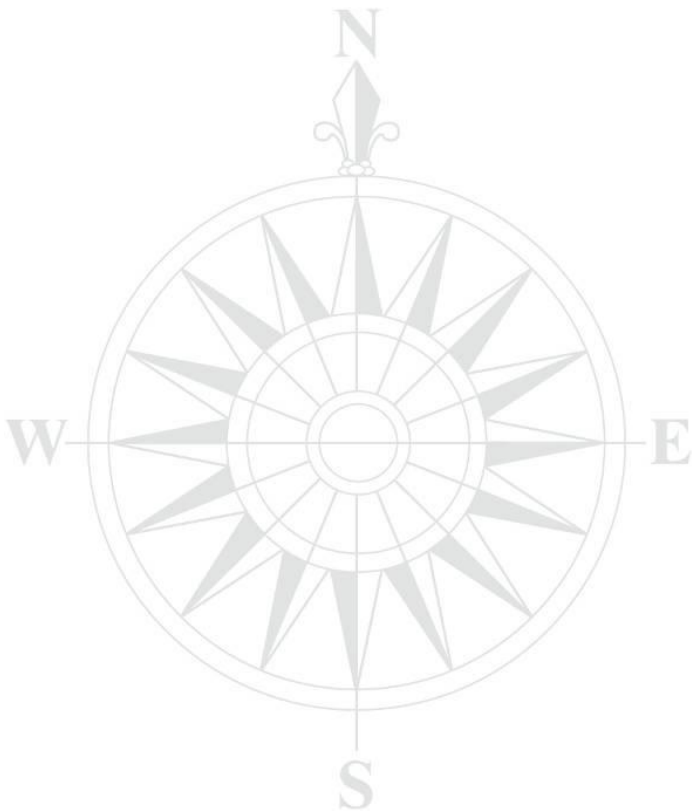


# AsteRx-m Product Family Hardware Manual

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Version 2.1.0



## AsteRx-m Product Family Hardware Manual

Version 2.1.0  
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## 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.

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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.

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

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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.

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

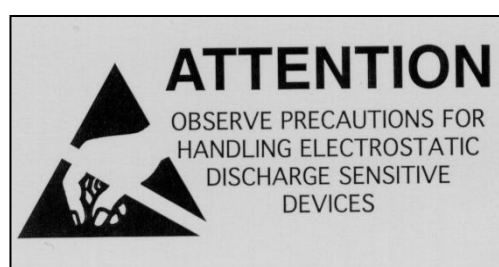
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## WARNING: Handling of ESD Sensitive Devices

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

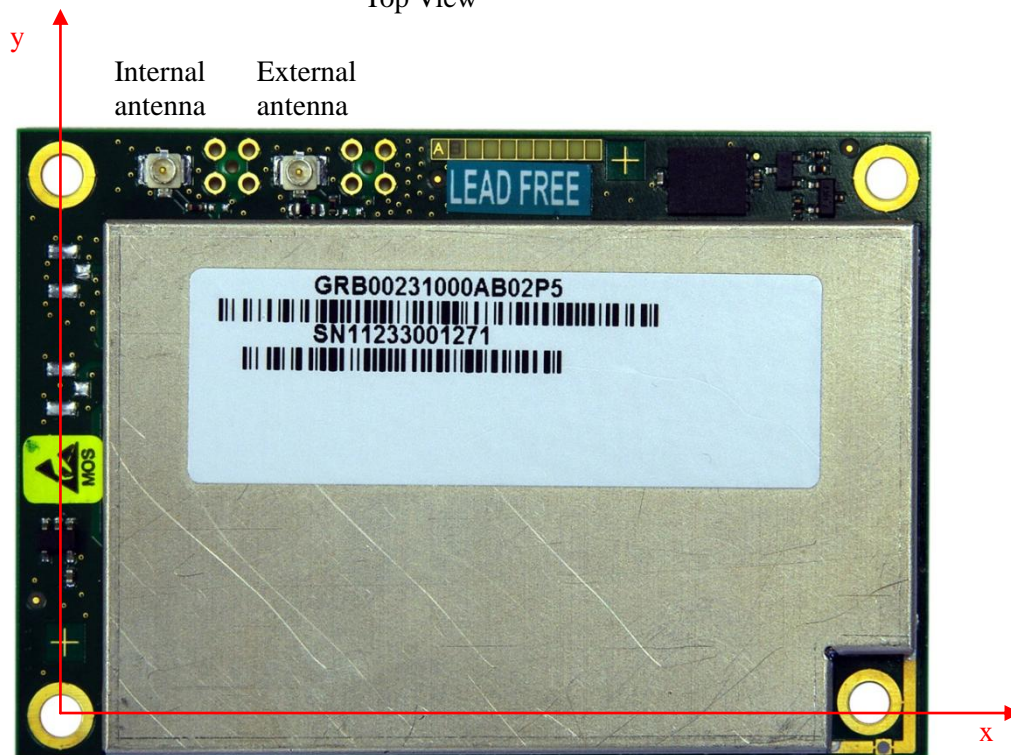
- Remove static-sensitive components and assemblies from their static-shielding bags only at static-safe workstations - a properly grounded table and grounded floor mat - and only when you are wearing a grounded wrist strap (with a resistor of at least 1 mega-ohm in series) or other grounding device. 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

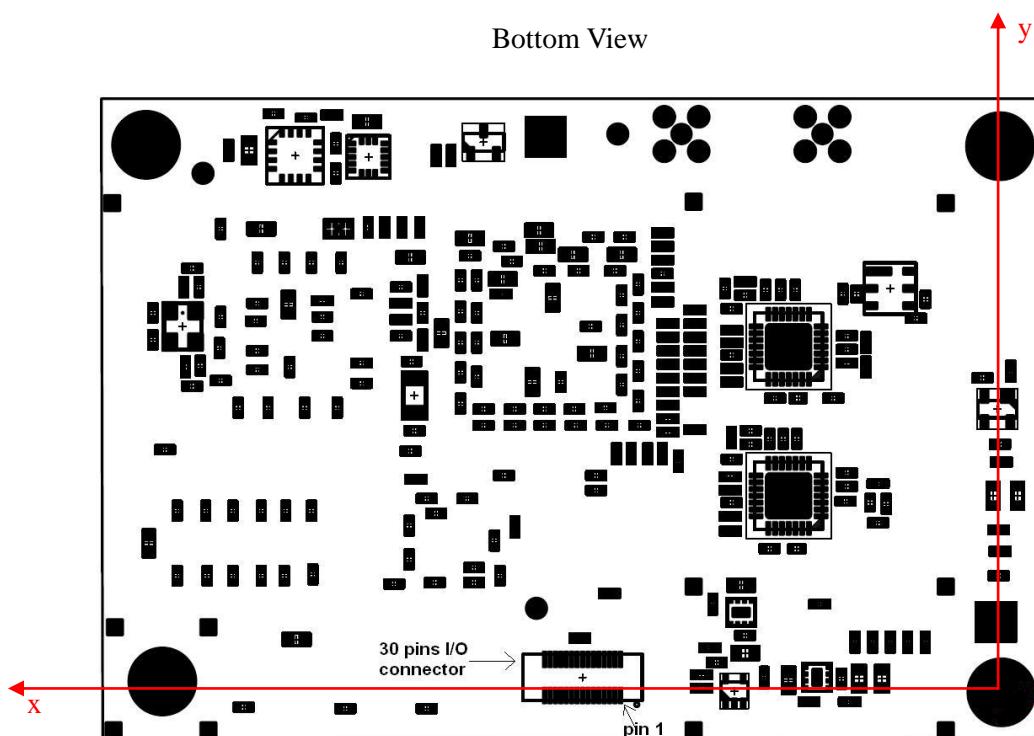
- Limit as much as possible the manipulation of ESD-sensitive devices and components.
- Handle ESD-sensitive parts as far as possible in their (original) protective packaging.
- Protect ESD-sensitive components against dust as this is a possible carrier of static loads. Assembled printed circuit boards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

# 1 AsteRx-m\_OEM

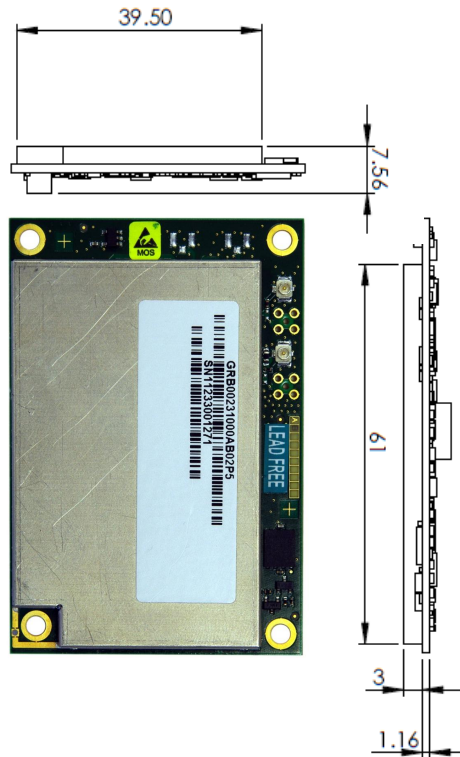
Top View



Bottom View



## 1.1 Receiver Dimensions



All dimensions in millimeters.

PCB Length	70 mm +/- 1mm
PCB Width	47.5 mm +/- 1mm
Mated stacking height	3.5 mm
Weight (with shielding)	47g

RF connectors (U.FL or MMCX depending on your receiver variant) are mounted on top side of the PCB. The 30-pin digital connector is mounted on the bottom side.

### 1.1.1 Connectors and Holes Coordinates

If the X and Y axes are as depicted in the pictures on page 7, the coordinates (x (mm),y (mm)) of items relevant for integration are as follows:

- Centre Mounting Hole 1: (0, 0); hole diameter 3.2 mm; outer ring diameter 5 mm
- Centre Mounting Hole 2: (0, 40.5) ; hole diameter 3.2 mm; outer ring diameter 5 mm
- Centre Mounting Hole 3: (63, 40.5) ; hole diameter 3.2 mm; outer ring diameter 5 mm
- Centre Mounting Hole 4: (61.9, 0.9) ; hole diameter 3.2 mm; outer ring diameter 5 mm
- Centre of DF40C-30DS-0.4V(51) I/O connector: (30.8, 1.4). This corresponds to the cross in the connector in the bottom view picture above. Pin 1 is indicated in the picture. Pin 2 is above pin 1, etc.
- Antenna connectors:
  - U.FL Variant (mounted at top side):
    - Connector centre, internal antenna: (7.8,40.9)
    - Connector centre, external antenna: (18.1, 40.9)
  - MMCX Variant (mounted at top side):
    - Centre pin, internal antenna: (12.9,41.2)
    - Centre pin, external antenna: (23.3, 41.2)



- Both right angled connectors are pointing into the Y-direction, and protrude 2mm beyond the edge of the PCB.
- Lower left PCB corner in top view picture above: (-3.5 +/- 1mm , -3.5 +/- 1mm). Notice the tolerance of 1mm in the position of the edge of the PCB.
- Upper right PCB corner in top view picture above: (66.5 +/- 1mm , 44.0 +/- 1mm). Notice the tolerance of 1mm in the position of the edge of the PCB.

## 1.2 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 detection current	< 6 mA
Noise Figure	External antenna input connector: 5dB Internal antenna input connector: 4dB
Antenna gain range	External antenna input connector: 10-40dB Internal antenna input connector: 0-20dB
Antenna input impedance	50 Ohms
Input IP3 (out-of-band)	0 dBm
Operating Temperature Range	-35 to 85 deg C

## 1.3 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 <b>setSignalTracking</b> command	Power Consumption
GPSL1CA+GEOL1	350 mW <sup>(1)</sup>
GPSL1CA+GEOL1+GLOL1CA	400 mW <sup>(2)</sup>
GPSL1CA+GPSL2PY+GPSL2C+GEOL1	500 mW <sup>(1)</sup>
GPSL1CA+GPSL2PY+GPSL2C+GEOL1+GLOL1CA+GLOL2CA	600 mW <sup>(2)</sup>

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

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

In power down mode (see nPDN pin in section 1.5), the power consumption drops to 150μW.

## 1.4 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.

## 1.5 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	Reserved
25	Reserved	26	Reserved
27	Reserved	28	Reserved
29	GND	30	Reserved

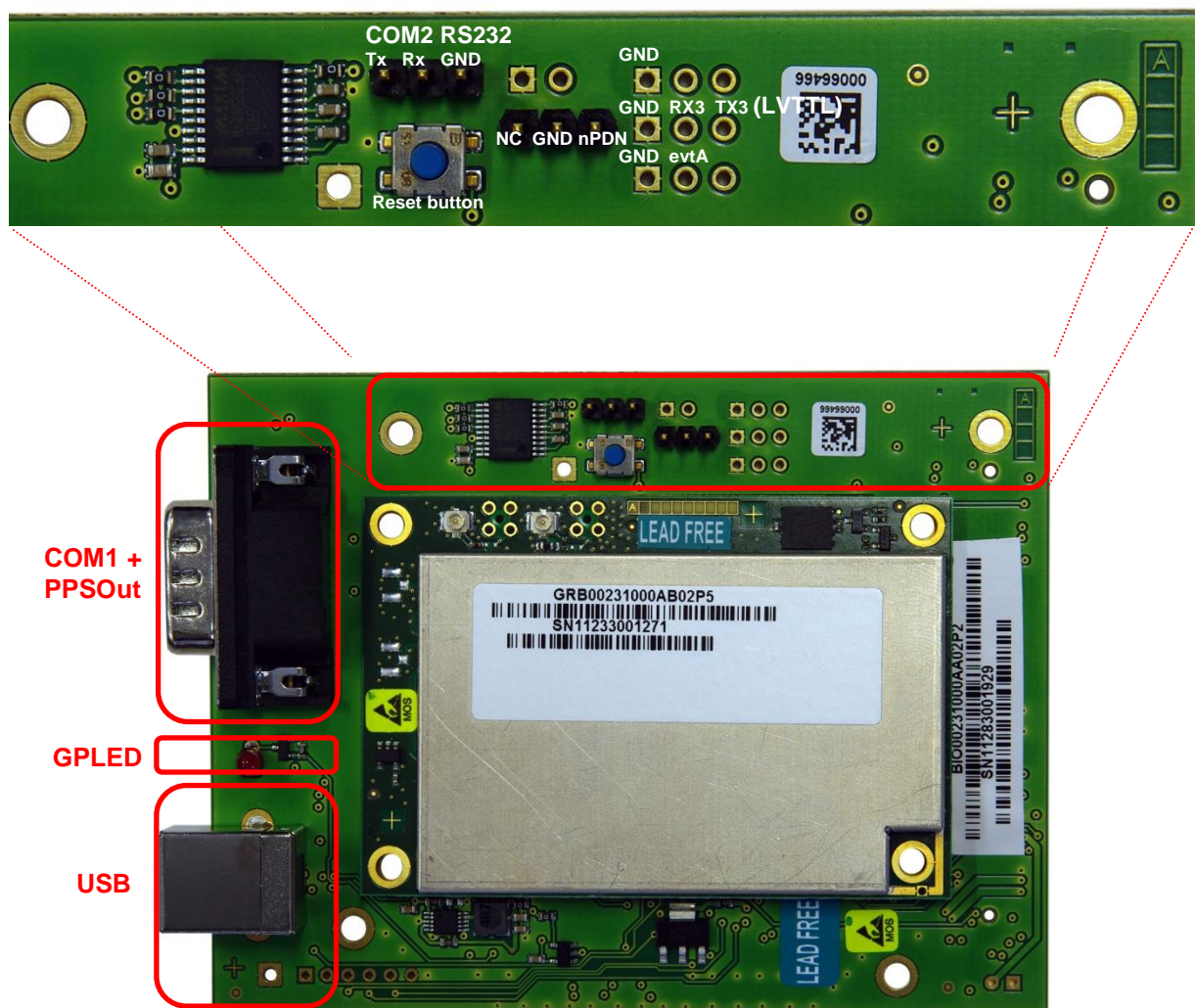
## Conventions:

- 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: pull up

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	P	$4.35V \leq V \leq 5.25V$	USB Power. Can 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	Reserved			Reserved	Leave unconnected.
27	Reserved			Reserved	Leave unconnected.
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	LVTTL	Reset input, active negative. Receiver resets when driven low.	Leave unconnected if not used.
10	RX1	I	LVTTL	Serial COM 1 receive line (inactive state is high).	Pull up to 3.3V if not used.
12	1PPS_OUT	O	LVTTL	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	LVTTL	Serial COM 2 receive line (inactive state is high).	Pull up to 3.3V if not used.
16	RX3	I	LVTTL	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	LVTTL	Receiver is shut down (lower power mode) when driven low.	Leave unconnected if not used.
22	GPLED	O	LVTTL	General purpose LED, see Appendix A.	Leave unconnected if not used. Max output current: 8mA.
24	Reserved			Reserved	Leave unconnected.
26	Reserved			Reserved	Leave unconnected.
28	Reserved			Reserved	Leave unconnected.
30	Reserved			Reserved	Leave unconnected.

## 2 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 LVTTL 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 LVTTL) is available from pin#9 of the subD-9 connector.

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

## Appendix A General Purpose LED Modes

The general purpose LED (GPLED) 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	<p>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).</p> <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> <p>The LED is solid 'ON' when the receiver is outputting differential corrections as a static base station.</p>	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
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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		
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