GENEQ F90 GNSS Receiver

User Manual

GENEQ F90 GNSS Receiver

Contents

1- Introduction

1.1 Company Introduction

GENEQ is a company professional in surveying and mapping industry. Advanced and high-quality products are our top priority. We try our best to offer prompt and good service to all our customers. Rich experience and abundant knowledge in this field guarantee that every decision we made is on the basis of scientific test. We strive to provide great products and service with reasonable price and believe it's the key to have more clients and gain more cooperation.

1.2 Outstanding Features of F90

Purchasing the right tools for a professional job is essential in today's competitive business environment. As the latest GNSS receiver, F90 distinguishes itself from other GNSS products. It is more compact and lightweight but integrating more advanced technology. Even still equipped with magnesium alloy fuselage, the dimension is only 140x157x76mm and the weight is just 1KG. Many revolutionary technology in F90 makes your survey work more quickly and efficiently. Some innovation features can be summarized as below :

(1) Board and L-Band

F90 is compatible with 3 kinds of GNSS board--Trimble BD990, NOVATEL 729, Hemisphere P328, makes it capable to track GPS, GLONASS, GALILEO, BEIDOU and can maximize the tracking to observe all visible GNSS satellites signal, thereby providing maximum performance of accuracy and real-time measurements. F90 also supports L-Band function, can get centimeter accuracy just with one receiver. L-Band is not standard configuration, need to pay for activation.

(2) Multi-Connectivity

F90 provides two connecting methods for receiver and controller---Bluetooth connection and Wi-Fi connection. Data transmission proves to be more stable with these new connection ways. Besides, F90 supports "fast connection", put your controller close to the receiver, click "fast connection" and it will search and connect the receiver automatically via Bluetooth when power on.

(3) WEB UI control

The second generation WEB UI control is fully compatible with all devices and all browsers. It's more convenient with WEB UI control.

(4) 4G Network

F90 has advanced 4G module, guarantee 4G network can transmit world-widely. It enables more convenient and stable network communication.

(5) Tilt Survey

Inserted with high-sensitive E-bubble and brand-new tilt survey algorithm. F90 is calibration-free. Immune to magnetic disturbance and free from limitation of tilt angles. F90 can measure points where a vertical placement of the pole is not possible such as house corner.

(6) Dual Batteries

Inserted with 2 smart hot swappable Lithium batteries, F90 can work maximum of 10hours without stopping. Battery level can be viewed at the press of one button on battery. The battery is also same as controller.

(7) Alarm System

In UHF model, when base is moved, with low power or no satellites, Rover will alarm immediately.

All of these innovations will increase your productivity and taking your performance to a new level.

2- General Information

2.1 Outlook of F90

Figure 2-1

The indicator status : dark, light or blink... It represents different status of the RTK equipment :

Power Button	Turn on/off the device. Light when device is turned on. Turn to red when with low power
Satellites Indicator	Blink when normally receive satellites signals. The times it blinks, the number of satellite it tracks. Light without blinking indicates F90 gets fixed solution
Datalink Indicator	Blink regularly with green color means correction data is transmitting or receiving normally ; blink regularly with blue color means static data is recording
Wi-Fi Indicator	Light when device used as hotspot or being connected as client
Bluetooth Indicator	Light when device has been connected via Bluetooth

2.2 Basic Operation

2.2.1 Turn on/off

Turn F90 on. This is the very first step to use F90. When the receiver has power, keep pressing power button for 4 seconds, then you will see the power button light up and hear beep.Turn F90 off. With voice guide : Keep pressing power button for 4 seconds, then you will hear voice guide “power off”, release and one press on the button again will turn the device off. Without voice guide : Keep pressing power button for 4 seconds, release and you can see all 5 indicators blink simultaneously, one press on the power button again will turn the device off.

2.2.2 Self check

F90 has self-checking function when you find some malfunctions like the indicators are abnormal or receiver can’t work normally or the device can not connect via Bluetooth or Wi-Fi, radio mode is not workable or can’t connect to CORS. Self-checking function covers radio mode check, GSM mode check, Bluetooth mode check and Wi-Fi mode check. There is voice guide to tell you whether it is OK or not.

When the receiver is turned on, keep pressing the power button for 4 seconds, then you hear “power off”, release and keep pressing the power button again for 4 seconds. You hear “self-check” and then following checking process and the results of each check.

3- Equipment List

3.1 Packing List of Base

F90 BASE SET					
1. Main body					
Name	**Type**	**Description**	**Picture**	**Weight**	**QTY**
Receiver main body	F90	Mainboard : BD990 OEM729 P328		1.2KG (with two batteries inside)	1
2. Accessories					
Name	**Type**	**Description**	**Picture**		**QTY**
Lithium Battery	BP-5S	7.2V 3400mAH			2
Charger	CH-04	Battery charger			1
Charger Adapter	DSA-40CA-12				1
UHF Antenna	QT440A	UHF antenna			1
Connector	RTK	connect Tribrach and Plummet			1
Tape	MTSP4	3m tape			1

Supporting Pole		25cm FRP supporting pole		1
Pallet				1
Base Case	YPCC1	yellow, rigid plastic carrying case		1

F90 Base A Suite of Product

	Carton Packing	G.W.	N.W.	Volume(CBM)
	0*20*40CM	6.3KG	5.3KG	0.04

3.2 Packing List of Rover

F90 ROVER SET					
1.Main body					
Name	Type	Description	Picture	Weight	QTY
Receiver main body	F90	Mainboard : BD990 OEM729 P328		1.2KG(with two batteries inside)	1
2.Accessories					
Name	Type	Description	Picture		QTY
Lithium Battery	BP-5S	7.2V 3400mAH			2
Charger	CH-04	Battery charger			1
Charger Adapter	DSA-40CA-12				1
UHF Anten-na	QT440A	UHF antenna			1
Connector	RTK	connect Tribrach and Plummet			1
Tape	MTSP4	3m tape			1
Bracket		B3			1

Carrying Case	YPCC2	yellow, rigid plastic carrying case		1
Pole		No Logo		1

F90 Rover A Suite of Product(Without Pole)				
	Carton Packing	G.W.	N.W.	Volume(CBM)
	50*20*40CM	6.45KG	5.4KG	0.04

F90 Rover A Suite of Product(With Pole)				
	Carton Packing	G.W.	N.W.	Volume(CBM)
	50*20*40CM	8.4KG	7.4KG	0.056

4- Setting Up

4.1 Setting Up Base Station

4.1.1 Choose a suitable place

A suitable place is essential for base station to better receive the satellites and transmit the UHF signals. A suitable position should comply with following conditions :

(1) Choose a wide open area in order to easy and better receive signal of satellites. Besides, make sure there is no covering like roof or heavy foliage.

(2) A higher place is better for transmitting the UHF signals. If rover is far away from base, then the enhanced antenna should be raised by tripod.

(3) Make sure there is no large area of water or objects intensely interfering the satellite signal.

(4) Check carefully that there is no high-power radio emission objects surrounded. And make sure there is no power lines around. Need keep at least 200m far from these objects.

4.1.2 Set up instrument

Mount the instrument to the tripod. Level and center the instrument precisely to ensure the best performance. You can set up base on random point or on given point. If you set base on random point, you just choose a position and level the instrument. If you set base on given point, you can follow below steps :

(1) Leveling and Centering the instrument
a.Setting up tripod
First, extend the extension legs to suitable length, make the tripod head parallel to the ground and tighten the screws.
b.Make the center of the tripod and the occupied point approximately on the same plumb line
c.Step on the tripod to make sure if it is well stationed on the ground.

(2) Attaching the instrument on the tripod
Place the instrument carefully on the tripod head and slid the instrument by loosening the tripod screw.

(3) Roughly leveling the instrument by using the circular vial
a. Turn the leveling screw A and B to move the bubble in the circular vial as below Figure 4-1 shown, in which case the bubble is located on a line perpendicular to a line running through the centers of the two leveling screw being adjusted.

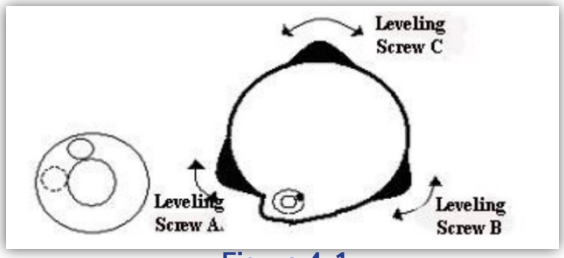


Figure 4-1

b. Turn the leveling screw C to move the bubble to the center of the circular vial.

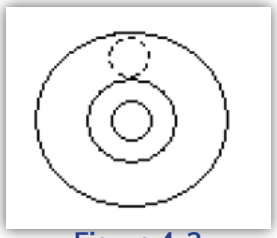


Figure 4-2

(4) Precisely leveling by using the plate vial

a. Rotate the instrument horizontally by loosening the horizontal clamp screw and place the plate vial parallel to the line connecting leveling screw A and B, and then bring the bubble to the center of the plate vial by turning the leveling screws A and B.

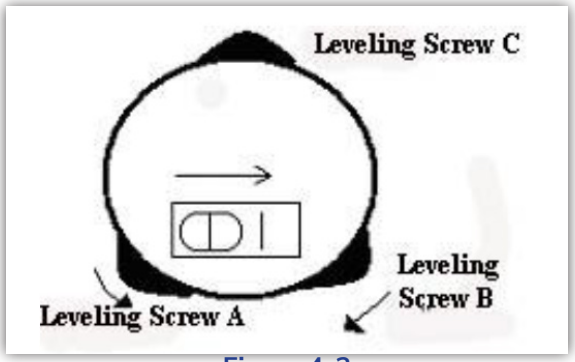


Figure 4-3

Rotate the instrument 900 around its vertical axis and turn the remaining leveling screw or leveling C to center the bubble once more

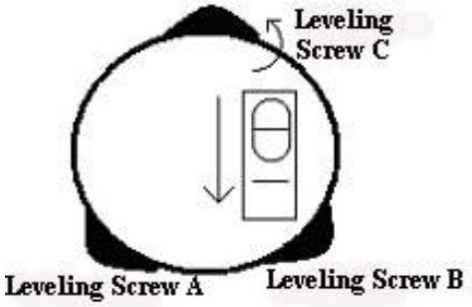


Figure 4-4

(c) Repeat the above a&b steps for each 900 rotation of the instrument and check whether the bubble is correctly centered in all directions.

4.1.3 Measure antenna height

The antenna height must be measured when we use F90 to collect static data or use it as base station. It's the "a" show in below Figure 4-5, the height from ground measured point to phase center, only get this height can we know coordinate of the ground measured point. There are 3 measuring methods to get the antenna height :

(1) Slant height

Measure the distance from the ground measured point to the middle of mainframe scale mark. It's the "d" shown in Figure 4-5.

(2) Pole height

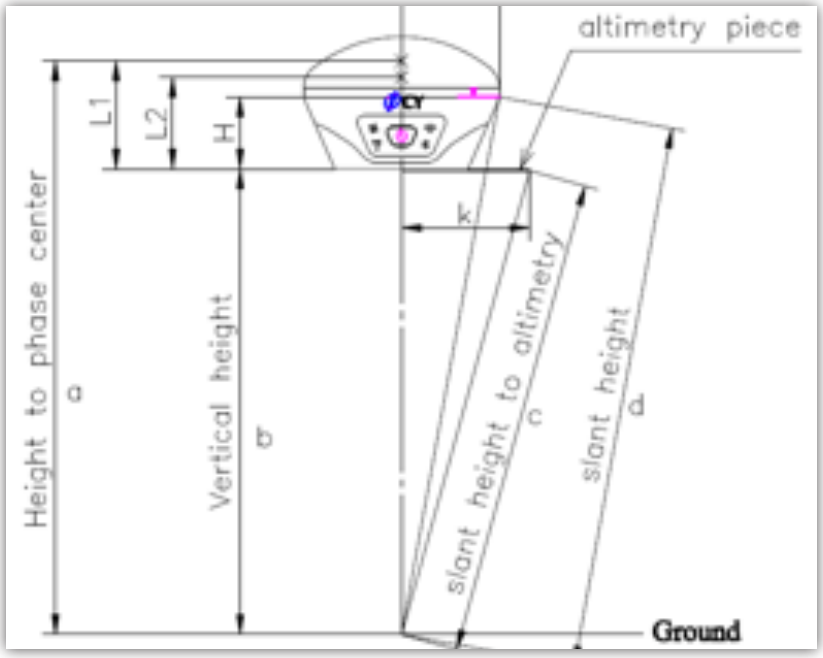
Measure the distance from bottom of device to ground directly. It's the vertical height "b" shown in Figure 4-5.

(3) Measuring plate

Measure the distance ground measured point to the upper edge of plate. It's the "c" shown in Figure 4-5.

Choose either one measuring method from above. Use measure tape measure the height you choose. Input the height in software. Then you can get the height from ground to phase center. The formula is as below :

a=b+L1



b= $\sqrt{c^2-k^2}$ b= $\sqrt{d^2-R^2}$ H

Figure 4-5 (Measure Antenna Height)

4.1.4 Transmit signal through external radio

Fix external enhanced antenna onto the tripod, and use connection cable to connect external radio with 5-pin port of receiver as shown in Figure 4-6. Plug power cable to external radio. Then turn on radio. You can set the channel on the external radio directly. The external serial port baud rate should be same as external radio. The baud rate for our device is 38400. If you use our radio, you have to set the baud rate to be 38400 for your receiver to match the radio.

4.1.5 Transmit signal through internal radio

For short distance, you can use internal radio to transmit the signal. First, fix the UHF antenna on F90 as shown in Figure 4-7. And then select internal radio mode via controller or WEB UI function. Internal radio covers distance around 5km.

4.1.6 Transmit signal through network

You can also use network (F90 has 4G module supports 4G network) to transmit signal. Insert SIM card into the receiver. And select network datalink via controller or WEB UI function.

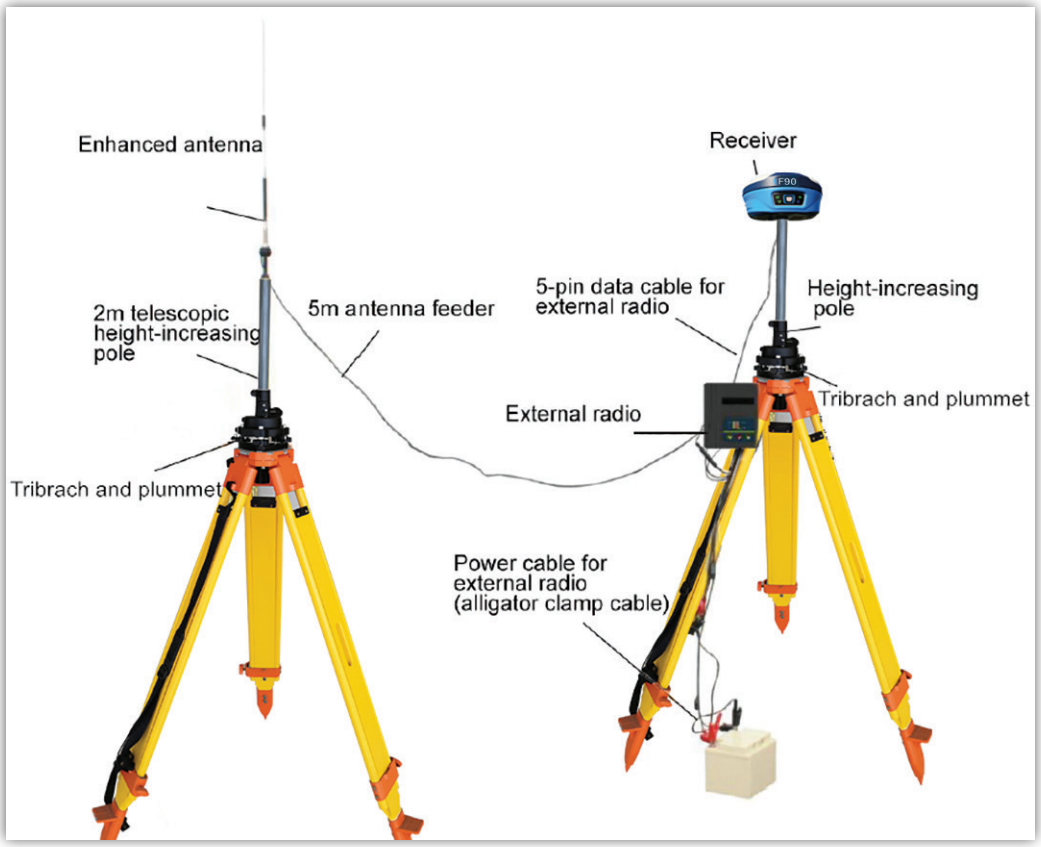


Figure 4-6 (Base Station with external radio)

Figure 4-7 (Base station with internal radio)

4.2 Setting Up Rover Station

Rover station can receive data through different datalink methods--internal radio, rover network and controller network.

4.2.1 Connect controller with rover

Attached the controller bracket to the pole. If use internal 4G, you need to insert the SIM card in controller. If use internal radio, then fix UHF antenna. You can connect the controller with rover through Wi-Fi or Bluetooth as you prefer.

(1) Via Wi-Fi
F90 can be used as a hotspot, use controller to search the Wi-Fi signal of F90, the Serial NO. of F90 will show on controller, then select it to finish connect.

(2) Via Bluetooth
Use controller to search the Bluetooth signal of F90, once found, the Serial NO. of F90 will show on controller, then select it to finish connect.

4.2.2 Rover internal radio

Fix UHF antenna on rover, then select internal radio mode on controller or via WEB UI function.

You can select radio channel and radio protocol, but make sure the channel and radio protocol are same as base. On controller, Channel 8 is able to edit. While channel 1~7 can not be edited.

4.2.3 Rover network mode

Insert SIM card on rover, then select network mode on controller or via WEB UI function. Input the CORS account and password, set APN and upload GGA..

4.2.4 Rover controller network

This method means the SIM card is inserted in controller. The controller gets the correction data and send to device via Bluetooth. It's less stable compare with device network.

4.2.5 Download backup data

Once finish surveying, you can download the backup data via WEB UI as shown in Figure 4-8. The backup data format is ".RTK"

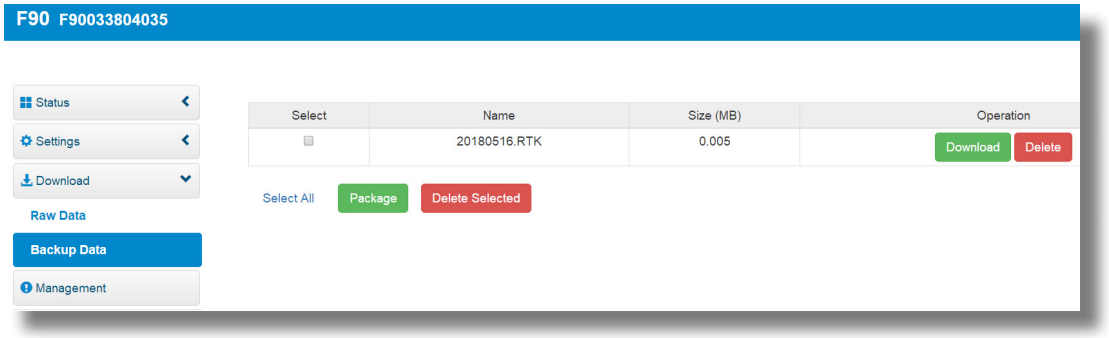


Figure 4-8

4.3 Static Surveying

Static surveying requests at least 2 receivers put on 2 points on a baseline. Keep these receivers in the same position and track at least 4 satellites then get relative distance of these 2 points. Static surveying provides the highest accuracy achievable and requires the longest observation times, from less than an hour to five hours or longer.

The static surveying function in F90 including outdoor surveying and indoor data post processing.

4.3.1 Baseline network design

(1) Synchronous pattern

As we know, static surveying uses at least two or more than two receivers track same satellites during same period. And then we can get data of these points. The pattern that formed by these points called synchronizing pattern. If use three or more than three receivers, the pattern formed by these points called synchronizing pattern cycle. As show in Figure 4-9.

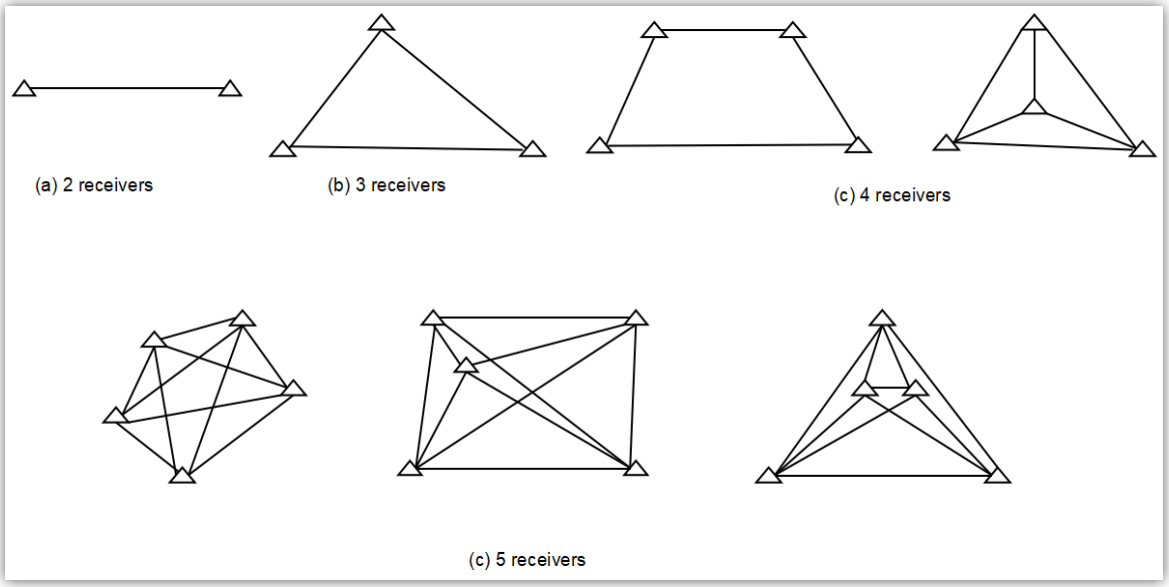


Figure 4-9(synchronous pattern)

(2) Asynchronous patter

If there are too many points in one baseline network, you should connect these synchronous cycle together and form the asynchronous pattern.

Asynchronous pattern can be connected via three ways as shown in Figure 4-10 :

(a) point connecting. Point connecting network is defined as a figure by connecting two adjacent shapes by only one common point. The advantage of this type is high efficiency, fast extending. But it can not confirm the high precision surveying. Therefore, it is not recommended in precise working.

(b) side connecting. Side connecting network is defined as a figure by connecting two adjacent shapes by their same side. It is widely used in the surveying field due to its high precision.

(c) point and side connecting. Because every type of network has its own advantage and disadvantage, we can combine these types to achieve higher efficiency but lower investment in time. Mixed connecting network is common in surveying work.

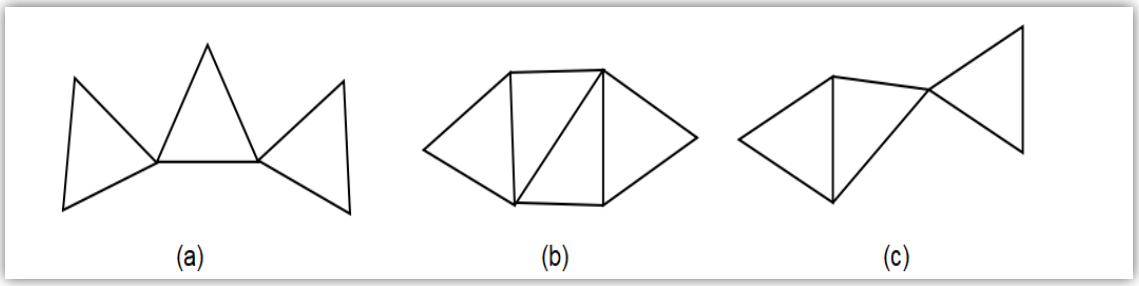


Figure 4-10(asynchronous pattern)

4.3.2 Outdoor surveying

(1) Choose suitable points

Suitable points is essential to make sure whole surveying work goes smoothly and efficiently. The points should be fixed only after you well analyze and collect full information of the surveying area. Choose these points best suits your accuracy and surveying purpose. When choose the point in static surveying, you should pay attention to below :

a. The points should comply with your surveying purpose.

b. The points should also be easy-to-use for other surveying methods.

c. Convenient transportation. So it's easy for you to set up device.

d. Away from high power radio emission objects, make sure no magnetic field influence nearby.

e. Away from large water area or mirror building, reduce the multi-path interface.

f. Good ground foundation, so the point can be saved enduringly.

g. Make marks after choose the points, including its position info and sketch for surroundings.

(2) Setting up devices

After choose the points, you set up the device on these points. Power on the device, then you can set "Static Mode" via controller software or WEB UI. As shown in below Figure 4-11.

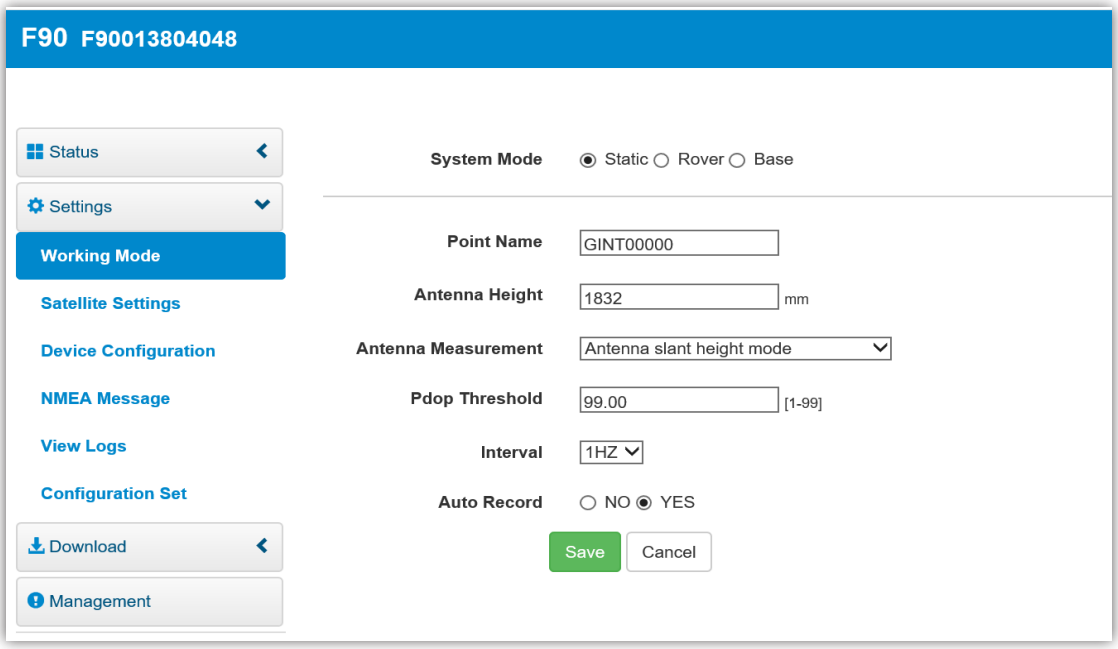


Figure 4-11

You can define the point name and set interval frequency and input the antenna height and others. Once working, you can observe the satellite signal status and record the satellite data in device or in controller.

4.3.3 Download data

Connect F90 via WEB UI) for data downloading. File name given should comply with the notes of outdoor surveying made by yourself. Data file name includes points name, day of year and surveying times. It is easy for you to distinguish. If the file name is 34661171.F14, the first four numbers “3466” can be defined by yourself. The later three numbers “117” represent the day of year, which can not be edited. Last number means the surveying times, which can not be edited either. Convert the data to RINEX format.

5- WEB UI Control

5.1 Connect and register WEB UI

F90 can be a Hotspot. You can connect it with phone, controller, PC or other devices through its Wi-Fi. The default Wi-Fi name is device number, no password needed.
After connecting the Wi-Fi, input IP"192.168.10.1" into your web browser to turn it on.

It will pop up a window like Figure 5-1, requests User name and password, default is as follow :

User name : admin **Password : password**

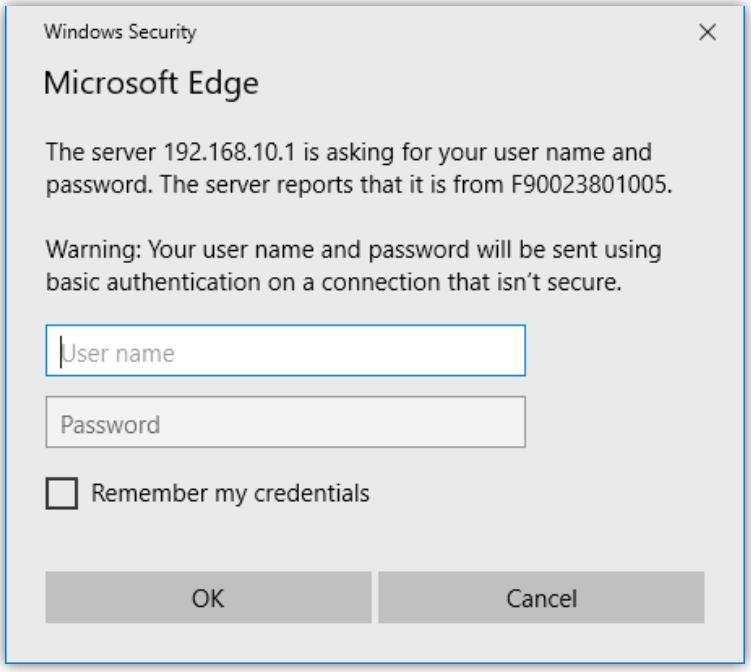


Figure 5-1

The WEB UI includes Status, Position, Settings, Download and Management.

5.2 Status

In status, you can see current work status of receiver and some basic information. Such as data-link, satellites and the device information.

5.2.1 Position

In "Position" you can see the system mode, coordinate and satellites.

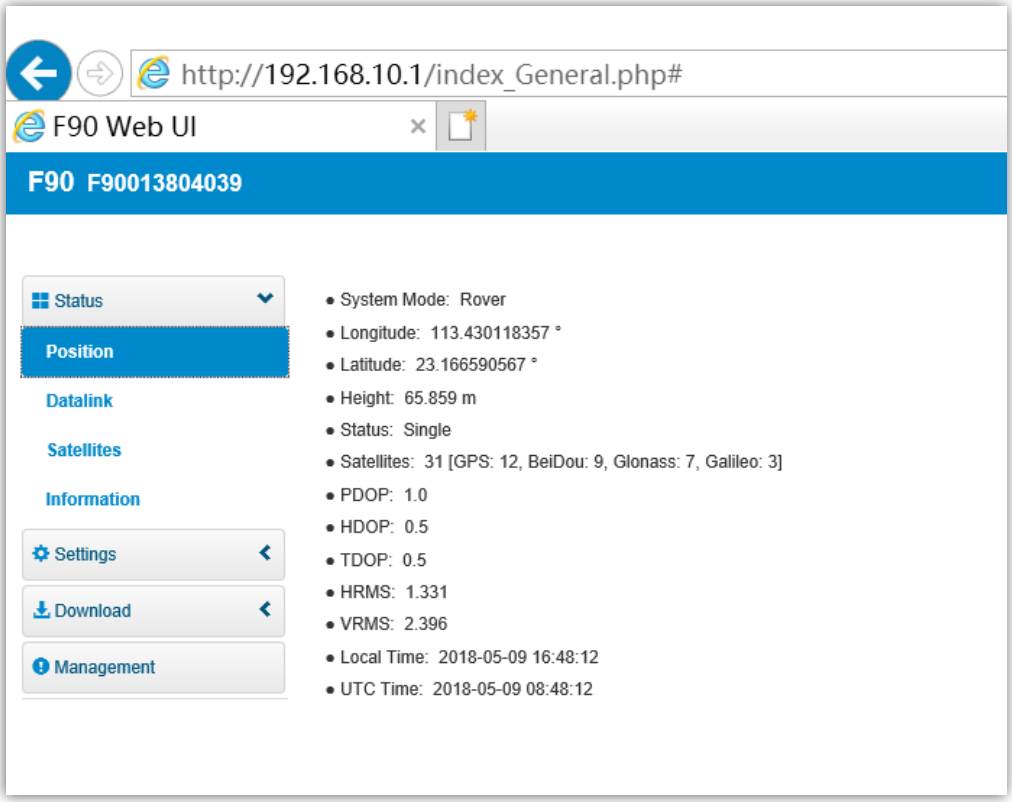


Figure 5-2

5.2.2 Datalink

In “Datalink” you can set the channel, frequency and protocol. And you can also do channel detection in this menu. Below pic shows internal radio datalink.

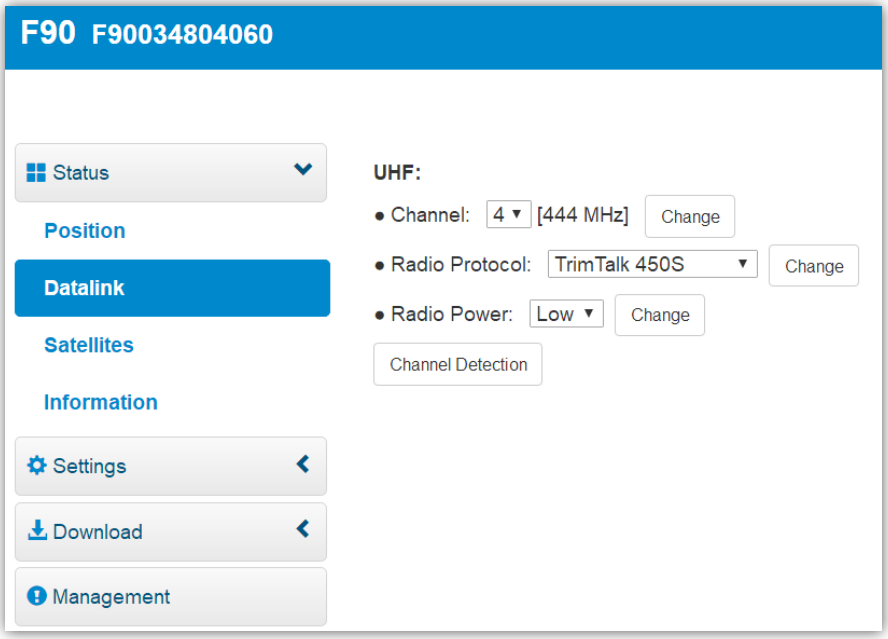
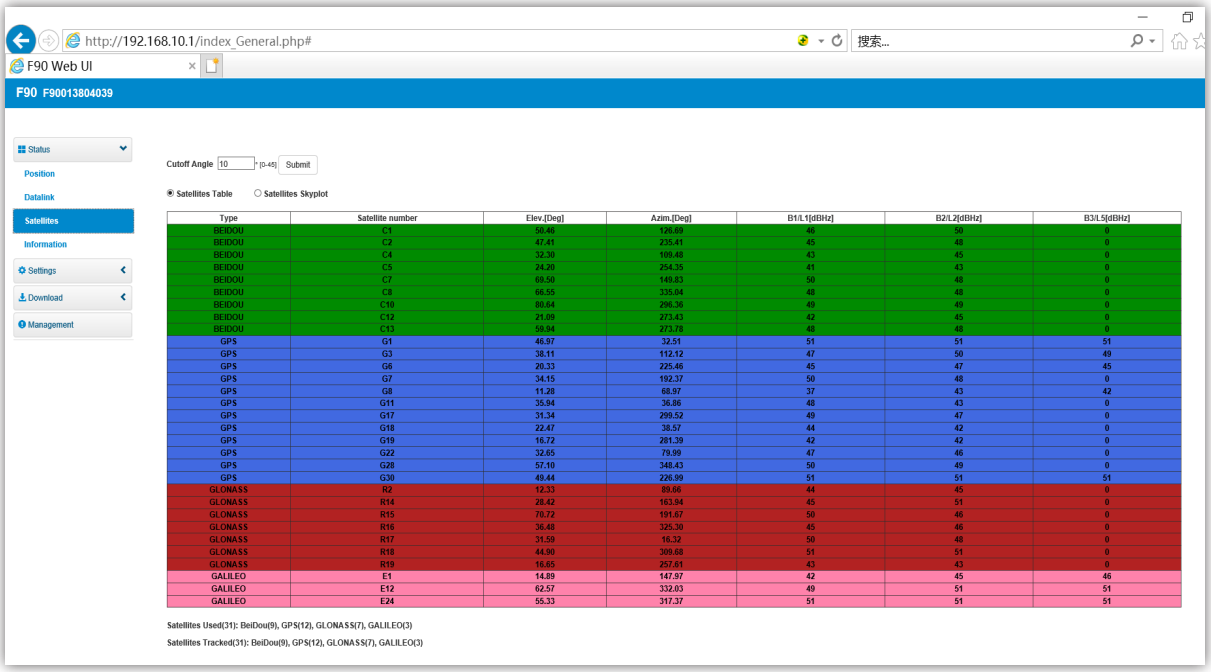


Figure 5-3

5.2.3 Satellites

In “Satellites” you can set the cutoff angle and can see satellites conditions.



Type	Satellite number	Elev.[Deg]	Azim.[Deg]	B1/L1[dBHz]	B2/L2[dBHz]	B3/L5[dBHz]
BEIDOU	C1	50.46	126.69	46	50	0
BEIDOU	C2	47.41	235.41	45	48	0
BEIDOU	C4	32.30	109.48	43	45	0
BEIDOU	C5	24.20	254.35	41	43	0
BEIDOU	C7	69.50	149.83	50	48	0
BEIDOU	C8	66.55	335.04	48	48	0
BEIDOU	C10	80.64	296.36	49	49	0
BEIDOU	C12	21.09	273.43	42	45	0
BEIDOU	C13	50.94	273.78	48	48	0
GPS	G1	46.97	32.51	51	51	51
GPS	G3	38.11	112.12	47	50	49
GPS	G6	20.33	225.46	45	47	45
GPS	G7	34.15	192.37	50	48	0
GPS	G8	11.28	68.97	37	43	42
GPS	G11	35.94	36.86	48	43	0
GPS	G17	31.34	299.52	49	47	0
GPS	G18	22.47	38.57	44	42	0
GPS	G19	16.72	281.39	42	42	0
GPS	G22	32.65	79.99	47	46	0
GPS	G28	57.10	348.43	50	49	0
GPS	G30	49.44	226.99	51	51	51
GLONASS	R2	12.33	89.66	44	45	0
GLONASS	R14	28.42	163.94	45	51	0
GLONASS	R15	70.72	191.67	50	46	0
GLONASS	R16	36.48	325.30	45	46	0
GLONASS	R17	31.59	16.32	50	48	0
GLONASS	R18	44.90	309.68	51	51	0
GLONASS	R19	16.65	257.61	43	43	0
GALILEO	E1	14.89	147.97	42	45	46
GALILEO	E12	62.57	332.03	49	51	51
GALILEO	E24	55.33	317.37	51	51	51

Figure 5-4

5.2.4 Information

In “Information”, you are able to check information details about this receiver, such as firmware version of the receiver, GPS firmware version, UHF mode information, Network information etc.

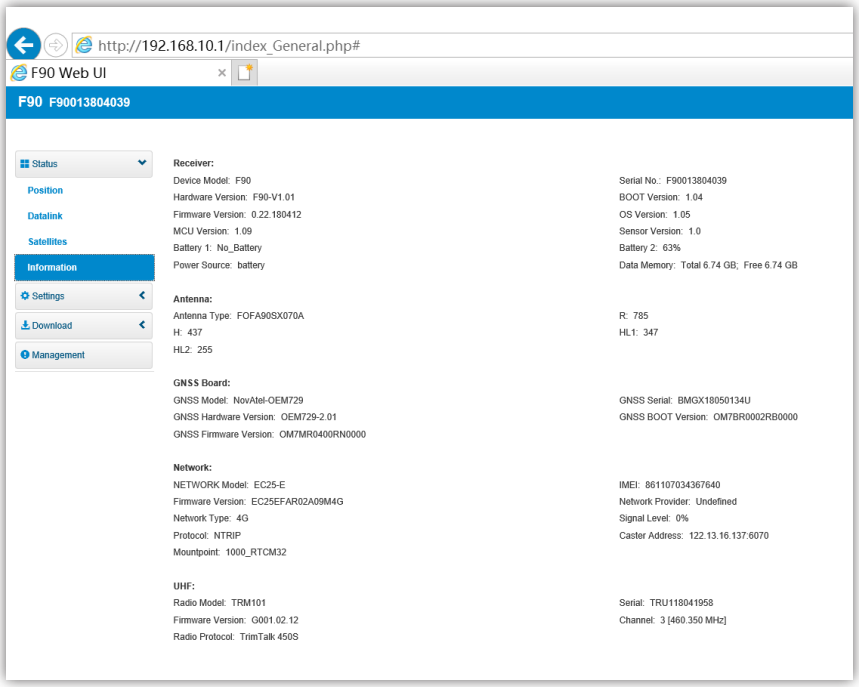


Figure 5-5

5.3 Settings

5.3.1 Working mode

In “Working Mode”, you can select different work mode : static, rover and base. In different mode, you can define different configuration.

(1) Static Mode

As the pic shows, you can input the point name, antenna height, PDOP threshold. Select antenna measurement method and interval. Last is the auto record, if you choose “YES”, the data will be collect automatically when the receiver is working.

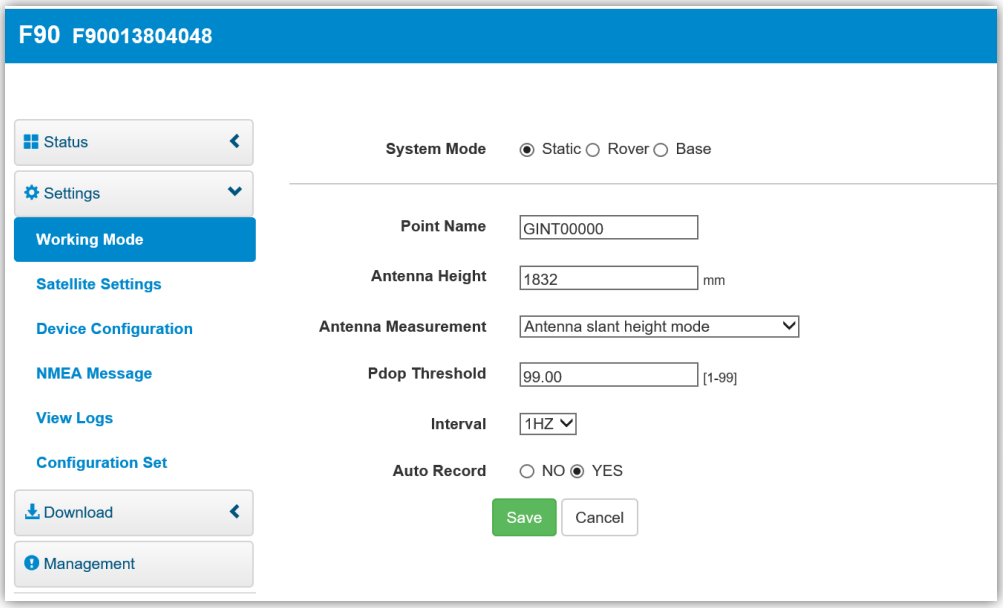


Figure 5-6

(2) Rover Mode

In rover mode, you can select different datalink. There are different configuration in each datalink method. The datalink methods are UHF, Network, External and Bluetooth.

If you choose UHF datalink, you can choose record raw data or not. Select the radio channel and radio protocol as you prefer. F90 is compatible with various protocols, such as : SATEL,P-CC-GMSK, TrimTalk 450S, South 9600, TrimMark III(19200) , South 19200, Hi-target 9600, Hi-target 19200.

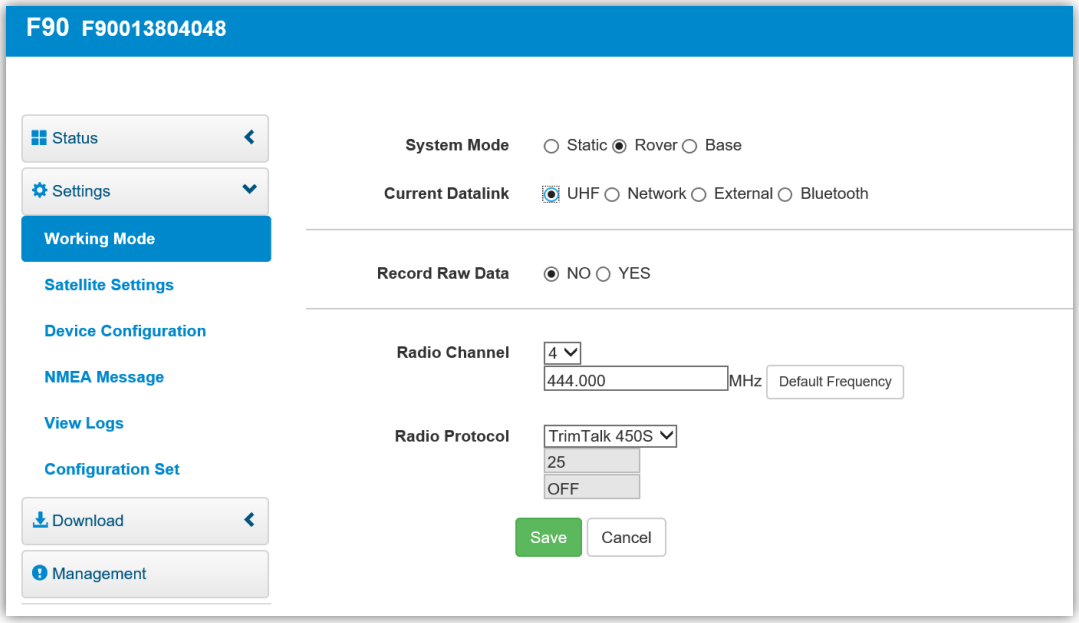
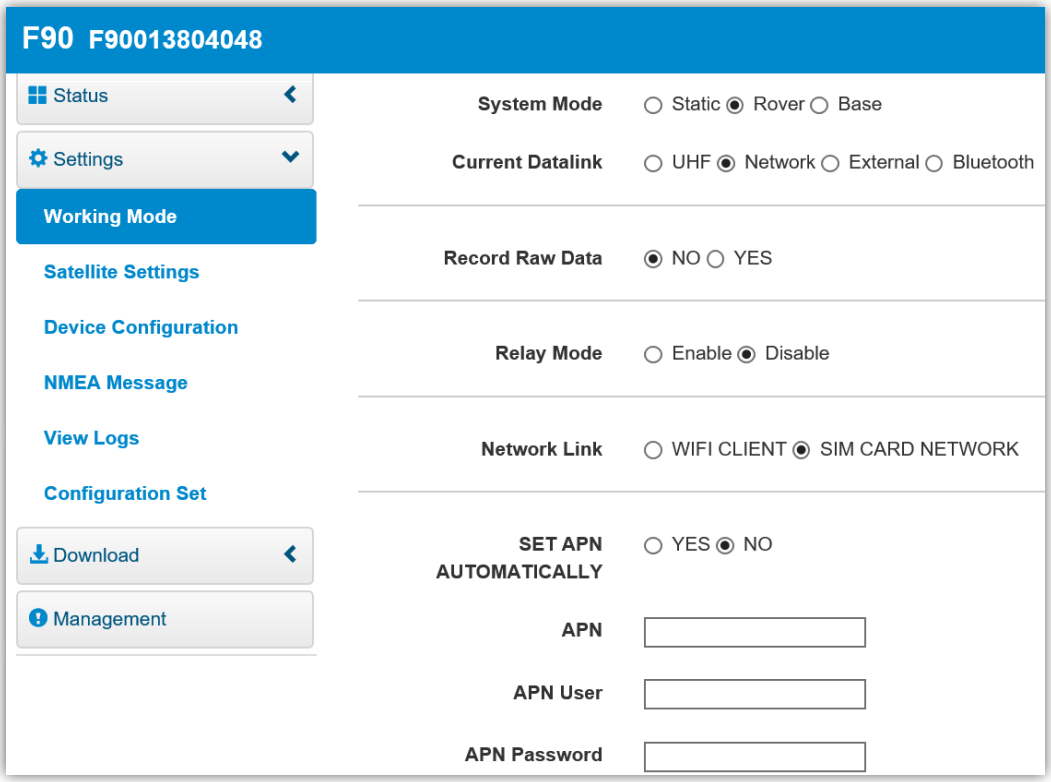


Figure 5-7 Rover mode(UHF datalink)

If you choose Network, you have to input the CORS and APN account, password and upload GGA.



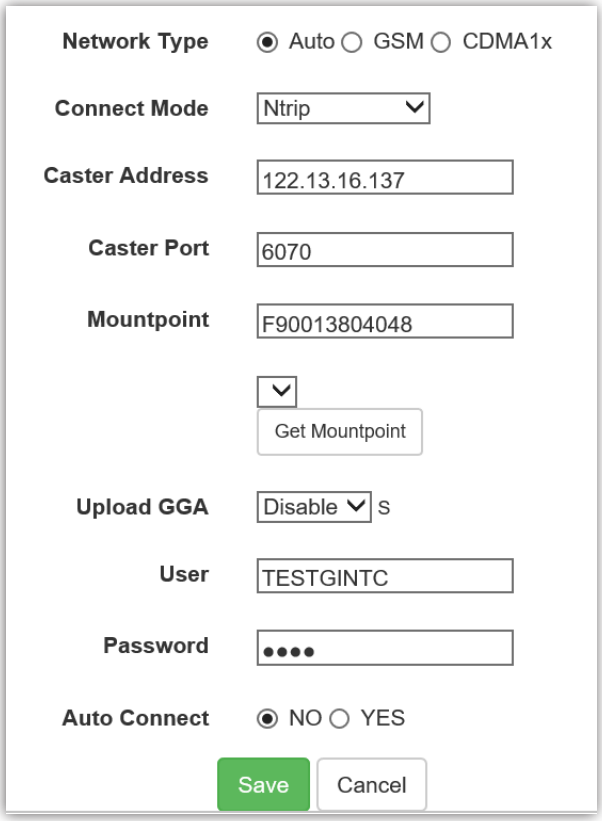


Figure 5-8 Rover mode(Network datalink)

If you choose External, it can connect to external radio. The external serial port baud rate has to be same with external radio. The baud rate for our device is 38400.

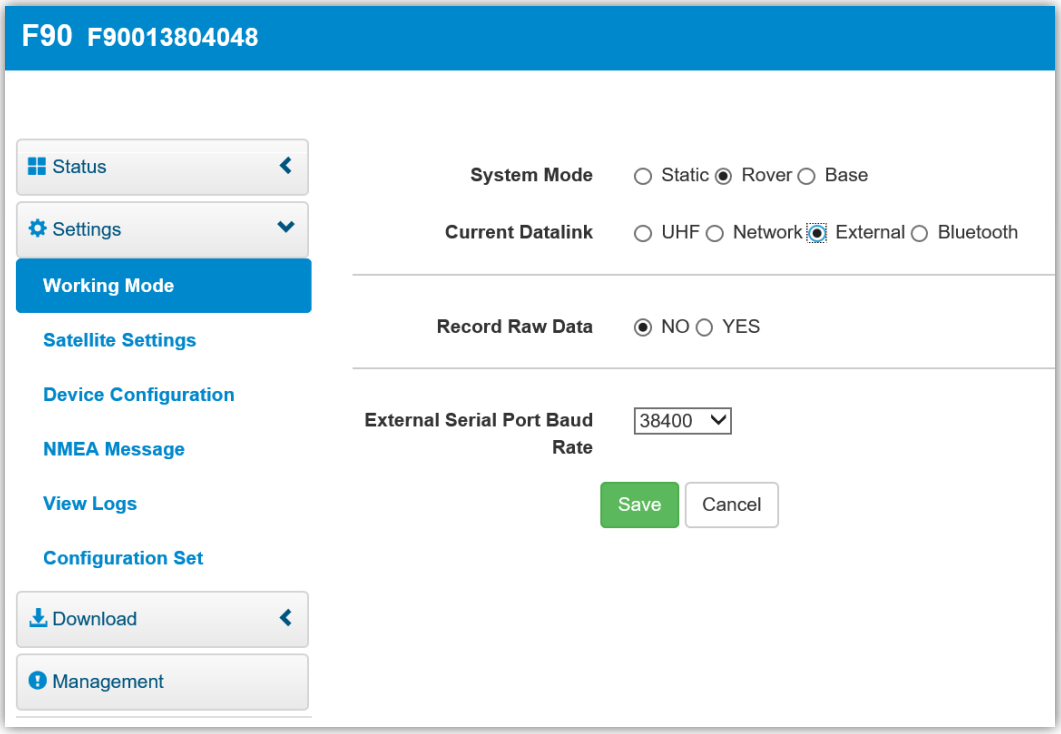


Figure 5-9 Rover mode(External datalink)

The last is Bluetooth, you can select record raw data or not as below pic shows.

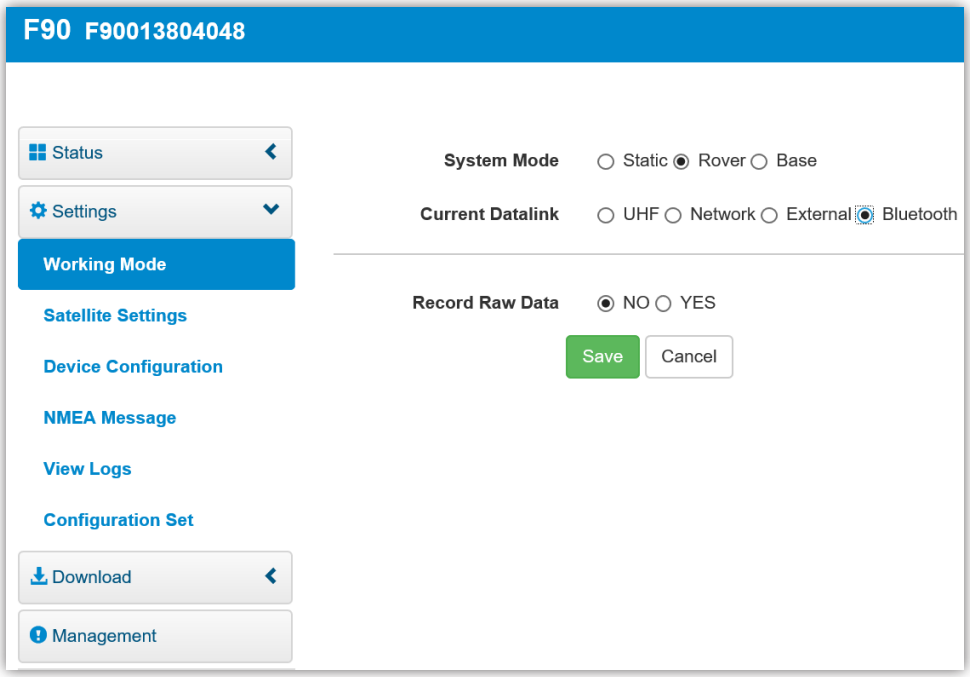


Figure 5-10 Rover mode(Bluetooth datalink)

(3) Base Mode

Base mode also contains different datalink, most parameters are same as rover. Just base has more options that can be edited.

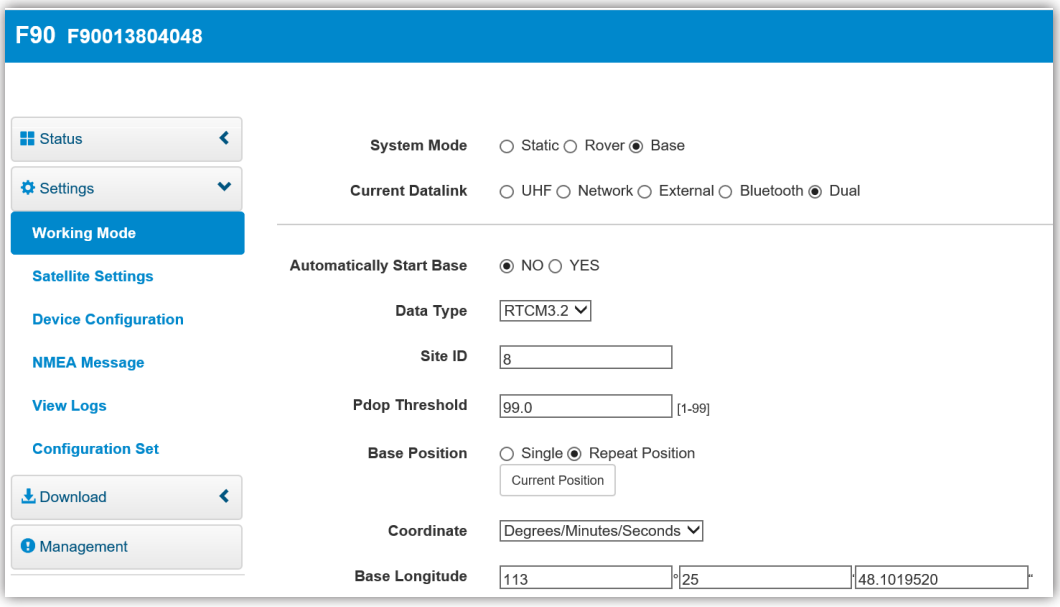


Figure 5-11 Base mode

If use External, you can connect F90 with external radio via Bluetooth. Besides, F90 can also connect with other devices via Bluetooth.

5.3.2 Satellites setting

In satellites setting, you can set the cutoff angle and select the satellites.

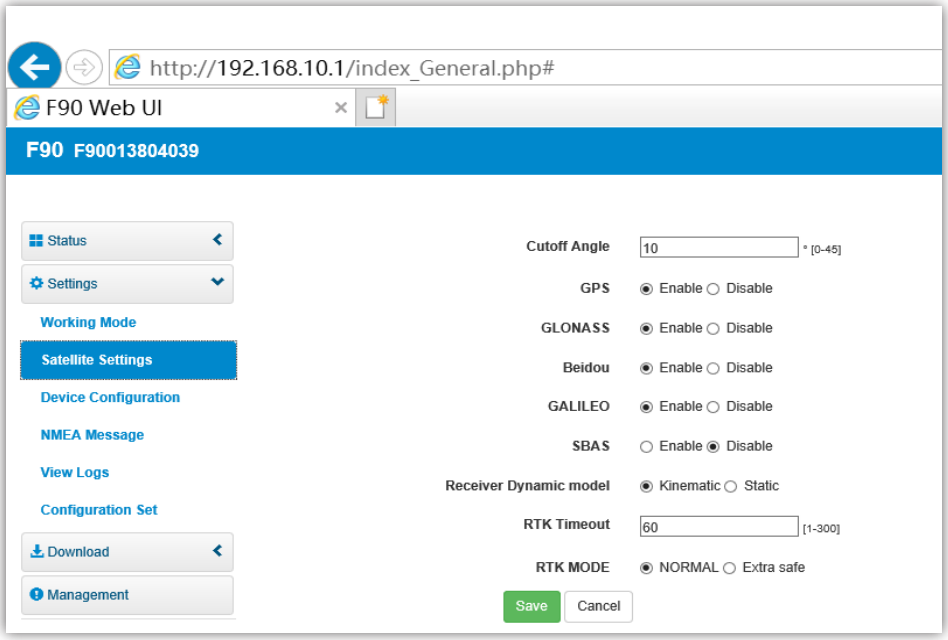


Figure 5-12

5.3.3 Device configuration

Device configuration can help you set many configuration. Such as select time zone, first storage position etc.

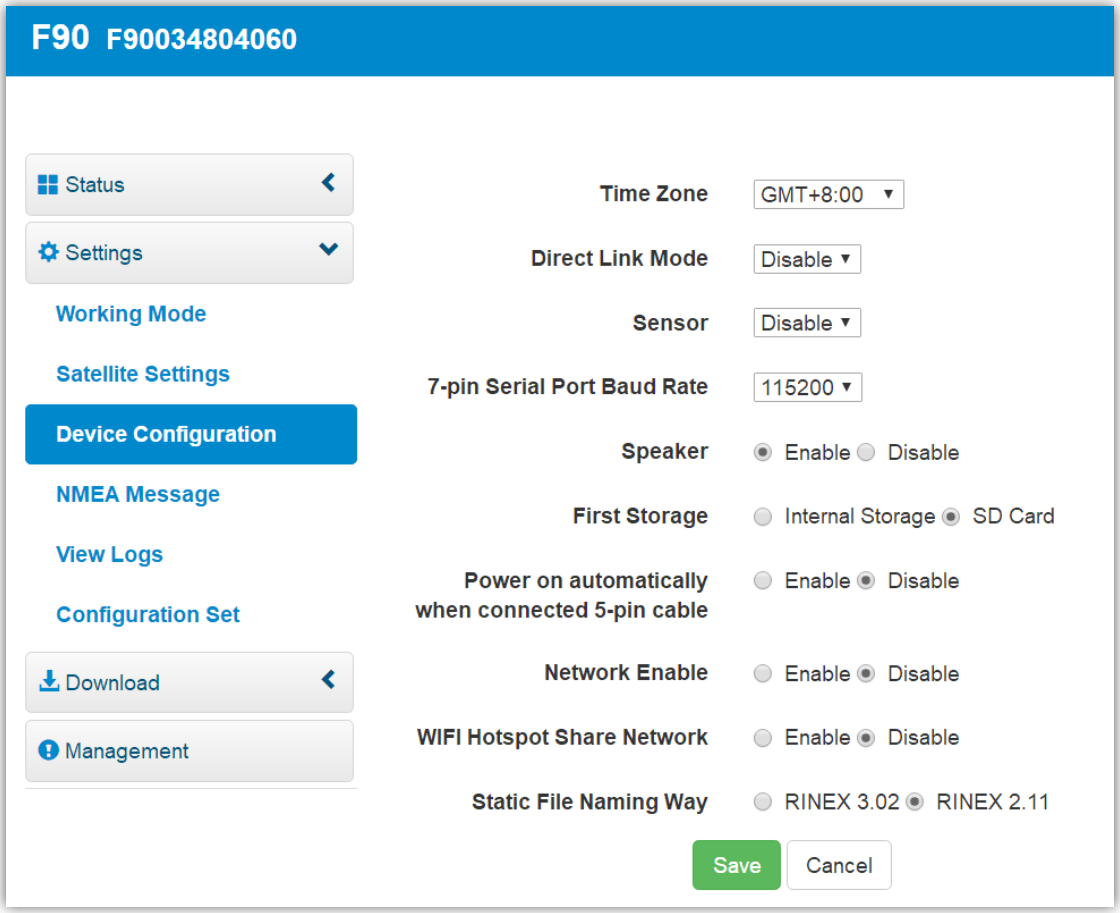


Figure 5-13

5.3.4 NMEA message

You can set the NMEA message, turn them on/off. You can also select the frequency here. NMEA includes GGA, GSA, GST, RMC, ZDA, GSV, VTG, GLL, GEDOP, GEREF,GESNR. Below pic shows the general settings.

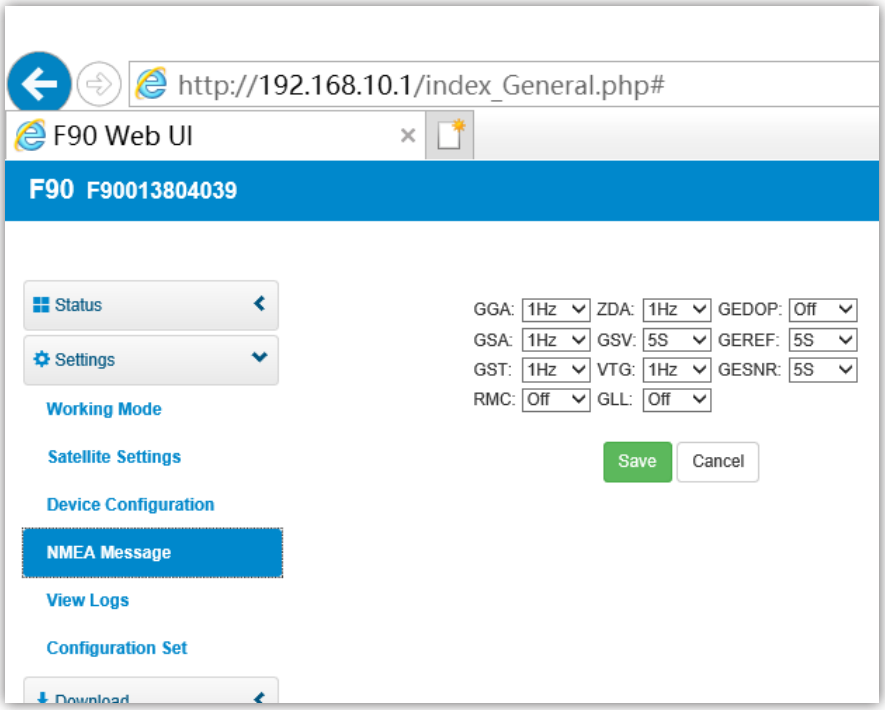


Figure 5-14

5.3.5 View logs and configuration set

In “View logs”, you can see previous malfunction record and see previous result of self-checking. You can view and download them.

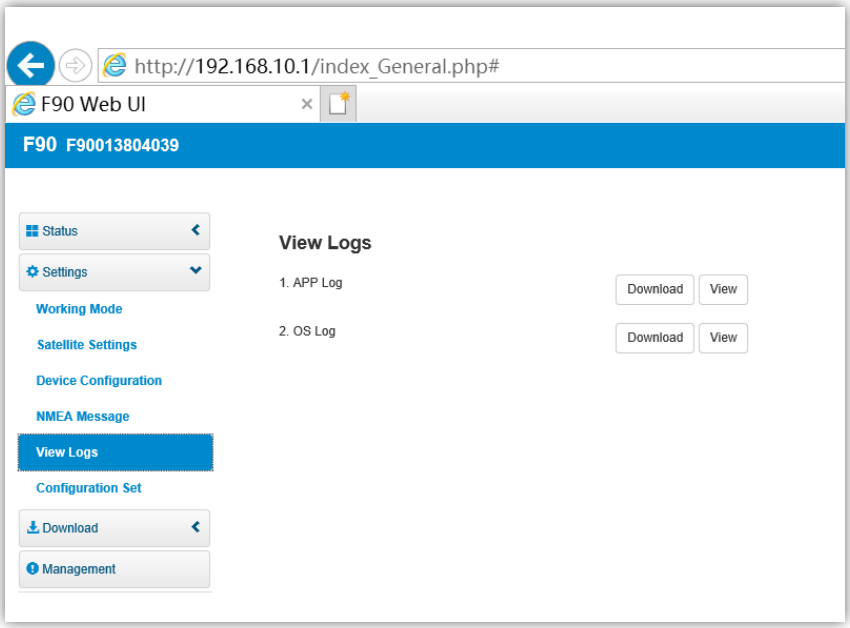


Figure 5-15

In “Configuration Set”, you can save current configuration you set and you can also use previous setting directly if you had saved.

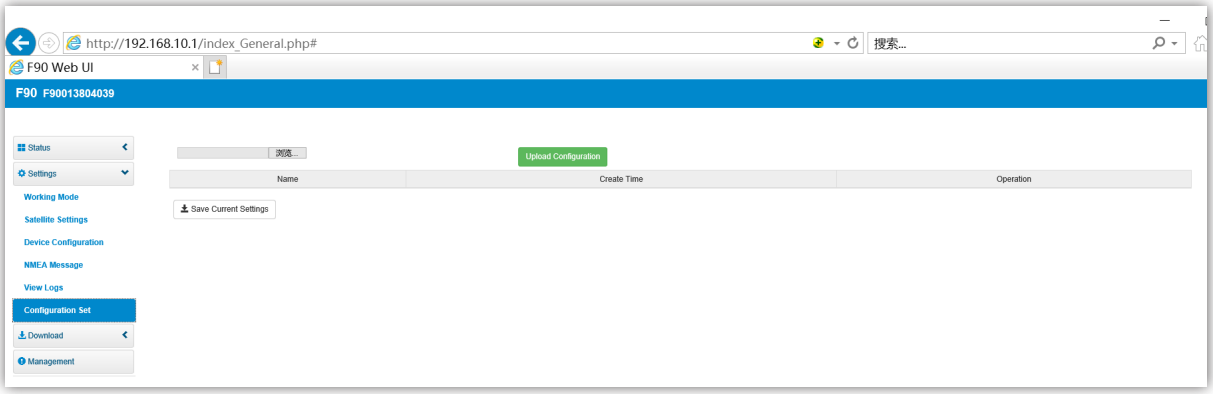


Figure 5-16

5.4 Download data

There are 2 kinds of data you can download--static data and backup data. For static data, you can convert it to Rinex.

5.4.1 Raw data

Raw data means static data. The format for raw data is “.dat” You can download and package them together.

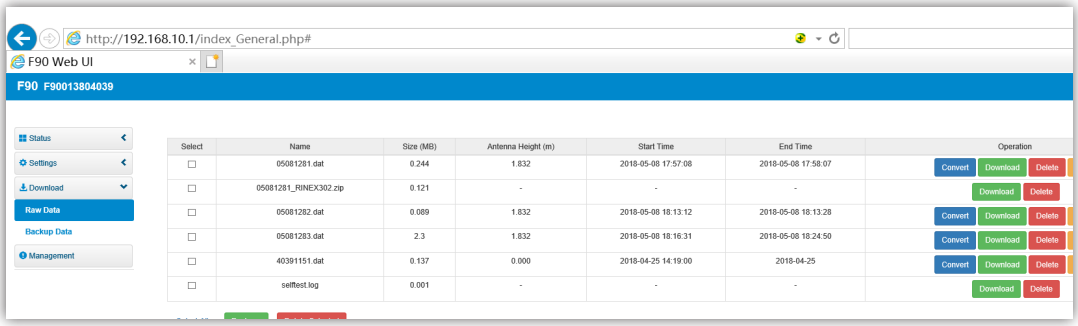


Figure 5-17

5.4.2 Backup data

Once you lose the data in controller. You can download backup data in WEB UI. The format for backup data is ".RTK"

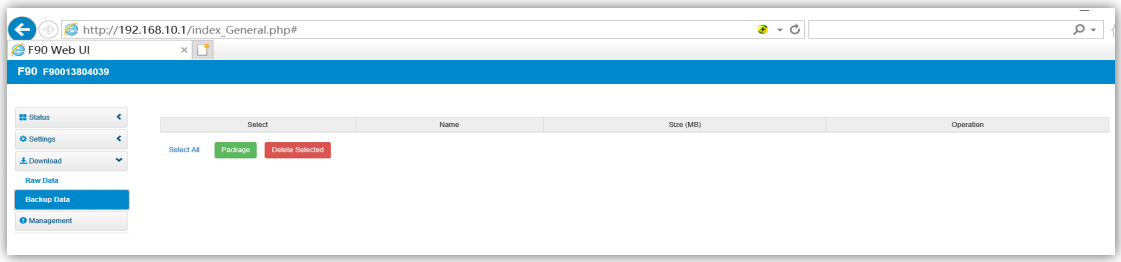


Figure 5-18

5.5 Management

Management contains many functions, you can register the device, do self-checking, change the password and restart the receiver.

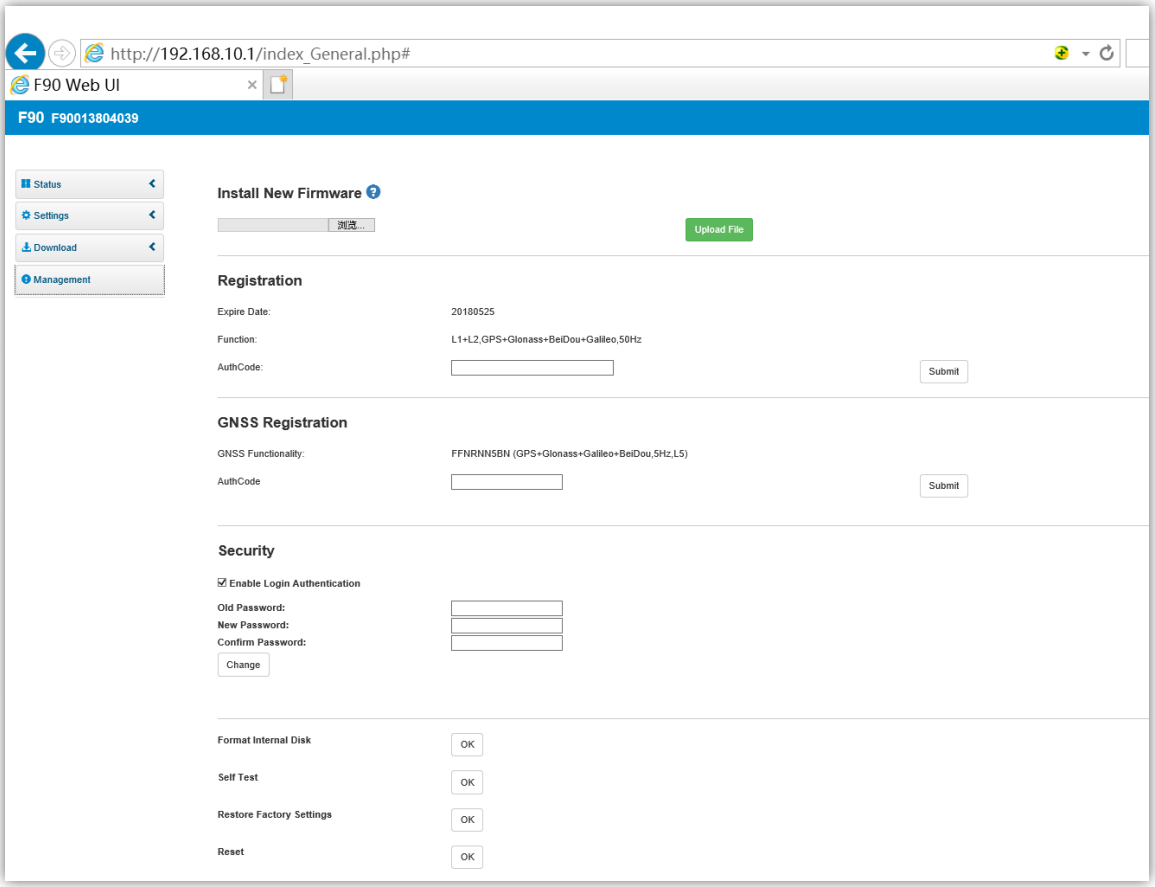


Figure 5-19

6- Frequently Use Functions

6.1 Device registration

The register code a 32 numbers and letters. For example :
F90034804060,20180821, A7ECAC8BB90494F57A1F2FDFFCBA4896, A7EC-AC8B-B904-94F5-7A1F-2FDF-FCBA-4896

F90034804060 is serial number
20180821 is Expiration date of this code
A7ECAC8BB90494F57A1F2FDFFCBA4896 is register code, when you register, you just need input this in Web UI.
A7EC-AC8B-B904-94F5-7A1F-2FDF-FCBA-4896 is also register code, it's same just separate by "-".
You can register the receiver through two methods : via WEB UI or via Controller. Detailed steps are as follow :

Register via WEB UI
After connecting the Wi-Fi, input IP "192.168.10.1" into your web browser. Then you can see page as show in Figure 6-1. Click "Management", you can find "Registration". Input your registration code into "Authcode", then click "Submit". The receiver will be registered.

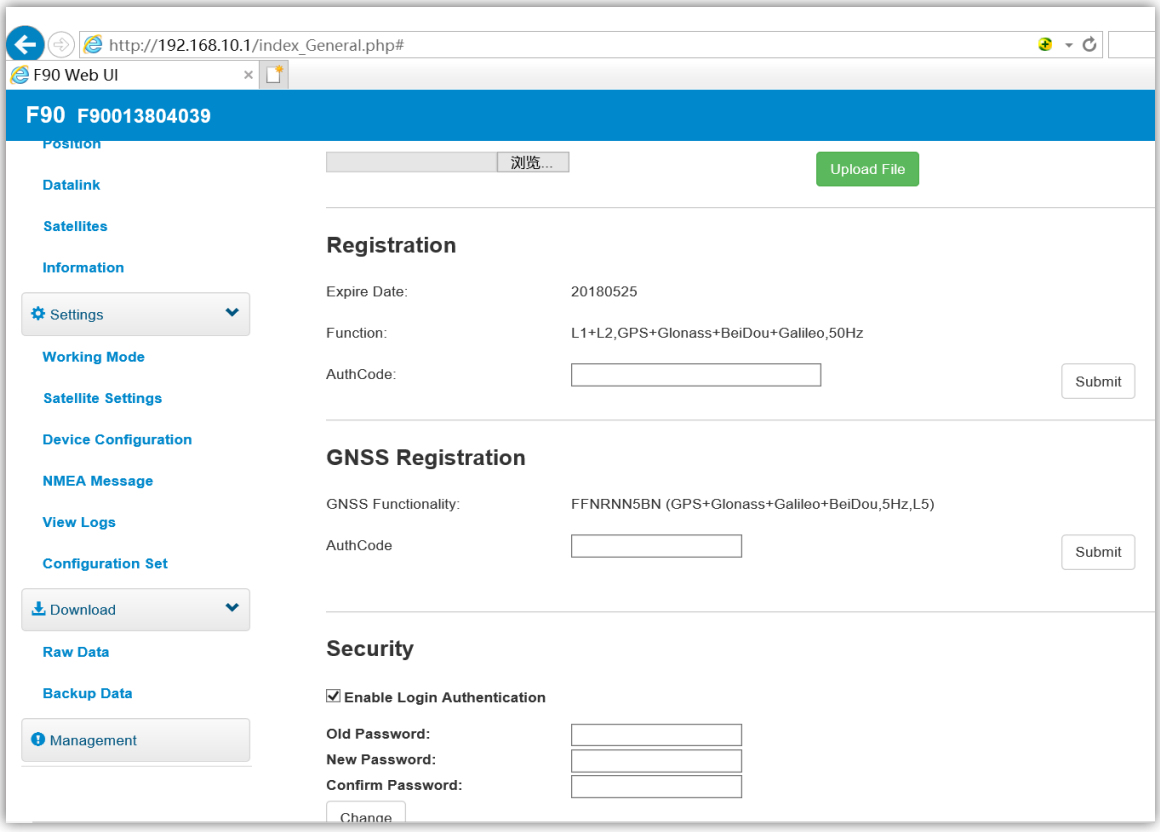


Figure 6-1

6.2 Download static data and Rinex change

In WEB UI function, you can find Download. Click Download, then see Raw data, and you can see page as below pic. Choose the data you need and click “Download”.

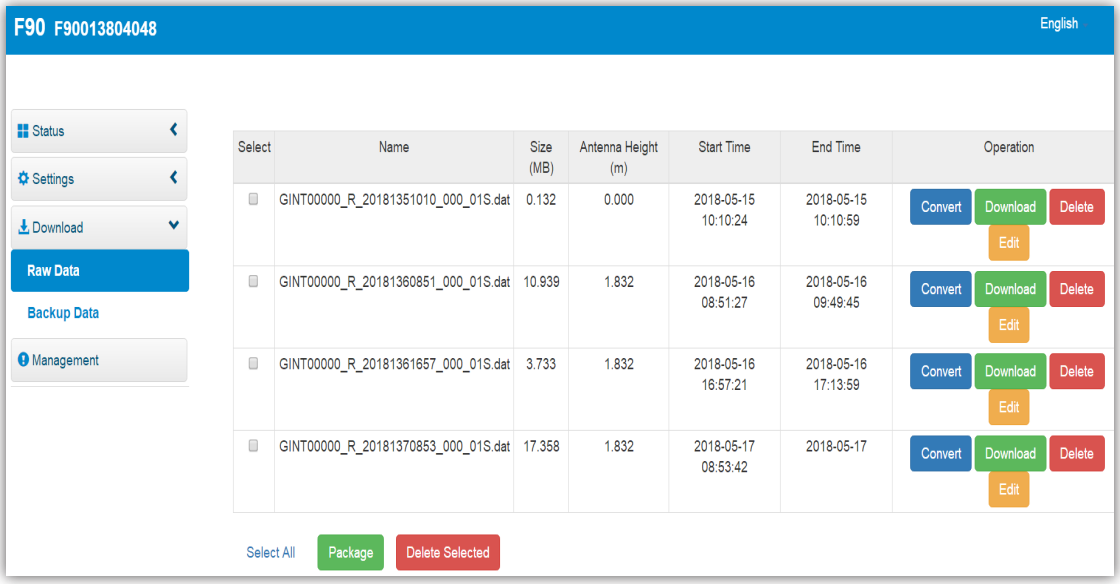


Figure 6-4

You can also see “Convert”, click Convert, then there are few file forms for you to choose. You can choose “Rinex 3.02” to change the data to Rinex.

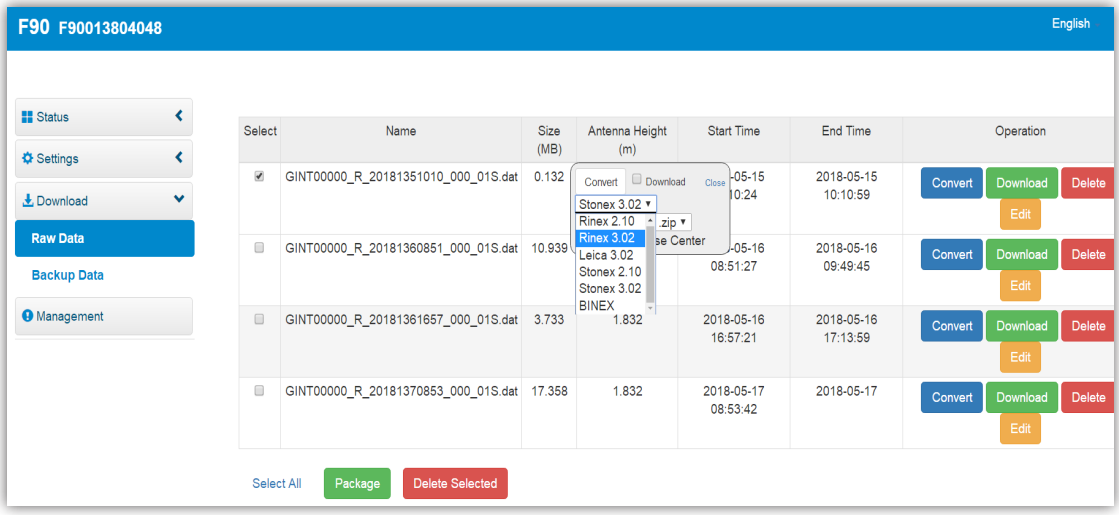


Figure 6-5

6.3 Upgrade firmware

You can upgrade firmware in WEB UI function. In “management”, you can find “Install New Firmware”. Click “browse” to select new version of firmware. After select the right version, click”Upload file” to finish upgrade.

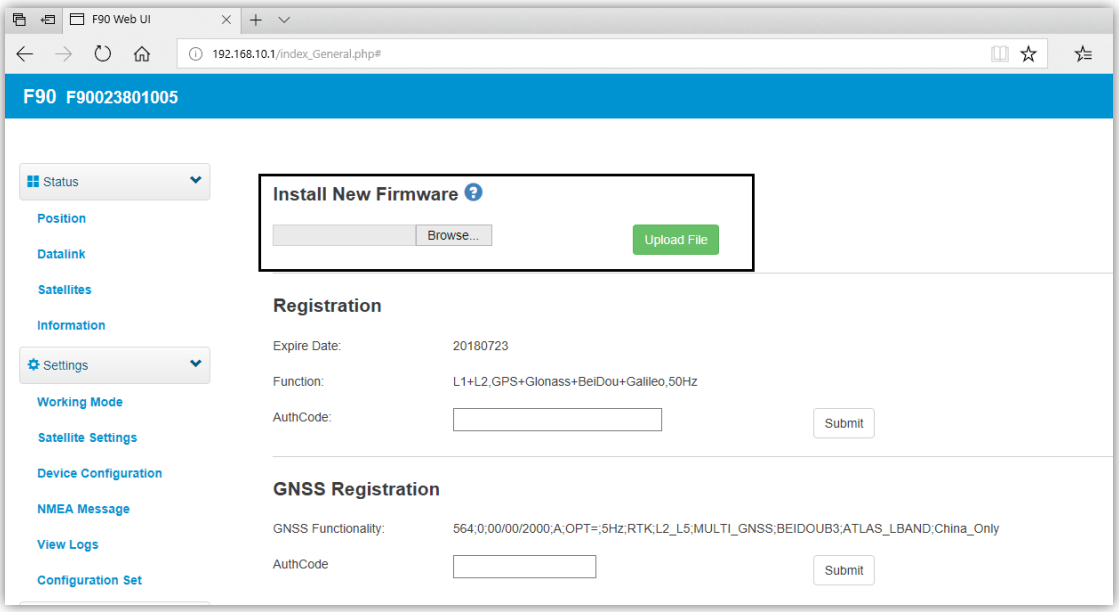


Figure 6-6

6.4 Restore factory settings

In WEB UI, “management” you can find “Restore Factory Settings” You can click “OK” to reset the device.

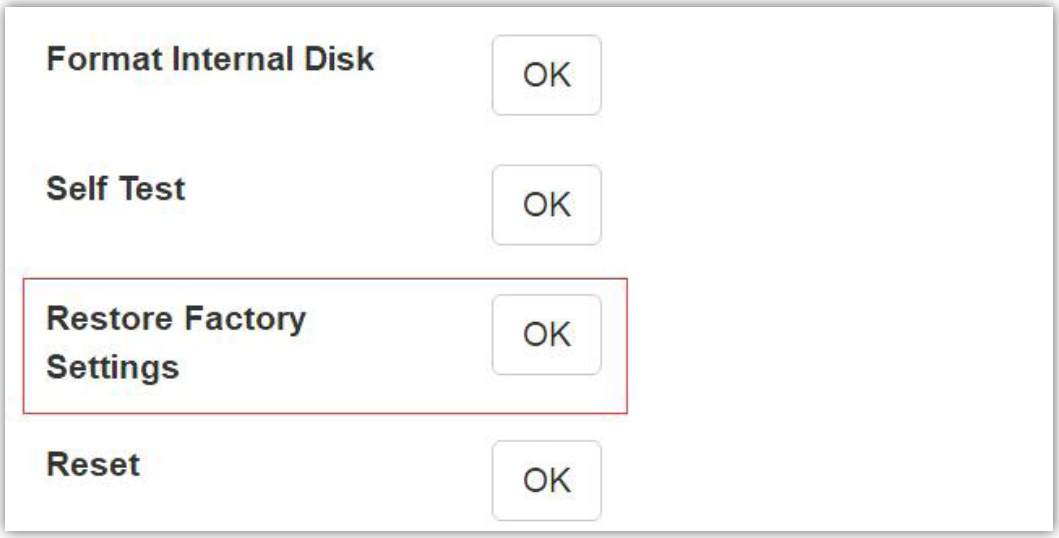


Figure 6-7

7- Technical Parameters

	Items	Specification		
GNSS	GPS Board	OEM729	P328	BD990
	Channel	555	394	336
	SATELLITE	GPS : L1CA/L1C/L2C/L2P/L5 GLONASS :L1CA/L2C/L2P/ L3/L5 BeiDou :B1/B2/B3 Galileo :E1/E5/AltBOC/E5a/ E5b/E6 NAVIC : L5 SBAS : L1/L5 QZSS : L1CA/L1C/L2C/L5/L6	GPS :L1CA/L1P/L1C/L2P/L2C/ L5 GLONASS : G1/G2, P1/P2 BeiDou :B1/B2/B3 GALILEO : E1BC/E5a/E5b QZSS : L1CA/L2C/L5/L1C SBAS : L1 CA/L5	GPS : L1 CA/L2E/L2C/L5 GLONASS :L1CA/L2CA/L3 CDMA BeiDou :B1/B2/B3 Galileo :E1/E5A/E5B/E5AltBOC/ E6 NAVIC : L5 QZSS : L1CA/L1SAIF/ L1C/ L2C/ L5 SBAS : L1 CA/L5
	Update rate	5Hz (Standard 5 Hz, can pay to activate 100HZ)	5Hz (Standard to 5 Hz, can pay to activate 50HZ)	50Hz (Standard 50 Hz)
	Static Accuracy	Horizontal :±(2.5+1×10^{-6}D) mm Vertical :±(5+1×10^{-6}D) mm	Horizontal :±(2.5+1×10^{-6}D) mm Vertical :±(5+1×10^{-6}D) mm	Horizontal :±(2.5+1×10^{-6}D) mm Vertical :±(5+1×10^{-6}D) mm
	RTK Accuracy	Horizontal :±(10+1×10^{-6}D) mm Vertical :±(20+1×10^{-6}D) mm	Horizontal :±(8+1×10^{-6}D) mm Vertical :±(15+1×10^{-6}D) mm	Horizontal :±(8+1×10^{-6}D) mm Vertical :±(15+1×10^{-6}D) mm
Power	Battery	Dual Battery, 7.2V/3400mAh*2 Can work at least 10 hours without stopping		
	Input	9~28V DC		

	OS	Linux	
	Memory	Internal 8G, TF Extended, Max≥32G	
	Bluetooth	V2.1+EDR / V4.1 Dual Mode, Class2	
	WIFI	802.11 b/g/n	
	4G	All areas without North America : EC25-E, 4G FDD LTE : B1/B3/B5/B7/B8/B20 TDD LTE : B38/B40/B41 WCDMA : B1/B5/B8 GSM : B3/B8	North America : EC25-A, 4G FDD LTE : B2/B4/B12 WCDMA : B2/B4/B5
	Internal UHF	TRM101 :Power 1W, Frequency 410-470MHz Work Distance : 5km in good environment	
	Protocol	SATEL, PCC-GMSK, TrimTalk 450S, South9600, TrimMark III(19200) , South 19200, Hi-target 9600, Hi-target 19200	
	Electric Bubble	Support, Support tilt survey	
	TNC	For UHF Antenna	
Interface	5 pins	External radio and external power	
	7 pin	Connect to PC controller and other external device, such as Echo Sounder	
	Others	SIM slot and TF slot	
	Button	Power button, also can show power status	
Interface	Indicator	5 indicators :Satellites, Datalink, Bluetooth, WIFI Status, Power indicator	
	Language	Supports TTS Multi language voice	
	Dimension	140x157x76mm	
Physical	Weight	1.2KG with 2 batteries inside	
	Work Temperature	-30°C ~ +65°C	
	Stock Temperature	-40°C ~ +80°C	
Environment	Protection	IP67	
	Shock	Withstand 2 meters pole drop, 1.2m drop without pole	
	Humidity	100 %	

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