EMB GNSS Modules

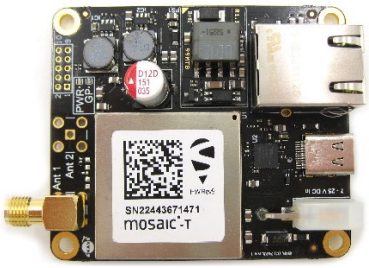
Technical Reference Guide

Advanced Navigation Solutions

Applicable Modules

This document applies to ANavS Ethernet Mosaic Board **(EMB)** modules based around the Septentrio MOSAIC chipset.

EMB MOSAIC-X5	EMB MOSAIC-H	EMB MOSAIC-T
70.40.0.6.4.00	70.40.0.6.5.00	70.40.0.6.6.00



Contents

History

Version	Date	Description
1.0	14.02.2025	First issue

External Reference Documents

Document	Link	version
mosaic-X5 Firmware v4.14.4 Reference Guide	https://www.septentrio.com/en/products/gps/gnss-receiver-modules/mosaic-x5#resources	4.14.10
mosaic-H Firmware v4.14.4 Reference Guide	https://www.septentrio.com/en/products/gps/gnss-receiver-modules/mosaic-h#resources	4.14.10
mosaic-T Firmware v4.14.4 Reference Guide	https://www.septentrio.com/en/products/gps/gnss-receiver-modules/mosaic-t#resources	4.14.10

1 Module Variants Overview

ANavS Ethernet Mosaic Board (EMB) modules are available in three variants. These are based on the MOSAIC family of GNSS receivers. The MOSAIC-X5 modules provide the base level of features with the -H and -T modules providing specialized capabilities and features.

All variants are quad band GNSS receivers and capable of receiving current and future signals across all constellations.

EMB-X5	EMB-H	EMB-T
P/N: 70.40.0.6.4.00	P/N: 70.40.0.6.5.00	P/N: 70.40.0.6.6.00
Small sized with outstanding performance. High update rates (up to 100 Hz) and low latency, both are crucial for control systems of any type of autonomous applications. High accuracy centimeter level positioning. Multi-constellations and multifrequency. Ideal for positioning and surveying applications	H-variant provides dual GNSS antenna input for precise, reliable and positioning independent heading information in addition to the X5.	T-variant provides high-precision solution for time and frequency synchronization under challenging conditions such as during GNSS jamming or spoofing. Furthermore, the receiver provides a 10MHz Clock input for improved stability and performance.

2 GNSS Performance

GNSS bands

GPS:	L1C/A, L1C, L1PY, L2C, L2P, L5
GLONASS:	L1CA, L2CA, L2P, L3 CDMA
Beidou:	B1I, B1C, B2a, B2I, B311
Galileo:	E1, E5a, E5b, E5 AltBoc, E611
QZSS:	L1C/A, L1C, L2C, L5, L611
Navic:	L5
SBAS:	Egnos, WAAS, GAGAN, MSAS, SDCM (L1, L5)

On module L-band

Accurate RTK Positioning (1σ)	
Horizontal accuracy	0.006 m ± 0.5 ppm
Vertical accuracy	0.010 m ± 1 ppm
Accurate Attitude* (1σ)	
1m antenna spacing	
Roll and Pitch	0.25°
True Heading	0.15°
5m antenna spacing	
Roll and Pitch	0.05°
True Heading	0.03°
* Performance when using dual antenna on MOSAIC-H Modules	
Velocity Accuracy	0.03 m/s RMS
Maximum update rate:	
Measurements only	100 Hz
Position	100 Hz
For the EMB-H variant:	
Standalone, SBAS, DGPS + attitude	50 Hz
RTK + attitude	20 Hz
Latency	< 10ms
Time precision	
xPPS out	5 ns
Event accuracy	< 20 ns
Time to first fix	
Cold start9	< 45 s
Warm start10	< 20 s
Re-acquisition	1 s
Tracking performance (C/N0 threshold)	
Tracking	20 dB-Hz
Acquisition	33 dB-Hz

3 Getting Started

3.1 Driver

The ANavS EMB modules use the drivers provided by Septentrio for the MOSAIC family of receivers. These can be found from on the Septentrio website:
https://customersupport.septentrio.com/s/article/How-to-install-the-drivers

3.2 Connect the module via USB-C

The Windows USB driver provided with your receiver emulates 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. 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.

3.3 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.

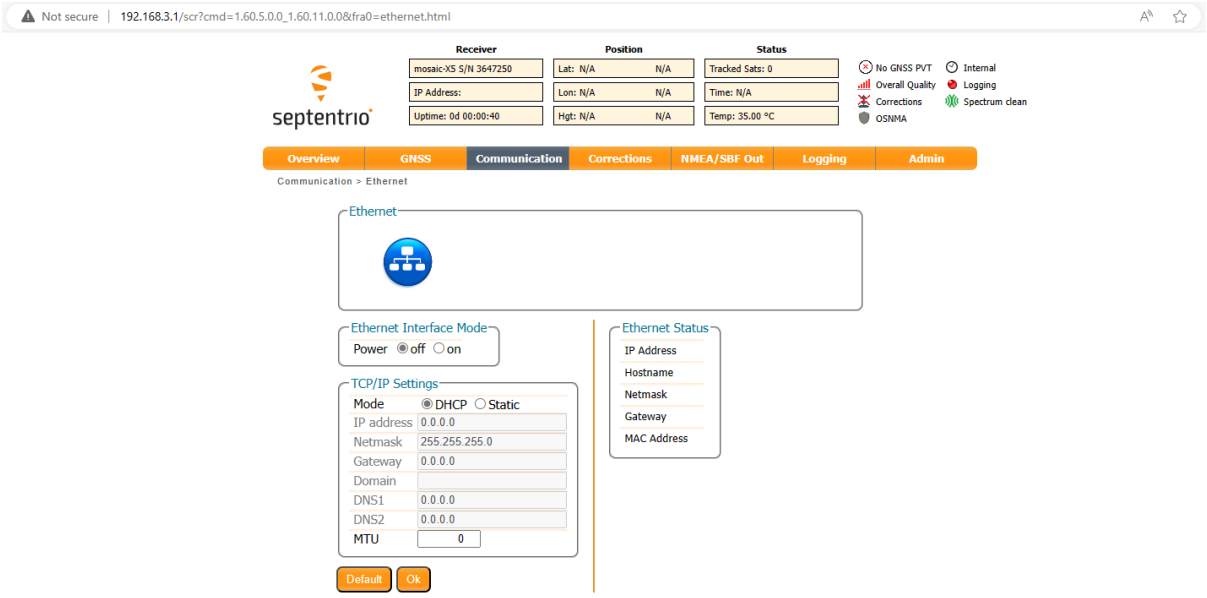
Most user commands described in section 3.2 in [**Fehler! Verweisquelle konnte nicht gefunden werden.**] can be accessed graphically from the web interface. You can also go to Admin > Expert Control > Expert Console to manually type ASCII commands and view replies.

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

3.4 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**



4 Interfaces

DC-in connector: Power supply for regulated continuous current in nominal range 7-25 V (maximum 4.5 - 28 V). The connector is a Molex 26-01-3114. It can be mated e.g., with Molex 2451350220 or other Molex Mini-Fit Jr. family products

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

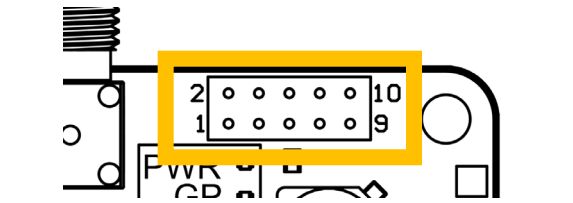
Ethernet port with power-over-ethernet (PoE) capabilities to power the module.

Ant 1: SMA connector for primary GNSS Antenna

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

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



5 Electrical

5.1 Electrical Specification

The EMB has 3 methods of powering, USB type-C, DC header, and Power over Ethernet (PoE). Power consumption of the EMB module varies slightly depending on the current activity state, and which signals are actively being used.

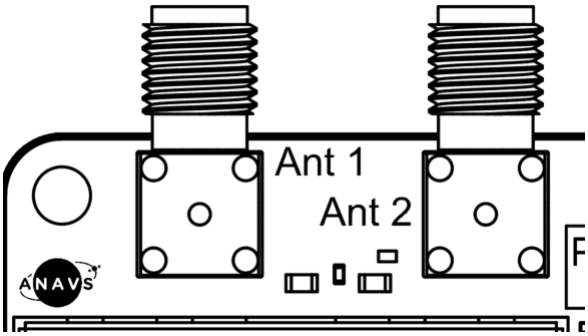
Power	Power consumption max 2.3 W, typ 1.8 W Voltage Range 4.5 – 28 V

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

5.2 Coax Connectors

ANavS smart GNSS cards have up to two SMA coaxial Interfaces (Ant 1 and Ant 2). Depending on the chipset, these connectors serve different functions:

	EMB-X5 and EMB-T	**EMB-H**
Ant 1	GNSS Antenna	GNSS Antenna 1
Ant 2	Not available	GNSS Antenna 2



5.2.1 LNA

A DC voltage is available via the one or two coax connectors to power low noise amplifiers (LNA) inside the GNSS antenna. The LNA supply is **4.5 – 5 V,** interlay limited to **150 mA.**

The MOSAIC chipset only provides LNA on one output (Ant 1). This is routed to the LNA output to both coax antenna connecters Ant 1 and Ant 2. The total power budget for the LNA is supplied is thus shared between both antennas, with the combined total current limit of 150mA.

In the case of an overcurrent event, such as a shorted antenna cable, the current is first limited to 150mA and the disabled after 10ms. The module will attempt to reenable the LNA supply periodically to check if the short condition is resolved.

5.2.2 Pre-amplification Gain Range

Pre-amplification for the onboard MOSAIC chipset is specified for an input gain range of 15-50 dB for Single Antenna modules (EMB-X,-T) and 15-35 dB for Dual antenna modules (EMB-H).

As defined by Septentrio, it is recommended that attenuators are used if pre-amp gain is higher than 35dB.

It is also noted that pre-amps gain should not differ more than 5dB. Ideally both IN1 and IN2 should have the same model of antenna where possible similar lengths of antenna cable.

5.3 Pulse Per Second (PPS)

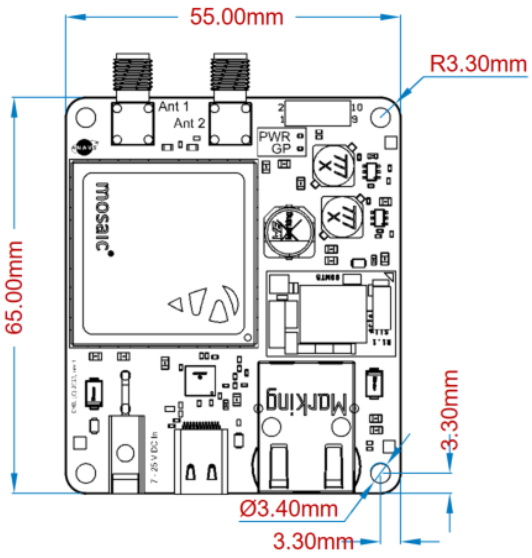
A time pulse input and output are available on pins 2 and 4, respectively. The Logic level of these pins is 1.8V.

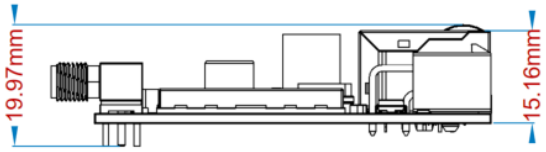
The time pulse input is routed through to EVENTA (pin AC6) on the MOSAIC. This pin can be used to tag external event with a time resolution of 20 ns.

The PPS out is directly connected to the PPSO (pin AC8). The pin pulses high for 1ms when powered on. It stays at high impedance while the module starts up, after which the PPS is output by pulsing high for 5ms every second.

For details on the use of these pins we refer to the MOSAIC Hardware Manual. This can be found in the External Reference Documents section.

6 Dimensions





Any questions?

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