KOLIDA K1Pro Positioning System

User Guide

Contents

Chapter Ⅰ Brief Introduction

In this chapter you will have a brief knowledge of KOLIDA Company and K1Pro measurement system.

§1.1 Introduction

Welcome to KOLIDA Instruments Co., Ltd, which is China's leading manufacturer of surveying equipment including GNSS receivers and Total Stations, etc. To know more about KOLIDA, please visit our official website http://www.kolidainstrument.com/.

In the guide, we'll show you how to operate the K1Pro RTK system as well as the accessories. We recommend you to read the guide carefully before getting started.

§1.2 Applications

Control Survey: In static measurement with dual frequency K1Pro we can get high accuracy result, which is valuable in deformation monitoring and control point measurement.
Highway Survey: In RTK measurement with K1Pro, we can use K1Pro to do the work such as road survey, topo survey, mapping, cross section measurement and so on.
CORS Connection: K1Pro can provide stable and convenient network data communication with all the CORS system.
Data Acquisition: Along with KOLIDA field survey software (app), K1Pro can have a quick and accurate data acquisition.
***Stakeout*:** Along with KOLIDA field survey software(app), K1Pro can achieve point stakeout, line stakeout and CAD stakeout.
***Power Survey*:** The anti-interference feature of K1Pro enables us to do the powerline survey.
***Marine Survey*:** K1Pro can connect to echo sounder to do the marine survey.

§1.3 Features

Intelligent Platform

Combining Linux system and KOLIDA cloud service, K1Pro is an intelligent system. Users are able to do register, upgrade and configurations by remote.

Full Constellations Tracking

With 336 GNSS channels solution, the usability of Glonass & Galileo satellites is greatly improved, so in harsh environment K1Pro is able to track more satellite than other receivers and provide more reliable positioning result.(672 channels optional)

IMU Survey

Thanks to the inertial measurement technology, K1Pro allows user to do a tilt survey in 2-4cm accuracy with a maximum tilt angle of 60 °. Centering is not a must and magnetic environment won't effect on the accuracy of tilt survey.

Star-Link

2cm Accuracy Star-Link correction service is available now! After subscribing to it, surveyors can work almost anywhere in the world without a base station or VRS network.

(Need subscription)

Star-Fill

This new function will let you continue working a few minutes when radio or mobile signal is becoming very poor or even lose in blind area, the accuracy is down to 2cm.

Bluetooth

Equipped with Bluetooth 4.0 module, K1Pro is able to build stable BT connections with both android and windows mobile devices.

WiFi

WIFI AP mode enables us to access to K1Pro' WEB UI and WIFI client mode enables K1Pro to connect to Internet downloading corrections.

Advanced Built-in UHF Module

K1Pro UHF module supports all the mainstream radio protocols in the market; and also supports radio router and radio repeater functions.

Speed Dial

Based on Linux platform and PPP dial up technology, K1Pro can have a fast and stable network connection.

Intelligent Interaction

We have two ways to access to K1Pro's WEB UI to config receivers, by WIFI and by USB network port mode.

Attractive OLED Display

1" colorful OLED screen can display K1Pro’ working status.

Smart Voice Guide

K1Pro now supports, English, Chinese, Turkish, Korean, Spanish, Russian, Portuguese voice guide. In the future, we'll support more language.

Large capacity power support

10000mAh Non-removable battery enables K1Pro to work 14 hours after 6 hours' charging.

Intelligent Storage

K1Pro can store raw data in formats such as STH, Rinex2.01 and Rinex3.02. The internal 8G memory ensures large size data collection. And OTG function allows K1Pro to use external flash disk for data storage.

The maximum storage rate is up to 50Hz.

Amazing Housing

With innovative design, K1Pro's shell is using magnesium alloy materials.

NFC Function

The NFC chip enables the quick touch and BT connection between controller and K1Pro.

Cloud Service

The cloud service can achieve real time online upgrade, register and remote check.

Chapter Ⅱ Hardware Structure

In this chapter, we can have knowledge on K1Pro hardware structure and basic function.

§2.1 Components of The Receiver

K1Pro size is 163mm in diameter and 96mm in height. The whole shell is made of magnesium alloy material, which makes K1Pro more rugged and durable. Two physical buttons and one 1-inch OLED screen in the front panel makes K1Pro easy to operate.

§2.1.1 Front Panel

Ref	Component	Description
①	**Indicators**	Indicates the working status for receiver
②	**F Key**	Page up/down, selection button
③	**Power Key**	Power on/off receiver, confirm button
④	**OLED Display**	Display the working mode and status of receiver

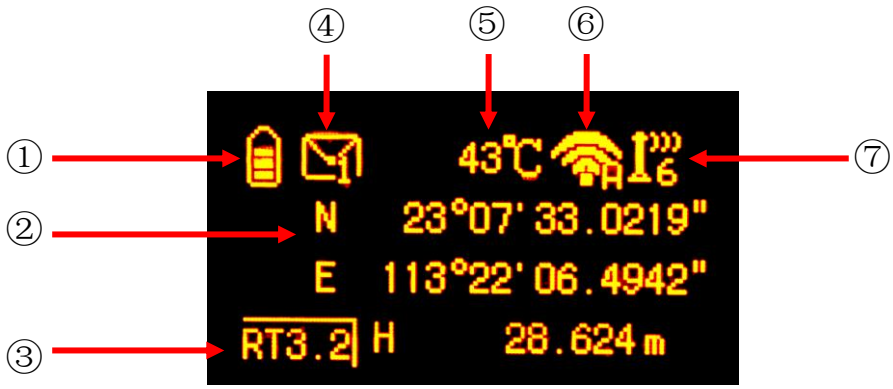
Indicators

The indicators are located at the left side of front panel, for details meaning please check the table below.

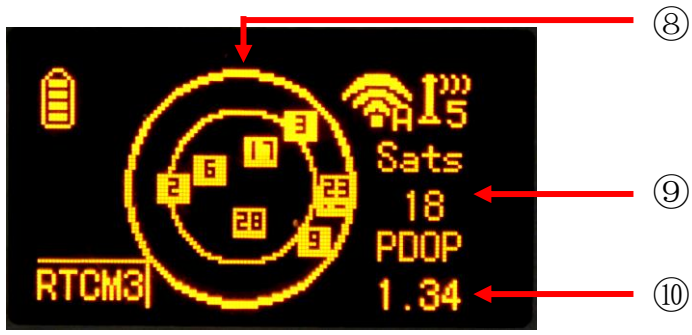
Component	Description
WIFI	Flashes in red to indicate that WIFI hotspot is broadcasting normally as AP mode.
DATA	**UHF mode:** Flashes in red to indicate that the signal is receiving/transmitting with the interval **Network mode:** 1) Fast flashes in red to indicate that the receiver is dialing; 2) Flashes in red with the signal receiving/transmitting interval after successful dial **WiFi mode:** 1) Fast flashes in red to indicate that the receiver is establishing WiFi connection; 2) Flashes in red with the signal receiving/transmitting interval after successful connection
REC	Flashes in red to indicate that static data collection is ongoing
BT	Keeps in red to indicate that Bluetooth connection is established
PWR	Keeps in red to indicate the remaining power is enough. Flashes in red to indicate the remaining power is not enough, and K1Pro needs to be charged.

Display and main interface

Power on K1Pro, and after initialization, K1Pro will access to the skyplot interface while detecting satellites. And then we will hear the voice indication about the current working mode. And 10 seconds later, the interface will switch to display coordinates and other information such as skyplot, the number of satellites and PDOP value.



Coordinates page



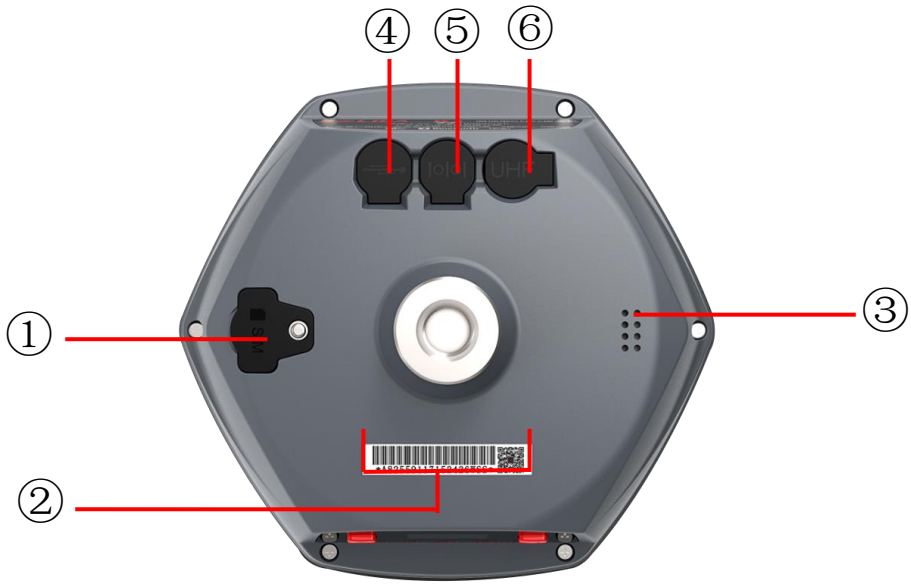
Skyplot page

Ref	Component	Description
①	**Battery symbol**	Display the remaining power in real-time
②	**Coordinates**	Display the coordinates
③	**Solution/Message type**	In base mode, it will display the base's transmitted correction message type; in rover mode, it will display the rover's current solution
④	**Message symbol**	The message symbol will appear automatically if receiver gets something error, such as error message. Press F key to read the message and press F key again to cancel
⑤	**Temperature**	Display the temperature of receiver in real-time
⑥	**WiFi symbol**	Display the WiFi status, when it shows  , that means the receiver is establishing WiFi connection as WIFI client, and if the WIFI successfully connected the

		symbol will change to be ; when it shows , that means the receiver is broadcasting its WIFI hotspot (We recommend to turn it off while unused.)
⑦	**Data link symbol**	K1Pro will indicate the current used datalink at this location. means internal UHF mode and the current channel, means the GPRS mode, means dual-emitting mode, means externl device mode
⑧	**Skyplot**	Display the satellites distribution
⑨	**Satellites**	The value under Sats indicates the number of satellites
⑩	**PDOP**	Display current PDOP value

§2.1.2 Side View

§2.1.3 Lower Housing



Ref	Component	Description
①	SIM card Slot	Where we can insert a SIM card when the receiver is set in GPRS mode
②	Serial number of the receiver	Apply for a registration code, Bluetooth ID
③	Voice indicator	Mode setting and working status prompt
④	7-pin port	USB port, OTG interface and Ethernet port
⑤	5-pin port	Power supply, differential correction communication and serial port to access K1Pro'receiver data
⑥	UHF Port	Insert UHF antenna

§2.2 Physical Key Operation

§2.2.1 Front OLED Interface

After K1Pro is powered on, press F key once to access to the configuration interface, where we can do Mode Select, Set Datalink, System Option, WIFI Config, UHF Info, Config Mode, Power Off and Quit.

Press F key to move the config option from one to another, and press Power key to confirm.

§2.2.2 Mode Select

In the configuration interface, press F key to access Mode Select option and press Power key to confirm. And then we can set the working mode as Base, Rover and Static.

Static Mode Setting

Press F key to select Static mode in Mode Select Interface and press Power key to confirm.

And then press power key again to access Record Option where we can set the point name, antenna height, sample interval, record mode and data type.

What we should do in the next is setup all the parameters for static mode. Press power key once and enter Record Option page, all the parameter items are displayed here including point name,

antenna height, sampling interval, record mode and data type.

Site: this is point ID for static, and it is the last 4 digits from serial number, but you can edit it if you choose this item, there are 0-9 and A-Z for each digit.

Ant.Hgt: This is the antenna height measure from ground point to measurement tape

Interval: This is the sampling rate for raw data storage

Rec.Mode: Auto indicates to collect static data automatically when the environment is OK; Manual indicates to start collection manually.

DataType: This is used to choose the data format for raw data storage, such as STH, Rinex2.01 and Rinex3.02

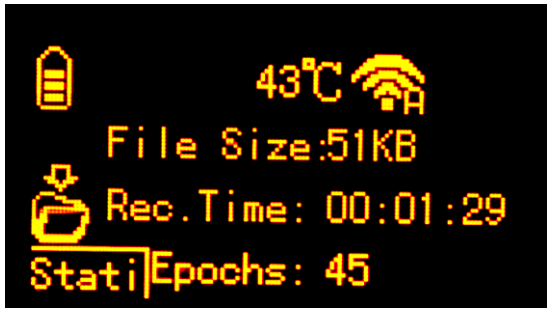
Press F key to move to **Edit** option and press power key to confirm, here you can select the item to edit by pressing F key. For example, press F key to move to Data type item and press power key to setup what kind of data format we are going to record, press F key to move to Rinex2.x or Rinex3.x and press power key to confirm, after that, press F key to move to OK option and press Power key to finish setting and return to the coordinate/skyplot page.

After the receiver starts to record static data, the recording information (file size, recording time and the epochs) will show on the screen.

File Size: Real-time display the size of data file

Rec.Time: Real-time display the recording time

Epochs: Real-time display the quantity of epochs receiver already obtained



NOTE: Please make sure the static parameters are the same when there are several receivers to collect static data at the same time.

Base Mode Setting

Press F key to select Base mode in Mode Select Interface and press Power key to confirm.

Start Base Option

This option is to set up base transmission parameters.

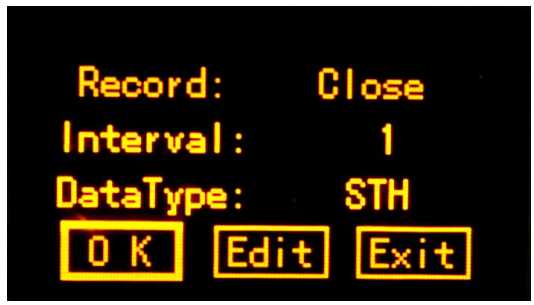
Base Mode: Manual, Repeat and AutoBase for optional to start the base station.

Diff Type: This is the correction format which base support to transmit, there are RTD, RTCM23, RTCM30, RTCM32,CMR, SCMRX for optional.

Mask Angle: The minimum GPS satellite elevation angle permitted by a particular receiver design. Satellites below this angle will not be used in position solution. 10-15 degree mask angle is recommended.

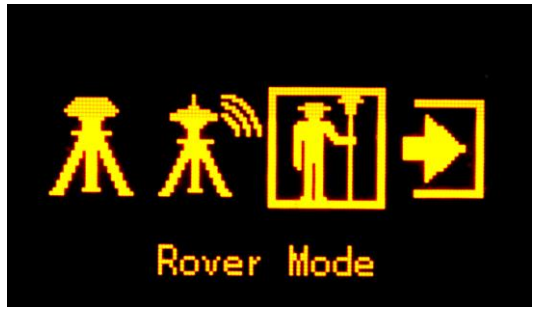
Record Option

This is used to set raw data collection parameters for base station.



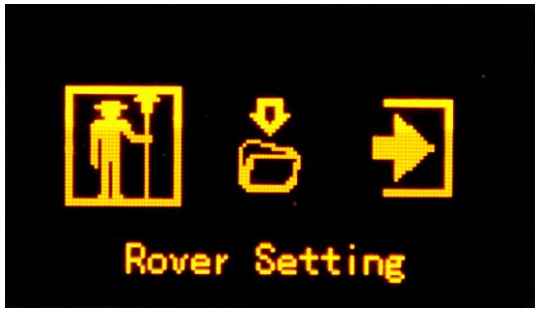
Rover Mode Setting

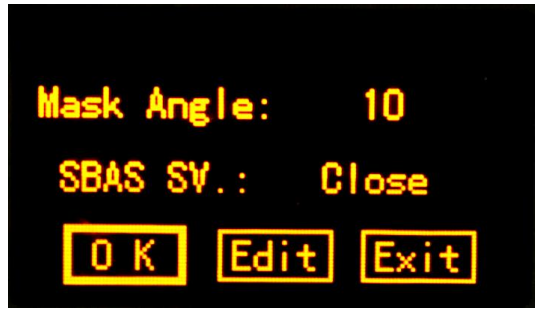
Press F key to select Rover mode in Mode Select Interface and press Power key to confirm.



Rover Setting

This is used to configure the mask angle and SBAS satellite view for rover receiver



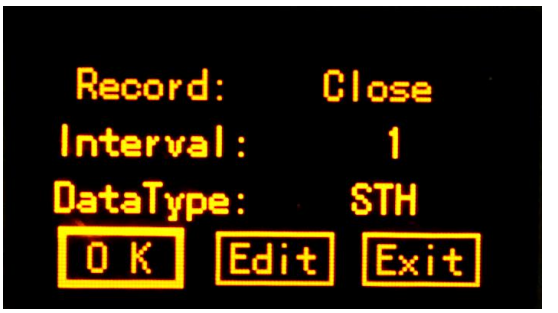


Mask Angle: The minimum GPS satellite elevation angle permitted by a particular receiver design. Satellites below this angle will not be used in position solution. 10-15 degree mask angle is recommended.

SBAS SV: This is used to control the rover receiver to track the SBAS system or not.

Record Option

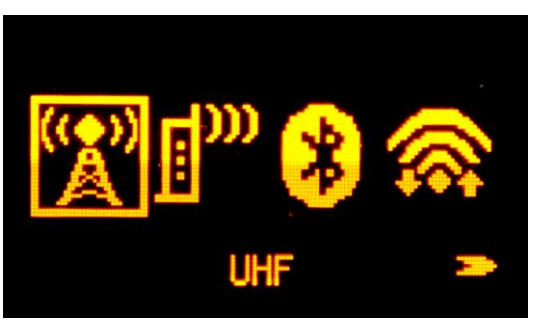
This is used to set raw data collection parameters for rover station.



§2.2.3 Datalink Setting

KOLIDA K1Pro is integrated with built-in UHF radio module, cellular module, bluetooth and WIFI, etc. K1Pro also can connect to external radio. When datalink is not used, we can close datalink to save power.

In the configuration interface, press F key to access Set Data Link option and press Power key to confirm. And then we can set the data link as UHF, Cellular Net, Bluetooth, Dual Transmitting, WIFI, External(radio) and Close datalink.

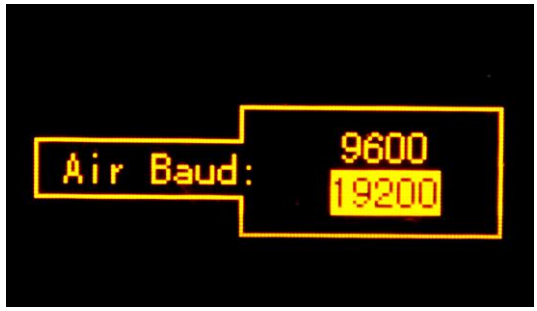


UHF Setting

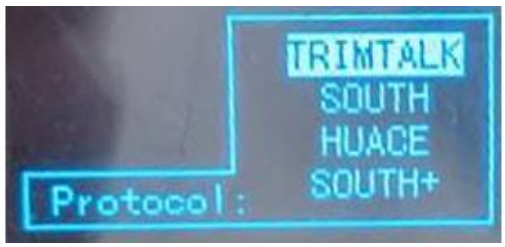
After selecting UHF option and in the configuration interface, we can set the channel, air baud rate, communication protocol and power for internal UHF.

Channel: This is the communication channels for internal UHF, the value of the channel must be the same in both Base and Rover.

Air Baud Rate: This represents the radio transmission rate of data, the higher value, the bigger size of data can be transmitted per second. 9600 is the recommended air baud rate to use.



Protocol: This is radio communication protocol for data transmission, SOUTH and TRIMTALK are optional in this page and SOUTH is the default setting, if it is changed, Base and Rover must use the same protocol for communication.



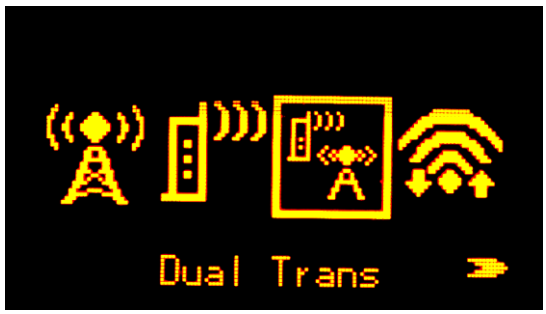
Power: This appears only in Base mode, the radio transmitting power is allowed to define in High, Middle or Low power.

Cellular Net Setting

This mode is to use the internal cellular module that connects to internet and access to reference station for the corrections.

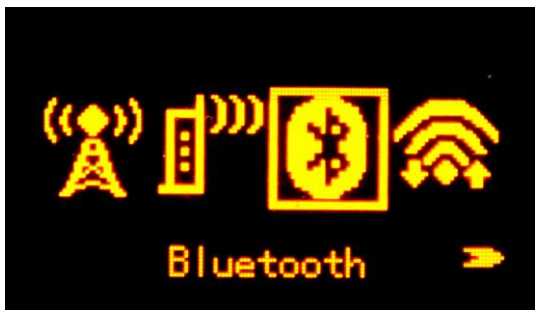
Dual Transmitting Mode

This mode enables Base station to transmit corrections by internal UHF and cellular net at the same time.



Bluetooth Mode Setting

This mode enables rover to access the reference station for corrections by the internet of data collector.



WIFI Datalink Setting

This is to use WIFI as the datalink that connect to the internet and access to reference station for corrections.

External Device

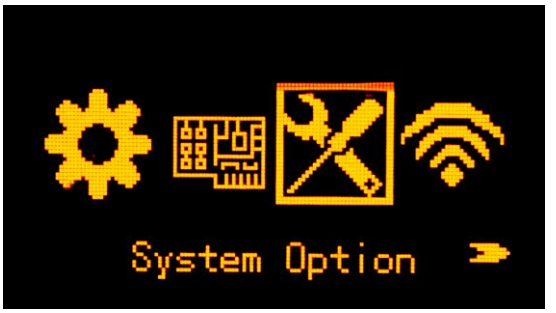
This mode enables receiver to connect external radio.

Close Datalink

This option is used to turn off all of the transmission method for development and customization, usually we keep all the datalink activated.

§2.2.4 System Setting

In the configuration interface, press F key to access System Option and press Power key to confirm. And then we can do configurations including Language setting, Voice option, self-check, online service, Online Option, Other Option and Copy Static File items.



Language

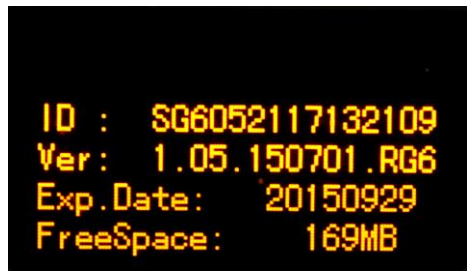
In language interface, we can set the receiver language into Chinese, English, Russian, Korean, Spanish, and Portuguese, Etc.

Voice Option

In voice option interface, we can set the voice indication and volume.

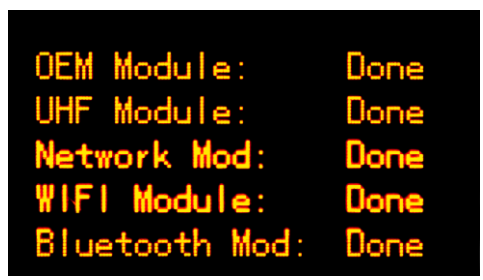
System Info

In system info interface, we can check receiver information including ID(serial number), firmware version, expire date and remaining memory.



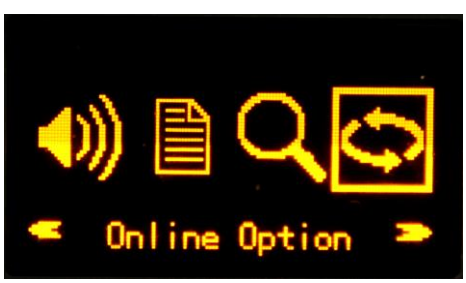
Self-Check

This is used to check whether there is something wrong with the internal modules such as OEM board, internal UHF, cellular module and Bluetooth module.



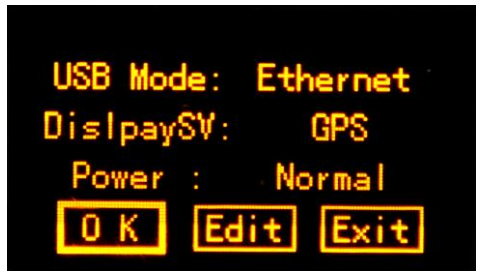
Online Option

This online service option is used for registration and upgrade firmware online for KOLIDA K1Pro, it is very convenient that you don't need any more PC software to do this.



Other Option

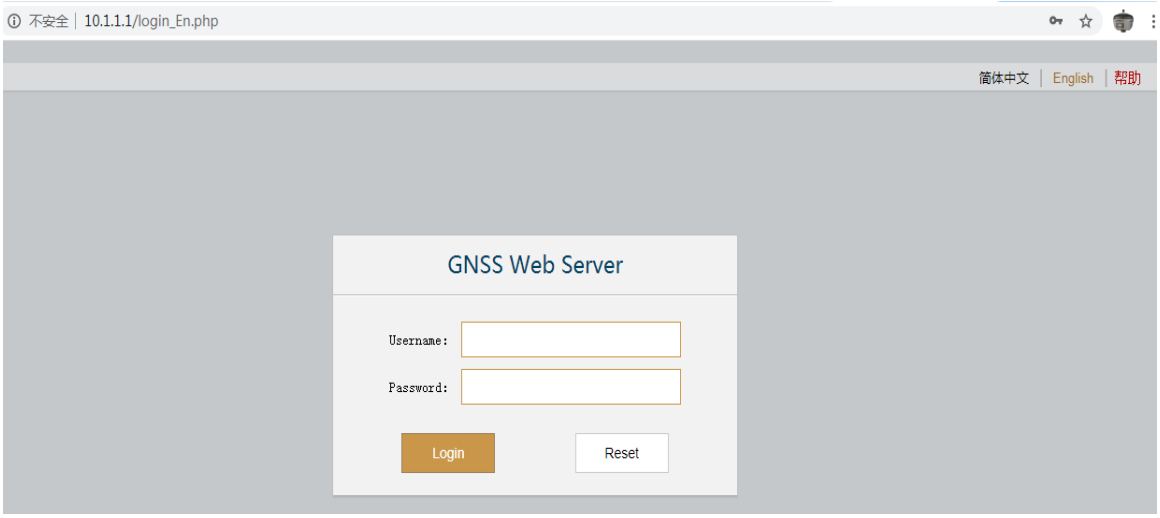
In this page, there are USB mode, Display SV and Power items displayed.



USB Mode: When we connect K1Pro to PC by 7-pin USB cable, there are two kinds of USB mode for selection: USB Disk and Ethernet (USB Network).

If USB Disk is selected, then K1Pro' internal memory will display in PC, and we can access to the memory to copy static data.

If Ethernet option is selected, then we can access to K1Pro' WEB UI by inputting IP 192.168.155.155, username (admin), password (admin) in browser.



DisplaySV: DisplaySV enables us to decide which satellite constellation displayed in skyplot page on screen. The default setting is to display GPS.

Power: If we select Saving, when there's no operations in a long time, the screen of K1Pro will turn off to save power automatically. And we can press any key to exit power saving mode.

Copy Static Files

In this mode, we set the USB mode as USB disk first, then we can use OTG cable to connect flash memory to K1Pro to copy static data directly from K1Pro' internal memory.

§2.2.5 WIFI Config

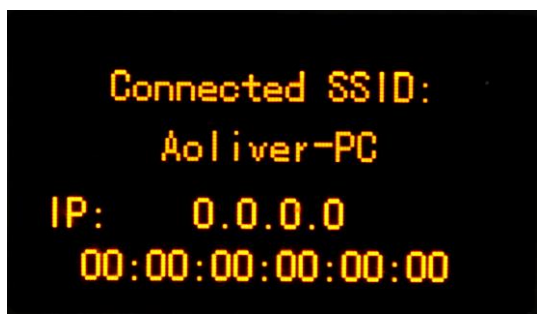
In the configuration interface, press F key to access WIFI Config and press Power key to confirm.

WIFI Info

If the WIFI working mode is selected to be "**Client**", the connected WIFI information will be displayed at WIFI Info page.

Connected SSID: This is the connected WIFI SSID which connects to internet.

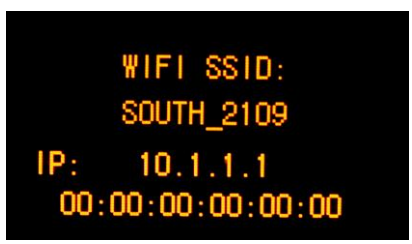
IP: K1Pro will generate an LAN IP address for accessing its internal web UI page after connecting to the WIFI.



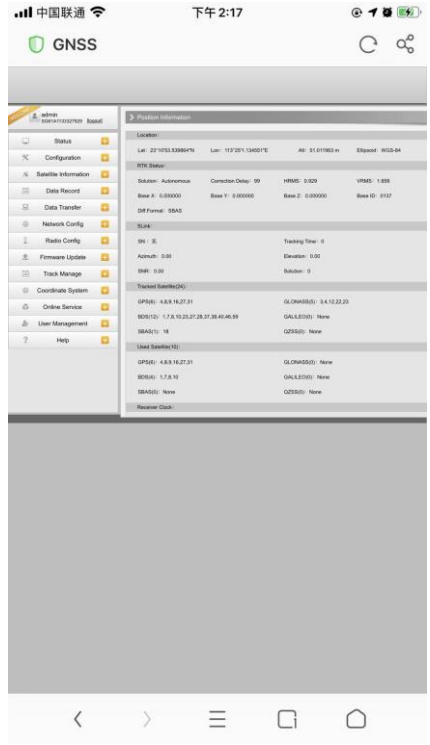
If the WIFI working mode is selected to be "AP", the WIFI hotspot information will be displayed at WIFI Info page.

WIFI SSID: This is the WIFI hotspot SSID which broadcasted by K1Pro, it is named with KOLIDA_xxxx (xxxx is the last 4 digits of SN).

IP: This is the default IP address which is used for the internal web UI access.

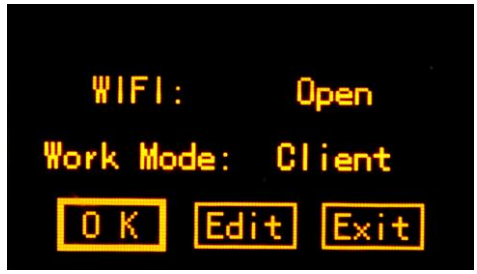


Search the WIFI SSID broadcasted by K1Pro with smartphone or laptop and connect it, then input the IP address 10.1.1.1 into the address bar of explorer and access to the web UI of K1Pro



WIFI Option

This is used to turn on/off the WIFI and setup what working mode of WIFI, such as AP (WIFI hotspot) and Client.



WIFI working mode setting

For the WIFI working mode, it is not only to be the hotspot, but also to be a datalink that help KOLIDA K1Pro to connect to internet and obtain corrections from reference station.

AP: This item means the WIFI hotspot broadcasted by K1Pro for mobile terminals such as smartphone or tablet to connect and access the Web UI.

Client: If this item is selected, K1Pro will connect to the internet via WIFI connection and then download the corrections from reference station.

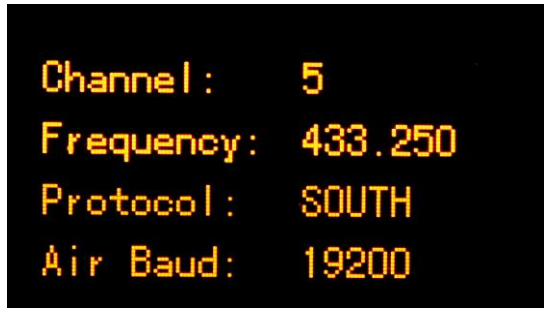
REMINDING: Turn off the WIFI is recommended if it is unused.

§2.2.6 Datalink Info (only for Base/Rover)

Under Base or Rover mode, there will be an additional option to view the information of current used datalink.

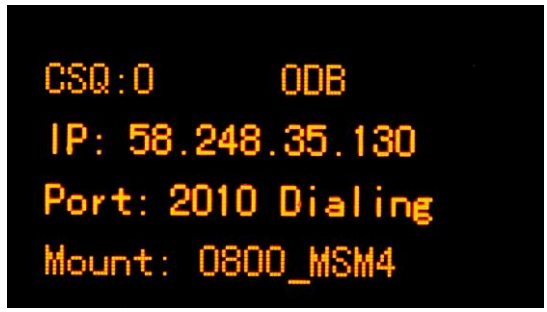
UHF Info

If the internal UHF mode is setup for Base or Rover, the **UHF Info** item will be displayed at main configuration page, move the select box to this item and press power key to view the information.



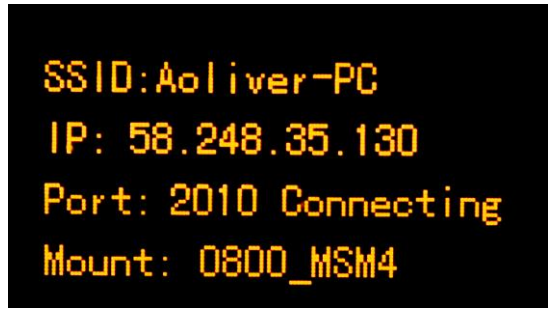
Network Info

If the Cellular Net mode or Dual Trans mode is selected as current datalink for Base or Rover, the **Network Info** item will be displayed at the main configuration page, choose this item and get into its page to view more information.



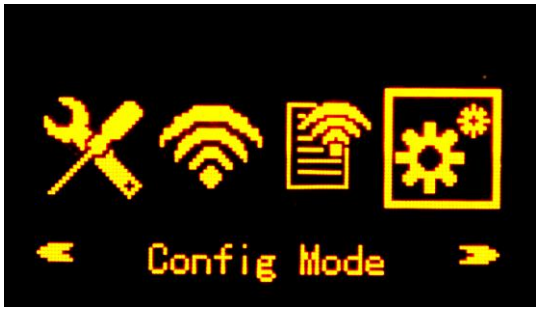
WIFI Status

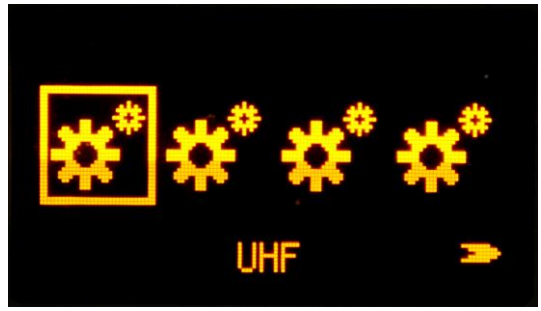
If the WIFI is selected to be current datalink for Base or Rover, the **WIFI Status** item will be displayed at the main configuration page, press F key to move the select box to this item and then press Power key to enter its page to view more information.



§2.2.7 Config Mode

This option is used to configure the modem-direct-connect mode for receiver debugging or problem diagnosis. UHF, Cellular Net, Sensor Config and GNSS OEM are contained in this mode.





§2.2.8 Power Off

There are two ways to power off receiver. One is to hold power button for 3 seconds directly; the other is to Press F key in configuration interface to access Power Off interface. In Power Off interface, we can select OFF to power off receiver or select RESET to restart receiver.

ChapterⅢ Web UI Configuration

§3.1 Overview

With the help of smart embedded Linux operating system and KOLIDA intelligent cloud technology, we can configure and monitor the status of K1Pro on WEB UI. There are two ways to access K1Pro' WEB UI, by WIFI hotspot and by USB Ethernet mode.

WIFI mode

First of all, get into WIFI Config option to open the WIFI hotspot by choosing AP option in WIFI Option.

Then use smartphone, tablet or laptop to connect the WIFI hotspot (KOLIDA_xxxx) and input the default IP (10.1.1.1) into explorer, input the default username and password for login.

USB mode

First of all, choose the Ethernet option in “System Option—Other option—USB Mode” to make the 7-pin port be an ethernet port, then connect K1Pro with computer via USB cable. Run the IE explorer and type IP 192.168.155.155 into IP address bar, then input the default username (admin) and password (admin) for login.

NOTE: install the corresponding driver to activate this function, the driver can be downloaded from official website.

Remote Login

If users would like to remote login the web UI of K1Pro, then K1Pro has to connect to the internet and forward its 80 port to the public network. For example, if the IP address 222.196.35.76 is the public network IP which K1Pro has connected, and the 80 port of K1Pro has been bounded with 8000 in public network, then users can input the public network IP address into IE explorer along with the forwarding port for login. (http:// 222.196.35.76:8000)

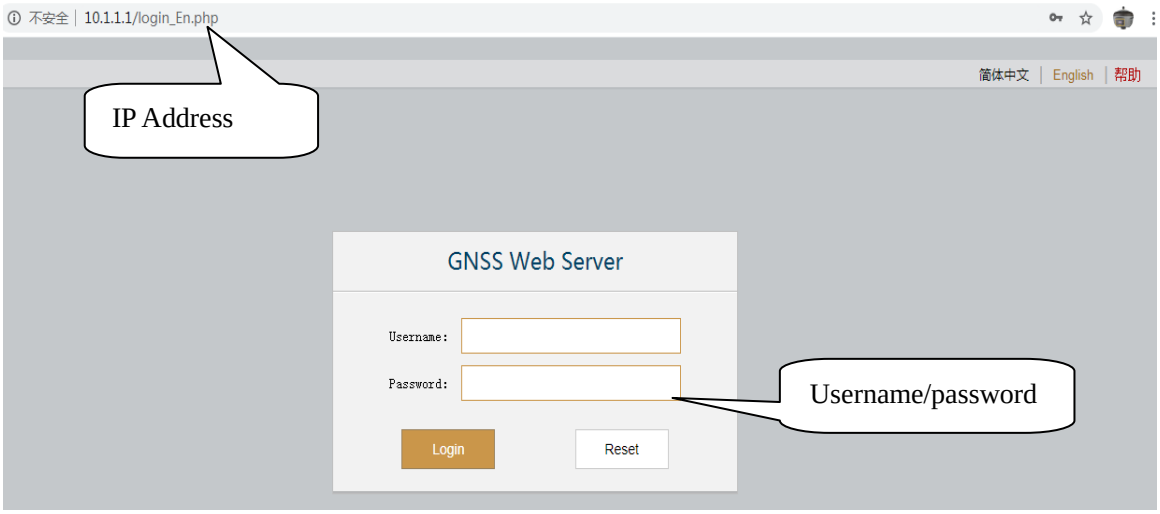
NOTE: please use the IE explorer for the Web UI login.

In this chapter, we will take “using the WIFI hotsopt to login the Web UI” for example.

Turn on the WIFI hotspot of K1Pro then search for the SSID by computer. Then connect the WIFI hotspot from K1Pro.

§3.2 Web UI main interface

After connecting to K1Pro' WIFI hotspot, we can input 10.1.1.1 in browser and the login page will appear.



In the Web UI home page, Status, Configuration, Satellite Information, Data Record, Data Transfer, Network Config, Radio Config, Firmware Update, User Management and Help are listed at left side. And the positioning informaiton including positioning information and satellites are diplayed at right side.

Ref	Component	Description
	Status	Positioning information, satellite tracking and the others will be displayed in this page
	Configuration	It contains registration for receiver, base configuration, antenna configuration, satellite configuration, receiver configuration and system configuration.
	Satellite Information	Display and control the satellites are used or not
	Data Record	Configure the parameters for static mode and raw data download
	Data Transfer	Contains NTRIP configuration, TCP/IP configuration and data transferring with PC
	Network Config	Contains network parameters configuration, WIFI configuration and the other functions
	Radio Config	Configure the parameters and frequency for radio modem
	Firmware Update	It is used to upgrade the firmware for receiver and each modem
	User Management	Add and manage the Web UI users

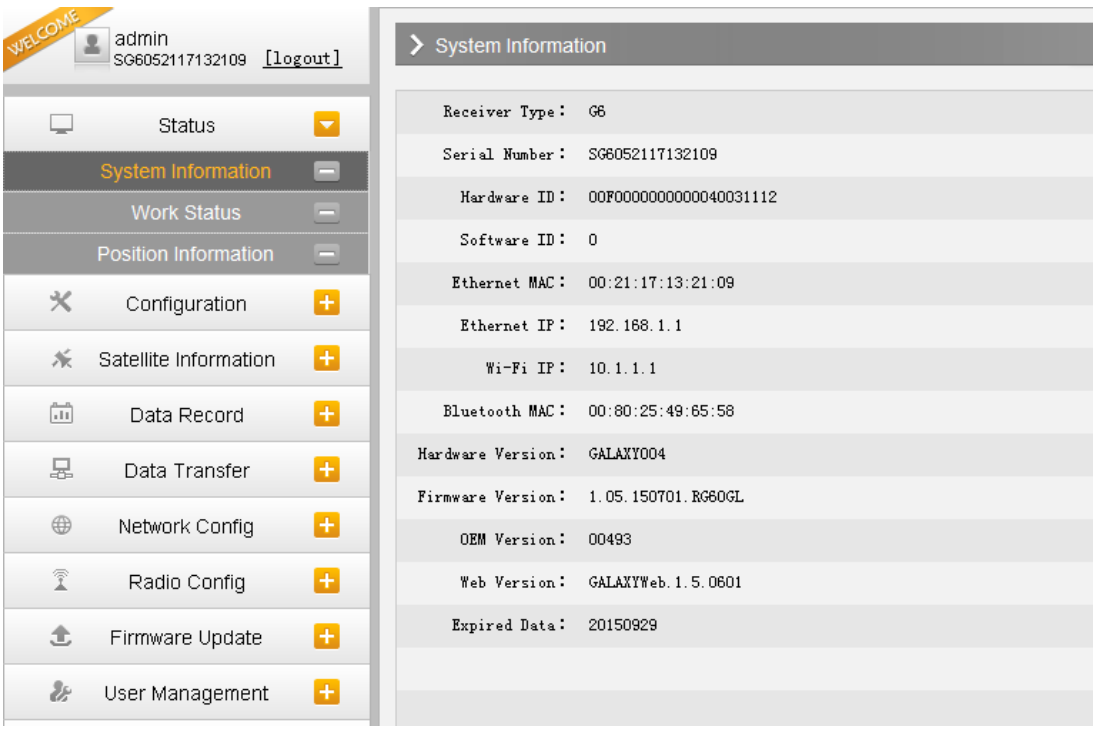
	Help	Offers solutions

§3.2.1 Status

System Information, Work Status and Position Information are listed under Status menu.

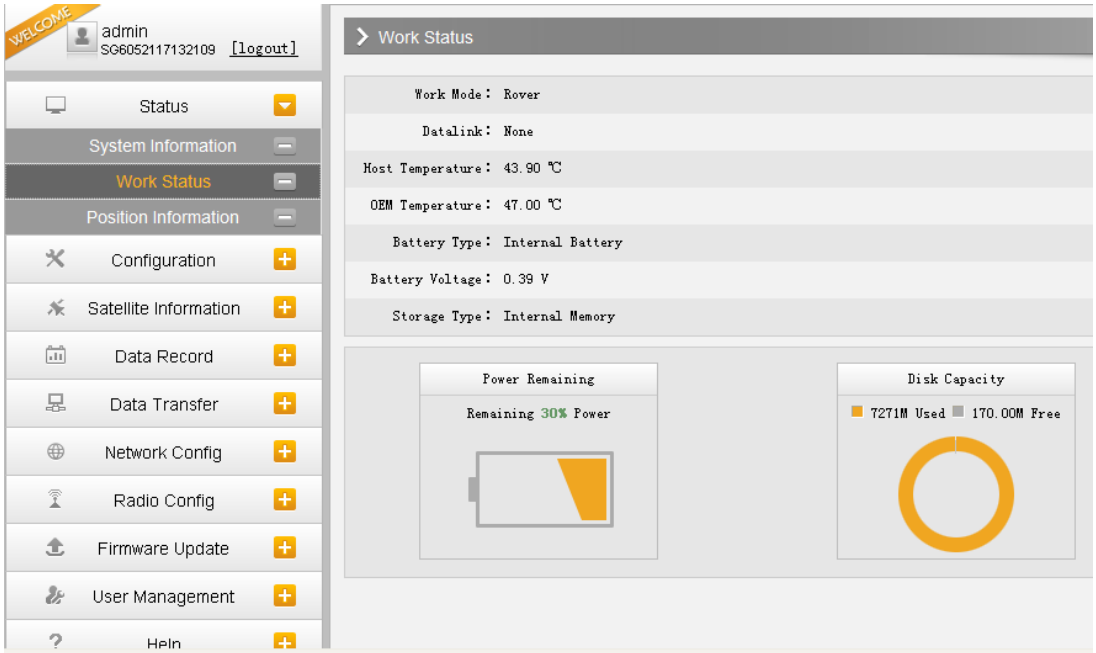
System Information

In this page, information such as serial number, hardware ID, MAC address, firmware version and so on are displayed.



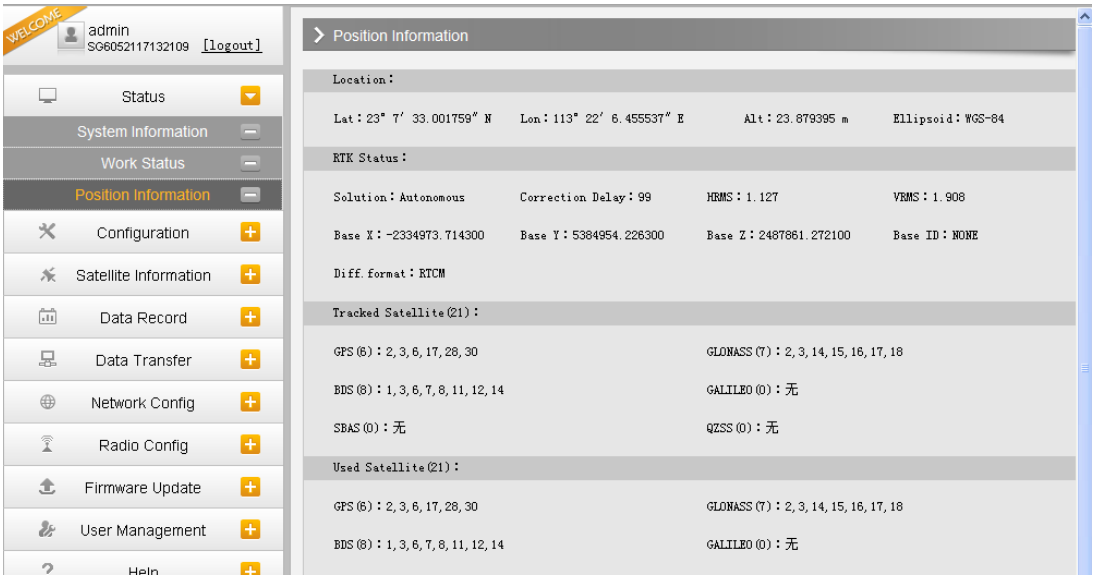
Work Status

K1Pro' status such as working mode, datalink, receiver temperature, remaining power and the free memory is displayed on this page



Position Information

In this page, we can have a clear glance at current K1Pro position and detected satellites information.



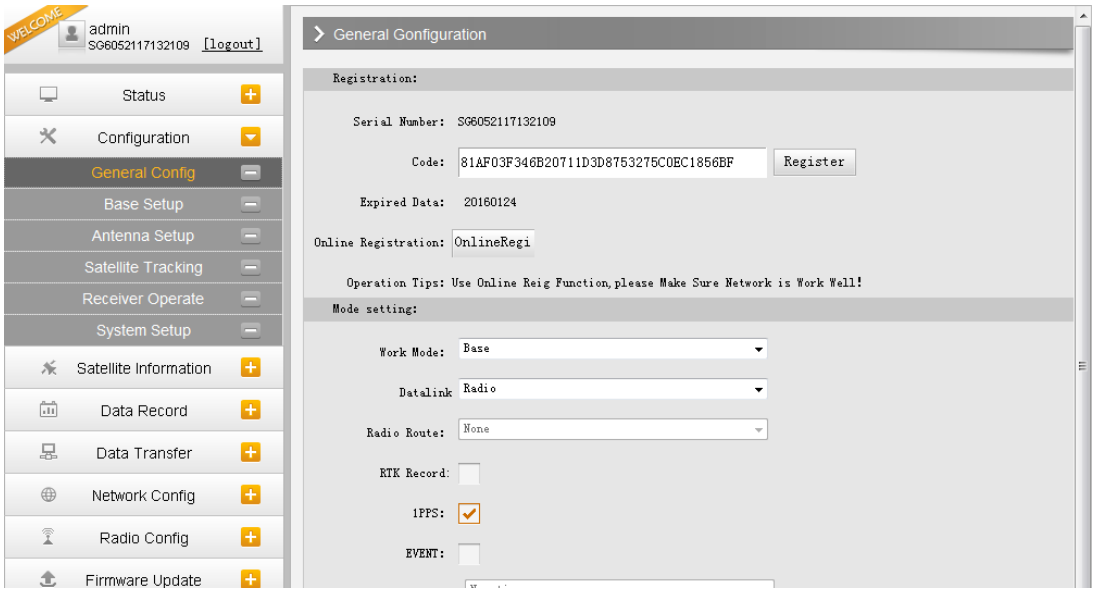
§3.2.2 Configuration

General Config, Base Setup, Antenna Setup, Satellite Tracking, Receiver Operate and Default Language are contained under Configuration menu. Users are able to configure all kinds of

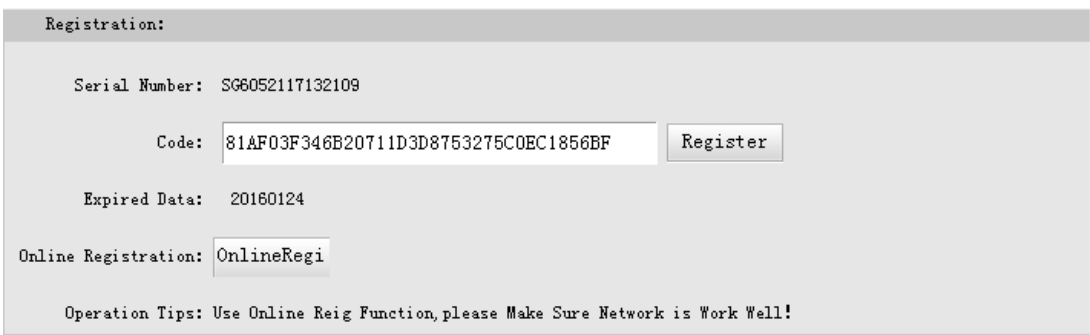
parameters for KOLIDA K1Pro under Configuration menu, and all the settings are immediately effected after saving.

General Config

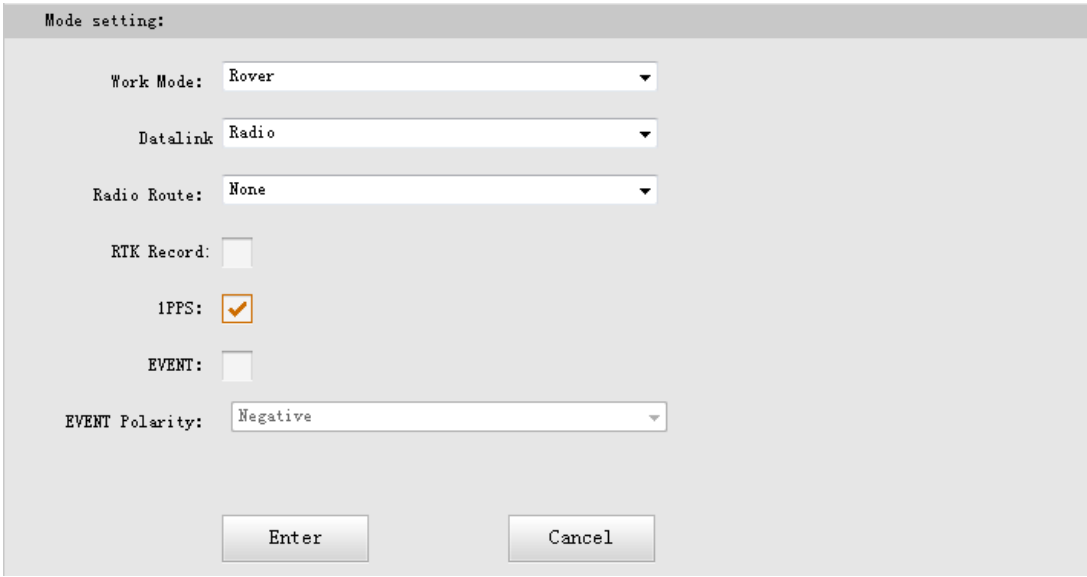
The registration and receiver working mode setting can be completed in this general configuration page.



If the code of K1Pro has expired or is going to be expired, please provide the serial number of your K1Pro to your local dealer to apply for another available code, then input the code into the blank or register the receiver online.

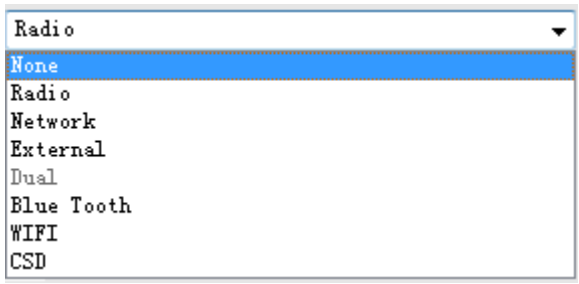


KOLIDA K1Pro is allowed to setup the working mode and datalink from this Web UI that only need the mobile phone or tablet PC is able to connect the wifi hotspot of K1Pro.

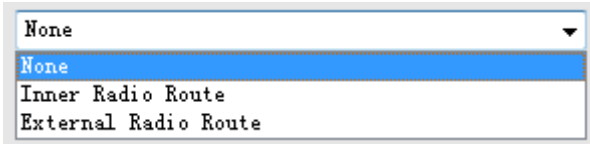


Work Mode: There are Rover, Base and Static contained in this dropdown list

Datalink: In the list, we have multible datalink options such as Radio, Network, External, Bluetooth and WIFI.



Radio Route: This function enables K1Pro to connect to reference station by network and transfer reference station's differential corrections to other receivers by radio.



RTK Record: This is used to enable raw data recording in base mode or rover mode for post-processing

1 PPS: This option is for the 1 pulse per second output

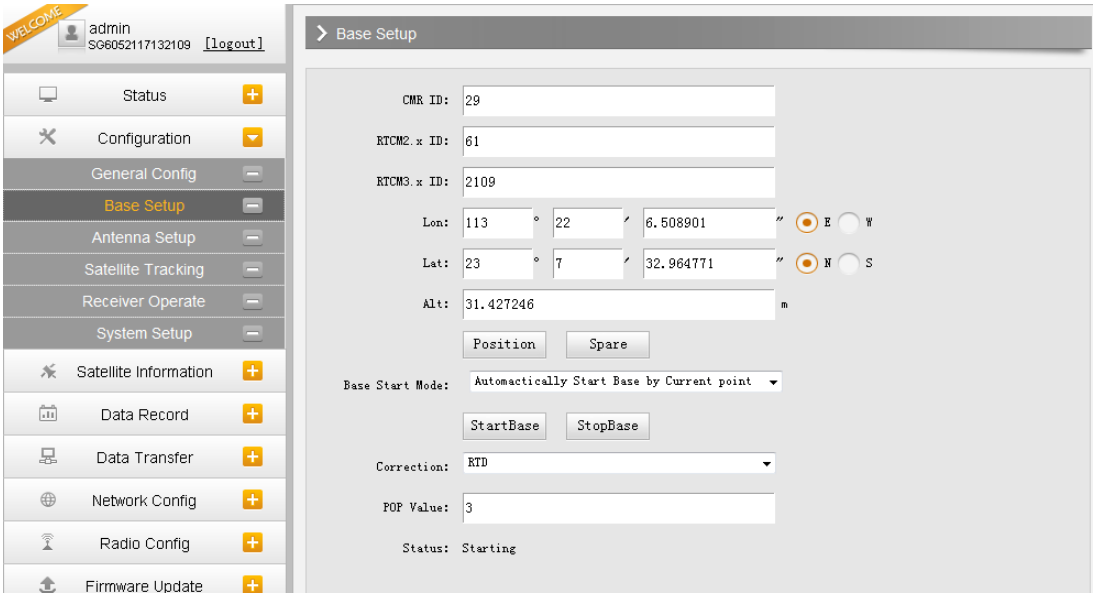
EVENT: This option is for the EVENT marker input

EVENT Polarity: EVENT input method.

Base Setup

When K1Pro works as a base, the basic configuration for base can be setup in this page. Users can input the correct coordinates or capture a current position for the base. Also users can define

what kind of correction format is transmitted.



CMR ID/RTCM2.X ID/RTCM3.X ID: Users can specify the ID for transmitting correction.

Position: Click this button to capture the coordinates for current position

Spare: This is used to the repeat station

Base Start Mode: Here contains 3 methods to start the Base, manually start base, automatically start base by fixed point, automatically start base by current point.

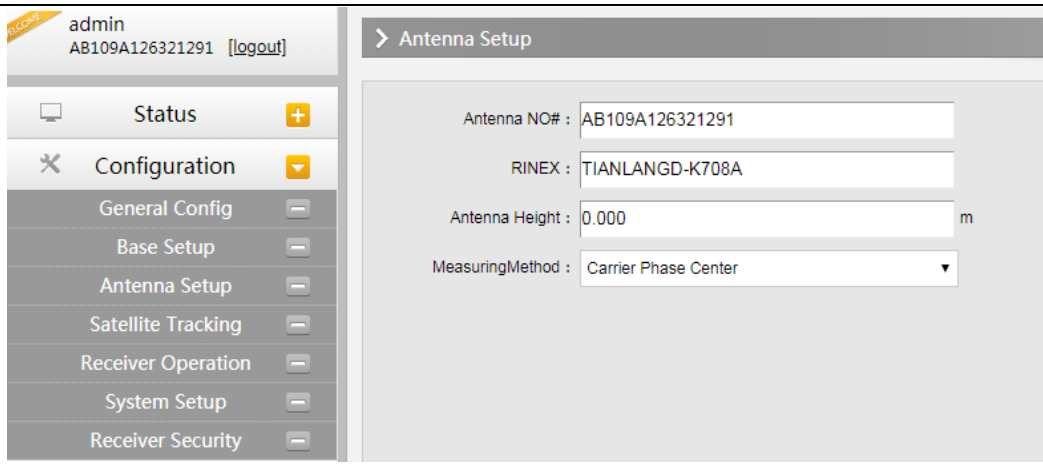
Correction: Here contains the global general used correction formats including RTD,RTCM23, RTCM30, RTCM32, CMR and SCMRx

POP Value: This value is setup for the PDOP limitation.

Status: Here will display the status for base in real-time.

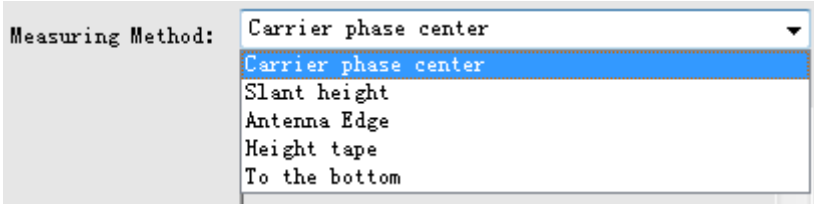
Antenna Setup

The antenna parameters are configured in this page including the antenna height, measuring method.



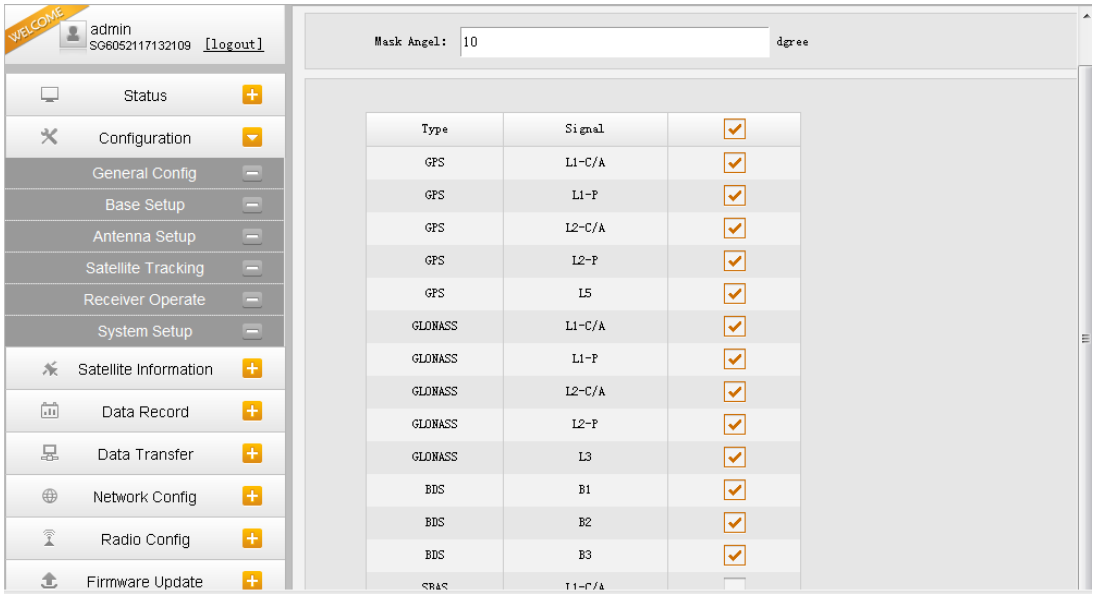
Antenna Height: This is the value for height of antenna while surveying.

Measuring Method: Here provides several methods for measuring the antenna height such as carrier phase center, slant height, antenna edge, height plate and to the bottom.



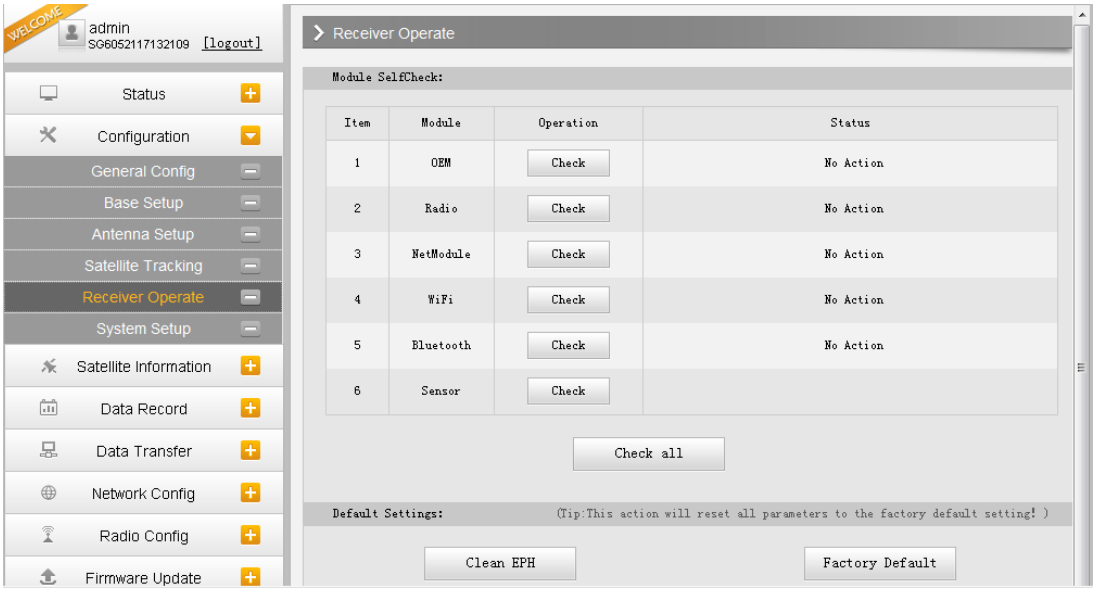
Satellite Tracking

In this page, users can define the mask angle for satellite tracking, and check on the box of corresponding band from the constellation that to use this band or not



Receiver Operate

The page provides all kinds of operations to control the receiver such as self-check operation, clean epochs, factory reset, reboot and power off.



Self-check: Users can also do the self-check from this configuration page, click on the Check all button to check all the modems or click on the check button corresponding to the modem to check one by one.

Clean EPH: Click this button to clear the remaining epochs to let recever track the satellites better.

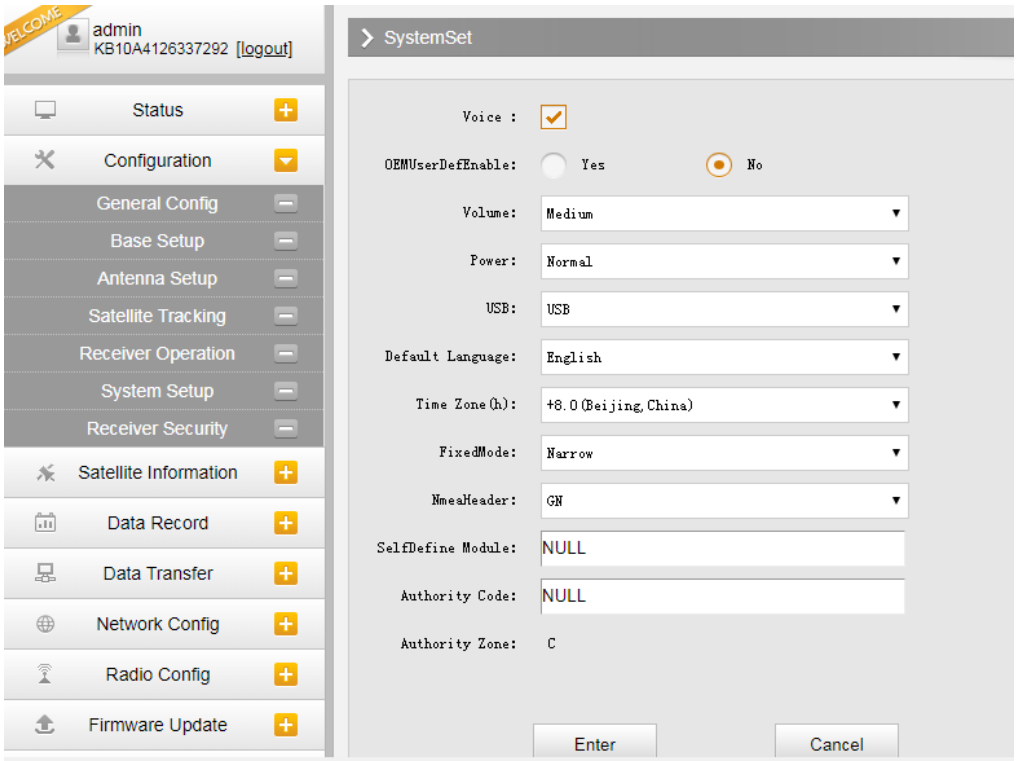
Factory Default: Click this button to bring the receiver back to factory default setting.

Reboot: Click this button to restart the receiver.

Power Off: Click this button to power off the receiver.

System Setup

In this interface, we can set receiver voice prompt, voice volume, power saving mode, USB mode and default language.



Voice Prompt: Check on this box to turn on the voice guide for K1Pro, cancel it to turn off the voice guide.

V**oice Volume:** Define the voice volume for K1Pro's speaker.

Power: Configure the receiver to use the power saving mode or not.

USB: This is used to configure K1Pro what kind of mode output from 7-pin port when connect the receiver with computer via USB cable. USB and network port for optional.

Default Language: Configure the default language for KOLIDA K1Pro.

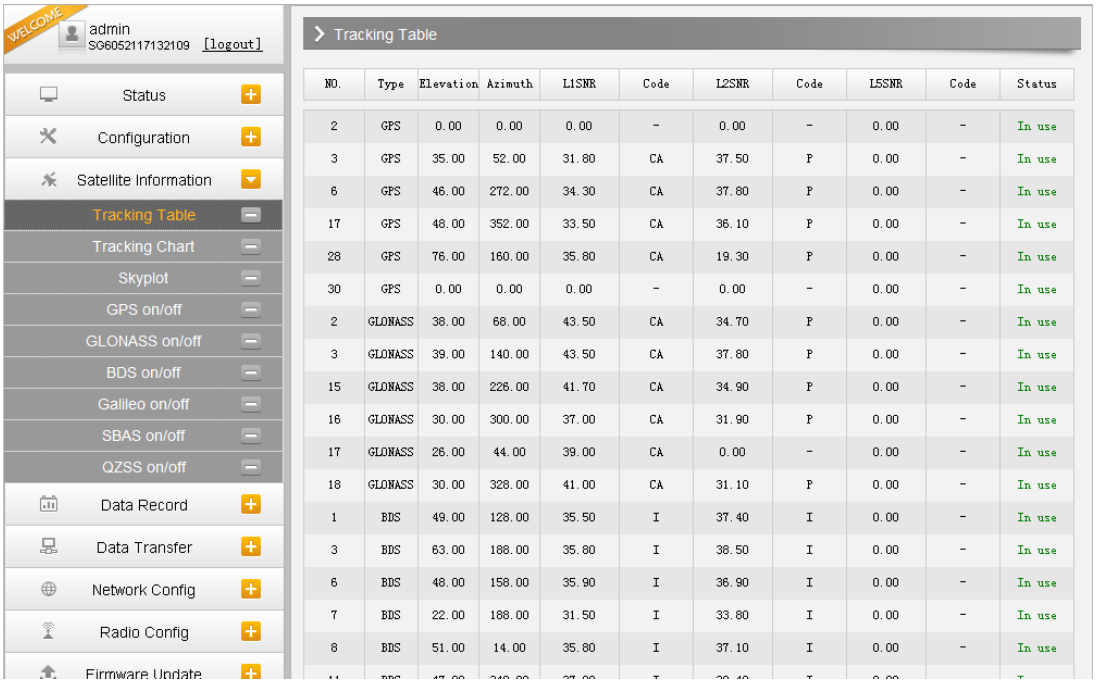
Authority Zone: C means this receiver works in China only/ W means it works worldwide

§3.2.3 Satellite Information

The "Satellite Information" provides all kinds of tables, graph and the skyplot to view the information of tracking satellites. And it is allowed to configure to use which satellite in constellation on/off page by checking on the corresponding box.

Tracking Table

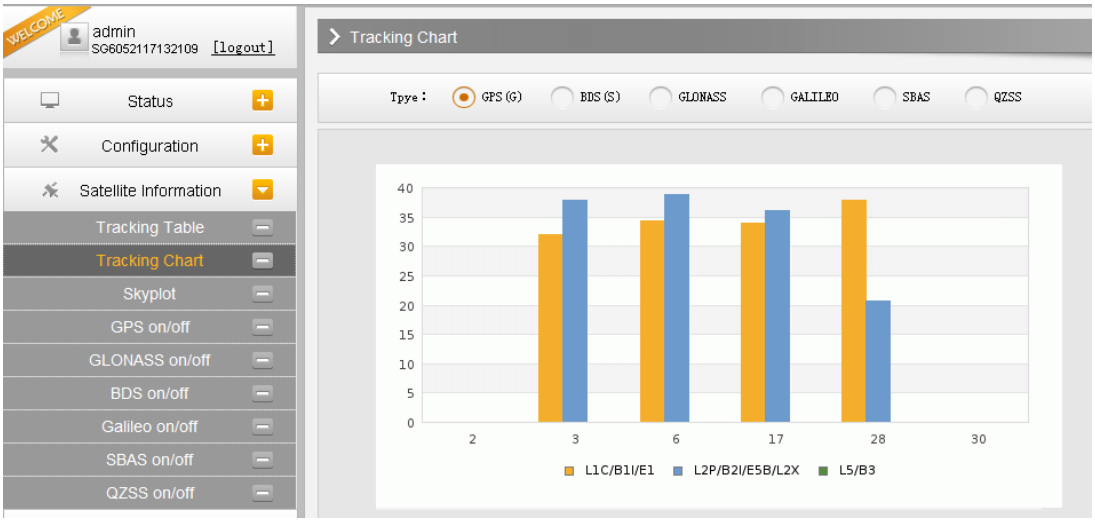
Here is the table to list all current used satellites and the other information for these satellites.



NO.	Type	Elevation	Azimuth	L1SNR	Code	L2SNR	Code	L5SNR	Code	Status
2	GPS	0.00	0.00	0.00	-	0.00	-	0.00	-	In use
3	GPS	35.00	52.00	31.80	CA	37.50	P	0.00	-	In use
6	GPS	46.00	272.00	34.30	CA	37.80	P	0.00	-	In use
17	GPS	48.00	352.00	33.50	CA	36.10	P	0.00	-	In use
28	GPS	76.00	160.00	35.80	CA	19.30	P	0.00	-	In use
30	GPS	0.00	0.00	0.00	-	0.00	-	0.00	-	In use
2	GLONASS	38.00	68.00	43.50	CA	34.70	P	0.00	-	In use
3	GLONASS	39.00	140.00	43.50	CA	37.80	P	0.00	-	In use
15	GLONASS	38.00	226.00	41.70	CA	34.90	P	0.00	-	In use
16	GLONASS	30.00	300.00	37.00	CA	31.90	P	0.00	-	In use
17	GLONASS	26.00	44.00	39.00	CA	0.00	-	0.00	-	In use
18	GLONASS	30.00	328.00	41.00	CA	31.10	P	0.00	-	In use
1	BDS	49.00	128.00	35.50	I	37.40	I	0.00	-	In use
3	BDS	63.00	188.00	35.80	I	38.50	I	0.00	-	In use
6	BDS	48.00	158.00	35.90	I	36.90	I	0.00	-	In use
7	BDS	22.00	188.00	31.50	I	33.80	I	0.00	-	In use
8	BDS	51.00	14.00	35.80	I	37.10	I	0.00	-	In use

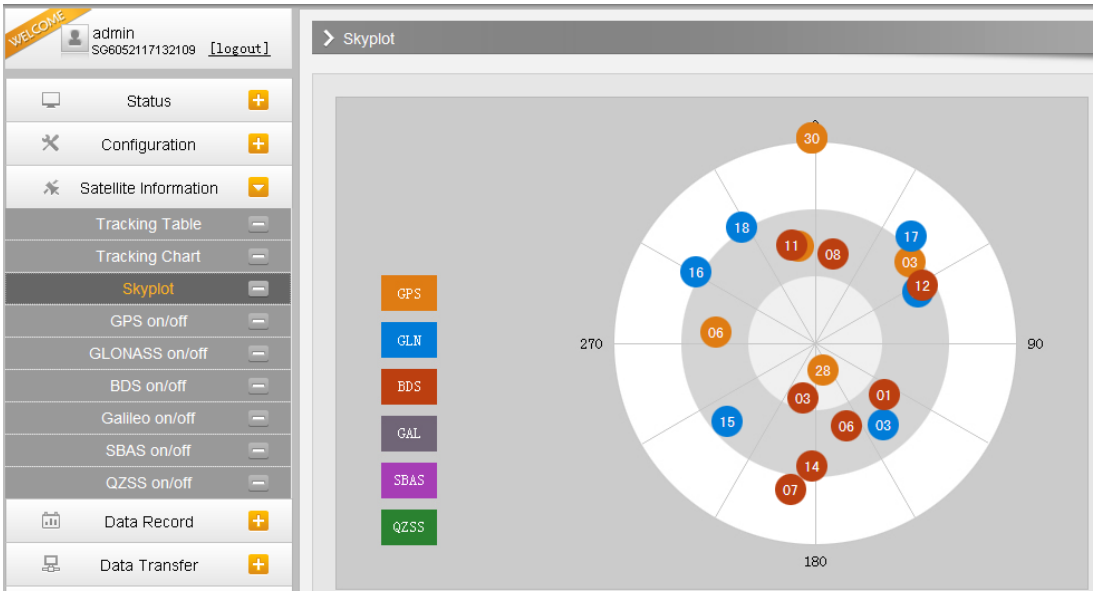
Tracking Chart

Tracking Chart is to show the used satellites' SNR (signal noise ratio).



Skyplot

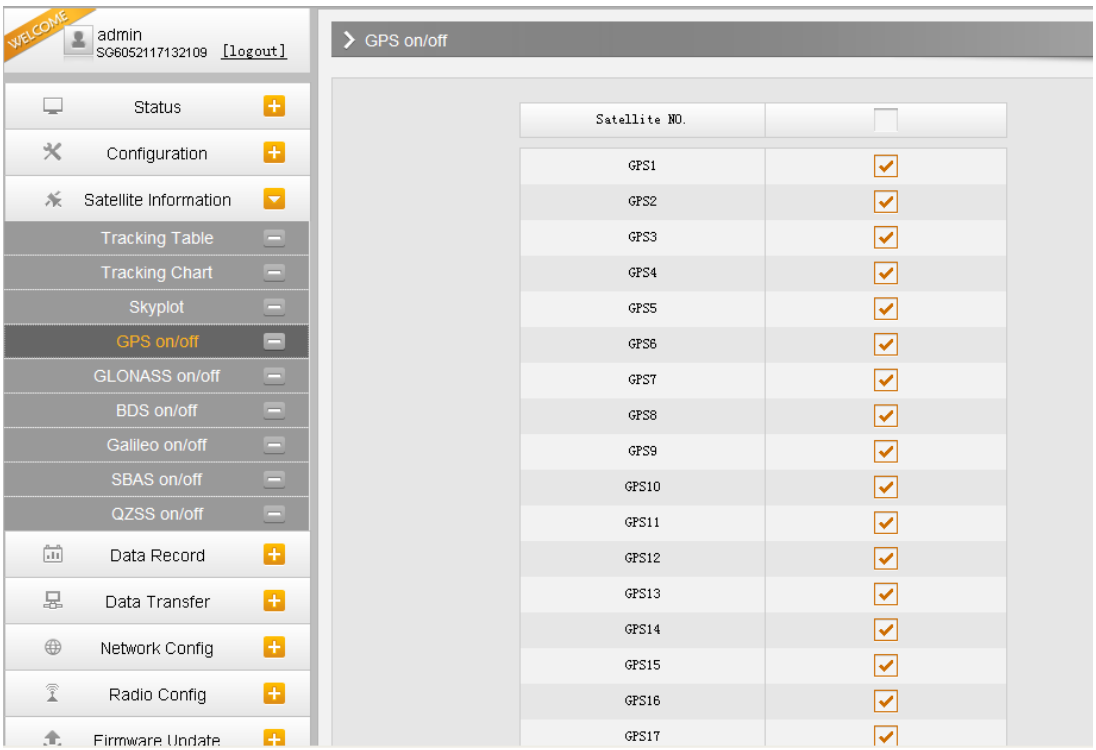
Skyplot is to show the used satellites sky position.



GPS on/off

For all the running GNSS constellations or the augmentation system, K1Pro allows to configure to use which satellite or not.

In gnss on/off page, all the running satellites are listed, and unselect the box corresponding to the satellite to not use it.



§3.2.4 Data Record

The “Data Record” is mainly used to configure all the parameters for receiver in static mode. Much more operations can be done on KOLIDA K1Pro such as storage path, interval, data format and data files download.

Recording Config

The page provides more practical operations for raw data storage.

Storage Option: Here are the options to be selected for where the raw data will be stored, internal memory or external memory.

Interval: This is the sampling interval for data storage, 50Hz(0.02s) sampling interval now is available for K1Pro.

File Interval: This is used to set the data storage time for the static file.

Data Format: K1Pro can store raw data format as STH, Rinex2.0 and Rinex3.0.

Point Name: A point name is required, the last 4 digits of SN is default setting for the point name.

Auto Delete: When the memory is full, K1Pro will delete previous data files automatically to release space for new collected data.

Format: Click this button to format the internal memory for K1Pro.

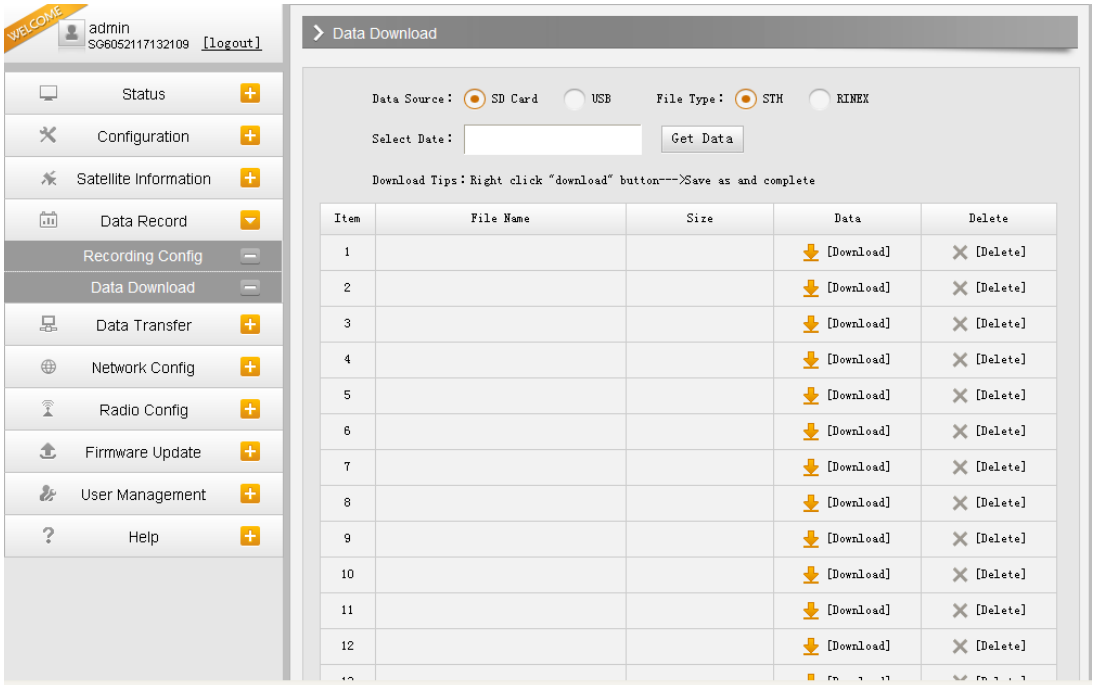
Recording Mode: Auto recording or manually start to record.

Start/Stop: Click these buttons to start recording or strop recording the raw data.

Recording Status: Here shows the status of static data storage.

Data Download

This interface is to download collected raw data.

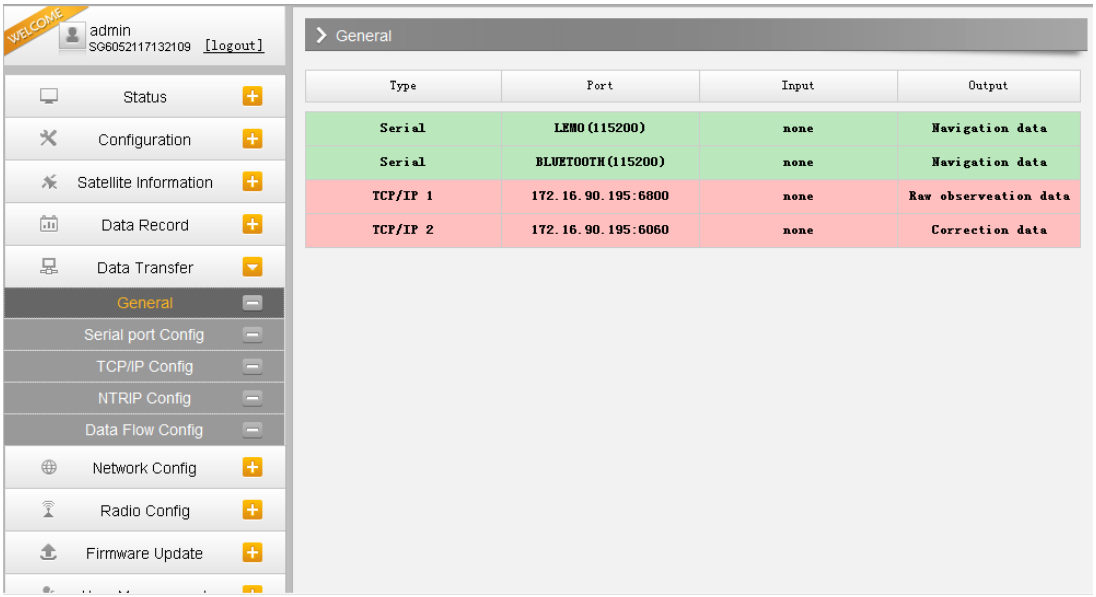


§3.2.5 Data Transfer

This function contains General, Serial Port Config, TCP/IP Config, NTRIP Config and Data Flow Config. The “Data Transfer” allows to configure the output mode for raw observation data and differential data, as well as to the NTRIP performance configuration.

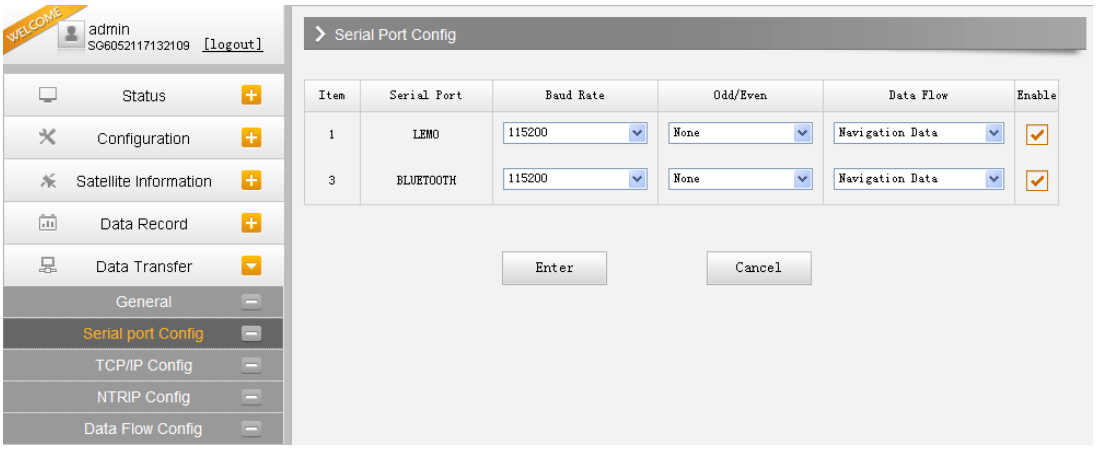
General

This page shows the service condition and the output contents of the ports, if the port item display in green, that means the port is being used, and the port is not used while the item display in red.



Serial port Config

This page is allowed to configure the baud rate, odd-even check and the data flow for serial port (5-pin port) and Bluetooth.



CAUTION: do not change the default value in this page for each item, if you want to change the settings, please contact with KOLIDA technician for further support.

In the dropdown list of data flow, there shows 4 items for selection.

Raw observation data: This is the raw observation data straight from OEM board.

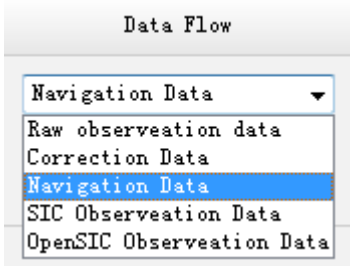
Correction Data: This is the correction data straight from OEM board.

Navigation Data: This is the navigation data output from receiver such as NMEA-0183, GSV, AVR, RMC and so on. It is configured in Data Flow Config page.

SIC Observation Data: This is the user-defined format observation data from KOLIDA.

OpenSIC Observation Data: This is the open version of KOLIDA user-defined format

observation data for secondary development.

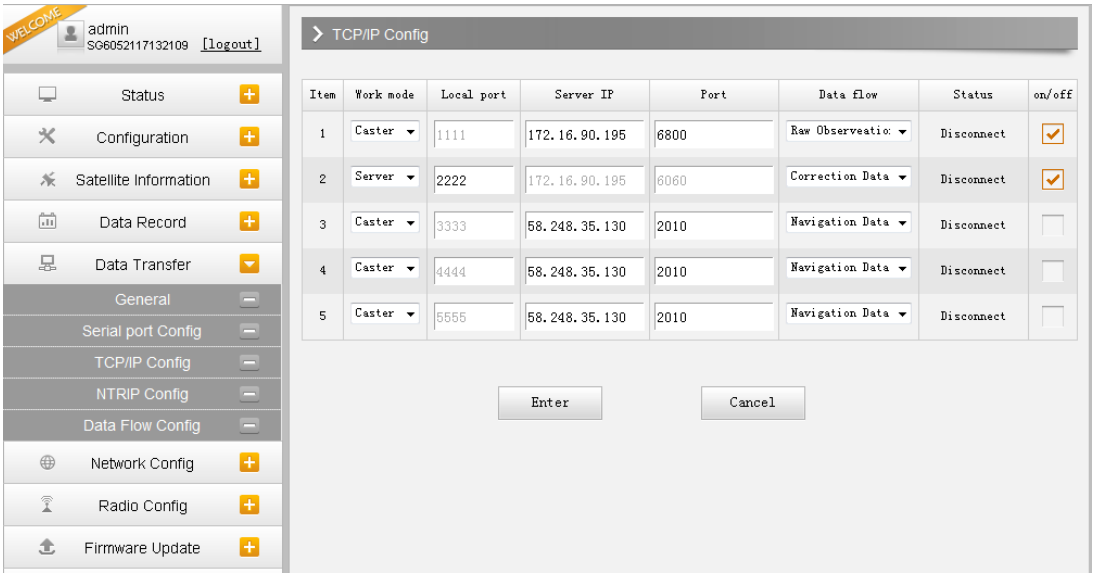


TCP/IP Config

This is used to configure the raw data or navigation data to be uploaded or transferred to a server. And there are Caster and Server working mode for this performance.

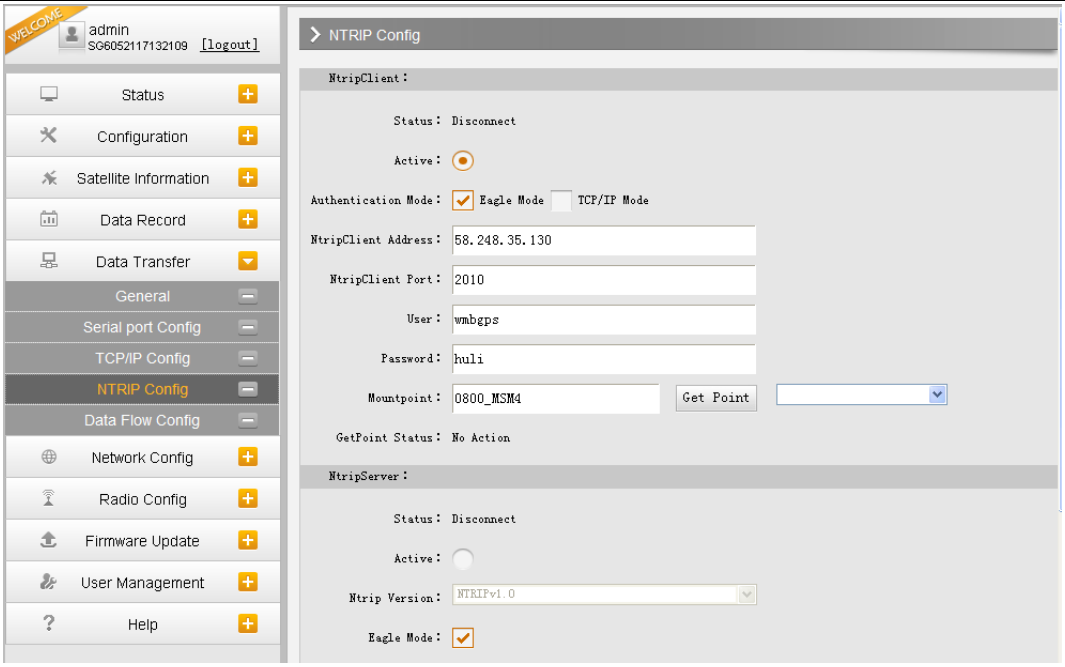
Caster: If this working mode is selected, K1Pro will be a client to upload the data to a specify server if it connects to the internet by WIFI or GPRS connection with SIM card inserted. Input the specified IP and port for server, and the data format what is uploaded. Then users are able to see the uploaded data on server.

Server: KOLIDA K1Pro will upload the data onto internet by the static WIFI if server is selected, then users are able to obtain its dynamic data by accessing to K1Pro through the IP from receiver.



NTRIP Config

This is used to configure the NTRIP performance while receiver is going to connect to internet. KOLIDA K1Pro supports complete NTRIP performance including NTRIP Client, NTRIP Server and NTRIP Caster.



NtripClient

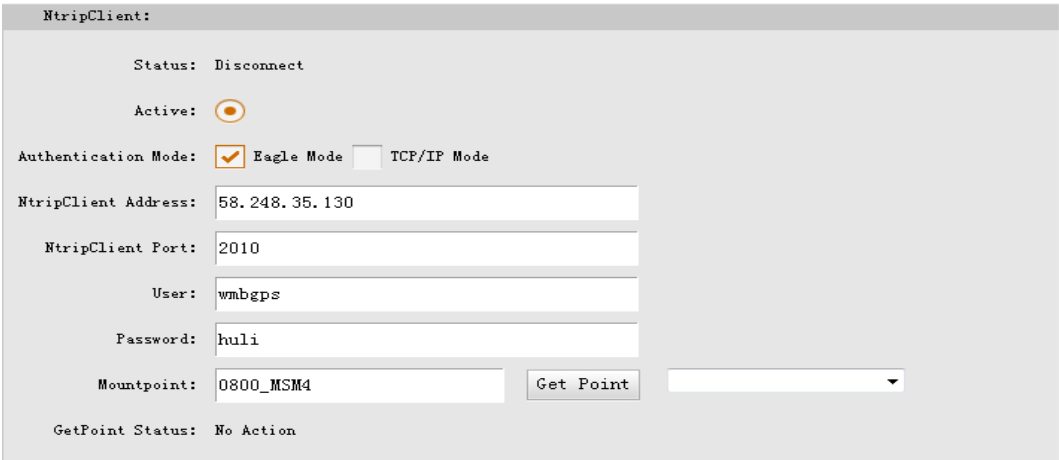
This function is for Rover in network mode to download corrections from server. We need to input IP, Port, assigned username and password to acquire mountpoint and connect to server.

Status: This field will display the status of NTRIP connection, connect or disconnect.

Active: Check on this circle to activate this function.

Authentication Mode: These two modes use different protocol standard for the connection, Eagle Mode is KOLIDA standard mode, and TCP/IP Mode is for private network use, usually, choose the Eagle mode for the default setting.

The next fields are the standard configuration for NTRIP connection, IP, port, username and password, after these information is input into the corresponding field, click on Get Point button to download the source table from server, then choose a proper mountpoint to access.

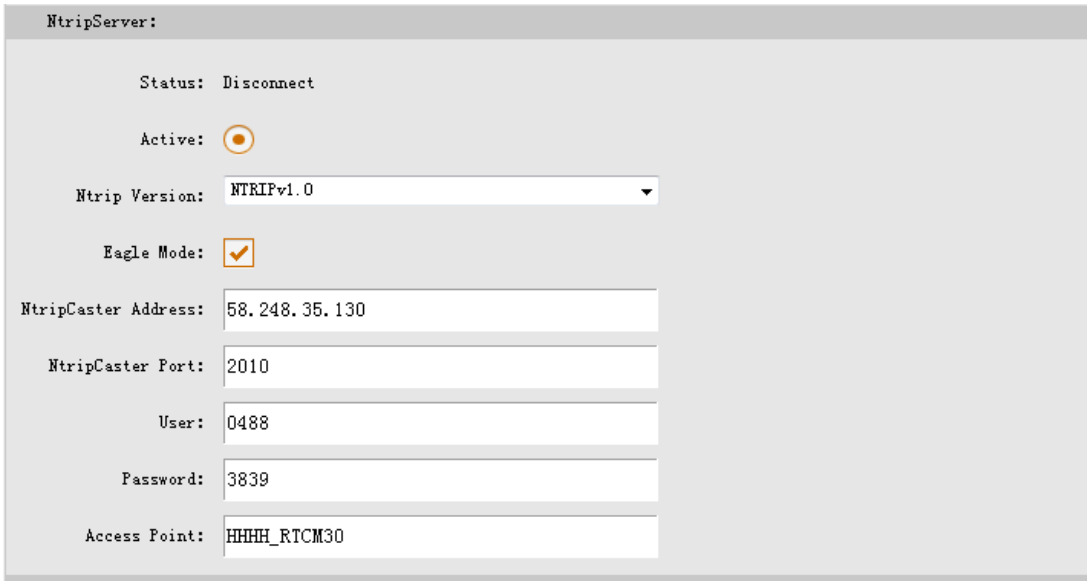


NtripServer

This function is for Base in network mode to upload its corrections to server. And then other rovers can connect to the server to download the corrections.

Ntrip Version: This field provides NTRIPv1.0 and NTRIPv2.0 for optional.

Access Point: This field is allowed to user-defined the correction format which base will transfer to the server, such as HHHH_RTCM30

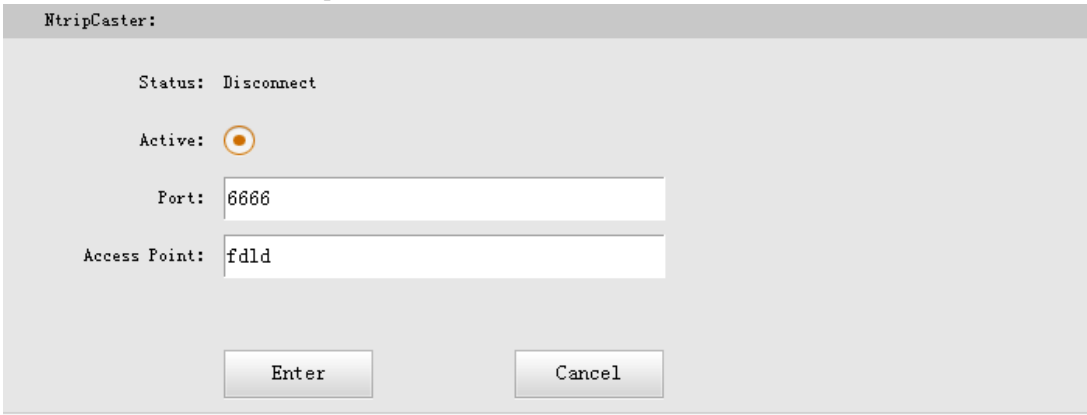


NtripCaster

This feature is finally realized on KOLIDA K1Pro, the receiver is equivalent to a CORS system that it generates and broadcasts the user-defined correction for rover if K1Pro connects a static IP address.

Port: This is the specify port for the access.

Access Point: This is mountpoint which can be user-defined.

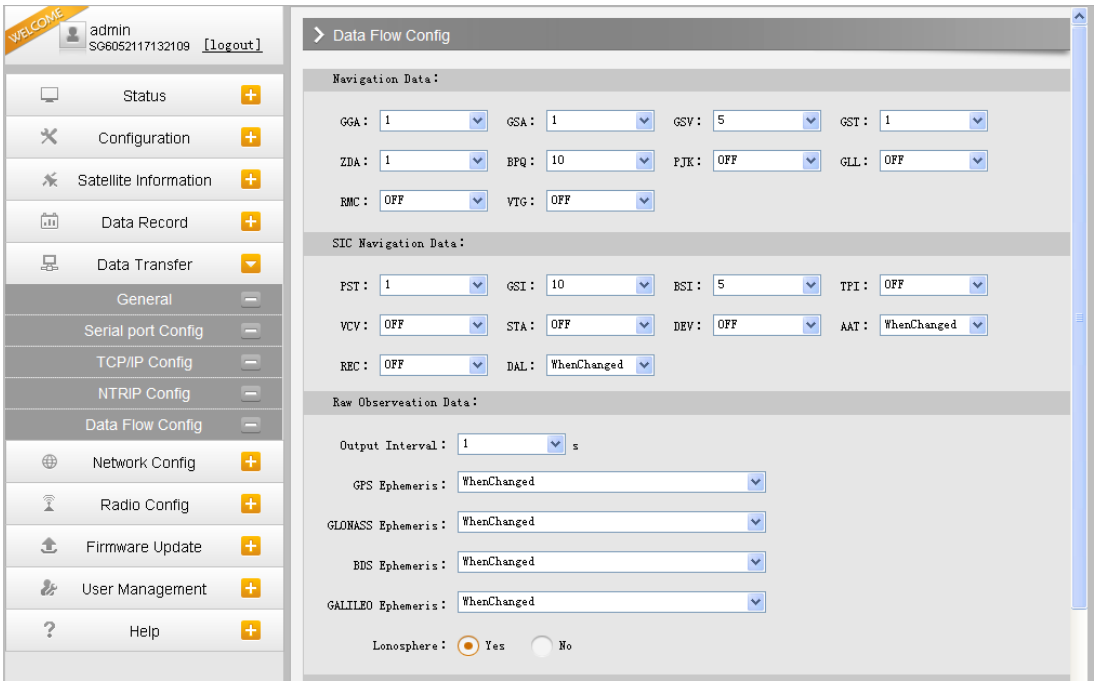


Data Flow Config

In this page, users can freely to configure the content and the update rate of data flow that to

output or not to output what kind of data format.

Click on the dropdown list for each data format to define the update rate



§3.2.6 Network Config

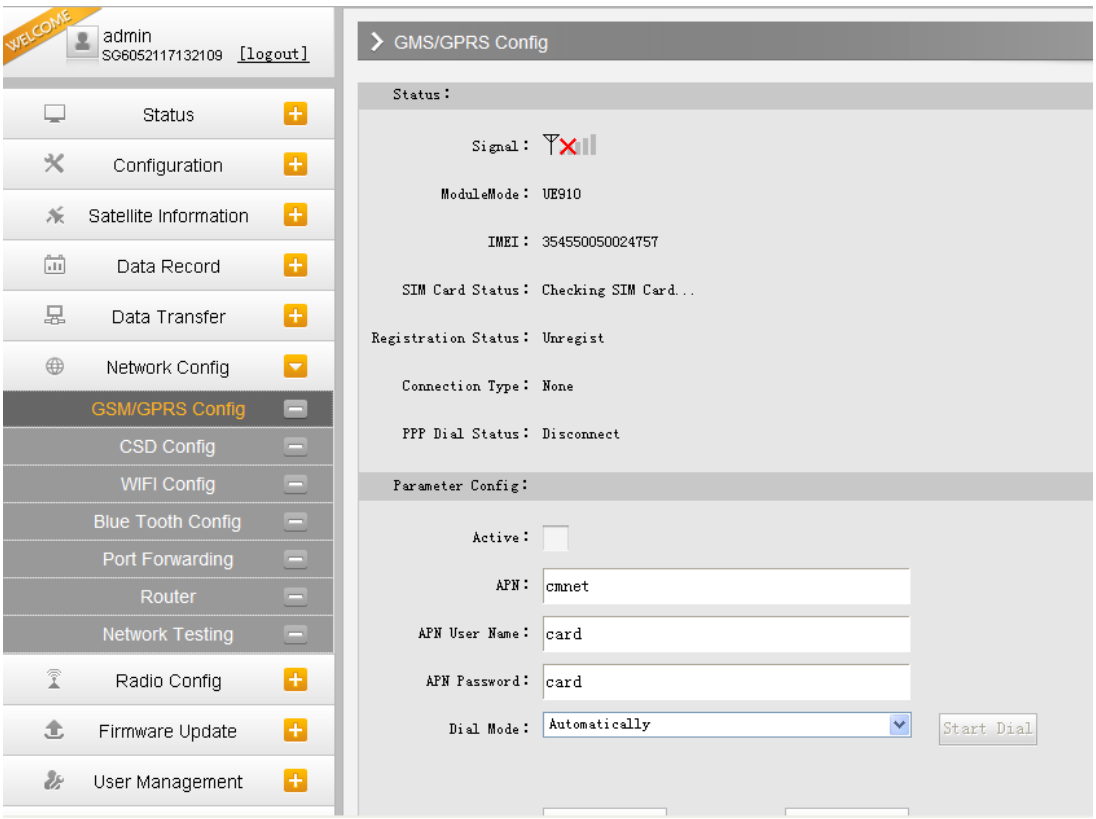
The “Network Config” is able to configure the ways and the contents for internet access of K1Pro. GSM/GPRS Config, CSD Config, WIFI Config, Bluetooth Config, Port Forwarding, Router and Network Testing are under the list of Network Config.

GSM/GPRS Config

In this page, all the information of receiver under Rover+GPRS mode will be displayed including the hardware information and dialing status.

Status: The dialing status and hardware information are displayed in this field that users can intuitively to view the signal of network, module model and the IMEI number of the module.

Parameter Config: The parameters of SIM card are input in this field including APN, assigned username and password, dial mode.



WIFI Config

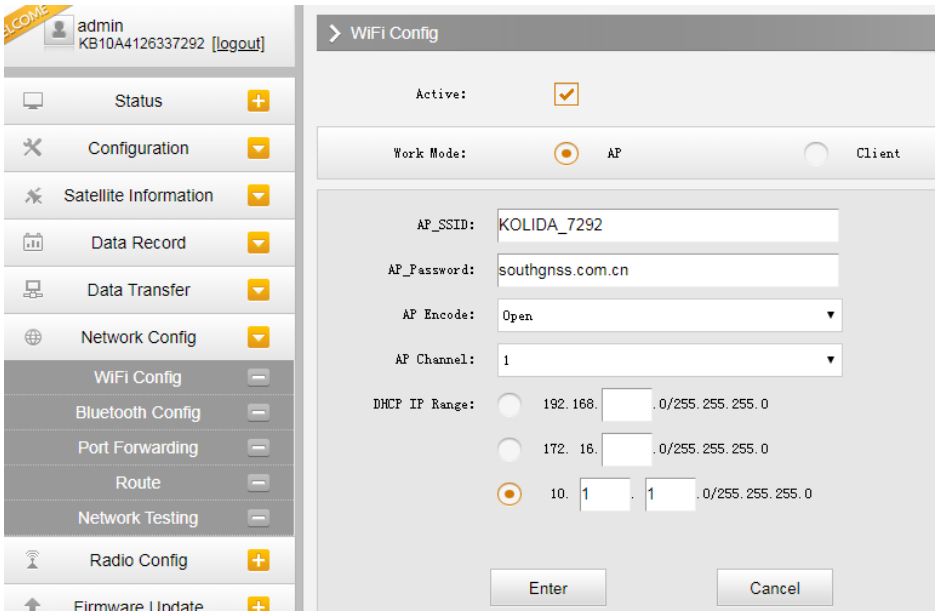
This is mainly used on the WIFI configuration for KOLIDA K1Pro, there are AP mode and Client mode for optional.

AP:

This is used to enable the WIFI hotspot for K1Pro to broadcast for mobile terminals such as smartphone or tablet to connect and access the Web UI.

Check the box of AP in Work Mode to enable the WIFI hotspot for K1Pro, and define the SSID, password, encryption method and broadcasting channel for WIFI connection.

DHCP IP Range: This is allowed to user-defined the IP for Web UI login.



Client:

This option enables K1Pro to search and connect the other WIFI hotspot which connects to the internet, the receiver is able to download and use the mountpoint from reference station.

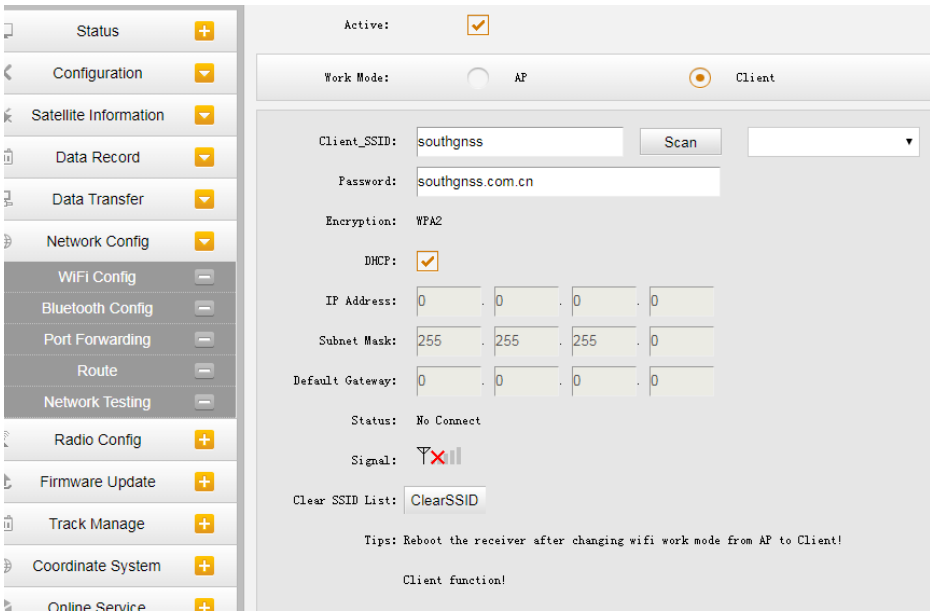
Client_SSID: This is the WIFI hotspot which sis going to connect

Scan: Click this button to search the surrounding available WIFI hotspot.

Password: This is the password which the WIFI hotspot requires.

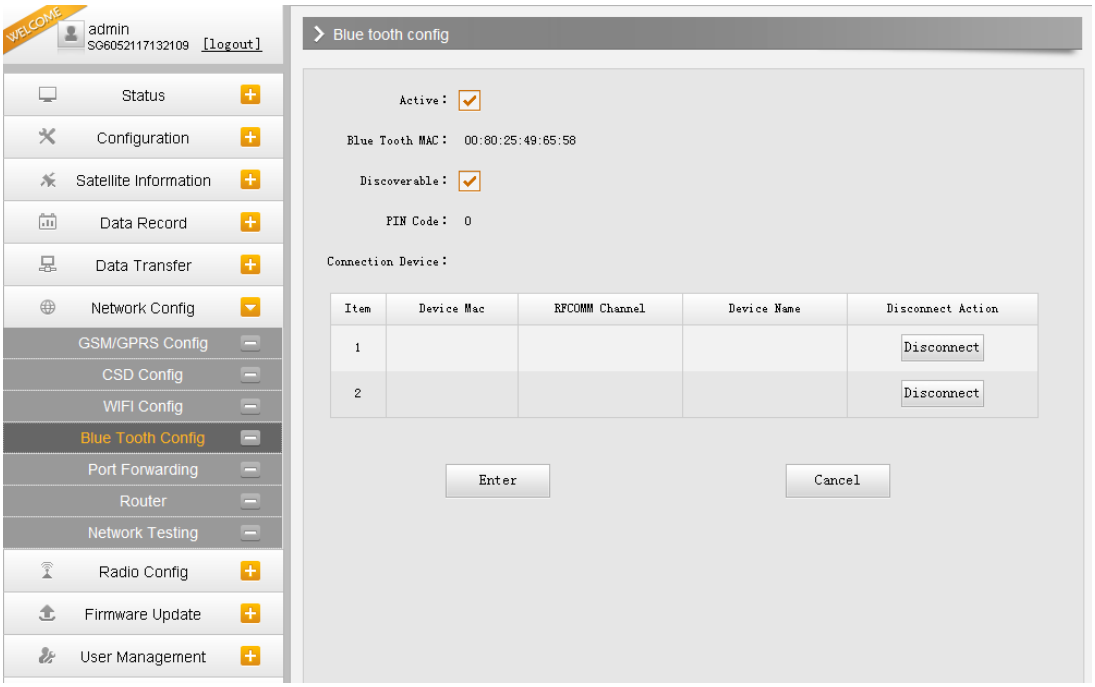
IP fields: If K1Pro successfully connects to the WIFI, there will be an LAN IP address generated by K1Pro.

ClearSSID: Click this button to clear the SSID list.



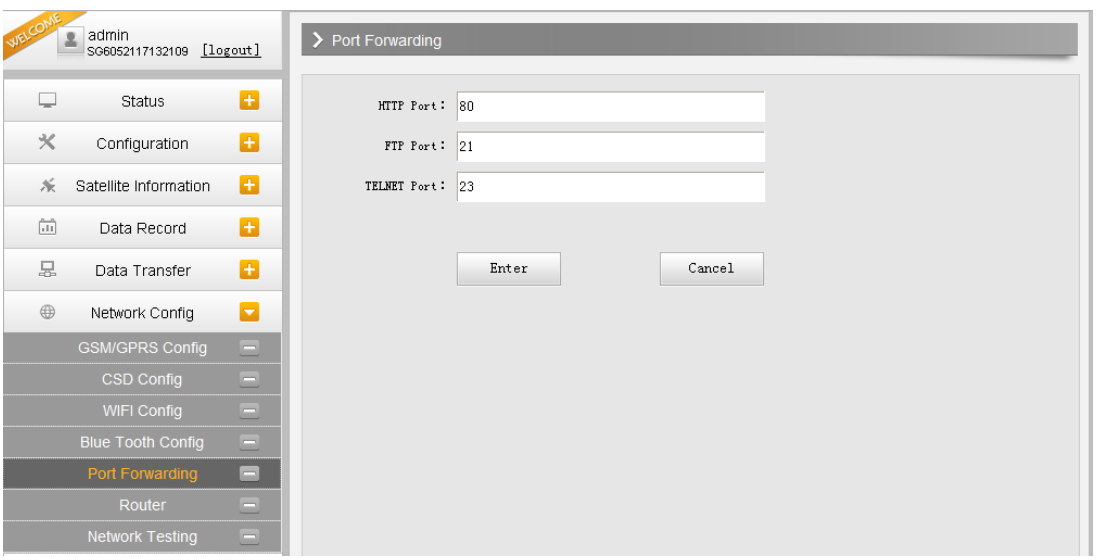
Bluetooth Config

In this page, users can view the information and connection status of Bluetooth, such the MAC of Bluetooth, discoverable or not, the PIN code, and the connection devices in following table.



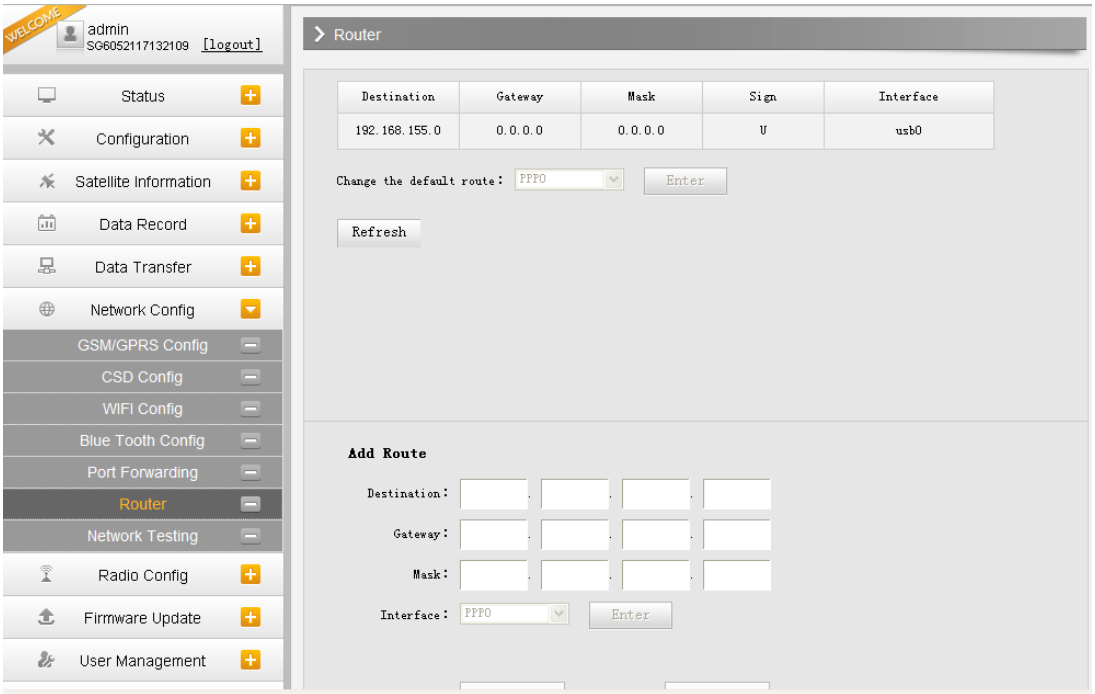
Port Forwarding

This page is mainly used to view and configure the internet transmission port for K1Pro, customize and debug receiver.



Router

This is mainly used to view and configure the parameters for router, only under the condition of customize and debug receiver.



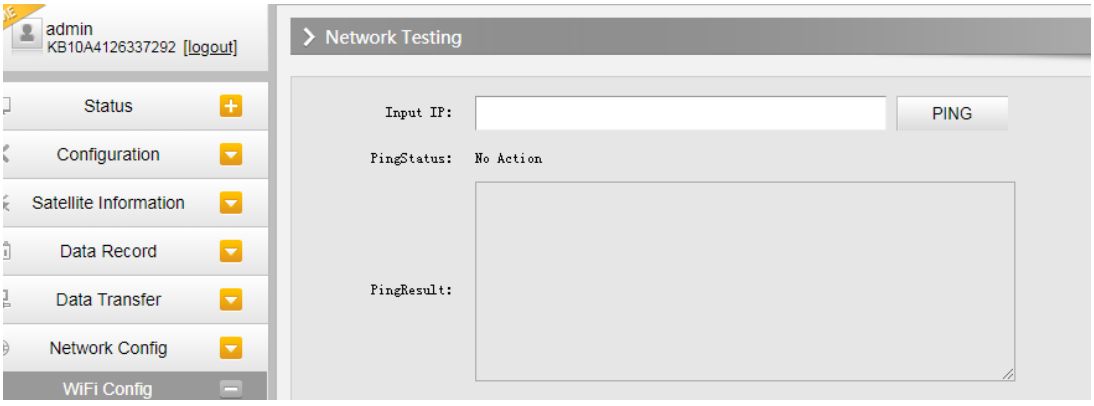
NOTE: Usually we will keep the default setting in this page, if you would like to modify it, please contact with KOLIDA technician for more supports.

Network Testing

This function is mainly used to test network status for K1Pro after logging on the internet.

How to do:

Input the IP address which K1Pro already connected, then click PING button, the testing information will be displayed in the following window.

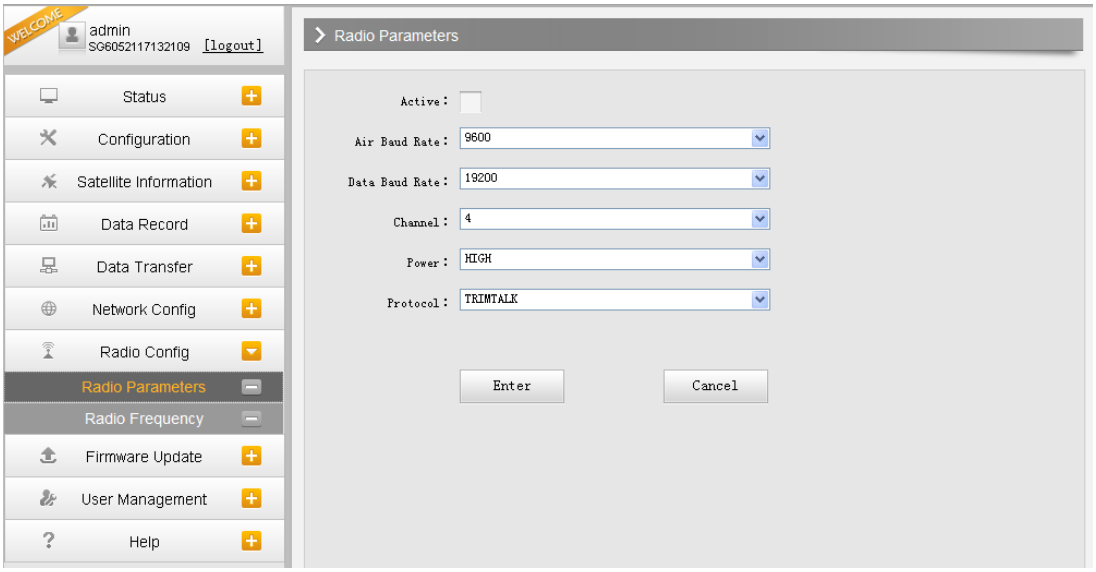


§3.2.7 Radio Config

All the settings related to the radio can be done in Radio Config. There are two main settings: Radio Parameter and Radio Frequency.

Radio Parameter

This page is mainly used to configure the parameters for internal radio module of KOLIDA K1Pro.



Air Baud Rate: This represents the data transmission rate in the air of internal radio, the higher value, the bigger of data size transmitted per second, usually keep the default setting.

Data Baud Rate: This represents the rate of data transmission port of internal radio, this rate should be the same in both Base and Rover. In general, the data baud rate of KOLIDA radio module has been unified to be 19200, keep it as default.

Channel: This is the communication channels for internal UHF, the value of the channel must be the same both in Base and Rover.

Power: This appears only in Base mode, the radio transmitting power is allowed to define in High, Middle or Low power.

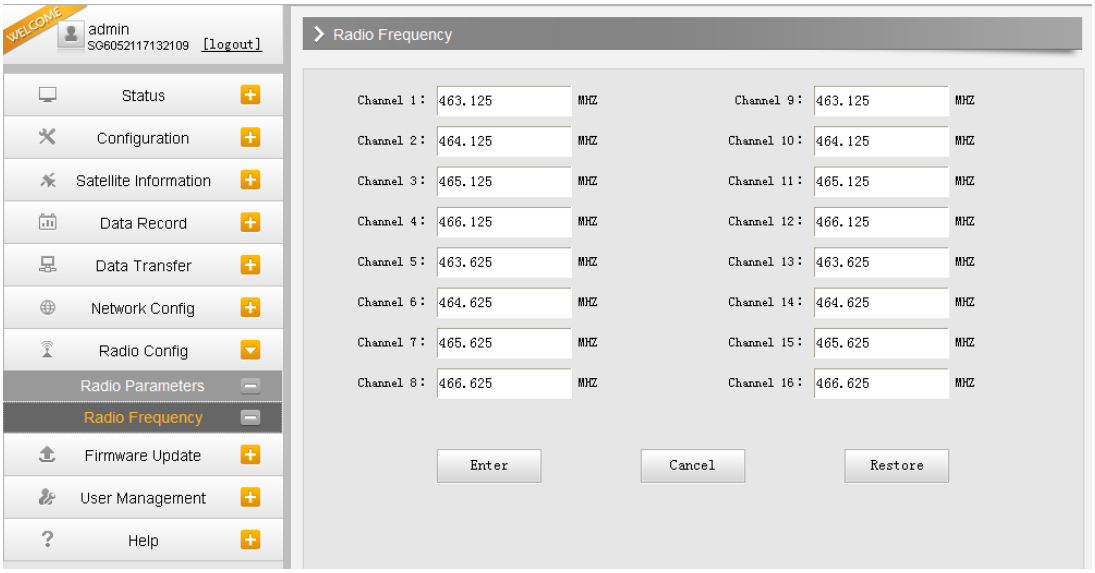
Protocol: This is radio communication protocol for data transmission, SOUTH(KOLIDA) and TRIMTALK are optional in this page and SOUTH(KOLIDA) is the default setting, if it is changed, Base and Rover must use the same protocol for communication.

Radio Frequency

For KOLIDA K1Pro, the powerful internal radio module supports much more radio channels apply to the legal frequency in different countries or areas.

There are 120 radio channels listed in this page after clicking on radio frequency. Users are able

to change the frequency freely in the channel spacing, click Restore button to bring the frequency of each channel back to default setting.

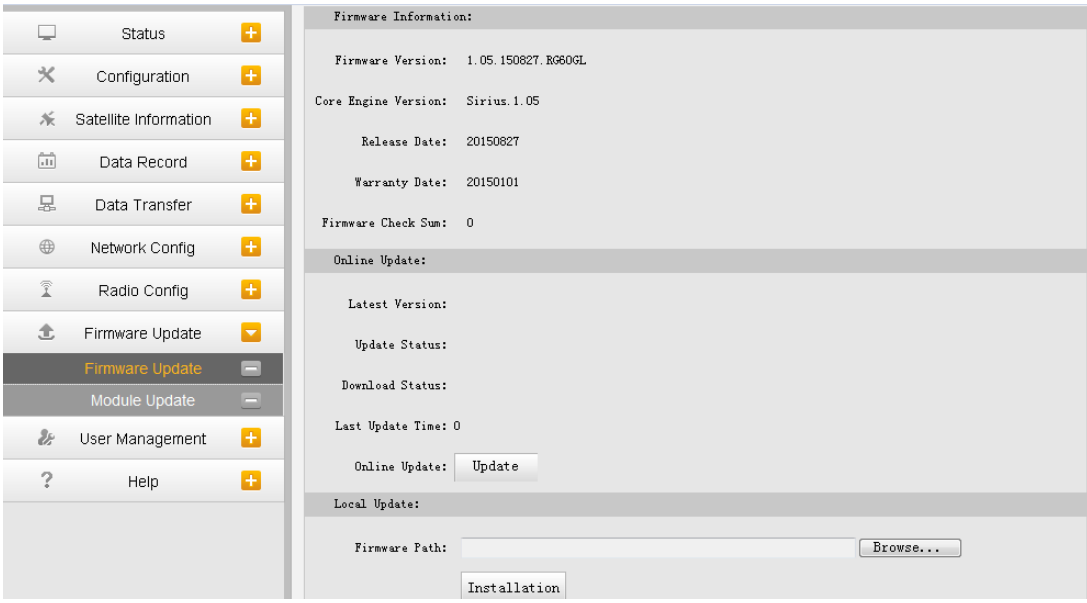


§3.2.8 Firmware Update

Update the latest firmware for receiver or for corresponding modems can be done in “Firmware Update”.

Firmware Update

We can update the firmware of receivers and modules in this interface.



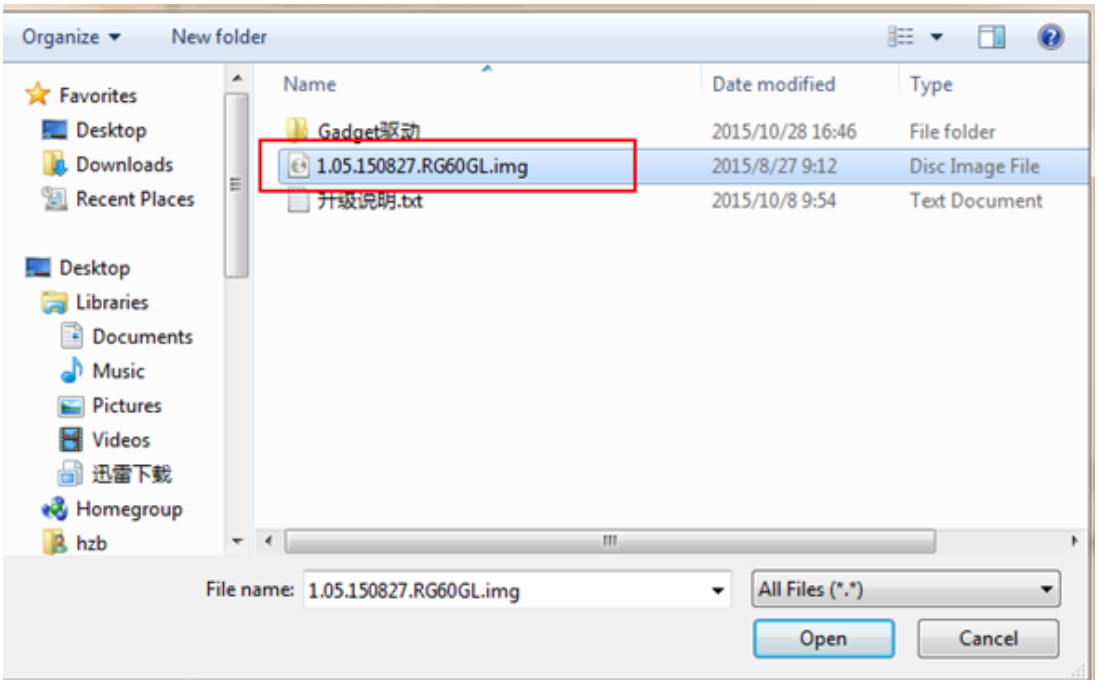
Online Update: KOLIDA K1Pro supports to update the firmware online anytime if there is

something update or optimized.

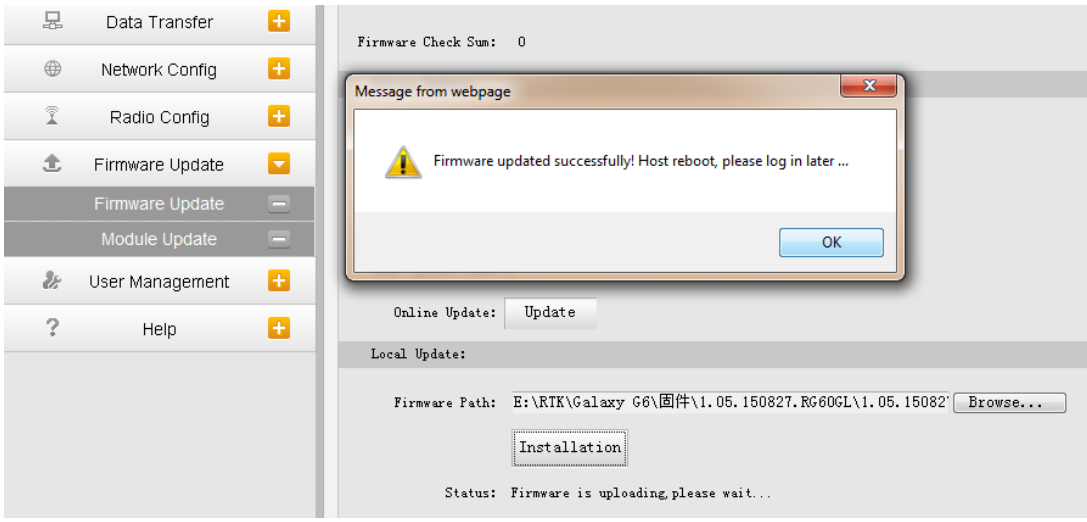
Local Update: Update the latest firmware by using a firmware file.

How to upgrade the firmware with Local Update

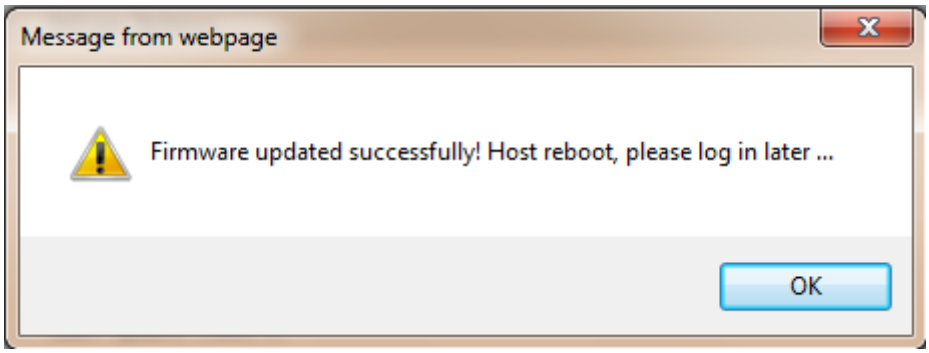
a) Click on "Browse" button to load firmware file (Please take in mind that the firmware is ended with .img as the extension name).



b) And then click "Installation" button to start upgrading.



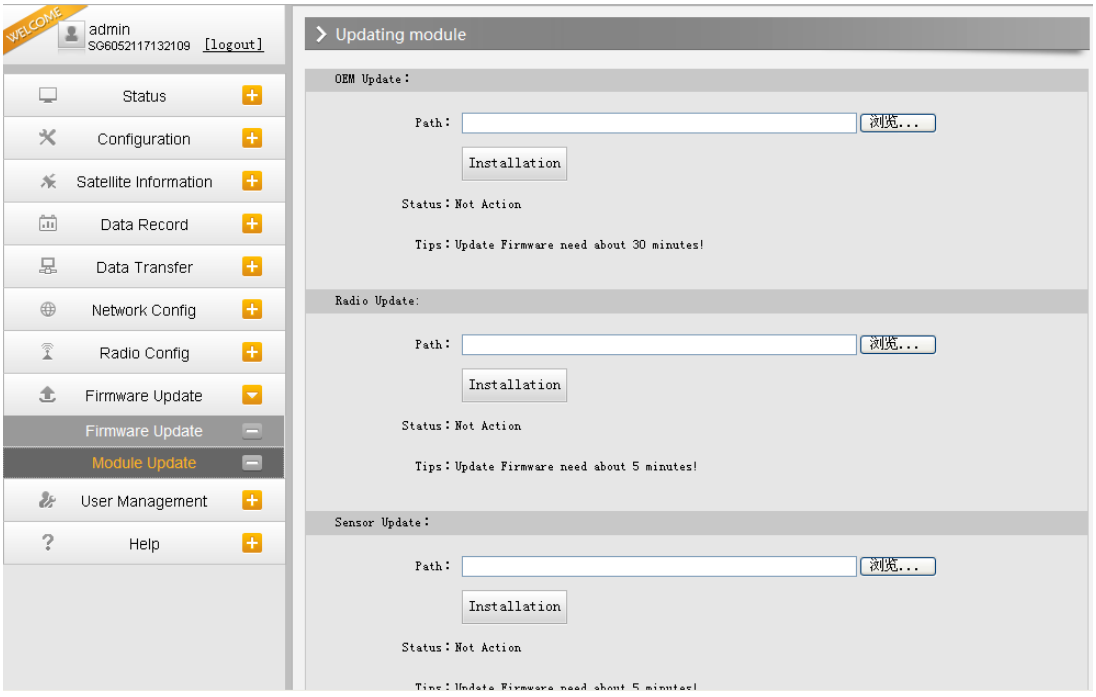
c) After the firmware is completed upgrading, a dialog will appear saying "Firmware updated successfully! Host reboot, please log in later…", then the receiver will restart automatically.



SPECIAL REMIND: KOLIDA K1Pro doesn't support to update the firmware with the help of INstar program any more, in the future, update the firmware for KOLIDA K1Pro shall be done through the Web UI.

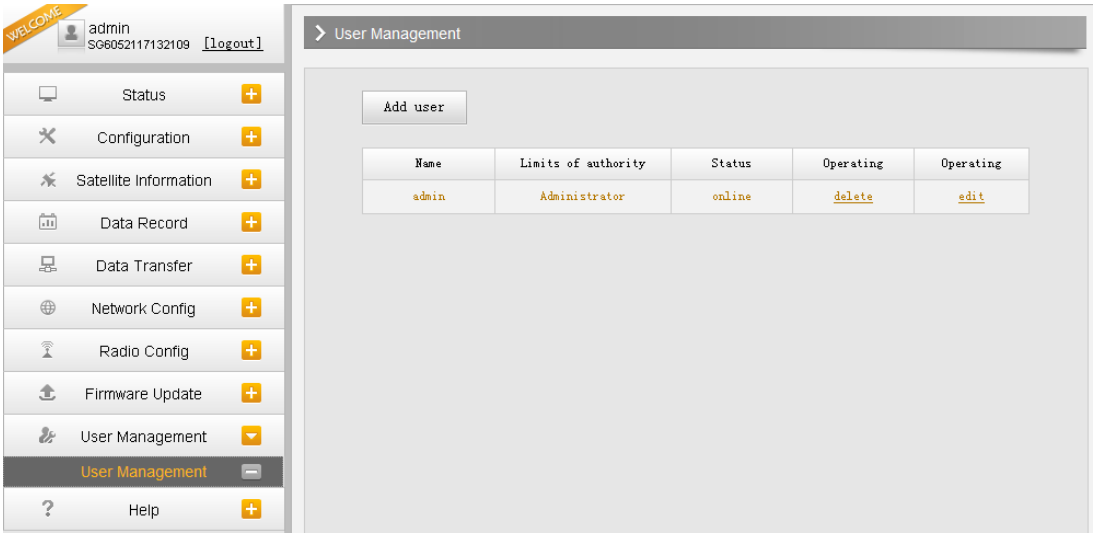
Module Update

This page is used to update the firmware for corresponding module parts such as GNSS board, radio module, network module and other sensors.



§3.2.9 User Management

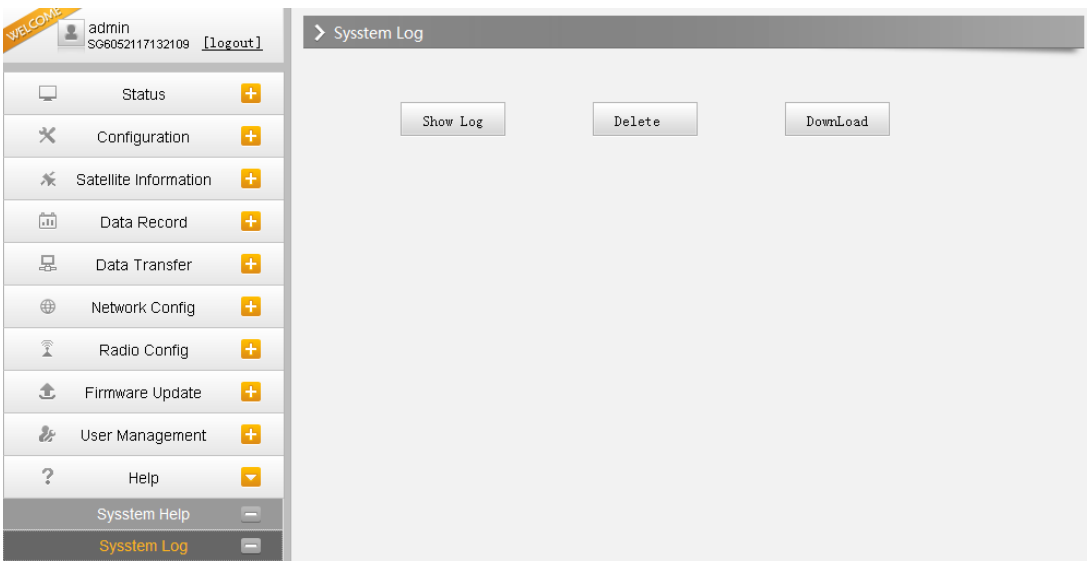
This page is used to manage the authority of login Web UI for users, including the username, password and add users.



§3.2.10 Help

In this page, users can get help and check the log book of receiver (the log book can help to backtrack the working status of receiver).

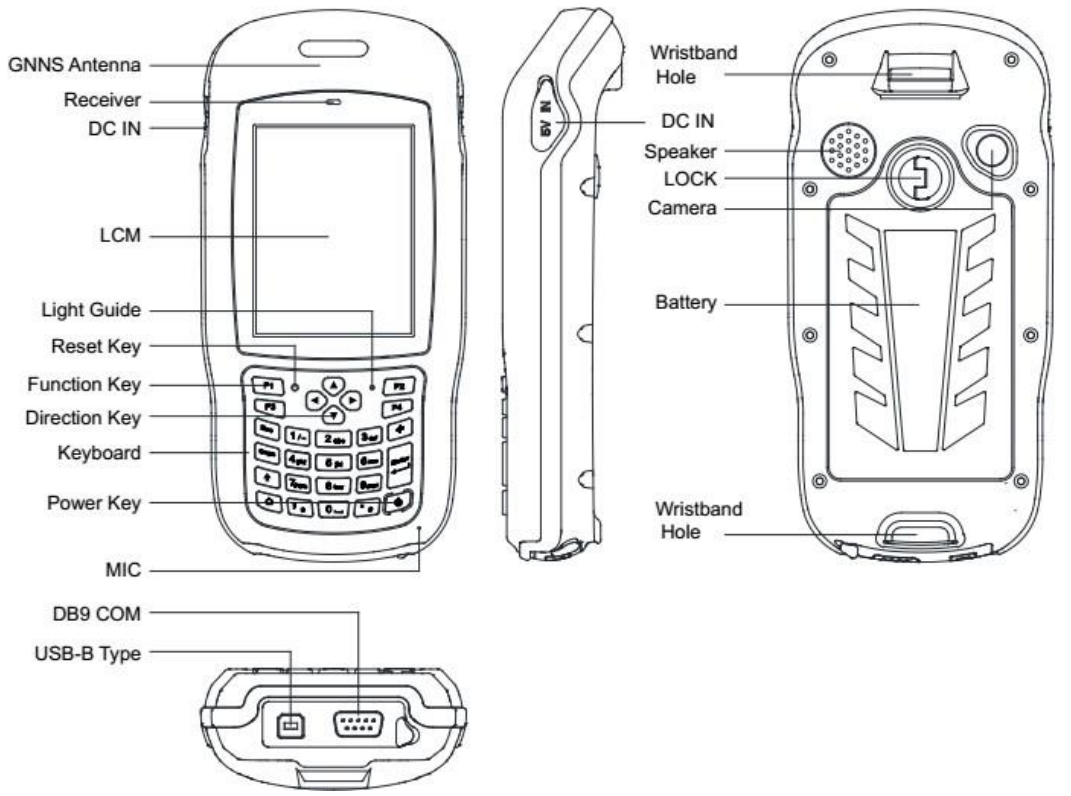
NOTE: Only the administrator can modify any parameters for receiver and manage users, and the ordinary users only have the right to view the relative parameters.

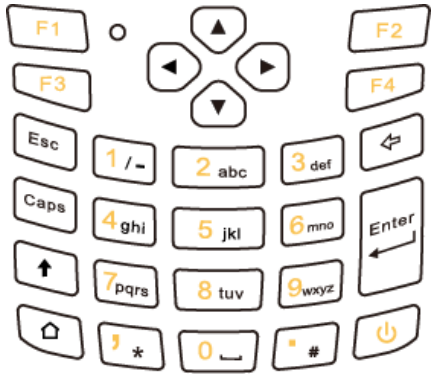


ChapterⅣ Data Collector T17N

§4.1 Basic introduction to the handheld

Here takes T17N for example (If you want to know more about KOLIDA controller, please go to KOLIDA website http://www.kolidainstrument.com/ for for informaiton), appearance of T17N:





The yellow sections are the system defaults, and the functions of the 4 hotkeys are below:

F1: Start menu.

F2: Off.

F3: Camera.

F4: System main interface

The other keyboard operation:

System Default	System defaults to the digital input method
	 ,
	 .
Press↑（shift）	Lowercase letters
	 Switch between / and -
	 *
	 #
	Press↑(shift) again, it will be digital input method
Press Caps	Capital letters
	Switch between / and -
	*
	 #
	Press the Caps button again for lowercase letters

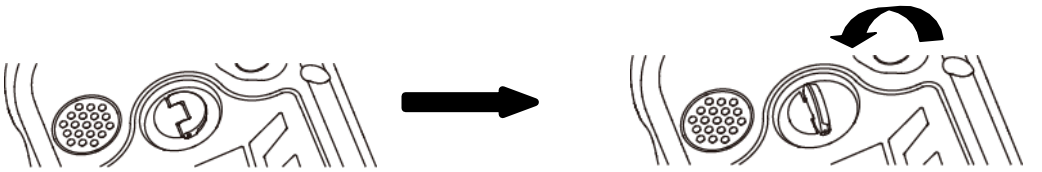
1. Charging

a) DC adapter: Open the DC IN cover on the right side, and charge with a specialized DC adapter. Charging current can reach 2A.

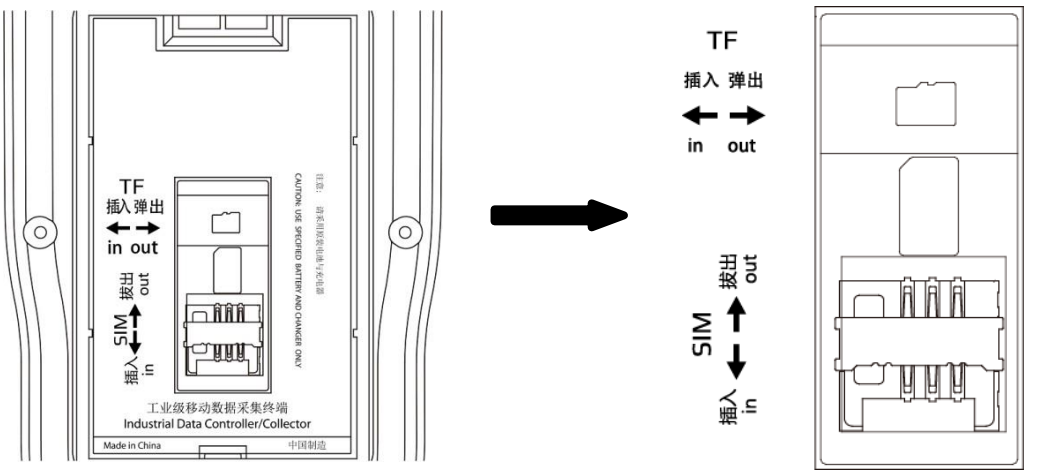
b) USB cable: A USB cable can also be used to charge the device, and current is limited to 500mA.

2. Installing Battery, SIM Card and Storage Card

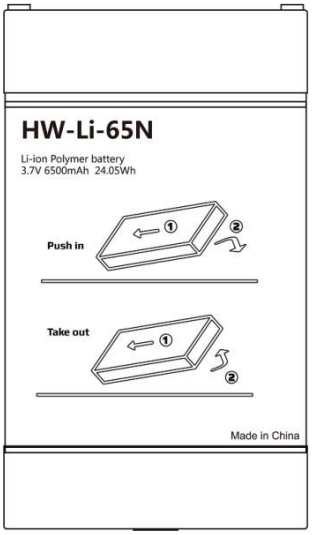
Turn the back cover screw to the open position according to the instructions on the back cover and take off the back cover.



Insert the SIM card and TF card according to the instructions in the battery cabin.



Insert the battery according the instructions on the battery label.



Close the back cover and turn the back cover screw to the lock position.

3. Power on/off

a) Make sure the battery has enough power, or connect the T17 to a DC adaptor.
b) Press power button for 3~5 seconds to turn on (until the boot screen appears).
c) Press the power button for 3~5 seconds, and confirm to power off.

NOTE: If there are abnormal situations, such as the T17 cannot operate normally, use the tip of the stylus to press the reset key to restart the T17.

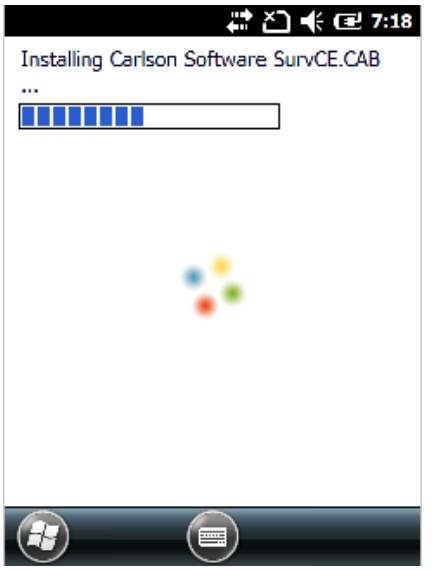
4. Connect to PC

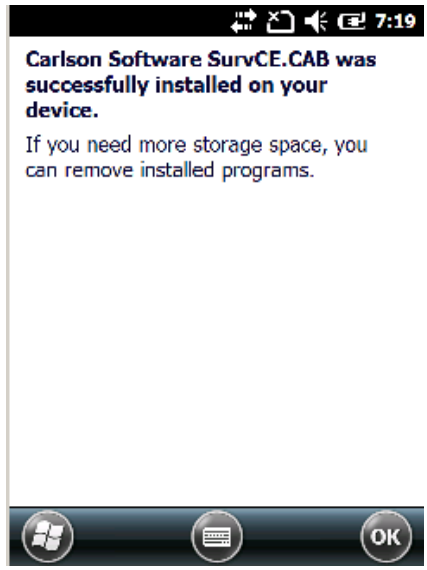
Make sure that you've installed **Microsoft ActiveSync 4.5** or higher version, if your computer equipped with win7 or win8 system, please make sure that you have installed **Windows Mobile Device Center** program.
Connect the Collector to PC via the Mini USB Data Cable.

Connection will be preceded automatically by Microsoft ActiveSync. Icon will turn green and an interface of Setting will come out, you can just click "Cancel". After this, you can manage and edit the data in Collector.

5. Installing Program

Make sure that collector is synchronized with PC. Run the Installation file at PC side.
If the installation program is also suitable for collector, you can copy the installation program into collector to install. You can just copy the folder into collector when you need.





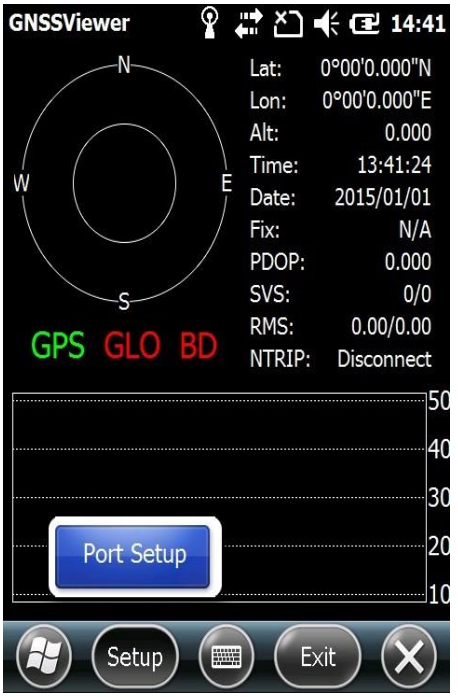
We suggest you installing programs into Flash Memory and save data into Storage Card.

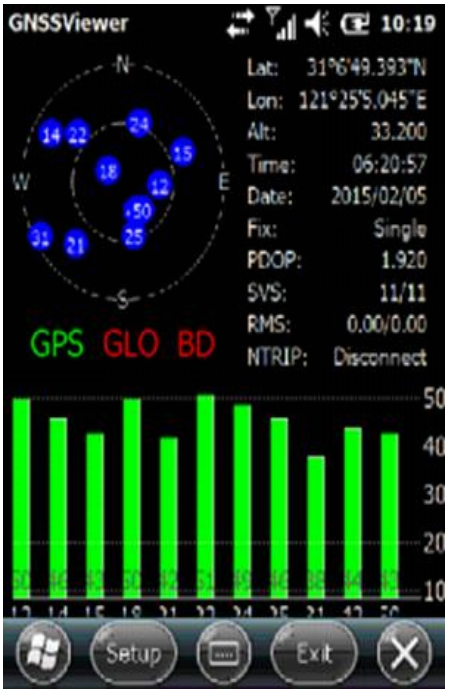
6. How to use GPS

a) Go to \My Device\GNSSViewer and run GNSSViewer.exe

b) T17 supports COM3 and COM5 GNSS ports and its BaudRate is 9600. Choose a GPS Port and BaudRate by clicking Setup->Port Setup as indicated below.

Click ‘OK ’.





If you want to check the working status of GPS via checking or collecting software, please set the COM port to COM6 and the baud rate to 57600.

7. Camera

a) Select ‘Start->Picture & Video’, select ‘Camera’ or the ‘camera’ key icon to take photos.

b) Press the camera key (F3) to take photos.

c) Click screen and select ‘OK’ to exit.

§4.2 Software installation and connecting

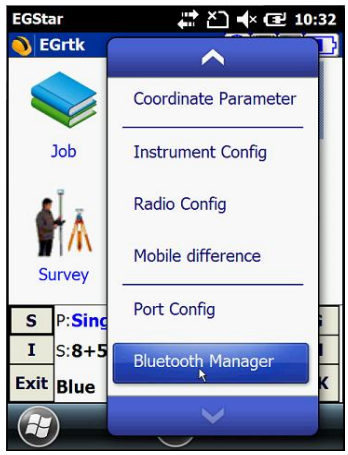
EGStar is the specific software for K1Pro measuring system, mainly for the collection and calculation of the measuring points.

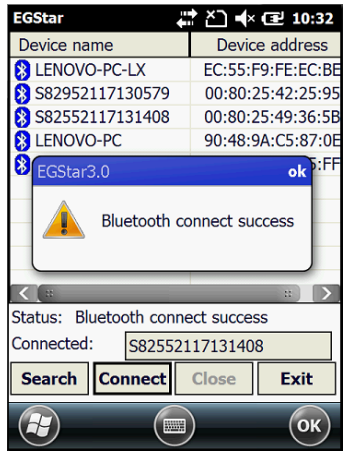
Before installing of EGStar, you need to install Microsoft Active Sync. After installing it on your

computer, connect handheld to computer with a cable, and install EGStar into the handheld, at the same time, keep the mainframe power on, then set as follows:

Open EGStar software and enter the main interface. Click “OK” on the "prompt" window.

2. Go to “Bluetooth Manager”, in this interface tap on “Search” button and the controller will search the surrounding Bluetooth devices, select the correct serial number from the list and click on “Connect” button, controller will connect to receiver without setting any COM port. If the prompt message “Bluetooth connect success” appears, that means that controller has successfully connected with receiver, then please check the Bluetooth indicator on receiver.





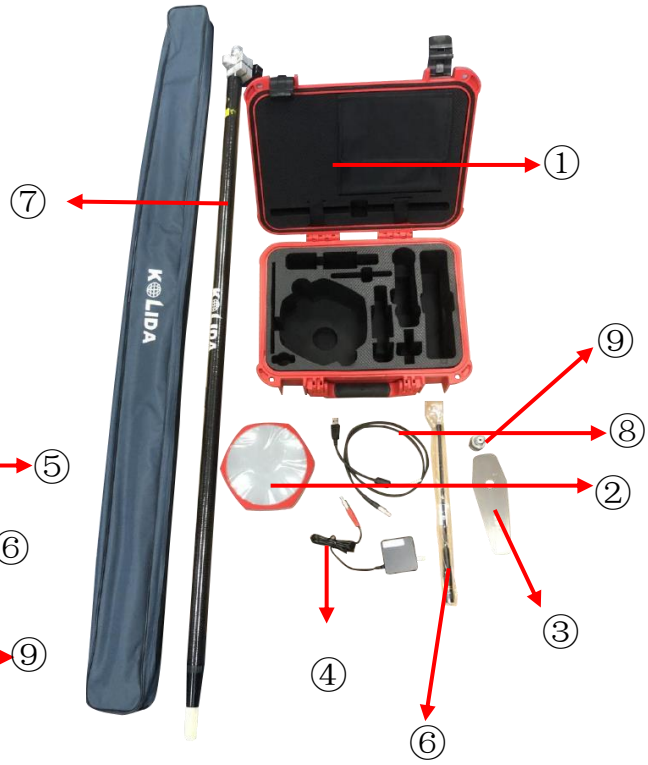
Please go to this website

https://1drv.ms/b/s!Ati6xekUm6DXgxEjcOJ7H_mMCCY6?e=ho8AAK

for more information if using Android EGstar.

Chapter Ⅴ Accessories

§5.1 Instrument Case and Accessories



Base Receiver and Accessories **Rover Receiver and Accessories**

① --- Instrument Case
② --- K1Pro Receiver
③ --- Height measurement piece
④ ---- Charger for K1Pro Receiver
⑤ --- Short Pole for Base receiver
⑥ --- UHF antenna for Base and Rover
⑦ --- Carbon fiber pole
⑧ ----7-Pins cable for connectin the receiver with computer for static data transmission, Web UI accessing and firmware update.
⑨ ---- Connector

NOTE: The models and types of instrument accessories will vary with the instrument upgrade

§5.2 Portable Battery Case (power bank)

Battery case SA6003 is an optional accessory, able to contain 4 batteries, provide extra power supply to base or rover.

①——Indicators, the indicators indicates how much power remain by pressing the power button.
②——The combination batteries installed into the portable power source
③—— Hang buckle, hang the battery package onto tripod
④—— 7-pin port, connect the cable with receiver for power supply.
⑤—— Power supply cable, this cable is used to connect the power source to receiver.

§5.3 Other Cables and Accessories

7-pin to OTG cable

This cable is used to connect an external storage directly to KOLIDA K1Pro for static data storage and copy.

Communication cable

This cable is used to connect the receiver to computer for receiver debugging, differential data checking and firmware update.

Other accessories include carbon-fiber pole, handheld controller bracket, tribrach, connectors, height measuring plate and measuring tape.

Tribrach & connector

Measuring tape

Support pole

Bracket for controllers

Chapter Ⅵ Measuring Operation

Reading this chapter, you can grasp in detail how to use the K1Pro measurement to do system static, RTK operations.

GPS measurement operation scheme refers to the operating scheme used to determine the relative position between the stations with the help of GPS technology. Point coordinate precision obtained is not the same; its operating methods and observation time are also different, thus having different range of applications. GNSS receiver operating program is divided into two types: static measurement and RTK dynamic measurement (including the base station and rover station).

Test environment requirements:

(1) Observation stations (ie, the receiving antenna settlements) should stay away from high-power radio transmitters and high voltage transmission lines in order to avoid the magnetic field around the GPS satellite signal interference. Receiver antenna and its distance shall not be less than 200 m;

(2) Observation stations should not be near to the large area waters or objects which can strongly reflect (or absorb) electromagnetic wave to weaken the effects of multi-path;

(3) Observation stations should be located in places where the receiving device can be installed easily, and good vision available. Elevation angle of obstacles in view should generally be greater than 10 °to 15 °, in order to weaken the effects of troposphere refraction;

(4)Observation stations should be selected in a convenient place, and easy to use other means of measuring, joint measurement and expansion;

(5) For the long baseline GPS network, should also consider the vicinity good communication facilities (telephone and telegraph, post and telecommunications) and power supply, for power between the stations and equipments.

§6.1 Static Operation

§6.1.1 Static Measurements Profile

Static measurements

GPS positioning measurement by installed three (or more) GNSS receivers to perform simultaneous observation and determine the relative position between the stations.

Scope

The establishment of a national geodetic control network (second or less);

The establishment of precision engineering control network, such as bridge measurement, tunnel measurements, etc;

The establishment of a variety of encryption control network, such as city measurements, Drawing Point measurement, road surveying, demarcation measurements.

For the GPS measurements of small and medium-sized cities, towns, as well as mapping, cadastral, land information, real estate, geophysical exploration, surveying, construction and other control measurement, should meet the accuracy requirements of the D, E grade GPS measurements.

§6.1.2 Operating Procedures

Pre-measurement

Project approval

Program design

Construction design

Surveying and mapping data collection and arrangement

Instrument test, test

Reconnaissance, choice of site, buried stone

Measurement

Operating team stationed in

Satellite status Forecast

Observation planning

Dispatch of operation and field work observation

After the measurement

Data transmission, dump, backup,

Baseline Solution and quality control

Network adjustment (data processing, analysis) and quality control

Finishing results, technical summary

Project acceptance

§6.1.3 Field Operation Notes

1)Static mode of KOLIDA K1Pro receiver can be set in EGStar software or other software (Such as SurvX, Field Genius or SurvCE), also can be performed by receiver keypad.

2)Set up a tripod on the control point, leveling and centering strictly on the measuring point.

3)Measure the instrument height three times, the difference of the results shall not be more than 3 mm, and average the results. The instrument height should be measured from the center of the control point to the mark line on the instrument.(Refer to §3.4)

4)Record instrument number, point name, instrument height, and start time.

5)Power on, confirm the static mode, the mainframe begins to search satellites and satellite lights begin to flash. Recording condition reached, the status light flashes in accordance with the set sampling interval, flashing once indicates the acquisition of an epoch.

6)After the test, the mainframe shut down, and then begins data transmission and data processing (data transmission sees Chapter IV, data processing, please read another manual GPS data processing software operation manual).

§6.1.4 GPS Net Design

The net design mainly subject to the users' requirement, but outlay, time interval of observation, type of receiver and the receiver 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 observation borders, such as triangle, polygon or connecting traverse, etc, to add checking conditions and to improve 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 evenly 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 level points, and the other points are normally united—surveyed with level surveying way or the equivalent way. You can also set some level united—surveying points in order to offer geoid's information.

4. In order to observe and level united survey, we often set GPS net points at a clear and easy arriving field.

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

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

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.

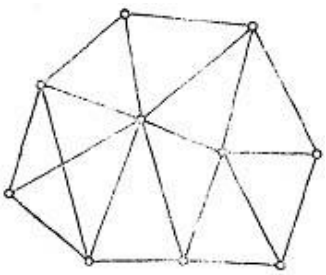
But this net need a lot of observation, especially when receivers are lacking it will greatly prolong the observation time. So only when accuracy and security are required very high, and receivers are more than three, we can use this graph, see fig 5-3.

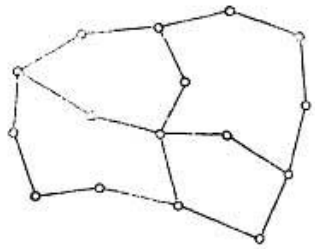
Circle net

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.

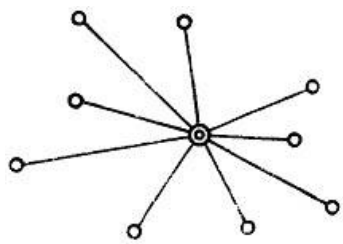




Star shape net

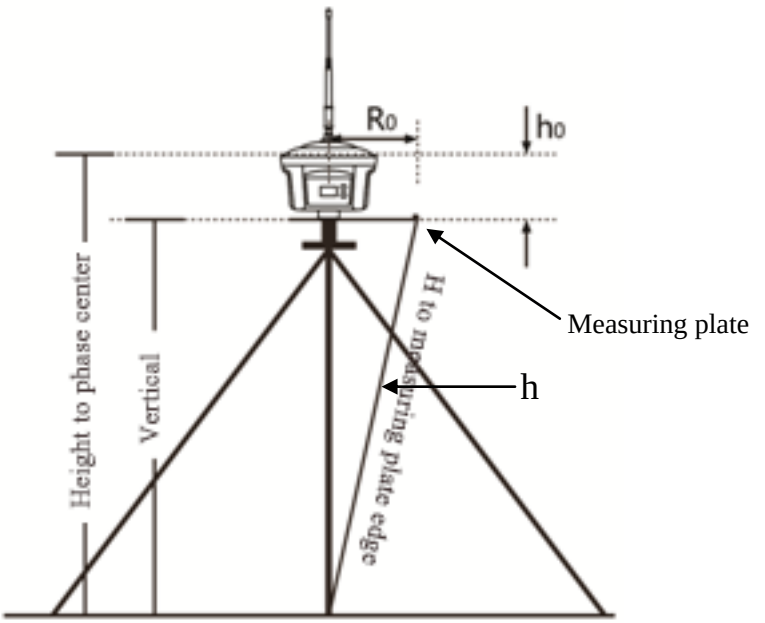
Star net has simple geometry graph, but the baselines of it mostly don't compose a closed graph, so it has a bad checking ability and consistency.

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



§6.1.5 Antenna Height Measurement

After fixed the instrument, user should measure antenna height at the beginning and the end of every period of time to ensure the accuracy "mm" level. 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 the following figure.



We use a formula to calculate antenna height.

$$H = \sqrt{h^2 - R_0^2} + h_0$$

"h" is the inclined height that measure from point on the ground to the measuring plate edge.

R_0 is the distance from middle of antenna to the edge of measuring plate.

h_0 is the distance from antenna phase center to the bottom of receiver (measuring plate).

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

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.*

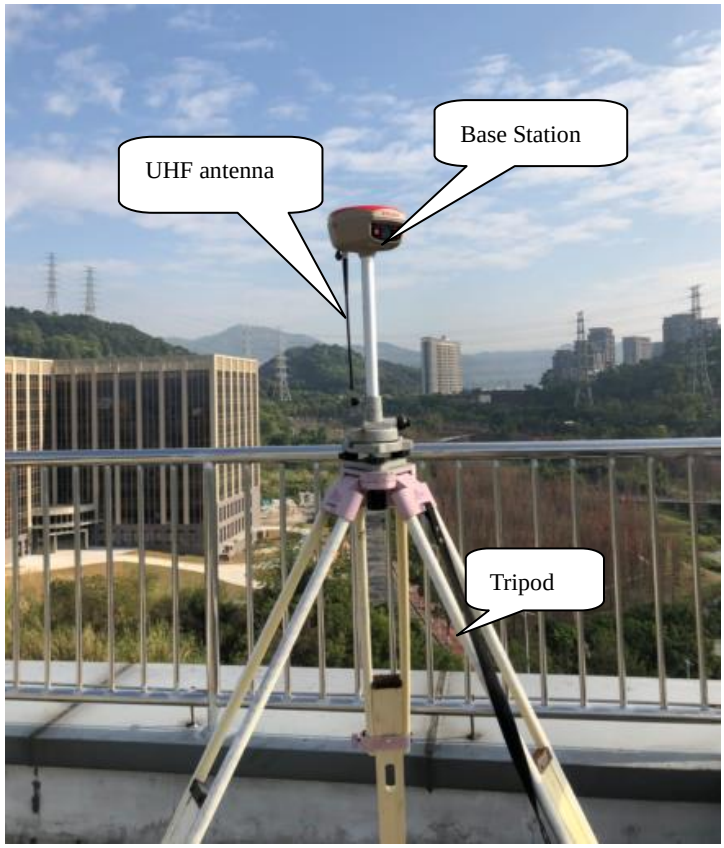
§6.2 RTK measurement

RTK is the abbreviation of Real-Time Kinematic measurements.

RTK technology is the real-time dynamic differential carrier phase positioning technology, combining global satellite navigation and positioning technology with data communication technology which includes base station and rover station. Base station transmits the data by radio or network to the rover station, which will perform differential analysis, thus providing real-time coordinates of the measurement point in the specified coordinate system.

Depending on the different ways of differential signals transmission, there are two methods for RTK operation by using the radio and internet (GPRS).

§6.2.1 By using radio (Internal radio)



§6.2.1.1 Base Station Set up

Base station shall be set up in the broad view, unobscured and higher places; avoid the vicinity of the high-voltage power transmission equipment and the transmitting and receiving antennas of radio communication equipment, the shade of trees, and the sides of waters, all of which will produce different degrees of impact on the GPS signal reception and emission of radio signals

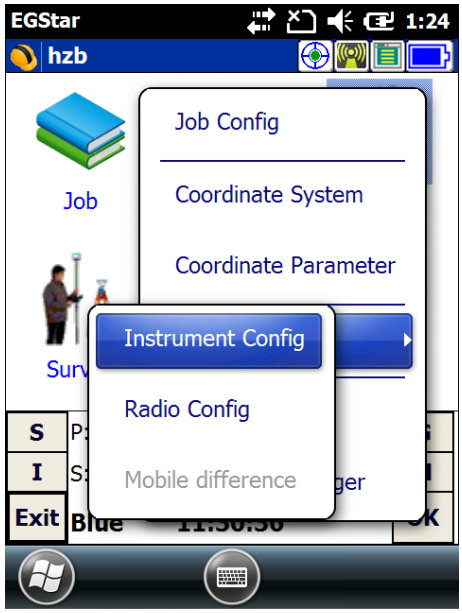
1) Set a tripod to the location with known coordinates (or unknown), attach base receiver to the tribrach adapter set (the measuring plate is recommended to install under base receiver).
2) Install the transmitting antenna onto the receiver.
3) Make sure all connections are alright, then power on receiver.
4) The receiver is set as base with internal radio mode. (set on the control panel, or on internal Web UI or on the software installed on data collector).

§6.2.1.2 Start the Base station

First time to start the base station, all the relative parameters are completely configured before starting.

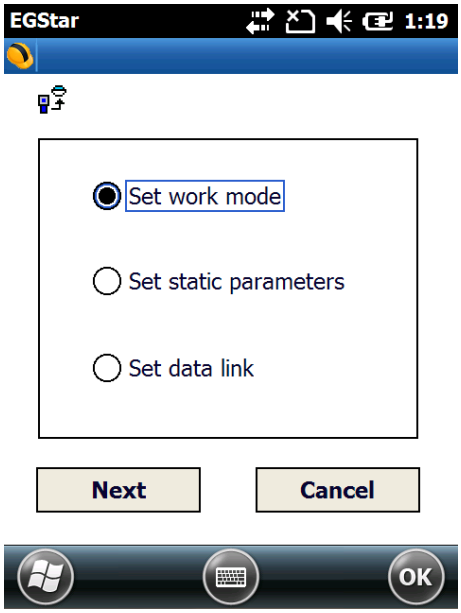
Using EGStar3.0

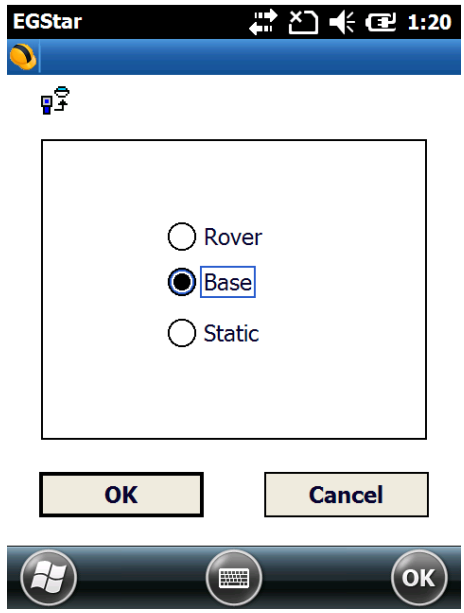
1) Run EGStar3.0 program on data collector;
2) Go to "Config—Device Config—Instrument Config" page to configure the working mode and datalink for base receiver.



3) Tap on "Work mode setting" and then check the box of "Set work mode", then click on "Next" to continue;

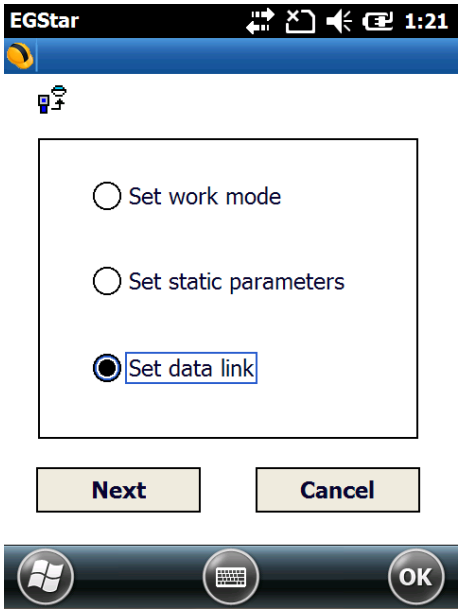
4) Check the box of “Base” option and click “OK” and return to Instrument setting page. At this moment, KOLIDA K1Pro prompts the correct working mode with voice guide.

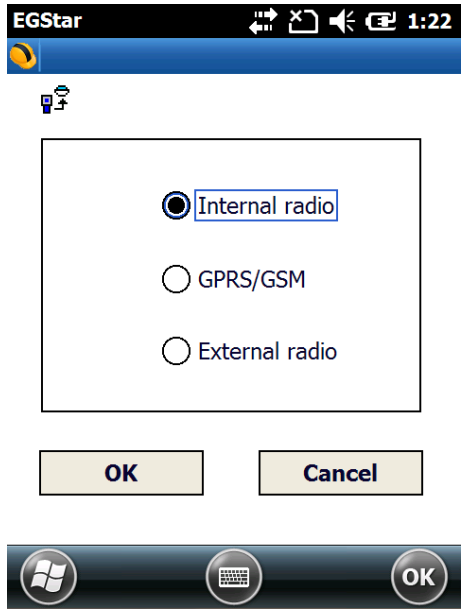




5) Then tap on “Work mode setting” and then check the box of “Set data link”, then click on “Next” to continue;

6) Check the box of “Internal radio” option and click “OK” to complete the settings.





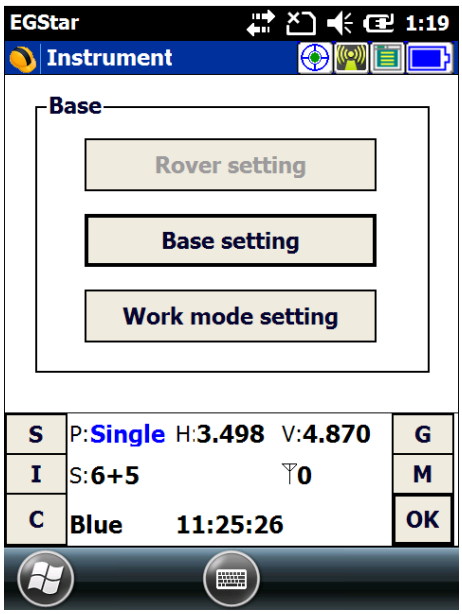
7) Return to the main interface and again get into instrument config page, tap on “Base setting” to get into Base configuration page.

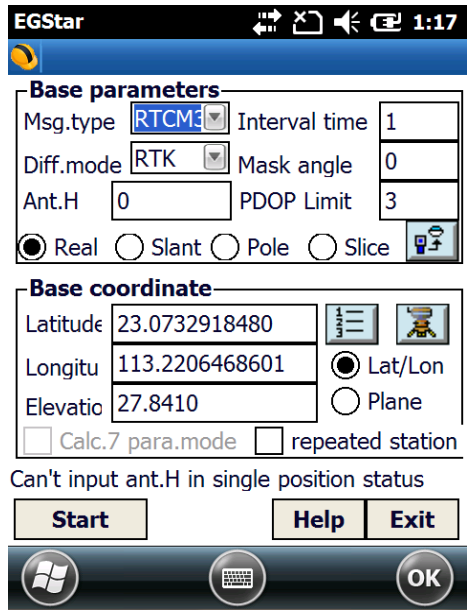
8) Choose the correction format in Msg,Type, choose the antenna measuring method and input correct antenna height in Ant,H, input the proper value for Interval time, Mask angle and PDOP limit.

9) Then tap on the symbol  to save and complete the parameters.

10) Input the coordinates for base location or tap on the symbol  to obtain a single position for base.

11) After all the parameters are completely set, click on "Start" button to start the base station.

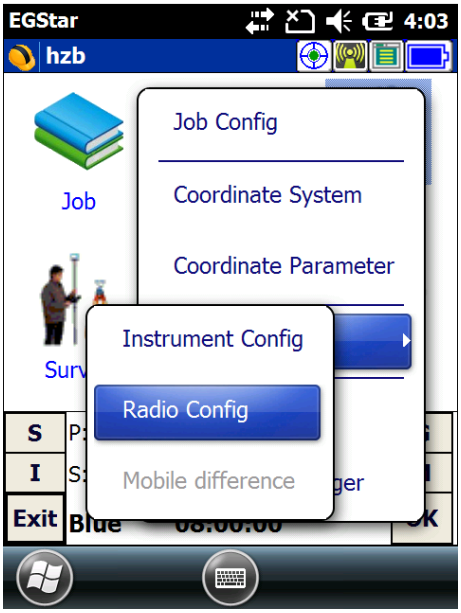


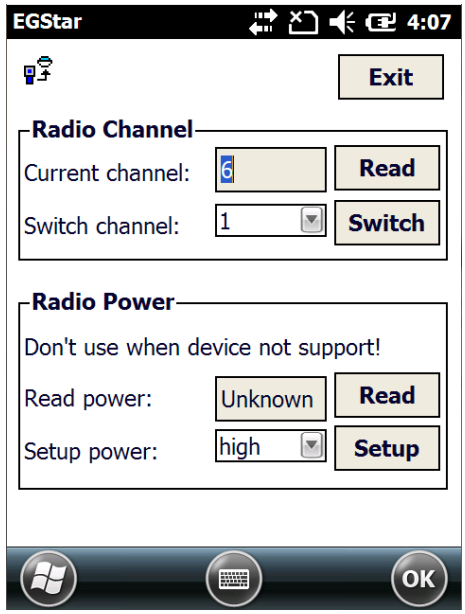


REMIND: If the base station is still set up on the same position next time, check the box of "repeated station" option and the base station will start automatically with known coordinates.

Radio channels setting

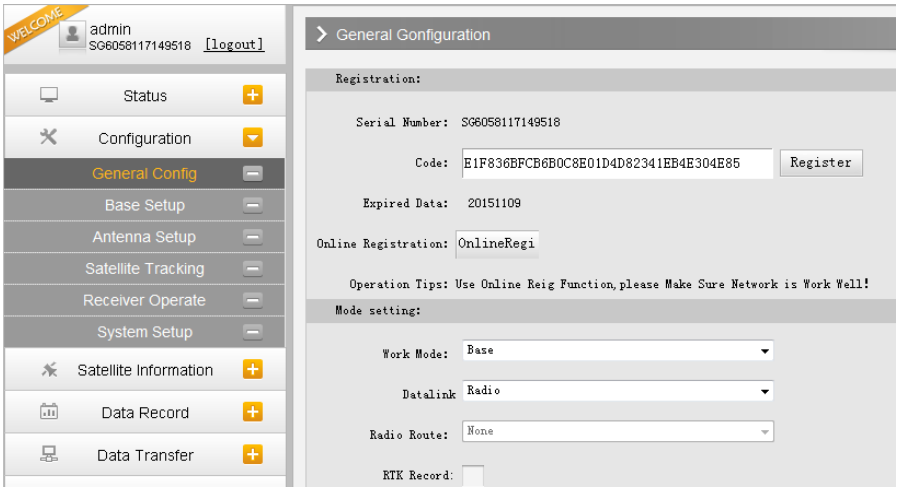
1) Go to "Config—Device Config—Radio Config" page.
2) In radio channel field, click on "Read" button to read the current channel value, or select a radio channel from the list and click on "Switch" button to change the radio channel.
3) In radio power field, click on "Read" button to read the current radio power, or select high/low from the list and click on "Setup" button to apply power for radio.

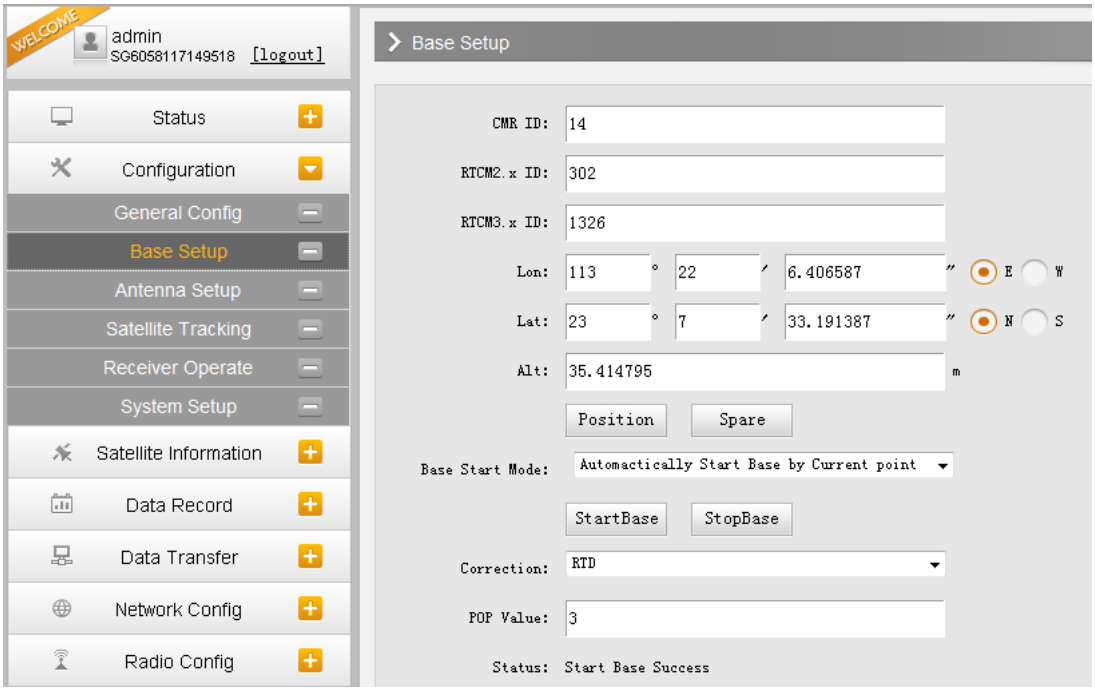




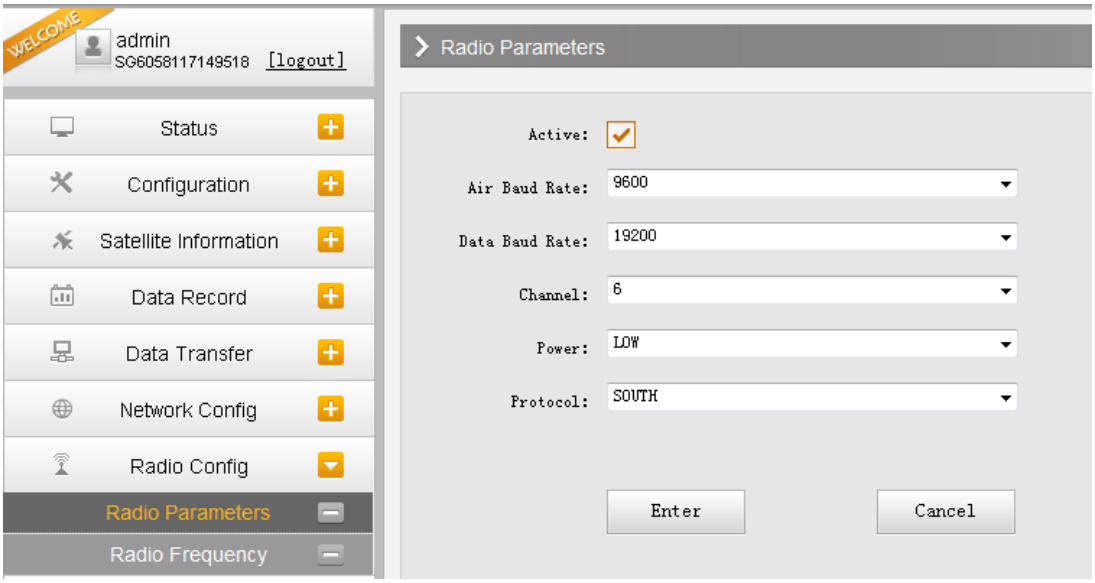
Using internal Web UI

1) Connect KOLIDA K1Pro with computer via 7-pin to USB cable and set the USB port to output as Ethernet on K1Pro. (a driver is required to installed on computer to enable this function).
2) Login the internal Web UI of K1Pro with the default username and password (admin/admin).
3) Get into “General Config” interface under “Configuration”;
4) Choose “Base” in “Work Mode” and “Radio” for “Datalink”, then click “Enter” button to save configurations;
5) Get into “Base Setup” interface, and input known coordinates or click “Position” button to obtain a single coordinates for base station;
6) Choose the correction format in “Corrections”, then click “StartBase” button to start the base station.





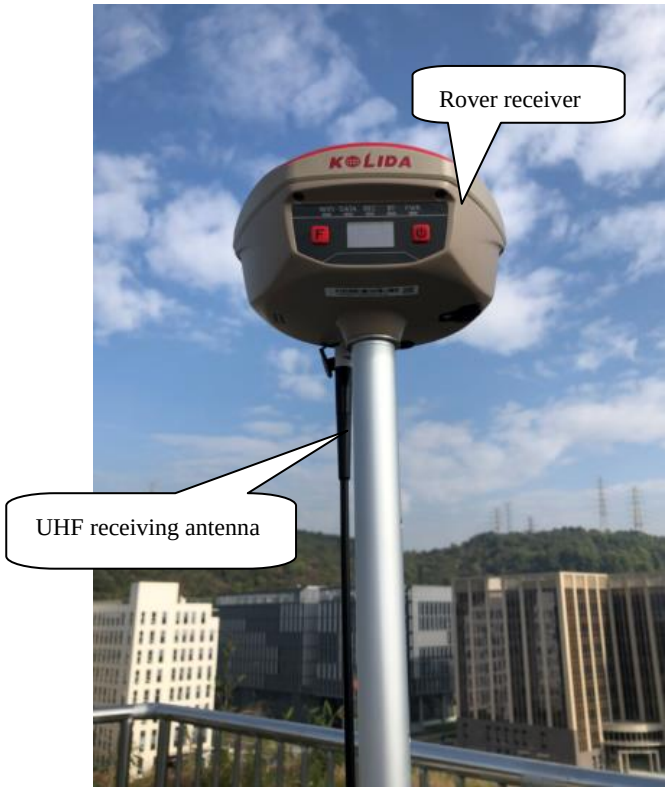
7) Get into “Radio Parameters” interface under “Radio Config”, configure the radio parameters for base station such air baud rate, channel value, power and protocol.



§6.2.1.3 Rover station set up

After verifying the successful transmitting of the Base station, the rover station shall be set up at this moment.

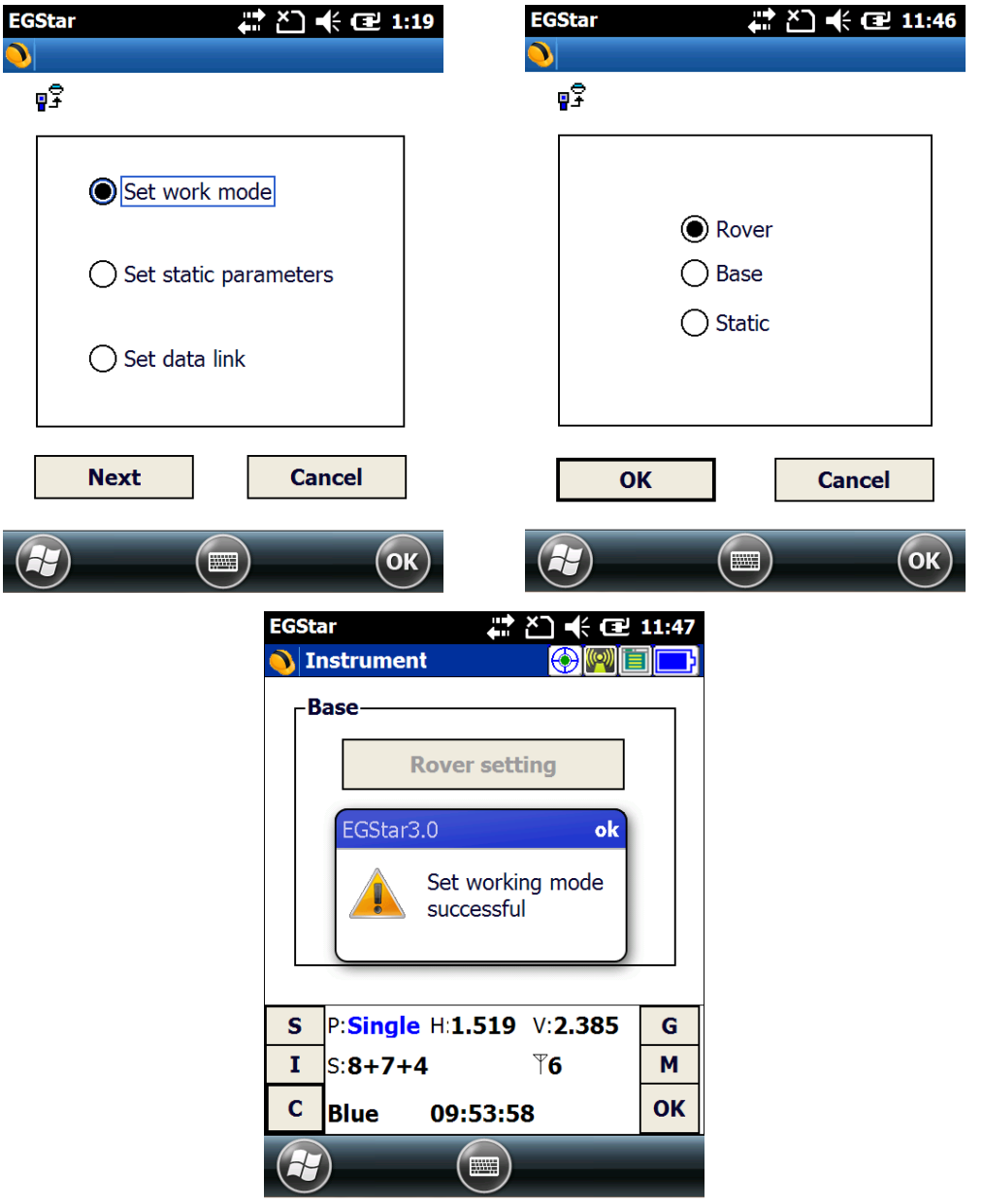
1) Install the bracket holder onto the carbon fiber pole, and fix the controller into the bracket, then power on the controller.
2) Install the receiving antenna onto the rover receiver, and screw the receiver into the carbon fiber pole, then power on the receiver.
3) Set the receiver as rover with internal radio mode. (set on the control panel, or on internal Web UI or on the software installed on data collector).



§6.2.1.4 Rover settings

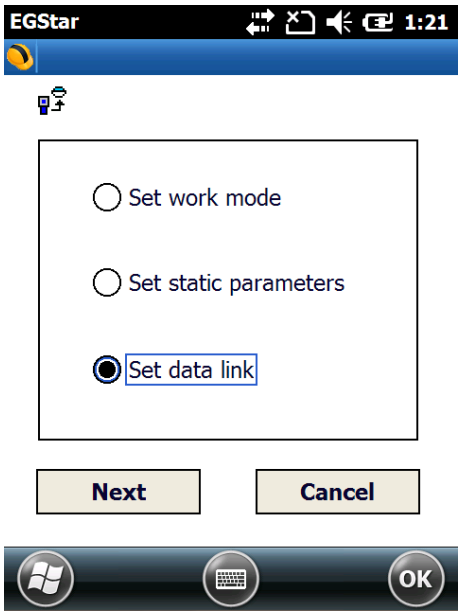
Using EGStar3.0

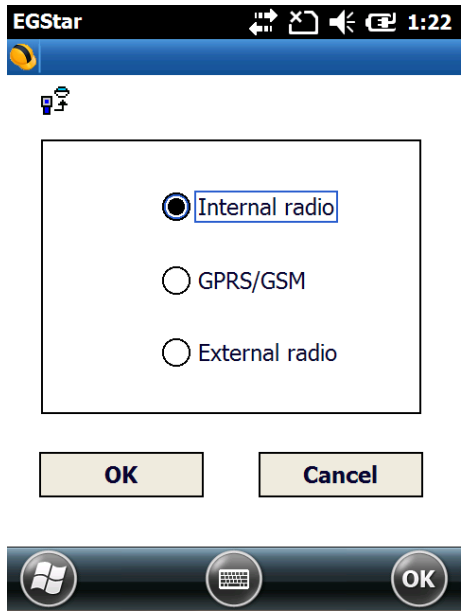
1) Run EGStar3.0 program on data collector;
2) Go to “Config—Device Config—Instrument Config” page to configure the working mode and datalink for rover receiver.
3) Tap on “Work mode setting” and then check the box of “Set work mode”, then click on “Next” to continue;
4) Check the box of “Rover” option and click “OK” and return to Instrument setting page. At this moment, KOLIDA K1Pro prompts the correct working mode with voice guide.



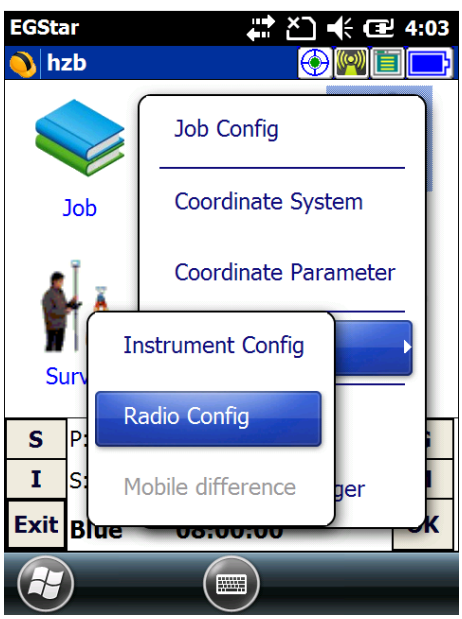
5) Then tap on “Work mode setting” and then check the box of “Set data link”, then click on “Next” to continue;

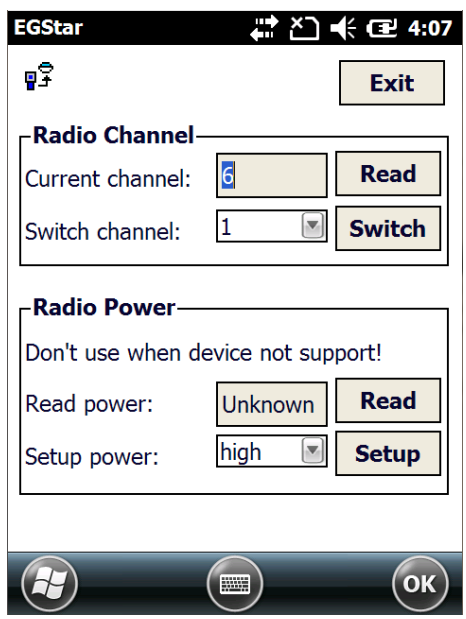
6) Check the box of “Internal radio” option and click “OK” to complete the settings.





7) Radio channels setting
8) Go to “Config—Device Config—Radio Config” page.
9) In radio channel field, click on “Read” button to read the current channel value;
10) Select the same radio channel value as set on base station from the list and click on “Switch” button to apply this channel value.



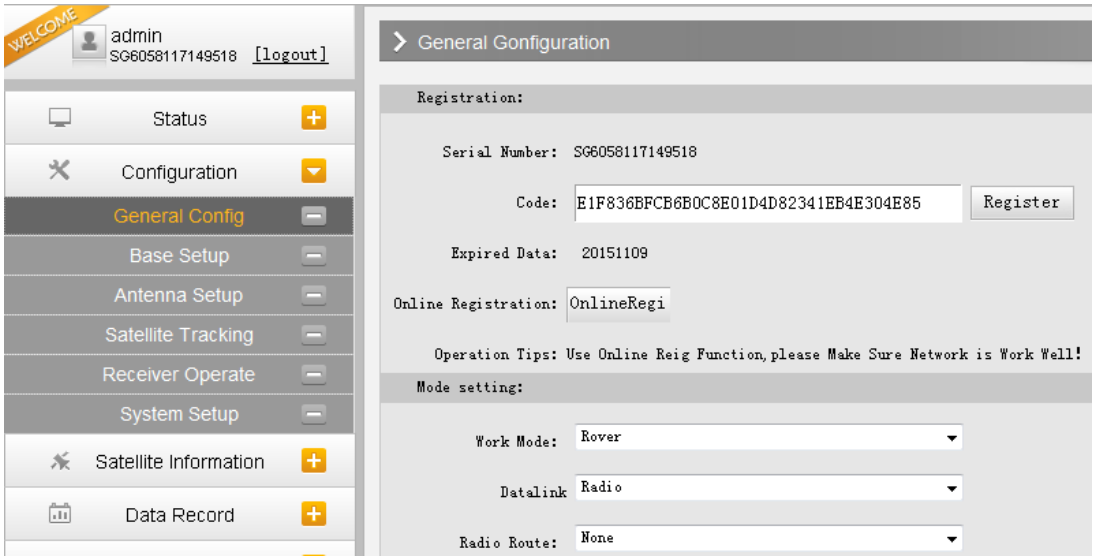


Using Web UI

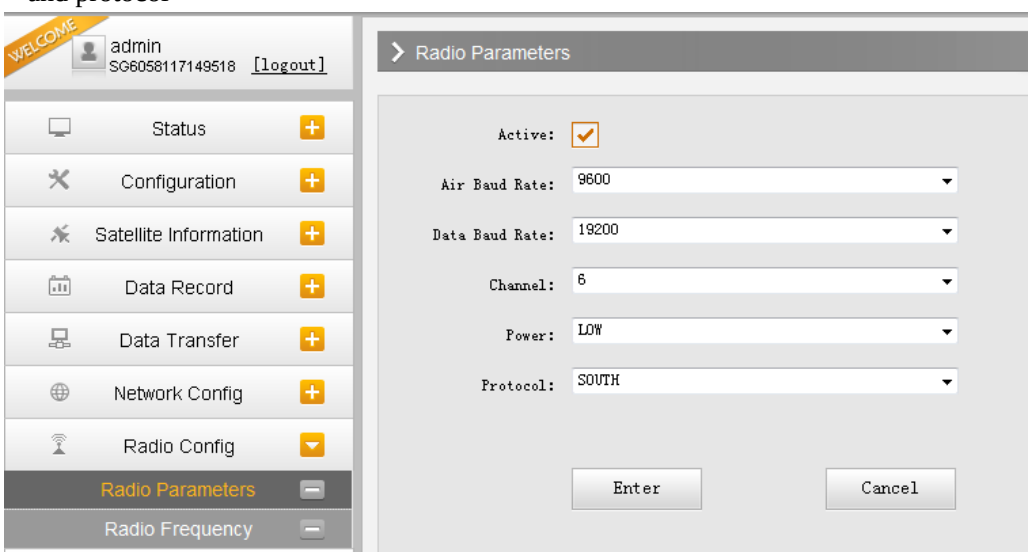
1) Connect KOLIDA K1Pro with computer via 7-pin to USB cable and set the USB port to output as Ethernet on K1Pro. (a driver is required to installed on computer to enable this

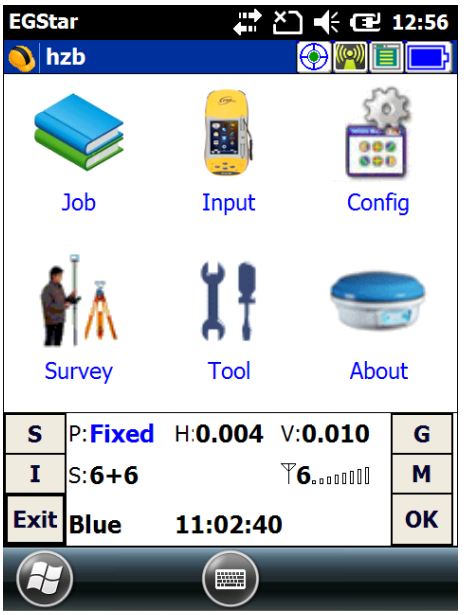
function).

2) Login the internal Web UI of K1Pro with the default username and password (admin/admin).
3) Get into “General Config” interface under “Configuration”;
4) Choose “Rover” in “Work Mode” and “Radio” for “Datalink”, then click “Enter” button to save configurations;



5) Get into “Radio Parameters” interface under “Radio Config”, configure the same radio parameters as set on base station for rover station such air baud rate, channel value, power and protocol

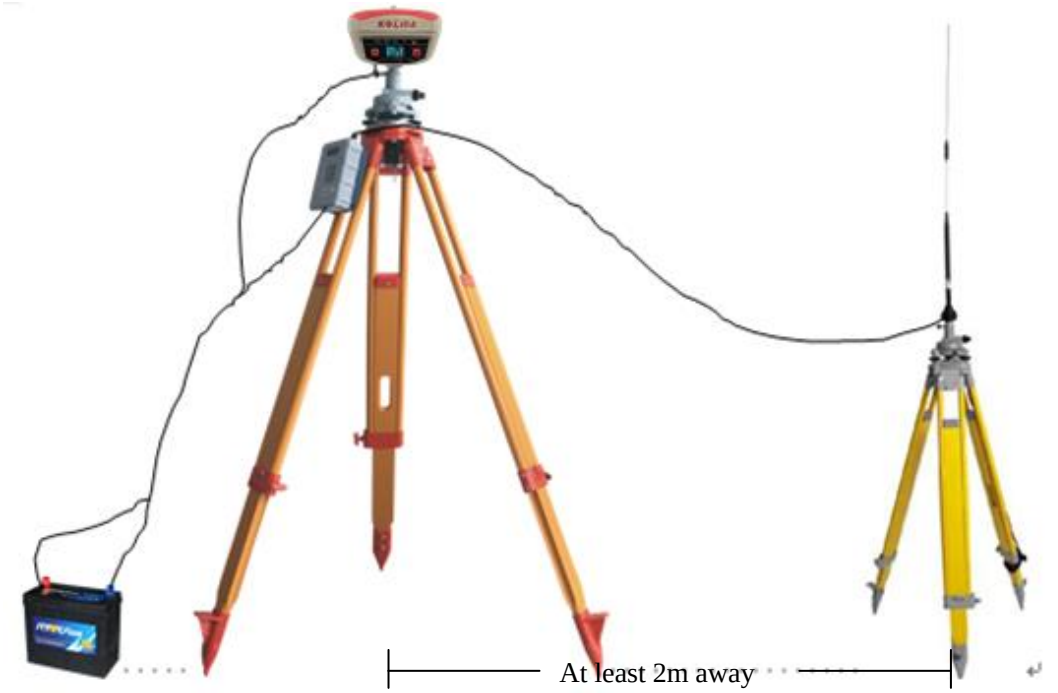




§6.2.2 By using radio (external radio)

§6.2.2.1 Base station setup

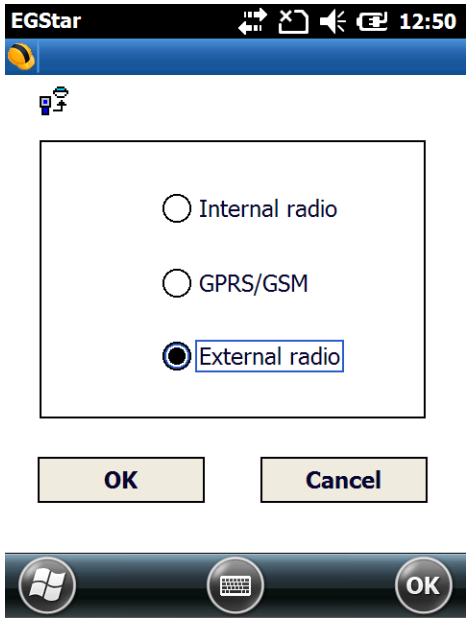
1) Set a tripod to the location with known coordinates (or unknown), attach base receiver to the tribrach adapter set (the measuring plate is recommended to install under base receiver).
2) Mount the UHF antenna set onto a tripod, and connect it to the external radio which is linked with the external power supply via the multi-function cable.
3) Power on the base receiver and set the receiver as base with external radio mode. (set on the control panel, or on internal Web UI or on the software installed on data collector).



NOTE: place the 2 tripods at least 2m away from each other against signal interference.

Using EGStar3.0

Set the base receiver as base working mode from "Config—Device Config—Instrument Config—Work mode setting—Set work mode--Base", choose the External option in "Set data link".



§6.2.2.2 Radio settings

1) Make sure all connections are alright, then power on the radio by pressing power button, and then press “C” button to define the channel for data transmission.
2) Please keep in mind the channel is selected to match the settings in controller later on.
3) Radio starts to transmit when TX LED is flashing.

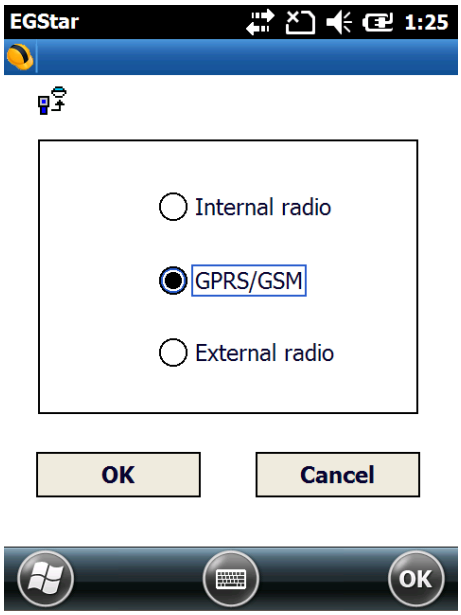
§7.2.2.3 Start Base Station (Please refer to 7.2.1.2)

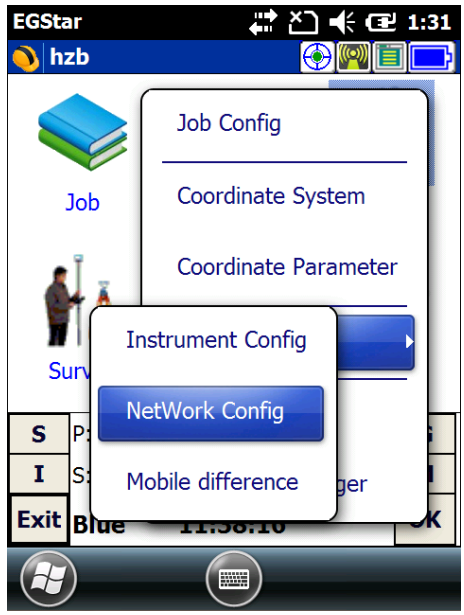
§6.2.3 By using internet (GPRS)

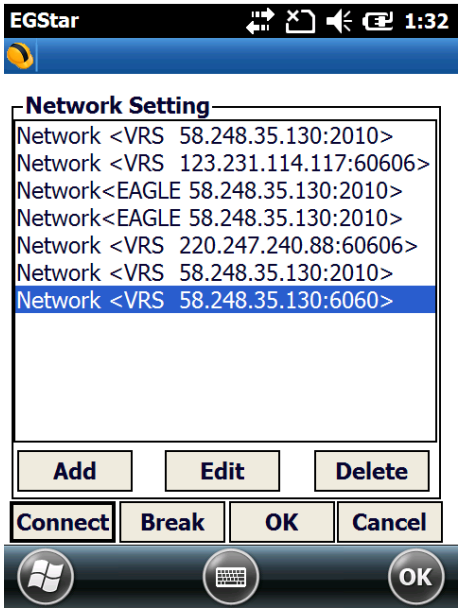
1) In this mode, base station is no longer to set up as CORS is permanently installed.
2) Insert a SIM card into the SIM card slot in battery component.
3) Power on the rover receiver and connect with controller via Bluetooth.

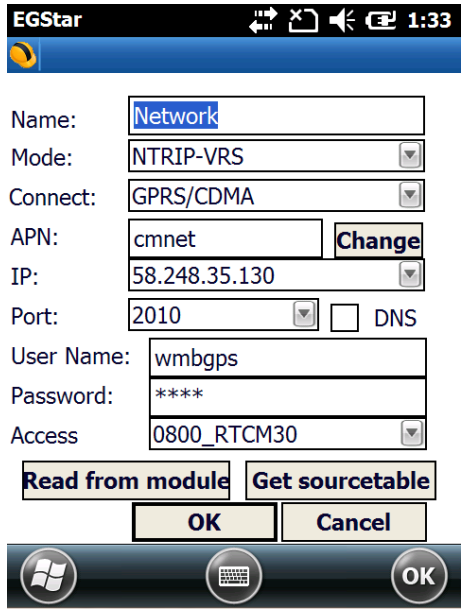
EGStar3.0 settings

1) Go to “Config—Device Config—Instrument Config—Work mode setting—Set data link” interface to choose “GPRS/GSM” option for rover station.
2) Then return to main interface and go to “Config—Device Config—Network Config” page.
3) Add a new NTRIP connection in this page or select the existed one to re-edit/use directly.



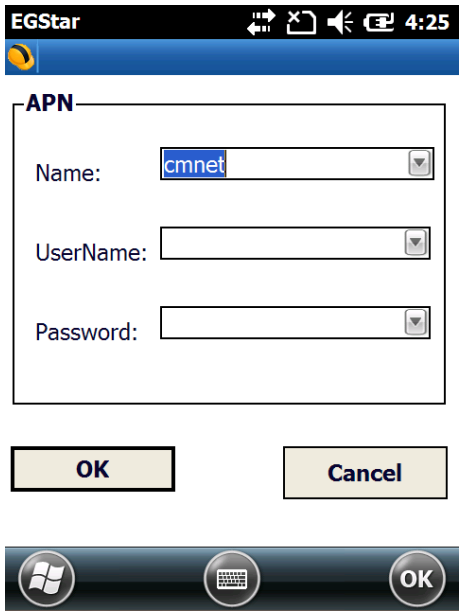






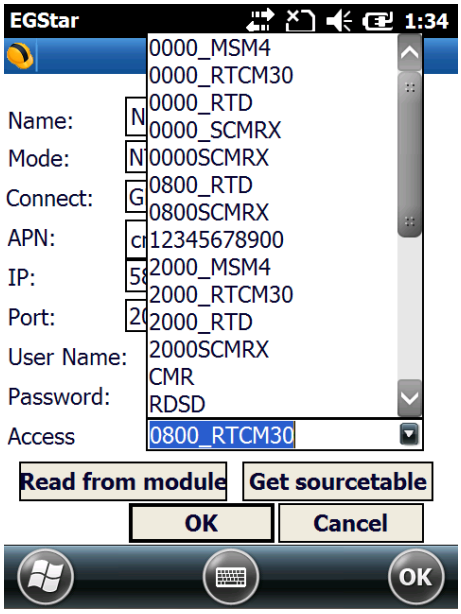
4) Input a name for NTRIP connection and choose “NTRIP-VRS” for “Mode” and choose “GPRS/CDMA” for Connect.

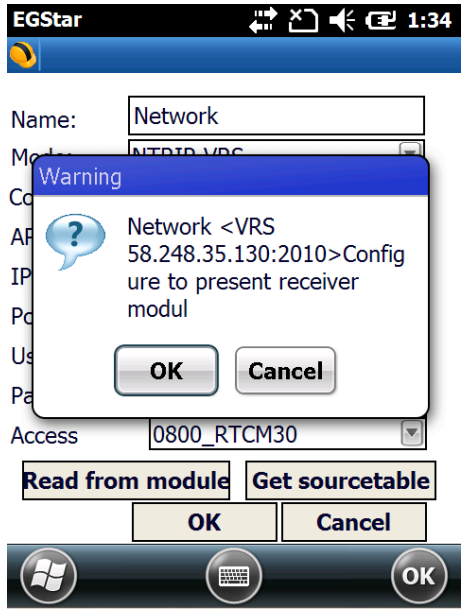
5) Then click on “Change” button to define the ANP for your local SIM card.



6) Input the IP address and port, then input the assigned username and password for your NTRIP connection.

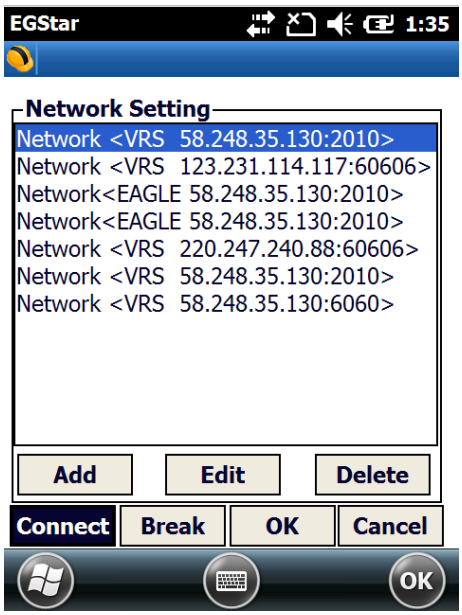
7) Press “Get Sourcetable” button to obtain mountpoint list, then select the appropriate one from the list in Access option, press “OK” button to confirm and return to Network Setting interface.

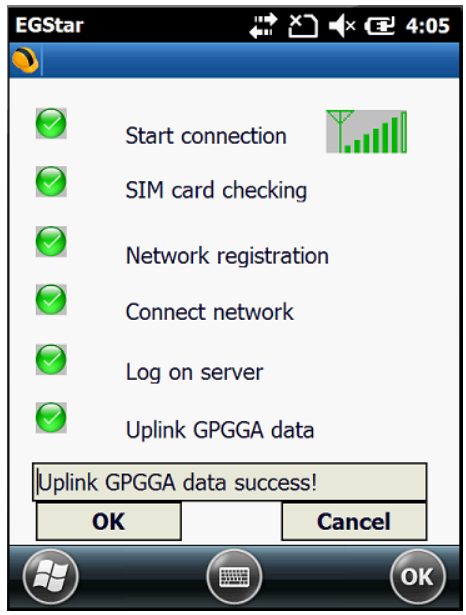




8) Press “Connect” button to access CORS network and obtain corrections from selected mountpoint.

9) After the message “Uplink GPGGA data success” appears in the status bar, click “OK” button to return to main interface, and check the general info at the bottom.

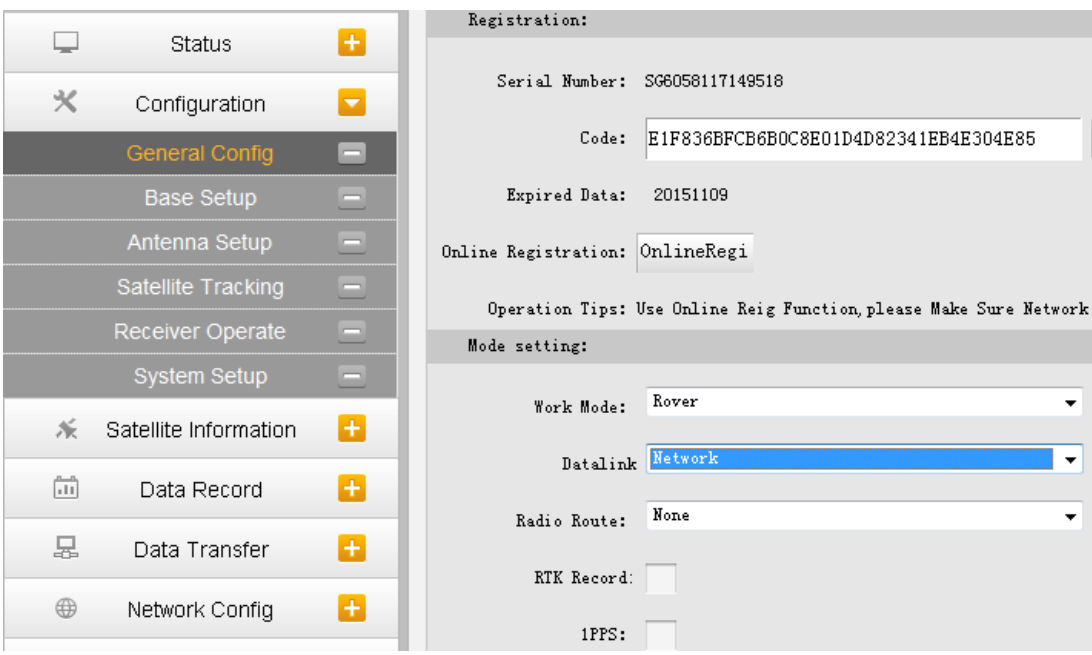


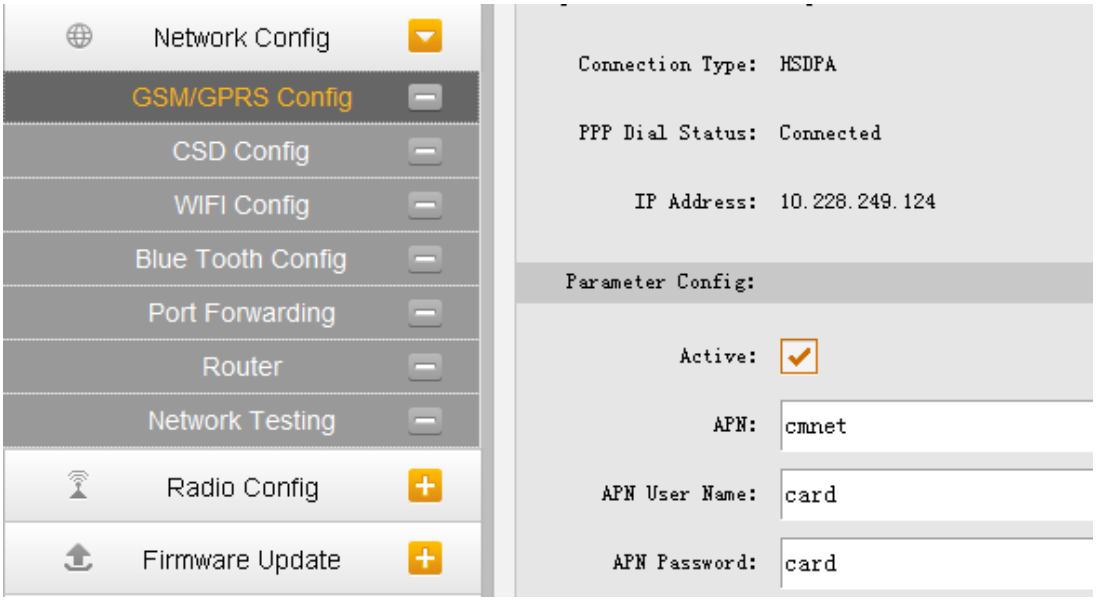


NOTE; the parameters would be automatically saved up once input, the receiver would track the CORS info most recently input and connect when it gets started next time.

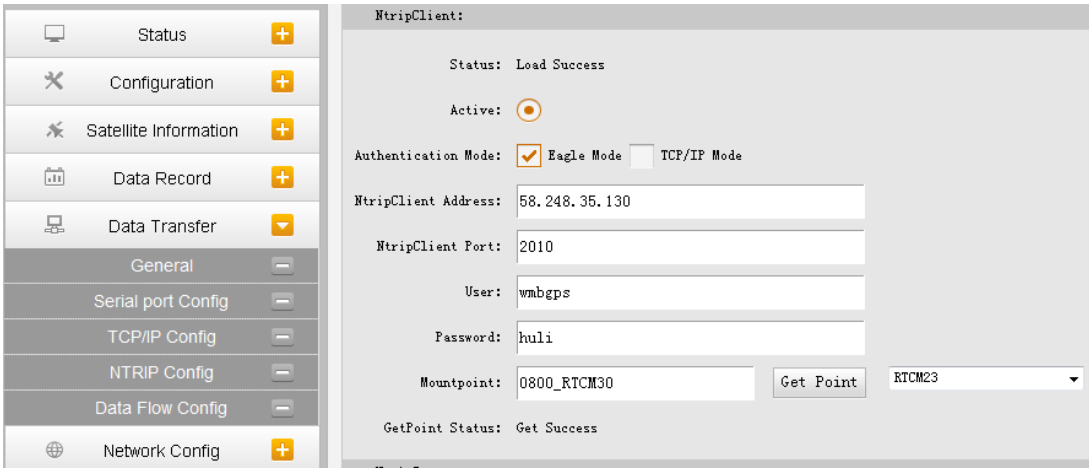
Web UI settings

1) Login the web UI of K1Pro and go to "General Config" interface, then choose "Network" in "Datalink" option, click on "Enter" button to confirm and save the settings.
2) Then go to "GSM/GPRS Config" interface under "Network Config" to check if the SIM card is detected, and input the APN information at the bottom.





3) Go to "NTRIP Config" interface under "Data Transfer", and input the CORS server information including IP, Port, User and password, then click "Get Point" button to download mountpoint list from server. Then select the appropriate one from the list and click on "Enter" button at the bottom to access.



§6.2.4 By using internet (WIFI)

WiFi datalink is a new feature and new technology adopted on KOLIDA K1Pro, it is more faster and stable in network RTK job.

Set the receiver as rover with WIFI mode on the control panel or on Web UI.

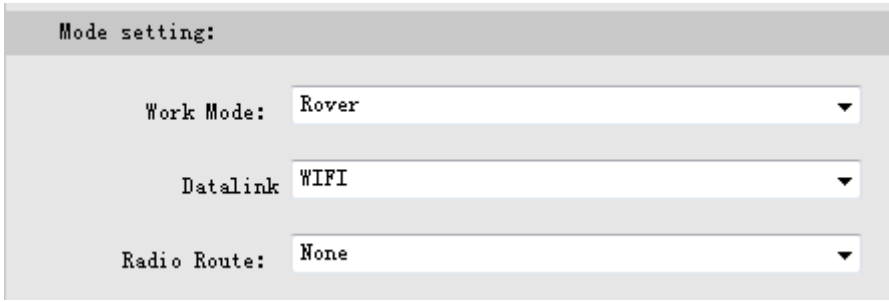
Instrument settings

1) After choosing the rover mode for receiver, then press F button and get into the "Set Data Link" configure page, then move the select box to "WIFI Datalink" option and press power button to confirm.

2) Then get into the "WIFI Config" configure page to check if the WIFI connection is already established.

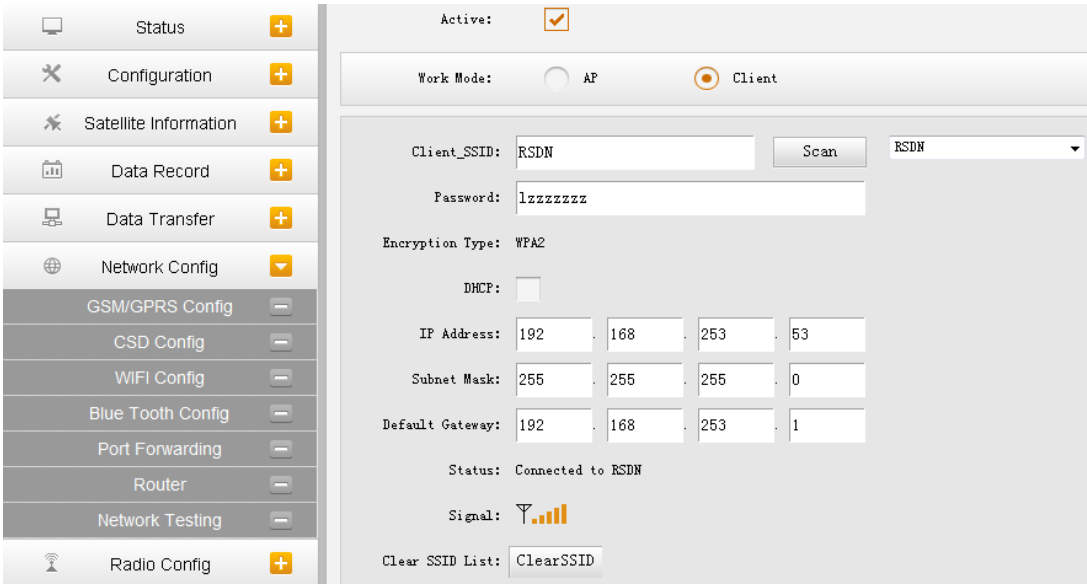
Web UI settings

1) Login the web UI of K1Pro and go to "General Config" interface, then choose "WIFI" in "Datalink" option, click on "Enter" button to confirm and save the settings.

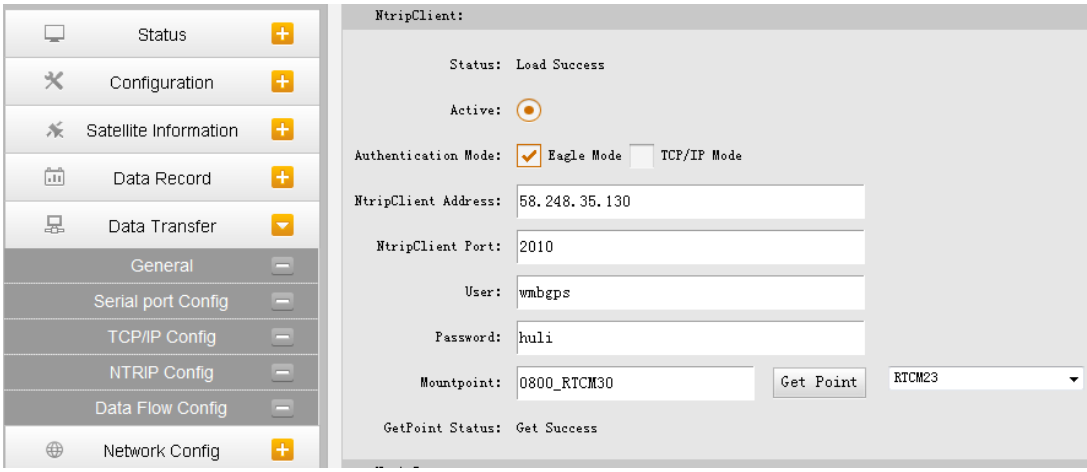


2) Then go to "WIFI Config" interface under "Network Config", there the option of "Client" is activated if WIFI used as datalink.

3) Click on the “Scan” button to search the surrounding available WIFI hotspot, then select a proper one and input the password, click the “Enter” button at the bottom to confirm and access



4) If the WIFI connection is successfully connected, go to “NTRIP Config” interface under “Data Transfer”, and input the CORS server information including IP, Port, User and password, then click “Get Point” button to download mountpoint list from server. Then select the appropriate one from the list and click on “Enter” button at the bottom to access.



§6.2.5 Inertial Measurement (IMU)

Equipped with IMU sensor, K1Pro IMU' tilt survey requires no calibration and is no longer affected by magnetic environment. Just by a quick shake, IMU tilt survey function can be

activated in a few seconds. K1Pro IMU supports tilt survey in as much as 60 degrees angle. Without leveling, K1Pro IMU' positioning efficiency has been increased by over 30%. And at the same time, the algorithm of IMU+GNSS will guarantee a stable and accurate positioning result.

There are several disadvantages in last generation of tilt survey (with tilt sensor compensation). It takes too much time to do E-bubble calibration and magnetic calibration before work. And the earth magnetic field has a great impact on the survey result. For K1Pro IMU, we don't need to do those calibrations and after K1Pro IMU gets fixed solution, with a quick shake to activate IMU tilt survey, we can start work.

Is there any added value of Inertial Measurement?

1. Bring more safety to your work

2. Work at Non-signaled Point

3. Conveniently Measure Inaccessible Points

SPECIAL REMIND: Please run this Website for more IMU info:
https://www.linkedin.com/pulse/inertial-measurement-rtk-k5-imu-bring-your-productivity-andy-lau/?published=t

§6.2.6 Star-link & Star-Fill

Star-Link

Built on Star-link technology, KOLIDA K1Pro provides high-accuracy GNSS positioning services via satellite or cellular delivery worldwide. It's ideal for jobs requiring the highest accuracy. Only K1pro provides accuracy of less than 2 centimeters, helping you get your job done fast with pinpoint accuracy.

After subscribing to it, surveyors can work almost anywhere in the world without a base station or VRS network. ideal solution for surveying and mapping, natural resource exploration in remote area.

SPECIAL REMIND:
Please contact with KOLIDA Team or Trimble official website to subscribe to this feature.

Star -Link

KOLIDA Star-Fill is a new service that extends RTK positioning for several minutes when the RTK correction stream is not available. KOLIDA Star Fill corrections are broadcast by satellite, so they are generally available within covered areas wherever the GNSS constellations are visible. This new function will surveyors to continue working a few minutes when radio or mobile signal is lost in blind area. The accuracy is down to 2cm.

SPECIAL REMIND: Please run this Website for more IMU info:
https://youtu.be/VvHJN6bkUDo

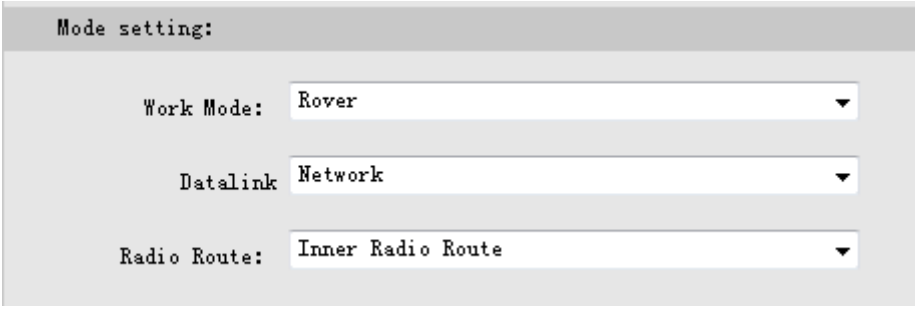
§6.2.7 Radio Router

This feature is used to transfer the correction which from the reference station for the other rover by radio, the rovers will have the same coordindates from the reference station.
NOTE: This function should be used under Rover+Network mode.

Before configuring on this function, go to “Radio Parameters” interface to check which radio channel value and what kind of protocol are being applied, please keep in mind on this channel

value and protocol that are selected to match on rovers later on.

Then choose “Network” for Datalink option and choose “internal radio” for Router option in “General Config” page, click on “Enter” button to confirm the settings.



At this moment, configure the parameters for rover to access to the CORS server for corrections. Then the other rovers are able to connect the rover router via internal radio with the same channel value, after rovers have fixed solution, the base coordinates are same as CORS station.

Appendix A KOLIDA K1Pro technical specifications

GNSS characteristics:

■ 336 GNSS channels (672 channels optional)

- GPS : L1C/A, L1C, L2C, L2E, L5
- GLONASS : L1C/A, L2C/A, L2P, L3
- BeiDou: B1, B2, B3
- Galileo: E1, E5A, E5B,E5AltBOC,E6
- IRNSS: L5
- SBAS: L1C/A, L5 （QZSS, WASS, MSAS, GAGAN, EGNOS）
- Global Correction Service (MSS L-Band)

■ **Initialization:**

Time <10s, reliability >99.99%

■ **Supported data formats:**

RTCM 2.1, RTCM 2.3, RTCM 3.0, RTCM 3.1,RTCM 3.2, CMR, CMR+

■ **Output data formats:**

NMEA 0183, PJK plane coordinates, Binary code,Trimble GSOF

L-band Correction Service

■ Star-fill: 5 minutes, down to 2 cm accuracy

■ Star-Link: down to 2 cm accuracy (need subscription)

Inertial Measurement

■ Tilt Angle: up to 60 degrees

■ Accuracy: down to 2cm

Positioning Accuracy

Code differential GNSS positioning

■ Horizontal: ±0.25m+1ppm

■ Vertical: ±0.50m+1ppm

■ SBAS positioning accuracy: Typically<5m 3DRMS

Static

■ Horizontal: ±2.5mm+0.5ppm

■ Vertical: ±5mm+0.5ppm

Real-time kinematic (RTK)

- Horizontal: ±8mm+1ppm
- Vertical: ±15mm+1ppm

Network RTK

- Horizontal: ±8mm+0.5ppm
- Vertical: ±15mm+0.5ppm

RTK initialization time

- 2~8s

Physical characteristics

Size

- 16.3 x 16.3 x 9.6 cm

Weight

- 1.33 kg (with built-in battery)

User interface

- Five Indicator lights, Two buttons
- OLED color screen, 1 inch, 128x64 res.
- Linux System

I/O interface

- 5PIN LEMO external power port+RS232
- 7PIN external USB(OTG)+Ethernet
- Bluetooth 2.1+EDR standard
- Bluetooth 4.0 standard, support android connection

Memory

- 8GB SSD internal storage
- Support external USB storage (up to 32 GB)
- Automatic cycle storage
- Changeable record interval
- Up to 50Hz raw data collection

Operation

- RTK rover & base
- RTK network rover: VRS, FKP, MAC
- NTRIP, Direct IP
- Post-processing

Environmental characteristics

- Operating temperature: -45° to +75° C
- Storage temperature: -55° to +85° C
- Humidity: 100% condensing
- IP68 waterproof, sealed against sand and dust
- Drop: 2m pole drop on concrete

Power characteristics

- Built-in internal battery, 7.4 V, 10,000 mAh
- Battery life: >14h (static mode),>7h (internal UHF base mode),>8 to 14h (rover mode)
- External DC power: 9-28 V

UHF Radio characteristics

- Built-in radio, 120 channels
- Frequency Range 410-470MHz
- Protocol: TrimTalk450s, TrimMark3, SOUTH (KOLIDA), Hi-target, CHC, Satel
- 1W/2W/3W switchable
- typically working range 7-8km
- "Barrier-Free" Measurement Technology: Repeater/ Router

Cellular module characteristics

- WCDMA/ CDMA2000/ TDD-LTE/ FDD-LTE 4G
- Compatible with 3G GPRS/ EDGE

WebUI

- Configure and monitor receiver by webserver via Wi-Fi or USB cable

NFC

- Close range (shorter than 10cm) automatic pair between receiver and controller (need NFC chip in controller)

Wifi

- 802.11 b/g standard
- Hotspot: allow device to access in
- data link: broadcast differential data

Voice Guide

- intelligent voice technology provides status indication and operation guide
- Chinese, English, Korean, Russian,Portuguese, Spanish, Turkish and user define

Standard system components

- K1Pro GNSS Receiver & built-in battery
- Charger and adapter
- All-direction antenna
- 30 cm pole extension (with base only)
- 7-pin to OTG cable
- Field software: Engineering Star (Windows Mobile)
- Post-processing software: KGO (Windows PC)
- 1 year warranty

Optional system components

- External Radio (410-470 MHz, 5-35W)
- Battery Case SA-6003
- Data collectors
  - H3 plus (Android), H5 (Android)
  - T17N (Windows mobile)
  - S50 (Android)
- Field software
  - Field Genius (Windows)
  - SurvX (Android)
  - Engineering Star 5.0 (Android)
- 1-2 year warranty extension

Appendix C Technical Terms

Ambiguity: unknown quantity is the integer number of cycles of the carrier phase measured from the satellite to the receiver.

Baseline: The connection line of the two measurement points, on which to receive GPS signals and collect observation data simultaneously.

Broadcast ephemeris: message released by the satellite demodulator satellite orbit parameters.

SNR (Signal-to-noise ratio): an endpoint signal power to noise power ratio.

Cycle skipping: interfere loop skips a few cycles from a balanced point, and stabilize in the new equilibrium point, this make the phase integer number of cycles to generate an error.

Carrier: As the carrier, Frequency, amplitude or phase modulation of the modulated wave by a known reference value.

C / A code: GPS coarse / acquisition code, modulate the pseudo-random binary code

for the 1023 bit duplex, the bit rate of which is 023MHz, and code repetition period of 1ms.

Difference measurement: GPS measurements employ cross-satellite cross-receiver and cross-epoch.

Difference Positioning: the method of determining the relative coordinates between two or more receiver by tracking the same GPS signal.

Geometric dilution of precision: Describe the contribution of satellite geometry errors factor in dynamic positioning

Eccentricity: $e=\sqrt{\frac{a^2-b^2}{b^2}}$ where a, b of the semi-major axis and semi-minor axis.

Ellipsoid: mathematical graphics formed when an ellipse moves around the minor axis of rotation in Geodetic Survey.

Ephemeris: the position of celestial bodies over time parameters.

Flattening: $f=\frac{1}{a}(a-b)=1-\sqrt{(1-e^2)}$

a is the semi-major axis, b is the semi-minor axis, e is the eccentricity.

Geoid: similar to the mean sea level and extends to the mainland special planes. Geoid everywhere perpendicular to the direction of gravity.

Ionosphere delay: delay of radio waves through the ionosphere (non-uniform dispersion medium)

L-band: The radio frequency range of 390-1550MHz.

Multipath error: the positioning error caused by the interference between two or more radio signal propagation path.Observing session: the use of two or more receivers at the same time to collect GPS data period.

Pseudo Range: GPS receiver in the time required to copy the code aligned with the received GPS code offset and multiplied by the speed of light to calculate the distance. This time offset is the difference between the signal reception time (time series of the receiver) and the signal emission time (satellite time series).

Receiver channel: GPS receiver RF mixer and IF channel, can receive and track satellites two carrier signals.

Satellite configuration: the configuration status of the satellite with respect to a specific user or a group of users within a specific time.

Static position: do not consider the point of measurement of the movement of the receiver.

FCC Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

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

Caution: Any changes or modifications to this device not explicitly approved by manufacturer could void your authority to operate this equipment.

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