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Chapter I : A brief introduction of S9III

The manufacture of this device is Stonex Europe Srl. STONEX® devoted itself to offer to surveyors the most advanced GPS tools. GPS RTK surveying technology plays an important role in surveying tasks and its use is getting more and more widespread. As a leading GPS RTK instrument producer, STONEX® guarantees that the S9III, our latest RTK GPS receiver, is suited for nowadays demands of precision, reliability and user friendliness.

S9III is able to receive both of GPS signal frequencies, but also satellite signals from GLONASS and GALILEO, so we must correctly speak of "GNSS" receiver.

S9III mainframe integrates a GNSS antenna, GNSS module, UHF transmitting and receiving radio, radio antenna, GSM/GPRS modem, Bluetooth device and battery. So S9III is totally integrated: it means that the surveyor only needs the handheld to start its job.

The exquisite outlook and the amazing color bring you a fashioned surveying station. This device has a higher stability, lesser power consumption, smaller volume and lighter weight than the previous STONEX® receivers. S9III has a special design which makes it waterproof, dustproof and vibration-proof. The batteries and built-in radio are set in the bottom of mainframe, giving more effective dustproof and waterproof qualities and makes the S9III a better performer in field of surveying. The Wireless receiver unit (weighs) 1.2 kg: the rover is light and easy to carry. The low power consumption of receiver allows users to carry out and work in long time with only one single battery.

Integrated design and anti-jamming property are combined perfectly: the former avoids the problem of a cumbersome external antenna, and the mainframe design can resolve the jamming problem effectively.

The performance of data-transfer radio technology is state-of-the-art: the bit error rate (*BER*) is 10^{-7} and the radio collision problem is reduced.

UHF antenna is studied in order to make its electromagnetic center connected with the electromagnetic center of dual-frequency antenna: in this way it reduces at the same time the

interference and makes the volume much smaller. The tight electronic shielding can avoid the interference more effectively.

The S9III receiver mounts a GPS/GLONASS antenna with a four feed technology. This design is able to reduce the electrical phase center error ellipsoid and in addiction it improves the Right Hand Circular Polarization Characteristics (RHCP) of the antenna, resulting in enhanced GPS signal tracking and improved multipath rejection, in case a polarization reversal has taken place as a result of the signal reflection.

At the same time S9III has a GPRS/GSM module which supports different network RTK technologies (VRS, FKP, etc.). This allows STONEX® S9III receiver to be a flexible system for demanding surveying applications. As a rover, it can be used as a static double frequency receiver or in a RTK configuration, where differential corrections are received from CORS via GSM/GPRS data modem (maximum range 70 km) or by another S9III receiver acting as base, linked by GSM/GPRS data modem or UHF radio modem.

In the last case S9III in base configuration can transmit with the built-in 0.5 W radio or can be connected to a more powerful external radio at user's disposal in order to reach the requested metric range.

The receiver can be connected to different RTK software for different applications. The data transfer is easy and fast, like a Plug and Play USB drive.

STONEX® provides two year of warranty to S9III receivers . It should be noted that high power signals from a nearby radio or radar transmitter can overwhelm the receiver circuits. Low power transmitter like those used in cell-phones do not normally interfere with receiver's operations. It's important to draw your attention to the operational temperatures, limits which should not be exceeded for a correct functioning (see pag. 55).

It is also important to point out that in each weather case after coming back from the field you should keep the container open in a warm and dry place and at the same time take out the controller and receiver from the container, in order to make them dry.

Anyway we recommend you to manage the instrument with reasonable care.

Even if you have used other GPS or GNSS products before, we recommend that you spend some time reading this manual to learn about the special features of this product.

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

ATTENTION:

In order to facilitate reading and operating, we offer one manual which take the S9Ⅲ GNSS for example to introduce our products. This manual is valid for S9Ⅲ GNSS, S9ⅢN GNSS, S8 GNS S, S8N GNSS. Most of their constructions, functions and operations are the same, just a little different between them and we list them on the page7, 8, 63, 64, 65. All of these will not affect the use of the products.

Chapter II: S9III mainframe

II.1 The outlook of mainframe

The mainframe has an almost cylindrical shape, with a base larger than the height. There are three parts: an upper cap, a rubber loop and the main structure. The upper cap protects the GNSS antenna placed inside. The rubber loop has the function of softening possible shocks or falls. In the front of the main structure there are 2 keys and 9 lights, on the bottom side there is one slot for the built-in radio and GSM/GPRS module, and one for the battery and SIM card. All the others components of the receiver (Bluetooth device, main board, OEM board, etc.) are contained inside the main structure.

Fig. 2.1 - S9III mainframe

Fig. 2.2 - S9III label

Fig. 2.3 - S9IIIN label

Fig. 2.4 - S8 label

Fig. 2.5 – S8N label

The labels above are of model S9III, S9IIIN, S8 and S8N. The NB marks of them are different. The GPS receivers with the model No. of S8N GNSS and S9IIIN GNSS carry the CE marking $C\epsilon 0890$ on the label. Accordingly, the GPS receivers with the model No. of S8 GNSS and S9III GNSS carry the CE marking $C\epsilon 0890 \oplus$. The GPS receivers with the $\oplus$ on the CE marking

are sold to the countries of Europe listed as follow:

Belgium

Croatia - Slovenia - Bosnia-Herzegovina

Czech Republic

Finland

France

Germany

Greece

Hungary

Slovakia

Italy

Luxembourg

Netherlands

Poland

Portugal

Romania

Russian Federation

Spain

Switzerland

Turkey

Ukraine

United Kingdom

II.2 Interfaces

The mainframe interfaces are shown in Fig. 2.6: the left port (five pins *LEMO*) is used for external power supply and external radio, the right port (seven pins *LEMO*) is used for data transferring between receiver and computer or between receiver and the handheld. Near the

radio module there is the radio antenna interface.
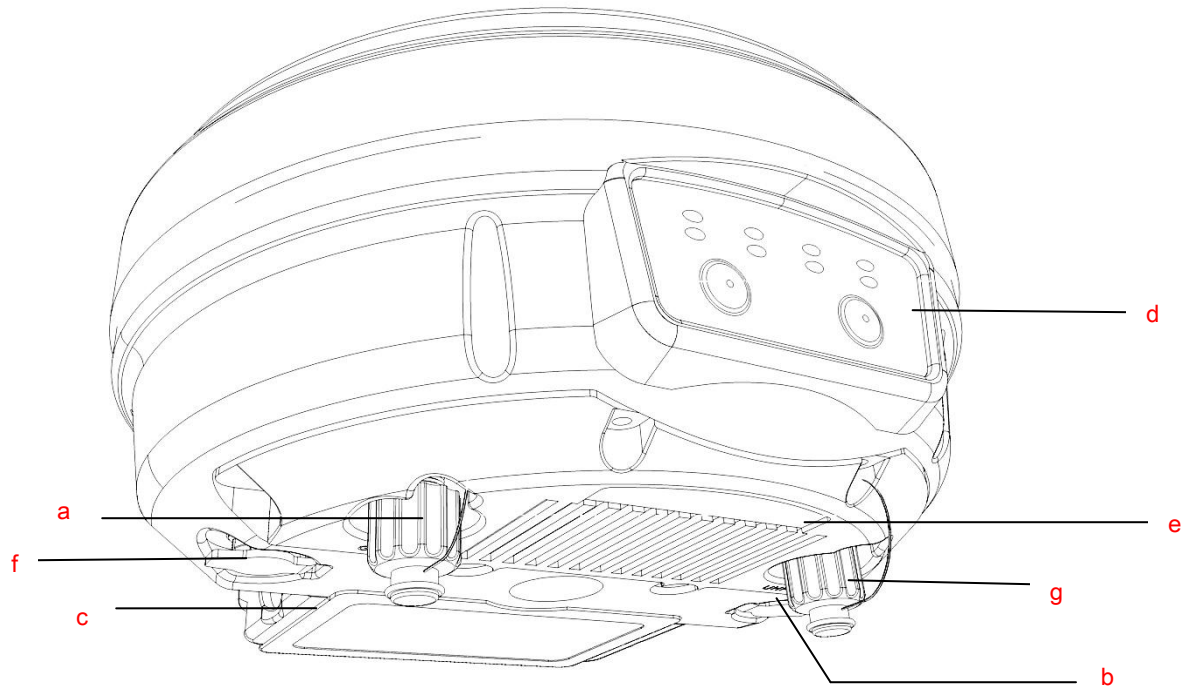
a)   TNC connector for GPRS/GSM antenna

b)   5pins Lemo port for external datalink connection

c)   Battery housing

d)   Front panel

e)   Built-in radio module

f)   7pins Lemo port for data transport.

g)   TNC connector for UHF radio antenna

Fig. 2.6 - S9III components and ports

Fig. 2.7 - 5-pins LEMO port

Fig. 2.8 - 7-pins port

II.3 The installation of battery
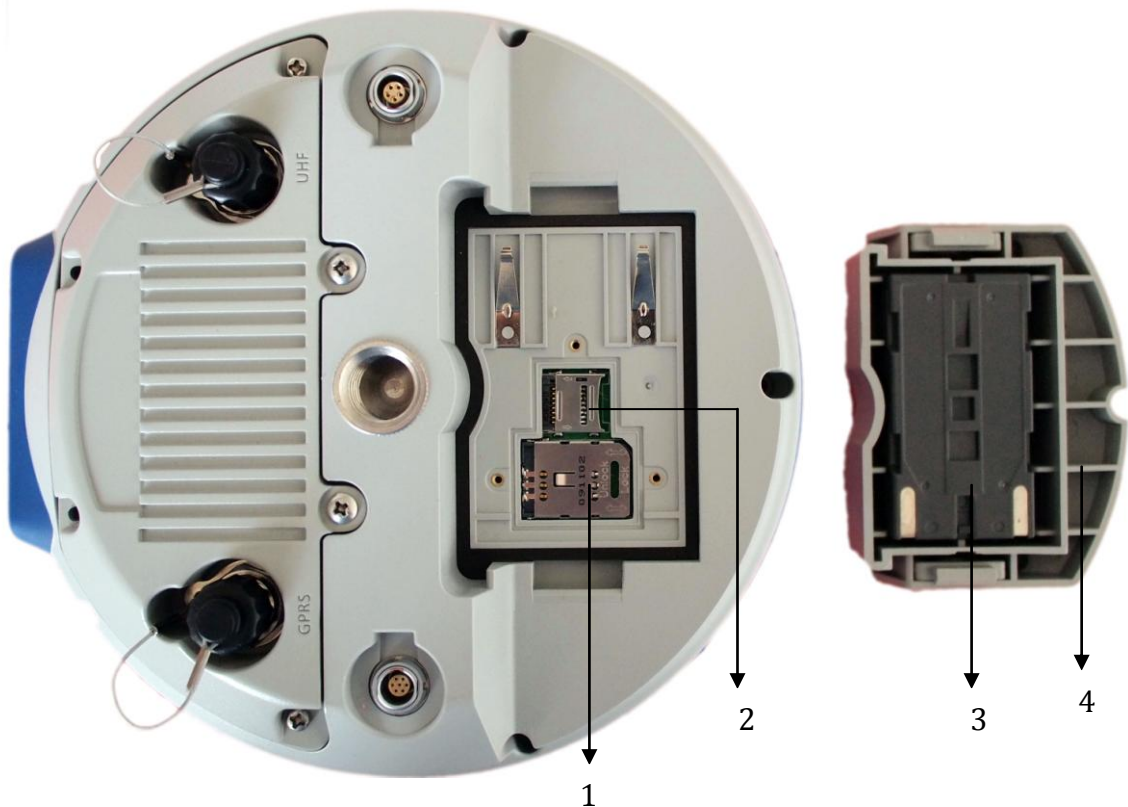
1. SIM card slot
2. MicroSD card slot
3. Battery
4. Battery housing

Fig. 2.9 - S9III battery housing

Under the place for the battery, there is a slot for SIM card, necessary when a connection by GSM is used.

II.4 Indicator leds and instrument setup

1. satellite led
2. static led
3. rover led
4. base led
5. Bluetooth led
6. internal radio led
7. GSM/GPRS led
8. external data link led
9. internal power led
10. Function Key
11. Power Key
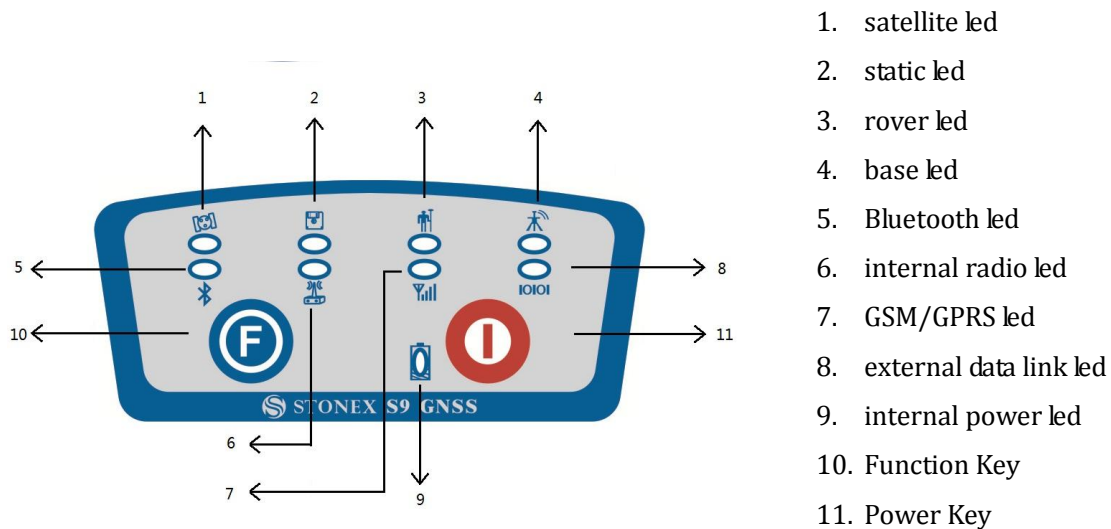
Fig. 2.10 - S9III keys and indicator leds

The functionality as follows, from left to right:

SATELLITE led *(green)*:

It shows the amount of locked satellites; when the receiver links one or more satellites

signal it will start to blink every 30 seconds for a number of times equal to the number of locked satellites.

Fig. 2.11 - S9III satellite led

STATIC led (*red*):

It switch on if the static mode is selected and it starts to blinks when the receiver is recording data, with the same frequency of the sample rate.
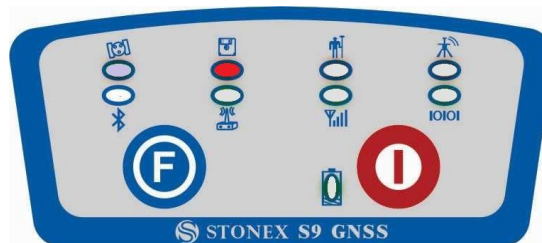
Fig. 2.12 - S9III static led

ROVER led (*red*):

Rover led is on when the receiver is working in rover mode.

Fig. 2.13 - S9III rover led

BASE led(*red*):

Base led is on when the receiver is working in base mode.
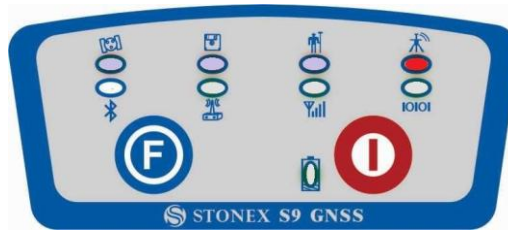
Fig. 2.14 - S9III base led

BLUETOOTH led (*blue*):

Once you have connected the receiver with the handheld, this led will on.

Fig 2.15 - S9III bluetooth led

INTERNAL RADIO led (*green*):

This led is ON when UHF radio is selected as RTK datalink.

It is blinking when is transmitting data in base mode or receiving data in rover mode.

Fig 2.16 - S9III internal radio led

GSM/GPRS led (*green*):

This light is on when 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).

Fig 2.17 - S9III internal radio led

EXTERNAL RADIO led (*green*):

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

Fig 2.18 - S9III external radio led

INTERNAL POWER led (green and red) :

It includes two kind of status:

1. Green: power supply in good condition.

2. Red: low power.

Usually when the light is red you have still one hour of power reservation. External power and internal battery share same power light. When external power is used, the led indicates external power level.

Fig. 2.19 - S9III power led

F Key : Function key

It can switch the working mode (static, base or rover) and RTK datalink (built-in radio, external radio or GPRS/GSM).

Switch working mode: Power on the receiver while pressing F key in the meantime, wait until all lights flash, then release both buttons. Now every time you press F key, you will see one red led switched on and moving through the three working mode.

Switch datalink: Press F key in ROVER or BASE mode, you will see one green led switched on, that moves every time you press F key through the three datalink.

I Key: Power key

It powers on/off the receiver function and has a confirm function.

Power on receiver: Press and hold I key for at least one second, the receiver will power on.

Power off receiver: Press and hold I key for few seconds, after three beeps all lights turn off, at that point release the key, the receiver is off .

Self-Check: it is a procedure predisposed for verifying the correct working of the instrument devices, the operation way is:

- Press and hold I key for more than 10 seconds, as for turning it off, but keeping pressed the key after all lights have turned off.

- Release the key when you hear another beep: receiver will start to make a self-check.

Self-check lasts typically around 1 minute. During this procedure the meaning of lights is:

- Internal radio led: ON if UHF module pass the test; *FLASH* if UFH module fails the test.

- GSM/GPRS led: ON if GSM/GPRS module pass the test; *FLASH* if GSM/GPRS module fails the test.

- satellite led: ON if GNSS OEM module pass the test; *FLASH* if GNSS OEM module fails the test

If you have noticed at least one problem during self-check, please contact your local dealer or email to support@stonex.it

After the self-check procedure the receiver will turn on and begin to work normally.

Note: The frequency setting of the internal UHF module is set back to factory default on self-test. Please contact your local dealer to obtain the frequency information in your country.

How can you select the working mode?

- Insert the battery in the battery box, then press and hold I key + F key: the receiver will start.

- Keep pressed I key + F key until the all lights blink at the same time (Fig. 2.14), then release the keys.

Fig. 2.20 - S9III, all led blinking at the same time (wrong picture)

- Now every time you press F key, the RECORD/ROVER/BASE lights will be on in the corresponding order. You can select three different red lights, each of them refers to one working mode.

- Press I key when the chosen light is blinking and the receiver will start the selected working mode . Summary of working modes:
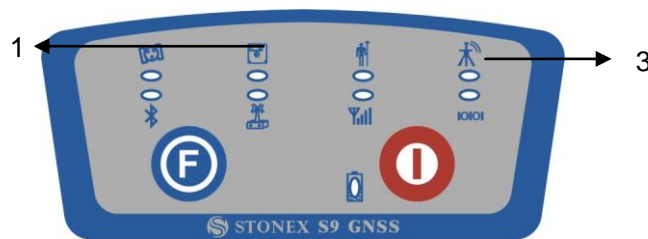
1. Static mode

2. Rover mode

3. Base mode

Fig. 2.21 - S9III summary of working mode led

How can you select data link?

After you have entered working mode, press F key, the UHF/GPRS/EXT lights will blink by turns. Then you can select different green lights, each one refers to different data link. This situation refers only to the rover and base mode, since in static mode there is no green light blinking.

Summary of data link types:
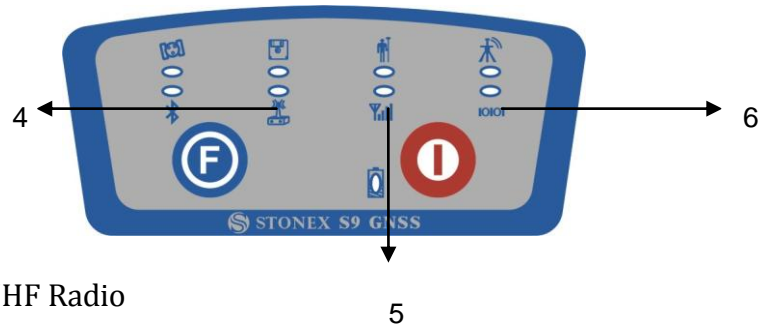
4. Internal UHF Radio

5. GPRS\GSM module

6. External radio

Fig. 2.22 - S9III summary of data-link led

Chapter III: S9III standard accessories

On the basis of the configuration chosen (base or rover) some of these accessories are included in the receiver bundle.

III.1 The case of S9III

There are two kinds of S9III cases: Rover case and Base case. The inner layout of the Base case and Rover case is different.

Base case has the room for external radio and Rover case has the room for the controller. You can distinguish them from nameplate.

Fig. 3.1 - S9III case

Fig. 3.2 - S9III Rover case

Fig. 3.3 - S9III Base case

Fig. 3.4 - S9III internal case of Rover

III.2 Power supply

Batteries

The standard configuration contains two batteries, a slot for charging batteries (named "charger" for simplicity) and an adaptor. The battery are "lithium-ion" battery (7.4 V - 2500 mAH): a technology which has an higher energy-to-weight ratio with respect to NiCd or NiMh batteries, no memory effect, and slow self-discharge when not in use.

Fig. 3.5 - Lithium-ion battery

Charger

The charger can charge both batteries simultaneously. The lights of the charger shows 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).

Fig. 3.6 - S9III charger and adaptor

III.3 The antennas

S9III adopts a UHF all-direction 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. They are suitable for field surveying, light and durable. The gain is 2.15 dBi.

Fig. 3.7 – built-in radio antenna (not in scale)

S9III adopts a GPRS/GSM all-direction transmitting and receiving antenna with a frequency in the ranges 824-960 MHz and 1710-1880 MHz. It is suitable for field surveying, light and durable, the length is about 20 cm, the gain is around 2 dBi .

Fig. 3.8 – Gprs/gsm antenna (not in scale)

For S9III , it is possible to use like additional accessory (not included in the standard configuration) a high-gain UHF all-directional transmitting antenna for base setup. The available ranges are: 410-430 MHz, 430-450 MHz and 450-470 MHz. The antenna is around 1 meter 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.

Fig. 3.9 –External radio antenna (not in scale)

III.4 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 the license.

Fig. 3.10 - 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) :

Fig. 3.11 - External power supply cables

III.5 Other accessories

The other accessories are: 2.45 m retractable pole, 40 cm supporting pole, two kind of brackets depending on the controller, tribrach with plummet, tripod (wood or aluminum, with quick or twist clamps), connector between receiver and tribrach, and measuring tape.

Fig. 3.12 – 2.45m retractable pole

Fig. 3.13 – 40cm supporting pole

Fig. 3.14 – Bracket B1 for Getac

Fig. 3.15 – Tribrach and adapter with optical plummer

Fig. 3.16 – Connector between tribrach and receiver

Fig. 3.17 – Measuring tape .

III.6 *Controller Getac PS236*

The Getac controller standard configuration includes only the adaptor, the battery, the USB cable.

The controller is not part of the accessories for S9III generation, it must be purchased separately.

Fig. 3.18 - Getac PS236 controller

Chapter IV: S9III Operations

IV.1 The installation of base and rover

BASE   ROVER

TX / RX ANTENNA   TX / RX ANTENNA

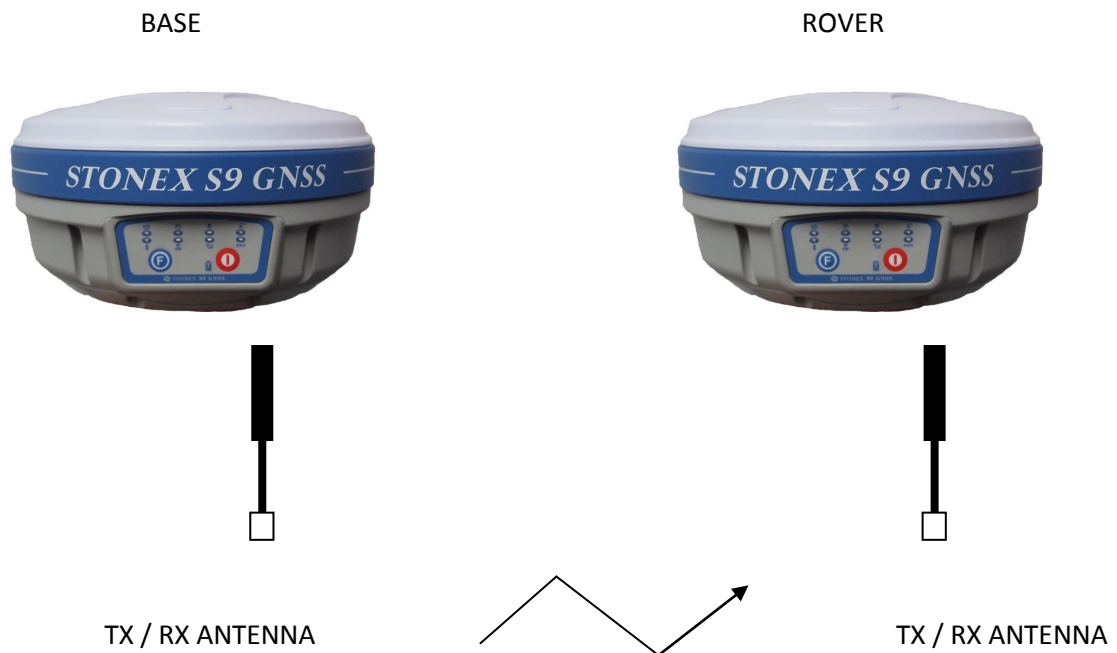Fig. 4.1 - Base and rover configuration

Installation of Base

1) Put a tripod on a location with known coordinates or unknown coordinates, attach receiver to tribrach.

2) Attach the transmitting radio antenna into the port "UHF": using the 40cm supporting pole is better, since increases the height of the antenna .

3) Switch on the receiver and select the base working mode.

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".

2) Power on the receiver and select the rover working mode.

3) Open the handheld and start the software, then you can do the setting of the instruments.

If you want to take very accurate measures (few cm), we recommend you to use a tripod and put the rover on it.

IV.2 The operation of keys

There are power key (I key) and function key (F key) in the mainframe, the operations are as follows:

- Power on: when the mainframe is in the OFF status (no light), press the I key, and then the mainframe will enter the initialization status.

- Power off: when the mainframe is in the ON status (power supply light ON), pressing I key for a while, when you listen beep for three times, relax the I key. The device is switched off.

Fig. 4.2 - Display keys

IV.3 Instrument settings

The settings of base and rover can be set by hand, the details are as follows:

Rover mode

Keep pressing I + F keys and wait for all lights flashing at the same time, then press F key to choose the working mode: press I key when ROVER is lighted to choose the working mode of rover. Wait for several seconds and then press the F key down for about 5 seconds, after one beep release F key, press F key to choose the data link. When RADIO is lighted, press I key to confirm the choosing of built-in radio data link mode. When GSM/GPRS is lighted, press I key to confirm the choosing of GSM/GPRS data link mode. When EXTERNAL *is* lighted, press I key to confirm the chosen external radio data link mode.

Base mode

Keep pressing I + F keys and wait for six lights flashing at the same time, then press F key to choose the working mode: press I key when BASE is lighted to choose the working mode of base.

The setting of the data link is the same described in the Rover mode configuration.

Static mode

Keep pressing I + F keys and wait for six lights flashing at the same time, then press F key to choose the working mode, press I key when the STATIC is lighted to choose the static mode.

The next time you open the receiver, the working mode will be the last selected.

If you prefer, you can select the correct data link by handheld software, but remember that you can't switch from one working mode to another by handheld, but only by hand or by STONEX® Assistant (see Cap. V).

By handheld software or by Assistant you can set some rover parameters, for instance sampling interval, minimum elevation angle, antenna height, etc. Without modifying the parameters the receiver will work with default parameters.

The static mode parameters cannot be selected by the controller, but only by Assistant.

IV.4 Operation of lights

Static mode

The STATIC and power light will keep lighted. When satellites fulfill the conditions (at least 4 GPS or 4 GLONASS satellite, PDOP< 3.5), receiver will start recording epochs, you will hear a beep, STATIC light will flash according to sampling interval (if you don't set up, the default is 1 second) and the satellite light will flash a number of times equal to the locked satellites.

Base mode

After setting up the mode, power on the mainframe, the base will enter into the transmit mode, Using external radio EXTERNAL light flashing every one second means the base transmit normal, the interval is 1 second. In the same way using built-in radio INTERNAL RADIO light will flash. If you need to change the transmit conditions, you should connect the handheld with mainframe by cable or Bluetooth firstly.

Rover mode

Bluetooth and power light will keep lighted. The satellite light will blink according to the number of satellites as described for static mode.

Using GPRS/GSM, GSM/GPRS light starts to blink with the frequency of the received data packets . In the same way using built-in radio INTERNAL RADIO light will flash.

IV.5 How to measure the antenna height

The height of receiver is 99mm, the diameter is 190mm, the height from the center of the sealed rubber ring to the bottom is 62mm.

The antenna height is conventionally defined as the vertical height from the phase centre to the ground surveyed point (the distance "h" in fig. 4.3). It is not possible to measure it directly: you have to measure other reachable heights (the distances "a", "d", "s" in fig.4.3). The distance "a" is the vertical height from the ground to the mainframe's bottom, "d" is the vertical height from the ground to the middle of the rubber ring: both are defined as "vertical heights". On the

contrary the distance "s" is measured from the ground surveyed point to the middle of the rubber ring and is called "slant height". You have to choose the measuring method according to the used software:
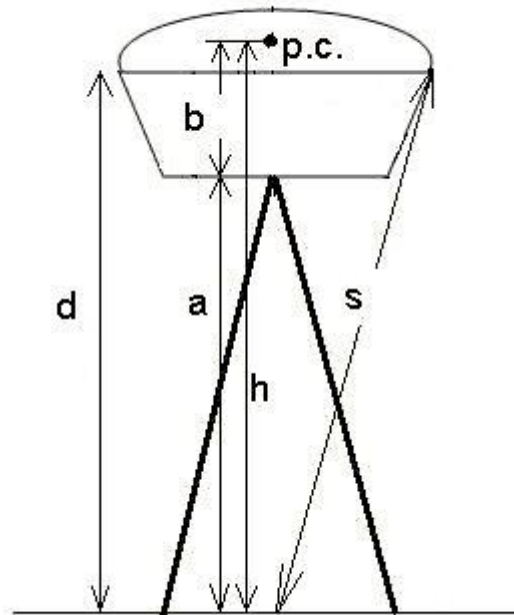

Fig. 4.3 - Different measures of the antenna height

1. In rover and base mode you have to insert the correct antenna height according to RTK software. In *STONEX® SurvCE* , for example , the distances "a" and "s" are permitted: software will add the distance "b" to "a" (or convert "s") to obtain "h". For other software please read the specific user guide.

2. In static mode you have to write the correct antenna height in .DAT or RINEX file. If you are using *STONEX® GPS Processor* you have to specify the correct antenna height before processing *.DAT* data or exporting it into RINEX format. Please read the specific manual of *STONEX® GPS Processor,* it should be noted that however the slant height "s" corresponds to the definition "Line of Edge of antenna", "a" to "Bottom of antenna" and "d" is equal to "Bottom

of antenna mount".

IV.6 How to download static data

For a correct connection between receiver and PC, follow the procedure described below. By using a different procedure it may be very difficult to make a connection.

At first Turn off the mainframe , then connect the cable to the communication interface of the receiver (7-pins Lemo port) , then insert the USB port in the PC. The taskbar will show as follows:

icon

Fig. 4.4 - Taskbar of windows including the receiver

The PC considers the receiver as a "removable disk", so open the "removable disk", and then you can get the data files in the memory.
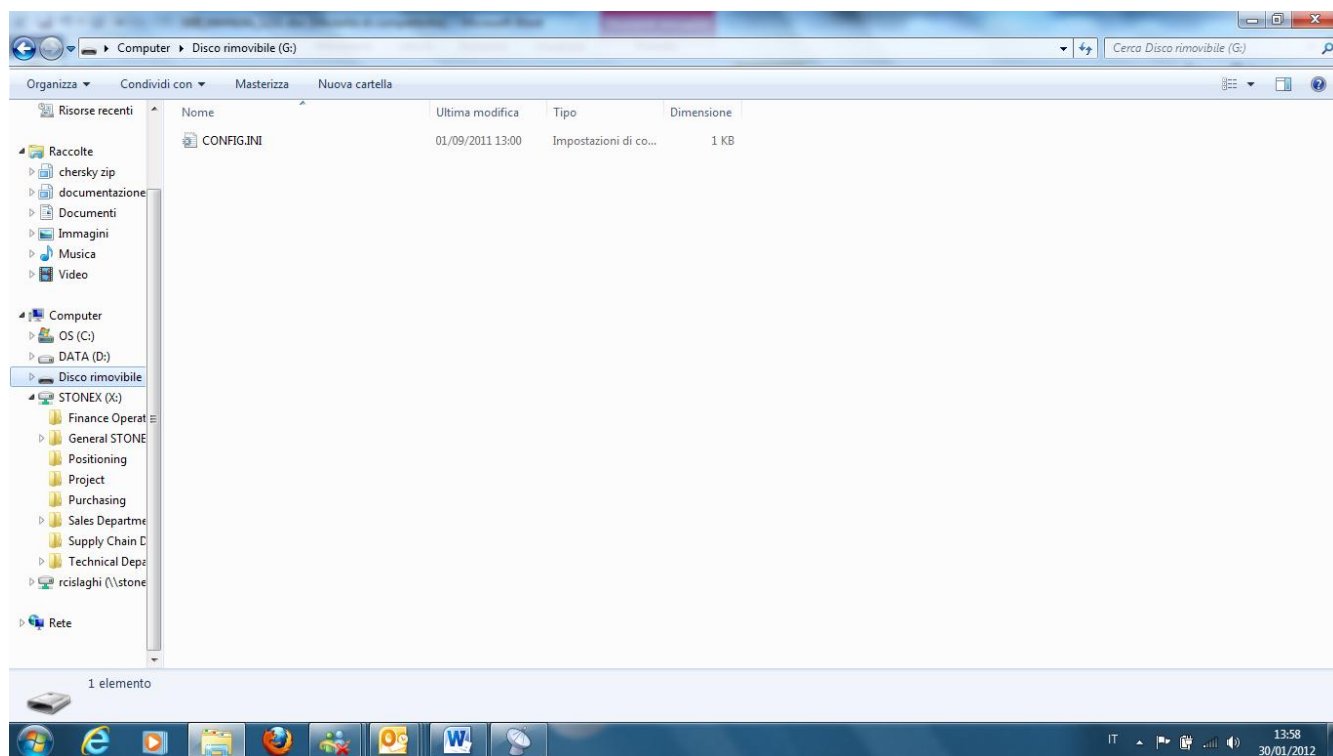
Fig. 4.5 - Example of receiver files

As Fig. 4.5 , for example ,shows, .*INI* file is the configuration file stored in the memory of S9III. You can copy the original file to PC and if necessary modify the file names. You can open also the "CONFIG.INI" file. You can open it as a simple text file and set some parameters of static mode: sampling frequency, minimum elevation angle, etc. Please modify this parameters with care and don't change any parameter which is not clear because you could compromise the correct working of the receivers.

You can use the STONEX® Assistant to download the raw data and set the parameters in a safer way, as explained in Chapter V.

IV.7 Registration of the receiver

If the provisional license expired, you need to insert a new license code in the receiver for continuing to use it.

The license is composed of a 32 characters code.

For inserting the new license you can use RTK software *STONEX® SurvCE*: you have to enter into the submenu "Equipment" → "GPS utilities" → "Send command", then write the command "SET,DEVICE.REGI,[license code]".

However it is also possible to register the receiver using the STONEX® Assistant, a software tool which is explained in Chapter V.

Chapter V: STONEX® Assistant for S9III

STONEX® Assistant is a tool which is conceived for aiding the user to make it easier for different operations with the receiver. It is contained on the bundle CD.
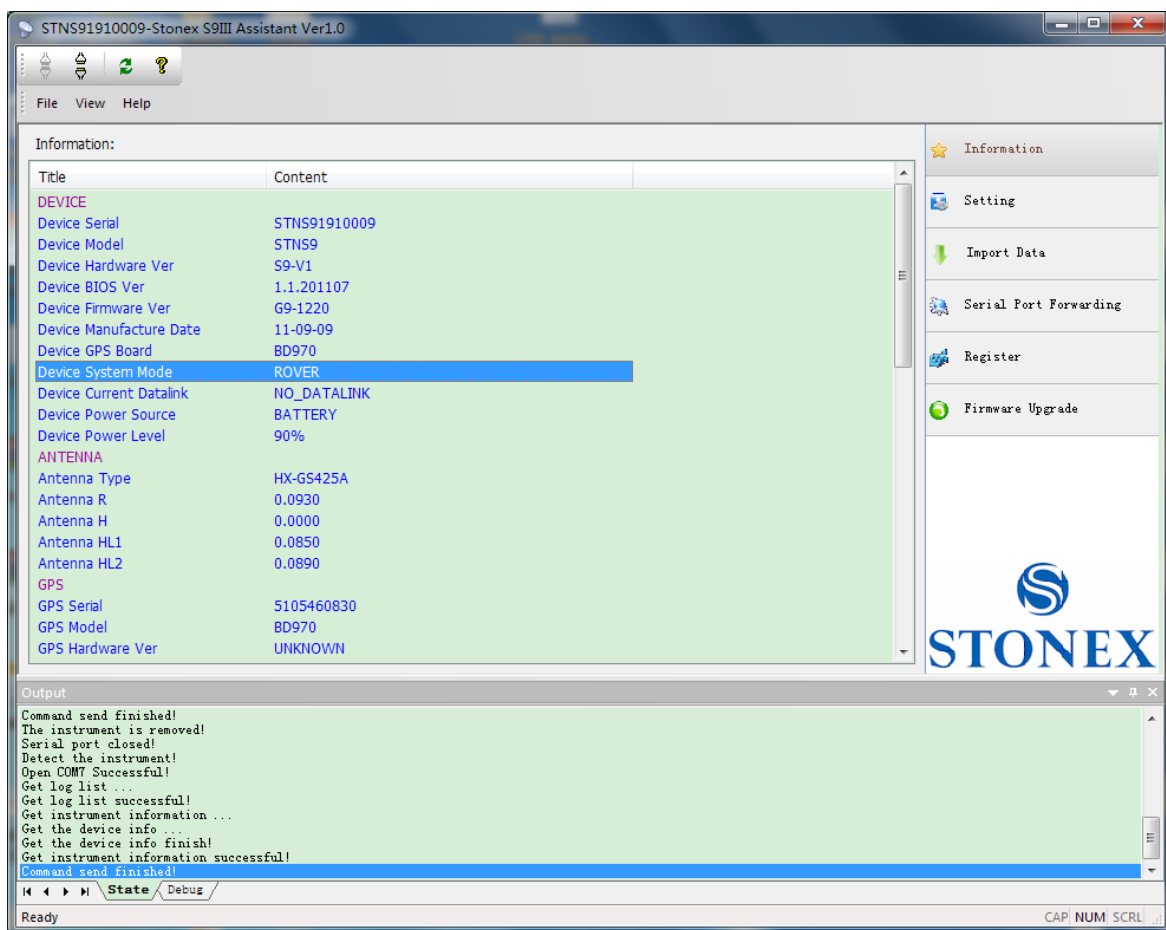

Fig. 5.1 – Information page of Stonex Assistant

The opening page, is showed in Fig. 5.1. It reports internal system configuration of the GPS

receiver S9 after get PC connection.

V.1 Start Stonex Assistant on your PC.

Connect the S9 to the PC using Lemo7 –USB/Serial cable.

Switch on the receiver; automatically the program should search the COM port where the receiver is connected. If this doesn't happen, select the right COM port manually. To select the right COM port manually, please click on "File"→"Connect" and you will get the Connect page, see Fig 5.2:

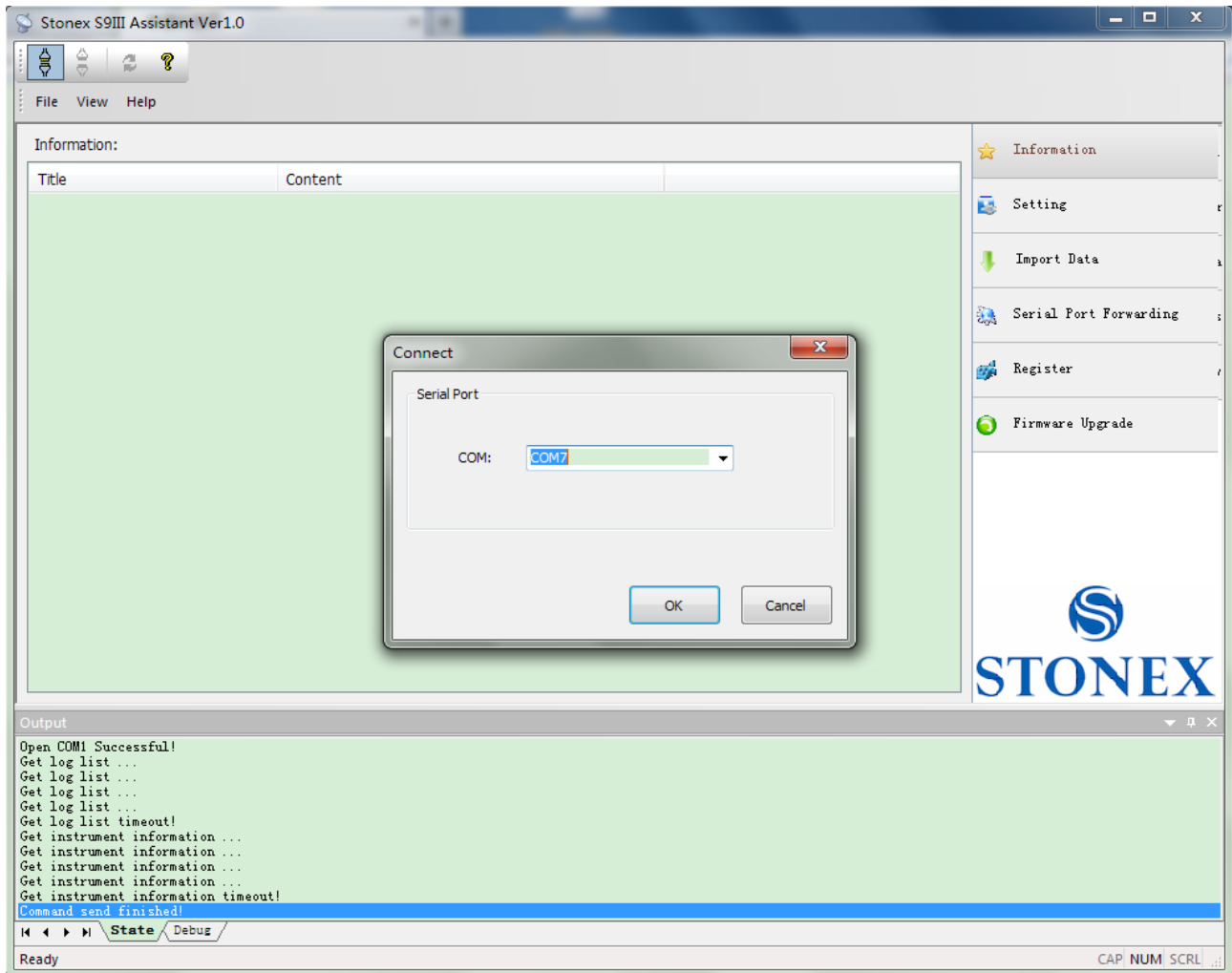Fig. 5.2-Opening COM port

Try to get connection inserting different COM number (like COM1, COM2, etc), and then select "OK" button. When you have find the right COM port, you should see the screen shown in Fig 5.1 (system information).

V.2 Import Data

This section of the Assistant allows the user to download raw data from S9III memory to Pc, instead of doing manual copy of files. After connecting the receiver click on "Import Data": a new window is opened as in Fig. 5.3.
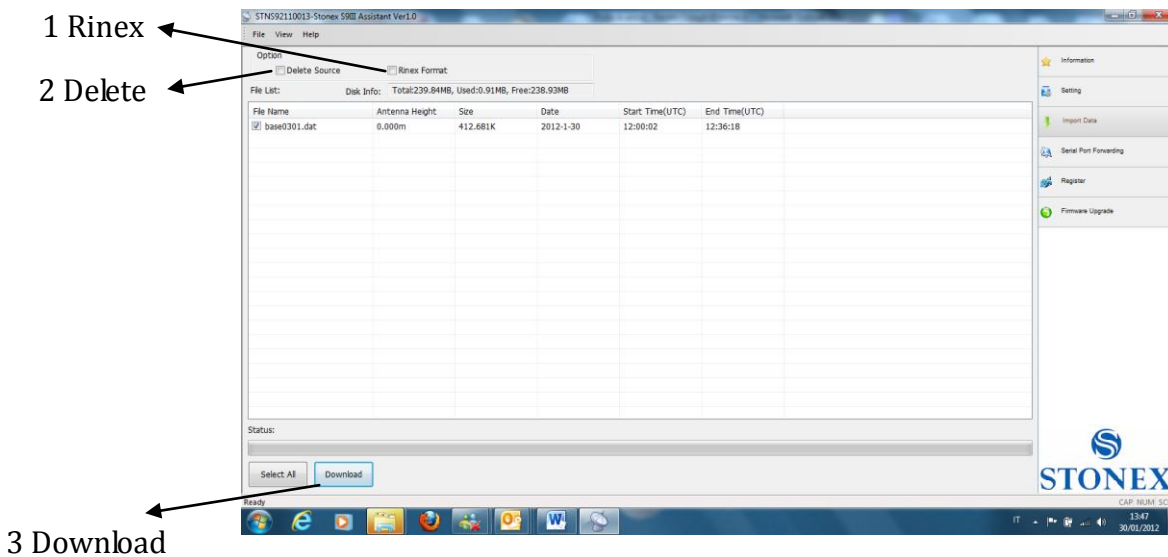
1 Rinex

2 Delete

3 Download

Fig. 5.3 – Import Data window

Inside this window you can see all files saved in the memory of S9III (excluding the configuration file), for example files with raw GPS measures. By checking only one box or more at the left of each file, you can select it for download operations.

You can also choose to convert the downloaded file into RINEX format by checking at box "RINEX" in the Option area on the top of the page. Checking at "DELETE SORCE" you can enable the automatic erase of the selected files after download on the PC memory.

Using the "Download" button, at the bottom of the form, you can save the marked files on your PC, in the folder you prefer. In this section you can also modify the value of the antenna height of the receiver used during survey.

V.3 Settings

If you click on the command "Setting" on right, a new Menu' window is opening as in Fig. 5.4.
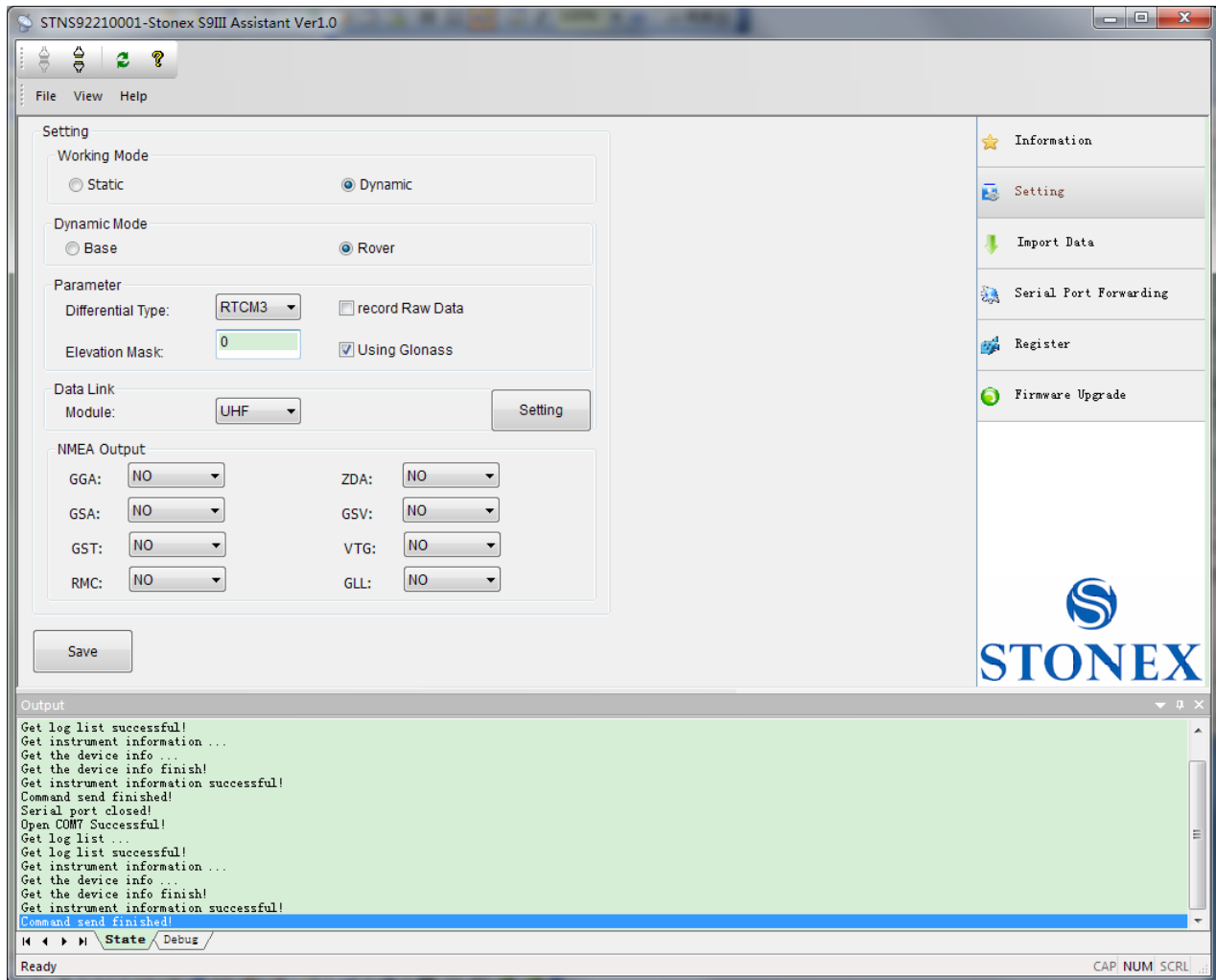

Fig. 5.4 – Setting window

From this window you can set the most important parameters of the receiver without opening the CONFIG .INI file and modifying it by hand in a text editor.

You can set the survey working mode (Static, Dynamic -Base/Rover) of S9III.

Setting the Dynamic working mode (Rover or Base) the following parameters should be specified:

a) Differential type: To select the format of the differential correction.

b) Elevation mask: to enable reception of signal only above the inserted horizontal angle.

c) Record Raw data: to record raw data inside memory of S9III.

d) Using Glonass: To enable/Disable Glonass reception.

Select "Static" for a Static Survey operation , "Dynamic" if you want to do RTK measures with your S9III.

V.3.1. Static Data Survey

Static mode data entry page is reported on Fig 5.5:
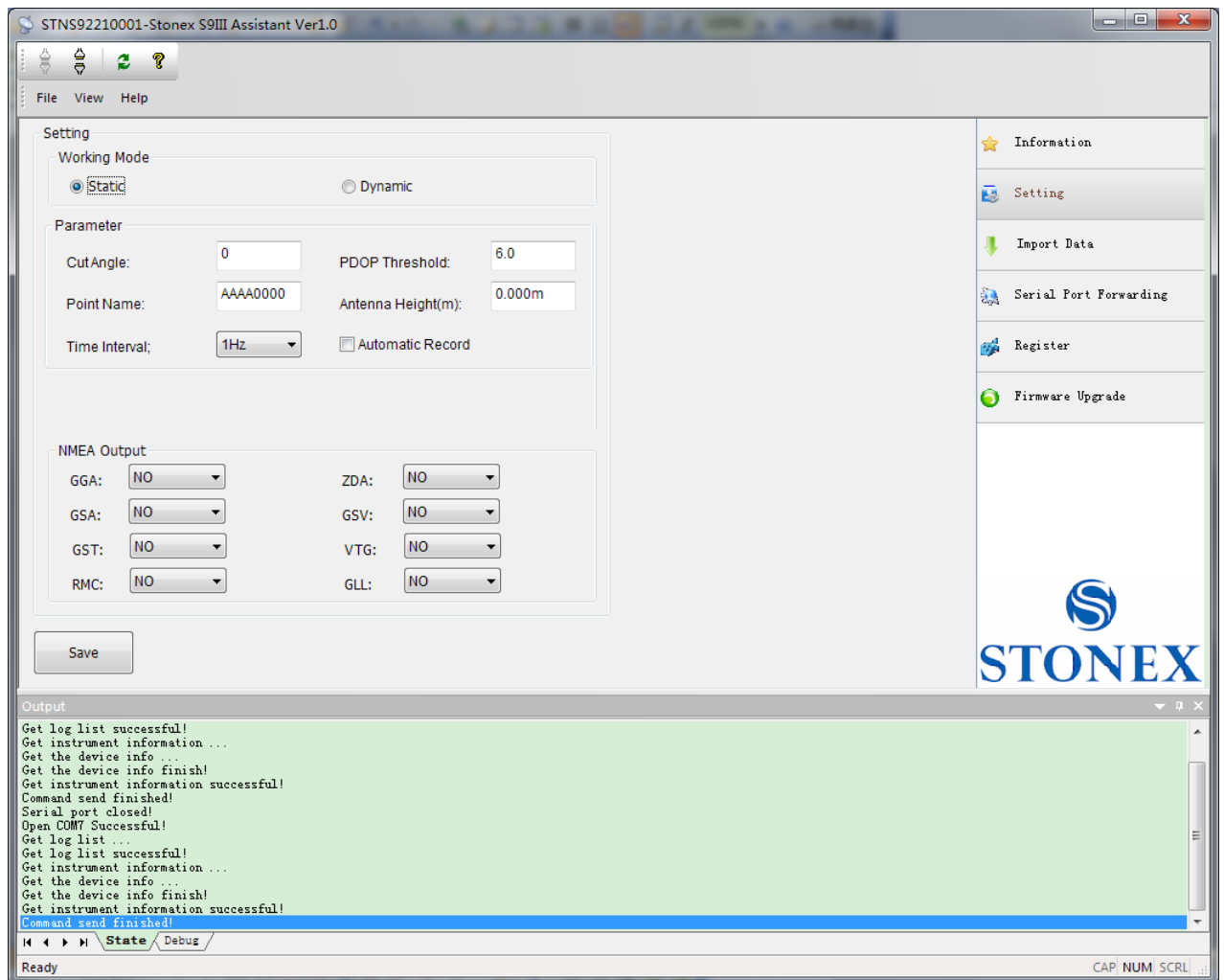
Fig. 5.5 – Static working mode

From here you can control following data settings:

Cut Angle : Define the minimum elevation of Satellite on (suggested value = 15)

PDOP Threshold : Define the maximum value of PDOP for valid GPS data.

Point Name : Assign a "name" to the point you are surveying.

Antenna Height : Introduce GPS antenna height from ground, see Par IV.5 .

Time Interval : Set time between different GPS epochs.

<u>Automatic Record</u> : Start automatic GPS static survey after power on. For static survey this option strictly NEED to be checked in Stonex PC Assistant.

When the configuration is completed, click on button "Save" to update the Receiver configuration.

V.3.2. Dynamic:

In this menu you can select between Base and Rover configuration:
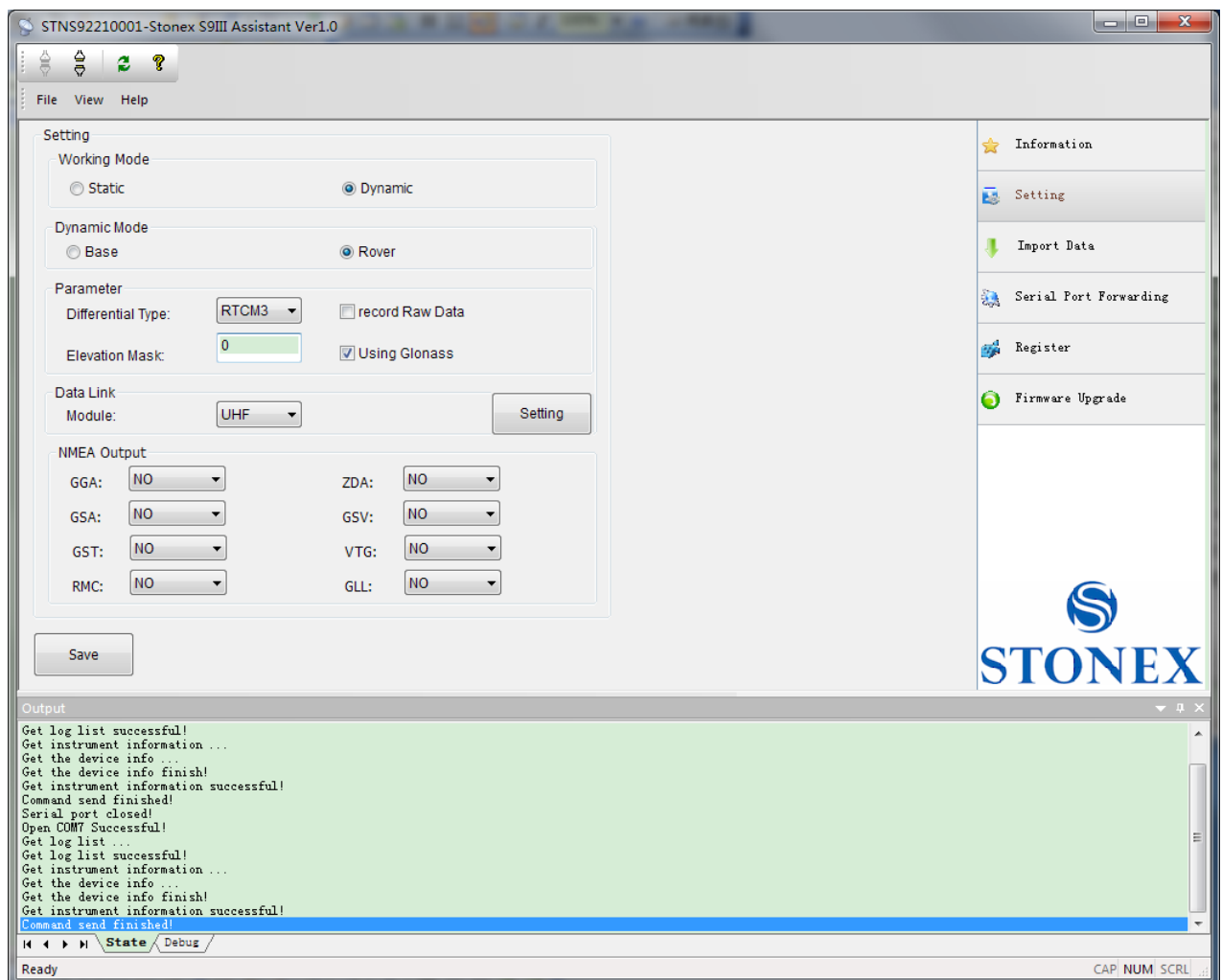
Fig. 5.6 – Dynamic Working mode

Some definitions:

Base   : is the fixed GPS station used to provide differential corrections to the mobile GPS receiver.

Rover : is the mobile receiver used to survey on field.

Choosing "Base" option, a "Base Setting" button will appear on the screen. Click on it, and the Base Setting module will appears on the screen, see Fig. 5.7:
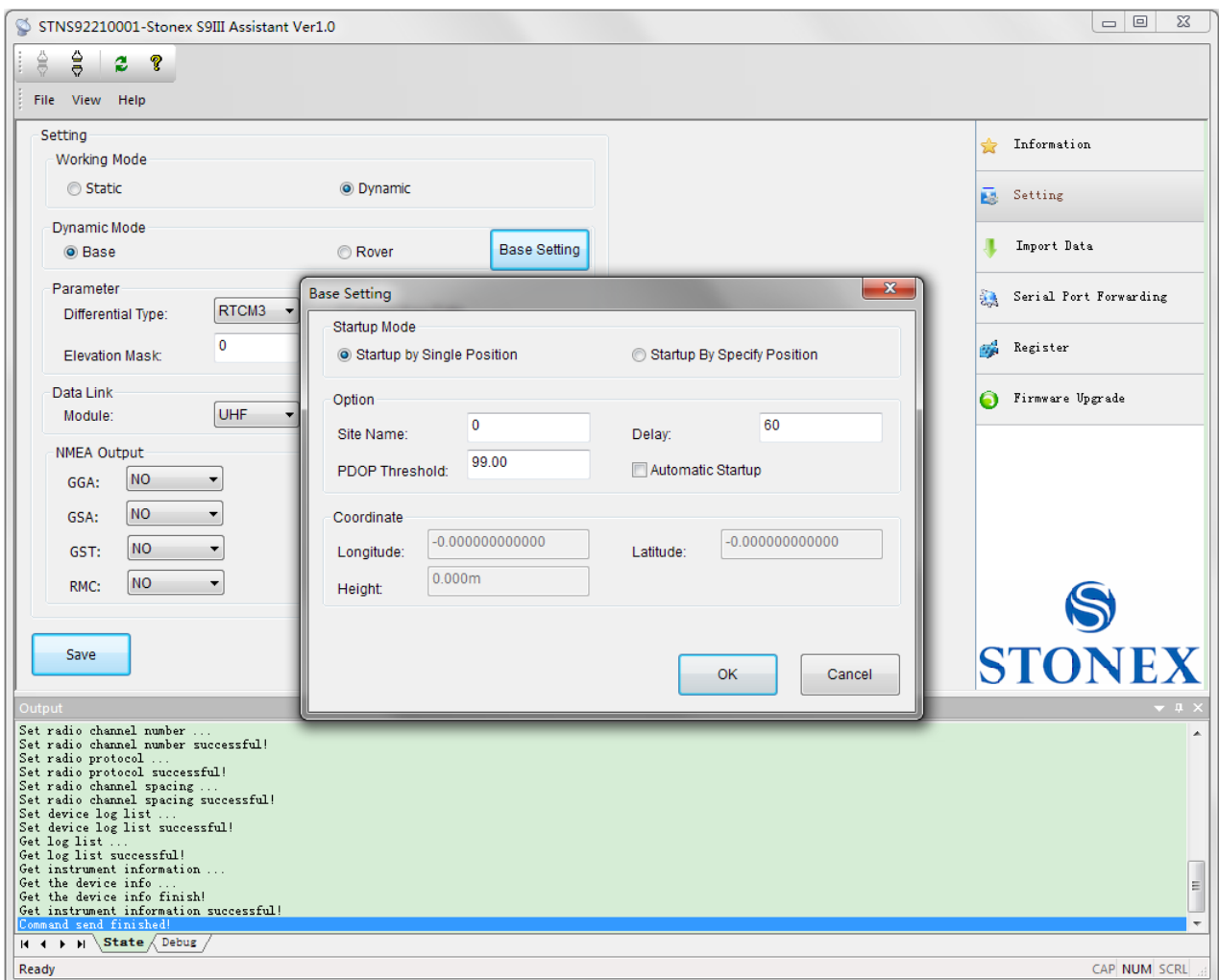
Fig. 5.7 – Base Setting

Inside this form , you can choose if the "Base" coordinates must be inserted manually ("Start Up By Specific Position ") or calculated from GPS observations (Automatic Start Up By Single Position) .

V.3.2.1. *Automatic Start Up By Single Position*

If checkbox "Automatic Start Up" is selected, the GPS Receiver will calculate the geographical coordinates of the base using an average value from GPS observations. The time delay after switch on for GPS data acquisition must be inserted in the Text Box "Delay".
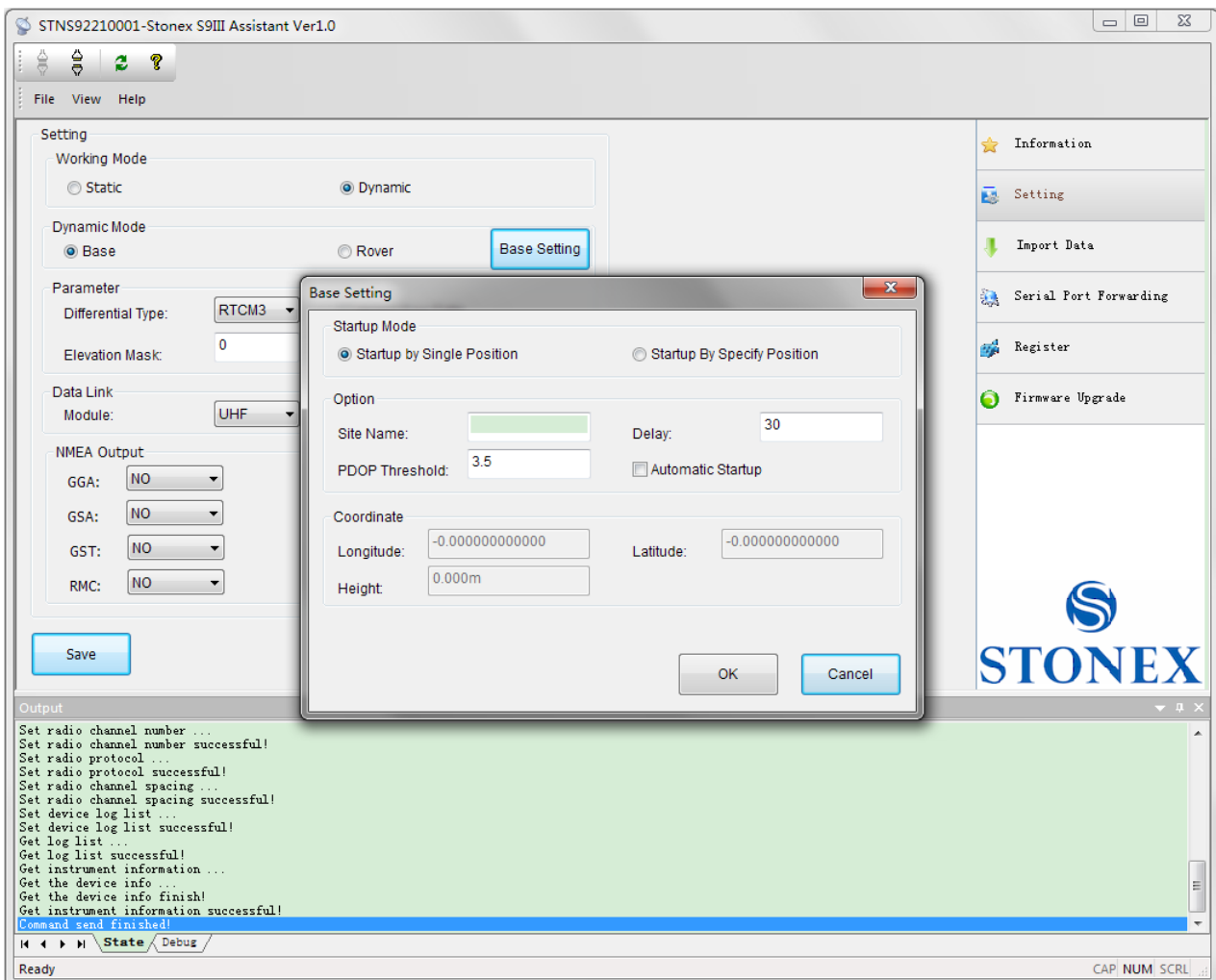
Fig. 5.8 – Automatic Start Up By Single Position

Click "OK" to confirm your data entry.

V.3.2.2. Start Up By a Specific Position:

By choosing the "Start Up by Specific Position" it is possible to introduce directly the geographical coordinates of the base (Known point).
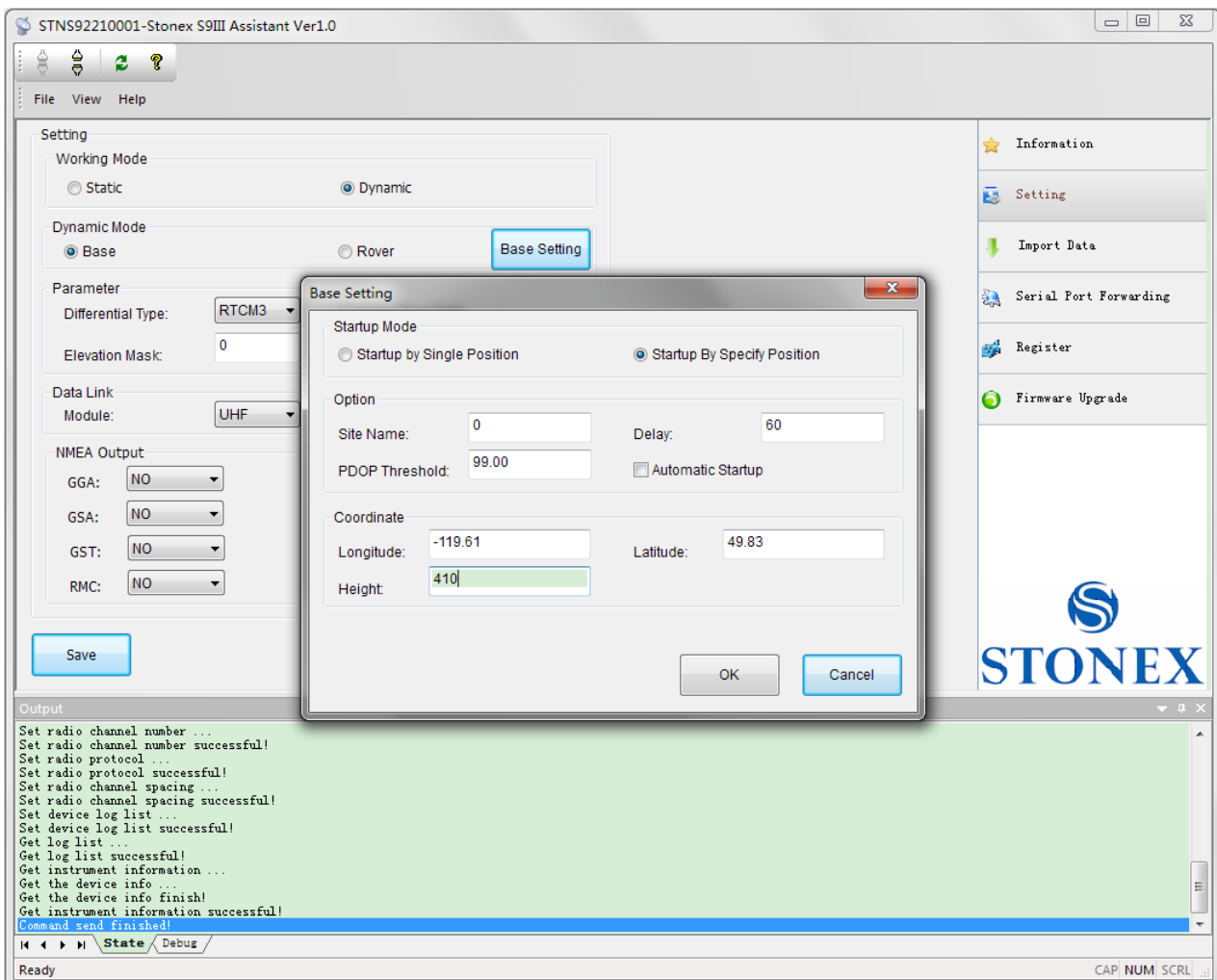
Fig. 5.9 – Start Up by a specific position

V.3.3. Data Link

Here you can select the type of data link used to get/provide differential corrections.

Four different options are available for "rover" mode, while two options for "base" mode (internal or external UHF radio).

V.3.3.1 Network

This option is relative to get GPS differential corrections from a CORS system.
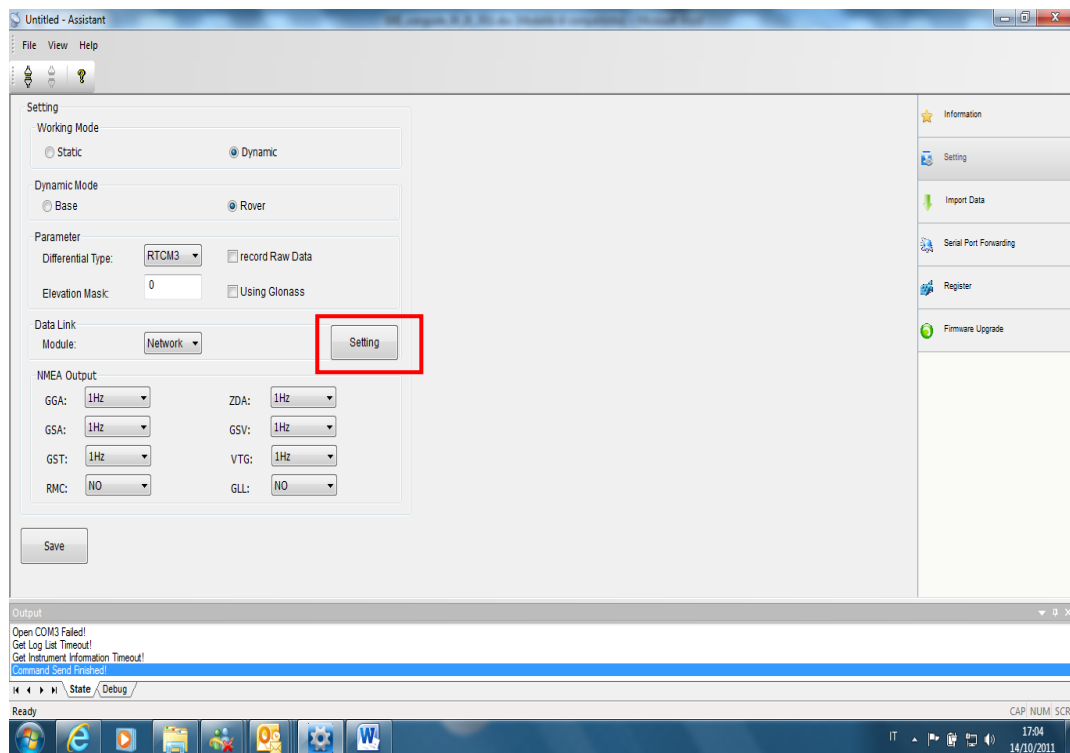
Fig. 5.10 – Network

If you will click on the button "Settings (red rectangle in Figure 5.10), a new form will open. From here you can choose the type of GPRS connection:
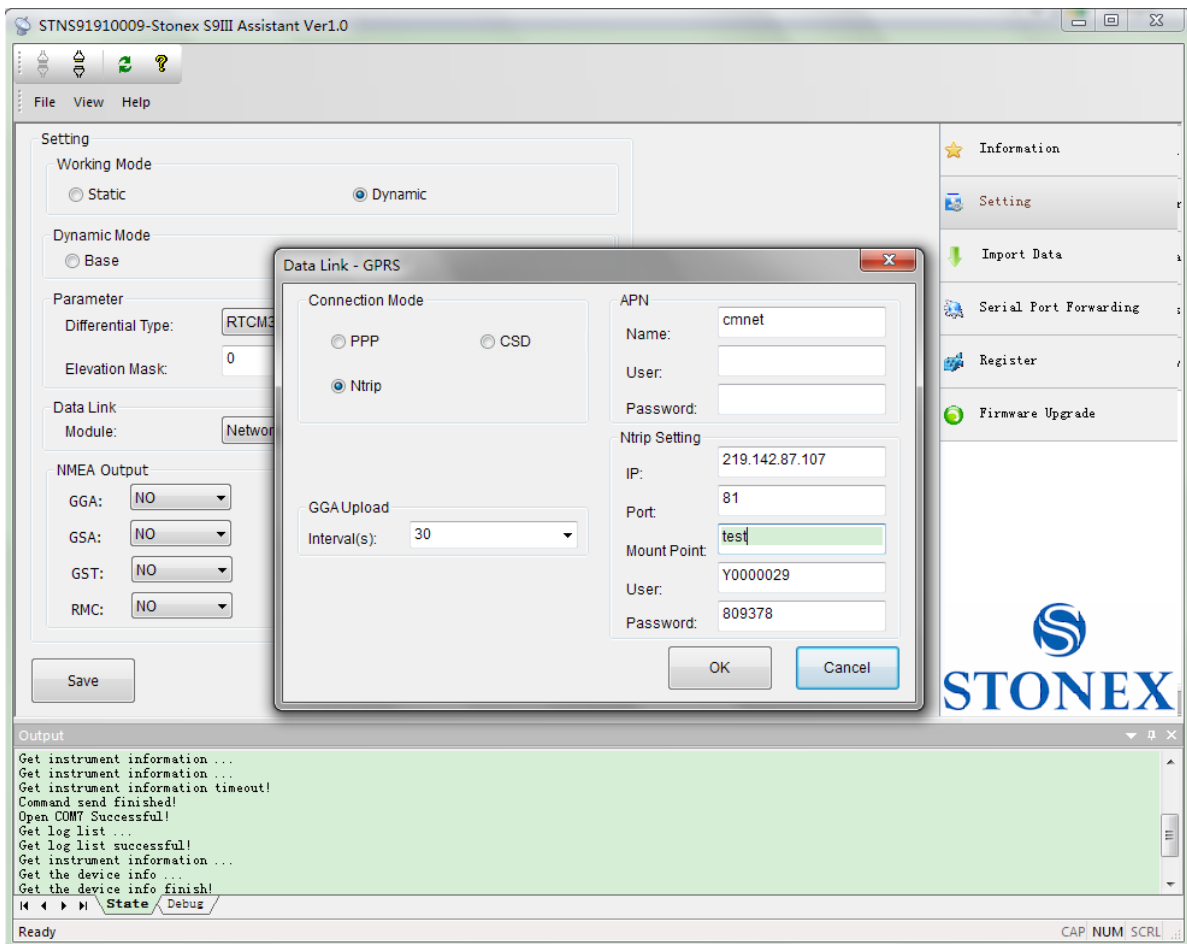
Fig. 5.11 – Network menu'

a) CSD: Normal dial GSM call, using a phone number that you can insert in "Base Number" Text Box.

b) PPP: For VPN (Virtual Private Network) users only. For VPN uses, each SIM card has assigned a static IP address. Therefore the rover can be connected directly to the base via entering the base IP.

c) NTRIP: Connection to a provider using data transfer in accord with NTRIP protocol. If you will select this option, the right side of the form (APN menu) will be activated, and from here you can insert data like:

    a) Name of APN provider → provider of the RF Network connection.

b) User and Password (normally not required).

c) NTRIP setting parameters like IP address of CORS provider, Port Address, Type of Mount Point, User Name and Password of the user.

The GGA input windows provide time or NMEA GGA string upload.

Click on "OK" button to confirm your entry.

V.3.3.2 UHF Radio

Choose this option when you are taking differential corrections from your GPS Base.

If you select UHF from the Scroll box the following page will be on your PC screen :
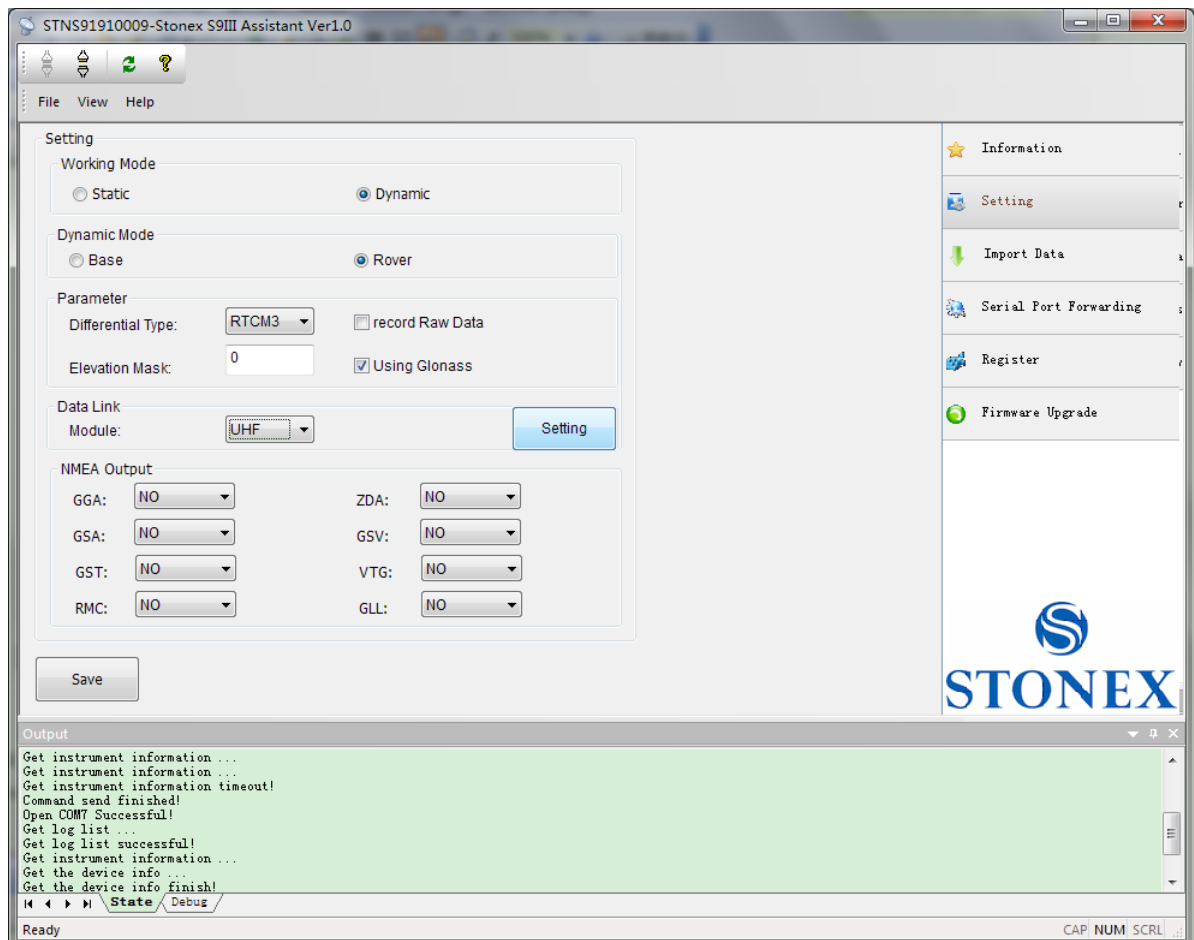
Fig. 5.12 – UHF Radio

By Clicking now the "Setting" Button will open a new form where you can introduce following data : Frequency settings , Station name , Channel number , Protocol and Channel Spacing .
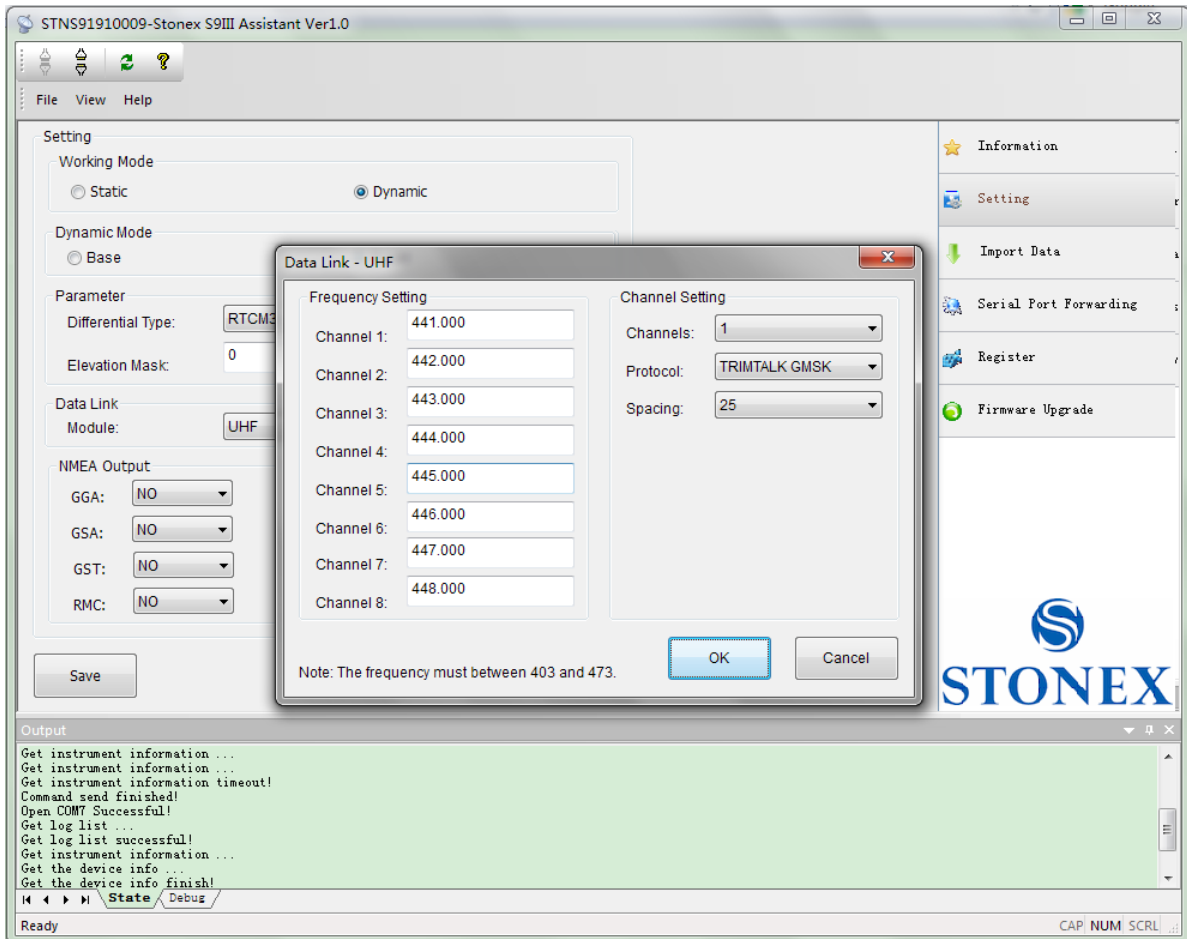
Fig. 5.13- UHF Radio Settings

a) Frequency setting: insert the frequency , expressed in Mhz , of the radio link associated to each channel .There are 8 channels available in the internal UHF radio .

b) Name : You can associate a name to each Radio .

c) Channels : Selected the "default" Radio channel active after power on .

d) Protocol : Select the type of Radio protocol . For internal Radio, Select TrimTalk GMSK.

e) Spacing : Select Minimum Channel Spacing (use 25KHZ like default) .

Click on button "OK" to confirm your choice.

V.3.3.3 Extend

This option give us the possibility to use an external UHF Radio connected by cable at lemo-5 connector .
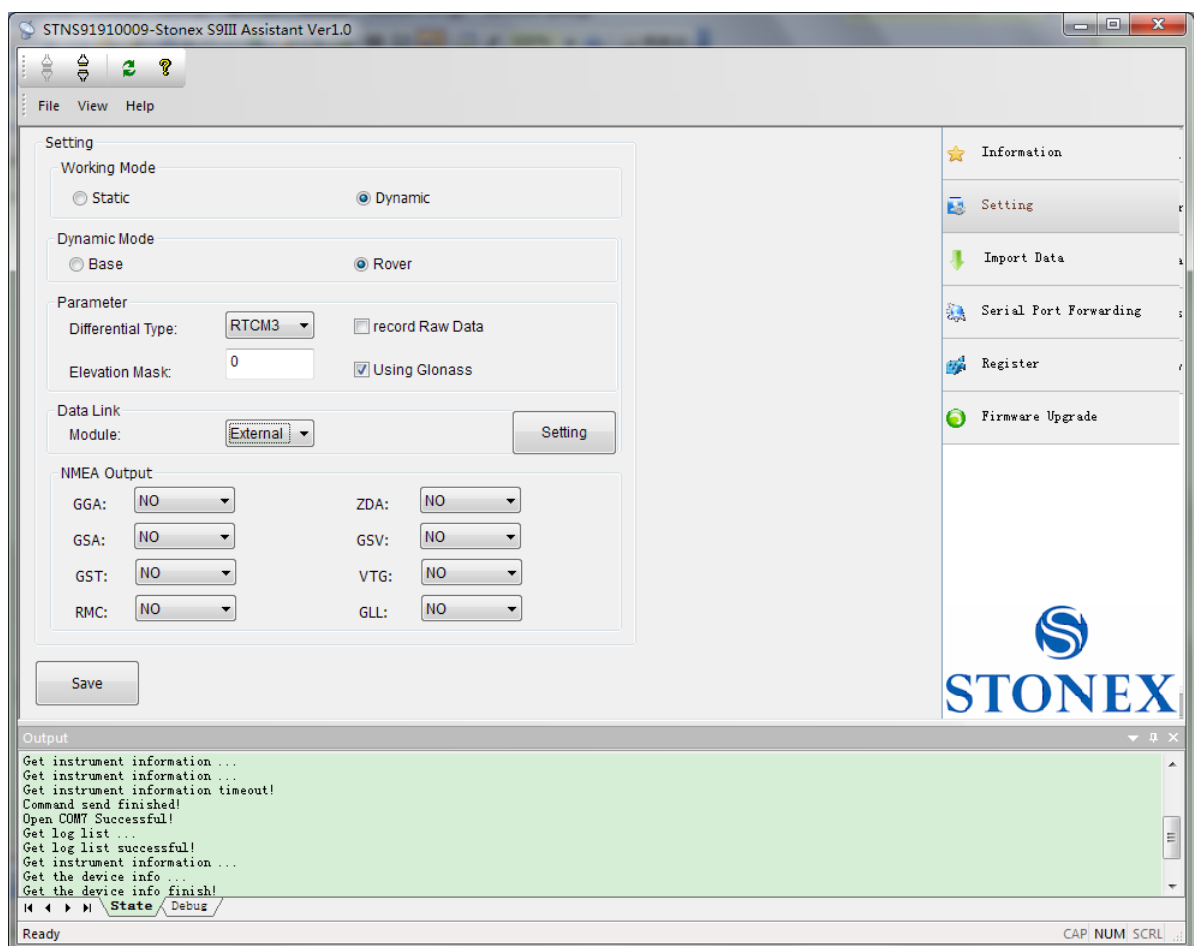
Fig. 5.14 – Extend (External Radio)

If you Click on "Settings" , a form will open and in this form you can insert the baud rate of the external radio.
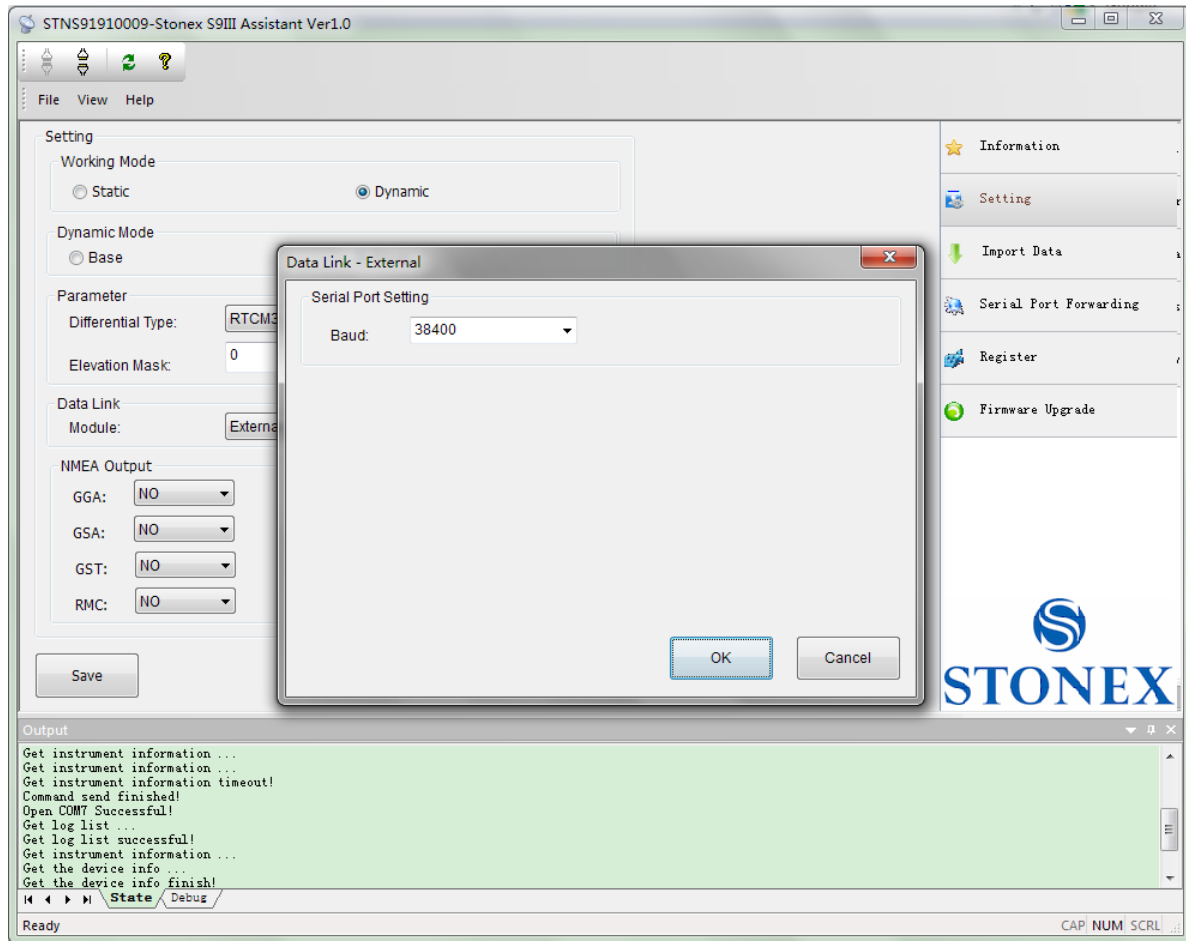
5.15-External radio baud rate

Click on button "OK " to confirm .

V.3.3.4. Bluetooth

To use Bluetooth for Data exchange. The RTK data share the same link with commands and position information between handheld and receiver (normally not used) .
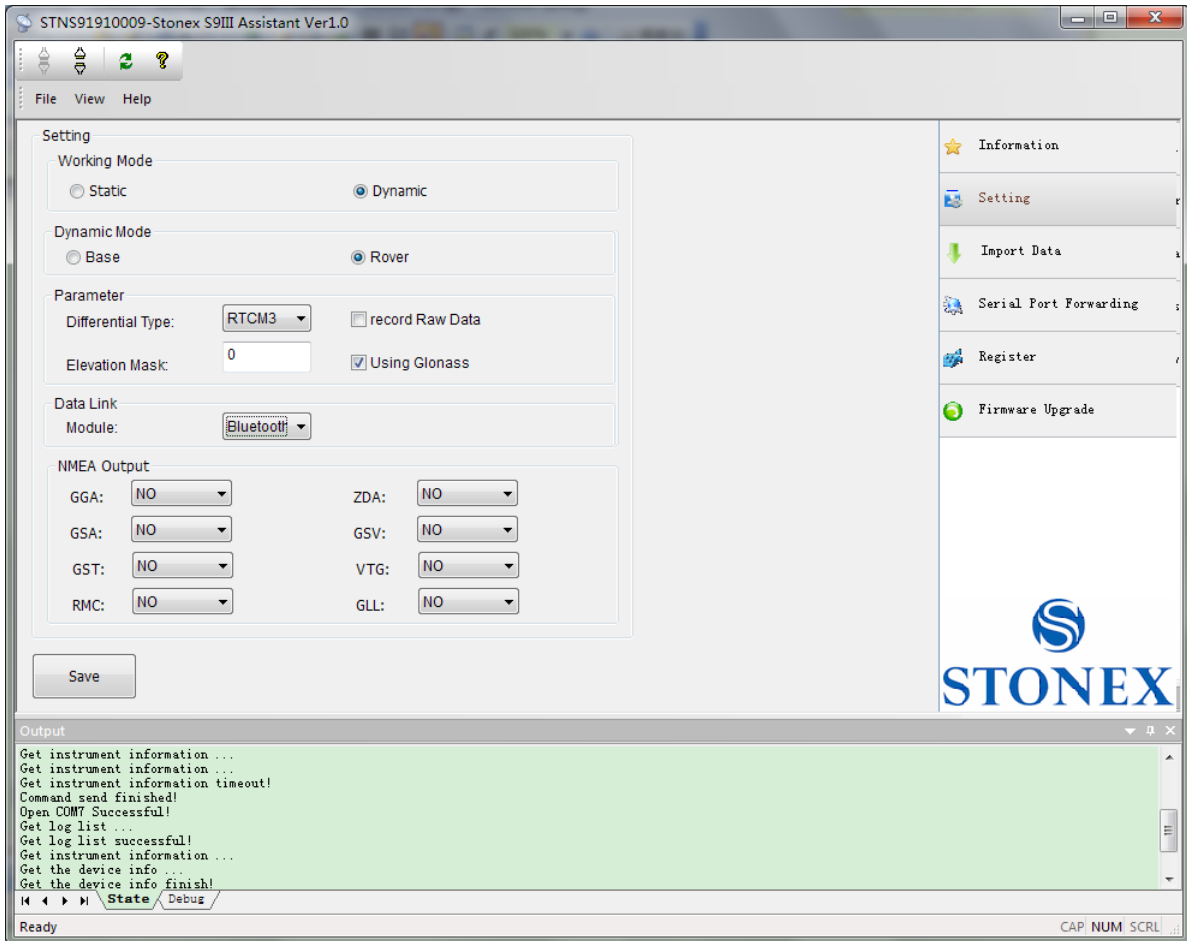
Fig. 5.16 - Bluetooth

When you have completed all your selection, please click on "Save" button and data will be stored inside S9 memory.

V.3.4 NMEA Output string.

NMEA output messages setting is available in the Setting session. See following figure:
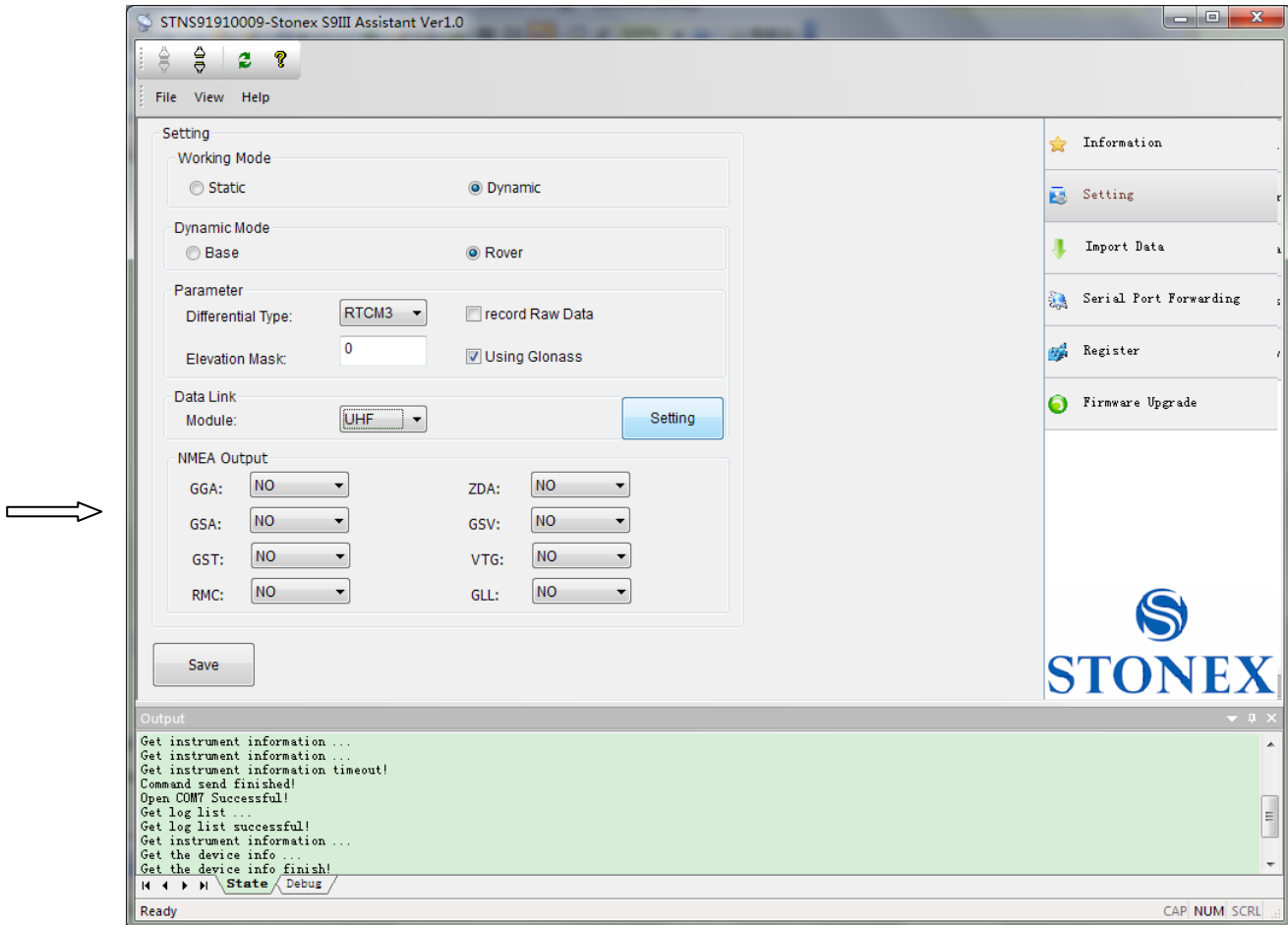
Fig 5.17- NMEA String

In this area you can configure the default NMEA messages that are output to the datalogger at the startup of the receiver.

V.4 Register the receiver

This command allows you to register the license code in a different way with respect to that explained in chapter IV.7. Click on "Register" and a window as in Fig. 5.16 is opened.

1) In the "Status" window, you can see the data of expiry of the temporary license .

2) In the "input authorization code" window you can insert the new temporary or permanent code provided by Stonex .

Click on " Enter" to confirm.
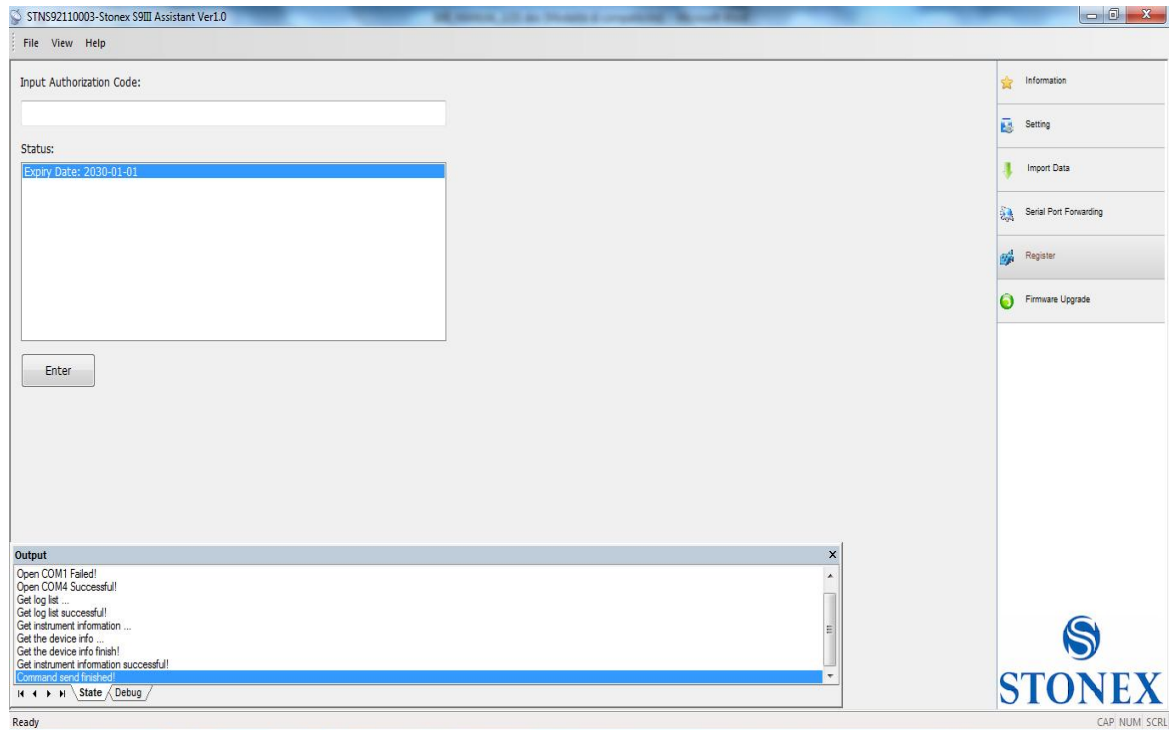
Fig. 5.18 –Register the receiver

V.6 Firmware update

Click the" Upgrade" button to select the location of the folder where the update firmware is located. Then select the firmware file and automatically it will be downloaded into the receiver.
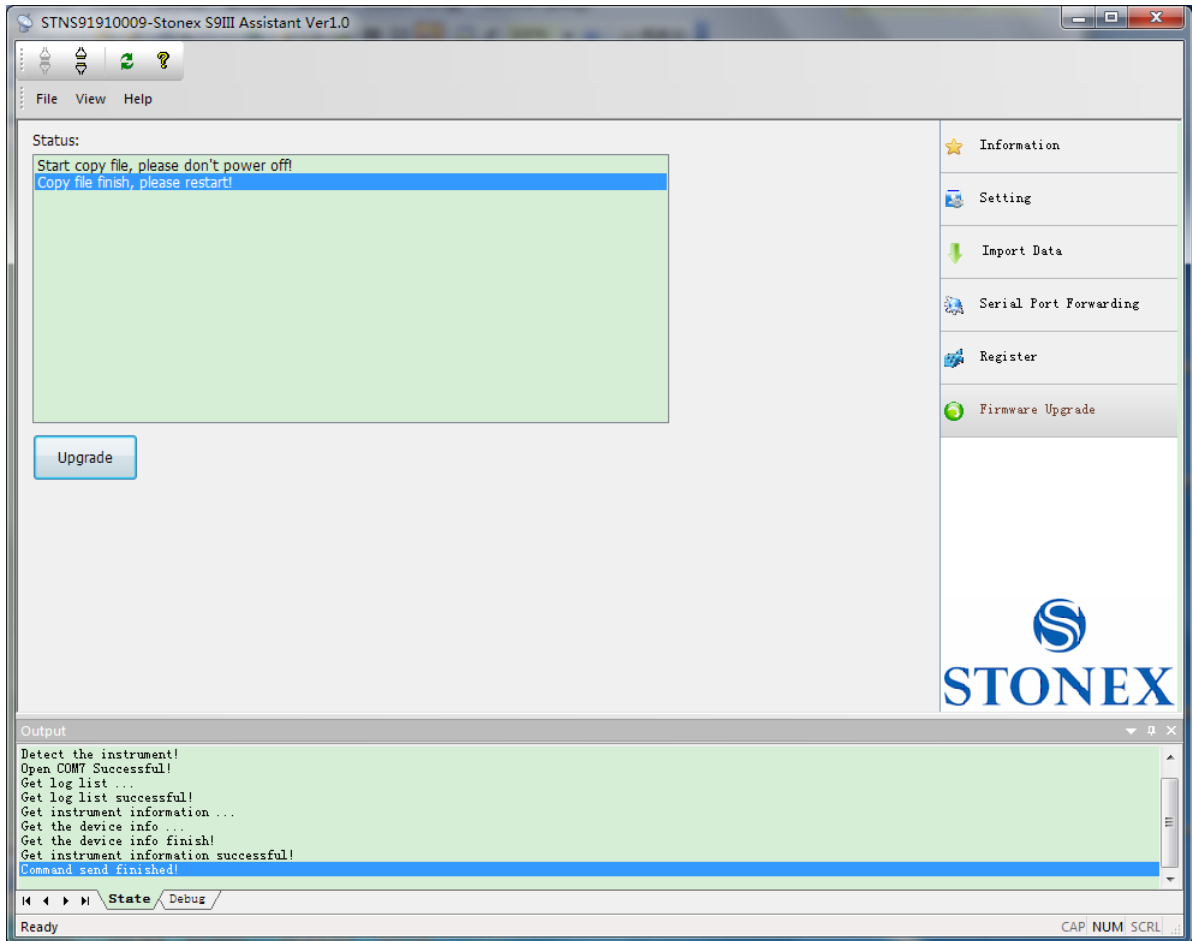
Fig. 5.19 – Firmware update window

V.7 Serial Port Forwarding

Note: This function is for advanced users and technical support only.

Port forwarding allows the configuration of the GNSS OEM module, UHF module and GPRS module directly. This functionality is valid only for DB9 serial port connection from 5-pin Lemo(LM.GK183.ABL). Select the module you want to connect and the serial port then press

"Open", then follow the instruction to restart the receiver. Then you will be able to communicate with the module directly. Please note that unintended commands might affect the operation of the receiver.
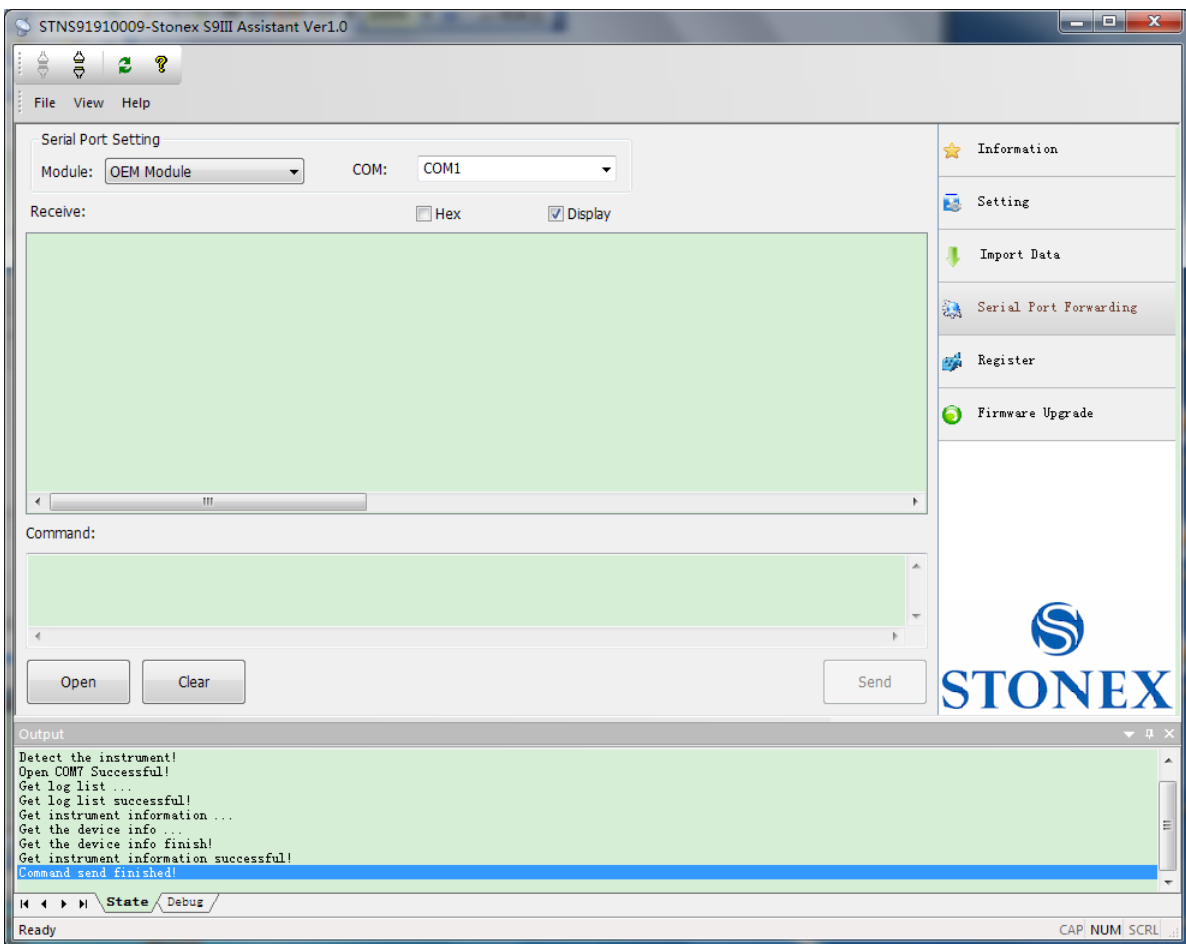
Fig. 5.20 – Serial Port Forwarding

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Appendix 1: Default Radio Settings

S9III uses a single UHF radio to cover the different the whole band 410-470 MHZ . Preset values is done directly from Stonex Europe in accord to the following tables :

Rate Channels	MHz
1 channel	411.050
2 channel	412.050
3 channel	413.050
4 channel	414.050
5 channel	415.050
6 channel	416.050
7 channel	417.050
8 channel	418.050

Tab. 6.1 – Internal radio default frequency (MDA)

Rate Channels	MHz
1 channel	438.125
2 channel	440.125
3 channel	441.125
4 channel	442.125
5 channel	443.125
6 channel	444.125
7 channel	446.125
8 channel	447.125

Tab. 6.2 – Internal radio default frequency (MDB)

Rate / Channels	MHz
1 channel	463.125
2 channel	464.125
3 channel	465.125
4 channel	466.125
5 channel	463.625
6 channel	464.625
7 channel	465.625
8 channel	466.625

Tab. 6.3 – Internal radio default frequency (MDC)

Appendix 2: Frequently Asked Questions

1. The receiver is set in static mode but it does not save data even if more than three satellites are locked. The three red lights are blinking.
Solution: the internal memory of receiver is full, please delete some files.

2. The external and built-in power lights are blinking and I do not succeed in receiving differential corrections.
Solution: The code license is expired, please contact STONEX® for a new code.

3. I do not succeed in connecting handheld and receiver by Bluetooth.
Solution: your receiver has a different working mode with respect to the menu of the controller, please switch mode. If the problem persists, please contact STONEX® .

4. The receiver is set in rover mode and GPRS/GSM data link, the SIM card is placed in its slot under the battery. However I do not succeed in reading the SIM card.
Solution: Every SIM has its PIN number, it must be disable. Moreover check on a cell-phone that there is enough money on SIM for connecting to the internet.

5. The base is transmitting a radio signal, the rover is set in rover mode and built-in radio data link, but data link light is turned off and rover doesn't receiver correction: probably the radio channel is wrong, use than handheld to select the correct radio channel on the rover.

Appendix 3: Technical Specifications

GNSS module specifications:

S9III GNSS/ S9IIIN GNSS	S8 GNSS/ S8N GNSS

Channels: 220
 	
Satellite signals tracked:
 	
  −GPS:L1 C/A, L2E, L2C, L5
  −GLONASS:L1C/A,L1P,L2C/A(only
    GLONASSM), L2P
  −SBAS:L1 C/A, L5
  −GIOVE-A:L1 BOC, E5A, E5B, E5AltBOC1
  −GIOVE-B:L1 CBOC, E5A, E5B, E5AltBOC1
  −COMPASS: (reserved)
	Channels: 120
	
	Satellite signals tracked:
	
	  − GPS: Simultaneous L1, L2E, L2C.
	  − GLONASS: Simultaneous L1, L2.
	  − Galileo: SimultaneousE1
	  − GIOVE-A/ GIOVE-B(test)
	  − SBAS
	  − COMPASS: (reserved)

- Very low noise GNSS carrier phase measurements with <1 mm precision in a 1 Hz bandwidth.
- High precision multiple correlator for GNSS pseudo range measurements.
- Unfiltered, unsmoothed pseudo range measurements data for low noise, low multipath error, low time domain correlation and high dynamic response.

- Proven low elevation tracking technology.
- 50 Hz raw measurement & position outputs.
- Signal recapture < 1 sec (**).
- RTK signal initialization typically < 10 sec (**).
- Initial capture time typically < 15 sec (**).
- Internal Memory: 4 Gb with micro SD card (over than 60 days of raw static data storage with recording sample every 1 second)

Receiver accuracy

	S9III GNSS/ S9IIIN GNSS		S8 GNSS/ S8N GNSS	
Static	horizontal accuracy	2.5mm + 1ppm RMS	horizontal accuracy	2.5mm + 1ppm RMS
	vertical accuracy	5mm + 1ppm RMS	vertical accuracy	5mm + 1ppm RMS
Fixed RTK	horizontal accuracy	8cm + 1ppm RMS	horizontal accuracy	10cm + 1ppm RMS
	vertical accuracy	15cm + 1ppm RMS	vertical accuracy	20cm + 1ppm RMS
Code differential positioning	horizontal accuracy	0.25cm + 1ppm RMS	0.4m RMS	
	vertical accuracy	0.5cm + 1ppm RMS		
SBAS positioning	horizontal accuracy	<1m 3DRMS	0.6m 3DRMS	
	vertical accuracy	<5m 3DRMS		
Startup time	<10s		<10s	
Reliability	＞99.9%		＞99.9%	

Connection devices and protocols :

- Connectors I/O: 7-pins LEMO and 5-pins LEMO interfaces.
- Multi-cable with USB interface for connecting with PC.
- 2.4GHz Bluetooth device class II: maximum range is 50m.
- GSM/GPRS data modem
- Cable for RTK connection by external datalink(optional).
- Serial protocols

    Reference outputs: CMR, CMR+, RTCM 2.3, RTCM 3.0, RTCM 3.1.

    Navigation outputs: GGA ZDA GST GSV GSA GGK GLL RMC VTG

Radio module

S9III GNSS/S8 GNSS	S9IIIN GNSS /S8N GNSS
Internal transmitting and receiving radio: MDS TRM 450	without radio module
Frequency range available: 410-470 MHz.	
Emitting power: 0.5 W	
Compatibility with Trimtalk protocol (Pacific Crest radio)	

GPRS/GSM module

The GPRS/GSM board mount a Telit_GC864-QUAD_V2 unit for GSM/GPRS communication. This module supports:

- Quad-band operation at 800 MHz, 900 MHz, 1800 MHz, 1900 MHz.

- GPRS Multislot class 12.

- EDGE (E-GPRS) Multishot class 10.

- GSM release 99.

- Output power: class 4 (2 W) for EGSM850 AND EGSM900, class 1 (1 W) for GSM1800 and GSM1900.

Power Supply:

- 9 to a 18V DC external power input with over-voltage.

- Voltage: 7.2 V.

- Working time in static mode: typically 6 hours.

- Working time in RTK rover mode: typically 4 hours.

- Charge Time: typically < 7 hours.

- Power consumption: < 3.8 W.

- Remaining time with battery light blinking: 1 hour.

Physical specification:

- Size: Height 99 mm x Diameter 190mm. 62 mm from the center of the rubber loop to the bottom.

- Weight: 1.2 Kg with internal battery, radio standard UHF antenna.

- Operational temperature: -30°C to 60°C (-13°F to 140°F) (Internal radio TX mode 50°C)

- Storage temperature: - 40°C to 80°C (-67°F to 185°F)

- Waterproof: protected from temporary immersion to depth of 1 meter and from 100% humidity.

- Dustproof.

- Shock resistance: designed to survive a 2m pole drop on the concrete.

- Vibration resistance.

*This specifications depends on weather and satellite visibility conditions

** This specification depends on satellite visibility conditions

Appendix 4: Copyrights, warranty and environmental recycling

Copyrights and trademarks

© 2012, STONEX® Limited. All rights reserved.

STONEX®, the STONEX® logo, and S9III GNSS receiver are trademarks of STONEX® Limited

STONEX® Assistant, *STONEX® GPS Processor* and *STONEX® SurvCE* 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 February 2012 release of the STONEX® S9III 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 2012

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 ® Europe warrants that its Products:

(1) are free from defects in materials or workmanship for generally 2 years (see appendix 4).

    a) accessories or specific parts for which different limited warranty period shall apply(see appendix 5).

(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® Europe will repair the product or send parts for replacement at its expense. STONEX® Europe 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® Europe 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®Europe. 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® Europe 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® Europe representative office and STONEX®

Europe is providing the shipping for return. Dealers needs to follow STONEX® Europe 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® Europe 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®Europe.

Above terms and policies shall apply as for hardware. Dealers needs to follow STONEX®Europe repair/service procedure (see appendix 4) to achieve a better and prompt service result.

Firmware/Software warranty.

Stonex Europe 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®Europe 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 NONINFRINGEMENT 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: S9 GNSS Series/Vector/ Walker II / PLT1

Accessories.

Accessories & Specific Parts Warranty :

For Accessories provided by Stonex with the instruments S9 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.

Restriction for GPS Boards.

For GPS receiving boards (Trimble, Novatel) used on S9 and S8 family of GPS receivers, Stonex Europe provides warranty time for one (1) year.

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® Europe and pay for it and so STONEX® Europe 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® Europe's authorization SPR no;

4) when dealer receive the SPR authorization no they can send back to STONEX® Europe appointed office the broken part with attached the SPR module;

5) when STONEX® Europe receives the broken part STONEX® Europe 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® Europe).

(3) If the instrument needs to be sent back to STONEX® Europe for repair/replacement, dealer/customer has to send to STONEX® Europe a "Returned Merchandise Authorization (RMA)" before they send back the fault instrument. STONEX® Europe 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.

Certification Information

FCC Certification

English：This equipment complies with FCC radiation exposure limits set forth for an

uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20cm between the radiator & your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

French：Ce matériel est conforme aux limites établies par IC

en matière d'exposition aux radiofréquences dans un

environnement non contrôlé. Ce matériel doit être installé

et utilisé à une distance d'au moins 20 cm entre l'antenne

et le corps de l'utilisateur.

Warning

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

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.

IC Certification

English： This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

French： Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

English： This Class【B】 digital apparatus complies with Canadian ICES-003.

French：Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.