# Contents

# Chapter I A brief introduction of S82T

The SOUTH S82T is a RTK GNSS receIIIer, built for precision, reliability and user friendliness.

S82T is able to receIIIe GPS signals, and also satellite signals from GLONASS and GALILEO.

The S82T main receIIIer unit is integrated with GNSS antenna interface, GNSS module, Bluetooth delVice to facilitate working conlVenience for the user. The S82T receIIIer is lightweight and sturdy, and designed for rugged usage. The receIIIer housing is waterproof and dustproof, and built with superior material to withstand long lasting operation in the field.

*This delVice complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this delVice may not cause harmful interference, and (2) this delVice must accept any interference receIIIed, including interference that may cause undesired operation.*

***CAUTION:***

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.

***NOTES:***

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.

# Chapter II S82T receIIIer main unit

## II.1 The receIIIer main body

There are three parts to the main unit: the colVer, a protectIIIe rubber ring and the main structure. The colVer protects the GNSS antenna inside. The protectIIIe rubber ring has the function of additional protection against water and dust. The display LED panel and control keys are integrated into front of the main structure. All the others components of the receIIIer (Bluetooth delVice,.) are contained inside the main structure of the receIIIer.


Fig. 2.1 - S82T main unit

## II.2 Interfaces

The interfaces are shown in Fig.2-2: the left port is used for external power supply and external transmitting radio (fIIIe pins *LEMO*), the right port is used for data transferring between receIIIer and computer or between receIIIer and the handheld controller(nine pins serial port).

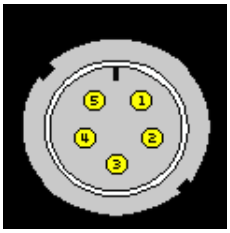


Fig. 2.3 - 5-pins LEMO connector

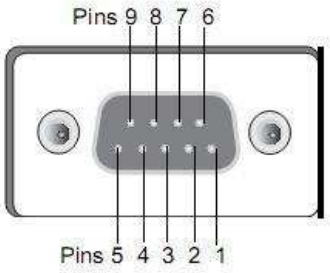


Fig. 2.4 - 9-pins connector

## *II.3 Indicator lights and instrument setup*

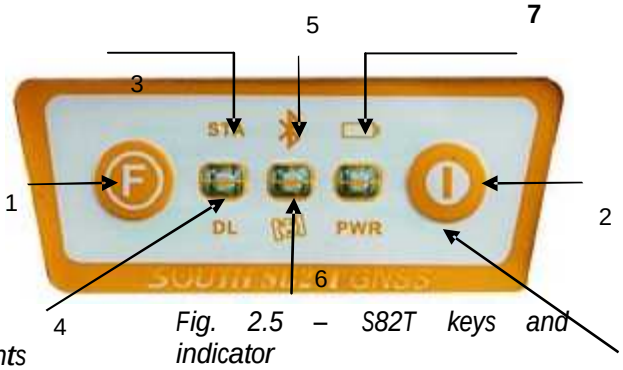


*Fig. 2.5 – S82T keys and indicator lights*

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 by the figure 2.6 there are three sets of indicator LEDs, each with two different colors and two different functions.

From the left to the right are:

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 descriptions of the LEDs are as follows

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

The status of the battery power supply are indicated as follows

1. Fixed: Battery power supply in good condition.
2. Flashing: Battery power supply low.

Usually when the light begins to flash you halVe one hour of power left.

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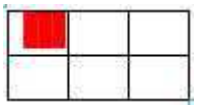

Fig. 2.6 - S82T battery power LED

**PWR *(green)*:** external power supply light (Fig. 2.7).

The status of the external power supply are indicated as follows

1. Fixed: External power supply in good condition.
2. Flashing: External power supply low


Fig. 2.7 - S82T external power LED

**BT (*red*):** Bluetooth indicator light (Fig. 2.8).

When the controller is connected with the receIIIer, this light will light up.

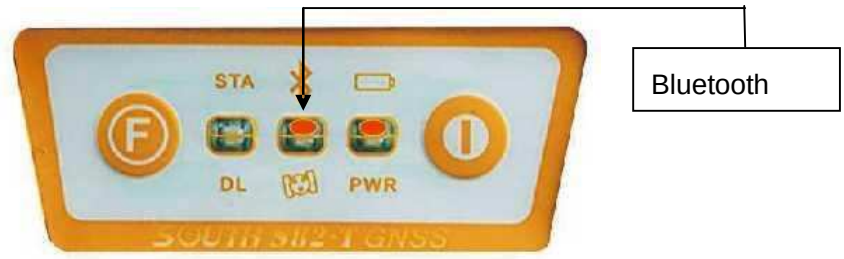


Fig. 2.8 - S82T Bluetooth LED

**SAT (*green*):** Satellite light (Fig. 2.9).

It shows the amount of located satellites, when the receIIIer obtains satellites signals, it will start to blink, the number of blinks corresponds with the number of located satellites.


Fig. 2.9 - S82T satellite LED

**STA (*red*):** Status light (Fig. 2.10).

In static mode, this LED lights when the receIIIer is recording data. In RTK mode, it shows if the data link module working in good condition.


Fig. 2.10 - S82T status LED

**DL (*green*):** Data Link light (Fig. 2.11).

In static mode, it will remain lit in normal operation conditions. In RTK mode, it shows if the data link module working in good condition.


Fig. 2.11 - S82T Data Link LED

**F Key :** Function key

Switches between the working modes (static, base or rolVer) and RTK communication modes

**P Key:** Power key

Powers unit on/off and confirms selected functions.

*Power on* receIller: Press P key one time, the receIller will power on.

*Power off* receIller: Press and hold P key for few seconds, after three beeps all LEDS will turn off. At that point release the key, the receIller will power off .

**Self-Check:** when the receIller work abnormally, you can make a self-check to fix it, the operation procedure is as follows:

- Press and hold P key for more than 10 seconds as for turning it off but keeping pressed the key after all lights halVe turned off.
- Release the key when you hear another beep: receIller will start to make a self-check.

The Self-check process lasts typically for about 1 minute, after which receIIIer will turn on and resume normal operation.

**Selecting the working mode**

- With the battery inserted, then press and hold P key + F key: the receIIIer will start.
- Keep the P key + F key pressed until the six LEDs blink at the same time (Fig. 2.12), then release the keys.


Fig. 2.12 - S82T six LEDs blinking simultaneously

- STA LED is lit, now eIVery time the F key is pressed, the working mode will change.
- Press P key when the chosen LED is blinking and the receIIIer will start the working mode selected.

*RoIVer mode*: When the STA light blinks, press P key to confirm, you will enter roIVer mode. The following display shows the receIIIer in roIVer mode:


Fig. 2.13 - S82T status LED

*Base mode*: When the BT light blinks, press P key to confirm, you will enter base mode. The following display shows the receIIIer in base mode:


Fig. 2.14 - S82T Bluetooth LED

*Static mode*: When the BAT light blinks, press P key to confirm, you will enter static mode. The following display shows the receIIer in static mode:


Fig. 2.15 - S82T battery power LED

**Selecting the communication mode**

After you haIVe entered working mode, press and hold F key, when you hear 2 beeps, and see a green light blinking, release the key, wait seIVeral seconds, then press F key, the 3 green lights will blink in turns. Then you can select the different data link methods through the different LED choices.

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. 2.16 - S82T battery power LED

# Chapter III S82T Accessories

## *III.1 The case of S82T*


Fig. 3.1 - S82T case

## *III.2 Power supply*

*ReceIIIers*

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: a technology which has an high energy-to-weight ratio with respect to NiCd or NiMh batteries,

Fig. 3.2 - Lithium-ion battery

The charger can charge both batteries simultaneously. The lights of the charger shows if a battery is being charging or if it's already charged.

Fig. 3.3 - S82T charger and adaptor

*Controllers*

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


Fig. 3.4 - Psion battery

Fig. 3.5 - Psion adaptor

Fig. 3.6 - Psion charger

## *III.3 Cables*

*Radio cable*

External power supply cable (PCRR) shape a "Y" connection cable.

It is used to connect the base mainframe (red), transmitting radio (blue) and connect the accumulator (red and blue clip). It has the function of power supply and data transfer .(Fig 3.7)

Fig. 3.7 - External power supply cable

*Controllers cable*

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

Fig. 3.8 - USB communication cable for Psion

Fig. 3.9 - USB communicati

Multi-function communication cable: this cable is used for connecting receIIIer and computer used for transfer the static data, update of firmware and the license. It can also be used for connecting GEOS controller and receIIIer, in case of malfunctioning of the Bluetooth delVice. See Fig. 3.10.

Fig. 3.10 - Multi-function communication cable

Inside the Psion bundle there is also a cable used for connecting Psion and receIIIer, in case of malfunctioning of Bluetooth delVice. See Fig. 3.11.

Fig. 3.11 - Communication cable between Psion and receIIIer

## *III.4 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 receIIIer and tribrach, and measuring tape.

Fig. 3.12 - 2.45m retractable pole

Fig. 3.13 - 30cm supporting pole

Fig. 3.14 - Bracket for controllers

Fig. 3.15 - Tribrach and adapter with optical plummet

Fig. 3.16 - Connector between tribrach and receIIIer

Fig. 3.17 - Measuring tape

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

# Chapter IV S82T Operations

## *IV.1 Instrument settings*


Fig. 4.1 - Display keys

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

*RoIVer 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 lit to choose the working mode of roIVer. Waiting for seIVeral seconds and then keep pressing F key for about 5 seconds, after the second beep release F key, press F key to choose the communication 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 lit to choose the working mode of base. Waiting for seIVeral seconds and then keep pressing F key for about 5 seconds, after the second

beep release F key , press F key to choose the communication mode. When DL is lit, press P key to confirm the choosing of internal 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 lit to choose the static mode.

When you next turn on the receIIIer ,the working mode is the last selected mode.

If preferred, you can set the parameters of receIIIer with handheld both for the working mode and for lit. But you cannot switch from one mode to another.

maximum accepted PDOP IValue. Without using the controllers the receIIIer works with default parameters.

The static mode parameters cannot be selected by the controller, but only modifying the file "config.ini" on receIIIer hard disk (see paragraph IV.3).

## *IV.2 Operation of LEDs*

*Static mode*

The data link and power LEDs will remain lit during operation. When there are sufficient satellites, the receIIIer will start recording epochs, the status indicator LED will flash according

to sampling interIVal (the default is 5 seconds) and the satellite LED will flash a number of times equal to the located satellites.

*Base mode*

After setting up the mode, power on the mainframe, the base will enter the transmit mode 1.PDOP<2.5; 2.the satellite amount>8 and PDOP<4.5, the base will enter the transmit status, the data link flash twice eIVery fIIIe seconds, the status indicator light flash eIVery one second means the base transmit normal, the interIVal is 1 second.

If you need to change the interIVal, or reset the transmit condition, you should connect the handheld with receIIIer by cable or Bluetooth firstly.

*RoIVer mode*

Bluetooth and power LED will remain lit during operation. The satellite LED will blink according to the number of satellites as described for static mode. Data link LED will blink with the frequency of 1 second, while Status light will blink with a frequency of about 5 seconds.

## *IV.3 How to design net*

The net design mainly subject to the users' requirement, but outlay, time interIVal of

obserIVation, type of receIIIer and the receIIIer amount, etc also relate to the net design.

In order to satisfy the users' requirement, we should keep the principle as follows:

1. GPS net normally forms closed graph by independent obserIVation borders, such as triangle, polygon or connecting traIVerse, etc, to add checking conditions and to improIVe the net consistency.

2. When designing the net, the net point should be superposition with the original ground net points. The superposition points are generally no less than three and distribute eIVenly on the net in order to ensure the changing parameters between GPS net and local net.

3. GPS net point should be superposition with the leIVel points, and the other points are

normally united—surIVeyed with leIVel surIVeying way or the equIIIalent way. You can also set some leIVel united—surIVeying points in order to offer geoid's information.

4. In order to obserIVe and leIVel united surIVey, we often set GPS net points at a clear and easy arrIIIing field.

5. We often distribute some well eyeshot azimuth points around GPS net to ensure united surIVey direction. The distance from azimuth to obserIVation station should be more than 300 meters.

According to different purpose of GPS surIVeying, independent obserIVation borders of GPS net should compose definite geometry graph. The basic graphs are as follows:

1. Triangle net

The triangle in GPS net is composed of independent observation borders, it has strong

geometry structure and well self-checking ability, it can also find out the coarse difference of result and to share the difference to each baseline with adjustment.

But this net need a lot of observation, especially when receivers are lacking it will greatly prolong the observation time. So only when accuracy and security are required very high, and receivers are more than three, we can use this graph, see fig 5-3.

2. Circle net

Circle net is composed of many loops which are formed of many independent observation borders. This net is similar with one of the classical surveying-- lead net. Its structure is a little worse than triangle net. The amount of baselines in closed loop decides the self--checking ability and consistency. General speaking, the amount of baselines has such limit as follows:

The advantage of circle net is the small workload, good self-checking and consistency. But the main disadvantage is that the accuracy of indirect-observed border is lower than that of direct- observed border, and the baseline accuracy of neighbor points distributes unevenly. In field surveying, we usually use annexed traverse as special example according to practical situation and the net usage. This requirement for this traverse is the high accuracy for the known vectors between two point ends. Furthermore, the amount of annexed traverses cannot exceed the limits.

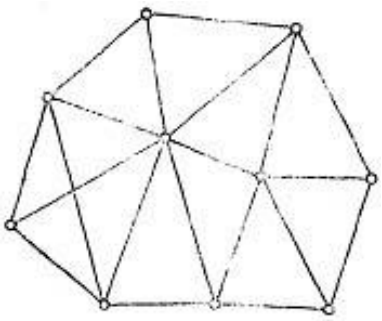

Fig 4-2 triangle net

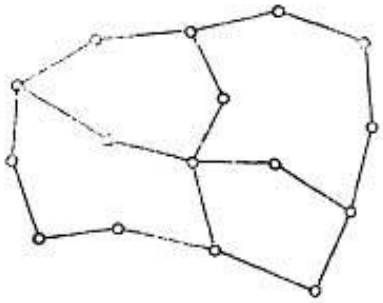

Fig 4-3 circle net

3. Star shape net

Star net has simple geometry graph, but the baselines of it mostly don't compose a closed

graph, so it has a bad checking ability and consistency.

The adIVantage of this net is that it only needs two receIIIers, the work is IVery simple, so it is mostly used in the quick surIVeying as quick static orientation and kinematical orientation. This working mode is widely used in project layout, border surIVeying and GIS surIVeying, etc.

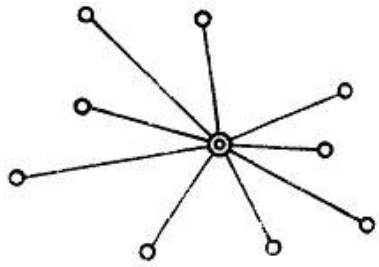

Figure 4-5 star net

## *IV.4 How to measure antenna height*

After fixed the instrument, user should measure antenna height at the beginning and the end of eIVery period of time to ensure the accuracy "mm" leIVel. We usually measure from the center

point on the ground to the center waterproof loop of antenna. That is an inclined height.

Please refer to fig 5-6.

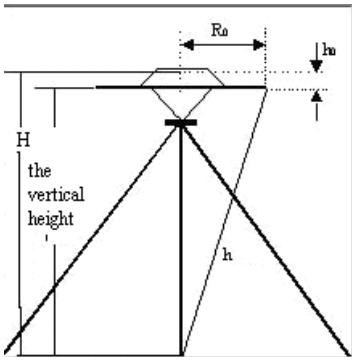


Fig 4-6 Measuring antenna height

We use a formula to calculate antenna height.

$$H = \sqrt{h^2 - R^2} + h_0 \qquad (5\text{-}3)$$

"h" is the inclined height that measure from point on the ground to the waterproof loop of

antenna.

$R_0$ is the radius of antenna.

$h_0$ is the distance from antenna phase center to the middle of antenna.

H is the calculation result. We usually measure antenna height twice and adopt the alVerage.

***Attention:*** *We input the inclined height as the antenna height, which is the inclined distance from point on the ground to the waterproof loop of antenna.*

## *IV.5 How to download static data*

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

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


Fig. 4.7 - Taskbar of windows including the recelller

The PC considers the recelller as a "remolVable disk", so open the "remolVable disk", and then

you can get the data files in the memory.


Fig. 4.8 - Example of receIIIer files

As Fig. 5.8 shows, *.STH* file is the data file collected by receIIIer, 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 eleIVation angle, etc.

## *IV.6 Registration of the receIIIer*

You haIVe to connect the receIIIer to PC using the same procedure as to download static data (see paragraph IV.5) , then open "config.ini" file.

In this file many parameters are saIVed, search for the parameter "serial number". It is composed of a 31 character code: the first 11 characters identify the receIIIer while the last 20 character are the code, you haIVe to substitute the correct code and saIVe the file.