

# **SL700 GNSS RTK System Getting Started**



**Satlab Geosolutions All Rights Reserved**

## Manual Revision

Revision Date	Revision Level	Description
Aug., 2018	1	SL700 GNSS RTK System User Guide

---

## Preface

### Introduction

Welcome to the SATLAB SL700 receiver. This introduction describes how to use this product.

### Experience Requirement

In order to help you use SATLAB series products better, SATLAB suggests you carefully read the instructions. If you are unfamiliar with the products, please refer to <http://www.satlabgps.com>.

### Tips for safe use

---



**Notice:** The contents here are special operations, and need your special attention. Please read them carefully.

---



**Warning:** The contents here generally are very important. Wrong operation may damage the machine, lose data, even break the system and endanger your safety.

---

### Exclusions

Before using the product, please read these operating instructions carefully, they will help you to use it better. SATLAB Geosolutions assumes no responsibility if you fail to operate the product according to the instructions, or operate wrongly due to misunderstanding the instructions.

SATLAB is committed to constantly perfecting product functions and performance,

improving service quality and reserves the rights to change these operating instructions without notice.

We have checked the contents of the instructions and the software & hardware, without eliminating the possibility of deviation. The pictures in the operating instructions are for reference only. In case of non-conformity with products, the products shall prevail.

## **Technology and Service**

If you have any technical issues, please call SATLAB technology department for help, we will answer your question.

## **Relevant Information**

You can obtain this introduction by:

1. After purchasing SATLAB products, you will find this manual in the instrument container to guide you on operating the instrument.
2. Log onto the SATLAB official website, download the electronic version introduction at the product page.

## **Advice**

If you have any suggestions for this product, please email <http://www.satlabgps.com>. Your feedback information will help us to improve the product and service.

# Contents

<b>Preface</b> .....	<b>III</b>
<b>Overview</b> .....	<b>1</b>
<b>1.1 Foreword</b> .....	<b>2</b>
<b>1.2 Features</b> .....	<b>3</b>
<b>1.3 Use and precautions</b> .....	<b>3</b>
<b>Product Introduction</b> .....	<b>5</b>
<b>2.1 Overall appearance</b> .....	<b>6</b>
2.1.1 Upper cover.....	6
2.1.2 Bottom cover .....	7
<b>2.2 Button &amp; indicator lamp</b> .....	<b>8</b>
2.2.1 Button function .....	8
2.2.2 Indicator lamp.....	10
<b>2.3 Static survey</b> .....	<b>11</b>
2.3.1 Steps of static survey .....	11
2.3.2 Static data storage .....	12
2.3.3 Static data download .....	13

---

2.4 Dynamic RTK survey.....	15
2.5 Firmware upgrade .....	17
<b>Technical Parameters.....</b>	<b>19</b>
3.1 Technical parameters.....	20
<b>Accessories and Interfaces .....</b>	<b>24</b>
4.1 SIM card installation.....	25
4.2 Data cable .....	26
4.3 Antenna.....	28
4.4 Benchmark.....	28
4.5 Battery & charger .....	29
4.5.1 Battery installation and unload.....	29
4.5.2 Battery and charger model .....	31
4.5.3 Power supply mode.....	31
4.5.4 Cautions for charging .....	32
4.5.5 Operation of charging.....	33

CHAPTER

---

**1**

## Overview

**This chapter contains:**

- **Foreword**
- **Features**
- **Use and precautions**

# 1.1 Foreword

A new generation of miniaturized SL700 GNSS RTK system, condensing our ultimate professional pursuit, with enthusiast performance configuration, using magnesium alloy structure, supporting tilt measurement, using Wi-Fi wireless connection, control distance up to 100 meters; built-in transceiver integrated radio, working distance farther. In addition, equipped with a new generation of quad-core full-strength Android handbook, with Satsurv professional measurement software, let you enjoy the comfortable work experience brought by professional quality.



**Cautions:** This manual does not represent the standard configuration. The contents of the box are adjusted according to different user requirements. The specific configuration is subject to the outbound order at the time of purchase. Before using the machine, it is recommended that you first check the package of the product for damage; please carefully open the package to confirm whether the contents of the box match the delivery order; if you find any loss of the product and its accessories or If it is damaged, please contact your local office or dealer immediately. Please read the instruction manual carefully before carrying, handling and using.

---



## 1.2 Features

1. New design, magnesium alloy structure, smaller size, lighter weight and higher quality;
2. Linux operating system, more powerful and more reliable;
3. The transceiver UHF radio enables switchable working modes between base and rover;
4. Built-in 8G storage space, support for inserting an external SD card;
5. Support long-distance Bluetooth and Wi-Fi connection for remote data transmission;
6. The new generation controller CHC30, rugged, dexterous and super endurance, accessible in various environments;
7. Based on Android system, developed a customized intelligent measurement software: Satsurv, with richer graphical performance and improved work efficiency;
8. Multi-function by one key, simple and convenient NFC operation, making your measurement quick and easy;
9. Double formats storage of static data (\*.GNS / RINEX).

## 1.3 Use and precautions

The SL700 receiver is designed with chemical and impact resistance, but precision instruments require careful use and maintenance.



**Notice:** The receiver must be within the specified temperature range when used and stored. Detailed requirements, please refer to Chapter 3: *Technical Parameters*.

---

In order to ensure the continuous tracking observation of the satellite and the quality of the satellite signal, it is required that the space above the station should be as wide as possible, and there should be no obstacles above the 15° elevation angle; in order to reduce the interference of various electromagnetic waves on the GNSS satellite signal, There should be no strong electromagnetic interference in the range of about 200m around the station, such as TV towers, microwave stations, high-voltage transmission lines; in order to avoid or reduce the occurrence of multi-path effects, the station should be away from the terrain and features that strong reflectors. Such as high-rise buildings, waters, etc.

## CHAPTER

---

**2**

## Product Introduction

**This chapter contains:**

- Overall appearance
- Button & indicator lamp
- Static survey
- Dynamic RTK survey
- Firmware upgrade

## 2.1 Overall appearance

The product appearance is divided into three parts, including the upper cover, bottom cover and control panel.



Figure 2-1-1Front

### 2.1.1 Upper cover

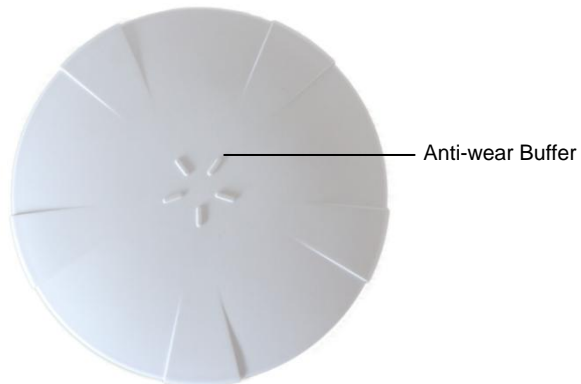


Figure 2-1-2Upper Cover

Anti-wear Buffer: Wear prevention points can enable the host to avoid scratching.

## 2.1.2 Bottom cover



Figure 2-1-3 Bottom Cover

1. Five-pin socket & Protective plug

2. Host label

3. Connection screw

4. Speaker

5. Battery compartment and cover

6. USB socket and protective plug

7. Network/radio antenna interface and protective plug

- Connection screw: For fixing the instrument to the base or a pole

- Protective plug: Used for dustproof and waterproof sockets.

- Five-pin socket: For external data linking and external power supply.

- Network/ Radio antenna interface: Network antenna when using the network, radio antenna when using the radio.

- USB socket: Connect the host with external devices, to upgrade firmware and download static

data. It can also be used as the USB to serial port, in special working modes (you need to install the driver).

- Speaker: Timely operate the instrument and broadcast the status with voice
- Battery compartment: Used to place the battery.
- Battery cover: Cover the battery cover to protect it from dust and water. It protects the battery and the components of the main unit.

## 2.2 Button & indicator lamp

### 2.2.1 Button function

Table 2-2-1 Button Function Description

Function	Description
Power-on	Long press the button for 1 second.
Power-off	In the power-on state, long press button more than 3 seconds and less than 6 seconds, the first voice of the speaker <i>Dingdong</i> , release the button to normal shutdown.
Auto-set base	In power off status, long press power button for 6s will enter the state of setting base station automatically, then release it ; the receiver will automatically set base mode.
Work mode switch	Double click power button enter the state of work mode switch,

	every double click will switch to another work mode.
Work mode	Single click to confirm the current work mode.
State query	See appendix.
Reset main board	In power on status, long press power button for more than 6s when voice prompts the second <i>dingdong</i> , then release it.
Mandatory power off	In power on status, long press power button for more than 8s.

### Appendix

Table 2-2-2 Detailed Description of the Status Query Function

<b>Working status</b>	<b>Broadcast Content</b>
GSMBase Station	GSMBase Station
UHFBBase Station	UHFBBase Station, Channel X, Power X
External Base Station	External Base Station
GSMRover	GSMRover
UHF Rover	UHF Rover, Channel X
Controller differential rover station	Controller differential rover station
ExternalRover	ExternalRover
Static	StaticInterval X, Elevation angel X, Existential space surplus X, Satellite number X

## 2.2.2 Indicator lamp

Table 2-2-3 Description of Indicator Lamp Function

Item	Status	Description
Power light (yellow)	Long-term lighting	In normal voltage Battery remaining $\geq 60\%$
Power lamp (red)	Always on	Battery remaining :10%~60%
	Slow flash	Low voltage: battery remaining $< 10\%$
Signal lamp (green)	Off	No GSM connection
	Always on	GSM module connect to server successfully
	Slow flash	Host is connecting to server
Data lamp (red)	Flash	1. The data link sends and receives data (the rover station only prompts to receive, and the base station only prompts to transmit) 2. Static acquisition flashes at sampling frequency (more than 1Hz flashes according to flash frequency (200ms)) ,in this status static data has been collected.
Satellite lamp (green)	Always on	Satellites tracked successfully
	Slow flash	Lose satellites and try re-track
Satellite	Fast flash	The motherboard is abnormal, the green light is off.



lamp (red)	Flash	In temporary static mode, flash according to the sampling interval.
Reset main board or static collecting error(Insufficient storage space )		Anomaly flashof 3 lamps

## 2.3 Static survey

SL700 receiver can be used for static measurement. It is set by double-clicking the power key to enter the mode switching, every double-clicking, switching one mode of operation. In the mode switching process, click the power key to confirm, the red state light flashes every few seconds (according to the sampling interval) and then collects one epoch. The collected static measurement data is stored in *static/gnss* files. Static data files need to be downloaded to the computer and processed with static post-proceed software.



**Notice:** Working mode switching: You can also switch through the controller, specific operation please refer to the *Satsurv software instructions*.

### 2.3.1 Steps of static survey

1. Set up receiver on a control point, centering and leveling strictly.
2. Measure the height of receiver for three times, on condition that the difference of each measuring is less than 3mm and the final height of the receiver should be the average height. Instrument height should be measured from control point to the upper of measurement bench marker. The radius of the SL700 receiver benchmark is 0.130m, and the phase center is

0.1018m high.

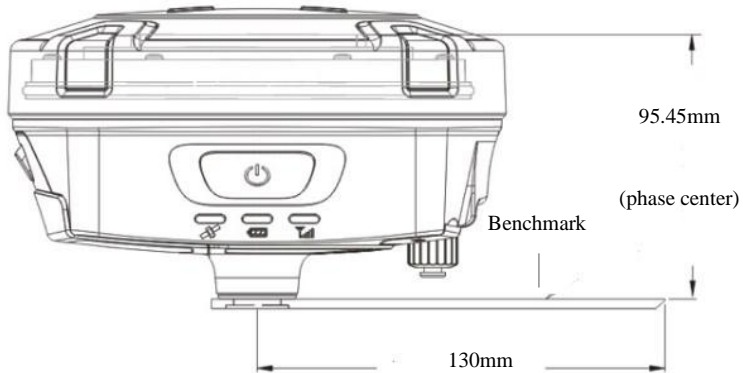


Figure 2-3-1 Benchmark Sketch

3. Record point name, receiver S/N, receiver height, beginning time.
4. Press power button to power on and double click power button to set static collecting mode; then single click power button to confirm it.
5. After the measurement is completed, turn off the machine and record the shutdown time.
6. Download and process data.



**Notice:** Don't move the tri-brach or change the collecting set while the receiver is collecting data.

### 2.3.2 Static data storage

The collected GNSS static data is stored in the static drive letter in the 8GB storage of the SL700 receiver (effective storage space is about 6.6GB). There are three folders: *log*, *gnss* and

*rinex*. The log folder stores log information. The data format stored in the *gnss* folder is \*.*gnss*; The data format stored in the *rinex* folder is a standard RINEX format data file. You can connect to your computer using a randomly configured USB cable and use the USB disk to copy static data to your computer.

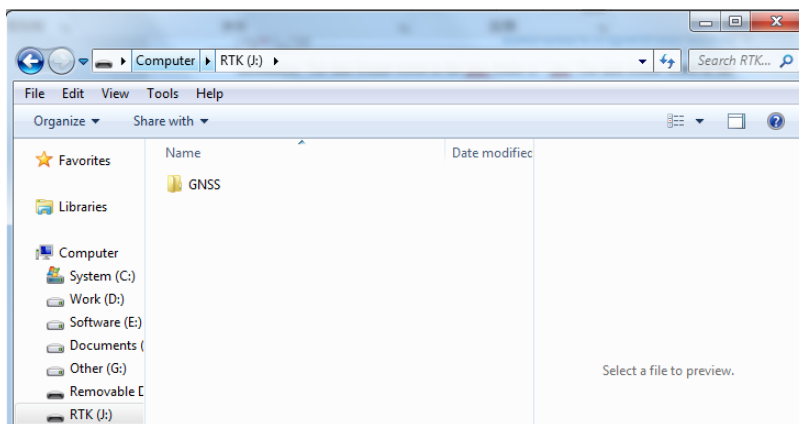


Figure 2-3-2 Static Data Storage



**Notice:** When the storage space inside and outside the receiver is less than 2MB, the data lamp (red light) fast flashes and then stops recording , meanwhile the existing data files will not be overwritten.

### 2.3.3 Static data download

SL700 receiver file management using U disk storage, plug-and-play, direct drag-and-drop download, do not need to download the management software. SL700 receiver can only download static data by using U disk mode, and can not write to the SL700 receiver.

SL700 receiver can download data through U-disk, use Mini USB cable when downloading.

Connect the receiver with computer by the Mini USB data cable. After the connection, a *static* code appears in the computer, then copy the collected static files out by opening the disk.



Figure 2-3-3 Static Drive

After downloading, steps of editing the point name and antenna height are:

1. Select \*.GNS static files, double click the mouse;
2. Pop up the *Document Edit* dialog box, edit the pointname and input the antenna height, then click *OK*

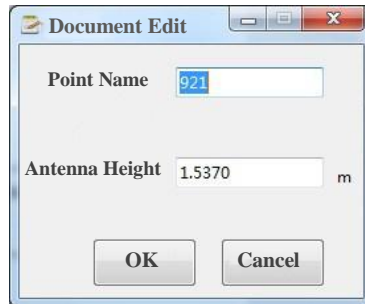


Figure 2-3-4 Edit File



**Notice:** Static files in removable disks can not be deleted directly, we can use controller software to conduct.

## 2.4 Dynamic RTK survey

The dynamic RTK measurement can be based on the propagation mode of the differential signal for the radio mode (internal radio, external radio, external station) and network mode.

### 1. Erection of instrument

The receiver is mounted on a stable known point or unknown point. In order for the receiver to be able to search for a large number of satellites and high-quality satellites, the base station should generally be selected in the open field of view around, to avoid large buildings and patches within the height of 15 degrees. At the same time, in order to further spread the differential signal, the reference stations should be erected in the higher position.

### 2. Connect the device

Start the Hi-Survey measurement software on the hand-held controller and enter the *Device* interface. Generally, use Bluetooth or Wi-Fi connection.

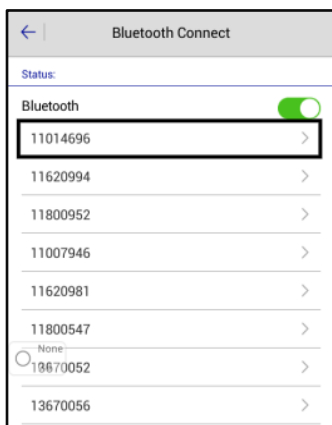


Figure 2-4-1 Bluetooth Connect

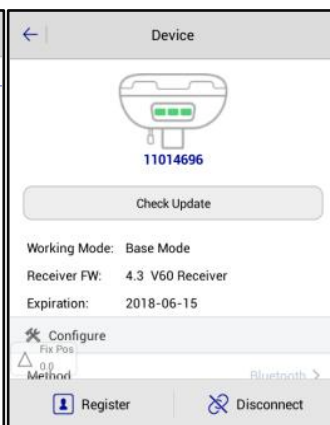


Figure 2-4-2 Device Connect

### 3. Parameter settings of base station

The base station parameters include setting the target height, base station coordinates, working mode and corresponding parameters, message format, elevation angle, and so on. After completing the relevant parameter editing, click the *Settings* button in the upper right corner, and the software prompts *Setup Successful!*

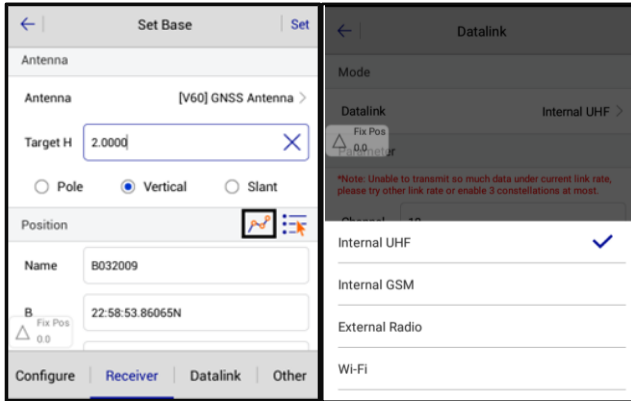


Figure 2-4-3 Receiver Settings

Figure 2-4-4 Choice of Radio

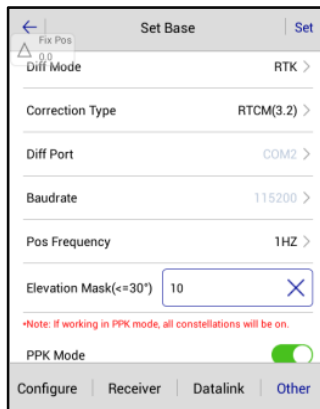


Figure 2-4-5 Other Settings

#### 4. Rover settings

The mobile station receiver is fixed on the telescopic centering pole, and the handbook is fixed on the handbook carrier. The mobile station settings are basically the same as the base station, mainly including the working mode setting, the altitude angle, and the like. The difference is that the mobile station working mode increases the handbook difference.

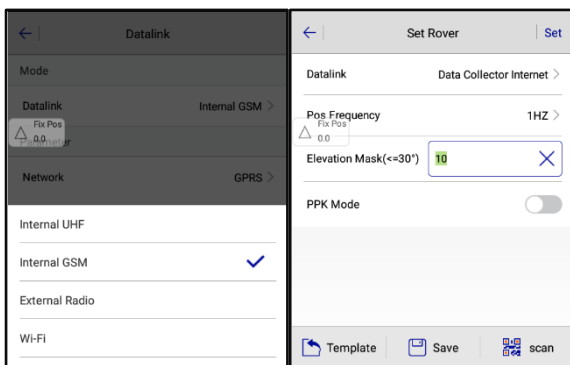


Figure 2-4-6 Choice of Radio

Figure 2-4-7Other Settings

## 2.5 Firmware upgrade

The receiver uses 3G network, and the host firmware can be automatically upgraded through the network ( please refer to: *Satsurv Software User Manual*), and the user can also choose to manually upgrade through U disk.

Steps to upgrading the firmwareby USB cable:

1. Turn on the receiver, connect the receiver and computer with the cable attached. It will show the *update* driveafter clicking thecomputer;

2. Copy the firmware (download from our official website or get it from the technical team) to the *update* drive. Disconnect the computer and receiver, and restart the receiver;



Figure 2-5-1 Update drive



CHAPTER

---

3

## Technical Parameters

This chapter contains:

- Technical parameters

## 3.1 Technical parameters

Table 3-1-1 Technical Parameters

Configuration		Detailed indicators
GNSS Configuration	Satellite signals tracked simultaneously	System: multi-star system core (OEM729)
		Channels: 555
		BDS: B1, B2, B3
		GPS: L1C/A, L1C, L2C, L2P, L5
		GLONASS <sup>[1]</sup> : L1C/A, L2C, L2P, L3, L5
		GALILEO <sup>[2]</sup> : E1, E5A, E5B, E6
		SBAS: L1, L5
		QZASS: L1 C/A, L1C, L2C, L5, L6
		IRNSS <sup>[3]</sup> : L5
	L-Band: up to 5 channels	
Output format	ASCII: NMEA-0183, binary data	
Positioning output	1-100Hz (5Hz with payment)	
Static data format	GNS and RINEX	
Message type	CMR, RTCM2.X, RTCM3.0, RTCM3.2	
System Configuration	Operating system	Linux
	Data storage	Built-in 8G memory
	Starting Time	3s

Accuracy and Reliability <sup>[4]</sup>	RTK Single baseline	Horizontal: 8mm+1ppmRMS
		Vertical: 15mm +1ppm RMS
	Network RTK	Horizontal: 8mm+ 0.5ppmRMS
		Vertical: 15mm + 0.5ppm RMS
	High-precisionstatic	Horizontal: 2.5mm +0.1ppm RMS
		Vertical: 3.5mm + 0.4ppm RMS
	Static and fast static	Horizontal: 2.5mm +0.5ppm RMS
		Vertical: 5mm + 0.5ppm RMS
	DGPS	Horizontal: 25cm RMS
		Vertical: 50cmRMS
SBAS	Horizontal: 50cmRMS	
	Vertical: 85cm RMS	
Initialization time	<10s	
Initialization reliability	>99.99%	
Communication	Internal 3G cellular mobile(Telit:HE910)	UTMS/WCDMA/GPRS/GSM
	WiFi	2.4G, 802.11b/g/n
	Bluetooth	V2.1 + EDR
	Radio	Built-in transceiver integrated radio; (Satel )
Power: 1W Frequency: 403MHz~473MHz(4FSK,GMSK)		

		Transmission rate:19.2kbps/9.6kbps adjustable
User Interface	Button	Singlebutton
	IndicatorLamp	Satellite lamp, signal lamp.power light
Intelligent voice	Voice broadcast	Report the working status of the receiver
	Function self-test	Voice broadcast receiver self-test results
Physical	Internal battery	2×5000mAh lithium-ion rechargeable and removable battery RTK rover(Cellular) ≥10 hours <sup>[5]</sup>
	Externalpower	6-28VDCexternalpowerinputwith over-discharge protection
	Dimensions	Φ 164mm×83.5mm
	Weight	≤1.4kg(includes battery)
	Power consumption	4.2W
	Materials	The shell is made of magnesium alloy material
Environment	Water/dustproof	IP67It can resist temporary immersion under 1 meter underwater, completely preventing dust from entering
	Freefall	Designedtosurvivea 2mnaturalfallontoconcrete
	Humidity	95%.condensing
	Operationtemperature	-40℃ ~ 65℃
	Storagetemperature	-40℃ ~ 85℃

Note:

[1] Hardware ready for L3 and L5

[2] E1bc and E6bc support only

[3] Hardware ready for L5

[4] Measurement accuracy and reliability are affected by many factors, including satellite geometry, satellite number, observation time, satellite ephemeris, ionospheric conditions, and multipath.

[5] Battery working time is related to work environment, working temperature and battery life.

---

CHAPTER

4

## Accessories and Interfaces

This chapter contains:

- SIM card installation
- Data cable
- Antenna
- Benchmark
- Battery & charger

# 4.1 SIM card installation

SL700 receiver supports the SIM card.

Table 4-1-1 SIM Card Description

SIM card	GPRS (ZHD/VRS)
	GSM

To implement an RTK work using the SL700 receiver, you need to prepare a SIM card and open the data communication service. The number of cards required depends on your RTK measurement system configuration.

**The SIM card installation steps are as follows:**

1. Remove the battery cover and remove the battery to expose the SIM card slot.



Figure 4-1-1 SIM Card Slot

2. The direction of the gap of the SIM card is the same as that of the card slot.
3. Insert the SIM card into the card holder and insert the front side (with metal contacts) into the card slot.



Figure 4-1-2 Installation

4. The entire SIM card is placed in the card slot. The installation is completed.



**Notice:** The receiver must be powered off before installing the card! If the SIM card is installed in the power on state, the receiver will not be able to detect the SIM card, and the setting of working mode is invalid!

## 4.2 Data cable

1. The Mini USB cable has a standard USB interface on one end and a Mini USB interface on the other end; it is used for connection between the host and external devices for data transmission.



Figure 4-2-1 Mini USB Data Cable



2.Five-pin data cable (DG-3): to connect the host and external radio to transmit differential data.



Figure 4-2-2Five-pin Data Cable



Figure 4-2-3Five-pin Plug



**Notice:** 1. When connecting various plugs of receiver, it shall align the red point in line joint at the red point in receiver socket, or it will damage the receiver socket and plugs of various lines.

2. When plug out the plug, directly grasp the sliding collar and pull out the plug with effort. It shall not rotate the plug.

3. After using the cable, it should be arranged in a place that is not easy to be squeezed to prevent damage to the plug. When installing the differential antenna, make sure that the hand is rotating the fixed nut at the bottom of the differential antenna. Do not hold the upper part of the differential antenna to rotate. Otherwise, It is easy to make the differential antenna contact bad, thus affecting the working distance.

---

## 4.3 Antenna

There are UHF internal radio antenna and 3G/GPRS antenna, you can select the appropriate antenna according to the operation mode. The UHF radio antenna is used in the UHF mode, and the external 3G/GPRS antenna is used in the internal GSM mode.



Figure 4-3-1 UHF Radio Antenna (above) and 3G/GPRS Antenna (below)

## 4.4 Benchmark

The benchmark is used to measure the height of the instrument.

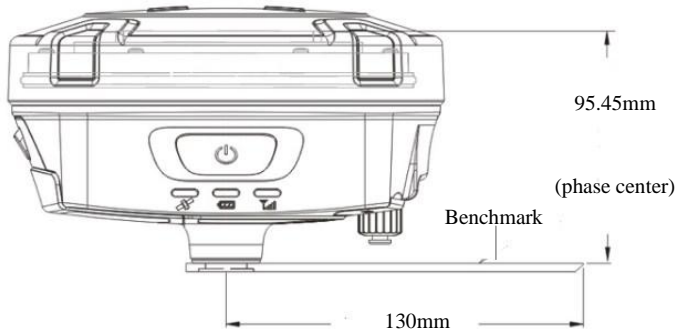


Figure 4-4-1 Benchmark

## 4.5 Battery & charger

### 4.5.1 Battery installation and unload

#### 1. Installation

Press the battery cover button gently and press down. The battery cover can be lifted upwards.

The battery cover and battery are removed as shown in the figure. To the right is unlocked and locked to the left.



Figure 4-5-1 Unload



Put the  on the bottom of the battery marked with *Open* to the battery compartment, and put  into the battery rack.



Figure 4-5-2 Installed Battery

## 2. Unload

Gently press and push in the direction marked *Open*, pour out the battery and complete the battery unloading.

## 4.5.2 Battery and charger model

Table 4-5-1 Battery and Charger Model

Name	Model
Lithium-ion battery	BL-5000
Battery charger	CL-8410

## 4.5.3 Power supply mode

Table 4-5-2 Power Supply Mode

Power Supply	Power supply mode	Lithium battery; 5-pin socket external power supply
	Power supply range	6V min and 28V max

You can also connect the receiver to an external power source through 5-pin socket.

External voltage range for GSM operation mode and UHF rover station is DC 6-28V and the current shall be more than 3000mA. If there is external power supply, the receiver will choose the high voltage between the lithium and external power supplies. When an external power supply is required, the specified dedicated power supply must be used.



**Notice:** 1. Service time of lithium battery will decrease with the reduction of temperature and increase of charging and discharging times. Generally, one new 5000 mAh lithium battery can be used for 10 hours for static data collection, or 8 hours as GPRS rover, or 7 hours as 2W internal transceiver transmitting station.

2. In order to extend the life of the battery, please charge the battery as soon as possible within 24 hours after the battery is exhausted, otherwise the battery life will be shortened.
  3. If the battery is not used for a long time, in order to prolong its service time, please charge the battery once per month.
- 

#### 4.5.4 Cautions for charging

BL-5000 lithium battery must be charged by CL-8410/CL-4400 lithium battery charger. Charging time is about 7 hours. CL-8410 chargers are designed with charging lamps, which becomes red during the charging period, and becomes green after charging. Then continue charging for 1~1.5 hours until the electric quantity of battery is in full state.





Figure4-5-3 Charger

## 4.5.5 Operation of charging



Figure 5-5-5 Method of Charging

1. Put the  on the bottom of the battery marked with *Open* to the battery compartment, and put  into the battery rack.
2. Install the battery by gently pressing and pushing it toward the end marked *Close*.
3. When the power is connected, the *charge indicator* is displayed in red to start charging.



- Notice:** 1. Only use battery and charger configured by manufacturer, and do not throw them into the fire or use the metallic short-circuit electrode.
2. In case of heating, deformation, liquid leakage, smell emission or other anomaly phenomenon during the use, charging or storage period of the battery, please stop using and replace it with new one.
3. If the service time of the battery is shortened obviously, please stop using the battery. It indicates that the battery has been aged; please replace it with new one.