



STONEX S980A
GNSS Receiver
User Manual



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Introduction

This document is the user guide for the Stonex S980A and it is intended to introduce how to use the receiver correctly.

The Stonex S980A GNSS receiver is a multiple-frequency receiver and designed for GNSS surveying applications. It is available as a base station, or as a standalone rover, which can be switched freely whenever and wherever, offering maximum versatility in the system configuration to meet your specific requirements. At the same time, S980A receiver can be upgraded easily to continually meet your new demand.

The integrated design of the receiver makes the Stonex S980A only 1.48 kg, which is light and portable. The internal antenna supports all satellite system signals like GPS, GLONASS, Galileo, Beidou, QZSS. The users no longer have to worry about upgrading RTK hardware to support other satellite systems.

The internal use of the latest Sensor Fusion system allows the user to take tilted measurements without calibration, making the field surveying more convenient.

An important feature inside S980A is **Atlas**: it is a differential correction system broadcasted on L-Band, it allows to increase the position accuracy in areas not covered by conventional CORS working under Ntrip Technology (lack of reference stations, lack of GPRS signals, etc). Atlas is broadcasted by satellite systems, so the reception is nearly ensured all over the world. Atlas uses similar technology compared to SBAS, but providing better positioning accuracy.

Stonex S980A has the new GSM modem. Worldwide LTE, UMTS/HSPA+ and GSM/GPRS/EDGE coverage. Multi-constellation GNSS receiver available for applications requiring fast and accurate fixes in any environment. EG25-G is backward-compatible with existing EDGE and GSM/GPRS networks, ensuring that it can be connected even in remote areas devoid of 4G or 3G coverage.

The Stonex S980A has new TRM 501 radio module. It supports the radio transmission on 410-470 Mhz frequency. The device supports the most used radio protocols such as Trimtalk 450(S), Satel, PCC-EOT and more others. The key point of this new radio module is the power, the TRM 501 can transmit up to 5 W.

The Stonex S980A is also equipped with a colored display full touch where the user can check the status of the receiver, position, quality of the solution and other important information. The user through the display touch can also start a base using the radio technology or start a base in communication with an external device like a radio. Through the display touch it is possible start a static session.

This chapter provides basic information to help you get familiar with S980A GNSS receiver.

Key Features:

- Rugged housing
- full constellation satellites support
- 4G LTE and Bluetooth / WLAN datalink support
- UHF datalink with internal 5 W radio module
- Radio UHF Antenna connector in upper side
- Atlas&aRTK support
- Easy configuration from Web UI and remote server
- Display touch menu
- 1PPS output support
- 2nd GNSS antenna support
- New Sensor for tilted measures
- Intelligent connection
- IP67

1. Receiver appearance

1.1 Front view



The following table contains the description of the receiver front view.

ITEM	DESCRIPTION
1. Satellite indicator	• Off: no satellites tracked • Flashing red: satellites tracked but not positioned • Flashing green: satellites positioned but not fixed • Green: fixed solution • Flashing green and red alternately: GNSS board abnormal

2. Datalink indicator	• Green: datalink setting succeeds • Flashing green: data in normal transmission/reception • Flashing green/blue: in rover mode, data in normal transmission/reception and record raw data enable • Blue: working mode static but not recording • Flashing blue: in static mode, flashing blue according to static sampling interval
3. Power indicator	• Green: the power supply in 30%-100% • Flashing green: power in 10%-30% • Flashing red: power < 10% with warning beep
4. Bluetooth indicator	• Blue: Bluetooth is connected • Off: No connection
5. PPS indicator	• Green: 1 PPS output enabled but no output • Flashing Green: 1PPS output enabled and data outputs • Off: 1 PPS output disabled
6. Sensor Fusion indicator	• Green: Sensor fusion is enabled and could be output without any problems • Off: Sensor fusion is disabled
7. LCD Display touch	• 1.45 inches touch LCD screen for interface display and operation settings
8. Power button	• Switch ON/OFF the receiver. • Short press to broadcast the current operation mode and status

1.2 Bottom view



The following table contains the description of the receiver bottom view.

ITEM	DESCRIPTION
1. 1PPS	To pulse signal output
2. 5-pin LEMO	To Connect external power and/or the external radio
3. Type-C	- Receiver Power Supply - Data transfer
4. GNSS	To connect the GNSS external antenna
5. SIM	Nano SIM card slot

1.3 Top View



1.4 Back-side view



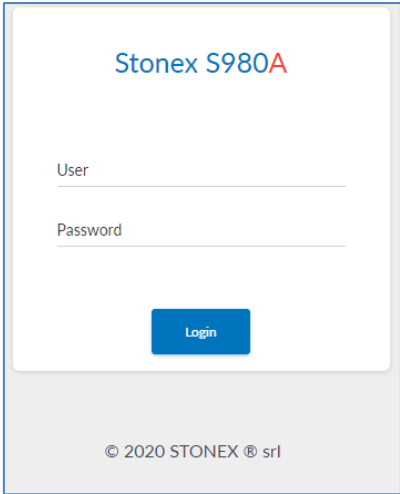
2. Web Interface

The Stonex S980A receiver has Web UI functionality. By getting access to its internal hotspot, you can easily manage it on the Web UI. As long as you have a smart phone, PC or handheld with WIFI functionality, you can easily connect to the S980A receiver to view status, download data and configure the receiver.

The Stonex S980A receiver is default to open WIFI automatically when it's powered on. Use smart phone/PC/handheld to search the receiver hotspot, whose name is its serial number, and connect it. Receiver WIFI only supports getting access to Web UI to check status and set up mode, not for Internet connection.

The WIFI hotspot name is the serial number of the receiver.

Enter the IP address: 192.168.10.1. in the address bar of any browser. A window will pop up, fill in with the information requested, "admin" in the field User, and "password" in the field Password.



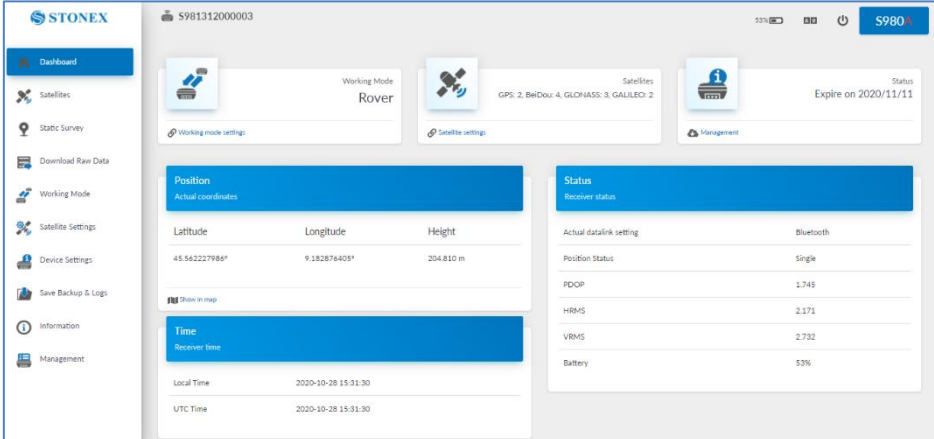
The image shows a web browser window displaying the login page for the Stonex S980A receiver. The page has a white background with a blue border. At the top, the text "Stonex S980A" is displayed in blue and red. Below this, there are two input fields: "User" and "Password", each with a horizontal line for text entry. A blue "Login" button is positioned below the password field. At the bottom of the page, the copyright notice "© 2020 STONEX ® srl" is visible.

2.1 Dashboard

In the Dashboard page, you can see the device serial number, power level, language and device name in the top of the page.

And you can also see the current working mode, satellites, expire date. Position information, time and status.

Inside the Dashboard is visible the status of the license of the receiver. If it is unlocked there will be PERMANENT, if not it will appear the expiration date.



The dashboard displays the following information:

- Device Information:** STONEX logo, Serial Number: S981312000003, Battery: 55%, Signal strength: 5 bars, Power: 100%, Device Name: S980A.
- Working Mode:** Rover
- Satellites:** GPS: 2, BeiDou: 4, GLONASS: 3, GALILEO: 2
- Expire Date:** Expire on 2020/11/11
- Position (Actual coordinates):**

Latitude	Longitude	Height
45.562227986°	9.182876403°	204.810 m
- Time (Receiver time):**

Local Time	UTC Time
2020-10-28 15:31:30	2020-10-28 15:31:30
- Status (Receiver status):**

Actual datalink setting	Bluetooth
Position Status	Single
PDOP	1.745
HDOP	2.171
VRMS	2.732
Battery	53%

*The position showed in map "show in map" is available only if the device used to access to the web UI is connected to internet.

2.2 Satellites

In this page, you can view satellites Sky plot and satellites table.

Always in this page you can set the cutoff angle (in DEG) up to 45°.

Satellites Used / Satellites Tracked

Total	8 / 13
GPS	5 / 5
BeiDou	2 / 3
GLONASS	1 / 3
GALILEO	0 / 2
SBAS	0 / 1

Settings

Cutoff Angle [0-45°]

5

Save

Satellites Skyplot

Satellites Table

Type	Satellite number	Elev. [Deg]	Azim. [Deg]	L1 / B1 [dBHz]	L2 / B2 [dBHz]	L5 / B3 [dBHz]
GPS	G10	15	288	43	31	37
GPS	G12	52	242	32	26	
GPS	G24	79	326	33	21	37
GPS	G25	18	242	39	20	36
GPS	G32	10	320	38	20	33
BeiDou	C14	12	324	35	35	39
BeiDou	C21	29	244	40	35	
BeiDou	C26	26	282	29	33	36
GLONASS	R7	38	306	0	40	
GLONASS	R8	5	344	0	35	
GLONASS	R9	23	278	33	35	
GALILEO	E1	49	266	29	39	
GALILEO	E4	43	290	0	41	
SBAS	S123	32	150	35	0	

2.3 Static Survey

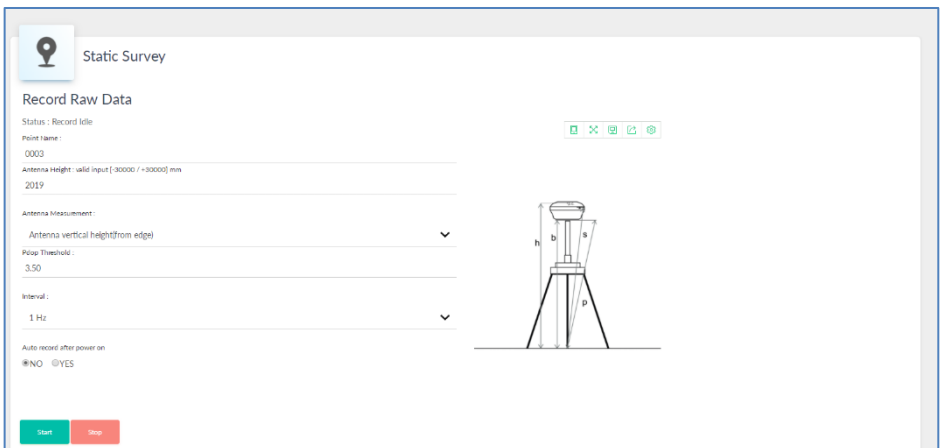
As the pictures shows, in static survey, the user can input the point name, antenna height, PDOP threshold, antenna measurement and sample interval. These are all the parameters that can be used in a static survey.

Antenna height options available are:

- Antenna phase center
- Antenna slant height mode
- Antenna vertical height (from edge)
- Altimeter pieces
- Antenna vertical height (from bottom)

The following picture shows the type of heights well detailed.

At last, there are two record options. If you activate auto record, it will collect data automaticly when you power on the receiver.



Static Survey

Record Raw Data

Status : Record Idle

Point Name : 0003

Antenna Height : valid input [-30000 / +30000] mm
2019

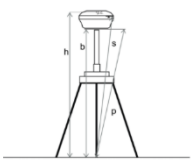
Antenna Measurement :
Antenna vertical height(from edge) ▼

PDOP Threshold : 3.50

Interval : 1 Hz ▼

Auto record after power on
☒ NO ☐ YES

Start Stop

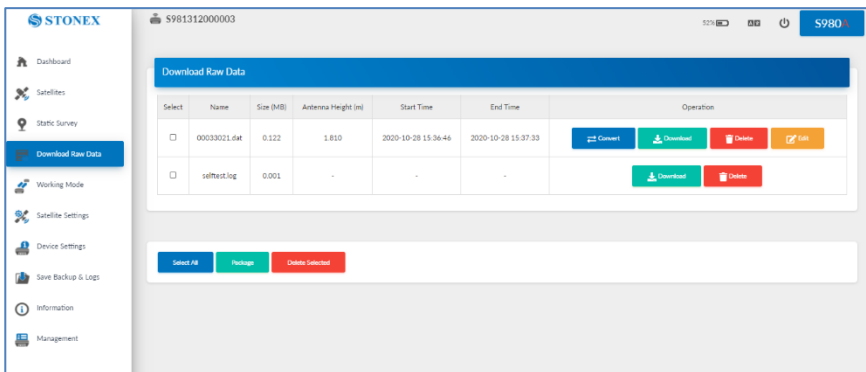


2.4 Download Raw Data

In this page, you can download, delete and edit the observation files and ephemeris.

It is possible to convert directly raw data into RINEX, select Convert.

For every raw data file is shown the start time and the end time, the name, the size of the file and the Antenna height set.



Download Raw Data

Select	Name	Size (MB)	Antenna Height (m)	Start Time	End Time	Operation
☐	00033021.dat	0.122	1.810	2020-10-28 15:36:46	2020-10-28 15:37:33	Convert Download Delete Run
☐	selftest.log	0.001	-	-	-	Download Delete

[Select All](#)
[Package](#)
[Update Collection](#)

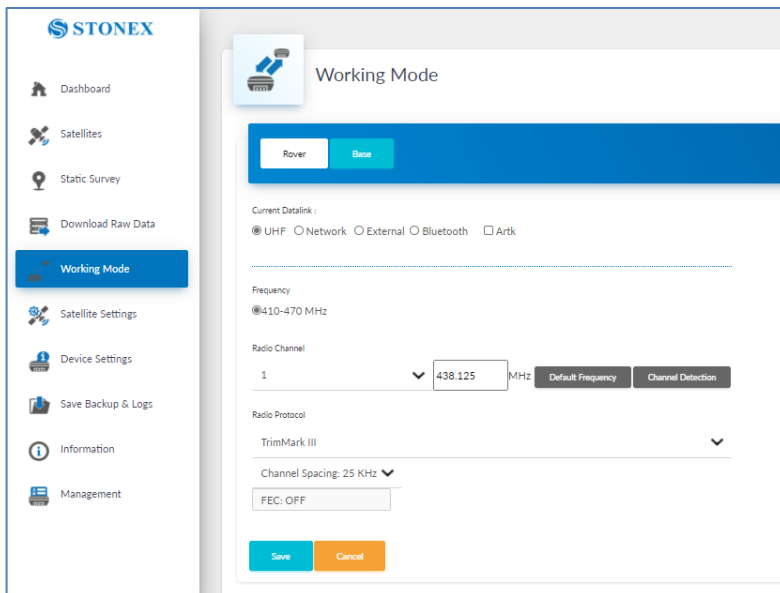
2.5 Working Mode

You can select Rover or Base as working mode.

2.5.1 Rover

In rover mode, you can select different datalinks. At the same time they also have different options that can be edited. The datalink option includes UHF, Network, External and Bluetooth.

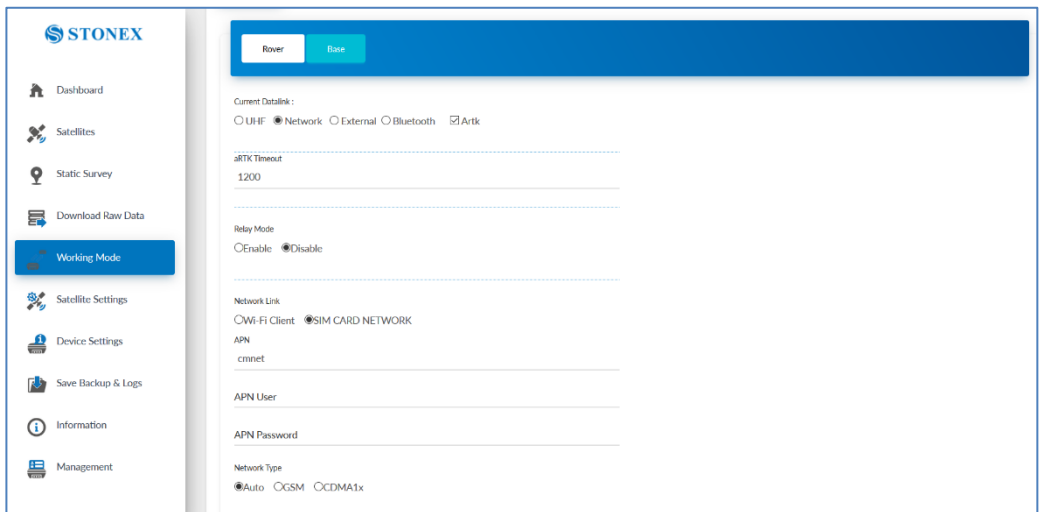
If you select UHF mode, you can select radio channel and radio protocol in the respectively drop-down list. You also can select if record raw data during the session or not. All channels frequencies are editable. Obviously, the channel frequency inserted must respect the frequency range 410-470Mhz and the frequency range of the UHF antenna used. The interface is as shown:



If you select Network, it appears the specific options of the network configuration. The user can type and set the parameters of the Caster Service and the respective User and Password if it used a NTRIP connection. Through the Web UI is possible to download the list of the mountpoints, the user can choose the mountpoint according to the service and then start the connection.

If the user uses a SIM card is necessary type the APN and eventually user and password.

If the user wants to use SIM card inside the receiver, it is suggested to disable the PIN code before the application.



STONEX

Dashboard

Satellites

Static Survey

Download Raw Data

Working Mode

Satellite Settings

Device Settings

Save Backup & Logs

Information

Management

RoverBase

Current Datalink :

☐ UHF
 ☒ Network
 ☐ External
 ☐ Bluetooth
 ☒ Artik

aRTK Timeout

1200

Relay Mode

☐ Enable
 ☒ Disable

Network Link

☐ Wi-Fi Client
 ☒ SIM CARD NETWORK

APN

cmnet

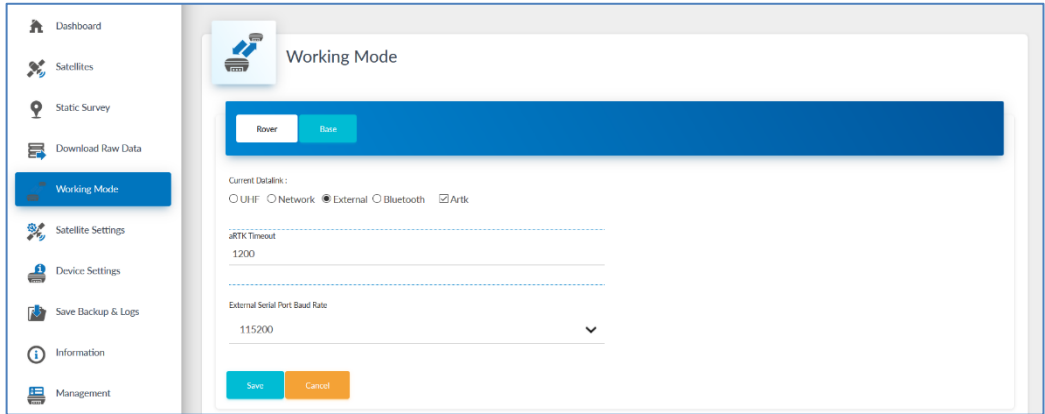
APN User

APN Password

Network Type

☒ Auto
 ☐ GCSM
 ☐ GCDMA1x

If you select External, it can be connected an external radio. The external serial port baud rate should be the same of the external radio used.



Working Mode

Rover **Base**

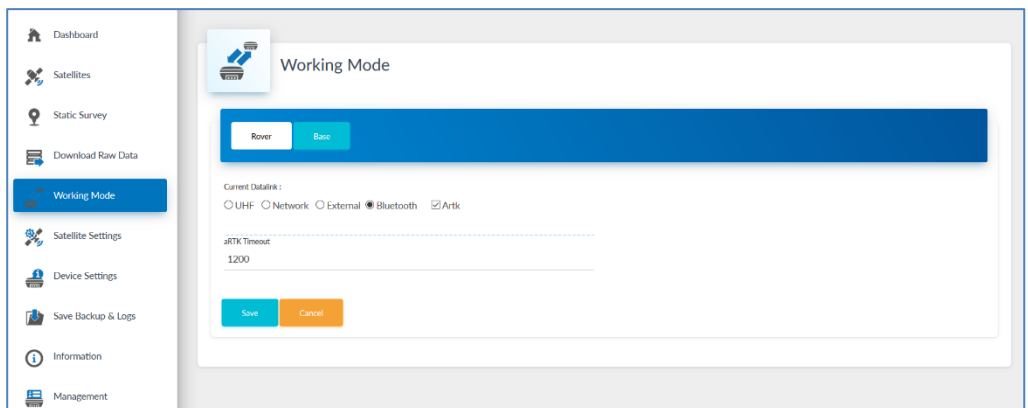
Current Datalink:
☐ UHF ☐ Network ☒ External ☐ Bluetooth ☒ Artk

arTK Timeout
 1200

External Serial Port Baud Rate
 115200

Save **Cancel**

If the user uses a controller, and establishes a Bluetooth connection, it appears Bluetooth.



Working Mode

Rover **Base**

Current Datalink:
☐ UHF ☐ Network ☐ External ☒ Bluetooth ☒ Artk

arTK Timeout
 1200

Save **Cancel**

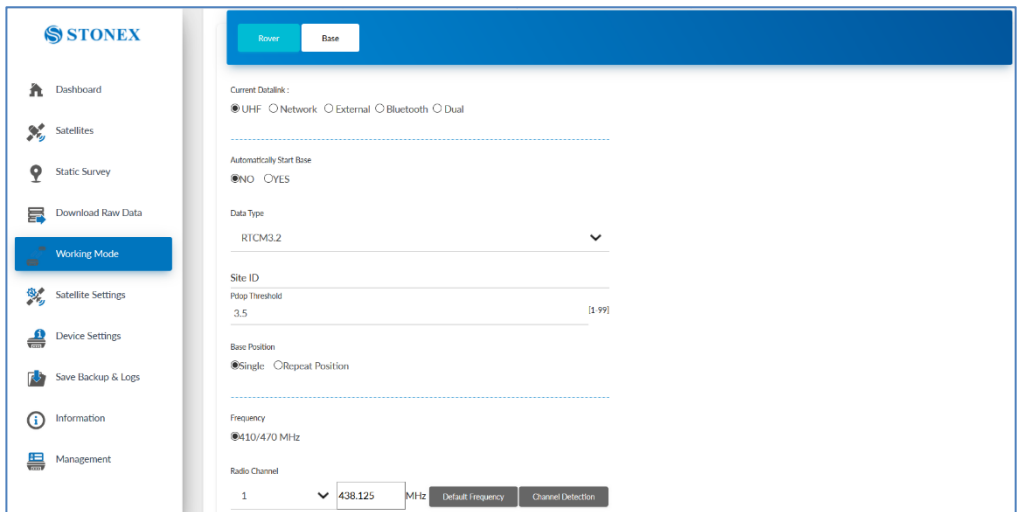
2.5.2 Base

Base mode, additionally to the rover configuration, has some specific parameters to set a base. For example you can set data type, start base, base position and so on.

Important parameters are the position of the base. User can set as Base position Single, if the position of the base is unknown or type directly the coordinates of the base point selecting Repeat Position.

If you select UHF mode, most of the settings are the same as in rover configuration. In addition you can set the radio power. To obtain the best performance it is suggested to set HIGH.

If you select Network, as in the rover mode, is possible to set the data type, site ID, base position and record raw data, APN account, APN user and password, connect mode, caster address and port. Furthermore, the parameters of the coordinates of the base can be set.

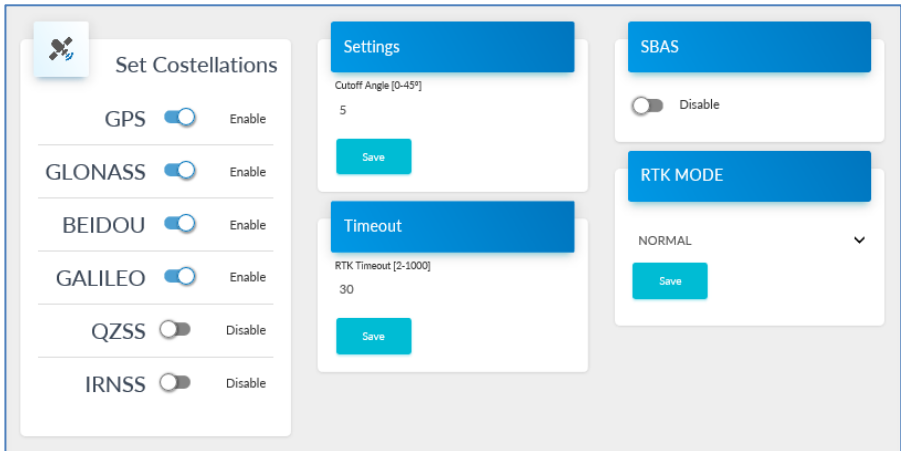


The screenshot shows the STONEX S980A GNSS Receiver software interface. On the left is a sidebar menu with icons and labels for: Dashboard, Satellites, Static Survey, Download Raw Data, Working Mode (highlighted in blue), Satellite Settings, Device Settings, Save Backup & Logs, Information, and Management. The main area has a top bar with 'Rover' and 'Base' tabs, with 'Base' selected. Below this, the 'Current Datalink' section shows radio button options: ☒ UHF, ☐ Network, ☐ External, ☐ Bluetooth, and ☐ Dual. The 'Automatically Start Base' section has radio button options: ☒ NO and ☐ YES. The 'Data Type' section shows a dropdown menu with 'RTCM3.2' selected. The 'Site ID' section has a text input field. The 'Pdp Threshold' section shows a text input field with '3.5' and a unit indicator '[1-99]'. The 'Base Position' section has radio button options: ☒ Single and ☐ Repeat Position. The 'Frequency' section shows radio button options: ☒ 410/470 MHz and ☐ MHz. The 'Radio Channel' section shows a dropdown menu with '1' selected, a text input field with '438.125', and a unit indicator 'MHz'. There are two buttons: 'Default Frequency' and 'Channel Detection'.

2.6 Satellite settings

In this page, you can set the information of satellite systems and the cutoff angle.

In satellite settings, it is possible to set the RTK mode between NORMAL or SureFix. Normal mode for normal survey, SureFix to enable the algorithm that provides more control checks in the calculation of the position.



The screenshot displays the 'Set Constellations' settings page for the Stonex S980A GNSS Receiver. The interface is organized into several sections:

- Set Constellations:** A list of satellite systems with toggle switches and labels: GPS (Enabled), GLONASS (Enabled), BEIDOU (Enabled), GALILEO (Enabled), QZSS (Disabled), and IRNSS (Disabled).
- Settings:** A section for 'Cutoff Angle [0-45°]' with a value of 5 and a 'Save' button.
- Timeout:** A section for 'RTK Timeout [2-1000]' with a value of 30 and a 'Save' button.
- SBAS:** A section with a toggle switch set to 'Disable'.
- RTK MODE:** A section with a dropdown menu currently set to 'NORMAL' and a 'Save' button.

2.7 Device settings

In this page, you can set the time zone, direct link mode, sensor, serial port baud rate, Speaker, Power on/off automatically when connected 5-pin cable, network enable and WIFI hotspot share network, and the NMEA configurations.

The user can set the NMEA output rate message of every NMEA message. Example, GGA message can be set to 1 Hz and GSA to 5 Hz.

General configuration

Time Zone	GMT+8:00	▼
Direct Link Mode	Disable	▼
Sensor	Disable	▼
5-pin Serial Port Baud Rate	115200	▼

Save

Hardware configuration

Speaker	☒
Power on automatically when connected 5-pin cable	☐
Power off automatically when disconnected 5-pin cable	☐
Network Enable	☐
Wi-Fi Hotspot Share Network	☐

Save

NMEA configuration

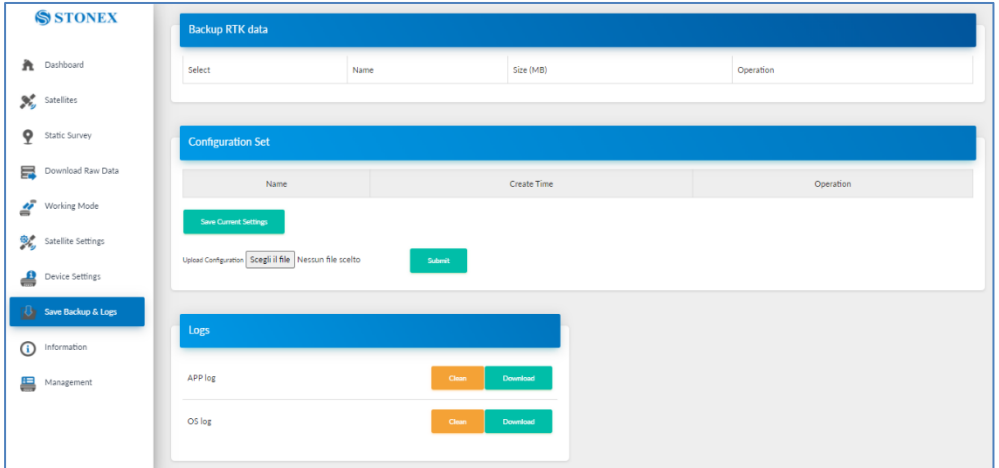
GGA:	1HZ	ZDA:	1HZ	GEDOR:	Off
GSA:	1HZ	GSV:	55	GEREF:	55
GST:	1HZ	VTG:	1HZ	GESNR:	55
RMC:	Off	GLL:	Off	GEVCV:	1HZ

Auto output GNSS PPP message ☒
External Port Output NMEA ☒

Save

2.8 Save Backup & Logs

In this page, you can download the backup data and logs.



STONEX

- Dashboard
- Satellites
- Static Survey
- Download Raw Data
- Working Mode
- Satellite Settings
- Device Settings
- Save Backup & Logs**
- Information
- Management

Backup RTK data

Select	Name	Size (MB)	Operation
--------	------	-----------	-----------

Configuration Set

Name	Create Time	Operation
------	-------------	-----------

Save Current Settings

Upload Configuration Nessun file scelto

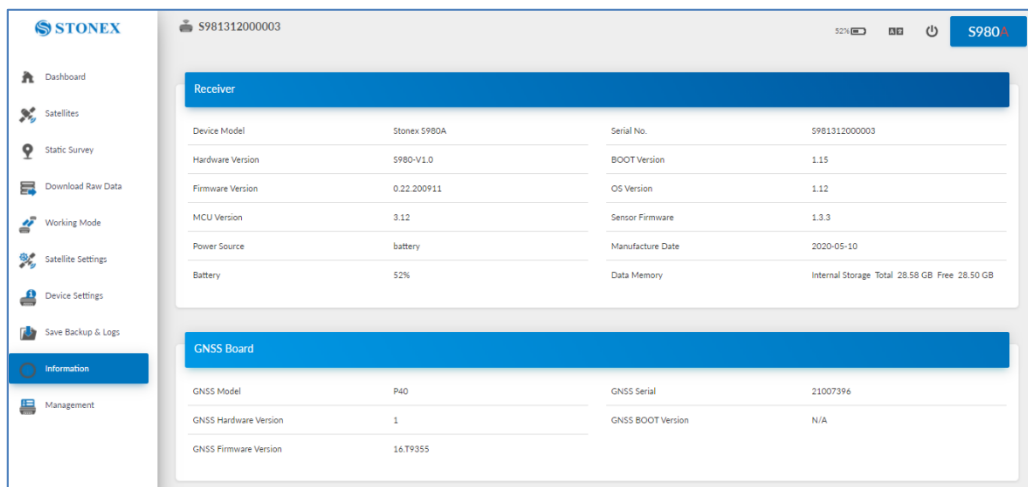
Logs

APP log	Clean	Download
OS log	Clean	Download

2.9 Information

This page displays the receiver specific info such as device model, serial number, firmware version and hardware version. It also displays the antenna info, GNSS board info, Network module and the UHF module information.

The most important information are the firmware versions. It is necessary to check them in the case new versions are available.



The screenshot shows the STONEX S980A web interface. The top bar includes the STONEX logo, the device ID 'S981312000003', a battery status indicator at 52%, and a power button. A sidebar on the left contains navigation links: Dashboard, Satellites, Static Survey, Download Raw Data, Working Mode, Satellite Settings, Device Settings, Save Backup & Logs, **Information** (highlighted), and Management.

The main content area is divided into two sections:

Receiver

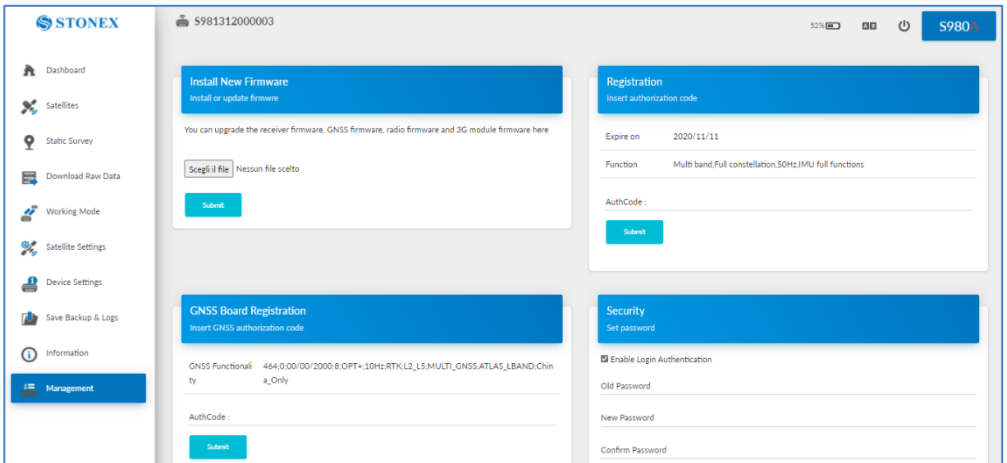
Device Model	Stonex S980A	Serial No.	S981312000003
Hardware Version	S980-V1.0	BOOT Version	1.15
Firmware Version	0.22.200911	OS Version	1.12
MCU Version	3.12	Sensor Firmware	1.3.3
Power Source	battery	Manufacture Date	2020-05-10
Battery	52%	Data Memory	Internal Storage Total 28.58 GB Free 28.50 GB

GNSS Board

GNSS Model	P40	GNSS Serial	21007396
GNSS Hardware Version	1	GNSS BOOT Version	N/A
GNSS Firmware Version	16.T9355		

2.10 Management

In this page you can upgrade the firmware, GNSS board and register the device. Set the password to protect or change the wi-fi connection can be also done in this page. Self-test, format internal disk and restore the receiver to factory settings are other useful options.



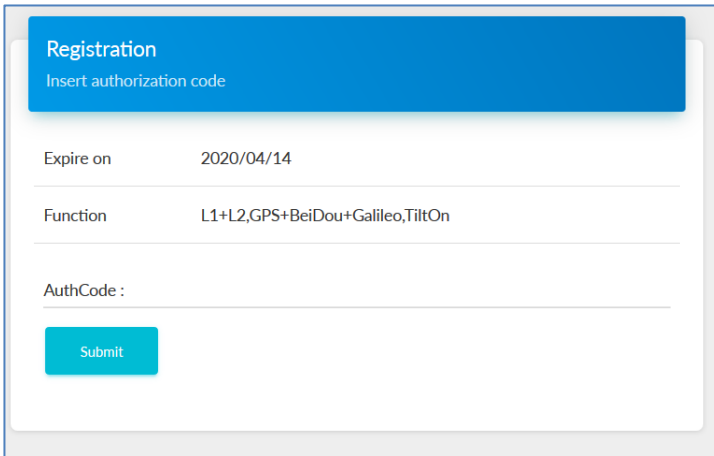
2.10.1 Install new firmware

In the management page of the WEB UI, you can see “Install New Firmware” section, click “browse”, select the file to upgrade the firmware, then click submit, the system will restart to upgrade. After the upgrade, you can view the current “firmware version” in the “instrument information” page.

2.10.2 Device registration

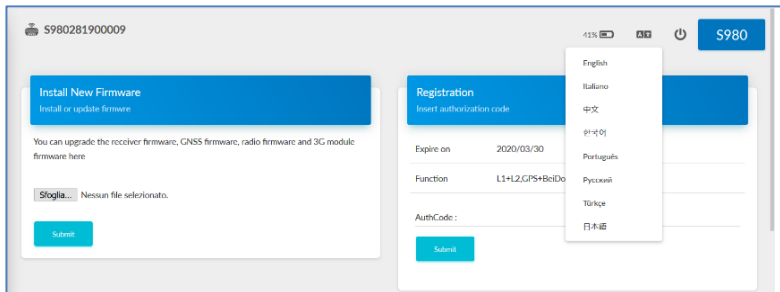
The registration code consists of 32 digits and letters. You can register the device via WEB UI. The detailed steps are the following.

In management page, you can see “Registration”. Enter the registration code and click submit, the registration will be completed. After the successful registration, you can check the expiration time.



2.11 Set the language

In the right-up side of WebUI, there is the language selection option. S980A has 8 languages to set up. They are Italian, Chinese, English, Korean, Portuguese, Russian, Turkish and Japanese.



3. Basic operation

3.1 Power on receiver

Short-press the power button, the power indicator will light on and you will hear one beep, then S980A will be powered on.

Wait up to the next 3 beeps to use the device.

After the 3 beeps the initialization can be considered complete.

3.2 Power off receiver

Long press the power button and release it when all indicators will start flashing and the voice will prompt "power off" (if it is enable) . Then short-press the power button to confirm.

3.3 Check & Switch of the current working mode

Check

When receiver is powered on, short press the power button and then the speaker will broadcast the current working mode and data link.

Switch

When the receiver is powered on, connect it to a handheld or controller and change the working mode following the instructions of the software.

3.4 Receiver Selfcheck

Self-check functionality is an option to check whether every module works normally. When S980A receiver has indicators off or a module doesn't work normally, you can use self-check option to inspect the receiver. S980A self-check consists of six parts, namely GNSS, radio, network, WIFI, Bluetooth and

sensor. The self-check results will be broadcasted in the process. Self-check operation and results are as it follows:

When receiver is powered on, press power button and hold it until the receiver voice broadcasts "power off". Press it again until the receiver sounds a beep and the speaker broadcasts "self-check", which means the receiver starts to operate the self-check procedure. New receiver is recommended to operate self-check at least once.

In the process of self-check, each module inspection is followed by its inspection results. If the module inspection passes, it will broadcast "OK" and module's led keeps on until the whole self-check is completed. If the module inspection fails, it will broadcast current module inspection fail, module's will flash and buzzer sound until you restart the receiver. Self-check lasts for about 1 minute. If there is a self-check failure, please contact local dealer.

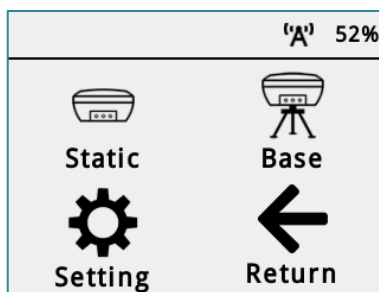
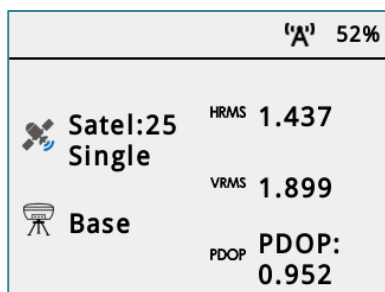
If every module indicator is lit with no flashing, and speaker broadcasts for all the modules "OK" (such as "GPS self-check. OK."), it means they work normally. Receiver starts to work after the whole self-check is completed.

3.4.1 Receiver Selfcheck with Display touch

With the new Stonex S980A, through the display the user can perform the self-check procedure

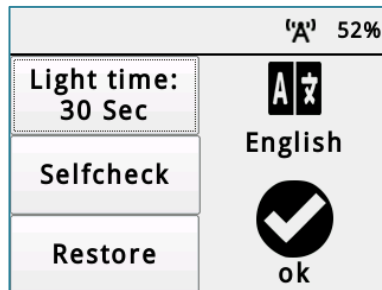
To start the selfcheck follow these steps:

From the **Status** window scroll to the left to open the **Working Mode** menu.



Then select **Setting** option.

Inside the Setting menu click **SelfCheck** to start the procedure.



The selfcheck will start automatically.

Wait until the procedure is complete, then it will be possible to continue working with the device.

3.5 Insert SIM card

If you need to use the SIM card, you have to insert it before powering on the S980A.

Procedure to insert the SIM card:

1. Open the slot on the bottom of the receiver
2. Move the SIM card slot to the left to unlock it
3. Insert the SIM card as shown on the cover slot
4. Close the SIM card slot and move it to the right to lock it.
5. Once it is locked, close the cover slot
6. Turn on the receiver



7. Display Touch Menu

The Stonex S980A is equipped with a Display touch.

Through the touch screen the user can check the status of the receiver, start a static session, start a base via UHF and start a base using an external device (e.g an external radio).

7.1 Status of the receiver

As default on the display, it appears the status of the receiver.

There, it is shown the HRMS, VRMS, PDOP of the current solution.

It shows the status, and the current working mode.

It is also shown the level of the battery.

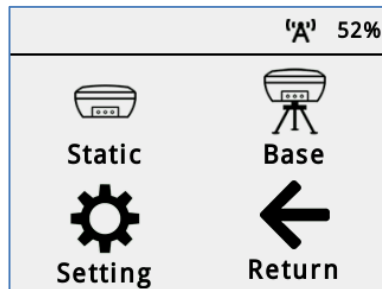
		'A'	52%
	Satel:25 Single	HRMS	1.437
		VRMS	1.899
	Base	PDOP	PDOP: 0.952

*To go back to the previous page in the menu scroll to the right.

7.2 Working mode

Scrolling to the right, the user will have the working mode menu.

There, the user can choose between Static, Base, Setting or return to the status window.

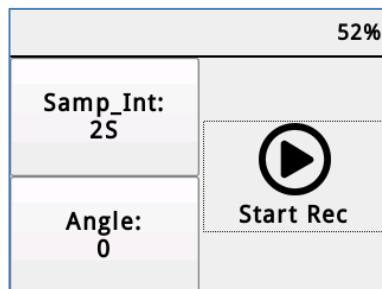


7.3 Static working mode

The user can access to the menu Static. Tap Static to configure it.

Inside it is possible to set the Interval sample and the cut off angle.

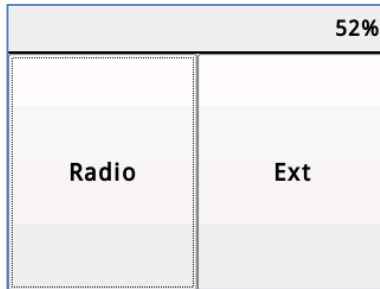
To start/stop the session tap Start/Stop Rec.



7.4 Base

Inside the working mode menu, the user can start a base. Tap Base to configure it.

Inside there will be 2 options, Radio and External (Ext)



7.4.1 Radio Base

Tap Radio to se set:

- Base ID
- PDOP Threshold
- Data Type
- Channel number
- Power level of the radio module
- Protocol type

When the user has set all the parameters, to start the base it is necessary to press Start. To Stop it, tap Stop

52%	
3 441.125Mhz	Power:Low
Protocol: TrimMark III	

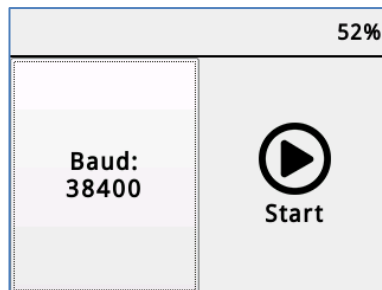
52%	
Base_ID: 1	Data Type: RTCM32
PDOP-Limit: 3.5	 Start

7.4.2 Base external

The user has also the possibility to start a base with an external device.

To do that, in radio mode menu, it is necessary to choose Ext

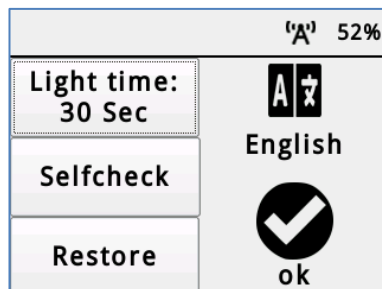
Inside Ext menu the user can set the communication Baud Rate of the external device via 5-Pin LEMO cable.



7.5 Settings

Inside menu Settings, the user can change the light time of the screen, start a self-check, start a Restore Factory Settings or change the Display touch language.

After every change, to confirm it, it is necessary to press OK.



8. New IMU Technology

The New S980A receiver is equipped with the new IMU¹ System that allows tilted measurements (TILT).

It has the following advantages:

- The initialization process is much simpler.

You can use *Stonex Cube-a* field software to calibrate the sensor; Cube-a will ask to initialize the IMU when need it and it will show how to do it. The process is very fast, usually a few seconds for IMU initialization.

- The receiver with integrated inertial navigation module ensures the real-time interference-free tilt compensation.

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

- Fast and precise survey.

It is possible survey and store points with just one measure with slant pole up to 60° (2 cm accuracy up to 30°, 5 cm accuracy up to 60°).



1.Optional activation

8.1 IMU with Stonex Cube-a

8.1.1 Sensor Activation and Configuration

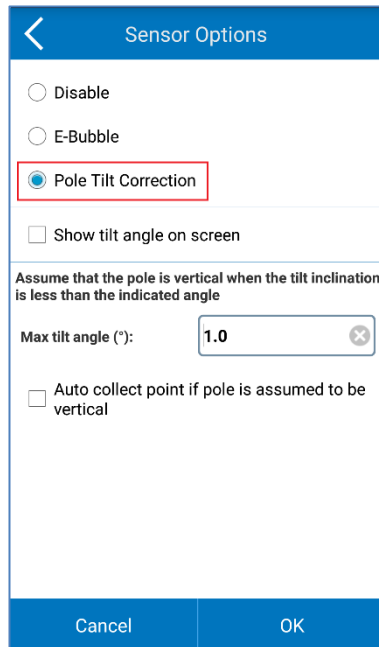
To use the S980A with new IMU technology it's necessary to enable the feature in the specific options menu.

Before using the receiver to collect points with the pole tilted, check if the pole tilt correction functionality has been enabled.

With Stonex Cube-a, follow this path to find the configuration menu:

Configure → System Settings → Sensor Options.

There, enable the **Pole Tilt Correction**.



Sensor Options

☐ Disable

☐ E-Bubble

☒ Pole Tilt Correction

☐ Show tilt angle on screen

Assume that the pole is vertical when the tilt inclination is less than the indicated angle

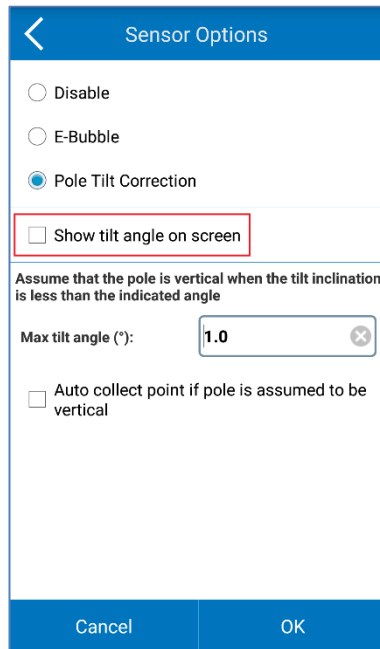
Max tilt angle (°):

☐ Auto collect point if pole is assumed to be vertical

Cancel OK

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

To show this information, flag the relative check box inside the Sensor Option menu.



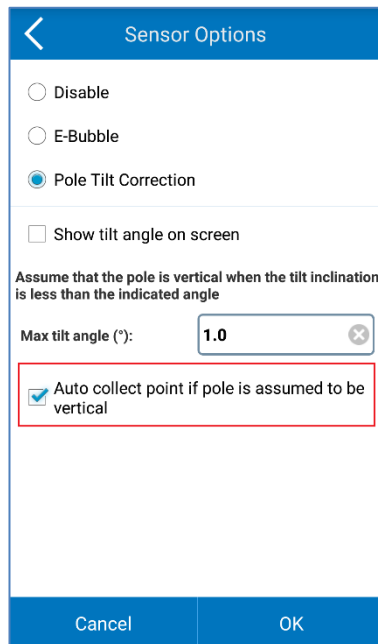
The user can also define the verticality tolerance of the instrument.

It means, the maximum value of the (sensor) tilt angle that the software shall accept when checking for the pole verticality.

The value is in decimal degrees.

Example: 0.3 means $\pm 0.3^\circ$ from true (local) verticality.

Finally, there is also the possibility of collect points automatically when the pole is considered vertical.



< Sensor Options

☐ Disable

☐ E-Bubble

☒ Pole Tilt Correction

☐ Show tilt angle on screen

Assume that the pole is vertical when the tilt inclination is less than the indicated angle

Max tilt angle (°):

☒ Auto collect point if pole is assumed to be vertical

Cancel OK

8.1.2 Initialization

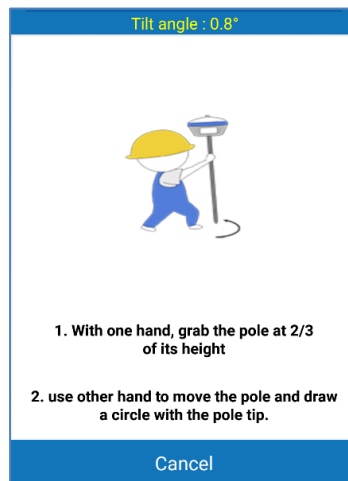
After the activation of the sensor, go in Survey mode.

If the sensor is not ready to work yet, Cube-a will show you which operations are necessary to perform its initialization.

There is a necessary pre-requisite to use the IMU: the status of the GNSS solution must be **Fixed** (Fixed, aRTK Fixed, Surefixed or ExtraSafe Fixed).

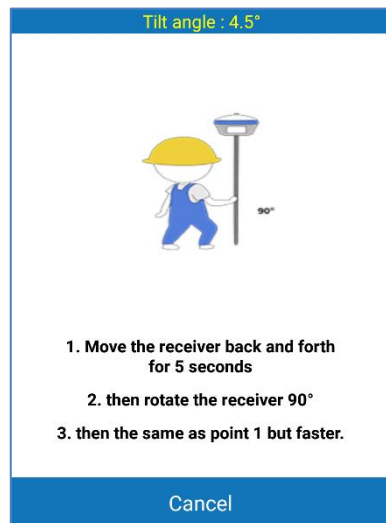
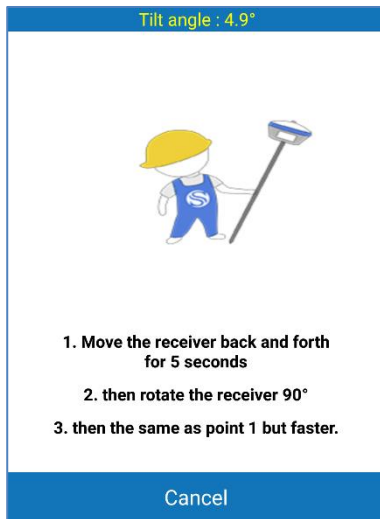
When, and only when, the receiver is in Fixed, and if the sensor needs to be initialized, two different screens could show up.

The first screen pops up seldomly: it lets the sensor adjust for the local magnetic field. Just rotate the pole with the device as shown in the picture below.



The second screen lets the sensor 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 system about 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 position to get lower RMS values and then repeat the two steps.

It could happen that during the survey, the screens show up: this means that the IMU accuracy has degraded and it's necessary to adjust it: shake the receiver for a few seconds and it will be ready to continue working.

8.1.3 RMS Study and Sensor Calibration

You can check the accuracy of the tilt compensation through the RMS quality check.

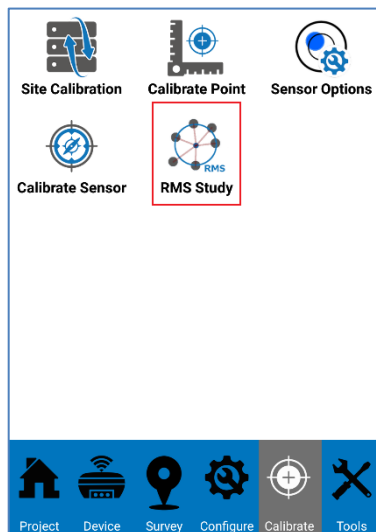
If the accuracy (RMS) is good, then you can continue working. If the accuracy (RMS) is not good, then calibrate the sensor using the Calibrate Sensor tool.

The RMS Study performs the study of the quality/accuracy of repeated measures (keep the pole tip at the same exact position on the ground).

How to use it?

Open the **Calibrate** menu, then select the **RMS Study** command.

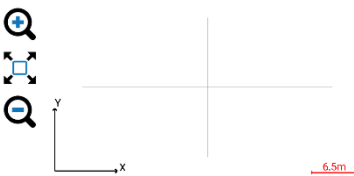
When inside the RMS Study screen, click **Start** to collect the measures.



The application will collect measures/positions at an average frequency of 1Hz. Collected positions will be averaged and RMS values will be computed.

The RMS values let the user to verify if the accuracy of the device falls within some required accuracy upper limit. If the RMS values are not satisfactory then the user can, and he should, proceed with the calibration.

Tilt angle : 0.5°

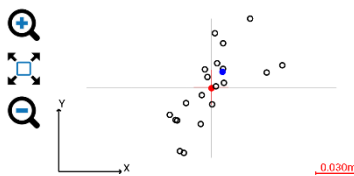


☒ Use the first point as the reference point

Number of points	0
Easting StdDev	-
Northing StdDev	-
Height StdDev	-
Average Easting	-
Average Northing	-

Clear	Delete last	Add
Start	Cancel	Save

Tilt angle : 4.9°



☒ Use the first point as the reference point

Number of points	21
Easting StdDev	0.019
Northing StdDev	0.023
Height StdDev	0.017
Average Easting	514247.961
Average Northing	5045444.463

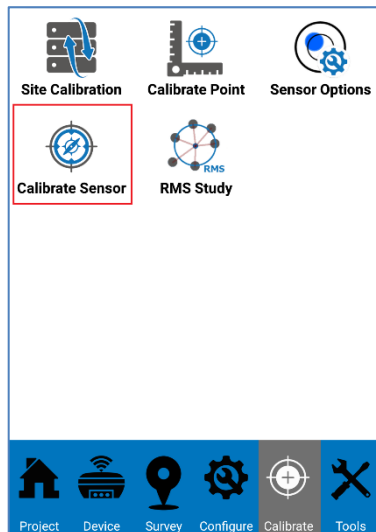
Clear	Delete last	Add
Start	Cancel	Save

The user has the control of the number of sample positions used in the RMS calculation. When the user decides to complete the check, he can press **Stop** to stop the automatic position acquisition.

As said, if the RMS values are not satisfactory then the user can, and he should, proceed with the sensor calibration.

This operation is also suggested when the user changes the pole height and/or the pole type (there could be a change in the straightness of the pole).

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

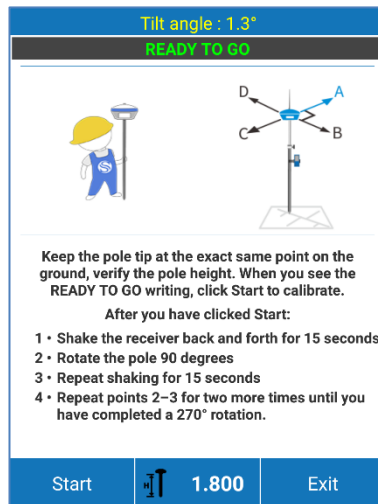


Follow the instructions shown to perform the calibration.

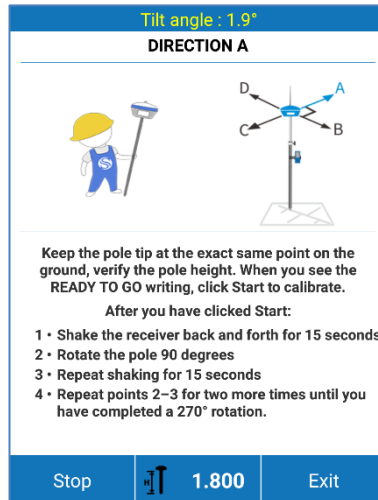
A **Fixed** GNSS solution is mandatory.

Check the antenna height: a wrong antenna height will make the calibration not accurate.

Wait for the message **Ready To Go**, start the calibration by clicking on the **Start** button.



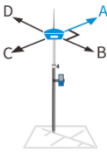
As shown in the picture below, to calibrate correctly the sensor, it's necessary to choose an arbitrary first direction as a reference (direction A), then start to move the receiver back and forth along that direction and until a message asking to change the direction appears.



Rotate the receiver 90 degrees clockwise, reaching the direction $A+90^\circ = B$, and continue to move back and forth the device.

Tilt angle : 1.5°

ROTATE OF 90° - A → B

Keep the pole tip at the exact same point on the ground, verify the pole height. When you see the **READY TO GO** writing, click Start to calibrate.

After you have clicked Start:

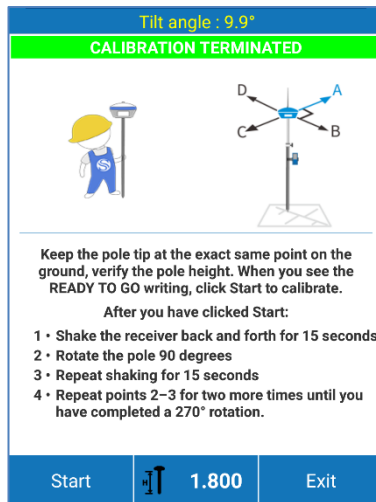
- 1 • Shake the receiver back and forth for 15 seconds
- 2 • Rotate the pole 90 degrees
- 3 • Repeat shaking for 15 seconds
- 4 • Repeat points 2~3 for two more times until you have completed a 270° rotation.

Stop
 **1.800**
Exit

This operation must be repeated for 3 times, thus every 90 degrees up to a total of 270° clockwise.

After moving the device back and forth along the direction D, the message **Calibration Terminated** will appear.

If the calibration fails, an error message will be shown. In this case, repeat the calibration procedure.



9. Accessories

9.1 Carrying case

The external appearance of the transport container is shown in the picture here below.



9.2 Standard accessories

P/N	Description
B10+150208	S980A GNSS, 800Ch, 4G, UHF 2/5W, WiFi, BT, - Bundle
30-350292	Power adapter with 4 plugs
30-350293	Charging Cable USB type C
30-350300	USB A to USB C
30-350063	Measuring tape 3m (MT-300)
30-350335	Carrying case for S980A (CC-980)
30-350176	Height measuring plate for GNSS (HM-100)
30-350084	UHF antenna, 430MHz-450MHz, TNC, 29cm (AR-430)
n/a	SW Cube-link
n/a	Pen Drive set 8Gb with Manual & Video Tutorial

10. Technical specification

RECEIVER

Satellite Signal Tracked	GPS: L1 C/A, L1C, L1P, L2C, L2P, L5
	GLONASS: L1C/A, L1P, L2 C/A, L2P, L3
	BEIDOU: B1, B2, B3, ACEBOC
	GALILEO: E1, E5A, E5B, ALTBOC, E6
	QZSS: L1 C/A, L1C, L2C, L5, L6
	IRNSS: L5
	SBAS: L1, L5
L-Band	Atlas H10 / H30 / Basic (optional) ⁵
Bridging of RTK outages	aRTK - Works up to 20 minutes
Channels	800
Position Rate	10 Hz (optional 20-50Hz) ⁵
Signal Reacquisition	< 1 s
RTK Signal Initialization	Typically < 10 s
Hot Start	Typically < 15 s
Initialization Reliability	> 99.9 %
Internal Memory	32 GB
Tilt sensor	E-Bubble
	IMU (optional) ⁵

POSITIONING¹

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 ²	
Accuracy	0.60 m RMS
REAL TIME KINEMATIC (< 30 Km) – NETWORK RTK ³	
Fixed RTK Horizontal	5 mm + 1 ppm RMS
Fixed RTK Vertical	10 mm + 1 ppm RMS
RTK Signal Initialization	2 to 8 seconds

INTEGRATED GNSS ANTENNA

High accuracy four constellation micro-strip antenna, zero phase center, with internal multipath suppressive board

INTERNAL RADIO 2-5 WATT

Type	Tx - Rx
Frequency range	410 – 470 MHz
Channel Spacing	12.5 KHz / 25 KHz
Range	5 Km in urban environment Up to 15 Km with optimal conditions ⁴

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
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COMMUNICATION

I/O Connectors	5 pins Lemo, connect the external power supply and external radio Type-C, for receiver power supply and data transfer 1PPS port GNSS port for external antenna
Bluetooth	2.1 + EDR, V4.1
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 device with WI-FI capability
Reference outputs	RTCM 3.0, 3.2 CMR, CMR+, DGPS
Navigation outputs	NMEA 0183

POWER SUPPLY

Battery	Internal Rechargeable 7.2 V – 13.600 mAh
Voltage	9 to 28 V DC external power input with over-voltage protection (5 pins Lemo)
Working Time	Up to 10 hours
Charge Time	Typically 4 hours

PHYSICAL SPECIFICATION

Dimensions	φ 151 mm x 92 mm
Weight	1.48 Kg
Operating Temperature	-40°C to 65°C (-40°F to 149°F)
Storage Temperature	-40°C to 80°C (-40°F to 176°F)
Waterproof/Dustproof	IP67
Shock Resistance	Designed to endure to a 2 m pole drop on concrete floor with no damage
Vibration	Vibration resistant

Specifications are subject to change without notice

1. 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 is the baseline, the longer must be the occupation time.
2. Depends on SBAS system performance.
3. Network RTK precision depends on the network performances and are referenced to the closest physical base station.
4. Varies with the operating environment and with electromagnetic pollution.
5. Optional, it can be activated via activation code.

Appendix 1: Default Radio configuration

The internal radio TRM 501 can transmit in the 410-470 MHz band; users can choose radio channel and radio protocol through the handheld software or WEB interface. The default frequencies of each channel are shown in the following table.

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

Main features and general performance of the internal radio are summarized below.

General performance		
Frequency range	Fixed frequency: 410-470 MHz	
Working Mode	Half-Duplex	
Band width	12.5 KHz, 25 KHz	
Modulation scheme	GMSK	
Working Voltage	7.5 V	
Transmitter		
RF output power	Power (5.0 W)	37 Bm@DC 7.5 V
	Power (2.0 W)	33 Bm@DC 7.5 V
Modem		
Rate	9600bp, 19200bps	
Modulation	GMSK	

The S980A can be ordered with radio power limited of low (2 W) or with both power output options (Low 2W. and High 5W). Please check before to make the order using the specific part numbers, in respect of the local legislation.

Appendix 2: Copyrights, warranty and environmental recycling

Copyrights and trademarks

© 2020, STONEX® Limited. All rights reserved.

STONEX®, the STONEX® logo, and S980A GNSS receiver are trademarks of STONEX® Limited.

STONEX® *Cube-a* and *Stonex® Cube Link* are trademarks of STONEX® Limited.

Bluetooth is a trademark owned by Bluetooth SIG, Inc. and licensed to Trimble Navigation Limited. All other trademarks are the property of their respective owners.

Release Notice

This is the October 2020 release of the STONEX® S980A 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.

Standard Limited Warranty

Version 2020

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® warrants 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 period shall apply).

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

The warranty period starts from date of first sale of the instruments. At its sole discretion, under the warranty period, STONEX® will repair the product or send parts for replacement at its expense. STONEX® agrees to repair or replace the defected instrument within thirty (30) days only if STONEX® Europe recognizes that the defects of the instrument are not caused by human factors or no obvious damage to its surface is visible. STONEX® warrants any new replaced parts or products are warranted to be free from defects in materials and workmanship for thirty (30) days or for the remainder of the Limited Warranty Period of the Product in which they are installed, whichever is longer. Faulty Parts or Products replaced under this Limited Warranty shall become property of STONEX®. All products that have to be repaired have to be returned to our technical representative office location via any delivery company the customer prefers, nevertheless STONEX® is not accountable for the unlikely event that the Products gets lost in transit. Any damage inflicted by the customer or by third party after the products has been delivered to the customer is excluded from the limited warranty as well any damage arising from an improper use, from any action or use not provided for in the enclosed user guides and/or manuals.

Shipping policy

The Customer or the dealer is required to pay for the charges for shipping of fault parts or instruments to STONEX® representative office and STONEX® is providing the shipping for return. Dealers need to follow STONEX® repair/service procedure to achieve a better and prompt service result.

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 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. Customer has to 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 as for hardware. Dealers need to follow STONEX® repair/service procedure to achieve a better and prompt service result.

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. Firmware/software Fix means an error correction or other update created to fix a previous firmware version that substantially doesn't conform to the instruments specification.

Over Warranty repair(s) policy

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

Disclaimer and Limitation of Remedy

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. Customer must read and follow all set-up and usage instructions in the applicable user guides and/or manuals enclosed. If customer fails to do so, this product may not function properly and may be damaged. Customer may lose data or sustain personal injuries. Stonex®, its affiliates and suppliers do not warrant that operation of this product will be uninterrupted or error free; as do all electronics at times. If this product fails to work as warranted above, customer's sole and exclusive remedy shall be repair or replacement. In no event will Stonex®, its affiliates or suppliers be liable to customer or any third party for any damage in excess of the purchase price of the product. This limitation applies to damages of any kind whatsoever including (1) damage to, or loss or corruption of, customer's records, programs, data or removable storage media, or (2) any direct or indirect damages, lost profits, lost savings or other special, incidental, exemplary or consequential damages, whether for breach of warranty, contract, tort or otherwise, or whether arising out of the use of or inability to use the product and/or the enclosed user guides and/or manuals, even if Stonex, or an authorized Stonex® representative, authorized service provider or reseller has been advised of the possibility of such damages or of any claim by any other party. Some jurisdictions do not allow the exclusion or limitation of incidental or consequential damages for some products, so the exclusions or limitations may not apply to customer. This limited warranty gives customer specific legal rights, and customer may also have other rights which vary from country/state/jurisdiction to country/state.

Instruments

STONEX® Products:

- Stonex S980A GNSS receiver: 2 years

Accessories

Accessories and specific parts warranty

For accessories provided by Stonex with the instruments S980A GNSS the following general warranty time is for reference:

- Accessories: 1 year.

Environmental recycling

The cardboard box, the plastic in the package and the various parts of this product have to be recycled and disposed of in accordance with the current legislation of your Country.

For countries in the European Union (EU)

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

Contact Local Authorities to obtain practical information about correct handling of the waste, location and times of waste collection centre. 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 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.



For countries outside European Union (EU)

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

Appendix 3: Safety Recommendations

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 damage to propriety. In particular, observe safety instructions that are presented in the following form:

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

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

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 a certification or license for the equipment in the country of use.

Instrument Approval

Covers technical features of the equipment relatives 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 modified the equipment to be subjected to grant.

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

UHF 410-470 MHz Data transceiver

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 on 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

For USA

The FCC has adopted a safety standard for human exposure to radio frequency 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) of 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

For Europe

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

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

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

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

Bluetooth/WiFi 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 match 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/WiFi may be restricted in some special situations or place, like aircraft , hospital ,etc. If you are unsure of existence of restrictions, you should ask for authorization before switching on the Bluetooth radio.

Raccomandation for installing antennas for internal radios

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 are intended to minimize the risk of personal injury and/or damage to propriety. In particular, observe safety instructions that are presented in the following form:

CAUTION

For your own 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.

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.

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 it can result in personal injury or damage to properties.

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 create damage at the rechargeable Lithium-ion battery.

A damaged battery can cause an explosion, with 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, 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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