ALTUS
POSITIONING
SYSTEMS

APS-U

User Manual

Revision 2.1

APS-U User Manual

Mention of third-party products in this document is for informational purposes only and does not constitute an endorsement or a recommendation. ALTUS Positioning Systems assumes no responsibility with regard to the performance or use of the APS-U due to GPS characteristics, USA Department of Defense operations control, atmospheric effects, multipath and RF interference. All understandings, agreements, or warranties take place directly between the seller and the prospective users. Every effort has been made to ensure that the information in this manual is accurate. ALTUS is not responsible for printing or clerical errors. All specifications are typical and subject to change without prior notice.

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1 Introduction

1.1 User Notice

This section provides information regarding Warranty and Customer Service with Support. All specifications are typical and subject to change without notice. ALTUS Positioning Systems reserves the right for improvements and changes to this document, products and services without notice or obligation.

1.2 Warranty

ALTUS provides a 2-year warranty for the APS-U receiver, free from defects in materials and workmanship, from date of sale on the invoice of the original buyer. A 90-day warranty is provided for the cables and other accessories. Firmware upgrades are free for life. Software support is free for 1-year from date of purchase.

The warranty does not cover:

- Defects due to accidents, abuse, misuse, negligence, abnormal use or any other non-recommended use
- Defects due to environmental conditions that do not conform to APS-U specifications
- Defects due to improper installation or operating procedures
- Defects due to modifications, alterations, or changes not made in accordance with the APS-U User Manual and other technical documentation or directly authorized by ALTUS
- Normal wear and tear use
- Shipping damage
- 3rd-party software included with the product, other than the warranty of the original manufacturer to the extent the manufacturer permits

Warranty is void if the APS-U has been tampered with or opened

1.1 Technical Support

Contact your ALTUS dealer for first-line support. For further information, please see the Altus support website for documentation and firmware upgrades, or contact ALTUS Technical Support:

North and South America:

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23848 Hawthorne Blvd., Suite 200
Torrance, California 90505, USA

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support@altus-ps.com

1.2 CE NOTICE

Receivers of the APS-U family carry the CE mark and are as such compliant with the 2004/108/EC -EMC Directive and amendments, 2006/95/EC - Low Voltage Directive, both amended by the CE marking directive 93/68/EC.

With regards to EMC, these devices are declared as class B, suitable for residential or business environment.

1.3 ROHS/WEEE NOTICE

Receivers of the APS-U 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 APS-U 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.

1.4 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 Altus (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.

 Statement 0008/WARNING: The outside of the instrument may be cleaned using a clean, lightly dampened cloth. Do not use any cleaning liquids containing alcohol, methylated spirit, ammonia etc.

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2 APS-U Overview

The APS-U provides multi-frequency RTK GNSS capability together with GNSS Heading, L-Band positioning from TERRASTAR, and wireless communications within a rugged MIL-STD-81 0 housing for the broadest range of applications.

For maximum flexibility, the design is scalable from a single antenna GNSS receiver to full options with Heading, wireless links and L-Band capability.

The rear panel has an extensive suite of interfaces for data output, timing, event marks, and a second antenna port for GNSS Heading. Integrated wireless options optional GSM cellular modem and UHF radio modem for transmission or reception of RTK corrections.

2.1 APS-U GNSS Features

- 272 Channel Septentrio AsteRx2eH GNSS Receiver, with L1/L2/L2C GPS, GLONASS and SBAS.

2.1.1 GNSS Navigation Accuracy

Navigation Performance	Horizontal (m)	Vertical (m)
Standalone (Autonomous)	1.3	1.9
SBAS (WAAS, EGNOS, MSAS)	0.6	0.8
DGNSS	0.5	0.9
TERRASTAR -D	0.1	0.2
RTK*	0.006 + 0.5 ppm	0.01 + 0.5 ppm

2.1.2 GNSS Heading Accuracy

Separation	Heading	Pitch or Roll
1 meter	0.3°	0.6°
10 meter	0.03°	0.06°

2.2 APS-U Variants

The APS-U is offered in different variants for Rover and Heading applications. Starting with single antenna models, available options include RTK Rover, L-Band (TERRASTAR), UHF and Heading. The table below lists all the available variants with the relevant options.

		Positioning Modes						Comm		GNSS		
Variant	**Partnumber**	Meter (SA, SBAS, DGNSS)	Decimeter (PPP/TERRASTAR)	Centimeter (RTK)	Relative (Moving Base)	Base	Orientation	UHF	Cellular Modem	GPS L1 & L2	GLONASS L1 & L2	L-Band (TERRASTAR)
APS-U-HLMU	400142B1474	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦
APS-U-HMU	400142B1473	♦		♦	♦	♦	♦	♦	♦	♦	♦	
APS-U-LMU	400142B1478	♦	♦	♦	♦	♦		♦	♦	♦	♦	♦
APS-U-MU	400142B1477	♦		♦	♦	♦		♦	♦	♦	♦	
SM_APS-U	400142B1471	**STOCK MODEL**										

All models include a 2GB internal memory and Ethernet connectivity. Bluetooth can be enabled with a firmware update.

Note: Due to a design limitation, the event markers are not functional on the current APS-U hardware when used together with the PPS-Out signal.

2.3 APS-U Design

2.3.1 Front Panel

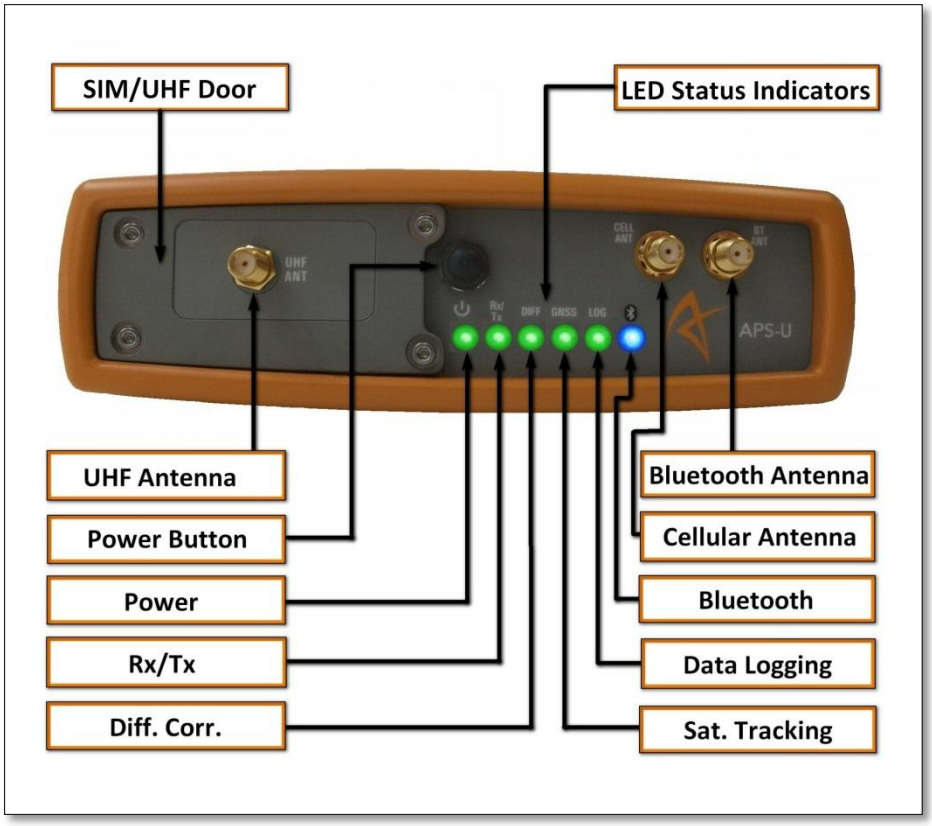


Figure 1: Front Panel

2.3.2 Rear Panel

There are 6 ports on the APS-U. The rear of the APS-U has two TNC connectors for GNSS antennas; one for the main antenna and one for the auxiliary antenna for heading applications

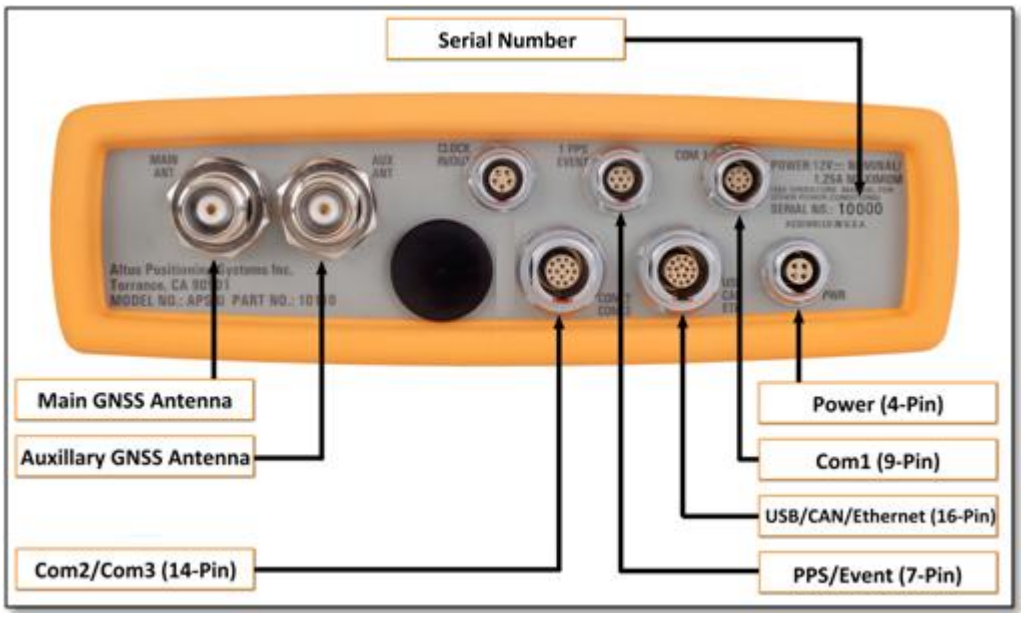


Figure 2: Rear Panel

LEMO	Description	Purpose
14-pin	Com2/Com3	Dual RS-232 to PC Com2 RS-232 to PC Com3 RS-232 PC
7-pin	PPS/Event	PPS Output & Event input (events currently not supported)
16-pin	USB/ETH	USB to PC & Ethernet to PC or Router
9-pin	Com1	RS-232 to PC
4-pin	Power	DC Power Input
5-pin	Clock In/out	Do not use

2.3.3 Mounting Brackets

Figure 3: Mounting Brackets

2.3.4 Shipping Contents

Figure 4: Shipping Contents (*Optional Accessory)

One APS-U system includes the following items:

Items	Purpose
Bluetooth Antenna	Bluetooth communication (future functionality)
UHF Antenna	UHF communication
Cell Antenna	Cellular communications
Com2 & Com3 Serial Cable (201955)	Dual RS232/Serial connectivity (Com2/Com3)
Power Cable (201863)	9-30 VDC external power input, open-ended
USB & Ethernet Cable (201955)	Configuration via USB and Ethernet
CD	Software Programs and Manuals

2.3.5 Front Panel LEDs

The APS-U has LEDs to indicate status of the GNSS receiver, as well as incoming differential corrections via external device.

Figure 5: LEDs

2.3.6 LED Description

LED	ICON	Status
Green		On: Receiver is Powered on Off: Receiver is Powered off
Green		On (Flashing): Rx/Tx Data Off: No Data
Green		On (Flashing): Rx RTK Corrections On (Solid): Tx RTK Corrections Off: No RTK Corrections
Green		Fast & Continuous (10 times per second) 0 Satellites Blinks 1 time, then pauses: 1,2 Satellites Blinks 2 times, then pauses: 3,4 Satellites Blinks 3 times, then pauses: 5,6 Satellites Blinks 4 times, then pauses: 7,8 Satellites Blinks 5 times, then pauses: 9+ Satellites
Green		On: Internal Data Logging enabled Off: Internal Data Logging not enabled Blinking slowly: Internal disk almost full Blinking quickly: Internal disk full, logging stopped
Blue		(future functionality) On: Established device communication Off: Idle for device bonding

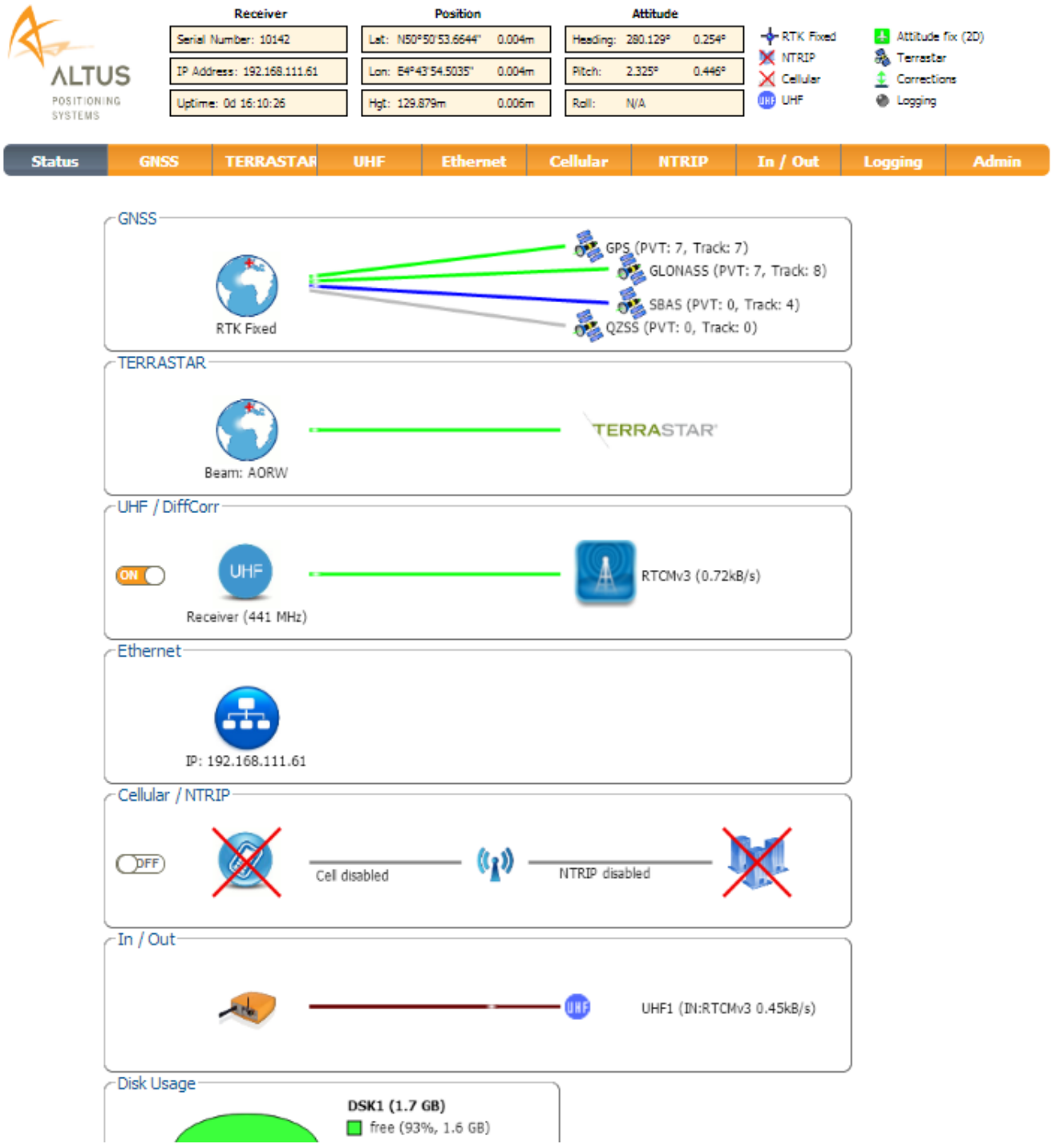
2.4 Internal Memory

The APS-U has 2GB Memory for internal data logging. When using with APS-U for internal data logging, data is logged in SBF or NMEA format, and may be retrieved after the logging session is complete. Files can be accessed via the logging tab using the APS-U web interface.

3 Web Interface

The APS-U has an on-board web interface, which is accessible from the Ethernet connection. All routine settings are made from the APS-U web interface for ease of use.

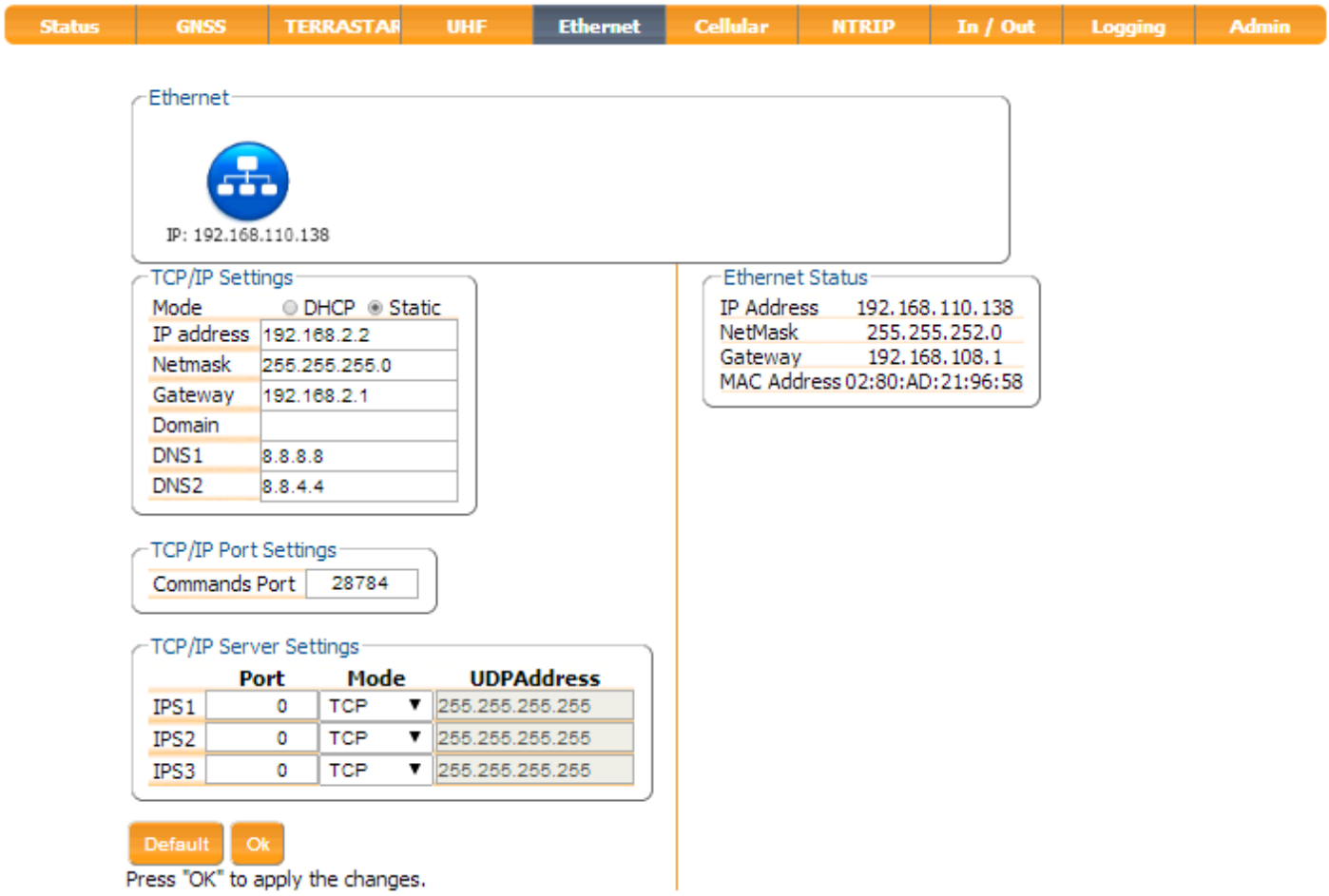
By default, the APS-U has a DHCP address http://aps-u-snxxxxx, where xxxxx are the five digits of the APS-U serial number, (to be found on the top right of the rear panel of the APS-U enclosure)



4 Receiver Administration

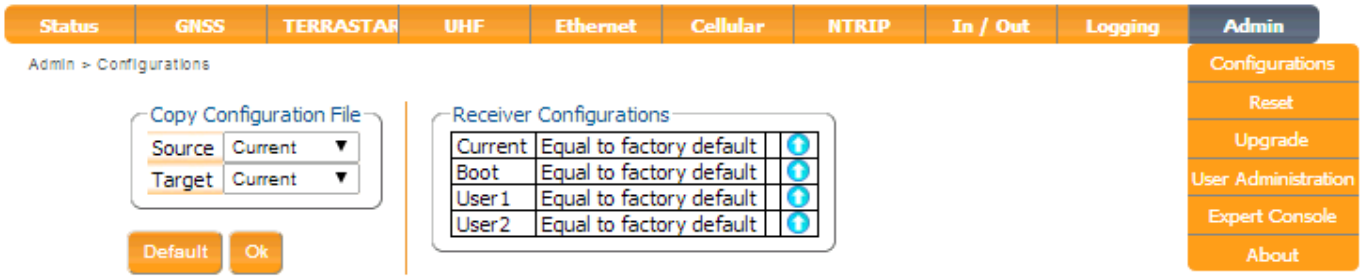
4.1 Change IP Settings

The default DHCP address can be changed into the desired static address selecting the tab “Ethernet”.
To apply the changes press “OK”



4.2 Configuration management

The receiver configuration includes all the user-selectable parameters, such as the elevation mask, the PVT mode, UHF, COM port settings etc.



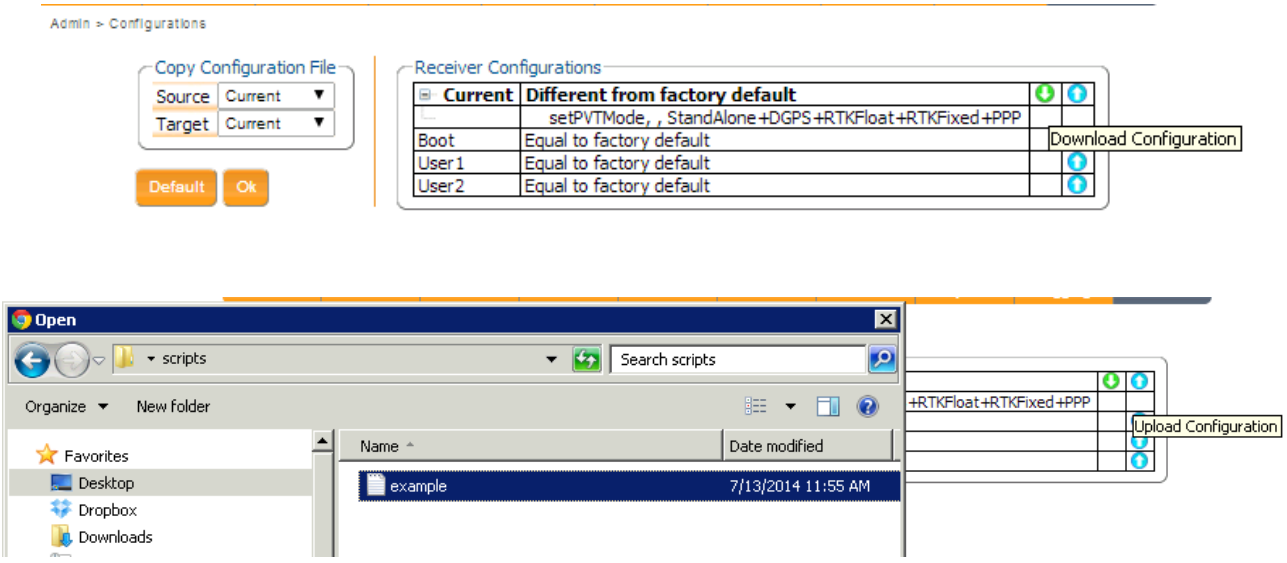
- The default configuration (RxDefault) contains factory settings which can be always retrieved.
- The Current configuration contains the current receiver configuration.
- The Boot file contains the configuration that is loaded at boot time.
- User-defined configuration files (User1, User2) can be used to store frequently-used user-specific configurations inside the receiver.
  The current receiver configuration can be saved and archived for future reuse or loaded on a different receiver. Once the configuration is saved, it can be recalled.

Any change to the default settings will be implemented in the current configuration of the APS-U and are not automatically copied in the boot configuration of the unit.

When changing the APS-U configuration from its factory settings, a pop-up at the bottom right corner of the screen will appear. To make the changing effective after booting press OK.

Changes applied can be visualized expanding the configuration. To download the configuration in a text file, click the green arrow.

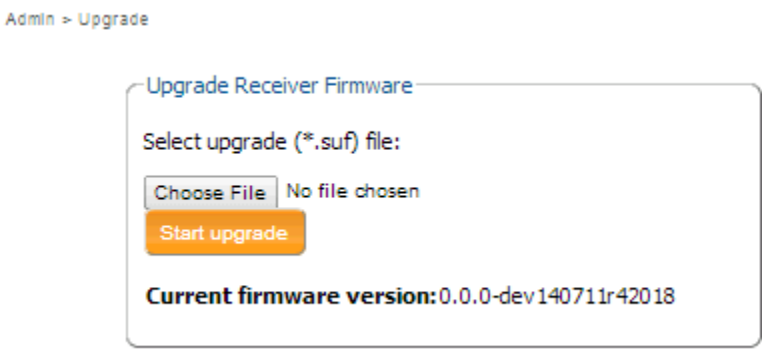
To upload a configuration script, select the light blue arrow and browse the desired file.



4.3 Upgrading the firmware or uploading a new permission file

The APS-U firmware can be upgraded via the “Upgrade” screen in the “Admin” menu. You can upgrade the unit by selecting a .SUF-file with a more of the firmware version.

This procedure can also be used to upload a new permissions file to enable additional features on the unit.

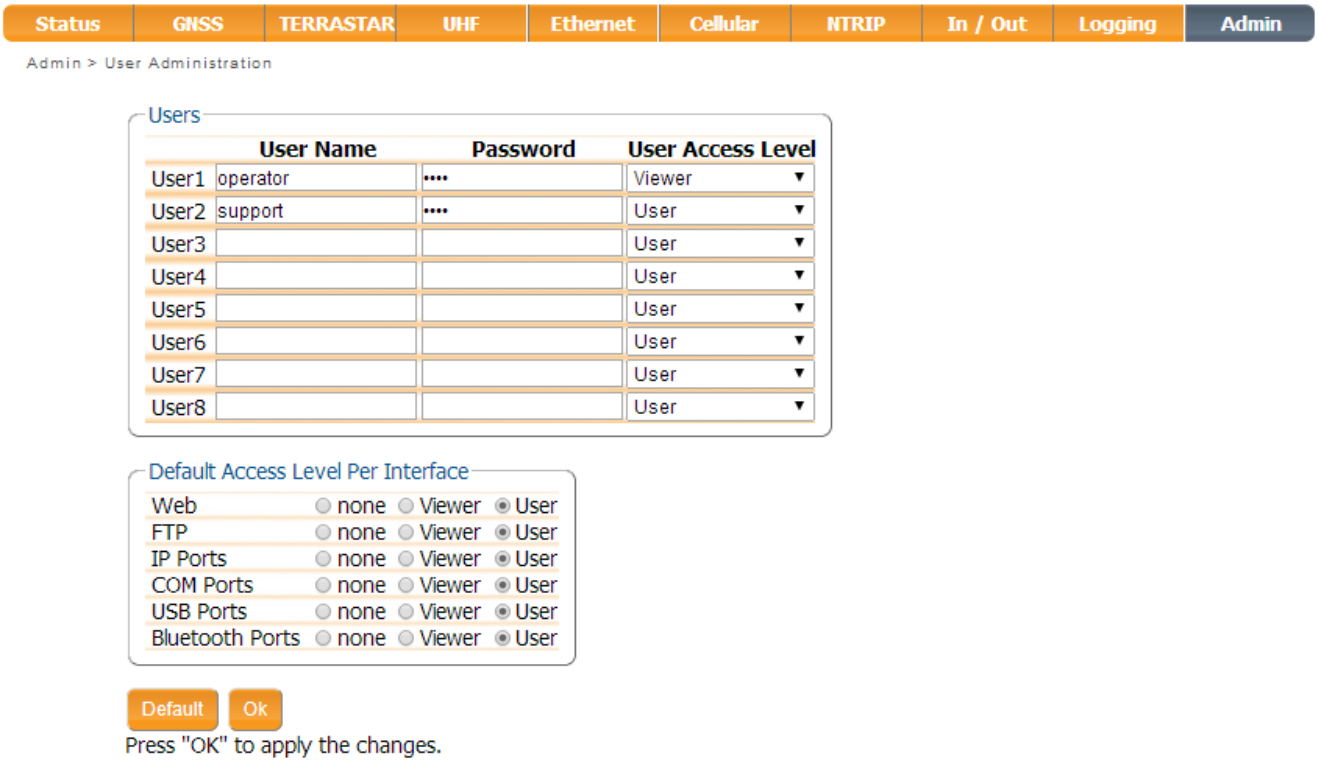


4.4 Reset the receiver to default settings

The receiver can be reset to the default settings via the “Reset” screen in the “Admin” menu. To reset the unit to factory configuration, mark the “config” checkbox before clicking “OK”.

4.5 User Administration

The User Administration screen in the Admin menu offers the possibility to configure access levels for different users. Users can be configured as “viewer” (view status and settings, but not change them) or “user” (full access).

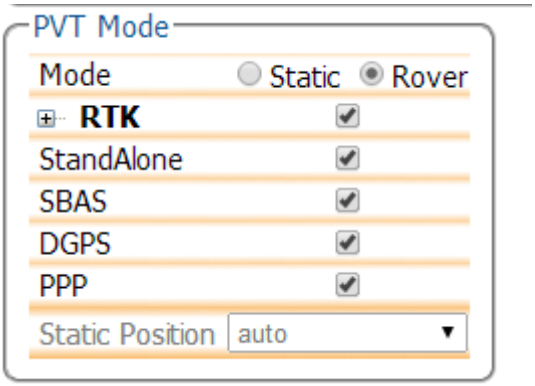


5 Basic Configurations

5.1 How to set the APS-U in RTK rover mode using the UHF radio

Step 1: Enable RTK Rover PVT mode

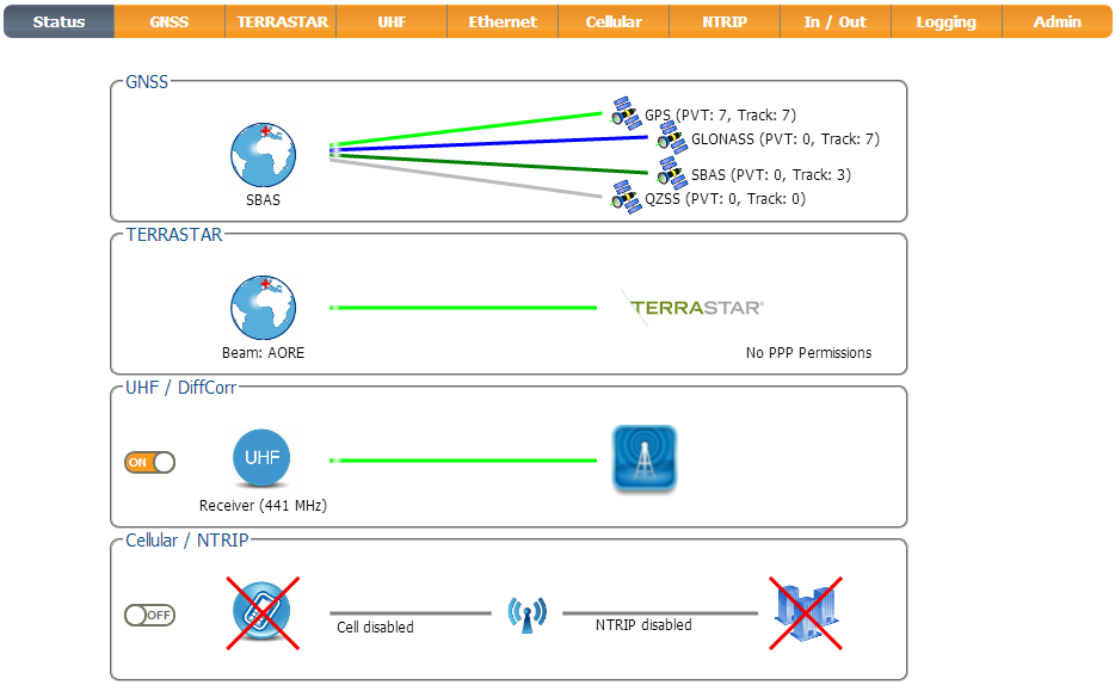
If when starting from the default configuration, RTK rover is enabled by default.



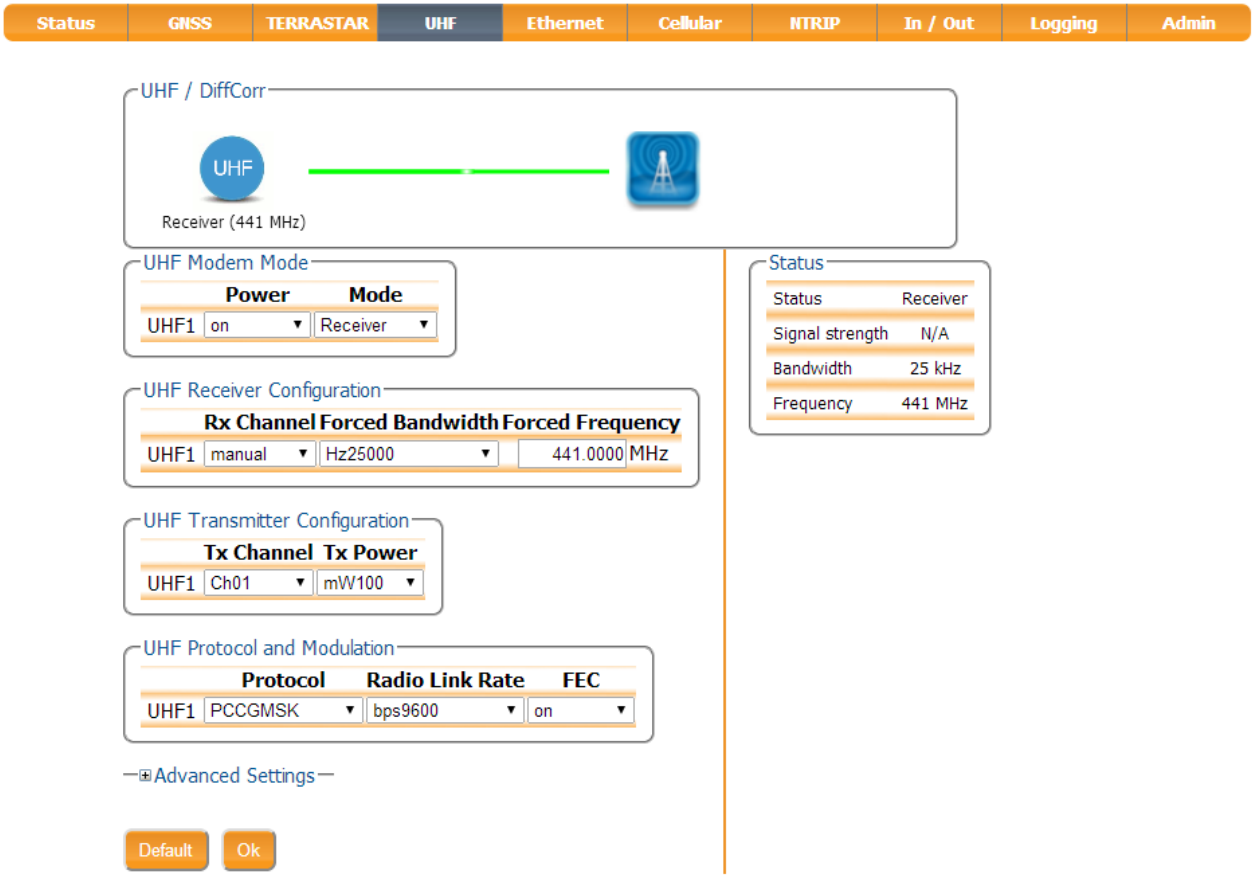
Step 2: Activate UHF radio.

When starting from the default configuration, in the status window, UHF can be activated in the UHF widget. If the unit was preconfigured before, UHF will now be activated and the unit will start receiving corrections.

Remark: If Ntrip was previously enabled, the user will be presented with the choice to use either UHF or Ntrip.



Step 3: Changing the basic settings to receive RTK corrections via UHF



-Mode of the UHF radio:

The user can turn the UHF modem on and off in the UHF tab and can change the radio mode as receiver or transmitter. To receive corrections, the UHF modem has to be set to Receiver.

-Receiver channel configuration:

To receive corrections, the UHF modem has to be tuned to the correct frequency. This can be done by either selecting the correct channel from the channel table, or manually forcing a frequency and bandwidth.

-Transmitter channel and transmit power:

To receive RTK corrections via UHF, the transmitter settings can be left default or unchanged.

-Radio communication protocol:

The radio protocol settings have to match those of the transmitter.

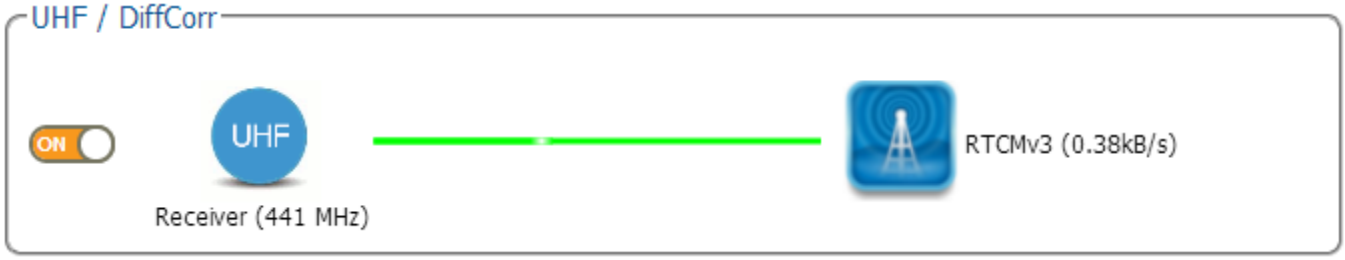
-The frequency table with 32 channels:

The frequency table can be used to preset frequencies which allows for quick changes between base stations. The frequency table can be found in the advanced settings section.

After changing the settings save and store the settings by pressing Ok on the bottom of the screen and Save in the pop-up window.

Step 4: Review proper operation

Once successfully connected with the UHF modem, the status bar will light up green and the type of received corrections will be displayed together with the data rate. The PVT Mode in the right upper corner of the web interface should be changed to RTK Fixed.

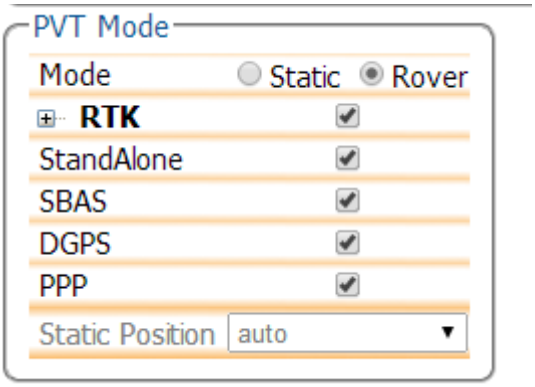


5.2 How to set the APS-U in RTK rover mode using the cell modem and NTRIP

Step 1: Enable RTK Rover PVT mode

If RTK option was purchased, RTK Rover PVT mode can be enabled

When starting from the default configuration, RTK rover is enabled by default.



Step 2: Activate Cellular modem.

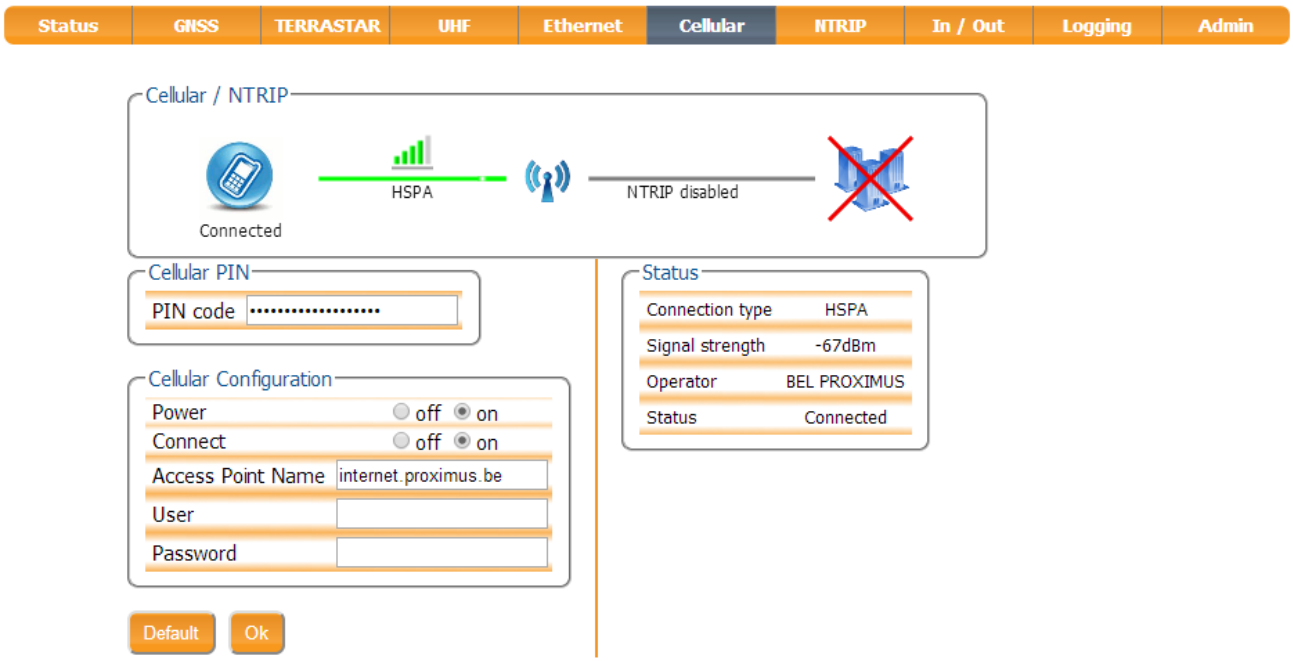
Ensure a valid SIM card is inserted into the APS-U. The SIM card slot is located behind the UHF door. In the status window, the cellular modem can be activated in the cellular/Ntrip widget. If the unit was preconfigured before, the cellular modem will now be activated and connect to the internet.

Step 3: The cellular modem settings.

The cellular modem settings can be changed in the cellular tab. The basic settings contain:

-Enter a Pin code;

-Cellular configuration.



Step 4: Changing the cellular settings to connect to the internet

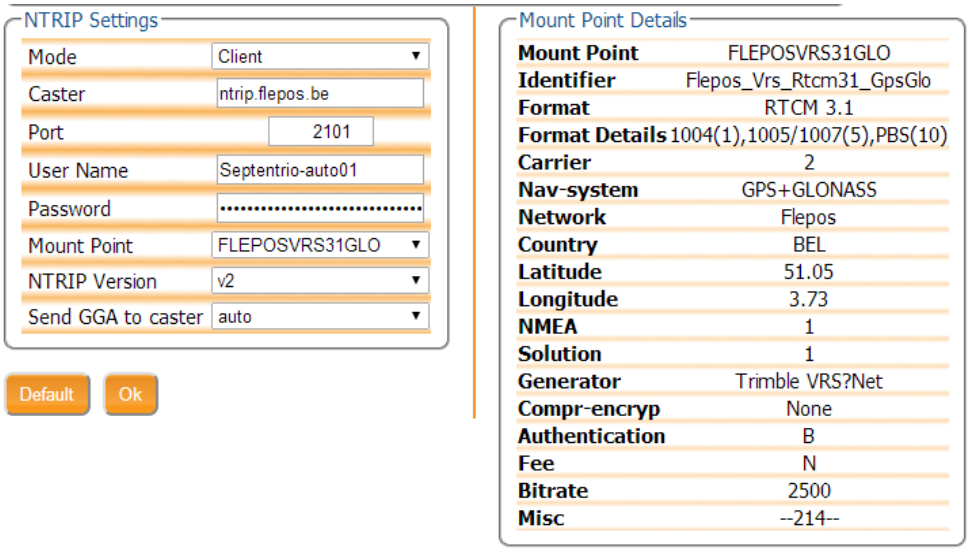
- If necessary for the SIM card, a Pin code has to be entered in the cellular pin;
  If no Pin code is required, leave this section blank.
- The cellular configuration has to be set based on the requirements of the cellular provider.

Step 5: Activating the Ntrip settings

To receive internet based RTK corrections, a connection to an internet service must be made. The Ntrip settings can be changed in the NTRIP tab:

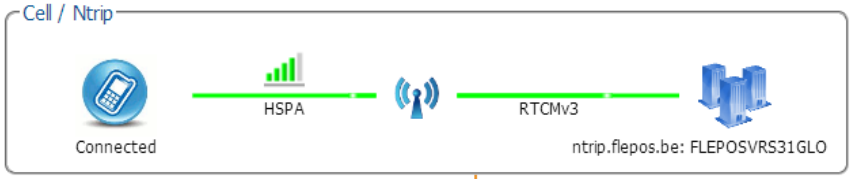
The Ntrip client settings, user name and password of the Ntrip account can be entered. If these details have been entered correctly, the Mount Point drop-down list will become active and the desired differential correction stream can be selected. Once the mount point is selected, the details of the mount point will be displayed. The Ntrip version can also be selected. The operator can also choose to send GGA to the Ntrip caster at different rates.

A sample configuration can be found in the screenshot below.



Step 6: Review proper operation

Once successfully connected to the Ntrip service, the status bar will light up green and the type of received corrections will be displayed.

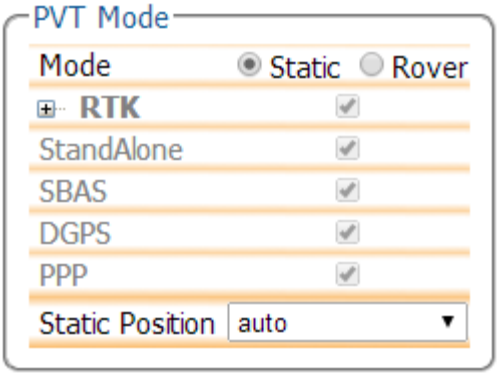


The PVT Mode in the right upper corner of the web interface should be changed to RTK Fixed.

5.3 How to configure the receiver as RTK base

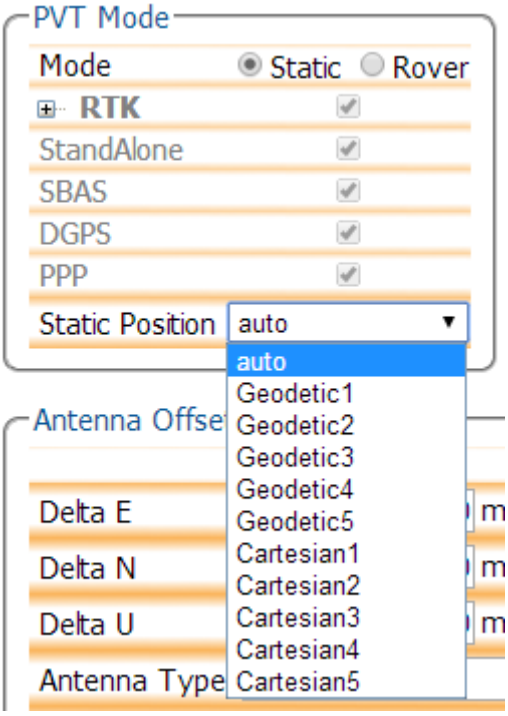
Step 1: Setting the receiver in static mode

When starting from the default configuration, go to the GNSS position tab and select static as the PVT mode.



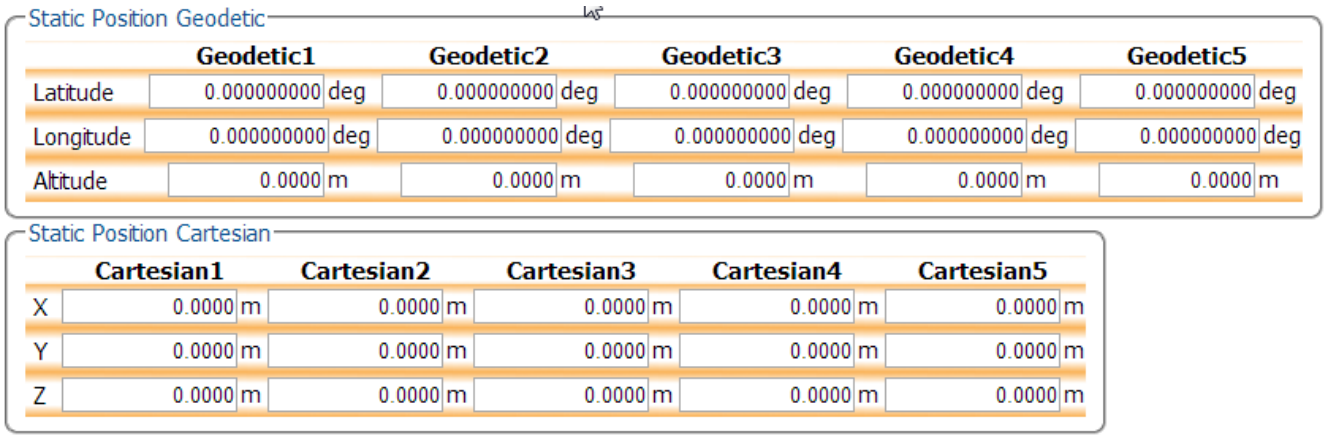
Step 2: Setting the Static Position of the receiver

The Static Position is set to auto by default. When set to auto the receiver will calculate an autonomous position and select this as its static position. The other available options are: Geodetic1-5 and Cartesian1-5.



Step 3: Setting the Geodetic1-5 and Cartesian1-5

Under the advanced settings of the GNSS position tab, the 5 geodetic static positions and 5 cartesian static positions can be set.



Step 4: Save settings

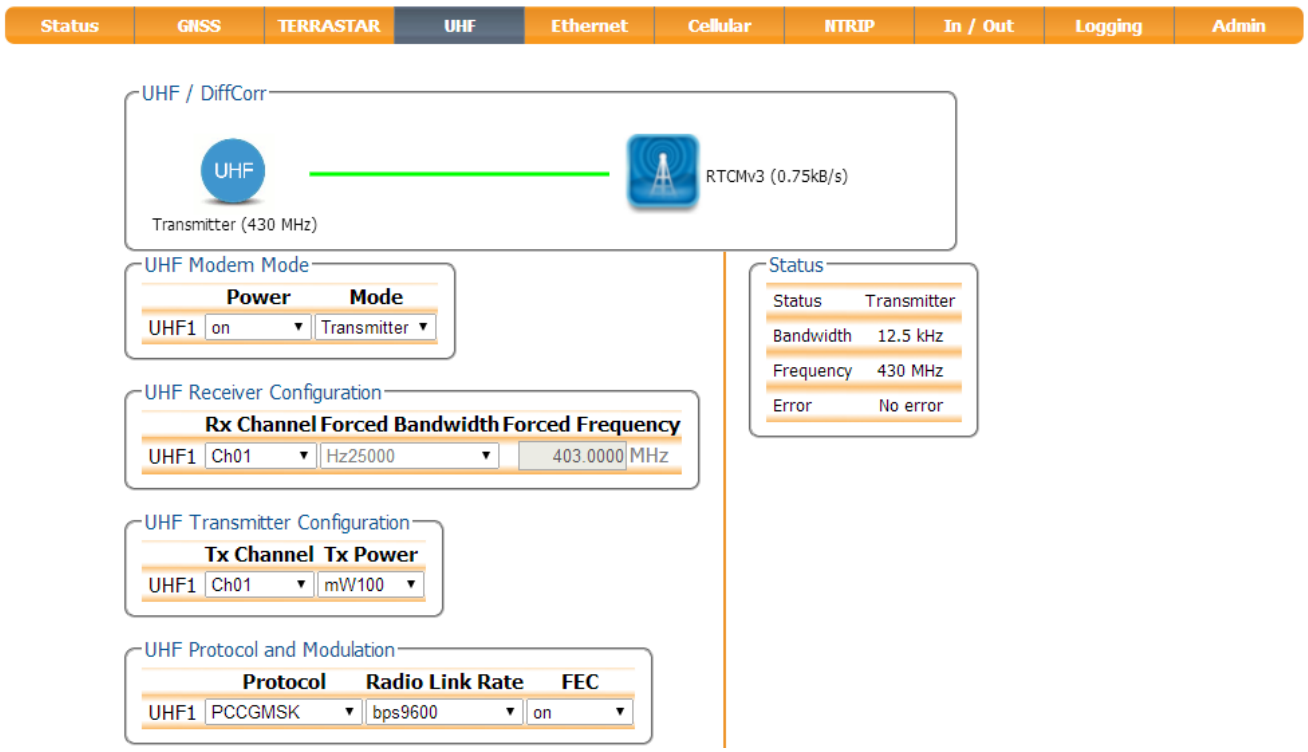
Click the Save button to store the settings.

Step 5: Outputting RTK corrections

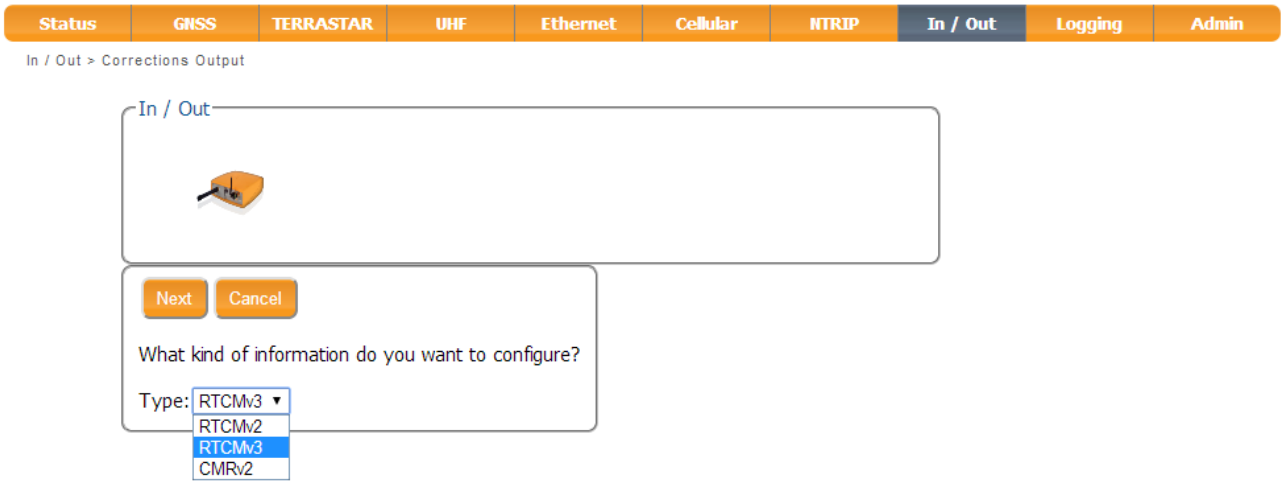
The output of RTK corrections can be configured using the wizard available in the Correction Output in the In/Out tab.

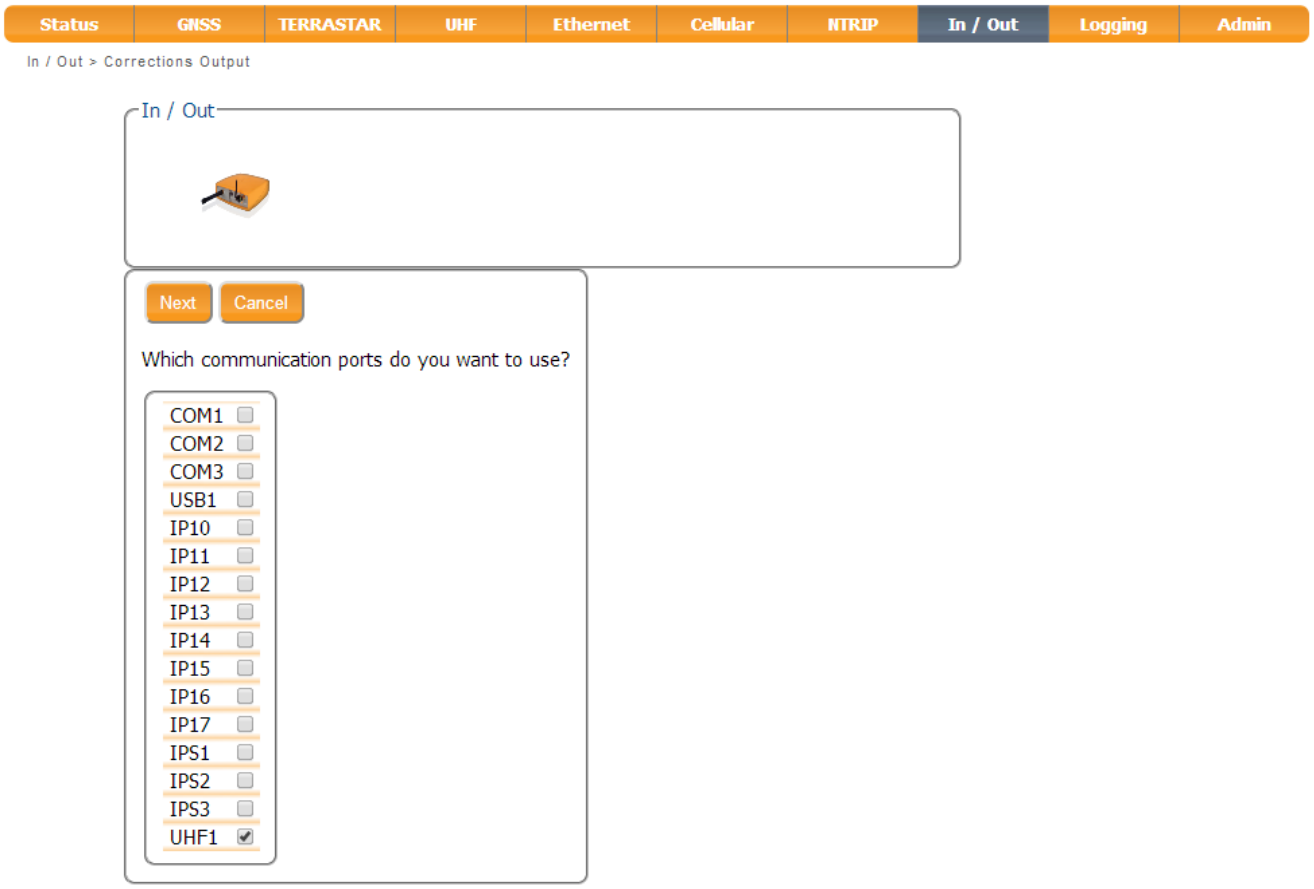
Once the GNSS receiver is set to static, to output RTCMv3 differential corrections via UHF, select the UHF tab. In the UHF Modem Mode, set the power to on and the mode to transmitter. In the UHF Transmitter Configuration, select the desired channel and transmitting power. For an advanced configuration of the UHF channel table can be edited and customized. In the UHF Protocol and Modulation select the protocol, radio link rate and forward error corrections (FEC) mode.

Press OK to apply the settings.



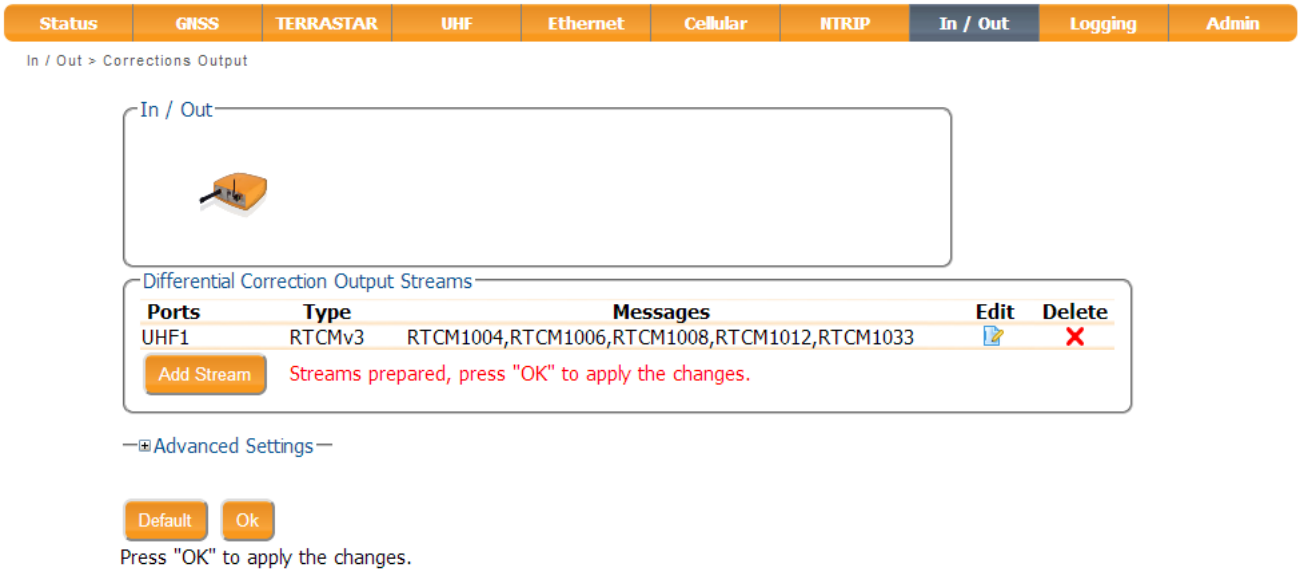
In the In/Out tab, select Corrections Output and follow the steps of the wizard to output RTCMv3 over UHF1



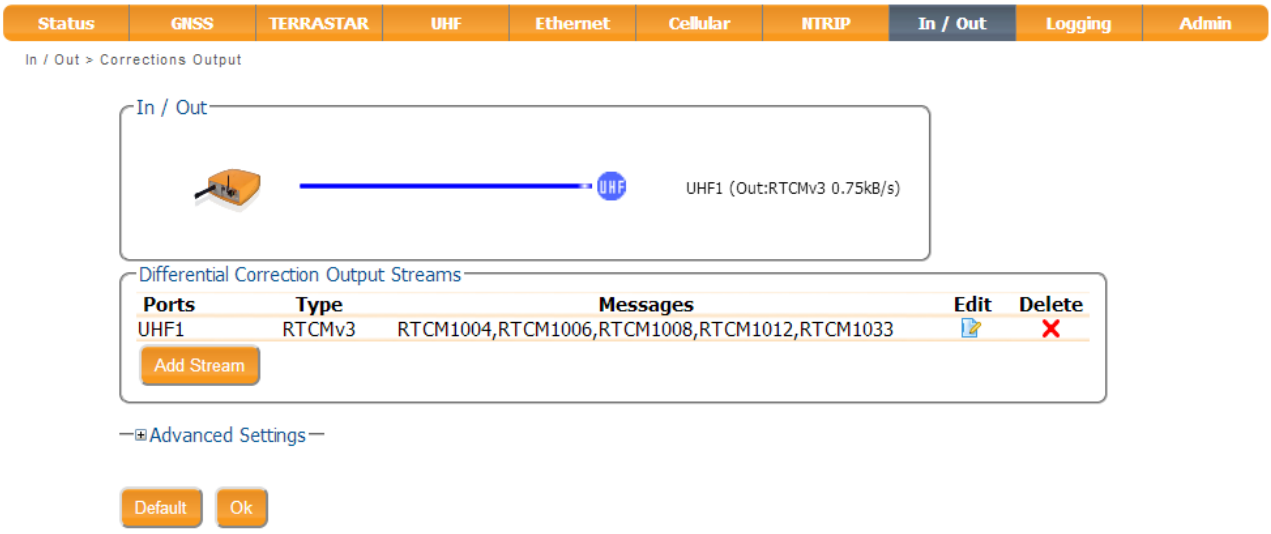


If needed, customize the set of messages to be output

The system will prepare the stream and prompt you to press OK to apply the changes.



Upon pressing “OK” the APS-u will start outputting the desired correction stream on the selected connection.

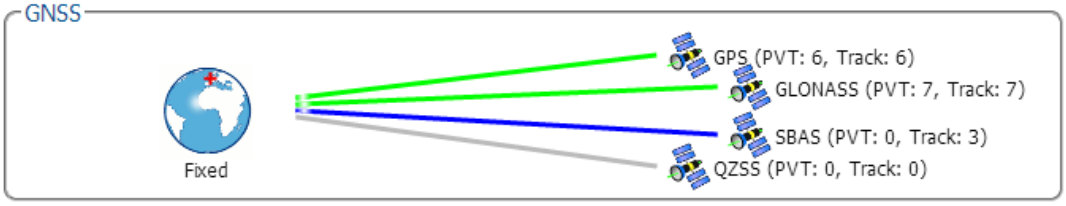


Step 6: Save and store settings

Press Ok to save the settings and click the Save button to store the settings.

Step 7: Review proper operation

Once successfully set as a base, the main GNSS widget will display fixed as operational mode.



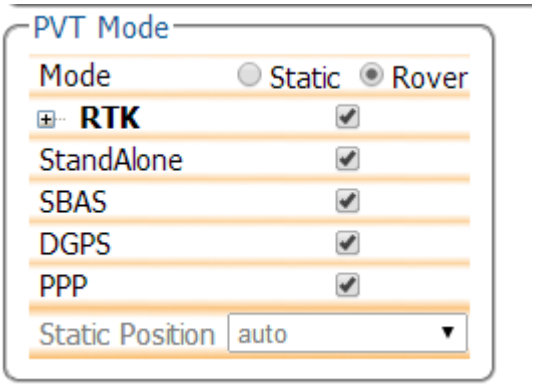
The In/Out widget will show a differential corrections output stream on the selected output port.

5.4 How to use TERRASTAR services

Step 1: Enable PPP PVT mode

If the L-band option was purchased, PPP PVT mode can be enabled.

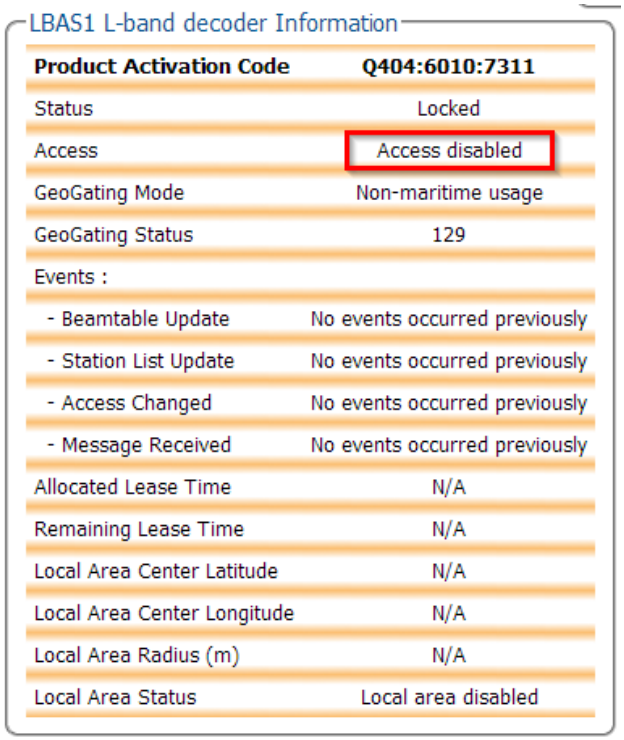
When starting from the default configuration, PPP is enabled by default.



Step 2: Check the TERRASTAR activation

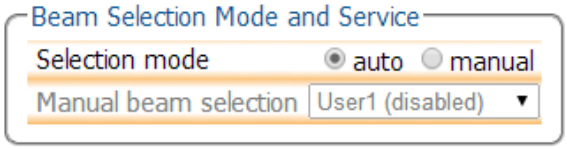
In the TERRASTAR tab, information of the TERRASTAR subscription is displayed in the LBAS1 L-band decoder Information. The product activation code (PAC) can also be found in this component. If the Access says enabled, then the APS-U will be able to receive TERRASTAR corrections. When the status says access disabled, then the receiver does not have a TERRASTAR subscription.

If you do not have a TERRASTAR subscription yet, please contact sales@altus-ps.com for more information how to obtain one.



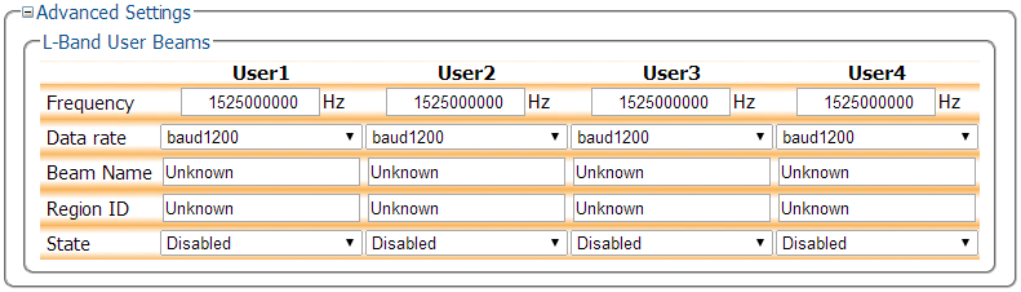
Step 3: Beam Selection Mode and Service

When starting from the default configuration, the auto mode is selected. The demodulator will try to lock to a visible beam. In manual mode the demodulator will attempt to lock to the beam identified in the drop-down menu 'Manual beam selection'.



Step 4: Changing the Advanced settings (optional)

The user-defined L-Band beam parameters can be defined in the Advanced Settings. A beam is characterized by its frequency and data rate. Optionally, a beam name and region ID can also be associated to each beam, for information only.

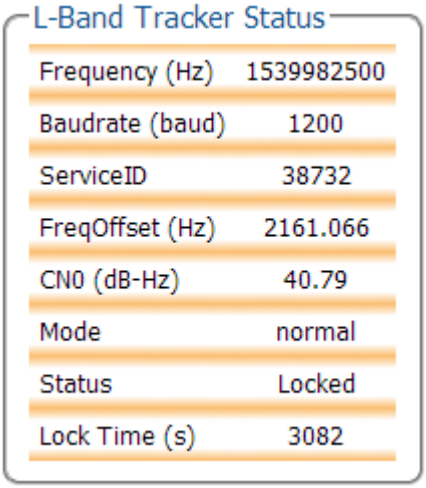


Step 5: Save and store settings

Click the Save button to store the settings.

Step 6: Review proper operation

The graphic view will report onto which Lband satellite the APS-U is locked, the “Lband tracker status” will give additional information about the tracking, displaying among other information the frequency, baud rate and carrier to noise. In order to be able to successfully use TERRASTAR services, the CN0 of the L-band has to be at least 34 dB-Hz.



The PVT Mode should first switch to Differential, followed by PPP.

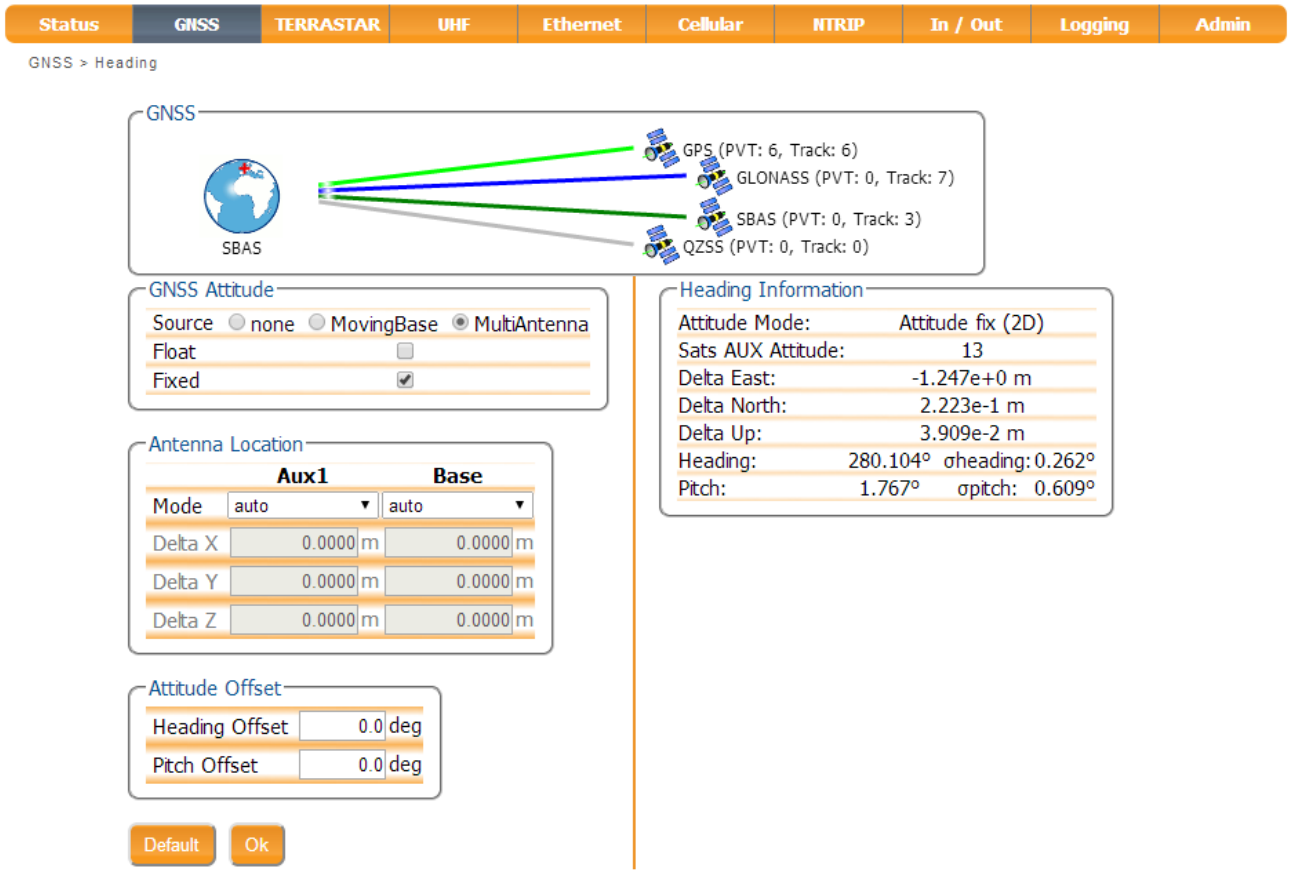
5.5 How to set up dual-antenna operations for heading output?

Step 1: Setting the receiver in dual antenna mode for heading output

If Heading option was purchased, the receiver will automatically be set up for heading operation when starting from the default configuration.

Step 2: Optimizing the dual antenna operation for heading output

Under the GNSS heading tab, the antenna location and attitude offset can be manually set. In addition, the heading can be turned off, be set on moving base or the default multi antenna mode.



Step 3: Save and store settings

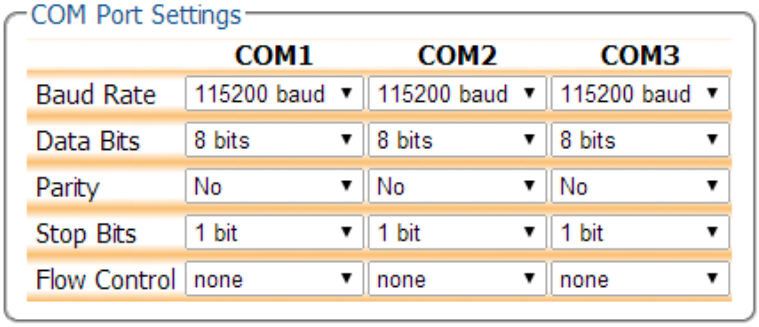
Press ok to save the settings and click the Save button to store the settings.

5.6 How to configure data output

Data output can be configured in the In/Out tab of the web interface. The data output can be configured on COM ports or via Ethernet.

Step 1a: configure the COM ports

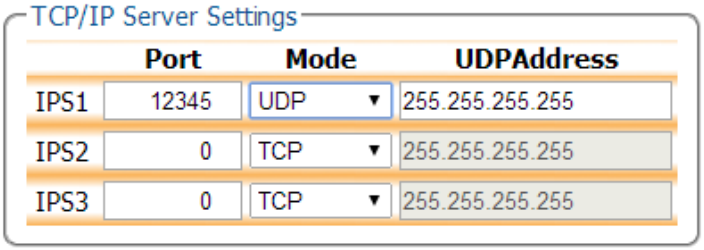
The COM port settings can be changed in the In/Out > Serial Port Settings window.



By default all COM ports are set to a baud rate of 115200 buad, using 8 data-bits, no parity, 1 stop-bit and no flow control.

Step 1b: Customize the TCP/IP port settings

In the Ethernet tab you can customize the TPC/IP port settings and the TCP/IP server settings.
For the TCP/IP port, select the desired port in the range 1-65535 and press on OK to apply changes.
In the TCP/IP server settings, you can select the port, the protocol mode and for UDP, the address to be used.

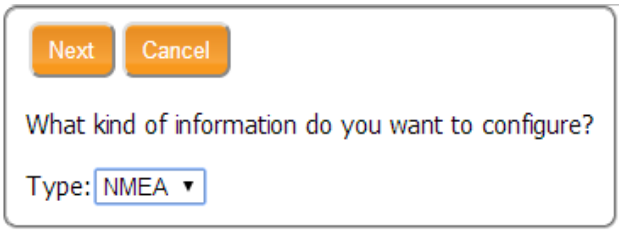


Step 2: Add output stream

The NMEA/SBF output streams can be configured in the In/Out > NMEA/SBF Output window. By clicking on Add Stream, the Output Port, Message Type and interval can be selected.

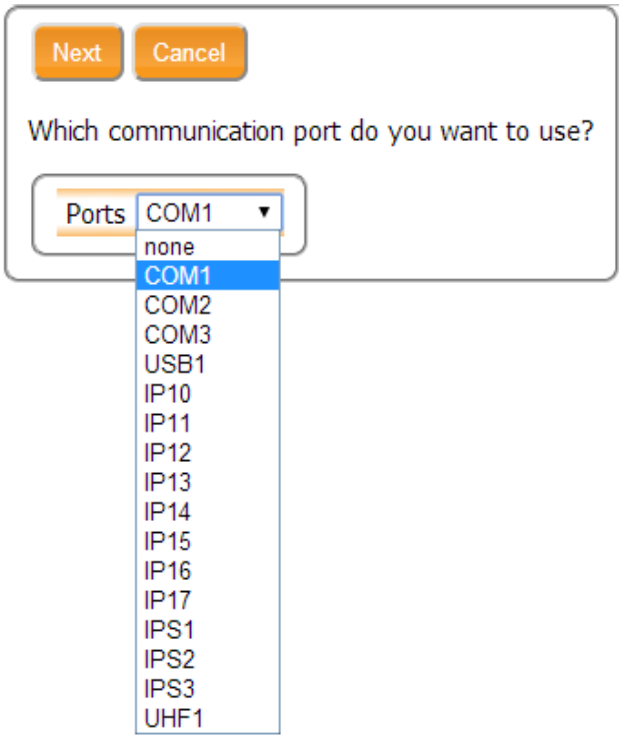
Step 3: Select output data type

In the next window, the output message type can be chosen; SBF or NMEA output can be selected.



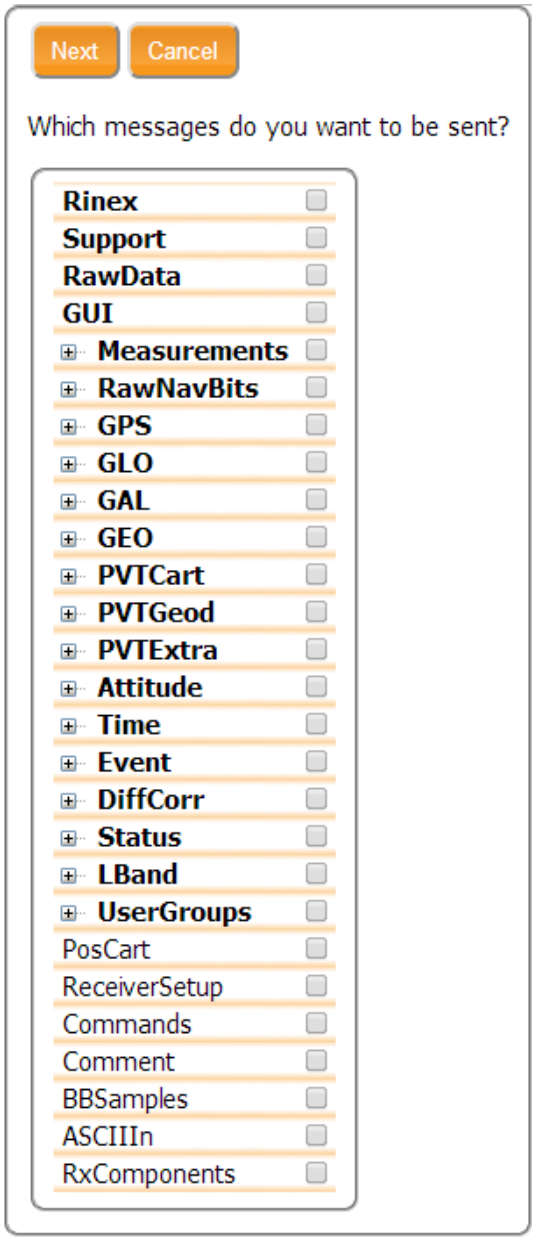
Step 4: Select communication port

The port, on which the data should be output, can be selected in the next screen.



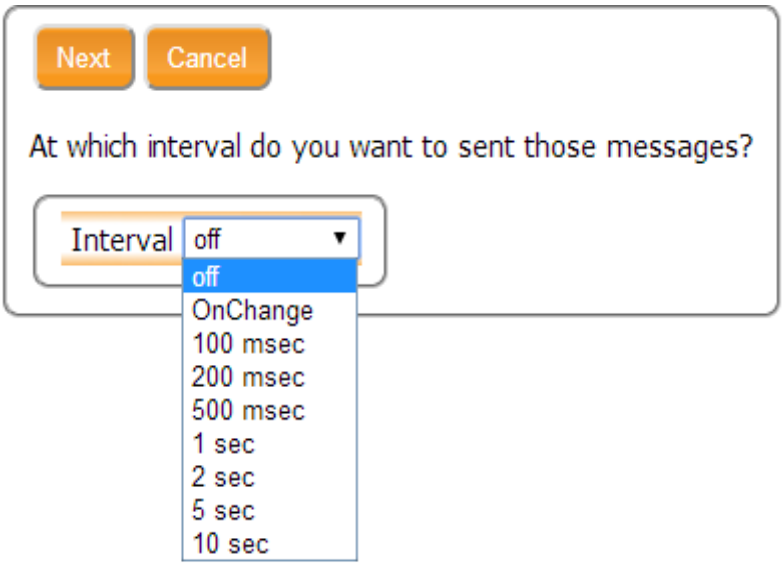
Step 5: Select the messages that should be output

Both for NMEA and SBF output, the messages to be output can be selected in the next step.



Step 6: Set the output interval

The interval that should be used to send out the messages can be selected in the next screen.



Step 7: Change the NMEA precision

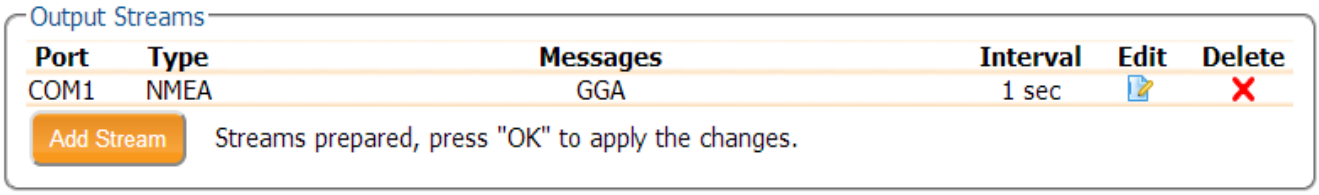
In the Advanced settings, the NMEA precision can be customized. In this window, the number of extra digits in the latitude, longitude and altitude reported in NMEA sentences can be defined. Here it is also possible to tune certain sentences to be compatible with third-party applications that are not fully compliant with the NMEA 0183 standard.

Step 8: Save and store settings

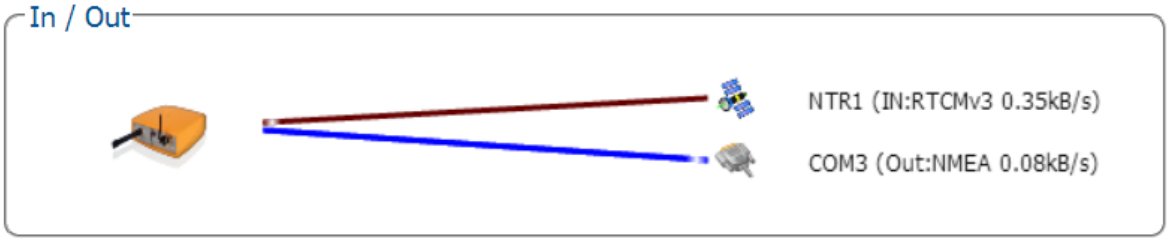
Press Ok to save the settings and click the Save button to store the settings.

Step 9: Review proper operation

Once the output stream is configured, it will be shown in the Output Streams window. Here, the stream can also be edited or deleted.



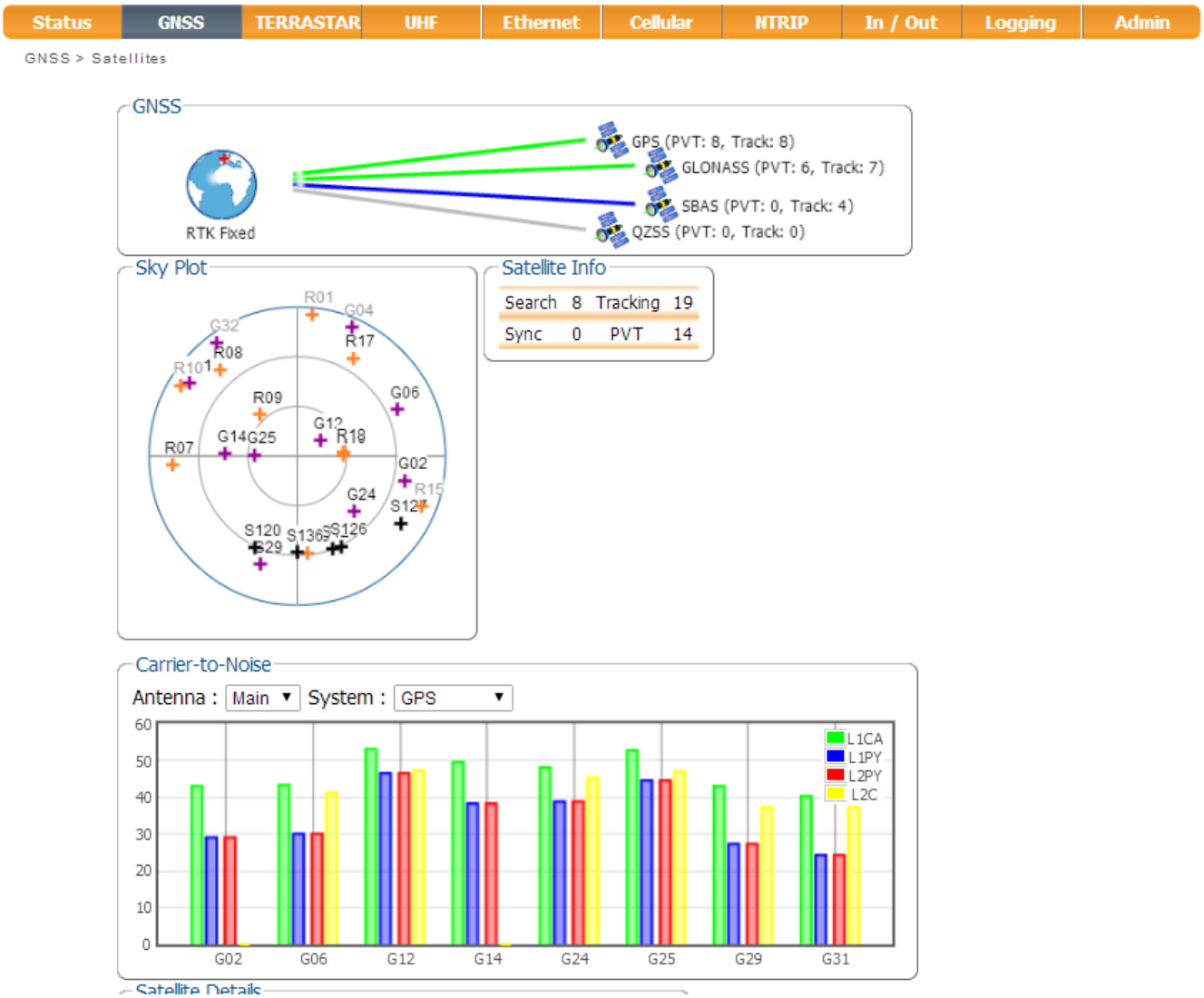
In the In/Out widget, the output stream will be shown as well. In the screenshot below, it is for example visible that NMEA is output on COM 3.



5.7 How to check tracked satellites

Step 1: Checking the tracked satellites

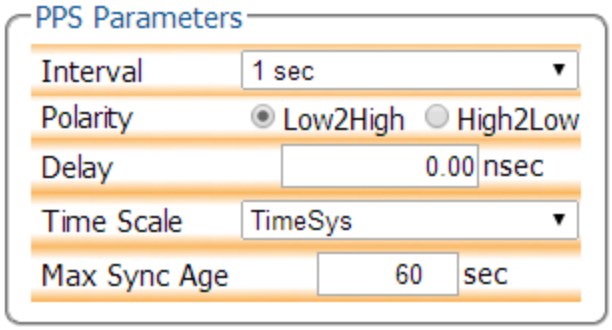
When starting from the default configuration, go to the GNSS satellites tab. In the GNSS satellites tab, it is possible to check several satellite parameters for every constellation, signal and antenna.



5.8 How to Enable PPS-Output

Step 1: Setting the PPS Parameters

When starting from the default configuration, go to the GNSS other tab. In the GNSS other tab, it is possible to set the PPS parameters.



The Interval specifies the time interval between the pulses. A special value “off” is defined to disable the PPS signal. The default value is 1 sec.

The Polarity defines the polarity of the PPS signal.

The Delay argument can be used to compensate for the overall signal delays in the system (including antenna, antenna cable and PPS cable). Setting Delay to a higher value causes the PPS pulse to be generated earlier. For example, if the antenna cable is replaced by a longer one, the overall signal delay could be increased by, say, 20 nsec. If Delay is left unchanged, the PPS pulse will come 20 nsec too late. To re-synchronize the PPS pulse, Delay has to be increased by 20 nsec.

By default, the PPS pulses are aligned with the satellite time system defined in Time Scale. . Using the TimeScale argument, it is possible to align the PPS pulse with the local receiver time (RxClock), with GLONASS time or with UTC.

When TimeScale is set to anything else than RxClock, the accuracy of the position of the PPS pulse depends on the age of the last PVT computation. During PVT outages (due for instance to signal blockage), the PPS position is extrapolated on the basis of the last available PVT information, and may start to drift. To avoid large biases, the receiver stops outputting the PPS pulse when the last PVT is older than the age specified in the MaxSyncAge argument. MaxSyncAge is ignored when TimeScale is set to RxClock.

Note that, the ZDA NMEA message comes always after the PPS pulse.

Step 2: Save and store settings

Press Ok to save the settings and click the Save button to store the settings.

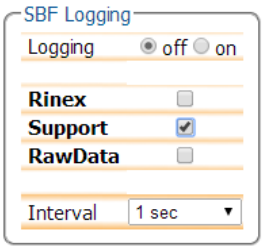
5.9 How to log data for Support and retrieve debugging information

When contacting Altus for assistance to resolve problems, the user is often asked to log some SBF data. This data can be used by the Altus support to analyze the behavior of the receiver and determine the cause of the problem.

Step 1: Log SBF data containing the Support block

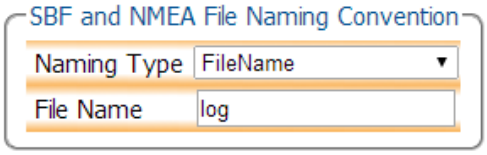
When starting from the default configuration, go to the Logging tab. The SBF Logging is disabled by default.

The logging of support data can be enabled as shown in the screenshot below. The interval can be left to its default value, which is 1 second.



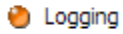
Step 2: Changing the SBF File name

By default, the File name is set to "log". The file naming can be changed in the Advanced Settings:



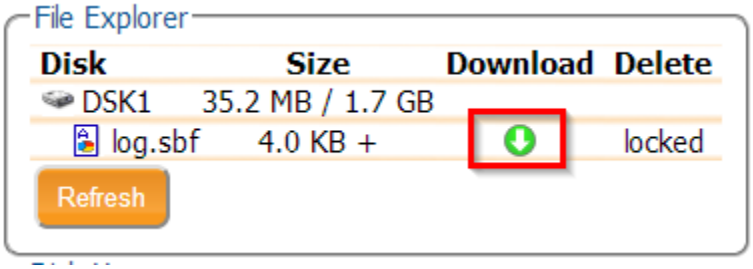
Step 3: Review proper operation

If the receiver is logging data onto the internal disk of the receiver, the Logging Led in the right upper corner of the web interface will be illuminated.



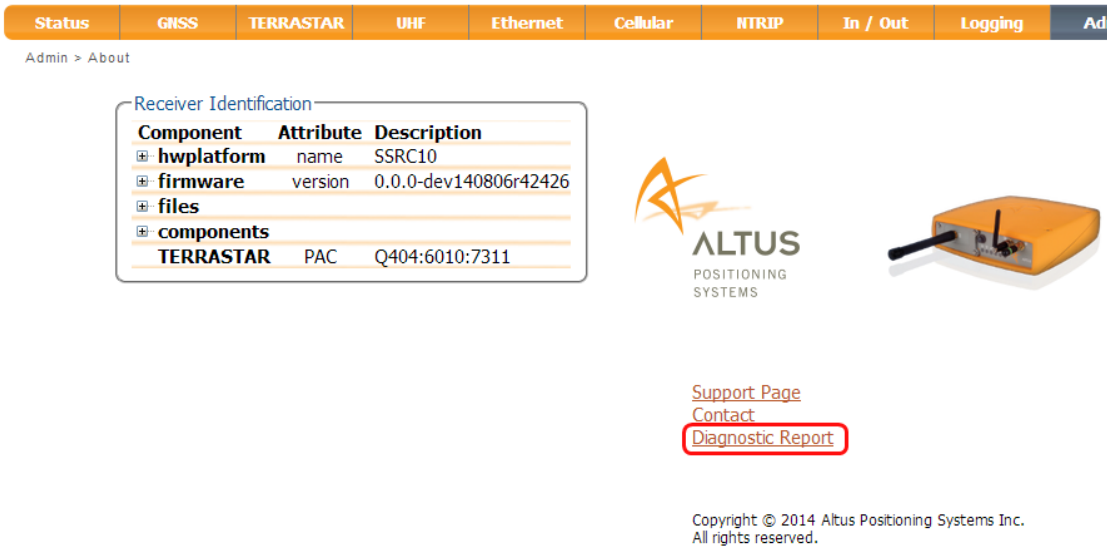
Step 4: Download the logged files from the internal disk

The logged files can be downloaded from the internal disk of the receiver from the File Explorer window.

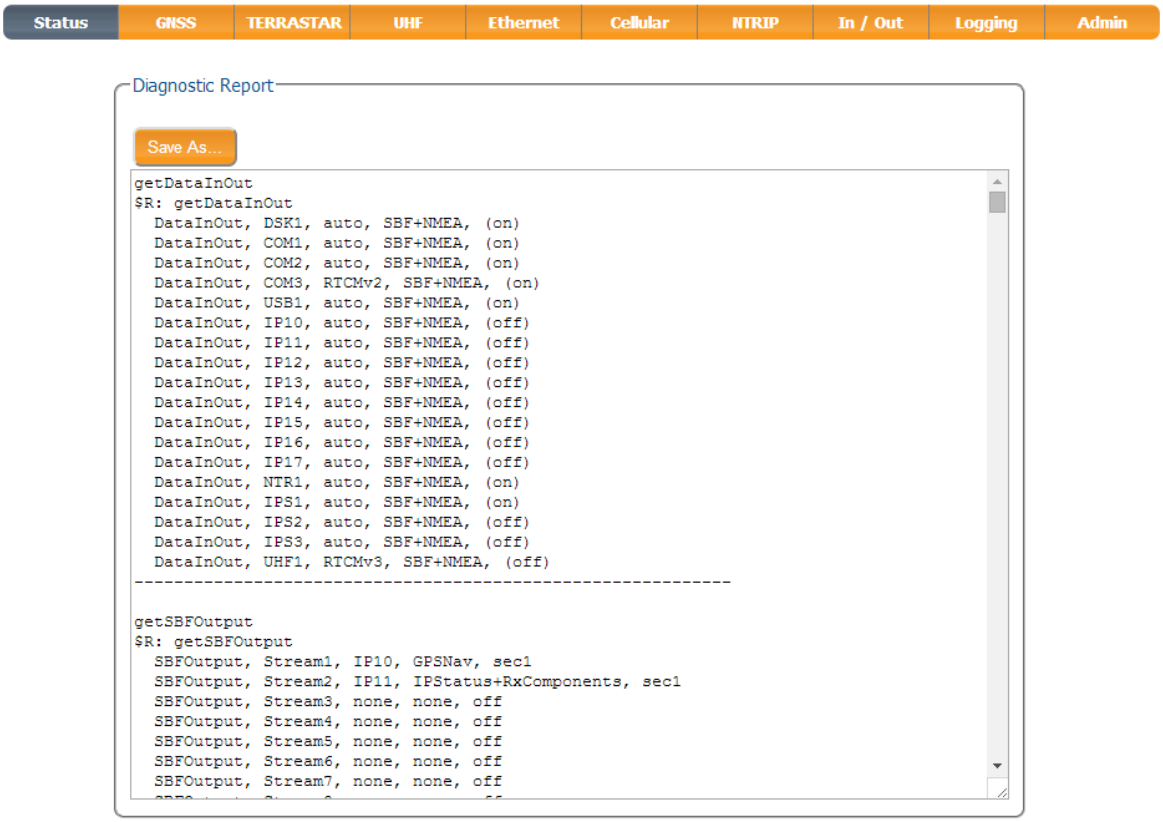


Step 5: Retrieve debugging information

To help identify problems, it is important to know exactly which firmware version is used and any error messages that are generated as well as the current receiver configuration. All this information is contained in the Diagnostic Report which can be generated from the Admin tab from the About menu as shown in the screenshot below.



The diagnostic report will then be displayed and can be saved as a .txt file by clicking on the Save As… button.



Step 6: Contact Support

From the About page in the Admin tab, it is also possible to contact Altus support and access the support page on the Altus website, where you can find the FAQs.,

6 Appendix

6.1 Port Descriptions

6.1.1 Clock In/Out

Leave this port unconnected.

6.1.2 PPS & Event In

This port uses cable assembly p/n 2001952 which has a 7-Pin Lemo plug to the APS-U rear panel that into a BNC connector for 1 Pulse Per Second (PPS) out, and wire connectors for Event A & B markers.

Note that due to a hardware design limitation, the Events cannot be used when the PPS-Out signal is enabled (see section 5.8).

Pin #	Description	Connector
1	Not Connected	Not Connected
2	Event A (3.3V-LVTTL input)	Tag with 'Event A'
3	Event B (3.3V-LVTTL input)	Tag with 'Event B'
4	Ground	Tag with 'GND'
5	Not Connected	Not Connected
6	Pulse Per Second (PPS) (3.3V-LVTTL out)	BNC Center Conductor
7	Ground	BNC Shell
*	Connect Pins 4 & 7 Together to Ground	Not Connected

6.1.3 COM1

This port uses cable assembly p/n 201954 which has 9-Pin Lemo plug to the APS-U rear panel and a DB9 connector for RS-232 communication with COM1 of the system; direct communication with the internal processor.

Pin #	Description	Connector
1	CTS	8 (DB9-Female)
2	Not Connected	Not Connected
3	Not Connected	Not Connected
4	Ground	Not Connected
5	Ground	Not Connected
6	RX	3 (DB9 Female)
7	TX	2 (DB9 Female)
8	RTS	7 (DB9 Female)
9	Ground	(DB9 Female)

6.1.4 COM2 & COM3

This port uses cable assembly p/n 201955, which has a Lemo 14-Pin plug that splits into 2 DB9 connectors for RS-232 communication with Com2 and Com3 of the system.

- COM2: Direct communication with the internal processor.
- COM3: Direct communication with the GNSS Receiver.

Pin #	Description	Connector
1	Not Connected	Not Connected
2	Not Connected	Not Connected
3	Not Connected	Not Connected
4	Not Connected	Not Connected
5	Tx3 for COM3	2 (DB9 Female)
6	Rx3 for COM3	3 (DB9 Female)
14	Ground for COM3	5 (DB9 Female)
7	CTS2 for COM2	8 (DB9 Female)
8	Rx2 for COM2	3 (DB9 Female)
9	RTS2 for COM2	7 (DB9 Female)
10	Tx2 for COM2	2 (DB9 Female)
11	Ground for COM2	5 (DB9 Female)
12	Not Connected	Not Connected

6.1.5 Ethernet & USB

The port uses cable assembly p/n 201956, which has a 16-pin Lemo plug that splits into a USB (Type A) port communicates directly to the internal processor, and an Ethernet RJ45. The Ethernet port can be connected for communication to a PC or Ethernet router. This is internally connected to an Ethernet hub to communicate with the APS-U.

Pin #	Description	Connector
1	Ground	Not Connected
2	LRXP	3 (Ethernet Plug)
3	LRXN	6 (Ethernet Plug)
4	LTXP	1 (Ethernet Plug)
5	LTXN	2 (Ethernet Plug)
7	USB_DM	3 (USB Type A Plug)
6	USB_DP	2 (USB Type A Plug)
8	USB_VBUS	1 (USB Type A Plug)
12	Ground	4 (USB Type A Plug)
9	CAN_TX0	Not Connected
10	CAN_RX0	Not Connected
11	NC	Not Connected
13	Ground	Not Connected
14	Ground	Not Connected
15	Ground	Not Connected
16	Ground	Not Connected

6.1.6 DC Power Input

The external power input is via the 4-pin LEMO connector. Cables 201863 (open end) or 214451 (with AC power adapter) can be used.

The specifications are:

- External Power: 9 VDC to 30 VDC
- Current: 0.89 A @ 12 VDC Nominal

Wire Color	Function
RED	Power (+)
BLACK	Ground (-)
---	Not Used
---	Not Used

6.2 List of Typical GNSS Related Acronyms

APME	A Posteriori Multipath Estimation
ARP	Antenna Reference Point
ASCII	American Standard Code for Information Interchange
CMR	Compact Measurement Record
CPU	Central Processing Unit
CR	Carriage Return
CTS	Clear to Send
DGPS	Differential Global Positioning System
DOP	Dilution of Precision
EGNOS	European Geostationary Navigation Overlay System
ESTB	EGNOS System Test Bed
FPGA	Field Programmable Gate Array
GLONASS	Global Orbiting Navigation Satellite System (Russian alternative for GPS)
GNSS	Global Navigation Satellite System
GPRS	General Packet Radio Service
GPS	Global Position System
GPX	GPS exchange
GSM	Global System for Mobile communications
GUI	Graphical User Interface
HERL	Horizontal External Reliability Level
HPL	Horizontal Protection Level
IGS	International GNSS Service
LAMBDA	Least-squares AMBiguityDecorrelation Adjustment
LED	Light Emitting Diode
MDB	Minimal Detectable Bias
MOPS	Minimum Operational Performance Standards
MSAS	Multi-functional Satellite Augmentation System
MT	Message Type
NGS	National Geodetic Survey
NMEA	National Marine Electronics Association
OEM	Original Equipment Manufacturer
OTF	On the Fly
PPS	Pulse Per Second
PVT	Position Velocity Time
RAIM	Receiver Autonomous Integrity Monitoring
RINEX	Receiver Independent Exchange Format
ROM	Read Only Memory
RTCA	Radio Technical Commission for Aeronautics
RTCM	Radio Technical Commission for Maritime Services
RTK	Real Time Kinematic
SBAS	Satellite Based Augmentation System
SD	Secure Digital
SDHC	Secure Digital High Capacity
SIM	Subscriber Identity Module
UHF	Ultra high frequency
VRS	Virtual Reference Station
WAAS	Wide Area Augmentation System