Accurate
positioning
22°43'59.57617"N 114°03'03.61546"E

# P-Box-X10

## Data Sheet


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# Version Update Notes

| Revised Version | Modification Date | Content Changes and Modifications | Modifier |
|---|---|---|---|
| V1.0 | 2024-12-13 | Initial Edition | Wu Youzhen |
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# 1. Function Description

## 1.1 Overview

The P-Box-X10 is a multi-frequency, multi-constellation GNSS receiver that offers top-tier positioning performance and can flexibly serve as either a base station or rover receiver. In dual-antenna mode, it provides heading and pitch or heading and roll information based on reliable and accurate positioning. GNSS heading delivers unparalleled performance under both static and dynamic conditions, eliminating reliance on vehicle dynamics or magnetic sensors. It can be applied in various fields such as drones, fully automated robots, precision control, and autonomous driving, featuring unique A IM+ anti-jamming technology that performs exceptionally well in complex environments, and is currently widely used in the GNSS mass market.

## 1.2 Product Features

- Utilizes high-performance chips
- Features over 2 million effective correlators
- 544 hardware channels for simultaneous tracking of most visible signals
- Default navigation update rate of 1Hz, with a maximum of 100Hz
- Ultra-low latency of less than 10ms
- Smooth tracking of satellite signals during high-frequency vibrations and rapid movements
- Supports full constellation, triple-frequency satellite tracking
- Integrated with T CXO, LNA, and a TF card slot of up to 32 G
- Flexible usage and easy integration
- Best-in-class SWaP (Size, Weight, and Power)
- Compact size (74*50*12.6mm±0.3mm), lightweight (67.50g±0.02g), suitable for relatively tight spaces
- Supports standard NMEA 0183, SBF, RINEX, RTCM, CMR/CMR+
- AIM+ the most advanced airborne anti-jamming and anti-spoofing technology on the market
- Equipped with interference indicators, interference mitigation, and spectrum measurement functions
- IONO+ ionospheric scintillation suppression
- Lock+ exceptional tracking robustness
- APME+ multipath mitigation technology
- RAIM+ receiver autonomous integrity monitoring
- Supports high-precision positioning and heading output, with an error of 0.2 degrees
- Supports OSNMA anti-spoofing
- Supports network functionality

## 1.3 Performance Indicators

| Parameters | Detailed description |
|---|---|
| Receivable satellites [1] | ■GPS:L1 C/A, L1C, L2C, L2 P(Y), L5 ■BDS:B1I, B1C, B2a, B2I, B3I<br>■GLONASS:L1 C/A, L2C/A, L3, L2P ■Navic:L5<br>■Galileo:E1, E5a, E5b ■QZSS:L1 C/A, L1C, L2C, L5<br>■SBAS:EGNOS, WAAS, GAGAN, MSAS, SDCM |

| | | | |
|---|---|---|---|
| Tracking performance (C/N0 threshold) | Tracking and navigation sensitivity | 20 dB-Hz | |
| | Acquisition sensitivity | 33 dB-Hz | |
| Positioning time [2] | Cold start | < 45s | |
| | Warm start | < 20s | |
| | Reacquisition | 1s | |
| RTK status [3,4] (RMS) | Horizontal position accuracy | 0.6cm+0.5ppm | |
| | Elevation accuracy | 1cm+1ppm | |
| | Initialization time | 7s | |
| Timing accuracy | xPPS output | 5ns | |
| | Event | < 20ns | |
| Velocity accuracy | 0.03m/s | | |
| Delay (99.9%) | < 10ms | | |
| GNSS Attitude Accuracy [3] (RMS) | 1m Antenna Spacing | Orientation 0.15°, Attitude 0.25° | |
| | 5m Antenna Spacing | Orientation 0.03°, Attitude 0.05° | |
| Position Accuracy [3] (RMS) | | Horizontal | Vertical |
| | Standalone | 1.2 m | 1.9 m |
| | SBAS | 0.6 m | 0.8 m |
| | DGNSS | 0.4 m | 0.7 m |
| Constraints | Dynamics | ≤ 4 g | |
| | Altitude | 18000 m | |
| | Speed | 515 m/s | |
| Baud Rate | 115200- 4M bps ( Default 115200bps ) | | |
| Maximum Update Rate | Position | 100Hz | |
| | Observations | 100Hz | |

✌1 Under open environment without obstacles

✌2 All satellites are at -130dBm

✌3 CEP 50%, 24 hours static, -130dBm, ≥ 12 used satellites

✌4 For every ten kilometers from the base station, the accuracy error increases by 1 centimeter (baseline < 40 kilometers)

## 1.4 Protocol Description

| Protocol | Type |
|---|---|
| NMEA 0183 v3.01,v4.0 | Input/output, ASCII |
| Septentrio Binary Format (SBF) | Input/output |
| RTCM v2.x, v3.x (including MSM messages) | Input/output |
| CMR v2.0 | Input/output |
| CMR+ | Input |

### 1.5 Antenna

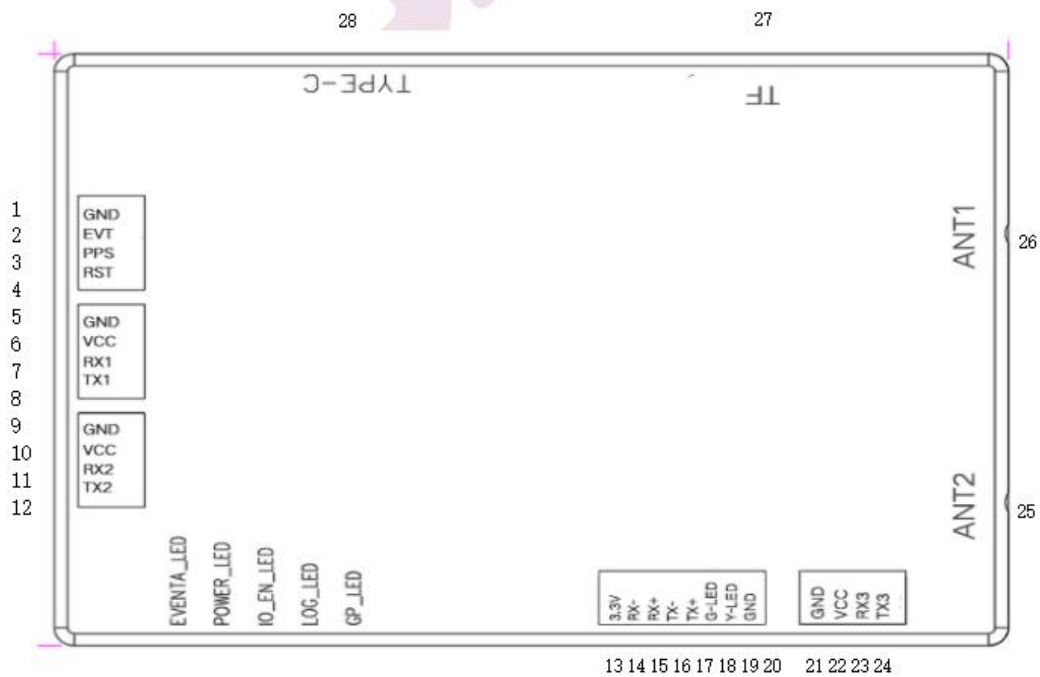
The P-Box-X10 is a dual-antenna version receiver, which requires the connection of both a main antenna and an auxiliary antenna during use. The main antenna must be connected to the connector marked 'ANT1' on the housing (positioning), and the auxiliary antenna must be connected to the 'ANT2' connector (orientation).

### 1.6 Product Applications

- Drone Applications
- Surveying and Measurement
- Intelligent Logistics Scheduling
- Intelligent Robotics
- Geographic Measurement
- Precision Agriculture and Positioning Services
- Driving Tests
- Heading Output
- Onboard Equipment Applications
- Precision Control

## 2. Pin Definition

### 2.1 Pin Assignment




| Number. | Name | Input/Output | Description |
|---|---|---|---|
| 1 | GND | - | Ground |
| 2 | EVT | Input | External event trigger, 5V fault tolerance |
| 3 | PPS | Output | Second pulse output |
| 4 | RST | Input | Reset |
| 5 | GND | - | Ground |
| 6 | VCC | - | Reserved |
| 7 | RX1 | Input | Serial Port 1 GNSS receive data |

| | | | |
|---|---|---|---|
| 8 | TX1 | Output | Serial Port 1 GNSS transmit data |
| 9 | GND | - | Ground |
| 10 | VCC | Input | GNSS power supply 4.5-12.0V |
| 11 | RX2 | Input | Serial Port 2 GNSS receive data |
| 12 | TX2 | Output | Serial Port 2 GNSS transmit data |
| 13 | 3.3V | Input | GNSS power supply 3.3V |
| 14 | RX- | Input | Ethernet receive data - input |
| 15 | RX+ | Input | Ethernet receive data + input |
| 16 | TX- | Output | Ethernet transmit data - output |
| 17 | TX+ | Output | Ethernet transmit data + output |
| 18 | G-LED | - | -- |
| 19 | Y-LED | - | -- |
| 20 | GND | - | Ground |
| 21 | RX3 | Input | Serial Port 3 GNSS receive data |
| 22 | TX3 | Output | Serial Port 3 GNSS transmit data |
| 23 | GND | - | Ground |
| 24 | VCC | Input | Power input (4.5 – 12.0V) |
| 25 | ANT1 | Input | GNSS positioning main antenna interface (3.0-5.5V DC) |
| 26 | ANT2 | Input | GNSS positioning auxiliary antenna interface (3.0-5.5V DC) |
| 27 | TF | Input/Output | The TF card slot supports a maximum of 32GB, and the TF card is used to record board data. |
| 28 | TYPE-C | Input/Output | The TYPE-C interface connects the board and supports USB 2.0 data and 5V power supply. |

## 2. 2 LED status indicators

### 2.2.1 EVENT_LED

When an event is triggered, the LED light stays on; when not triggered, the LED light is off.

### 2.2.2 POWER_LED

After power on, the LED light stays on; when power is off, the light is off.

### 2.2.3 LOG_LED

LOGLED reports the SD card mounting status and log recording status.

| LED | LED Status |
|---|---|
| LOGLED | When the SD card is not in place or not mounted, the LED light is off. When the SD card is in place and mounted, the LED light is on. A short blink indicates log recording. Maximum output current: 10mA; output impedance: 20Ω |

Note: During the startup period, specifically in the first second after the receiver is powered on, the state of the LED is not defined.

### 2.2.4 GP_LED

The General Purpose LED (GPLED) is configured using the set LED Mode command. It supports the following two modes. The default mode is 'PVTLED'.

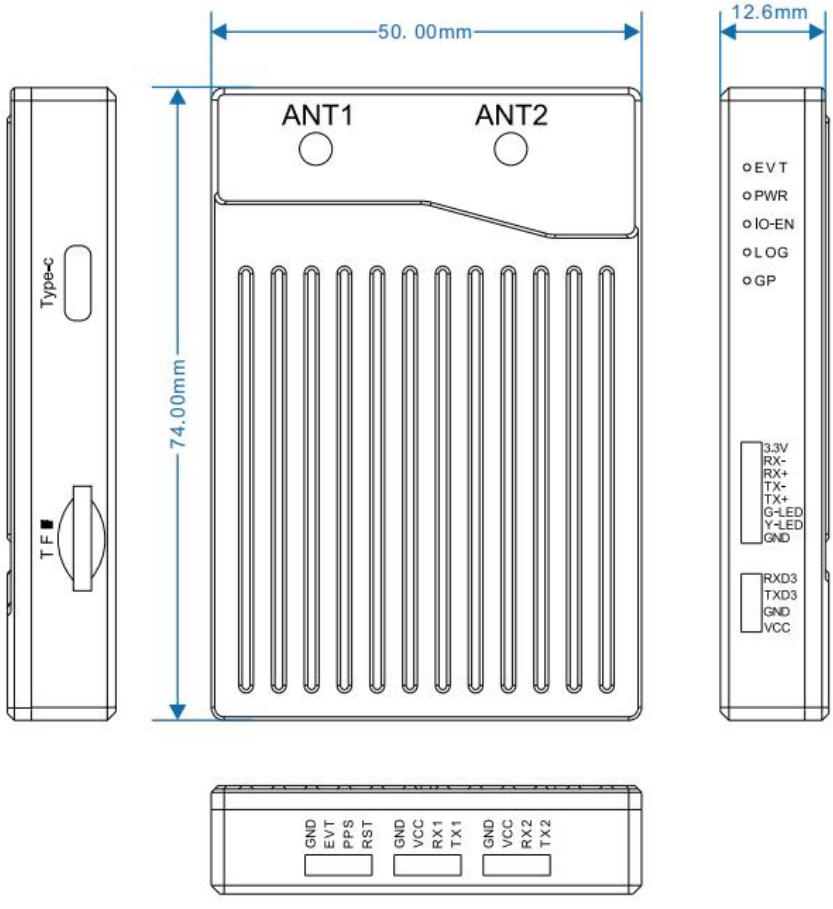
| GPLED Mode | LED Status |
|---|---|
| PVTLED | The LED remains on when the PVT solution is available. |
| DIFFCORLED | Differential Correction Indicator. In rover PVT mode, this LED reports the number of satellites providing differential corrections in the most recently received differential correction information (RTCM or CMR).<br>**LED Status Indication** — **Number of corrected satellites**<br>LED Off — No differential correction information received<br>Fast continuous flashing (10 times per second) — 0<br>Flashes once, then pauses — 1，2<br>Flashes twice, then pauses — 3，4<br>Flashes three times, then pauses — 5，6<br>Blink 4 times, then pause — 7，8<br>Blink 5 times, then pause — ≥9<br>When the receiver outputs differential corrections as a static base station, the LED is continuously on. |
| TRACKLED | **LED Status Indication** — **Number of satellites in tracking**<br>Fast continuous flashing (10 times per second) — 0<br>Flashes once, then pauses — 1，2<br>Flashes twice, then pauses — 3，4<br>Flashes three times, then pauses — 5，6<br>Blink 4 times, then pause — 7，8<br>Blink 5 times, then pause — ≥9 |

# 3. Electrical Characteristics

| Parameters | Symbol | Minimum | Normal | Maximum | Unit |
|---|---|---|---|---|---|
| Power supply voltage range | VCC | 4.5 | 5.0 | 12.0 | V |
| Average current* | Capture current | 320@5.0V | 330@5.0V | 420 @5.0V | mA |
| | Tracking current | 310 @5.0V | 320@5.0V | 360 @5.0V | mA |
| Antenna supply current | RF_VCC | - | - | 150mA @5.0V | mA |
| Maximum ripple at VCC port | Vrpp | 0 | 50 | 50 | mV |
| | Vin | -0.5 | Vcc +0.2 | - | mV |
| Electrostatic protection | VESD(HBM) | -- | 2000 | 2000 | V |
| Storage temperature | Tstg | -55 | - | 85 | °C |
| Operating temperature | Tstg | -40 | - | 85 | °C |
| Humidity | RH | 5 | Non-condensing | 95 | %rh |

* Passive antenna testing, all signals, all GNSS constellations

# 4. Mechanical Dimensions



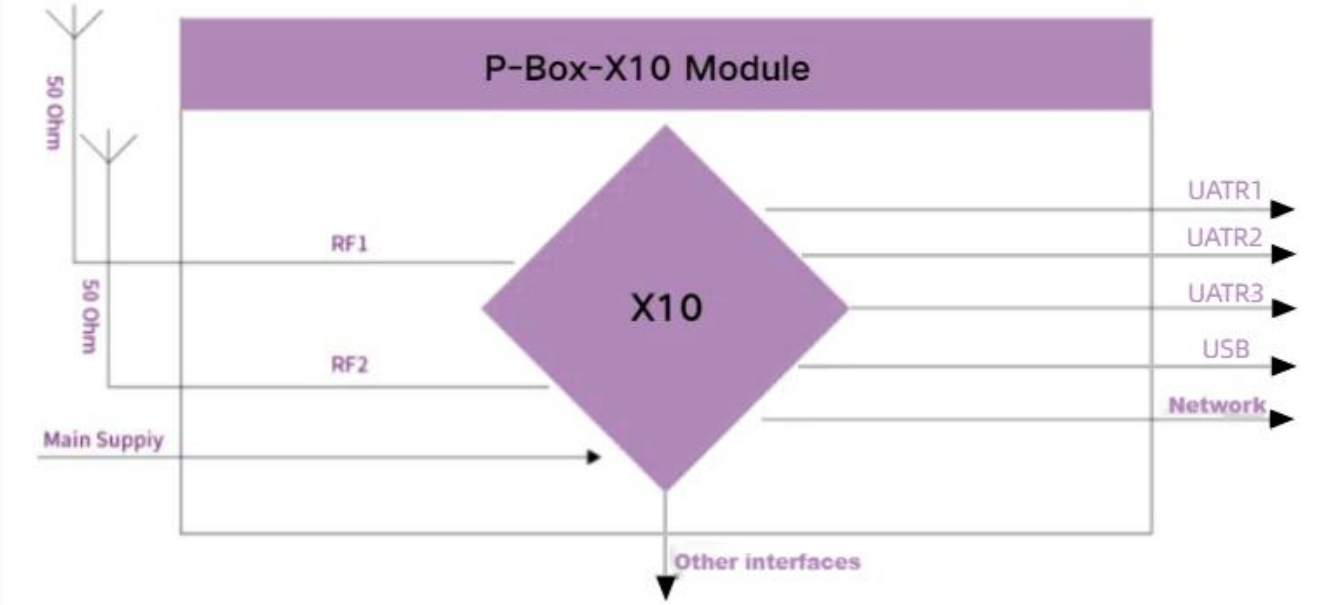

Unit: mm Dimension tolerance: ±0.3mm

# 5. Interface Configuration Selection

The P-Box-X10 module includes 3 UART ports, one USB interface, and one network port, which can be used for communication with the host. Different hardware interfaces can be selected through various connections.

1 PPS output time pulse and 1 EVENT external event trigger.

**Block Diagram**




# 6. Basic Operation Instructions

## 6.1 Download and Install RxTools Software

The current latest version is 22.0.0. The RxTools software installer and user manual can be downloaded via the following link:

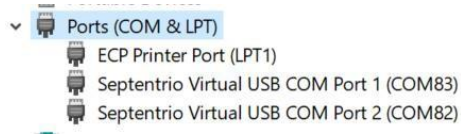
1. Septentrio official website download:
   https://www.septentrio.com/en/support/software/rxtools

After downloading, proceed with the installation directly, avoiding any Chinese characters in the installation directory. Upon successful installation, the following assemblies will be available:

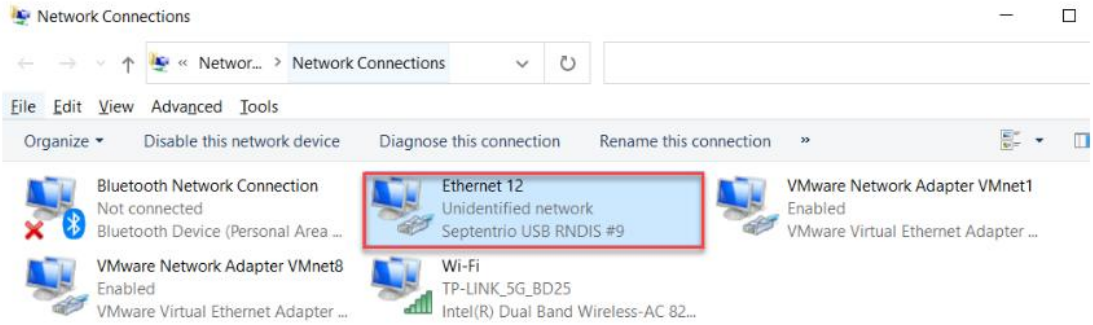

## 6.2 Hardware Connection

1. Connect the satellite antenna using an MMCX connector to TNC or SMA interface.
2. Use a serial port connection; you can directly use a standard serial-to-USB cable to connect to the computer's USB port, allowing communication with the receiver using Septentrio's upper computer software RxTools or serial assistant tools. The default baud rate for the serial port is 115200.
3. Connect the device to the computer using a USB cable.

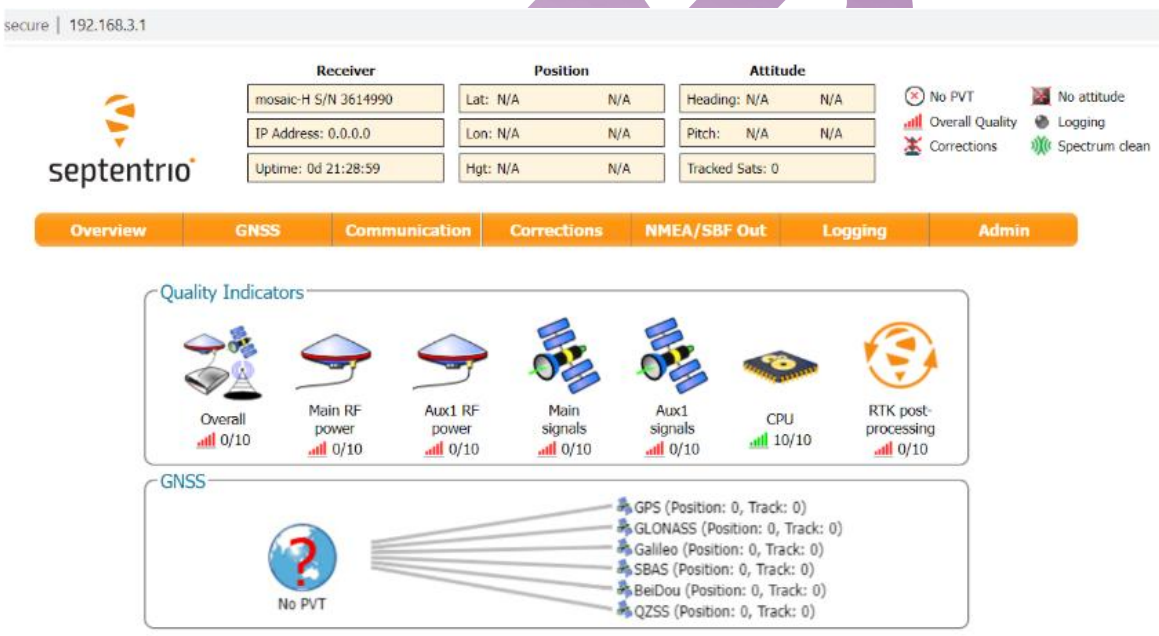
3.1 The board will virtually connect 2 serial ports on the computer side, and the serial port numbers can be viewed through the Device Manager interface:




3.2 At the same time, the USB connection will also create a virtual network interface. In the network connection interface, a virtual network card labeled 'Septentrio USB RNDIS' can be seen, with a fixed IP address of 192.168.3.1.




At this point, entering 192.168.3.1 in the browser will allow access to the receiver's web interface.




2. Connecting using RJ45 network port

4.1 First, the Ethernet network function of the receiver needs to be enabled. There are two ways to enable it:

4.1.1. By sending the command: setEthernetMode, on

4.1.2. In the RxControl program, set the Power option to on in Communication/Network Settings/General/Ethernet Interface Mode.

Directly connecting the receiver's network cable to the computer

When directly connected to the computer via the RJ45 network port, it is also necessary to set the receiver and the computer to static IP addresses in the same subnet (for example, receiver IP: 192.168.5.2, gateway: 192.168.5.1). This can be done by:

1. Send the command set IP Settings,Static,192.168.5.2,,192.168.5.1

2. In the RxControl program, set the following under Communication/Network Settings/General/TCP/IP Settings:

(1) Mode：Static

(2) IP address: 192.168.5.2

(3) Gateway：192.168.5.1

Set the local connection of the computer to a static IP: 192.168.5.3, with a gateway of 192.168.5.1.

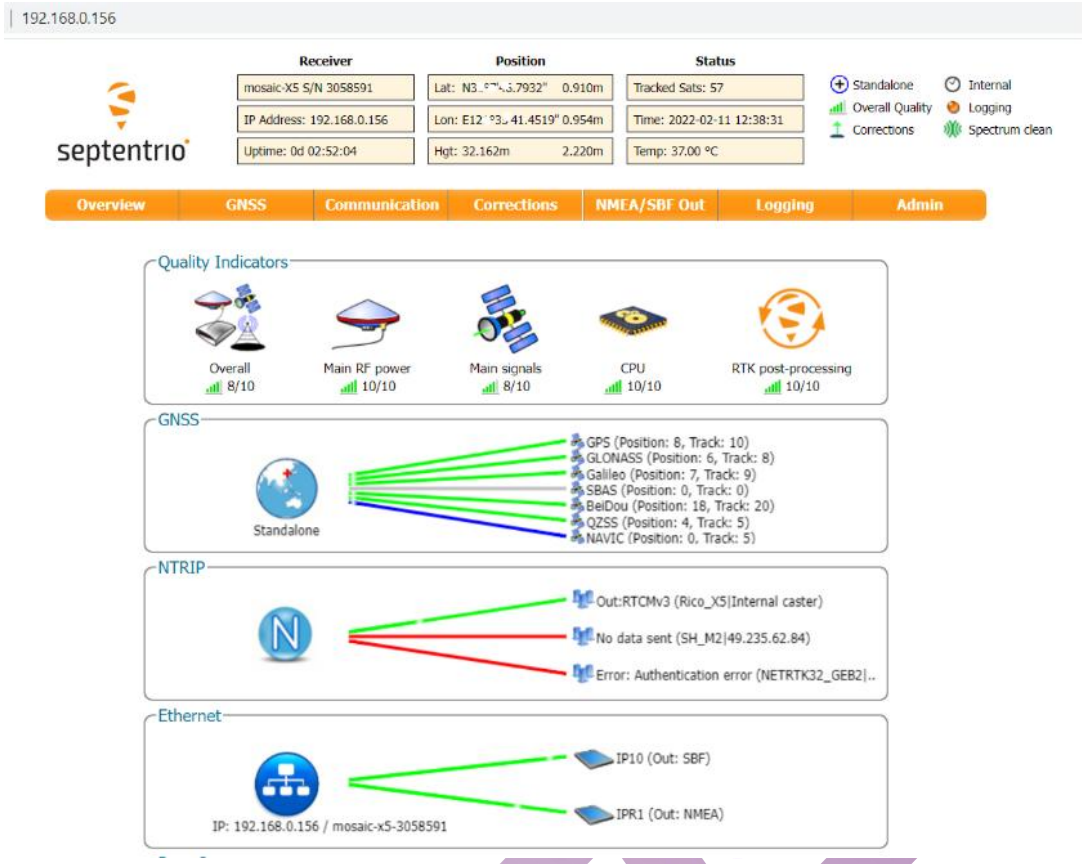
Once the above steps are completed, you can access the receiver's web interface by entering the receiver's IP: 192.168.5.2 in a browser.

## Connect the receiver's network cable to the router.

When connected to a switch or router via the RJ45 port, simply set the receiver to DHCP mode using the command set IP Settings,DHCP. The router will dynamically assign an IP address to the receiver. You can query the assigned IP address of the receiver using the command: lif,ipparameters, as shown in the figure below, where 192.168.0.156 is the current IP address of the receiver.

```
< lif,ipparameters
 > $R; lif,ipparameters
 > <?xml version="1.0" encoding="ISO-8859-1" ?>
 > <ipparameters>
 >     <interface name="eth0"  type="Ethernet" hostname="mosaic-x5-3058591">
 >         <hardware addr="8C:1C:DA:50:6C:C1"/>
 >         <inet addr="192.168.0.156" mask="255.255.255.0" gateway="192.168.0.1" mode="dhcp"/>
 >     </interface>
 >     <resolv>
 >         <nameserver addr="192.168.0.1"/>
 >     </resolv>
 > </ipparameters>
```

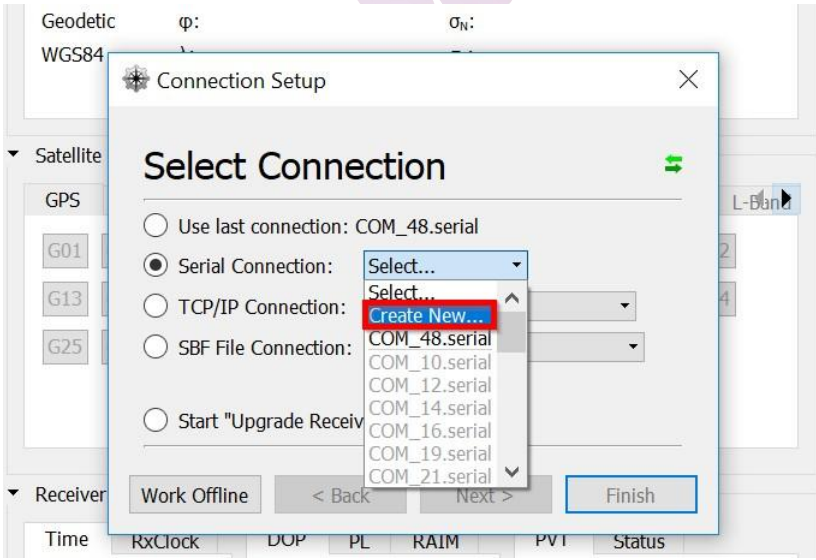
Using a computer connected to the same router or switch, you can now access the receiver's web interface at 192.168.0.156:



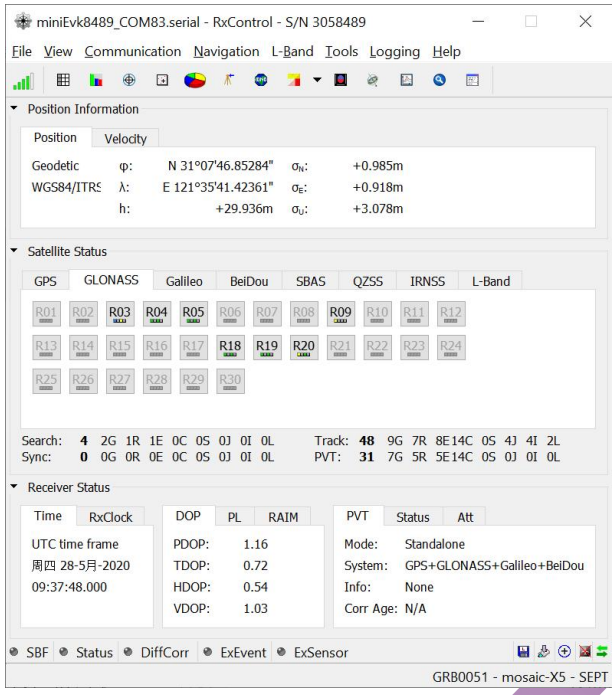

## 6.3 RxControl Software Connection Board

1. Launch the RxControl software, and the Connection Setup dialog will pop up. Select Serial Connection/Create New…

1.1 For the first connection, you need to create a new one; for subsequent connections, simply select the previously created serial connection.



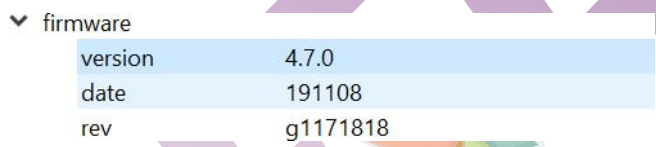

2. Once connected successfully, you will see the RxControl interface as shown below:




## 6.4 Check Firmware and Upgrade

1. Confirm the firmware version of the board.

1.1 Check the firmware version through the RxControl software Help/Receiver Identification.



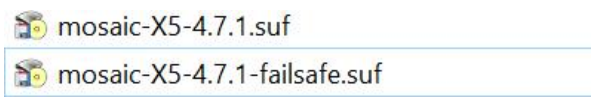

1.2 The current latest firmware version for mosaic is 4.14.4 (June 2023), and you can also check https://www.gnss-imu.com/down/html/48.html for firmware version updates and download them.

2. Firmware Upgrade

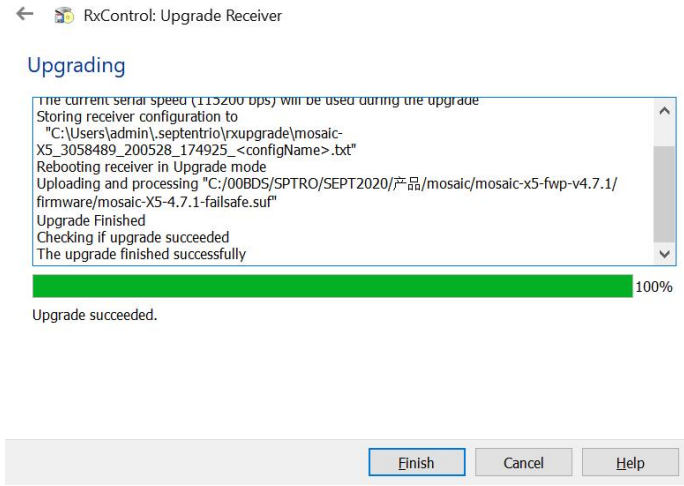
If the firmware is not the latest version as discovered in the previous step, perform a firmware upgrade refer to the following steps, taking version 4.7.1 as an example:

2.1 RxControl software File/Upgrade Receiver using Current Connection...

2.2 Select the latest firmware file; there are 2 firmware files, first upgrade the failsafe.suf firmware file, then upgrade the 4.7.1.suf firmware file.



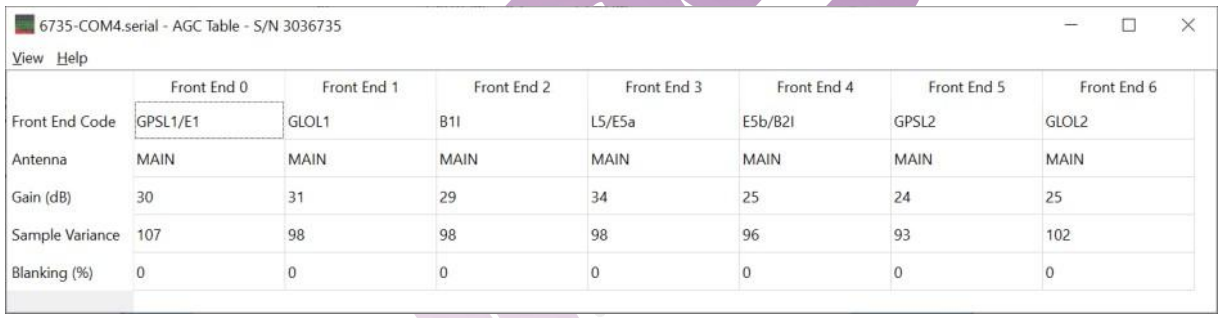

2.3 Upgrade successful.




2.4 Reconnect RxControl and confirm that the firmware version information has been updated through Help/Receiver Identification.

## 6.5 View Board Status

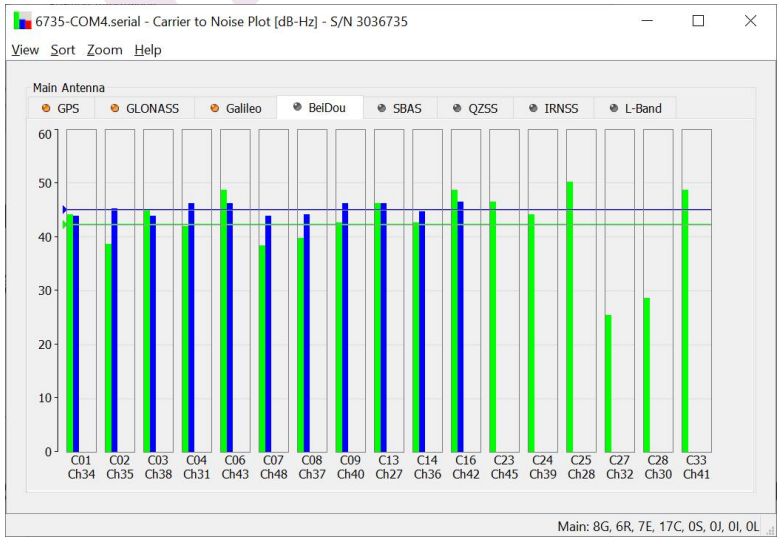
The antenna gain for the board to operate normally is between 15-50dB; excessively high gain indicates poor antenna connection or excessive cable loss. The antenna gain value can be determined through RxControl->View->AGC Table.




| | Front End 0 | Front End 1 | Front End 2 | Front End 3 | Front End 4 | Front End 5 | Front End 6 |
|---|---|---|---|---|---|---|---|
| Front End Code | GPSL1/E1 | GLOL1 | B1I | L5/E5a | E5b/B2I | GPSL2 | GLOL2 |
| Antenna | MAIN | MAIN | MAIN | MAIN | MAIN | MAIN | MAIN |
| Gain (dB) | 30 | 31 | 29 | 34 | 25 | 24 | 25 |
| Sample Variance | 107 | 98 | 98 | 98 | 96 | 93 | 102 |
| Blanking (%) | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

## 6.6 View Satellite Acquisition and Signal-to-Noise Ratio

The satellite search status can be referenced in the RxControl main interface under Satellite Status, and the

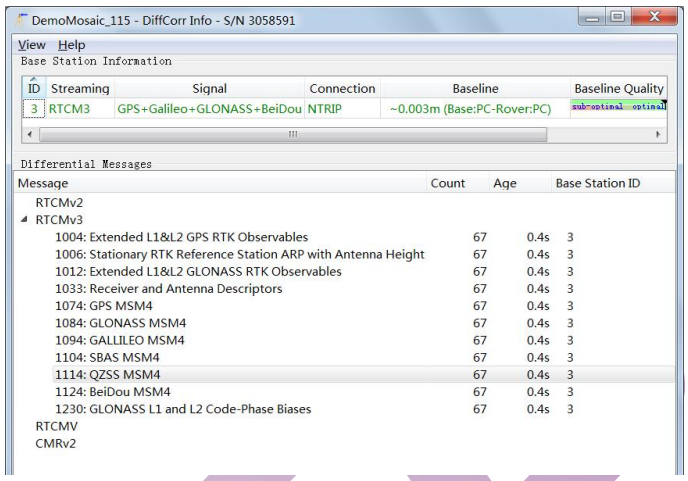



signal-to-noise ratio can be viewed through View -> Carrier to Noise Plot.

## 6.7 View Differential Data

By accessing the RxControl software and navigating to View/DiffCorr Info View, you can enter the following interface, where you can see the differential source signal system, baseline length, and data for RTCMv2 or RTCMv3.

## 6.8 View Board Positioning and Orientation Status



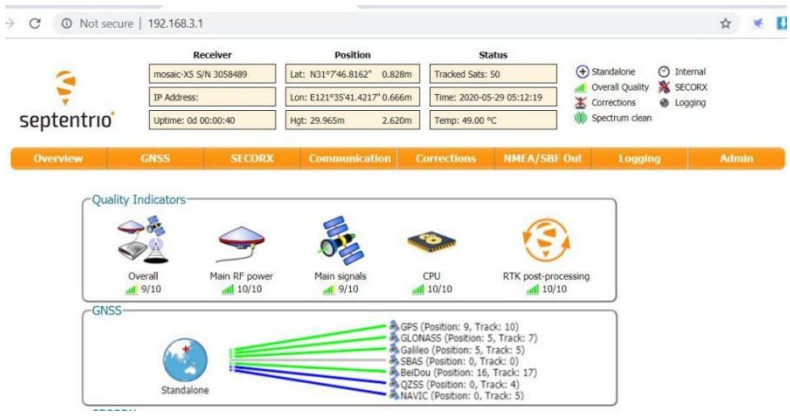

The positioning status can be viewed in the RxControl main interface; the Position Information section contains the antenna location information, and the PVT section in the lower right corner displays the positioning status of the board and the satellite systems used for positioning.

## 6.9 RxControl Command Line Window

By using the RxControl software, enter commands in the Tools/Expert Console/GRB0051 window; the window will automatically prompt command information as you type, and you can also enter 'help' to return all supported commands.

## 6.10 Web Interface

By connecting via USB, a virtual network port will appear on the computer side, with a fixed IP address of 192.168.3.1. Open it in a browser, and the interface is as follows:



Receiver settings can be configured through Admin/Expert Control/Control Panel.


# 7. Set Tracking and PVT Solution Satellites/Frequencies

## 7.1 Tracking Satellites

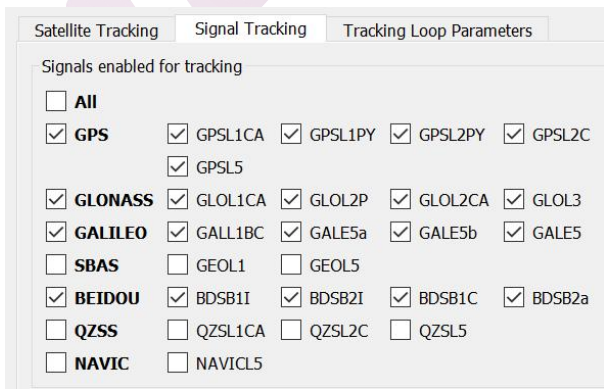
1. Set tracking satellites in the RxControl software under Navigation/Advanced User Setting/Tracking/Satellites Tracking, selecting all GPS+Glonass+Galileo+Beidou.

*Command line: sst,GPS+Glonass+Galileo+Beidou*

## 7.2 Tracking Frequencies

1. Set tracking frequency points in the RxControl software under Navigation/Advanced User Setting/Tracking/Signal.

Tracking, select all frequency points for GPS+Glonass+Galileo+Beidou.




*Command line: snt,GPS+Glonass+Galileo+Beidou*

### 7.3 PVT Solution Satellites

1. Set calculation satellites in the RxControl software under Navigation/Advanced User Setting/PVT/Satellites Usage, selecting all GPS+Glonass+Galileo+Beidou.

*Command line: ssu,GPS+Glonass+Galileo+Beidou*

### 7.4 PVT Solution Frequencies

1. Set the solution frequency points in the RxControl software under Navigation/Advanced User Setting/PVT/Signal Usage, check all GPS+Glonass+Galileo+Beidou frequency points.

*Command line: snu,all,all*

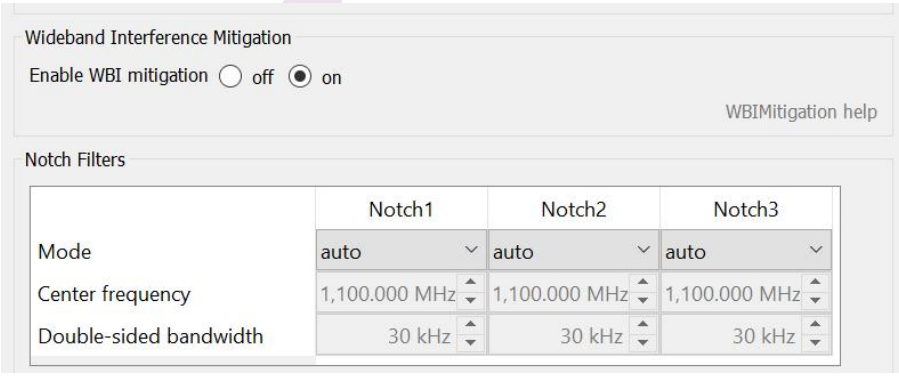
# 8 Performance Optimization Settings

### 8.1 Anti-Interference

To enable the anti-interference function, follow these steps: RxControl/Navigation/Advanced User Setting/Frontend and Interference Mitigation:

Wideband Interference Mitigation/Enable WBI mitigation: **ON**

Notch Filters: Notch 1 – **Auto**; Notch 2 – **Auto**; Notch 3 – **Auto**




*Command line: setWBIMitigation,on// Wideband interference suppression- enable*
*setNotchFiltering,all,auto,,// Narrowband interference suppression- enable*

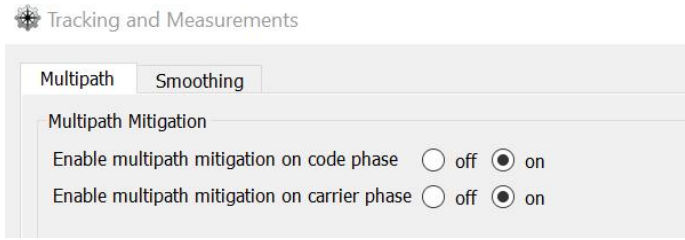
### 8.2 Multipath Suppression

To view and set multipath mitigation options, follow these steps: RxControl/Navigation/Receiver

Operation/Tracking and Measurements/Multipath:

Enable multipath mitigation on code phase: **ON**

Enable multipath mitigation on carrier phase: **ON**



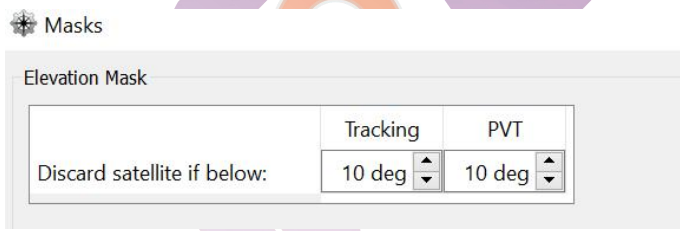

*Command line: setMultipathMitigation,on,on// Multipath mitigation- enable*

## 8.3 Elevation Mask

Recommended elevation mask setting is 10°. View and set via:

RxControl/Navigation/Mask/Elevation Mask:

Discard satellite if below: Tracking: **10** degree**;** PVT: **10** degree**;**



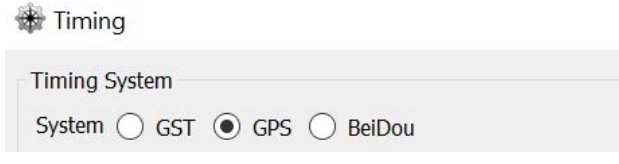

*Command line: setElevationMask,tracking,10//Set elevation mask to 10°*

*setElevationMask,pvt,10//Set PVT elevation mask to 10°*

## 8.4 Satellite Time System

The default satellite time system for the board uses GPS time. If interference with GPS signals is found in the actual application scenario, affecting positioning quality and preventing RTK Fixed status, it is recommended to change the time system to Beidou satellite system time. The method is as follows:

RxControl/Navigation/Rover Operation/Timing / Timing System: **GPS**

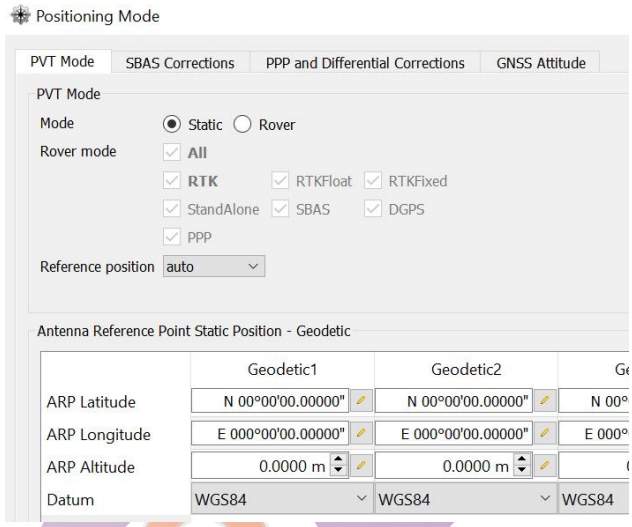


*Command line: setTimingSystem,GPS//Set the time system to GPS Timing System*

# 9 RTK mode

## 9.1 Base Station Mode

1. Configure the board to Static mode: RxControl/Navigation/Position Mode




Set the Reference position to Auto, or specify the latitude and longitude coordinates, for example, input the latitude and longitude coordinates in Geodetic1, then select Geodetic1 for the Reference position.

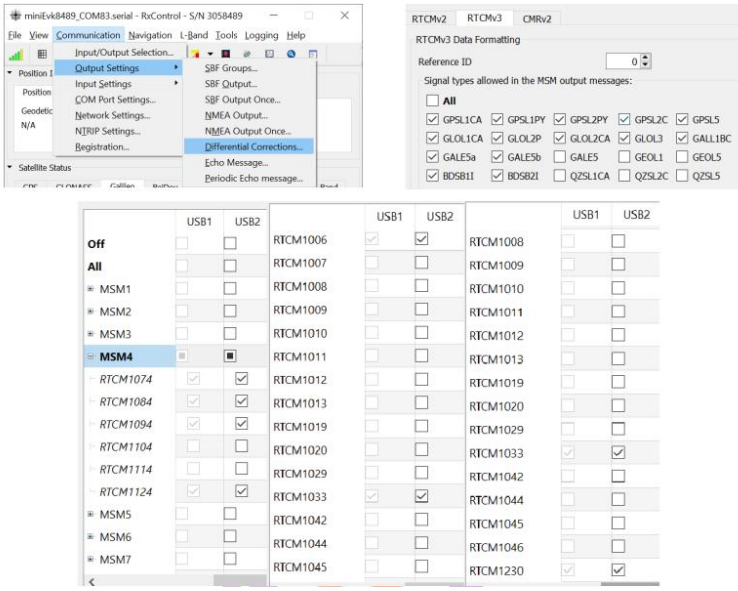
*Command line: setpvtmode,static,,auto// Set to static base station, auautomatically obtain position*

*Command line:*

*setStaticPosGeodetic,Geodetic1,11.1234,22.1234,33.123 //Set Geodetic1 latitude and longitude*

*setpvtmode,static,,geodetic1* //Set as base station and use the position of Geodetic1

2. Set RTCMv3 output




Follow the steps in the above screenshot to set up RTCMv3 data output, and configure the satellite frequency bands used by RTCMv3, as well as the output data types for RTCMv3.

*Command line:*

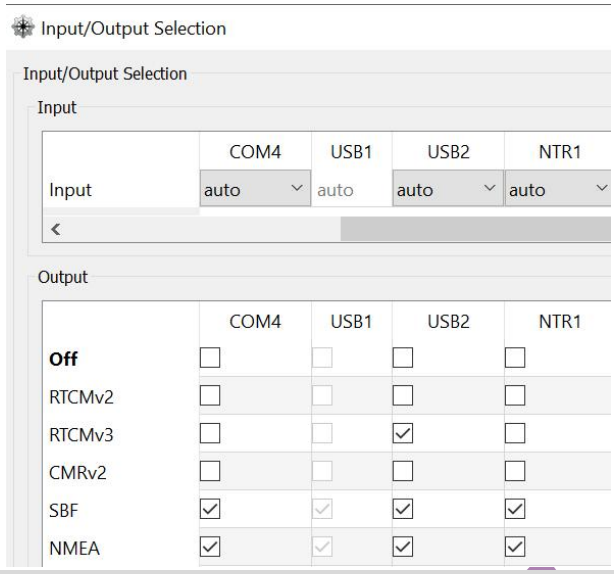
*setRTCMv3Formatting,0,GPSL1CA+GPSL1PY+GPSL2PY+GPSL2C+GPSL5+GLOL1CA+GLOL2P+GLOL2CA+GLOL3+GALL1BC+GALE5a+GALE5b+BDSB1I+BDSB2I*

*// Set the RTCMv3 output satellites frequency bands*

*setRTCMv3Output,usb2,RTCM1006+RTCM1033+RTCM1074+RTCM1084+RTCM1094+RTCM124+RTCM1230*

*// Set RTCMv3 output, output through usb2 port*

3. Port enables output of RTCMv3 data

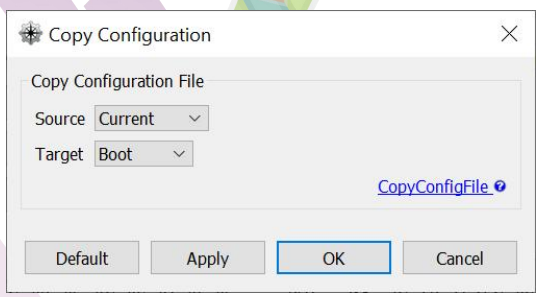



*Command line: setDataInOut,USB2,auto,RTCMv3// Open USB2 port output RTCMv3*

4. Save Settings

Regardless of whether in RxControl, the command line, or the web interface, settings must be saved after changes are made; otherwise, they will not take effect when power on again after power off

In the RxControl software, you can save the Current to Boot through the File/Copy Configuration interface to save it to the boot startup file.



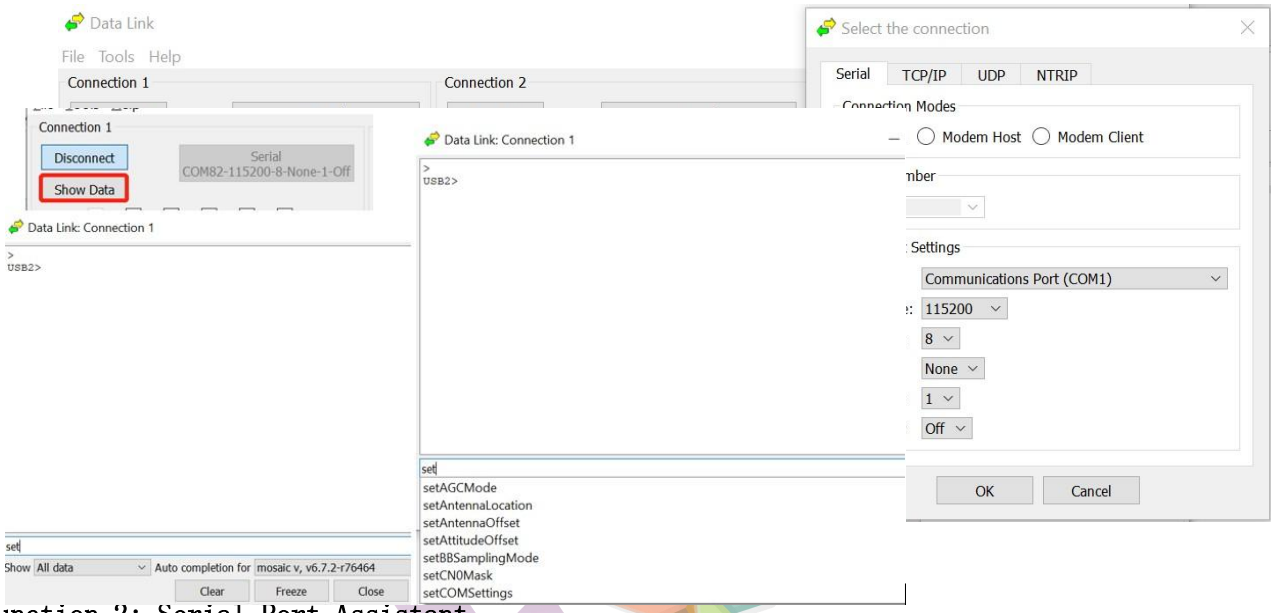

*Command line: eccf,current,boot// Save settings*

## 9.2 Datalink Program

### Function 1: Port Linkage, Data Distribution

The Datalink program can establish direct data links with different connections, allowing data from one

port to be forwarded to other connections via Datalink. For example, in the Datalink program, there are 6 connections; connection1 can receive data from a serial port or NTRIP differential and then distribute it to other different connection links.




Function 2: Serial Port Assistant

Connect the board using the Serial port method, with a default Baud Rate of 115200. Click Connect to establish the connection, then click Show. Data displays the serial port monitoring interface.

In the bottom right corner of the serial port monitoring interface, select Auto completion for **mosaic v**, so that when entering commands in the command line, the input box will automatically suggest command format prompts.

**Function Three: Output port data recorded to a file.**

After the serial port monitoring interface captures the port data, return to the Datalink main interface and click Log File to save the data to a file.


## 9.3 Rover Mode

1. First, set the board to switch to Rover mobile station mode via the RxControl software Navigation/Positioning.

```
Command line: setPVTMode,rover,RTK+Standalone//   Set PVT Rover mode.
```

Mode interface PVT mode: Rover.

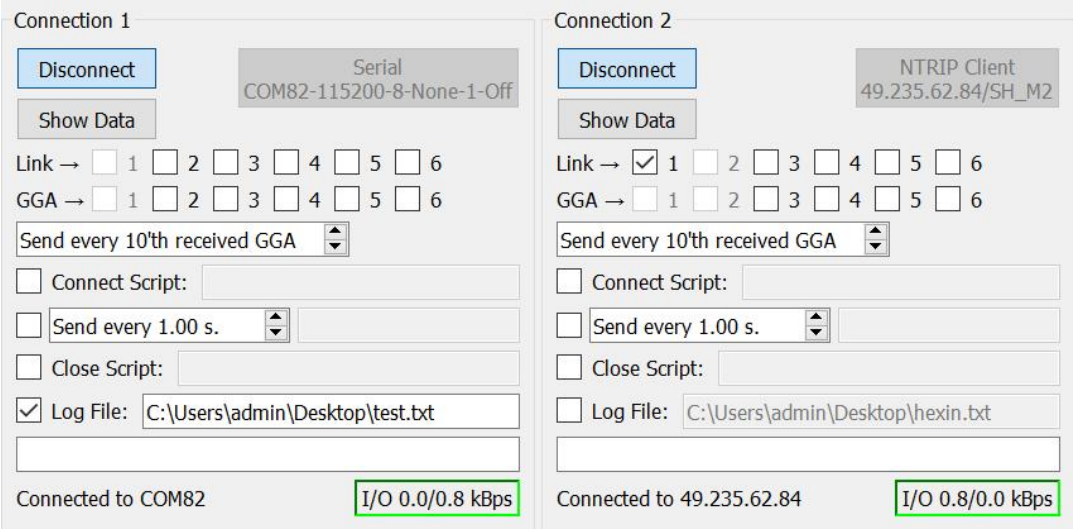
2. RxControl software File/Copy Configuration/Current->Boot.

```
Command line: eccf,current,boot//                    Save settings
```

3. Set differential input in the Datalink software
    a. Set Connection1 to connect to the USB2 port of the Mosaic MiniEVK (the corresponding virtual serial port can be viewed through the device manager on the computer)
    b. Set Connection2 to connect to the differential source via serial port or NTRIP, and confirm the valid reception of differential data through Show Data
    c. Link the differential data from Connection2 to Connection1, so that the MiniEvk board can obtain the differential data

Note: If using Qianxun NTRIP or other CORS station differential data, it is necessary to set the board to receive differential data outputting 1Hz GGA data; specific settings can be found in Real-time output of NMEA data port

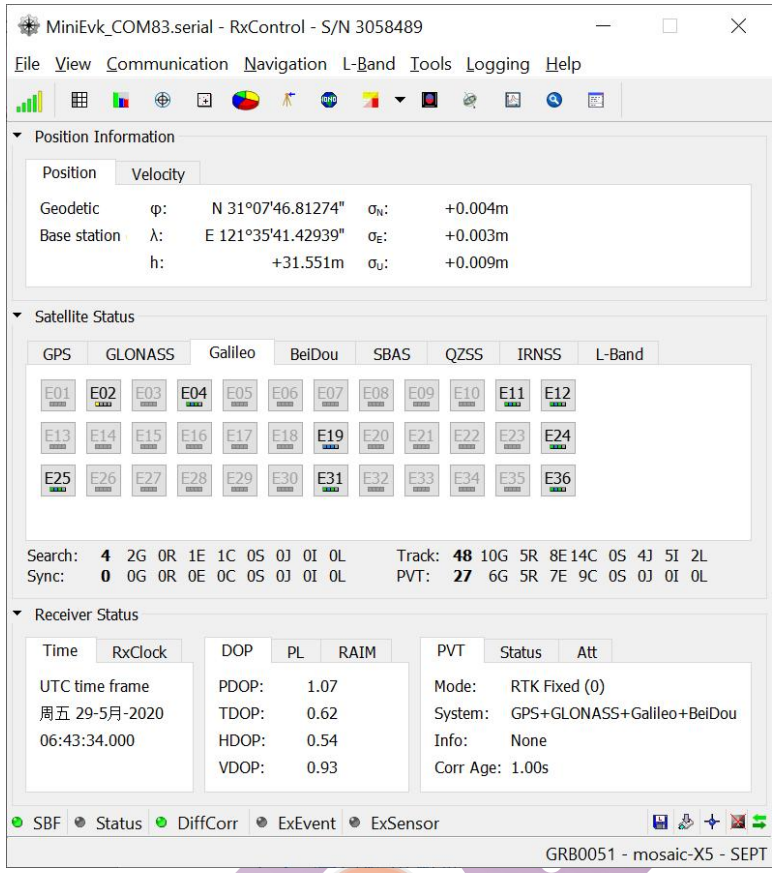
4. RTK Fixed status verification




4.1 Return to the RxControl software, and the Position Information information bar will display the positioning accuracy

4.2 In the lower right corner, the PVT information bar shows whether the current RTK status is RTK Fixed, as well as the satellite system for PVT solution.

4.3 The flashing DiffCorr light in the lower left corner indicates that differential data is being received in real-time.




# 10 NMEA Data

## 10.1 Real-time Output via Port

1. Through the RxControl software, navigate to Communication/Output Settings/NMEA Output/NMEA Output.

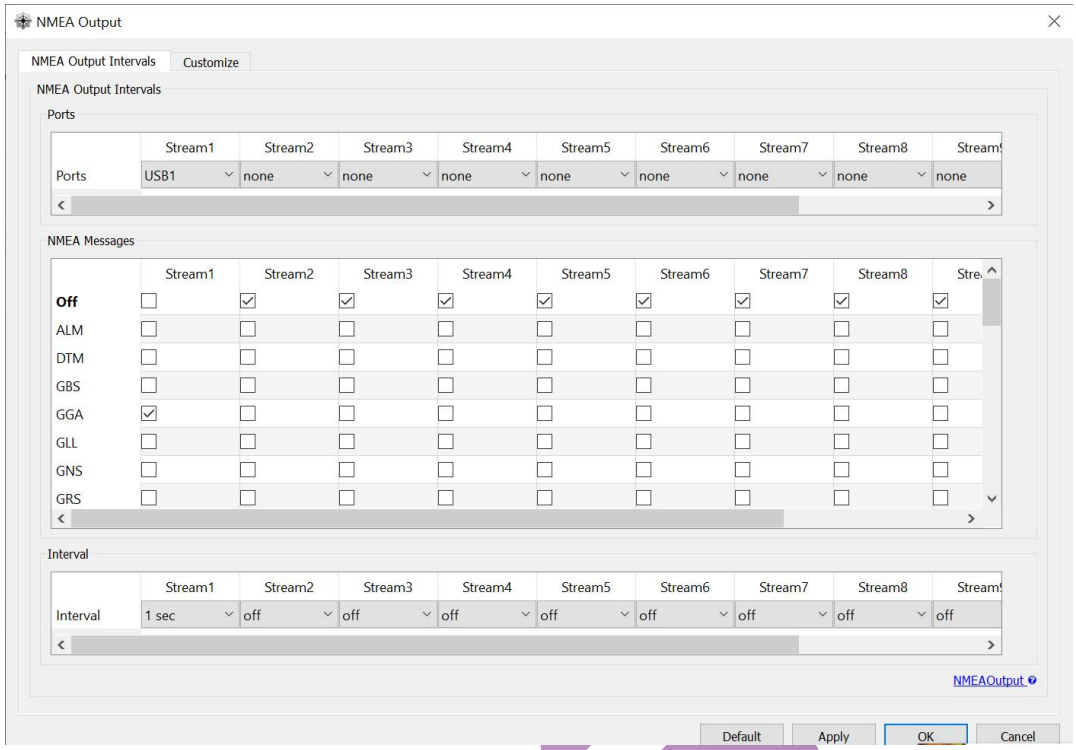
   Intervals settings.

   d. Output port.

   e. NMEA data type.

   f. Output frequency.

2. Save settings, File/Copy Configuration/Current->Boot.




*Command line: sno,stream1,ubs2,gga,sec1// Set USB2 port output 1hz GGA.*
*Command line: eccf,current,boot// Save settings*

## 10.2 Log Data to Memory Card

The Mosaic MiniEvk supports loading a TF memory card, which can record data to the memory card.

1. Through the RxControl software, navigate to Communication/Output Settings/NMEA Output/NMEA Output Intervals settings.

   1.1 The output port is DSK1

   1.2 NMEA data types

   *Command line: sno,stream1,ubs2,gga,sec1// Set USB2 port output 1hz GGA.*

   1.3 Output frequency

2. Save settings, File/Copy Configuration/Current->Boot.

   *Command line: eccf,current,boot// Save settings*

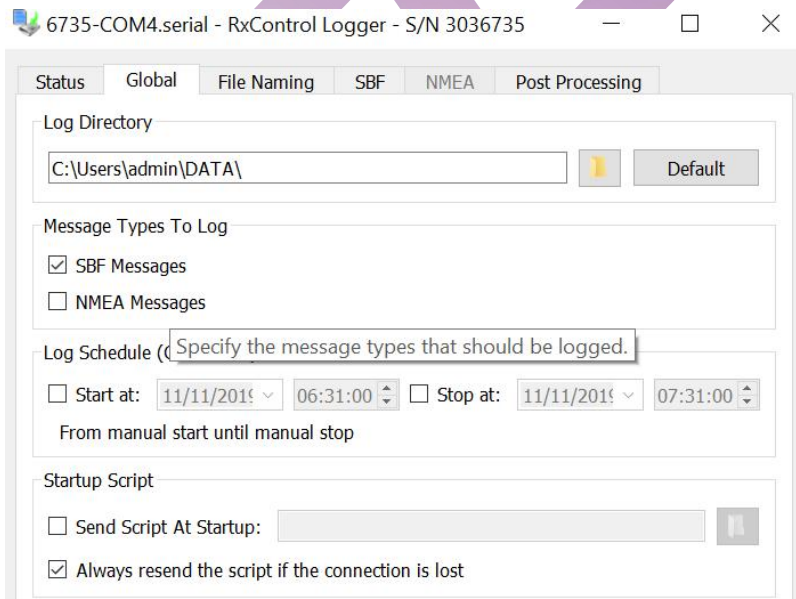
## 10.3 Log Data to Computer File

**Method 1: Through Datalink**

1. The Datalink program can connect to the USB2 port of the Mosaic MiniEVK, and set the output data by listening to the serial port interface input commands, and check Log to file (see details in Datalink the program )

**Method 2: Logging through RxLogger or RxControl software**

1. In RxControl software, use the Logging/RxControl Logging function or run the RxLogger program, connect to the USB port of the Mosaic MiniEVK, and enter the following interface




2. In the Global menu, set Message Types To Log, and check NMEA.

*Note: If checked here, it needs to be set and recorded. If SBF is not needed, it should be unchecked.*

3. In the File Naming menu, set the file path and file name, and optionally set the size and duration of a single file.

4. In the NMEA menu, set the output data type and interval

5. Click Start Logging to begin recording to a computer file

# 11 SBF raw data

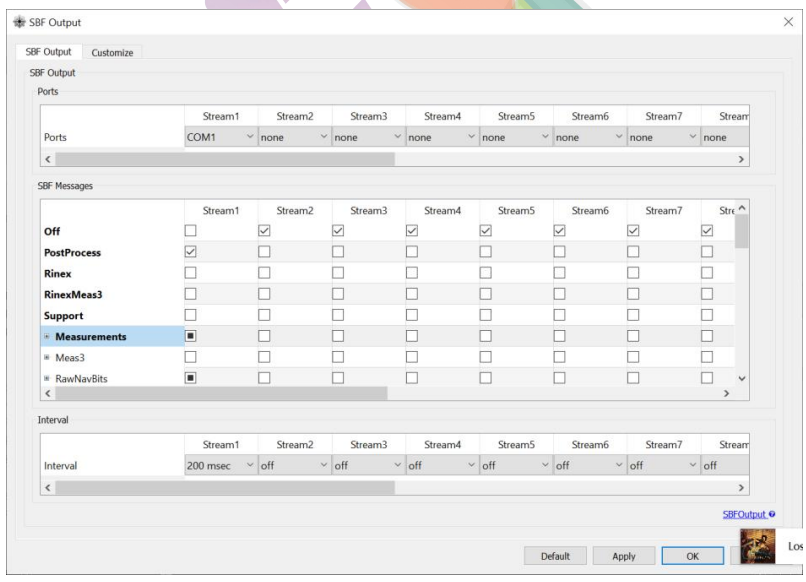
SBF - Septentrio Binary Format files are proprietary binary format files from Septentrio, which record comprehensive information.

## 11.1 Port Output of Raw Data

In the RxControl software interface, go to Communication/Output Settings/SBF Output, and set

1. Output port.
2. Data type

   For the required data types, please refer to Chapter 4 SBF Reference of the Mosaic Firmware Guide
3. Output interval
4. Save settings, File/Copy Configuration/Current->Boot.




*Command line:*

*sso,stream1,ubs2,PostProcess,msec200//* *Set USB2 port output 5hz PostProcess data*

*Command line: eccf,current,boot//* *Save settings*

### 11.2 Log Data to Memory Card

The method of recording to the memory card is basically the same as the serial port output method; just change the serial port number to DSK1.

### 11.3 Log Data to Computer File

The setup steps are the same as recording NMEA data to a computer file, just change NMEA data to SBF data and ensure the required SBF data types are checked.

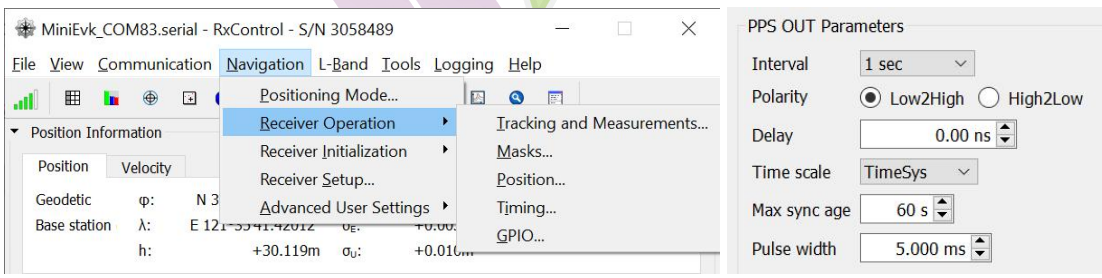
*Note: SBF data is recorded to the computer. If you need to change the recording interval, you must use the RxLogger program for recording.*

*Recording SBF under RxControl cannot be set; the default is 1Hz.*

## 12 External Events

### 12.1 PPS Output

RxControl software interface, set Navigation/Receiver Operation/Timing for PPS output, and save the settings.




*Command line: setPPSParameters,sec1,Low2high // set1 PPS output (maximum 100), pulse from low to high.*

*Command line: eccf,current,boot // save settings.*

### 12.2 Event

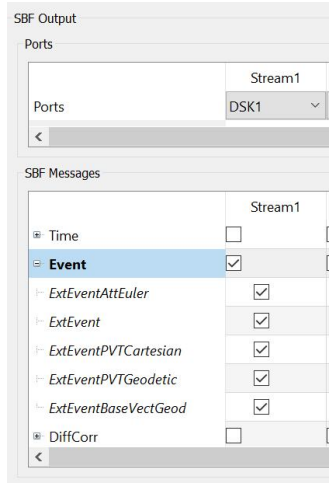
1. RxControl software interface, set Event under Navigation/Receiver Operation/Timing, and set.

To record SBF data, you need to check the Event data type; this way, the position information at the moment of external trigger will be recorded.

Command line:

*sso,stream1,ubs2,PostProcess+Event,msec100*

*// Set USB2 port output 10hz PostProcess+Event data*




2. Save Settings

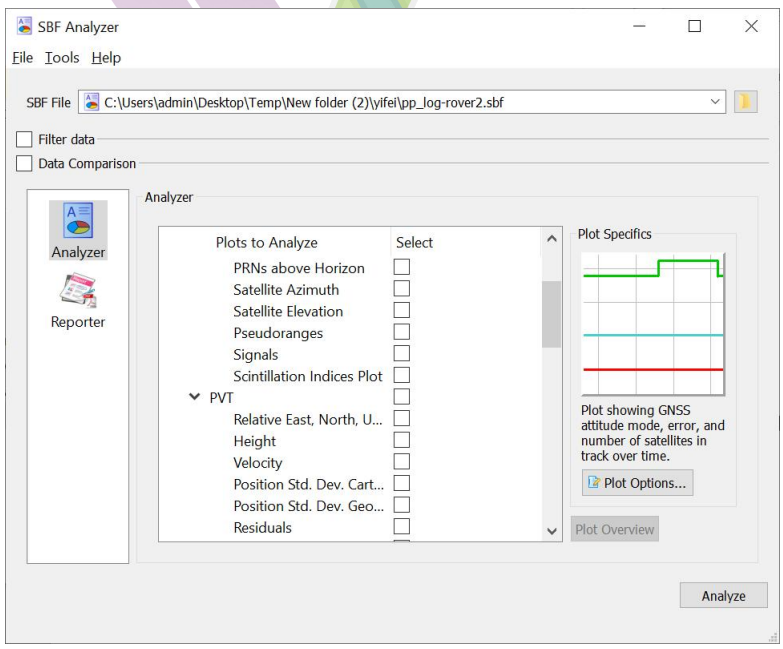
*Command line: eccf,current,boot//  Save settings*

# 13 SBF data analysis

## 13.1 SBF Analyzer

When installing the RxTools software, the SBF Analyzer will be installed automatically. Below is a brief introduction to the usage of the SBF Analyzer program:

1. Double-click to run the SBF Analyzer program, or right-click on the SBF format file and select SBF Analyzer

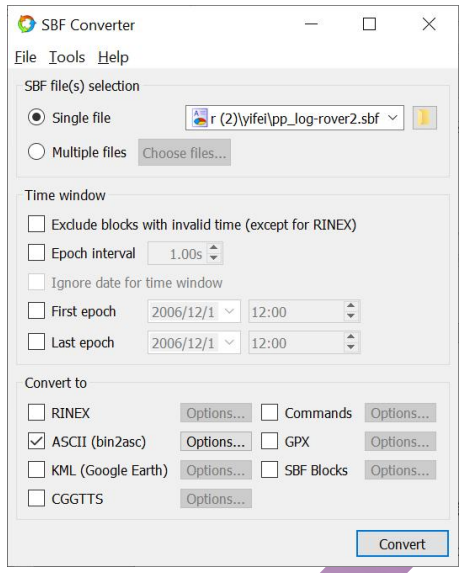



2. Check the content to be analyzed and click Analyze

## 13.2 SBF Convertor

The SBF Converter program can convert SBF to the required generic format.

1. Run the SBF Converter program or right-click on the SBF file and click Convert SBF




2. It can convert SBF to Rinex, ASCII files, etc.

3. If it is an Event application, view the external trigger moment recorded position data through

ExtEventPVTGeodetic1

# 14 Troubleshooting

## 14.1 Diagnosis Report

1. There are several ways to obtain the diagnostic report or its contents: connect to the board using the RxControl software, select File/Display Diagnostic Report, or press the shortcut key Ctrl+C, and then save the report as a PDF file.

2. Through the web interface Admin/About/Diagnostic Report, then use Save As to save it as a text file.

3. Or through a serial port assistant, input the following command, and copy the content returned by the board to a file.

g. lstInternalFile, Identification
h. lstInternalFile, Permissions
i. getReceiverCapabilities
j. getReceiverInterface
k. lstConfigFile, Boot
l. lstConfigFile, Current

m. lstInternalFile, Ipparameters
n. getSbfOutput
o. getDataInOut
p. lstInternalFile, Error
q. lstInternalFile, SetupError
r. lstInternalFile, rxMessages
s. lstDiskInfo, all

## 14.2 Support SBF Files

If technical support is needed to analyze data quality and troubleshoot board anomalies, it is necessary to record Support SBF data, documenting the steps for SBF operations such as. ***SBF Raw data.*** Introduction.

By default, the Support SBF data can be set to 10Hz, and the recording frequency of Support SBF can be adjusted based on whether the scenario is stationary or moving. It is recommended to check Support+BBSamples to record to the memory card or computer file.

```
Command line: sso,stream1,dsk1,support+BBsamples,msec100// record support+BBsamples to the
Command line: eccf,current,boot//                                    Save
```