



AsteRx-m

Product Family Hardware Manual

Version 3.3.0



AsteRx-m Product Family Hardware Manual

Version 3.3.0

December 21, 2016

© Copyright 2000-2016 Septentrio nv/sa. All rights reserved.

Septentrio
Greenhill Campus, Interleuvenlaan 15i
3001 Leuven, Belgium

<http://www.septentrio.com>
support@septentrio.com
Phone: +32 16 300 800
Fax: +32 16 221 640
 @septentrio

1 Table of contents

1	TABLE OF CONTENTS.....	3
2	ASTERX-M OEM	7
2.1	Receiver Dimensions.....	8
2.2	Connector Types	8
2.3	Physical and Environmental	9
2.4	Power Consumption.....	9
2.5	Antenna Selection	9
2.6	30-pin Connector	10
2.7	SD Memory Card Usage	11
2.8	Power Down	13
3	ASTERX-M EVALUATION BOARD.....	14
4	ASTERX-M UAS	16
4.1	Connectors	17
4.2	Power Supply Options.....	17
4.3	LEDs.....	18
4.4	Temperature Range.....	18
4.5	Schematics	18
	APPENDIX A LED STATUS INDICATORS.....	20

ROHS/WEEE NOTICE



Receivers of the AsteRx-m family comply with European Union (EU) Directive 2002/95/EC on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS Directive).



Receivers of the AsteRx-m family comply with the European Union (EU) Directive 2002/96/EC on waste electrical and electronic equipment (WEEE). The purpose of this Directive is the prevention of waste electrical and electronic equipment (WEEE), and in addition, the reuse, recycling and other forms of recovery of such wastes so as to reduce the disposal of waste. If purchased in the European Union, please return the receiver at the end of its life to the supplier from which it was purchased.

SAFETY INFORMATION



Statement 0000/WARNING: IMPORTANT SAFETY INSTRUCTIONS

This warning symbol means danger and indicates that you are in a situation that may result in body injury and physical damage. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and familiarize yourself with standard practices for preventing accidents. Use the statement number provided at the beginning of each warning to locate its translation in the translated safety warnings that accompanied this device.



Statement 0001/WARNING: The power supply provided by Septentrio (if any) should not be replaced by another. If you are using the receiver with your own power supply, it must have a double isolated construction and must match the specifications of the provided power supply.



Statement 0003/WARNING: Ultimate disposal of this product should be handled according to all national laws and regulations.



Statement 0005/WARNING: The equipment and all the accessories included with the product may only be used according to the specifications in the delivered release note, in the manual and in all other documents delivered with the receiver.



Statement 0007/WARNING: Never place the equipment in direct sunlight.

WARNING: Handling of ESD Sensitive Devices

Electrostatic discharge is a sudden flow of current from one object to another either object or to ground. Electrostatic charges can accumulate on common items such as polystyrene drinking cups, cellophane tape, synthetic clothing, untreated foam packaging material, and untreated plastic bags and work folders, to name but a few.

Electronic components and assemblies, such as Septentrio OEM receivers, can be permanently damaged or destroyed when near or in contact with electro-statically charged objects. When you handle components or assemblies that are not in protective bags and you are not sure whether they are static-sensitive, assume that they are static-sensitive and handle them accordingly.



Everyone who is working with ESD-sensitive devices must be aware of these rules.

General rules

Always test your ground strap, bench mat, conductive work surface, and ground cord before either removing components and assemblies from their protective bags or before beginning any disassembly or assembly procedures. Perform all service procedures in a static-protected environment. Always use techniques and equipment designed to protect personnel and equipment from electrostatic discharge.

Handling

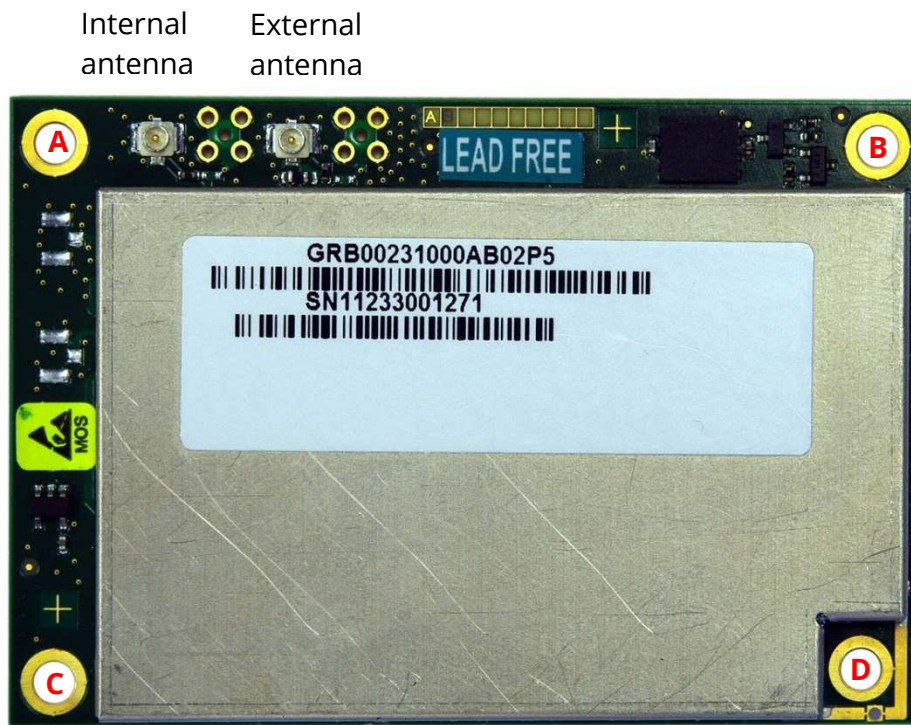
- Remove static-sensitive components and assemblies from their static-shielding bags only at static-safe workstations - a properly grounded table and grounded floor mat - and only when you are wearing a grounded wrist strap (with a resistor of at least 1 mega-ohm in series) or other grounding device. Avoid having non-ESD safe material on the workbench. Clear the work station of static generators like e.g. polyethylene, vinyl's, foam, notebooks, document holders, etc.
- Use only grounded tools when manipulating static-sensitive components and assemblies.
- Place and seal static-sensitive components and assemblies in their original static-shielding bags before removal from static-protected areas.
- Stacking of board assemblies should be avoided to prevent physical damage to devices.

Transport & Storage

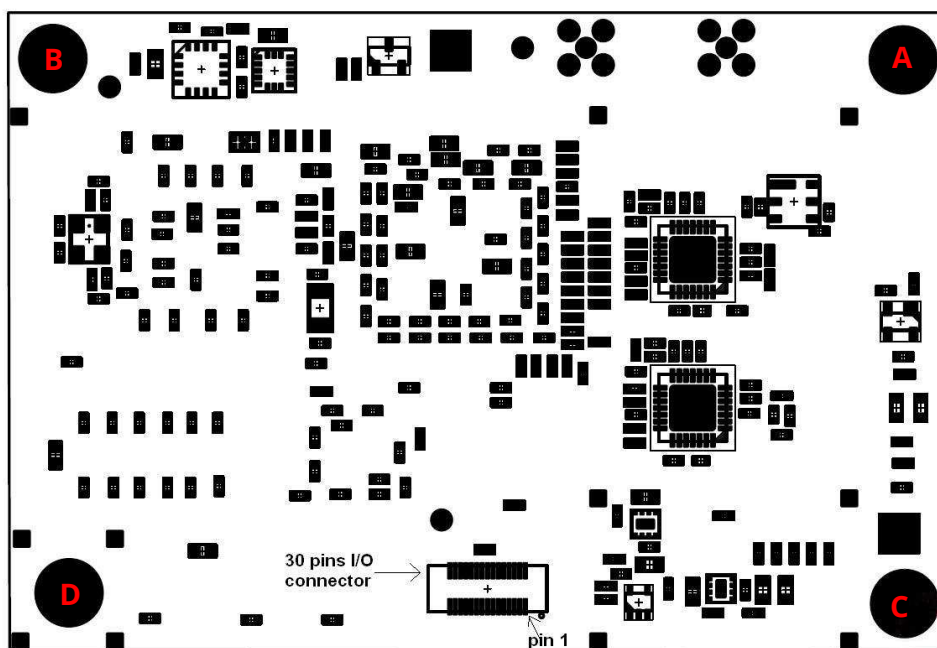
- Limit as much as possible the manipulation of ESD-sensitive devices and components.
- Handle ESD-sensitive parts as far as possible in their (original) protective packaging.
- Protect ESD-sensitive components against dust as this is a possible carrier of static loads. Assembled printed circuit boards (PCB's) must always be placed in an anti-static shielding bag, box or PCB containers during transport between workplaces or to a warehouse.

2 AsteRx-m OEM

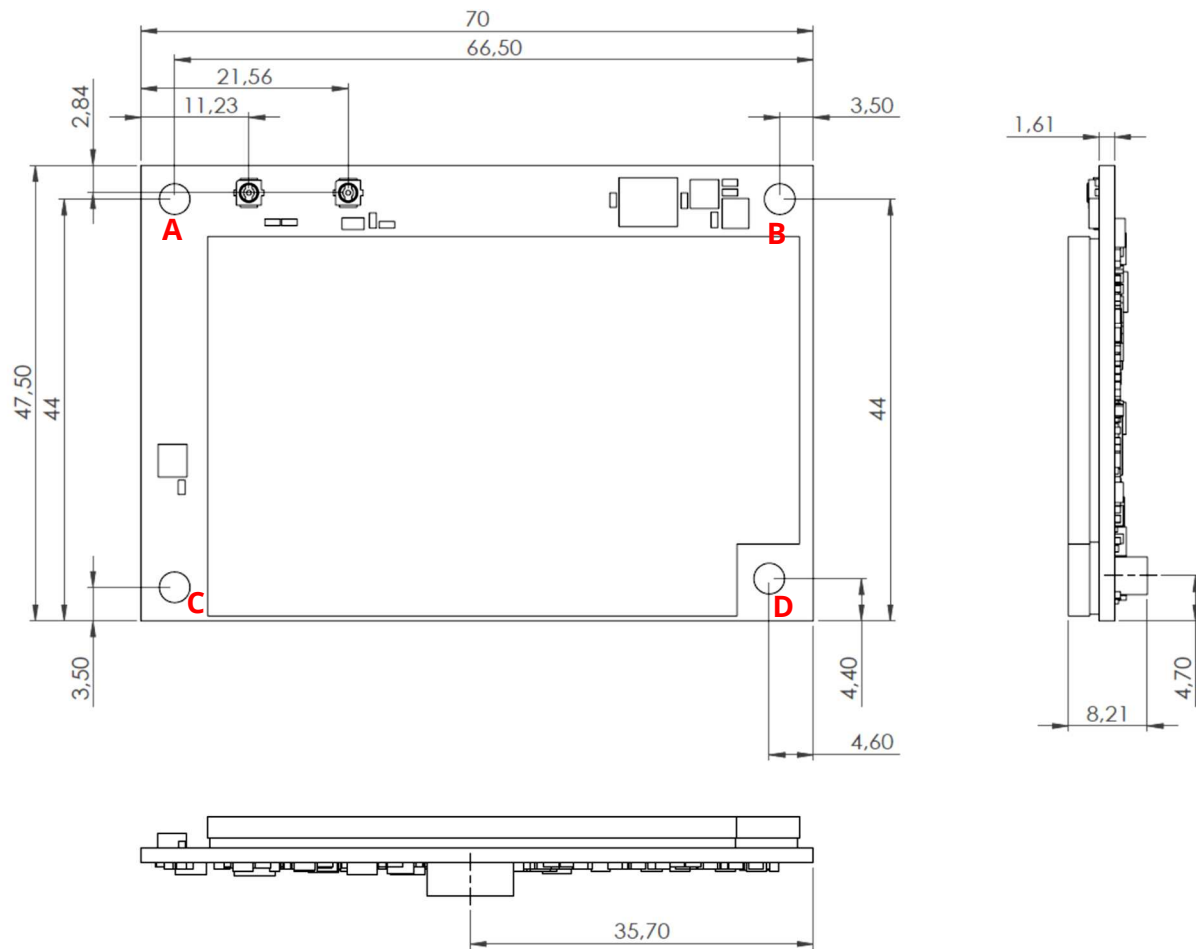
Top View



Bottom View



2.1 Receiver Dimensions



All dimensions in millimeters.

Mounting holes (marked A,B,C,D above): Diameter: 3.2mm
Outer ring diameter: 5mm

Weight: 26.7g

2.2 Connector Types

RF connectors: U.FL

Digital connector: 30-pin DF40C-30DS-0.4V(51). Pin 1 is indicated in the bottom view picture. Pin 2 is above pin 1, etc. The mated stacking height is 3.5mm.

2.3 Physical and Environmental

Input supply voltage	3.3V +/- 5%
Antenna supply voltage	3-6V
Maximal antenna current	200 mA per RF connector (built-in current limit)
Antenna gain range	External antenna input connector: 10-40dB Internal antenna input connector: 10-30dB
Antenna input impedance	50 Ohms
Operating Temperature Range	-40 to 85 deg C

2.4 Power Consumption

The power consumption lies between 350mW and 600mW depending on the set of GNSS signals enabled by the “**setSignalTracking**” command.

The following table shows the typical power consumption for selected sets of signals.

Signals enabled with the setSignalTracking command	Power Consumption
GPSL1CA+GEOL1	350 mW ⁽¹⁾
GPSL1CA+GEOL1+GLOL1CA	400 mW ⁽²⁾
GPSL1CA+GPSL2PY+GPSL2C+GEOL1	500 mW ⁽¹⁾
GPSL1CA+GPSL2PY+GPSL2C+GEOL1+GLOL1CA+GLOL2CA	600 mW ⁽²⁾

(1) Assuming an average of 12 satellites in tracking (GPS+SBAS)

(2) Assuming an average of 20 satellites in tracking (GPS+GLONASS+SBAS)

2.5 Antenna Selection

By default, the receiver automatically switches to the external antenna when an active antenna is detected on the external antenna input connector. Detection is based on the monitoring of the current drawn from the external antenna connector. When that current exceeds 6mA, an active antenna is assumed to be connected and the receiver switches to the external connector.

This default operation can be overruled with the command **setAntennaConnector**.



If your external antenna is not powered by the receiver, automatic detection will fail. A typical case when this can happen is when the receiver is connected to a power splitter and not directly to the antenna.

In such case, you must enter the command “**setAntennaConnector, Ext**” to guarantee correct operation.



Likewise, when connecting the external antenna connector to a GNSS signal simulator, you must enter the command “**setAntennaConnector, Ext**” to make sure the receiver is using the external antenna connector.

2.6 30-pin Connector

The I/O connector is the Hirose 30 pins DF40HC(3.5)-30DS-0.4V(51) connector.

The mating connector is Hirose DF40C-30DP-0.4V(51) which is available from Digikey (order number H11622CT-ND).

Pin	Description	Pin	Description
1	Vin: 3.3V +/- 5%	2	Vin: 3.3V +/- 5%
3	GND	4	GND
5	USB_D+	6	USB_D-
7	USB_VBUS	8	nRST
9	TX1	10	RX1
11	GND	12	1PPS_OUT
13	TX2	14	RX2
15	TX3	16	RX3
17	GND	18	VANT
19	evtA	20	nPDN
21	Reserved	22	GPLED
23	GND	24	SPI1_nCS1
25	Button	26	SPI1_SCK
27	LOGLED	28	SPI1_MOSI
29	GND	30	SPI1_MISO

Conventions:

- Pin Type: I=Input, O=Output, P=Power, LVTTL=3V3 Low Voltage TTL.
- LVTTL means $V_{IL} \leq 0.8V$, $V_{IH} \geq 2.0V$, $V_{OL} \leq 0.4V$, $V_{OH} \geq 2.4V$.
- PU: pulled up
- The shaded pins are only available from board revision 07. The board revision can be checked on the board label, e.g. GRB00231000AC**07**xx.

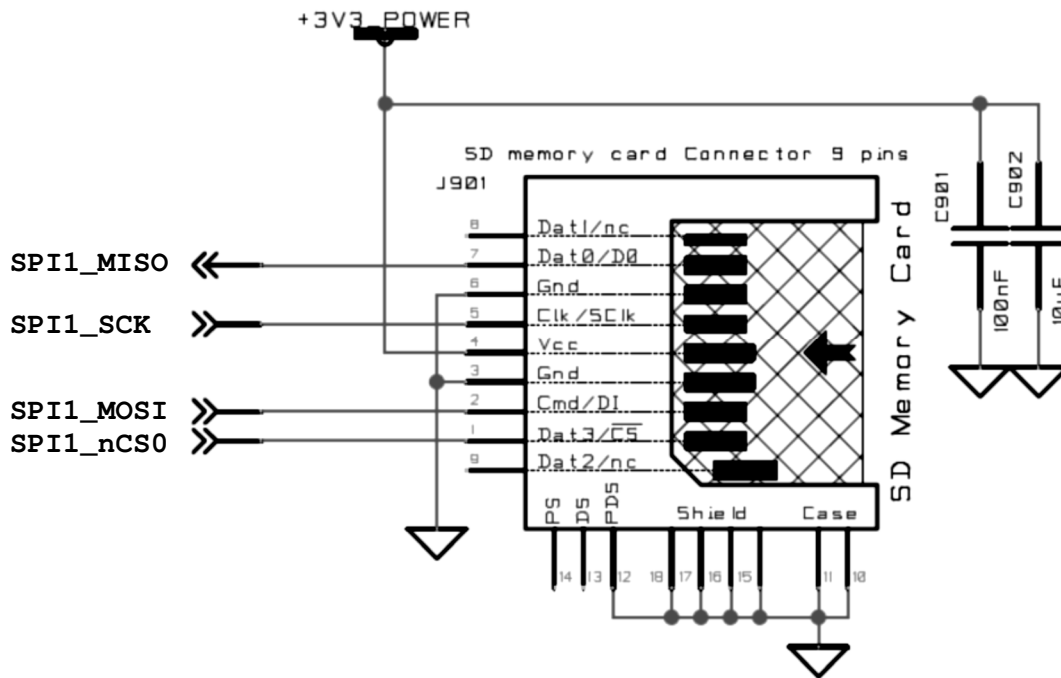
Pin#	Name	Type	Level	Description	Connection Tips
1	Vin	P	3.3V +/-5%	Main power supply input	Both Vin pins (pin#1 and pin#2) must be tied together.
3	GND	Gnd	0	Ground.	All ground pins must be connected.
5	USB_D+	I/O	USB	USB data signal positive D+.	Leave unconnected if USB not used.
7	USB_Vbus	I	4.35V ≤ V ≤ 5.25V	USB VBUS.  This pin cannot be used to power the receiver!	Leave unconnected if USB not used.
9	TX1	O	LVTTL	Serial COM 1 transmit line (inactive state is high)	Leave unconnected if not used.
11	GND	Gnd	0	Ground.	All ground pins must be connected.
13	TX2	O	LVTTL	Serial COM 2 transmit line (inactive state is high)	Leave unconnected if not used.
15	TX3	O	LVTTL	Serial COM 3 transmit line (inactive state is high)	Leave unconnected if not used.
17	GND	Gnd	0	Ground.	All ground pins must be connected.
19	evtA	I, PU	LVTTL	Event A input (see Firmware User Manual for operation instructions)	Leave unconnected if not used.
21	Reserved			Reserved	Leave unconnected.
23	GND	Gnd	0	Ground.	All ground pins must be connected.
25	Button	I, PU	LVTTL	Input can be connected to a push button used to control SD card logging. Low state is interpreted as "button pressed". See section 2.7 for details.	Debouncing must be done externally (no debouncing circuit on board). Leave unconnected if not used (internally pulled up with 10k).

27	LOGLED	O	LVTTTL	Internal logging status indicator, see Appendix A.	Leave unconnected if not used. Max output current: 8mA.
29	GND	Gnd	0	Ground.	All ground pins must be connected.

Pin#	Name	Type	Level	Description	Connection Tips
2	Vin	P	3.3V +/-5%	Main power supply input	Both Vin pins (pin#1 and pin#2) must be tied together.
4	GND	Gnd	0	Ground.	All ground pins must be connected.
6	USB_D-	I/O	USB	USB data signal negative D-.	Leave unconnected if USB not used.
8	nRST	I, PU	LVTTTL	Reset input, active negative. Receiver resets when driven low.	Leave unconnected if not used.
10	RX1	I	LVTTTL	Serial COM 1 receive line (inactive state is high).	Pull up to 3.3V if not used.
12	PPSout	O	LVTTTL	PPS output. Polarity and rate user selectable. See Firmware User Manual for operation instructions. Pulse duration: 3ms.	Leave unconnected if not used.
14	RX2	I	LVTTTL	Serial COM 2 receive line (inactive state is high).	Pull up to 3.3V if not used.
16	RX3	I	LVTTTL	Serial COM 3 receive line (inactive state is high).	Pull up to 3.3V if not used.
18	VANT	P	0< VANT < 6V	Antenna supply, max current per antenna 200mA. The voltage provided on this pin is transferred to the central conductor of the two antenna connectors.	Typically tie to Vin pins to provide a 3.3V voltage to the antenna.
20	nPDN	I, PU	LVTTTL	Receiver is shut down (low power mode) when driven low. It is recommended to keep nPDN low for at least 5 seconds to ensure complete power-down. ⚠ This functionality is not available on old board revisions. See section 2.8 for details.	Leave unconnected if not used. See section 2.8 if you need to implement the nPDN functionality on GRB00231000AB03xx or GRB00231000AB04xx.
22	GPLED	O	LVTTTL	General purpose LED, see Appendix A.	Leave unconnected if not used. Max output current: 8mA.
24	SPI1_nCS0	O	LVTTTL	SPI1 chip select. Can be connected to an external SD memory card, see section 2.7.	Leave unconnected if not used.
26	SPI1_SCK	O	LVTTTL	SPI1 clock. Can be connected to an external SD memory card, see section 2.7	Leave unconnected if not used.
28	SPI1_MOSI	O	LVTTTL	SPI1 MOSI. Can be connected to an external SD memory card, see section 2.7	Leave unconnected if not used.
30	SPI1_MISO	I	LVTTTL	SPI1 MISO. Can be connected to an external SD memory card, see section 2.7	Leave unconnected if not used.

2.7 SD Memory Card Usage

The receiver can interface to an external SD memory card through pins 24, 26, 28 and 30. The recommended circuit to a 9-pin SD memory card socket is shown below.



The receiver is compatible with SD cards of up to 32GB. The file system is FAT32.

Shortly driving the button pin (pin#25) low toggles SBF and NMEA logging on and off. Driving the button pin low for at least 5 seconds unmounts the SD card if it was mounted, or mounts it if it was unmounted. The SD card mount status can be checked with the LOGLED pin (see Appendix A).

To avoid data corruption, the SD card needs to be unmounted (i.e. the LOGLED must be off) before turning off the power supply. This can be done in two ways:

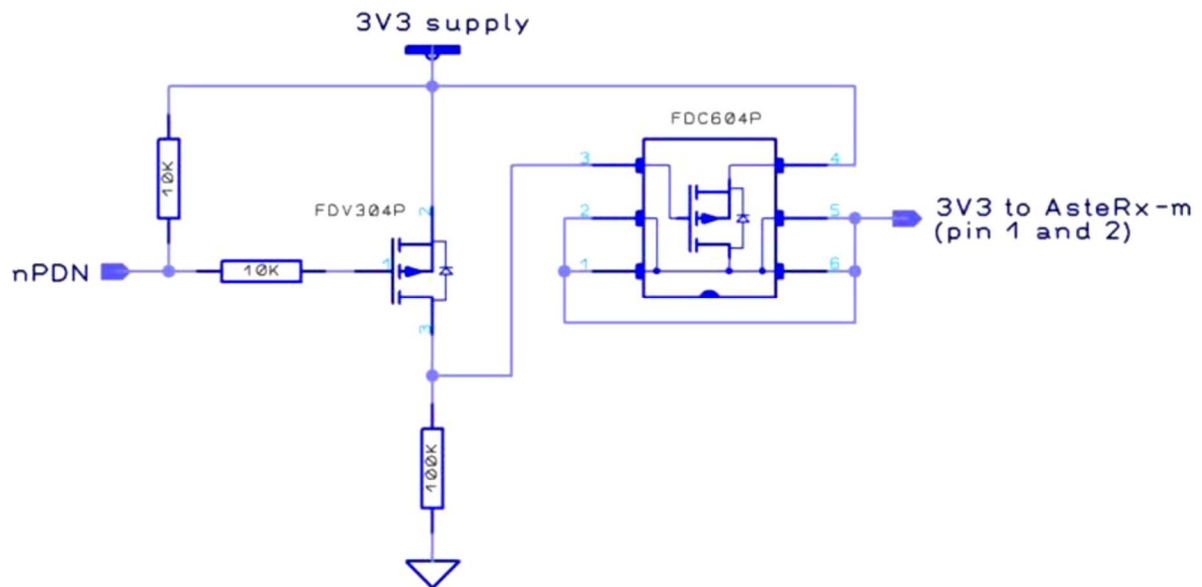
1. By entering the **"exePowerMode, StandBy"** command before turning off the receiver.
2. By driving the button pin (pin#25) low for at least 5 seconds before turning off the receiver.

All log files are stored in the directory /ssn/SSRC5 on the SD card.

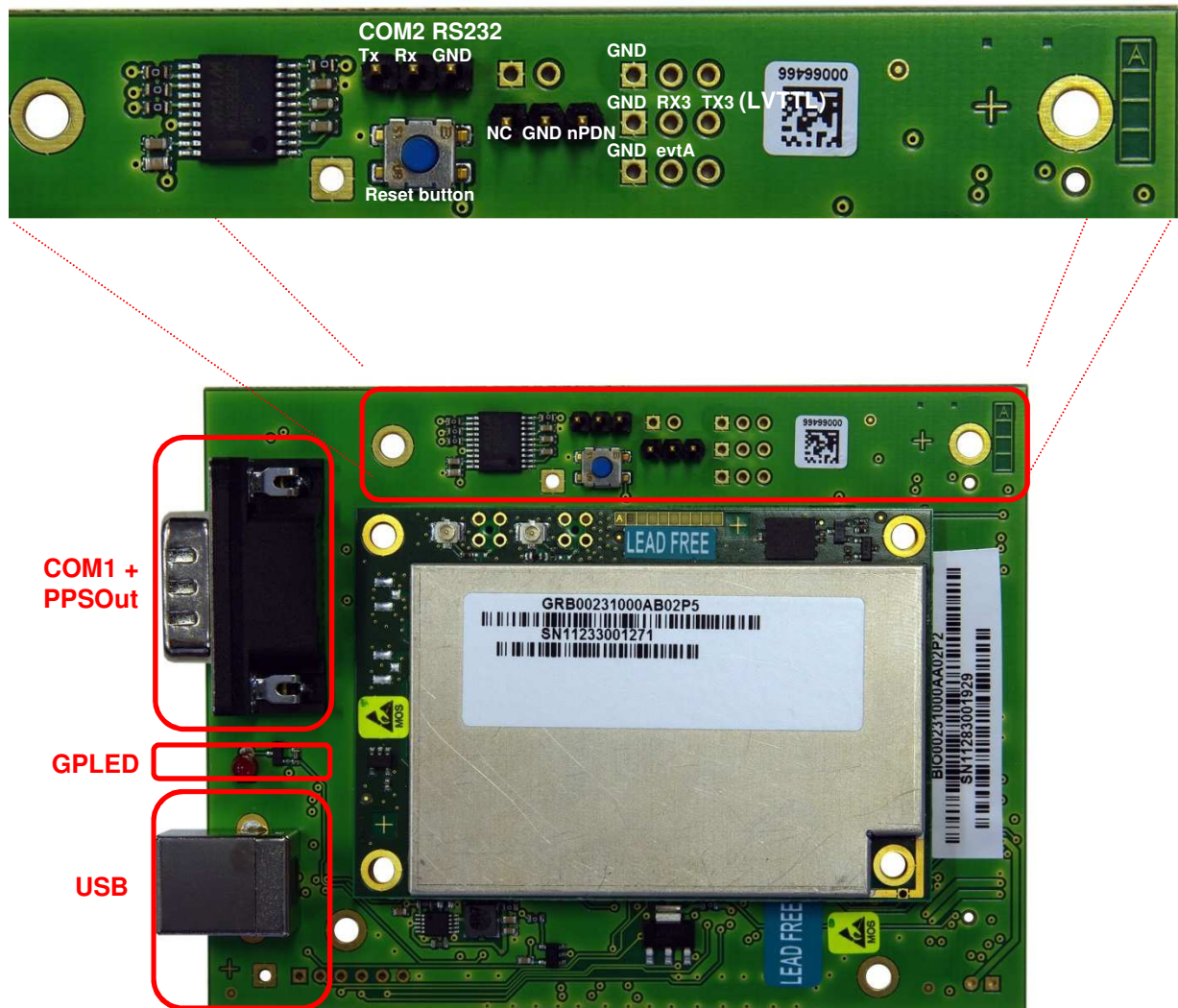
2.8 Power Down

The nPDN pin (pin#20) is not functional on older board versions (versions GRB00231000AB03xx and GRB00231000AB04xx). The board version is printed on the board label.

In case you need the nPDN functionality and it is not available in your particular version of the board, we recommend implementing the following circuit:



3 AsteRx-m Evaluation Board



In a typical configuration, connect the USB connector to your PC using a standard USB cable, and connect your antenna to one of the antenna connectors of the AsteRx-m OEM board.

The evaluation board is powered from the PC through the USB connector. No external power supply is required.

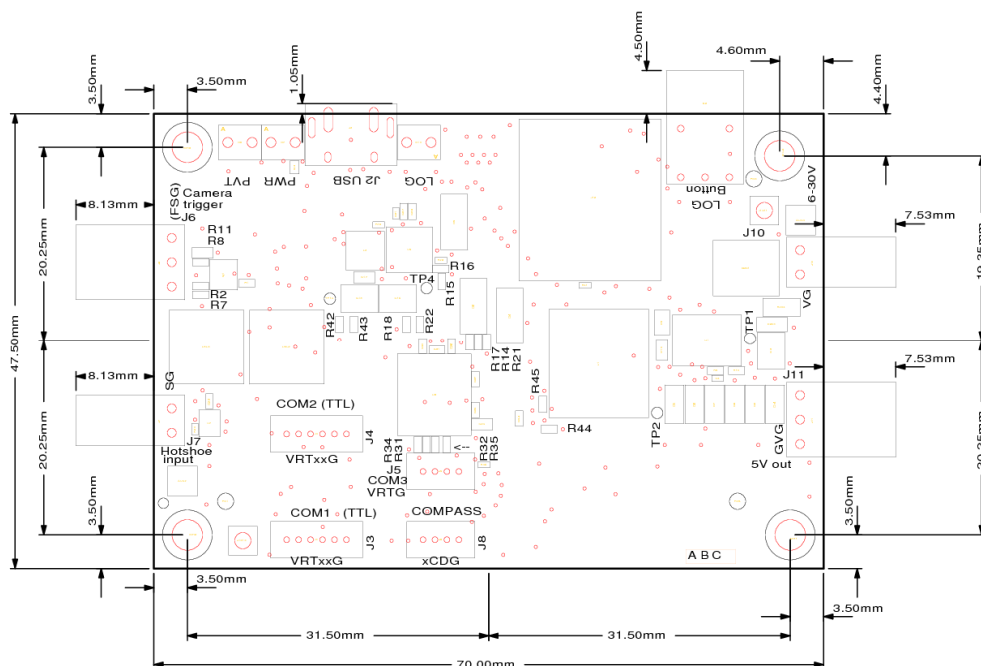
The COM1 subD-9 connector can be used to communicate with the receiver's COM1 serial port. Only the Receive (pin#2) and Transmit (pin#3) lines of the subD-9 connector are functional. The electrical level is RS232.

COM2 and COM3 are available on 3-pin headers. COM2 is at RS232 level and COM3 at LVTTTL level. See picture above for a description of the header pins. Note that the headers may not be mounted on your evaluation board.

The PPS Out signal (3.3V LVTTTL) is available from pin#9 of the subD-9 connector.

The DC voltage at the antenna connectors is set to 3.3V.

The AsteRx-m UAS consists of an AsteRx-m receiver board mounted on an interface card specifically designed for easy integration in UAS (Unmanned Aerial Systems) and mobile mapping applications. This chapter provides information on the interface card only. Refer to chapter 2 for the specifications of the AsteRx-m receiver board.



4.1 Connectors

ID	Type	Description	Usage Example
J1	30-pin DF40C	Connector to the AsteRx-m board	
J2	Micro B USB	USB interface to AsteRx-m	Connect to laptop or PC to power the board and control the AsteRx-m.
J3	DF13-6P-1.25DSA	COM1 TTL UART from AsteRx-m. Pin#1 is a 5V power input	Connect to the GPS-port of a Pixhawk (compatible with standard Pixhawk cables)
J4	DF13-6P-1.25DSA	COM2 TTL UART from AsteRx-m.	
J5	DF13-4P-1.25DSA	COM3 TTL UART from AsteRx-m. Default TTL, but RS232 possible via solder jumper.	
J6	.1" RA Header 1x3	Pin#2 is connected to ground for 30ms starting at the rising edge of the PPS pulse from the AsteRx-m. Otherwise it is floating.	This feature can be used to control a camera trigger from the PPS output signal of the AsteRx-m.
J7	.1" RA Header 1x2	3.3V-LVTTL event input. Connects to the EVENT pin of the AsteRx-m receiver through an inverter. A high-to-low transition at J7 connector level corresponds to a low-to-high transition at AsteRx-m level and vice versa.	This header can be connected to the flash port of a camera (e.g. via Hot Shoe or Prontor-Compur interface), to allow the AsteRx-m to timetag the pictures and provide the position at the exact time the picture was taken.
J8	DF13-4P-1.25DSA	Reserved	
J10	.1" RA Header 1x2	6-30V DC supply	Can be directly connected to a battery pack.
J11	.1" RA Header 1x3	5V DC out (max 2A)	
J12	DM3AT-SF-PEJM5	µSD-card socket for GNSS measurement logging	
J13	.1" V Header 1x2	Connects to the Button pin of AsteRx-m	Push-button to start/stop logging and mount/unmount the SD-card. The interface board contains a debouncing circuit. See section 2.7.

Refer to the board schematics in section 4.5 and to the picture on page 16 for the pinout of each connector.

4.2 Power Supply Options

When an USB cable is connected, the interface board is powered from the computer through the USB connector (J2).

Alternatively, the power can be applied from either:

- Pin#1 of the COM1 connector (J3, or optionally with solder jumper J4 and J5)
- An external 6-30V DC supply (J10).

Power can be applied to more than one connector at the same time. On-board diodes prevent short circuits (see schematics in section 4.5).

The interface card provides the 3V3 supply to the AsteRx-m receiver: there is no need for a separate 3V3 supply for the receiver.

The interface card provides a 5V DC voltage to the VANT pin of the AsteRx-m.

4.3 LEDs

The PWR LED is lit if the interface card is powered and the supply voltage after the diode selector is above 4V.

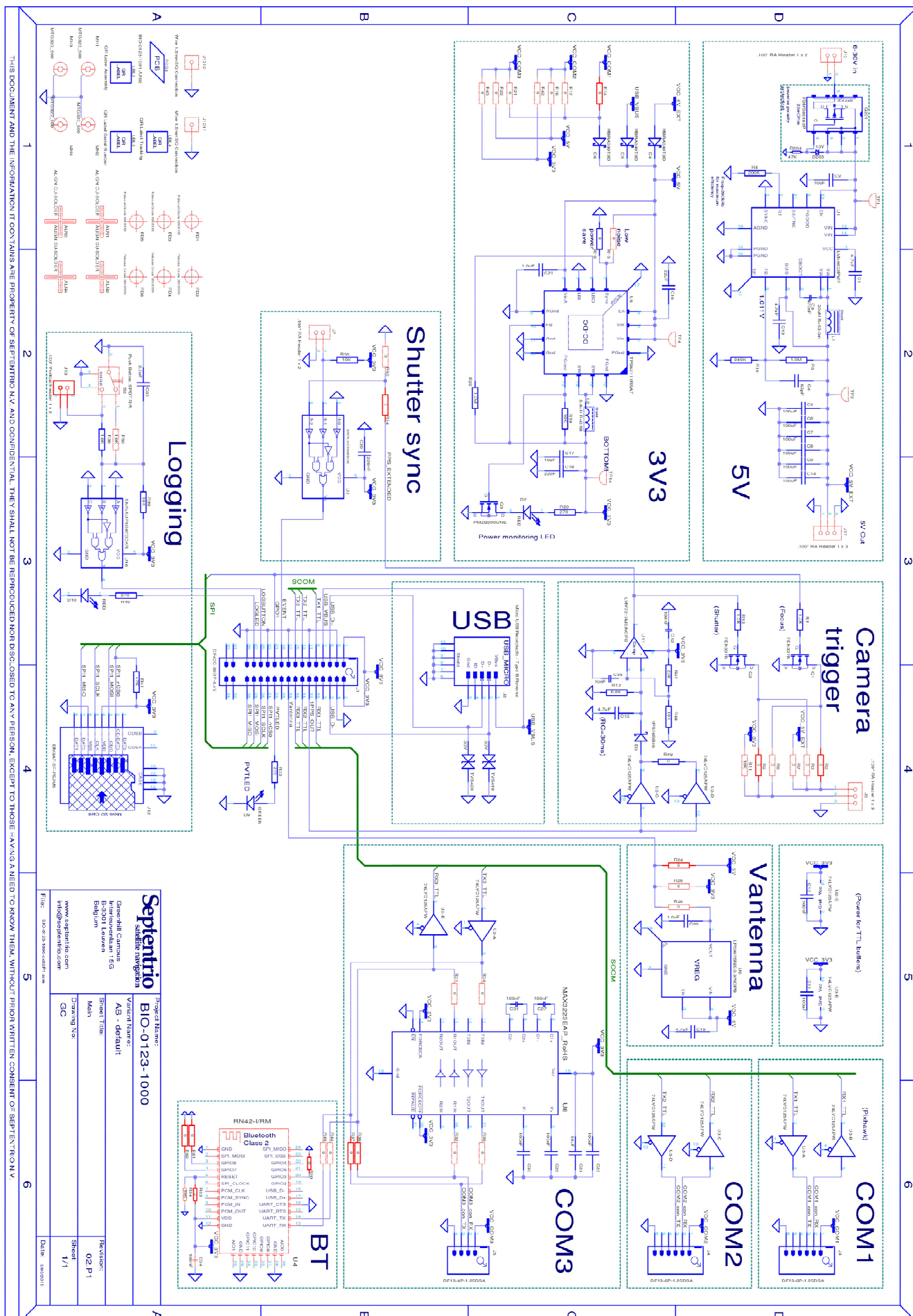
Refer to Appendix A for a description of the LOG and PVT LEDs.

4.4 Temperature Range

The interface board operates in the same temperature range as the AsteRx-m receiver (-40 to 85°C).

4.5 Schematics

The complete interface board schematics is shown below. Components in dashed red color are non fitted by default. Components in bold red color are fitted.



Appendix A LED Status Indicators

The LED pins report the status of key processes inside the receiver. They can be used to drive external LEDs (max drive current 8mA). It is assumed that the LED lights when the electrical level of the corresponding pin is high.

The general purpose LED (GPLED pin) is configured with the **setLEDMode** command. The following modes are supported. The default mode is "PVTLED".

GPLED mode	LED Behaviour																
PVTLED	LED lights when a PVT solution is available.																
DIFFCORLED	Differential correction indicator. In rover PVT mode, this LED reports the number of satellites for which differential corrections have been provided in the last received differential correction message (RTCM or CMR). <table> <tr> <th>LED behaviour</th><th>Number of satellites with corrections</th></tr> <tr> <td>LED is off</td><td>No differential correction message received</td></tr> <tr> <td>blinks fast and continuously (10 times per second)</td><td>0</td></tr> <tr> <td>blinks once, then pauses</td><td>1, 2</td></tr> <tr> <td>blinks twice, then pauses</td><td>3, 4</td></tr> <tr> <td>blinks 3 times, then pauses</td><td>5, 6</td></tr> <tr> <td>blinks 4 times, then pauses</td><td>7, 8</td></tr> <tr> <td>blinks 5 times, then pauses</td><td>9 or more</td></tr> </table> The LED is solid 'ON' when the receiver is outputting differential corrections as a static base station.	LED behaviour	Number of satellites with corrections	LED is off	No differential correction message received	blinks fast and continuously (10 times per second)	0	blinks once, then pauses	1, 2	blinks twice, then pauses	3, 4	blinks 3 times, then pauses	5, 6	blinks 4 times, then pauses	7, 8	blinks 5 times, then pauses	9 or more
LED behaviour	Number of satellites with corrections																
LED is off	No differential correction message received																
blinks fast and continuously (10 times per second)	0																
blinks once, then pauses	1, 2																
blinks twice, then pauses	3, 4																
blinks 3 times, then pauses	5, 6																
blinks 4 times, then pauses	7, 8																
blinks 5 times, then pauses	9 or more																
TRACKLED	<table> <tr> <th>LED behaviour</th><th>Number of satellites in tracking</th></tr> <tr> <td>blinks fast and continuously (10 times per second)</td><td>0</td></tr> <tr> <td>blinks once, then pauses</td><td>1, 2</td></tr> <tr> <td>blinks twice, then pauses</td><td>3, 4</td></tr> <tr> <td>blinks 3 times, then pauses</td><td>5, 6</td></tr> <tr> <td>blinks 4 times, then pauses</td><td>7, 8</td></tr> <tr> <td>blinks 5 times, then pauses</td><td>9 or more</td></tr> </table>	LED behaviour	Number of satellites in tracking	blinks fast and continuously (10 times per second)	0	blinks once, then pauses	1, 2	blinks twice, then pauses	3, 4	blinks 3 times, then pauses	5, 6	blinks 4 times, then pauses	7, 8	blinks 5 times, then pauses	9 or more		
LED behaviour	Number of satellites in tracking																
blinks fast and continuously (10 times per second)	0																
blinks once, then pauses	1, 2																
blinks twice, then pauses	3, 4																
blinks 3 times, then pauses	5, 6																
blinks 4 times, then pauses	7, 8																
blinks 5 times, then pauses	9 or more																

The LOGLED reports the SD card mount status and logging activity.

LED	LED Behaviour
LOGLED	LED is off when the external SD card is not present or not mounted. LED is on when the SD card is present and mounted. Short blinks indicate logging activity.

During boot, i.e. during the first seconds after powering the receiver, the state of the LEDs is not defined, except for the POWERLED.