FORA® GNSS
ADVANTAGES OF A LEADER

GEOBOX FORA 20H

GNSS RESEIVER



MANUAL

Contents

Introduction....3
Chapter 1 Introduction to 20H PRO Full-Featured RTK....3
1.1 Introduction....3
1.2 Product Features....3
1.3 Usage and Precautions....3
Chapter 2 Geobox Fora 20H RTK System....4
2.1 Geobox Fora 20H Receiver....4
2.2 Geobox Fora P3 Data Controller....8
2.3 External UHF Radio....8
2.4 Receiver Accessories....9
Chapter 3 Field Surveying in SurPad....12
3.1 Connecting 20H to the Controller....12
3.2 Project Management....13
3.3 Points Database and Import....13
3.4 File Export....14
3.5 Localization....15
3.6 Rover Mode....15
3.7 Base Mode....16
3.8 Static Mode....16
3.9 Point Survey and Stakeout....17
3.10 Measurement with a slope....18
3.11 SurPad registration....19
Chapter 4 WebUI Application....20
4.1 Position Status....20
4.2 Setting....20
4.3 Download....21
4.4 Management....22
4.5 Static Recording....22
4.6 Instrument Registration....22
Appendix 1 20H Mainframe Specifications....23
Appendix 2 P3 Specifications....24
Appendix 3 UHF Radio Appendix 3 UHF Radio Settings....25

Chapter 1 Introduction to Geobox Fora 20H Full-Featured RTK

1.1 Introduction

Welcome to Geobox products. As a technology leader in GNSS RTK instrument manufacturer, the company is committed to providing the most advanced GNSS measurement tools.

This manual is applicable to Geobox Fora 20H product and explains how to install, set up and use the RTK system. Even if you have used other RTK products of our company, in order to get a better experience, we recommend that you read this manual carefully before use.

Geobox Fora 20H is an ultra-miniaturized GNSS receiver of Geobox brand. It adopts a brand-new design, magnesium alloy structure, and supports GPS, GLONASS, Galileo and Beidou satellite systems to meet the accuracy requirements of modern measurement, providing reliable measurement results and friendly User operation brings you the perfect user experience.

1.2 Product Features

- 1408 channels, Full constellation system supports GPS, GLONASS, Galileo, Beidou and other satellite navigation system
- Convenient and small
- Full magnesium alloy body design
- Smart dual battery, support hot swap
- Built-in full-band radio, 4G Netcom network
- IMU Surveying
- Waterproof, dustproof, shockproof design
- Built-in combination antenna, zero phase center difference
- Onboard 8G memory
- A-RTK, ATLAS (Pay-for-use)

1.3 Usage and Precautions

Transportation:
During the transportation of the instrument, make sure that the instrument and its accessories are properly placed in a professional instrument box to prevent direct shock and vibration to the instrument. Special attention is paid to the fact that the Geobox Fora 20H equipment box contains a lithium-ion battery during transportation, need to ensure compliance with relevant national and international regulations.

Storage:
When storing the instrument, it is necessary to strictly comply with the temperature limit; the battery of the device should be discharged to 30% or less before being stored; the device should be charged again before being used again after being stored; the instrument should be kept dry before being stored and used. Store in an environment and set the temperature within a reasonable range to reduce battery self-discharge.

Clean and Air-Dry:
Use a clean, soft, lint-free cloth to clean the surface of the instrument. If necessary, clean it with a cloth dampened with clean water. In all weather conditions, after the field operations are returned, they should be open the instrument box in a warm, dry place, remove the hand book and receiver from the container, dry it, and then repack it; ensure that all connector plugs are clean and dry, and that the dust caps can be covered under the dry conditions.

Chapter 2 Geobox Fora 20H RTK System

Geobox Fora 20H System consists of four main parts: Receiver, Data Controller * with SurPad field software *, external UHF Radio 35W * and Accessories. Receiver Geobox Fora 20H is based on the UniStrong system. The following sections introduce the four parts.

* - supplied optionally

2.1 Geobox Fora 20H Receiver

2.1.1 Receiver Appearance

Receiver Size is 156mm*76mm, weight 1.2kg. The appearance is shown in Fig. 1 and Fig. 2. The front side of the main unit is a control panel, which consists of a power button and four indicator lights. The bottom of the main unit is UHF antenna and wired cable interface.



Figure 1



Figure 2

2.1.2 Bottom Interface

The S/N of the receiver is affixed to the bottom label of the instrument. The bottom interface is shown in Fig. 3, and the protective plug covered on the bottom of the instrument is used for the dustproof and waterproof of the external interface.



Figure 3. Bottom

TNC connector: Connect the internal radio antenna.

5-Pin Lemo interface: used to connect external power supplies and external radio stations.

7-Pin Lemo interface: used to connect a PC for data copy (USB port), firmware upgrade (serial port).

2.1.3 Control Panel

The control panel is shown in Fig. 4.



Figure 4. Control Panel

The function description of the power button and indicator is shown in Table 1.

Table 1 Indicator function description

LED	Status&Meaning	Details
Power Button 	Boot Shutdown Broadcast Status Self-Check	Boot: Short press once Shutdown: Press and hold the power button to hear whether or not to shutdown the Receiver, press briefly to shutdown Short press once: Broadcast current working mode and status Self-Check: Press and hold the power button, and hear
Satellite 	Satellite (Green&Red)	Unlit: Not searched satellite Red Flashing: less star search and not positioned Flashing green: Positioning but not fixed Green light: Fixed Alternating linking green&red lights: Abnormal
DataLink 	DataLink (Green&Blue)	Green light: Data link settings are normal Green flashing: Normal data transmission received Blue flashes: Static model data collection
Power 	Power (Green&Red)	Steady green light: Power 30%-100% Green flashing: Power 10%-30% Red flashing: Power <10%, voice broadcast beep ...
Bluetooth 	Bluetooth (blue steady) Controller Network (blue flashes)	Steady light: There is a device connected to Bluetooth Off : No device connection Flashing: Device connected and transmitting differential data

2.1.4 Mode Checking and Switching

a. Model Checking

In the power on state, tap the power button to voice broadcast the current working mode and data link.

b. Model Switching

After the Receiver computer is turned on, connect the Receiver computer (or other device) to the Receiver computer to set and switch the Receiver operating mode.

2.1.5 Receiver Self-Check

The self-check function mainly predicts in advance whether each module of the receiver is working properly. You can use the self-test feature to detect the receiver when the Geobox Fora 20H receiver's indicator is off or a module is not working properly.
The Geobox Fora 20H receiver self-checking part includes GNSS, radio, network, WiFi, Bluetooth, and voice announcement detection results during the self-test. Self-check operations and results are shown below:

a. When the receiver is turned on, press and hold the power button until the voice broadcast “Close the device” and release the power button, press and hold the power button again until you hear a beep, and voice announcement “start self-test” loose.
Open the button, release the button and the receiver enters the self-test state (the new machine is best self-tested once).

b. In the receiver self-check process, each module will have a voice broadcast inspection result. If the module test is successful, the voice announcement is "successful" and the indicator lights until the self-test is completed. If there is a failure of the module self- test, the voice broadcast will fail the self-test of the current module, the module indicator will flash continuously, and the buzzer will sound continuously until the user restarts the receiver. The self-test process lasts approximately 1 minute. If the self-test fails, contact your local dealer.

c. If the lights of each module are on without flashing, there will be a voice announcement for each module to work properly

2.2 Geobox Fora P3 Data Controller (supplied optionally)

2.1.1 Receiver Appearance

Geobox Fora P3 Data Controller size is 230mm*87mm*22.7mm with build-in multi-function physical keyboard and Android 11 operating system . Also P3 supports WiFi, Bluetooth, and mobile network communication. It has a wide range of applications in data communication and 13 MP camera for photo-fixation objects of survey. The controller is equipped with a USB-C connector for data transfer and charging, a slot for a nano-SIM card and a TF memory card.



Figure 5. Controller Front



Figure 6. Controller Rear



Figure 7. Controller Side

2.2.1. SurPad software (supplied optionally)

Field software for making a full range of geodetic works and control of the 20H receiver.

2.3 External UHF Radio (supplied optionally)

TRU35 smart radio station is an Rx/Tx high-power data transmission radio. It has a waterproof rating of IP65 and is of a rugged and durable construction. It is ideally suited for field use under various weather conditions.

TRU35 Smart Radio（Fig. 8） weighing about 1.5kg, it has five LEDs, one digital tube, and three buttons to make it easier for users to boot, switch channels, power levels, low-voltage alarms, and indicate the current operating channel.

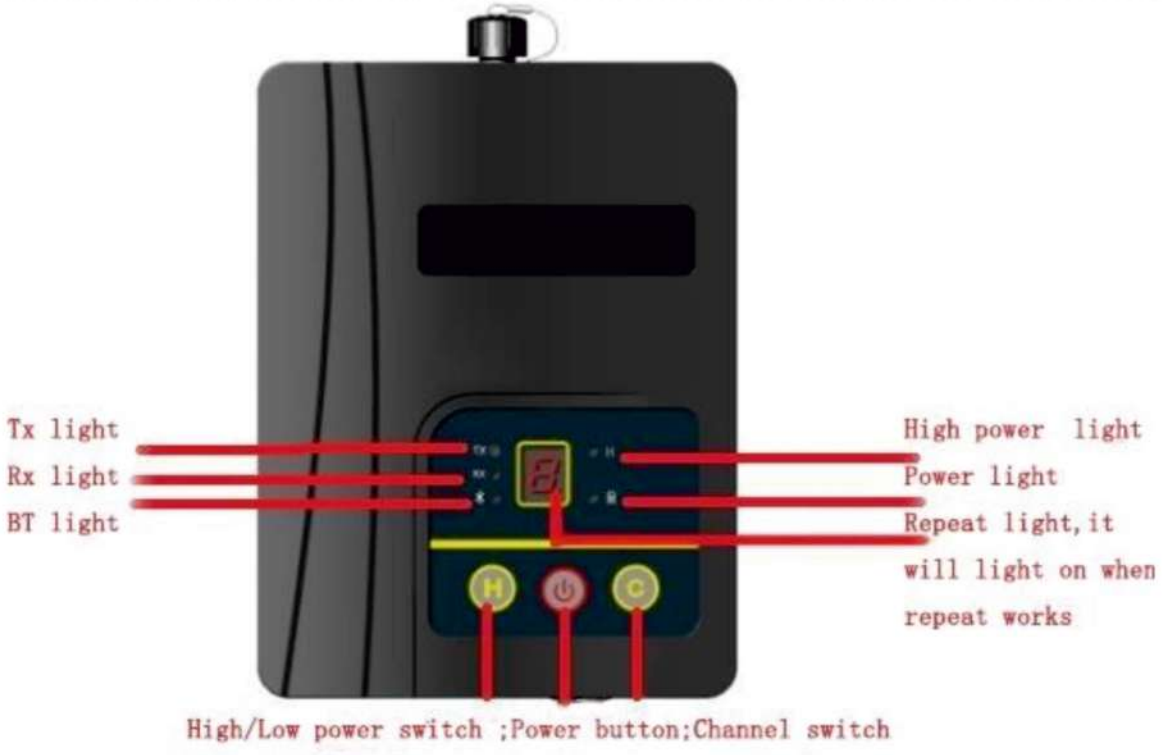


Figure 8. TRU35 Smart Radio

2.4 Receiver Accessories

2.4.1. Batteries

The 20H receiver is equipped with two smart batteries with a charge level display on their case of 3400 mAh each. Hot swapping of batteries is supported to continue working after changing the battery without having to turn off the receiver.



Figure 9. Batteries

2.4.2 Charger

The 20H main unit uses two removable batteries, which can be charged using the charger, as shown in Fig. 10.



Figure 10. Charger

2.4.3 UHF Differential Antenna

When the receiver selects the internal radio mode it needs UHF differential antenna, as shown in Fig. 11.



Figure 11. UHF differential antenna

UHF antenna has three models covering three frequency bands, as shown in Table 5.

Table 5 UHF Antenna Model Description

Model	QT410A-1	QT440A-1	QT450A-1
Frequency(MHz)	410~430	430~450	450~470

2.4.4 7-pin serial cable (supplied optionally)

The 7-pin serial port on one end of the 7-pin serial cable is used to connect the RTK receiver, and the USB port and DB9 port on the other end are used for data transmission with the receiver and the data controller respectively, as shown in Fig. 12.



Figure 12. 7-pin Serial Cable

2.4.5 Other Accessories (supplied optionally)

Other accessories include extension rod, bracket, adapter, trays, and tape measures.



Figure 13. Extension Rod



Figure 14. Bracket



Figure 15. Adapter



Figure 16. Tray



Figure 17. Tape Measures

Chapter 3 Field Surveying in SurPad

To perform work on the 20H, use the SurPad field software installed on your controller (the controller and SurPad software are available optionally on customer request)

GPS Control network design principles

1) In order to ensure continuous tracking and monitoring of satellites and the quality of satellite signals, it is necessary to open the sky above the receiver, the height of obstacles in the field of view should not exceed 15 degrees.

2) In order to reduce or avoid interference of electromagnetic waves with satellite signals, the station should be far away from high-power radio transmission sources (such as television stations, radio stations, microwave stations, etc.), and there should be no nearby objects (such as large buildings) that strongly reflect satellite signals.

3) The control points must be securely fixed, have a stable foundation and be stationary.

3.1 Connecting 20H to the Controller

Press [Device] -> [Communication] (Fig. 18), enter the device connection interface. Select the manufacturer (Geobox), RTK device type (Fora20HNT), communication mode (Bluetooth or WiFi), click [Search]. Browse the list of devices, select the appropriate device serial number, and click [Connect] (Fig. 19). After successfully connecting the device, it will return to the main interface.

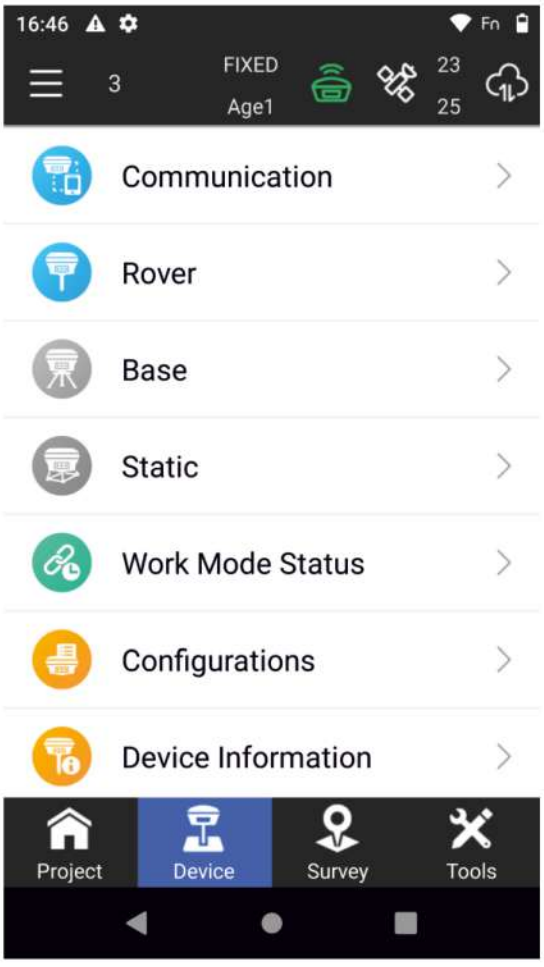


Figure 18

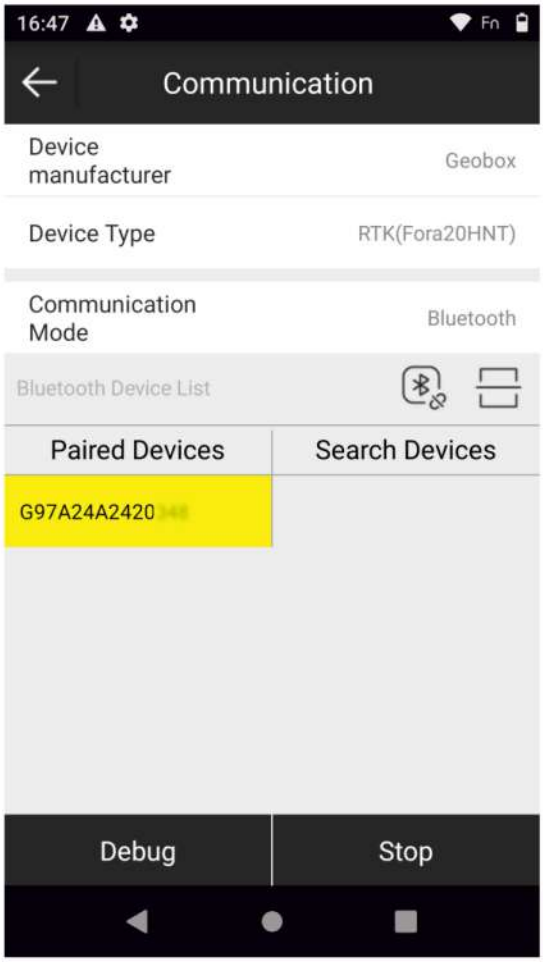


Figure 19

3.2 Project Management

After successfully connecting the receiver, press [Project] -> [Project manager] (Fig. 20). Click [New] to create a new project and set the coordinate system parameters (Fig. 21).

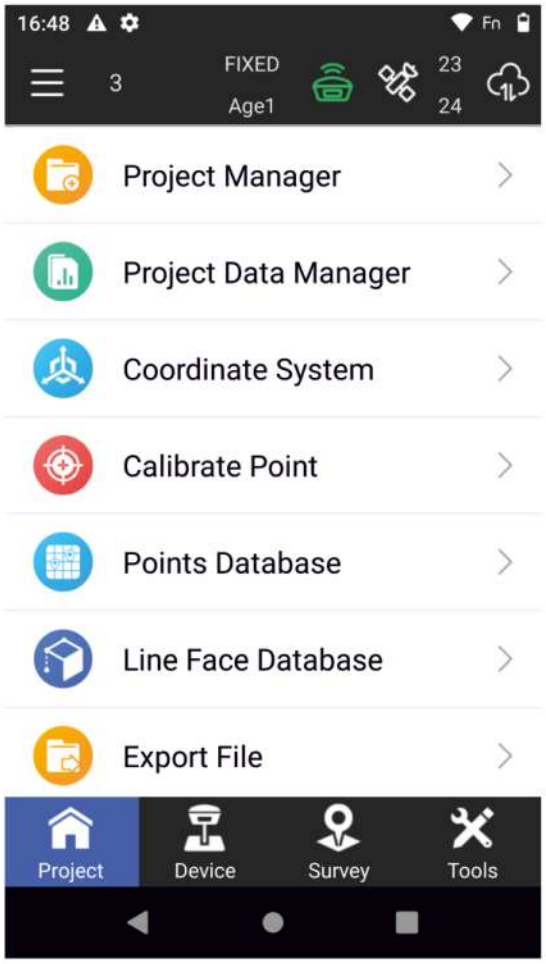


Figure 20

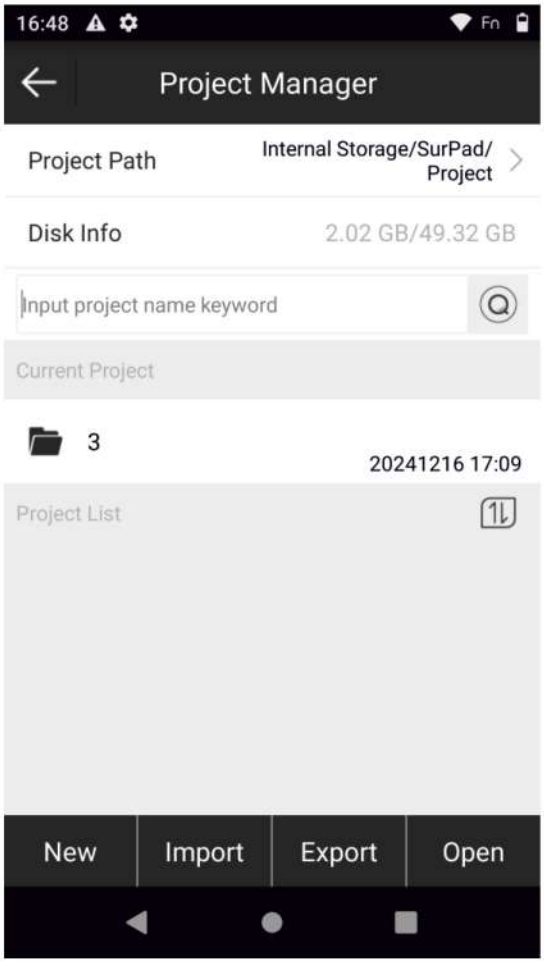


Figure 21

3.3 Points Database and Import

Click [Project] -> [Points Database]. Here you can add, edit, delete and import points (Fig. 22).

Click [Add], you can manually enter the name of the point, the code and the coordinates (Fig. 23).

Select a coordinate point, press [Edit], you can edit and change the name and code of the point; Select a point (hold on the screen), the [Delete] function will appear, you can delete the point, you can also select several points or all points [Select all] for batch deletion.

Click [Import] in the lower right corner of the screen, the import menu will open. You can customize the format of the imported file by clicking [Format manager], the format editor opens. You can import text or CAD files.

Click [...] in the lower right corner of the Point Library screen, a list of operations will appear - Delete, Recover, Share and Export.

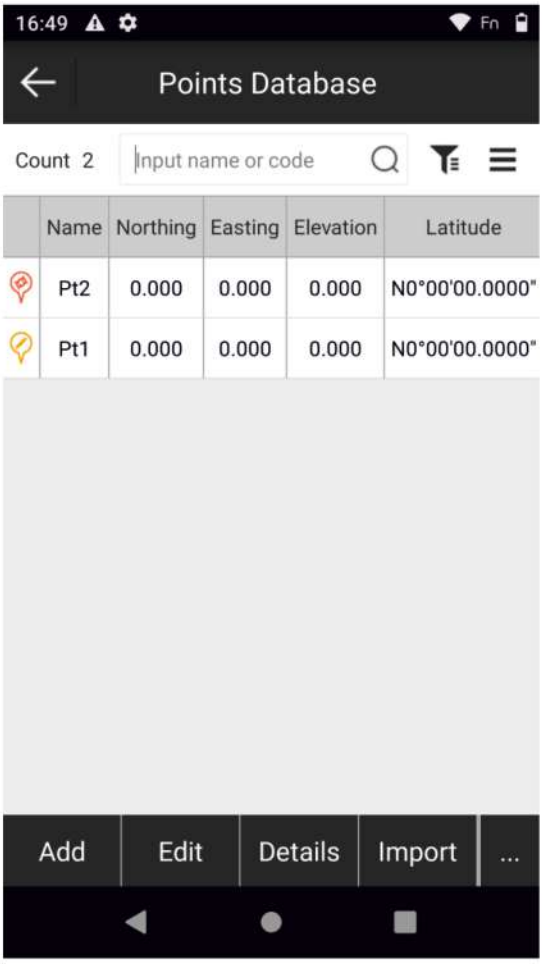


Figure 22

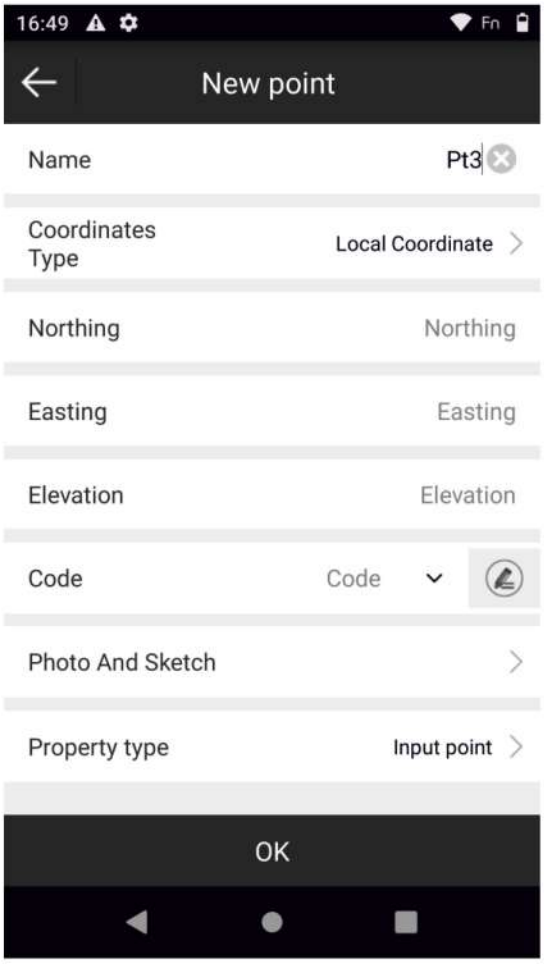


Figure 23

3.4. File Export

Click [Project] -> [Export File], select the data file to export, the type and format of the file.
You can set up your format for export via the menu [Format manager] (Fig. 24).
You can export text or CAD files.

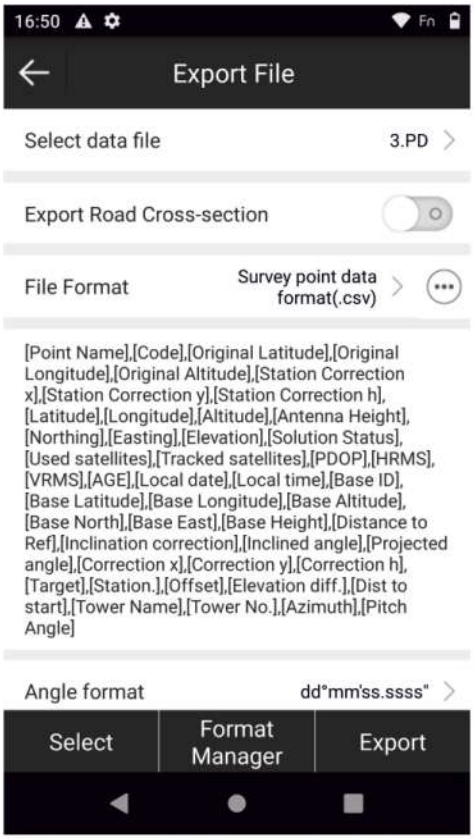


Figure 24

3.5 Localization

If you have coordinate parameters, you can directly set the values of the coordinate system.
You can also use control points. To add control points manually, click [Project] -> [Point Database] -> [Add] -> [Property type] -> [Control point].
Click [Tools] in the main menu -> [Localization], select control points and click [Calculate].

3.6 Rover Mode

Press [Device] in the main menu -> [Rover] (Fig. 25). In order for the GNSS receiver to receive a high-precision solution (Rover station), it is also necessary to receive a signal from another nearby GNSS device with a fixed position (Base station).

The following options are available to start work: Phone Internet, Device Internet, Internal Radio, External Radio (Fig. 26).

To use the Internet of the Controller, install a SIM card in it or connect to a Wi-Fi network, to use the Internet in the device, install a Sim card at the 20H. A valid RTK subscription is required to work in these modes.

Set the elevation mask in the range of 5 – 15° for an open area or 10 – 15° when shooting in a relatively wooded or built-up area. Choose NTRIP in Connect mode and enter CORS Settings received from the Differential correction Provider.

Internal or External Radio. To work in Radio Mode, you will need a second receiver as a Base (see §4.8)

Attention: when working in this mode, a radio antenna must be installed.

It is necessary to ensure that the Protocol and Frequency of rover correspond to the protocol and frequency of the transmitting station (Base station) so that data can be received.

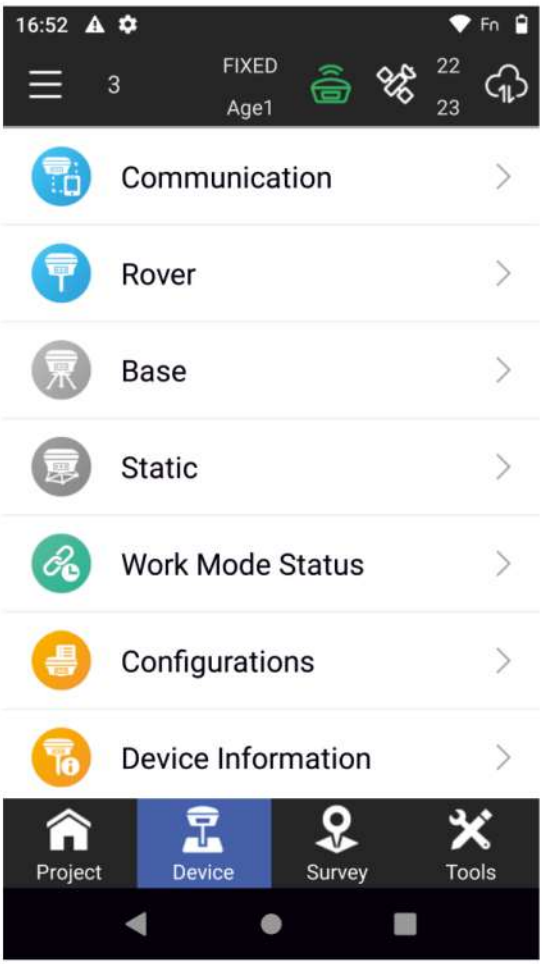


Figure 25

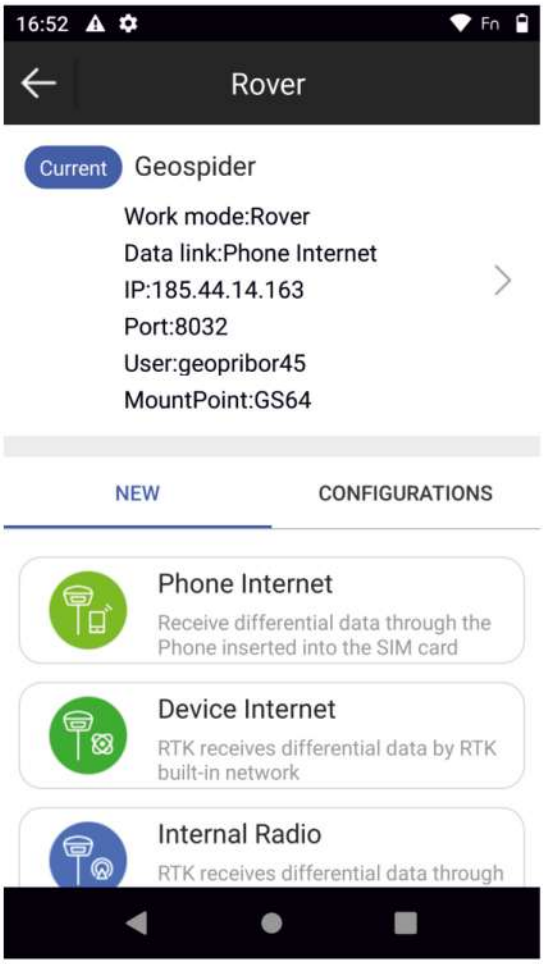


Figure 26

3.7 Base Mode

Geobox Fora 20H can become a Base station.
Click [Device] in the main menu -> [Base].
The following options are available: External Radio, Device Internet Connection, Internal Radio, Dual, Bluetooth (Fig. 27).
In these modes, the Base receiver will distribute corrections to the Rover receiver.
The Base receiver must be fixed on a tripod.

For working in Internal Radio mode radio antenna must be installed.

Set the elevation mask for Base station in the range of 5° (recommended).
For internal and external radio mode it is necessary to ensure that the Protocol and Frequency of the Base station correspond to the Protocol and Frequency of the Rover so that data can be received.
Fora 20H can also broadcast amendments over the Internet.

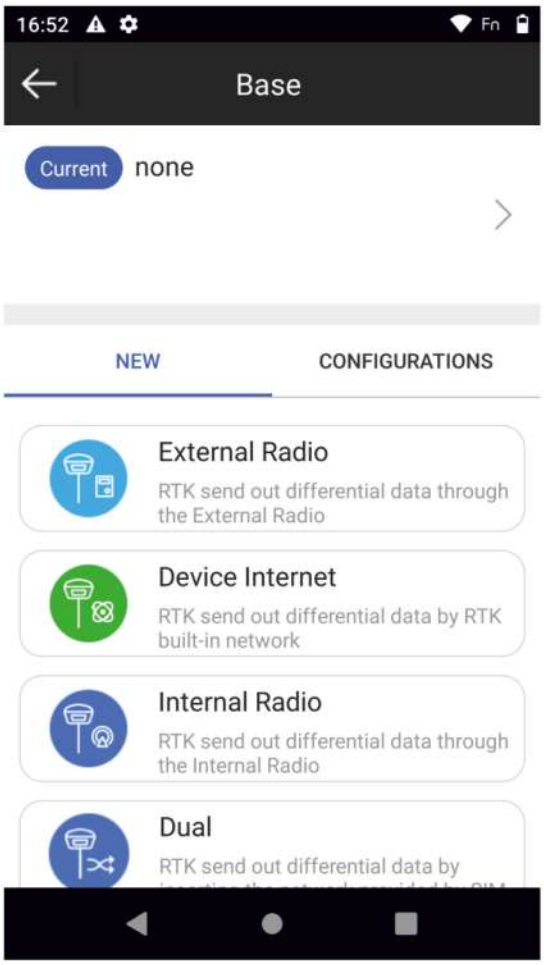
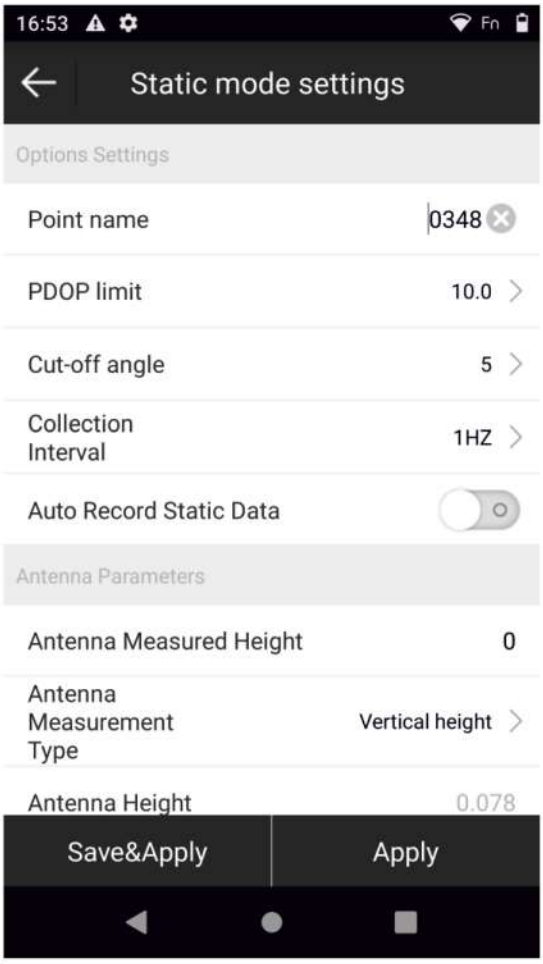


Figure 27

3.8 Static Mode

For static recording go to [Device] -> [Static] -> Apply, also you can configurate Static Mode here (Fig. 28). Download file you can in WebUI (see §4.5). The 20H must be fixed on a tripod. Set the elevation mask in the range of 5° (recommended). Collect static data and then data should be transferred to the program for post-processing.

Figure 28



3.9 Point Survey and Stakeout

Click [Survey] -> [Point Survey] to enter the point measurement interface (Fig 29). You will be taken to the shooting screen (Fig 31).

At the top of the interface, you can view the current positioning accuracy of the receiver (H: horizontal accuracy, V: altitude accuracy), the status of positioning information (SINGLE – only by satellite signals, DGNSS, FLOAT, FIXED – by satellite signals with clarification of differential corrections), Age (age of correction) and the number of visible and used satellites. The name of the point that was shot is shown at the bottom of the interface, click on the shooting button (a large button with a punch, freely movable on the screen) to enter the point settings, set the point name, the point name recording template and the default code.

The parameters displayed on the bottom of the display are configurable. To do this, hold down the bottom panel for a few seconds, a selection window will appear:

N - North coordinates, E - East coordinates, Elev - Altitude, PDOP, Base Distance, etc. Select the necessary items.
The toolbar on the left side of the screen contains a number of icons, including: centering the screen, connecting the map layer, enabling the tilt measurement mode (see §3.10), entering the height of the milestone, and others.

To adjust the height parameter of the device (antenna), click the "receiver height measurement" icon and enter the height of the milestone in Antenna Parameters menu.
The menu options on the left side of the screen are configured via the Toolbar settings (the lower right icon of the settings on the screen).

The right side of the screen contains the following icon for selecting the type of point: Topo, Control, Quick and Auto. For each type, you can configure the accuracy parameters and measurement averaging (recording a point in 1 step or averaging a series of points), to do this, click the settings icon at the bottom right of the screen, having previously selected the desired point type. There are also scaling icons on the right, CAD menu for working with drawings, point libraries, settings, etc.

To place points on the terrain (split points), select [Survey] -> [Point Stakeout]. In the menu that opens, you can set the coordinates of the takeaway point manually or import a text file (Fig. 30).
To stake out points and objects directly from the CAD file, select [Survey] > [CAD] and upload the dxf file.

For surveying or staking out in RTK set the elevation mask (in the rover settings) to 10-15, control the following parameters on the surveying screen: the type of solution is FIXED, PDOP is at least 3, the delay age is no more than 5 seconds.

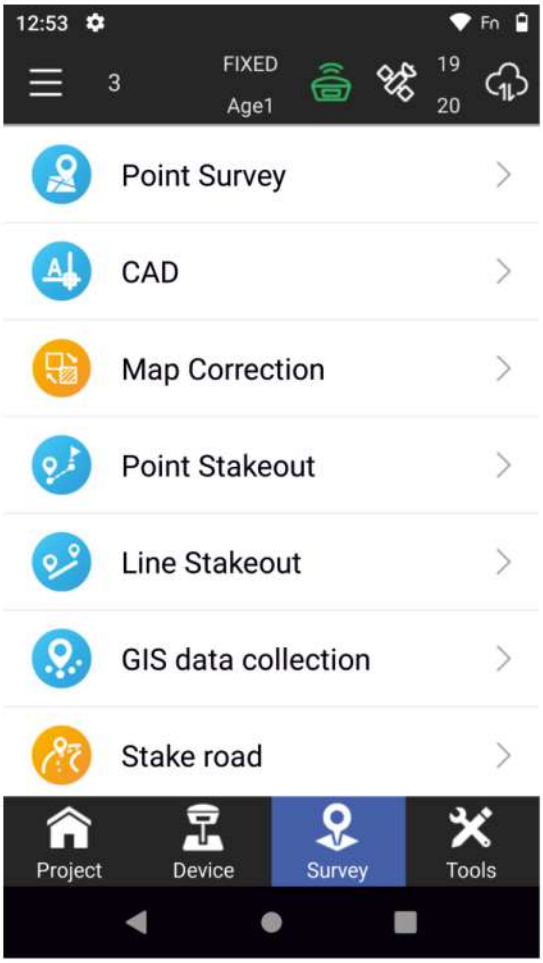


Figure 30

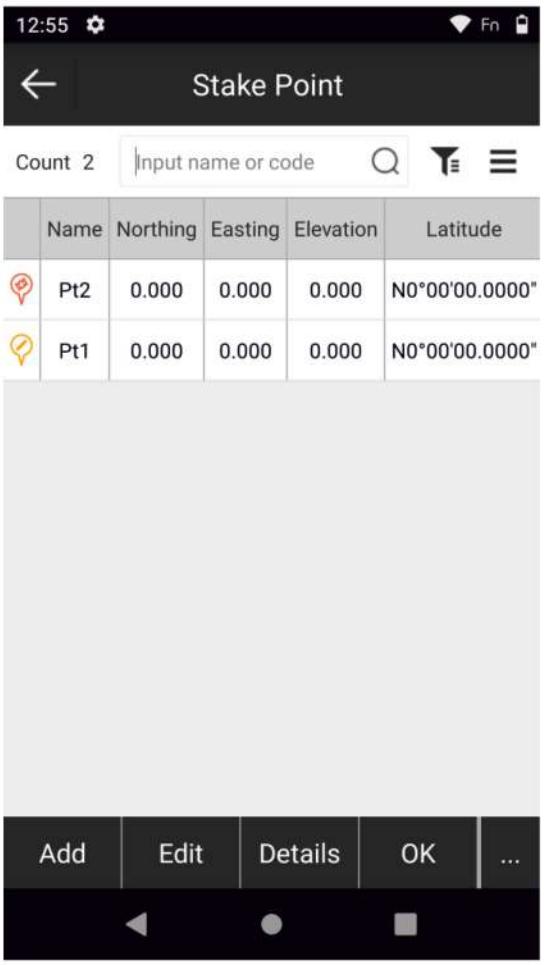


Figure 31

3.10 Measurement with a slope

Click [Survey] -> [Point Survey] to go to the point shooting page, click the receiver icon (upper right corner) to enter the antenna parameter (height), and then click on the slope measurement icon.

Red, as shown in Fig. 31, means that the tilt sensor (IMU) calibration is required. For calibration, the receiver must be in a fixed solution, tilt the receiver forward and backward for 5~10 seconds, then turn 90°, continue to tilt the milestone forward and backward until the tilt measurement icon turns green, as shown in Fig. 32, then measurements can be performed.

Note: When shooting at an angle using an IMU sensor, it is important to set the exact height of the milestone.

The tilt sensor works for angles of no more than 60°.

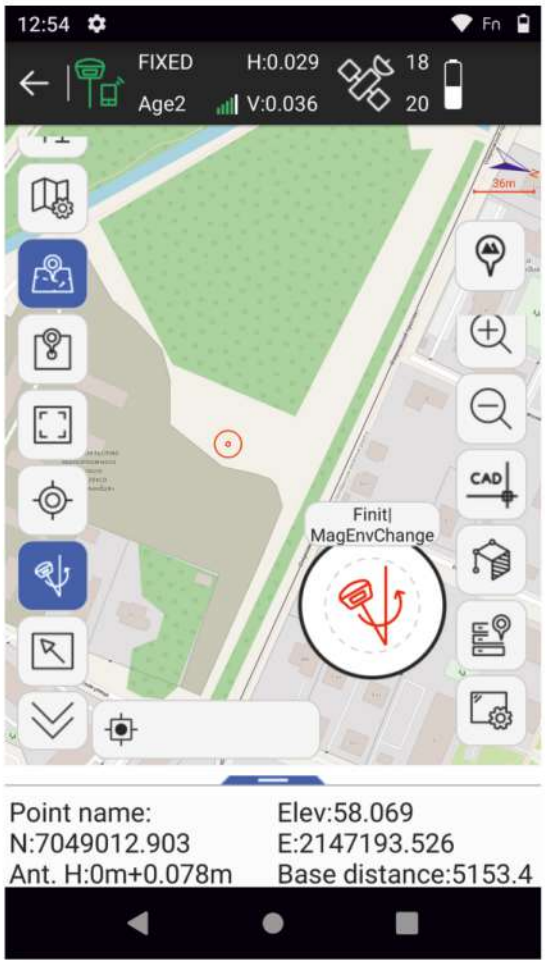


Figure 30



Figure 31

3.11 SurPad registration

Click [Project] -> [About Software], you can view information about the software version and copyright information.
Click [Software Activation], the software registration interface opens, check the software ID and the corresponding expiration time after the expiration date of the software, enter the activation code received from the supplier, or scan the QR code during authorization and click [Activate] to activate the software.

Chapter 4 WebUI Application

Geobox Fora 20H has WebUI function, access Geobox (UniStrong) built-in hotspots, easy to manage the 20H through Web browser operation interface. As long as you have a smartphone, PC, or controller with WiFi, you can easily connect to the 20H and read status settings, download data, and Receiver settings.

The 20H automatically starts WiFi by default. The hotspot of the receiver can be searched using a smartphone/PC/controller, etc. The hotspot name is displayed by the S/N of the receiver and is connected to the receiver's WiFi (the receiver's WiFi can only log in to the web page to check the receiver status and setting mode, etc).

After connecting the 20H WiFi, log in to the browser and enter192.168.10.1 in the IP address. A window pops up when you log in. You need to fill in the username and password. The username is admin, and the default password is password. After entering the user's name and password, you can log in to the WebUI page of the 20H receiver.

4.1 Position Status

Geobox Fora 20H Position Status page shows the current status of the 20H receiver, including location information, data link status, satellite maps, and instrument information. Click on a module to display its details, as shown in Fig. 33.

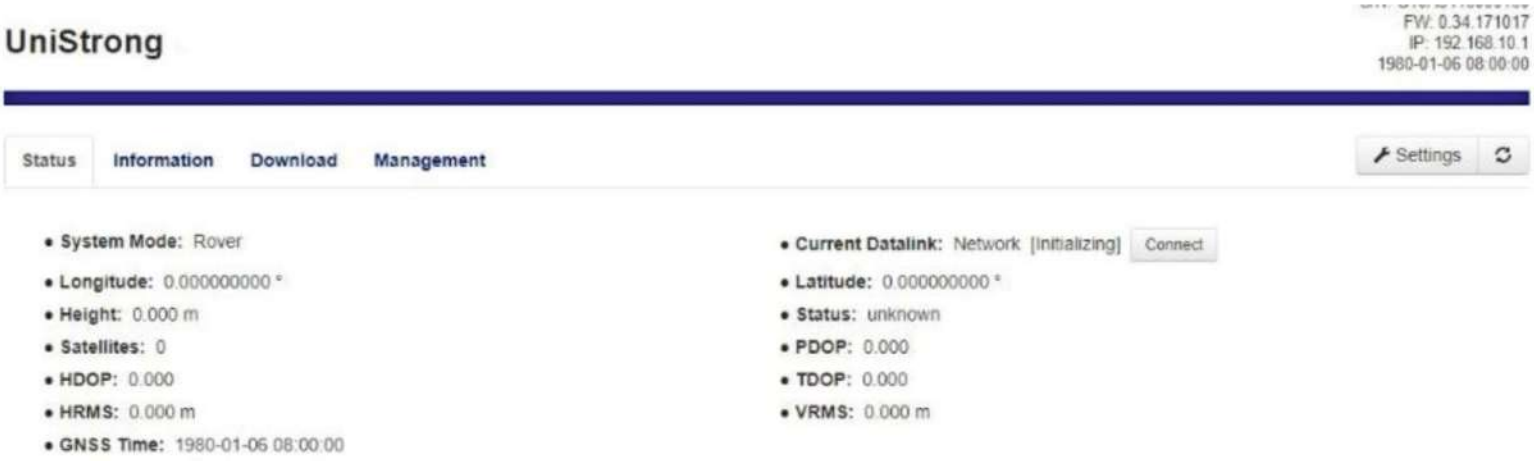


Figure 33. WebUI Position Status

4.2 Setting

The setting page includes six options for operating mode, satellite settings, system parameters, NMEA messages, viewing logs, and configuration sets. You can set Receiver operating mode, satellite system, system parameters, and NMEA messages here. You can also view and download Logs, and upload, download, delete, and apply related configurations. Click on a module to display
its details, as shown in Figure 34.

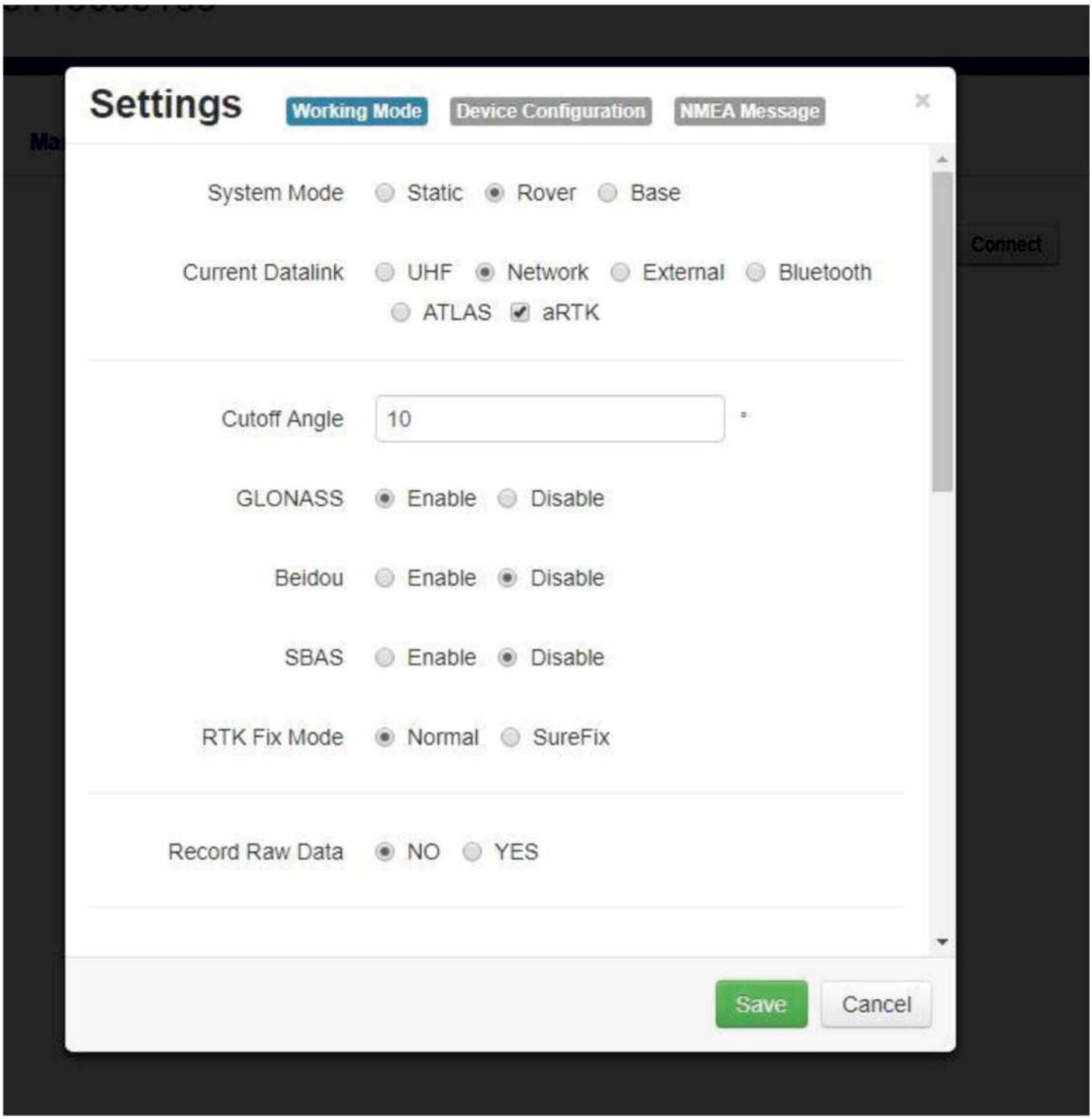


Figure 34. Satellite Settings

4.3 Download

The download page provides downloads of raw data and backup data. Click on a module to display its details, as shown in Fig. 35.

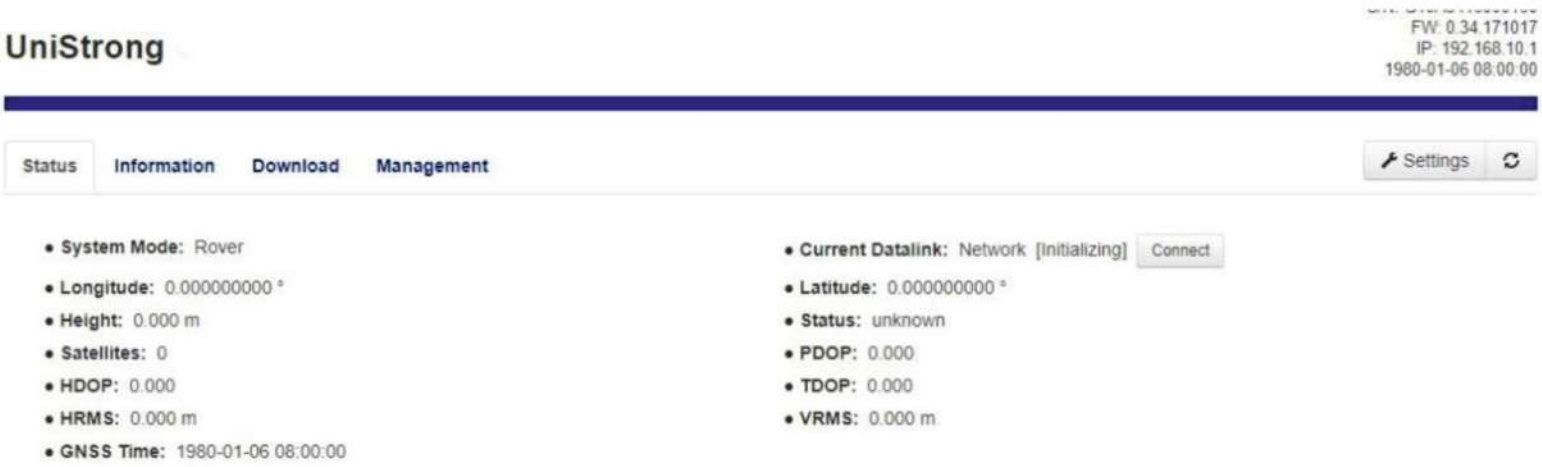


Figure 35. Data Backup

4.4 Management

Online update, device registration, password change, device disk formatting, self- test, factory reset, and device restart are shown in Fig. 36.

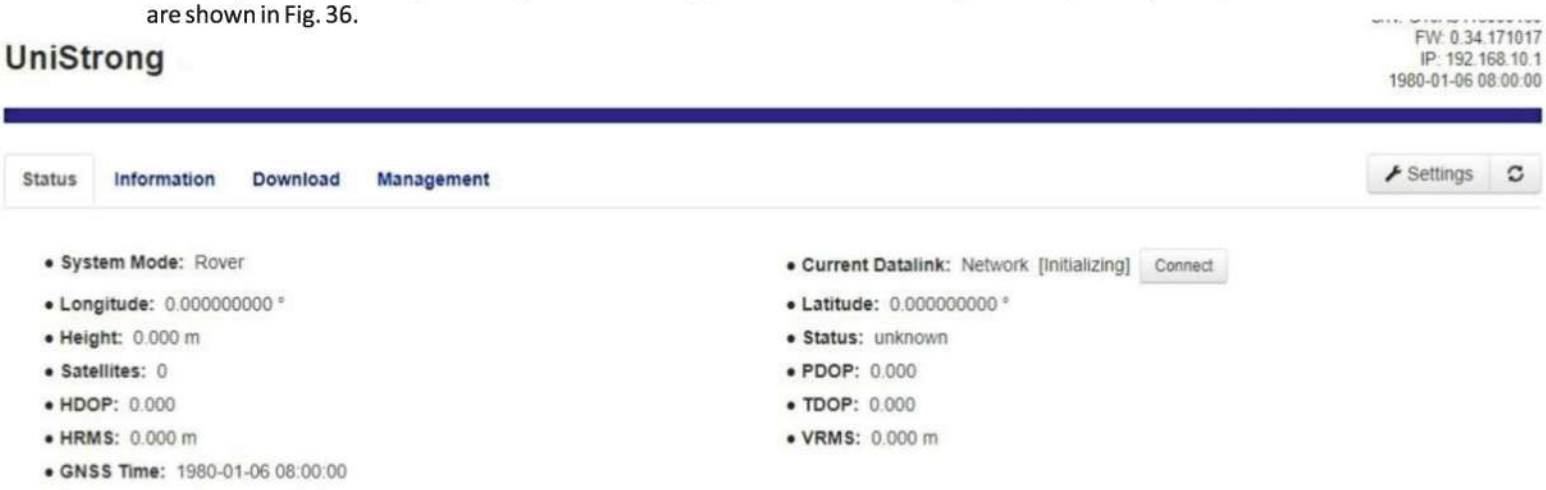


Figure 36. Management page

4.5 Static Recording

For Static recording go to menu [Settings] -> Working Mode -> System mode and choose Static, also you can configurate Static mode here, then go to menu [Status] -> Position -> System Mode: Static and enter Start Record. After recording tape Stop Record.
Go to menu [Download] -> Raw Data and download file.

4.6 Instrument Registration

The instrument registration code consists of 32 digits and letters. You can register through the WebUI function.
The specific steps are as follows.

In the management page of the Web UI, you can see "instrument registration", enter in the registration code field.
The corresponding registration code of the instrument, and then click submit, the instrument will complete the registration automatically. After registration, you can see the expiration of this registration on the expiration date of the page.

Appendix 1 Geobox Fora 20H Mainframe Specifications

Model	Fora 20H
Satellite system	
Satellite system	GPS/GLONASS/BDS/Galileo
GNSS	
Channel	1408
GPS	L1C/A, L1C, L2C, L2P(Y), L5
GLONASS	G1, G2, G3
BDS	B1I, B2I, B3I, B1C, B2a, B2b
Galileo	E1, E5a, E5b, E6
Aux.Signals	NAVIC: L5 SBAS L1C/A QZSS L1C/A, L1C, L2C, L5
L-BAND	RTX（Option）
Accuracy	
Static Horizontal	±（2.5mm+1ppm）RMS
Static Vertical	±（5mm+1ppm）RMS
RTK Horizontal	±（8mm+1ppm）RMS
RTK Vertical	±（15mm+1ppm）RMS
SBAS Positioning (typical)	Horizontal ＜0.6m 3DRMS Vertical ＜1.2m 3DRMS
Initialization Time	＜10s
Initialization Reliability	＞99.99%
Update Rate	Standard 5Hz, Highest 50Hz
Memory and Data	
Memory	8G, support expandable MicroSD
Differential output	RTCM3/3.2, CMR PLUS, CMR, DGPS

DataLink	
Bluetooth	Built-in, V2.0 Class2 / V4.1LE
WiFi	802.11 b/g
Protocol	SATEL, PCC-GMSK, TrimTalk450S / TrimMask 3 SOUTH19200； PCC EOT：South9600
UHF Radio	Internal Rx/Tx：0.5W/1W(Adjustable) External Tx：5W/35W(Adjustable) Frequency：410-470MHz
Network	4G-LTE, TD-SCDMA, CDMA（EVDO,2000), WCDMA, GSM (GPRS)
GNSS Antenna	
GNSS Antenna	Integrated antenna, zero phase center difference
Environment	
Work Temperature	-30℃~+60℃
Storage Temperature	-40℃~+80℃
Dustproof&Waterproo	IP67
Fall	Resistance to 2 meters drop with rod (hardwood ground)
Waterproo f	Underwater 1 meter soak (30 minutes)
Humidity	100% non-condense
Physical and pow er characteristics	
Usage Time	More than 10 hours
Size	ø156mm×76mm
Weight	1.2kg
Battery Capacity	Double battery compartment design, 7.2V 3400mAh
Button	switching on/off

The above technical parameters are subject to the actual product and are subject to change without notice.

Appendix 2
Geobox Fora P3 controller Specifications

Hardware Specifications	
Size	230mm *87mm *22.7mm
Weight	430 g
CPU	MT8768
RAM	4GB LDDR3 RAM
Storage	64GB + microSD up to 512 Gb
Screen	5.5-inch 1080*1920
Battery	9000mAh ; Battery life 18 hours
Keyboard	27 keys multi-function physical keyboard, LED backlight
Camera	13MP with autofocus, flashlight
Environment	
Proof	IP67
Temperature	Working Temperature：-30℃~+60℃ Storge Temperature：-40℃~+80℃
Humidity	5-95% non-condense
Fall	1.2m plywood on the concrete floor falls without damage
Data communication	
WiFi	802.11b/g/n/ac
Bluetooth	Bluetooth 2.1/ 5.0 LE
Mobile Network	2G/3G/4G Nano-SIM
Operating Sy stem	
Operating System	Android 11

The above technical parameters are subject to the actual product and are subject to change without notice.

Appendix 3
UHF Radio Settings

The frequency and port protocols of the radio's eight channels can be changed via Web pages for easy operation. The frequency range of the radio is 410MHz-470MHz. Users can set the required frequency.

Channel	Frequency	Protocol
1	438.125MHz	Trimtalk 450S
2	440.125MHz	Trimtalk 450S
3	441.125MHz	Trimtalk 450S
4	442.125MHz	Trimtalk 450S
5	443.125MHz	Trimtalk 450S
6	444.125MHz	Trimtalk 450S
7	446.125MHz	Trimtalk 450S
8	447.125MHz	Trimtalk 450S