JUMPSTAR

Accurate positioning

22°43'59.57617"N 114°03'03.61546"E

G27SH-AH

All-Constellation All-Frequency GNSS Receiver

Data Sheet

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Version Update Description

Revision	Date	Content Changes and Modifications	Modified by
V1.0	2025-09-28	First Version	WW

1 Product Introduction

1.1 Overview

G27SH-AH is a multi-band, multi-constellation positioning and heading receiver equipped with rich data interfaces. This module boasts excellent characteristics of low latency and predictable delay, meeting the needs of stable and precise control systems; G27S-AH can not only track all signals of the Global Navigation Satellite System (GNSS), but is also compatible with all current signals and supports future signals, while being compatible with mainstream open-source autopilots. It can be widely used in applications with high-precision requirements such as drones, fully autonomous robots, precision control, and autonomous driving.

1.2 Product Features

- Uses high-performance chips
- All-in-view satellites tracking, multi-constellation, multi-frequency
- 789 hardware channels, enabling simultaneous operation
- Navigation update rate up to 20Hz
- Ultra-low latency less than 10 milliseconds
- Supports GPS, GLONASS, BDS, Galileo, QZSS, NavIC, SBAS satellites
- Integrated TF card slot up to 32GB
- Supports standard NMEA 0183, SBF, RINEX, RTCM, CMR/CMR+
- AIM+ advanced interference and spoofing detection and automatic mitigation features
- LOCK+ robust tracking capability with excellent resistance to mechanical shock and vibration
- IONO+ advanced protection against ionospheric interference
- APME+ multipath mitigation to separate direct signals from those reflected by nearby buildings
- Complete raw measurement data available
- Includes interference indicator, interference mitigation, and spectrum measurement functions
- Supports ultra-short baseline heading output
- Standard IP67 waterproof and dustproof design

1.3 Performance Specifications

Parameters	Description
Receivable Satellites	■GPS:L1C/A, L1C, L2C, L2PY, L5 ■BDS:B1I, B1C, B2a, B2I, B2b,B3I ■GLONASS:L1CA, L2CA, L2P, L3 CDMA ■Galileo:E1, E5a, E5b,E6 ■QZSS:L1C/A, L1C/B, L2C, L5, L6[1]
Tracking Performance (C/N0 threshold)	Tracking and Navigation Sensitvity 20 dB-Hz Acquisition Sensitivity 30 dB-Hz
Time To First Fix[2]	Cold Start < 35s Warm Start < 10s Reacquisition 1s
RTK Status[3]	Horizontal Accuracy 0.6cm+0.5ppm[4] Vertical Accuracy 1cm+1ppm[4] Initialization Time 7s
Other Positioning Status[3]	Horizontal / Vertical Standalone 1.2m / 1.9m DGNSS 0.4m / 0.7m
Heading Accuracy	Heading / Pitch/Roll 1m antenna spacing 0.15° / 0.25° 5m antenna spacing 0.03° / 0.05°
Timing Accuracy	xPPS 1.4ns Event accuracy < 3ns
Latency	99.9% < 10ms
Velocity	0.03m/s
Baud Rate	4800- 4M bps (default 115200bps)
Maximum Data Update Rate	20 Hz
Radio Parameters (Optional)	
Operating Frequency	410MHz ~470MHz
Operating Mode	Half Duplex
Channel Spacing	125KHz/250KHz/500KHz
Modulation Method	CSS
Receiver Sensitivity	-129dBm, Transmission Distance 5km (Clear and open area, no obstacles; Max power, height 2m, air rate 2.4kbps)
Power Consumption	Receive Power: 0.17W~0.18W Transmit Power: 0.18W~0.5W

✌1 Special firmware support required

✌2 All satellites at -130dBm

✌3 RMS levels, 24 hours static, -130dBm, ≥ 12 satellites used

✌4 Accuracy error increases by 1cm per ten kilometers distance from base station (Baseline range <40km)

1.4 Protocol Description

Protocol	Type
NMEA 0183 v2.3,v3.03,v4.0	Input/output, ASCII
Septentrio Binary Format(SBF)	Input/output
RTCM v3.x(includes MSM)	Input

1.5 Antenna

The X27H-AH can be set to single-antenna mode or dual-antenna mode. When using single-antenna mode, the built-in antenna can be used for successful positioning. When using dual-antenna mode, an auxiliary antenna needs to be connected externally at the TNC port to achieve dual-antenna heading functionality.

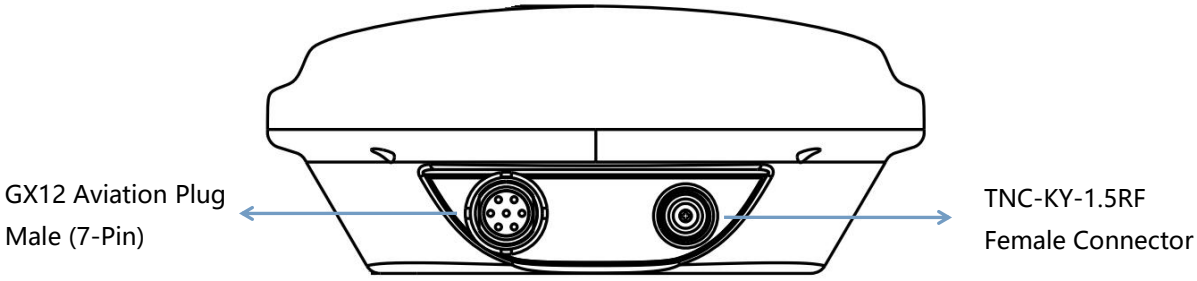
Item	Parameters
Aux Antenna Preamp Range	15-35dB
Antenna Bias Voltage	3.0-5.5V（Built-in current limit:150mA）

1.6 Product Applications

- UAVs/Drones
- Smart Logistics Dispatch
- Smart Robotics
- Geomatics / Surveying
- Precision Agriculture
- Geological Disaster Monitoring
- Heading Output
- Vehicle-Mounted Apllications
- Vehicle Navigation
- Precision Control

2 Pin Definitions

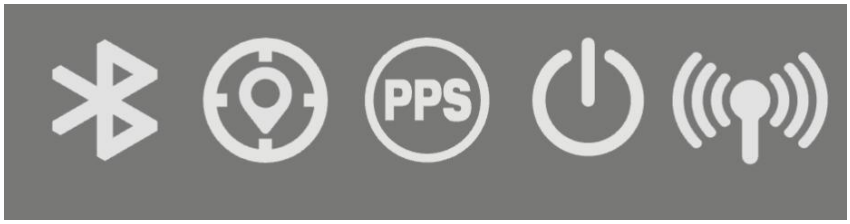
2.1 Pin Assignment



1. Red: VCC
2. Black: GND
3. Yellow: TX2
4. White: RX2
5. Green: TX1 (232-TX, CANH)
6. Blue: RX1 (232-RX, CANL)
7. Orange: PPS

No.	Color	Name	Input/Output	Description
GX12Aviation Plug Male (7-Pin)				
1	Red	VCC	Input	GNSS Power Supply 3.5-12.0V Typical 5V
2	Black	GND	-	Ground
3	Yellow	TX2	Output	Serial Port 2 GNSS Transmit Data
4	White	RX2	Input	Serial Port 2 GNSS Receive Data
5	Green	TX1	Output	Serial Port 1 GNSS Transmit Data
6	Blue	RX1	Input	Serial Port 1 GNSS Receive Data
7	Orange	PPS	Input	Pulses Per Second
TNC-KY-1.5 RF Female Connector: External antenna for positioning/heading				

2.2 Indicator LED



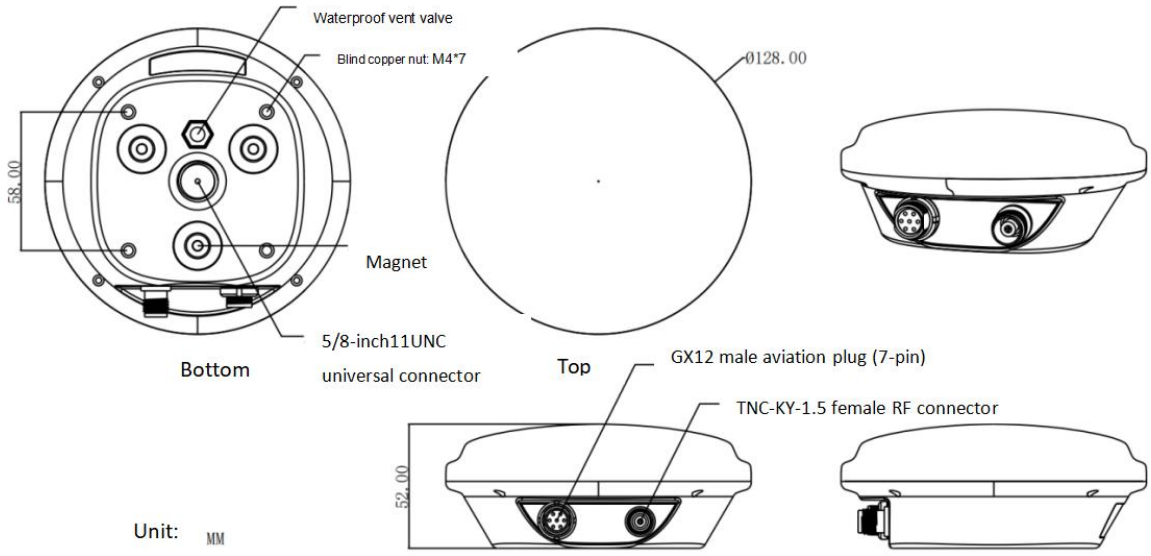
Icon	Name	Description
	BT	Flashes at power-on, steady on when connected successfully
	RTK	Off: 3D, 1 flash/sec: FLOAT, Steady On: RTK Fixed
	PPS	Off: Not positioned, Flashes once per second when positioned
	POWER	Steady on when powered
	DTU	Steady on when working

3 Electrical Characteristics

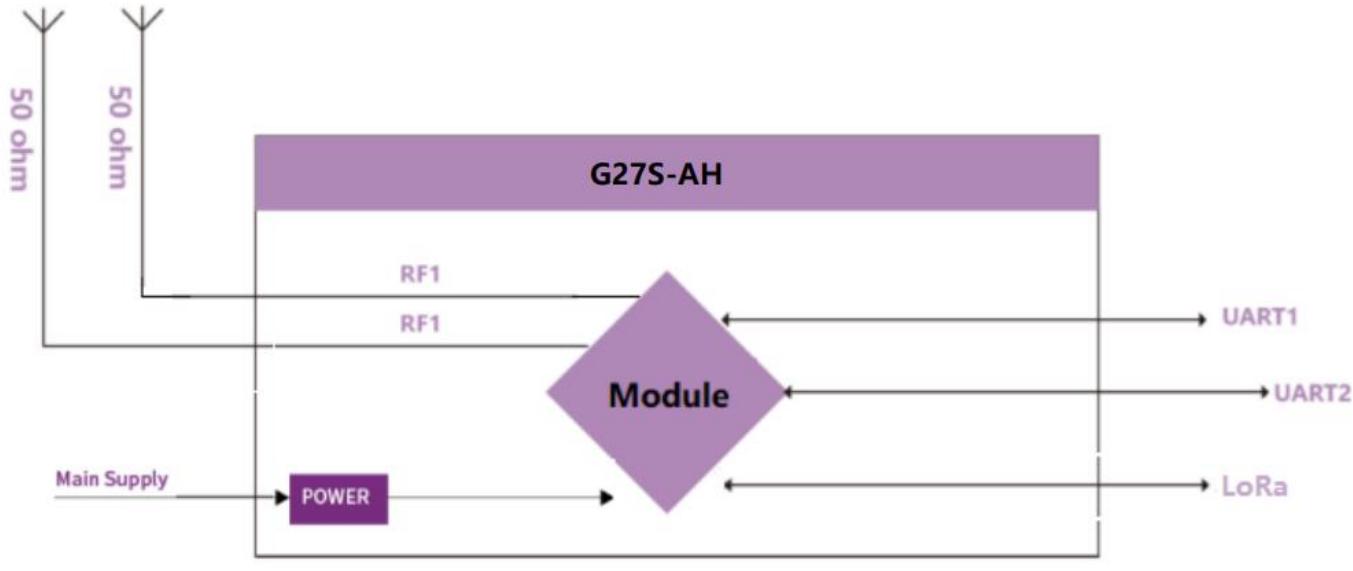
Parameter	Symbol	Min	Typ	Max	Unit
Supply Voltage Range	VCC	3.5	5.0	12.0	V
Operating Current*	Lopr	172@5.0V	186@5.0V	193@5.0V	mA
VCC Port Max Ripple	Vrpp	0	50	50	mV
	Vin	-0.5	Vcc +0.2	-	mV
ESD Protection	VESD(HBM)	--	2000	2000	V
Storage Temperature	Tstg	-45	-	85	°C
Operating Temperature	Tstg	-40	-	85	°C
Humidity	RH	-	Non-condensing	95	%rh

*Excluding radio power consumption

4 Mechanical Dimensions



5 Block Diagram



6 Basic Operation Instructions

6.1 Download and Install RxTools Software

The RxTools software installer and user manual can be downloaded from the following link:

1. Septentrio Website:

https://www.septentrio.com/en/support/software/rxtools

After downloading, install it directly, avoiding Chinese characters in the installation directory. After successful software installation, the following program suite will be available:

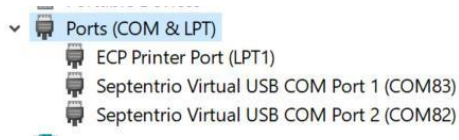
6.2 Hardware Connection

1. Connect the positioning antenna using an MMCX to TNC or SMA adapter (Note: Do not hot-plug).

2. For serial port connection, use a standard serial-to-USB cable connected to the computer's USB port. You can then use the Septentrio host computer software RxTools or serial port assistant tools to communicate with the receiver. The default serial baud rate is 115200.

3. Connect the device to the computer using a USB cable.

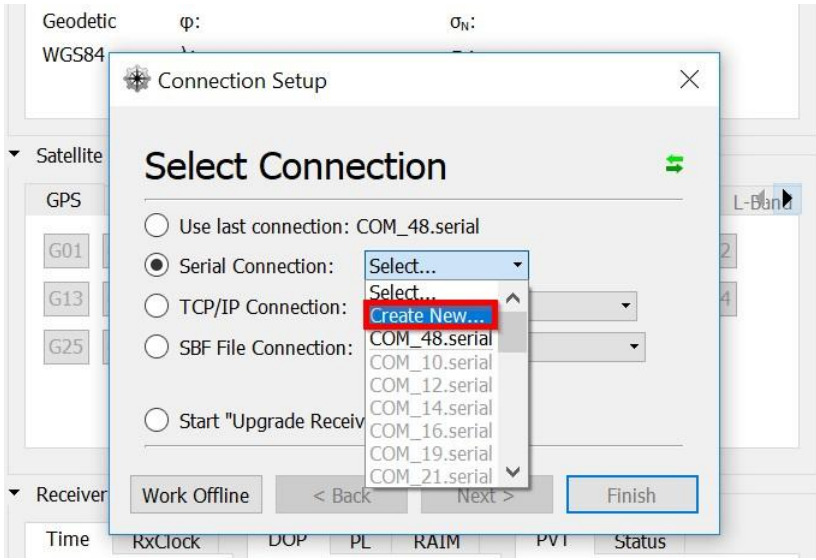
3.1 The board will virtually connect 2 serial ports on the computer end. Check the serial port numbers via the Device Manager interface



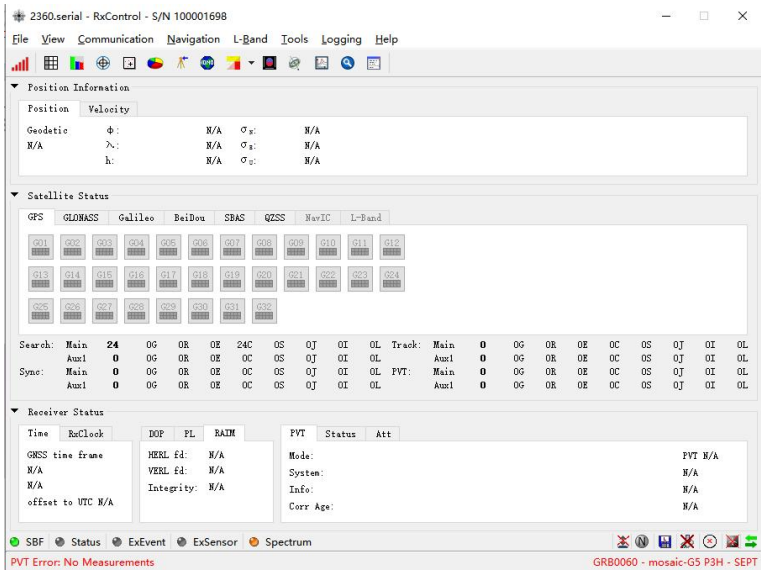
6.3 RxControl Software Connect to Board

1. Start the RxControl software. The Connection Setup dialog box will pop up. Select Serial Connection / Create New...

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



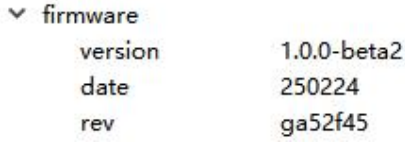
2. After successful connection, the RxControl interface will look like the following:



6.4 Check Firmware and Upgrade

1. Confirm the board firmware version

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



1.2 The current latest mosaic firmware version is 1.0.0-beta2 (February , 2025). The latest firmware can also be downloaded from the following link:

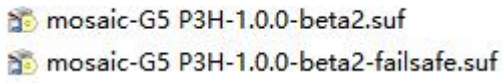
https://www.septentrio.com/en/products/gps/gnss-receiver-modules

2. Firmware Upgrade

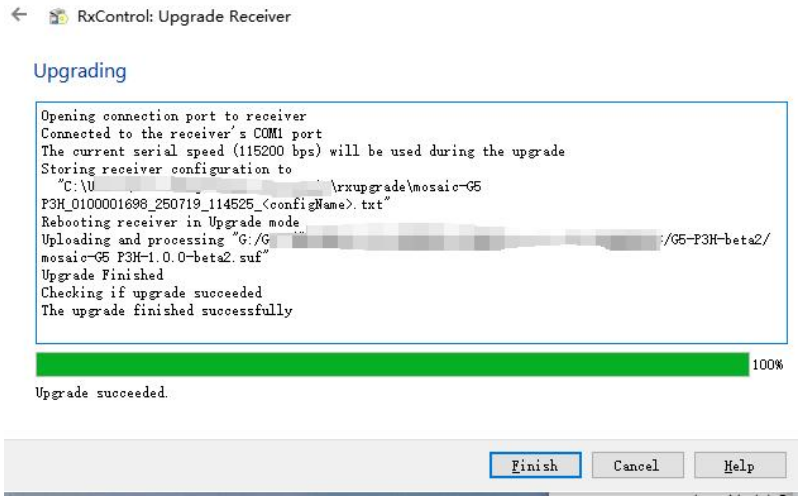
If the firmware is not the latest version as found in the previous step, perform the firmware upgrade as follows, using version 1.0.0-beta2 as an example:

2.1 In 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 1.0.0-beta2.suf firmware file.



2.3 Upgrade successful



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

6.5 View Board Status

The antenna preamplifier range is between 15-50dB for a single antenna and 15-35dB for dual antennas. A gain that is too high indicates poor antenna connection or excessive cable loss. You can determine the antenna gain value via RxControl -> View -> AGC Table, using the formula: 65 - AGC Gain = Antenna Gain

Value.

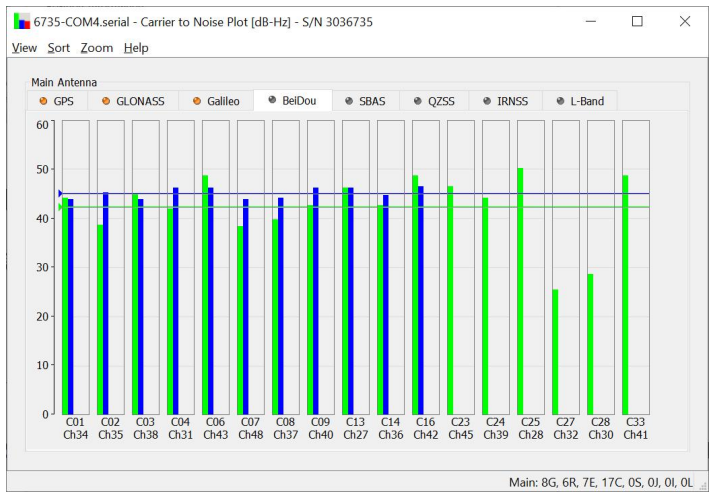
6735-COM4.serial - AGC Table - S/N 3036735

View Help

	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

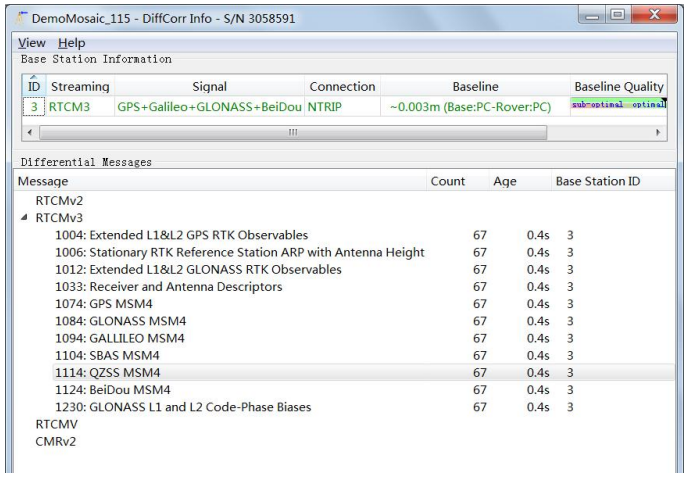
6.6 View Satellite Acquisition and Signal-to-Noise Ratio

Satellite search status can be referred to in the RxControl main interface Satellite Status. The signal-to-noise ratio can be viewed via View -> Carrier to Noise Plot.



6.7 View Differential Data

Enter the following interface via RxControl software View / DiffCorr Info View, where you can see the differential source signal system, baseline length, and RTCMv2 or RTCMv3 data.



6.8 View Board Positioning and Heading Status

Positioning status can be viewed on the RxControl main interface. Antenna position information is in the Position Information section. The PVT section in the lower right corner shows the board's positioning status and the satellite systems used for positioning.

6.9 RxControl Command Line Window

Through the RxControl software, enter commands in the Tools / Expert Console / GRB0060 window. The window will automatically prompt command hints while typing. You can also enter 'help' to return all supported commands.

7 Set Tracking and PVT Solution Satellites & Frequency Bands

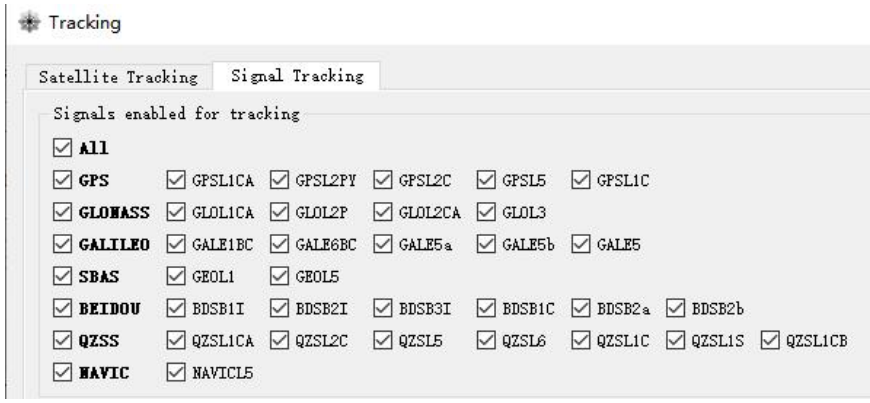
7.1 Tracking Satellites

1. Set tracking satellites: RxControl software Navigation / Advanced User Setting / Tracking / Satellites Tracking, check all for GPS+Glonass+Galileo+Beidou.

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

7.2 Tracking Frequency Bands

1. Set tracking frequency bands: RxControl software Navigation / Advanced User Setting / Tracking / Signal Tracking, check all frequency bands for GPS+Glonass+Galileo+Beidou.



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

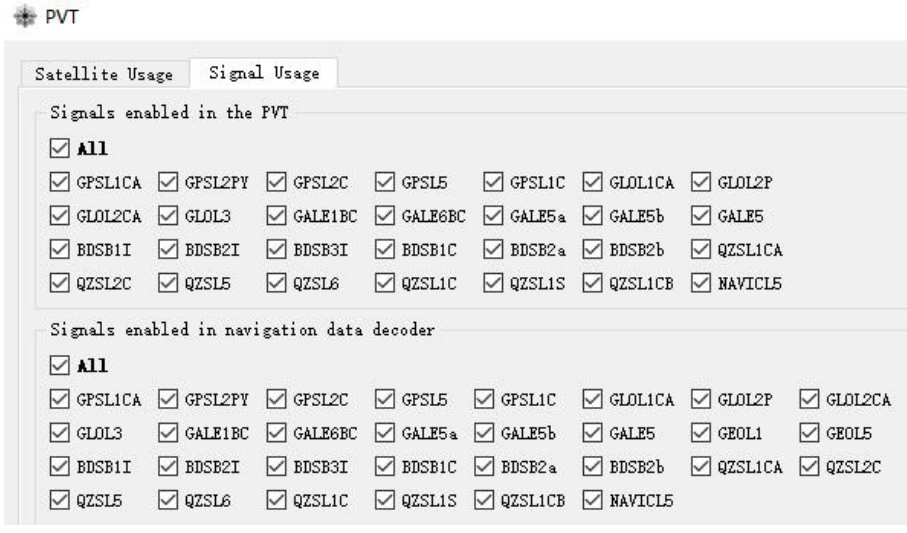
7.3 PVT Solution Satellites

1.Set PVT solution satellites: RxControl software Navigation / Advanced User Setting / PVT / Satellites Usage, check all for GPS+Glonass+Galileo+Beidou.

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

7.4 PVT Solution Frequency Bands

1. Set PVT solution frequency bands: RxControl software Navigation / Advanced User Setting / PVT / Signal Usage, check all frequency bands for GPS+Glonass+Galileo+Beidou.



Command line: snu,all,all

8 Performance Optimization Settings

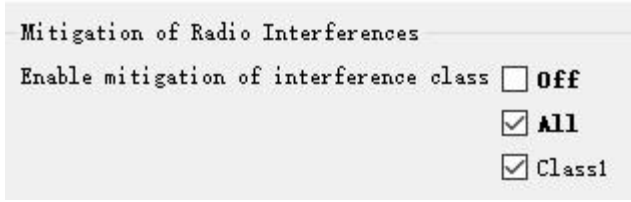
8.1 Anti-interference

Enable the anti-interference function options via the following steps: RxControl / Navigation / Advanced

User Setting / Frontend and Interference Mitigation:

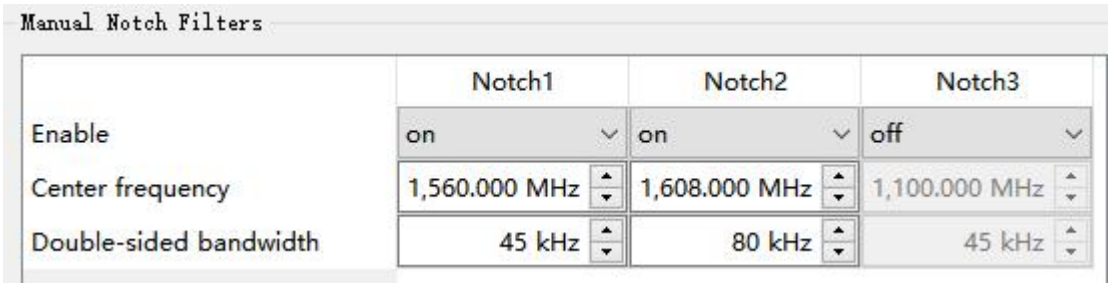
- Enable interference mitigation

  Mitigation of Radio Interferences /Enable mitigation of interference class: **Class1**



- Enable Narrowband Anti-Interference (for known fixed interference), 3 different frequency points can be set:

  Manual Notch Filters: Notch 1 – **on**; Notch 2 – **on**; Notch 3 – **on**



Command Line: setRFInterferenceMitigation, Class1//// Enable Broadband Interference Mitigation
Command Line: setManualNotchFilter, Notch1, on// Enable Narrowband Interference Mitigation

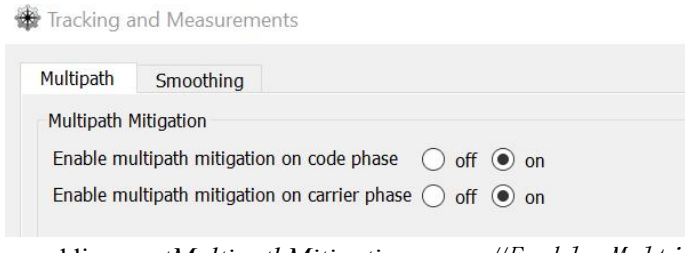
8.2 Multipath Suppression

View and set multipath suppression options via the following steps:

RxControl/Navigation/Receiver Operation/Tracking and Measurements/Multipath:

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

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



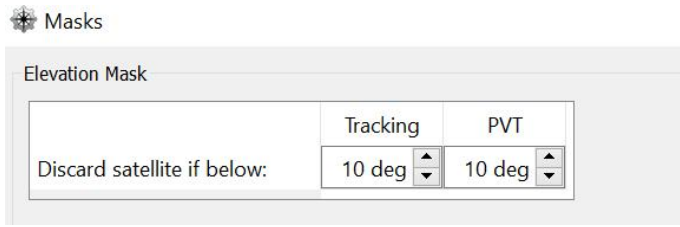
Command line: *setMultipathMitigation,on,on //Enable Multipath Suppression*

8.3 Elevation Mask

It is recommended to set the elevation mask to 10°. View and set the elevation mask option via the following steps:

RxControl/Navigation/Receiver Operation/Masks.../Elevation Mask:

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



Command line: *setElevationMask,tracking,10//Set Tracking Elevation Mask to 10°*

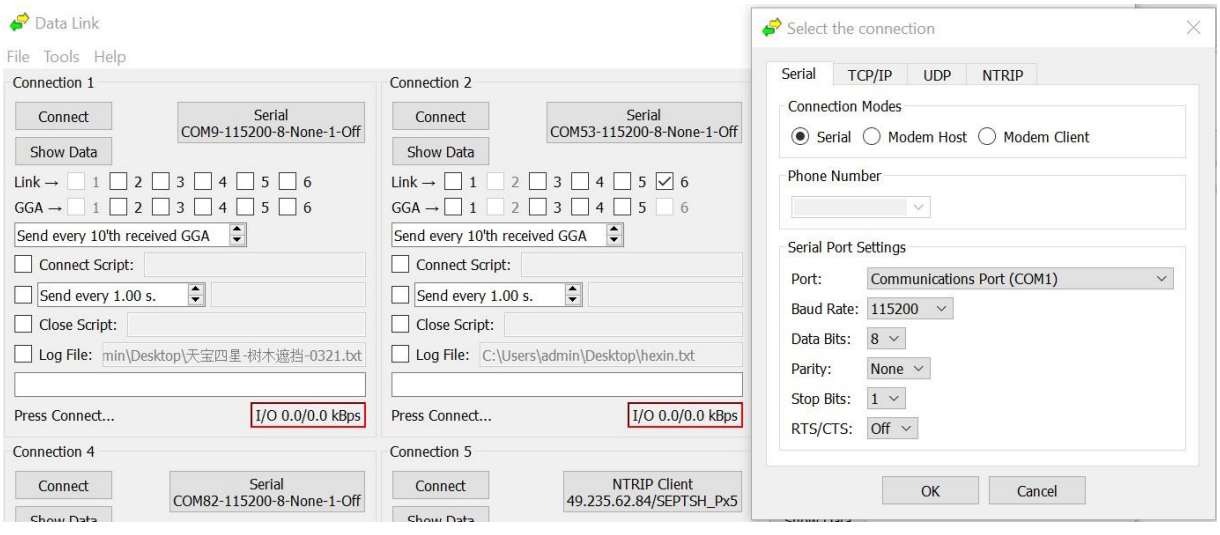
Command line: *setElevationMask,pvt,10//Set PVT Elevation Mask to 10°*

9 RTK Mode

9.1 Datalink Program

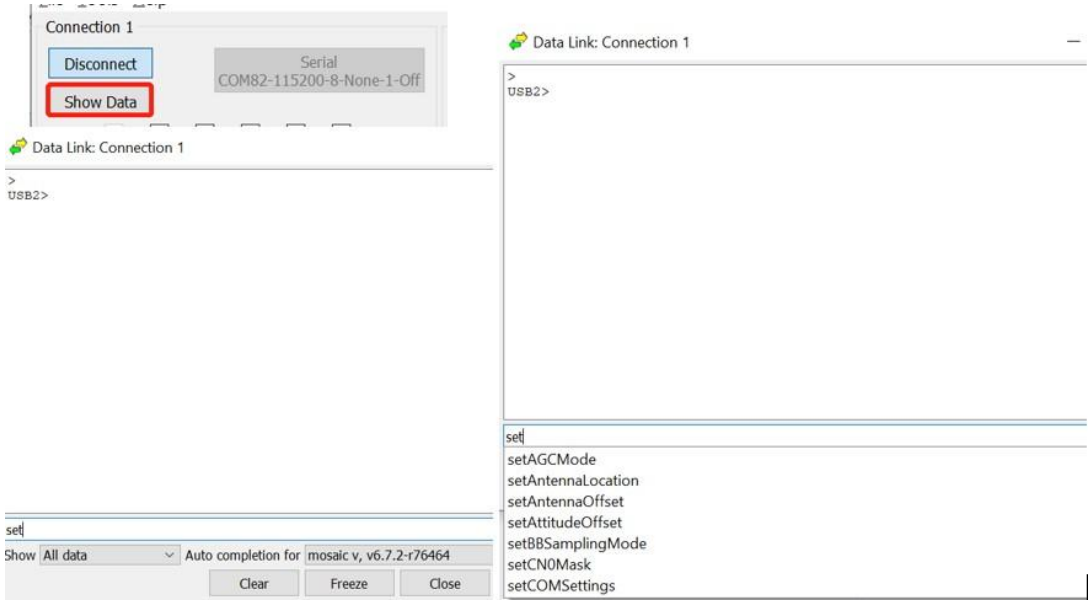
Function 1: Port Linking, Data Distribution

The Datalink program can establish data links between different connections. It can forward data from one port to other connections. For example, with 6 connections under the Datalink program, connection1 can receive serial port or NTRIP differential data and then distribute it to other different connection links.



Function 2: Serial Port Assistant

Connect to the board using the Serial connection method, default baud rate is 115200. Click Connect to establish the connection, then click Show Data to display the serial port monitoring interface.



Select 'Auto completion for **mosaic v** in the lower right corner of the serial port monitoring interface. This way, when entering commands, the input box will automatically prompt the command format.

Function 3: Logging Port Output Data to File

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

9.2 Rover Mode

1. First, set the board to Rover mode via RxControl software Navigation / Positioning Mode interface: PVT mode: Rover

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

2. Save the configuration via RxControl Software File/Copy Configuration/Current->Boot

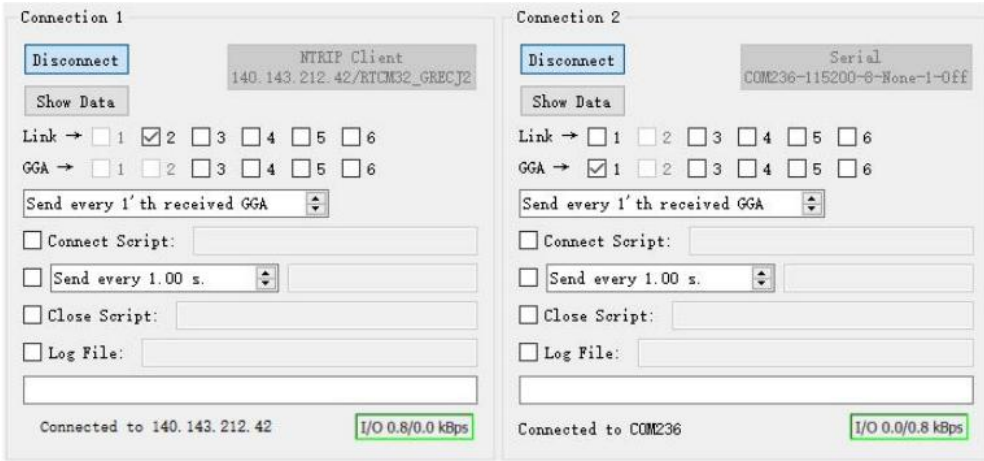
```
Command line: eccf,current,boot                    //Save settings
```

3. Set up differential input in the Datalink software

   a. Set Connection1 to connect to the differential source via serial port or NTRIP, and confirm effective reception of differential data via Show Data.

   b. Set Connection2 to connect to the Mosaic MiniEVK's USB2 port (check the corresponding virtual serial port via the computer's Device Manager).

   c. Link the differential data from Connection1 to Connection2, so the MiniEVK board can receive the differential data.



Note: If using Sixents NTRIP or other CORS station differential data, you need to set the port receiving the differential data on the board to output 1Hz GGA data. You can modify the GGA Talk ID. For specific settings, see NMEA Data Real-time Port Output.

4. RTK Fixed Status Verification

4.1 Return to the RxControl software, the Position Information bar shows the positioning accuracy.

4.2 The PVT information bar in the lower right corner shows whether the current RTK status is RTK Fixed, and the satellite systems used for PVT solution.

4.3 The DiffCorr light in the lower left corner flashes, indicating real-time reception of differential data.

10 NMEA Data

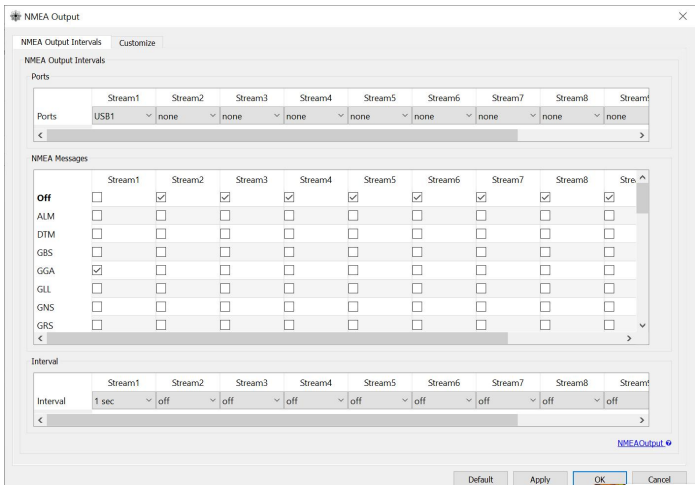
10.1 Real-time Output via Port

1. Via RxControl software, Communication / Output Settings / NMEA Output / NMEA Output Intervals, set:

d. Output Port

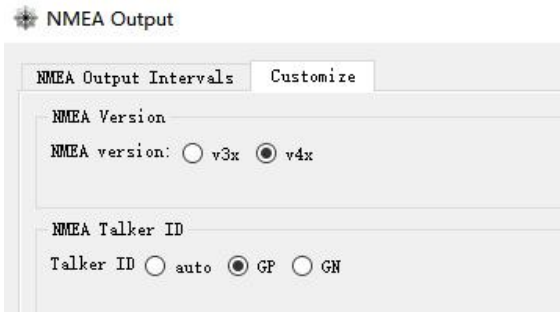
e. NMEA Data Type

f. Output Frequency

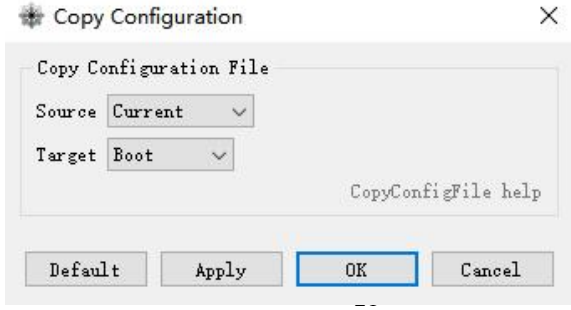


2. Via RxControl software, Communication / Output Settings / NMEA Output / Customize, set:

g. Can modify GGA talkID to GP (default header is GN)



3. Save settings，File/Copy Configuration.../Source Current--->Target Boot



Command line: sno,stream1,ubs2,gga,sec1 //Set USB2 port to output 1Hz GGA
Command line: eccf,current,boot //Save Settings

10.2 Logging Data to Memory Card

The Mosaic MiniEVK supports loading a TF memory card to log data

1. Via RxControl software, Communication / Output Settings / NMEA Output / NMEA Output Intervals, set: 1.1Output Port as DSK1

```
Command Line: sfn, DSK1, FileName, log1 // Set log save to SD card
setSBFOutput,Stream5,DSK1,+support,sec1 //Set SBF support log output 1Hz to SD card
```

1.2 NMEA Data Type, Output frequency

```
Command line: sno,stream1,ubs2,gga,sec1 //Set USB2 port to output 1Hz GGA
```

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

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

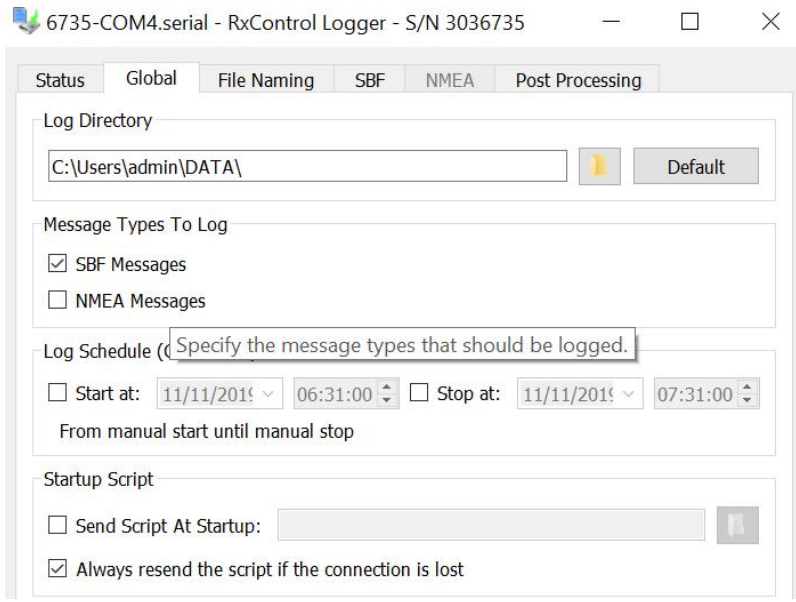
10.3 Logging Data to Computer File

Method 1: Via Datalink

1. The Datalink program can connect to the Mosaic MiniEVK's USB2 port. Set output data commands via the serial port monitoring interface, and check Log to file (see Datalink Program)

Method 2: Via RxLogger or RxControl Software Logging

1. Use the Logging / RxControl Logging function under RxControl software or run the RxLogger program, connect to the Mosaic MiniEVK's USB port, and enter the following interface:



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

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

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

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

5. Click Start Logging to start logging to the computer file.

11 SBF Raw Data

SBF - Septentrio Binary Format files are Septentrio's proprietary binary format files, recording comprehensive information.

11.1 Port Output of Raw Data

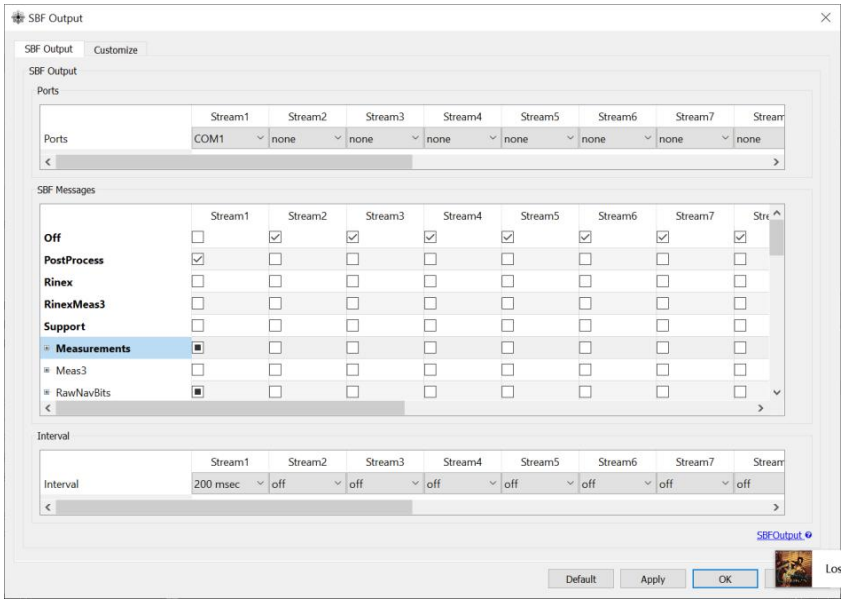
In the RxControl software interface, go to Communication / Output Settings / SBF Output, and Set:

1. Output Port
2. Data Type

For 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 to output 5Hz PostProcess data

Command line: eccf,current,boot //Save Settings

11.2 Logging Raw Data to Memory Card

The method for logging to the memory card is basically the same as for serial port output, just change the serial port number to DSK1.

11.3 Logging Data to Computer File

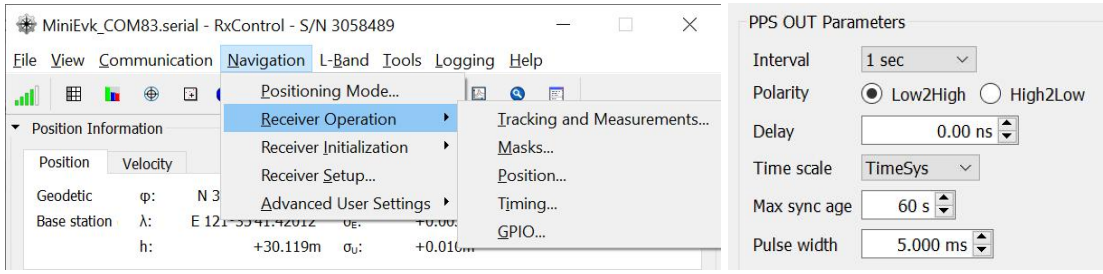
The setup steps are the same as for logging NMEA data to a computer file, just change NMEA data to SBF data, and confirm the required SBF data types are checked.

Note: For logging SBF data to a computer, if you need to change the logging interval, you need to use the RxLogger program for recording. Recording SBF under RxControl does not allow setting the interval; it defaults to 1Hz.

12 External Events

12.1 PPS Output

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



Command line: setPPSParameters,sec1,Low2high //Set 1 PPS output (max 100), pulse from low to high

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

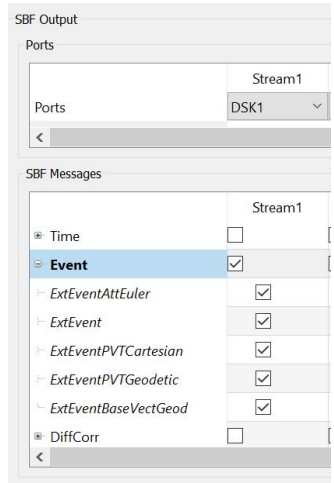
12.2 Event

1. In the RxControl software interface, set Event via Navigation / Receiver Operation / Timing, and set the recording of SBF data. You need to check the Event data type so that the position information at the moment of external triggering is recorded.

Command line:

sso,stream1,ubs2,PostProcess+Event,msec100

//Set USB2 port to output 10Hz PostProcess+Event data



2. Save Settings

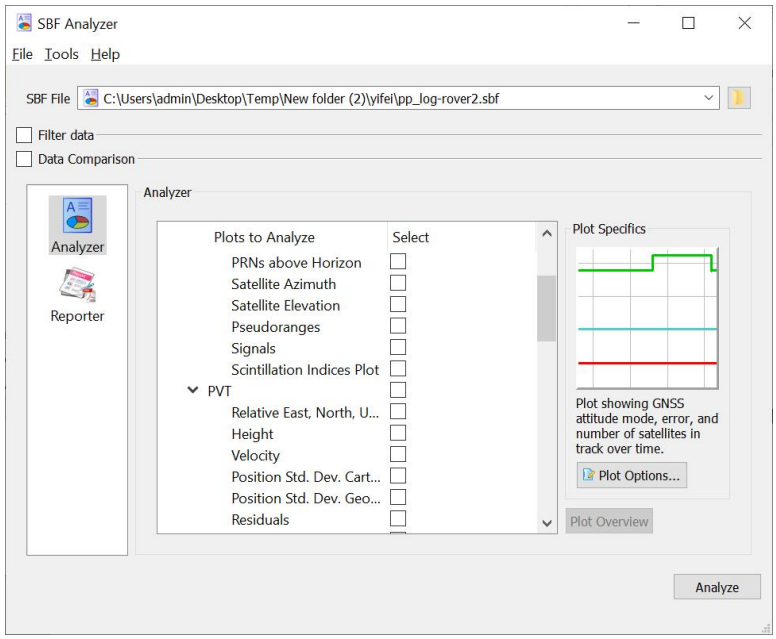
Command line: eccf,current,boot //Save Settings

13 SBF Data Analysis

13.1 SBF Analyzer

SBF Analyzer is automatically installed when the RxTools software is installed. The following is a brief introduction to using the SBF Analyzer program:

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

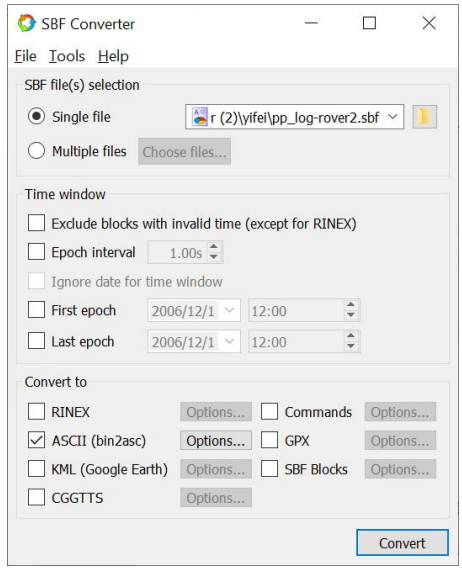


2. Check the content you want to analyze and click Analyze.

13.2 SBF Convertor

The SBF Convertor program can convert SBF to required common formats.

1. Run the SBF Convertor program or right-click an SBF file and click Convert SBF.



2. Can convert SBF to Rinex, ASCII files, etc.

3. For Event applications, check the position data recorded at the moment of external triggering via ExtEventPVTGeodetic1.

14 Troubleshooting

14.1 Diagnostic Report

There are several ways to obtain a diagnostic report or its content:

1. Connect the board via RxControl software, File / Display Diagnostic Report or press the shortcut key Ctrl+C, then save the report as a pdf file.

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

3. Or via a serial port assistant, enter the following commands and copy the content returned by the board to a file:

d. lstInternalFile, Identification
e. lstInternalFile, Permissions
f. getReceiverCapabilities
g. getReceiverInterface
h. lstConfigFile, Boot
i. lstConfigFile, Current
j. lstInternalFile, Ipparameters
k. getSbfOutput
l. getDataInOut
m. lstInternalFile, Error
n. lstInternalFile, SetupError
o. lstInternalFile, rxMessages
p. lstDiskInfo, all

14.2 Support SBF File

If technical support is needed to analyze data quality or troubleshoot board abnormalities, it is necessary to record Support SBF data. The steps for recording SBF are as introduced in ***SBF Raw Data***.

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

Command line: sso,stream1,dsk1,support+BBsamples,msec100 //Record support+BBsamples to memory card

Command line: eccf,current,boot //Save Settings