STONEX

STONEX S900+
GNSS Receiver
User Manual

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www.stonex.it

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1. Introduction

This document is the user guide for S900+ and it's intended to introduce how to use the receiver correctly.

S900+ is a multiple-frequency receiver designed for GNSS surveying applications. It can work as a base station or as a rover, the configuration can be switched freely whenever and wherever is needed, offering maximum versatility in the system configuration to meet your specific requirements. At the same time, the S900+ receiver can be upgraded easily to continually meet new demand.

The integrated design of the receiver makes the S900+ only 1.3 kg, which is light and portable. The internal antenna supports signals from GPS, GLONASS, Beidou, Galileo, and QZSS satellite systems.

The use of tilt correction doesn't require calibration at every start-up thanks to the integrated Sensor Fusion system. In this way, the surveyor can start to record points after a very quick initialization after obtaining a Fixed solution.

S900+ GSM modem is enabled to work with Worldwide LTE, UMTS, and GSM based networks.

The Key Features of S900+ are:

- Multi-frequency and multi-constellation satellites reception
- 4G/3G/2G Network connectivity
- 2.1+EDR/5.0 Bluetooth
- Easy configuration using Stonex Cube-a Android application and Web User Interface
- Double removable battery
- Rugged housing
- IP67
- UHF datalink with internal TX/RX 1W radio module (optional)
- Tilt correction IMU sensor (optional)

2. Receiver appearance

2.1 Front view

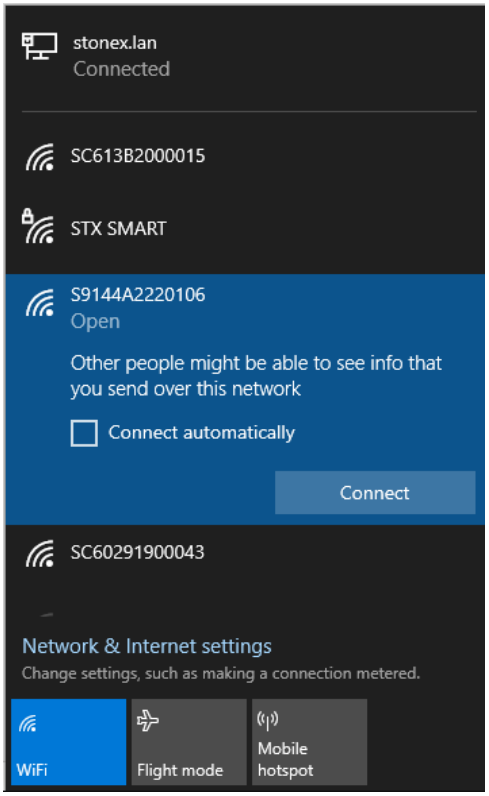
Num.	Item	Description
1	Satellite indicator	**Off**: no satellite tracked **Flashing red**: satellites tracked, a position not calculated **Flashing green**: position calculated without a fixed solution **Green**: fixed solution **Flashing green and red alternately**: GNSS board abnormal
2	Datalink indicator	**Green**: datalink setting success **Flashing green**: data in normal transmission **Flashing blue**: raw data recording, flashing frequency according to the sampling interval
3	Power button	**Power on**: keep pressed until you hear a beep. After three short beeps, the device is ready to work **Current working mode**: short press, if the speaker is enabled the device will describe the current working mode. **Power off**: keep pressed until all LED start to flash, release then short press **Self test:** keep pressing until all LED start to flash, release then long press until the LED stops flashing. The device will test the internal modules. If an error is found the device will start to beep, to stop it short press the power button. Please contact your local dealer if this happens.
4	Battery indicator	**Green**: charge level between 30% and 100% **Flashing green**: charge level between 10% and 30% **Flashing red**: charge level lower than 10% with a warning beep Device off while charging: **Green**: charge completed **Red**: in charge
5	Bluetooth indicator	**Blue**: connected **Off**: no connection

2.2 Bottom view

Num.	Item	Description
1	Serial Number	Serial number of the device
2	5/8' connector	Screw connector for support
3	Battery slot A	Battery locks in by sliding toward the metal connector so that it would not fall if the cover were opened while the receiver is mounted on a pole. The cover is removed by pressing the lateral button and can be locked.
4	Battery slot B	Battery locks in by sliding toward the metal connector so that it would not fall if the cover were opened while the receiver is mounted on a pole. The cover is removed by pressing the lateral button and can be locked.
5	External memory slot	MicroSD card can be used to expand the memory up to 32Gb, the card is locked in by sliding the metal cover. The plastic cover is held by pressure.
6	Sim card slot	Slot for Nano SIM Card, the card must not have a PIN code, insert the card while the device is off. The card is locked in by sliding the metal cover. The plastic cover is held by pressure.
7	TNC connector for UHF antenna	Screw connector for UHF module external antenna. The plastic cover is held by pressure.
8	5-pin LEMO port	Can be used to connect an external power source, batteries are not needed. Batteries in the device will not be charged up. Can also be used for differential correction serial transmission to/from external devices such as UHF.
9	7-pin LEMO port	Can be used to access the device's internal memory if connected to a PC using the USB connector of the provided cable. Can also be used for NMEA message serial transmission.

3. Web Interface

S900+ Web User Interface (WebUI) functionality allows managing the receiver by connecting to its Wi-Fi hotspot. The name of the Stonex GNSS receiver hotspot is the receiver serial number.

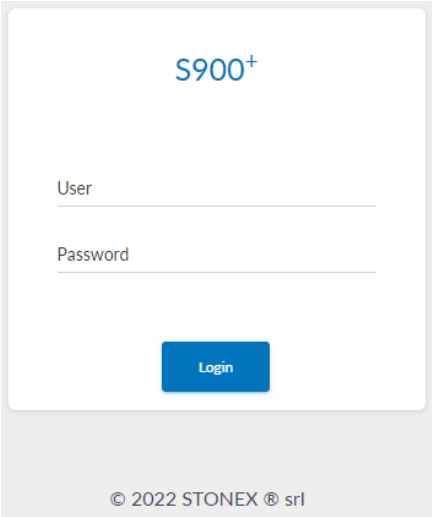


Once connected with a smartphone or PC, using any internet browser the WebUI is found at the IP address: **192.168.10.1**

The standard credentials to access the WebUI are:

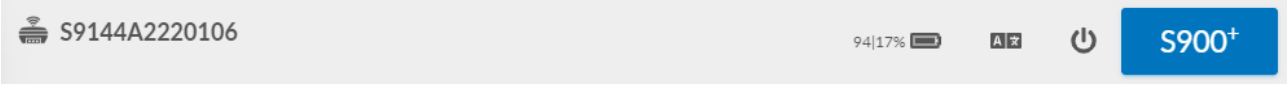
User: **admin**

Password: **password**



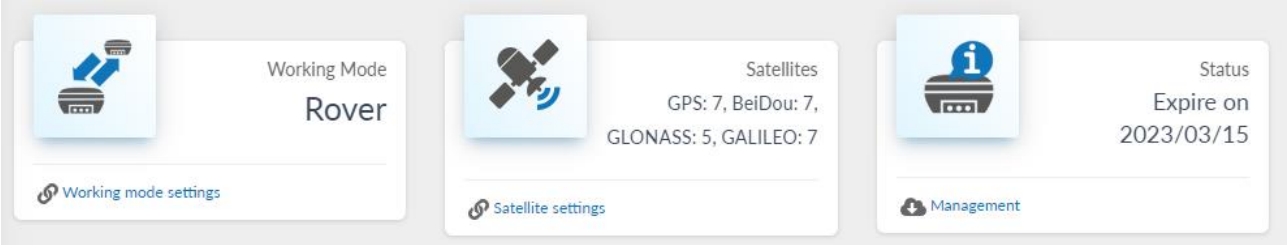
3.1 Dashboard

It's a summary of the status of the receiver, the top line is shared with all the other pages, it contains the serial number of the device, the battery charge status, the language selection button, the power options, and the device model.

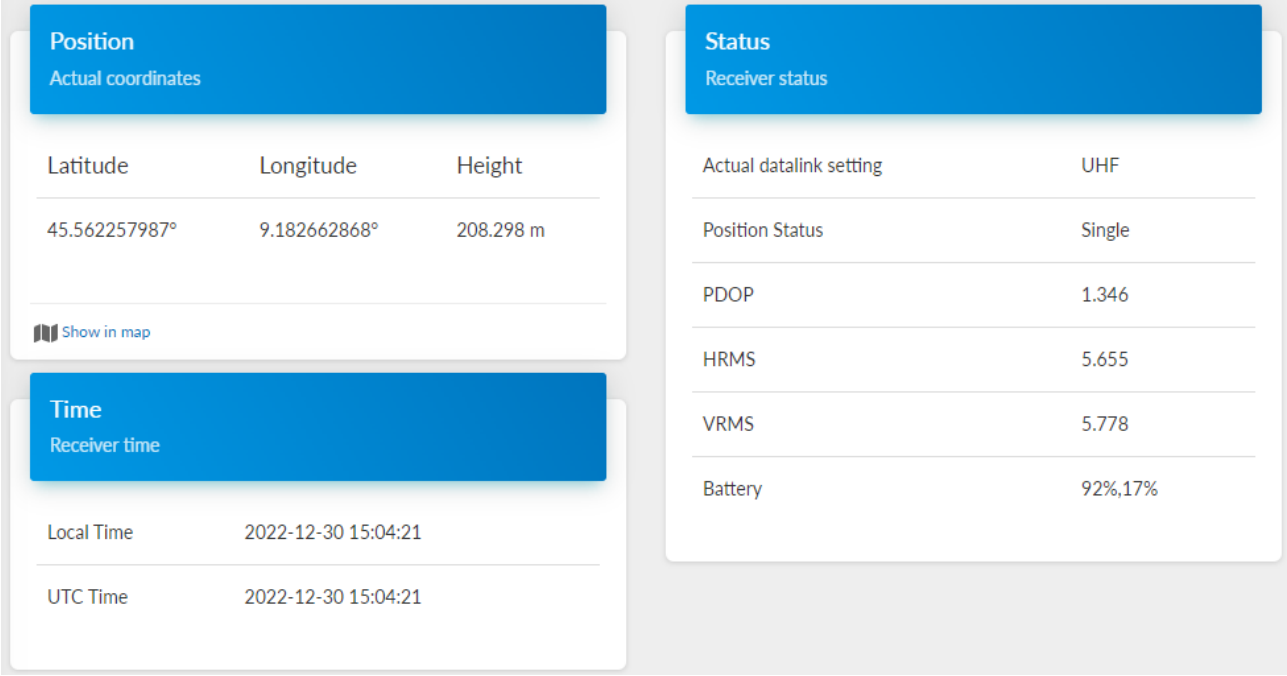


The language selected modify the language of the WebUI and, if available, the language of the voice messages.

The second section contains the current working mode, the number of satellites used for positioning, and the expiration date of the current activation code.

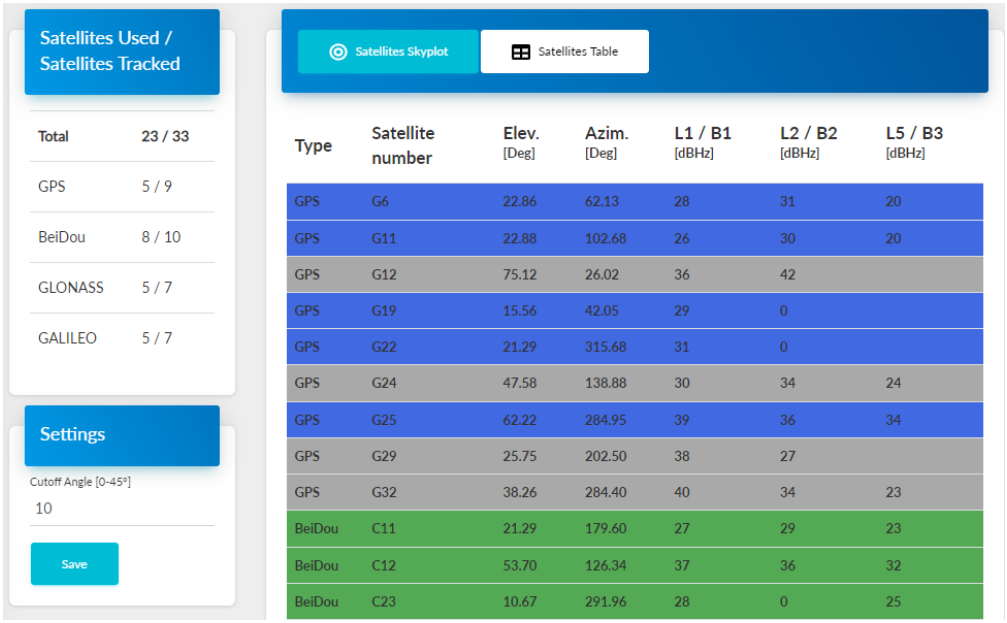


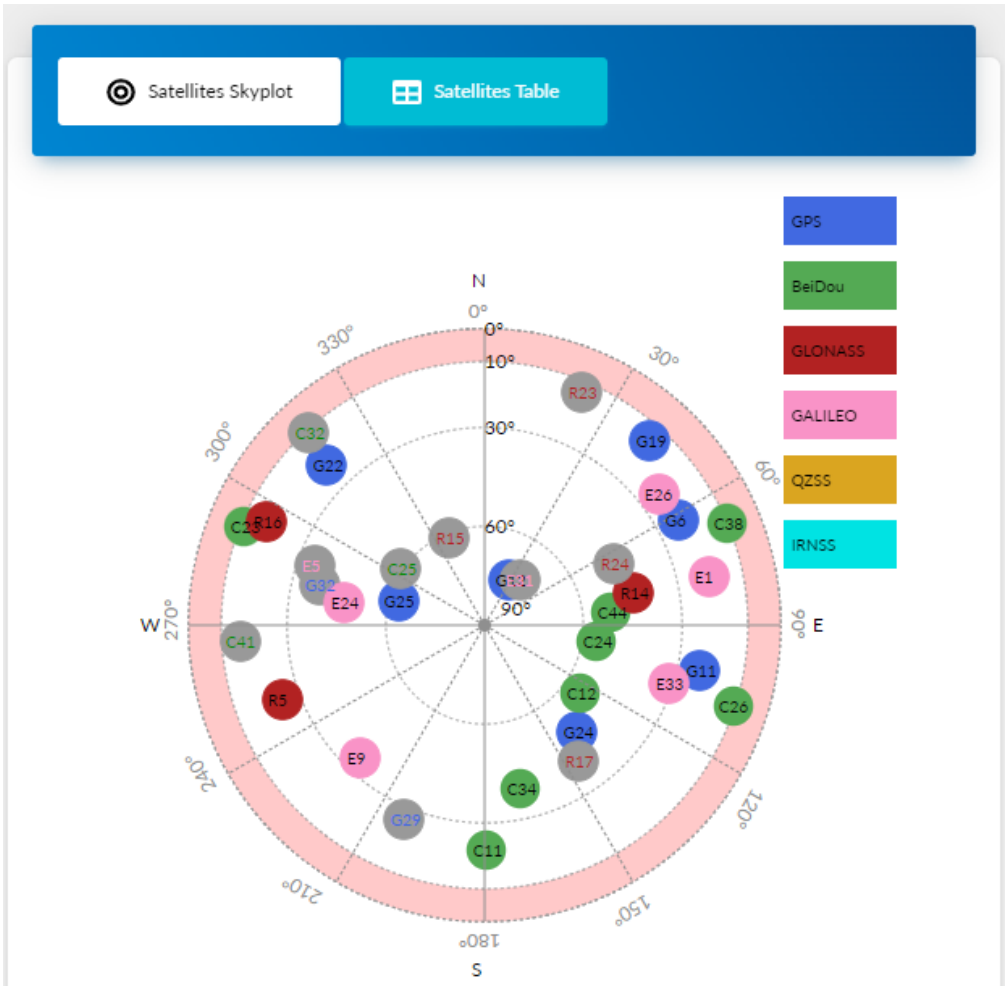
The third section recaps current WGS84 coordinates, Receiver time, and quality of the solution.
Local time refers to the time zone set on the device setting page.



3.2 Satellites

Here are shown the satellites tracked in the form of a Table and Skyplot. In both views, constellations are color coded. Satellites shown in grey are tracked but not used for positioning. It's also possible to set the cut-off angle, every satellite with a lower elevation will not be considered as not tracked.





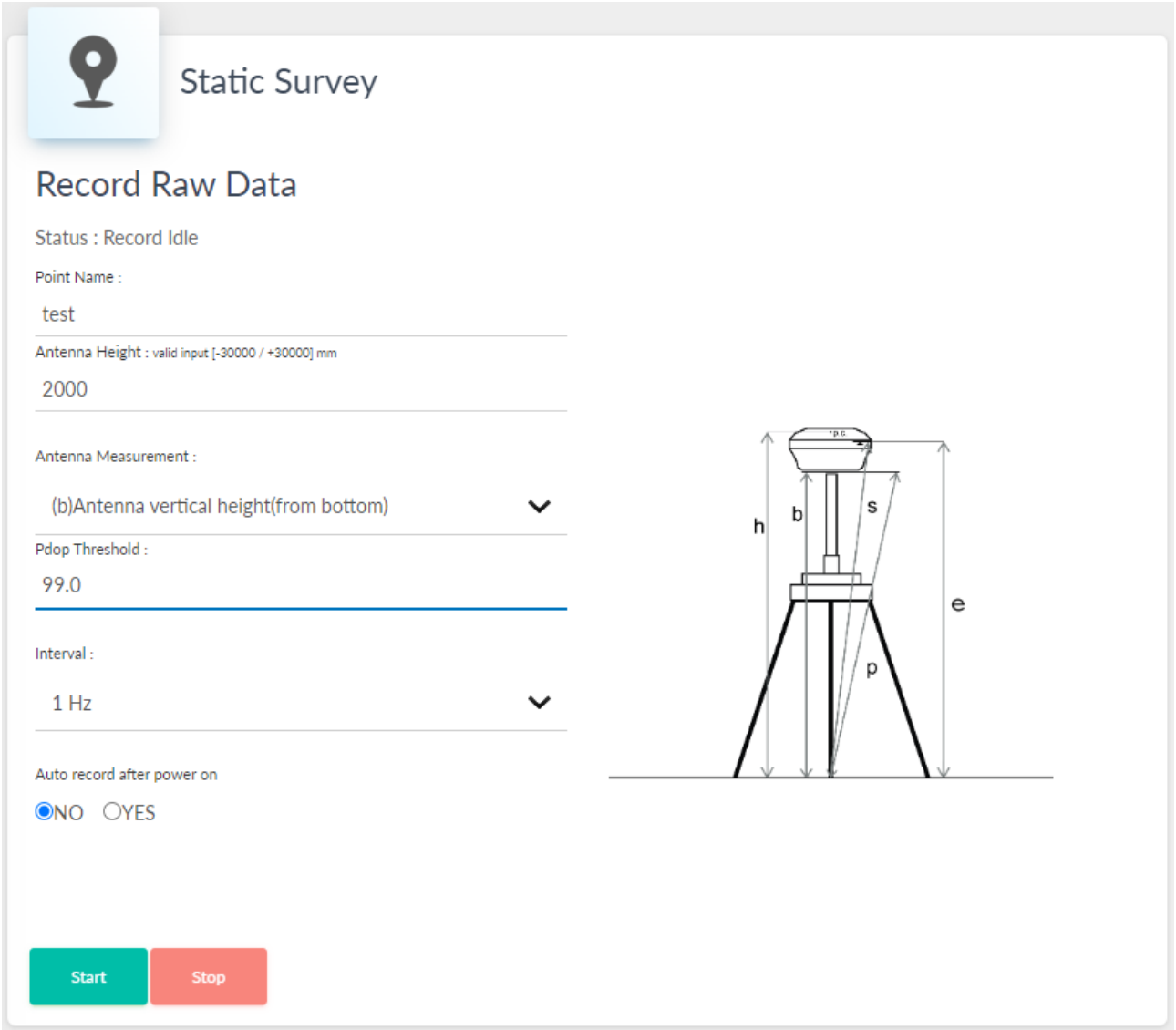
3.3 Static Survey

S900+ it's able to record raw data even while working as a rover or base, in this page is possible to set the option for raw data recording. Before changing any setting be sure that the device is not recording.

The name can contain at maximum 4 characters, the antenna height can be measured with five different methods explained by the picture. Select the correct method so that the phase center offset is applied correctly.

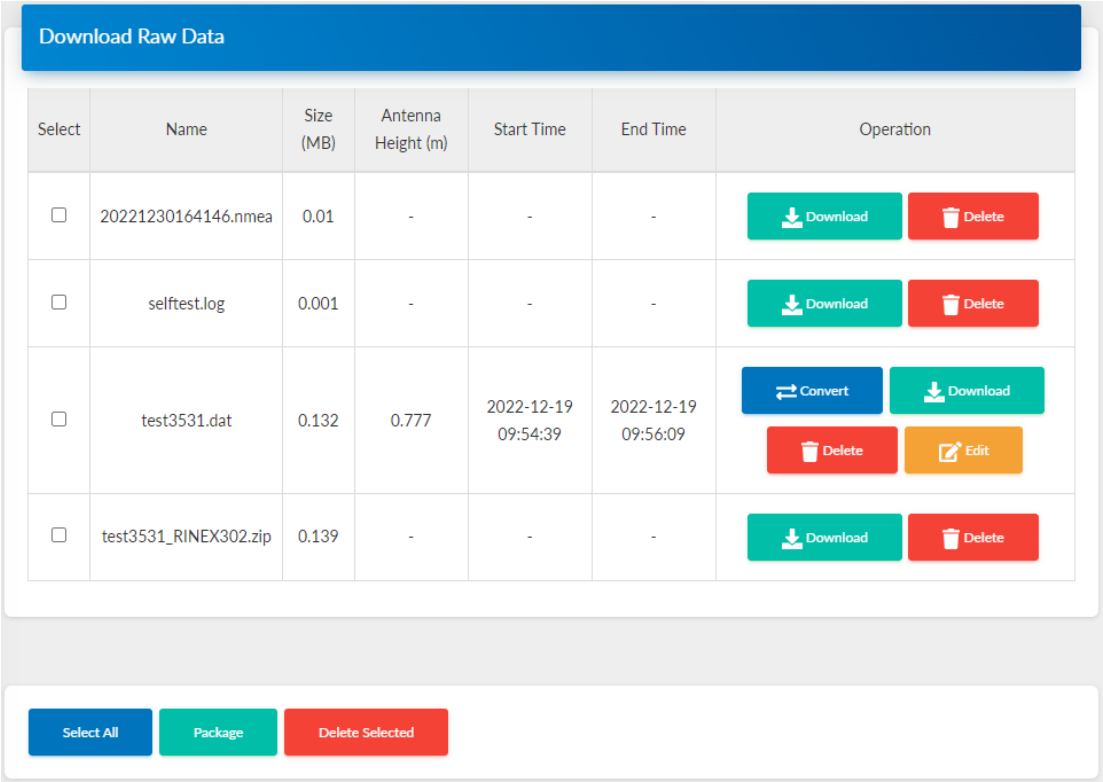
Enabling "auto record after power on" will cause the receiver to start to record as soon as the PDOP value is lower than the threshold.

To save the settings press Start.

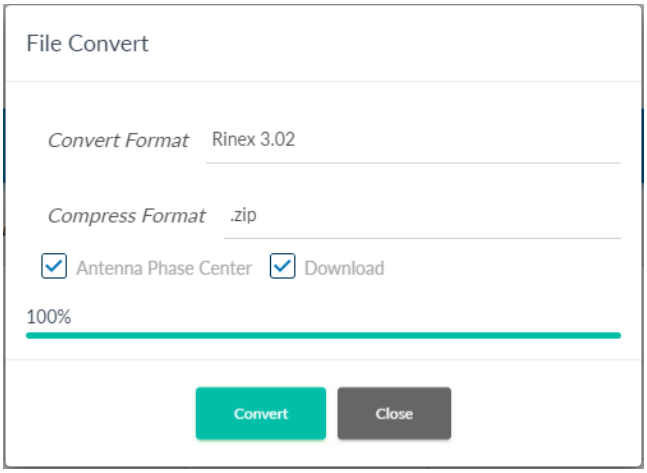


3.4 Download Raw Data

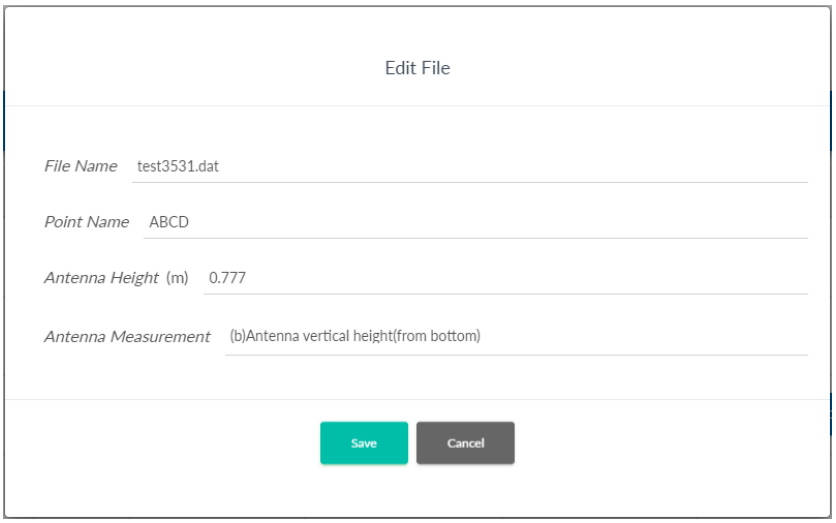
From this page, it's possible to download and delete the log files (Raw data, Rinex, NMEA, selftest), singularly on in batch.



Is possible to convert the raw data files (*.dat) in Rinex format by pressing Convert. The Rinex format can be changed as well as the compression format. If Antenna Phase Center is selected, the height in the Rinex will be the one of the Antenna Phase Center. If Download is selected the Rinex files will be downloaded automatically at the end of the conversion.



For every raw data file is showed the start time and the end time, the name, the size of the file, and its set antenna height. By pressing Edit, is possible to change the file name, point name, antenna height, and measurement type.



It's possible to manage the log files also by accessing the record folder in the internal memory of the device from a PC.

3.5 Working Mode

This page contains all the settings to set up RTK datalink

3.5.1 Rover

In Rover mode, S900+ automatically recognizes the RTK corrections format between:

- RTCM 3.2
- RTCM 3.0
- RTCM 2.3
- CMR+
- CMR
- DGPS

It's necessary to correctly set the datalink between:

- UHF
- Network (SIM, Wi-Fi)
- External (Serial)
- Bluetooth

3.5.1.1 UHF Radio

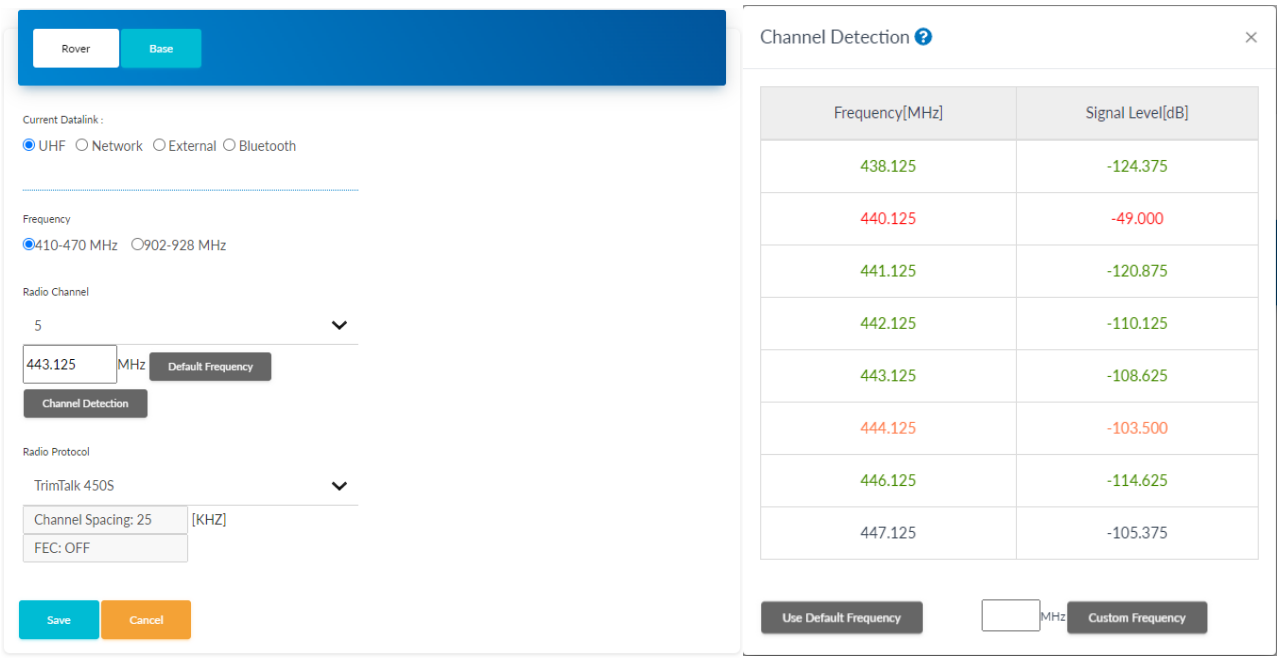
S900+ can have two different radio modules:

- TRM101 as default, with a working frequency between 410MHz and 470MHz
- TRM121 as optional, with two frequency bands: standard 410-470MHz and hopping 902.4-928MHz

For the 410-470MHz band, 8 channels with pre-set frequencies are available for quick configurations, the frequency values can be edited and saved.

The channel detection function allows one to check if the channel frequencies in the area are already used for transmission. In the example below it's possible to see a transmission on frequency 440.125 MHz, while the other frequencies are unused.

To receive the RTK corrections from the base, select the same frequency, radio protocol, spacing, and FEC. Be sure to connect a UHF antenna to adapt to the frequency of the transmission. For hopping frequencies is necessary to match the channel instead of the frequency.

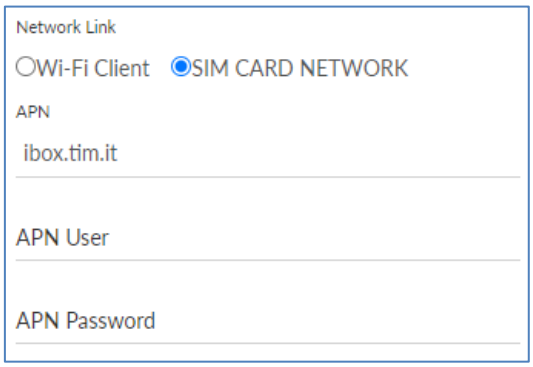


3.5.1.2 Network

S900+ can connect to the Internet using a SIM card or a Wi-Fi connection.

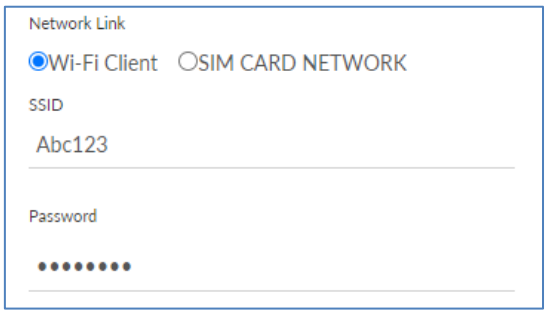
Internet Settings

To use a SIM card, it must not have a PIN code, then set the SIM provider's Access Point Name (APN).



To use a Wi-Fi connection, the SSID and the password must be set manually. SSID and password must contain only alphanumeric characters.

Attention! Using this functionality will disable the S900+ Wi-Fi hotspot and the IP address of the WebUI will change. To access the WebUI the procedure is the same as shown in Chapter 3, but it's necessary to connect to the same Wi-Fi network set in the WebUI and use the IP address associated with the S900+ by the network instead of 192.168.10.1.
It's possible to reactivate the S900+ Wi-Fi hotspot, using Stonex Cube-a by setting Wi-Fi connect mode: Master in Device > Wi-Fi Mode Settings.



Connection Settings

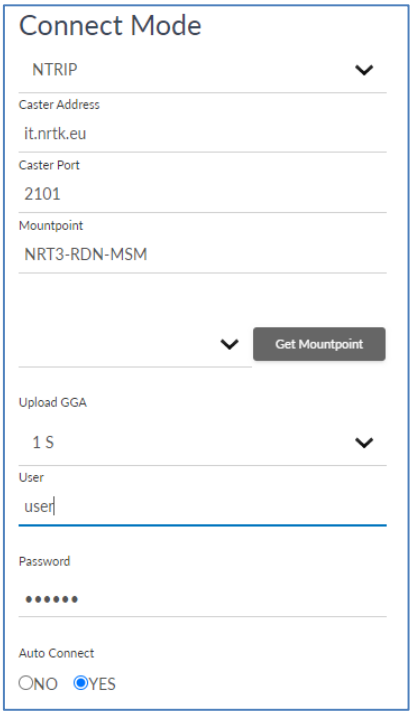
S900+ uses the NTRIP protocol to receive corrections from the network.

To connect to an NTRIP caster it's necessary to set its IP address and port. The mount point can be written manually or selected from the list obtained by pressing Get Mountpoint, internet connection and caster IP address and port must be already set.

NTRIP Network often needs to know the position of the rover to provide the corrections, in these cases the GGA upload must be set at 1 second at least.

The user and Password are the ones necessary to access the Caster if needed.

If the "Auto connect" option is enabled, at start-up the S900+ will use the last settings to connect automatically to the NTRIP caster.



CSD connect mode, allow receiving RTK corrections using a phone call, so it's necessary to have a SIM card enabled to perform phone call (voice and data).

3.5.1.3 External (Serial)

By selecting External, the only setting necessary is the external port baud rate, it must match the baud rate of the source of the transmission. The serial port used for this datalink is the 5-pin port.

The baud rate available are:

- 9600
- 19200
- 38400
- 57600
- 115200

3.5.1.4 Bluetooth

Bluetooth has no settings. The datalink's fully managed by the source of the transmission, for example, a controller with Stonex Cube-a will set the datalink to Bluetooth if the "Phone network" communication mode is selected.

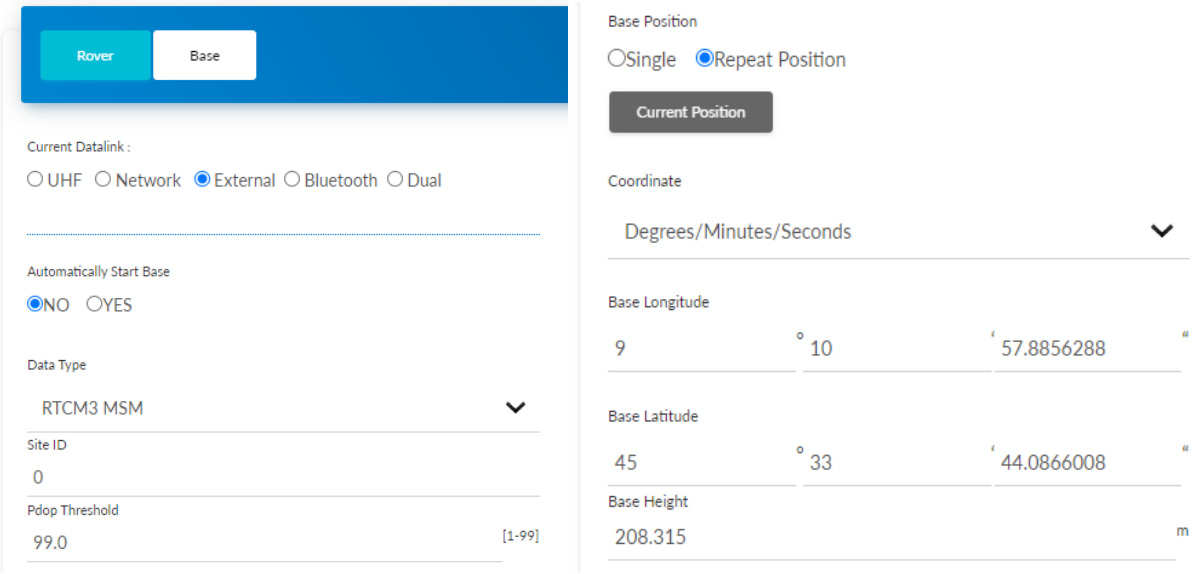
3.5.2 Base

As Base S900+ can provide RTK corrections in the following formats:

- RTCM 3.2
- RTCM 3.0
- RTCM 2.3
- CMR+
- CMR
- DGPS

The PDOP threshold limits the use of the base if the PDOP value is higher.

To set the base position select Repeat Position, the coordinates requested are Longitude/Latitude/Height of the S900+ phase center. The phase center offset can be found on the label of one of the two battery covers, or the Information page.
By selecting the “Single” option for the base coordinates, the S900+ will set the phase center coordinates calculated at the start of the base transmission.



3.5.2.1 UHF Radio

S900+ can have two different radio modules:

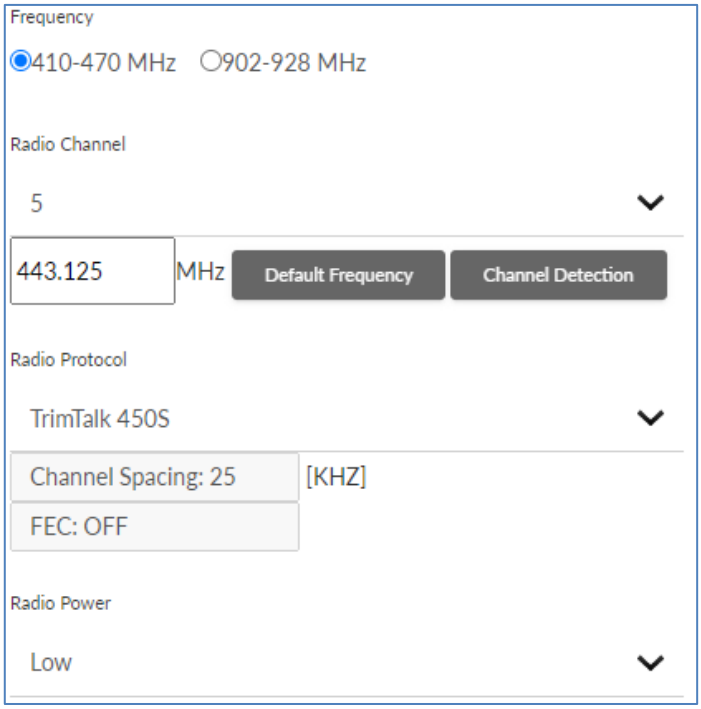
- TRM101 as default, with a working frequency between 410MHz and 470MHz
- TRM121 as optional, with two frequency bands: standard 410-470MHz and hopping 902.4-928MHz

For the 410-470MHz band, 8 channels with pre-set frequencies are available for quick configurations, the frequency values can be edited and saved.

The channel detection function allows one to check if the channel frequencies in the area, are already used for transmission. In the example below it's possible to see a transmission on frequency 440.125 MHz, while the other frequencies are unused. To avoid interference, use another frequency for the transmission. Be sure to connect the correct UHF antenna for the frequency of the transmission.

The maximum power output for the S900+ UHF module is 1W, when radio power is set to Low the output is 0.5W.
The radio power affects the transmission range and the battery duration.

Attention! Local regulations can limit the use of UHF radio. Check before starting the transmission.

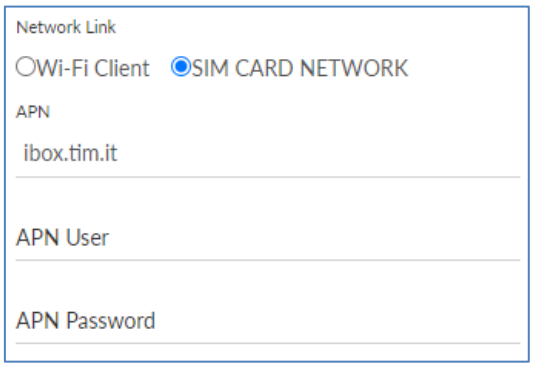


3.5.2.2 Network

S900+ can connect to the Internet using a SIM card or a Wi-Fi connection.

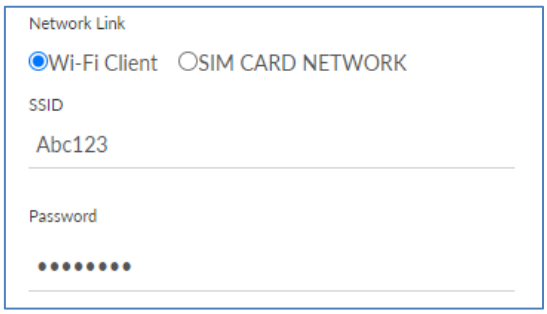
Internet Settings

To use a SIM card, it must not have a PIN code, then set the SIM provider's Access Point Name (APN).



To use a Wi-Fi connection, the SSID and the password must be set manually. SSID and password must contain only alphanumeric characters.

Attention! Using this functionality will disable the S900+ Wi-Fi hotspot and the IP address of the WebUI will change. To access the WebUI the procedure is the same as shown in Chapter 3, but it's necessary to connect to the same Wi-Fi network set in the WebUI and use the IP address associated with the S900+ by the network instead of 192.168.10.1.
It's possible to reactivate the S900+ Wi-Fi hotspot, using Stonex Cube-a by setting Wi-Fi connect mode: Master in Device > Wi-Fi Mode Settings.



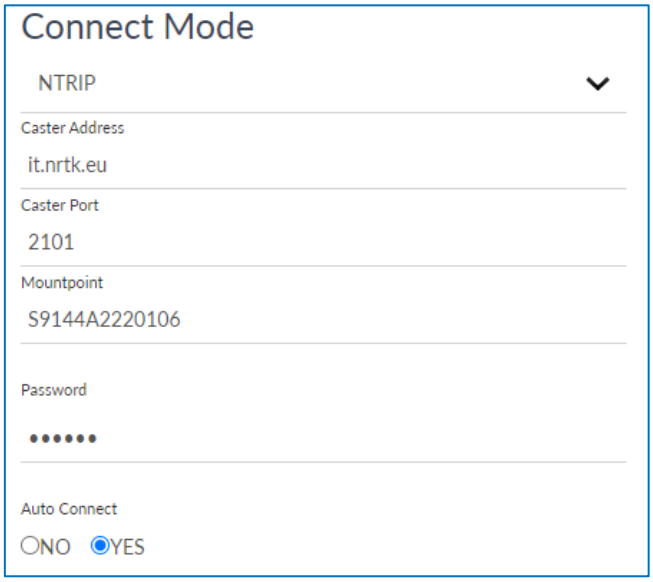
Connection Settings

S900+ uses the NTRIP protocol to transmit corrections to a caster.

To connect to an NTRIP caster it's necessary to set its IP address and port.
Mountpoint is fixed to the device serial number.
The password is the one that can be requested by the Caster for the bases.

If the "Auto connect" option is enabled, at start-up the S900+ will use the last settings to connect automatically to the NTRIP caster.

S900+ has a basic internal caster, to work as a standalone base. IP address and port to transmit the corrections to the internal caster are 127.0.0.1 and 9010.



To receive the corrections from this base with a rover, the rover configuration must contain:

- IP address of the base in the network used for the transmission
- Port: 9010
- Mountpoint: DIFF1
- GGA Upload: not necessary
- User: not necessary
- Password: same as the one set for the base

CSD connect mode, allow transmitting RTK corrections using a phone call, so it's necessary to have a SIM card with a phone number.

3.5.2.3 External (Serial)

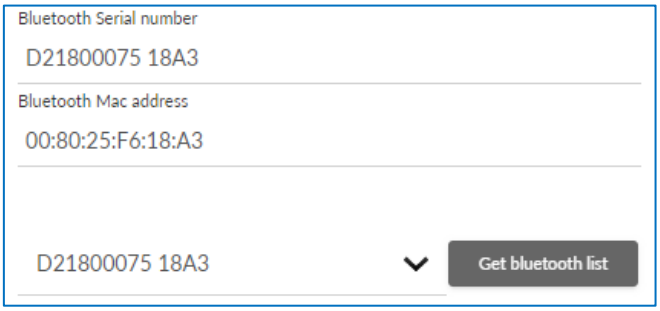
By selecting External, the only setting necessary is the external port baud rate, it must match the receiver baud rate. The serial port used for this datalink is the 5-pin port.

The baud rate available are:

- 9600
- 19200
- 38400
- 57600
- 115200

3.5.2.4 Bluetooth

Using Bluetooth datalink allows the transmission of the corrections via Bluetooth to another device (ex. SR02 external radio). It's possible to scan for nearby Bluetooth devices, selecting a voice from the scan results will automatically complete the Serial number and Mac address field



3.6 Satellite Settings

From this page, it's possible to choose which constellation to track. Like on the Satellite page, it's possible to change the satellite cut-off angle.

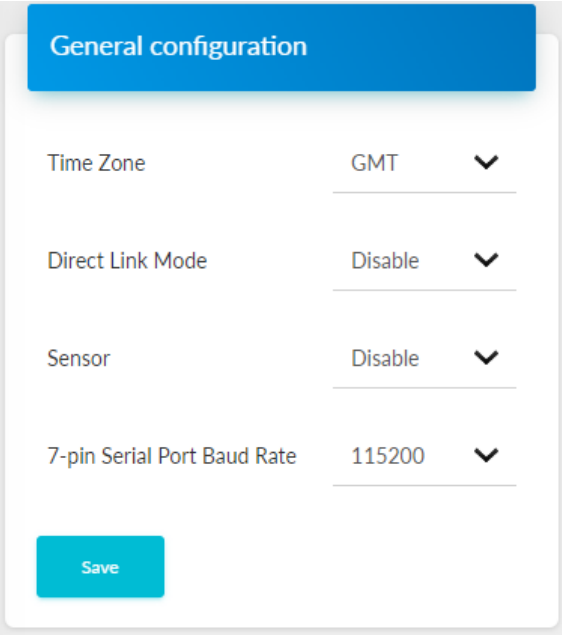
RTK timeout is the number of seconds that must pass without receiving RTK correction to consider the connections lost, and so revert the solution to single.

SBAS enables or disables the use of SBAS corrections. We suggest not using SBAS correction while working as a base or together with other correction types.

3.7 Device Settings

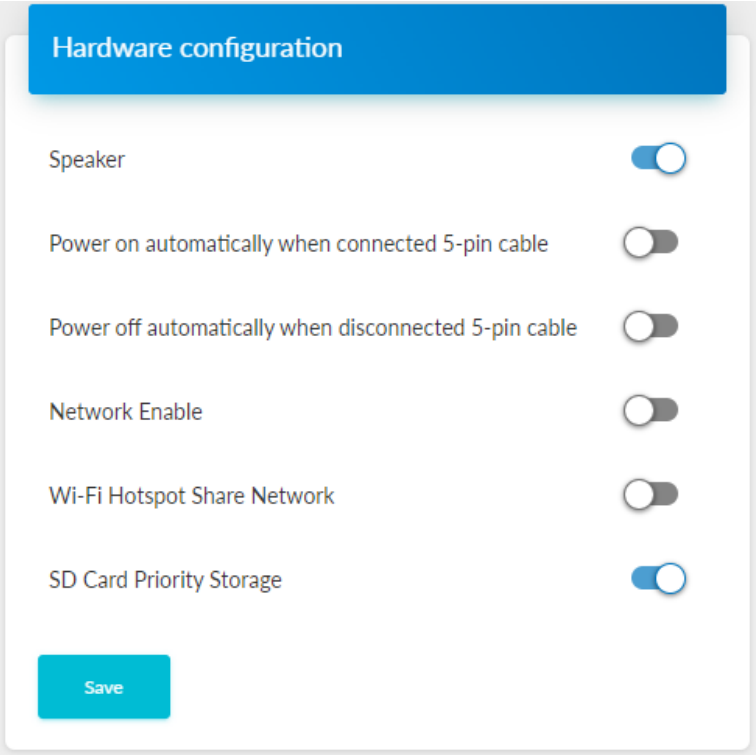
This page contains other configuration option for S900+, the first section include:

- Time zone: set the time zone to change the Local time as shown in the Dashboard
- Direct Link Mode: Service option, do not use
- Sensor: set the refresh rate of the IMU sensor
- 7-pin Serial Port Baud Rate



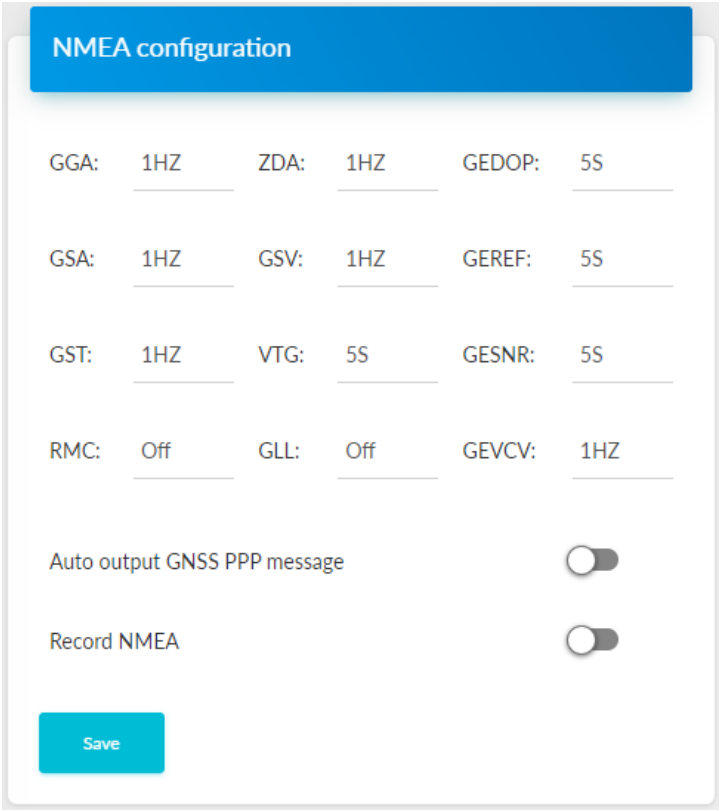
Hardware Configuration section contains:

- Speaker: enable/disable the voice messages
- Power on automatically when connected 5-pin cable: automatically turn on the S900+ when the power supply is received on 5-pin port
- Power off automatically when disconnected 5-pin cable: automatically turn off the S900+ when the power supply is no longer received on 5-pin port
- Network Enable: Enable 2G/3G/4G network
- Wi-Fi Hotspot Share Network: Internet connection sharing with devices connected to S900+ Wi-Fi hotspot
- SD Card Priority Storage: if an SD card is inserted the log files will be saved in it instead of using the internal memory. Also, change the memory information shown in Information and Download Raw Data pages



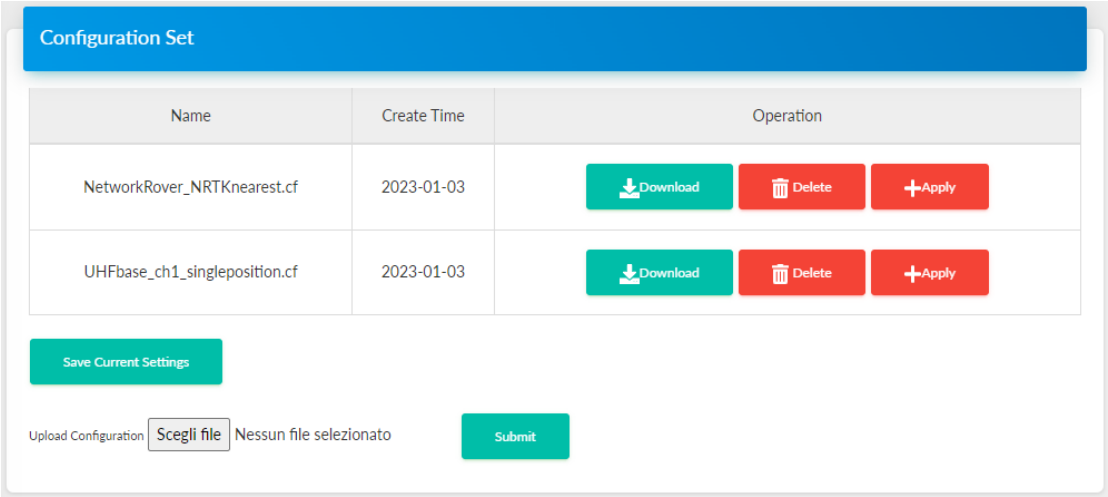
In NMEA Configuration is possible to set the frequency of the NMEA messages (up to 20Hz) transmitted via Bluetooth or 7-pin to DB9 cable.

Enabling Record NMEA will create log files available in the Download Raw Data section.

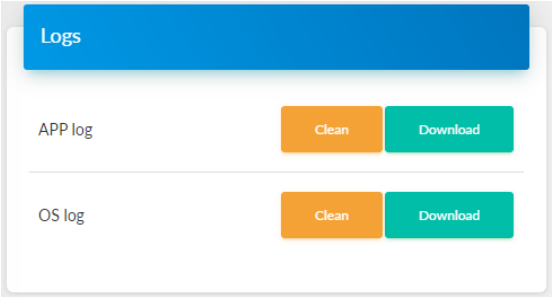


3.8 Save Backup & Logs

On this page is possible to manage configuration settings. Since S900+ maintains the latest configuration set even if powered off, this function can be useful if is often necessary to switch between different configurations.



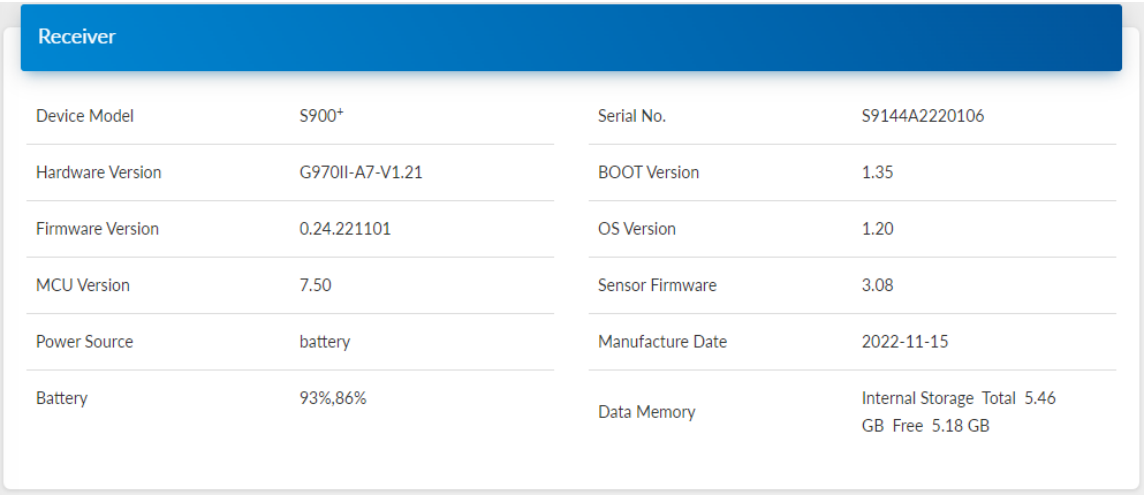
Here are also available the system logs



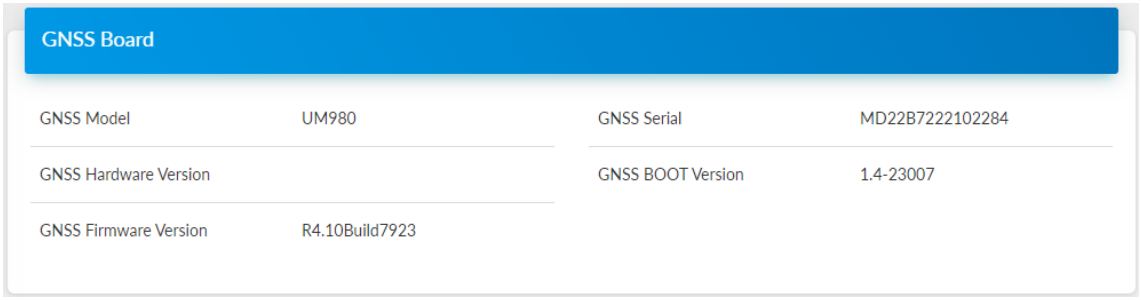
3.9 Information

This page contains information about the S900+ hardware and firmware.

In the Receiver section, is shown the motherboard firmware version together with much other useful information like the available memory and the battery status.



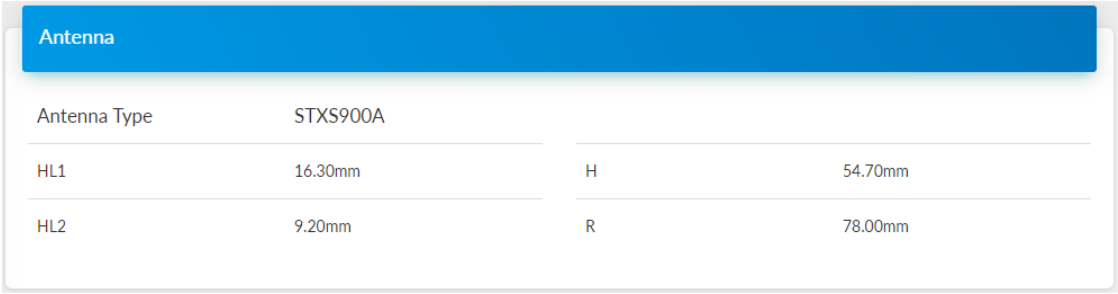
The GNSS Board section shows the GNSS board serial number and firmware version.



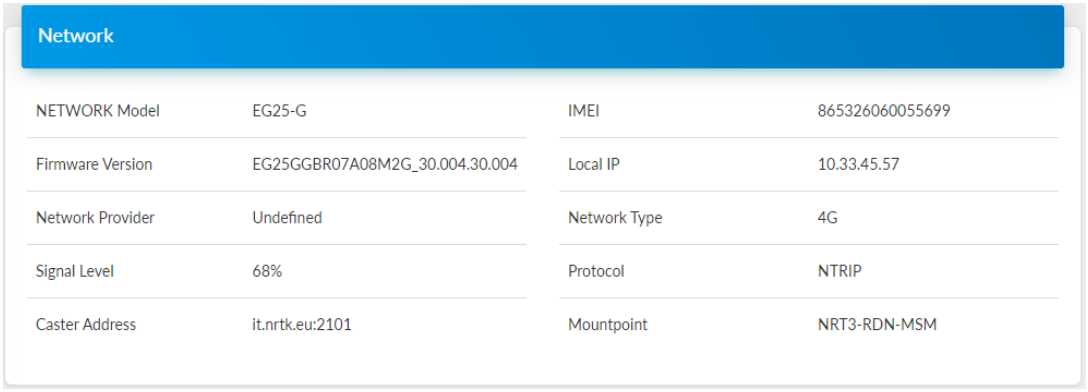
The antenna section contains the model and the geometrical values of the GNSS antenna:

- HL1: distance of the L1 frequency phase center from the GNSS antenna base
- HL2: distance of the L1 frequency phase center from the GNSS antenna base
- H: distance of GNSS antenna base from the S900⁺ base
- R: radius of the GNSS antenna

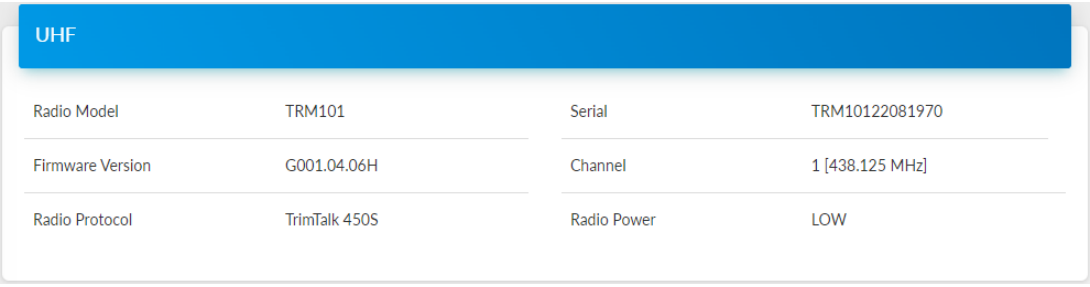
So, the phase center offsets from the base of the S900⁺ are calculated as H+HL1 and H+HL2.



In the Network section are located information about the S900⁺ internal modem, as well as the current Internet connection settings.



And lastly, the UHF section shows the current radio settings and the current UHF firmware

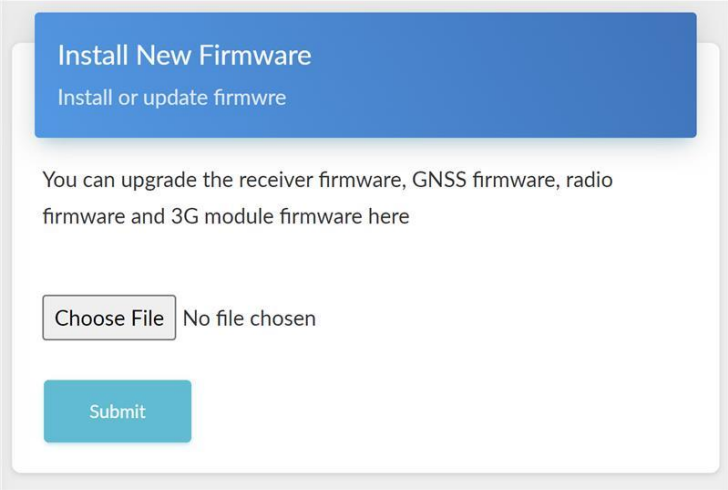


3.10 Management

The management page contains functions for the correct operativity of S900+.

3.10.1 Firmware Update

To update a firmware, select the firmware file using the file explorer (Choose File) then press Submit.



When the file has been decompressed, press Confirm to start the update. The motherboard firmware update will restart automatically the S900+.

Attention! Do not turn off the receiver during the update.

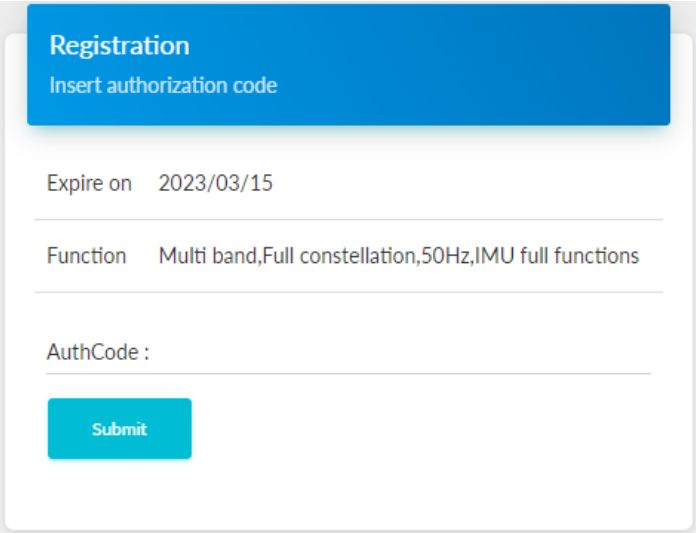
Once the firmware updates are completed perform a Factory Reset.

Attention! Use only firmware files provided by your local reseller.

3.10.2 Device Registration

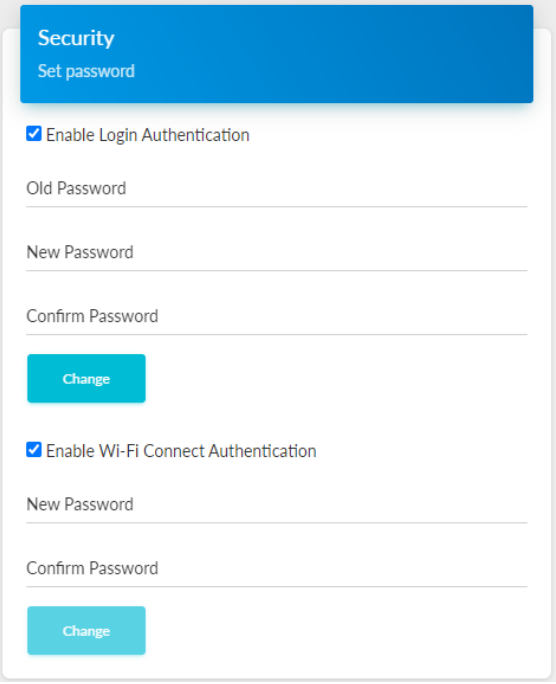
The S900+ must be correctly registered to work correctly. If the registration has expired the device will beep and it will not track satellites. Contact your local reseller to request the authorization code.

To upgrade the registration, insert the 64 characters code provided by the local reseller, without any space, and press Submit. Shortly the new expiration date will be visible.



3.10.3 Security

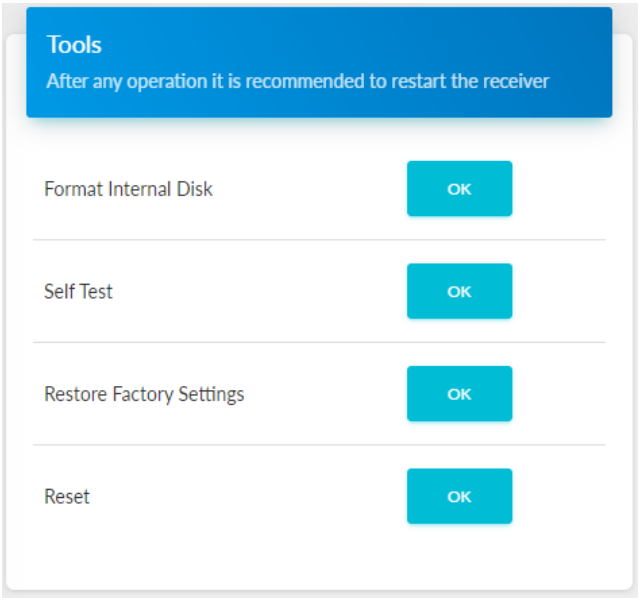
In this section is possible to change the password to access the WebUI and the S900+ Wi-Fi hotspot password.



3.10.4 Tools

This section contains the following functions:

- Format Internal Disk: remove all the log files saved in the internal memory
- Self Test: the device will test the internal modules. Each module inspection is followed by its result, if the module inspection passes, it will say “OK” and the respective LED will stay on until the whole self-check finishes. If the module inspection fails, it will say “FAIL”, the respective led will flash until the whole self-check finishes (ex. “GPS self-check. OK.”). Self-check lasts for about 1 minute, at the end there will be a single beep if no module failed the test, otherwise, it will continue to beep until the power button is pressed. The receiver starts to work after the whole self-check finishes. Contact your local dealer if an error is found.
  The test results are also shown in real-time in the WebUI, and a copy is saved in the internal memory.
- Restore Factory Settings: the device will perform a self-test then it will proceed with the factory reset. Factory reset does not change the firmware installed nor the file in the internal memory but will reset the device configuration.
- Reset: restart the device



4. IMU Technology

The S900⁺ is equipped with IMU Technology that allows measurements with a tilted pole.

This brings the following advantages:

- Fast and precise survey.

  It's possible to survey and store points with just one measure with a slant up to 60° (maximum 2cm error with a slant up to 30°, maximum 5cm error with a slant up to 60°).

- Simple and quick initialization process.

  After the first calibration, once a FIXED solution is obtained, is a matter of seconds to initialize the sensor and start to work.

- Guided calibration with *Stonex Cube-a*

  You can use *Stonex Cube-a* field software to calibrate the sensor; Stonex Cube-a provides all the instructions to initialize and calibrate the IMU sensor.

- Integrated inertial navigation module ensures real-time interference-free tilt compensation.

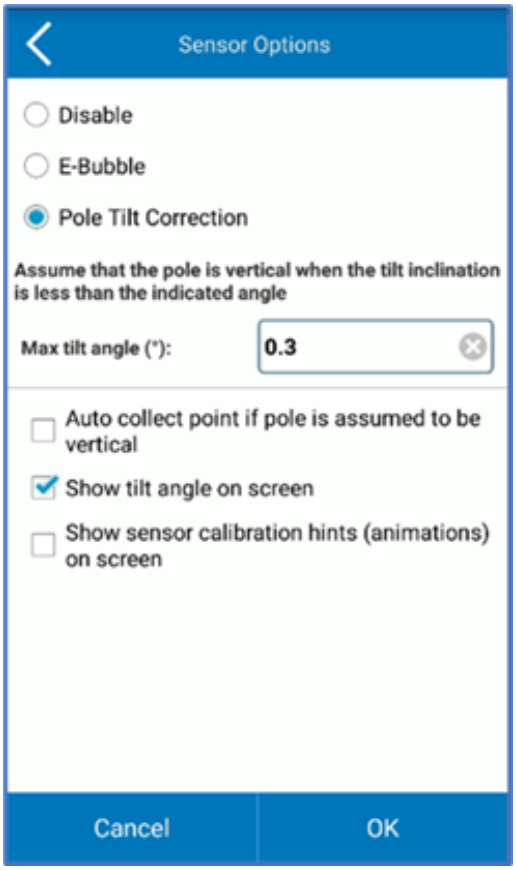
  It's not affected by any geomagnetic and external metal structures or other environmental influences. It adopts "satellite and inertial navigation" dual inspection.

4.1 IMU with Stonex Cube-a

4.1.1 Sensor Activation and Configuration

Before using the receiver to collect points with the slanted pole, check if the pole tilt correction functionality has been enabled. The settings to enable the Pole Tilt Correction using Stonex Cube-a, are in the Calibrate → Sensor Options page.

On the same screen, it is possible to set the software to show on screen the tilt angle (in decimal degrees, 0° = true vertical).

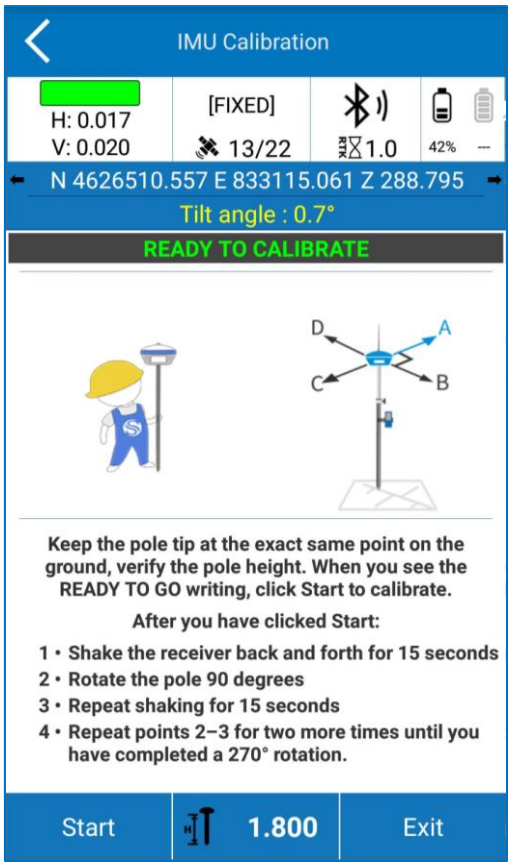


4.1.2 Calibration

To calibrate the sensor, select the Calibrate page and then click on the Calibrate Sensor command.

A FIXED solution is mandatory. Set the pole to be high at 1.8m as well as the measured height set in Stonex Cube-a.

Wait for the message Ready to Calibrate to appear then start the calibration by clicking on the Start button.



The calibration consists of the same operation repeated along 4 orthogonal directions: while keeping the pole tip on the same point on the ground oscillate the receiver back and forth along the current direction for about 15 seconds, and Stonex Cube-a will show when to change direction.

When the calibration is completed the message Calibration Terminated appear.

Now the S900⁺ is ready to work.

4.1.3 Initialization

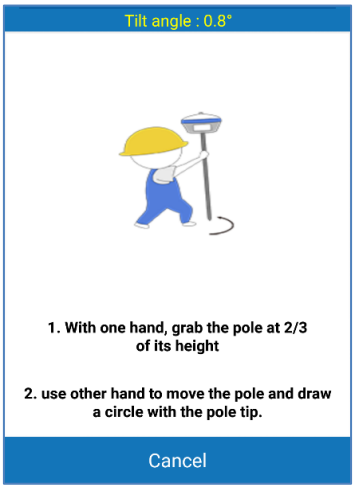
After the activation of the sensor, go to Survey mode.

If the sensor is not ready to work yet, Stonex Cube-a will show you which operations are necessary to perform its initialization, if “Show sensor calibration hints (animations) on screen” is enabled in Configure → System Settings → Sensor Options page.

There is a necessary pre-requisite to use the IMU: the status of the GNSS solution must be Fixed.

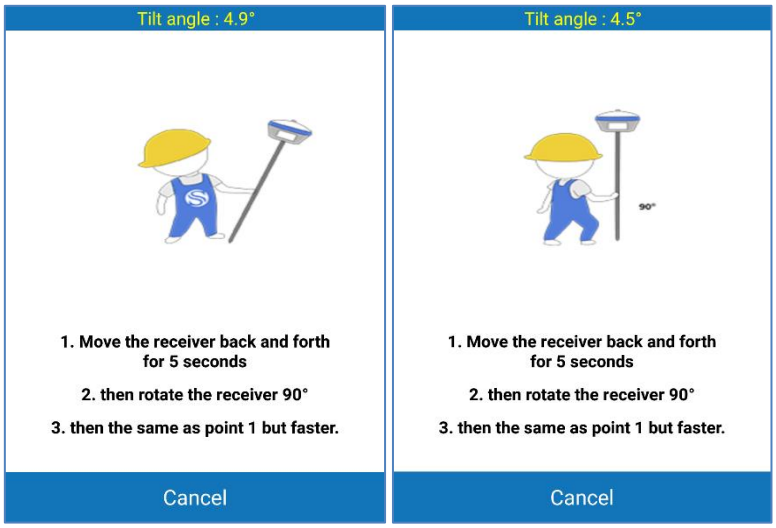
Then, if the sensor needs to be initialized, two different popup screens could show up.

The first screen contains the instruction for the magnetic initialization. Move the pole tip to draw a circle on the ground.



The second screen shows how to aid the sensor to adjust the calibration parameters based on the local GNSS position and accuracy.

Move the receiver back and forth for a few seconds in a direction. Then rotate the receiver by 90 degrees and repeat the movements, in the same direction as before, as shown in the picture below.



If the screen does not disappear, try changing the position to get lower RMS values and then repeat the two steps.

These screens could appear during the survey: this means that the IMU accuracy has degraded and it’s necessary to adjust it.

5. Accessories

5.1 Standard accessories

Carrying case

Power supply

2 Li-Ion battery, model: BP-5S 7.4V-3400mAh

1 Charger, model: CH-04

1 Power adaptor for a charger with EU/UK/US/AU power socket, model: PSAA30R-150

Cable

Multi-port link cable (model: LM.GK205.ABL) between receiver and PC or controller; USB or 7-pins LEMO for PC or controller and 7-pins LEMO for the receiver.

6. Technical specification

RECEIVER	
Satellite signals tracked	GPS: L1 C/A, L1C, L2P, L2C, L5
	GLONASS: L1, L2, L3[1]
	BEIDOU: B1I, B2I, B3I, B1C, B2a, B2b
	GALILEO: E1, E5a, E5b, E6
	QZSS: L1, L2, L5
	IRNSS: L5[1]
PPP	B2b PPP[1], HAS[1]
Channels	1408
Position Rate	Up to 20Hz
Signal Reacquisition	< 1 s
RTK Signal Initialization[2]	2 to 4 seconds
Hot Start	Typically < 15 s
Initialization Reliability	> 99.9 %
Internal Memory	8 GB
OS	Linux
Micro SD Card	Expansion slot up to 32 GB
Tilt sensor	IMU and E-bubble (optional)[3]

POSITIONING[4]	
STATIC GNSS SURVEYING	
High Precision Static Horizontal	2.5 mm + 0.1 ppm RMS
High Precision Static Vertical	3.5 mm + 0.4 ppm RMS
Static and Fast Static Horizontal	3 mm + 0.5 ppm RMS
Static and Fast Static Vertical	5 mm + 0.5 ppm RMS
CODE DIFFERENTIAL POSITIONING	
Accuracy	0.40 m RMS
SBAS POSITIONING[5]	
Accuracy	0.60 m RMS
REAL TIME KINEMATIC (< 30 Km) – NETWORK RTK[6]	
Fixed RTK Horizontal	5 mm + 0.5 ppm RMS
Fixed RTK Vertical	10 mm + 0.5 ppm RMS

INTEGRATED GNSS ANTENNA
High-accuracy multi-constellation antenna, zero phase center, with internal multipath suppressive board

INTERNAL RADIO (optional)[3]	
Type	Tx – Rx
Frequency Range	410 - 470 MHz 902.4 – 928 MHz[7]
Channel Spacing	12.5 kHz / 25 kHz
Range	3-4 Km in an urban environment Up to 10 Km with optimal conditions[2]

INTERNAL MODEM

Band	LTE FDD: B1/B2/B3/B4/B5/B7/B8/B12/ B13/B18/B19/B20/B25/B26/B28 LTE TDD: B38/B39/B40/B41 UMTS: B1/B2/B4/B5/B6/B8/B19 GSM: B2/B3/B5/B8 Nano SIM card

COMMUNICATION

I/O Connectors	7-pin Lemo and 5-pin Lemo interfaces. Multifunction cable with USB interface for PC connection
Bluetooth	2.1 + EDR, V5.0
Wi-Fi	802.11 b/g/n
Web UI	To upgrade the software, manage the status and settings, data download, etc. via smartphone, tablet, or other electronic devices with Wi-Fi capability
Reference outputs	RTCM2.3, RTCM3.0, RTCM3.2 MSM, CMR, CMR+, DGPS
Navigation outputs	NMEA 0183

POWER SUPPLY

Battery	2 rechargeable and replaceable 7.2 V – 3.400 mAh Intelligent lithium batteries
Voltage	9 to 28 V DC external power input with over-voltage protection (5-pin Lemo)
Working Time	Up to 12 hours (2 batteries hot swap)
Charge Time	Typically 4 hours

PHYSICAL SPECIFICATION

Dimensions	Ø 157 mm x 76 mm
Weight	1.19 Kg (with one battery) 1.30 Kg (with two batteries)
Operating Temperature	-30°C to 65°C (-22°F to 149°F)
Storage Temperature	-40°C to 80°C (-40°F to 176°F)
Waterproof/Dustproof	IP67
Shock Resistance	Designed to endure a 2 m pole drop on a hardwood floor with no damage
Vibration	Vibration resistant

Specifications are subject to change without notice.

1. Available with a future firmware update.

2. Varies with the operating environment and with electromagnetic pollution.

3. Optional, it can be activated via an activation code.

4. Accuracy and reliability are generally subject to satellite geometry (DOPs), multipath, atmospheric conditions, and obstructions. In static mode they are subject even to occupation times: the longer the Baseline, the longer must be the occupation time.

5. Depends on SBAS system performance.

6. Network RTK precision depends on the network performances and is referenced to the closest physical base station.

7. On request when ordering.

7. Appendix 1: UHF radio technical details

7.1 Default channel frequencies

Channel	Frequency
1	438.125 MHz
2	440.125 MHz
3	441.125 MHz
4	442.125 MHz
5	443.125 MHz
6	444.125 MHz
7	446.125 MHz
8	447.125 MHz

7.2 Protocol tables

7.2.1 TRM101

Protocol	Bandwidth (kHz)	Modulation Type	Radio link rate (bps)	FEC
TRIMTALK(4800)	12.5	GMSK	4800	Off
TRIMTALK 450S	25	GMSK	9600	Off
TRIMMARK III	12.5	GMSK	9600	Off
TRIMMARK III	25	GMSK	19200	Off
PCC-GMSK	12.5	GMSK	4800	On
PCC-GMSK	25	GMSK	9600	On
PCC-4FSK	12.5	4FSK	9600	Off/On
PCCFST	12.5	4FSK	9600	Off/On
PCCFST_ADL	12.5	4FSK	9600	Off/On
Satel	12.5	4FSK	9600	Off/On
Satel	25	4FSK	19200	Off/On
Satel_ADL	12.5	4FSK	9600	Off/On
Satel_ADL	25	4FSK	19200	Off/On
South 9600	12.5	GMSK	9600	On
South 19200	25	GMSK	19200	On

7.2.2 TRM121

7.2.2.1 Fixed frequency

Protocol	Bandwidth (kHz)	Modulation	Radio link rate (bps)	FEC	Scramble
TRIMTALK(4800)	12.5	GMSK	4800	Off	N/A
TRIMTALK 450S	25	GMSK	9600	Off	N/A
TRIMMARK III	12.5	GMSK	9600	Off	N/A
TRIMMARK III	25	GMSK	19200	Off	N/A
PCC-GMSK	12.5	GMSK	4800	On	N/A
PCC-GMSK	25	GMSK	9600	On	N/A
PCC-4FSK	12.5	4FSK	9600	Off/On	N/A
PCC-Satel	25	4FSK	19200	Off/On	Off/On
PCC-Satel	12.5	4FSK	9600	Off/On	Off/On
PCCFST	12.5	4FSK	9600	Off/On	N/A
PCCFST_ADL	12.5	4FSK	9600	Off/On	N/A
Satel	12.5	4FSK	9600	Off/On	N/A
Satel	25	4FSK	19200	Off/On	N/A
Satel_ADL	12.5	4FSK	9600	Off/On	N/A
Satel_ADL	25	4FSK	19200	Off/On	N/A
South 9600	12.5	GMSK	9600	On	N/A
South 19200	25	GMSK	19200	On	N/A

7.2.2.2 Hopping

Protocol	Bandwidth (kHz)	Modulation	Radio link rate (bps)
900M Hopping	280	GMSK	115200
GEO FHSS	280	GMSK	115200

8. Appendix 2: Copyrights, warranty, and environmental recycling

8.1 Copyrights and trademarks

© 2023, STONEX® Srl. All rights reserved.

STONEX®, the STONEX® logo, and the S900⁺ GNSS receiver are trademarks of STONEX® Srl.

STONEX® Cube-a is a trademark of STONEX® Srl.

All other trademarks are the property of their respective owners.

8.2 Release Notice

This is the June 2023 release of the STONEX® S900⁺ GNSS new model receiver user guide.

The following limited warranties give you specific legal rights. You may have others, which vary from state/jurisdiction to state/jurisdiction.

8.3 Standard Limited Warranty

Version 2023

The terms and conditions of this Limited Warranty constitute the complete and exclusive warranty agreement between The Customer or Dealer and STONEX® for the Product and supersedes any prior agreement or representation made in any STONEX® sales document or advice that may be provided to Customer by any STONEX® representative in connection with Customer's purchase of the Product. No change to the conditions of this Limited Warranty is valid unless it is made in written form and signed by an authorized STONEX® supervisor.

STONEX® declares that its Products:

(1) are free from defects in materials or workmanship for generally 1 year (accessories or specific parts for which different limited warranty periods shall apply).

(2) have been tested/calibrated in proper working status before shipment.

The warranty period runs from the date of the first sale of the instruments.

At its sole discretion, within the warranty period, STONEX® will repair the product or send parts for replacement at its expense.

STONEX® agrees to repair or replace the defective instrument within thirty (30) days only if STONEX® acknowledges that the defects in the instrument are not caused by human factors or that no obvious damage to its surface is visible.

STONEX® warrants that replaced new parts or products will be free from defects in materials and workmanship for thirty (30) days or the remainder of the Limited Product Warranty Period in which they are installed, whichever is longer.

Defective parts or Products replaced under this Limited Warranty shall become the property of STONEX®.

All products that need to be repaired must be returned to our technical representative's office via whatever delivery company the customer prefers, however, STONEX® is not responsible for the unlikely event that products are lost in transit.

Any damage inflicted by the customer or a third party after the products have been delivered to the customer is excluded from the limited warranty, as is any damage resulting from improper use, any action or use not contemplated in the accompanying user guides, and/or manuals.

8.4 Shipping policy

The Customer or the dealer is required to pay for the charges for shipping faulty parts or instruments to STONEX® representative office and STONEX® is providing the shipping for the return.

Dealers need to follow STONEX® repair/service procedure to achieve a better and prompt service result.

8.5 Return policy Dead on Arrival instruments

All returned products have to be shipped to STONEX® representative office.

The original Purchaser has a period of seven (7) days starting from the date of purchasing to signal the existence of a defect in the instrument for a full refund (less shipping and handling), provided the merchandise is in new, resalable condition and returned in the original, undamaged packaging. Customers must pay for both the return and the original freight fees, regardless of the original freight paid by the Company. All warranty books, instruction manuals, parts, and accessories must be included as well as the original box in which the item was shipped. We recommend placing the original carton inside another box, to avoid any additional damage to the carton itself. In some cases, returns of special items will require a re-stock fee. Acceptance of returned merchandise is final only after inspection by STONEX®.

Above terms and policies shall apply to hardware. Dealers need to follow STONEX® repair/service procedure to achieve a better and prompt service result.

8.6 Firmware/Software warranty

STONEX® doesn't warrant that operation of Firmware/Software on any instruments will be uninterrupted or error-free, or that functions contained in Firmware/Software will operate to meet your requirements.

STONEX® will forward the Software/Firmware Fix to the dealer or customer. A firmware/software Fix means an error correction or other update created to fix a previous firmware version that substantially doesn't conform to the instrument's specification.

8.7 Over Warranty repair(s) policy

The customer shall pay the standard repair fees for any service (whether part replacement or repairs) performed by STONEX® under request and explicit authorization of the customer itself. In this case, the customer is charged for return shipping fees as well.

8.8 Disclaimer and Limitations

All other express and implied warranties for this product, including the implied warranties of merchantability and fitness for a particular purpose and/or non-infringement of any third party's rights, are hereby disclaimed. Stonex® expressly disclaims all warranties not stated in this limited warranty. Any implied warranties that may be imposed by law are limited in duration to the term of this limited warranty. Some jurisdictions do not allow the exclusion of implied warranties or limitations on how long an implied warranty lasts, so the above exclusions or limitations may not apply to customer.

It is the customer's responsibility to read and follow all setup and usage instructions in the accompanying user guides and/or manuals. Failure to do so may result in product malfunction and damage. The customer may lose data or suffer personal injury.

Stonex®, its affiliates, and suppliers do not guarantee that the operation of this product will be uninterrupted or error-free, as is the case with all electronic products. If this product fails to function as warranted above, the customer's sole and exclusive remedy will be repair or replacement.

In no event shall Stonex®, its affiliates, or suppliers be liable to the customer or any third party for damages more than the purchase price of the product.

This limitation applies to damages of any kind, including:

(1) damage to, or loss or corruption of, customer's records, programs, data, or removable storage media

(2) any direct or indirect damages, loss of profits, loss of savings, or other special, incidental, exemplary, or consequential damages, whether for breach of contract, tort or otherwise, or whether arising out of the use of or inability to use the product and/or the accompanying user guides and/or manuals, even if Stonex, or an authorized Stonex® representative, authorized service provider or retailer has been advised of the possibility of such damages or any claim by a third party.

Some jurisdictions do not allow the exclusion or limitation of incidental or consequential damages for certain products, so the exclusions or limitations may not apply to you. This limited warranty gives the customer specific legal rights, and the customer may also have other rights that vary from country/state/jurisdiction to country/state.

8.9 Environmental Recycling

The cardboard box, the plastic in the package, and the various parts of this product must be recycled and disposed of by the current legislation of your Country.

8.9.1 For countries in the European Union (EU)

The disposal of electric and electronic devices as solid urban waste is strictly prohibited: they must be collected separately.

Contact Local Authorities to obtain practical information about the correct handling of the waste, location, and times of waste collection center. When you buy a new device of ours, you can give back to our dealer a used similar device.

The dumping of these devices at unequipped or unauthorized places may have hazardous effects on health and the environment.

The crossed-out dustbin symbol means that the device must be disposed of in authorized collection centers and must be managed separately from solid urban waste.

8.9.2 For countries outside European Union (EU)

The treatment, recycling, collection, and disposal of electric and electronic devices may vary by the laws in force in the Country in question.

9. Appendix 3: Safety Recommendations

9.1 Warnings and Cautions

An absence of specific alerts does not mean that there are no safety risks involved in the use of this equipment.

Always follow the instructions that accompany a Warning or Caution, reported in this.

This information is intended to minimize the risk of personal injury and/or property damage. Observe safety instructions that are presented in the following form:

WARNING - A Warning alerts about the risk for health and/or damage to the propriety. A warning identifies the nature of the risk and the extent of the possible injury and/or damage. It also describes how to protect yourself and/or the equipment from this risk.

CAUTION - A Caution alert about a possible risk of damage to the equipment and/or loss of data, but no risk to human safety.

9.2 Wireless Module Approval

The receivers use internal wireless modules or can be connected to an external data communications UHF radio. Regulations regarding the use of the radio-modems vary greatly from country to country. In some countries, the unit can be used without obtaining an approval license. Other countries require specific approval or auto certification by the set maker.

Before using this instrument, check if authorization to operate the receiver is required in your country. It is the responsibility of the importer to verify if it is necessary to obtain a certification or license for the equipment in the country of use.

9.3 Instrument Approval

Covers technical features of the equipment relative to electromagnetic emissions that can cause interference and disturbances to other instruments (note like EMC compatibility) or generate not correct functionalities of the instrument itself. Approval is granted by the manufacturer of the equipment. Some countries have unique technical requirements for operation in particular frequency bands. To comply with those requirements, Stonex Srl may modify the equipment to be subjected to a grant.

Unauthorized modification of the unit voids already got approvals, the warranty time, and the operational licenses of the instrument.

9.4 General Antenna Installation Warning

1. All antenna installation and servicing are to be performed by qualified technical personnel only. When servicing the antenna, or working at distances closer than those listed below, ensure the transmitter has been disabled.

2. Typically, the antenna connected to the transmitter is a directional (high gain) antenna, fixed-mounted on the side or top of a building, or a tower. Depending upon the application and the gain of the antenna, the total composite power could exceed 90 watts ERP. The antenna location should be such that only qualified technical personnel can access it, and that under normal operating conditions, no other person can touch the antenna or approach within 0.6 meters of the antenna.

You can see below a table showing the Antenna Gain versus Recommended Safety Distance:

Antenna Gain	0-5 dBi	5-10 dBi	10-16.5 dBi
Minimum RF safety distance	0.6 meters	1.06 meters	2.3 meters

9.4.1 USA

The FCC has adopted a safety standard for human exposure to radiofrequency electromagnetic energy. Proper use of this radio modem results in exposure below government limits. The following precautions are recommended:

DO NOT operate the transmitter when someone is located less than 20 cm (7.8 inches) from the antenna.

DO NOT collocate (place within 20 cm) the radio antenna with any other transmitting instruments.

DO NOT operate the transmitter unless all RF connectors are secure, and any open connectors are properly terminated.

DO NOT operate the equipment near electrical blasting caps or in an explosive atmosphere.

All equipment must be properly used according to the installation instructions for safe operation.

All equipment should be repaired and calibrated only by a qualified technician.

9.4.2 Europe

The European Community provides some Directives for the electronic equipment introduced on the market.

All the relevant information's available on the European Community website:

https://ec.europa.eu/growth/sectors/electrical-engineering/

From this link, you can download Directive 2014/53 / UE RED relating to telecommunication equipment, the LVD Low voltage directive, and the EMC directive for electromagnetic compatibility.

9.5 Bluetooth/Wi-Fi radio Module

The radiated output power of the internal Bluetooth module of this equipment is far below the FCC and EU radio frequency exposure limits. In any case, be sure to use the equipment with the radio far at least 20 cm from the human body. The Bluetooth module matches the guidelines found in radio frequency “safety standards and recommendations “published by Scientific organizations.

Stonex Srl, therefore, believes the internal wireless radio is safe for use by end users. The level of energy emitted is far less than the electromagnetic energy emitted by wireless devices such as UMTS phones. However, the use of Bluetooth/Wi-Fi may be restricted in some special situations or places, like aircraft, hospitals, etc. If you are unsure of the existence of restrictions, you should ask for authorization before switching on the Bluetooth radio.

9.5.1 Recommendation for installing antennas for internal radios

UHF Antennas having a gain greater than 5 dBi, are strictly prohibited for use with this device. The required antenna impedance must be 50 ohms.

CAUTION

For your safety, and to match the RF Exposure requirements of the FCC, always observe these precautions:

- Always maintain a minimum separation distance of 20 cm (7.8 inches) between yourself and the radiating antenna.
- Do not collocate (place within 20cm) the radio antenna with any other transmitting device.
- Do not switch on the GSM or UHF module without the antenna mounted to the external connector.

9.6 Rechargeable Lithium-ion batteries

These receivers use a rechargeable Lithium-ion battery.

WARNING

- Avoid direct contact with the rechargeable Lithium-ion battery if it appears damaged. Battery liquids are corrosive and contact with them can result in personal injury or damage to proprieties.

To prevent injury or damage:

- If the battery leaks, avoid contact with the battery fluid.
- If battery fluid gets into your eyes, immediately rinse your eyes with clean water and seek medical attention. Do not rub your eyes!
- If battery fluid gets onto your skin or clothing, immediately use clean water to wash off the battery fluid.

WARNING

- Do not damage the Lithium-ion battery.

A damaged battery can cause an explosion, with a risk of fire, and can result in personal injury and/or property damage.

To prevent injury or damage:

- Do not use or charge the battery if it appears to be damaged. Signs of damage are discoloration, warping, and leaks of liquids.
- Do not expose the battery to fire, high temperature, or direct strong sunlight.
- Do not introduce the battery in water or liquid substance, in general.
- Do not use or store the battery in very hot ambient.
- Do not drop or puncture the battery.
- Do not open the battery and do not put in short-circuit its electrical contacts.

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