Accurate positioning

22°43'59.57617"N 114°03'03.61546"E

JS-BSK43H-AH

Data sheet

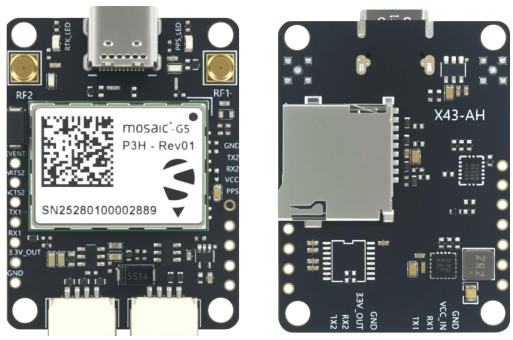

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Table of Contents

Version Update Notes

Version	Date	Contents Changes and Modifications	Modified by
V1.0	2025-07-01	Initial Version	WW

This document applies to the following products:

Product Type	**Model No.**	**Key Features**			
		Multi-Con. Multi-Freq.	Anti-Intf.	Dual-Ant.	Raw Obs. Output
Board	JS-BSK43-AH	√	√	-	√
Board	JS-BSK43H-AH	√	√	√	-
Board	JS-BSK43R-AH	√	√	-	√
Board	JS-BSK43HR-AH	√	√	√	-

1 Product Introduction

1.1Overview

JS-BSK43H-AH is a new multi-band, multi-constellation satellite receiver with multiple data interfaces. In addition to high-precision positioning, it also provides heading and pitch angles or heading and roll angles, making it an ideal choice for autonomous navigation. It is suitable for unmanned aerial vehicles (UAVs), fully autonomous robots, precision control, autonomous driving, and various other application fields. This module features the low and predictable latency required for stable and precise control systems. It can track all Global Navigation Satellite Systems (GNSS), supporting current and future signals, and is compatible with popular open-source autopilots. Its performance is especially outstanding in complex environments, providing a performance benchmark for GNSS positioning in the mass market, and is currently widely used in the GNSS mass market.

1.2 Product Features

- High-performance chip
- All-view point satellite tracking, multi-constellation, multi-frequency
- 789 hardware channels enabling simultaneous operation
- Up to 20Hz navigation update rate
- Ultra-low latency less than 10 milliseconds
- Supports GPS, GLONASS, BDS, Galileo, QZSS, NavIC, SBAS satellites
- Integrated TCXO, LNA, and a TF card slot up to 32GB
- Compact size (39.8*30.0*8.2mm ±0.3mm), weight only 9g
- Supports standard NMEA 0183, SBF, RINEX, RTCM, CMR/CMR+
- AIM+ with advanced features for interference and spoofing detection and automatic mitigation
- LOCK+ with robust tracking capability, excellent resistance to mechanical shock and vibration
- IONO+ with advanced anti-ionospheric interference protection
- APME+ multipath mitigation to separate direct signals and those reflected by nearby structures
- Provides complete raw measurement data
- Interference indicator, interference mitigation, and spectrum measurement functions
- Supports ultra-short baseline heading output

- Supports GNSS navigation
- Supports Galileo OSNMA

1.3 Performance Metrics

Parameters	Details		
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/NO Threshold)	Tracking and Navigation Sensitivity	20 dB-Hz	
	Acquisition Sensitivity	30 dB-Hz	
Time To First Fix (TTFF)[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
Timing Accuracy	xPPS output	1.4ns	
	Event accuracy	< 3ns	
Latency	99.9%	< 10ms	
Velocity Accuracy	0.03m/s		
Heading Accuracy (Dual Antenna)[3]		Heading	Pitch/Roll
	1m Antenna Spacing	0.15°	0.25°
	5m Antenna Spacing	0.03°	0.05°
Baud Rate	4800- 4M bps (default 115200bps)		
Maximum Data Update Rate	20 Hz		

✌1 Need special Firmware Support

✌2 All Satellites at -130dBm

✌3 RMS Levels, 24-hour Static, -130dBm, ≥12 Satellites available for using

✌4 Accuracy degrades by 1cm per 10km from base station (Baseline range <40km)

1.4 Protocol Description

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

1.5 Antenna

Item	Parameters	
Antenna Pre-amplification Range	Single Antenna	Dual Antenna
	15-50dB	15-35dB
Antenna bias voltage	3.0-5.5V (built-in current limit: 150mA)	

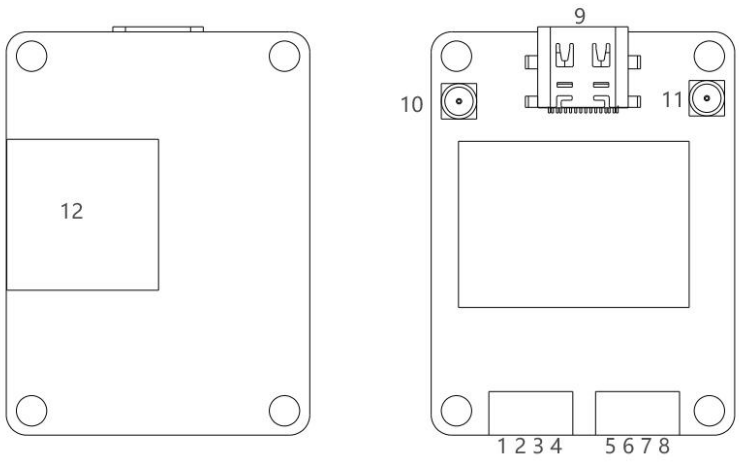
JS-BSK43H-AH operates in dual-antenna mode; both ANT1 and ANT2 need to be connected during use, supporting dual-antenna positioning and heading function. determination.If use this module(Model No. JS-BSK43-AH) to operate in single-antenna mode; connecting only RF1 is sufficient for RTK positioning.

1.6 Application Scenarios

- UAV/Drones
- Base Station (plan to support in 2026)
- Intelligent Logistics Dispatch
- Intelligent Robots
- Geodetic Surveying & Mapping
- Precision Agriculture
- Geological Hazard Monitoring
- Heading Output
- Vehicle-mounted Equipment
- Precision Control

2 Pin Definitions

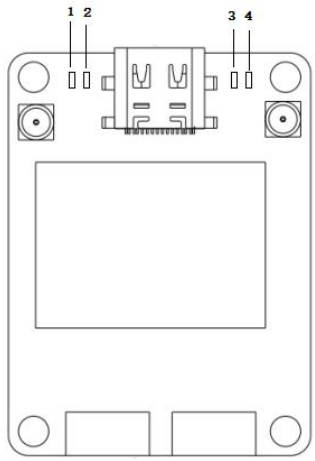
2.1 Pin Assignment



No.	Name	Input/Output	Description

1	GND	-	Ground
2	VIN	Input	Power Supply 4.0-12.0V
3	RX1	Input	UART1 Receive data
4	TX1	Output	UART1 Transmit data
5	GND	-	Ground
6	VOT	Output	3.3V, Can be used to power other devices.
7	RX2	Input	UART2 Receive
8	TX2	Output	UART2 Transmit
9	USB	Input/Output	TYPE-C Power Supply + Data Transmit
10	ANT1	Input	Main Antenna Input for positioning, power supply voltage 3.0-5.5V
11	ANT2	Input	Aux Antenna Input for heading, power voltage 3.0-5.5V
12	SD	-	For GNSS data storage , max. up to 32GB

2.2 Indicator LED



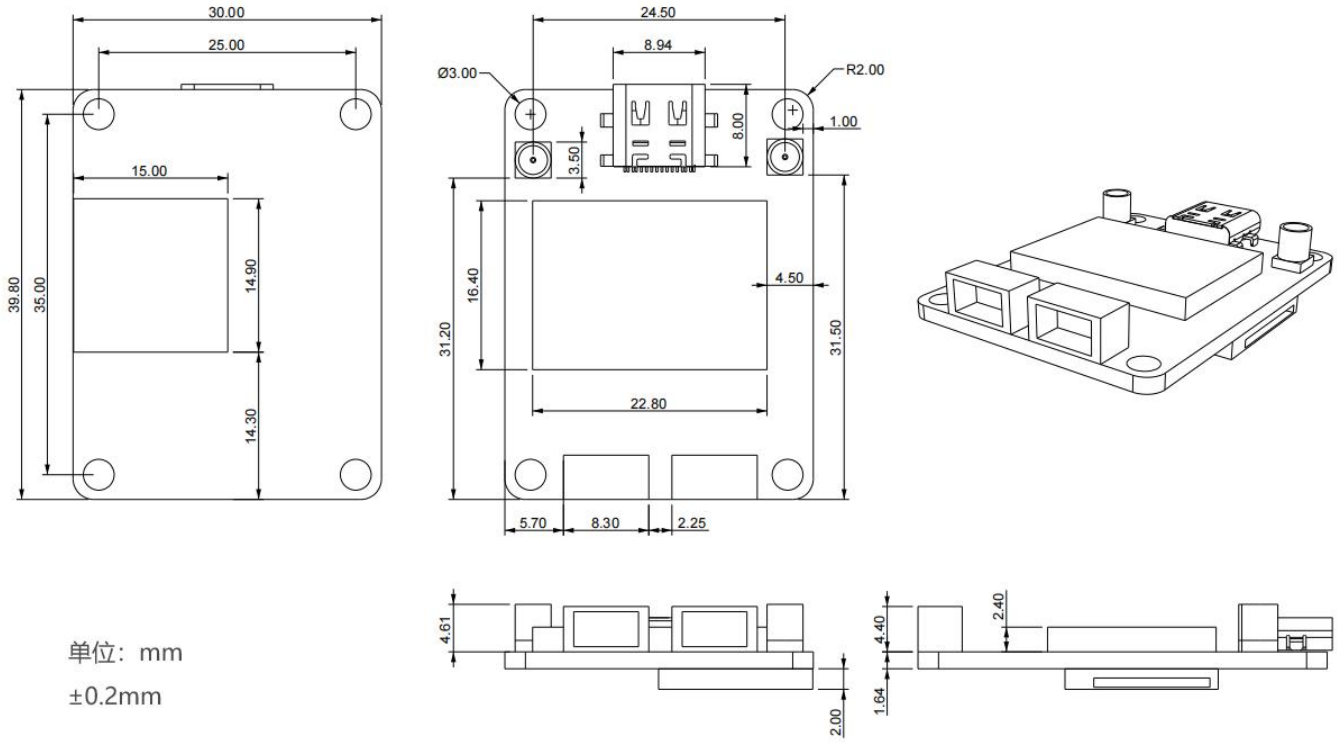
No.	Name	Input/Output	Description
1	RTK	O	RTK Positioning Indicator, active high level. LED Flashes for Float solution, LED stays steady ON for RTK Fixed solution. Outputs low level (LED off) for other positioning states or no positioning. (Green LED)
2	GPIO1	-	Reserved
3	GPIO2	-	Reserved
4	PPS	O	Pulse per second（Green LED）

3 Electrical Characteristics

Parameters		Symbol	Min	Typical	Max	Unit
Supply Voltage Range		VCC	4	5.0	12.0	V
Average Current* DCDC	Single Ant	Capture current	-	130@5.0V	140@5.0V	mA
		Tracking Current	-	95@5.0V	125@5.0V	mA
	Dual Ant	Capture current	-	150@5.0V	190@5.0V	mA
		Tracking Current	-	125@5.0V	160@5.0V	mA
Antenna Supply Current		RF_VCC	-	-	150mA @5.0V	mA
Max.ripple at the VCC pin.		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					95	%

* Tested with passive antenna

4 Mechanical Dimensions



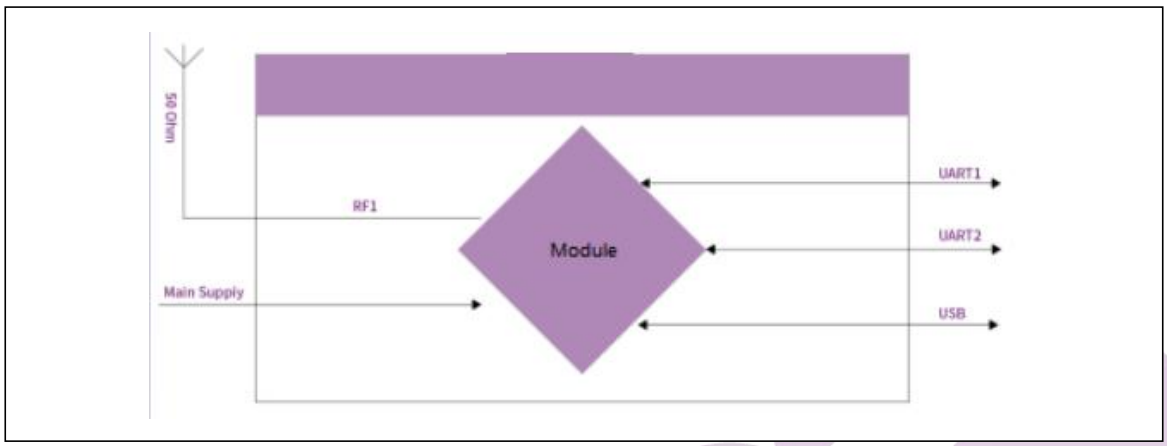
5 Interface Configuration Options

The JS-BSK43H-AH module defaults to have 2 UART ports and one USB interface for communication with the host. Selections can be made based on the required output ports and additional functions, mainly as follows:

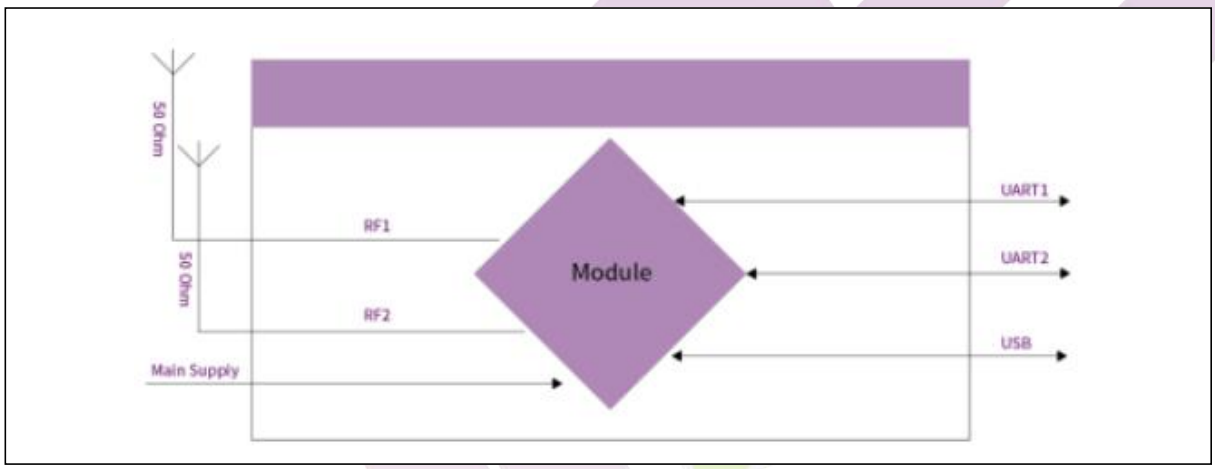
Model No.	Positioning	Heading	TTL	RS232
JS-BSK43-AH	√	-	√	-
JS-BSK43H-AH	√	√	√	-
JS-BSK43R-AH	√	-	-	√
JS-BSK43HR-AH	√	√	-	√

Block Diagram

1、JS-BSK43-AH



2、JS-BSK43H-AH



6 Basic Operation Instructions

6.1 Download and Install RxTools Software

Download the RxTools software installer and user manual from the following link:

1.Septentrio Official Website Download:

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

Install directly after download, avoiding installation paths with Chinese characters. After successful installation, the following programs will be available:

6.2 Hardware Connection

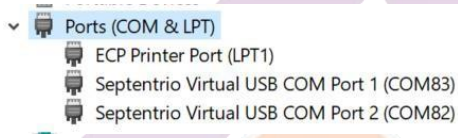
1. Connect the positioning antenna using an MMCX to TNC or SMA adapter cable (Avoid hot-plugging).

2. For serial port connection, use a standard USB-to-serial cable connected to the computer's USB port. Use Septentrio's RxTools software or a serial terminal tool to communicate with the receiver. Default baud rate is 115200.

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

3.1 The board will create two virtual COM ports on the computer.

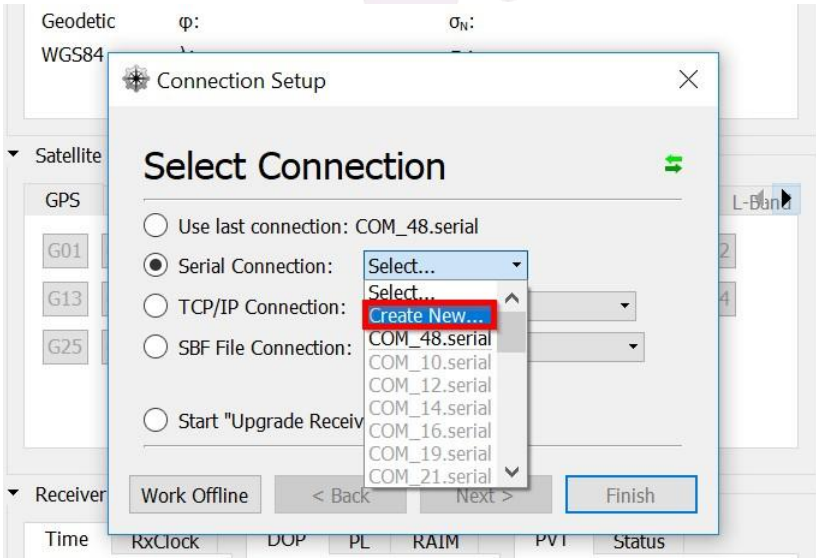
Check the port numbers in Device Manager:



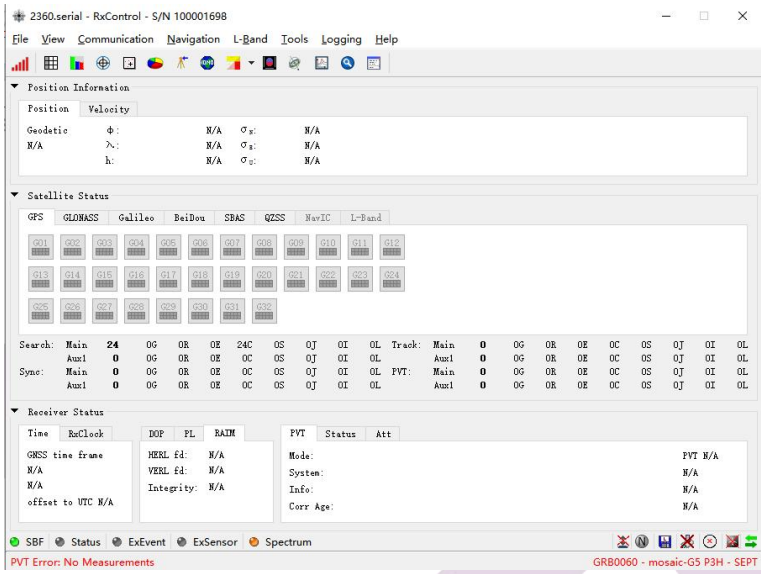
6.3 Connect Board via RxControl Software

1. Launch RxControl software. The Connection Setup dialog will appear. Select Serial Connection/Create New...

1.1 Create a new connection for the first time. Select an existing serial port connection for subsequent connections.



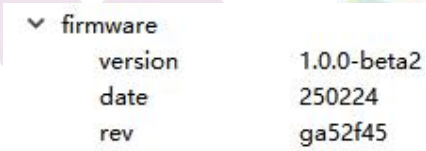
2. After successful connection, the RxControl interface will be displayed as shown below:



6.4 Check Firmware and Upgrade

1. Confirm Board Firmware Version

1.1 View firmware version via RxControl: Help / Receiver Identification.



1.2 The current latest firmware version for Mosaic is mosaic-G5 P3H-1.0.1. The latest firmware can also be downloaded from:

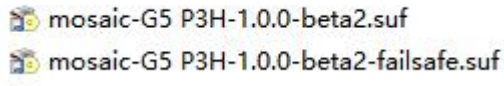
https://www.septentrio.com/en/products/gps/gnss-receiver-modules

2. Firmware Upgrade

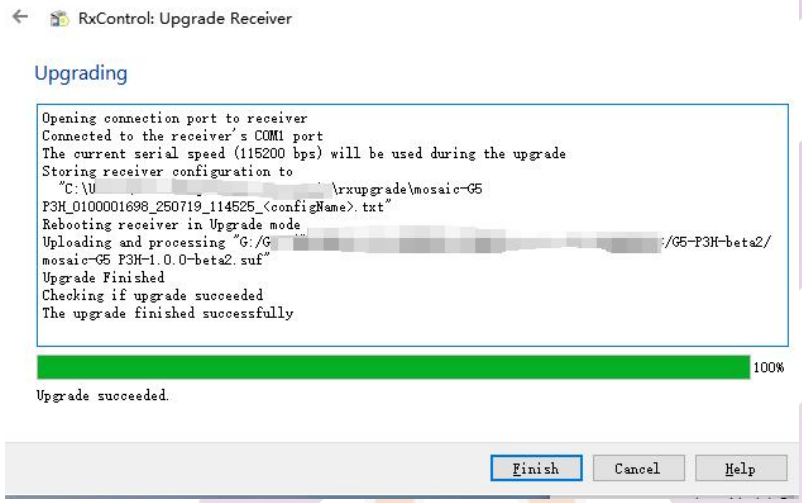
If the firmware is not the latest version as per the previous step, upgrade using the following steps (using version 1.0.0-beta2 as an example):

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

2.2 Select the latest firmware files. There are 2 firmware files: upgrade failsafe.suf first, then upgrade 1.0.0-beta2.suf.



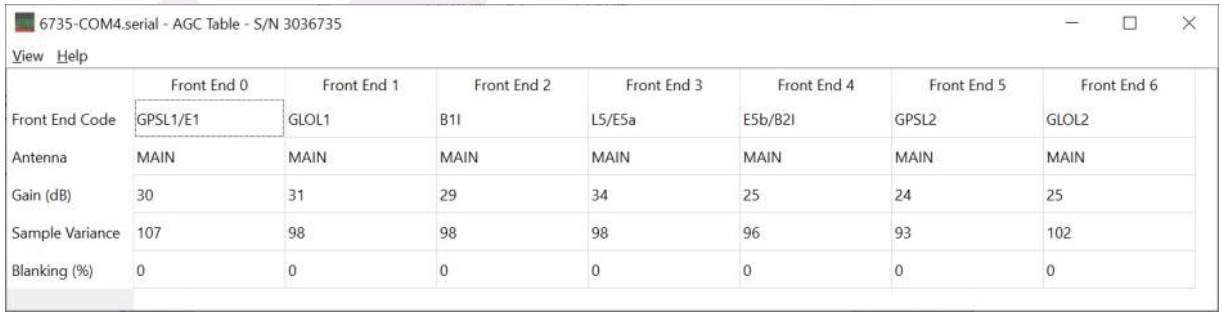
2.3 Upgrade Successfully



2.4 Reconnect RxControl. Confirm the firmware version is updated via Help/Receiver Identification

6.5 View Board Status

The antenna pre-amplification range is 15-50dB for single antenna and 15-35dB for dual antenna. Gain values that are too high indicate poor antenna connection or excessive cable loss.View the antenna gain value via RxControl -> View -> AGC Table. Gain Value = 65 - AGC Gain.

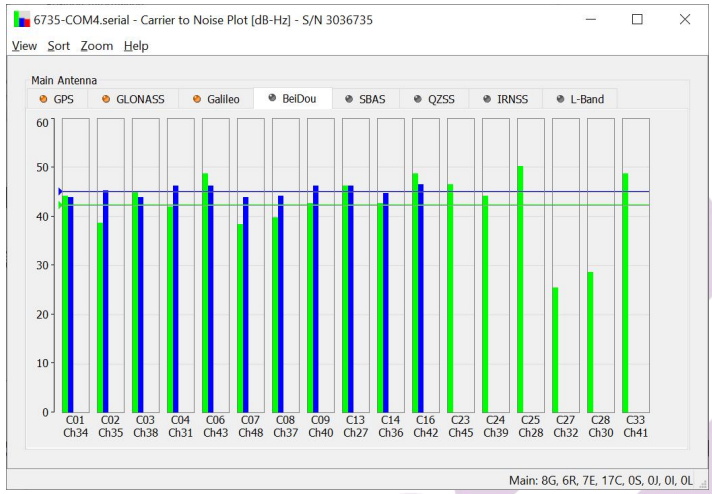


	Front End 0	Front End 1	Front End 2	Front End 3	Front End 4	Front End 5	Front End 6
Front End Code	GPSL1/E1	GLOL1	B1I	L5/E5a	E5b/B2I	GPSL2	GLOL2
Antenna	MAIN	MAIN	MAIN	MAIN	MAIN	MAIN	MAIN
Gain (dB)	30	31	29	34	25	24	25
Sample Variance	107	98	98	98	96	93	102
Blanking (%)	0	0	0	0	0	0	0

6.6 View Satellite Reception and SNR

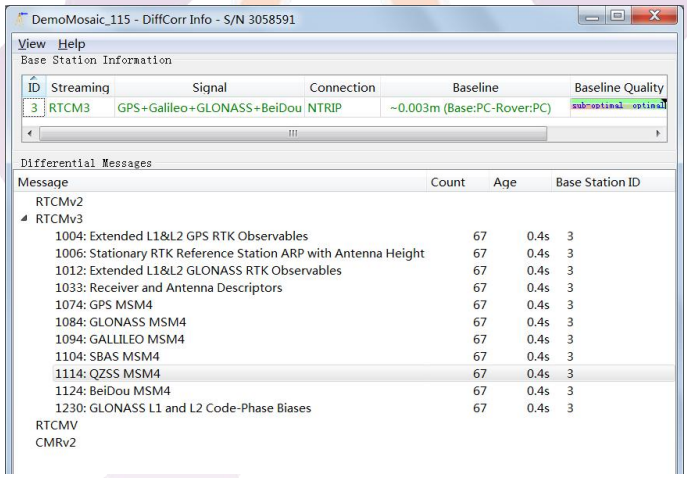
View satellite acquisition status in the RxControl main interface (Satellite Status). View Signal-to-Noise

Ratio (SNR) via View -> Carrier to Noise Plot.



6.7 View Differential Data

Access differential data information via RxControl: View / DiffCorr Info View. This interface shows the differential source signal system, baseline length, and RTCMv2 or RTCMv3 data status.



6.8 View Board Positioning and Heading Status

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

6.9 RxControl Command Line Window

Via RxControl software, Tools / Expert Console / GRB0060 window, input commands. The window will auto-suggest commands as you type. You can also input 'help' to return all supported commands.

7 Set Tracking and PVT Solution Satellites/Frequencies

7.1 Tracking Satellites

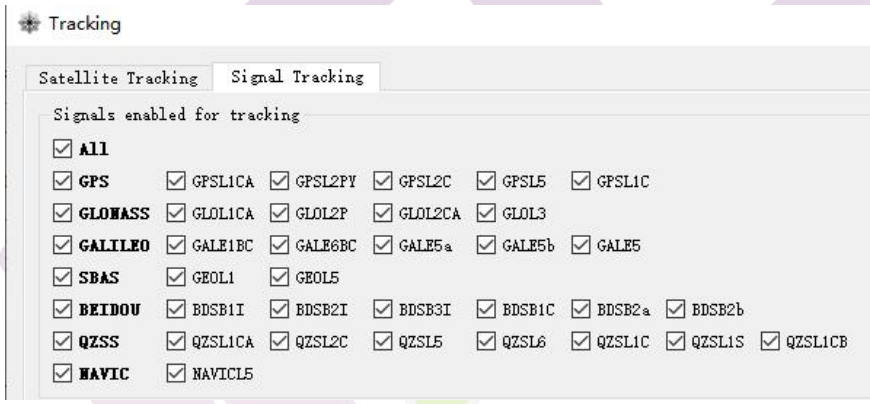
1. Set Tracking Satellites: RxControl: Navigation / Advanced User Setting / Tracking / Satellites Tracking

Check all : GPS+Glonass+Galileo+Beidou

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

7.2 Tracking Frequencies

1. Set Tracking Frequencies: RxControl: Navigation/Advanced User Setting/Tracking/Signal Tracking, check all frequencies for GPS+Glonass+Galileo+Beidou



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

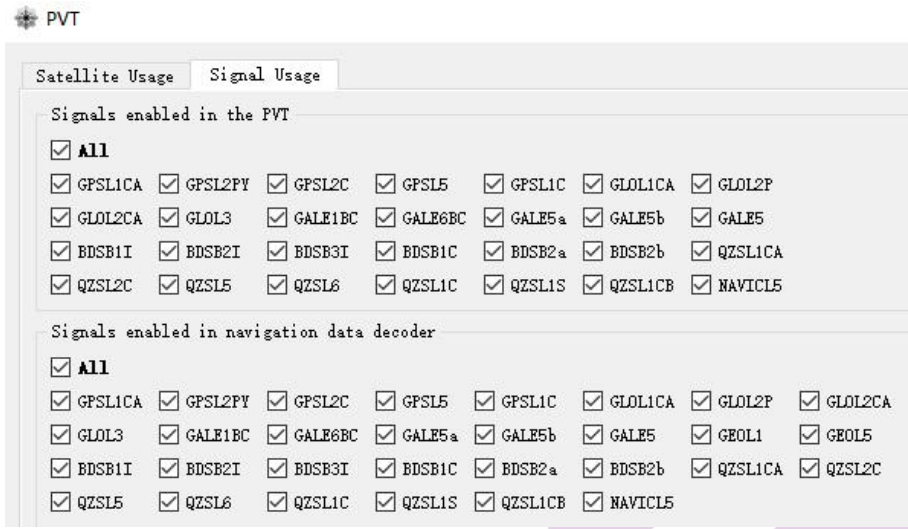
7.3 PVT Solution Satellites

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

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

7.4 PVT Solution Frequencies

1. Set PVT Solution Frequencies, RxControl: Navigation/Advanced User Setting /PVT/Signal Usage, Check all frequencies for GPS+Glonass+Galileo+Beidou



Command line: snu,all,all

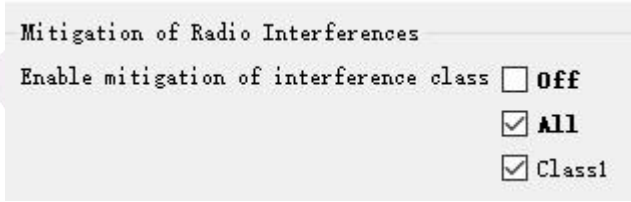
8 Performance Optimization Settings

8.1 Anti-Interference

Enable interference mitigation features via: RxControl/Navigation/Advanced User Setting/Frontend and Interference Mitigation:

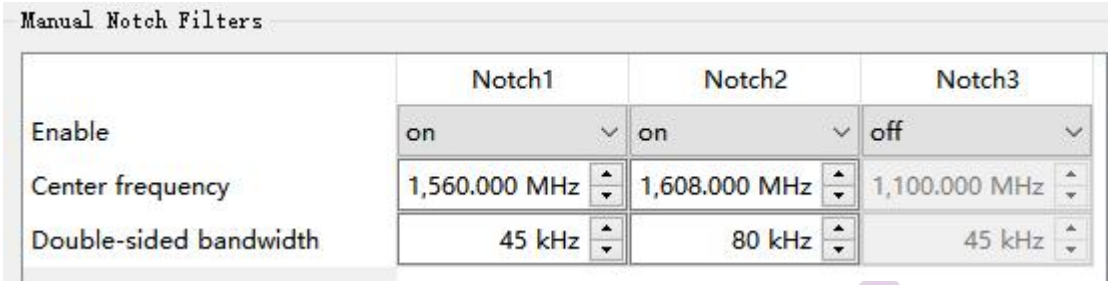
- Enable Interference Mitigation

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



- Enable Manual Notch Filters,narrowband anti-jamming (for known fixed interference): Can set up to 3 different notches.

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



Command line: setRFInterferenceMitigation, Class1//Enable Class1 broadband interference mitigation
setManualNotchFilter, Notch1, on//Enable Notch1 narrowband interference mitigation

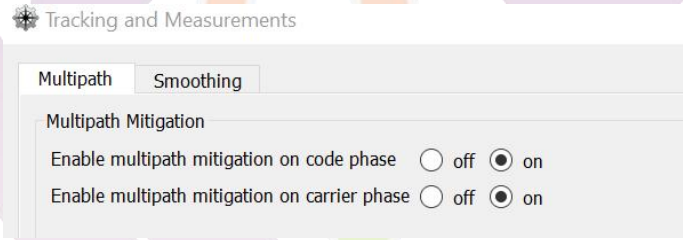
8.2 Multipath Mitigation

View and set multipath mitigation options via RxControl: RxControl/Navigation/Receiver

Operation/Tracking and Measurements/Multipath:

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

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



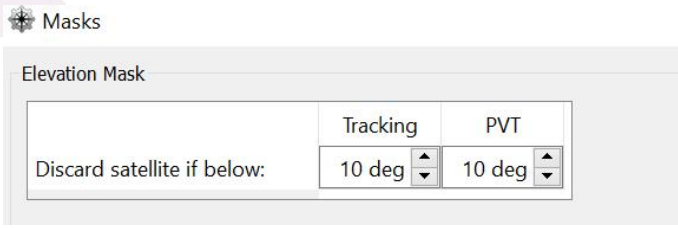
Command line: setMultipathMitigation,on,on //Enable multipath mitigation

8.3 Elevation Mask

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

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°*

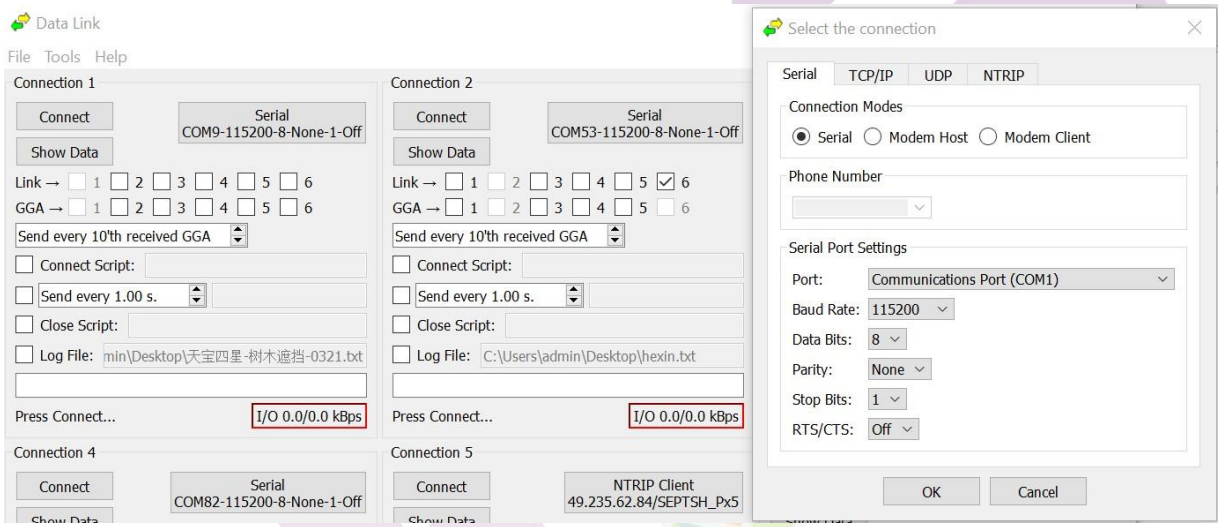
setElevationMask,pvt,10//Set PVT elevation mask to 10°

9 RTK Mode

9.1 Datalink Program

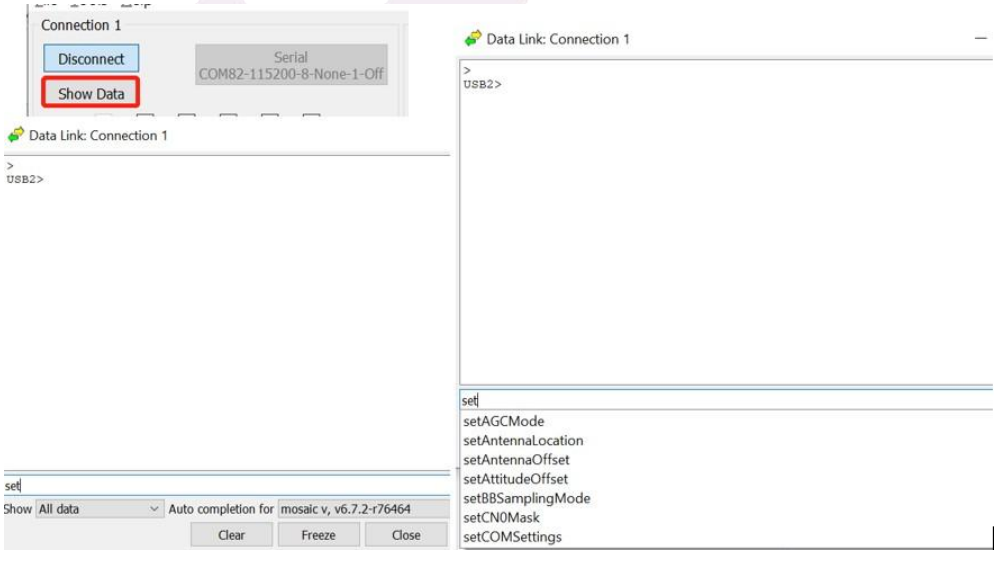
Function 1: Port Linking & Data Distribution

Datalink establishes data links between different connections. It can forward data from one port to other connections. For example, with 6 connections in Datalink, Connection1 can receive serial or NTRIP differential data and distribute it to other connections.



Function 2: Serial Port Assistant

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



In the serial port monitoring interface, select "**Auto completion for mosaic v**" in the bottom right corner.

This will auto-suggest command formats when typing in the input box.

Function 3: Log Port Output Data to File

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

9.2 Rover Mode

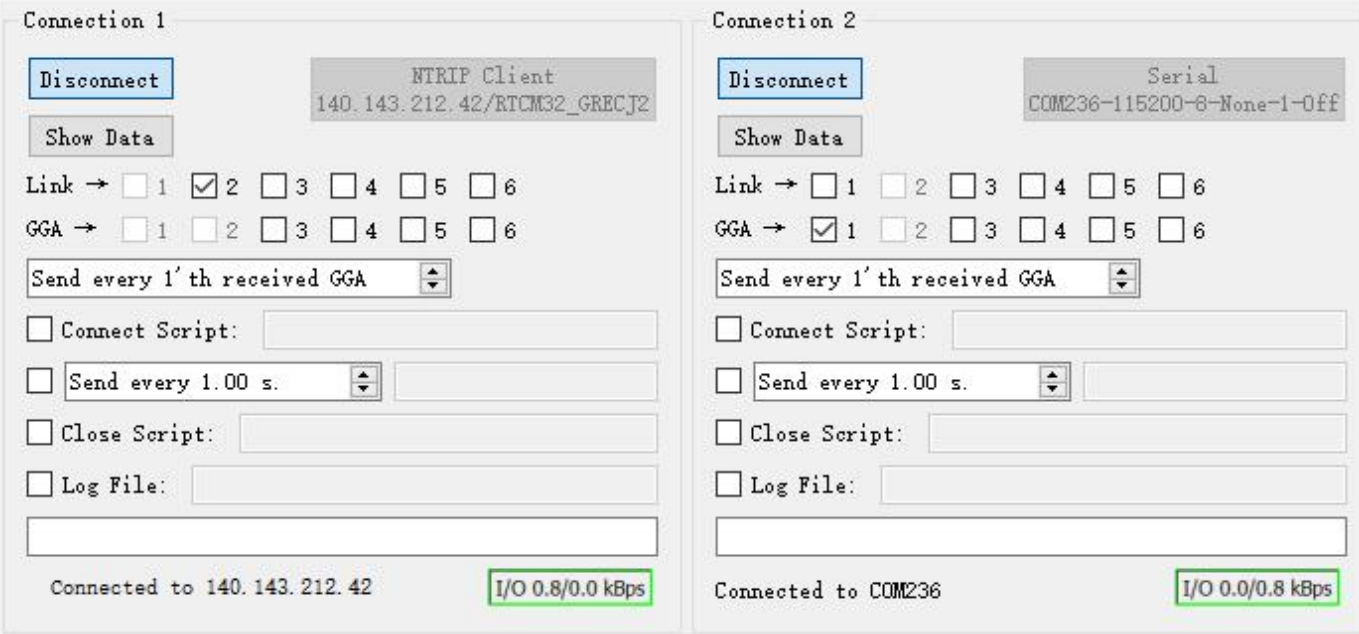
1. First, set the board to Rover mode via RxControl software: Navigation/Positioning Mode/PVT mode: Rover

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

2. In 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 differential source via serial port or NTRIP. Confirm effective differential data reception via Show Data.
   b. Set Connection2 to connect to the Mosaic MiniEVK's USB2 port (check the corresponding virtual serial port in the computer's Device Manager).
   c. Link the differential data from Connection1 to Connection2. This way the MiniEVK board receives the differential data.



Note: If using Sixent NTRIP or other CORS station differential data, the board's port receiving differential needs to output 1Hz GGA data.

Modify GGA Talk ID if needed (see NMEA Data Port Output).

4. Verify RTK Fixed status

4.1 Return to RxControl software. Position Information shows positioning accuracy.

4.2 The PVT section in the bottom right shows whether the current RTK status is RTK Fixed, and the satellite systems used for PVT solution.

4.3 The DiffCorr light in the bottom left blinks, indicating real-time differential data reception

10 NMEA Data

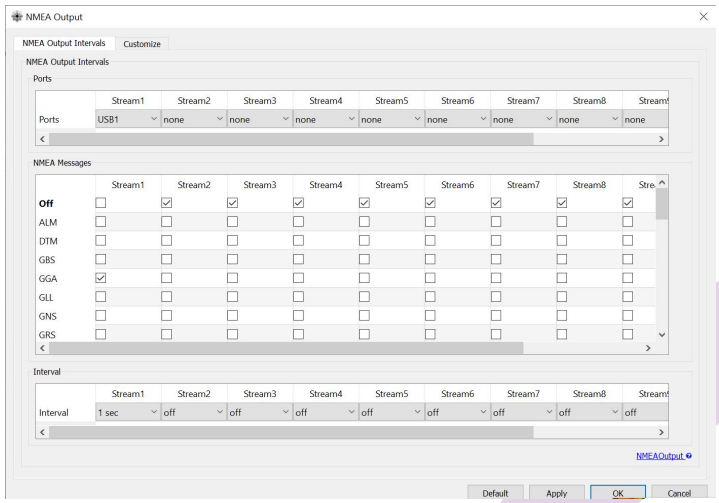
10.1 Real-time Output via Port

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

d. Output port

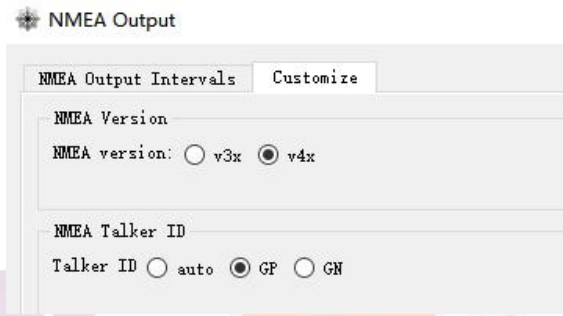
e. NMEA data type

f. Output frequency

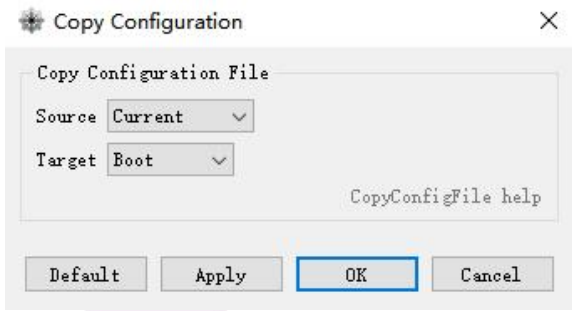


2. Via RxControl software: Communication / Output Settings / NMEA Output / Customize

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 Log Data to Memory Card

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

1. Configure via RxControl software: Communication/Output Settings/NMEA Output/NMEA Output Intervals

1.1 Set output port to DSK1

Command line: sfn, DSK1, FileName, log1 //Set log data to SD card

(Optional SBF Support Log): set SBFOutput,Stream5,DSK1,+support,sec1 //Output 1Hz Support SBF to SD Card

1.2 . Set NMEA data type and output Intervals

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

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

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

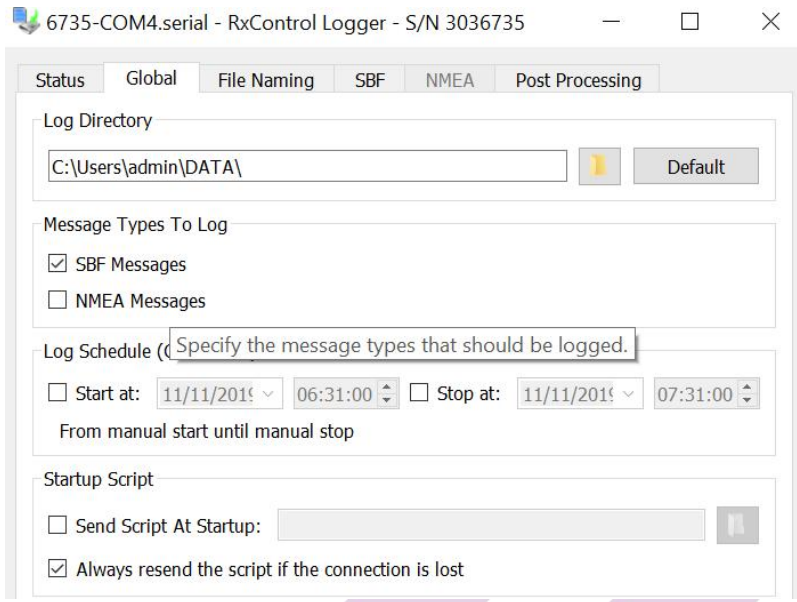
10.3 Log Data to Computer File

Method 1: Via Datalink

1. The Datalink program can connect to the Mosaic MiniEVK's USB2 port. Use the serial port monitoring interface to input commands for setting output data, and check the Log to file option. (See 9.1 Datalink Program section for details.)

Method 2: Via RxLogger or RxControl Software Logging

Under RxControl software: Logging / RxControl Logging function, or run the RxLogger program. Connect to the Mosaic MiniEVK's USB port. Enter the following interface:



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

   Note: If checked here, it needs to be set and logged. If SBF is not needed, uncheck it.

2. Under the File Naming menu, set the file path and name. Optionally set single file size and duration.

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

4. Click **Start Logging** to begin logging to the computer file.

11 SBF Raw Data

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

11.1 Port Output Raw Data

Set in the RxControl software interface: Communication/Output Settings/SBF Output

1. Output port

2. Data type

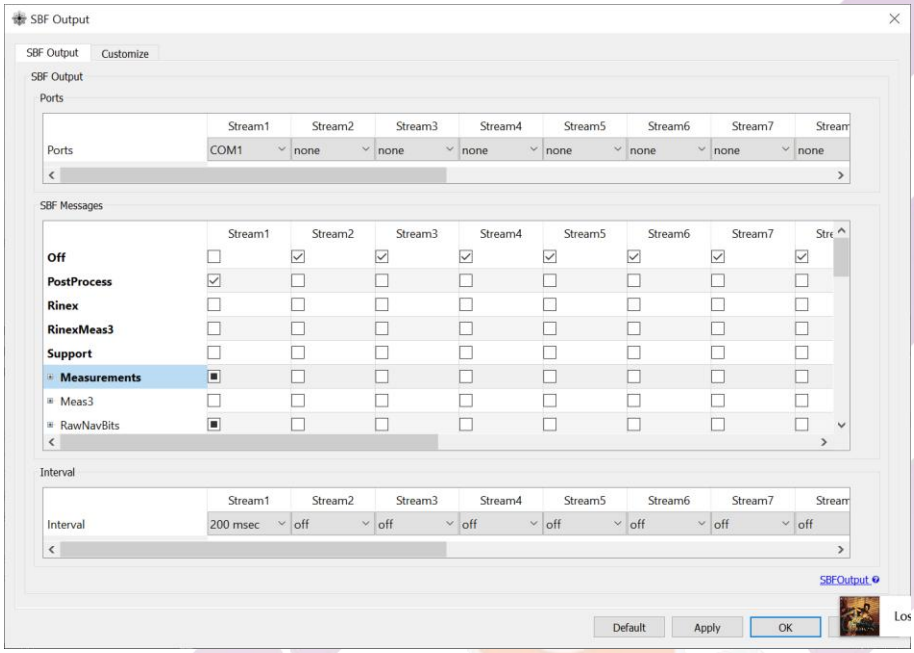
   For required data types, refer to the Mosaic Firmware Guide, Chapter 4 SBF Reference.

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 Log 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 port number to DSK1.

11.3 Log 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.

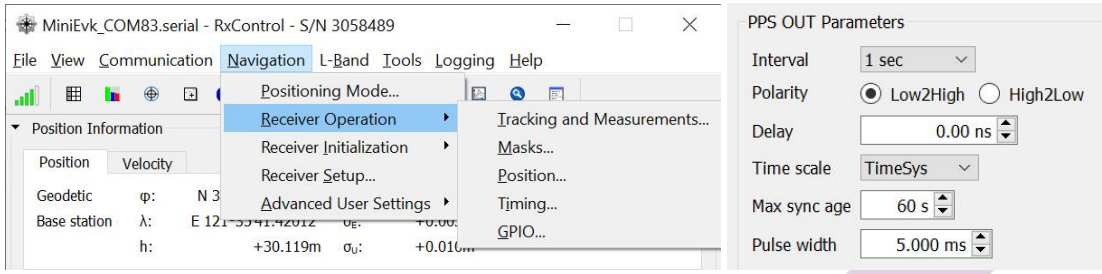
Note: When logging SBF data to a computer via RxControl Logging, the output interval cannot be changed (defaults to 1Hz). Use the standalone RxLogger program for interval control.

12 External Events

12.1 PPS Output

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

settings.



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

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

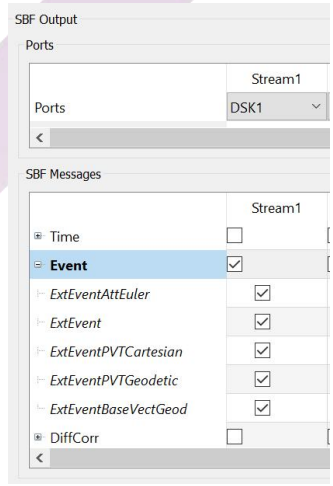
12.2 Event

1. Set up Event in the RxControl software interface: Navigation / Receiver Operation / Timing,. Set SBF data logging and check the Event data type to record the position information at the moment of external trigger.

Command line:

sso,stream1,ubs2,PostProcess+Event,msec100

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



2. Save settings.

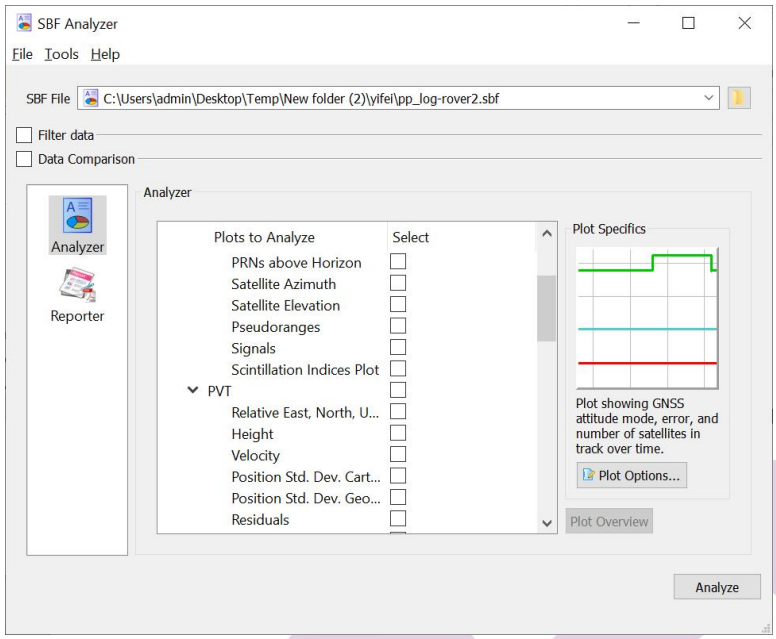
Command line:eccf,current,boot //Save settings

13 SBF Data Analysis

13.1 SBF Analyzer

SBF Analyzer is installed automatically with RxTools. Here's a brief introduction:

1. Double-click to run SBF Analyzer, or right-click an SBF file and choose Open with SBF Analyzer.

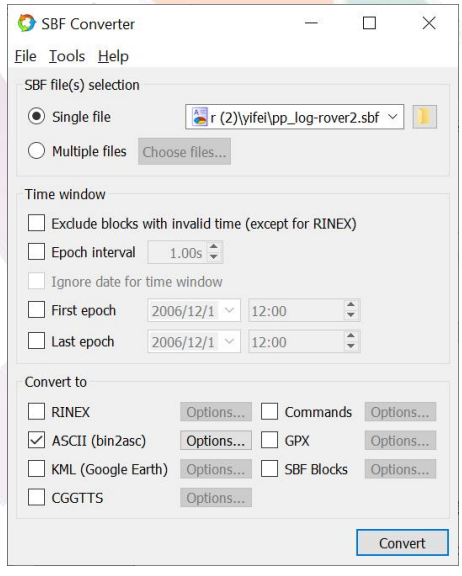


2. Check the content to be analyzed, then click Analyze.

13.2 SBF Convertor

The SBF Converter program can convert SBF to common formats.

1. Run SBF Converter, or right-click an SBF file and choose Convert SBF.



2. SBF can be converted to Rinex, ASCII files, etc.

3. For Event applications, view the position data recorded at the external trigger moment via ExtEventPVTGeodetic1.

14 Troubleshooting

14.1 Diagnostic Report

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

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

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, input the following commands and copy the board's returned content to a file:

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

14.2 Support SBF File

To assist technical support in analyzing data quality or troubleshooting board issues, logging Support SBF data. Steps to log Support SBF data are described in Section 11 (***SBF Raw Data***).

Support SBF is typically set to 10Hz. Adjust the logging frequency based on whether the scenario is static or kinematic.

It is recommended to log Support+BBSamples to the memory card or computer file.

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

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