PolaRx5TR

User Manual

User Manual Revision 2.7
Applicable to version 5.5.0 of the PolaRx5TR Firmware

February 09, 2024
Thank you for choosing the PolaRx5TR. This user manual provides detailed instructions on how to use PolaRx5TR and we recommend that you read it carefully before you start using the device.

Please note that this manual provides descriptions of all functions of the PolaRx5 product family. However, the particular PolaRx5TR you purchased may not support functions specific to certain variants.

While we try to keep the manual as complete and up-to-date as possible, it may be that future features, functionality or other product specifications change without prior notice or obligation. The information contained in this manual is subject to change without notice. We recommend you to look for new or updated information in our Knowledge Base at https://customersupport.septentrio.com/s/topiccatalog

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1 Introduction

1.1 User Notices

1.1.1 CE Notice

PolaRx5TR receivers 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.

1.1.2 ROHS/WEEE Notice

PolaRx5TR receivers are compliant with the latest WEEE, RoHS and REACH directives. For more information see www.septentrio.com/en/environmental-compliance.

1.1.3 Safety information

Statement 1: 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 2: Ultimate disposal of this product should be handled according to all national laws and regulations.

Statement 3: The equipment and all the accessories included with this product may only be used according to the specifications in the delivered release note, manual or other documents delivered with the receiver.

1.1.4 Support

For first-line support please contact your PolaRx5TR dealer.

Additional documentation can be found in the following manuals:

- **The PolaRx5TR Reference Guide** (contained inside the Firmware Package zip on our website) includes information on the receiver operation, the full list of receiver commands and a description of the format and contents of all SBF (Septentrio Binary Format) blocks.
- **The RxControl Manual** covers the RxTools software suite, including RxControl and RxLogger.

The Septentrio website has a dedicated Support section (http://www.septentrio.com/support), where the User Manual, the Firmware Reference Guide and the latest officially supported Firmware version are readily available for download.

Further information can be found on our website or by contacting Septentrio's Technical Support department.

In case the PolaRx5TR does not behave as expected and you need to contact Septentrio's Technical Support department, you should attach a short SBF log file containing the support blocks and a Diagnostic Report of the receiver (see Section 6.3).

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2 PolaRx5TR overview

2.1 Hardware specifications

2.1.1 Physical and Environmental

Size:	235 x 140 x 37 mm (length includes connectors) (9.25 x 5.51 x 1.45 in)
Weight:	940 g (2.07 lb)
Operating temperature:	-40 to +65 °C (-40 to +149 °F)
Storage temperature:	-40 to +85 °C (-40 to +185 °F)
Certification:	IP65, RohS, CE FCC Class B Part 15

2.2 PolaRx5TR design

2.2.1 Front panel

The front-panel layout of the PolaRx5TR is shown in Figure 2-1. A description of the front-panel sockets as well as their PIN assignments can be found in Appendix A. The cables available for use with the PolaRx5TR are listed in Appendix D and the LED behavior is described in Appendix E.

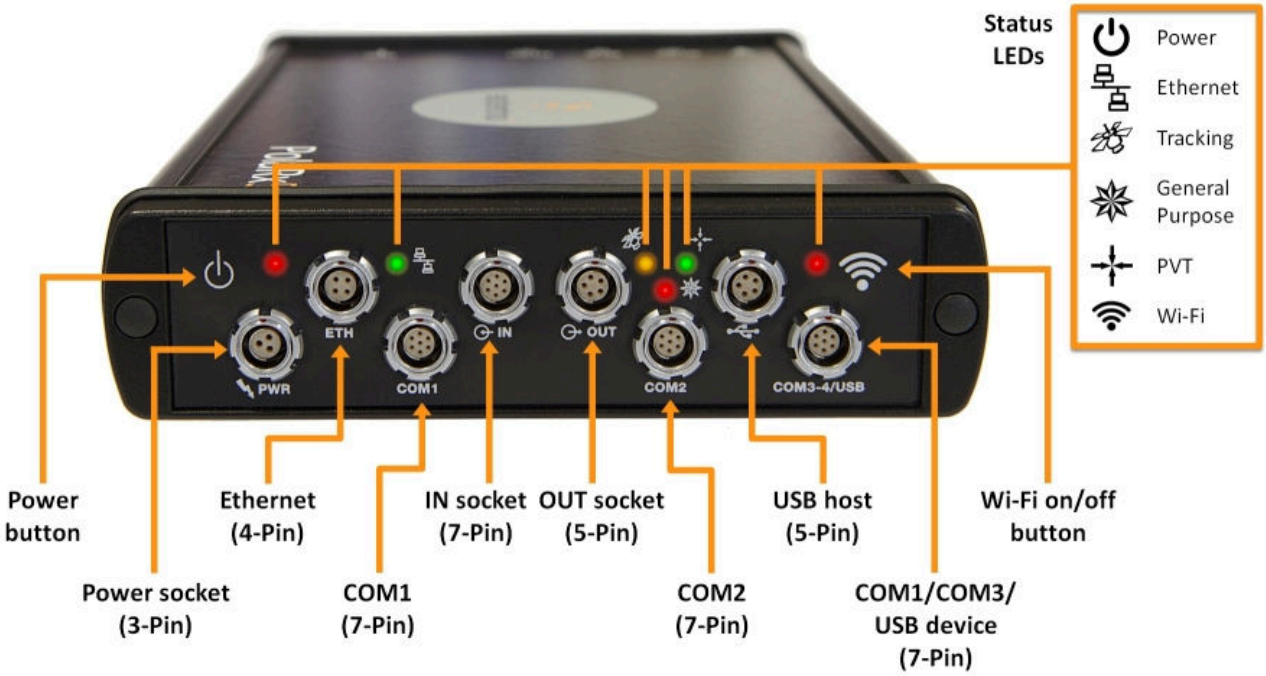


Figure 2-1: PolaRx5TR front-panel layout

2.2.2 Rear panel

Figure 2-2 shows the layout of the rear-panel connectors on the PolaRx5TR. More information on these connectors can be found in Appendix B.

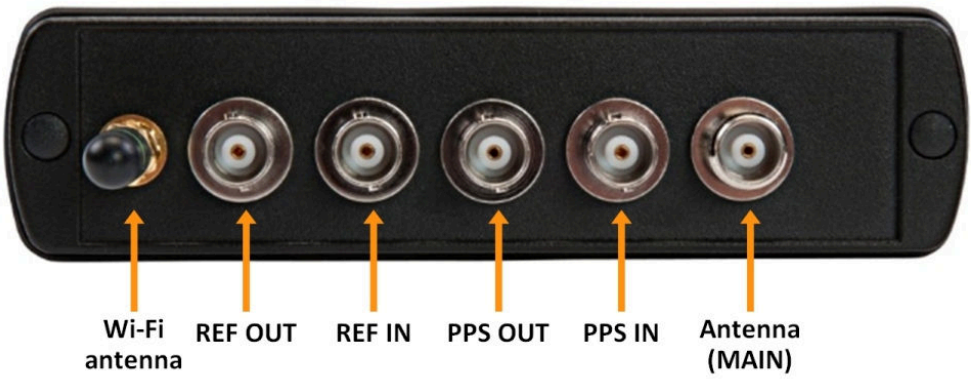


Figure 2-2: PolaRx5TR rear-panel layout

2.2.3 Powering the Receiver

The receiver can be powered through either:

- The PWR connector (9-30 VDC)
- The Ethernet connector (Power over Ethernet - PoE, 37-57 VDC). Please note that only mode A, as specified in the 802.3af standard, is supported.

If power is provided through both the Ethernet and the PWR connectors, Ethernet power takes precedence. This allows the connection of a back-up battery to the ODU PWR connector. The battery will only be used in case of an outage of the power over Ethernet.

The current power source (PWR or Ethernet connector), and the voltage at the PWR connector are reported in the `PowerStatus` SBF bock.

2.2.4 Power Button

When power is initially applied to the PWR or Ethernet connector, or after a power outage, the receiver always starts up without the need to press the power button.

In case the receiver is only powered through PoE, pressing the power button resets the receiver. After a few seconds, the receiver will restart.

In case the receiver is powered through the PWR connector or through both PWR and PoE, pressing the power button turns the receiver off. Pressing the button again switches the receiver back on.

In all cases, the state of the power button is not retained across a power outage. If the receiver was off before the power outage, it will restart when power is restored.

2.2.5 WiFi Button

The WiFi button toggles the WiFi modem on and off.

When the receiver starts up, WiFi is enabled or disabled according to the settings of the **setWiFiMode** command stored in the boot configuration file. When the receiver is operating, pressing the WiFi button turns WiFi on and off in turn. The red WiFi LED next to the WiFi button lights when WiFi is enabled.

2.2.6 Internal memory

The PolaRx5 has a 16 GB Memory for internal data logging. Data can be logged in SBF, RINEX, BINEX, NMEA or RTCM-MSM format and may be retrieved via the âĂŸLoggingâĂŹ menu of the web interface.

2.2.7 External memory

The PolaRx5TR can log data to an external memory device.

3 Getting started with the PolaRx5TR

This section details how to power-up, connect to and communicate with the PolaRx5TR. The PolaRx5TR has an on-board web interface which you can connect to in three ways: Ethernet, USB or WiFi. The PolaRx5TR is fully configurable using the web interface. Please note that older versions of certain browsers may not properly display the web interface.

3.1 Powering the PolaRx5TR

You can power the PolaRx5TR by connecting the power adapter that is supplied as standard to the front-panel power socket as indicated in Figure 3-1. The receiver will start up automatically without pressing the power button.

Figure 3-1: Front-panel power socket

The PolaRx5TR can also be powered over Ethernet (PoE) as described in Section 2.2.3 or by supplying 9 to 30 V via PIN 1 of the open-ended power cable (CBLe_PWR_OE) as detailed in Appendix A.8.

3.2 Connecting an antenna

The rear panel of the PolaRx5TR has a TNC connector labeled **MAIN** to connect a GNSS antenna. Connect an antenna to the PolaRx5TR using an antenna cable as shown in Figure 3-2. The connector can provide 5V DC and up to 200 mA to power an antenna (see Appendix B.1 for more information).

Figure 3-2: Rear-panel antenna connector

Before connecting an antenna, the orange front-panel tracking LED will be blinking fast indicating that the receiver is searching for satellites. After connecting an antenna that has a clear view of the sky, the PolaRx5TR will start to track satellites and the tracking LED will

start to blink more slowly. The number of blinks between pauses indicates the number of satellites being tracked as described in Appendix E.

3.3 Connecting to the PolaRx5TR via the Web Interface

You can connect to the receiver on any device that supports a web browser using the receiver's on-board Web Interface. The connection can be made over USB, Ethernet or WiFi. The following sections describe each of the connection methods.

3.3.1 Using the USB cable

Connect the USB cable (CBLe_USB) to the socket labeled **COM3-4/USB** on the front panel of the PolaRx5TR as indicated in Figure 3-3.

Figure 3-3: Connecting to the front-panel USB socket

The first time that the USB cable is connected to your PC, you may be prompted to allow installation of drivers which can take several minutes. When the drivers have been installed, it is recommended to unplug then re-plug in the USB cable on your device to fully activate the drivers.

If the USB drivers do not install automatically, they can be installed manually by double clicking on the executable installer file found in the folder 'driver' as shown in Figure 3-4.

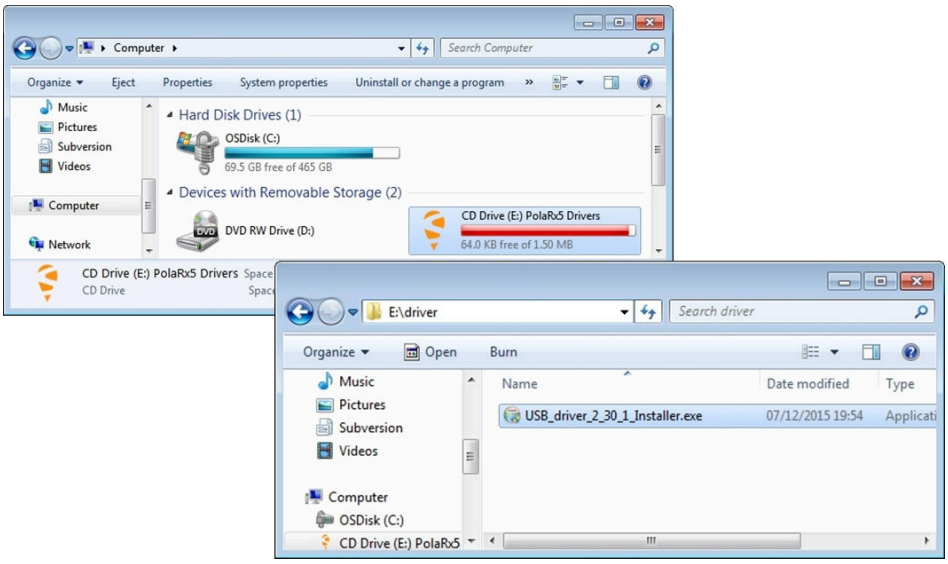


Figure 3-4: Manually installing the USB drivers

Again, when the drivers have been installed, it is recommended to unplug then re-plug in the USB cable on your device to fully activate the drivers.

The USB connection on the PolaRx5TR functions as network adapter and the DHCP server running on the receiver will always assign the PolaRx5TR the IP address 192.168.3.1.

To connect to the PolaRx5TR, you can then simply open a web browser using the IP address **192.168.3.1** as shown in Figure 3-5.

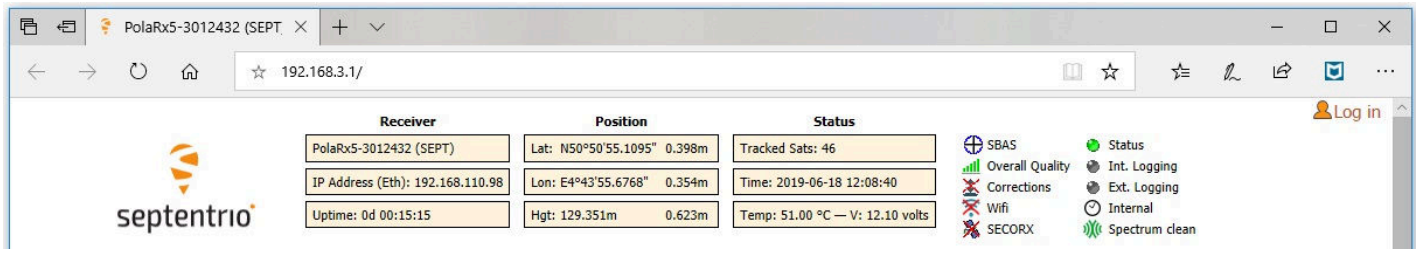


Figure 3-5: Connect to the Web Interface of the PolaRx5TR over USB using the IP address **192.168.3.1** on any web browser

3.3.2 Over WiFi

The Web Interface can also be accessed over a WiFi connection. You can turn on the WiFi modem of the PolaRx5TR by pressing firmly on the WiFi button as shown in Figure 3-6.

Figure 3-6: Press firmly on the front-panel WiFi button to turn on the WiFi modem. When active, the red WiFi led will be lit.

On your PC or tablet, search for visible WiFi signals: the PolaRx5TR identifies itself as a wireless access point named 'PolaRx5TR-*serial number*'. The serial number of the PolaRx5TR can be found on an identification sticker on the receiver housing. Select and connect to the PolaRx5TR as shown in Figure 3-7.

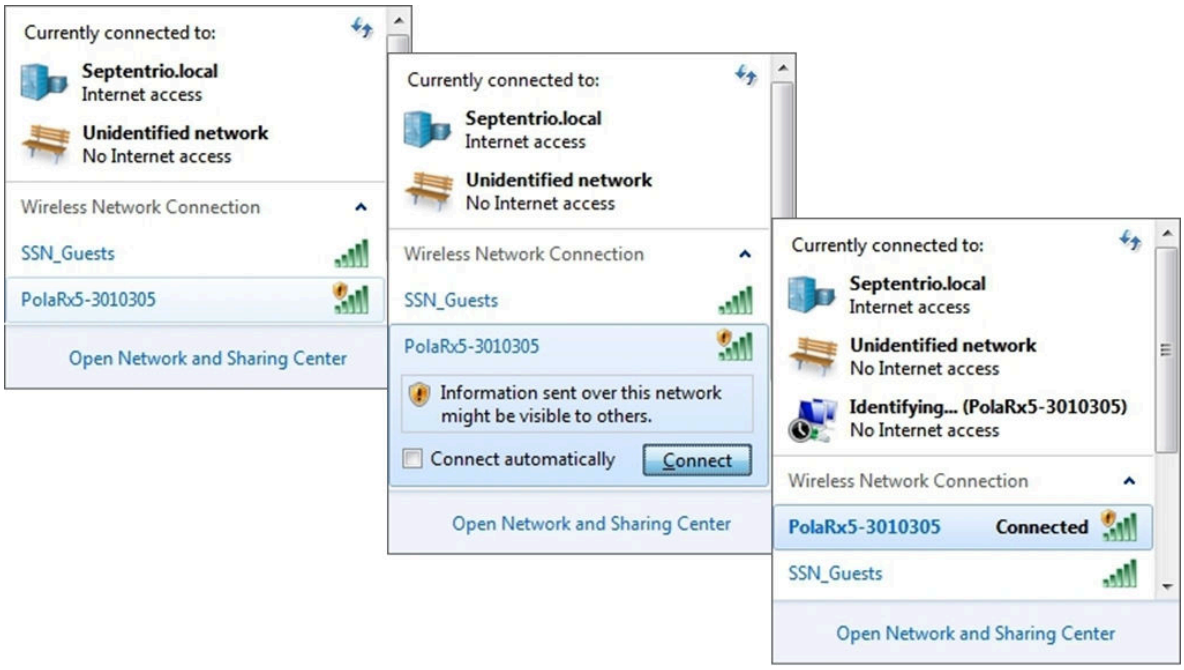


Figure 3-7: Select the PolaRx5TR from the list of detected wireless signals and connect

When your PC has connected to the PolaRx5TR WiFi signal, you can open a web browser using the IP address **192.168.20.1** as shown in Figure 3-8.

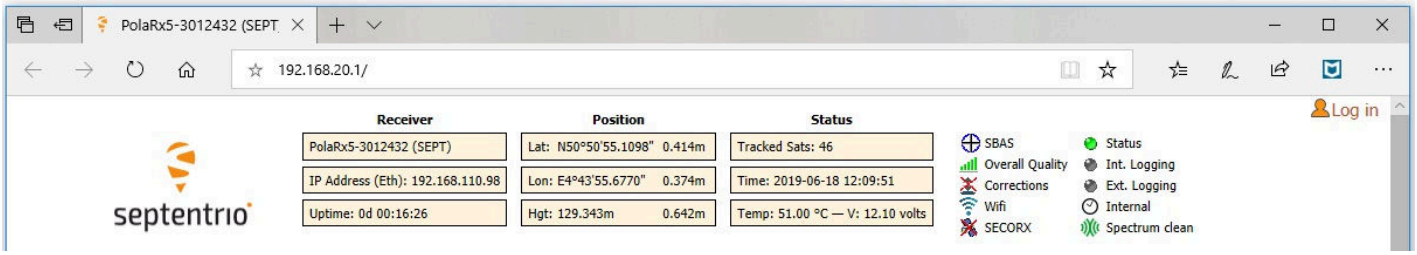


Figure 3-8: Connect to the Web Interface of the PolaRx5TR over WiFi using the IP address **192.168.20.1** on any web browser

3.3.3 Using the Ethernet cable

Connect the Ethernet cable (CBLe_ETH_MS) to the socket labeled **ETH** on the front panel of the PolaRx5TR as shown in Figure 3-9.

Figure 3-9: Connecting to the front-panel Ethernet socket

For the most straightforward setup, the RJ45 socket of the Ethernet cable should be connected to a network running a DHCP server. The IP address assigned to the receiver will be associated with the hostname 'PolaRx5TR-*xxxxxxx*', where *xxxxxxx* are the 7 digits of the serial number of the GNSS Receiver Board (GRB) inside the PolaRx5TR. This number can also be found on an identification sticker on the receiver housing. You can then make a connection to the receiver using the web address **http://PolaRx5TR-*xxxxxxx***.

Figure 3-10 shows a screenshot of an Ethernet connection to a PolaRx5 receiver with serial number 3013369 using '**http://polarx5-3013369/**'.

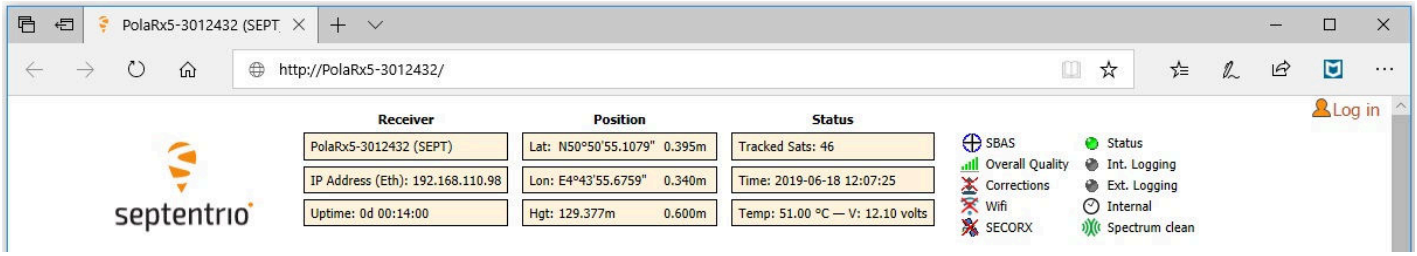


Figure 3-10: Connecting to the Web Interface over Ethernet

4 The PolaRx5TR for time and frequency transfer

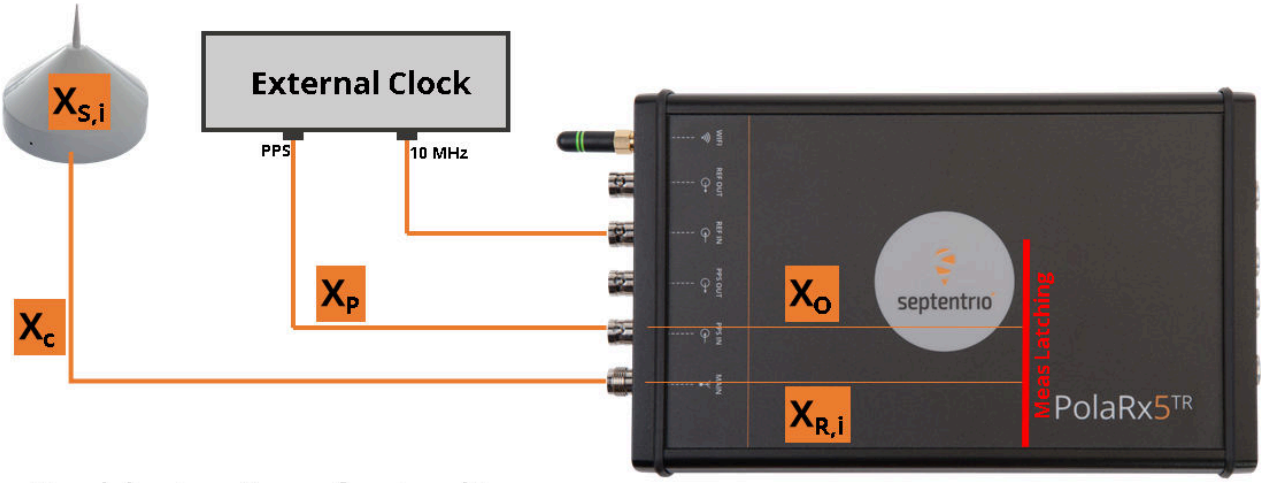
This chapter details the configuration of the PolaRx5TR receiver and the RxControl tool for timing applications and CGGTTS generation.

4.1 Setup for timing applications

In time and frequency transfer applications, the receiver is fed with a 10 MHz reference and a PPS signal originating from an external clock. The 10 MHz reference signal is connected to the REF IN connector, and the PPS signal is connected to the PPS IN connector of the PolaRx5TR. This has the effect of aligning the receiver time with the time of the external clock, bypassing the receiver's internal clock.

It is important that the PPS input signal and the 10 MHz REF IN reference are generated from the same external clock and that the PPS input signal be roughly synchronized to UTC (offset with UTC should be smaller than 0.5 milliseconds). It is also necessary that the REF IN and PPS IN signals are present from the start-up of the receiver. Plugging in a PPS input signal when the receiver is already operating will lead to erroneous measurements.

A typical setup is shown in Figure 4-1. The various delays involved in time-transfer applications are also indicated in the figure.



$X_{S,i}$: delay in antenna for signal i
$X_{R,i}$: delay in RF section of receiver for signal i
X_C: delay in RF cable (including amplifier and splitter)
X_P: delay in PPS cable
X_O: delay between PPS IN connector and internal receiver time reference (X_O = 0 on PolaRx5TR when auto-calibration is enabled)

Figure 4-1: Typical setup for time-transfer applications showing relevant delays

4.2 Calibration of the delay from PPS IN to the internal time reference

The receiver synchronizes its own internal time reference (i.e. its measurement latching) with the low-to-high transitions of the reference time signal at the PPS IN connector. This synchronization occurs with some small delay, often referred to as 'X_O' in the literature (see Figure 4-1). In the PolaRx5TR, X_O can take any value from 24ns to 59ns depending on the phase relationship between the 10 MHz frequency reference and the PPS input signal at the REF IN and PPS IN connectors respectively. X_O remains constant when the receiver is reset or power-cycled, but changes when the cables feeding the REF IN and/or the PPS IN connectors are changed.

X_O can either be left uncompensated, or can be measured and compensated for by the receiver itself. For legacy reasons, the compensation is disabled by default. In new installations that have not been calibrated yet, it is easier to enable X_O compensation. Both options are described below.

4.2.1 X_O uncompensated

This is the default behavior. To verify that the X_O compensation is disabled, check that 'off' has been selected in the 'PPS In Parameters' field on the Timing>PPS window of the Web Interface as shown in Figure 4-2.

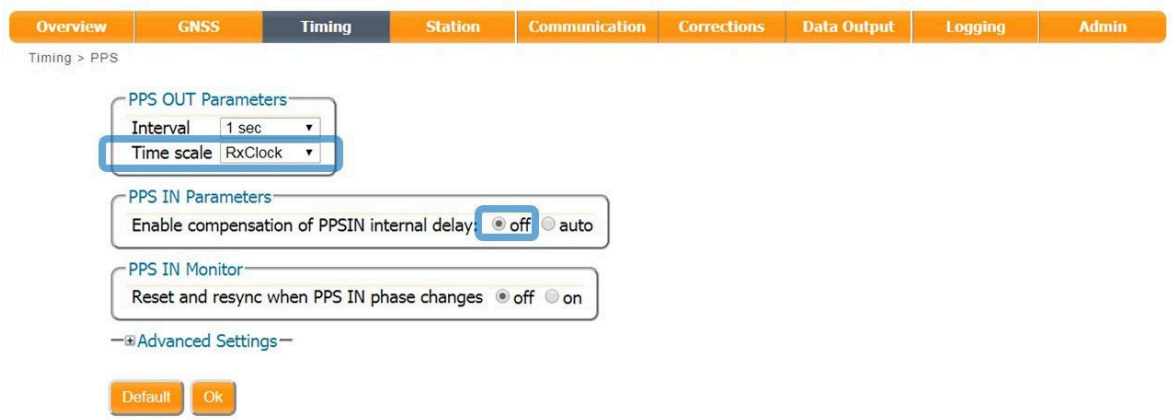


Figure 4-2: Configuration to disable automatic PPS IN internal delay compensation (PPS IN Parameters) and to bring the measurement latching strobe to the PPS OUT connector (PPS OUT Parameters)

The X_O delay is the delay from the PPS IN connector to the actual measurement latching (see Figure 4-1). The measurement latching is an internal signal, but it can be brought to the PPS OUT connector so that it can be monitored externally. This is done by selecting 'RxClock' in the 'PPS OUT Parameters' field as shown in Figure 4-2. In this configuration, the PPS OUT materializes the internal receiver time reference.

An example of a setup which can be used to manually determine the delay between the PPS IN and the internal time reference (X_O) is shown in Figure 4-3. For this calibration, it is not necessary to connect an antenna to the receiver. For the most straightforward interpretation of the results, cables C1 and C2 should have the same length.

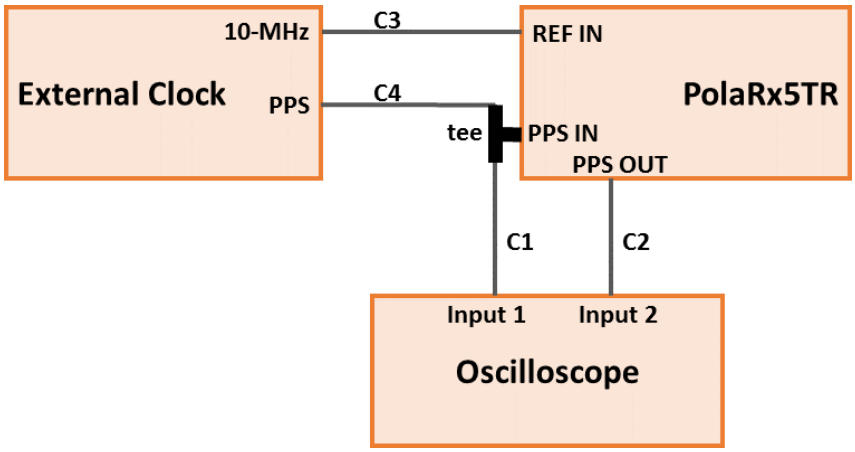


Figure 4-3: Manual calibration of the PPS IN to internal reference delay

X_O is the time difference between the leading edges of the pulses on the Input 1 and Input 2 ports of the oscilloscope. The oscilloscope trigger level should be set to 1V.

The measured X_O should be a value between 24ns and 59ns. The value depends on the relative length of the REF IN and PPS IN cables, as shown in Figure 4-4.

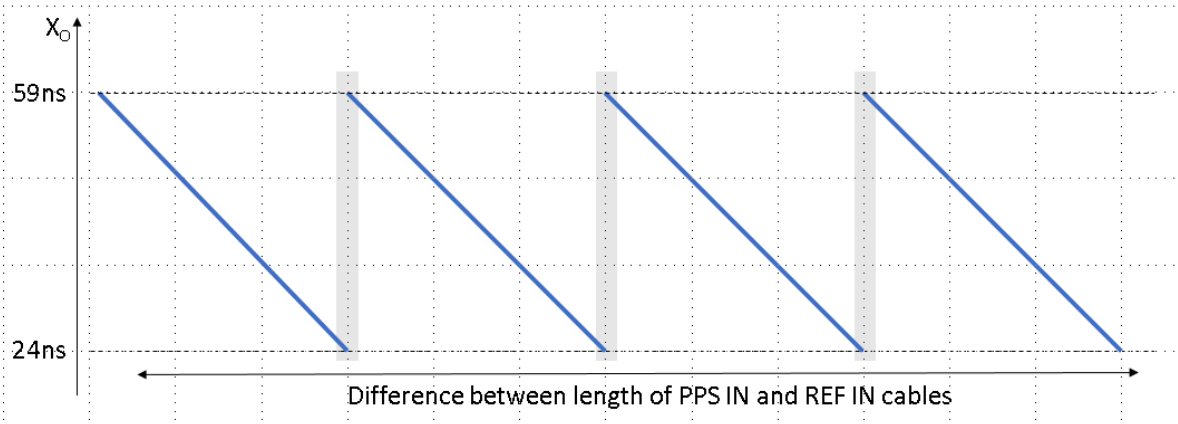


Figure 4-4: Variation of X_O as a function of the relative cable length

It is recommended to avoid operating the receiver in the gray zones of Figure 4-4. Therefore, if X_O is found to be lower than 26ns or larger than 57ns, it is recommended to change the length of the REF IN or of the PPS IN cable. A change of 1 meter in the cable length corresponds to a change of X_O by about 5ns. Adding length to the REF IN cable increases the X_O value. Adding length to the PPS IN cable decreases the X_O value.

4.2.2 Auto-Calibration and compensation of X_O

The PolaRx5TR incorporates a circuit to calibrate the PPS IN internal delay and to compensate for it. Enabling X_O compensation can be done on the Timing>PPS window of the Web Interface, as shown in Figure 4-5.

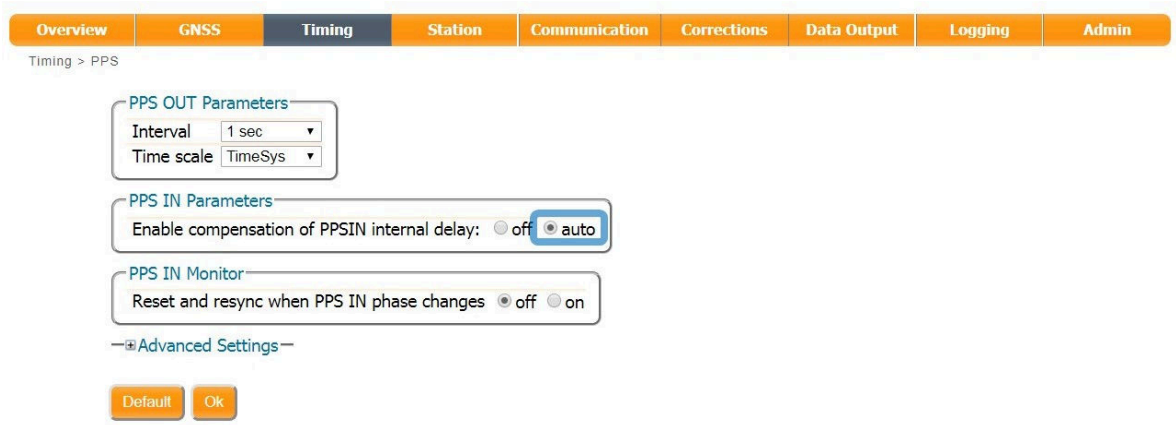


Figure 4-5: Select 'auto' in the PPS IN Parameters field to enable automatic PPS IN internal delay compensation

To ensure that the receiver continues to compensate for the X_O delay following a reboot or reset, click 'Save' on the pop-up that appears on the web page, as shown in Figure 4-6.

Figure 4-6: Click 'Save' on the pop-up to save the new settings to the boot configuration

From now on, if a PPS signal is fed into the PPS IN connector, the PolaRx5TR calibrates the X_O delay and adjusts its measurements accordingly. This calibration is repeated again after each reboot or reset. The result of this process is that X_O can be considered zero in time transfer applications, for example when generating a CGGTTS file.

The calibration takes up to 20 minutes (this time being required to ensure that most of the temperature transients have vanished) during which time the X_O estimation gradually improves to reach a final accuracy of 100 ps. During calibration, the xPPS output signal is unavailable, but all other receiver functions work normally. The PPS_IN_CAL bit of the `RxState` field of the `ReceiverStatus` SBF block is set to indicate that calibration is ongoing. When calibration is complete, the receiver outputs a message with the result of the calibration. It can be viewed in the 'Receiver Messages' window such as is shown in Figure 4-8.

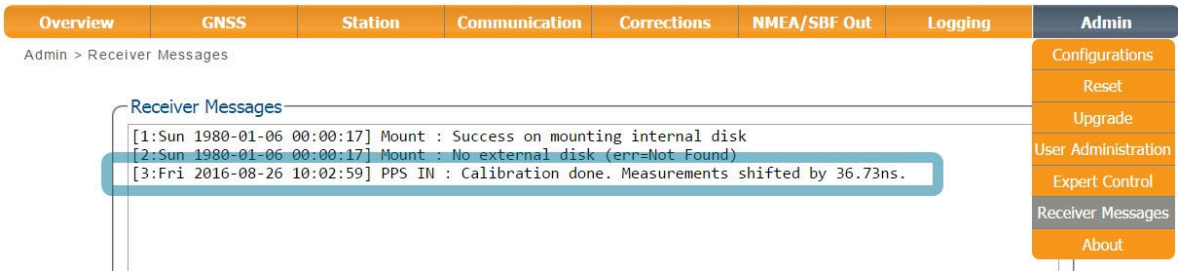


Figure 4-7: Calibrate complete message

4.3 PPS IN monitoring

By default, the receiver uses the PPS IN signal only at startup for initial synchronization and delay calibration. During operation, PPS IN is ignored and the receiver time is kept in sync by counting the cycles of the 10 MHz REF IN reference. It is assumed that the phase of PPS IN remains constant with respect to the 10 MHz reference, or in other words, that there are exactly 10 millions of cycles of the 10 MHz reference between each PPS IN pulse.

In some cases, this assumption is not valid, for example when the PPS IN phase can jump independently of the 10 MHz reference. The receiver can detect such PPS IN phase changes and reset and resynchronize when they occur. If auto-calibration of the X_O delay is enabled (see section 4.2.2), the new delay is measured.

To enable PPS IN monitoring, open the Timing>PPS page of the Web Interface and select 'on' in the PPS IN Monitor section, as shown below.

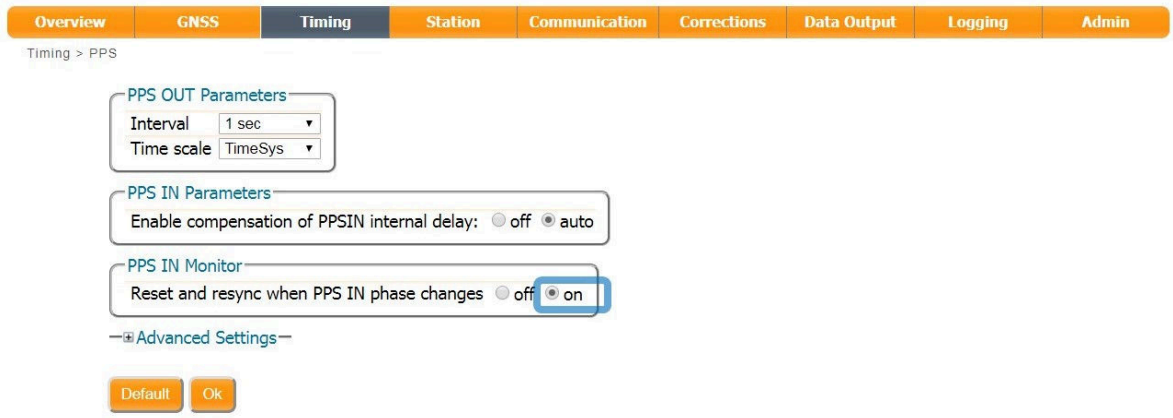


Figure 4-8: Enabling PPS IN monitoring and reset in case of a PPS IN phase change

Note that the the PPS IN jump detection threshold is set to about one nanosecond.

4.4 How to log CGGTTS files

CGGTTS is a data format for accurate transfer of time and frequency using GNSS receivers. The PolaRx5TR supports CGGTTS version V2E. As of firmware version 5.3, the PolaRx5TR receiver can autonomously log CGGTTS files on its internal disk and FTP them to a remote server at the end of each day. The different constellations (GPS, GLONASS, Galileo and BeiDou) are logged in separate CGGTTS files.

This section explains how to configure CGGTTS logging using the receiver's Web Interface. Before starting, make sure that the PolaRx5TR is synchronized to your external clock. The set-up is described in Section 4.1. If the REF IN and the PPS IN signals are properly connected and recognized by the receiver, the Web Interface will report the "ExtFreq+ExtTime" status next to the clock icon, confirming that the receiver is now using the external frequency and time sources.

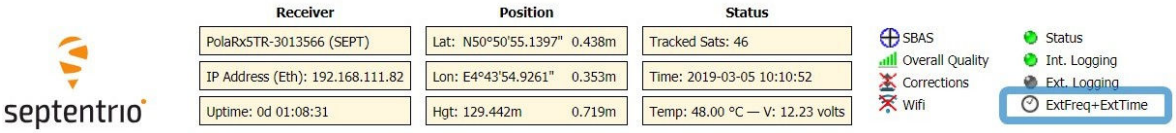


Figure 4-9: The "ExtFreq+ExtTime" status

4.4.1 Configuring the CGGTTS parameters

Go to the Timing>CGGTTS page of the Web Interface to enter all the parameters that the receiver will need to generate CGGTTS files. The page is split in three tabs.

Under the "Antenna Phase Center Coordinates" tab, enter the X, Y, Z coordinates of the antenna phase center. These are the coordinates that will appear in the header of the CGGTTS files, and that the receiver will use for its CGGTTS computations. By default, the same coordinates are used for all constellations, but it is also possible to enter a different set of coordinates for GPS, GLONASS, Galileo and BeiDou, in case the phase centers would significantly differ between them.

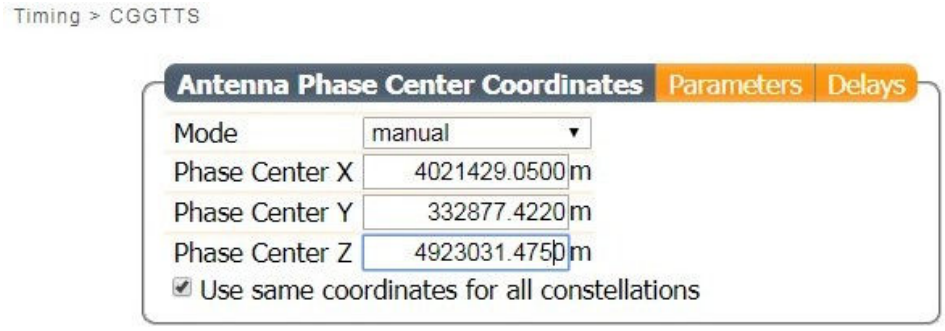


Figure 4-10: Coordinates of the antenna phase center

Under the "Parameters" tab, enter all the information that will be put in the CGGTTS header or be used to generate the CGGTTS file name. The elevation mask used for the CGGTTS generation can also be set.

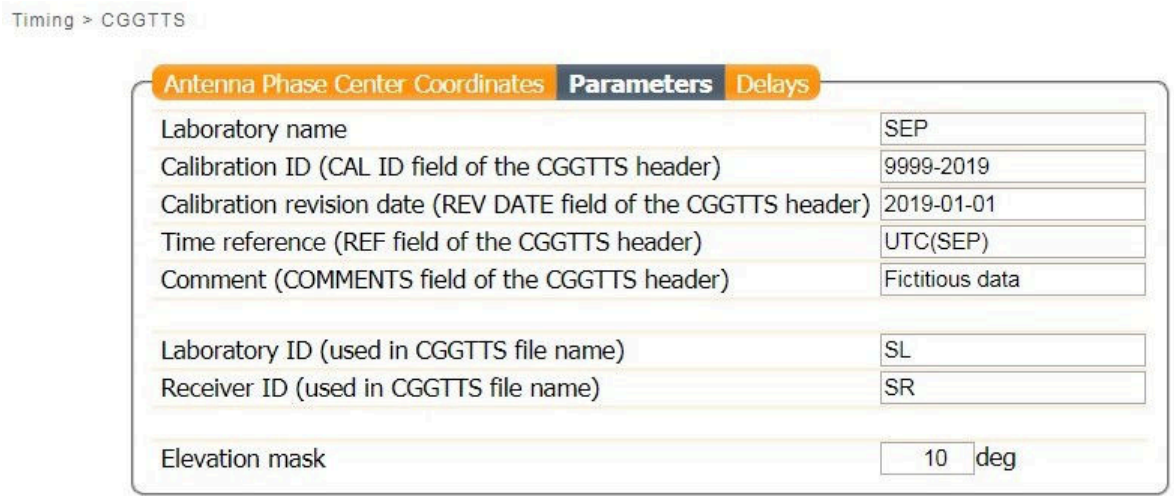


Figure 4-11: Laboratory and time calibration information

Finally, under the "Delays" tab, enter all the delays applicable to time transfer:

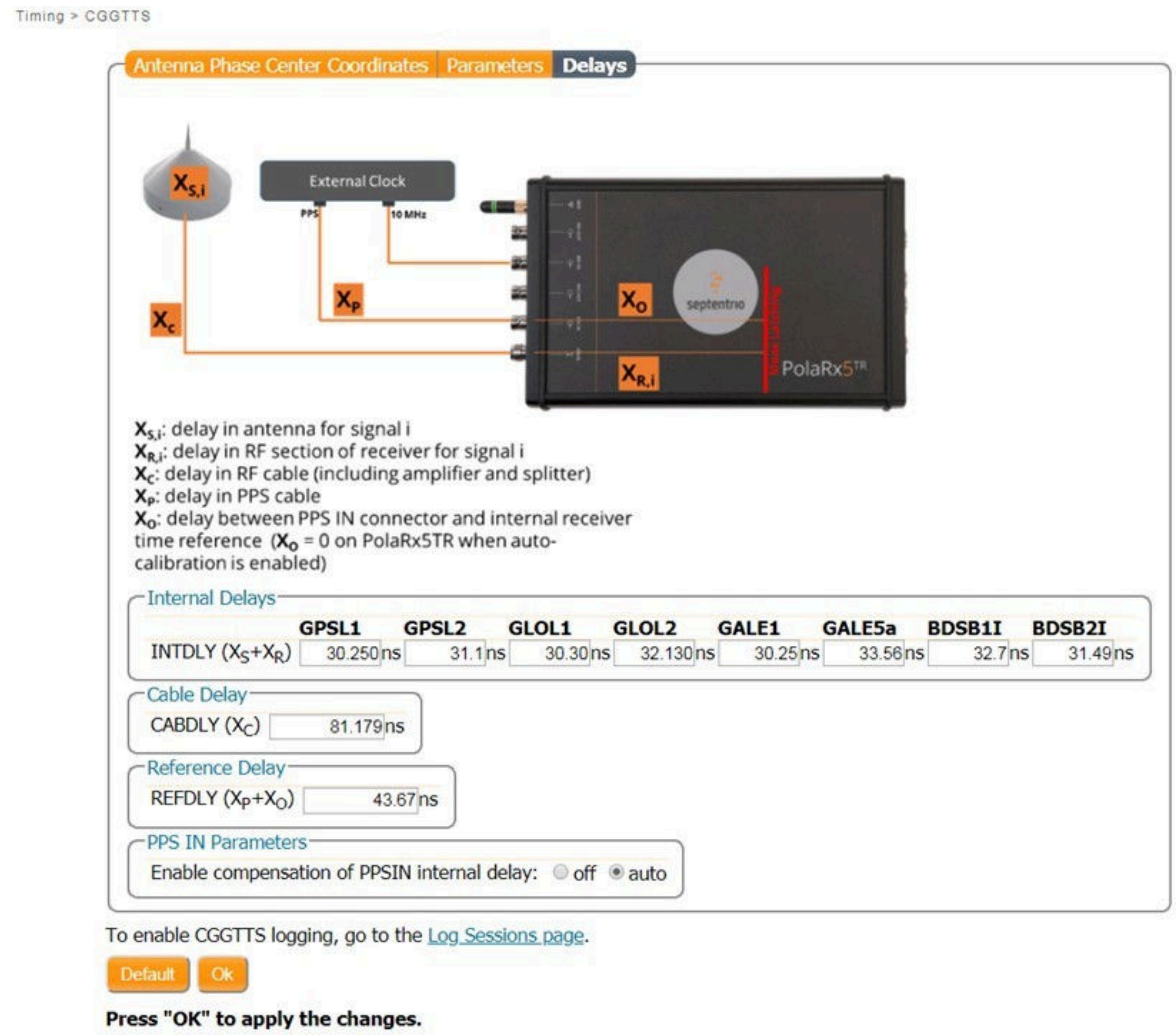


Figure 4-12: Time transfer delays

INTDLY = X_S+X_R is the combined antenna and receiver RF delays. They are usually determined by comparison with a calibrated reference receiver from BIPM. For

timing labs contributing to TAI, BIPM have a set of traveling reference receivers for this purpose (http://www.bipm.org/jsp/en/TimeCalibrations.jsp). A second, absolute method for determining these delays involves the use of a calibrated GPS simulator.

CABDLY = X_C is the delay in the antenna cable, which must be measured using appropriate equipment.

REFDLY = X_P+X_O is the delay between the external reference (the PPS from the external clock) and the receiver internal time reference. Referring to Figure 4-13, this is the delay between A and B if X_O compensation is disabled and the PPS OUT is configured in 'RxClock' mode (see section 4.2.1), or the delay between A and C if X_O compensation is enabled (i.e. it is only the PPS cable delay X_P in that case, X_O being zero as explained in section 4.2.2).

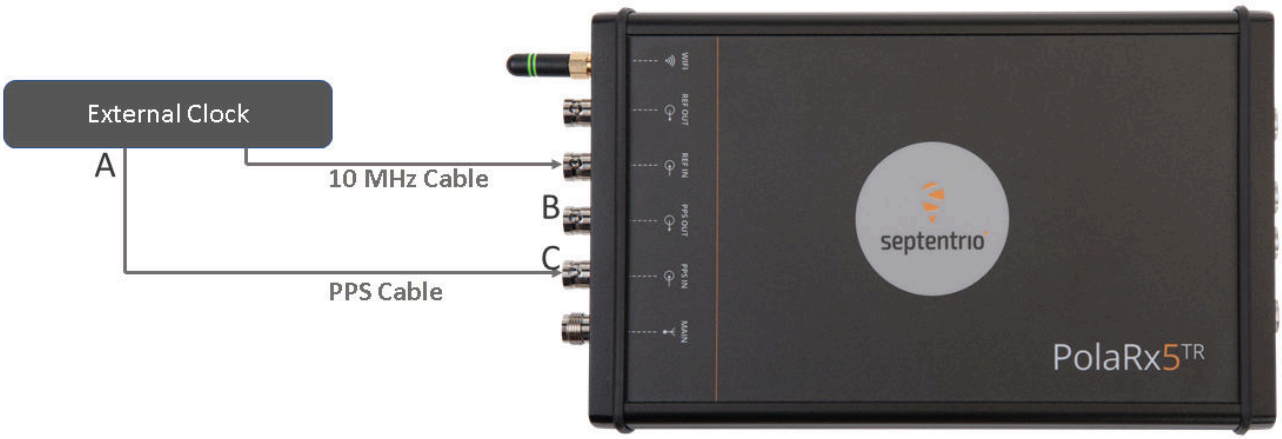


Figure 4-13: The reference delay (X_P+X_O) corresponds to the A-B delay if X_O compensation is disabled, and to the A-C delay if it is enabled

In the example illustrated in Figure 4-12, the compensation of PPS IN delay is enabled (see "auto" in the PPS IN Parameters tab). This means that the REFDLY only contains the delay in the cable from the clock to the PPS IN connector, as X_O is zero.

After entering all information under the three tabs, click the orange 'Ok' button at the bottom of the page. To ensure that all CGGTTS parameters are kept after a power cycle, click 'Save' on the pop-up that appears in the bottom right corner (see Figure 4-6).

4.4.2 Configuring the CGGTTS logging and FTP push

After having configured the CGGTTS parameters as explained in section 4.4.1, it is time to define where to log the CGGTTS files and where to FTP push them at the end of each UTC day.

CGGTTS logging configuration is done in the Logging>Log Sessions page of the Web Interface:

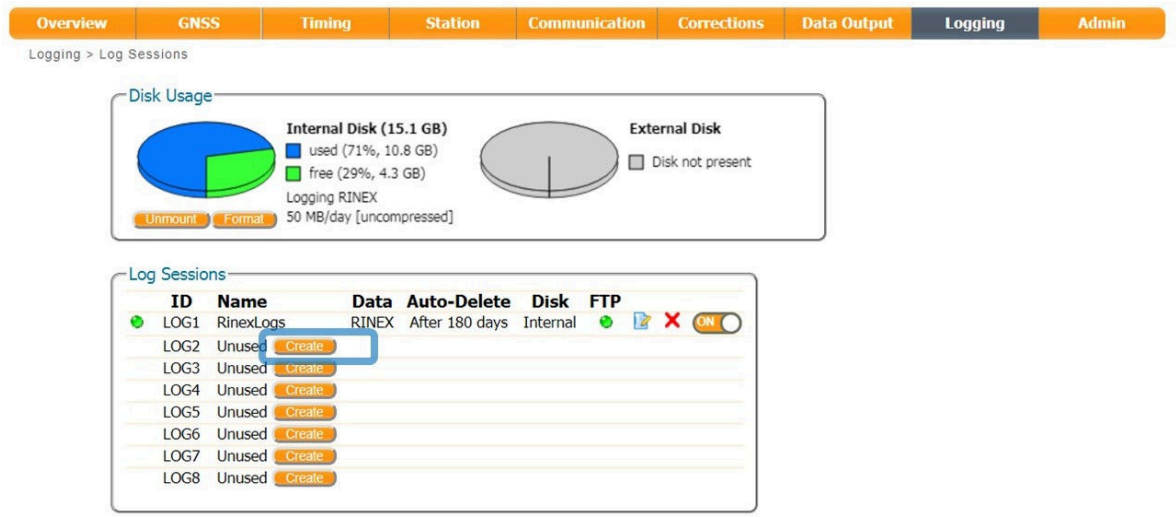


Figure 4-14: Overview of the log sessions

The receiver supports eight different log sessions (LOG1 to LOG8). In the example above, LOG1 is already configured, but the other sessions are still unused. CGGTTS files can be logged in any log session, including those that are already logging other formats (such as RINEX). Here, we will for example decide to log CGGTTS files in the second log session (LOG2). Clicking the "create" button for LOG2 brings you to the "Edit Session" page:

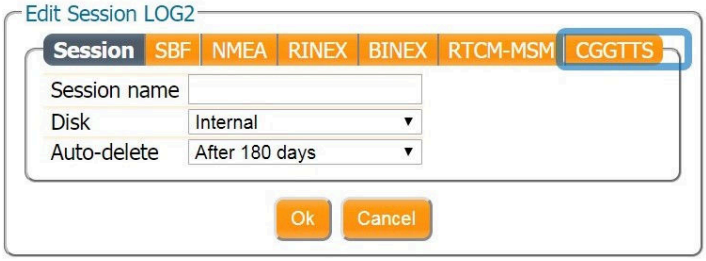


Figure 4-15: Configuration of a log session

It is possible to give a name to the log session or to leave the name empty (as shown above). It is also possible to tell the receiver to delete files after a prescribed duration. In the example shown above, the LOG2 session is configured to keep files for 180 days.

Log sessions can log many different file formats, each of them being configured in their respective tab. Click the "CGGTTS" tab to open the CGGTTS logging tab, and then click "Configure CGGTTS logging":

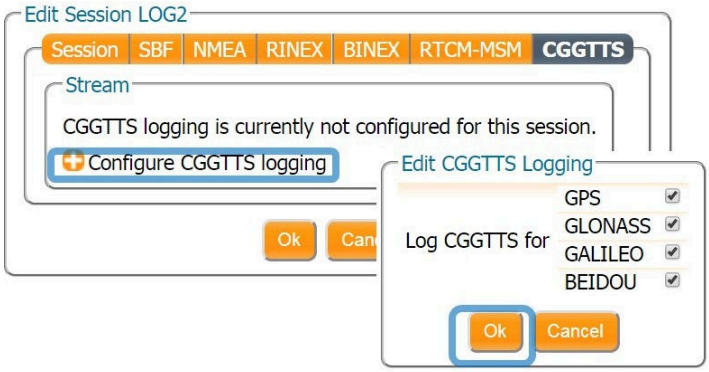


Figure 4-16: Configuration of the CGGTTS logging

In the "Edit CGGTTS Logging" page, you can specify which CGGTTS file types (GPS, GLONASS, Galileo and BeiDou) need to be logged in this log session. In the example shown, the four CGGTTS types are enabled. Each constellation is logged in a different file, as per CGGTTS V2E convention. Clicking 'Ok' brings you back to the session overview page, where it is now possible to configure the FTP server to which the CGGTTS files need to be FTP-pushed (if applicable).

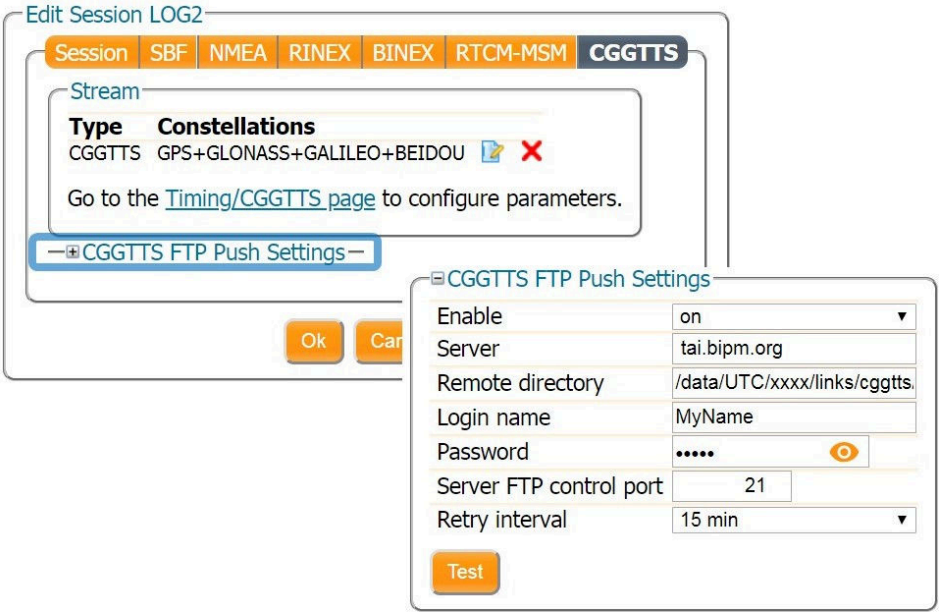


Figure 4-17: Configuration of the CGGTTS FTP push

The "Test" button allows to test that the specified folder of the FTP server can be written to.

Click 'Ok' when ready, and then 'Save' on the pop-up that appears on the web page.

4.4.3 Downloading the CGGTTS files

The CGGTTS files are logged in daily folders in the log session(s) configured in section 4.4.2. The daily folders are of the form `yyddd` with `dd` the 2-digit year, and `ddd` the day of year.

Note that it can take up to 30 minutes between enabling CGGTTS logging and actually seeing the CGGTTS file on the disk. This is because CGGTTS data are generated at a very low rate (typically every 16 minutes).

At any time, it is possible to download the current CGGTTS files (the ones from the current day), or the previous files. There are many ways to do this, as explained in the "Download Log Files from the Receiver" section of the Reference Guide. For example, this can be done through the Logging>Disk Contents menu of the Web Interface:

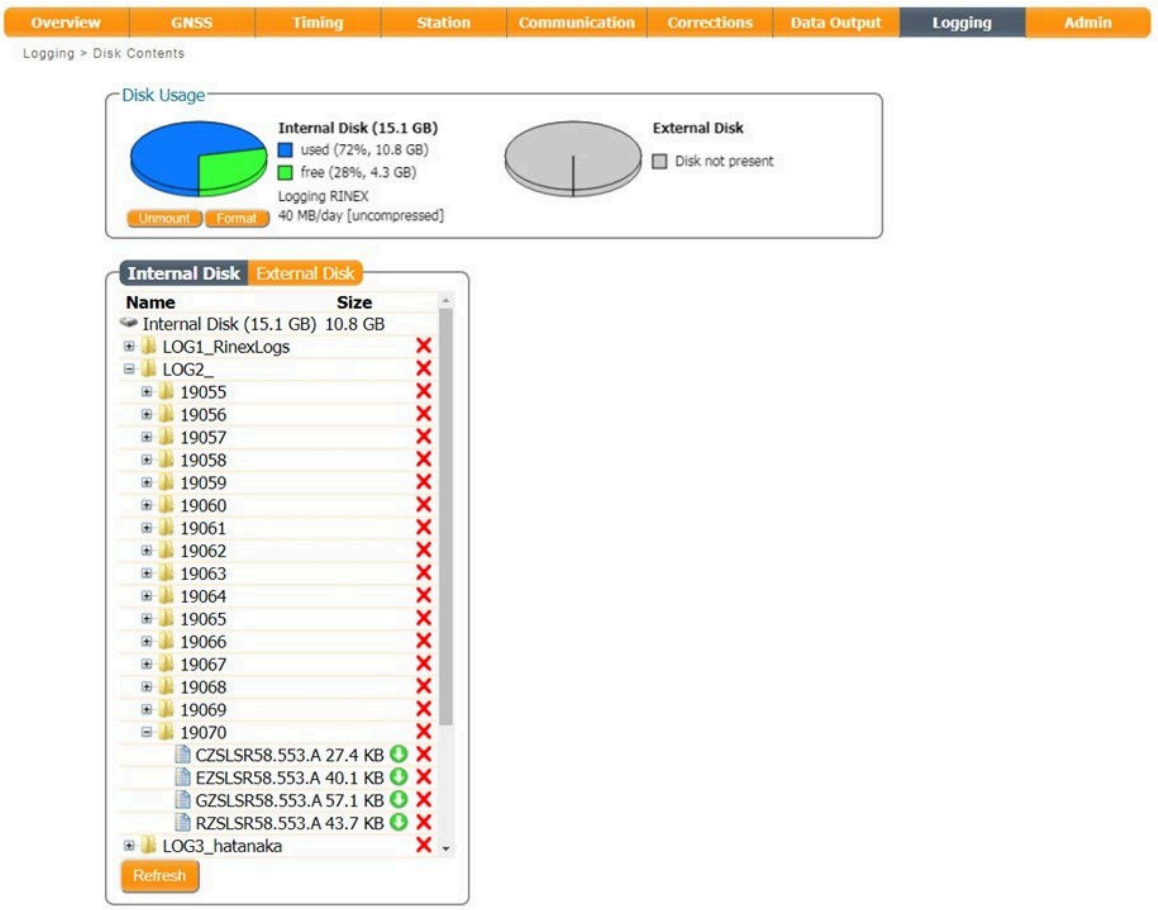


Figure 4-18: Disk Contents

The CZ, EZ, GZ and RZ files correspond to the BeiDou, Galileo, GPS and GLONASS constellations respectively. The ".A" suffix at the end of a file name indicates that this file is currently being written to. This suffix is removed when the file is complete. Click on the download icon next to a file to download it.

The "Disk Usage" panel at the top of the page indicates which data format has been logged in the last second. In the above example, "Logging RINEX" means that RINEX data has been logged in the last second. As data are added to the CGGTTS file only every 16 minutes, it is normal not to see "Logging CGGTTS" in the "Disk Usage" panel.

4.5 Generating CGGTTS files using RxControl

For completeness, this section shortly explains how to generate CGGTTS files using the RxControl program. This procedure is primarily relevant to PolaRx5TR receivers running firmware version 5.2 or earlier. As of version 5.3, the PolaRx5TR supports internal CGGTTS logging and it is recommended (and easier) to configure CGGTTS logging through the Web Interface as explained in section 4.4.

CGGTTS generation with RxControl involves logging SBF files on the RxControl computer and then converting them to CGGTTS. To start, select **Logging** then **RxControl Logging...** in the main window of RxControl, as shown in Figure 4-19. This will open up RxControl Logger where all the necessary settings can be made.

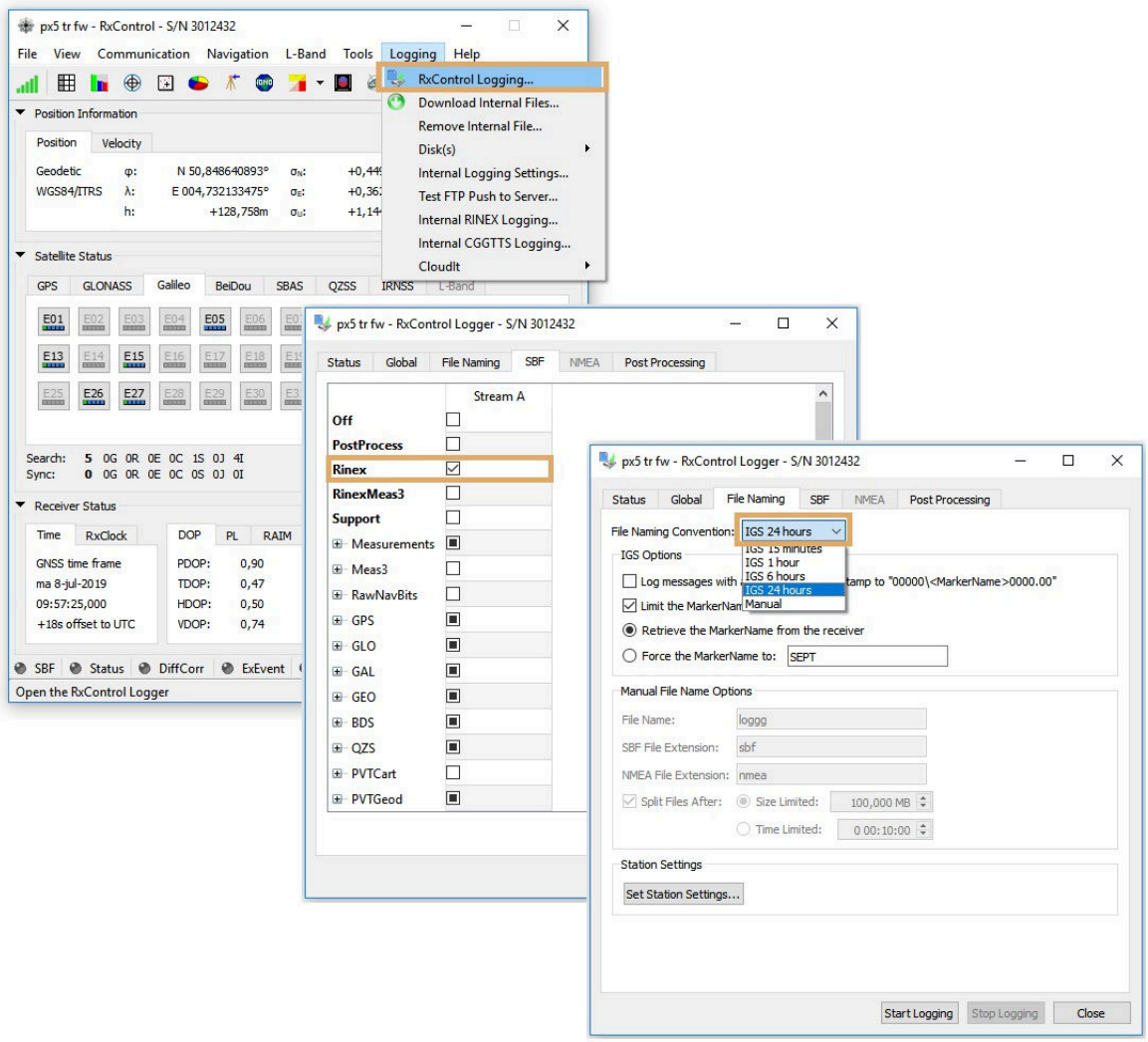


Figure 4-19: Using RxControl to log the SBF data needed for CGGTTS file generation

In the **SBF** tab, check the **Rinex** box as shown. This will automatically select all the SBF blocks needed for CGGTTS generation.

In the **File Naming** tab, you can select the size and naming convention for SBF files. The selected value of 'IGS 24 hours' means that 24 hr SBF files will be logged and named according to IGS naming convention. This is the recommended settings to generate daily CGGTTS files.

In the **Post Processing** tab you can define what you want to happen to the SBF file as Figure 4-20 shows. Click on **Add** to define a new conversion and then select **CGGTTS Conversion** from the drop-down list as shown.

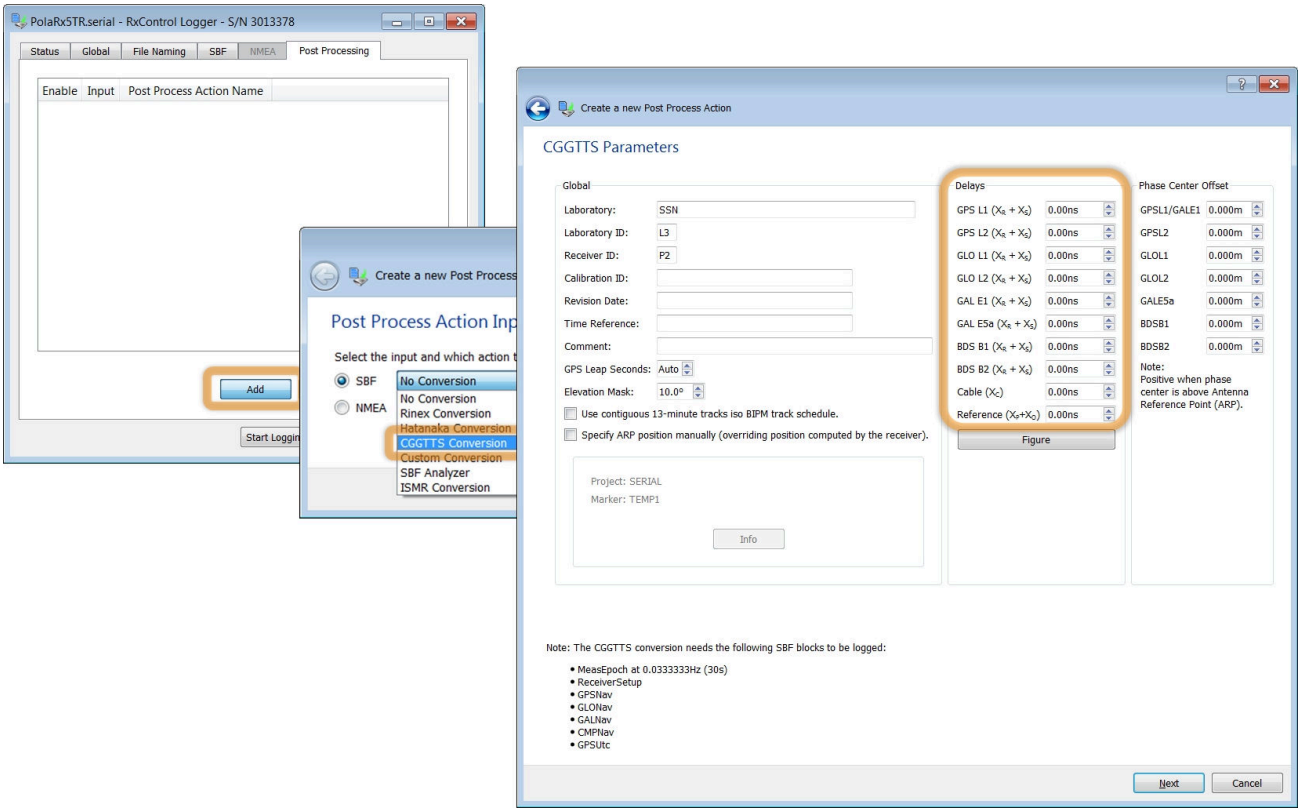


Figure 4-20: Entering the CGGTTS file parameters

The **CGGTTS Parameters** window contains all the parameters needed to generate the CGGTTS files. Most parameters are identical to those defined in section 4.4.1. A noteworthy difference between the CGGTTS configuration through the Web Interface and through RxControl is the handling of the antenna coordinates. In the Web Interface (see Figure 4-10), you must provide the phase center coordinates directly. With RxControl, you must specify the antenna reference point (ARP) or just use the ARP position from the SBF file, and also provide the phase center offsets for the different frequency bands. RxControl will then compute the corresponding phase center coordinates to put in the CGGTTS file header.

5 Reference station operation

5.1 How to configure the PolaRx5TR as an RTK base station

The PolaRx5TR can be configured to work as a base station and provide differential correction data to one or more rover receivers. The steps below describe how to configure the position of the reference station and output differential corrections over an Ethernet connection. Connecting to the PolaRx5TR over Ethernet is described in Section 3.3.3.

Step 1: Configuring the PolaRx5TR base station position

Set the position as static

To work as a base station, the position of the PolaRx5TR should be set to static. If not, the PolaRx5TR will still work as a base station however the position of the rover may show more variation. The 'Static' position mode can be selected in the 'Position' window of the 'Station' menu as shown in Figure 5-1.

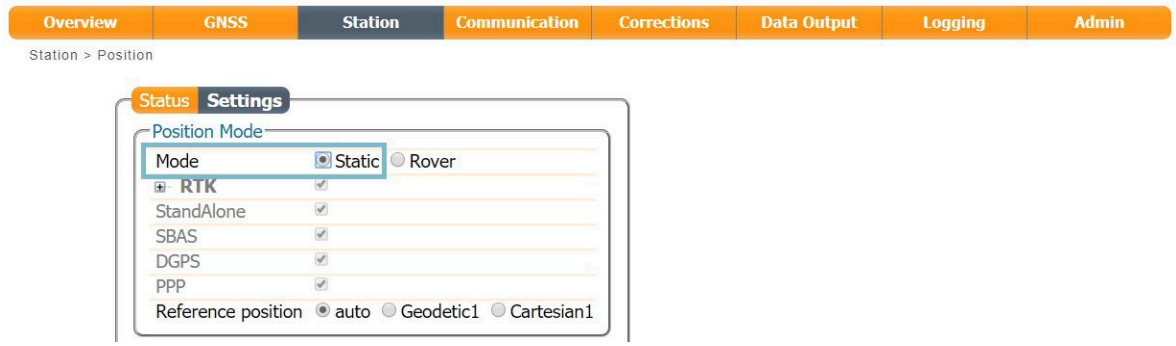


Figure 5-1: Setting the PolaRx5TR base station position to static

Set the correct position

An accurate position of the antenna that is connected to the PolaRx5TR should also be set. The default setting of 'auto' can be used for demonstrations however, for most other purposes, a properly surveyed position is advisable. In the example shown in Figure 5-2, the position stored under 'Geodetic1' is used. The antenna position can be entered in either Geodetic or Cartesian coordinates.

Select the Datum of the antenna position

In the **Datum** field, you can select the datum to which the antenna coordinates refer. The selected value is stored in the `Datum` field of position-related SBF blocks (e.g. `PVTCartesian`) and also in any output differential corrections. Please note that the **Datum** setting does not apply any datum transformation to the antenna position coordinates.

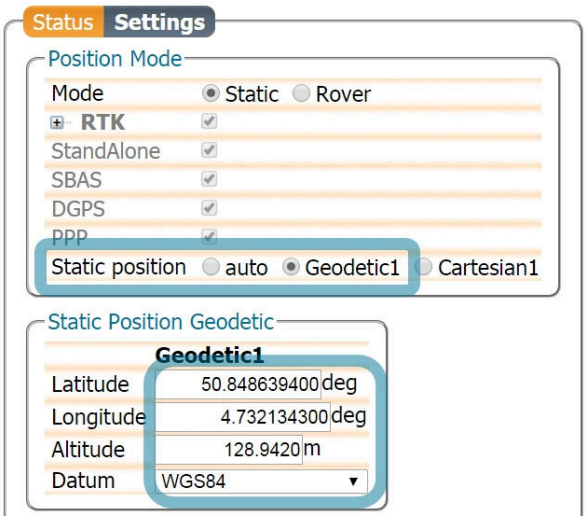


Figure 5-2: Setting the static position of the reference station antenna

Click on '**Ok**' to apply the new settings

Step 2: Configure output of correction data over Ethernet

Output of differential corrections can be configured in the **Corrections Output** window as Figure 5-3 shows. Click on **New RTCM3 output** to start the sequence of configuration steps.

RTCMv3 is the most compact and robust differential correction format and it is recommended to use this format where possible.

Select the Ethernet port you wish to use avoiding the commands port (28784), the webserver port (80), the FTP port (21) as well as the default NTRIP port (2101) and the NTP port (123). The example shown in Figure 5-3 uses port 28785.

The messages necessary for RTK and DGNSS are selected by default. A summary of other RTK messages can be found in the 'PolaRx5TR Reference Guide'.

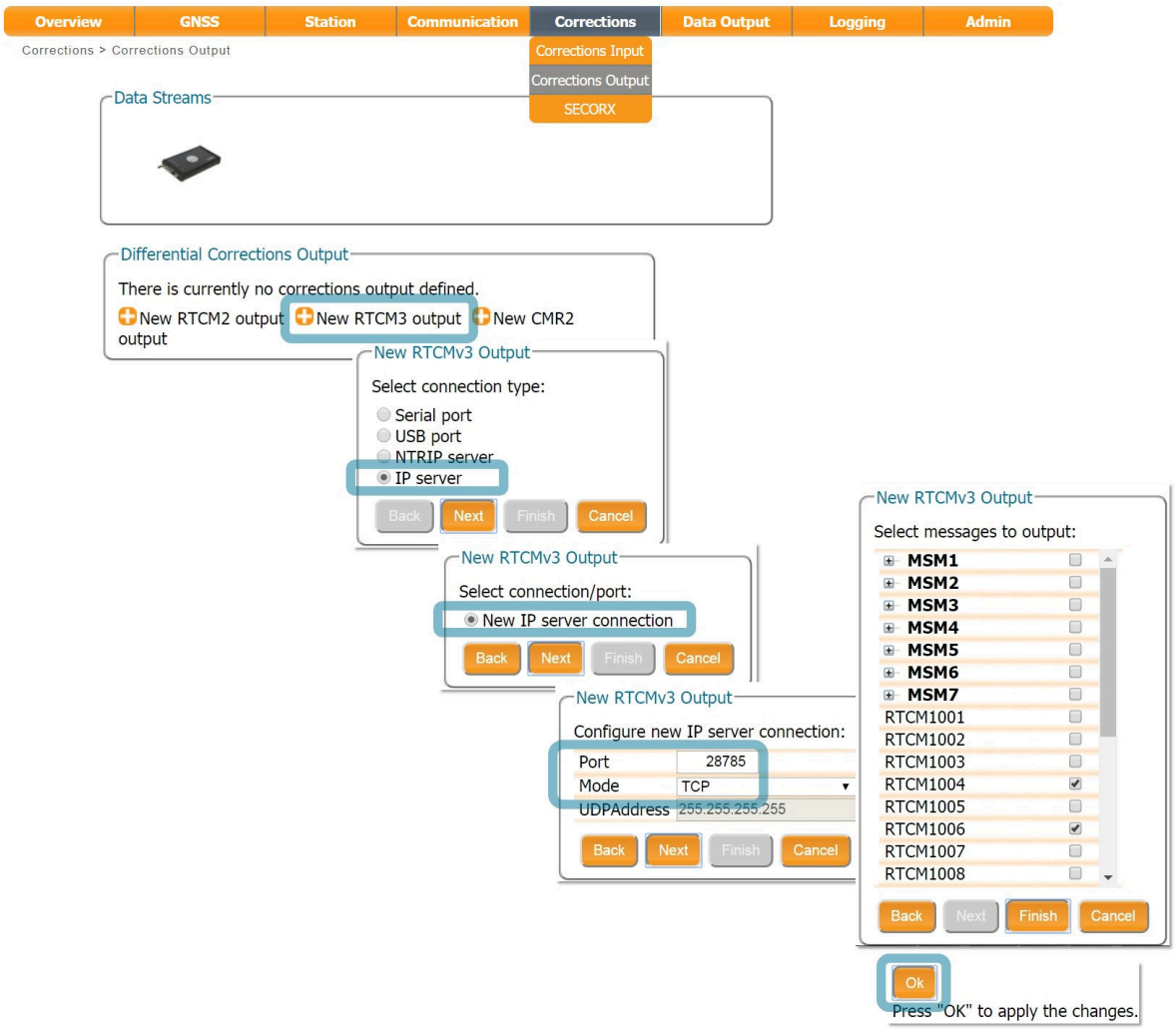


Figure 5-3: Click **New RTCM3 output** to start the configuration steps to output differential corrections over Ethernet

Step 3: Verifying the configuration

Having configured the settings and clicked 'Ok' to apply them, you can now connect to the configured Ethernet port of the PolaRx5TR using a terminal emulator tool such as Data Link*. The Ethernet IP address you need can be found in the information bar at the top of the web interface. In the example shown in Figure 5-4, the IP address is: 192.168.105.246.

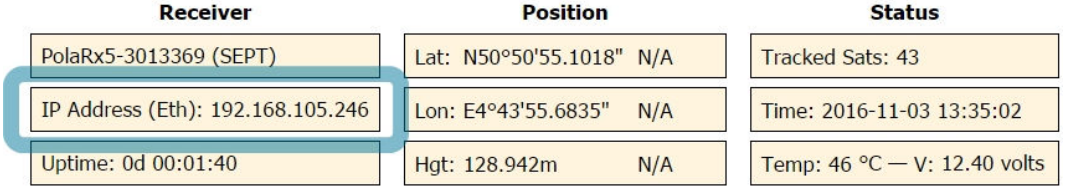


Figure 5-4: The IP address of the PolaRx5TR can be found on the information bar

* Data Link is part of Septentrio's RxTools suite of GUI Tools supplied with the PolaRx5TR

This IP address and the port number 28785 can then be used to configure a Data Link connection as shown in Figure 5-5.

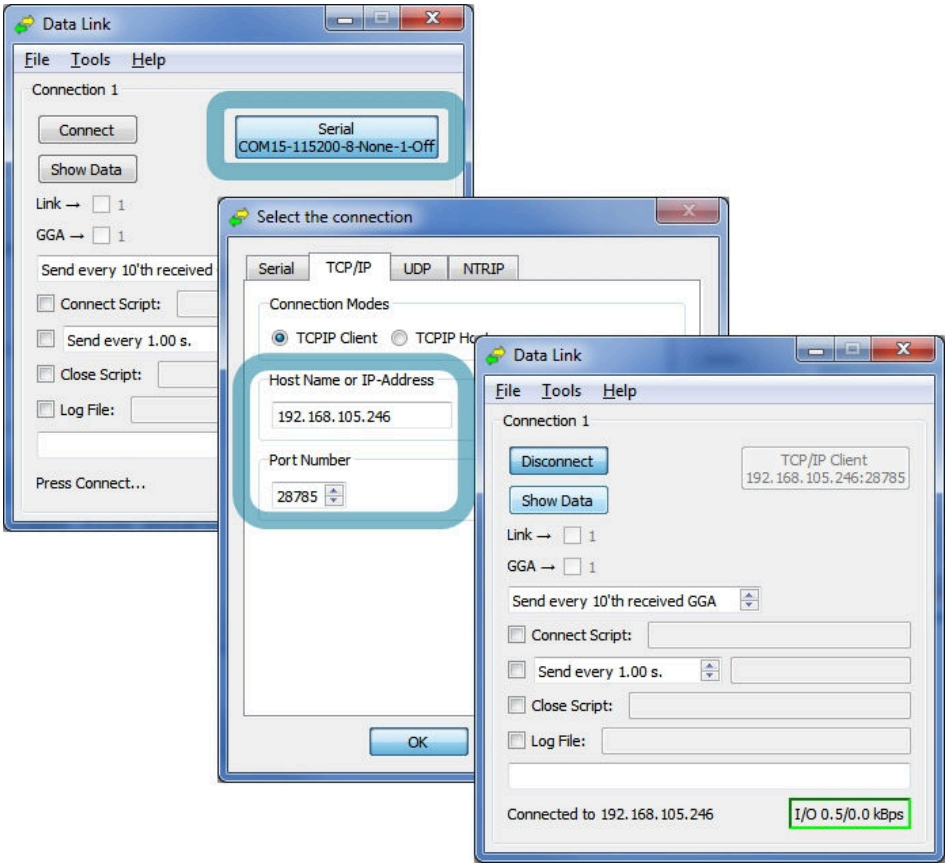


Figure 5-5: Configure the Data Link terminal emulator tool to connect to the PolaRx5TR Ethernet port over which differential corrections have been configured

When connected to the output correction stream, click on the 'Show Data' button on Data Link and you should see output similar to that shown in Figure 5-6.

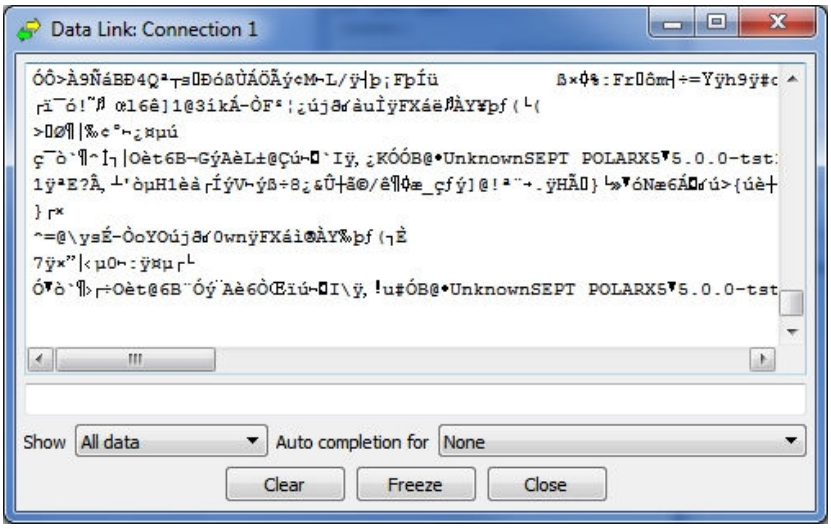


Figure 5-6: The RTCMv3 differential correction stream output from the IPS1 Ethernet connection of the PolaRx5TR

When a connection to the configured Ethernet port has been established, in this example using Data Link, the 'Data Streams' field on the Corrections Output window should now show the active blue connection shown in Figure 5-7 and the corrections output icon in the information panel should appear active.

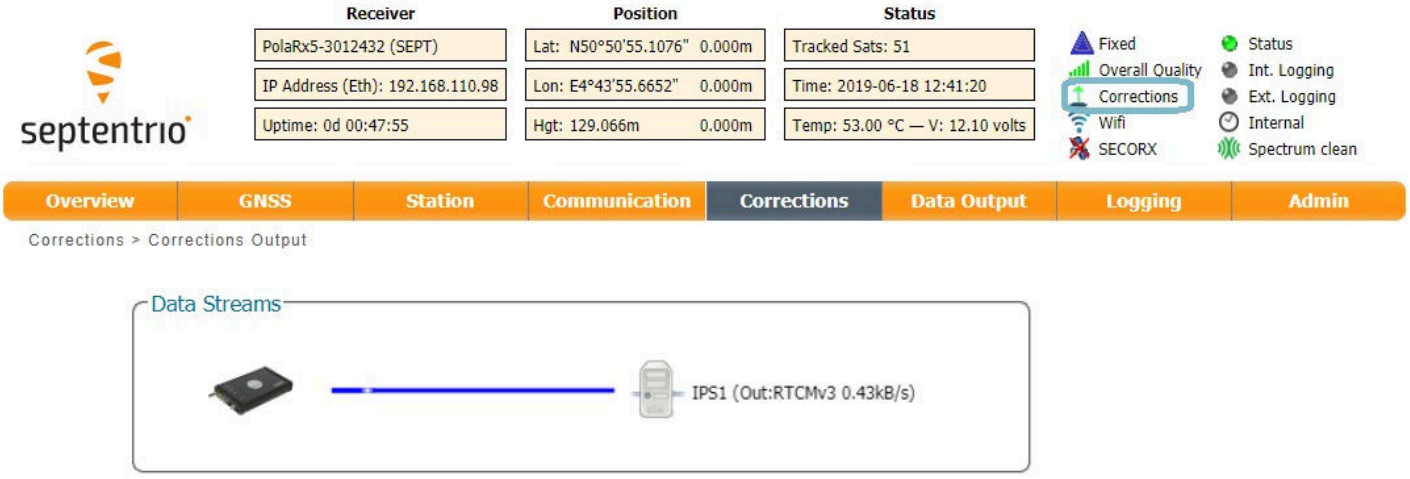


Figure 5-7: Web Interface showing differential corrections output over an Ethernet connection

5.2 Configuring the PolaRx5TR NTRIP Caster

The PolaRx5TR includes a built-in NTRIP Caster that makes correction data from the PolaRx5TR available to up to 10 NTRIP clients (or rovers) over the internet. The caster supports up to three mount points and can also broadcast correction data from a remote NTRIP server.

All settings relating to the PolaRx5TR NTRIP Caster can be configured on the NTRIP Caster window of the Web Interface shown in Figure 5-8.

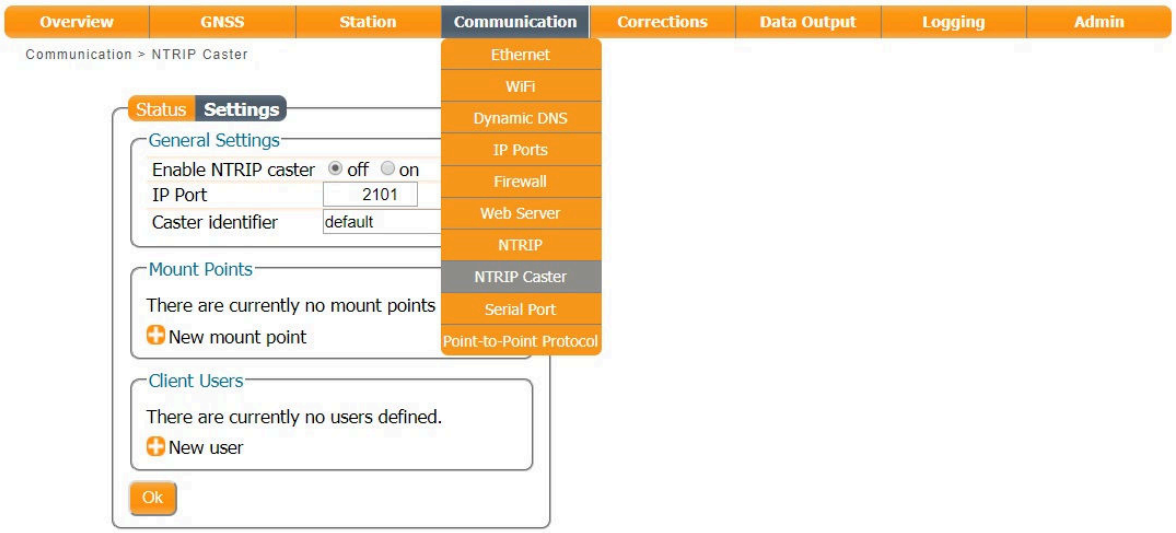


Figure 5-8: The NTRIP Caster configuration window of the Web Interface

Step 1: Define a new mount point

In the NTRIP Caster window, click on 'Settings'.

In the General Settings field, enable the NTRIP Caster and select the IP port over which you wish to send correction data: the default port is 2101.

Click on '**New mount point**' as indicated in Figure 5-9. Select '**Yes**' to enable the mount point and give it a name. This is the name that will appear in the caster source table. Up to 3 mount points can be defined each with a different name. You can also select the type of **Client authentication** for the mount point: **none** - any client can connect without logging in or, **basic** - clients have to login with a username and password.

To select a correction stream from the NTRIP server of the PolaRx5TR, select '**No**' in the 'Allow external server' field*.

Click on the '**Local Server ...**' button to enable the local NTRIP server of the PolaRx5TR and to select the individual messages you want to broadcast. By default, correction messages necessary for RTK are pre-selected. Click 'Ok' to apply the settings.

* By setting 'Allow external server' to '**Yes**' the mount point can receive a stream from a remote NTRIP server

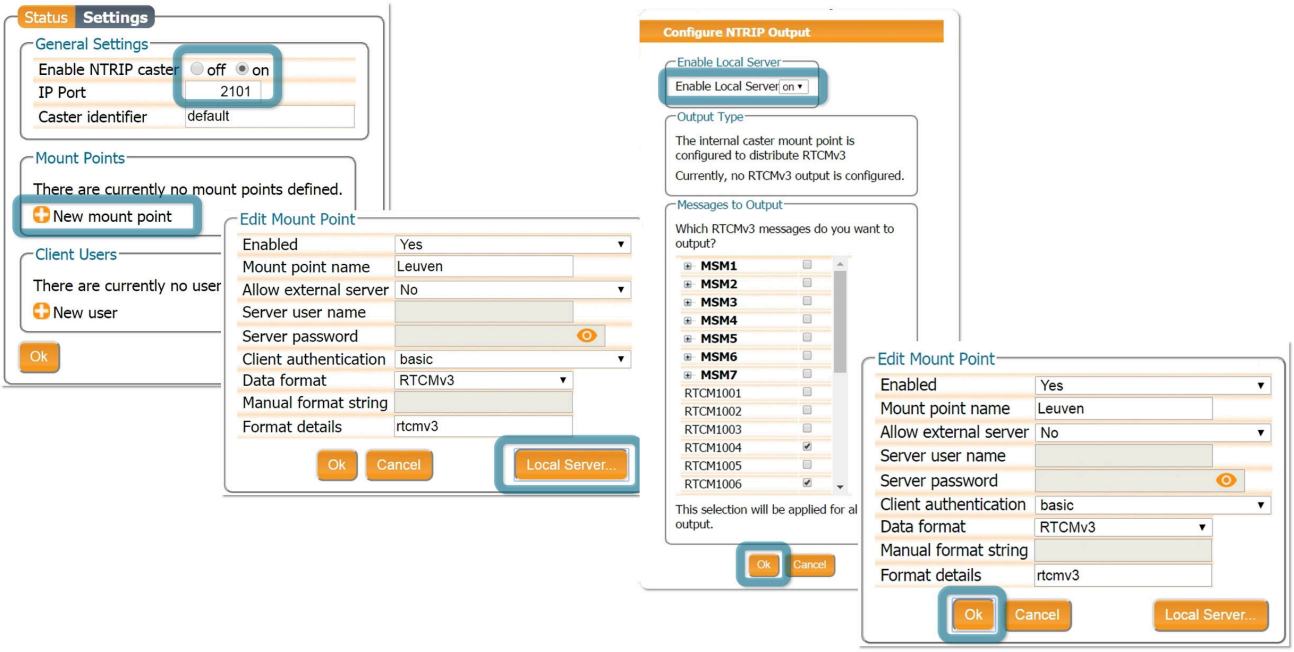


Figure 5-9: The configuration sequence for defining a new mount point

Step 2: Define a new user

If you selected '**basic**' client authentication when configuring the mount point in the previous step, you will need to define at least one user. The user name and password are the credentials needed for the NTRIP client (rover) to access the correction stream.

In the 'Client Users' section, click on '**New User**' as shown in Figure 5-10. Enter a User Name and Password for the user and select the mount points that they will have access to. Up to 10 NTRIP clients can log in as a particular user. Click 'Ok' to apply the settings.

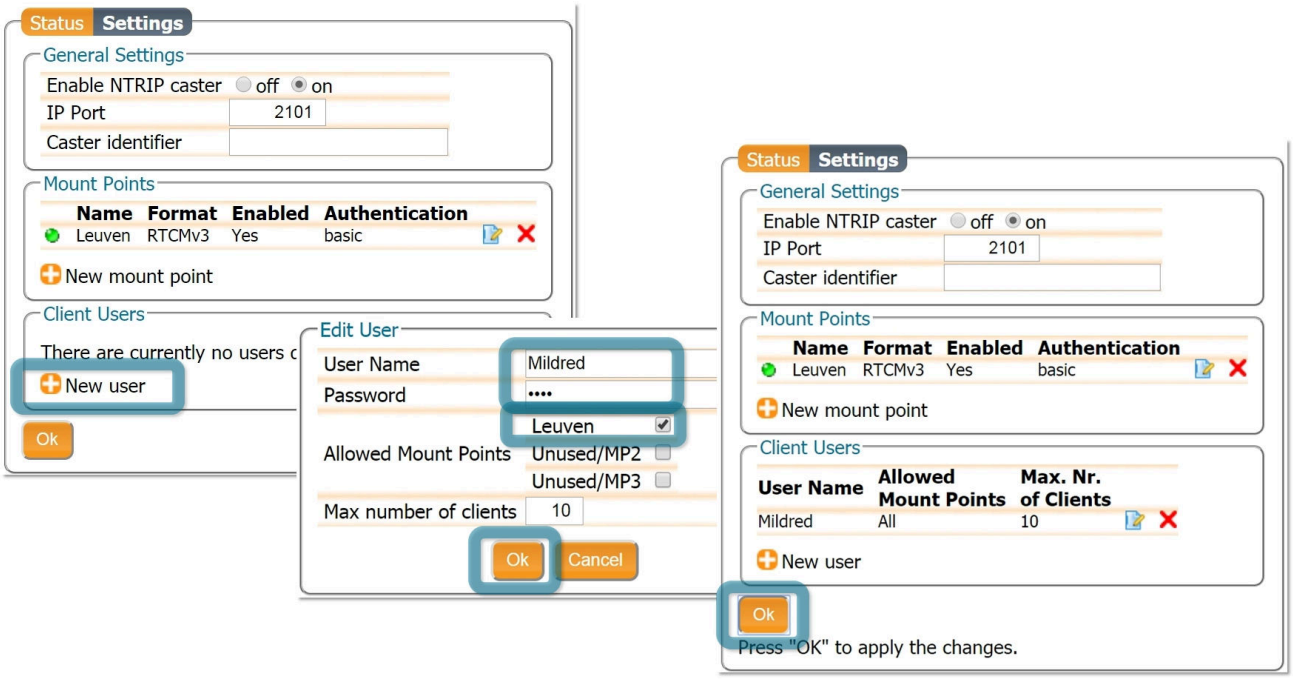


Figure 5-10: Configuring the login credentials for a user

Step 3: Is the NTRIP Caster working?

In the '**Status**' tab of the NTRIP Caster window, you can see a summary of the NTRIP Caster to make sure that it has been properly configured. In the example shown in Figure 5-11, two rover clients are connected to the mount point named 'Leuven' as user 'Mildred'.

If the client rover receivers are configured to send a GGA message to the caster (as was the case in Figure 5-12), then their position will also be visible.

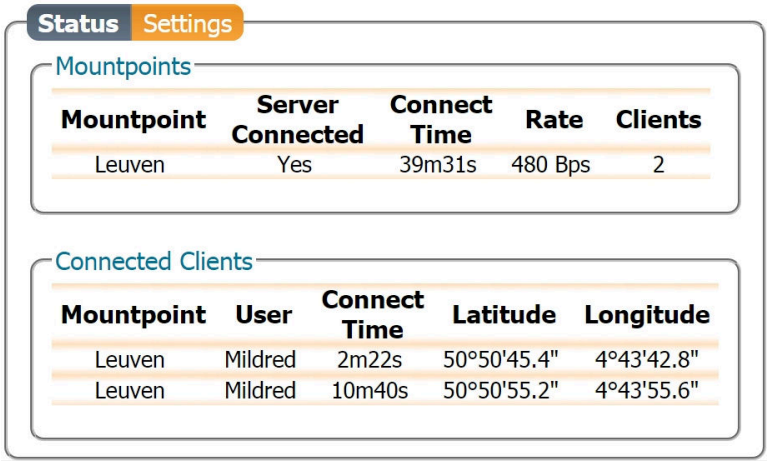


Figure 5-11: Connecting as a client to the PolaRx5TR NTRIP Caster

On the NTRIP Client side

Rover receivers can connect to the NTRIP Caster by entering its IP address and Port as shown in Figure 5-12. After clicking 'Ok', the mount point source table will be filled and a mount point can be selected. The user name and password can then be entered and within a few seconds, the rover receiver should report an RTK fixed position.

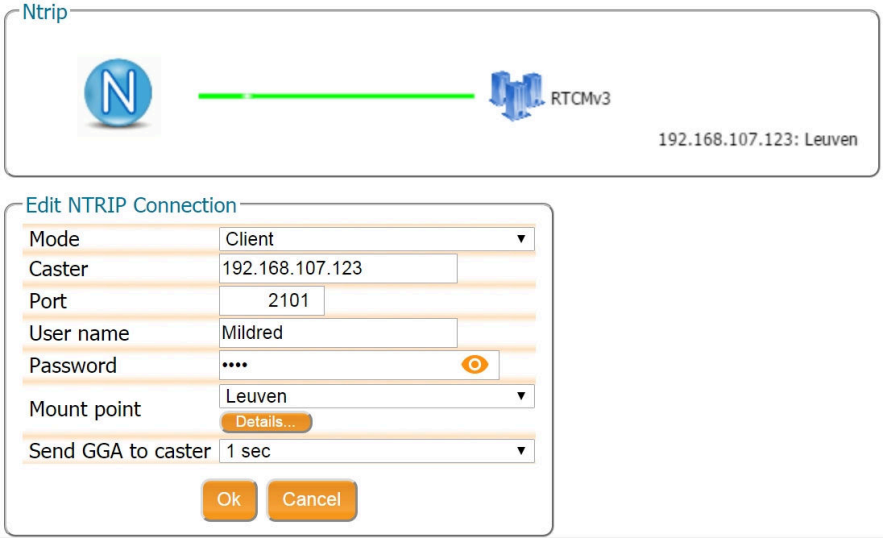


Figure 5-12: Connecting as a client to the PolaRx5TR NTRIP Caster

5.3 How to output a PPS (Pulse-per-Second) signal

The PolaRx5TR can output a PPS (Pulse-per-Second) signal that can be used for example, to synchronize a secondary device to UTC time.

Step 1: Connect a cable with a BNC connector

Connect a cable with a BNC connector to the rear-panel connector labeled 'PPS OUT' and indicated in Figure 5-13.

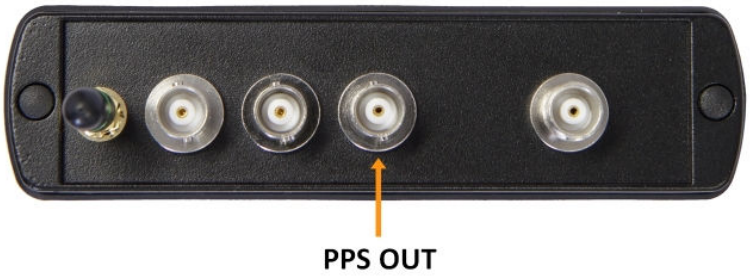


Figure 5-13: PPS connector on the rear panel of the PolaRx5TR

Step 2: Configure the PPS settings

You can configure the PPS settings on the 'Timing' window of the 'GNSS' menu as shown in Figure 5-14.

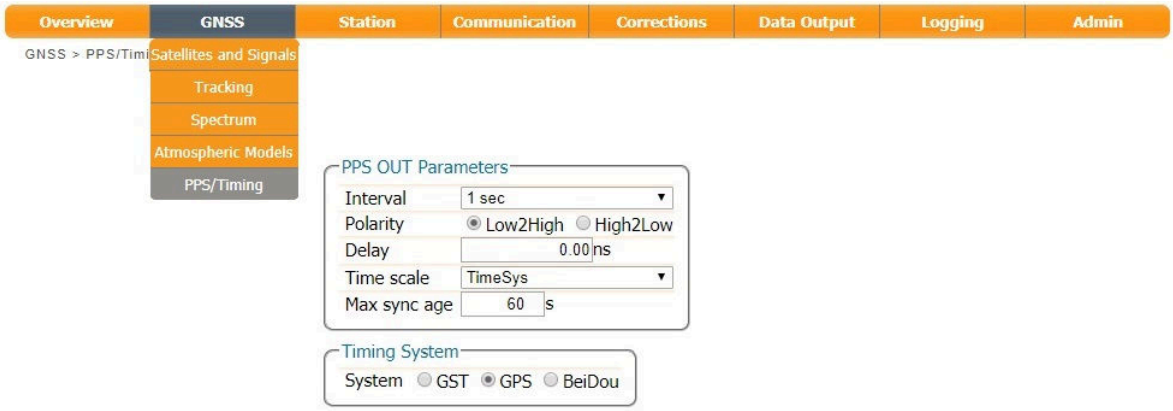


Figure 5-14: PPS configuration field in the web interface

The **Interval** is the time interval between successive timing pulses and is selectable between 10 ms and 10 s. The default **Polarity** of the PPS signal is a low-to-high transition which can be alternatively configured as high-to-low.

The **Delay** argument can be used to compensate for signal delays in the system (including antenna, antenna cable and PPS cable). For example, if the antenna cable is replaced by a

longer one, the overall signal delay would be increased by say, 20 ns. If the Delay value is left unchanged, the PPS pulse will arrive 20 ns too late. To re-synchronize the PPS pulse, the Delay should be increased by 20 ns. The delay can be configured with values between -1 ms and +1 ms.

By default, PPS pulses are aligned with the satellite time system (TimeSys) as shown in the **Time Scale** field. PPS signals can alternatively be aligned with UTC, local receiver time (RxClock) or GLONASS time.

When Time Scale is set to anything other than RxClock, the accuracy of the time of the PPS pulse depends on the age of the last PVT computation. During PVT outages, the PPS generation time, which is extrapolated from the last available PVT information, may start to drift. To avoid large biases, the receiver stops outputting the PPS pulse when the last available PVT is older than the specified **MaxSyncAge**. The MaxSyncAge is ignored when TimeScale is set to RxClock.

Step 3: Click on 'Ok' to apply settings

The new configuration can also be saved as the boot configuration by clicking 'Save' in the pop-up.

5.4 How to enable the NTP server

NTP (Network Time Protocol) is an Internet protocol for clock synchronization between computer systems over data networks. It is intended for synchronizing participating computers to within a few milliseconds of UTC. The NTP server functionality on the PolaRx5TR can be configured as shown in Figure 5-15. When enabled, the NTP server accepts UDP time-stamp requests on port number 123.

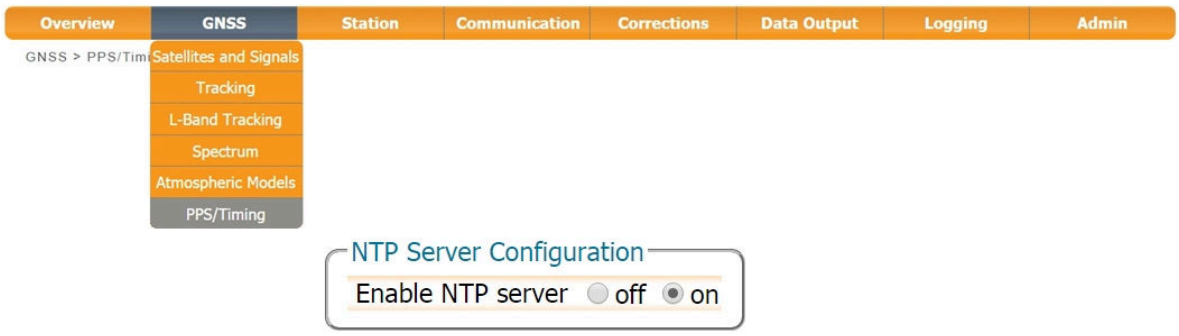


Figure 5-15: Enabling the NTP server

5.5 How to log data

The PolaRx5TR has a 16 GB memory for internal data logging. Data can also be logged to an external USB memory disk.

5.5.1 Internal logging

Step 1: Defining the Disk Full action

When setting up a logging session for the first time, it is a good idea to define what you would like to happen when the internal memory is full. This can be configured on the 'Disk Full Management' page of the 'Logging' menu as shown in Figure 5-16. There are two options, either the receiver stops logging when the memory is full or it continues logging by making space for new files by deleting the oldest. The default setting is 'Delete oldest'.

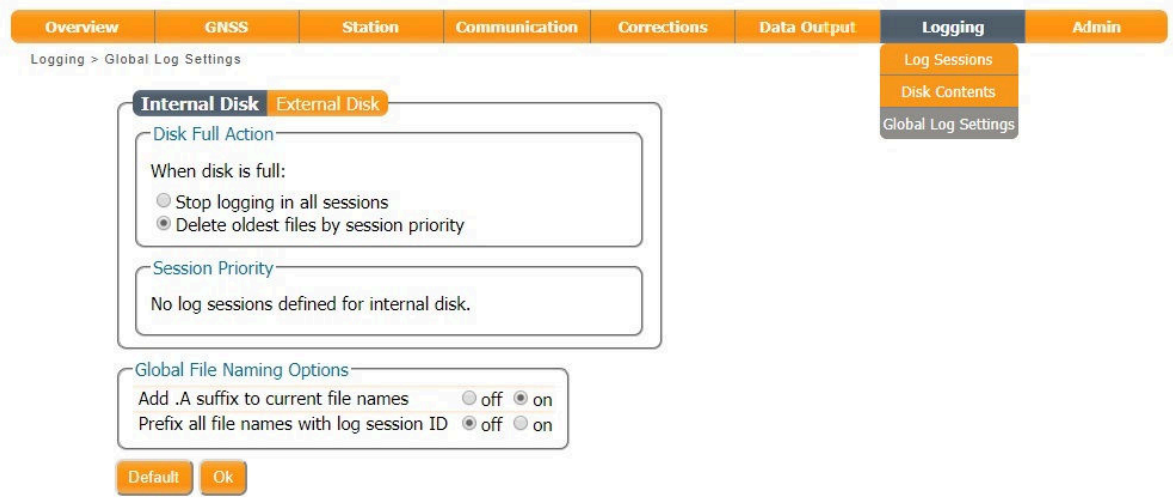


Figure 5-16: Selecting what you wish to happen when the internal 16 GB memory is full

Step 2: Configuring a logging session

On the 'Log Sessions' window of the 'Logging' menu you can check which logging sessions have already been defined and define new ones. Up to 8 simultaneous logging sessions can be defined independently: logging Septentrio Binary Format (SBF), RINEX, BINEX, NMEA and RTCM (MSM).

To define a new logging session, click on a **Create** button as shown in Figure 5-17.

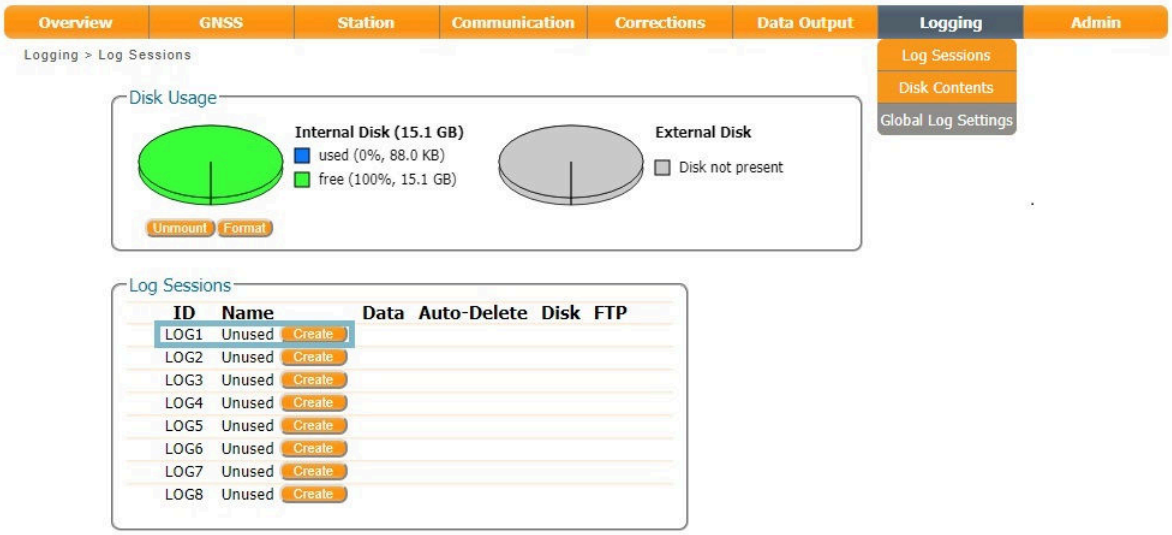


Figure 5-17: Click on a 'Create' button to start defining a new logging session

You can then follow the sequence of steps shown in Figure 5-18 selecting the various configuration settings for the logging session. In this example, the default settings of 'Internal' Disk and 'Never' for Auto-Delete* have been selected. In the 'Edit SBF Stream' window, the messages required for RINEX generation have been selected as well as those useful for the Support department for diagnosing problems. SBF messages can also be selected individually.

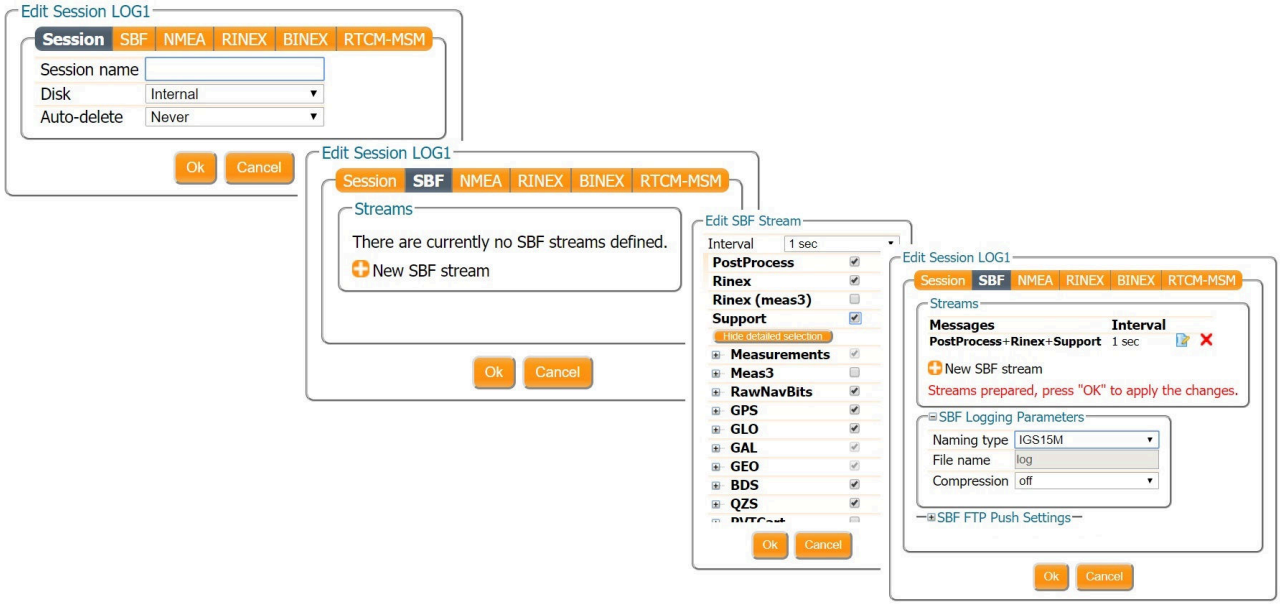


Figure 5-18: Follow the sequence of windows to fully configure the logging session

* Please note that, this setting is overruled by the 'Disk Full Action' setting defined in the **Global Log Settings** window.

Step 3: Verifying the configuration

When you have finished configuring the logging session, the 'Log Sessions' window will show a summary of the defined logging sessions as in Figure 5-19. An estimate of the daily size of data generated with the current logging configuration is also given.

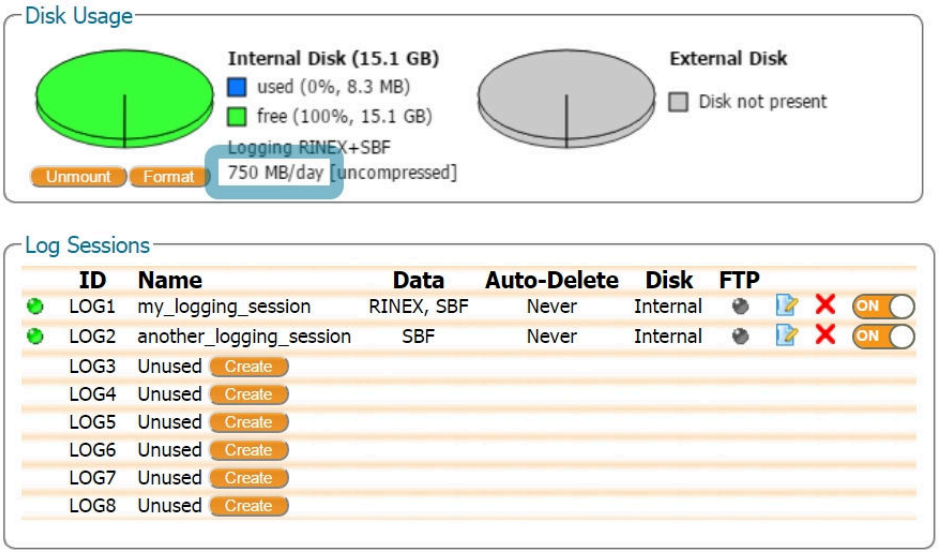


Figure 5-19: A summary of the newly defined logging sessions showing the expected amount of data generated daily

5.5.2 Logging to an external USB memory device

The PolaRx5TR can also log data to an external memory device. To connect the device, you will need a USB Host cable* (CBLe_USB_HOST) to connect to the front-panel socket indicated by the USB icon as shown in Figure 5-20.

A high-quality memory device is recommended for external logging as multiple logging sessions can result in a large throughput of data. The 4K random write speed should be greater than 0.1 MBps, and the 4K random read speed should be at least 2 MBps†.

Figure 5-20: Connecting an external USB memory device to the PolaRx5TR

With an external memory device connected, the new device should be visible in the 'Log Sessions' window as shown in Figure 5-21. If the device is not formatted or the formatting is not compatible with the receiver file system, you will be prompted to format the device. This can be done by clicking on the 'Format' button.

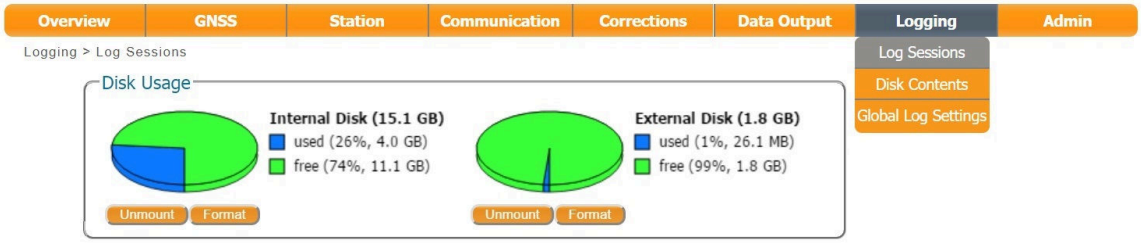


Figure 5-21: With a 2 GB external USB memory device connected to the PolaRx5TR

New logging sessions can then be defined in a similar way as in Section 5.5.1 making sure to select 'External' from the drop-down list in the 'Disk' field as shown in Figure 5-22.

* The CBLe_USB_HOST is an optional item. It is not part of the standard PolaRx5TR delivery

† The 4K random read/write speed is a standard specification for memory devices. More information and a list of benchmarked devices can be found on: http://usb.userbenchmark.com

Figure 5-22: Select 'External' from the drop-down list to log data to an external memory device

5.5.3 How to FTP push logged data to a remote location

SBF, RINEX and BINEX files can also be automatically sent to a remote FTP server (FTP push). A different FTP server can be configured for each logging session and, SBF and RINEX files logged in the same session can be sent to different servers.

The FTP server settings can be entered in the 'Edit Session' window, after configuring SBF or RINEX logging, as shown in Figure 5-23. FTP push will create the folder 'data' on the remote server if it does not yet exist. If file transfer fails, the receiver will retry after the 'Retry Interval' which has been selected as 15 minutes in this example.

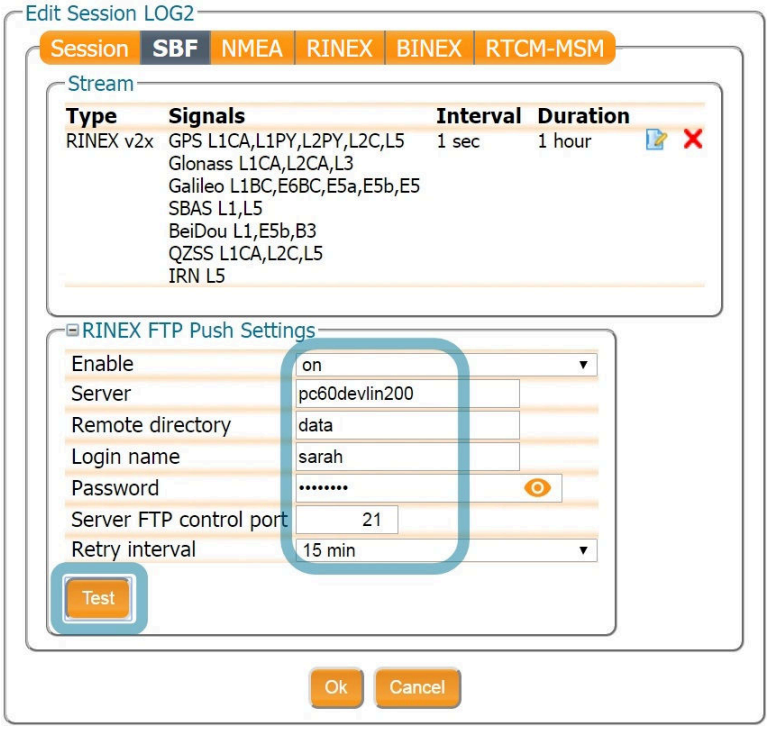


Figure 5-23: Configure pushing of RINEX files to an external FTP server

You can check that the FTP server credentials are correct by clicking on the 'Test' button. This will push a small test file to the remote folder and then delete it. The receiver reports whether or not the file was successfully sent and deleted as shown in Figure 5-24. If the

server is configured such that files cannot be deleted then the receiver will also report this and the test file will remain in the remote folder.

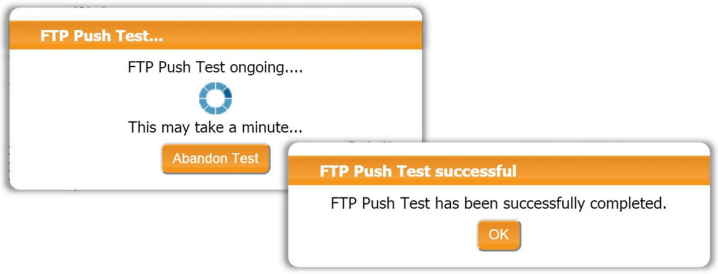


Figure 5-24: Testing the remote FTP server credential are correct

5.6 How to access logged data

5.6.1 Downloading data using the web interface

Data files logged by the PolaRx5TR, both on its internal memory and to an external USB device, can be downloaded using the web interface on the 'Disk Contents' window of the 'Logging' menu. Each logging session is logged to a separate folder. Individual files can be downloaded by clicking on the green download arrow next to the file name as shown in Figure 5-25.

If you need to download multiple files from the receiver, it may be more convenient to use the FTP server of the PolaRx5TR as described in Section 5.6.2.

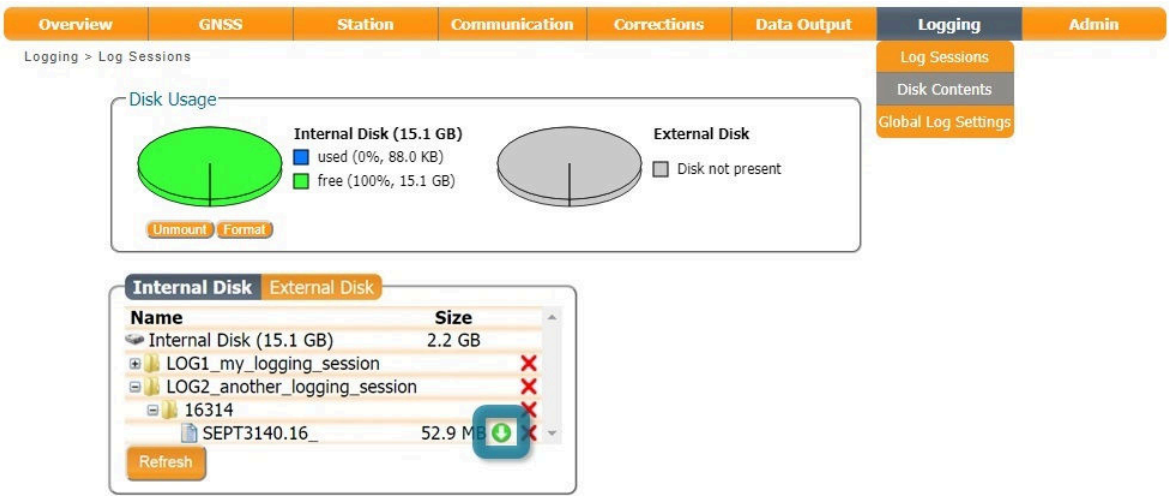


Figure 5-25: Downloading logged data files from the PolaRx5TR

5.6.2 Downloading data using the on-board FTP server

FTP, SFTP or rsync can be used to download data files logged on the PolaRx5TR. The example below details how the on-board FTP server can be used to download data files logged both internally or to an external device. Using an FTP client application such as FileZilla, multiple files can queued for download. The Host name is simply the address in the URL bar of the web interface. Figure 5-26 shows how to connect using FTP with FileZilla over both the USB connection (**192.168.3.1**) and over Ethernet (**PolaRx5TR-3010305***).

The **DSK1** folder contains data files logged on the internal memory while **DSK2** contains files logged to an external device.

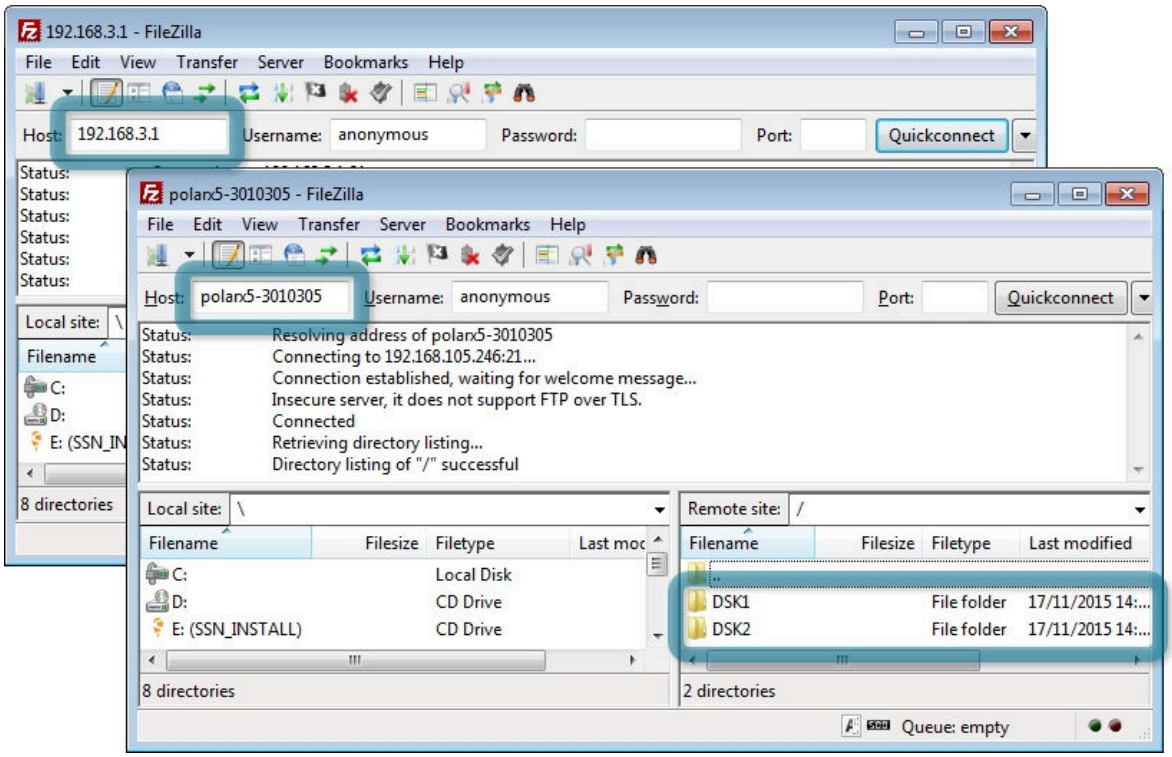


Figure 5-26: Downloading logged data files using the PolaRx5TR FTP server with a FileZilla client (**DSK1**: files logged on the internal memory, **DSK2**: files logged on an external USB device)

You can also connect over FTP using a file manager such as Windows File Explorer. When connected to the PolaRx5TR over USB for example, just enter **ftp://192.168.3.1** in the address bar as shown in Figure 5-27.

* The 7-digit number is the serial number of the receiver.

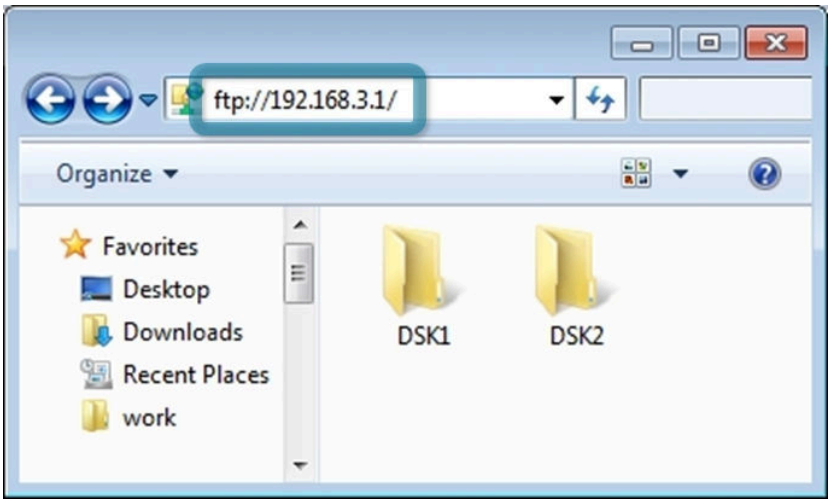


Figure 5-27: Downloading logged data files using the FTP server with Windows File Explorer. (**DSK1**: files logged on the internal memory, **DSK2**: files logged on an external USB device)

5.7 Point-to-Point Protocol (P2PP)

The PolaRx5TR features a Point-to-Point Protocol (P2PP*) server, which emulates an IP link over a serial port.

5.7.1 How to configure P2P Protocol

To start configuring the Point-to-Point Protocol, go to the Point-to-Point window as shown in Figure 5-28

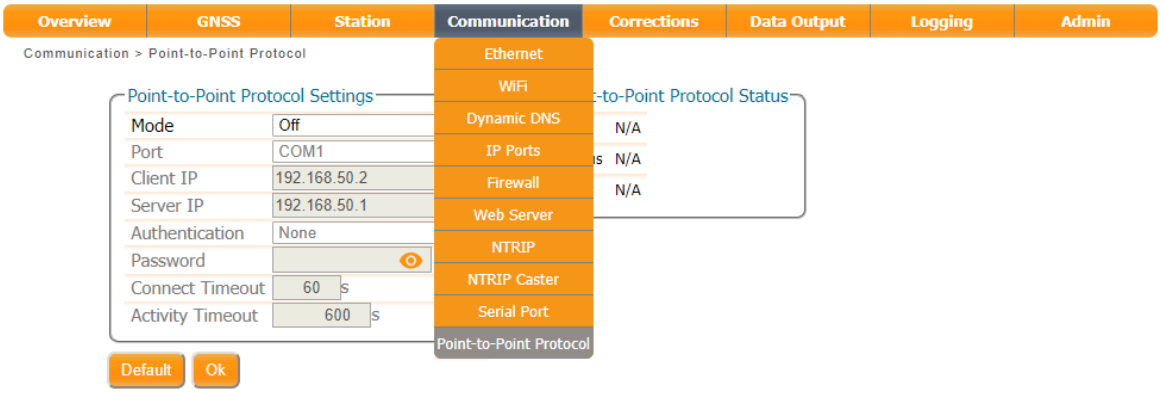


Figure 5-28: The Point-to-Point window

In the current version, the receiver implements a single P2PP server, and the first argument (ServerID) can only take the value P2PP1 .

To enable the P2PP server, change the Mode setting to 'Server'. Note that it is disabled by default. Once the server is enabled, all the other P2PP settings can be configured as shown in Figure 5-29. The Port option allows to select the COM port to be used for the point-to-point communication. Next the client and server IP's will need to be set. The ClientIP sets the IP address that will be given to the client (remote from the receiver's perspective) when a connection is established while the ServerIP refers to the IP address that will be given to the server (local from the receiver's perspective) when a connection is established.

* Though sometimes abbreviated as PPP, this feature is referred to as P2PP in Septentrio receivers as to avoid confusion with Precise Point Positioning.

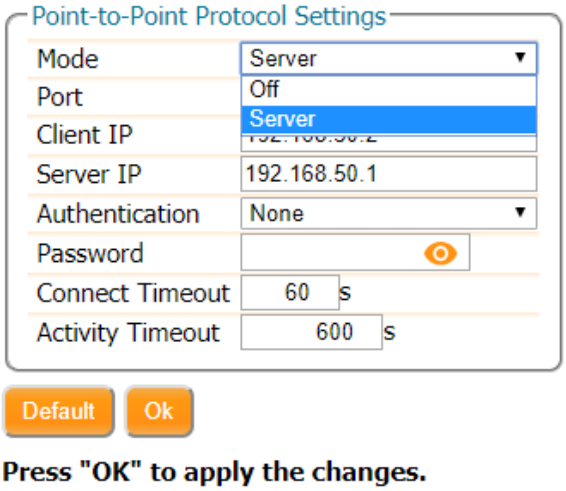


Figure 5-29: Configuring P2PP

It is possible to require authentication when establishing the connection. To enable authentication, you will need to choose either the PAP or the CHAP protocol as shown in Figure 5-30. PAP will use Password Authentication Protocol and CHAP will use Challenge Handshake Authentication Protocol. When authentication is enabled, a password needs to be set in order to successfully configure this feature.

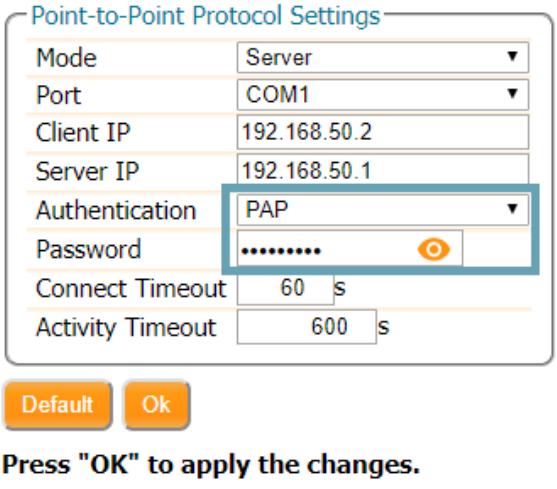


Figure 5-30: Enabling P2PP authentication

Finally, Connect Timeout determines the maximum amount of time, in seconds, that a connection attempt may consume before being refused. Meanwhile, Activity Timeout sets the maximum time, in seconds, that a connection may be idle (no data transfer) before it is disconnected. When a timeout occurs, the receiver will shut down the P2PP server and restart it. When a server is enabled, and the configuration is correct, the receiver will start the P2PP server within a maximum of 30 seconds.

5.8 CloudIt

CloudIt offers an alternative to FTP for RINEX or SBF file submission from the PolaRx5TR receivers and supports OpenAM for authentication. To learn more about the CloudIt feature and learn how to set it up, please check the knowledge base on the Septentrio website.

6 Receiver monitoring

6.1 Basic operational monitoring

The 'Overview' page of the web interface in Figure 6-1 shows at a glance a summary of the PolaRx5TR's operational status.

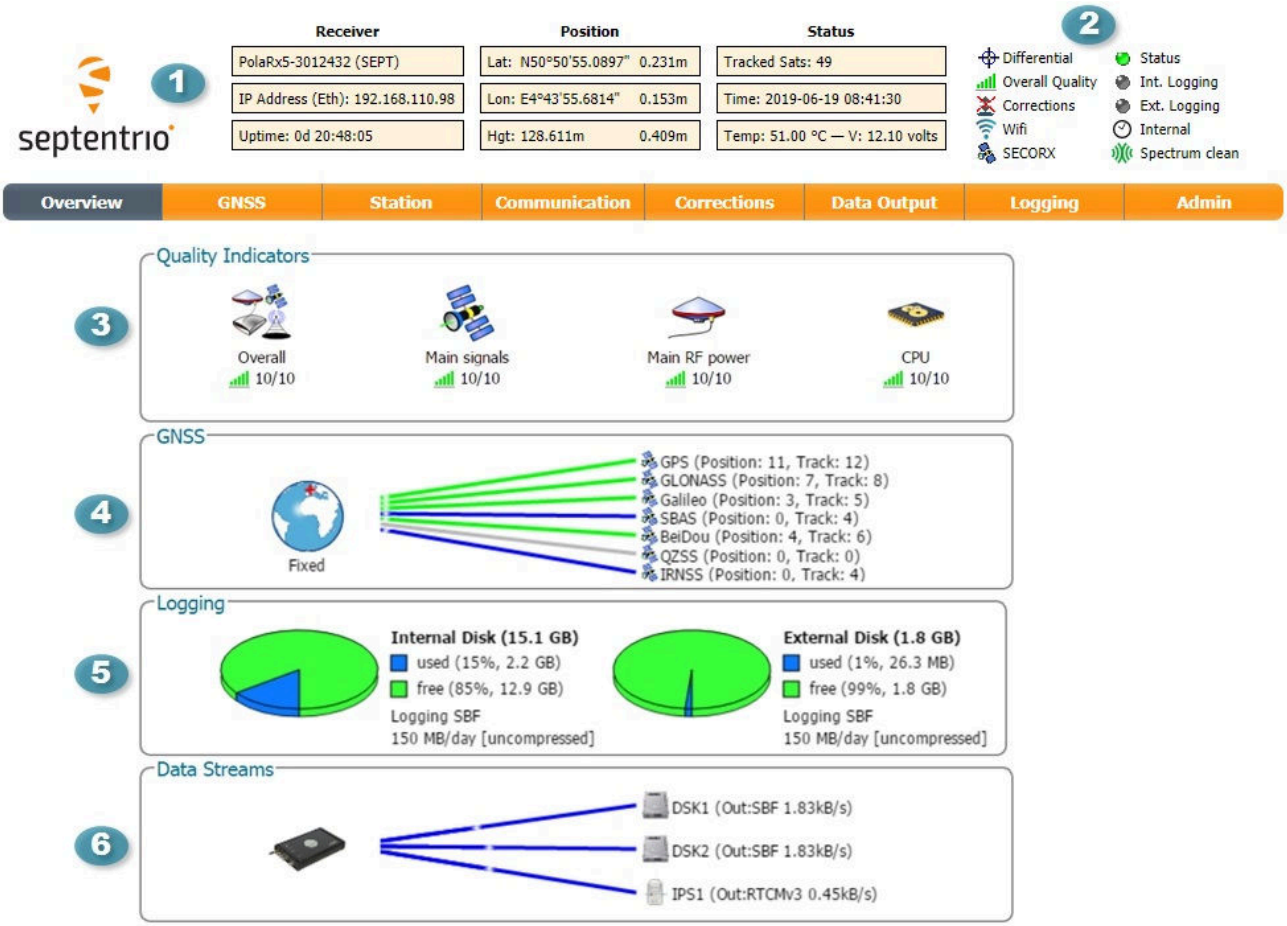


Figure 6-1: Overview page of the web interface

1 The main information bar at the top of the window gives some basic receiver information: receiver type, serial number and position. The length of time since the last power cycle (Uptime) and the total number of satellites in tracking is also given. The temperature of the receiver board and the voltage supplied is also shown.

2 The icons to the right of the information bar show that, in this example, the position of the receiver is fixed, the overall signal quality is Excellent (5 out of 5 bars) and the receiver is logging both internally (Int. Logging) and to an external USB memory device (Ext. Logging). The Corrections icon indicates that differential corrections are being sent out to a rover receiver. The active WiFi icon shows that the on-board WiFi modem is turned on and the clock icon shows that in this case, the receiver is using its own internal clock[†].

[†] In the case of the PolaRxS receiver, this icon will indicate that an **External** clock is being used

3. The Quality indicators gives a simple overview of signal quality, RF antenna power and CPU load of the receiver.

4. The GNSS field details how many satellites for each constellation are being tracked and used in the position solution (PVT). A green line indicates that at least one satellite in the constellation is being used in the PVT, a blue line indicates that satellites are being tracked but not used and a grey line that there are no satellites from that particular constellation in tracking. More information can be found in the **Satellites and Signals** page on the 'GNSS' menu.

5. The Logging field summarizes the current logging sessions and disk capacities. The complete logging information and configuration windows can be found via the **Logging** menu.

6. The **Data Streams** field gives and overview of the data streams into (green lines) and out from (blue lines) the receiver. In this example, the receiver is logging SBF data to the internal memory (DSK1) and an external device (DSK2). The receiver is also sending out RTCMv3 differential correction data over the IPS1 port.

6.2 AIM+: Detecting and mitigating interference

The PolaRx5TR is equipped with a sophisticated RF interference monitoring and mitigation system (AIM+). To mitigate the effects of narrow-band interference, three notch filters can be configured in either auto or manual mode. These notch filters effectively remove a narrow part of the RF spectrum around the interfering signal. The L2 band being open for use by radio amateurs is particularly vulnerable to this type of interference. The effects of wideband interference both intentional and unintentional can be mitigated by turning on the WBI mitigation system. The WBI system also reduces, more effectively than traditionally used pulse-blanking methods, the effects of pulsed interferers.

The spectrum view plot

In the Spectrum window of the GNSS menu, you can monitor the RF spectrum and configure three separate notch filters to cancel out narrowband interference. Figure 6-2 shows the L2 frequency band with the GPS L2P signal at 1227.60 MHz indicated. Different bands can be viewed by clicking on the 'Show table' button as shown. The spectrum is computed from baseband samples taken at the output of the receiver's analog to digital converters.

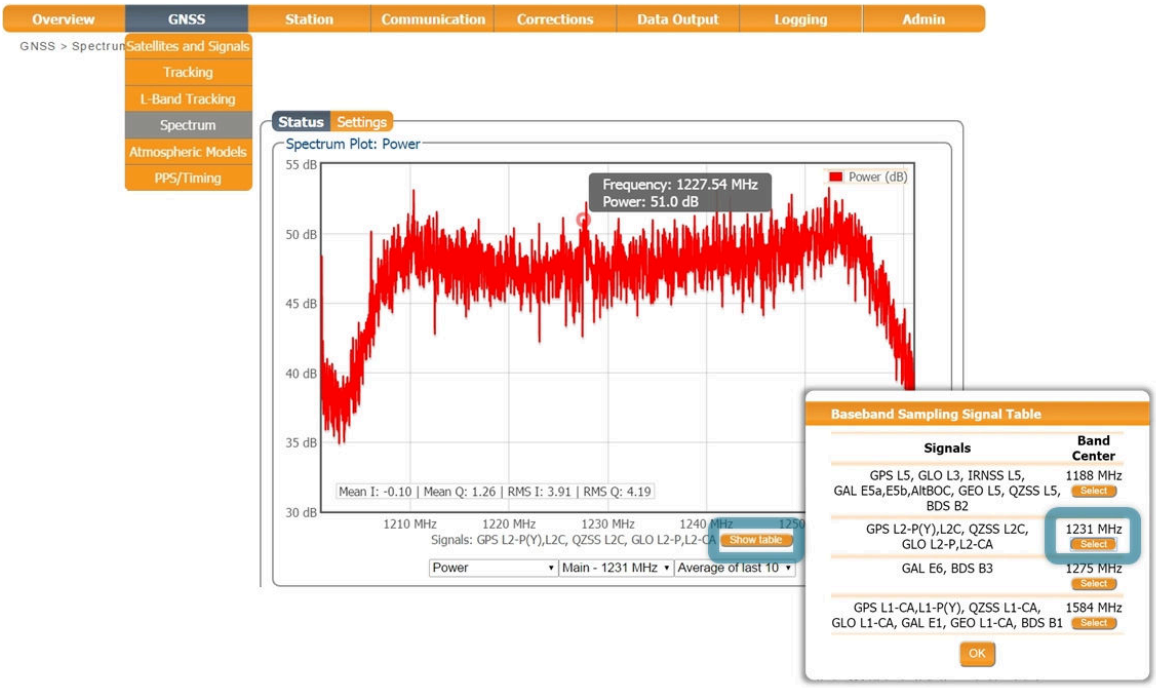


Figure 6-2: The RF spectrum of the L2 Band

6.2.1 Narrowband interference mitigation

Configuring the notch filters

In the default auto mode of the notch filters, the receiver performs automatic interference mitigation of the region of the spectrum affected by interference. In manual mode as shown configured for Notch1 in Figure 6-3, the region of the affected spectrum is specified by a centre frequency and a bandwidth which is effectively blanked by the notch filter.

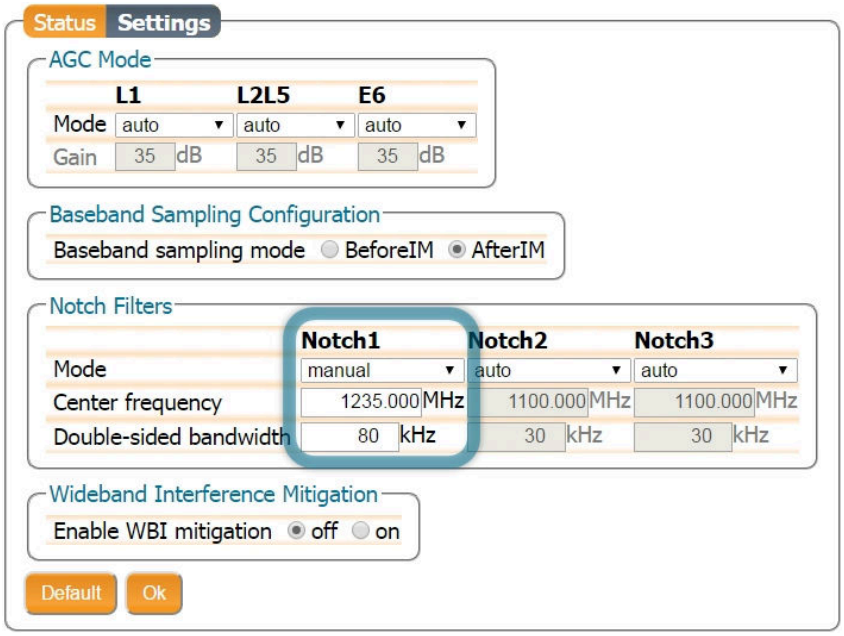


Figure 6-3: Configuring the first notch filter Notch1 at 1235 MHz

With the **Notch1** settings as shown in Figure 6-3, the L2-band after the notch filter (After IM) is shown in Figure 6-4 with the blanked section clearly visible.

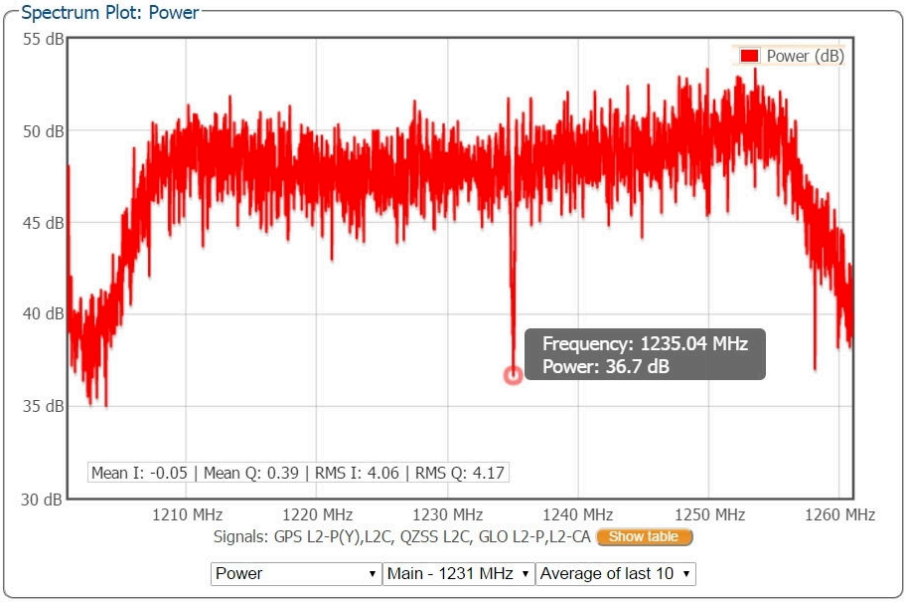


Figure 6-4: The RF spectrum of the L2 Band after applying the notch filter at 1235 MHz

6.2.2 Wideband interference mitigation

Wideband interference of GNSS signals can be caused unintentionally by military and civilian ranging and communication devices. There are also intentional sources of interference from devices such as chirp jammers. The wideband interference mitigation system (WBI) of the PolaRx5TR can reduce the effect of both types of interference on GNSS signals.

Configuring WBI mitigation

The Wideband Interference Mitigation system (WBI) can be enabled by selecting **on** as shown in Figure 6-5. Enabling WBI will increase the power consumed by the PolaRx5TR by about 160 mW.

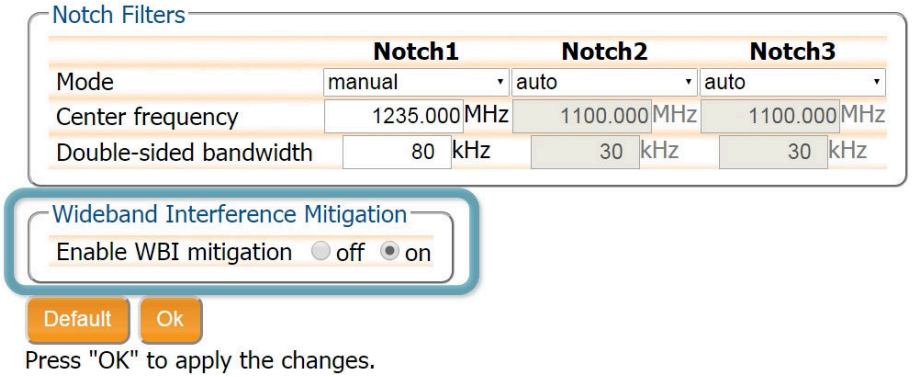


Figure 6-5: Select **on** to enable Wideband Interference Mitigation then 'OK' to apply the new setting

WBI mitigation in action

The GPS L1 band interference shown in Figure 6-6 is produced by combining the GNSS antenna signal with the output from an in-car GPS chirp jammer.

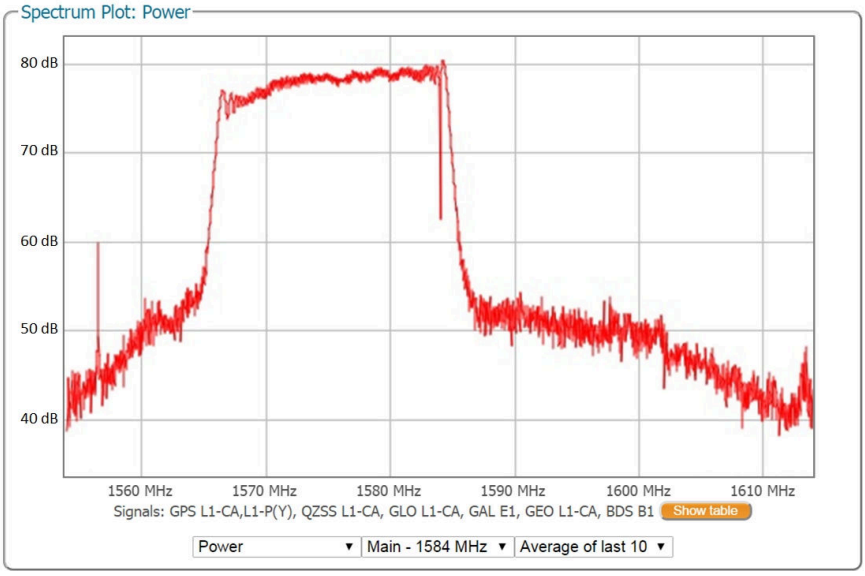


Figure 6-6: Simulated wideband interference in the GPS L1 band using an in-car chirp jammer

When WBI mitigation is enabled the effect of the interference is dramatically reduced to the extent that the small signal bump at the GPS L1 central frequency of 1575 MHz is clearly visible as Figure 6-7 shows.

In this particular test, the interference signal caused the receiver to fall back to the less precise DGNSS or standalone positioning modes. With WBI mitigation enabled however, the receiver was able to maintain an RTK fix position throughout.

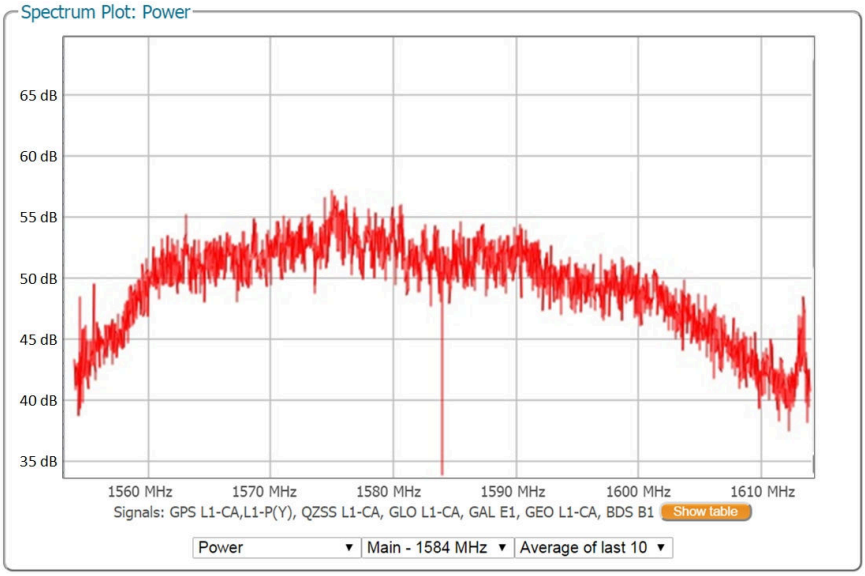


Figure 6-7: Enabling WBI interference mitigation greatly reduces the effect of the interference caused by the chirp jammer

6.3 How to log data for problem diagnosis

If the PolaRx5TR does not behave as expected and you need to contact Septentrio Support Department, it is often useful to send a short SBF data file that captures the anomalous behavior, as well as a Diagnostic Report from the receiver.

6.3.1 Support SBF file

Step 1: Configuring a new logging session

On the menu bar select 'Logging' then the 'Log Sessions' window where you can define a new logging session.

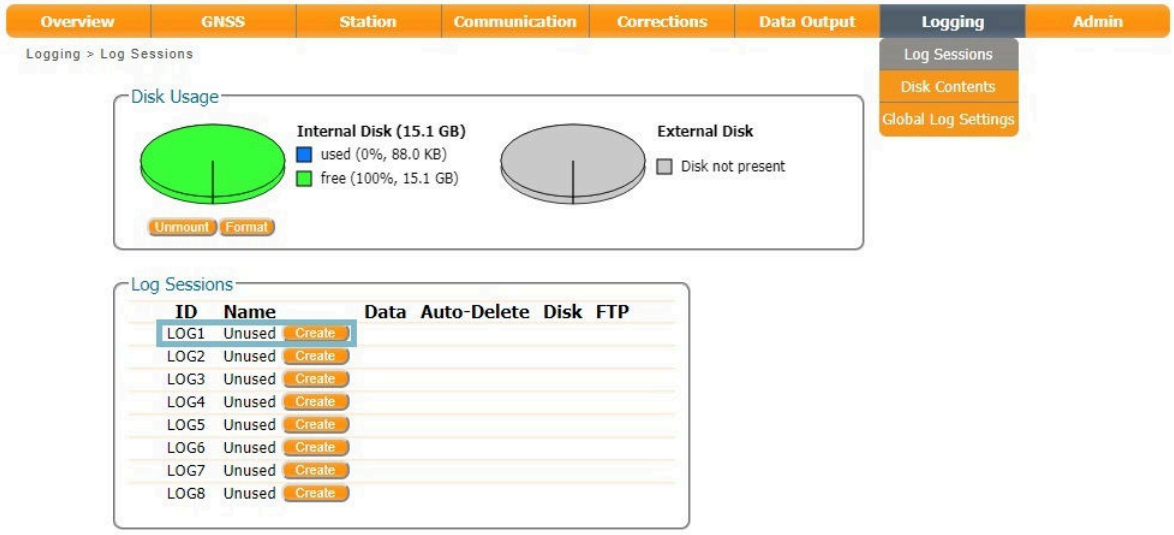


Figure 6-8: Click on the 'Create' button to start defining a new logging session

Step 2: Select to log the Support data blocks

In the 'Edit Session' window click on 'SBF Logging' and 'New SBF stream' as usual. In the final 'Edit SBF Stream' field, make sure to select the 'Support' option as shown in Figure 6-9. This option automatically selects all the SBF blocks that are useful for the Support Department to help diagnose receiver problems.

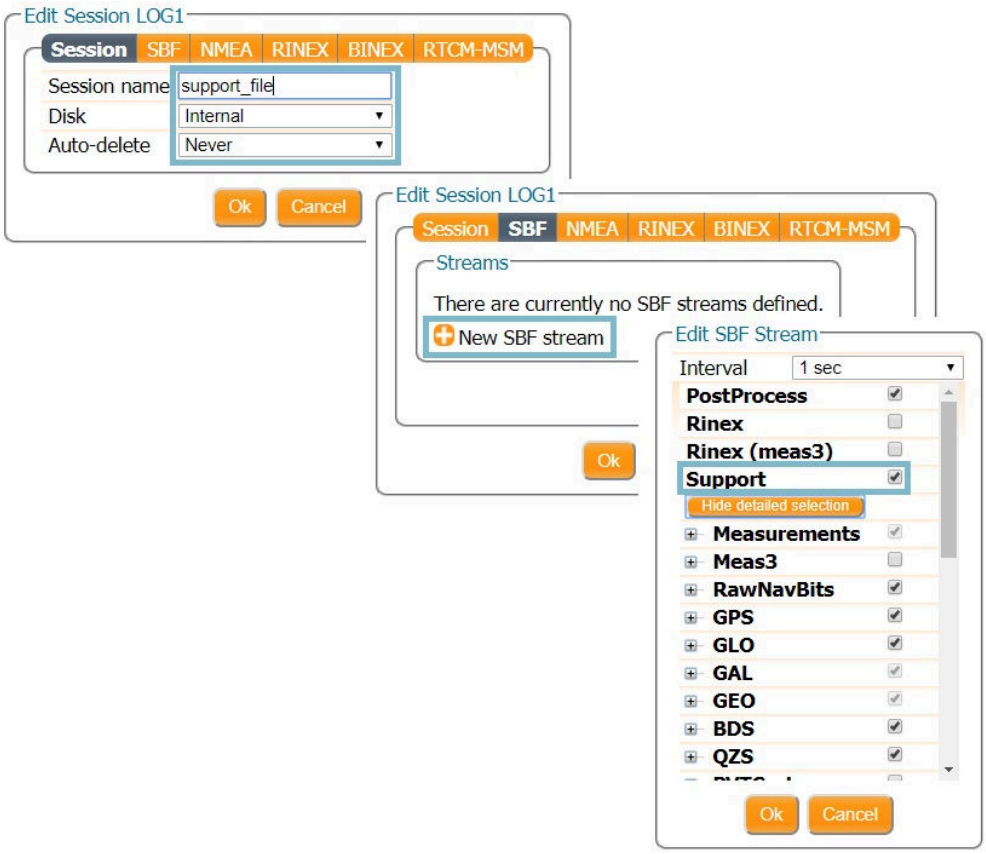


Figure 6-9: Configure a logging session selecting 'Support' in the 'Edit SBF Stream' field

When logging has been correctly configured, the 'Log Sessions' window will show the newly defined session as active as indicated in Figure 6-10.

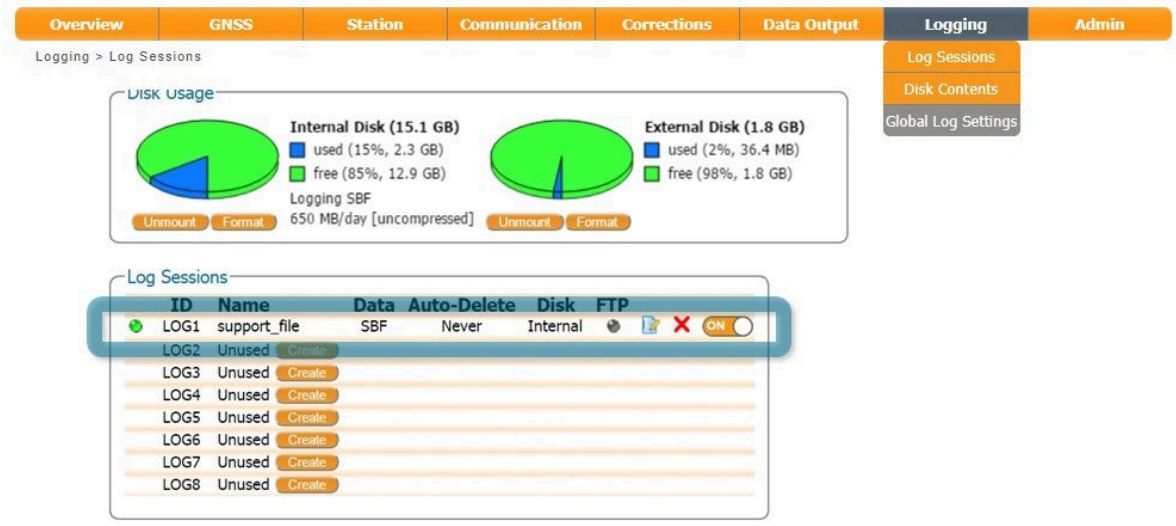


Figure 6-10: The 'Log Sessions' window showing an active logging session

Step 3: Downloading the logged SBF file

The logged SBF file can be downloaded on the 'Disk Contents' page as shown in Figure 6-11. Click on the download icon next the SBF file you want to download.

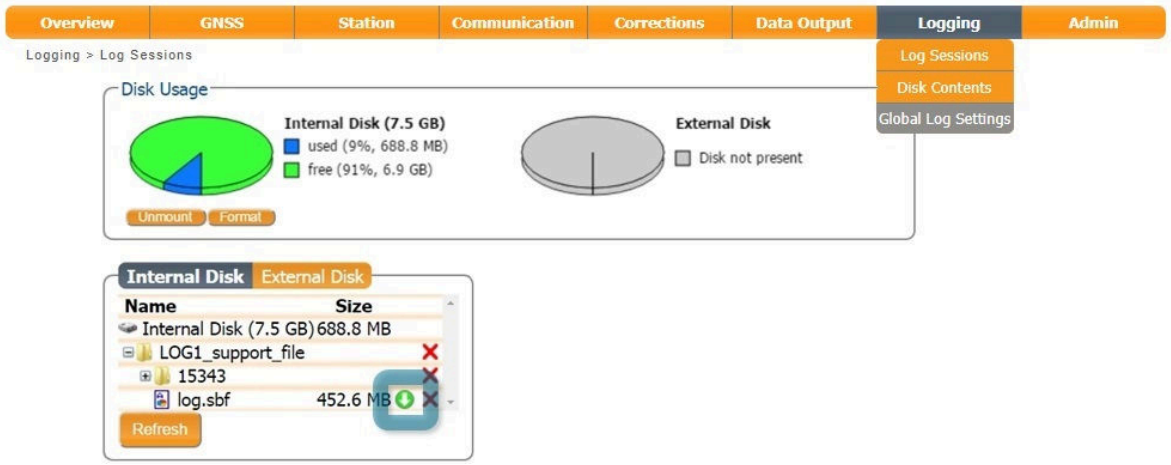


Figure 6-11: Click on the green download icon to next to the file you want to download

6.3.2 Diagnostic Report

A **Diagnostic Report** can be generated under the **Admin/About** tab on the Web interface as shown in Figure 6-12 and saved to your PC.

Figure 6-12: Generate a Diagnostic Report

6.4 Activity logging

The PolaRx5TR reports various events in the 'Receiver Messages' window of the 'Admin' menu that can be used to check the receiver operations. The example in Figure 6-13 shows that four, 15 minute SBF files have been successfully FTP pushed to a remote location.

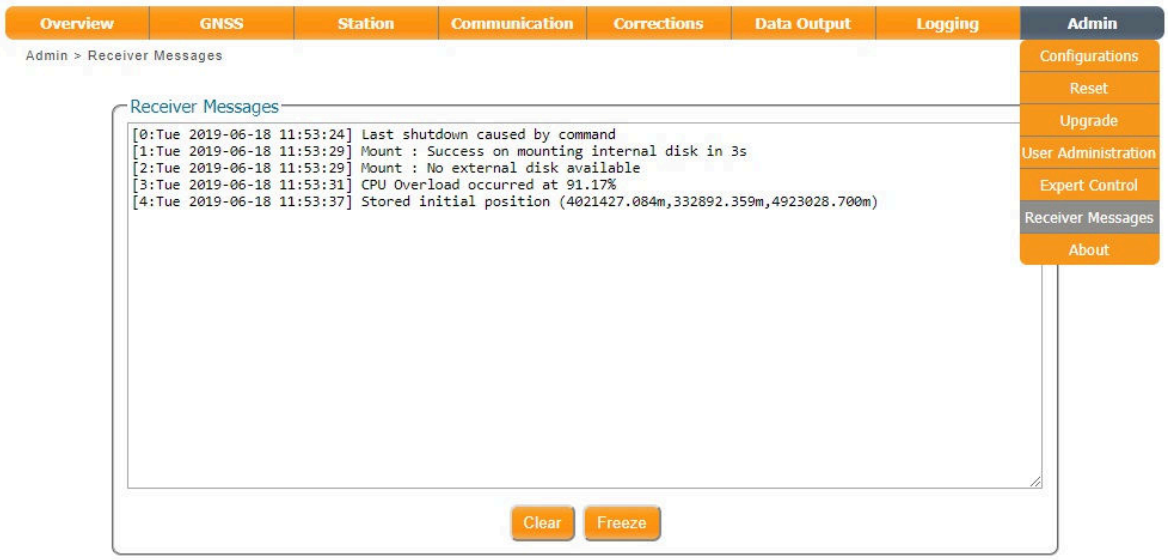


Figure 6-13: Receiver events reported by the PolaRx5TR in the Receiver Messages window

6.5 How to use the Monitoring feature to configure the receiver to power down on low voltage

The monitoring feature allows the receiver to turn itself off when the external voltage supply is below a certain threshold. Note that the monitoring feature only considers the external voltage supplied to the 3-pin PWR connector and will not consider the voltage when the receiver is powered using Power over Ethernet or through the internal battery (in case of the PolaRx5e). While in standby mode, the power consumption of the receiver is reduced to approximately 0.22W.

6.5.1 Configuring the monitoring feature

Step 1: Define a voltage threshold and standby time

On the menu bar, select 'Station' and then 'Power Mode'. Next, click on the 'Monitoring'-tab. Here you can configure the voltage threshold and define how long the receiver should remain in standby before attempting to wake up again as shown in Figure 6-14. If the voltage level is still below the threshold value when the receiver tries to wake up, it will remain in standby and will periodically (as defined by the standby duration) check the voltage level until the voltage is at a sufficiently high level for the receiver to wake up.

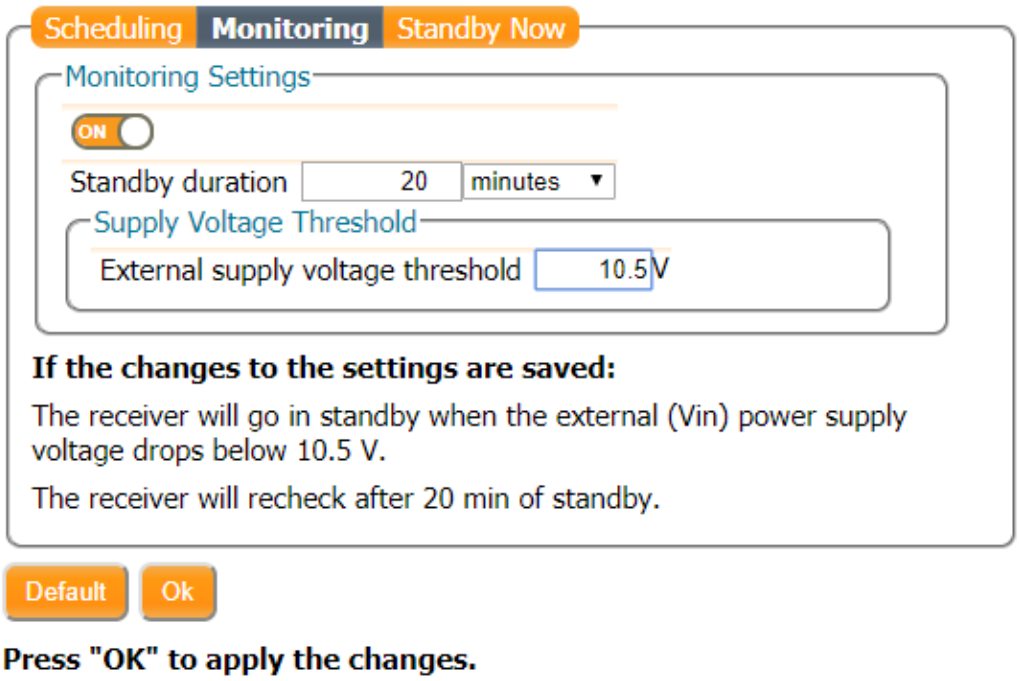


Figure 6-14: Defining a voltage threshold and standby time. In this example, the receiver is configured to go into Standby mode when the voltage level drops below 10.5V and to check the voltage after 20 minutes.

Step 2: Save the configuration

Press "OK" to apply the changes. Since the receiver will load the boot configuration when waking up again after having gone into standby due to low voltage, make sure to save the configuration to boot as shown in Figure 6-15. Note that, if the current voltage is lower than the threshold value defined in step 1, the receiver will not go into standby immediately but will display a warning and wait for 30 seconds, allowing the user to save the configuration to boot or increase the threshold value.

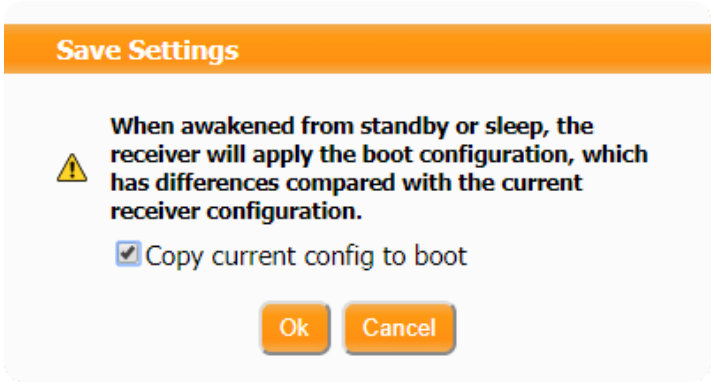


Figure 6-15: Saving the configuration to boot after configuring the Monitoring feature

Note that the receiver will not attempt to wake up to check the voltage levels during time periods for which scheduled sleep is enabled. For more information see Section 6.6.

6.6 Scheduled sleep

The Scheduled Sleep feature allows users to configure the receiver in such a way that it will sleep for a predefined amount of time and/or during a number of predefined intervals.

6.6.1 Configuring scheduled sleep

Step 1: Configure a new Wake-Up Schedule

On the menu bar select 'Station' and then 'Power Mode'. Next, click on the 'Scheduling'-tab. Here you can configure a full 'Wake-Up Schedule' as shown in Figure 6-16.

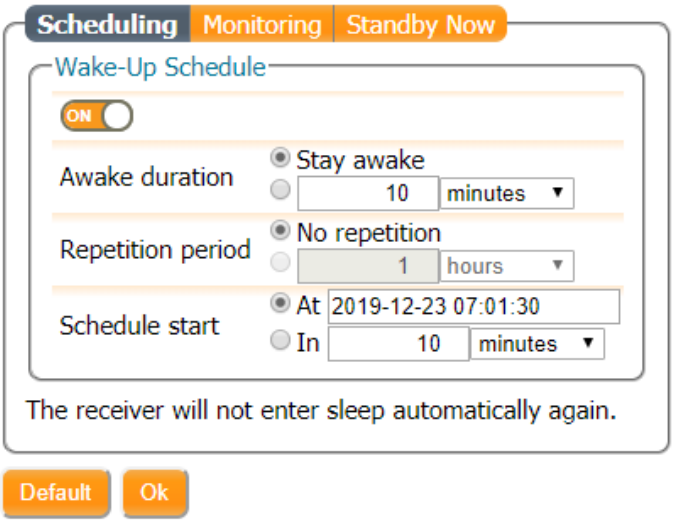


Figure 6-16: Overview of the Wake-Up Schedule

The Wake-Up schedule allows you to configure both the length of the period the receiver should be awake and whether or not this wake-up period should recur, and if so, how frequently (See Figure 6-17).

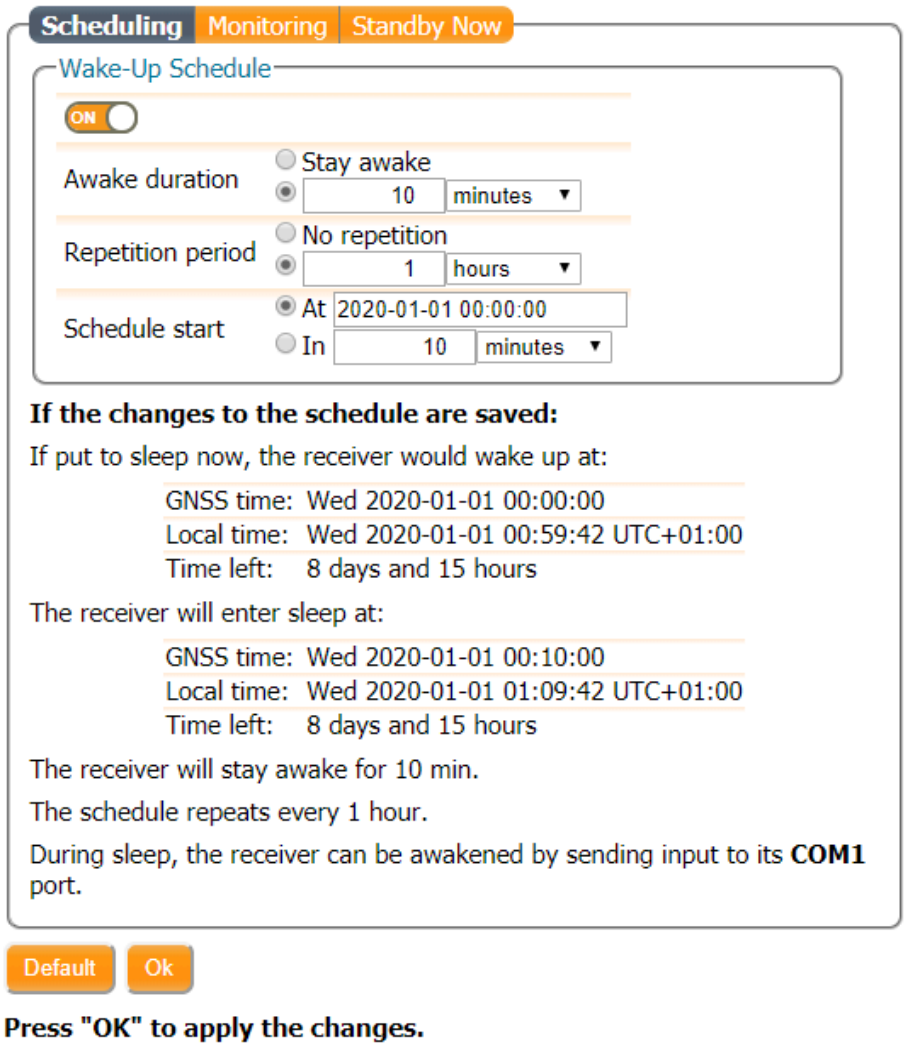


Figure 6-17: Example of a fully configured Wake-Up schedule.

Step 2: Determine the awake duration

To determine how long the receiver should stay awake, fill in the desired time span in the Awake duration field. In the example shown in Figure 6-17, this is set to 10 minutes.

Step 3: Define the repetition period

Next, determine how often the receiver needs to wake up for the previously configured period of time. If you wish for the receiver to wake up just once, leave the Repetition Period option at its default value of 'No RepetitionâĂŹ. The example shown in Figure 6-17 shows a receiver which is configured to wake up for 10 minutes every hour.

Step 4: Choose when the schedule should start

Finally, define a time in the Schedule Start field to choose when you want the Wake-Up Schedule to start taking effect. This effectively corresponds to the first time the receiver will attempt to wake up from standby mode for the period of time defined in the 'Awake DurationâĂŹ field.

Step 5: Save the configuration

After pressing 'Ok' to apply the changes, the receiver will suggest to copy the current configuration to boot. This is because when waking up from standby or sleep, the receiver will apply the boot configuration which at this point does not contain the recently configured changes (Figure 6-18).

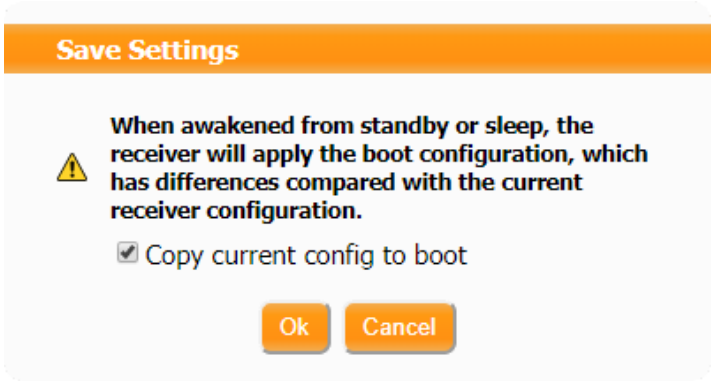


Figure 6-18: Upon applying the changes, the receiver will show a warning suggesting to copy the current configuration to boot

Note that you can also configure the receiver to wake up at a certain point in the future and then just stay awake. To do this, simply leave both the Awake duration and Repetition Period options at their default setting and define when the receiver should wake up by choosing an appropriate Start Schedule time as shown in Figure 6-19.

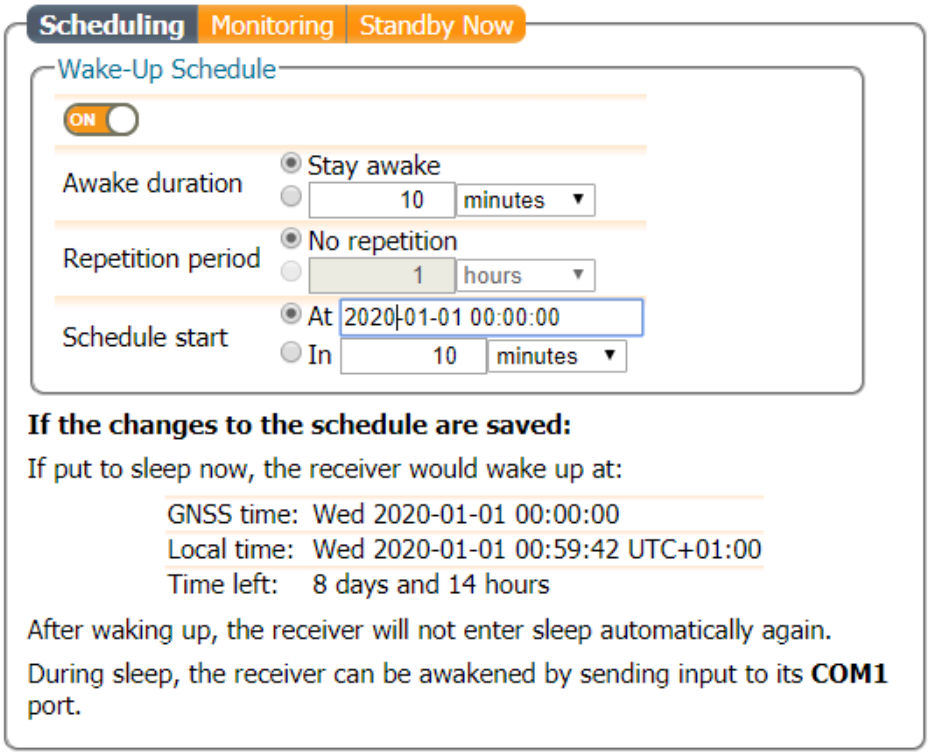


Figure 6-19: Example of how to configure the receiver to wake up at a certain point in the future and then just stay awake. In this example, the receiver is set to wake up at the first of January 2020

6.6.2 Combining the Monitoring and Scheduling features

It is possible to combine the monitoring feature with a Wake-Up Schedule. In this case, when the receiver is scheduled to be awake, but the voltage level is below the threshold value defined in the monitoring tab, the receiver will remain in standby but will periodically attempt to wake up in order to check the voltage level. Conversely, during time periods for which the receiver is scheduled to sleep, the receiver will not attempt to wake up to check the voltage levels. An example illustrating this behavior is shown below in Figure 6-20.

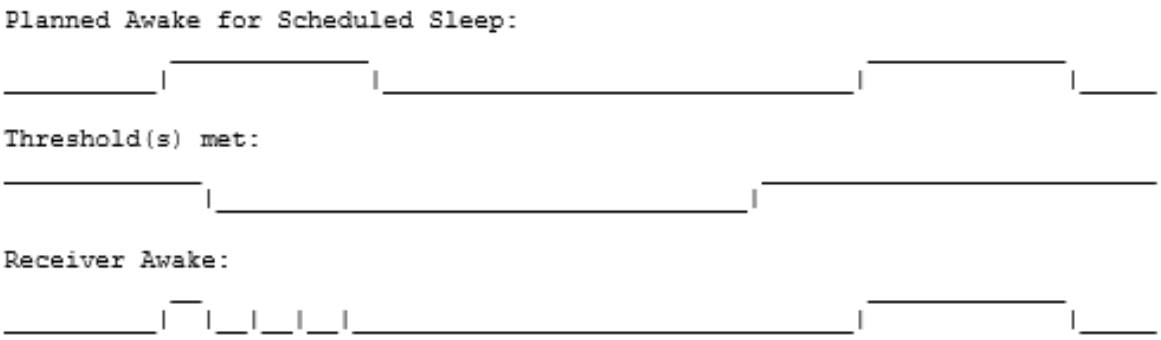


Figure 6-20: Combining the monitoring feature with a Wake-Up Schedule will lead the receiver to remain in standby but periodically check the voltage level when the receiver is scheduled to be awake, but the voltage level is below the threshold value. When the receiver is scheduled to sleep, the receiver will not attempt to wake up to check the voltage levels.

7 Security

7.1 How to manage access to the PolaRx5TR

You can manage the access that users have to the PolaRx5TR in the 'User Administration' window of the 'Admin' menu.

By default, the web interface, file transfer and communication ports are all assigned User-level access as shown in Figure 7-1. 'User' level allows full control of the receiver while 'Viewer' level only allows viewing the configuration. The File Transfer is by default at the âĂŹViewerâĂŹ level such that anonymous users can only read files.

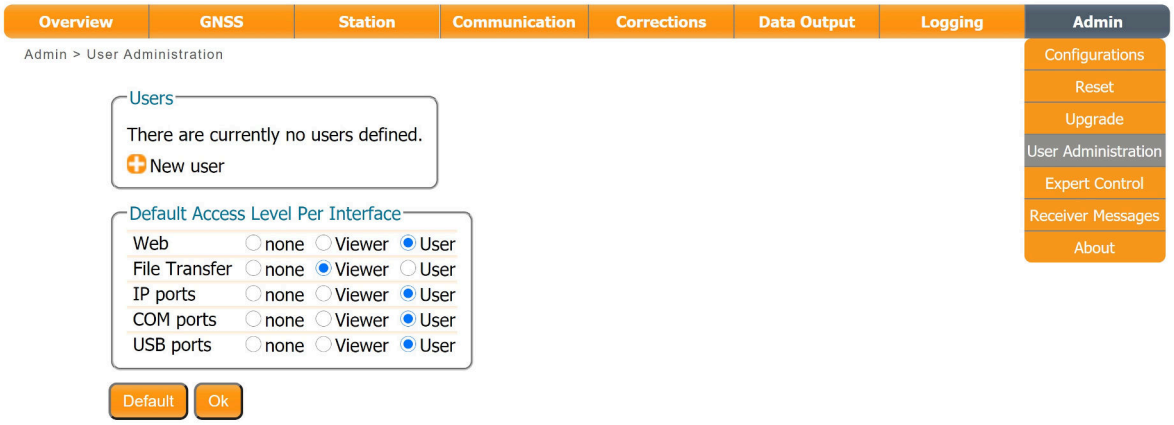


Figure 7-1: The default access levels of the PolaRx5TR

In the example shown in Figure 7-2:

Web Interface: Anonymous users (without password) can connect to the receiver via the web interface as Viewers. They can browse the various windows but cannot change any of the settings.

File Transfer: For the File Transfer argument, Viewer means that the anonymous user is allowed to download log files from the receiver using FTP, SFTP or rsync, but not to delete them. User means that the anonymous user can both download and delete files, and none disables anonymous accesses.

IP, COM and USB Ports: Only users with User access to the IP, COM and USB ports so can change receiver settings over these connections. Users with Viewer access to the IP, COM and USB ports so can only send commands to show the configuration. Anonymous users can neither change or view the receiver configuration over these connections.

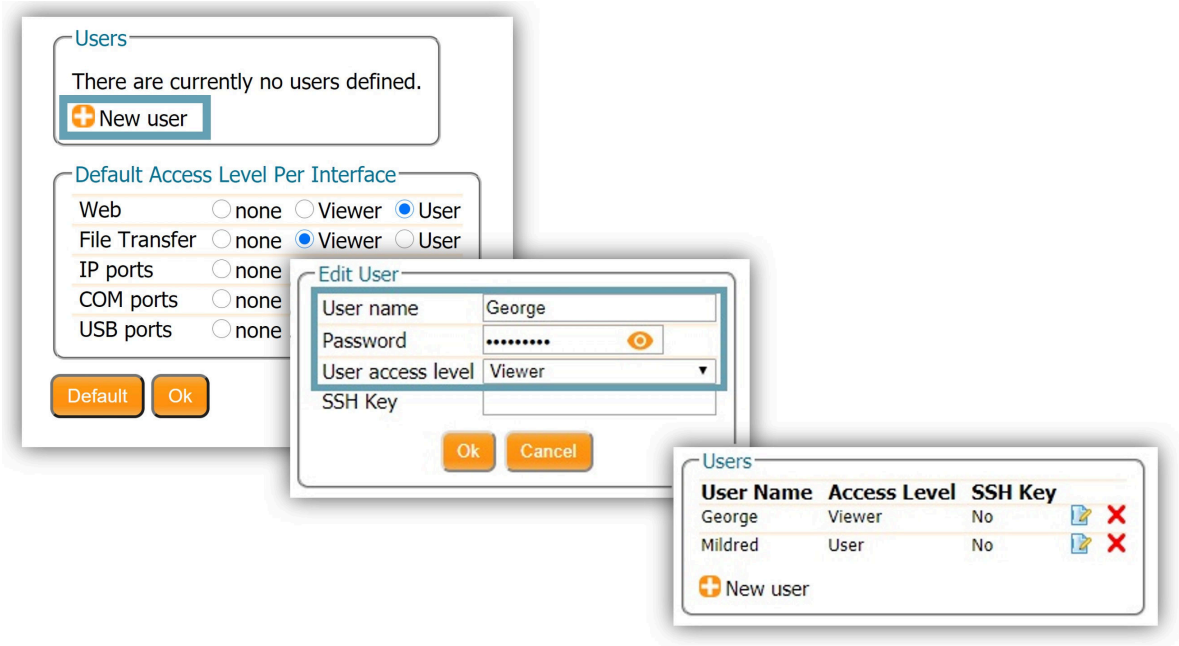


Figure 7-2: Defining user access levels

After defining the Users/Viewers and their access levels, they can login on the web interface by clicking on **Log in** on the upper-right corner as shown in Figure 7-3.

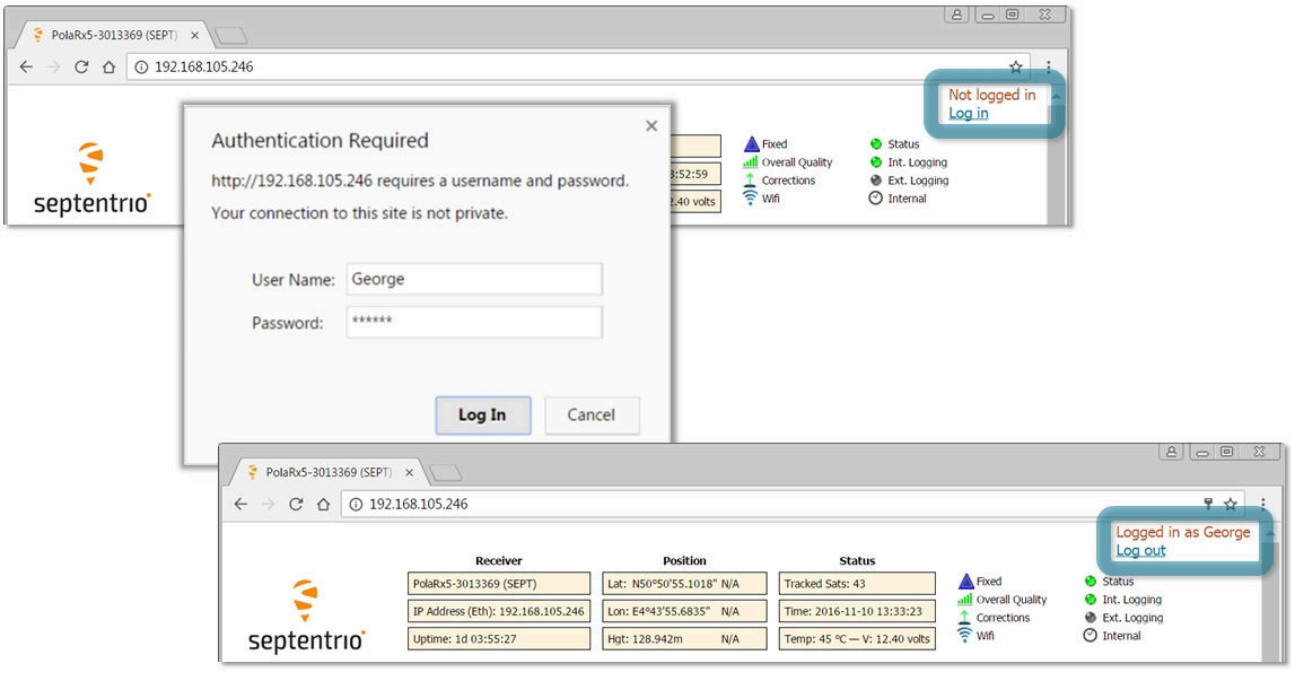


Figure 7-3: Logging in to the PolaRx5TR web interface

Users/Viewers can logout by clicking on **Log out** on the upper-right corner and leaving the 'User Name' and 'Password' fields of the pop-up empty as shown Figure 7-4.

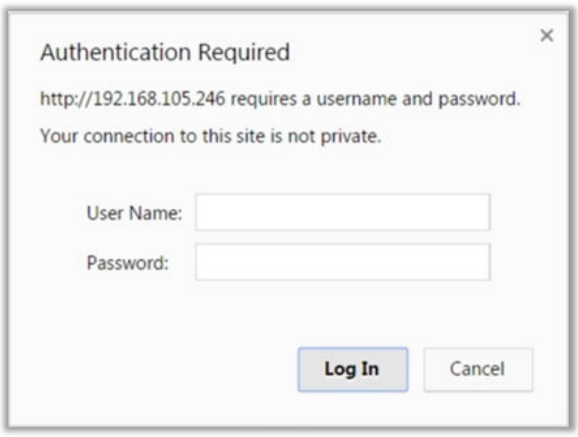


Figure 7-4: Adding an SSH key

7.1.1 SSH key authentication

By default, anonymous users have full access over FTP, SFTP and rsync to the files logged on the PolaRx5TR. FTP, SFTP and rsync access can be limited by configuring user access, as described in Section 7.1. For added security, user authentication for SFTP and rsync access can be configured using an SSH public key. When an SSH key is defined, the configured user can download files using SFTP or rsync without entering a password provided of course, that the matching private key is known by the key agent running on the same PC.

You can generate public and private keys using for example, **PuTTY Key Generator** as shown in Figure 7-5.

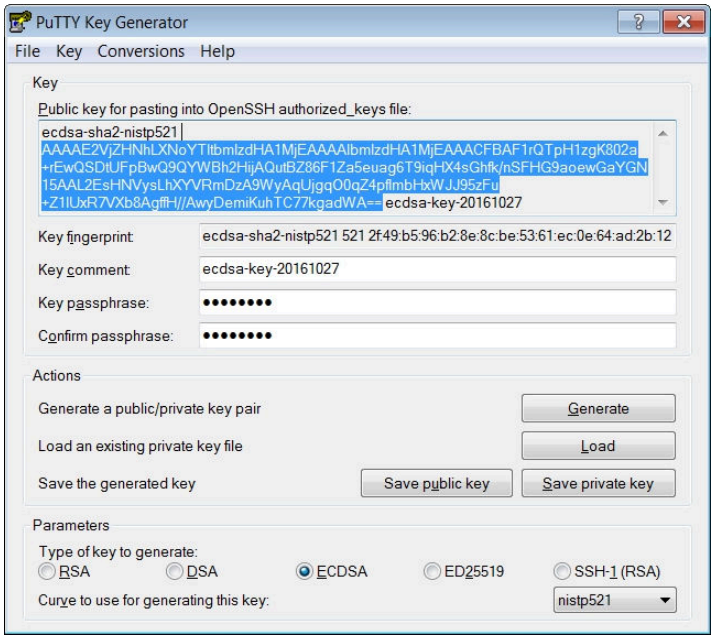


Figure 7-5: Generating SSH keys using the PuTTY Key Generator. The public key is highlighted.

The generated public key is the highlighted text that can be pasted directly into the **SSH Key** field of the PolaRx5TR Web Interface as shown in Figure 7-6.

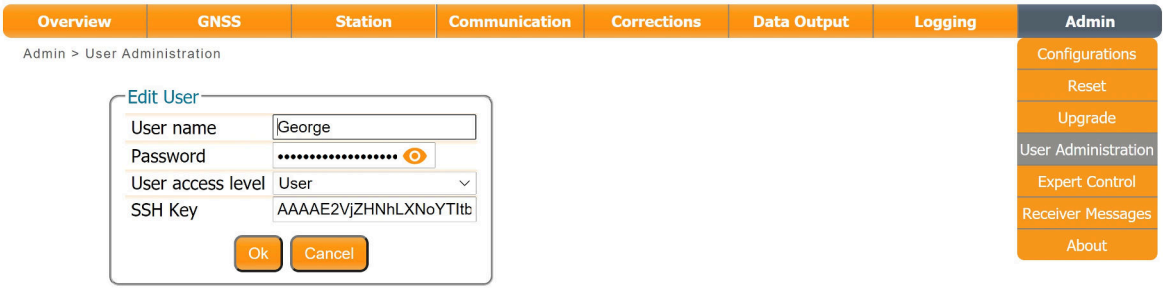


Figure 7-6: Logging out

521-bit ECSDA keys offer the best security however, ECSDA 256 and 384-bit keys can also be used. Alternatively, RSA 512 and 1024 key encryption is also supported.

7.2 How to control access using the PolaRx5TR Firewall

You can control access to the PolaRx5TR using the receiver's firewall in the **Firewall** window. By default, all Ethernet and WiFi ports are open (i.e. those defined on the **IP Ports** menu).

In the example shown in Figure 7-7, Ethernet ports 2101, 2102 and 2103 are accessible but only from devices with the IP address 84.199.9.148. Similarly, all WiFi ports are open but only those from IP 84.199.9.148.

Please note that the firewall settings do not apply when connecting to the web interface using USB. In the case of WiFi, firewall settings only apply when the receiver is in WiFi client mode.

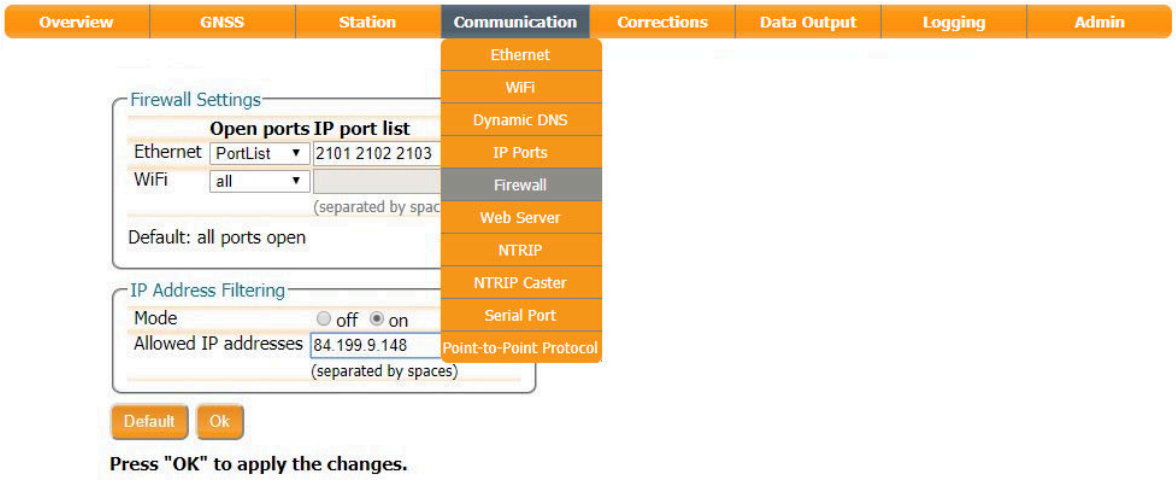


Figure 7-7: Configuring the Firewall of the PolaRx5TR

8 Receiver administration operations

8.1 How to change IP settings of the PolaRx5TR

The IP settings of the PolaRx5TR can be configured in the Ethernet window of the Communication menu. By default, the PolaRx5TR is configured to use DHCP to obtain an IP address. You can specify a 'Static' address in the TCP/IP Settings field as shown in Figure 8-1.

In Static mode, the receiver will not attempt to request an address via DHCP but will use the specified IP address, netmask, gateway, domain name and DNS. DNS1 is the primary DNS and DNS2 is the backup DNS. In DHCP mode, the arguments IP, Netmask, Gateway, Domain, DNS1, and DNS2 are ignored.

Having entered the settings, click on 'Ok' then 'Apply And Reboot' in the pop-up dialog as shown, as the receiver needs to be reset for the new settings to become active.

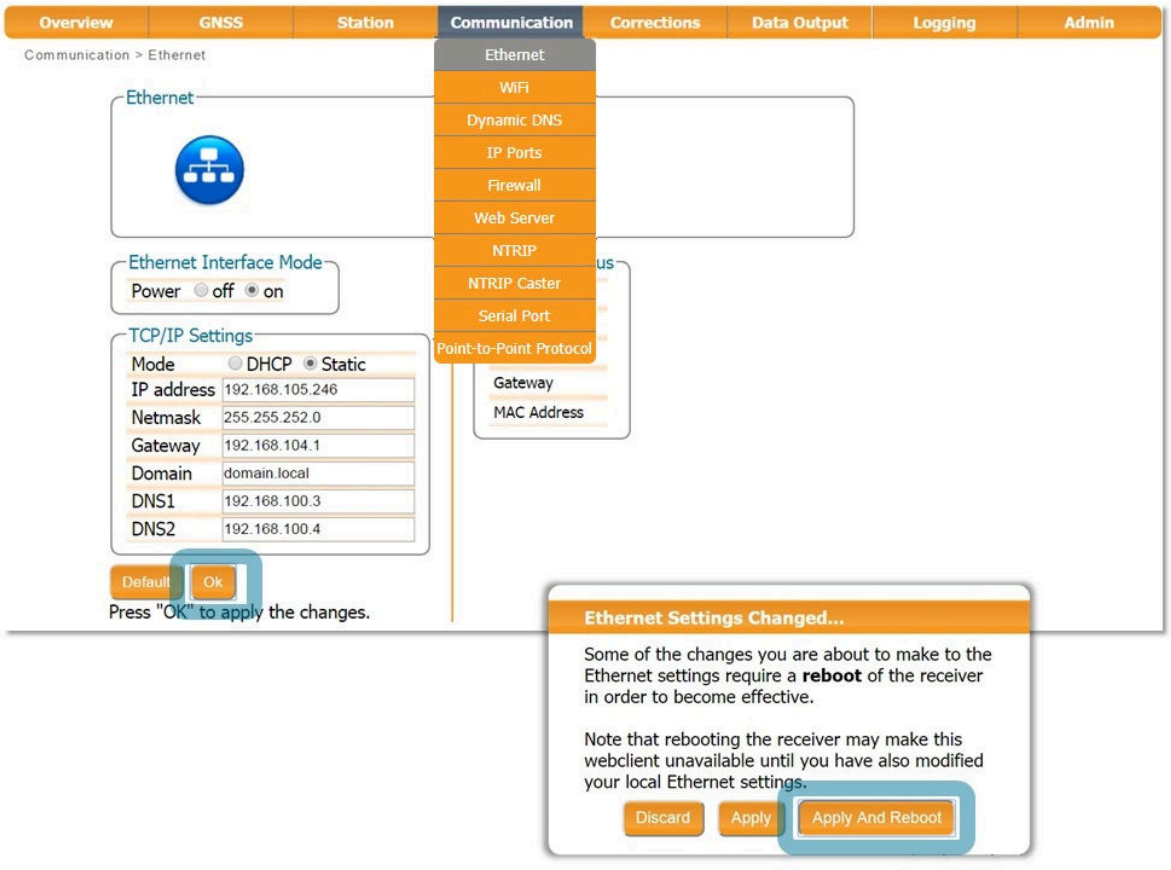


Figure 8-1: Changing the TCP/IP settings of the PolaRx5TR

After reboot, the Ethernet Status field should now show the correct IP settings as shown in Figure 8-2.

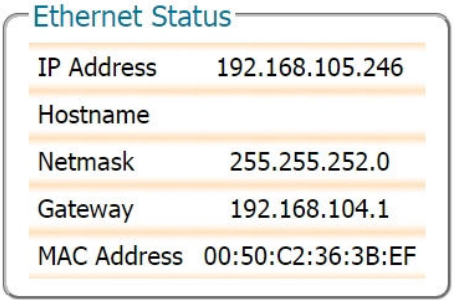


Figure 8-2: TCP/IP settings

Note that the IP settings will keep their value after a power cycle and even after a reset to factory default in order to avoid accidentally losing an Ethernet connection to the receiver.

8.2 How to configure Dynamic DNS

Dynamic DNS allows remote contact with the PolaRx5TR using a hostname.

When devices are connected to the internet, they are assigned an IP address by an internet service provider (ISP). If the IP address is *dynamic* then it may change over time resulting in a loss of connection. Dynamic DNS (DynDNS or DDNS) is a service that addresses this problem by linking a user-defined hostname for the device to whichever IP address is currently assigned to it.

To make use of this feature on the PolaRx5TR, you should first create an account with a Dynamic DNS provider (**dyndns.org** or **no-ip.org**) to register a hostname for your receiver. In the example shown in Figure 8-3, the hostname *polarx5.mine.nu* has been registered with dyndns.org. The *Bind* option, selected in this case, tells the Dynamic DNS provider only to update IP addresses assigned over an Ethernet LAN connection.

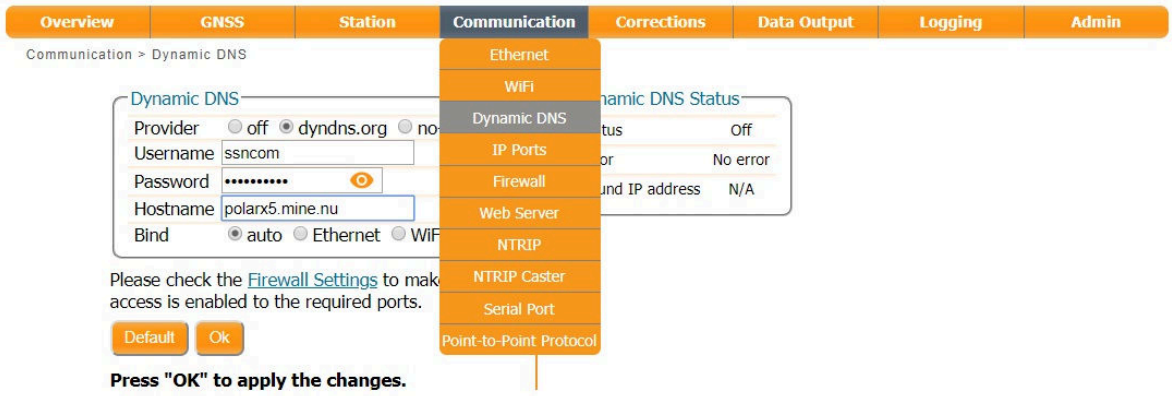


Figure 8-3: Configuring Dynamic DNS

8.3 How to upgrade the firmware or upload a new permission file

The PolaRx5TR firmware and permission files both have the extension .suf (Septentrio Upgrade File) and can be uploaded to the PolaRx5TR as shown in the steps below. Firmware upgrades can be downloaded from the Septentrio website and are free for the lifetime of the receiver. Permission files enable additional features on the PolaRx5TR and can be purchased from our sales department.

Step 1: Select the .suf file and start the upgrade

The upgrade procedure is started by clicking on the 'Choose file' button in the 'Upgrade' window of the 'Admin' menu and which is highlighted in Figure 8-4.

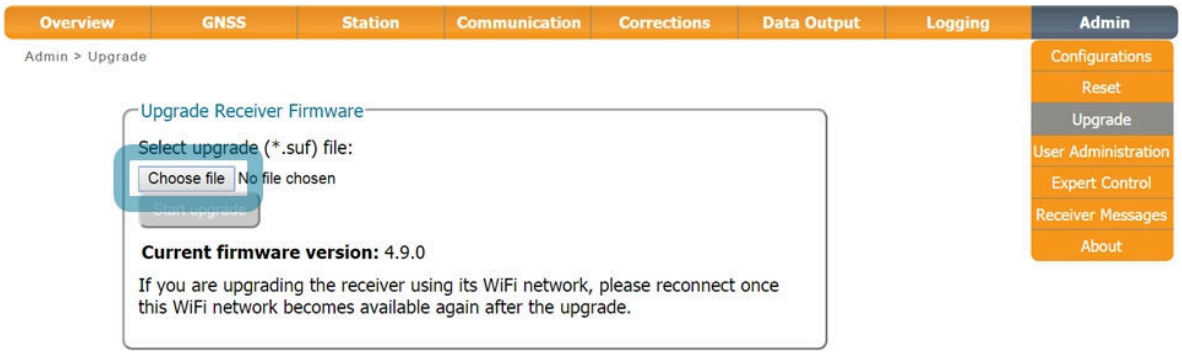


Figure 8-4: Selecting the .suf file to upload to the receiver

Having already saved the .suf file to your PC, you can then select this file and click on the 'Start upgrade' button. The pop-up window shown in Figure 8-5 will show the progress of the upgrade.

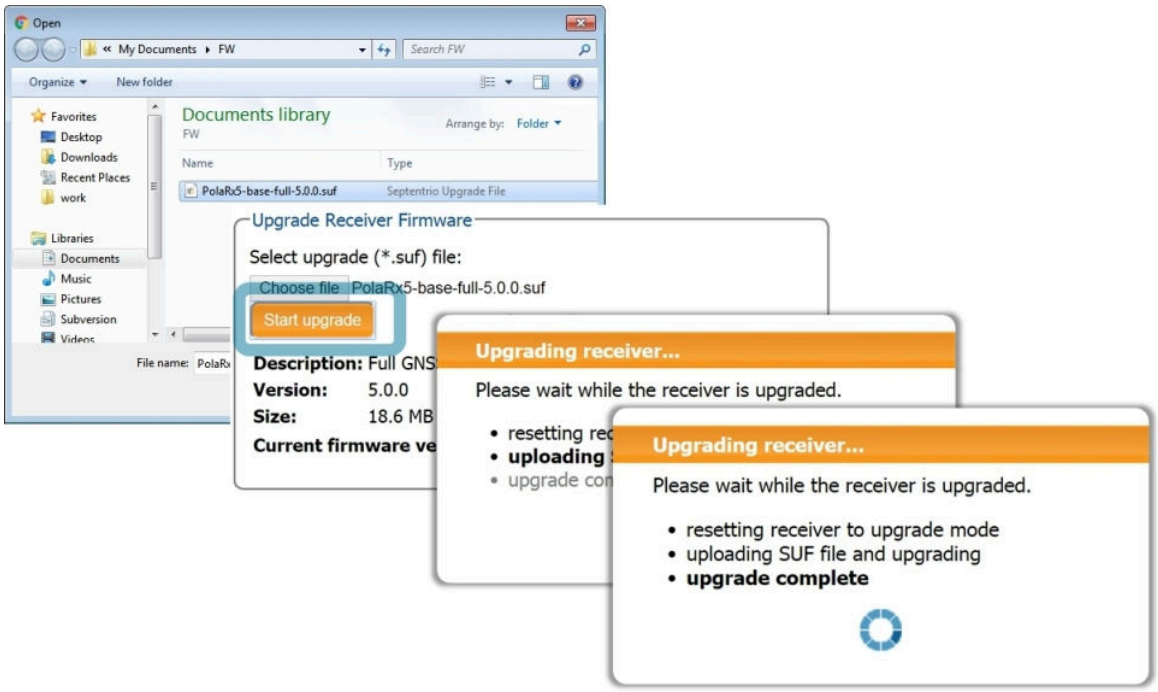


Figure 8-5: The upgrade procedure

Step 2: Verifying the upgrade

If there were no problems with the upgrade, the message 'Upgrade successful' will appear. You can then check on the Admin/About window, as shown in Figure 8-6, that the new firmware version or permission file has been updated.

Figure 8-6: Checking the firmware and permission file versions

8.4 How to set the PolaRx5TR to its default configuration

You can set the PolaRx5TR configuration to its default settings on the Configurations window of the Admin menu as shown in Figure 8-7. Select 'RxDefault' from the 'Source' drop-down list and either 'Current' or 'Boot' in the 'Target' menu. You will then be prompted to Save the new current configuration as the boot configuration so the receiver will boot up with saved configuration after a power cycle.

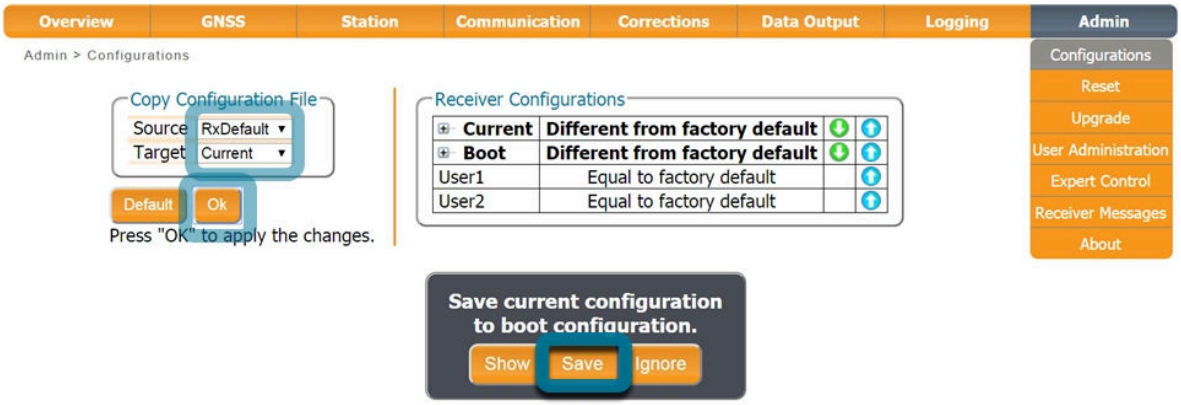


Figure 8-7: Setting the PolaRx5TR to its default configuration

8.5 How to reset the PolaRx5TR

If the PolaRx5TR is not operating as expected, a simple reset may resolve matters. The PolaRx5TR can be fully power-cycled by disconnecting then reconnecting the power supply. However, on the Admin/Reset window as shown in Figure 8-8 different functions can be reset individually. A 'Soft' level reset will cause the PolaRx5TR to boot up with its current configuration while a 'Hard' reset will use the configuration stored in the boot file.

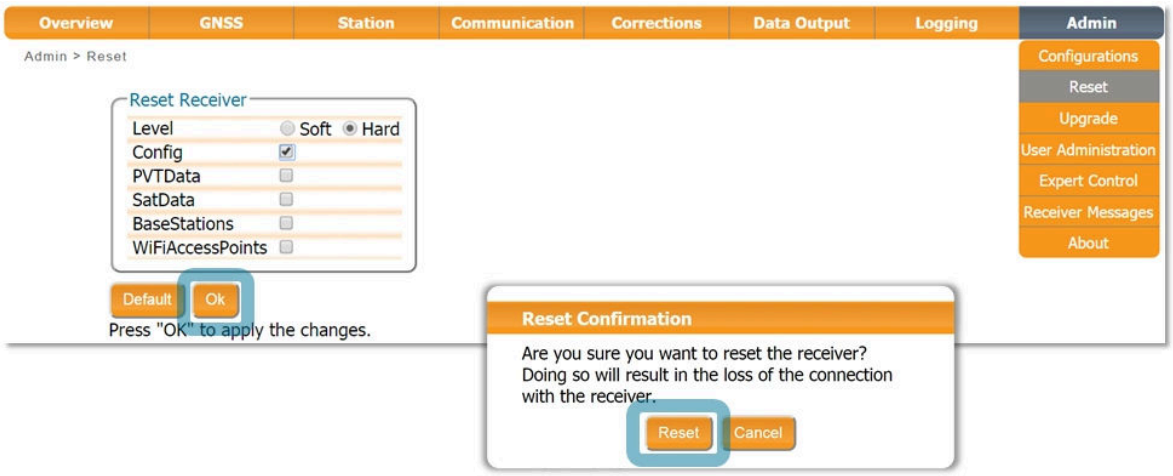


Figure 8-8: Resetting the PolaRx5TR configuration to its boot configuration using a Hard reset

8.6 How to copy the configuration from one receiver to another

In the Admin/Configurations window, the configuration of a PolaRx5TR can be easily saved to a PC as a text file. A saved configuration can then be uploaded to any other PolaRx5TR.

Step 1: Downloading the configuration from a PolaRx5TR

Click the green download arrow next the configuration you wish to download as shown in Figure 8-9. The configuration will be saved as a .txt file.

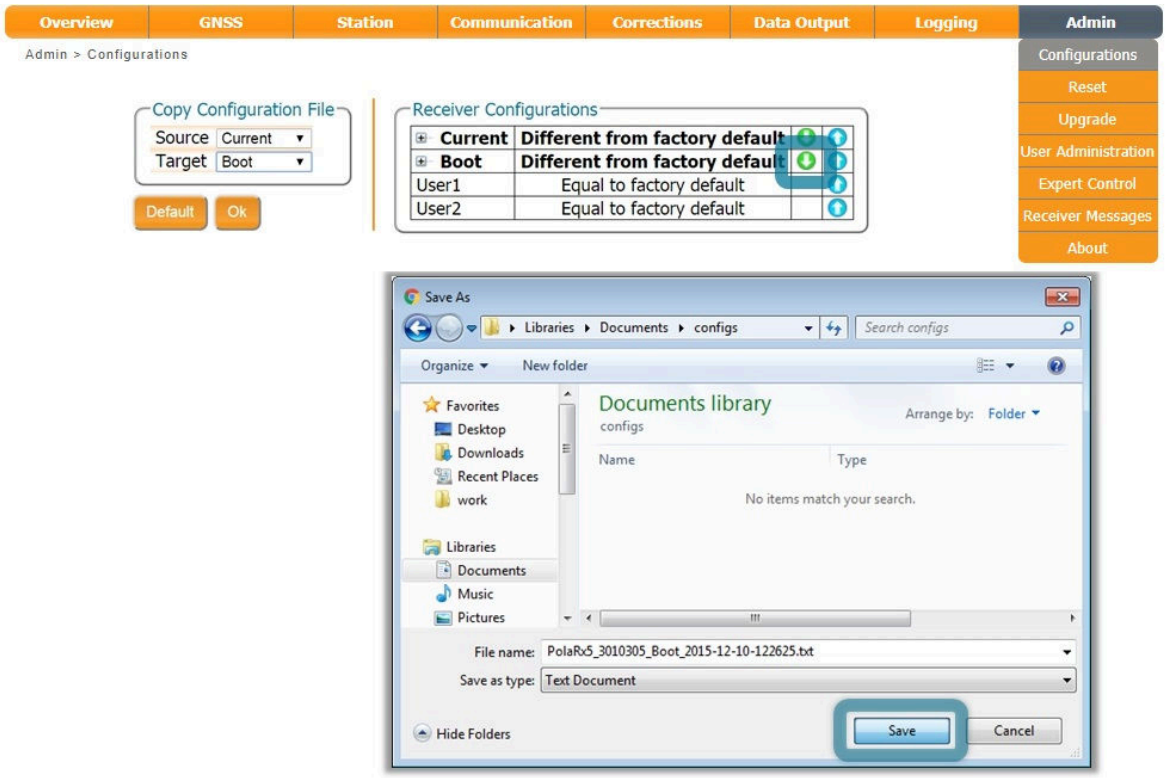


Figure 8-9: Saving a configuration from a PolaRx5TR as a text file

Step 2: Uploading the configuration to another PolaRx5TR

Again on the Admin/Configurations window, click on the blue upload arrow , as indicated in Figure 8-10, to upload a configuration file stored on you PC. In this example, the saved file will be uploaded as the Boot configuration.

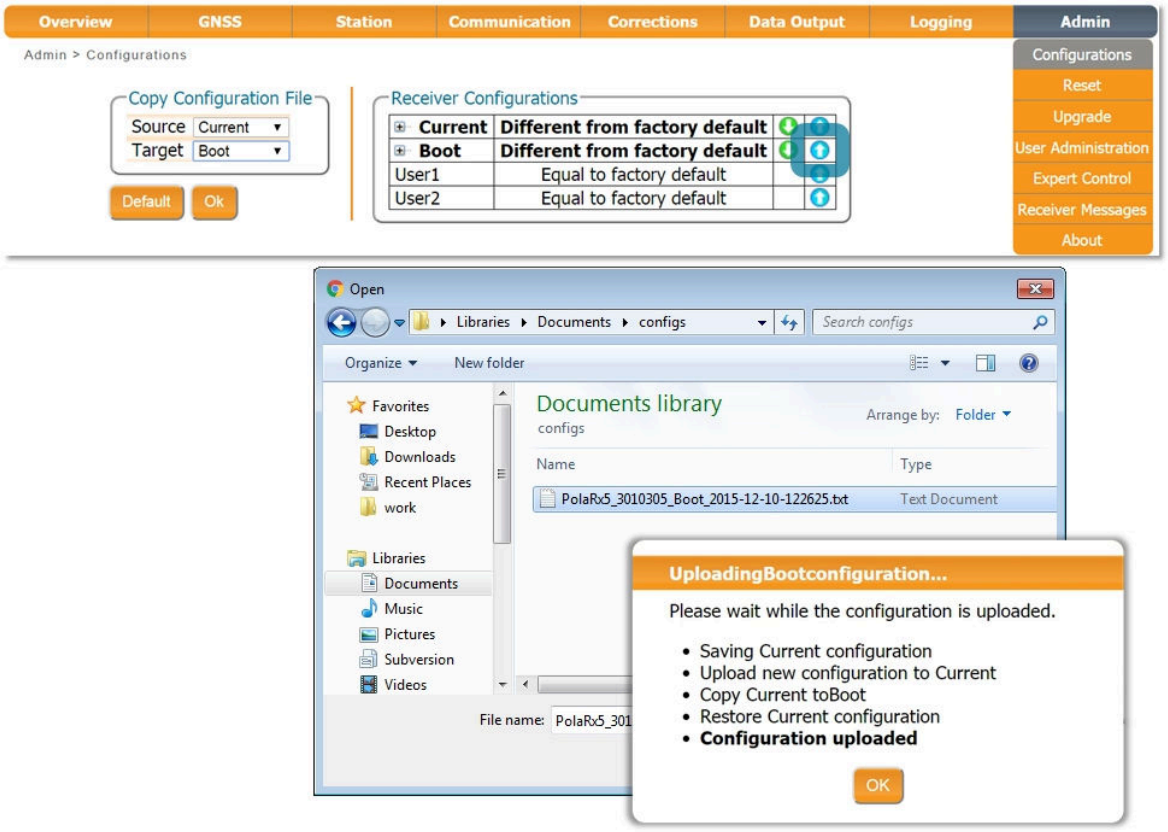


Figure 8-10: Uploading a configuration to a PolaRx5TR

A Front-panel port descriptions

The PolaRx5TR front panel features 8 ODU connectors which are described in the following sections. These connectors are all of type ODU MINI SNAP Series F. The pinout of the female connectors and the ODU part number of the corresponding male connectors are shown in Figure A-1.

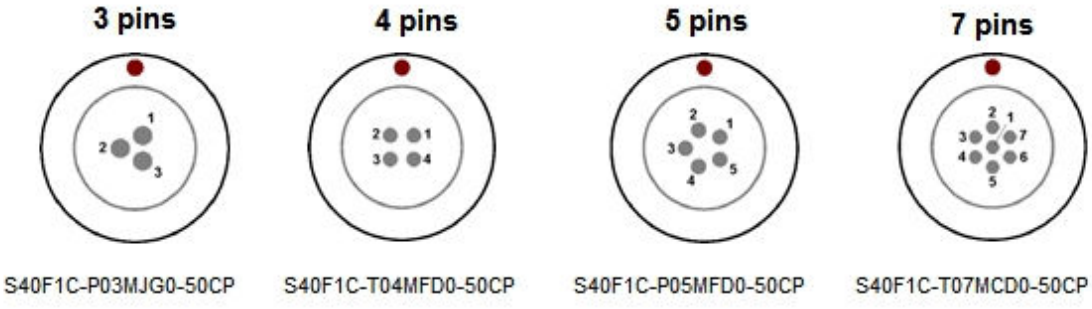


Figure A-1: Pinout of the front-panel female connectors and the ODU part numbers of the corresponding male connectors

A.1 COM1

This 7-pin connector provides access to the first serial port (COM1). The receiver behaves as Data Terminal Equipment (DTE).

PIN #	Description
1	Not connected
2	Signal ground (GND)
3	Not connected
4	Not connected
5	Receive Data (RXD - input to the receiver)
6	Transmit Data (TXD - output from the receiver)
7	Not connected

A.2 COM2

This 7-pin connector provides access to the second serial port (COM2). The receiver behaves as Data Terminal Equipment (DTE).

PIN #	Description
1	+5V DC output
2	Signal ground (GND)
3	Clear To Send (CTS - input)
4	Request To Send (RTS - output)
5	Receive Data (RXD - input to the receiver)
6	Transmit Data (TXD - output from the receiver)
7	Not connected

A.3 COM3-4/USB

This 7-pin connector can be configured in two modes:

- COM3 and COM4
- USB device

The electrical level at pin#7 defines the operating mode.

COM3-4 device

This mode is selected by leaving pin#7 unconnected.

PIN #	Description
1	Not connected
2	GND
3	COM4 RX
4	COM4 TX
5	COM3 RX
6	COM3 TX
7	Leave unconnected

USB device

This mode is selected by applying 5V DC to pin#7.

PIN #	Description
1	Not connected
2	GND
3	USB D−
4	Reserved
5	USB D+
6	Reserved
7	USB Vbus

A.4 Ethernet

The receiver can be powered through the Ethernet port (Power-Over-Ethernet). Please note that the receiver supports mode A, as specified in the 802.3af standard.

PIN #	Description
1	TxD+
2	TxD−
3	RxD+
4	RxD−

A.5 OUT

PIN #	Description
1	Reserved
2	GND
3	GP1 output, 3.3V. Use the command **setGPIOFunctionality** to set the level of this pin.
4	GP2 output, 3.3V. Use the command **setGPIOFunctionality** to set the level of this pin.
5	nRST_OUT. Open-collector output, driven low when the receiver is resetting.

A.6 IN

PIN #	Description
1	Reserved, leave unconnected.
2	Ground
3	Reserved, leave unconnected.
4	nRST_IN. Driving this pin low resets the receiver. Internally pulled-up. Debouncing and deglitching is foreseen.
5	EVENTA input, 0-30V, pulled down. Input voltage should be at least 3V to be detected as high. First input for external event timing. Event polarity is controlled by the **setEventParameters** command.
6	EVENTB input, 0-30V, pulled down. Input voltage should be at least 3V to be detected as high. Second input for external event timing. Event polarity is controlled by the **setEventParameters** command.
7	ANT_EXT, external antenna power. Can be used to apply an external supply voltage to the antenna. The voltage applied to ANT_EXT(V_{ANT}) determines the voltage source on the MAIN connector, as follows: • if $V_{ANT} < 2.0V$ or ANT_EXT left open, the antenna is powered by the internal 5V supply; • if $3.0V < V_{ANT} < 4.0V$, there is no power provided to the MAIN connector; • if $5.0V < V_{ANT} < 12.0V$, the antenna power supply is taken from ANT_EXT. **Warning:** Exceeding 12.0V for V_{ANT}, or drawing more than 200mA from the antenna connector can permanently damage the receiver.

A.7 USB Host

PIN #	Description
1	USB-H VBus (max current: 500mA)
2	Ground
3	USB-H D−
4	USB-H D+
5	Reserved

A.8 PWR

PIN #	Description
1	Power: 9 to 30V DC
2	Always ON. When this pin is tied to pin#1 the receiver is always on regardless of the state of the power button. Connect to Ground to enable the power button.
3	Ground

B Rear-panel connectors

The following sections describe the connectors on the rear-panel of the PolaRx5TR.

B.1 MAIN (TNC)

Connect an active GNSS antenna to this connector. The gain at the connector (antenna gain minus cable losses) must be in the range 15 to 50dB.

By default, the receiver provides a 5V DC supply on the MAIN connector to feed the antenna. Other voltages can be supplied through pin ANT_EXT of the IN connector on the front panel (see Appendix A.6). The maximum supported current is 200mA.

Never inject a DC voltage into the MAIN connector as it may damage the receiver. When using a splitter to distribute the antenna signal to several receivers, make sure that no more than one output of the splitter passes DC. Use DC-blocks otherwise.

B.2 PPS IN (BNC)

Use this connector to provide a one pulse-per-second signal to synchronize the receiver internal time with an external timing reference. The input signal level should not exceed 5.5V. V_{IH}>2.3V and V_{IL}<1.0V. There is an internal 10-KΩ pull down resistor.

More details on the use of the PPS IN signal can be found in section 4.1.

B.3 PPS OUT (BNC)

xPPS output (5V, output impedance 50-Ω). The rate and polarity of the xPPS output signal can be specified by the **setPPSParameters** command or on the Web Interface. The pulse duration is 5ms.

B.4 REF IN (BNC)

Use this connector to provide the receiver with an external 10 MHz frequency reference to be used instead of the internal oscillator. The reference signal should preferably be sinusoidal with a peak-to-peak amplitude (unloaded) ranging from 0.5V to 10V (-8dBm to +18dBm on a 50-Ω load).

Connecting or disconnecting the external 10 MHz reference is preferably done with the receiver switched off. If the 10 MHz reference is connected or removed during operation, the receiver will reset.

Use of the REF IN signal is described more fully in 4.1.

B.5 REF OUT (BNC)

The REF OUT connector provides a 10 MHz output signal synchronized with the receiver's frequency reference. It is a sinusoidal signal with unloaded peak-to-peak amplitude of 1.1V and output impedance of 50 Ω.

If a 10 MHz reference is fed to the REF IN connector, REF OUT simply duplicates REF IN which allows to chain receivers using the same clock reference.

If REF IN is not used, the 10 MHz signal at the REF OUT connector is taken from the internal receiver clock.

Note that the REF OUT signal can be turned off with the **setREFOUTMode** command.

B.6 WiFi (SMA)

Connector for the WiFi antenna.

C Power consumption

The power consumption of the PolaRx5TR depends on its configuration. The following settings directly influence the amount of power consumed:

- Activation of the Ethernet interface: in power-critical applications, it is recommended to not use Ethernet and to turn off the associated hardware. This can be done with the **setEthernetMode** command.
- Activation of the WiFi interface: use the **setWiFiMode** command or press the WiFi button to turn the WiFi module off or on.

The following table shows the nominal power consumption measured when 12 VDC is supplied to the PWR connector:

Configuration	Power Consumption
All-in-view all-band tracking and PVT	3.5W
Enabling Ethernet	+650mW
Enabling WiFi	+450mW
Enabling REFOUT	+30mW
Enabling Wideband Interference Mitigation (WBI)	+160mW
Enabling internal logging at 1 Hz/10 Hz	+50mW/+70mW
Enabling the L-Band demodulator	+100mW

D Cables

<table>
<tr><th>Cable Name
(Part #)</th><th>Details</th></tr>
<tr><td>CBLe_COM_1.8_rev.1
(216374, replaces 200416)</td><td>COM1/COM2 to PC (DSUB9-female). To be connected to either the COM1 or COM2 connector. Note that RTS/CTS lines are only available when connected to COM2.</td></tr>
<tr><td>CBLe_COM_DUO_7_rev.1
(216373, replaces 201204)</td><td>Dual COM3 and COM4 to PC (DSUB9-female). To be connected to the COM3-4/USB connector. Note that RTS/CTS is not supported on these ports.</td></tr>
<tr><td>CBLe_GPO_OE_5_rev.1
(216367, replaces 201203)</td><td>Open-ended cable to be used with the OUT connector (see pinout in Appendix A.5).
<table><tr><th>Pin #</th><th>Function</th><th>Wire Colour</th></tr><tr><td>1</td><td>Reserved</td><td>Blue</td></tr><tr><td>2</td><td>Ground</td><td>Blue/Black</td></tr><tr><td>3</td><td>GP1 output</td><td>Orange</td></tr><tr><td>4</td><td>GP2 output</td><td>Green</td></tr><tr><td>5</td><td>nRST_OUT</td><td>Brown</td></tr></table></td></tr>
<tr><td>CBLe_GPI_OE (200419)</td><td>Open-ended cable to be used with the IN connector (see pinout in Appendix A.6).
<table><tr><th>Pin #</th><th>Function</th><th>Wire Colour</th></tr><tr><td>1</td><td>PPS_IN</td><td>Blue</td></tr><tr><td>2</td><td>Ground</td><td>Blue/White</td></tr><tr><td>3</td><td>IO1</td><td>Orange</td></tr><tr><td>4</td><td>RESET</td><td>Green</td></tr><tr><td>5</td><td>EVENTA</td><td>Brown</td></tr><tr><td>6</td><td>EVENTB</td><td>Green/White</td></tr><tr><td>7</td><td>ANT_EXT</td><td>Orange/White</td></tr></table>Do not leave the Brown and Green/White wires floating, tie them to ground if not used. This will avoid crosstalk effects that could lead to spurious level transitions on the EvA and EvB inputs.</td></tr>
<tr><td>CBLe_USB_rev.1
(216377, replaces 201202)</td><td>USB device cable to be connected to the COM3-4/USB connector.</td></tr>
<tr><td>CBLe_USB_HOST_rev.1
(216371, replaces 214935)</td><td>USB host cable to be connected to the USB host connector.</td></tr>
<tr><td>CBLe_ETH_MS_rev.1
(216375, replaces 200418)</td><td>Ethernet to hub/switch (straight) (RJ45). To be connected to the ETH connector.</td></tr>
</table>

<table>
<tr><th>Cable Name
(Part #)</th><th>Details</th></tr>
<tr><td>CBLe_PWR_OE_rev.1
(216376, replaces 200422)</td><td>Open-ended cable for the PWR connector (see pinout in Appendix A.8).
<table>
<tr><th>Pin #</th><th>Function</th><th>Wire Colour</th></tr>
<tr><td>1</td><td>Power</td><td>Blue and blue/white with red sleeve (these two wires are both connected to Pin#1)</td></tr>
<tr><td>2</td><td>ON/OFF</td><td>Orange</td></tr>
<tr><td>3</td><td>Ground</td><td>Green and green/white with black sleeve (these two wires are both connected to Pin#3)</td></tr>
</table></td></tr>
<tr><td>PWRe_ADAPTER
(200431)</td><td>A power adapter to be connected to PWR connector.</td></tr>
</table>

E LED behavior

<table>
<tr><th>LED name</th><th>colour</th><th>Icon</th><th>Behavior</th></tr>
<tr><td>POWERLED</td><td>red</td><td>  </td><td>Off: Receiver is powered off
On: Receiver is powered on</td></tr>
<tr><td>LANLINKLED</td><td>green</td><td>  </td><td>Off: No Ethernet connection
Blinking: Sending or receiving data over Ethernet</td></tr>
<tr><td>TRACKLED</td><td>orange</td><td>  </td><td>
<table>
<tr><th>Behavior</th><th>Number of satellites in tracking</th></tr>
<tr><td>Blinks fast (10 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>
</td></tr>
<tr><td>GPLED</td><td>red</td><td>  </td><td>By default, GPLED functions as DIFFCORLED but, it can also be configured as LOGLED using the setLEDMode command. In rover PVT mode, when acting as DIFFCORLED, 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>Behavior
(configured as DIFFCORLED)</th><th>Number of satellites with corrections</th></tr>
<tr><td>Off</td><td>No diff corr received</td></tr>
<tr><td>On</td><td>The LED is solid ‘ON’ when the receiver outputs differential corrections as a static base station.</td></tr>
<tr><td>Blinks fast (10 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>
<table>
<tr><th>Behavior
(configured as LOGLED)</th><th>Logging status</th></tr>
<tr><td>Off</td><td>Not logging</td></tr>
<tr><td>On</td><td>Logging active</td></tr>
</table>
</td></tr>
</table>

LED name	colour	Icon	Behavior
PVTLED	green		**Off**: No PVT available **On**: PVT available
WIFILED	red		**Off**: WiFi disabled **On**: Access-point mode or client mode **Blinking slowly**: Establishing a connection in client mode **Blinking quickly**: Error, not connected

F RxTools

The RxTools is a suite of Graphical User Interface tools for advanced monitoring and configuration of the receiver. They can be used to log SBF (Binary Format) data files (including raw measurements) as well as analyze the logged SBF data files and convert them to various other formats. The RxTools manual contains detailed instructions on how to use the tools.

RxControl is a graphical user interface which allows configuration and monitoring of the receiver in real time. It offers numerous views for monitoring data and a simple logger for recording data files. RxControl can also be used to upgrade receiver firmware.

SBF Converter is a GUI for converting SBF data files to various other formats including ASCII, RINEX and KML.

SBF Analyzer allows users to generate time plots from SBF files for detailed analysis. It can also create standard reports for reporting purposes.

RxLogger allows flexible logging of SBF and NMEA data. Users can select multiple streams each with a different update rate.

RxPlanner is a Satellite Mission Planning software. It shows the satellite visibility and DOP at the user defined location over a selectable time period.

F.1 Installing RxTools

You can install the full suite of RxTools by running the RxTools Installer. The Installer file can be found on the memory stick provided with the receiver. The latest version of the Installer is also available for download from the Support section of the Septentrio website: `http://www.septentrio.com/support`

To run the Installer, double click on the executable file.

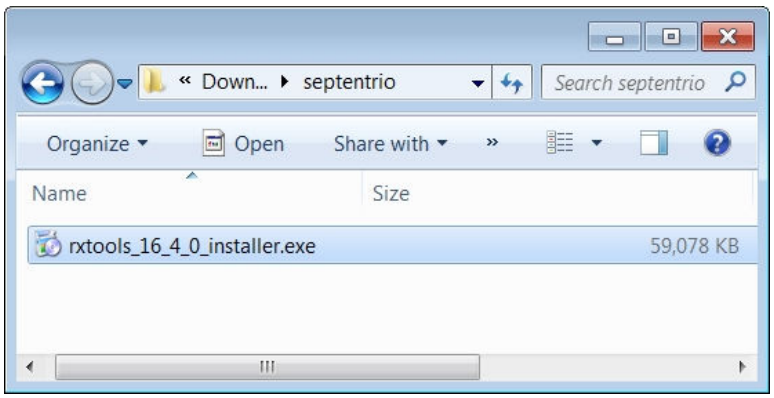


Figure F-1: Install the suite of RxTools by running the Installer file

G Connecting to the PolaRx5TR using RxControl

You can connect to RxControl over a serial, USB or internet connection. If you don't have the RxControl icon on your desktop, type 'RxControl' in the Start menu of your PC to locate the tool as shown in Figure G-1.

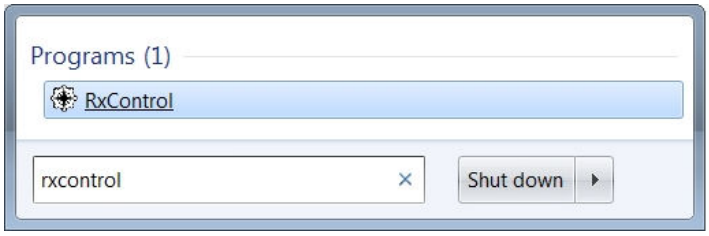


Figure G-1: Type RxControl in the Start menu of your PC

In the 'File' menu, select 'Change Connection...'. In the example shown in Figure G-2, a USB cable was used. The USB connection of the PolaRx5TR maps onto two virtual serial connections which are identified as 'USB COM Port 1' and 'USB COM Port 2'. Select one of these connections and give it a name. When connected to a receiver, the various information fields in RxControl will be filled as shown.

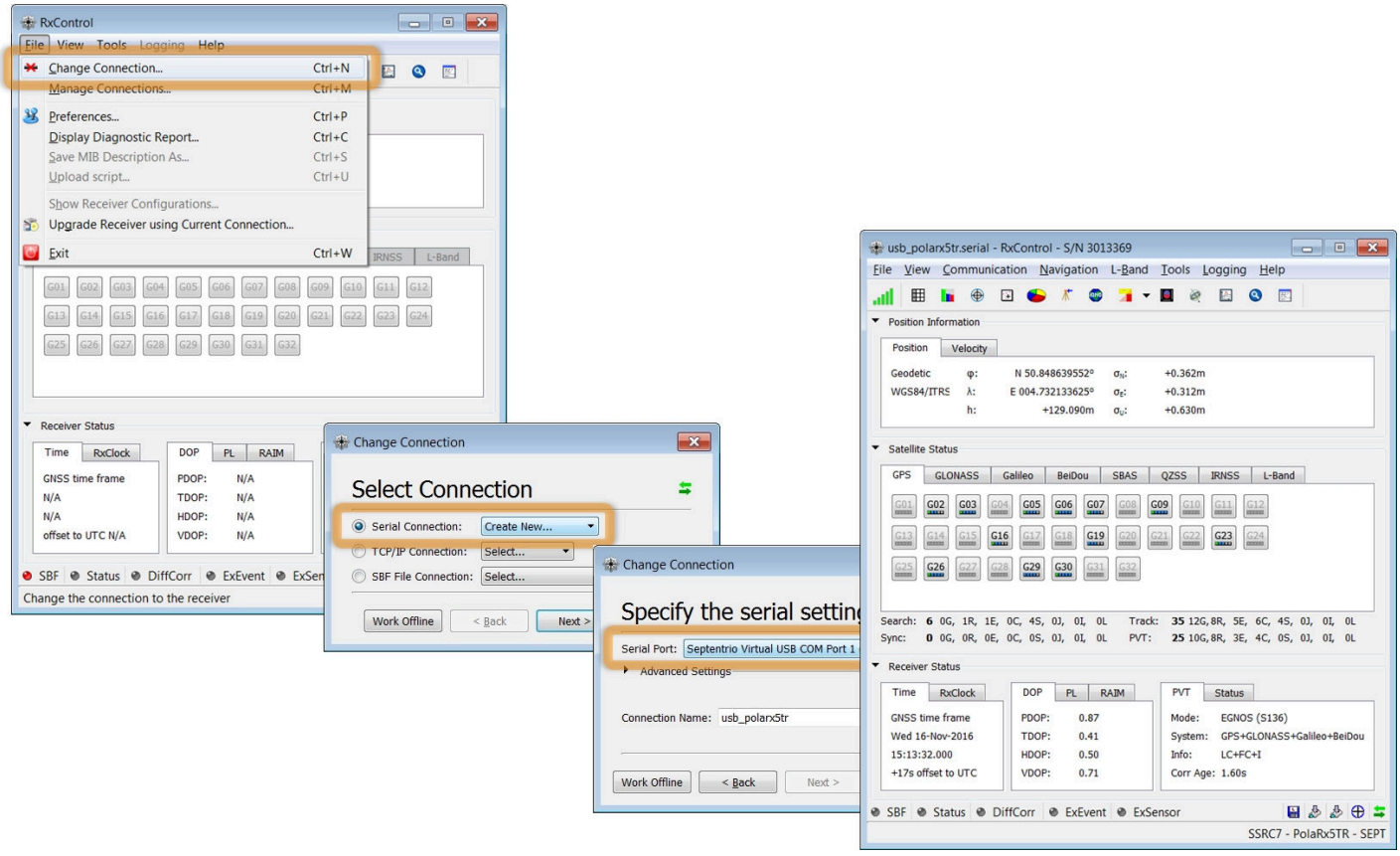


Figure G-2: Connecting to the PolaRx5TR over a USB connection using RxControl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