# KOLIDA K3 IMU Positioning System

# User Guide

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# Chapter Ⅰ Preface

*In this chapter you will have a brief knowledge of KOLIDA Company and K3 IMU 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 K3 IMU RTK system as well as the accessories. We recommend you to read the guide carefully before getting started.

## §1.2 Applications

***Control Survey:*** static measurements can accurately complete the high-precision deformation observation, photo-control point measurement.
***Highway Survey:*** quickly complete the encryption of the control points, road topographic mapping, cross-section measurement, profile measurement with K-survey.
***CORS Application:*** provide more stable and convenient data link for field operations. It is seamlessly compatible with all types of domestic CORS applications.
***Data acquisition measurement:*** perfect match KOLIDA's various measurement software to do quick and easy data acquisition.
***Stakeout shot*:** large-scale point, line, plane lofting.
***Electric Power Measurement*:** power line measurement orientation, ranging, angle calculation.
***Marine application*:** oceanographic research, dredging, piling, inserted row, making the marine operations convenient and easy.

# §1.3 Main Features

**Best-in-Class GNSS Signal Tracking**

The integrated advanced 965-channel GNSS technology helps K3 IMU to collect signal from GPS, Glonass, Beidou, Galileo, QZSS, in particular the latest BeiDou III. It greatly improved the data quality and satellite signal capturing speed of GNSS surveying.

**A Huge Leap in Working Hours**

Thanks to the high-capacity battery and the intelligent power management plan. K3 IMU can work up to 12 hours in RTK radio rover mode, up to 15 hours in static mode. The charging port is Type-C USB, users can choose KOLIDA quick charger or their own smartphone charger or power bank to recharge.

**Constantly Updated GNSS + IMU Technology**

The K3 IMU is equipped with KOLIDA's 3rd generation inertial sensor and algorithm. The working speed and stability have been improved for 30% from the last version. When the GNSS fixed solution is lost and recovered again, Inertial sensor can remain the working status in a few seconds, no need to spend time to reactivate it.

**A Lightest Receiver, Comfortable Experience**

K3 IMU is an ultra light GNSS receiver that leaves the competition behind. Its total weight is only 0.69 kg including battery, 40% even 50% lighter than a traditional GNSS receiver. The light-weight design reduces surveyor's fatigue, increase their mobility, is especially helpful to work in challenging environment.

**More Intelligent SOC Platform**

"SOC", System-On-Chip technology features highly integration, faster computing speed, and stronger processing capabilities that improve RTK performance and work efficiency. The receiver can be much lighter and smaller. The power consumption is low, receiver can work 12-15 hours. The "High-Low Integration" antenna can effectively restrain the interruptive signal.

### Advanced UHF module

KOLIDA K3 IMU enjoys a new and excellent datalink system, which is compatible with current radio protocols in the market, and realizes the random switching of the radio range 410MHZ-470MHZ. “Farlink” technology improves the signal-catching sensitivity from -110db to-117db, so K3 IMU can catch the very weak signal from a base station far way.

### Internal Web UI management

Embedded Web UI management platform supports WIFI and USB mode connection. Users can monitor the receiver status and configure it via the internal Web UI management platform.

### Bluetooth and NFC

KOLIDA K3 IMU is equipped with dual-mode Bluetooth v4.0 standard which is able to connect the other smart devices and compatible with Bluetooth v2.1 standard. It not only enlarges the work range but also makes the data communication become more stable. The internal NFC module can make the complicated Bluetooth communication easy and simple.

### WiFi

As the new feature and technology adopted on K3IMU, it not only can be used as data link to access to internet, but also can be as a hotspot which can be accessed by any other smart devices to configure the receiver.

### Intelligent Storage

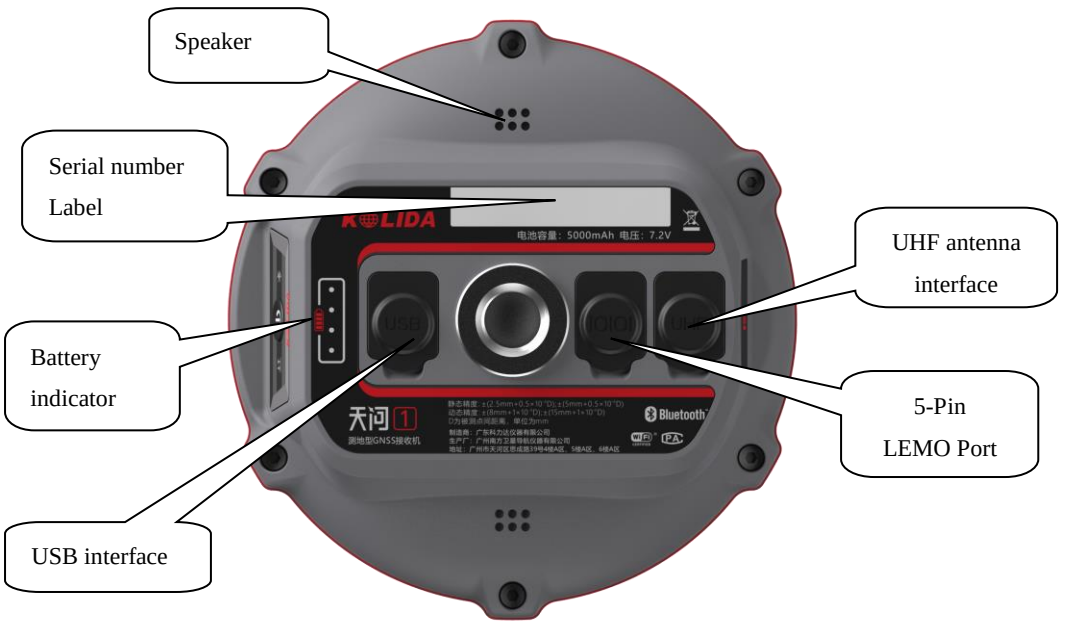
The raw data including STH, Rinex2.01 and Rinex3.02 not only can be saved in the internal memory (8G SSD), but also can be stored into an external USB device (OTG). The configurable sample frequency is really up to 20Hz.

# Chapter Ⅱ Hardware Introduction

*Reading this chapter, you can grasp the components, installation and the function of KOLIDA K3 IMU measuring system.*

The receiver is round and flat with height of 60mm and diameter of 137mm. It looks elegant, strong and durable. And it adopts a combination design of voice and buttons, easier to operate. The bottom of the receiver has commonly used interfaces.

# §2.1 Bottom Components




| Component | Description |
|---|---|
| **Speaker** | Mode setting and working status prompt |
| **SN label** | Apply for a registration code, Bluetooth ID |
| **Battery indicator** | Real-time indication of battery level. |
| **USB interface** | 1. USB for data transmission and Ethernet port for login web interface.<br>2.Battery charging port. |
| **UHF antenna interface** | Install UHF antenna. |
| **5-pin LEMO port** | 1.As a power port connected with an external power supply device.<br>2. As a differential transmission port connected with an external radio.<br>3.As a serial port to check data output and debug. |

## §2.2 Indicator and buttons

**Control Panel**

| Ref | Component | Description |
|---|---|---|
| | **Power Button** | 1.Power on/off receiver.<br>2.Confirm working mode and data link.<br>3. Perform general settings on the receiver.<br>4. Always on when power on, flashing on low power. |
| | **Data Indicator** | **Rover Mode**: Flashes red light when the correction data is received but not Fixed solution.<br>Flashes green light after getting Fixed solution.<br>**Base Mode:** Flashes red light when there is differential data transmission.<br>**Static mode:** Flashes by the data sampling interval to indicate the data file is recording. |
| | **Bluetooth Indicator** | Glows in blue to indicate that Bluetooth connection has established between controller and receiver. |

## §2.3 Check the remaining power

When K3 IMU is charging, the corresponding light flashes before charging to the corresponding power. Press the power button once, the current battery level will show several lights.

For example, when the battery is fully charged, the four lights of 25%, 50%, 75%, and 100% are all green on. When the battery is 60%, press the power button once, and the 25% and 50% indicator lights will be red on.

## §2.4 Check and switch working mode

**1. Check work mode**

When K3 IMU is working normally, press the power button once, and then there will be voice broadcast of the current working mode.

**2. Switch work mode**

Press and hold the power button for more than six seconds to broadcast the "Start to set work mode" voice, then release the power button. At this moment, K3 IMU will say “Rover mode, Base mode and Static mode” one by one, when you hear the working mode you need, press power key to confirm.

## §2.5 Receiver self-check

Self-check is a useful operation to simply check the main hardware components if the instrument is abnormal or not working properly.

Press and hold the power button for about 10 seconds and pass over the state of power off and mode selection (do not release the power button even the instrument says power off and start to set work mode), then K3 IMU will say “start to self-check”, at this moment, release power button, the instrument will perform self-check automatically for the modules one by one.

The sequence of modules checking is:

* OEM board checking * UHF module checking * Sensors checking
* WIFI module checking * Bluetooth module checking

If all the modules are normal during self-check, the instrument will get into the state of power-on.

## §2.6 Factory reset

Press and hold the power button for about 20 seconds and pass over the foregoing states (power off, start to set work mode and self-check), K3 IMU will get into factory reset progress with voice message saying “start to restore factory default”, at this moment, release power button, the instrument will perform factory reset automatically. After this progress complete, the instrument will restart automatically with the factory default settings.

Video: https://www.youtube.com/watch?v=zuxUCUZs_E4

# ChapterⅢ Web UI Management

## §3.1 Overview

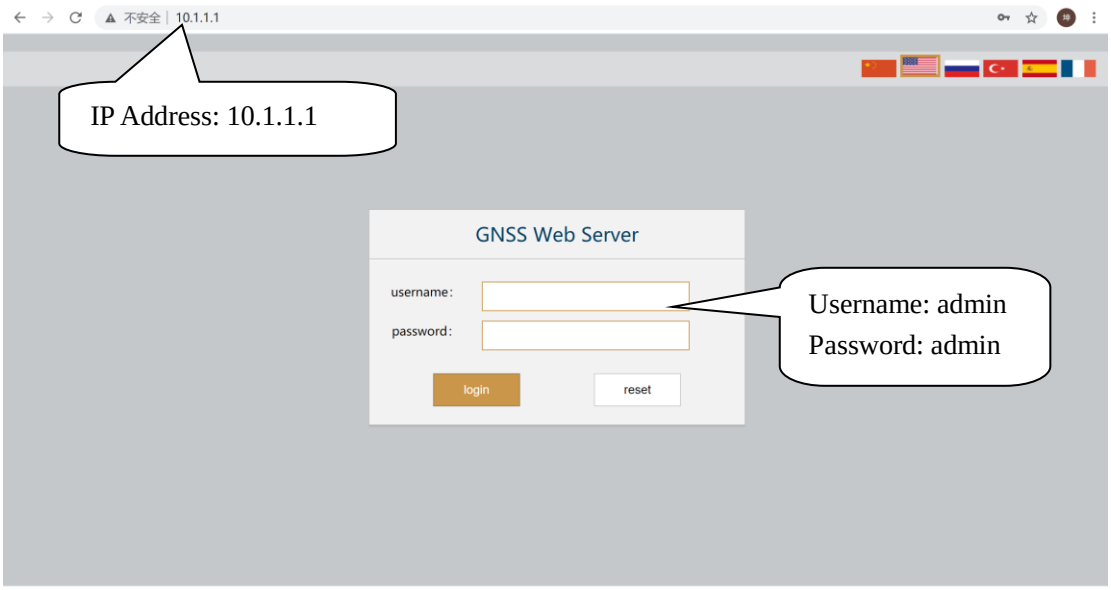
Because of using the smart embedded Linux operating system and KOLIDA intelligent cloud technology, the web UI allows users to configure and monitor the status of K3 IMU in real-time. The accessing way is not only by WIFI connection, but also can be USB mode.

## §3.2 Access by WiFi

The WIFI hotspot is default broadcasted by K3 IMU, search the WIFI hotspot which named with KOLIDA_xxxx using smartphone, tablet or laptop, then establish the WIFI connection, input the **default IP (10.1.1.1)** into broswer, on the login interface, apply "admin" for the username and password.

For example, search the WIFI hotspot broadcasted by a KOLIDA receiver using a laptop PC, choose the WIFI hotspot and click on connect button to establish the connection without password.

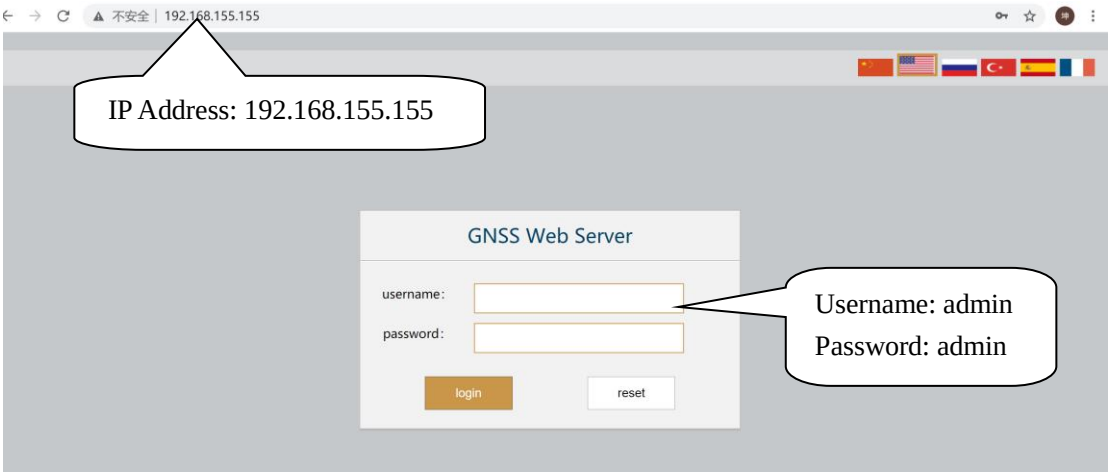
Run IE broswer on computer and input the default IP (**10.1.1.1**) into address bar, after a while, the system login interface is refreshed, then apply **"admin"** for username and password to login.




## §3.3 Access by USB

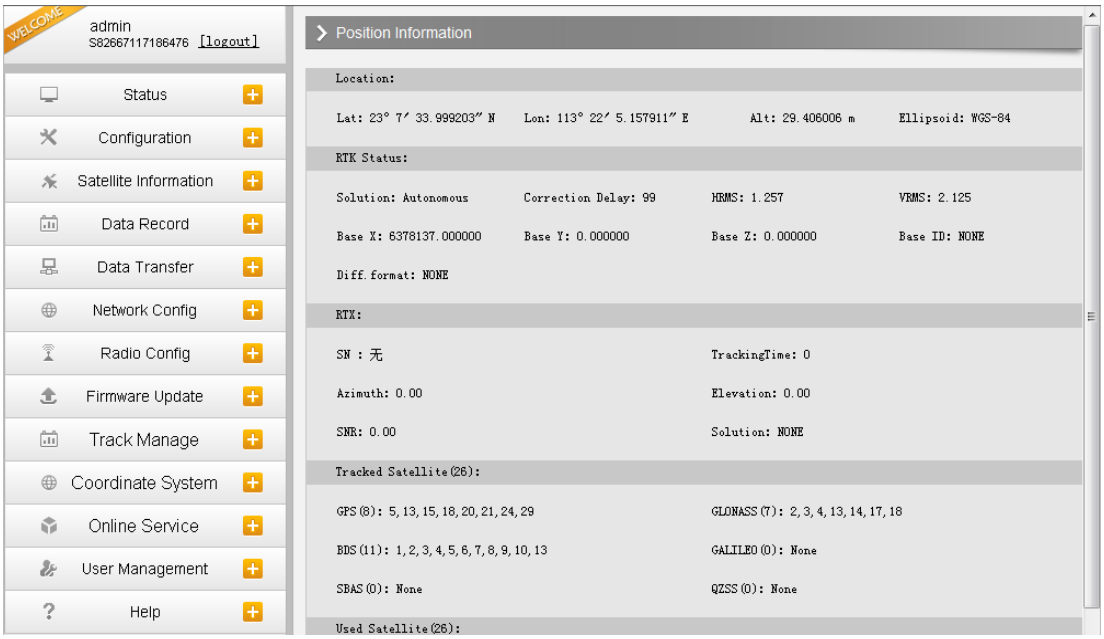
On this mode, the type-C USB port of K3 IMU works as an Ethernet port, then internal web UI shall be accessed via USB cable connection with computer.A corresponding driver is required to install to the computer, then this function could be activated. You can contact with KOLIDA technician for the driver and support.

Run IE broswer on computer and input the default IP (**192.168.155.155**) into address bar, after a while, the system login interface is refreshed, then apply **"admin"** for username and password to login.



# §3.4 Web UI main interface

After login the Web UI management of K3 IMU by WIFI or USB connection, the main interface appears with displaying configuration items and positioning. As shown at following figures.




In the Web UI home page, the configuration items are listed at left side. And the positioning informaiton including coordinates 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 |

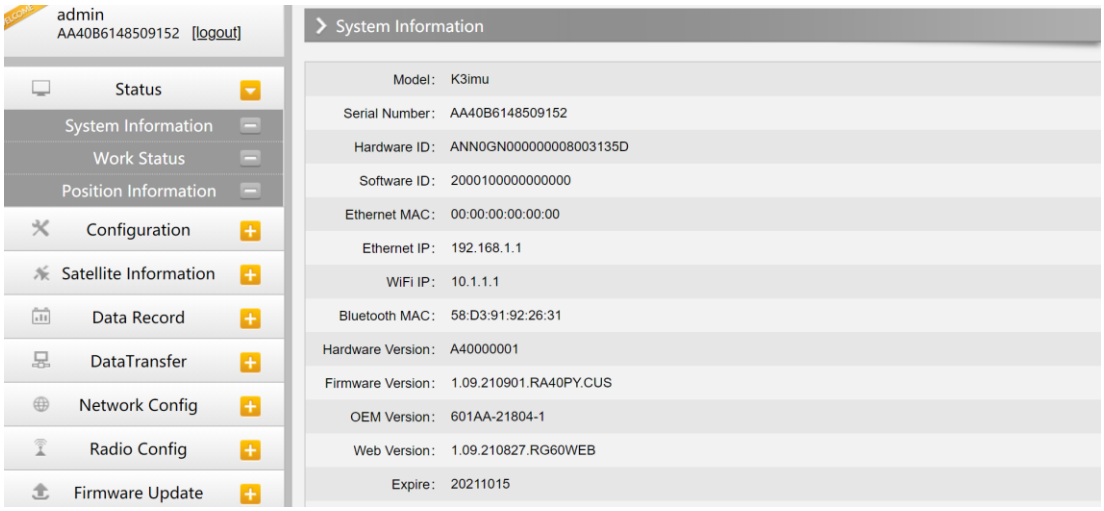
| | | |
|---|---|---|
| | **Network Config** | WIFI configuration and the other functions |
| | **Radio Config** | Configure the parameters and frequency for radio modem |
| | **Firmware Update** | It is used to upgrade the firmware for receiver and each modem |
| | **Track Manage** | Record track file while doing measurement |
| | **Coordinate System** | Setup a local coordinate system for K3 IMU |
| | **Online Service** | Upload data onto a server in real-time |
| | **User Management** | Add and manage the Web UI users |
| | **Help** | Offers solutions |

## §3.4.1 Status

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

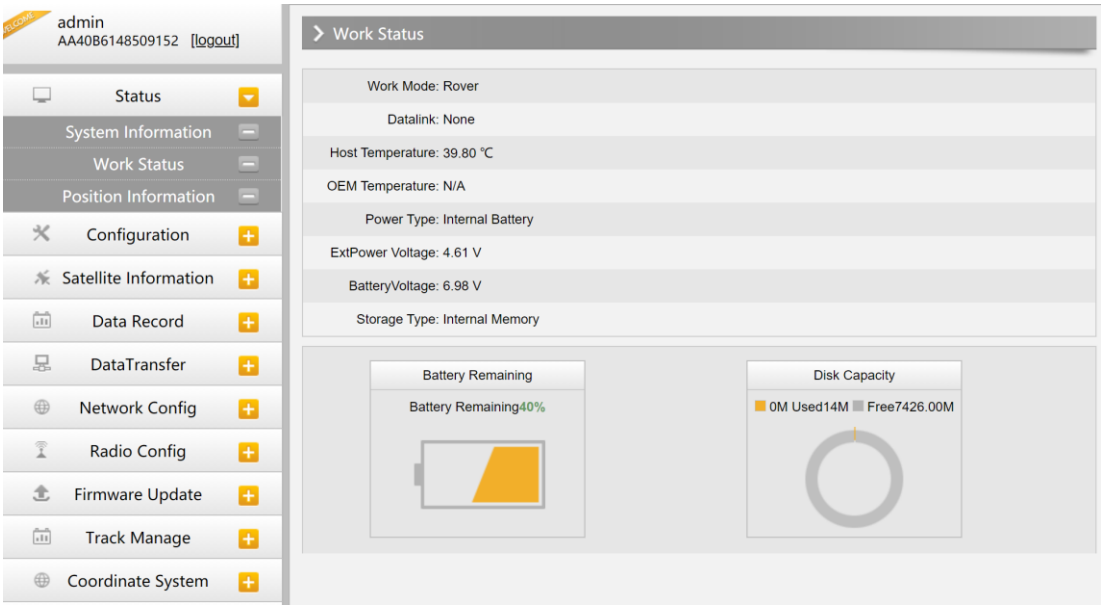
### System Information

In this page, all the information of K3 IMU is diplayed such as serial number, hardware ID, MAC address, firmware version and so on.



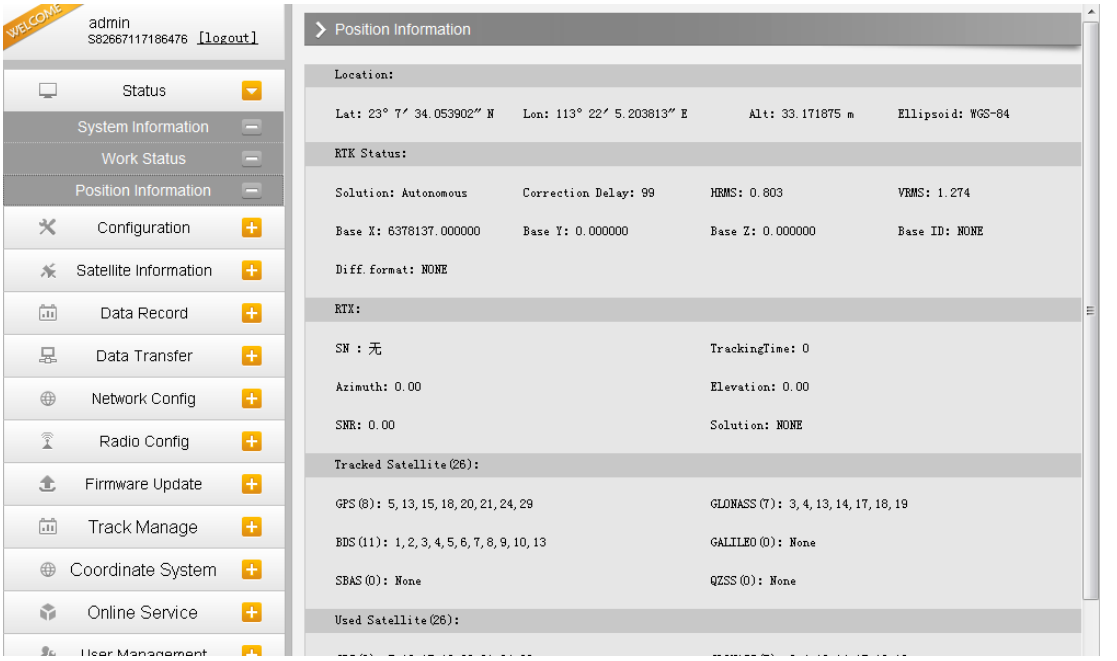
## Work Status

The physical state of K3 IMU such as working mode, datalink, host temperature, remaining power and the free memory is obtained from this page.




## Position Information

In this page, users can be clear at a glance on current position information and satellite information.

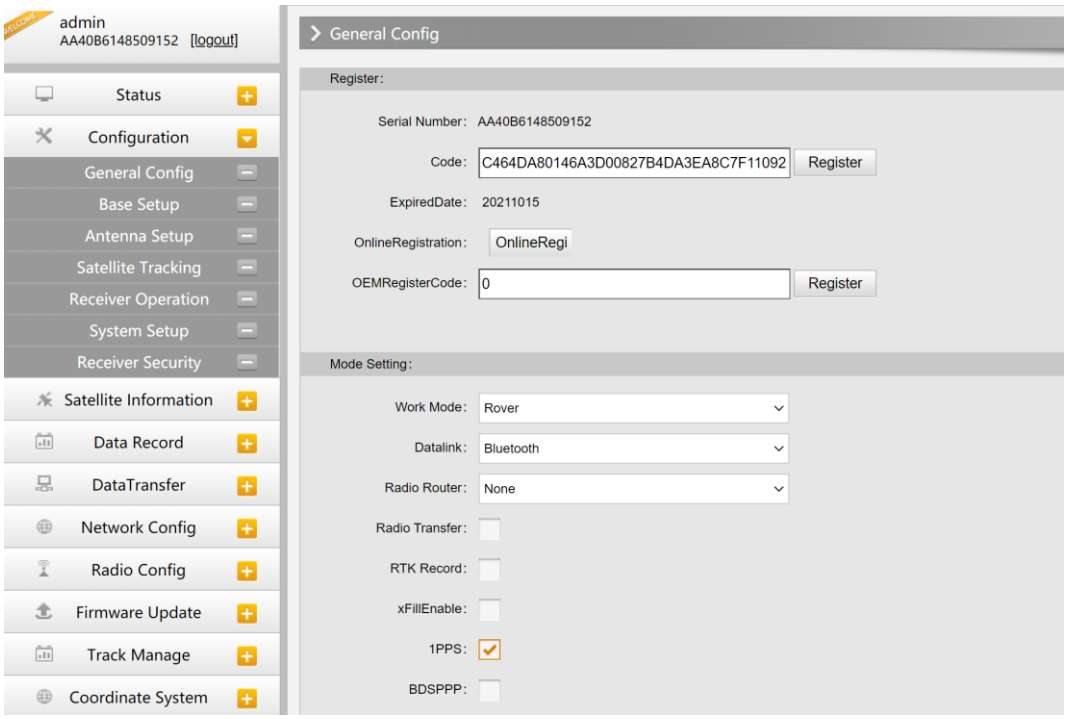


## §3.4.2 Configuration

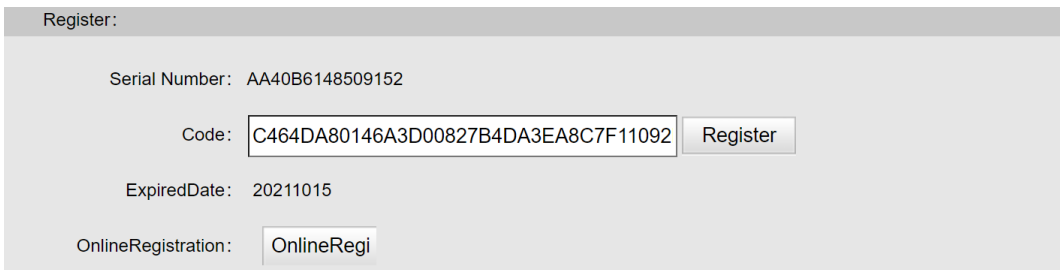
General Config, Base Setup, Antenna Setup, Satellite Tracking, Receiver Operate and Default Language are contained under Configuration menu. Users are able to configure all kinds of parameters for K3 IMU under Configuration menu, and all the settings are immediate effect after saving.

### General Config

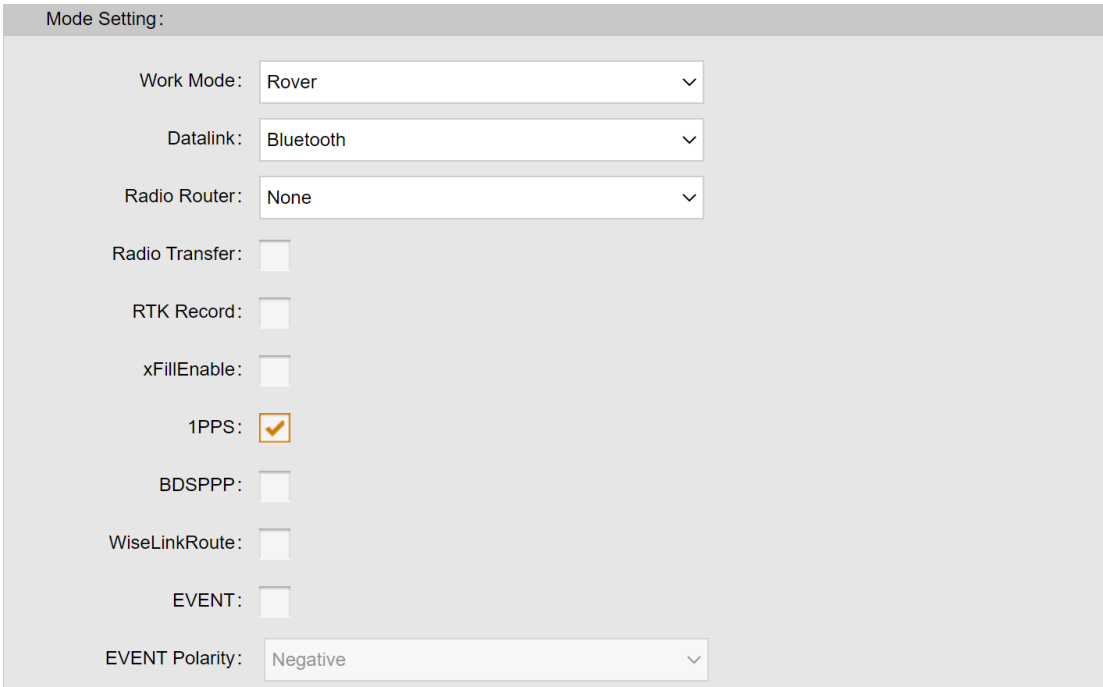
The registration for receiver working mode setting can be completed.




If K3 IMU is expired, please provide the serial number of your K3 IMU for us to apply for another available code, then input the code into the blank or register the receiver online.

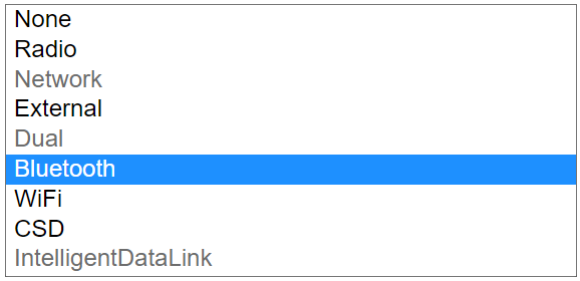


K3 IMU allows users to setup the working mode and datalink from this Web UI that only need the mobile phone or tablet PC is able to connect the wifi hotspot of K3 IMU.




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

**Datalink:** Pull down the list, there will be all kinds of options for datalink, such as radio, External, Bluetooth, WIFI and CSD.




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

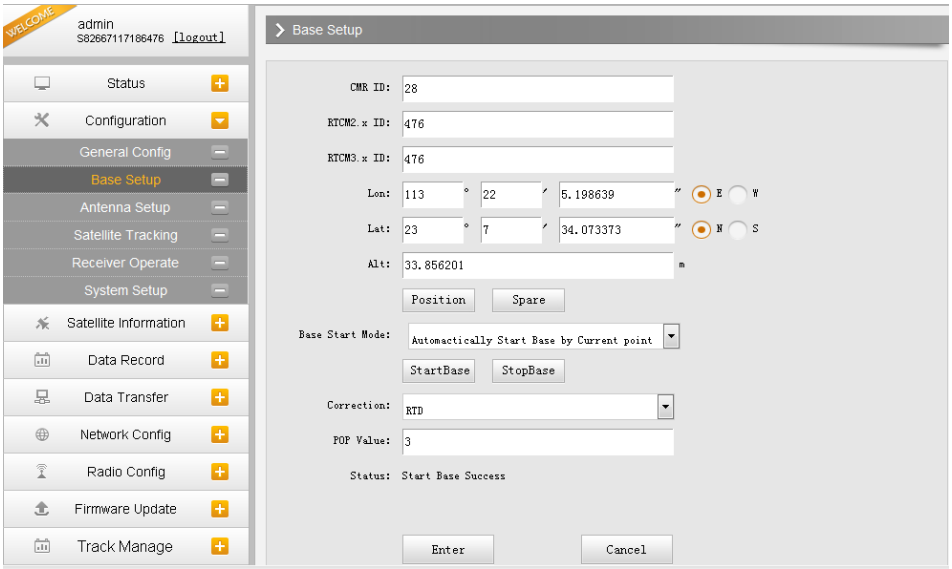
**1 PPS:** This option is for the 1 pulse per second output

**EVENT:** This option is for the EVENT marker input

**EVENT Polarity:** EVENT input method.

## Base Setup (works as an internet base station)

When K3 IMU works as Base station, 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.

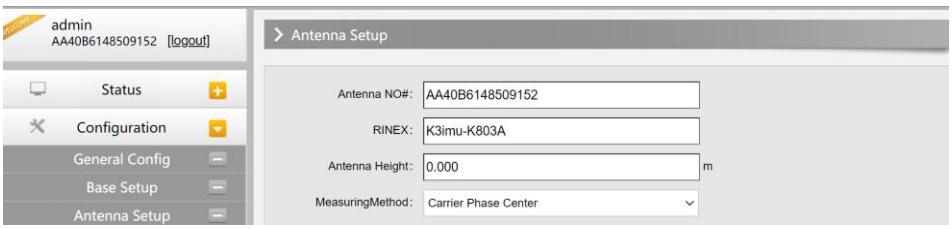
**Correction:** Here contains the global general used correction formats including RTD,RTCM23, RTCM30, RTCM32, CMR and SCMRx

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

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

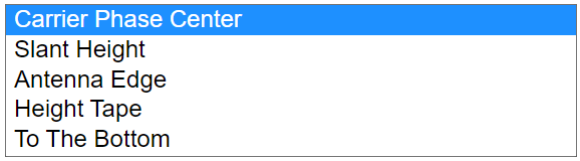
## Antenna Setup

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



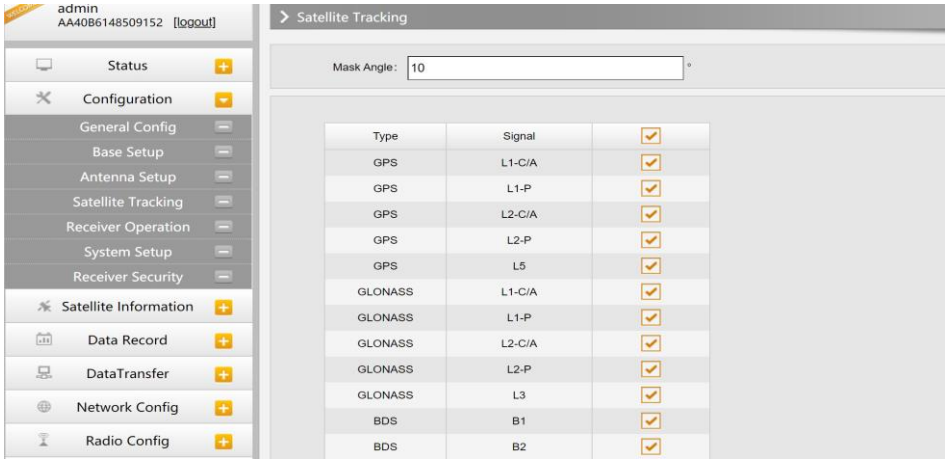
**Antenna Height:** This is the value for height of antenna while surveying.

**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.



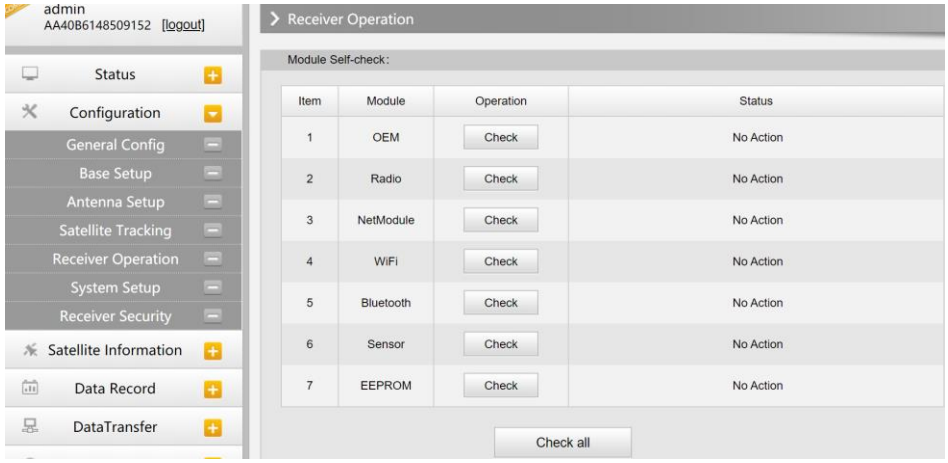

## Satellite Tracking

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 Operation

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.

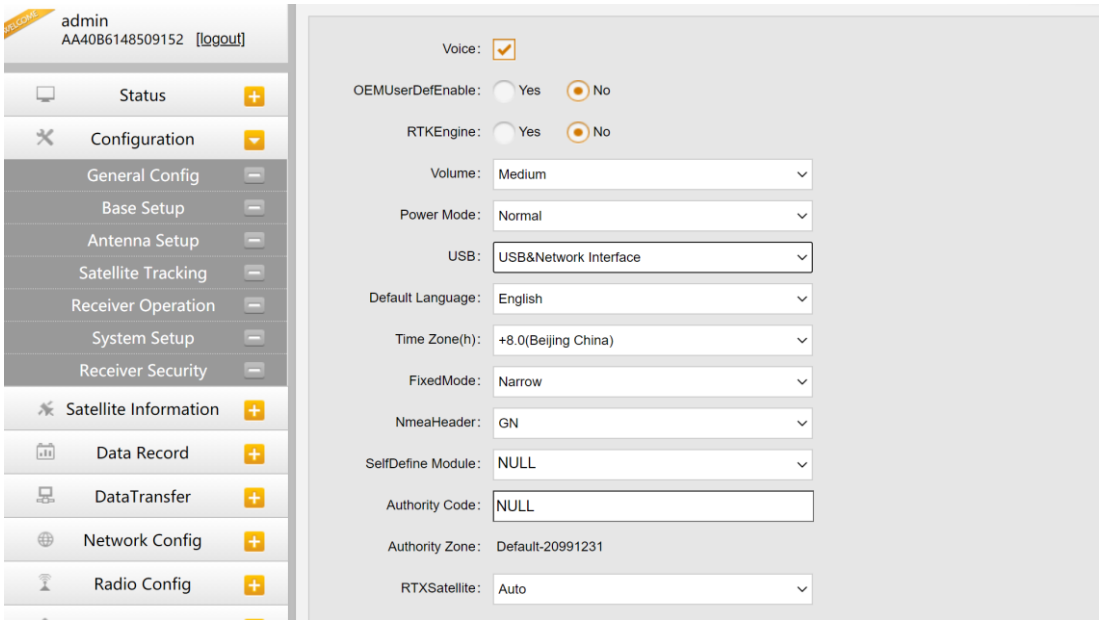
**Factory Default:** Click this button to bring the receiver back to factory default setting.

**Reboot:** Click this button to restart the receiver.

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

## System Setup

This page is used to control Voice prompt, volume of voice, power saving and the default language for receiver.




**Voice Prompt:** Check on this box to turn on the voice guide, uncheck it to turn off the voice guid.

V**oice Volume:** Define the voice volume for K3 IMU's speaker.

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

**USB:** The Type-c interface of K3 IMU is set to USB disk and network interface mode at the same time, no need to set up it for K3 IMU.When connected to the computer, you can open internal memory and runweb Ui at the same time for K3 IMU.

**Default Language:** Configure the default language for K3 IMU which associates with voice guid.

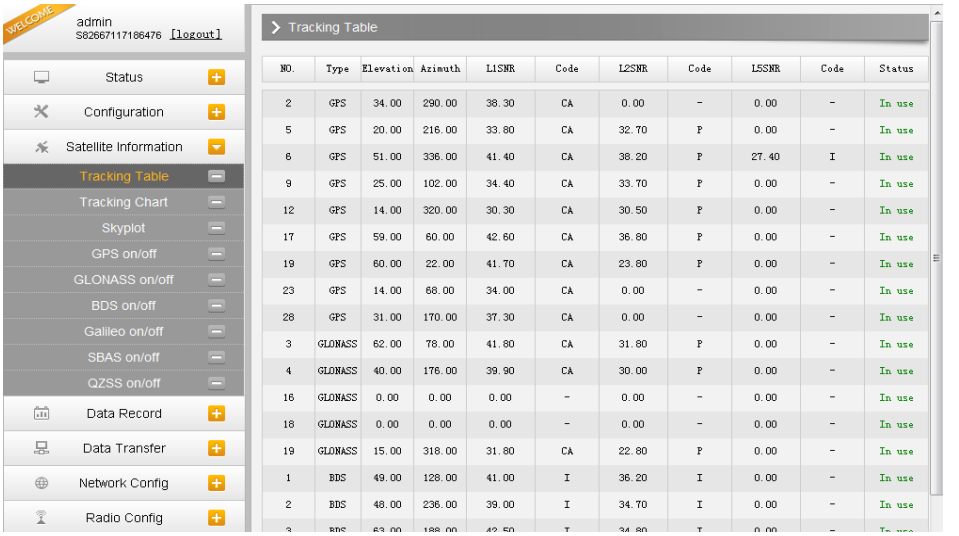
**Time Zone (h):** Use this to setup the corresponding time zone for your country or area.

# §3.4.3 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

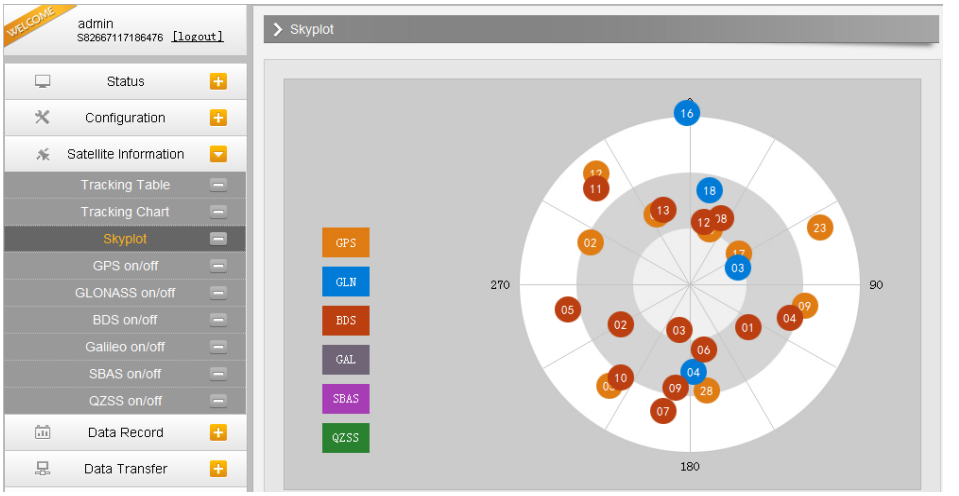
Here is the table to list all current used satellites and the other information for these satellites.




| NO. | Type | Elevation | Azimuth | L1SNR | Code | L2SNR | Code | L5SNR | Code | Status |
|---|---|---|---|---|---|---|---|---|---|---|
| 2 | GPS | 34.00 | 290.00 | 38.30 | CA | 0.00 | - | 0.00 | - | In use |
| 5 | GPS | 20.00 | 216.00 | 33.80 | CA | 32.70 | P | 0.00 | - | In use |
| 6 | GPS | 51.00 | 336.00 | 41.40 | CA | 38.20 | P | 27.40 | I | In use |
| 9 | GPS | 25.00 | 102.00 | 34.40 | CA | 33.70 | P | 0.00 | - | In use |
| 12 | GPS | 14.00 | 320.00 | 30.30 | CA | 30.50 | P | 0.00 | - | In use |
| 17 | GPS | 59.00 | 60.00 | 42.60 | CA | 36.80 | P | 0.00 | - | In use |
| 19 | GPS | 60.00 | 22.00 | 41.70 | CA | 23.80 | P | 0.00 | - | In use |
| 23 | GPS | 14.00 | 68.00 | 34.00 | CA | 0.00 | - | 0.00 | - | In use |
| 28 | GPS | 31.00 | 170.00 | 37.30 | CA | 0.00 | - | 0.00 | - | In use |
| 3 | GLONASS | 62.00 | 78.00 | 41.80 | CA | 31.80 | P | 0.00 | - | In use |
| 4 | GLONASS | 40.00 | 176.00 | 39.90 | CA | 30.00 | P | 0.00 | - | In use |
| 16 | GLONASS | 0.00 | 0.00 | 0.00 | - | 0.00 | - | 0.00 | - | In use |
| 18 | GLONASS | 0.00 | 0.00 | 0.00 | - | 0.00 | - | 0.00 | - | In use |
| 19 | GLONASS | 15.00 | 318.00 | 31.80 | CA | 22.80 | P | 0.00 | - | In use |
| 1 | BDS | 49.00 | 128.00 | 41.00 | I | 36.20 | I | 0.00 | - | In use |
| 2 | BDS | 48.00 | 236.00 | 39.00 | I | 34.70 | I | 0.00 | - | In use |

## Skyplot

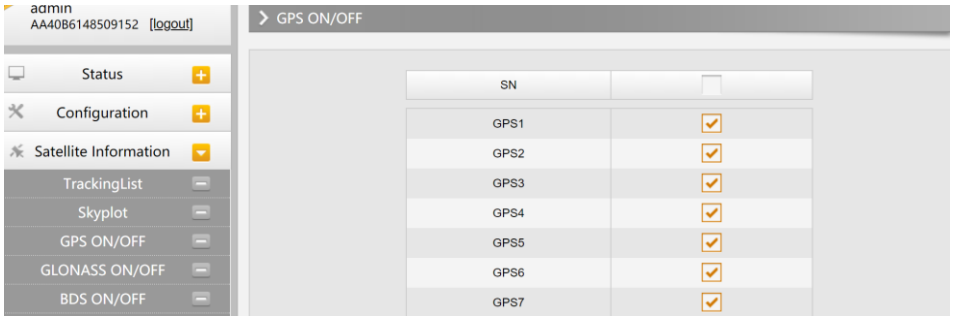
In this page, all the tracking satellires are shown on the skypolt, this let users intuitively view and know where the current position of satellite is.



### GPS on/off

For all the running GNSS constellations or the augmentation system,KOLIDA K3 IMU 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.

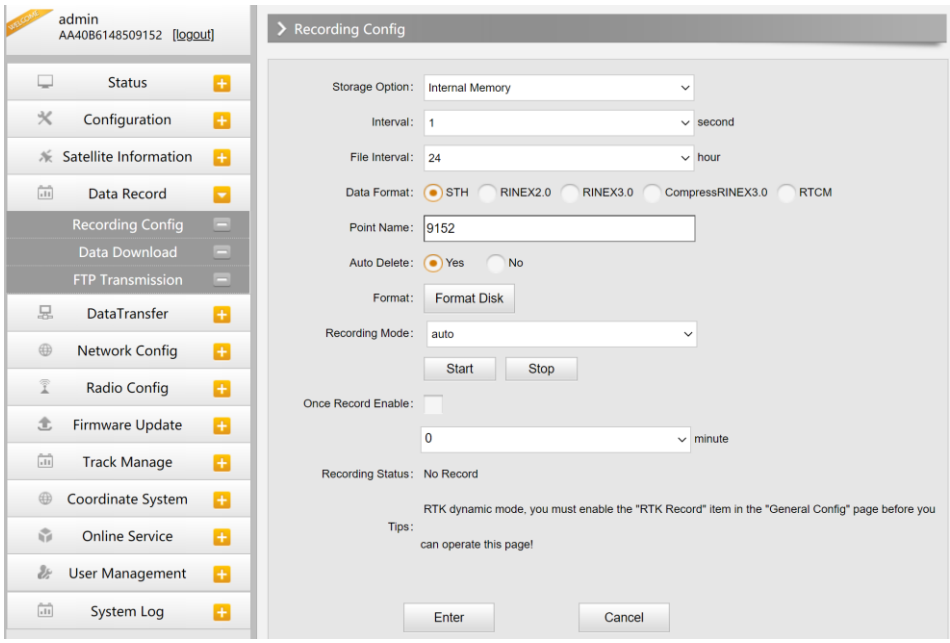



## §3.4.4 Data Record

The “Data Record” performance is mainly used to configure all the parameters for receiver in static mode. Much more operations can be done on KOLIDA K3 IMU 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, 20Hz sampling interval now is available for K3 IMU.

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

**Data Format:** Here are 3 options to selected for KOLIDA K3 IMU to store what kind of format data, 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:** This is used to configured KOLIDA K3 IMU to delete the previous data files automatically if the memory is full.

**Format:** Click this button to format the internal memory for KOLIDA K3 IMU.

**Recording Mode:** Here are 2 options to configure KOLIDA K3 IMU to record raw data automatically or not if it achieves the sampling conditions.

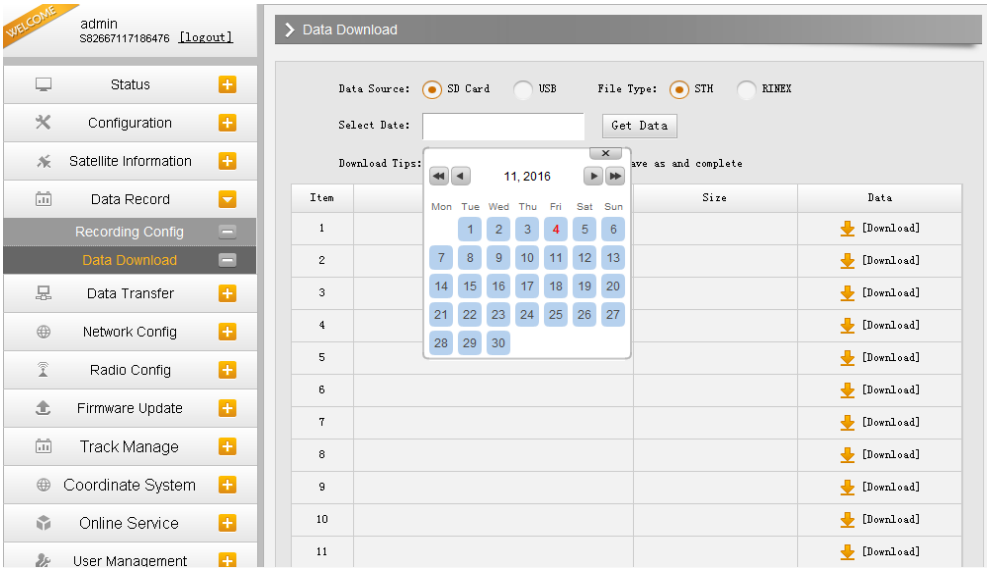
**Start/Stop:** Click these buttons to start recording or strop recording the raw data.

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

## Data Download

This page provides the data files to download.

Choose the storage where the static data recorded, and file type, then click on the blank of "Select Date" to choose what date the data was recorded and click "Get Data" button, all the files recorded in the date you choose will show in the table, tap download button to download the data files.

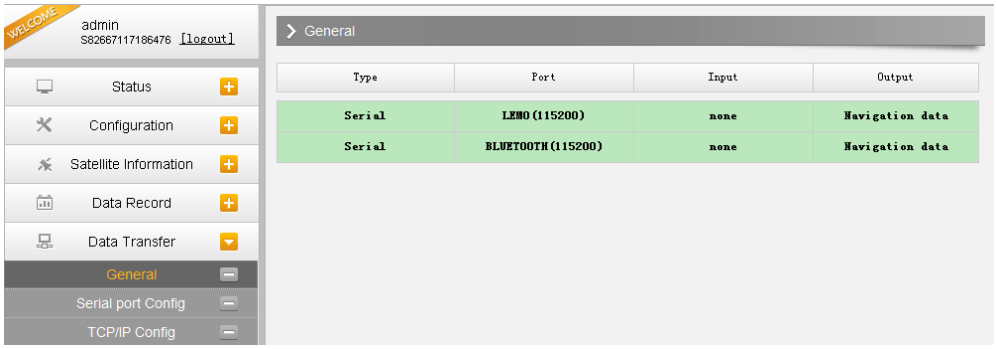


## §3.4.5 Data Transfer

This performance 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.

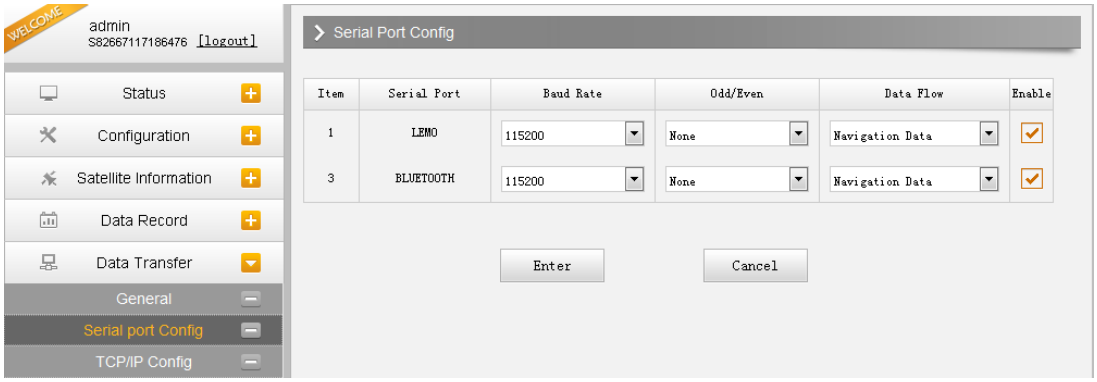
### General

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.

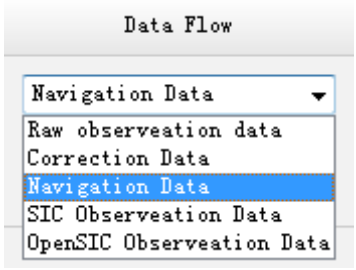
**Correction Data:** This is the correction data straight from OEM board.

**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.

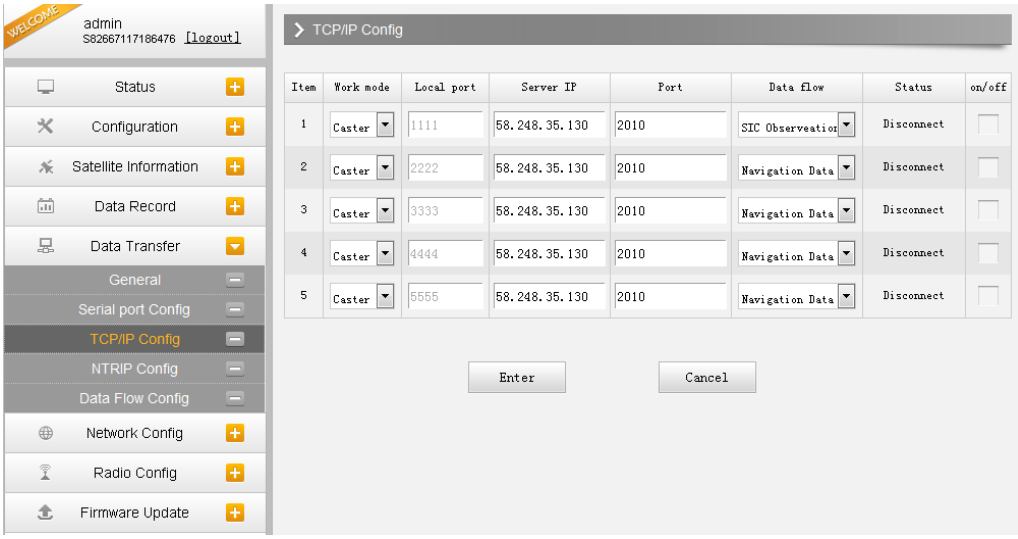



## TCP/IP Config

This is used to configured 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, KOLIDA K3 IMU will be a client to upload the data to a specify server if it connects to the internet by WIFI. 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.

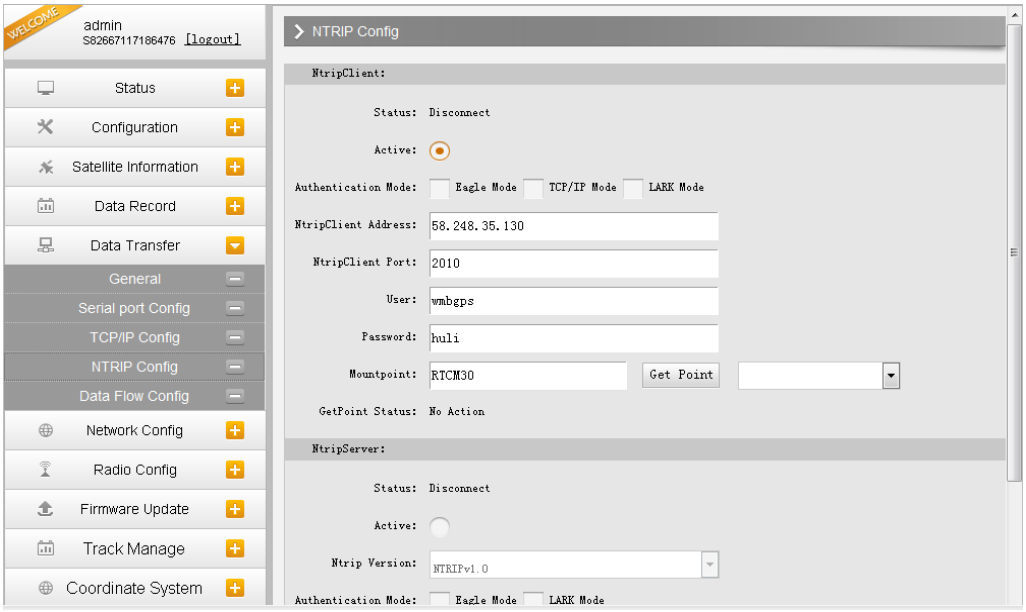
**Server:** KOLIDA K3 IMU will upload the data onto internet by the static WIFI if server is selected, then users are able to obtain its dynamic data by accessing to K3 IMU through the IP from receiver.




## NTRIP Config

This is used to configure the NTRIP performance while receiver is going to connect to internet. KOLIDA K3 IMU supports complete NTRIP performance including NTRIP Client, NTRIP

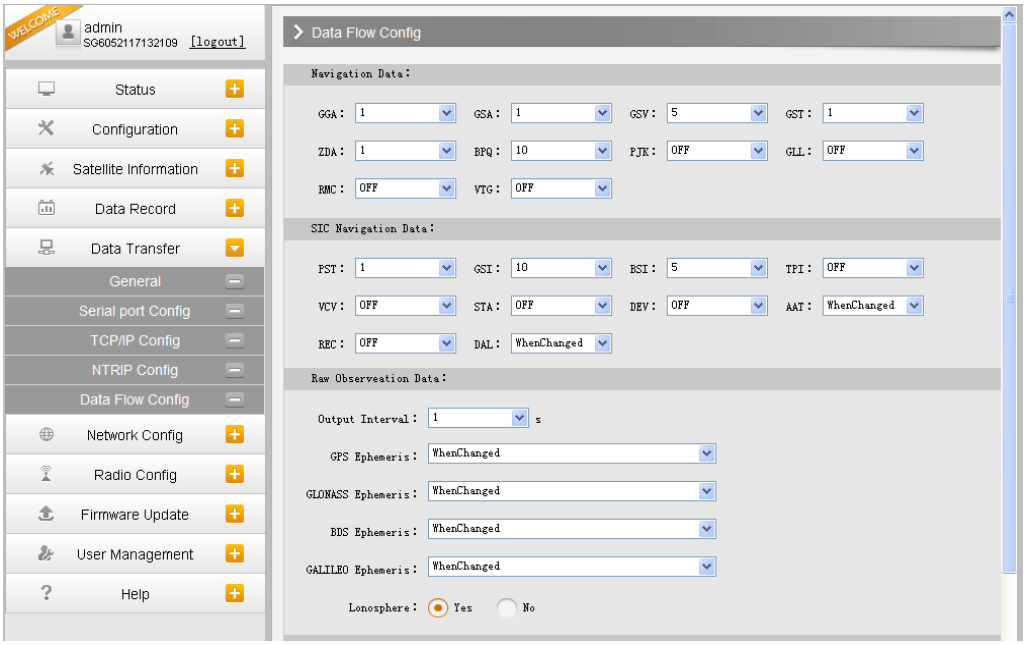
Server and NTRIP Caster.




## Data Flow Config

In this page, users can optionally 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



# §3.4.6 Network Config

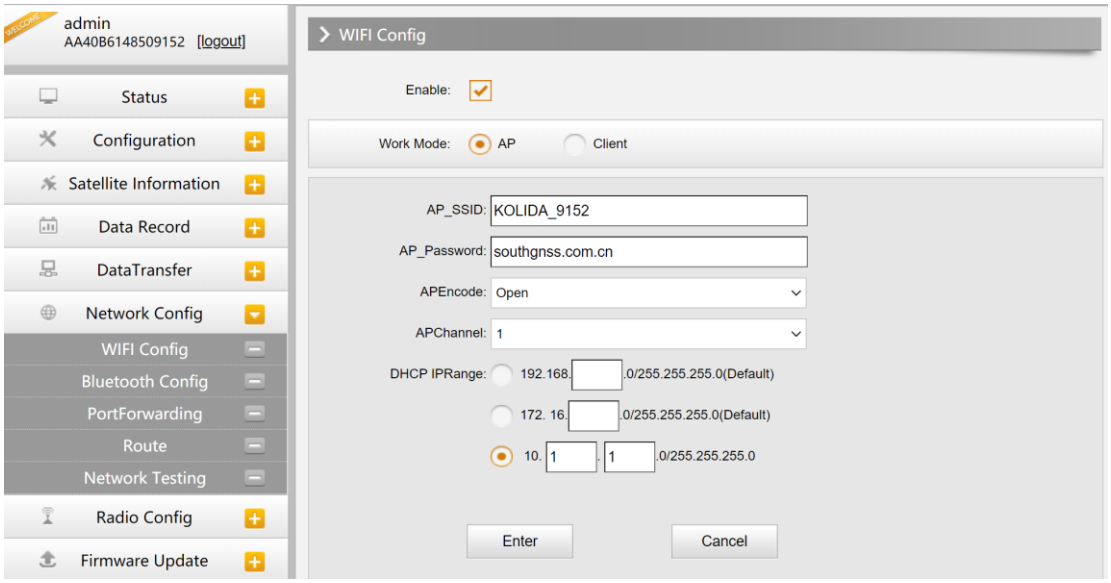
## WIFI Config

This is mainly used on the WIFI configuration for KOLIDA K3 IMU, there are AP mode and Client mode for optional.

**AP:** This is used to enable the WIFI hotspot for KOLIDA K3 IMU 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 KOLIDA K3 IMU, 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 KOLIDA K3 IMU 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.

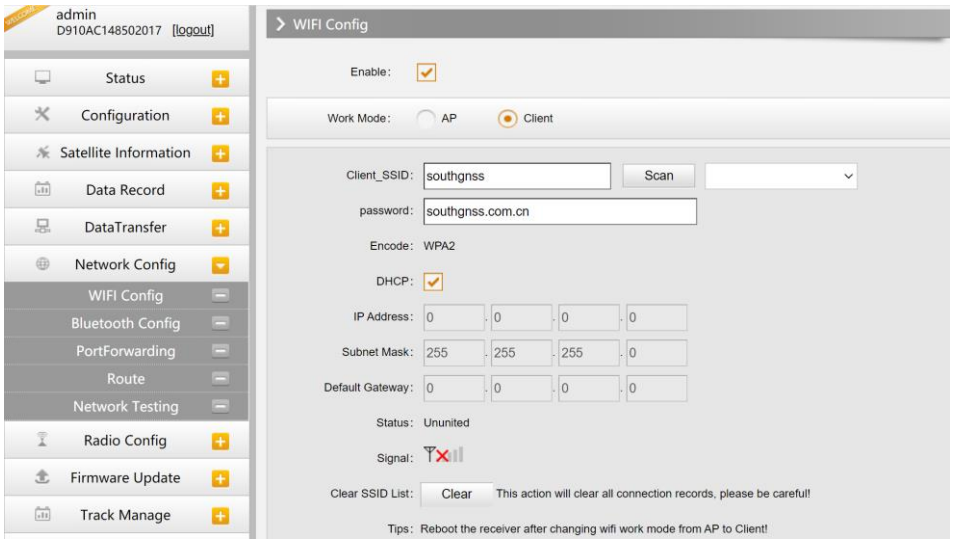
**Client SSID:** This is the WIFI hotspot which KOLIDA K3 IMU is going to connect

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

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

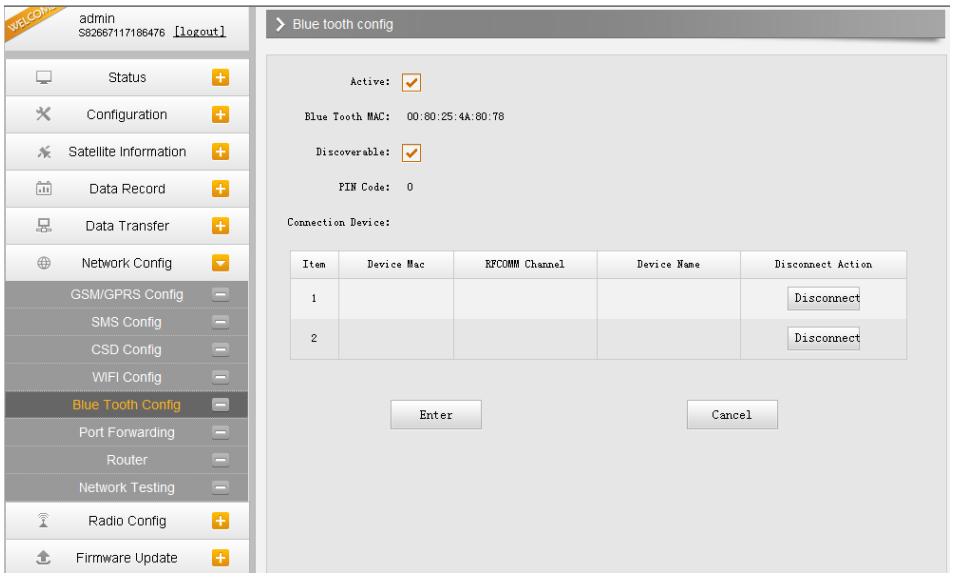
**IP fields:** If KOLIDA K3 IMU successfully connects to the WIFI, there will be an LAN IP address generated by KOLIDA K3 IMU.

**Clear SSID:** Click this button to clear the SSID list.



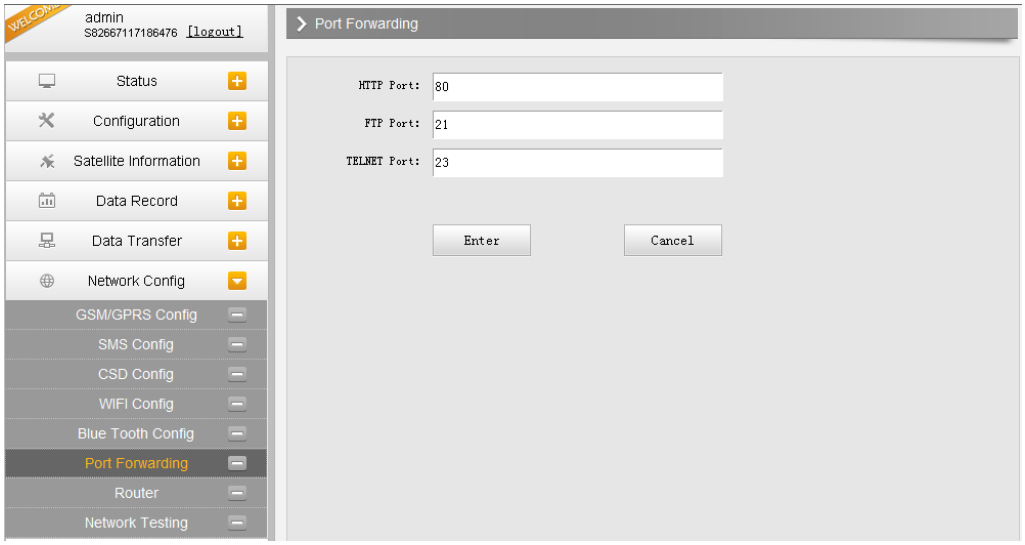

## Bluetooth Config

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.



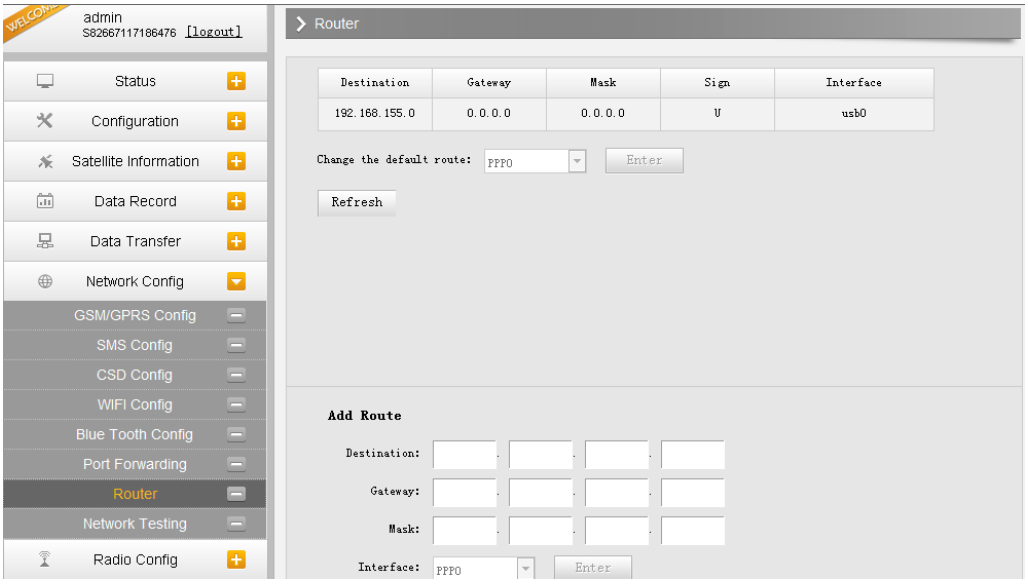

## Port Forwarding

This page is mainly used to view and configure the internet transmission port for KOLIDA K3 IMU, 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.



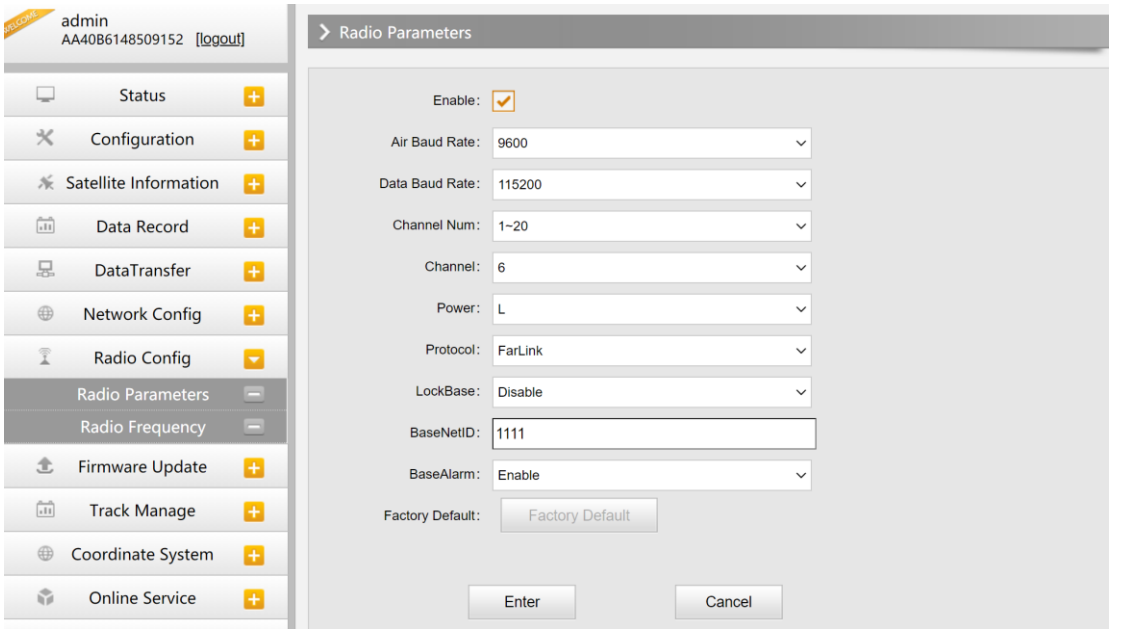

*NOTE: Usually we will keep the default setting in this page, if you would like to modify it, please contact with KOLIDA technician for more supports.*

## §3.4.7 Radio Config

As the name implies, the parameters of radio can be done in “Radio Config”, it is divided into Radio Parameter and Radio Frequency.

### Radio Parameter

This page is mainly used to configure the parameters for internal radio module of KOLIDA K3 IMU.




**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. The 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 115200, 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.

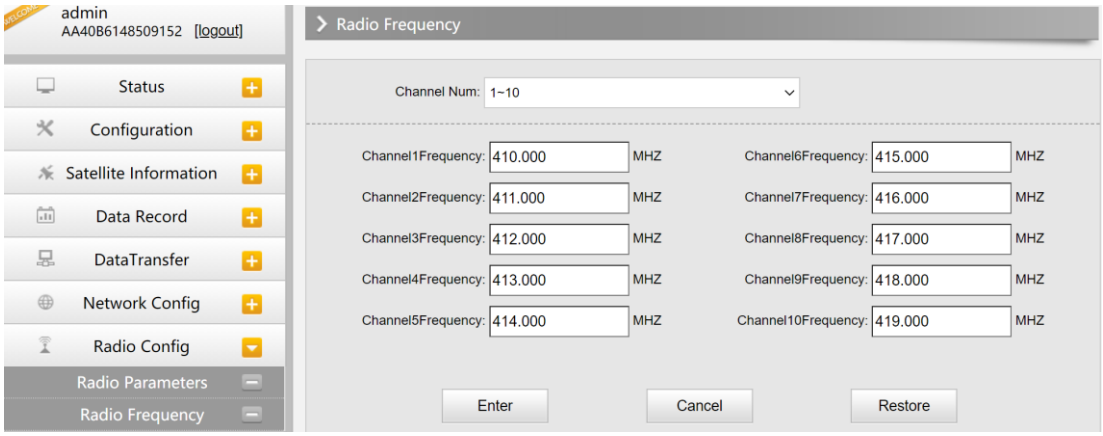
**Power:** This appears only in Base mode, the radio transmitting power is allowed to define in High, Middle or Low power.

**Protocol:** This is radio communication protocol for data transmission, SOUTH (KOLIDA ) ， Farlink 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.

**Factory Default:** Click this button to restore the factory default for internal UHF module.

### Radio Frequency

There are 10 (Farlink protocol) or 20 (other protocol) 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.




## §3.4.8 Firmware Update

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

### Firmware Update

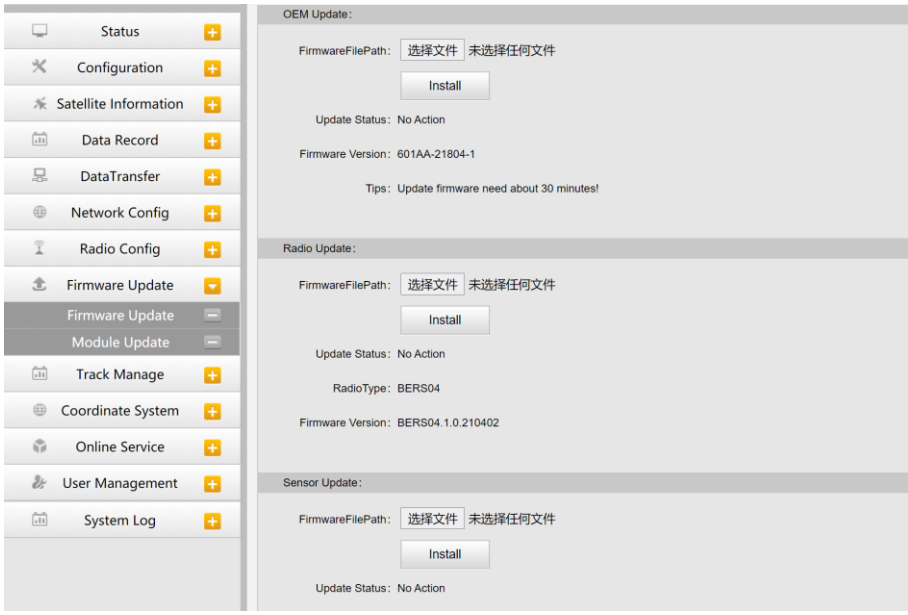
This page displays all the information of the firmware which current installed on KOLIDA K3 IMU, and allows to update the latest version firmware for receiver. To get latest version firmware please contact with KOLIDA technician.

**Online Update:**KOLIDA K3 IMU 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.

### Module Update

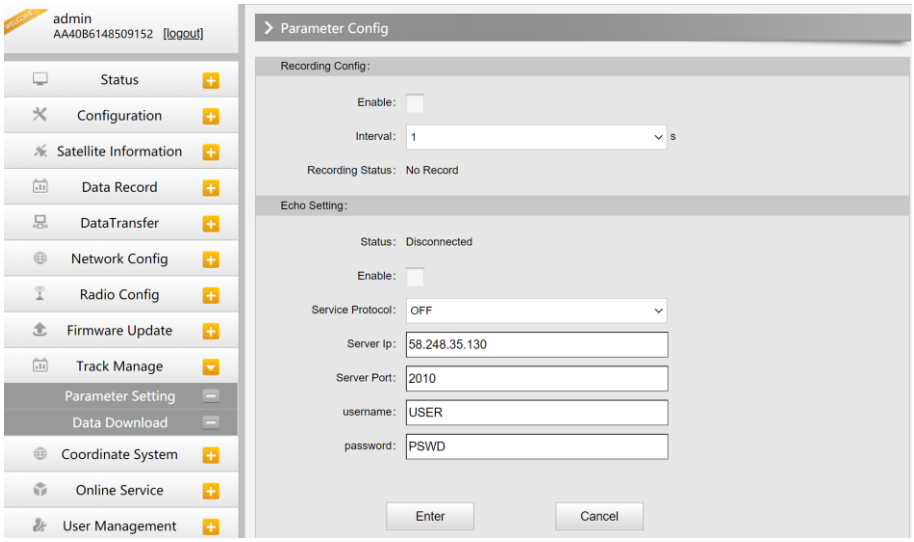
This page is used to update the firmware for corresponding modem such as OEM board, radio module and sensor.




## §3.4.9 Track Manage

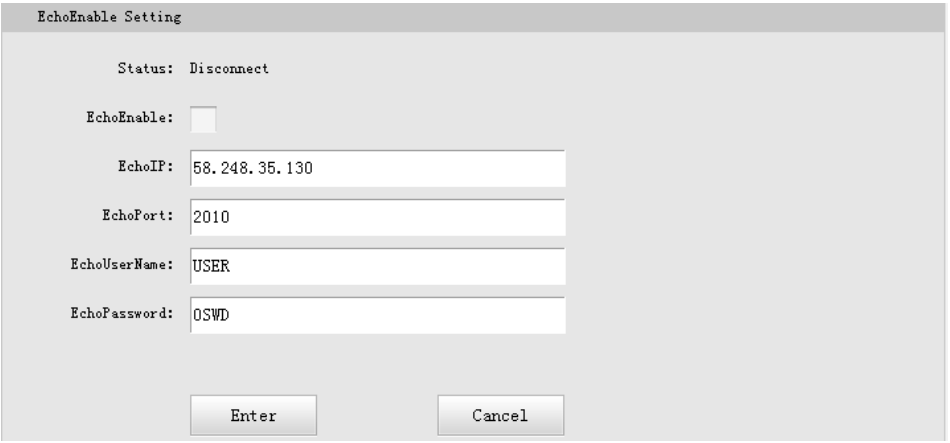
K3 IMU supports to record the track while doing measurement, and upload the data onto the server.

### Parameter Setting



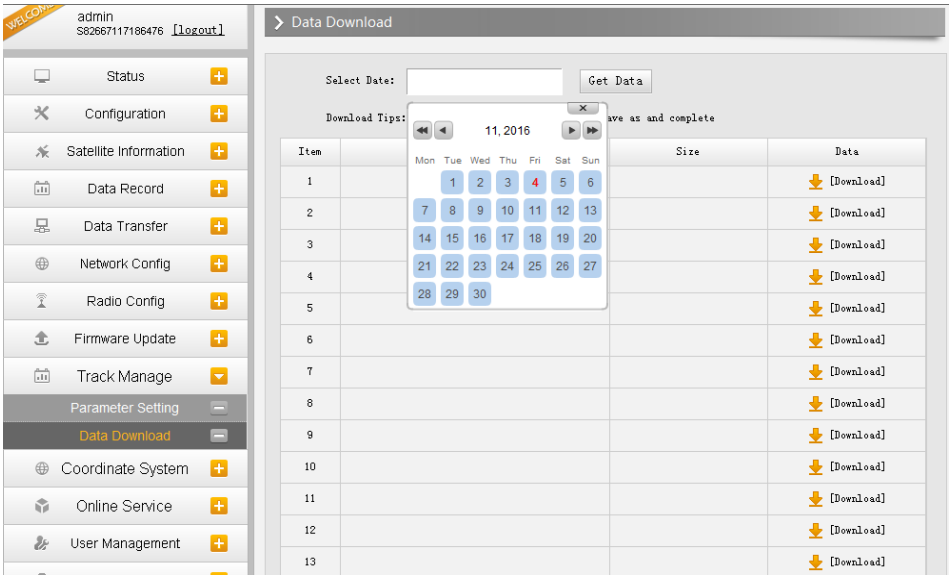
**Record Config:** Check on the box of “Record Enable” to activate track recording function, and choose a proper recording interval in dropdown list of “Record Interval”.

**Echo Config:** This configuration dialog is used to upload the recording data to a server in real-time.



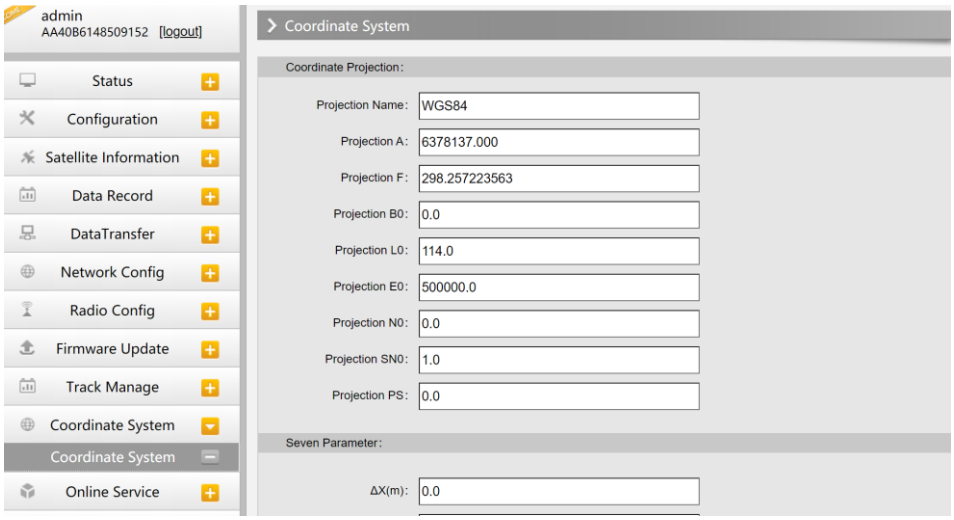

## Data Download

On this page, users can download the track data file from receiver. Choose the recording date and click “Get Data” to load all the data files recorded at that day, then choose the files and click download button.



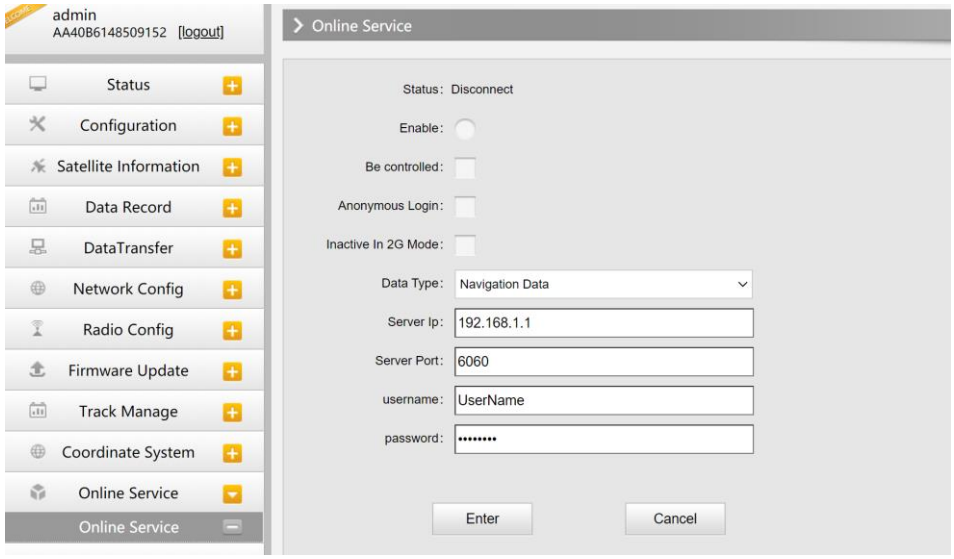
## §3.4.10 Coordinate System(reserve)

K3 IMU allows users to setup the local coordinate system on internal web UI management. The instrument would output the local coordinates according to this coordinate system.



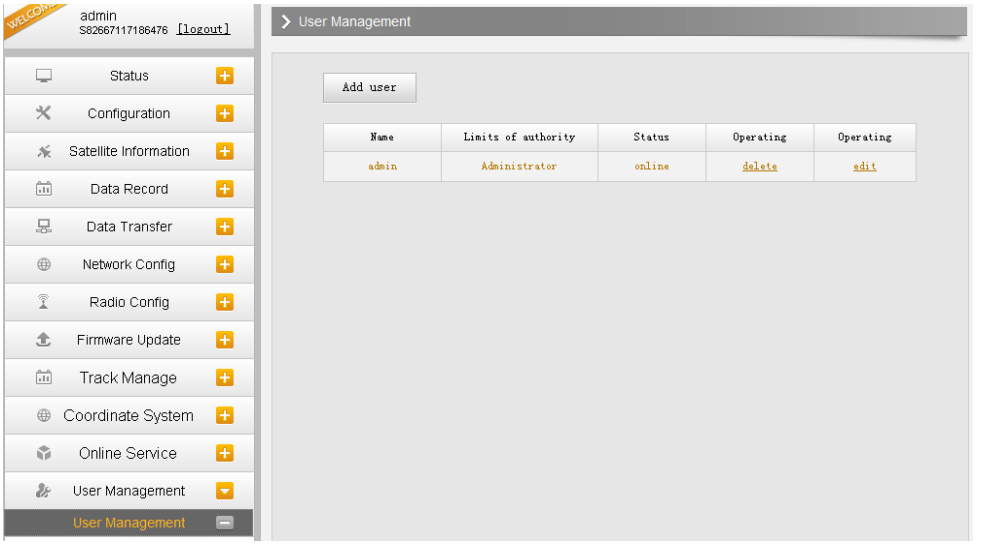

## §3.4.11 Online Service (reserve)

This function is to upload the data onto a server real-time, including Navigation data, raw observation data, correction data, SIC observation data and open SIC observation data.



## §3.4.12 User Management

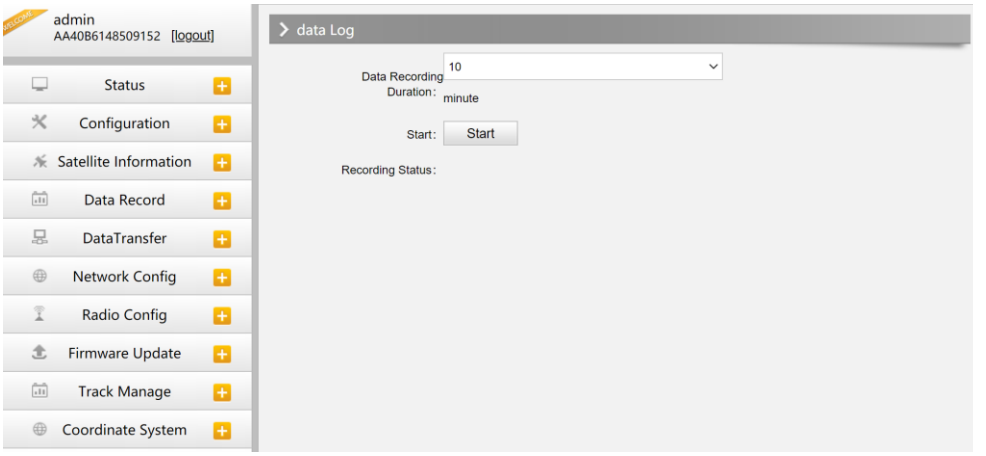
This page is used to manage the authority of login Web UI for users, including the username, password and add users.




## §3.4.13 System log

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.



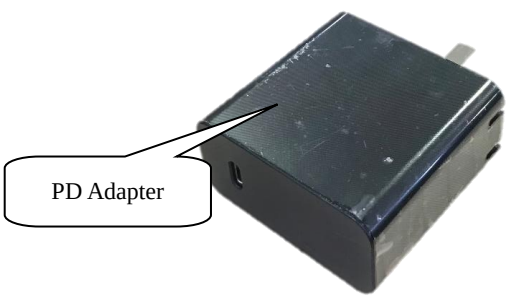
# ChapterⅣ Accessories

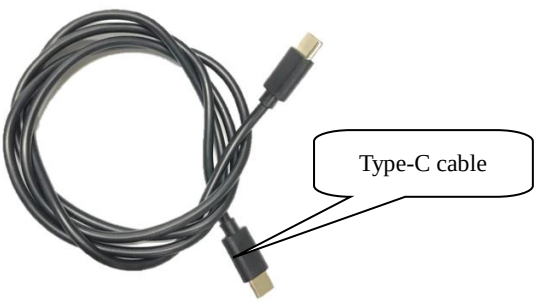
## §4.1 Instrument Case

The instrument case for KOLIDA K3 IMU contains two layers of packing: the inner layer is filled with anti-collision foam, the host and other accessories can be dispersed and embedded; the outer layer is a hard instrument case, sealing-strong, wear-resistant anti-wrestling. Compact, durable, can effectively prevent the impact, easy to clean.

## §4.2 Charger &Adapter

Equipped with a rechargeable internal battery, it uses a Type-c cable with PD adapter for the fast charging.



## §4.3 Differential Antenna

The UHF differential antenna is required to install to the interface at the bottom of receiver if KOLIDA K3 IMU is set up into internal UHF mode.

## §4.4 Cables

### Type-C data cable

The cable is to connect the receiver and the computer to transfer static data and upgrade the host firmware.

## §4.5 Other Accessories

Other accessories include carbon fiber pole, controller bracket, connector, tribrach, etc.

The model and type of instrument accessories will change with the upgrade of the instrument. The specific configuration can refer to accessories list.

# Appendix A: KOLIDA K3 IMU technical specifications

| GNSS Performance | |
|---|---|
| **Channels** | 965 |
| **GPS** | L1C/A, L2P, L1C, L2C, L5 |
| **GLONASS** | G1, G2, G3 |
| **BeiDou** | B1I, B2I, B3I, B1C, B2a, B2b |
| **Galileo** | E1, E5b, E5a, E6, E5AltBoc* |
| **QZSS** | L1C/A, L5, L1C, L2 |
| **SBAS** | L1, L5 |
| **IRNSS** | L5* |
| **L-Band*** | Reserved |

| Positioning Accuracy | |
|---|---|
| **Code Differential GNSS Positioning** | Horizontal: ±0.25m+1ppm<br>Vertical: ±0.50+1ppm |
| **SBAS Positioning** | Typically<5m 3DRMS |
| **Fast Static and Static** | Horizontal: ±2.5mm+0.5ppm<br>Vertical: ±5mm+0.5ppm |
| **Post Processing Kinematic (PPK)** | Horizontal: ±8mm+1ppm<br>Vertical: ±15mm+1ppm |
| **Real Time Kinematic (RTK)** | Horizontal: ±8mm+1ppm<br>Vertical: ±15mm+1ppm |
| **Network RTK (VRS, FKP, MAC)** | Horizontal: ±8mm+0.5ppm<br>Vertical: ±15mm+0.5ppm |
| **RTK Initialization Time** | 2-8s |
| **Positioning Rate** | 1Hz-20Hz |
| **Inertial Measurement** | Tilt Angle: up to 60 degrees<br>Accuracy: down to 2cm |

| Data Formats | |
|---|---|
| **Positioning Data** | NMEA 0183, PSIC, PJK, Binary Code<br>RTCM 2.1, RTCM 2.3, RTCM 3.0, |
| **Differential Correction** | RTCM 3.1, RTCM 3.2,CMR,CMR+ |
| **Static** | STH, Rinex 2, Rinex 3 |
| **Network** | Supported VRS, FKP, MAC, Ntrip |

| Operation Mode | |
|---|---|
| **Base** | Base External Radio\Base WIFI |
| **Rover** | Rover UHF\Rover Bluetooth |
| **Static** | Static\PPK |

| UHF Radio Chracteristics | |
|---|---|
| **TX\RX** | Only Receiving |
| **Frequency Range** | 410-470MHz |
| **Protocols** | Farlink\Trimtalk\SOUTH(KOLIDA) |
| **Channels** | 60 channels for Farlink protocol<br>120 channels for other protocols |

| Hardware | |
|---|---|
| **Size** | 137mm*60mm |
| **Weight** | 690g |
| **Data Storage** | 8GB SSD internal storage<br>Support external USB storage (up to 32 GB)<br>Automatic cycle storage<br>Changeable record interval<br>Up to 20Hz raw data collection |
| **Communication** | 4 Indicator lights<br>1 Button<br>1 Type C USB port<br>1 5-PIN LEMO external power port<br>1 UHF antenna port<br>Soc System<br>WEB UI<br>WIFI: 802.11 b/g/n standard<br>Bluetooth 4.2 standard and Bluetooth 2.1+EDR<br>NFC<br>Supported USB, FTP, HTTP data communication |
| **Voice Guide** | Intelligent voice technology provides status indication and operation guide<br>Chinese, English, Korean, Russian, Portuguese, Spanish,Turkish and user define |
| **Environment** | Operating: -30°C to +70°C<br>Storage: -40°C to +80°C |
| **Humidity** | 100% condensation |
| **Ingress Protection** | IP68 waterproof, sealed against sand and dust |
| **Shock** | Survive 2m pole drop on concrete |

| Power | |
|---|---|
| **Battery** | 7.2V, 5000mAh unremovable battery |
| **Battery Life** | 12-15 hours |
| **Fast Charge** | 4 hours charge to full power |
| **USB charge** | Type-c USB/Power Bank |

# Appendix B 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 makes 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.