Advanced Navigation Solutions

Product-Line Smart Modules:
Quick-Start-Guide for ANavS Embedded lineup

Applicable to:

- M.2 GNSS receiver card with chipset Septentrio Mosaic-X5, -H or -T
- EMB (Ethernet-to-Mosaic Board) with chipset Septentrio Mosaic-X5, -H or -T
- M.2 key E to USB-C adapter

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Abstract

ANavS offers a wide range of positioning modules for precise position, velocity, and attitude information and timing. They can easily be integrated into your application. The M.2 Key E format is a common standard for industrial and Embedded PCs or development. With adapter boards, the cards can be used via USB or Mini PCIe slots on even more devices.

ANavS® GNSS receiver cards are available with the following chipsets:

- Septentrio MOSAIC-X5
- Septentrio MOSAIC-H (Heading-Version)
- Septentrio MOSAIC-T (Timing-Version)

The following guide provides a short description of how to connect with the receiver. Further details can be found on the website in the documentation of the corresponding GNSS chips (Mosaic [AD-01]).

Typographical Conventions

`abc -param`	Command-line instructions, e.g., in shell
abc -param	MSRTKF command-line instructions

List of Acronyms

Document Change Log

Issue	Revision	Sections Affected	Details of Change
1	0	All	The initial version of the document.
1	1	M.2 to USB-C adapter M.2 Mosaic Receiver Card	Added additional information
1	2	1.4	Corrected voltage for pin 8 (TP_FROM_MOD/UART_CTS)
1	3	All	Removed ublox-chipset from guide

Applicable Documents

Applicable documents are to be considered an integral part of this document. Applicable documents listed below are referred to as AD-n in this document. The latest revision of the document applies unless specified otherwise.

ID	Document Title	Reference/Link	Version

AD-01	mosaic-X5 Firmware v4.14.0 Reference Guide: Document describes the interfaces, messages, formats, etc. for the Mosaic chipsets	https://www.septentrio.com/en/products/gps/gnss-receiver-modules/mosaic-x5#resources	4.14.0
AD-02	u-blox F9 HPG L1L5 1.40 Interface description: Document describes the interfaces, messages, formats, etc. for the u-blox chipsets	https://www.u-blox.com/en/product/zed-f9p-module?legacy=Current#Documentation-&-resources	1.40

Content

1. M.2 Mosaic Receiver Card

The M.2 Mosaic Receiver Card (M2_Mosaic) comes in an M.2 key-E compatible form factor.

It can be directly used in industrial and embedded PCs, or development boards, providing a large enough M.2 Key E slot. Over the slot, USB and UART as communication interfaces, power supply, and some additional signals like a pulse-per-second (PPS) signal, are usable.

The M.2 card is available in three variants:

- M.2_MOSAIC-X5 with the Septentrio Mosaic-X5 chipset
- M.2_MOSAIC-H with the Septentrio Mosaic-H chipset (Heading)
- M.2_MOSAIC-T with the Septentrio Mosaic-T chipset (Timing)

Refer to section 4.4 for a detailed guide on how to use the Mosaic Receiver Card after being connected to a processor.

1.1. Electrical Specifications

Power	Power consumption max 2.3 W, typ 1.8 W V_{IN} = 3.3 V on the VCC_3p3 pins
Temperature range	-40 … +85 °C
GNSS antennas	LNA supply: 4.5 – 5 V, max. 150 mA Single-antenna modules (-X5 and -T): 15-50 dB (AGC gain: 15-50dB) Dual-antenna modules (-H): 15-35dB (AGC gain: 30-50dB) ESD protection

1.2.Connectors

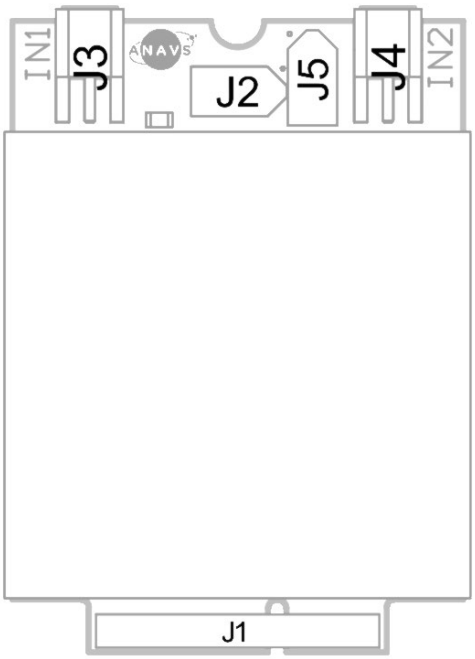

Figure 1 Connectors on the M2_Mosaic

1.2.1. Coaxial connectors

The card has up to two MMCX ports (J3 and J4). Depending on the chipset, the one (for -X5 variant) or two (for -H and -T variant) MMCX-coaxial connectors J3 and J4 have different functions:

	Mosaic-X5	Mosaic-H	Mosaic-T
IN 1 (J3)	GNSS Antenna	GNSS 1 Antenna	GNSS Antenna
IN 2 (J4)	Not connected	GNSS 2 Antenna	Ext. clock in

By default, the GNSS Antenna connectors provide DC power for powering external GNSS antenna amplifiers (LNAs).

1.2.2. Edge-connector

You can find the exact pinout of the M.2 edge connector (J1) below. This is mostly compatible with the standard M.2 key E specification, augments it however with an additional PPS out (pin 34), sync (pin 36), and global reset (pin 23) pin:

Pin-Designator	Name
1	GND
2	VCC_3P3
3	USB_D+
4	VCC_3P3
5	USB_D-
6	\LED1_OD
7	GND
8	NC (not connected)
9	NC (not connected)
10	NC (not connected)
11	NC (not connected)
12	NC (not connected)
13	NC (not connected)
14	NC (not connected)
15	NC (not connected)
16	\LED2_OD
17	NC (not connected)
18	GND
19	NC (not connected)
20	NC (not connected)
21	NC (not connected)
22	UART_FROM_MOD_1P8
23	\GLOBAL_RESET_1P8
32	UART_TO_MOD_1P8
33	GND (not connected)
34	TP_FROM_MOD_1P8
35	NC (not connected)
36	TP_TO_MOD_1P8
37	NC (not connected)
38	NC (not connected)
39	GND
40	NC (not connected)
41	NC (not connected)
42	NC (not connected)
43	NC (not connected)
44	NC (not connected)
45	GND
46	NC (not connected)
47	NC (not connected)
48	NC (not connected)
49	NC (not connected)
50	NC (not connected)
51	GND
52	NC (not connected)
53	NC (not connected)
54	NC (not connected)
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56	NC (not connected)
57	GND
58	NC (not connected)
59	NC (not connected)
60	NC (not connected)
61	NC (not connected)
62	NC (not connected)
63	GND
64	NC (not connected)
65	NC (not connected)
66	NC (not connected)
67	NC (not connected)
68	NC (not connected)
69	GND
70	NC (not connected)
71	NC (not connected)
72	VCC_3P3
73	NC (not connected)
74	VCC_3P3
75	GND

1.3. Dimensions

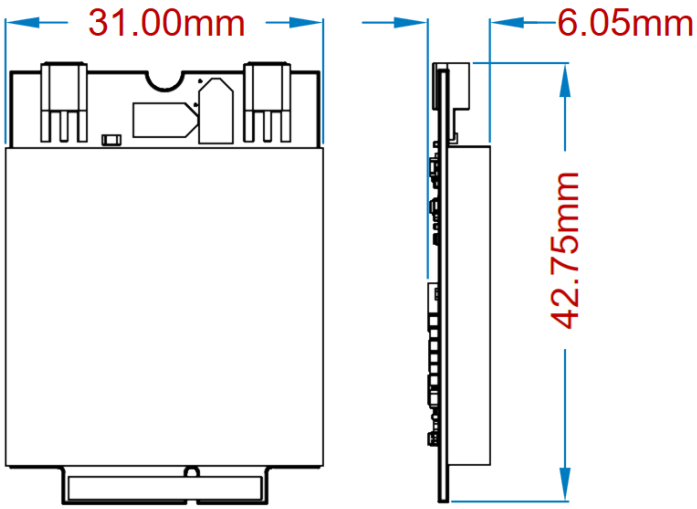


Figure 2 Dimensions for M2_Mosaic (all variants)

1.4. M.2 to USB-C Adapter

To get the maximum out of your M.2 board, ANavS offers several adapter boards (e.g. USB and mini-PCIe).

ANavS offers a compact M.2 to USB-C adapter. This can be used both for rapid development and permanent use. It will forward the USB 2.0 from the M.2 connector to the USB port from which it is also powered.

Figure 3 M.2 Mosaic GNSS receiver board with USB-C Interface board

Some additional signals are available on the GPIO header next to the USB-C port:

Pin	Signal name
1	SDIO wake (output, 1.8 V level)
2	UART_TXD (input, 1.8 V level)
3	GLOBAL_RESET/SDIO_RESET (input, 1.8 V signaling, weak pull-up)
4	UART_RXD (output, 1.8 V signaling)
5	+3.3 V power output
6	TP_TO_MOD/UART_RTS (input, 1.8 V signaling)
7	+5.0 V power output
8	TP_FROM_MOD/UART_CTS (output, 1.8 V signaling)
9	Ground
10	PM_WAKEUP_N/UART_WAKE_N (output, 3.3 V signaling)

Adapter dimensions:

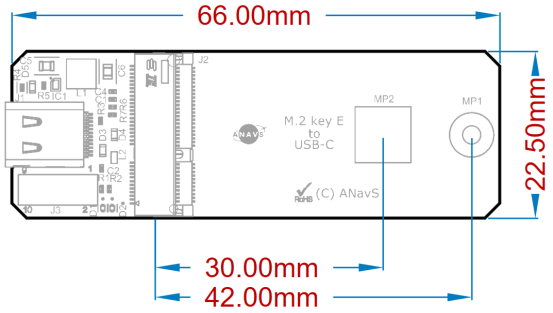


Figure 4 Dimensions of M.2 USB-C adapter

2. EMB (Ethernet-Mosaic Board)

2.1. Electrical Specifications

Power	Power consumption max 2.3 W, typ 1.8 W Voltage Range 4.5 – 28 V
Power-over-ethernet	IEEE802.3af compliant
Temperature range	-40 … +85 °C
GNSS antennas	LNA supply: 4.5 – 5 V, max. 150 mA Single-antenna modules (-X5 and -T): 15-50 dB (AGC gain: 15-50dB) Dual-antenna modules (-H): 15-35dB (AGC gain: 30-50dB) ESD protection

2.2. Interfaces

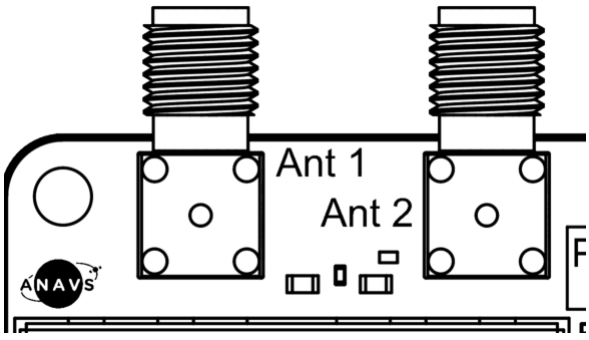
DC-in connector: Power supply for regulated continuous current in nominal range 7-25 V (maximum 4.5 - 28 V)

USB-C connector. For data communication and powering of the module

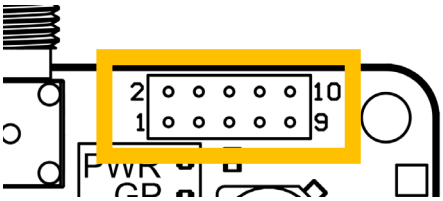
Ethernet port with power-over-ethernet (PoE) capabilities to power the module.

Ant 1: SMA connector for primary GNSS Antenna

Ant 2 (only for Mosaic-H): SMA connector for secondary GNSS Antenna.



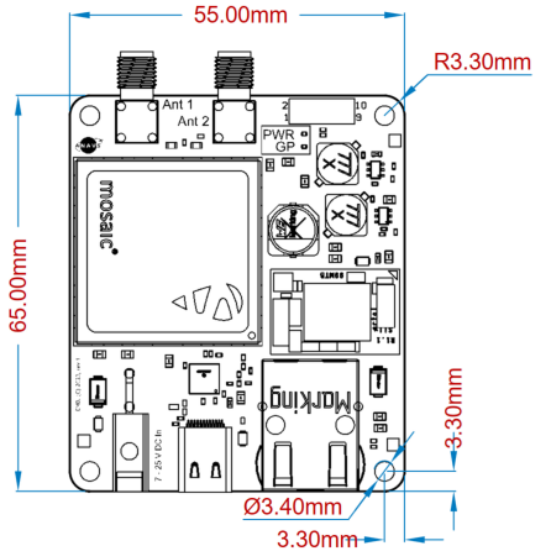
General purpose pin-header

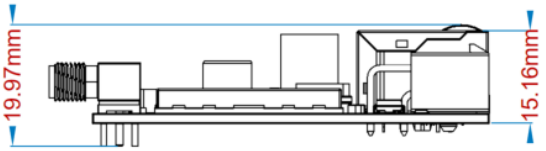


On the general-purpose pin header, different connectors can be attached or soldered on for additional applications.

Pin	Net Name
1	+5V
2	TimeSync_input_1p8
3	GND
4	PPS_output_1p8
5	+3V3
6	GND
7	Led2
8	nRST_IN_3p3
9	UART_from_GNSS_3p3
10	UART_to_GNSS_3p3

2.3. Mechanical Dimensions





2.4. Getting Started

2.4.1. Connect the module via USB-C

The Windows USB driver provided with your receiver emulates two virtual serial ports, which can be used as standard COM ports to access the receiver. The Windows USB driver can be installed through the Septentrio RxTools software suite. On Linux, the standard Linux CDC-ACM driver is suitable. Most terminal emulation programs will make no distinction between virtual and native COM ports. Note that the port settings (baud rate, etc) for virtual serial ports are not relevant, and can be left in their default configuration in the terminal emulation program.

When connecting the USB cable to a Windows PC, a new drive appears in the file manager. This drive contains an installer for the USB driver. Running this installer is not needed if you have already installed the Septentrio RxTools suite.

When a USB cable is connected, the receiver supports Ethernet-over-USB. The IP address allocated to the Ethernet-over-USB interface is 192.168.3.1. That address cannot be changed, so this feature is only to be used when a single receiver is connected to your computer.

By default, the receiver is not allowed to access the Internet over USB. This can be changed with the **setUSBInternetAccess** command [AD-01]. Note that this requires allowing Internet sharing on your computer. The procedure to do so depends on your operating system. For example, on Windows, it involves enabling "Allow other network users to connect through this computer's Internet connection." in the properties of the adapter providing Internet access. When Internet sharing is enabled, the receiver gets its IP address from a DHCP server on your computer. Depending on your computer's routing table, it may be that it is not reachable anymore at 192.168.3.1.

2.4.2. Use via a Web Browser

The receiver can be controlled and configured using a web browser. The hostname or fixed IP address is defined as explained in the previous section.

For example, if your receiver's hostname is mosaic-x5-1234567, simply use the following URL in your preferred web browser:

http://mosaic-x5-1234567

or, for a secure connection:

https://mosaic-x5-1234567

The HTTPS certificate (.pem file) can be uploaded through the Communication > Web Server/TLS menu of the web interface.

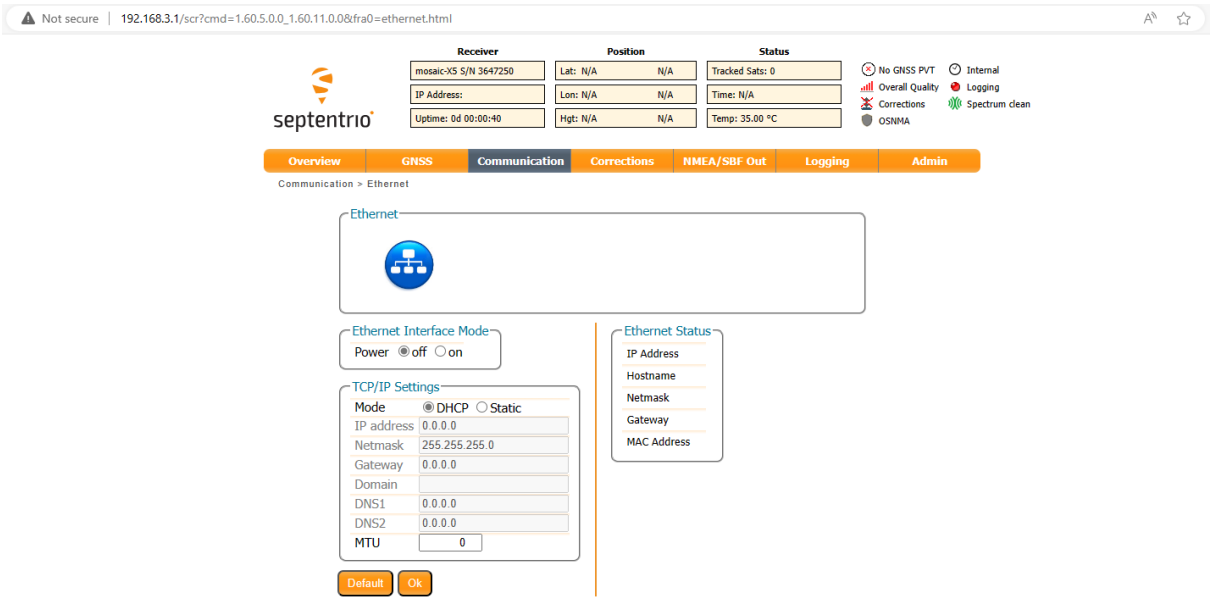
Most user commands described in section 3.2 in [AD-01] can be accessed graphically from the web interface. You can also go to Admin > Expert Control > Expert Console to manually type ASCII commands and view replies.

By default, the web interface provides unrestricted read and write access to the receiver. This can be changed, as further explained in section 1.24 of this document. Note that a lightweight (text only) version of the web interface is available by appending /lite to the URL, for example:

http://mosaic-x5-1234567/lite

2.4.3. Use of the Ethernet port

By default, the Ethernet port is disabled. To enable it, connect the module via USB-C to a computer. You will have to install the Mosaic USB driver which can either be downloaded from the Septentrio website or from the mass-storage which automatically opens when the device is connected. Once the driver is installed, the module will appear as a network interface device with the fixed IP address 192.168.3.1. You can now open the configuration page on your web browser and enable Ethernet in **Communication** -> **Ethernet** -> Ethernet Interface Mode -> Power -> **on**



2.4.4. RTK-Correction data for M.2 to USB-C adapter board

Providing RTK correction data to the module is essential to get the best possible positioning performance. There are some open-source tools, which can stream the correction data, e.g., with your laptop, and provide this stream to one of the virtual COM ports of the M.2 receiver.

A very nice tool for this job is the RTK-Libs streamserver-software package (https://www.rtklib.com/). Please get in contact with the ANavS support team to learn more about this feature and the possibilities.

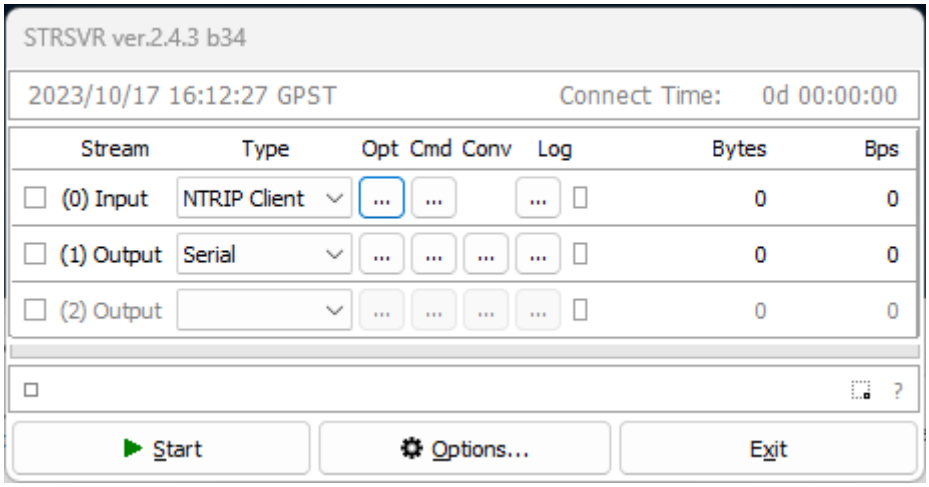


Figure 5: RTK-Lib stream server software for distributing RTK correction data