



STONEX S9i GNSS Receiver **User Manual**



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1. Introduction to Stonex S9i GNSS

This chapter is mainly used to introduce the key features and the appearance of S9i.

S9i brings several technical news, like the new electronic bubble for levelling or the double battery system for battery hot swap without powering off the receiver .

If you are not familiar with GNSS technology, we suggest you to read a specific book in order to understand in the best way the contents of this manual. Anyway, you can ask for any technical support by sending an email to our address support@stonex.it or contacting your local dealer.

2. Key features

Designed and developed by a group of excellent developers, S9i has many technical innovation.

All of the innovation are studied to complete the survey quickly and with high efficiency. These main innovation be summarized in following 5 points:

(1) Electronic bubble

S9i uses electronic bubble technology. The bubble is visualized on the controller display. Thanks to the electronic bubble user doesn't need to check the liquid bubble (mounted on the pole) before to record a point since point recording is allowed only when the pole is vertical.

(2) WIFI wireless connection

When WIFI function is active, S9i can be used like hotspot. You can connect your phone to the receiver via WIFI. Using the WEB UI is possible to change configurations of the receiver, like set the work mode (base-rover-static) set the datalink (GSM-UHF-Bluetooth) or download record static data and other.

(3) Dual mode Bluetooth

S9i supports Bluetooth technology, allowing connection to mobile phone, windows mobile controller, digital consume products.

(4) Double backup of the survey data

S9i provide double back-up of data, both on the controller and on the receiver (in raw format) so to make the survey safe and reliable.

(5) Compatible with all satellite constellations

S9i can track all the available satellite constellation, GPS-Glonass-Beidou-Galileo.

Additional technical innovation is the double battery system, allowing hot swap without switching off the receiver.

In addition there are some other nice characteristics:

(1) Compact and lightweight design.

The dimensions of S9i are: diameter 15.9cm × height 8.9cm. Weight is just 1.2kg. The compact and light weight design allow easy transport of it.

(2) Advanced datalink

The UHF radio module is compatible with the main RTK products in the market and allow usage with other brand of RTK products. The 3.75G modules support WCDMA and GPRS technology. It can continuously and stably connect with reference stations.

(3) Innovation double high-capacity batteries

3400mAH high capacity battery. The double batteries design ensures long worktime on field.

(4) 20HZ high-speed acquisition

S9i supports maximum 20HZ data rate acquisition.

(5) Large capacity storage

In addition to 4GB of internal memory, S9i also supports storage expansion up to 32GB (by micro SD card).

3. S9i mainframe

The mainframe of S9i is a flat cylindrical, 89mm in height, 159mm in diameter. The front side has 2 functional buttons and 6 indicators. The back side house the battery compartment. Here there are two slots, the first for SIM card and the second for Micro SD card.

On the bottom of the receiver are located the UHF radio and GSM antenna connector, a 5 pin external power interface and a 7 pin RS232/USB interface.

3.1. Front side of the mainframe

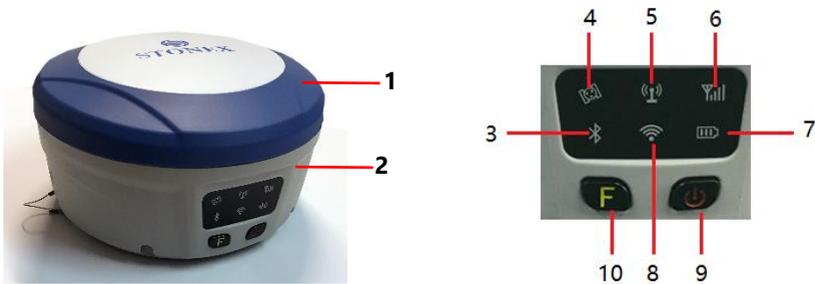


Figure 3 - 1 Front panel

Number	Name	Function
1	Top housing	Protect the antenna
2	Lower housing	Protect the receiver in case of drop.
3	Bluetooth led	It will be light when S9i is connected via Bluetooth.
4	Satellite led	How many time it blinks, means how many satellites are locked, cycle once every 5 seconds.
5	Radio led	When the receiver is transmitting/receiving radio signals, it will blink.
6	Network led	It will blink when S9i is receiving network signals from Cors
7	Power led	After the S9i turn on, the led always

		light and monitor the remaining energy.
8	WIFI led	light when the S9i is connected with WIFI.
9	Function key	Selection key
10	Power key	Power on/off the receiver.

Satellite led (green)

It shows the amount of locked satellites; when the receiver links one or more satellites signals it will start to blink every 30 seconds for a number of times equal to the number of locked satellites. When the receiver doesn't lock satellites, the satellite led does not shine.



Figure 3 - 2 Satellite led

UHF internal radio led (green)

This led is ON when UHF internal radio is selected as RTK datalink. It is blinking when it is transmitting data in base mode or receiving data in rover mode.



Figure 3 - 3 Internal radio led

Network led (green)

This light is on when GSM/GPRS module is selected as RTK datalink. It starts to blink when there is data transfer ongoing (download in rover mode and upload in base mode).



Figure 3 - 4 Network led

Bluetooth led (blue)

Once you have connected the receiver to the handheld via Bluetooth, this led will be on. This led is switched off Bluetooth is not connected .



Figure 3 - 5 Bluetooth led

WIFI led (green)

This led will on when you turn on the WIFI function. When you turn off the WIFI function, this led does not shine.



Figure 3 - 6 WIFI led

Internal power led (green and red)

When you power on the S9i, the power led will be on. According to the remaining quantity of power in the battery, it monitor three kinds of status:

1. Green: power supply in good condition.
2. Red: low power (below 20%).
3. Red blinking and beeping: very low power (below 10%).

Note:

Usually when the light is red you have still one hour of power reserve. External power and internal battery share same power light. When external power is used, the led indicates the external power level. When the power is below 10%, the red led will flash and you also hear three beeps every 60s.

3.2 Back side of the mainframe



Figure 3 - 7 S9i back side

Number	Name	Function
1	Battery compartment cover	Protect the battery
2	Compartment locker	Open/lock the cover
3	SIM card slot	Put and read SIM card
4	Micro SD card slot	Put and read Micro SD card

Installing/Uninstalling SIM card and microSD card

To install the SIM card, push the SIM card holder left. With the SIM card's chip side facing down put the card into the slot. Close the holder then. The microSD card installation is similar to the SIM card installation.

To remove the SIM card and microSD card, push the holder and then take out the card.

Note: When you select network mode to work, you need to install SIM card.



Figure 3 - 8 Installing/uninstalling SIM/microSD card

Installing/Uninstalling battery

To install the battery, push the compartment locker, insert the battery into the battery compartment, then lock the compartment locker.

To remove the battery, push the compartment locker and then take out the battery.



Figure 3 - 9 Installing/uninstalling the battery

3.3 The bottom of mainframe



Figure 3 - 10 S9i bottom



Figure 3 - 11 5-PIN interface



Figure 3 - 12 7-PIN interface

Number	Name	Function
1	Network antenna interface	Connect to network antenna
2	Radio antenna interface	Connect to radio antenna
3	5 pin interface	Connect to external radio and external battery
4	7 pin interface	USB port, also can connect to the controller via the multi-function cable
5	Beeper	Broadcast voice message

4. Basic operations of S9i

In this section, we highlight the basic operations of S9i like setting for base and rover, the operation of functional key, how to change the work mode and datalink, how to start self-test procedure.

4.1 The installation of base and rover

The installation of base

1. Install the tripod on the chosen position, level it and attach the receiver into tribrach.
2. Attach the transmitting radio antenna into the "UHF" connector. If you are using a direct GSM connection, you should attach the GSM antenna into "UMTS" connector.
3. Switch on the receiver and select the base working mode. If it is not correct, please see next paragraph 2.3 for understanding how to select the correct working mode or you can change it later using the handheld survey software.
4. Switch on the handheld and start the software for the selected datalink configuration. It is possible to make the settings also by Web UI function.

The installation of rover

1. Fix the bracket on the pole, fix the handheld to the bracket, put the rover on the pole and attach receiving antenna into the port "UHF" or GSM antenna into the port "UMTS", depending on the connection used.
2. Power on the receiver and select the rover working mode. If it is not correct, please see next paragraph 2.3 for understanding how to select the correct working mode or you can change it later using the handheld software.
3. Switch on the handheld and start the survey software.

Note: If you want to take very accurate measures (around or below cm accuracy), we recommend you to use a tripod also for the rover.

4.2 The operation of keys

There are 1 power key and 1 function key in the mainframe; the operations are as follows.

Power key

The main function of power key is power on/off and “confirm button”.

- Power on: when the mainframe is in the OFF status (no light), press the power key, and then the mainframe will enter the initialization status. Then you will hear 3 beeps and an audio feedback (if enabled) reporting the current receiver status .
- Power off: when the S9i mainframe is in the ON status (power supply light ON), press and hold power key for few seconds until all lights blink, then release the power key. An audio feedback report “If you want to turn off the device”. Press the power key to confirm and S9i will be turned off.

F key: Function key

It could switch the working mode (static, base or rover) and RTK datalink (built-in radio, external and network). Press the F key lightly, it will broadcast the current receiver status.

4.3 Switch work mode and datalink

It is possible to switch work mode and datalink via the receiver or via controller running survey software. Switch desired work mode first (it includes base, rover, and static). Then select the datalink (GSM- internal UHF- External UHF radio)

1. Keep press the F key and Power key until all lights blinking at the same time, then the mainframe will voice broadcast to select work mode. Release F and power keys and then press the F key to select the wanted working mode: every time you press the F key, the mode will switch to another mode (static, base and rover). Press the power key to confirm the selection
2. After setting work mode, the mainframe will voice broadcast to select the datalink. Press the F key to select the datalink: every time you press the F key, it will switch to one of three datalink modes (radio, external and network). When the receiver switch to the datalink mode you want, press the power key to confirm.

3. Then the mainframe will voice broadcast "set WIFI". Press the F key gently, then there will be a voice broadcast "WIFI enable" or "WIFI disable". Press the power key to confirm, and there will be a voice broadcast "set successfully".
4. Finally, press the F key gently, voice broadcast the mainframe current working mode and datalink status.

Note: It is possible to switch work mode and datalink using Web UI function.

4.4 Self-checking

If the indicators are abnormal or the receiver can't work normally, for example if the Bluetooth can't be connected or the radio mode does not work you can use the automatic self-checking functions to detect the failure. Self-checking will check GPS, radio, GSM, Bluetooth, WIFI and sensor. This process has voice guide reporting the status of the module.

1. When the receiver is in powered on status, press and keep the power key until a voice broadcast "if you want to turn off the device", then release the power key. Keep press the power key again until you hear a beep . Now a voice broadcast "start self-checking" , release the power key and self check will start .
2. In the process of device self-checking, there will be voice broadcast the test results. If the module checking is successful, voice broadcast "success" and the led always on until the self-checking is completed. If the module checking fails, voice broadcast "self-checking fails", the led will continue blink and the buzzer beeps until you restart S9i. Self-checking procedure require about 1 minute.
3. If all module leds are ON (not blinking) and voice broadcast that the self-checking success (for example "self-checking GPS success"), it means the modules could work normally.

Note: After self-checking, built-in radio frequency will return to factory settings. If necessary, please contact your local dealer to change the frequency to match your usage.

4.5 Measure the antenna height



Figure 4 - 1 Altimetry line

Base and Static mode antenna height measurement

The main used method of antenna height measurement are :

Slant Height : You can measure from the ground to the altimetry line of the mainframe,

Antenna vertical height: standard measure from the ground (known point) to bottom of receiver.

Rover mode antenna height measurement

Measure methods of rover mode includes pole height, straight height and slant height.

(1) Pole height, the height of the carbon pole, we can read it from the pole, then input to the software.

(2) Straight height, including the antenna phase center height. Straight height = the height from ground to bottom of mainframe + antenna phase center to the bottom of mainframe.

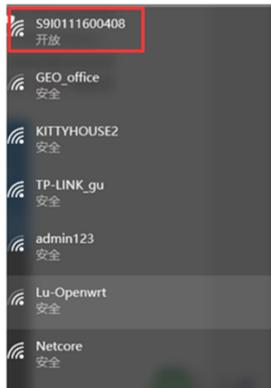
(3) Slant height, measure from ground to the altimetry line of the mainframe. Select slant height in the software, then input the height you measured.

5. Web UI function

S9i has WIFI function that works as a hotspot with Phone, controller, PC and other devices. The default WIFI name is device number, there is no password for WIFI.

Before using this function, you should make sure the WIFI function is available. If the WIFI led is ON, it means the WIFI function is enable. If the WIFI led is OFF, you should open the WIFI function first (refer to the paragraph 2.3 to open the WIFI function).

After you open the S9i WIFI function, you could search the hotspot via phone/PC/controller. The hotspot name is the S9i serial number (This WIFI don't have the internet access, you could just login the web page to view the receiver status and set modes).



After connecting the WIFI, input IP "192.168.10.1" into your web browser to open. Then it will pop up a window. It ask for log account and password, default is:

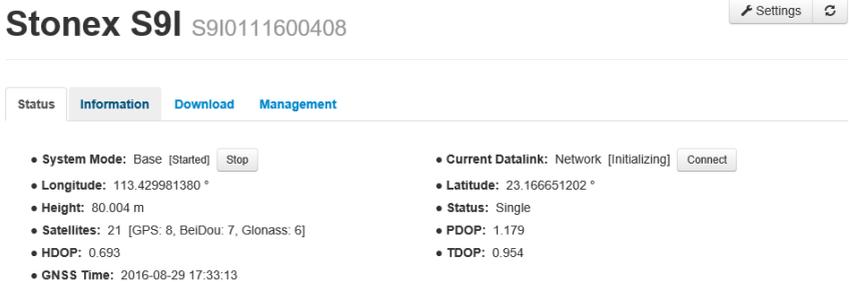
Account: admin

Password: password

The Web UI contains Status, Information, Download, Management, and Settings. It also can show the device number in the web.

5.1 Status

In Status, you can see the current work status of the receiver, some basic information. Such as system mode, current datalink, coordinate, satellites, solution and so on. The detailed information you can see from the picture.



Stonex S9i S9I0111600408 Settings

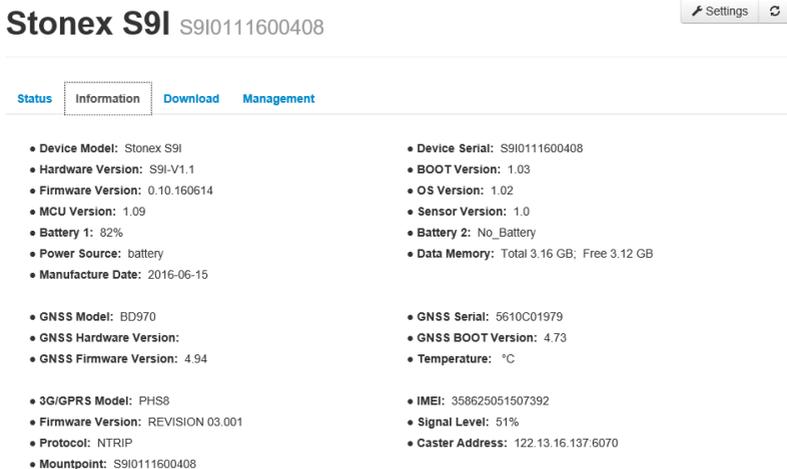
Status | Information | Download | Management

- **System Mode:** Base [Started] Stop
- **Longitude:** 113.429981380 °
- **Height:** 80.004 m
- **Satellites:** 21 [GPS: 8, BeiDou: 7, Glonass: 6]
- **HDOP:** 0.693
- **GNSS Time:** 2016-08-29 17:33:13
- **Current Datalink:** Network [Initializing] Connected
- **Latitude:** 23.166651202 °
- **Status:** Single
- **PDOP:** 1.179
- **TDOP:** 0.954

Figure 5 - 1 Status

5.2 Information

Then it's the "Information", this menu shows the information inside the receiver, such as firmware version of the receiver, GNSS firmware version, GSM mode information, sensor version, battery information and so on.



Stonex S9i S9I0111600408 Settings

Status | **Information** | Download | Management

- **Device Model:** Stonex S9i
- **Hardware Version:** S9i-V1.1
- **Firmware Version:** 0.10.160614
- **MCU Version:** 1.09
- **Battery 1:** 82%
- **Power Source:** battery
- **Manufacture Date:** 2016-06-15
- **Device Serial:** S9I0111600408
- **BOOT Version:** 1.03
- **OS Version:** 1.02
- **Sensor Version:** 1.0
- **Battery 2:** No_Battery
- **Data Memory:** Total 3.16 GB; Free 3.12 GB
- **GNSS Model:** BD970
- **GNSS Hardware Version:**
- **GNSS Firmware Version:** 4.94
- **GNSS Serial:** 5610C01979
- **GNSS BOOT Version:** 4.73
- **Temperature:** °C
- **3G/GPRS Model:** PHS8
- **Firmware Version:** REVISION 03.001
- **Protocol:** NTRIP
- **Mountpoint:** S9I0111600408
- **IMEI:** 358625051507392
- **Signal Level:** 51%
- **Caster Address:** 122.13.16.137:6070

Figure 5 - 1 Information

5.3 Download

“Download” is for downloading raw or rinex data files. The format of raw data is “.dat”.

Stonex S9i S9I0111600408 Settings

Status **Information** **Download** **Management**

Select	Name	Size	Start Time	End Time	Operation
<input type="checkbox"/>	_.1232111	3.964M	2016-07-29 09:54:58	2016-07-29 10:14:40	
<input type="checkbox"/>	_.1232112	14.355M	2016-07-29 10:40:56	2016-07-29 11:58:43	
<input type="checkbox"/>	_.1232113	16.085M	2016-07-29 13:46:28	2016-07-29 15:13:20	
<input type="checkbox"/>	_.1232114	539.825K	2016-07-29 15:39:03	2016-07-29 15:41:55	
<input type="checkbox"/>	_.1232115	221.912K	2016-07-29 15:41:56	2016-07-29 15:42:56	
<input type="checkbox"/>	_.1232116	1.166M	2016-07-29 15:42:56	2016-07-29 15:48:40	
<input type="checkbox"/>	_.1232141	44.213K	2016-08-01 09:32:30	2016-08-01 09:32:41	

Figure 5 - 2 Download

5.4 Management

“Manage” includes many useful functions like upgrade firmware, register the receiver, start self-checking, change the log password and restart the receiver.

Status Information Download Management

Install New Firmware

Registration

Expire 20161007
Date:

AuthCode

Security

Enable Login Authentication

Old Password:

New Password:

Confirm Password:

View Logs

- 1. APP Log
- 2. OS Log

Format Internal Disk

Self Test

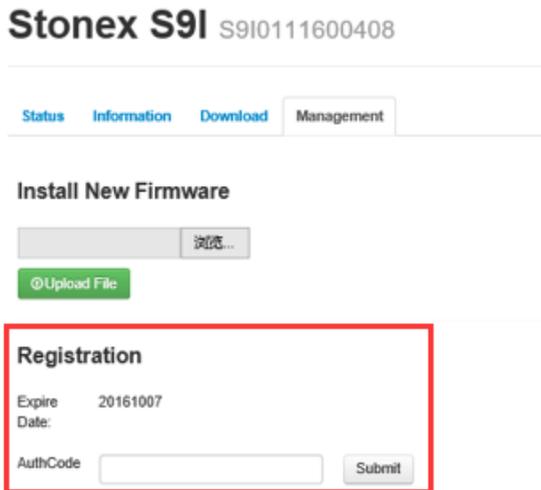
Reset

Figure 5 - 3 Management

5.4.1 Device register

The register code is a 32 digits and letters, you could register the device via WEB UI function. The detailed steps as follow.

In management page, you could see “registration”. Input register code to “Authcode” then click submit, the receiver will be registered.



The screenshot shows the web interface for a Stonex S9i receiver. At the top, the device model 'Stonex S9i' and its ID 'S9I0111600408' are displayed. Below this is a navigation bar with tabs for 'Status', 'Information', 'Download', and 'Management'. The 'Management' tab is selected. Underneath, there is a section for 'Install New Firmware' with a file upload area containing a '浏览...' (Browse) button and a green '@Upload File' button. A red rectangular box highlights the 'Registration' section, which includes the text 'Expire Date: 20161007', an 'AuthCode' input field, and a 'Submit' button.

Figure 5 - 5 Registration

You could also register device via controller with surpad software if installed on your controller . Connect S9i with the surpad software . Click “About”, you will see “Register instrument”, then click it. The last step is inputting code, then finish registration.

5.5 Settings

“Settings” includes “Working Mode”, “Device Configuration” and “NMEA Message”. Here will introduce every selection.

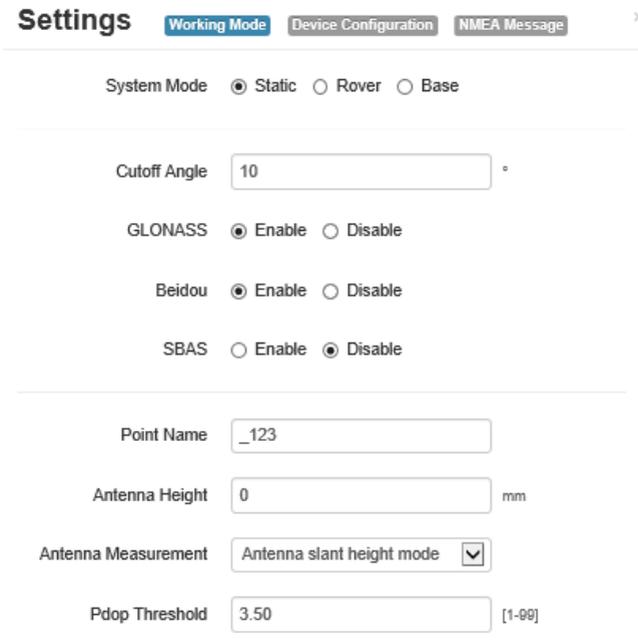
5.5.1 Working mode

You can select static, rover and base mode. Each mode support different configurations:

① Static mode

It is possible to set cutoff angle, select satellites system, input the point name, antenna height, PDOP threshold and the collect time interval.

If enable the auto record, s9i will collect data automatic when you power on the receiver.



The screenshot shows the 'Settings' window with the 'Working Mode' tab selected. The 'System Mode' is set to 'Static'. The 'Cutoff Angle' is 10 degrees. 'GLONASS' is enabled, 'Beidou' is enabled, and 'SBAS' is disabled. The 'Point Name' is '_123', 'Antenna Height' is 0 mm, 'Antenna Measurement' is 'Antenna slant height mode', and 'Pdot Threshold' is 3.50 [1-99].

Setting	Value
System Mode	Static (selected), Rover, Base
Cutoff Angle	10 °
GLONASS	Enable (selected), Disable
Beidou	Enable (selected), Disable
SBAS	Enable, Disable (selected)
Point Name	_123
Antenna Height	0 mm
Antenna Measurement	Antenna slant height mode
Pdot Threshold	3.50 [1-99]



Interval

Convert to RINEX NO YES

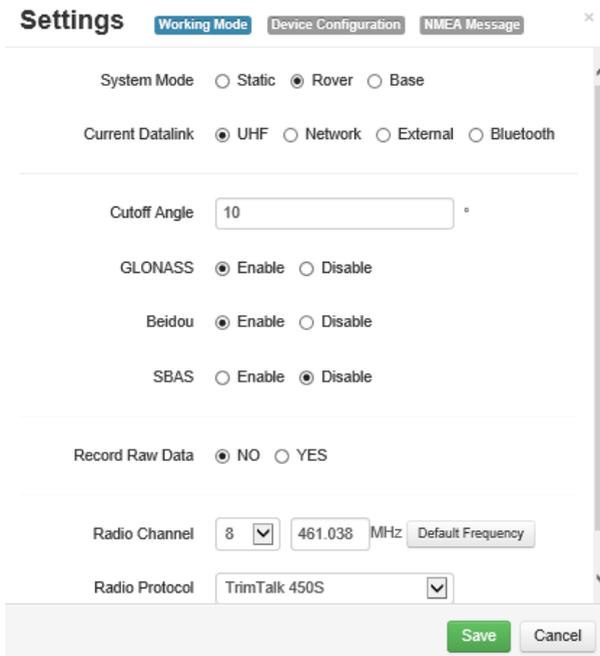
Auto Record NO YES

Figure 5 - 6 Static mode

② Rover Mode

Select the datalink like first step. Each datalink provides different options . The datalink are UHF, Network, External and Bluetooth.

UHF mode: select radio channel and radio protocol like your choice. You also can enable storage of raw data and enable the satellite constellation. The interface is as follow:



Settings Working Mode Device Configuration NMEA Message

System Mode Static Rover Base

Current Datalink UHF Network External Bluetooth

Cutoff Angle °

GLONASS Enable Disable

Beidou Enable Disable

SBAS Enable Disable

Record Raw Data NO YES

Radio Channel MHz

Radio Protocol

Figure 5 - 7 Rover mode (UHF datalink)

Network: the most important setting here are CORS information, such as IP, port, userID, password and mount points .

Settings

System Mode Static Rover Base

Current Datalink UHF Network External Bluetooth

Cutoff Angle °

GLONASS Enable Disable

Beidou Enable Disable

SBAS Enable Disable

Record Raw Data NO YES

Relay Mode Enable Disable

APN

APN User

APN Password

Connect Mode ▾

Caster Address

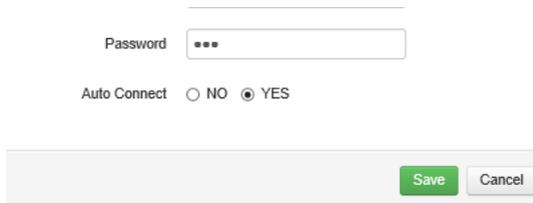
Caster Port

Mountpoint

▾

Upload GGA ▾ s

User

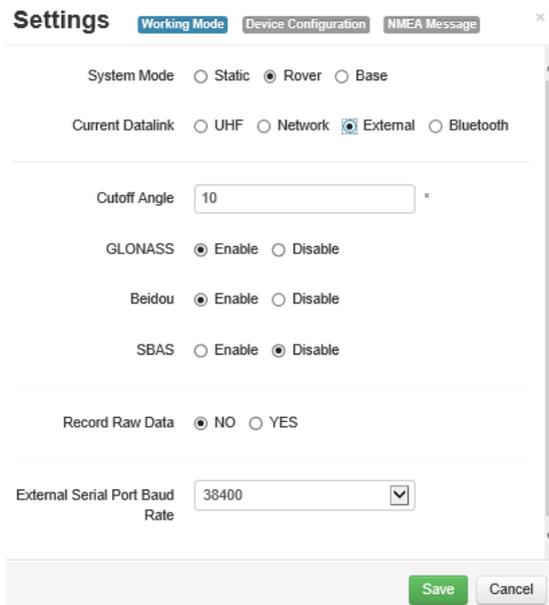


Password

Auto Connect NO YES

Figure 5 - 4 Rover mode (Network datalink)

External: to connect an external radio. Set the external serial port baud rate equal to the one programmed on the external radio.



Settings Working Mode Device Configuration NMEA Message

System Mode Static Rover Base

Current Datalink UHF Network External Bluetooth

Cutoff Angle °

GLONASS Enable Disable

Beidou Enable Disable

SBAS Enable Disable

Record Raw Data NO YES

External Serial Port Baud Rate

Figure 5 - 9 Rover mode (External datalink)

Bluetooth: to set datalink to Bluetooth. You can configure, the cutoff angle, satellites system and enable record of raw data.

Settings

Working Mode
Device Configuration
NMEA Message
✕

System Mode Static Rover Base

Current Datalink UHF Network External Bluetooth

Cutoff Angle °

GLONASS Enable Disable

Beidou Enable Disable

SBAS Enable Disable

Record Raw Data NO YES

Save
Cancel

Figure 5 - 10 Rover mode (Bluetooth datalink)

③ Base Mode

Most of the parameters are same as Rover mode. The only difference is the base mode has some more options (base coordinates) that can be edited. A base can be automatically activated after power on if the option is enable.

Settings

Working Mode
Device Configuration
NMEA Message
➤

System Mode Static Rover Base

Current Datalink UHF Network External

Automatically Start Base NO YES

Data Type

Site ID

Pdop Threshold [1-99]

Base Position Single Repeat Position

Figure 5 - 11 Base mode

5.5.2 Device configuration

Here are available the basic configurations via WEB UI function, such as changing language, select time zone ,enable electronic bubble and speaker, definition of storage locations and other options reserved to developer and service engineers .

Settings Working Mode **Device Configuration** NMEA Message ×

Language

Time Zone

Direct Link Mode

Sensor

Speaker Enable Disable

First Storage Internal Storage SD Card

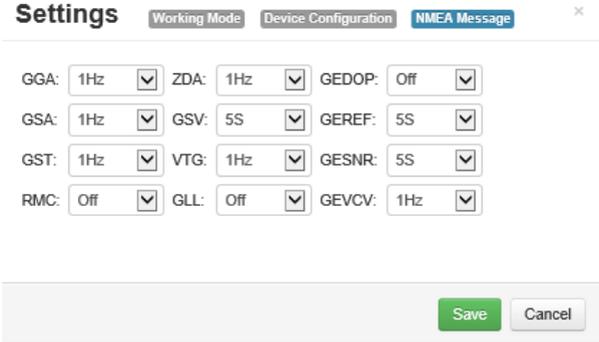
Tracker Enable Disable

Remote Debug Enable Disable

Figure 5 - 12 Device configuration

5.5.3. NMEA Message

Control NMEA message, turn on/off them. If you need them out, select the update frequency. The NMEA contains GGA, GSA, GST, RMC, ZDA, GSV, VTG, GLL, GEDOP, GEREf, GESNR and GEVCV strings.



Setting	Value
GGA	1Hz
ZDA	1Hz
GEDOP	Off
GSA	1Hz
GSV	5S
GEREF	5S
GST	1Hz
VTG	1Hz
GESNR	5S
RMC	Off
GLL	Off
GEVCV	1Hz

Figure 5- 13 NMEA message

6. S9i standard accessories

6.1 The case of S9i

Robust, contains different accessories in accord to the configuration (Base or Rover) .



Figure 6 – 1 S9i internal

6.2 Power supply

6.2.1 Batteries

The standard configuration contains two batteries, a slot for charging batteries (named "charger") and an adaptor. The battery is "lithium-ion" battery (7.4 V - 3400 mAh): a technology which has a higher energy-to-weight ratio respect to NiCd or NiMh batteries, no memory effect, and slow self-discharge when not in use.



Figure 6 - 2 Lithium-ion battery

6.2.2 Charger

The charger can charge two batteries simultaneously. The lights of the charger show if the battery is being charged (red light CHARGE) or if it's already charged (green light FULL). Red light POWER shows if the charger is powered on and there is also a light which turns on in case of too high temperature (red light TEMP).



Figure 6 – 3 S9i charger and adaptor

6.2.3 The antennas

S9i uses UHF transmitting and receiving antenna. Since there are three different internal radio settings with different frequency range, the corresponding antennas have different length. The available range are: 410-

430 MHz, 430-450 MHz and 450-470 MHz. the corresponding antennas have length of: 40, 37,5 and 34 cm. The antenna gain is 2.15 dBi.



Figure 6 - 4 built-in radio antenna (not in scale)

S9i adopts a GPRS/GSM all-direction transmitting and receiving antenna . The length is about 21.5 cm, the gain is around 1.8-2.2/2.1-3 dBi in accord to the used frequency band.



Figure 6 – 5 GPRS/GSM antenna (not in scale)

Additional accessory (not included in the standard configuration) is a high-gain UHF all-directional transmitting antenna for base setup. The available frequency ranges are: 410-430 MHz, 430-450 MHz and 450-470 MHz. The antenna is around 1meter long and can be mounted on a retractable pole or a tripod (for better performance). The higher the antenna is, the larger cover area does it has for the radio signal. The gain of the antenna is 5 dBi.



Figure 6- 6 External radio antenna (not in scale)

6.3 Cables

Receivers cables (LM.GK205.ABL)

This is a multi-function communication cable: it is used for connecting receiver and computer used for transferring the static data, updating the firmware and recording license.



Figure 6 -7 Multi-function communication cable

Auxiliary cables (LM.GK185.ABL+ LM.GK224.AAZ)

External power supply cables (LM.GK185.ABL+ LM.GK224.AAZ) can be ordered and used to connect an external battery (red and black clips) to the receiver (small 5-pin LEMO):



Figure 6 - 8 External power supply cables

6.4 Other accessories

They are are: 2.45 m retractable pole, 40 cm supporting pole, bracket depending on the controller, tribrach with plummet, tripod (wood or aluminum, with quick or twist clamps), connector between receiver and tribrach, measuring tape.

Table 6 - 9 Other accessories

No	Name	Figure (not in scale)
1	2.45m retractable pole	
2	40cm support pole	
3	Bracket	
4	Tribrach with optical plummet and adapter	
5	Connector between tribrach and receiver	
6	Measuring tape	

Appendixes

Appendix 1: Default radio configuration

The frequency and protocol of the 8 channels could be modified via Web UI or controller. The frequency range is from 410MHz to 470MHz.

Table 5- 1 Default frequency and protocol of internal radio

Channel	Frequency	Protocol
1	438.125MHz	Trimitalk 450S
2	440.125MHz	Trimitalk 450S
3	441.125MHz	Trimitalk 450S
4	442.125MHz	Trimitalk 450S
5	443.125MHz	Trimitalk 450S
6	444.125MHz	Trimitalk 450S
7	446.125MHz	Trimitalk 450S
8	447.125MHz	Trimitalk 450S

Appendix 2: Specification

GNSS	
GNSS	BeiDou-2+GPS+GLONASS+Galileo
Tracking	
Channels	220
GPS	L1 C/A, L2E, L2C, L5 (option)
GLONASS	L1, L2 , L3 (option)
BDS	B1, B2
GALILEO	E1, E5a, E5b, AltBOC
Assistance position	WASS, MSAS, EGNOS, QZSS
Performance index	
Static Accuracy	Horizontal: $\pm (2.5\text{mm}+1\text{ppm})$ RMS Vertical: $\pm (5\text{mm}+1\text{ppm})$ RMS
RTK Accuracy	Horizontal: $\pm (8\text{mm}+1\text{ppm})$ RMS Vertical: $\pm (15\text{mm}+1\text{ppm})$ RMS
SBAS	Horizontal <0.5 RMS
Accuracy(typical)	Vertical <0.85 5m RMS
Initiation time	$<10\text{s}$
Initiation Reliability	$>99.99\%$
Storage and data	
Internal Memory	4GB memory on board External MicroSD card storage, support maximum 32G
Differential	RTCM 2.3/3.0/3.2 MSM, CMR, CMR+,sCMRx
Wireless Communication	
Bluetooth	Internal, V2.0 Class2
Network	Five bands WCDMA 3.75G module (850-800-900-1900-2100) Four bands GSM (850-900-1800-1900 MHZ)
UHF Radio Protocol	TrimTalk-TrimMark-SOUTH-PCC EOT
UHF radio	internal radio receiver and transmitter : 0.5W/1W (adjustable) Frequency : 410-470MHz
GNSS antenna characteristics	
GNSS antenna	Integrated four feed and micro-point internal, zero phase center, built-in multi-path mitigation board, imported high-end ceramic material

Environmental	
Operating temperature	-30°C ~ +65°C
Storage temperature	-40°C ~ +80°C
IP Rating	IP67
Shock	Withstand 2 meter pole drop onto the cement ground naturally
Waterproof	Soak in the 1 meter water (30 minutes)
Humidity	100% non-condensing
Physical and Electrical	
Battery life	Over 10 hours Double battery works, and support hot swap
Dimensions	Φ159mm×89mm
Wight	1.2kg
Battery	3400mAh (Standard configuration: 2 batteries)
Button	2

Appendix 3: Copyrights, warranty and environmental recycling

Copyrights and trademarks

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STONEX®, the STONEX® logo, and S9i GNSS receiver are trademarks of STONEX® Limited.

STONEX® Assistant, STONEX® GPS Processor and STONEX® Surpad are trademarks of STONEX® Limited.

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

Copyrights, warranty and environmental recycling

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 supersede 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) Be free from defects in materials or workmanship for generally 2 years.
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® 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 part or instruments to STONEX® representative office and STONEX® is providing the shipping for return. Dealers need to follow STONEX® repair/service procedure (see appendix 6) 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 to place 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 (see appendix 4) 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 not 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

Two (2) years on STONEX® Products:

GPS receiver

S9i GNSS

Accessories

Accessories & Specific Parts Warranty

For Accessories provided by Stonex® with the instruments S10 GNSS the following general warranty time is for reference:

Batteries	7 months
Battery chargers	7 months
Adapters for battery chargers, Cables, Tribrach, Pole, Antennas	2 years

Service Procedure

Repair/Service procedure for dealers:

- (1) S/N of the instrument and a detailed description of the defect (sometimes pictures or video) will be required to indicate the cause and problem.
- (2) If dealer wants to repair an instrument under warranty period on their site:
 - 1) If dealers don't have the part in stock they have to send an official order to STONEX® and pay for it and so STONEX® will send the new part to them so they can repair the instrument.
 - 2) When the repair is over, the dealer has to fill the "Spare Part Refund" module and send it to the dedicated mail address.
 - 3) Wait for STONEX®'s authorization SPR no;
 - 4) When dealer receive the SPR authorization no they can send back to STONEX® appointed office the broken part with attached the SPR module;
 - 5) When STONEX® receives the broken part STONEX® shall verify it and if everything is ok the cost of the part shall be refund (refund will be done only after check of the failure part and final approval of STONEX®).
- (3) If the instrument needs to be sent back to STONEX® for repair/replacement, dealer/customer has to send to STONEX® a "Returned Merchandise Authorization (RMA)" before they send back the fault instrument. STONEX® shall, at its sole discretion, decide on the place of performance for work under warranty.

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 centres. 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 dustbin symbol means that the device must be taken to authorized collection centers and must be handled 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.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on,

the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Appendix 4: 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 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:

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 uses 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 is 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.

GPRS/GSM/UMTS modem

Be sure the use of this product is allowed in the country and in the environment required. The use of this product may be dangerous and has to be avoided in the following areas:

- Where it can interfere with other electronic devices in environments such as hospitals, airports, aircrafts, etc.
- Where there is risk of explosion such as gasoline stations, oil refineries, etc.

It is responsibility of the user to enforce the country regulation and the specific environment regulation.

Do not disassemble the product; any mark of tampering will compromise the warranty validity.

Cautions have to be taken for the SIM, checking carefully the instruction for its use. Do not insert or remove the SIM when the product is in switched on.

Every module has to be equipped with a proper antenna with specific characteristics. The antenna has to be installed with care in order to avoid any interference with other electronic devices and has to guarantee a minimum distance from the body (20 cm).

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:

<http://ec.europa.eu/enterprise/sectors/rtte/documents/>

The text of the Directive 99/05 regarding telecommunication equipments is available, while the applicable Directives (Low Voltage and EMC) are available at:

<http://ec.europa.eu/enterprise/sectors/electrical>

FOR USA

For your own safety, and in terms of the RF Exposure requirements of the FCC always observe the precautions listed here.

- Maintain a minimum separation distance of 20 cm (7.8 inches) between yourself and the radiating antenna.
- Do not collocate (place within 20 cm) the radio antenna with any other transmitting device.

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.

GSM/UMTS Antennas having a gain greater than 3 dBi (for mobile applications) are strictly prohibited for use with this device.

To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropical radiated power (e.i.r.p.) is not more than the one necessary to get successful connection.

Rechargeable Lithium-ion batteries

These receivers use a rechargeable Lithium-ion battery.

WARNING

- Do not creates damage at the rechargeable Lithium-ion battery.
A damaged battery can cause an explosion, with risk or 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.

WARNING

- Avoid direct contact with the rechargeable Lithium-ion battery if it appears damage. Battery liquids are corrosive and, and contact with it 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.



STONEX® SRL

Via Cimabue, 39 - 20851 Lissone (MB)

Tel : +390392783008 ; +390392785575 | Fax :+390392789576

www.stonexpositioning.com | info@stonexpositioning.com