



Stonex Surveying

- ▶ *Stonex[®] GPS Processor*
User Manual

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Chapter I : A brief introduction of S9

STONEX® devoted itself to offer to surveyors the most advanced GPS tools they need. GPS RTK surveying technology plays an important role in surveying work and its use is getting more and more widespread. As a leading GPS RTK instrument produced, STONEX® guarantees the S9, its latest RTK GPS receiver, is suited for the requests of precision, reliability and user friendliness of nowadays.

S9 is able to receive both frequencies of GPS signal, but also satellite signals from GLONASS and GALILEO, so we must correctly speak of “GNSS” receiver.

S9 mainframe is integrated with GNSS antenna, GNSS module, UHF radio, receiving radio antenna, GSM/GPRS modem, Bluetooth device and battery. S9 is totally integrated: that means that the surveyor only needs the handheld to start its job.

The exquisite outlook and the amazing color bring you a fashioned surveying situation. The design has a higher stability, less power losing, smaller volume and lighter weight than the previous STONEX® receivers. S9 has a special design which makes it waterproof, dustproof and quakeproof. The batteries and built-in radio are set in the bottom of mainframe, giving more effective dustproof and waterproof qualities, and making S9 a better performer in field surveying. Wireless receiver unit weights 1.2 kg: the rover is light and easy to carry. The low power losing of receiver allows the single battery to meet a long time workability.

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 at the same level of international advanced technology: 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 centre connected with the electromagnetic centre of dual-frequency antenna, at the same time it reduces the interference and makes the volume much smaller. The tight electronic shielding can avoid the interference more effectively.

The S9 receiver mount a GPS/GLONASS antenna with a four feed technology. This design is able to reduce the electrical phase center error ellipsoid and in addition 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 S9 has a GPRS/GSM module which supports different net RTK technologies (VRS, FKP, etc.). This allows STONEX® S9 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 by CORS via GSM/GPRS data modem (maximum range 70 km) or by another S9 receiver acting as base, linked by GSM/GPRS data modem or UHF radio modem.

In the last case S9 in base configuration must be connected to an external radio: there are three different radios, with different power output, at user's disposal in order to reach the requested metric range.

The embedded receiver firmware can customize different RTK software for different applications. The data transfer is easy and fast, like a Plug and Play USB drive.

STONEX® provide S9 receivers with a two year complete international warranty.

It should be remembered 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. 42).

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

Anyway we recommend you to treat 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 to read a specific book in order to better understand the contents of this manual. Anyway you can ask for any technical support to our address support@stonexeurope.com or contact your local dealer.

Chapter II : S9 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 blows or falls. In the front side of the main structure there are keys and lights, on the bottom side there are one slot for the built-in receiver radio and GSM module, and one for the battery and SIM card. All the others components of the receiver (Bluetooth device, main board, GSM module, etc.) are contained inside the main structure.



Fig. 2.1 - S9 mainframe

II.2 Interfaces

The mainframe interfaces are shown in Fig.2-2: the left port is used for external power supply and external transmitting radio (five pins *LEMO*), the right port is used for data transferring between receiver and computer or between receiver and the handheld (nine pins serial port). Near the radio module there is the radio antenna interface.

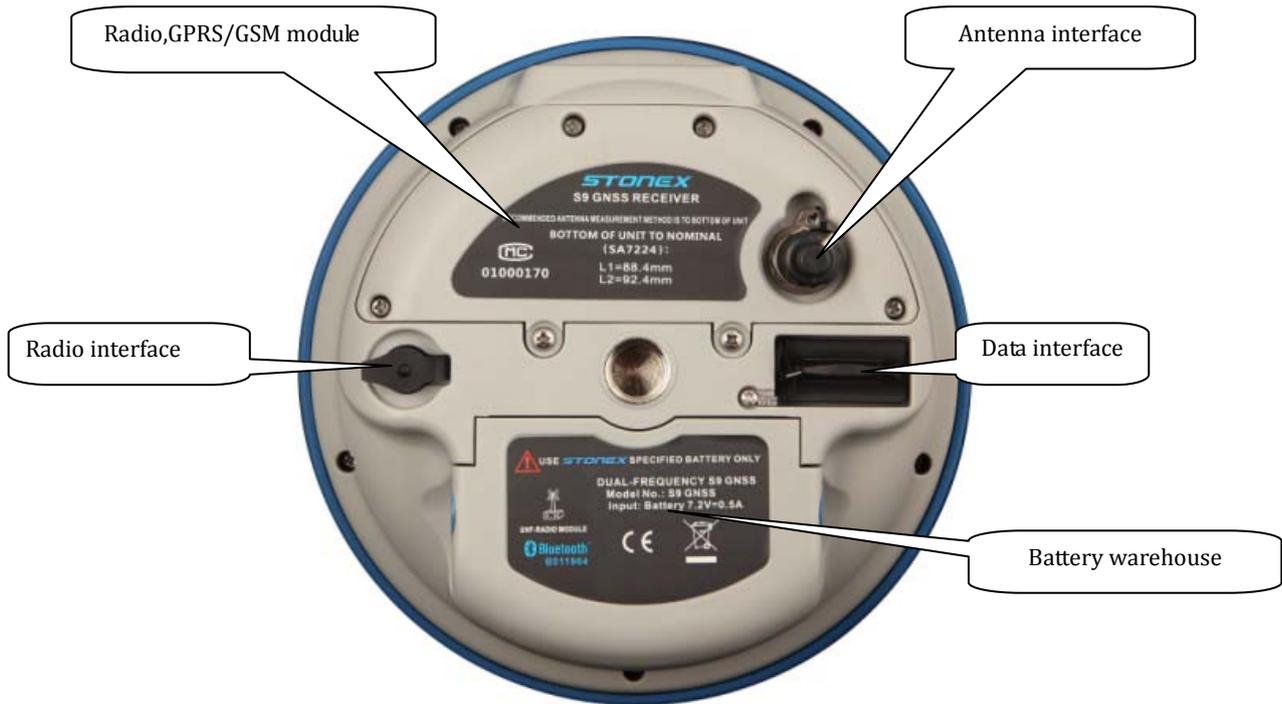


Fig. 2.2 - S9 bottom and interfaces

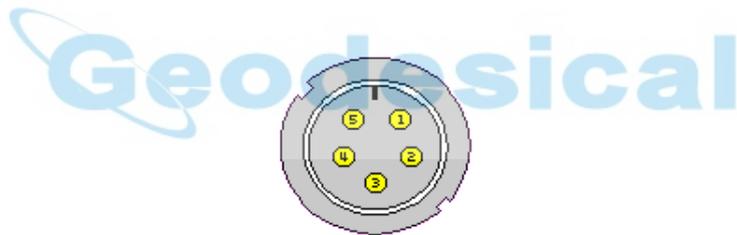


Fig. 2.3 - 5-pins LEMO connector

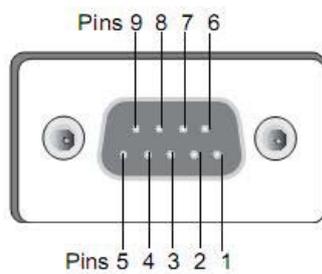


Fig. 2.4 - 9-pins connector

II.3 The installation of battery

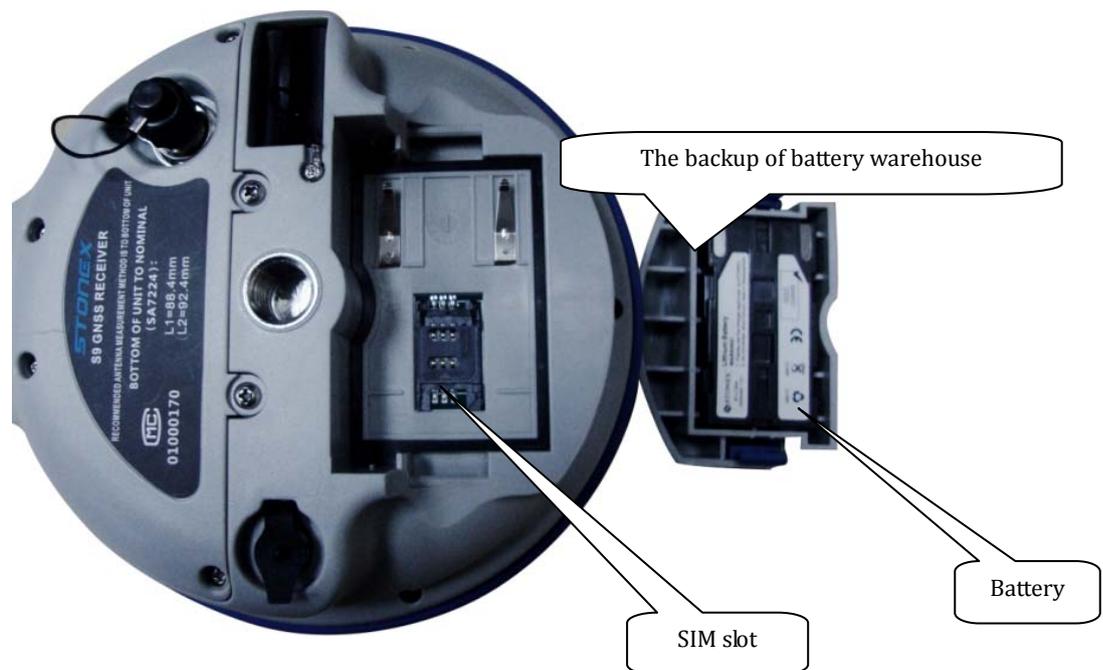


Fig. 2.5 - S9 battery warehouse

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

II.4 Indicator lights and instrument setup

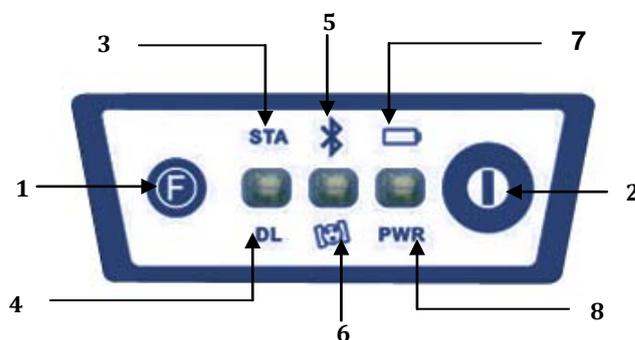


Fig. 2.6 - S9 keys and indicator lights

1. Function Key
2. Power Key
3. Status light
4. Data link light
5. Bluetooth light
6. Satellite light
7. Built-in power supply light
8. External power supply light

As you see in figure 2.6 there are three indicator lights, each one with two different colors referred to two different functions.

From the left to the right:

1st indicator: status indicator light (red), data link indicator light (green)

2nd indicator: Bluetooth indicator light (red), satellite indicator light (green)

3rd indicator: Battery power light (red), external power supply indicator light (green).

The usages of them are as follows

BAT (red): Built-in power supply light (Fig.2.7).

It includes two kind of status

1. Fixed: electricity supply in good condition.
2. Flashing: lack of electricity.

Usually when the light begins to flash you have still one hour of power



Fig. 2.7 - S9 built-in power light

PWR (green): external power supply light (Fig. 2.8).

It includes two kinds of status.

1. Fixed: electricity supply in good condition.
2. Flashing: lack of electricity



Fig. 2.8 - S9 external power light

BT (red): Bluetooth indicator light (Fig. 2.9).

Once you have connected controller with receiver, this light will keep.



Fig. 2.9 - S9 Bluetooth light

SAT (green): Satellite light (Fig. 2.10).

It shows the amount of locked satellites, when the receiver gets satellites signal it will start to blink for a number of times equal to the amount of locked satellites.



Fig. 2.10 - S9 satellite light

STA (red): Status light (Fig. 2.11).

In static mode, its blinking means that the receiver is recording data. In base mode its blinking means that base is transmitting data. In rover mode and GSM data link, its blinking after connection shows that the data link module is working in good condition.



Fig. 2.11 - S9 status light

DL (green): Data Link light (Fig. 2.12).

In static mode, it will keep lighted. In rover mode and radio data link, its blinking shows that the is receiving corrections. In rover mode and GSM data link, its blinking after connection means that data link module working in good condition.



Fig. 2.12 - S9 Data Link light

The following table summarizes the most common situations which user can find:

Receiver Mode	Power LED (red)	Status LED (red)	Data Link LED (green)	Satellite LED (green)
Receiver ON Healty Power	ON	Not relevant	Not relevant	Not relevant
Receiver ON Low power	flashing	Not relevant	Not relevant	Not relevant
Logging of static data	ON	Flashing with frequency of data sampling	ON	Flashing for a number of times equal to the amount of locked satellites
Transmitting data by external radio	ON	Flashing every second	Not relevant	Flashing for a number of times equal to the amount of locked satellites
Receiving data by internal radio	ON	Not relevant	Flashing every second	Flashing for a number of times equal to the amount of locked satellites
Receiver data by GSM	ON	flashing every 10 seconds	flashing every second	Flashing for a number of times equal to the amount of locked satellites

Tab. 2.1 - S9 light configuration

F Key : Function key

It can switch the working mode (static, base or rover) and RTK kind of communication (built-in radio, external radio or GSM).

P Key: Power key

It has power on/off receiver function and confirm function.

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

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

Self-Check: when the receiver works abnormally, you can make a self-check to fix it, the operation way is:

- Press and hold P 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 1 minute: during this procedure first you see the data link green light turning on, then also the other two green lights turns on and you also hear a repeated beep sound. After that receiver will turn on and return to work correctly. It's better for a new machine to have self-checking once.

How can you select the working mode?

- Insert the battery in the battery box, then press and hold P key + F key: the receiver will start.
- Keep pressed P key + F key until the six lights blink at the same time (Fig. 2.14), then release the keys.



Fig. 2.13 - S9 six lights blinking at the same time

- Now every time you press F key, the 6 lights will begin to blink by turns from right to left. You can select three different red lights, each of them refers to one working mode.

- Press P key when the chosen light is blinking and the receiver will start the working mode selected.

Rover mode: When the light stops on the STA light, press P key to confirm, you will enter rover mode. Such as following figure:



Fig. 2.14 – S9 status light

Base mode: When the light stop on the BT light, press P key to confirm, you will enter base mode. Such as following figure:



Fig. 2.15 - S9 Bluetooth light

Static mode: When the light stops on the BAT light, press P key to confirm, you will enter static mode. Such as following figure:



Fig. 2.16 - S9 built-in power light

How can you select data link?

After you have entered working mode, press and hold F key, when you hear 2 beeps, and see a green light blinking, release the key, wait some seconds, then press F key, the 3 green lights will blink by turns. Then you can select different green lights, each one refers to different data link.

In rover mode, you can see 3 green lights blinking by turns; in base mode, you can only see 2 green lights blinking, this means that you can only select GPRS/GSM module and external radio, not built-in radio. In static mode, there is no green light blinking.

Built-in radio: When the green light stops on DL light, press P key to confirm, you will use built-in radio, such as following figure:



Fig. 2.17 - S9 data link light

GPRS/GSM module: When the green light stops on STA light, press P key to confirm, you will use GPRS/GSM module as data link, such as following figure:



Fig. 2.18 - S9 satellite light

External radio: When the green light stops on PWR light, press P key to confirm, you will use external radio as data link, such as following figure:



Fig. 2.19 - S9 external power light

How can you check the working mode and data link during work ?

You can press F key one time to check the work mode and data link. There are 6 kinds of status,

such as follows.

Static mode: When you press F key one time and see the following figure, it means static mode.



Fig. 2.20 - S9 built-in power light

Rover & built-in radio: When you press F key one time and see the following figure, it means rover & built-in radio mode.



Fig. 2.21 - S9 status and data link light

Rover & GPRS/GSM module: When you press F key one time and see the following figure, it means rover & GPRS/GSM module mode.



Fig. 2.22 - S9 status and satellite lights

Rover & external radio: When you press F key one time and see the following figure, it means rover & external radio mode.



Fig. 2.23 - S9 status and external power light

Base & external radio: When you press F key one time and see the following figure, it means base & external radio mode



Fig. 2.24 - Bluetooth and external power lights

Base & GPRS/GSM module: When you press F key one time and see the following figure, it means base & GPRS/GSM module mode.



Fig. 2.25 - Bluetooth and satellite light

Chapter III : S9 external radio

III.1 Introduction of radios

The external radios are high speed wireless semi-manual data transfer radios whose baud rate can reach 19,200 bps, which is used in S9 GNSS RTK GPS system.

These radios adopt GMSK adjust mode, and they have a very low bit error rate (BER).

They adopt a transparent mode to transfer data to the RTK GPS system.

The data transfer interface of radios is the 5-pins LEMO; it can do data transferring with any terminal equipment which owns 5 pins LEMO.

They adopt advanced wireless booting technology, data processing technology and base band processing technology which secures it a long time life.

The eight radio channels and relative frequency are listed in the following table:

Channels \ Rate	450-470MHz
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. 3.1 – Radio channels

The corrections sent by the base through the radio have different formats (CMR, CMR+, RTCM, RTCM3). After you have selected one of them in the base settings, rover will set itself automatically on the correct format, so there is no need to check it every time.

III.2 Introduction of GDL25 radio outlook

The outlook of GDL 25 radio is simple, the control panel indicator lights show the radio status,

the operation of the keys is simple, one to one interface can avoid connection error.



Fig. 3.1 - GDL25 external radio

The panel of GDL25 radio:

- CHANNEL key: by press this key can switch trough the 8 radio channels.
- ON/OFF key: power on/off the radio.
- AMP PWR indicating light: when is lighted, it means that radio is working with lower emitting power.
- TX indicating light: it blinks every second when it is transmitting signal properly.

The panel looks as follows:



Fig 3.2 - Panel of radio

These are the interfaces of GDL25 radio:

- Antenna interface: BNC connector
- Mainframe interface: 5-pins, for connecting GPS receiver and power supply.



Fig. 3.3 - Radio interfaces



Fig 3.4 - 5-pins interface (for receiver and power supply)

Size of GDL25 radio:

- Volume: 175mm×157mm×67mm
- Weight: 1000g

Power switch:

The switch is used for adjusting radio power, the AMP PWR light shows the radio power, when it is lighted, it means that the power is low, when it shuts off, means the power is high. See as follows:

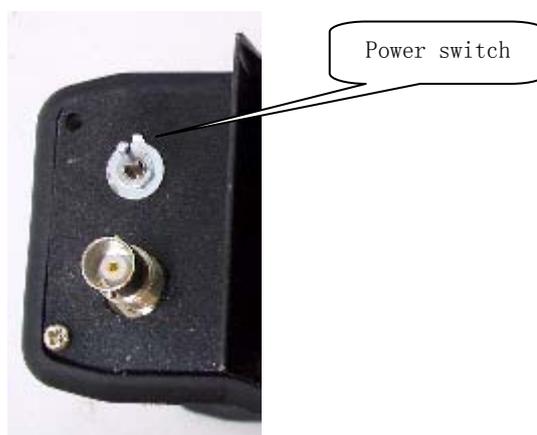


Fig 3.5 - Power switch

Note: it's better to use the low power. For high power will double consume the power, and will lower power life.

III.3 Notices for GDL 25

The specification of power supply is as follows:

- GDL25 radio power input is 12-15V (typical is 13.8V), the RF power is 25W, the current is lower than 7.1A (when power is 13.8V)
- The quality of power has effect on communication, so the quality of power should be promised; the ripple coefficient of power should be lower than 40mV, for the minimum effect on radio-frequency spectrum, and for increase the quality of communication.
- Before switching on the GDL25 radio, you should check whether the anode and cathode are connected correctly, if they are reverse, it will damage the radio.
- Suggestion: Using 12V/36Ah external power supply; when using external steady power supply, it should keep the current at 10A.
- Using 12V/36Ah external power supply, if lower than that, it may has effect on the working distance of radio, and lower the usage life of battery.
- The battery should be charged in time, don't overuse the battery.

For instance:12V/36Ah can provide the radio working for 14 hours(15W), if the time beyond 14 hours, then it will have effect on the transmit, and besides, it will lower the usage life of battery.

- Using 25W radio will add the consumption of battery, usually the 15W is enough, if the interference is strong, then you can select the 25W.
- After the battery has been used for half a year to one year, the working distance will be shorten, so change the battery to maintain the working distance of radio.

III.4 GDL2/GDL5 external radios

There are two other external radios which have a transmitting power much lower than GDL25.

You can use these radios if you have to transmit data for shorter distance (few kilometers). The power characteristics of these radio are the follows:

- GDL2: Power output 0.5W/2W
- GDL5: Power output 2W/5W



Fig. 3.6 - GDL2/GDL5 external radios

The panel of GDL2/GDL5 radios:

- CHANNEL key: by press this key can switch trough the 4 radio channels.
- ON/OFF key: power on/off the radio.
- ARM light: when is lighted, it means that radio battery is low.
- PWR light: when is lighted, it means that radio is on.
- TX light: it blinks every second when it is transmitting signal properly.
- AMP light: when is lighted, it means that radio is working with lower emitting power.
- Power switch: is used for adjusting radio power.

The panel looks as follows:

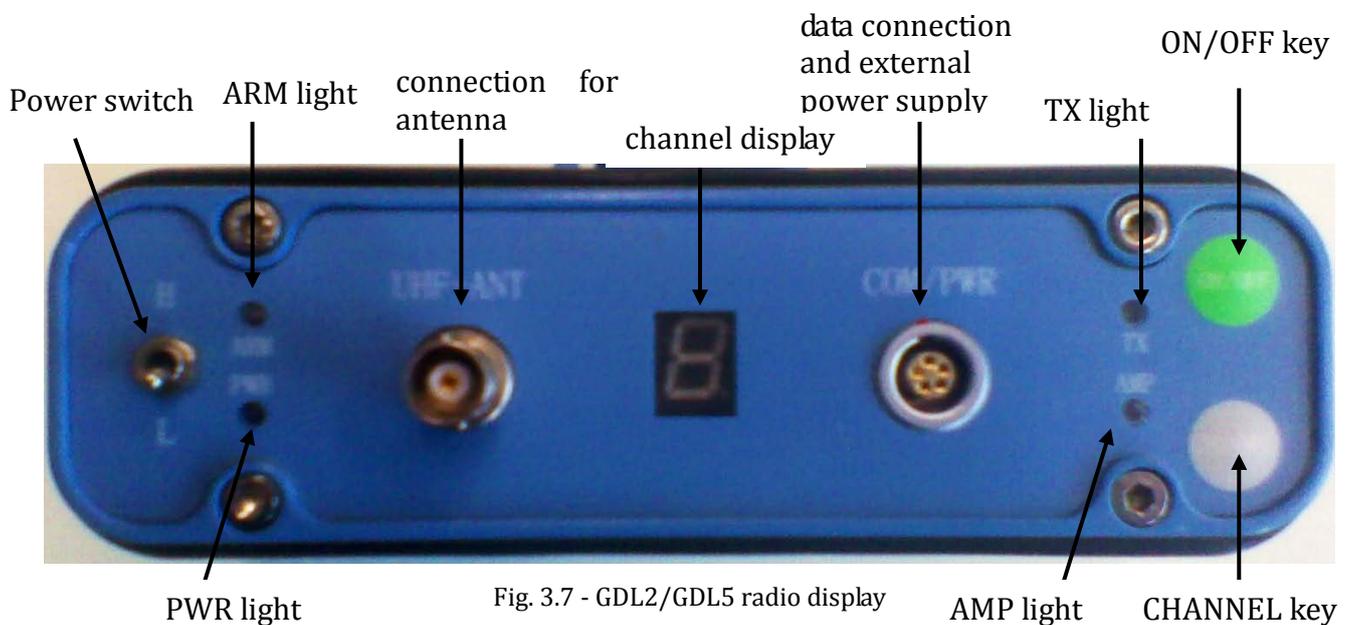


Fig. 3.7 - GDL2/GDL5 radio display

You can charge the radio battery connecting the adapter in Fig. 3.8 into the port at the rear of radio (Fig. 3.9).



Fig. 3.8 - radio adaptor



Fig. 3.9 - GDL2/GDL5 radio connection for battery charging

III.5 The tool for modifying the radio baud-rate

These external radios can use a baud-rate of 9,600 bps or 19,200 bps. Also S9 receiver can use both baud-rate, even if the higher is preferable, in order to make safer differential data transmission. For this reason the external radios have a default baud-rate value of 19,200. However older STONEX® receiver like S82 and S86 allow only a baud-rate of 9,600 bps, so in the case of an interaction between new and older receivers, user must have the possibility of decreasing radio baud-rate to 9,600. The tool *GdlSetTool8*, contained in the base software CD, is

used for this aim.

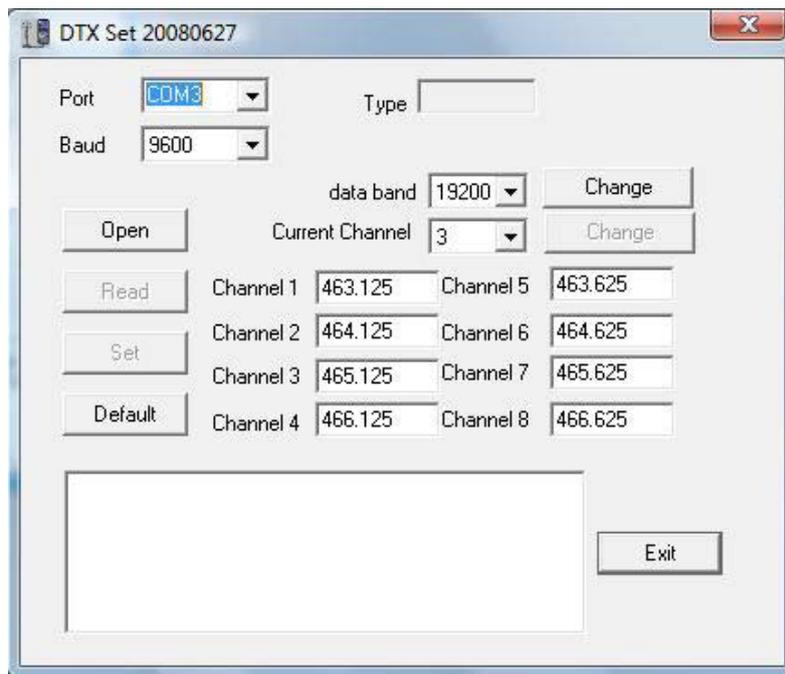


Fig. 3.10 – GdlSetTool8 window

After connecting the radio to the serial port (using a specific cable called CCFMG and described in Chapter IV), first you must select the correct port number and the actual baud-rate (boxes “Port” and “Baud”). Then click on “Open”, the program will showed you the messages “Connect” and “Change work” as in Fig. 3.11.

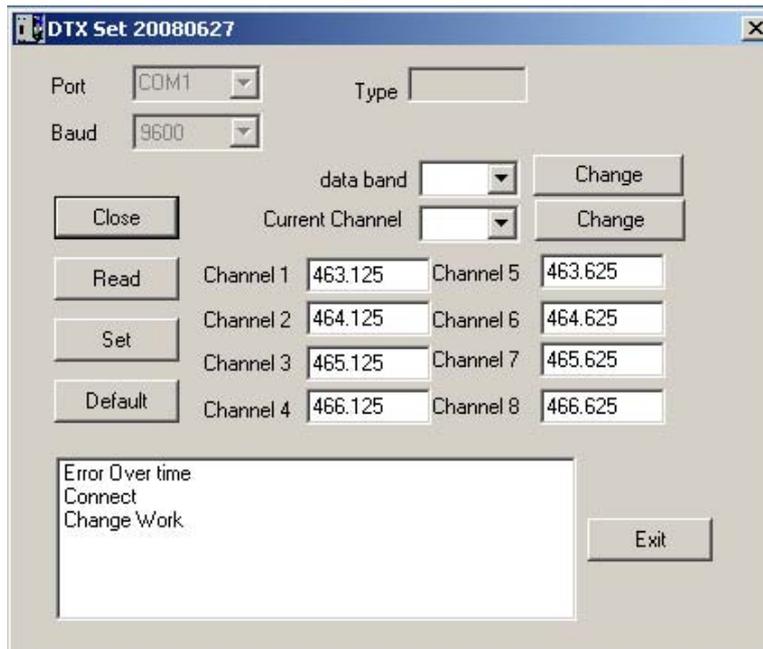


Fig. 3.11 – Opening the connection with radio

Now you can select another baud-rate in “data band” box and click on “Change”. If there are no errors, the program will show you the message “Change channel” as in Fig. 3.12.

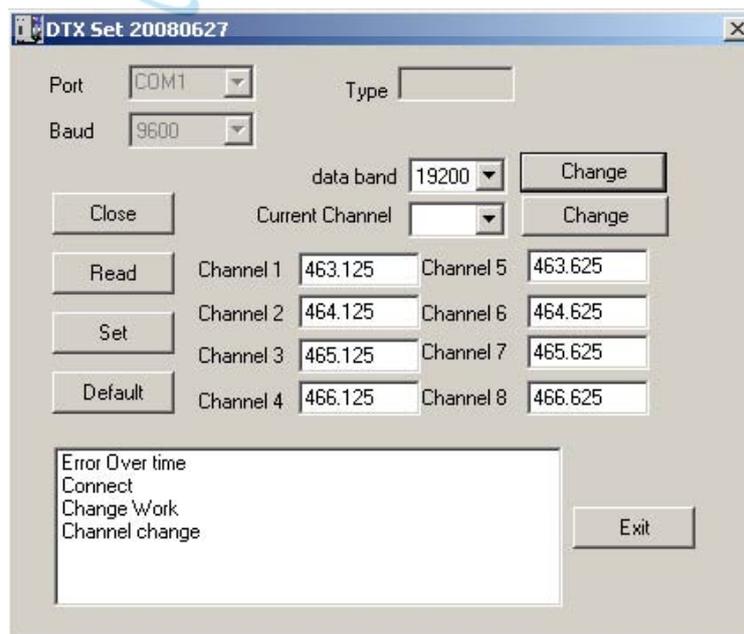


Fig. 3.12 – Changing the baud-rate

Chapter IV : S9 accessories

IV.1 The case of S9

There are two kinds of S9 cases: Rover case and Base case. The internal 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. 4.1 - S9 case



Fig. 4.2 - S9 Rover case



Fig. 4.3 - S9 Base case



Fig. 4.4 - S9 internal case

IV.2 Power supply

Receivers

The standard configuration contains two batteries and a slot for charging batteries (named “charger” for simplicity) and an adaptor. The battery are “lithium-ion” battery (7.2 V - 2300 mAH): a technology which has an high energy-to-weight ratio with respect to NiCd or NiMh batteries, lack of memory effect, and slow self-discharge when not in use.



Fig. 4.5 - Lithium-ion battery

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



Fig. 4.6 - S9 charger and adaptor

Controller Psion

The Psion controller standard configuration includes two batteries, a charger and an adaptor.



Fig. 4.7 - Psion battery



Fig. 4.8 - Psion adaptor



Fig. 4.9 - Psion charger

Also Psion batteries are Lithium-Ion battery (3.7 V – 2700 mAH). The charger has a green light

which blinks during the charging and keeps on once the battery is full.

Controller Geos

The Geos controller standard configuration includes one battery and an adaptor.



Fig. 4.10 - GEOS battery



Fig. 4.11 - GEOS adaptor

The battery is a Lithium-Ion battery (3.7 V – 3900 mAh).

IV.3 The receiving antenna and transferring antenna of data link

S9 adopts a UHF transferring antenna which is suitable for field surveying, and a receiving all-

direction antenna (frequency 450MHz), the specifications of them are light and durable.



Fig. 4.12 - Transferring antenna & receiving antenna (not in scale)

IV.4 Cables

Radio cable

External power supply cable (PCRR) has three different functions. It is used to connect the base mainframe and transmitting radio by two five pins LEMO, the smaller with the receiver and greater with the radio. Besides of this, it can be used to connect the accumulator (red and black clips) and charge radio or receiver (Fig 4.13) :



Fig. 4.13 - External power supply cable

Moreover user can connect to this cable another cable (CFFMG, see Fig. 4.14) and modify radio

transmission baud rate.



Fig. 4.14 – Cable for change radio baud rate

You have to connect CFFMG cable to your Pc by serial port and to PCRR cable by jack, then you can use the software tool “GdlSetTool8” for modifying the baud rate as explained in Chapter III.

Controllers cable

USB communication cable is used for connecting handheld and computer, using the software Microsoft ActiveSync if you use Windows XP or an earlier version, or Windows Mobile Device Center if you use Vista or Windows 7 (you can free download these programs from Microsoft website). There are different cables for different controllers.



Fig. 4.15 - USB communication cable for Psion



Fig. 4.16 - USB communication cable for Geos

Receivers cable

Multi-function communication cable: this cable is used for connecting receiver and computer used for transfer the static data, update of firmware and the license. It can also be used for connecting GEOS controller and receiver, in case of malfunctioning of the Bluetooth device. See Fig. 4.17.



Fig. 4.17 - Multi-function communication cable

Inside the Psion bundle there is also a cable used for connecting Psion and receiver, in case of malfunctioning of Bluetooth device. See Fig. 4.18.



Fig. 4.18 - Communication cable between Psion and receiver

IV.5 Other accessories

The other accessories are 2.45 m retractable pole, 30 cm supporting pole, bracket for controller, tribrach with plummet, tripod (wood or aluminum, with quick or twist clamps), connector between receiver and tribrach, and measuring tape.



Fig. 4.19 - 2.45m retractable pole



Fig. 4.20 - 30cm supporting pole



Fig. 4.21 - Bracket for controllers



Fig. 4.22 – Tribrach and adapter with optical plummet



Fig. 4.23 –Aluminum tripods: on the right side with twist clamp, on the left with quick clamp



Fig. 4.24 –Wooden tripods: on the right side with quick clamp, on the left with twist clamp



Fig. 4.25 – Connector between tribrach and receiver



Fig. 4.26 – Measuring tape

On the basis of the configuration chosen (base or rover) some of these accessories are included or not in the receiver bundle.

Chapter V : S9 Operations

V.1 The installation of base and rover



Fig. 5.1 - Base and rover configuration

Installation of Base

- 1) Put tripod on a location with known coordinates or unknown coordinates, attach receiver to tribrach.
- 2) Set the transmitting antenna and radio: using pole support is better, rise the antenna as high as possible, then put the radio at suitable position, connect the PCRR cable.
- 3) Make sure the connection is right, then switch on the radio and mainframe.

Installation of Rover

- 1) Install the pole, rover and receiving antenna, then power on the mainframe.
- 2) Install the bracket, fix the handheld to the bracket, open the handheld to connect the

Bluetooth, then you can do the setting of the instrument.

V.2 The operation of keys

There are power key (P 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 P key, and then the mainframe will enter the initialization status.
- Power off: when the mainframe is in the ON status (the P key is ON), pressing P key for a while, when you listen beep for three times, relax the P key. The device is switched off.



Fig. 5.2 - Display keys

V.3 Instrument settings

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

Rover mode

Keep pressing P+F keys and wait for six lights flashing at the same time, then press F key to choose the working mode: press P key when STA is lighted to choose the working mode of rover. Waiting for several seconds and then keep pressing F key for about 5 seconds, after the second beep relax F key, press F key to choose the data link. When DL is lighted, press P key to confirm the choosing of built-in radio data link mode. When SAT is lighted, press P key to confirm the choosing of GSM data link mode. When PWR is lighted, press P key to confirm the choosing of external radio data link mode.

Base mode

Keep pressing P+F keys and wait for six lights flashing at the same time, then press F key to choose the working mode: press P key when BT is lighted to choose the working mode of base. Waiting for several seconds and then keep pressing F key for about 5 seconds, after the second beep relax F key , press F key to choose the data link. When SAT is lighted, press P key to confirm the choosing of GSM transmit mode. When PWR is lighted, press P key to confirm the choosing of external radio transmit mode.

Static mode

Keep pressing P+F keys and wait for six lights flashing at the same time, then press F key to choose the working mode, press P key when the BAT is lighted to choose the static mode. When you open next time ,the working mode is the last selected.

If you prefers, you can set the parameters of receiver with handheld both for the working mode and for data link. But you can't switch from one mode to another.

For instance the rover parameters includes: sampling interval, mask angle, antenna height, maximum accepted PDOP value. Without using the controllers the receiver works with default parameters.

The static mode parameters cannot be selected by the controller, but only modifying the file "config.ini" on receiver hard disk (see paragraph V.6).

V.4 Operation of lights

Static mode

The data link and power light will keep lighted. When satellites fit the condition, receiver will start recording epochs, you will heard a beep and the status indicator light will flash according to sampling interval (if you don't set up, the default is 5 seconds) 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 the transmit mode, the status indicator light flash every one second means the base transmit normal, the interval is 1

second.

If you need to change the interval, or reset the transmit condition, 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 GSM, data link light will blink with the frequency of 1 second, while Status light will blink with a frequency of about 5 seconds. Using radio, data link light will blink with the frequency of 1 second.

V.5 How to measure the antenna height

The height of receiver is 96mm, the diameter is 186mm, the height from the center of the sealed rubber ring to the bottom is 60mm.

The antenna height is conventionally defined as the vertical height from the phase centre to the ground surveyed point (the distance “h” in fig. 5.3). It is not possible to measure it directly: you have to measure other reachable heights (the distances “a”, “d”, “s” in fig. 5.3). 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:

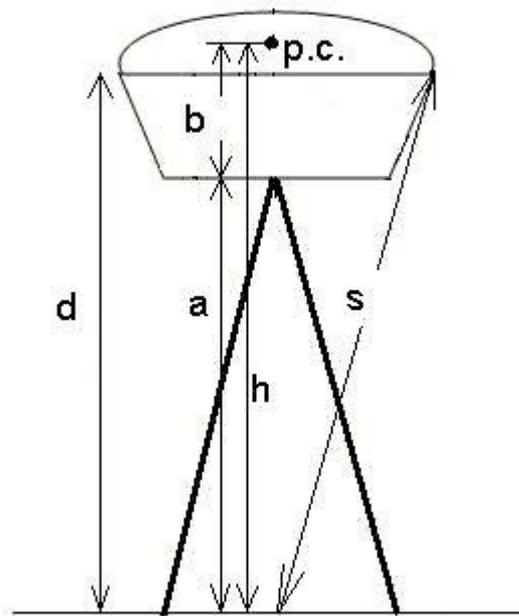


Fig. 5.3 - Different measures of the antenna height

1. In rover and base mode you have to insert the correct antenna height according to RTK software. In *STONEX® SurvCE* for example only the distance “a” is permitted: software will added the distance “b” to fix “h”. For other software please read the specific user guide.
2. In static mode you have to write the correct antenna height in .STH or RINEX file. If you are using *STONEX® GPS Processor* you have to specify the correct antenna height before processing .STH data or exporting it into RINEX format, please read the specific manual. It should be noted however that 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”.

V.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.

Turn on the mainframe firstly, then connect the cable to the communication interface of the receiver (9-pins port) , then insert the USB port in the PC. The taskbar will show as follows:



Fig. 5.4 - 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.

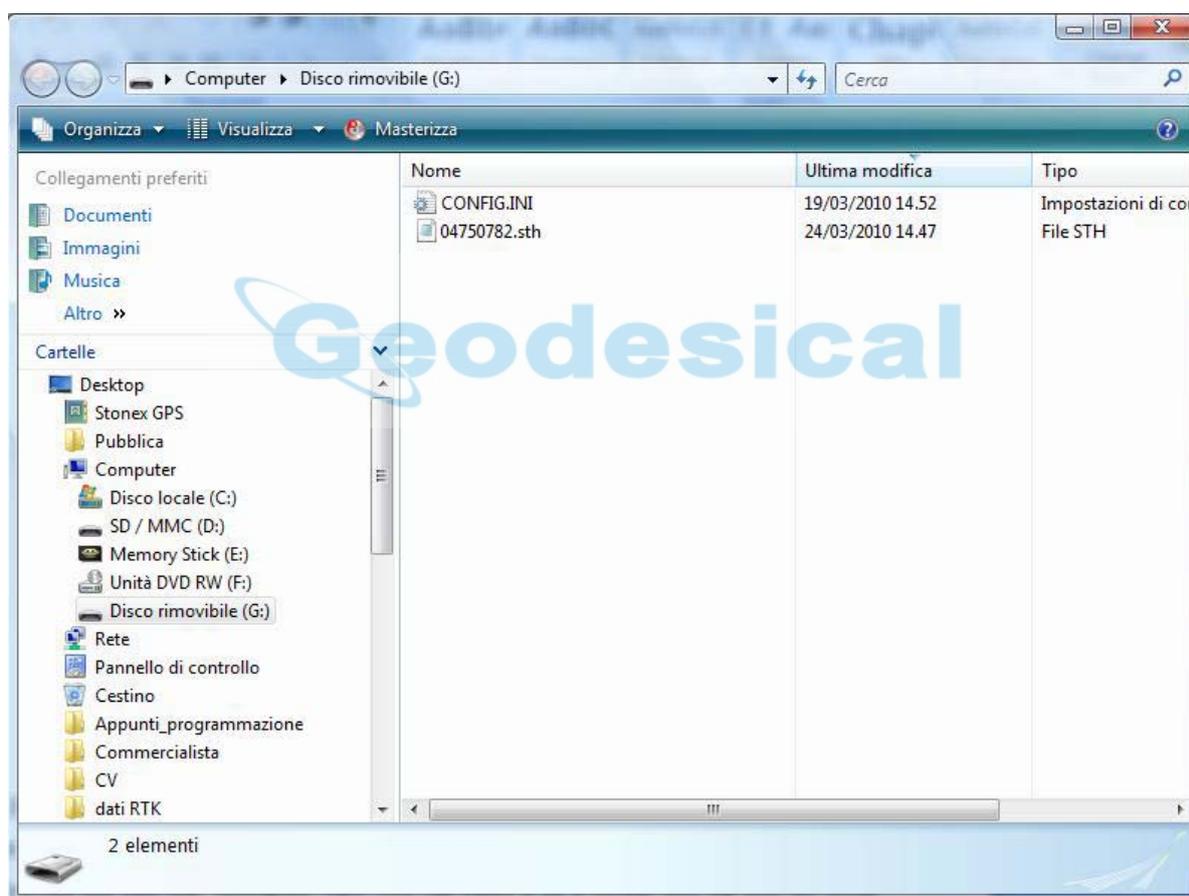


Fig. 5.5 - Example of receiver files

As Fig. 5.5 shows, .STH file is the data file collected by mainframe, the modified time is the time of the last epoch collected. You can copy the original file to PC and if necessary modify the file names. You can see also the “CONFIG.INI” files. 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.

For download the raw data and set the parameters in a safer way, you can use the STONEX® Assistant, a software tool which is explained in Chapter VI.

V.7 Registration of the receiver

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

You have to connect the receiver to PC using the same procedure as to download static data (see paragraph V.6) , then open "CONFIG.INI" file with any text editor.

In this file many parameters are saved, search for the parameter "serial number". It is composed of a 27 character code: the first 11 characters identify the receiver while the last 16 character are the code, you have to substitute the correct code and save the file.

Also with RTK software *STONEX® SurvCE* is possible to update the expired license code: you have to enter into the submenu "Equipment" → "GPS utilities" → "Send command", then write the command "REGI + space + serial number".

However we recommend you to register the receiver using the STONEX® Assistant, a software tool which is explained in Chapter VI.

Chapter VI : STONEX[®] Assistant

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

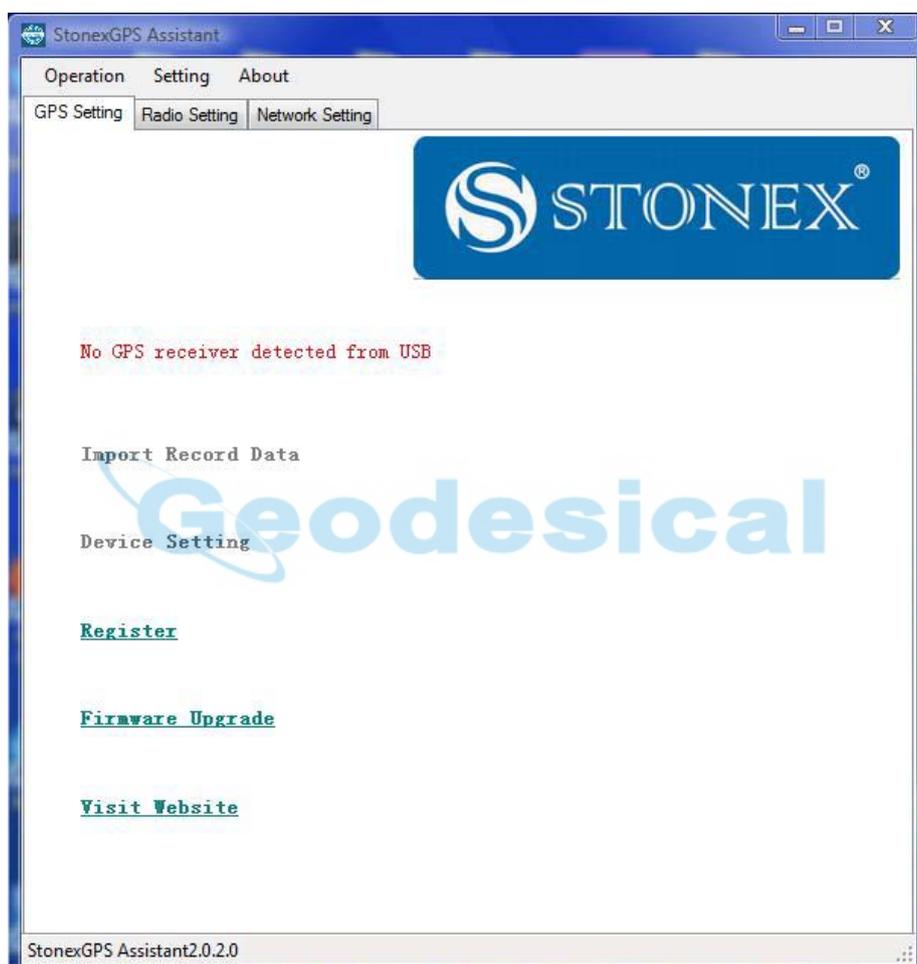


Fig. 6.1 – Main page of Stonex Assistant

The main page is showed in Fig. 6.1. When there are no receivers connected the message “No GPS receiver detected from USB port” appears. When you connect in the correct way the receiver to your Pc by USB port, as explained in V.6, then the message will change into “GPS receiver detected”.

VI.1 Import Record Data

This command allows the user to automatically download raw data from receiver hard disk to Pc, instead of manually copying the files. After connecting the receiver click on “Import Record Data”: a new window is opened as in Fig. 6.2.

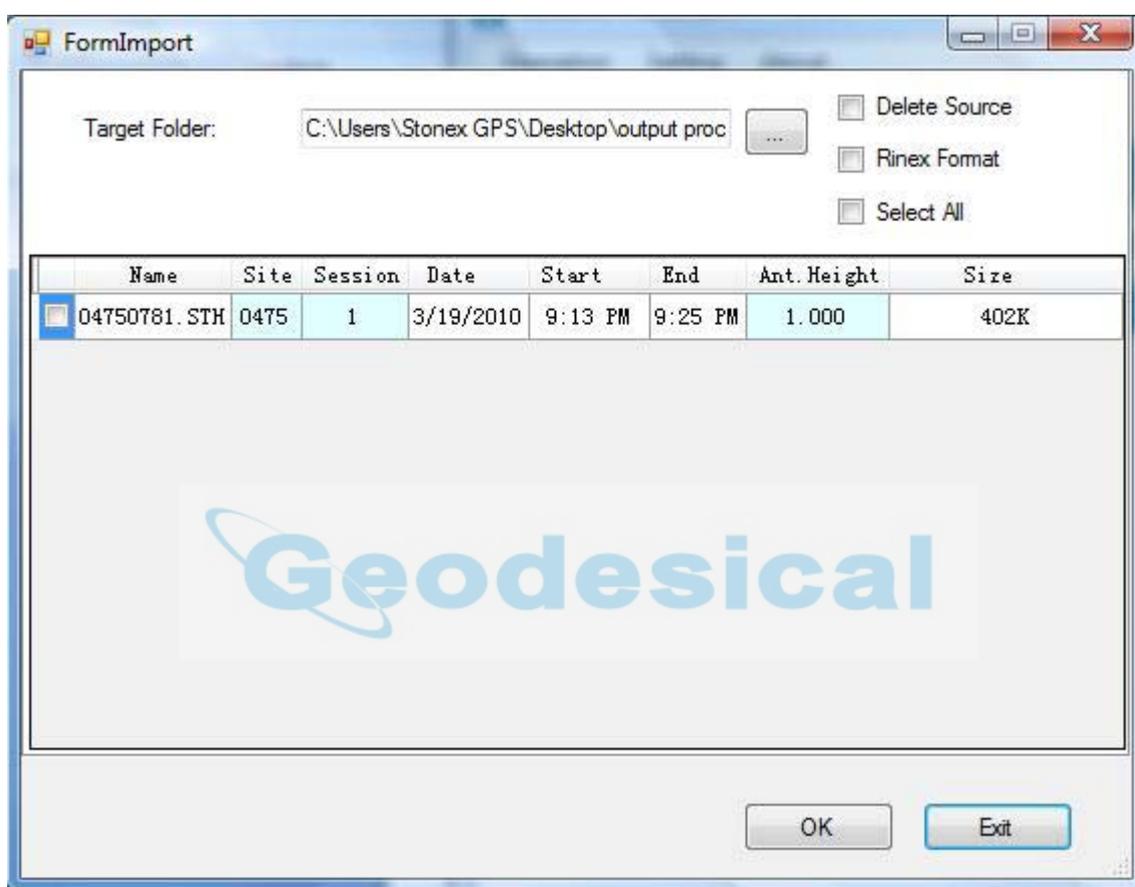


Fig. 6.2 – Import Record Data window

From this window you can see some information about raw GPS data collected, you can select those you want to download, you can modify the antenna height, the name of site and the number of the session. You can also choose to convert the downloaded file into RINEX format. You have then to select the destination folder and the transfer starts. It takes few seconds, when it is finished STONEX® Assistant will ask you if you want to start STONEX® GPS Processor as in Fig. 6.3, in order to be ready to process your data.

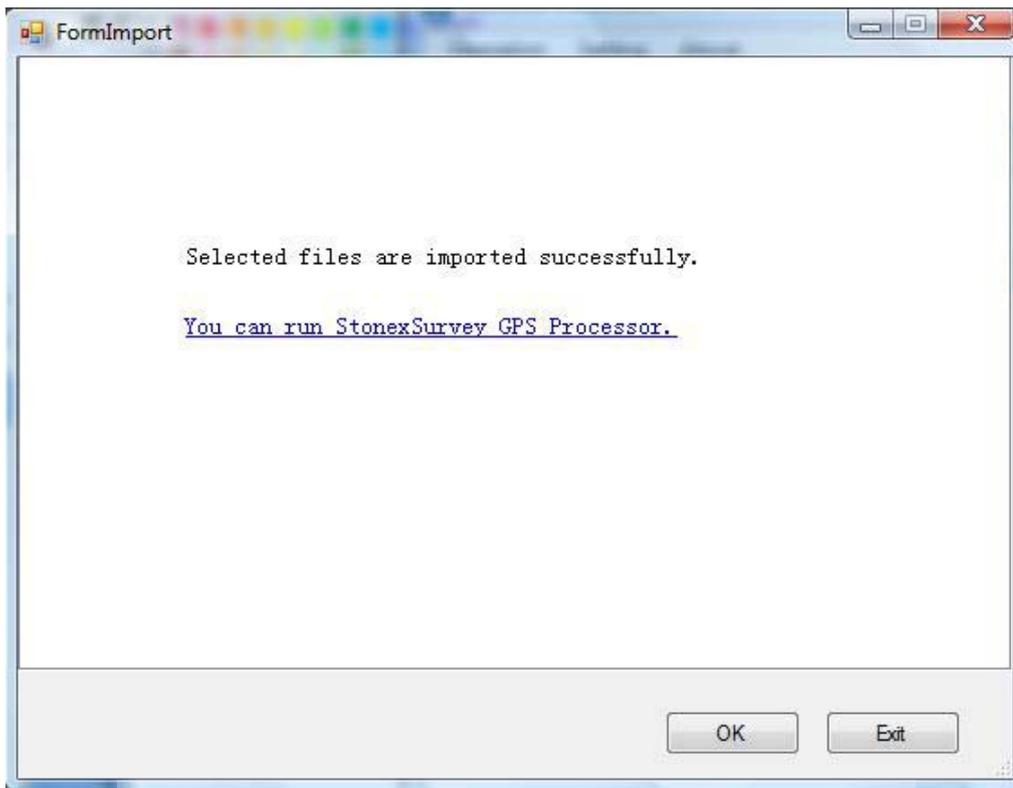


Fig. 6.3 - Import Record Data window

Geodesical

VI.2 Device Settings

If you click on the command "Device Settings" a new window is opened as in Fig. 6.4.

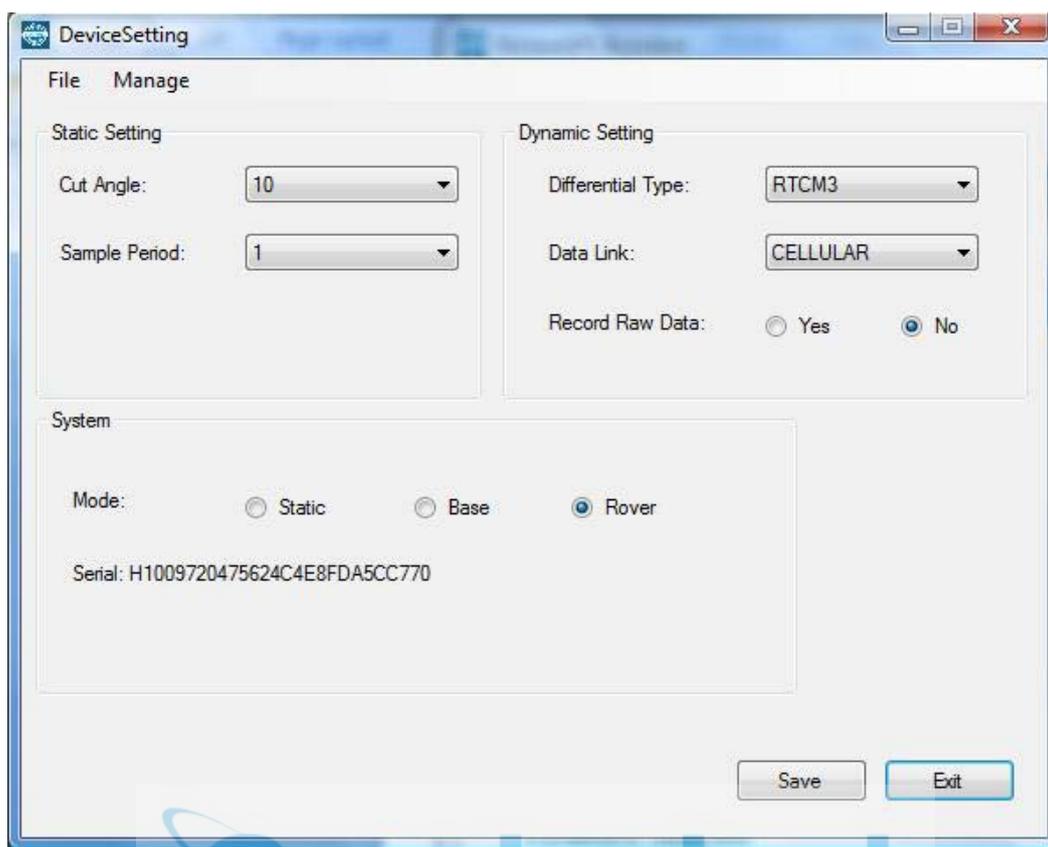


Fig. 6.4 – Device Settings window

From this window you can set the most important parameters of receiver without the need of opening CONFIG.INI file. You can set the mode, the data link, the format of the correction, if the receiver will record raw kinematic data, the minimum elevation of satellites and the sampling interval. Then click “Save” and the receiver will work with the new settings.

VI.3 Register the receiver

This command allows you to register the license code in a different way with respect to that explained in V.7. Click on “Register” and a window as in Fig. 6.5 is opened.

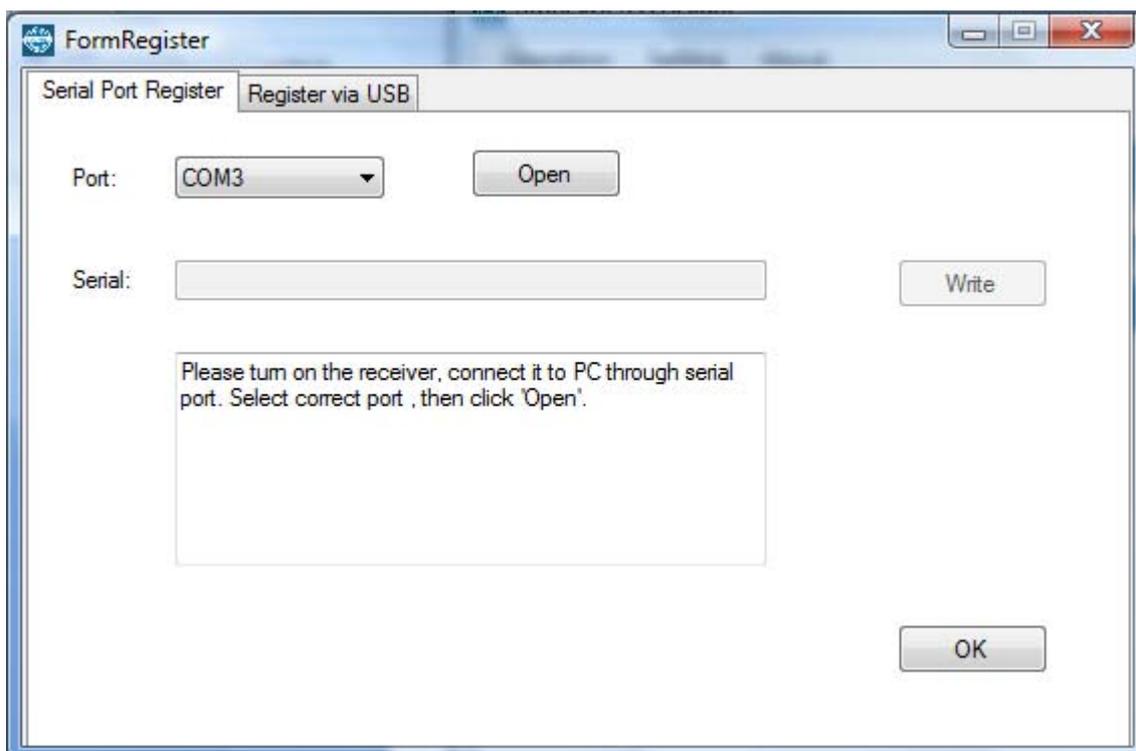


Fig. 6.5 – Serial Port Register window

To insert the correct license code you can connect the receiver by USB port or by serial port. If you choose the serial port, after connecting the receiver with Pc, power on receiver, you will hear three beeps, then click “Open”, input the correct code of 27 characters (11 serial number + 16 license code), click “Write” to complete registration.

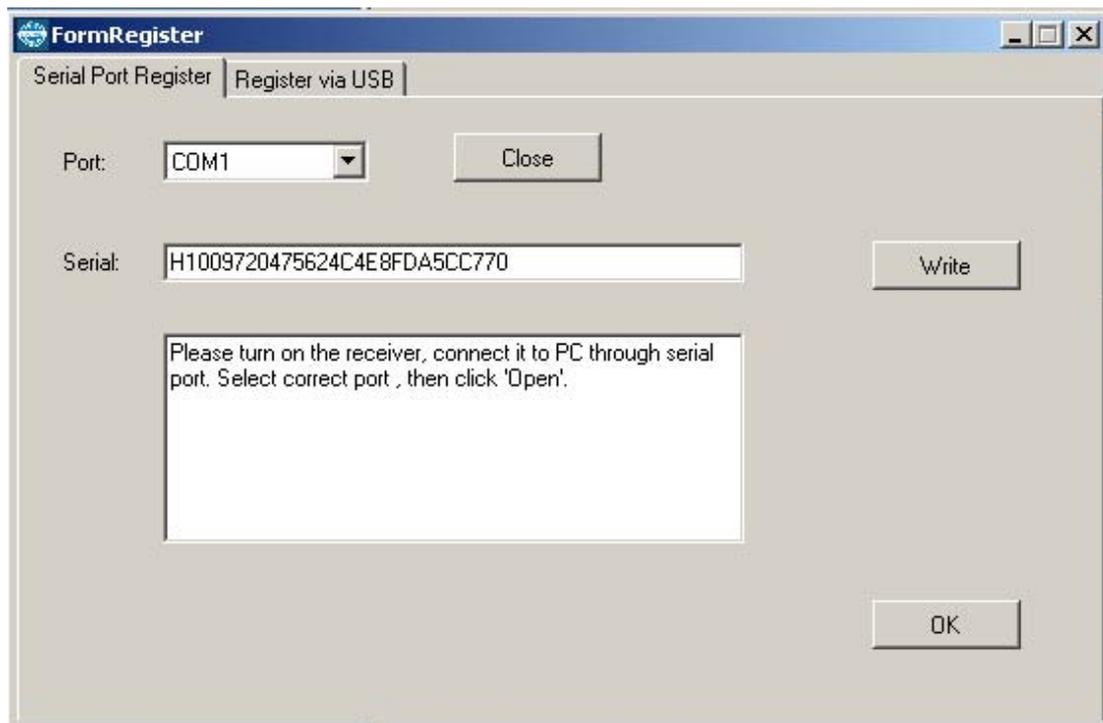


Fig. 6.6 – Serial Port Register window

If the code is correct the message “Serial code successfully updated. Please restart” appears as in Fig. 6.7, otherwise “Receiver refuse the registration code” appears.

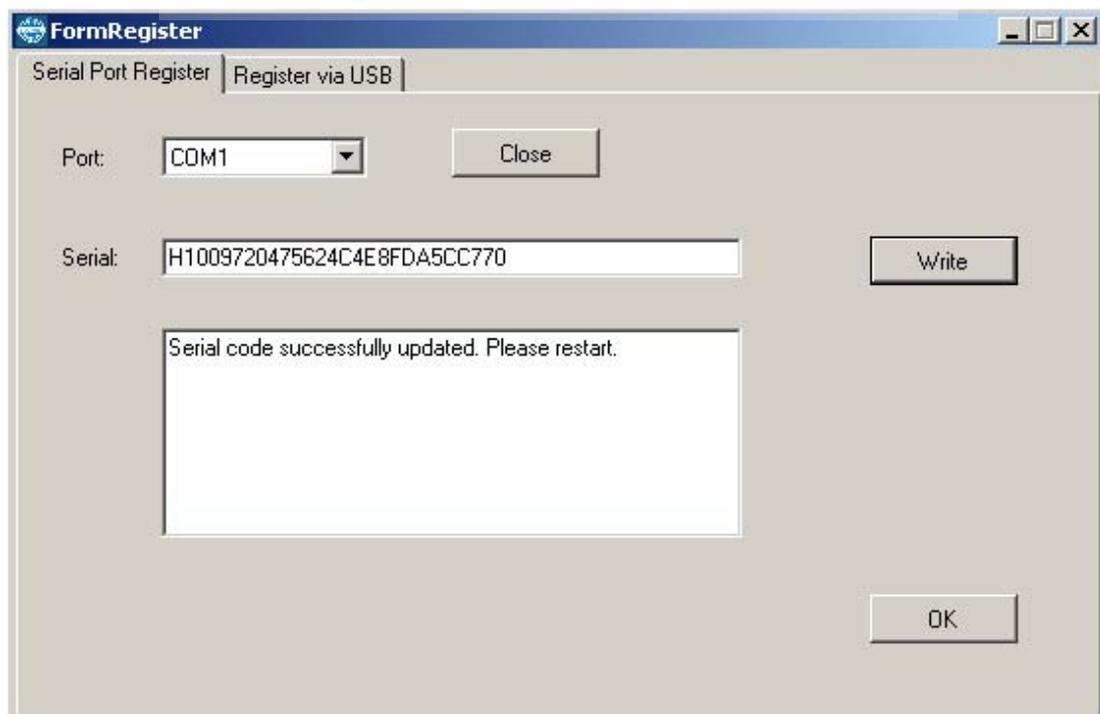


Fig. 6.7 – Serial Port Register window

Click “Ok”, disconnect the receiver from Pc, restart it and it will correctly work.

If your Pc has not a serial port, you can in any case use USB port. Select the submenu “Register via USB” in the Register menu, a window as in Fig. 6.8 is opened.

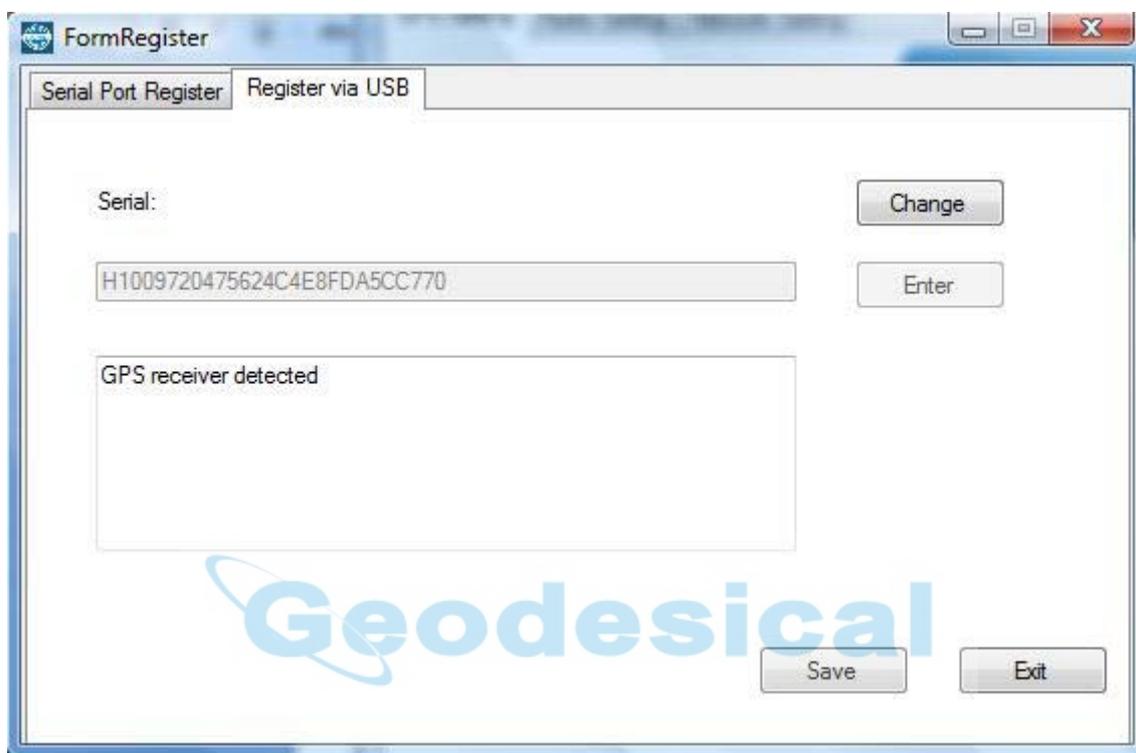


Fig. 6.8 – Register via USB window

Click on “Change”, the code in “Serial” box becomes modifiable, write the new code, then click “Enter”, software ask you a confirmation as in Fig. 6.9.

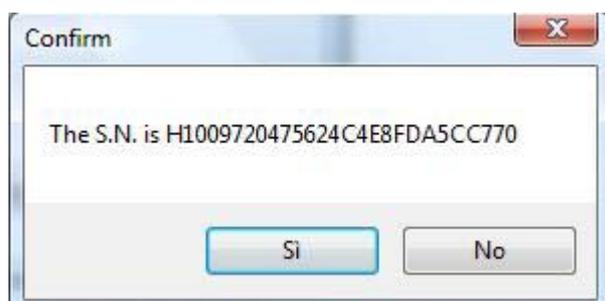


Fig. 6.9 – Register via USB window

Click “Yes”, then click on “Save”, the message “Configuration save successfully” appears, click “Exit”, disconnect the receiver, restart it and it will correctly work.

VI.4 Firmware update

The mainframe software may need to be updated in specific situation. You can make an upgrade by USB or serial port. Anyway we recommend you to avoid this operation except for specific case, since it can compromise the correct working of receiver. Click on “Firmware Upgrade” on the main page for using this function, a window as in Fig. 6.10 appears.

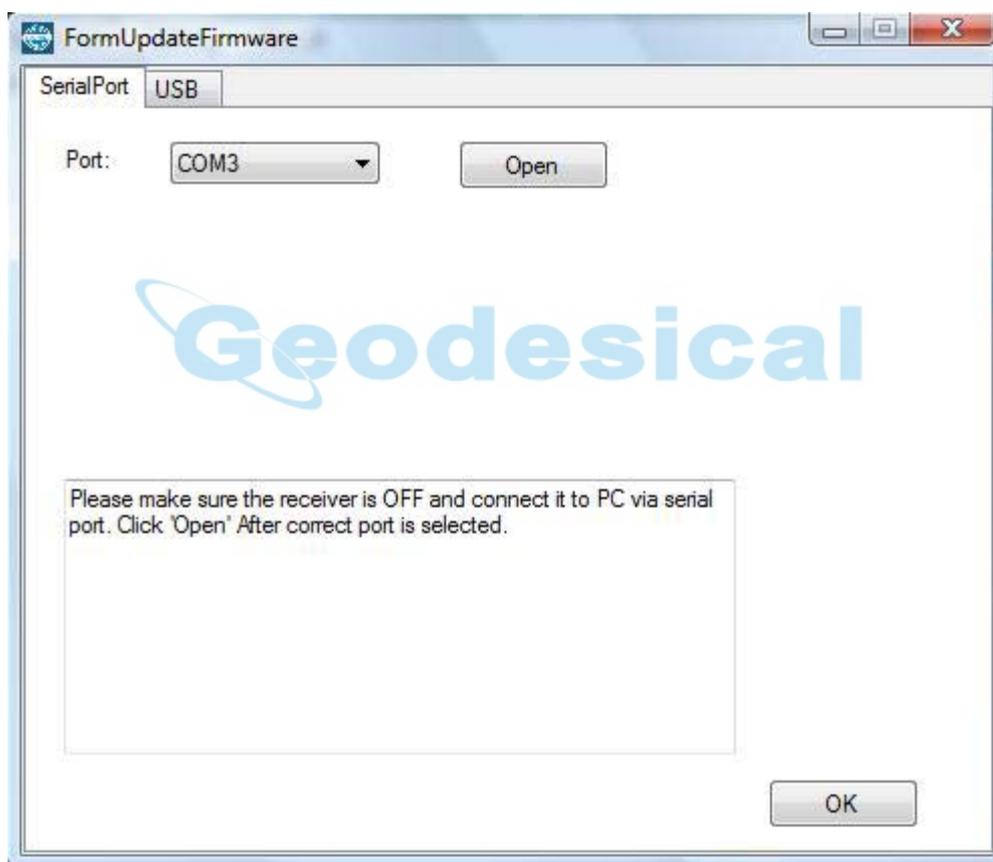


Fig. 6.10 – Firmware update window

If you choose to use serial port, after connecting the receiver with Pc, click “Open”, then power on receiver: a new form is opened as in Fig. 6.11.



Fig. 6.11 – Firmware update window

You have to select the proper firmware file (.DAT): if you can't find it please ask to your dealer or to support@stonexeuropa.com. After selecting the correct file, click on "Ok": you can see the progress of the procedure as in Fig. 6.12.

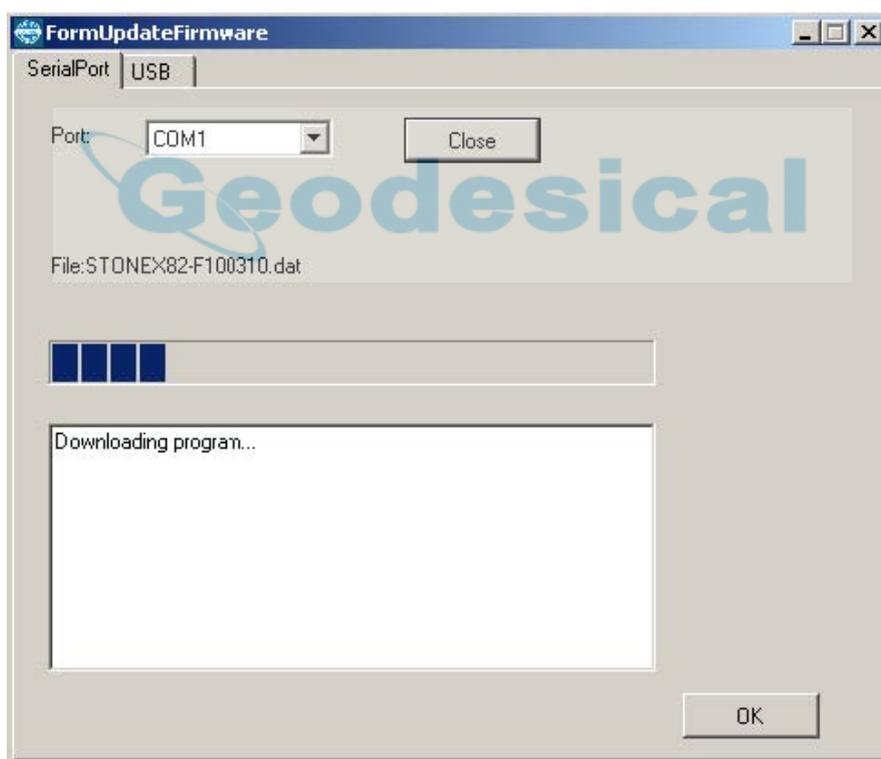


Fig. 6.12 – Firmware update window

When the procedure is finished the message "Upgrade Done" appears, then click "Ok" and the receiver will automatically restart.

If you choose to use the USB port, you have to select the submenu "USB" as in Fig. 6.13.

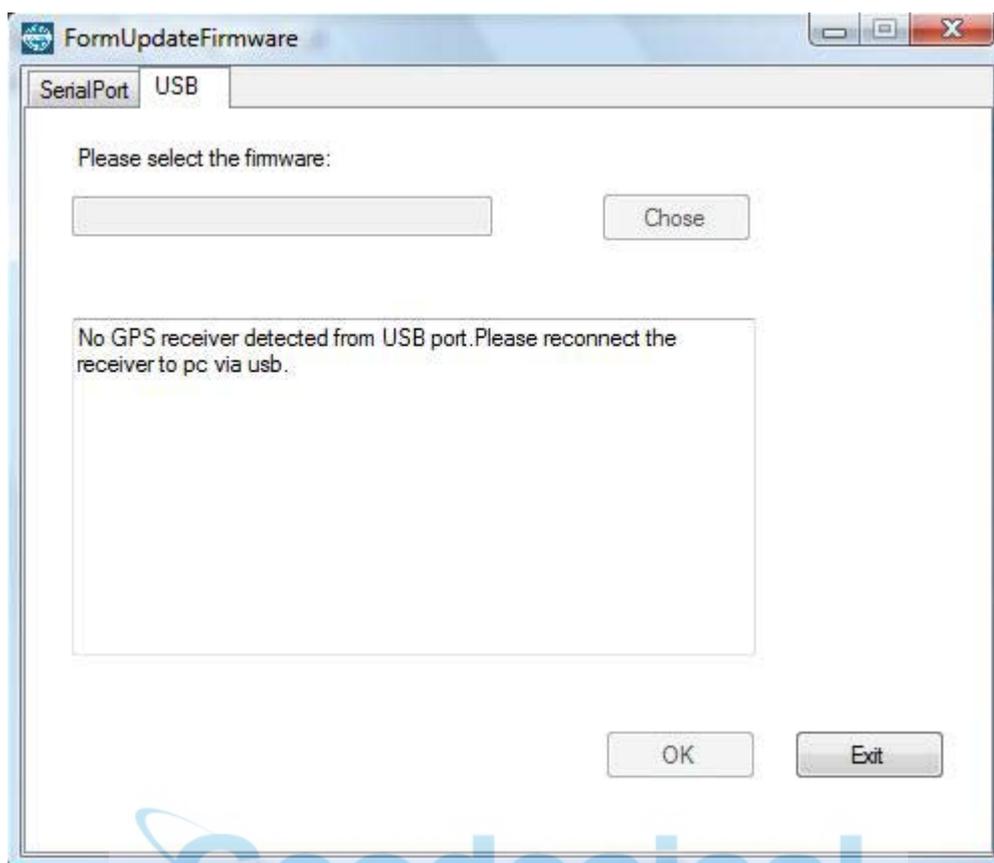


Fig. 6.13 – Firmware update window

Then connect the receiver to Pc by USB, the command “Chose” becomes active, click on it, then a window for selecting the correct firmware file (.DAT) is opened. After selection, software ask you to restart the receiver as in Fig. 6.14, restart it and the receiver begins to turn on the light and to sound in a different way with respect to the normal working. This means that receiver is completing the firmware update. When the procedure is finished receiver will turn off. If you restart again it, you can use it with the update firmware.

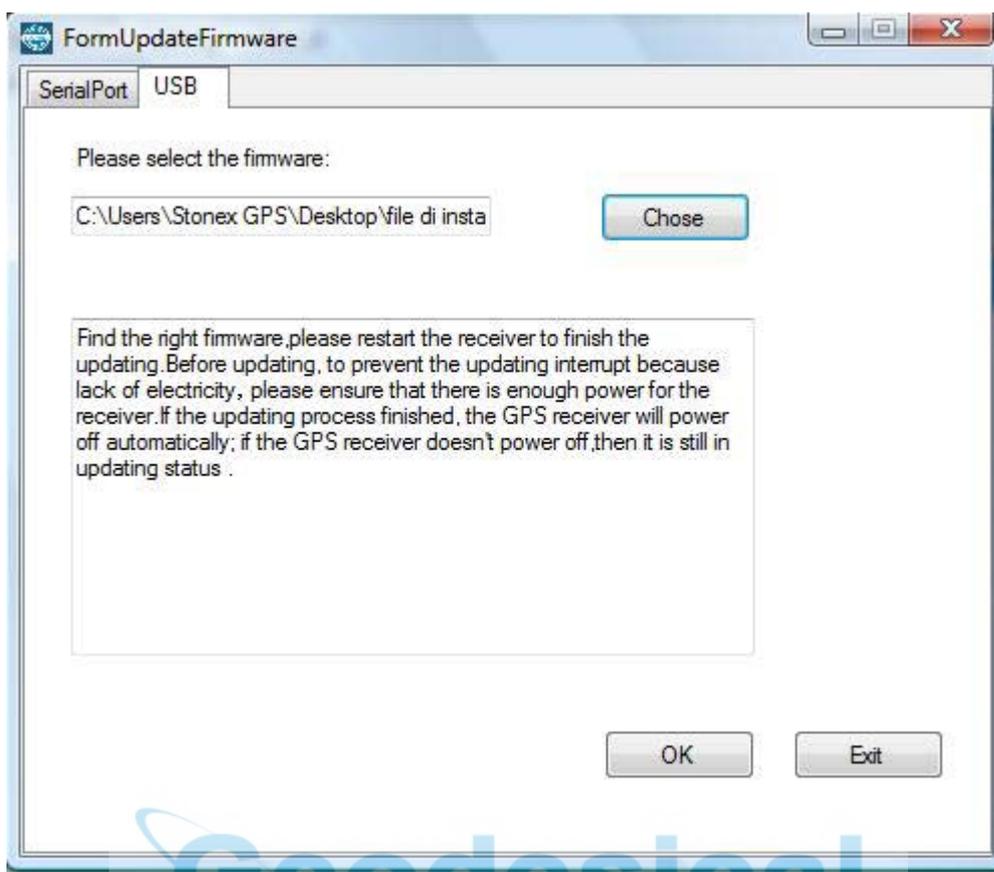


Fig. 6.14 – Firmware update window

VI.5 Visit website

The last function of STONEX® Assistant tool is the connection with STONEX® Europe website. If you click on “Visit Website” command, software will open your predefined browser and directly connect it to our website, where user can see the news, download the last version of this user guide and other useful documents.

Appendix 1: 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: you are in static mode and Bluetooth is disabled, please switch mode.

If you are in rover or base mode and Bluetooth still does not work, please make a receiver self-check.

If the problem persists please check CONFIG.INI file, it may be in a wrong format, please contact STONEX® for a new CONFIG.INI file.

4. The receiver is set in rover mode and 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 handheld to select the correct radio channel on rover.

Otherwise if rover is receiving the correction but it doesn't obtain a "fixed" position, maybe the baud-rate is wrong. Use the handheld to select for the base the same baud-rate which radio is using: if you don't know the baud-rate you can use the tool *GdlSetTool8* to check it.

Appendix 2: Technical Specifications

GNSS module specifications:

- Channels: 220

Satellite signals tracked:

- GPS: Simultaneous L1 C/A, L2E, L2C, L5.
- GLONASS: Simultaneous L1 C/A, L1 P, L2 C/A (GLONASS M Only), L2 P.
- SBAS: Simultaneous L1 C/A, L5.
- GIOVE-A: Simultaneous L1 BOC, E5A, E5B, E5AltBOC1.
- GIOVE-B: Simultaneous L1 CBOC, E5A, E5B, E5AltBOC1.
- COMPASS: (reserved): B1 (QPSK), B1-MBOC (6, 1, 1/11), B1-2 (QPSK), B2 (QPSK), B2-BOC (10, 5), B3 (QPSK), B3BOC (15, 2.5), L5 (QPSK).
- Very low noise GNSS carrier phase measurements with <1 mm precision in a 1 Hz bandwidth.
- High precision multiple correlator for GNSS pseudorange measurements.
- Unfiltered, unsmoothed pseudorange measurements data for low noise, low multipath error, low time domain correlation and high dynamic response.
- Proven low elevation tracking technology.
- Up to 50 Hz raw measurement & position outputs.
- Signal recapture < 1 sec (**).
- RTK signal initialization typically < 10 sec (**).
- Initial capture time typically < 15 sec (**).
- Internal Memory: 64 Mb (over than 15 days of raw static data storage with recording sample every 15 seconds)

Receiver accuracy

- Static horizontal accuracy= 3mm ± 1ppm (RMS) (*).
- Static vertical accuracy= 5mm ± 1ppm (RMS) (*).

- Fixed RTK horizontal accuracy= 1cm ± 1ppm (RMS) (*).
- Fixed RTK vertical accuracy= 2cm ± 1ppm (RMS) (*).

- Code differential positioning accuracy= 0.45m (CEP) (*).

- Stand Alone RTK positioning accuracy= 1.5m (CEP) (*).

- SBAS positioning accuracy typically < 5m (3D RMS) (*).

Connection devices:

- Connectors I/O: 9-pins serial port (baud rate up to 115.200kbps) and 5-pins LEMO interfaces.
- Multicable with USB interface for connecting with PC.
- 2.4GHz Bluetooth device class II: maximum range is 50m.
- Internal Radio: frequency 450MHz.
- GSM/GPRS data modem: maximum range=70km.
- External cell phone support for RTK and VRS operation (optional).
- External radio: frequency 450MHz, emitting power and maximum range depending on model, maximum range=22km.
- Serial protocols
 - Reference outputs: CMR, CMR+, RTCM 2.1, RTCM 2.3, RTCM 3.0, RTCM 3.1.
 - Navigation outputs: ASCII (NMEA-0183 GSV), AVR, RMC, HDT, VGK, VHD, ROT, GSK, GSA, ZDA, VTG, GST, PJT, PJK, BPQ, GLL, GRS, GBS, GSOF.

GSM module

The GSM board mount a GTM 900-B unit for GSM/GPRS communication. This module supports:

- Single band operation at 800 MHz.
- Dual band operation at 900 MHz and 1800 MHz.
- Tri-band operation at 800 MHz, 900 MHz, 1800 MHz.
- Packet data service of GPRS: CLASS 10.
- Maximum rate of transmission 85.6 kbit/s.
- Embedded TCP/IP protocol suite that supports multiple links and provides ACK answer and large-capacity cache.

Power Supply:

- 9 to a 15V 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 96 mm x Diameter 186mm. 60 mm from the center of the rubber loop to the bottom.
- Weight: 1.2 Kg with internal battery, radio standard UHF antenna.
- Operational temperature: -25°C to 60°C (-13°F to 140°F)
- Storage temperature: - 55°C to 85°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

The logo for Geodesical, featuring the word 'Geodesical' in a blue, sans-serif font. A blue orbital ring is positioned around the 'G'.

Appendix 3: Copyrights, warranty and environmental recycling

Copyrights and trademarks

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STONEX®, the STONEX® logo, and S9 GNSS receiver are trademarks of STONEX® Limited

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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 March 2010 release of the STONEX® S9 GNSS 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

Two (2) Years on Stonex® products

The terms and conditions of this Limited Warranty constitute the complete and exclusive warranty agreement between The Customer 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® Europe warrants that its Products:

- (1) are free from defects in materials or workmanship;
- (2) are in conformity with the factory specifications in effect at the time they were manufactured;
- (3) have been tested/calibrated in proper working status prior to shipment.

At its sole discretion, STONEX® Europe will restore the Product to original working order (in accordance with factory specifications in effect at the time the Product was manufactured) OR replace the Product with one at least equivalent to the original Product. 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. Parts or Products replaced under this Limited Warranty shall become property of STONEX® Europe. All parts that have to be replaced have to be returned to our 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.

Warranty repair(s) policy

Customer shall pay the standard repair fees for any service (whether part replacement or repairs) excluded from this Limited Warranty 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. 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

Once warranty is over and/or for reasons stated above, the Customer or the dealer from whom the customer has bought the product (whichever is agreed upon) is required to pay for the charges for shipping to STONEX® Europe representative office (address listed above) and STONEX® Europe will provide the shipping for return. Any other purported transfer or assignment of this Limited Warranty is void.

Return policy

All returned products have to be shipped to STONEX® Europe representative office. The original Purchaser has a period of seven (7) days or otherwise specified to return any purchase 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 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, as imposed by the manufacturer. Used items may not be returned, if in anyway damaged. Acceptance of returned merchandise is final only after inspection by STONEX® Europe. Once approved, allow fourteen (14) business days after return for refund to be issued or credited to the account.

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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/JURISDICTION.

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)

- a) The disposal of electric and electronic device as solid urban waste is strictly prohibited: they must be collected separately.
- b) 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.
- c) The dumping of these devices at unequipped or unauthorized places may have hazardous effects on health and environment.
- d) The crossed dustbin symbol means that the device must be taken to authorized collection centres 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.

