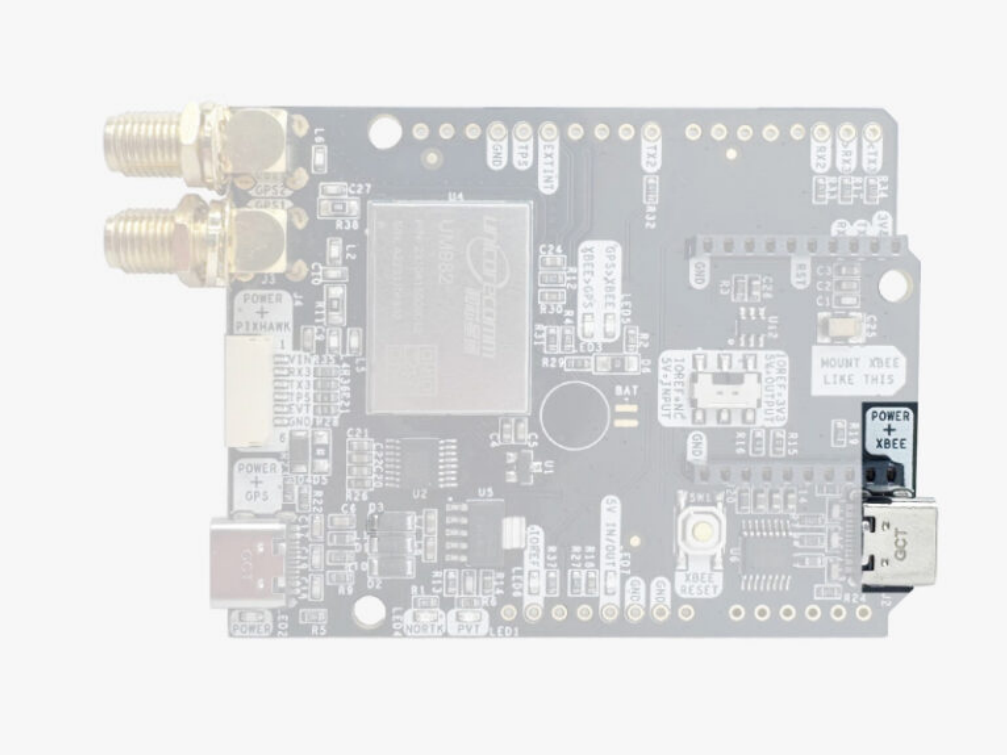
with your favorite terminal tool to read NMEA or have full access to the UM982 using the UPrecise tool.

By default NMEA is disabled on this module so we recommend you to start with the UPrecise tool.
If your PC doesn't recognize the device, you will need the VCP driver from FTDI:
https://ftdichip.com/drivers/vcp-drivers/

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/

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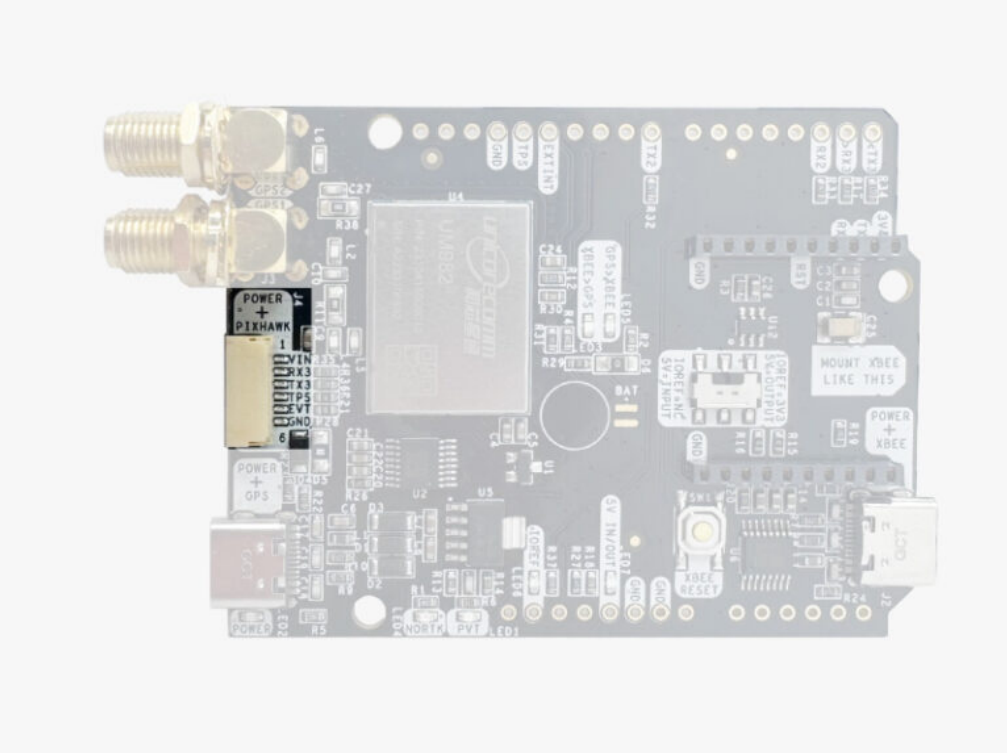
Pixhawk connector



This connector is a standard JST GH that can be used to connect the simpleRTK3B Compass 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: Unicore COM3 RX (3.3V level)
- 3: Unicore COM3 TX (3.3V level)
- 4: Timepulse output (3.3V level)
- 5: Extint (3.3V level)
- 6: GND

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

Arduino rails

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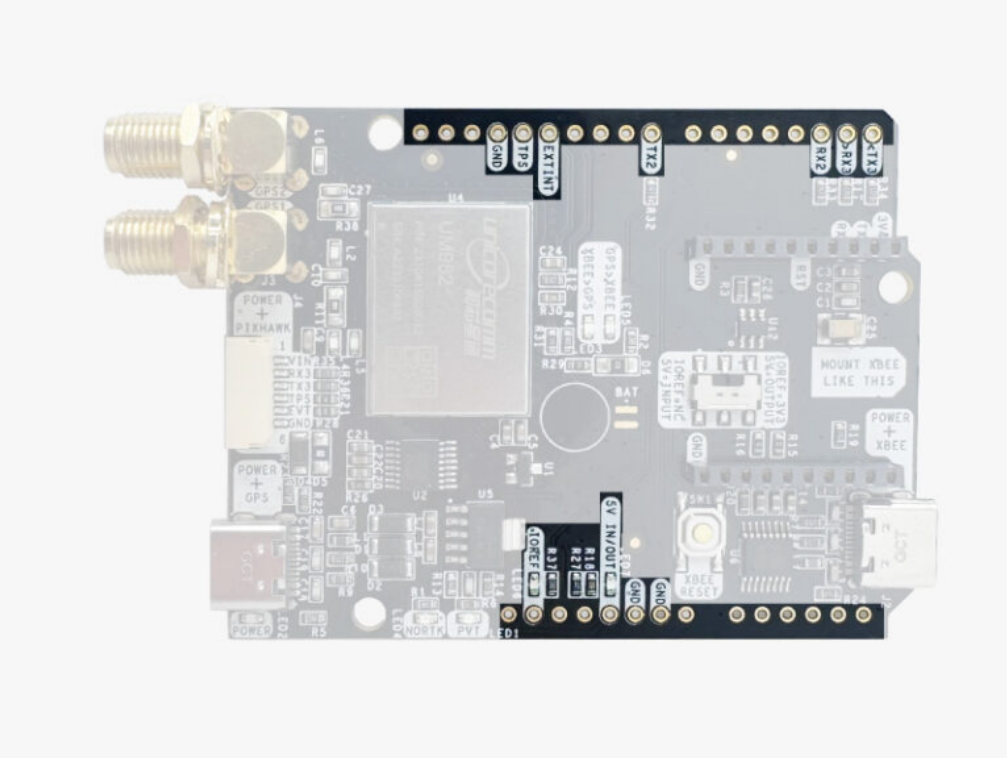

simpleRTK3B Compass has optional rails to connect to other arduino UNO compatible devices.

- **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, can power simpleRTK3B Compass from this pin.
    For example, just plug it on top of an Arduino UNO board, and simpleRTK3B Compass will turn ON. (check if your arduino can power 300mA @ 5V shields).
  - Alternatively, you can now use simpleRTK3B Compass to power other shields. Just turn ON the switch “5V=OUTPUT” and simpleRTK3B Compass board will output 5V at this pin.
- **IOREF:** This pin is disconnected when the onboard switch is towards “IOREF = NC”. Alternatively it outputs 3.3V when the onboard switch is towards “IOREF = 3V3”. You can use this functionality to provide a voltage reference to other Shields that require this pin as an input.
- **TX2,RX2,TX3,RX3:**These pins work as an output at 3.3V, and as an input accepting from 2.7 to 3.6V.
  - TX2: Unicore COM2 TX (this pin is also connected to XBee UART RX)
  - RX2: Unicore COM2 RX (this pin is also connected to XBee UART TX)
  - TX3: Unicore COM3 TX
  - RX3: Unicore COM3 RX

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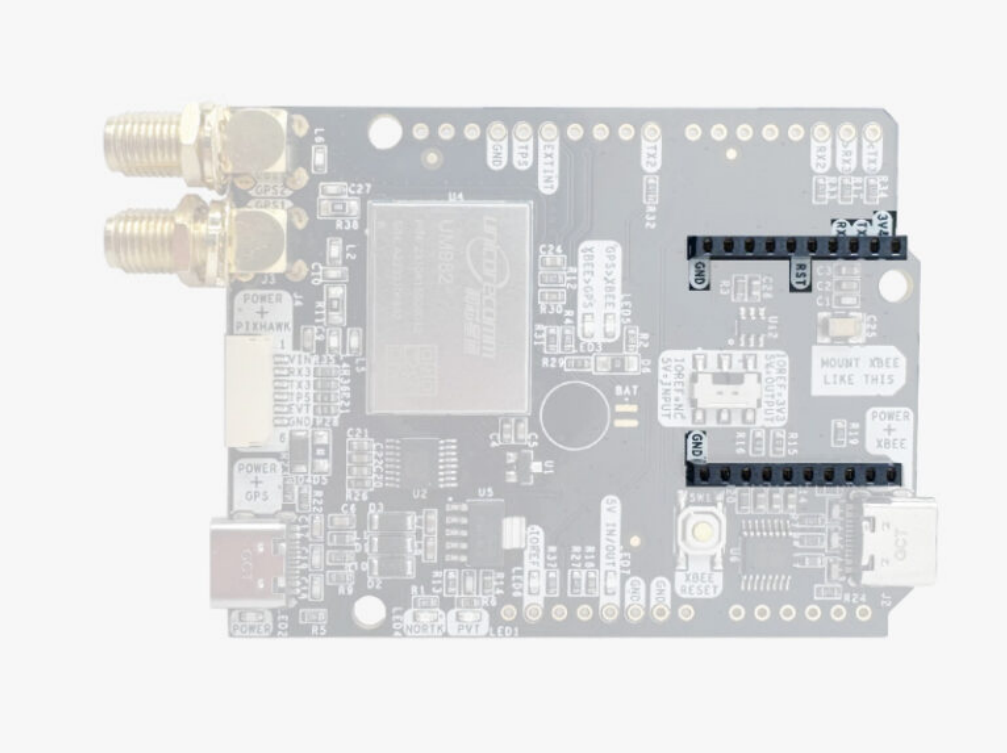
High Power XBee socket



The simpleRTK3B Compass 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 maximum current 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 Unicore COM2. Remember that you can add a second XBee socket to your board with the Shield for Second XBee socket.

Special function pins

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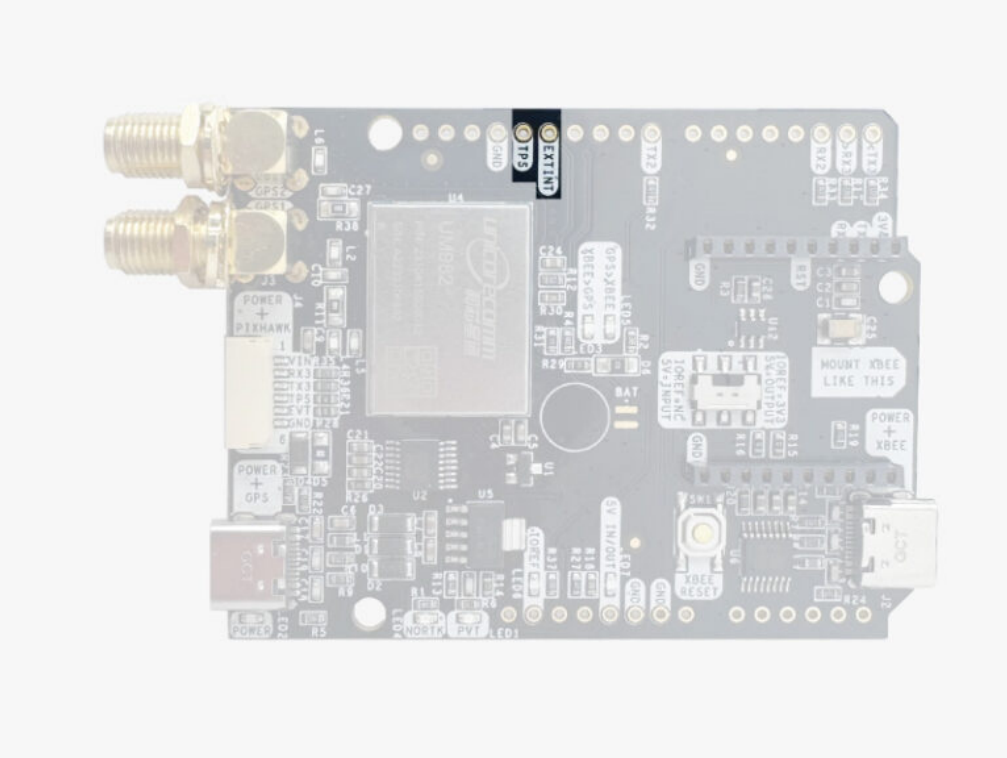

In addition to above, there's also a few additional pins available for the most advanced users. These pins are also available in the JST connector, as in the simpleRTK3B Pro.

If you are going to use simpleRTK3B Compass 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 behaviors.

- Timepulse (TPS): 3.3V configuration time pulse output.
- Extint (EXTINT): time synchronization input, maximum voltage 3.6V.
  This input is filtered to avoid glitches.

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

GPS/GNSS Antenna

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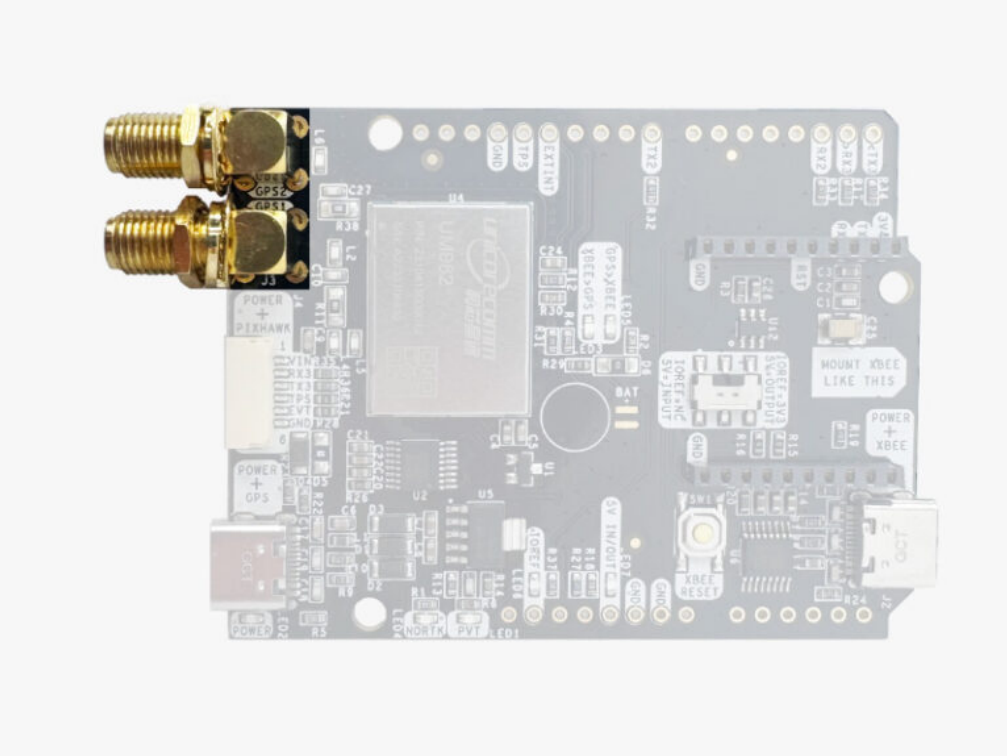

simpleRTK3B Compass does not include, but requires a good quality GPS/GNSS antenna.

simpleRTK3B Compass supports full L1/L2/L5 bands. If you want to get the most out of this module, we recommend a Triple Band simpleANT3B series 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.

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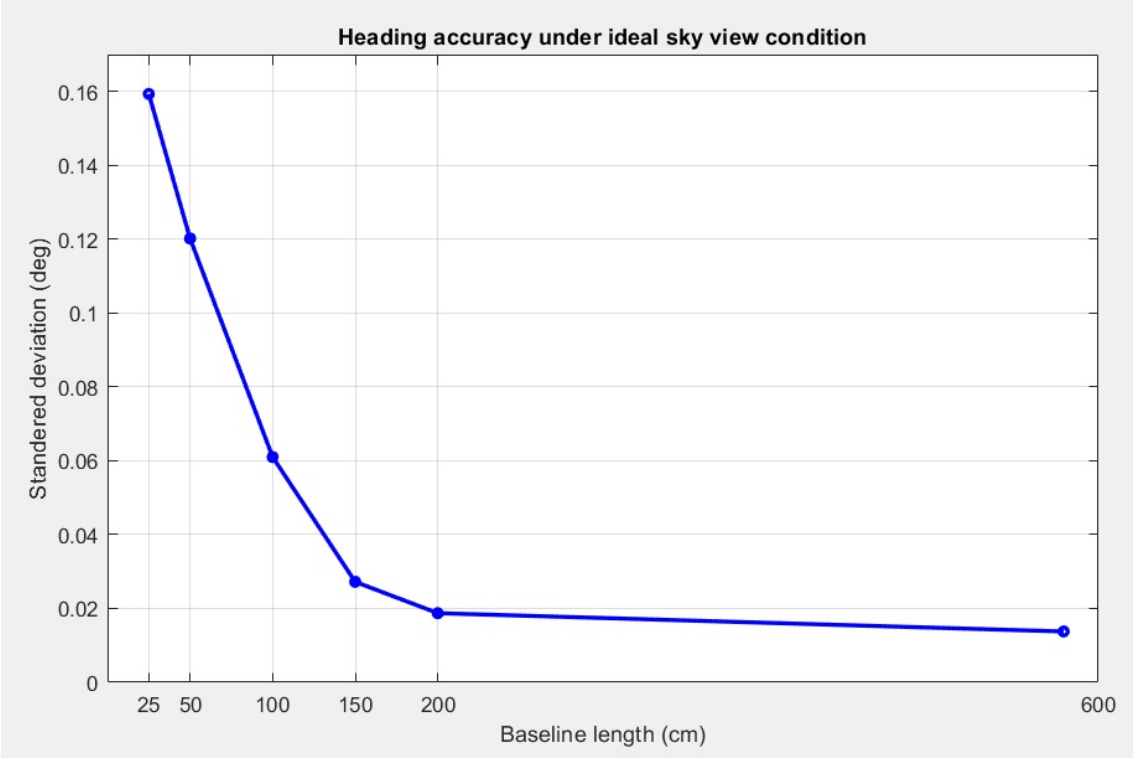
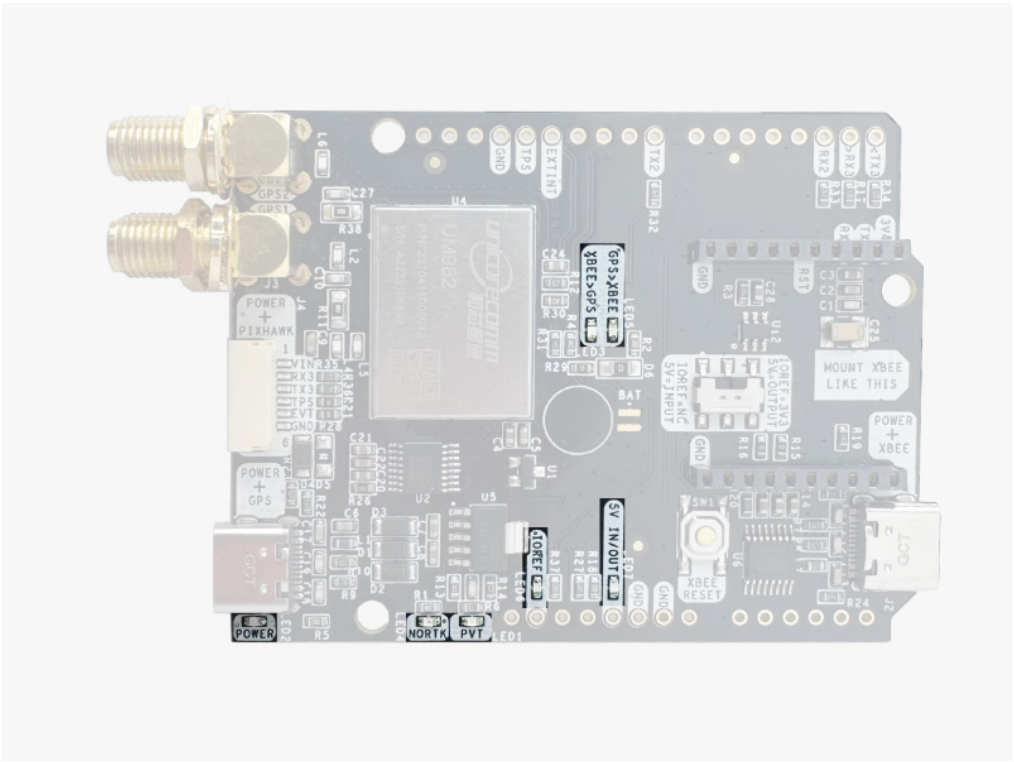


If you want to learn how installation impacts performance, please have a look at our GPS/GNSS antenna installation guide or look this video.

LEDs



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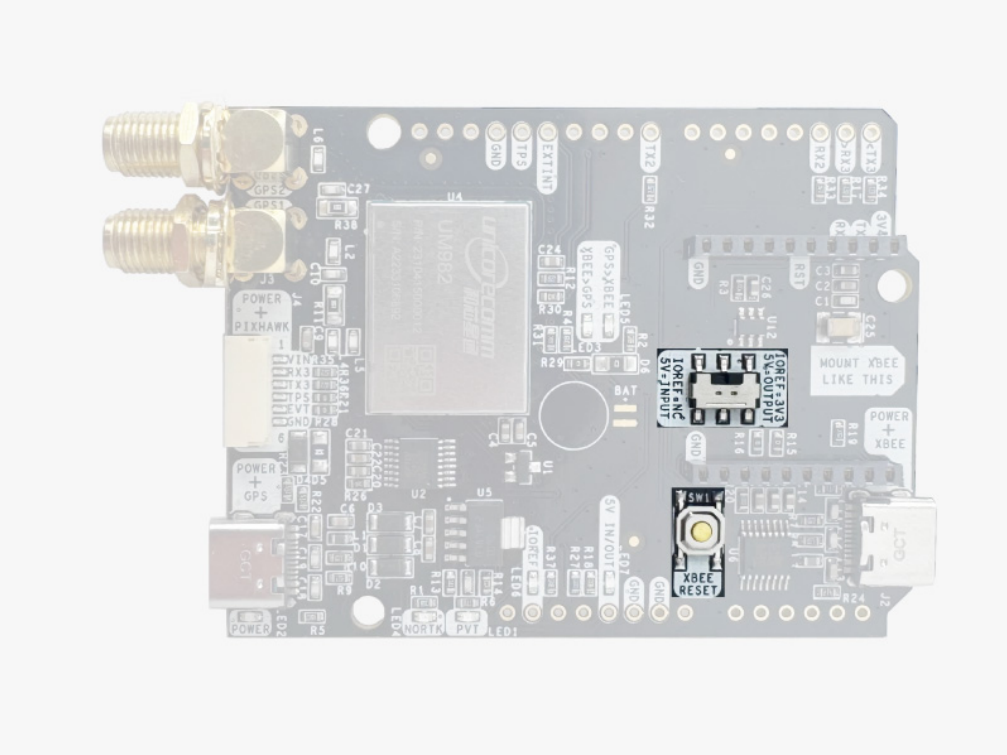
The board includes 7 status LEDs, which indicate that:

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

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.

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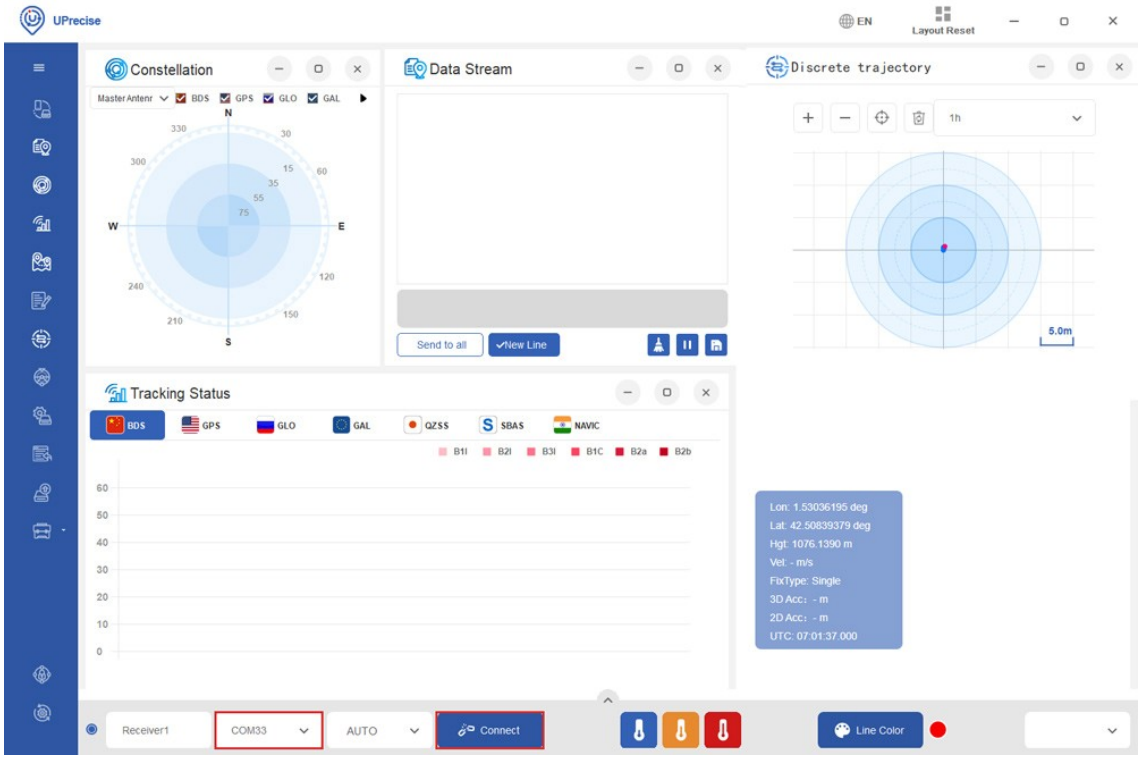
Get started

Connect to UPrecise

1. Connect the GNSS antenna to your receiver. Make sure the antenna has a good view of the sky for testing functionality. Or you won't see satellites view and signal.
2. Connect the receiver to your PC via the USB port labelled as **POWER+GPS**.
3. Open Uprecise. Select the **COM** port (If you don't know which COM port check the device manager of your PC). At baud rate choose **115200** or **AUTO**. Press **Connect**.



4. Click the **Receiver Configuration** icon on the left side menu bar. Here you can enable you preferred NMEA messages (By default NMEA is disabled on this module **)**. We recommend checking GGA, GSA, GSV, GST and RMC. It will work well with SW Maps and most applications. Then click **Enter**.

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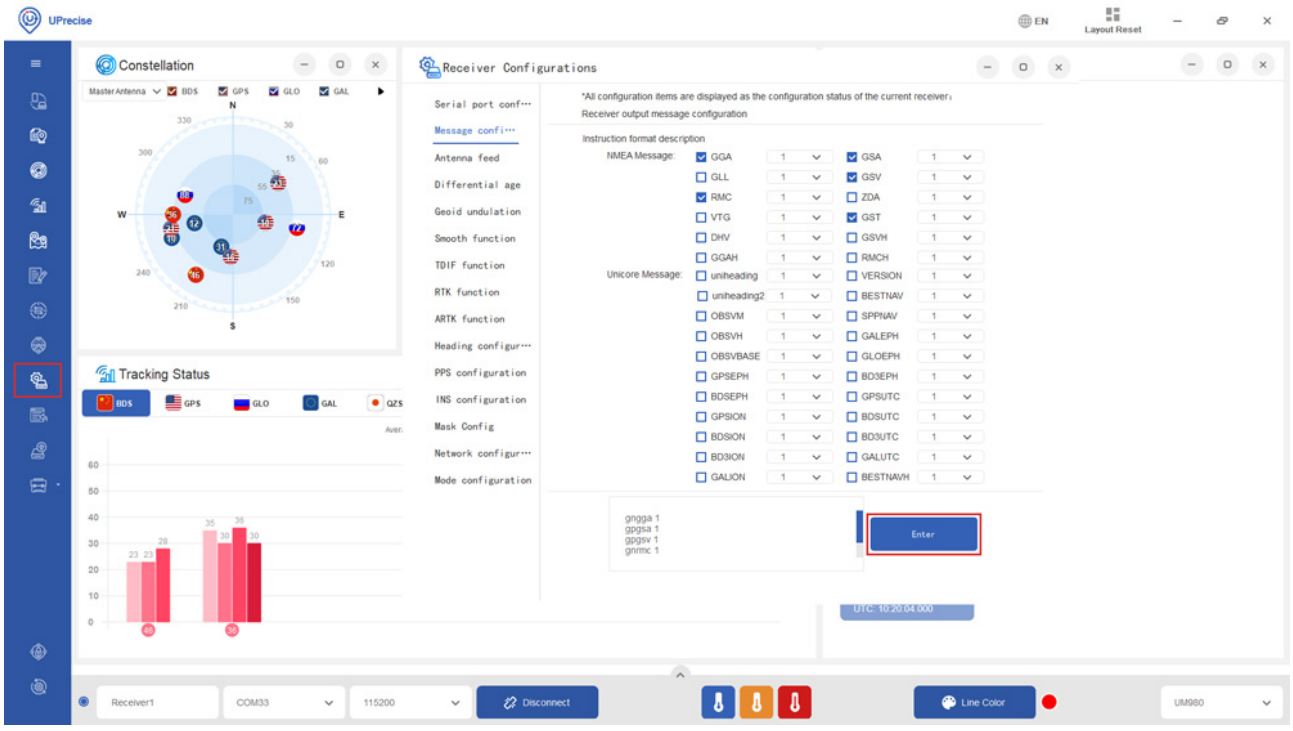
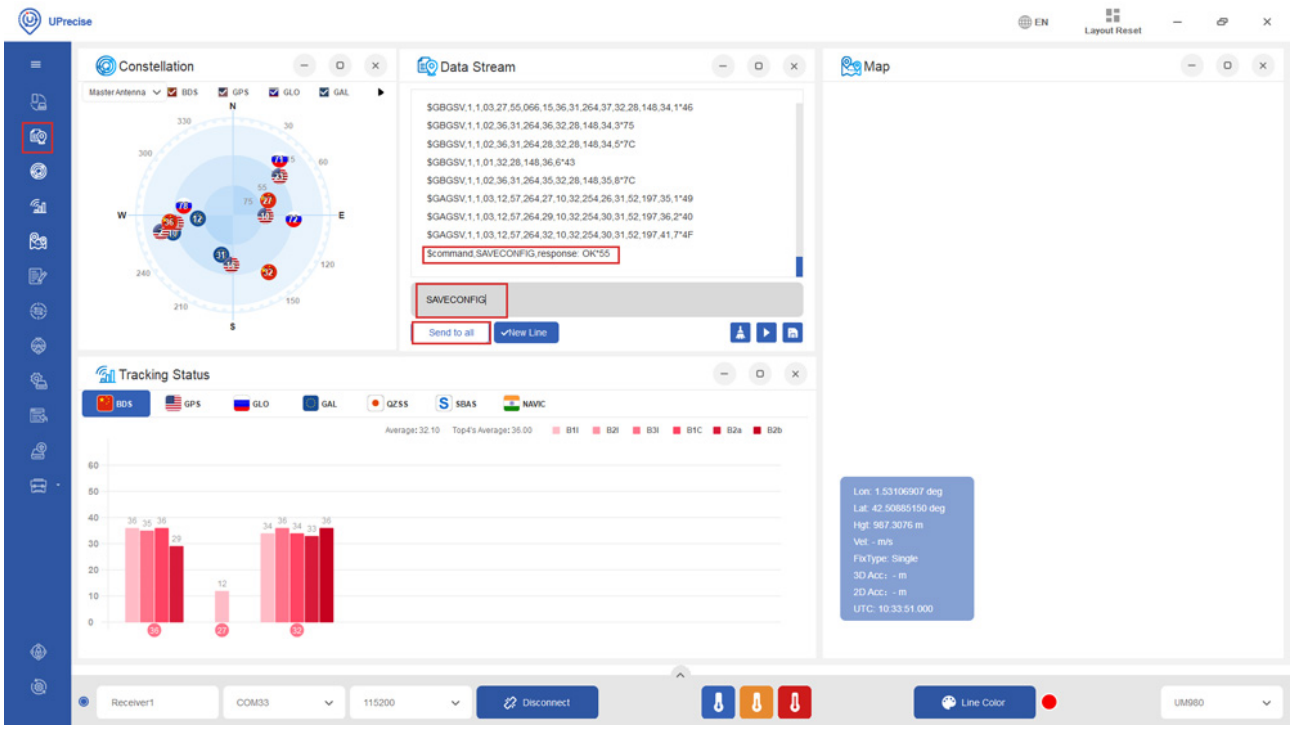


5. At Menu bar choose the **Data Stream** icon. At Data Stream window type in **SAVECONFIG** and press **Enter**. On the Data Stream you will see **Command, SAVECONFIG, response: OK**. It means your configuration is saved to the Flash of your receiver.



6. You will see the Constellation, Data Steam and Tracking Status on the screen.

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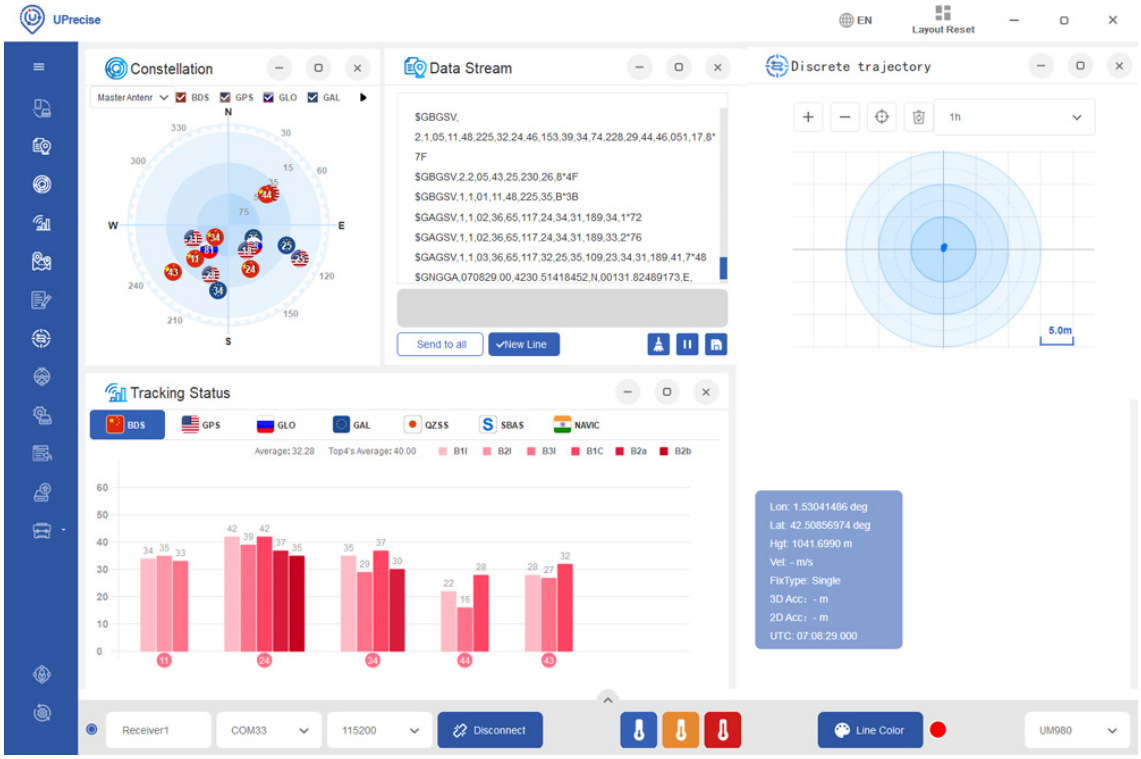

Send NMEA messages to Xbee Socket

7. The Xbee socket is connected to Unicore COM2. If you want to connect with Bluetooth, BLE, radio or other communication plugins, you need to enable NMEA messages on COM2.
8. For example if you want to send GGA to COM2, at the commend window type in **GPGGA COM2 1.** It will output 1Hz GGA message at COM2.
9. Repeat the same for the NMEA messages you need. We recommend to enable **GGA, GSA, GSV, GST** and **RMC**. It will work well with SW Maps and most applications.

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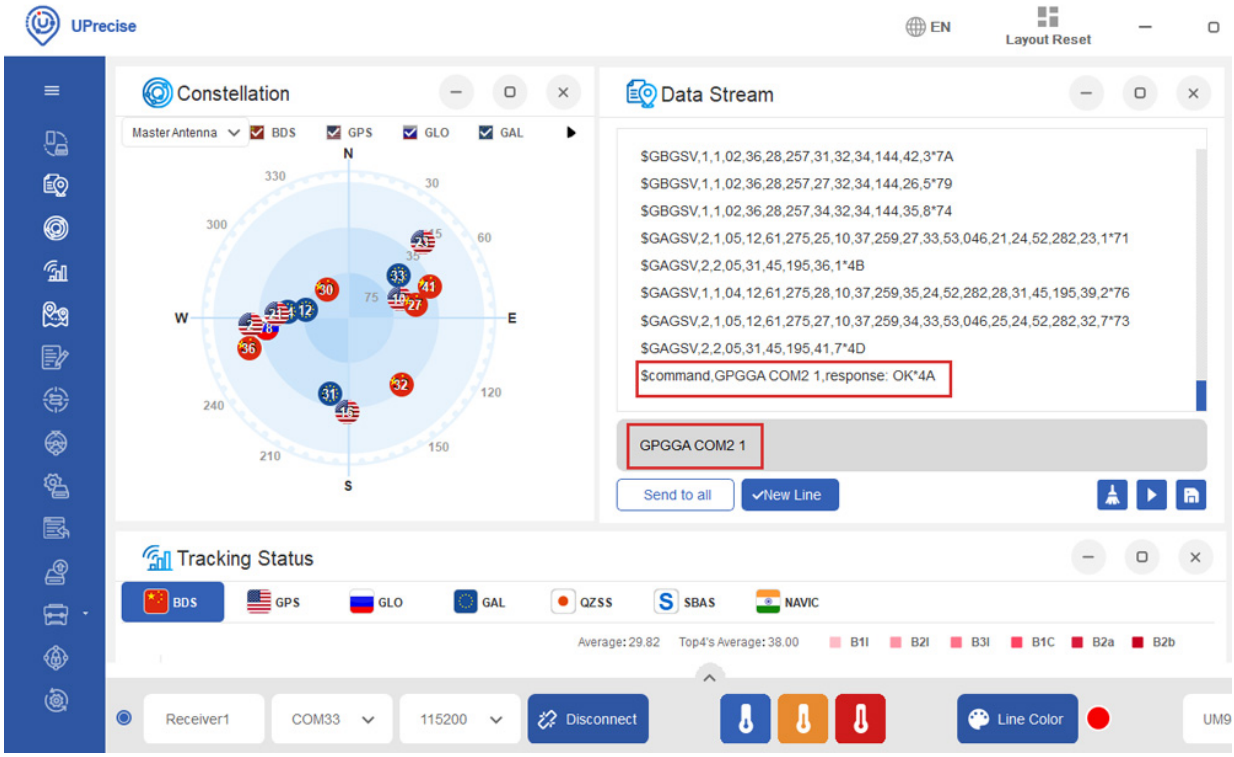

10. At the commend window type in **SAVECONFIG,** then press **Enter** to save current configuration into memory.

Connect to NTRIP

In order to achieve centimeter/millimeter level accuracy with our GNSS receivers, you need to have corrections.
If you don't have your own base station for corrections, you can find third party base stations at RTK Correction Services in your Country.

11. Click the **toolbox** icon and select **RTCM**.

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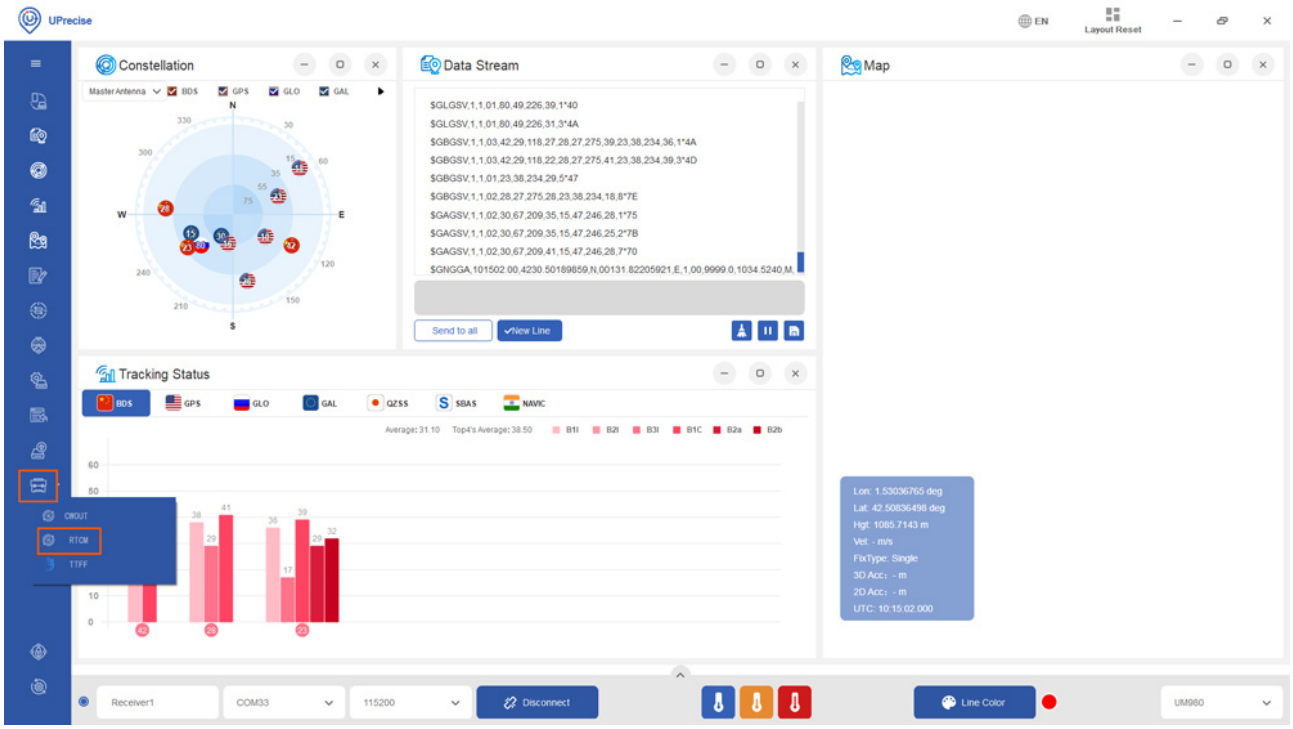
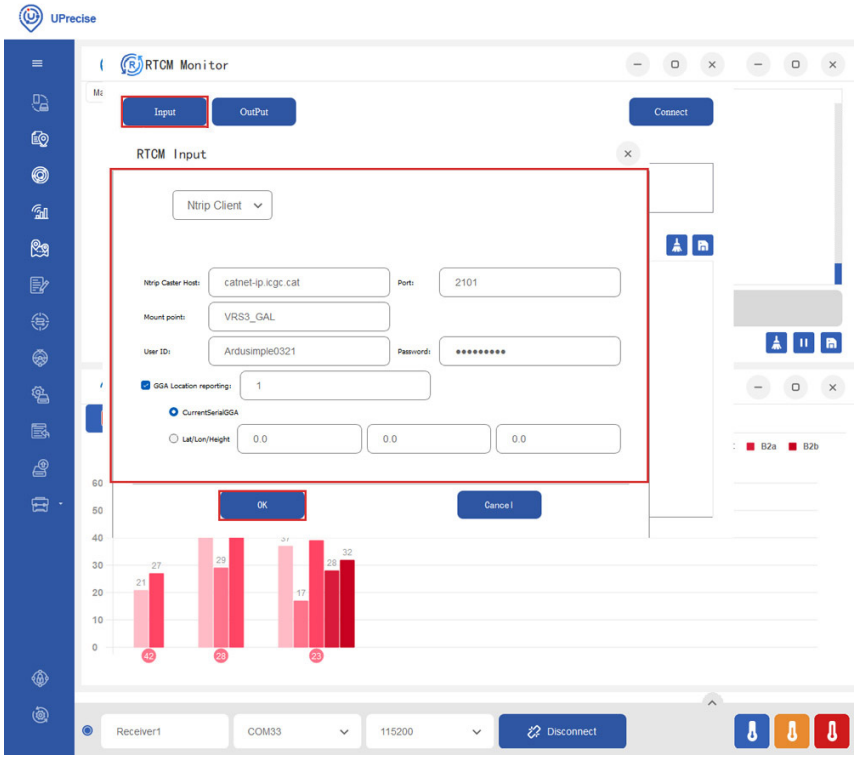


12. Click **Input**. Choose **Ntrip Client.** Set your Ntrip Caster Host, Port, Mount point, ID and Password. If your Ntrip Caster need the location of your rover, set GGA Location reporting at 1, and select **CurrentSerialGGA**. Click **Ok**.



13. Click the **OutPut.** Select **Serial Port**, and choose the COM port of your receiver.

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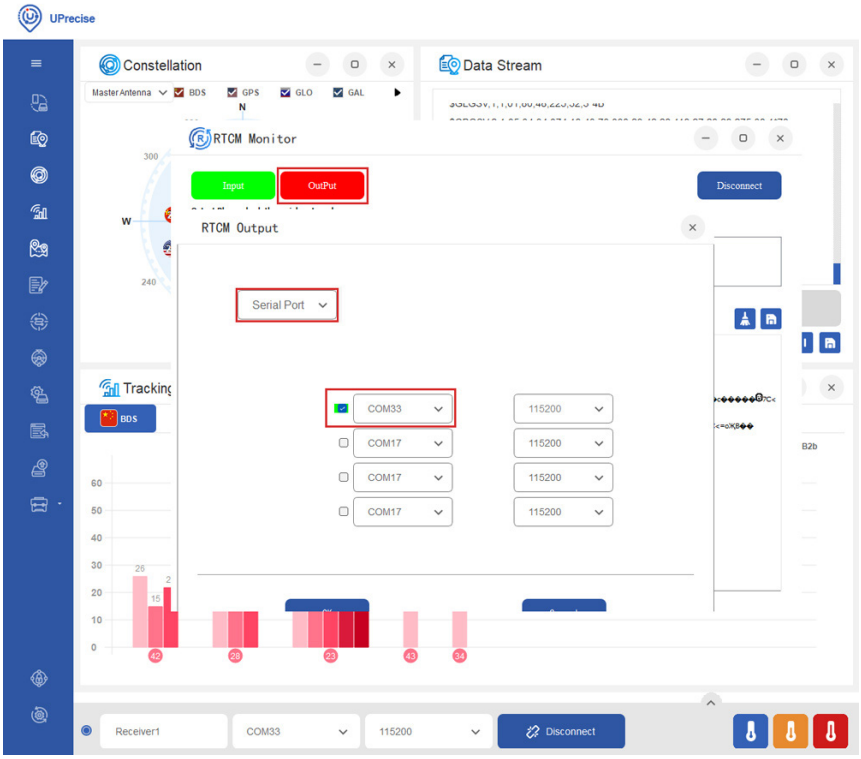
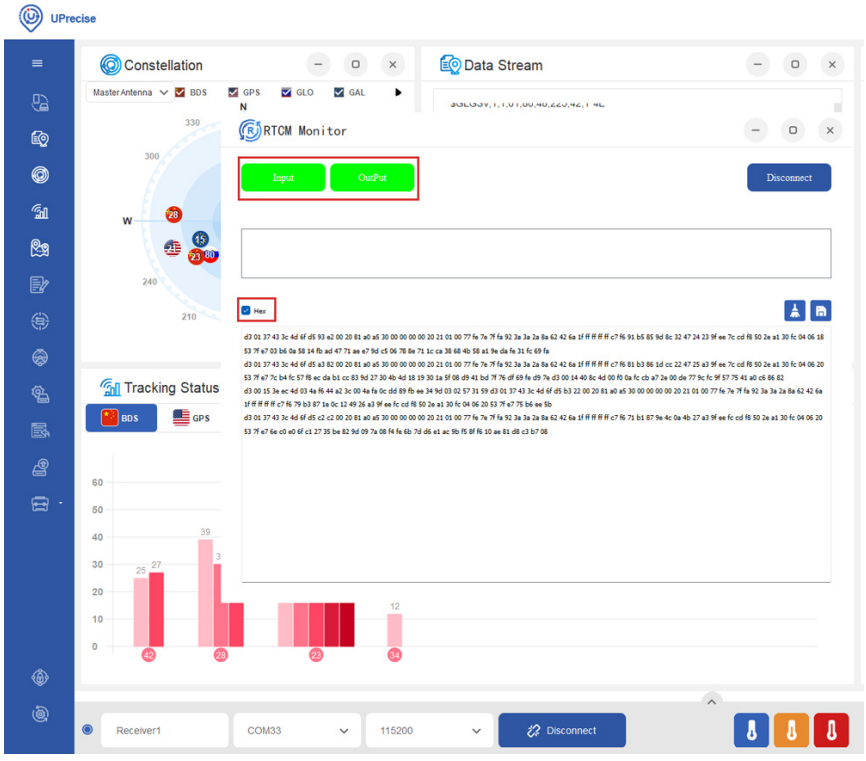


14. You will see the Input and OutPut change into green. Check **Hex,** you will see the RTCM messages from the server.



15. In a few minutes, you will see the Fix Type change to RTK Float or Fixed.

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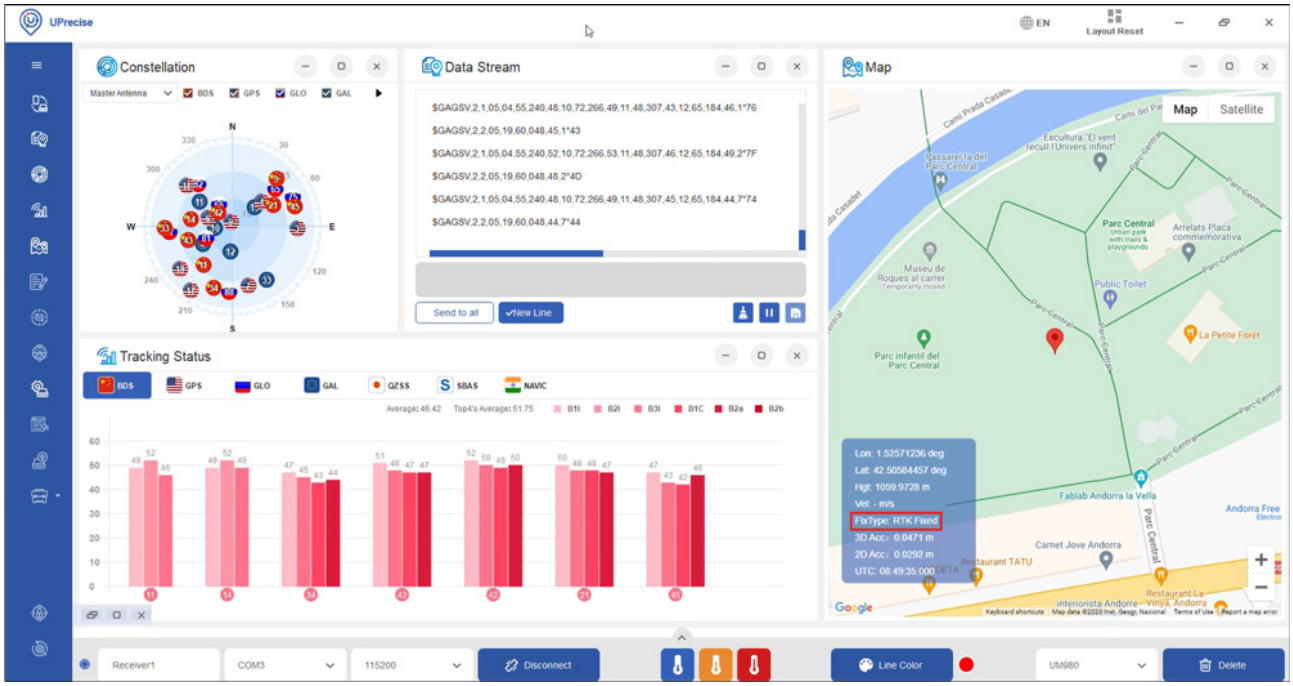

Enable Galileo HAS

The Galileo High Accuracy Service (HAS) provides free of charge access, through the Galileo signal (E6-B) and by terrestrial means (Internet), to the information required to estimate an accurate positioning solution using a Precise Point Positioning algorithm in real-time.

Galileo HAS is available on simpleRTK3B Budget and simpleRTK3B Compass. It is not supported with the current firmware version of simpleRTK3B Fusion.

16. Type in the following commands one by one to enable HAS.
    CONFIG PPP ENABLE E6-HAS
    CONFIG PPP DATUM WGS84
    CONFIG PPP CONVERGE 50 50
    CONFIG SIGNALGROUP 2 (Use this command if you have a simpleRTK3B Budget)
    CONFIG SIGNALGROUP 3 6 (Use this command if you have a simpleRTK3B Compass)
    SAVECONFIG

17. In a few minutes you should see the fix type change to Float.
    If you want to disable PPP, type in command:
    CONFIG PPP DISABLE
    And use command **CONFIG PPP ENABLE E6-HAS** to enable it again.

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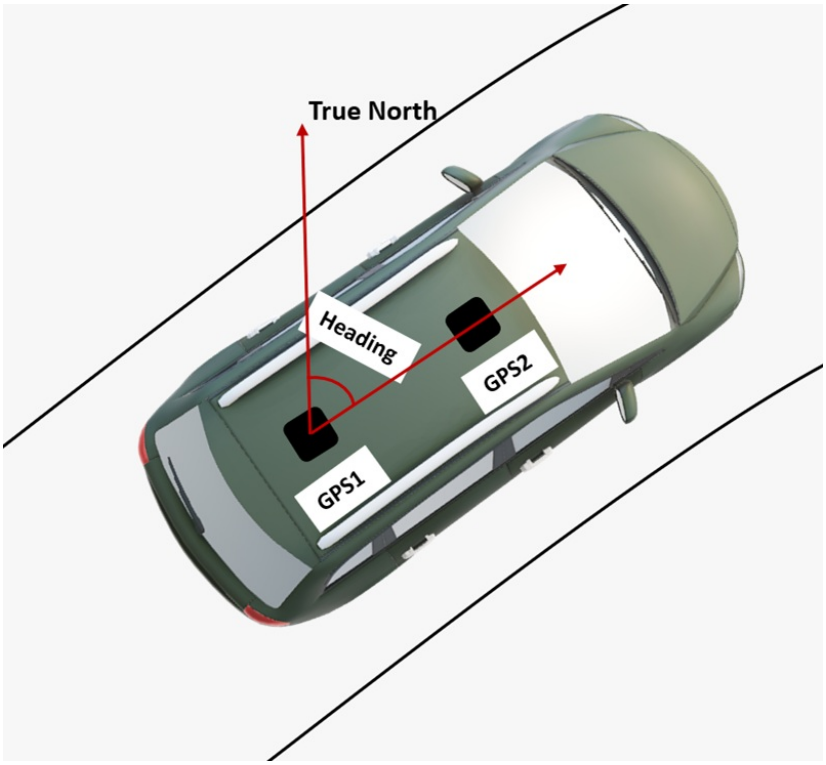
Heading Configuration

18. When connected to a single antenna, the simpleRTK3B compass functions as a typical GPS, providing location information. When connected to dual antennas, it can also provide heading and pitch information.

    Unicore 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.



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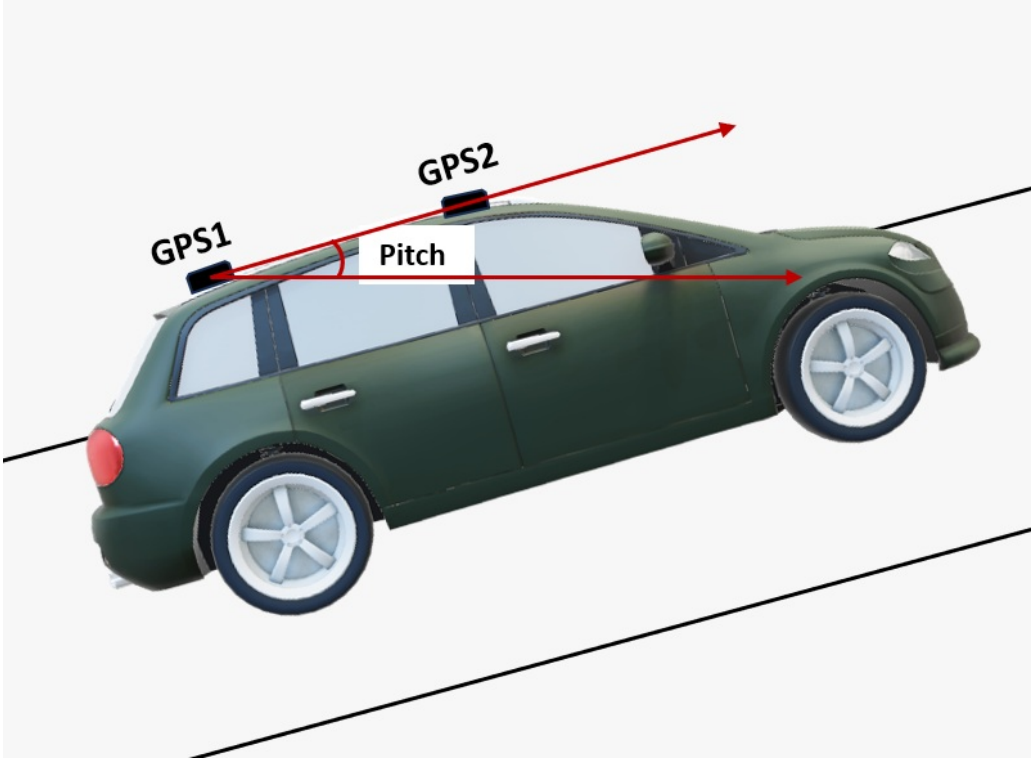
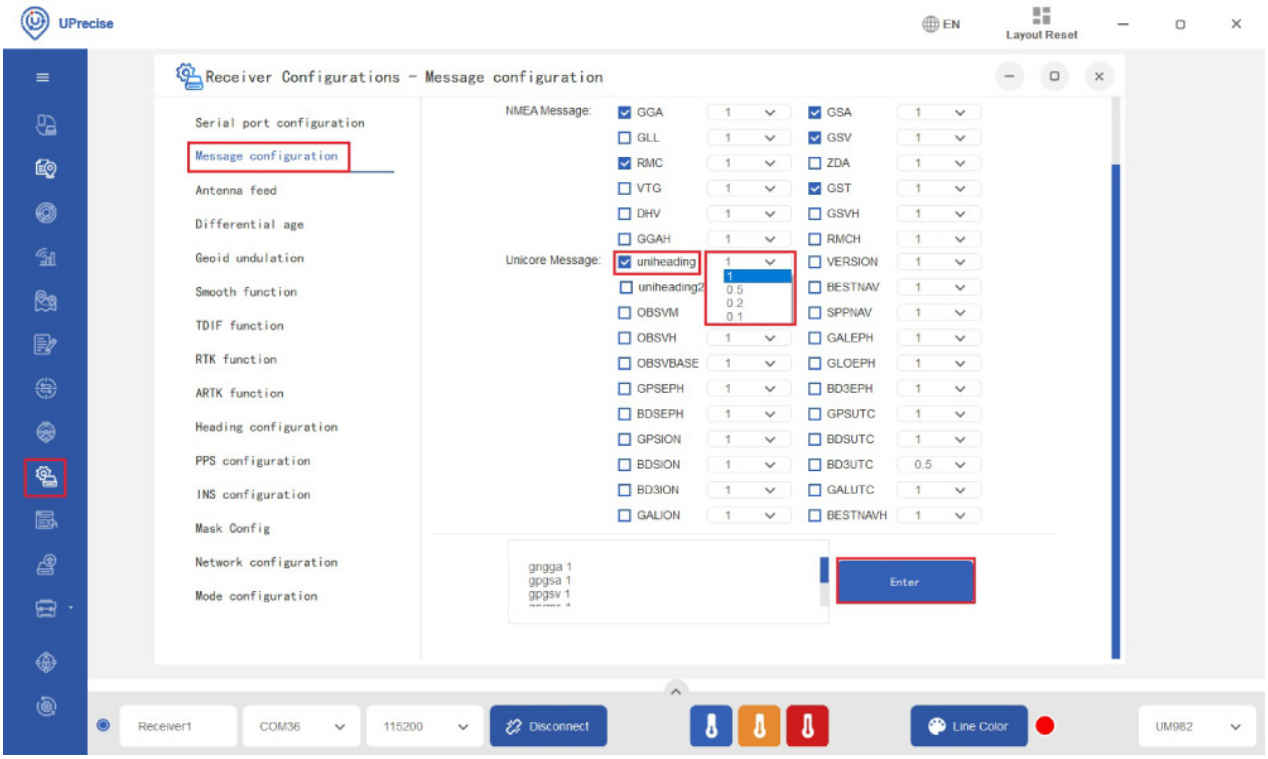


19. To enable heading message, go to **Receiver Configuration–>Message configuration–>Unicore Message**. Check **uniheading**.
    You can select the frequency in the drop-down menu. For example, 0.2 means sending message every 0.2 seconds, which is 5 Hz.
    Click **Enter**.



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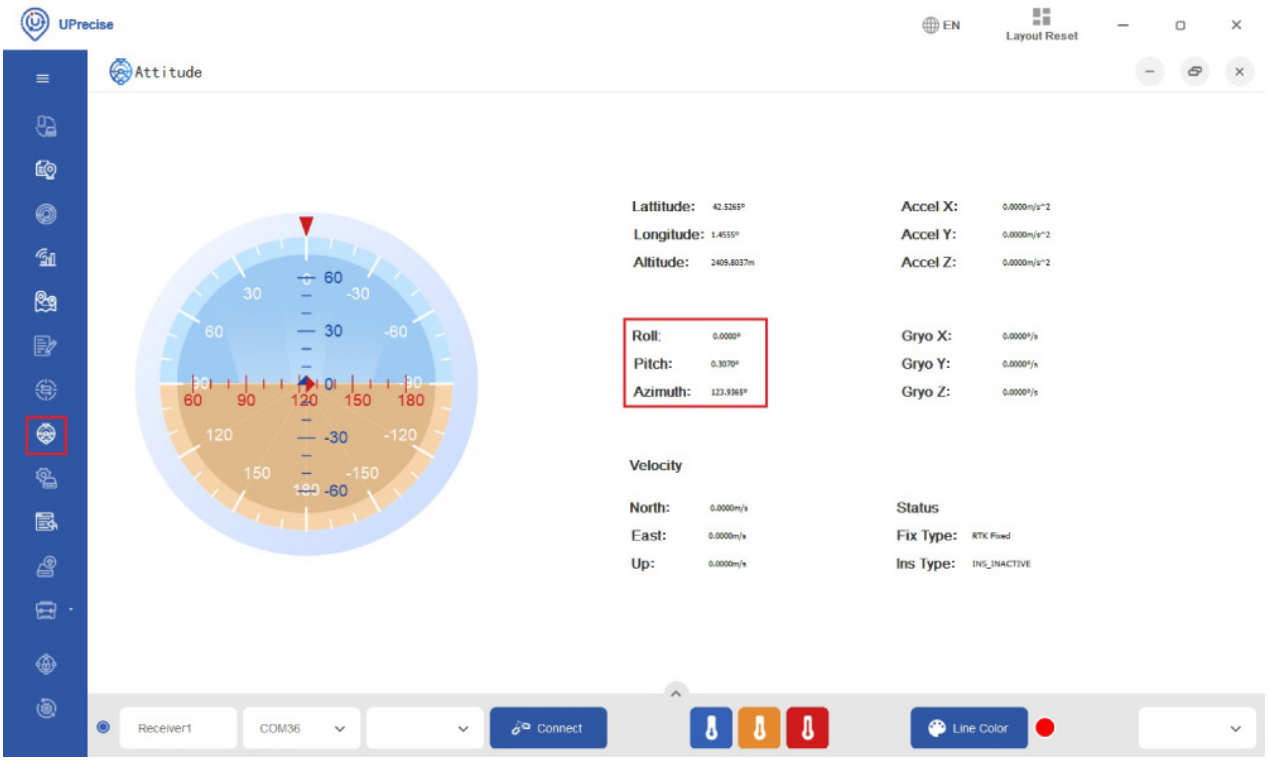
20. You can check heading information at **Attitude**.



21. At **Data Stream** you can see the UNIHEADING Message. Don't forget to type **saveconfig** and press **Enter** to save your configuration.

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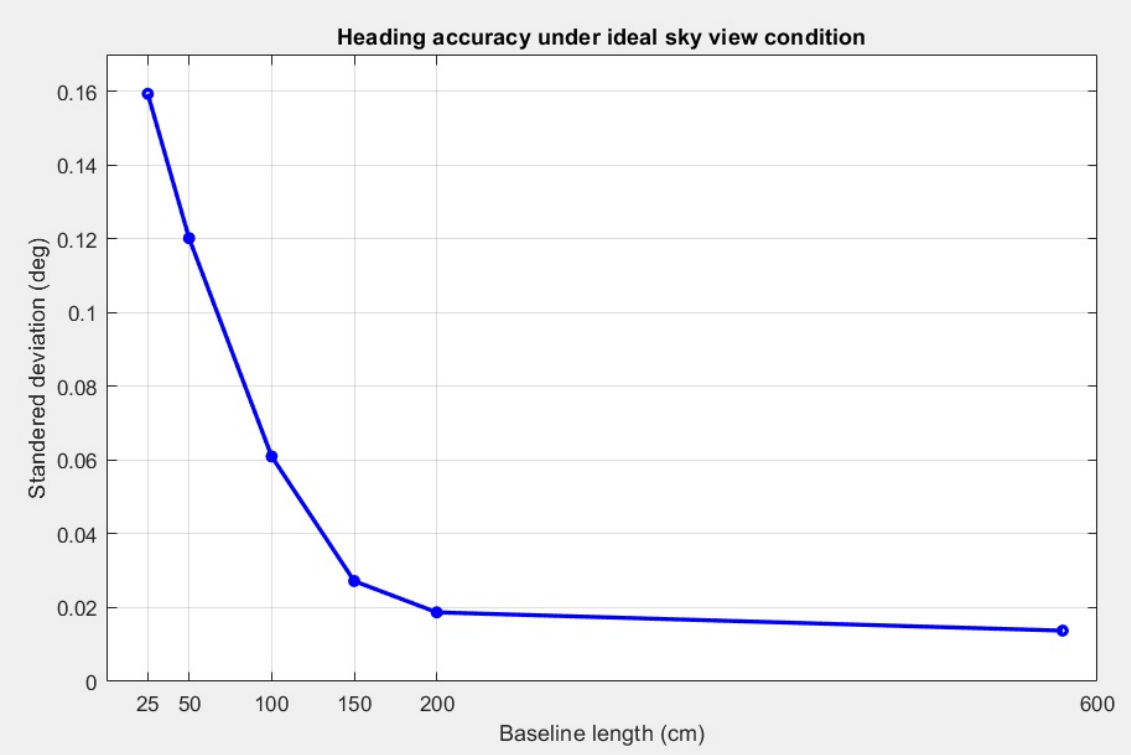
22. If you would like to learn more in-depth information, such as Message Structure, commends, and advanced configuration please refer to the Unicore Reference Commends Manual.

Antenna installation

23. 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.



24. 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.

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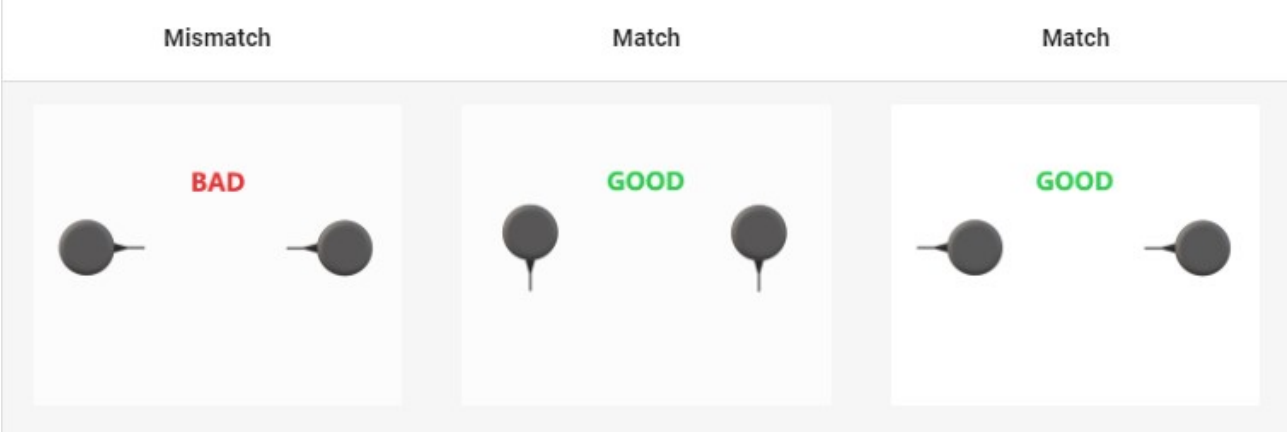
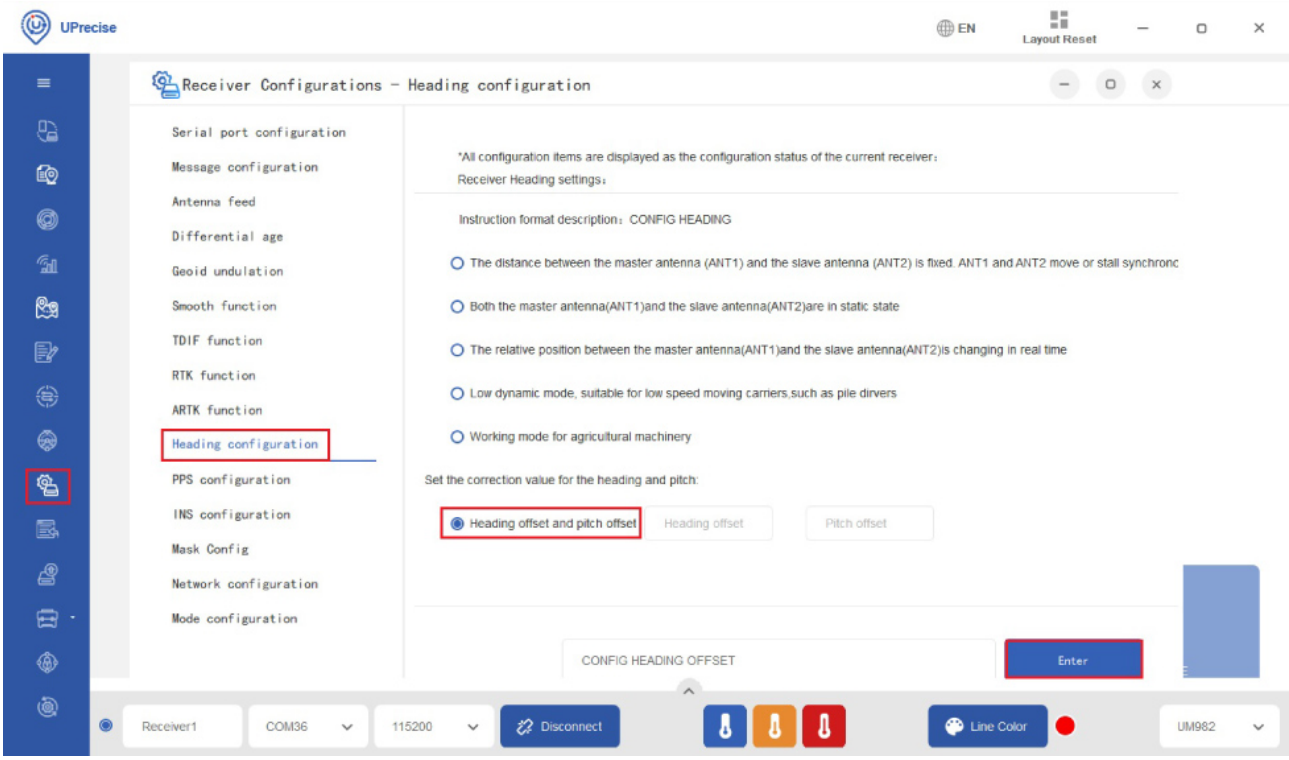


25. In the default configuration, the antennas should be placed longitudinally along the vehicle, with the master antenna (GPS1) positioned at the back.

    Or you need to set Heading offset at Receiver **Configurations–>Heading configuration**.



If you need additional information, such as upgrading firmware, configuring the receiver as a base or rover please refer to the [Unicore configuration page](#).

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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

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