Matrix VI User Manual

Contents

Chapter I Summary

1.1 Summary

In recent years, the α-GEO company has been committed to making field measurement easier and easier. According to the engineering experience accumulated in the past 30 years and the experience in the research and development of Surveying and mapping related instruments, I am familiar with the current situation and development direction of Surveying and mapping products, and can organically introduce other disciplines and technologies into the field of surveying instruments.

MATRIX VI is a high-end intelligent GNSS receiver launched by α-GEO, which is a compact new generation of Visual RTK designed for any surveying project using the latest GNSS technology. It adopts multi-satellite and multi-frequency technology, with built-in all constellation motherboard, supports BeiDou3 satellite, with advanced IMU technology, and Linux operating system runs more stably and smoothly. The operation mode is simple and flexible, in terms of function, performance, speed and power consumption Meet the higher requirements of users.

1.2 Product features

Good design, advanced algorithm, smart interaction, and equipped with an efficient Linux platform; The miniaturized zero phase antenna adopts multi-satellite and multi-frequency GNSS main board, supports multiple satellite system signals of BDS, GPS, GLONASS and Galileo, with good electromagnetic shielding and stable receiving satellite signals;

When the stakeout points are marked directly on the ground, surveyors can easily find the exact location of the stakeout points. By following the arrows on the real-life map, you can stake out points in one go, without having to move the pole back and forth, making the stakeout work more accurate and efficient;

The world's exclusive patented laser measurement quick calibration technology can easily achieve centimeter-level measurement accuracy, making measurement more accurate and user-friendly. Besides the camera used in the equipment overcomes the difficulty of aiming under sunlight, making field measurement operations faster and more efficient;

The built-in high-performance 9-axis IMU module eliminates the need for users to perform complicated calibration. The maximum inclination angle can reach 120 degrees, and the accuracy can be maintained within 2cm. What you reach is what you measure, no more waiting;

Provide rich data link mode, with Wi-Fi and 4G Internet access function to transmit differential data; when using network to transmit differential data, the Rover receiver of other manufacturers can connect to the reference station established by the measurement receiver, and the measurement Rover can also connect to the CORS reference station of other companies;

1.3 Precautions

MATRIX VI is a precision instrument. Although it is designed to resist chemical corrosion and earthquake, it should be used and maintained carefully in actual use.

1. Packing and transportation: please make sure that the receiver and all accessories are

placed in the instrument box in the correct position to prevent the instrument from being damaged by impact and vibration during transportation. Please dry the instrument surface with a cloth when it is wet by rain, and then pack it after it is dried. The receiver and data collector are equipped with built-in lithium battery. Please ensure to comply with the national laws and regulations during express transportation.

2. Storage: when using and storing the receiver, please make sure it is within the specified temperature range. Before storage, take out the lithium battery from the host and turn off the manual. After using the instrument at ordinary times, it shall be packed in time to prevent the loss of accessories.

3. Please do not disassemble the instrument when using the GNSS receiver. In case of failure, please contact the supplier;

4. Please use the original battery charger. When using an external power supply, you must ensure that the nominal voltage is correct.

5. Do not use receiver and pole in thunderstorm days to prevent accidental injury caused by lightning stroke.

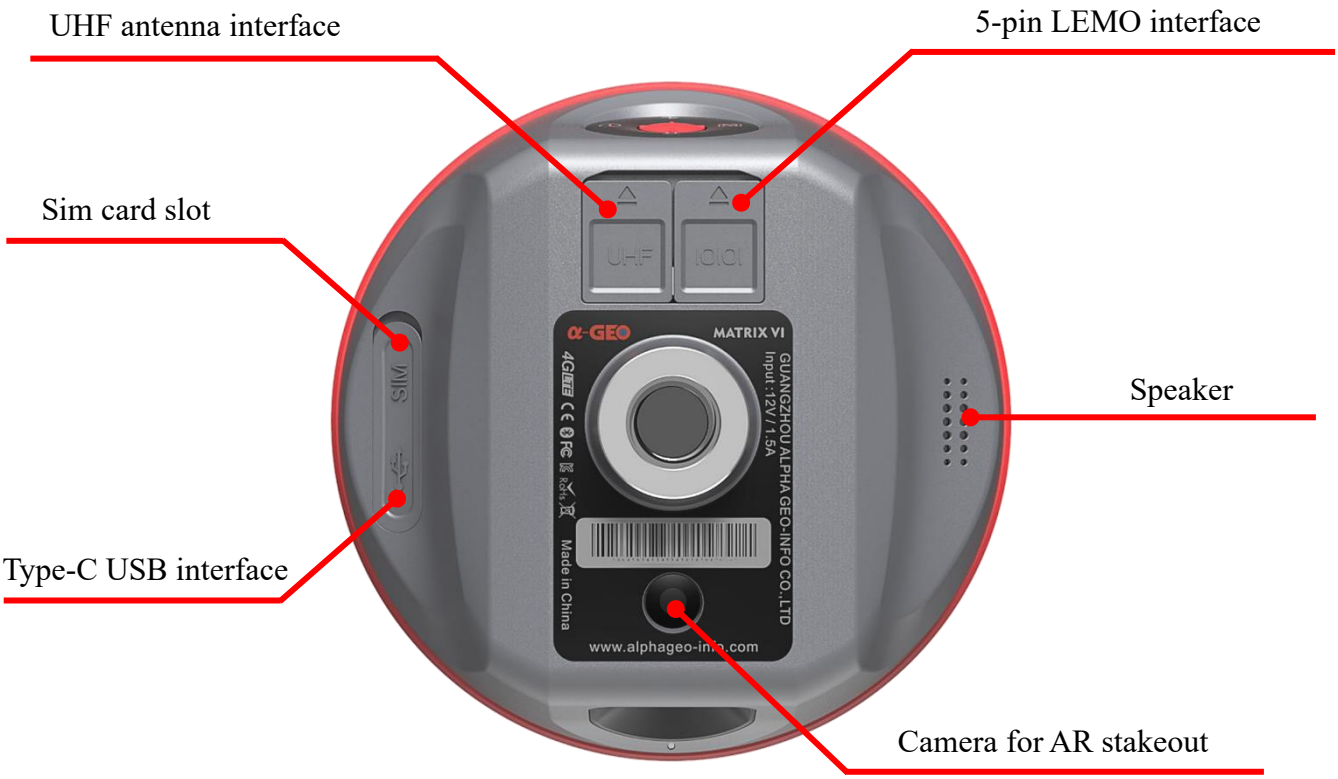
6. In order to ensure the quality of the satellite observation signal, the sky over the station should be as wide as possible, and there should be no obstacles above the altitude angle of 15 degrees. High voltage line, microwave station, TV Tower and other strong electromagnetic interference equipment shall be avoided within 200m around the station. In order to reduce the influence of multipath effect on the observation, the station should be far away from large water areas, glass curtain walls of high-rise buildings and other areas with strong electromagnetic wave reflection.

Chapter II Hardware Operation

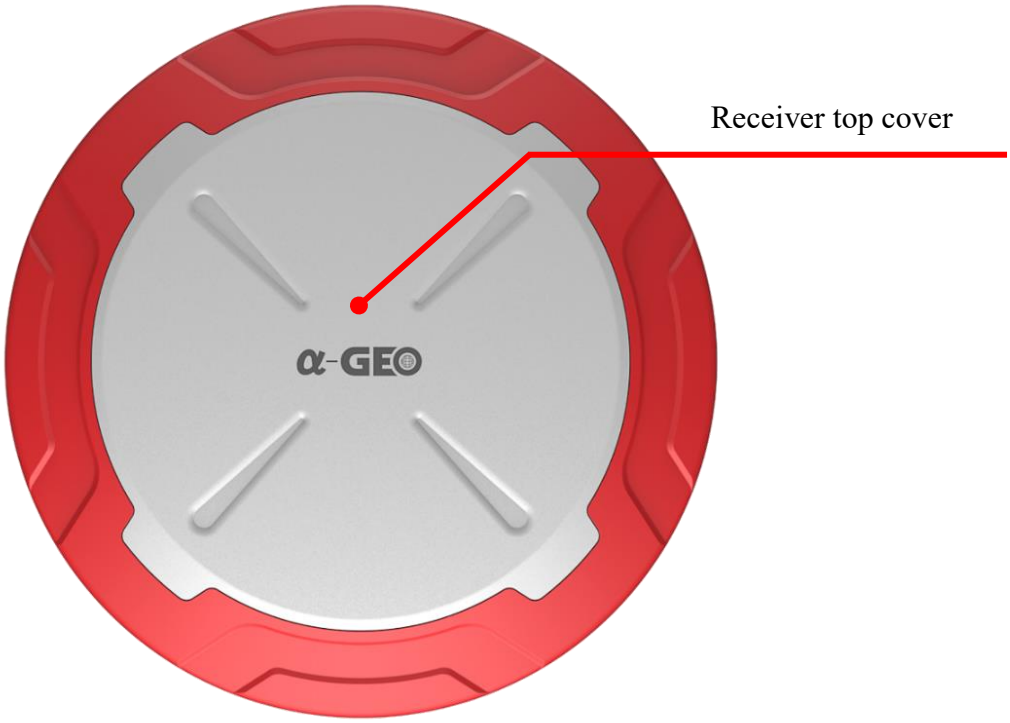
2.1 Device components

Button/Indicators	Remark	Descriptions
	Power button	Pressing to power on/off receiver
	Power indicator	Indicates power-on status and battery status
	Bluetooth	Indicates Bluetooth connection status
	Satellite	Indicates satellites locked/tracking status
	Data	Indicates data communication status


MATRIX VI
LASER/VISION
Camera for photogrammetry and laser aiming
Laser transmitter
Laser receiver


UHF antenna interface
5-pin LEMO interface
Sim card slot
Speaker
Type-C USB interface
Camera for AR stakeout
UHF
SIM
MATRIX VI
GUANGZHOU ALPHA GEO-INFO CO.,LTD
Input:12V/1.5A
Made in China
www.alphageo-info.com

Components	Descriptions
UHF antenna interface	Built-in radio antenna interface, the antenna must be mounted to use the built-in radio
5-pin LEMO interface	External power supply; Serial cable connection control; External radio data transmission
Sim card slot	Install a nano SIM card for device internet datalink communication
Reset key	For reset the device when some unexpected issue happens
Type-C USB interface	Charge the device and download the data
Speaker	Working mode and status voice prompted
AR Camera	For live scene stake out

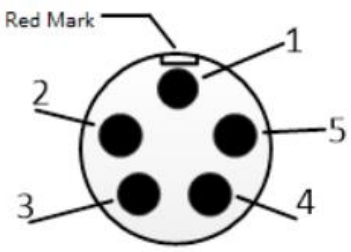


2.2 Accessories

2.2.1 Carrying case

If there is water on the surface of the instrument or inside the box, please do not directly pack the box, and then cover it tightly after drying. If the inside of the box is wet and the field is eager to transport it, it should be opened and dried in time when returning to the room.

2.2.2 Lemo interface (5-pin)



Note: The 5-pin interface are all arranged in a counterclockwise direction when looking at the front (that is, facing the front side of the notch of the 5-pin interface of the receiver)

(1) Three uses of the 5-pin interface:

1. When the interface is connected to the computer, it is used to connect the PC control software of the test;

2. When the interface is connected to the external radio, the data cable is used for the receiver and the external radio communication;

3. When the interface is connected to the adapter, it can supply power to the receiver.

(2) Signal description

1	Power(12V)
2	Signal (Ground)
3	RXD
4	TXD
5	Power (Ground)

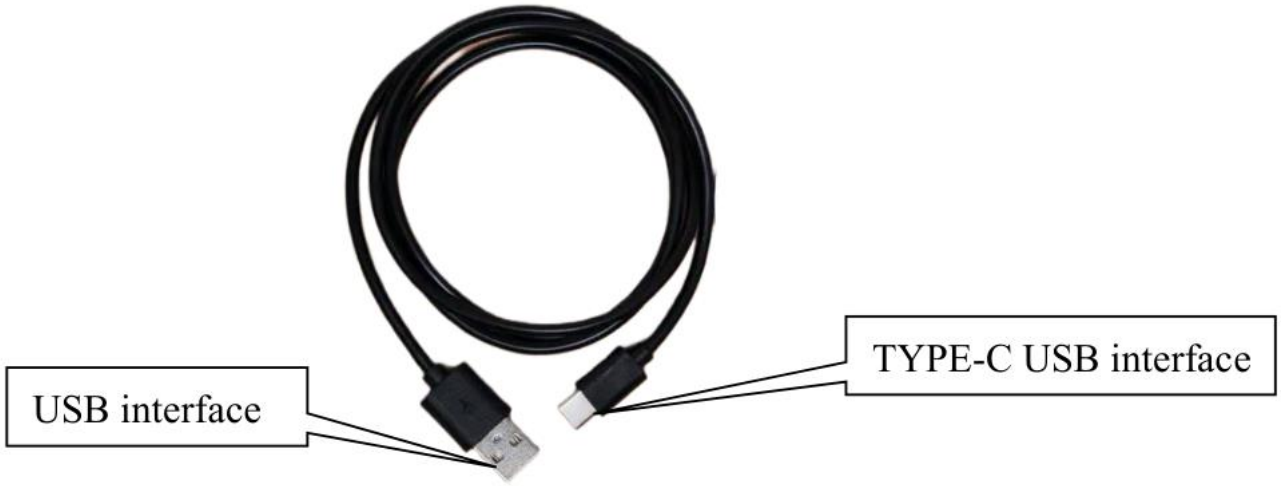
Note: When connecting the 5-pin interface, make sure that the red mark of the 5-pin head is aligned with the red point on the small 5-pin interface, and then it can be inserted gently. If it is not aligned, it cannot be inserted to protect the 5-pin interface.

2.2.3 Type-C Cable

The USB interface is located on the side of the receiver. Open the rubber plug on the side of the receiver to see the interface. The Micro USB interface of the receiver is used

as follows:

(1) Connect the charger via the Type-C USB cable and charge the device;



Type-C USB cable

For Type-C cable, one end is a standard USB interface, and the other end is a Type-C USB interface, which is mainly used for data transmission between computer and receivers and charging.

2.2.4 Internal UHF antenna

The receiver is equipped with a UHF built-in radio antenna, the specific use is as follows:

(1) In any case where the built-in radio is used as a data link, whether it is a dual-transmission mode or a radio repeater mode, the UHF built-in radio antenna must be inserted.

(2) The receiver integrates a 4G built-in antenna, and users do not need to plug in a 4G antenna.

Internal UHF antenna

When using the built-in radio as the data link, the radio communication protocol and radio frequency can be set on the data collector.

2.2.5 SIM Card Installation

When using the built-in network communication, a mobile phone card needs to be inserted, and the receiver supports Nano-SIM card. SIM card installation method: Open the battery cover, as shown in following figure, insert the SIM card notch into the card slot with the chip facing down. When removing, just press the SIM card to automatically eject part of it, then pull out the card.

Tip: The receiver has a built-in 4G antenna, and no external antenna is required when using the built-in network communication.

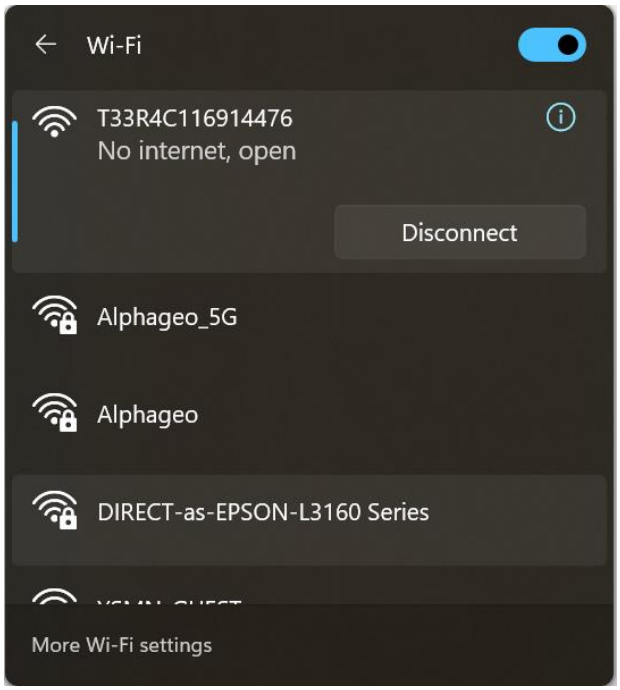
Chapter III Internal Web UI introduction

3.1 Web UI login

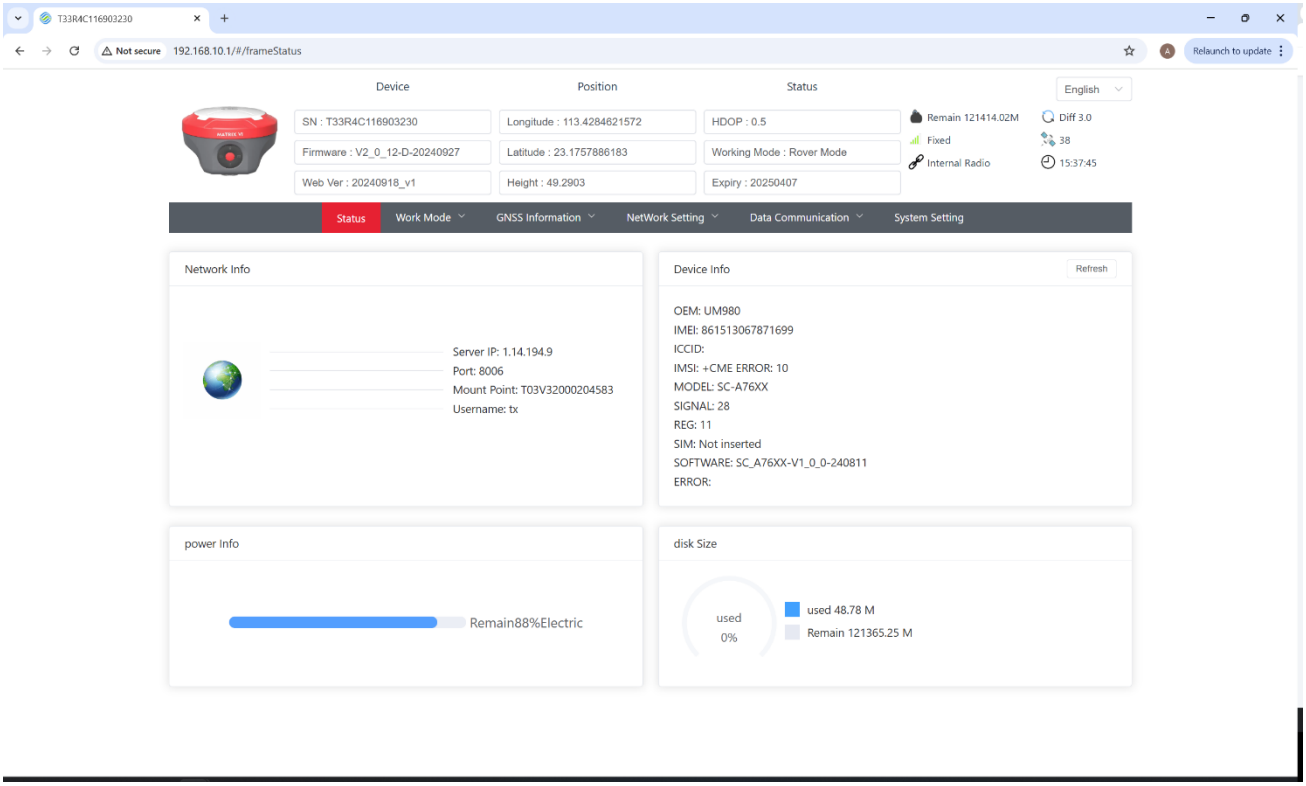
MATRIX VI can be fully configured and monitored by using the WEB UI. Any Wi-Fi device can connect to MATRIX VI via the WEB UI. The steps how to connect to Wi-Fi is as below.

1. Wait till MATRIX VI has fully booted after switching on (about 10 seconds).

2. The wireless access point name will be shown up which is same as the serial number as shown in following figures. The password is 12345678.

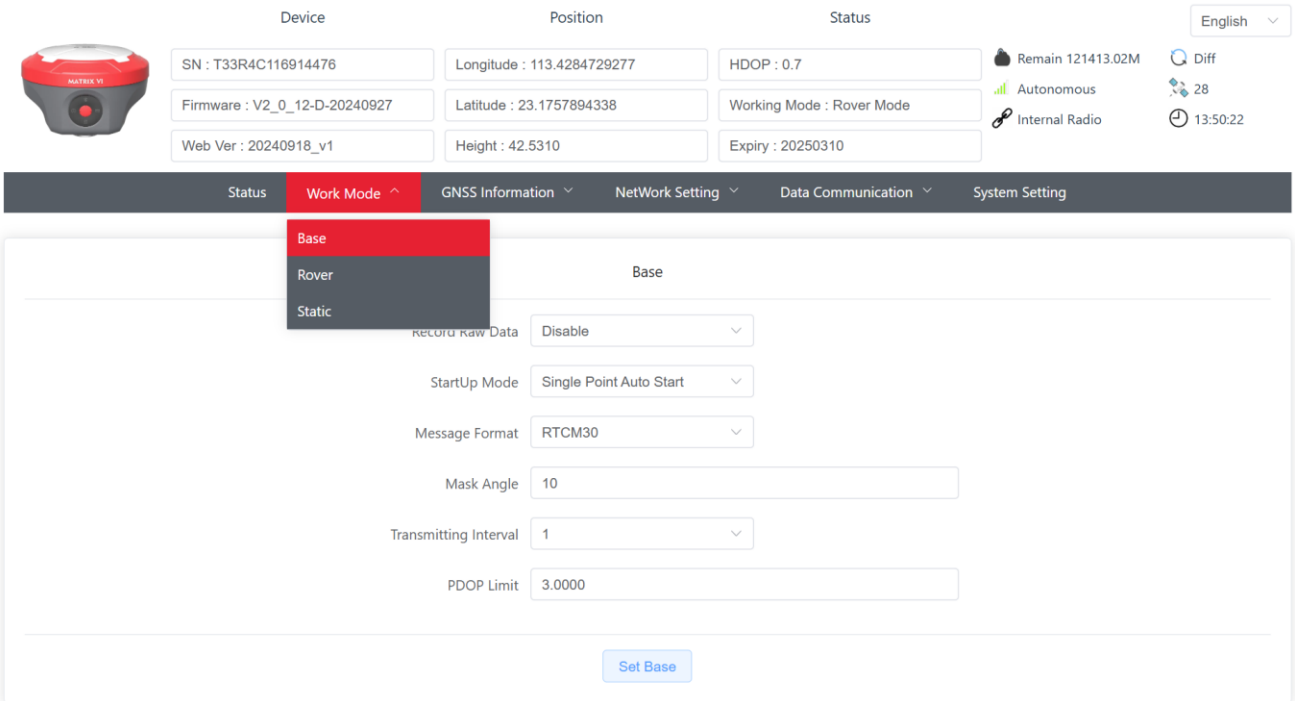


3. Run a browser and type the IP 192.168.10.1 in the address bar, if requires username and password, type “admin” for both username and password. The browser will open the ‘Overview' page of the Web Interface as shown in Figure 3-2. Basic information of receiver will be display in this interface, including receiver SN, firmware version, position information, etc.



3.2 Configuring the device as a Base

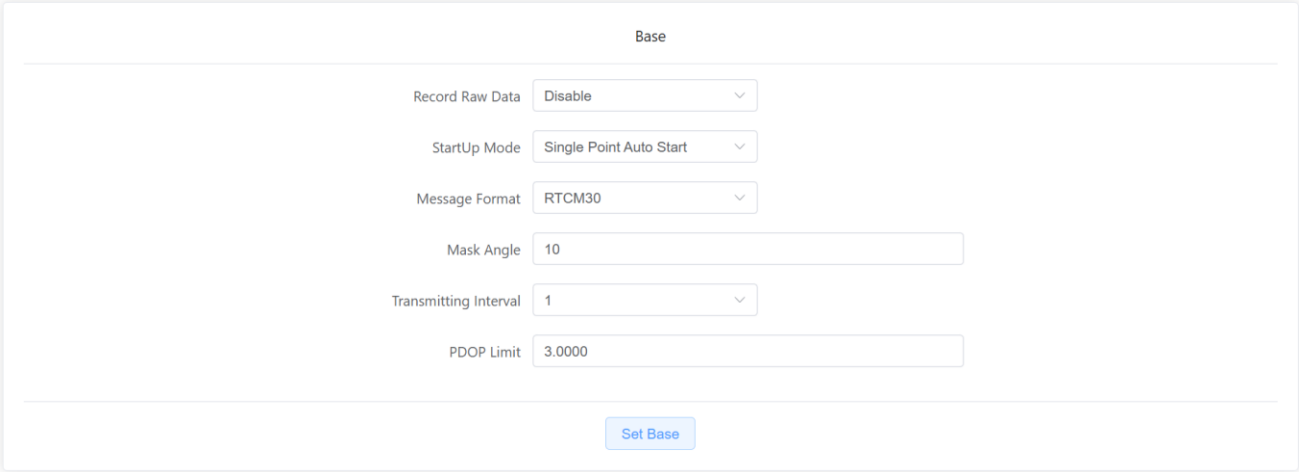
The MATRIX VI is able to be set as Base, and can be started as internal UHF, Network, Ntrip Caster. Check the Base in work mode field, as shown in following figure.



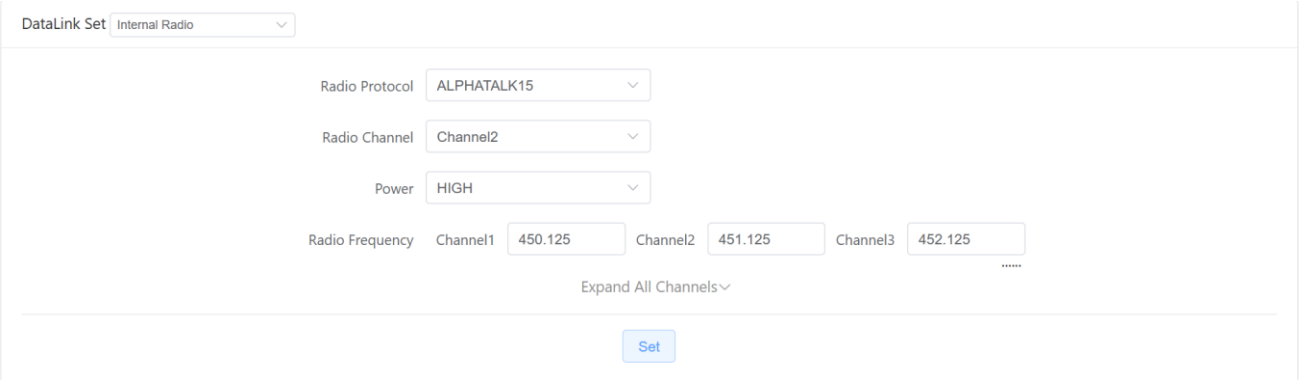
3.2.1 Transmitting via Internal UHF

1. Mount the UHF antenna to the MATRIX VI for transmitting the signal.

2. Select the Base work mode field, set the coordinate, antenna height, the differential message type, PDOP and mask angle, as shown in following figure.

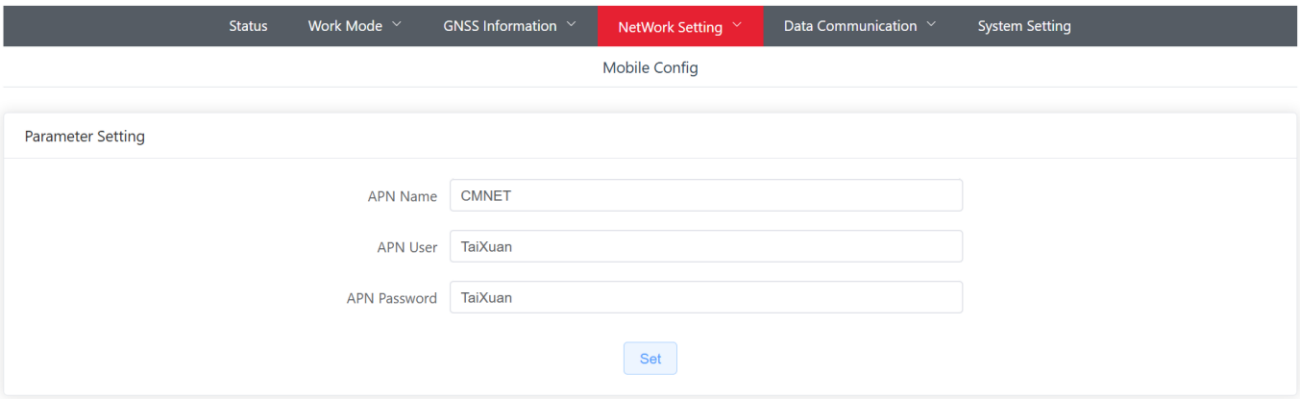


3. Select the Built-in Radio in Datalink field, set the required radio protocol, channel, frequency and power level, as shown in following figure.

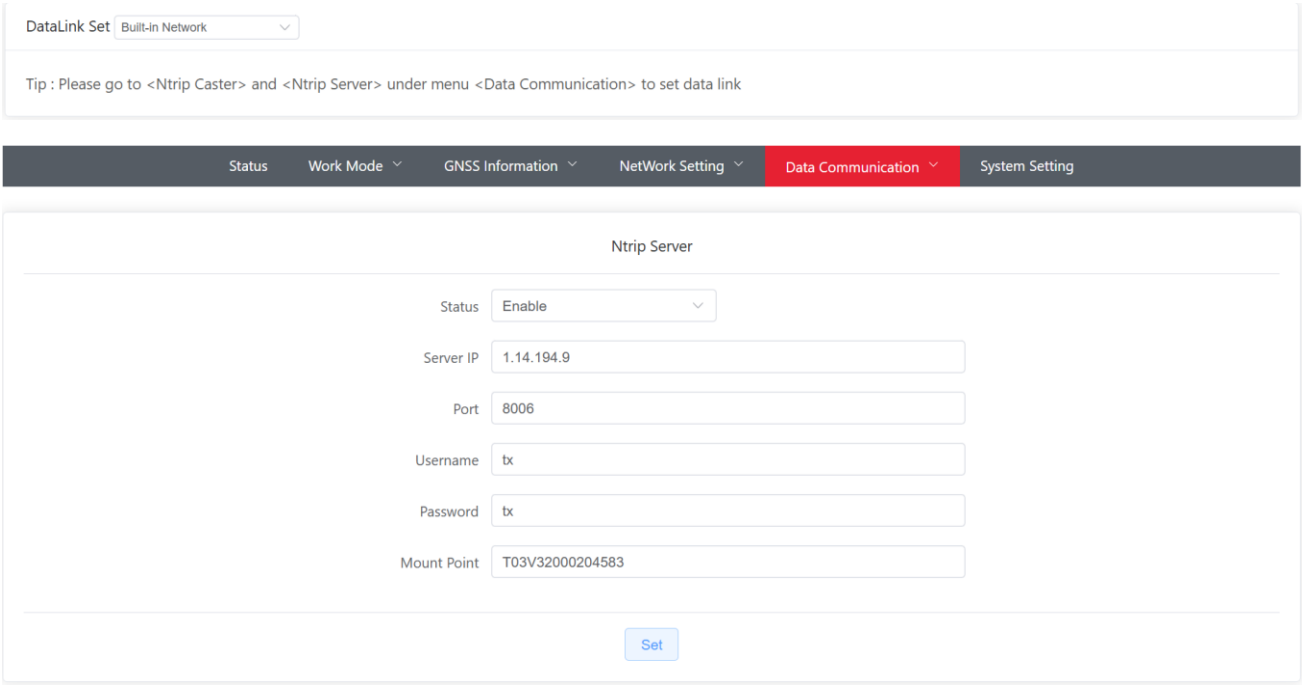


3.2.2 Transmitting via Network

1. Insert a sim card into the device and configure the APN parameters in Network Setting field → Mobile Config to activate it, as shown in following figure.



2. Select the “Built-in Network” in Datalink field, and enter the Ntrip Server parameters in the corresponding filed. You will need to provide a name of the mountpoint in Access Point filed, as shown in following figure.



3.2.3 NTRIP Caster

The NTRIP Caster is a HTTP server which receives streaming RTCM data from one or more NTRIP Servers and in turn streams the RTCM data to one or more NTRIP Clients via the internet. MATRIX VI is equipped with Wi-Fi module, so it can be a server and perform as Ntrip Caster to transmit the RTCM data, which is a very good feature for

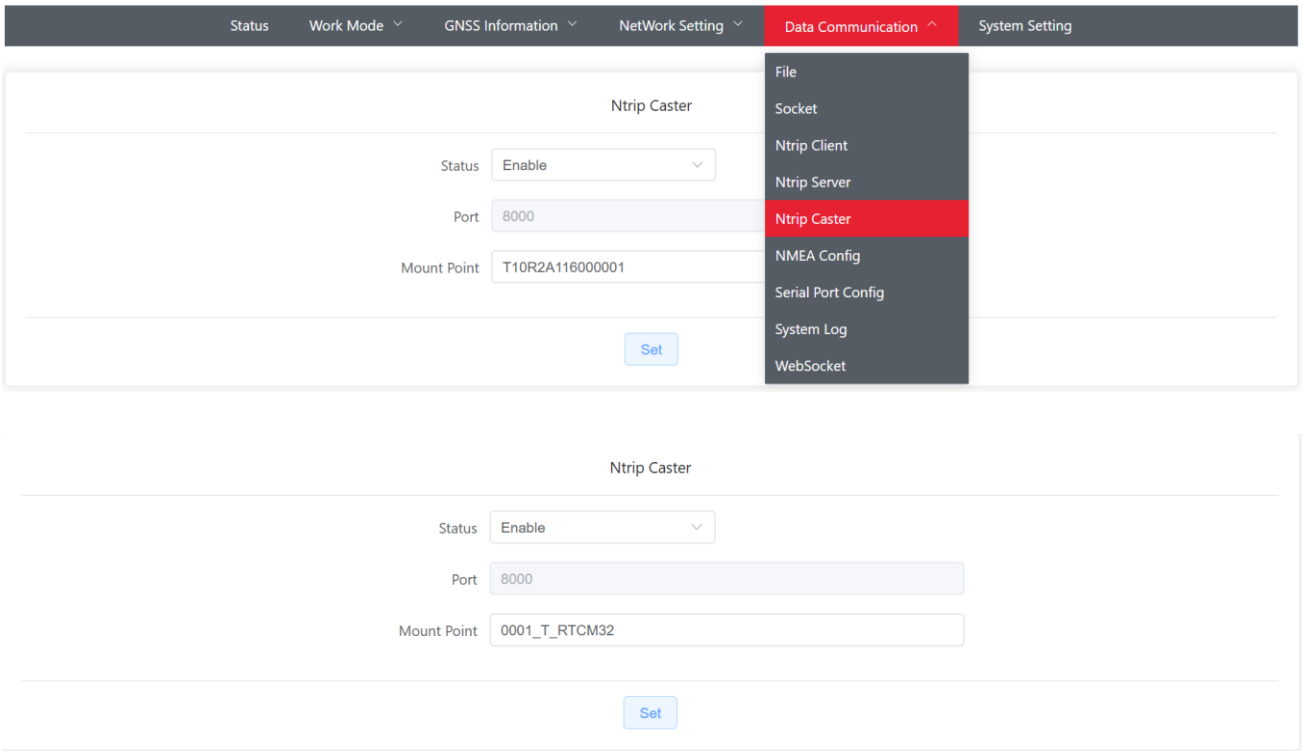
drone's application.

Base Configuration

1. Set the Base start parameters as usual, and select the external radio as datalink method.

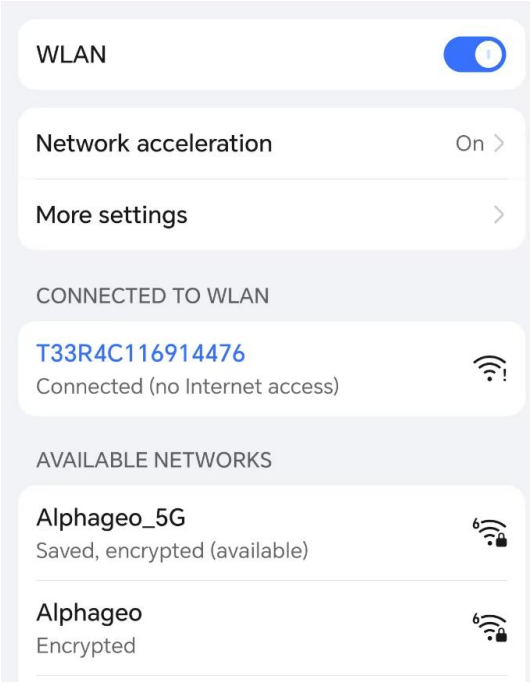
2. Select the NTRIP Caster in Data Communication field as shown in following figure.

3. Set the port number and the mountpoint name as shown in following figure.

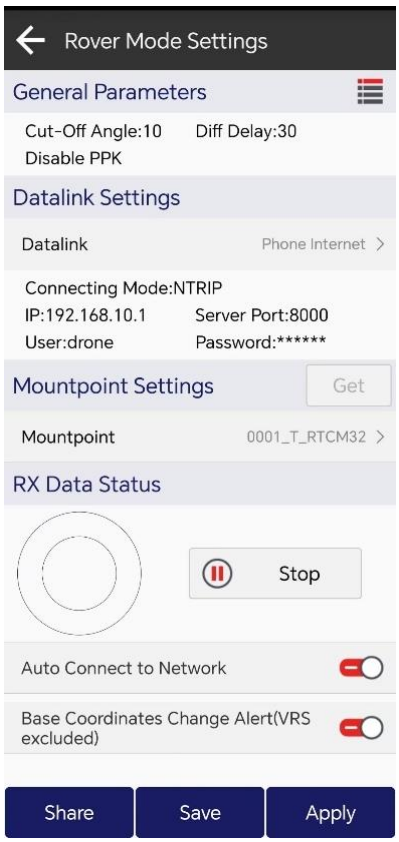


Rover Configuration

1. Connect data collector or Drone's controller to MATRIX VI's Wi-Fi hotspot without entering any password, as shown in following figure.



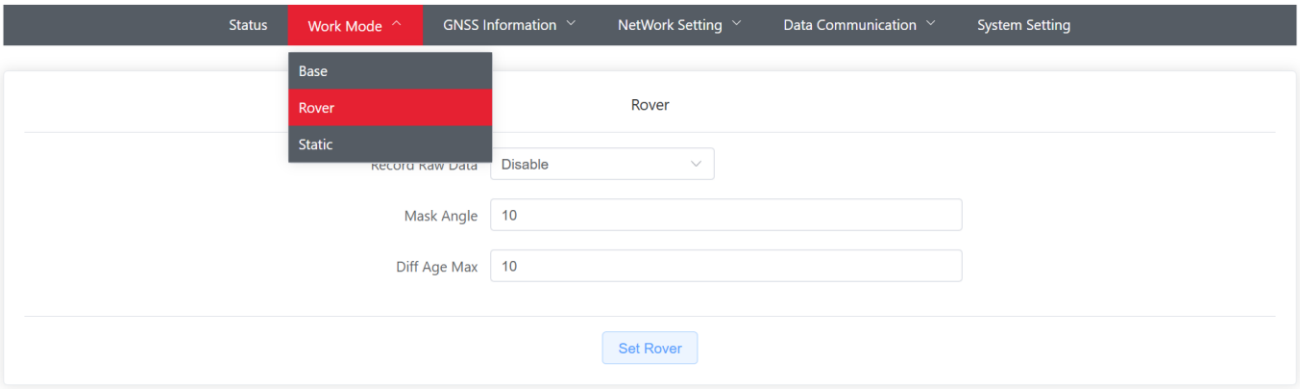
2. Run the controller software and go to the Ntrip Configuration menu, enter the IP 192.168.10.1 and port (e.g., 8000) as set in Base configuration. The mountpoint (e.g., 0001_T_RTCM32) will be shown in the list, as below following figure.



3.3 Configuring the device as a Rover

3.3.1 Standard Rover settings

For the MATRIX VI to operate as a rover and accept differential correction data from a Base station, check that Rover is selected in the “Work Mode” field as shown in following figure. This is the default operating mode of the MATRIX VI.

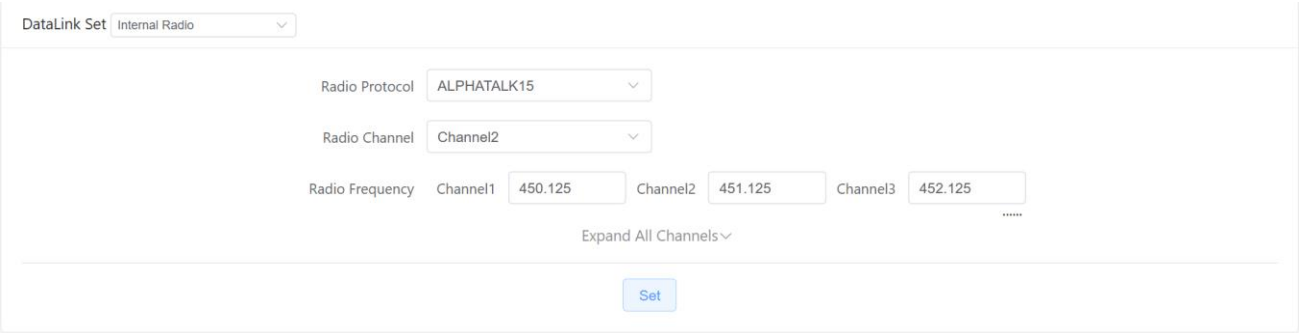


Note: When the “record raw data” is checked, the receiver will record raw data in Rover mode.

3.3.2 Data link in Rover mode

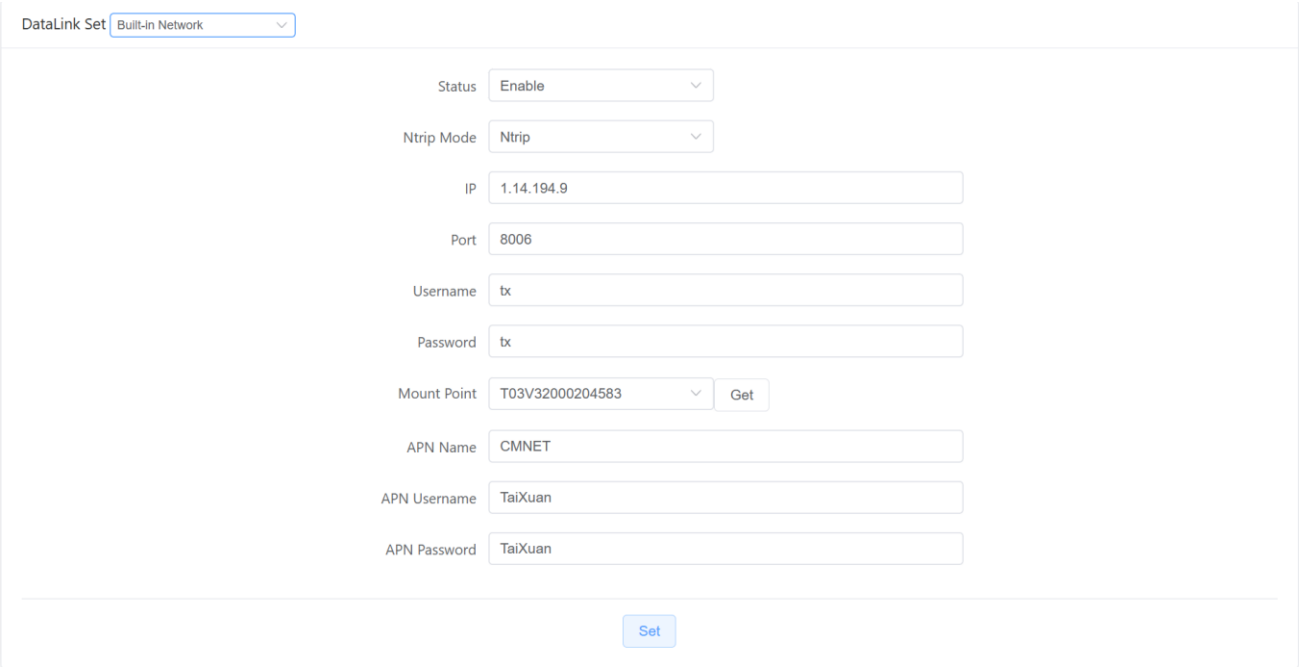
Built-in Radio

Configure the radio parameters as same as Base as shown in Figure 3-3-2-1. And the radio antenna must be inserted when using internal radio.



Built-in Network

When built-in network is selected, a NANO SIM card must be inserted to the MATRIX VI to get the 4G signal. At the same time the APN parameters would be set in “Network Settings” field → Cellular menu. After that, the CORS details will be set as following figure.



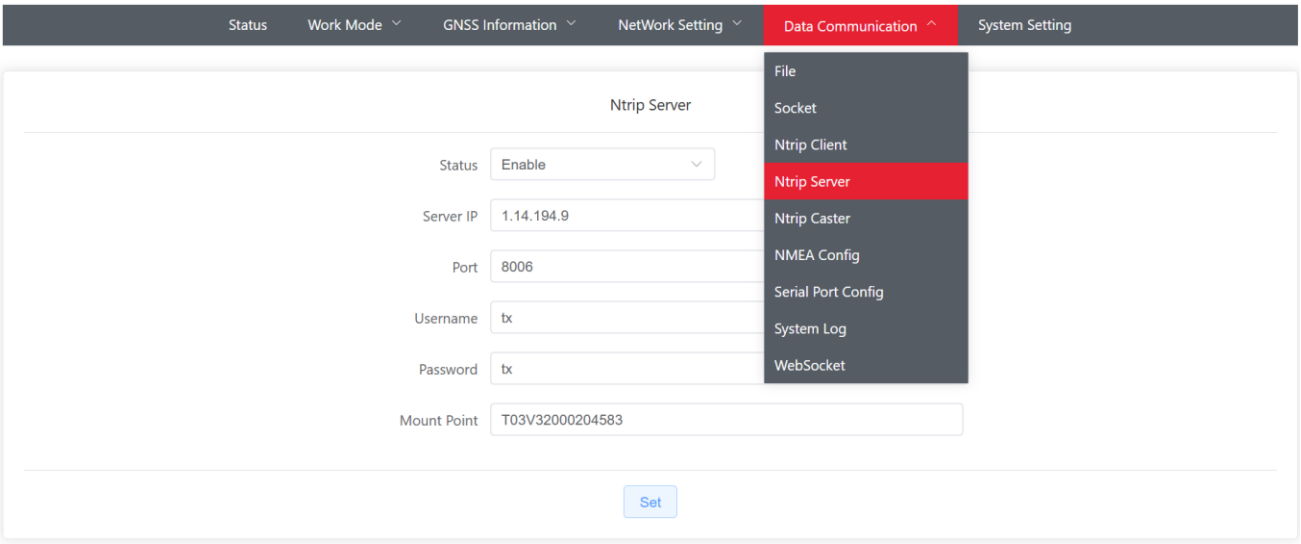
3.4 NTRIP and TCP/IP configuration

3.4.1 NTRIP Server

An NTRIP server is a broadcast Internet server that manages authentication and password control for differential correction sources such as VRS networks, and relays corrections from the source that you select. NTRIP is the acronym for Networked Transport of RTCM via Internet Protocol which is fully supported by the MATRIX VI receiver, as shown in following figure. The settings are as below:

1. Make sure you have a cellular connection as described in the previous section.

2. Select the corresponding NTRIP version and fill the NTRIP Sever details in the corresponding box. The username and password can be any letters, and the mount point name needs to be set in “Access point” field.

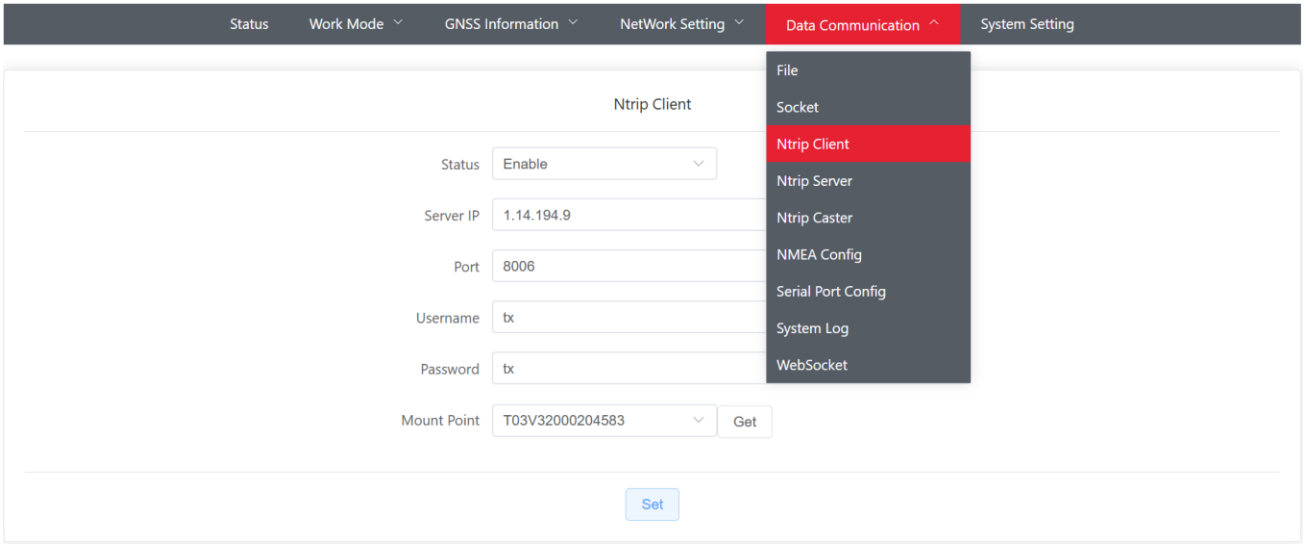


3.4.2 NTRIP Client

An NTRIP Client is the software element used by the rover (the GNSS devices out in the field) used to connect to an NTRIP Caster such as SurPro6.0 to gain access to the data stream with the positional corrections it needs. There are also two methods to get the correction data, one is via internal network of receiver and the other is via data collector internet. But there is only internal network available when configuring it in WEB UI. You can find the related settings in “Data Communication” field NTRIP Client, as shown in following figure.

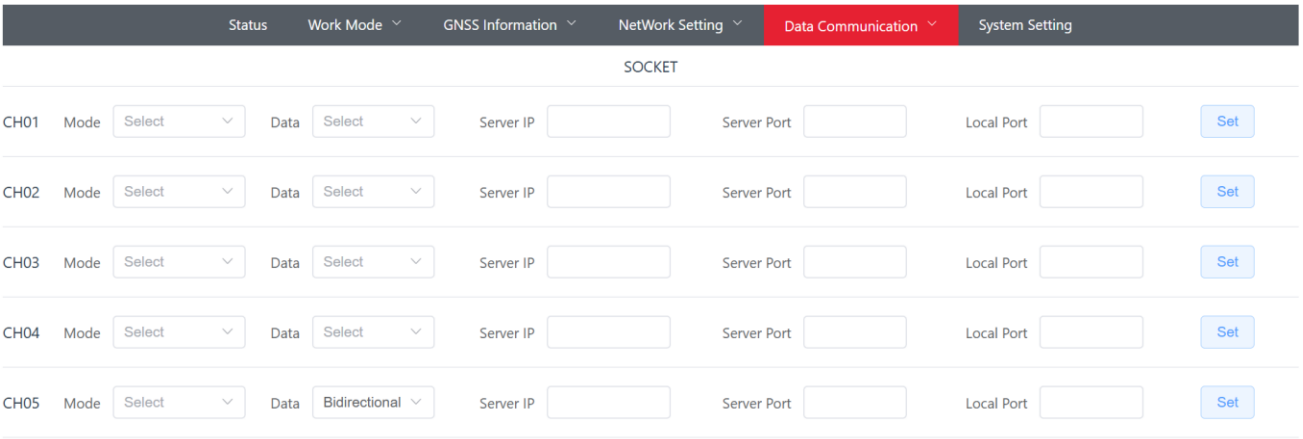
1. Make sure you have a cellular connection as described in the previous section.

2. Input the CORS details in the corresponding box. The username and password must be correct, and the mount point list can be updated in “Access point” field.



3.4.3 TCP/IP

The MATRIX VI can be set as a reference station to broadcast the raw data/differential data to the specified server. There are 5 channels supported which allows to send data to 5 servers at the same with different data format, as shown in below following figure. When the server is connected to MATRIX VI, the “Status” button will become green and that means it is connected successfully.

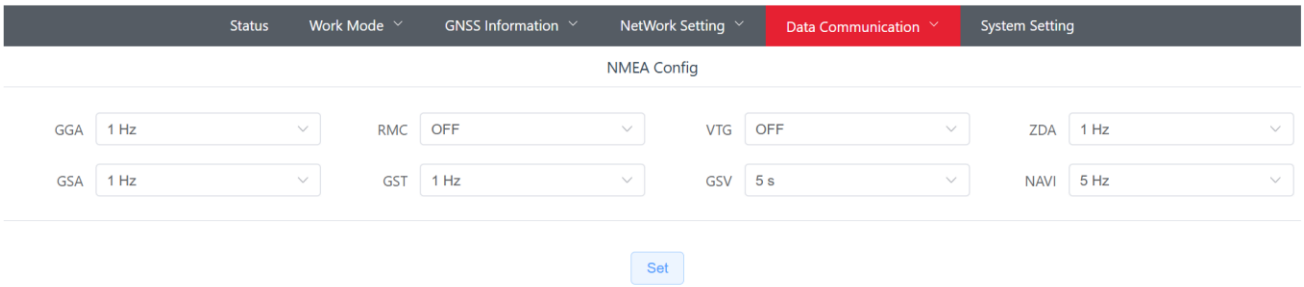


3.4.4 Data Stream

NMEA output

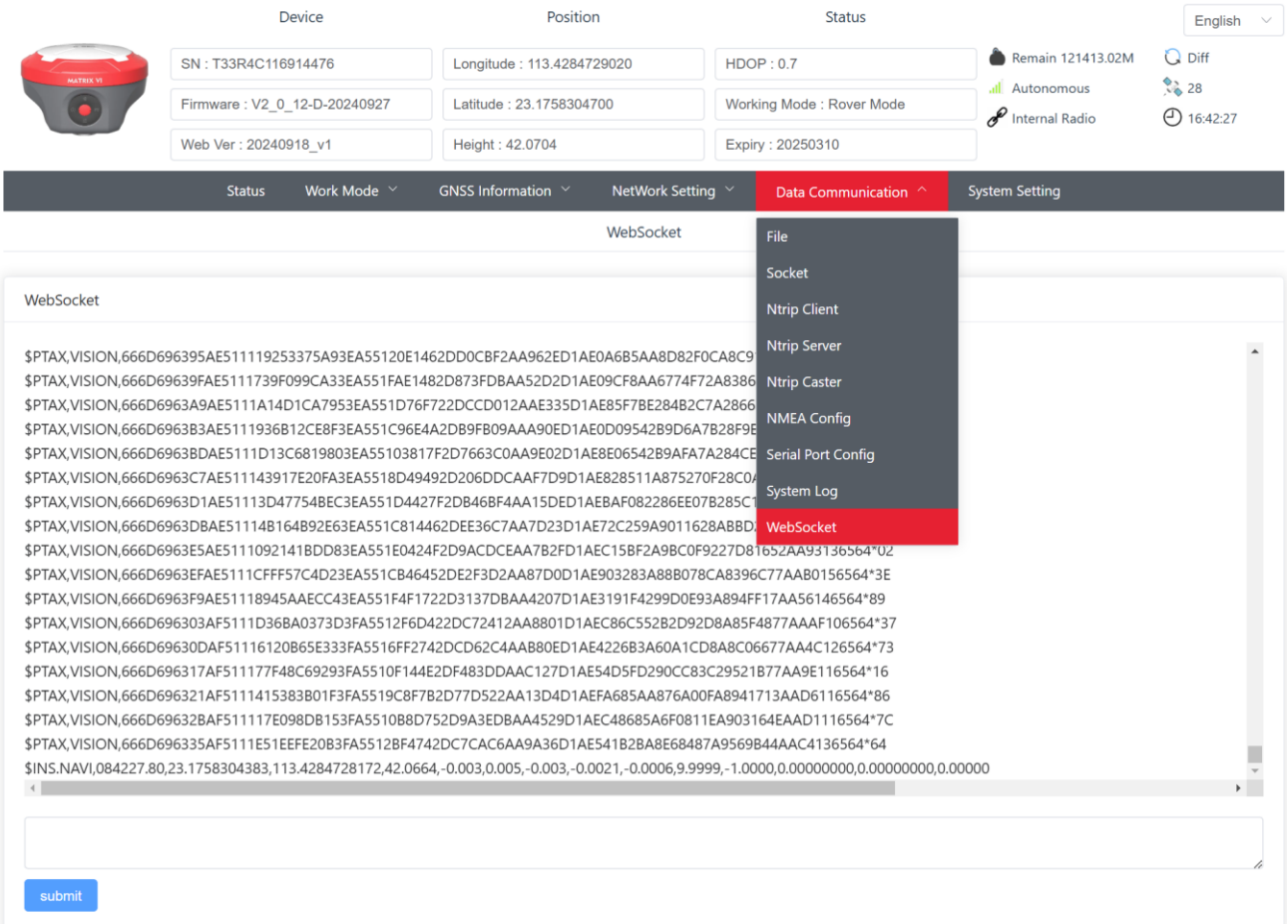
Select the NMEA Config in “Data Communication” field, here allows to define the

NMEA message outputs, as shown in following figure.



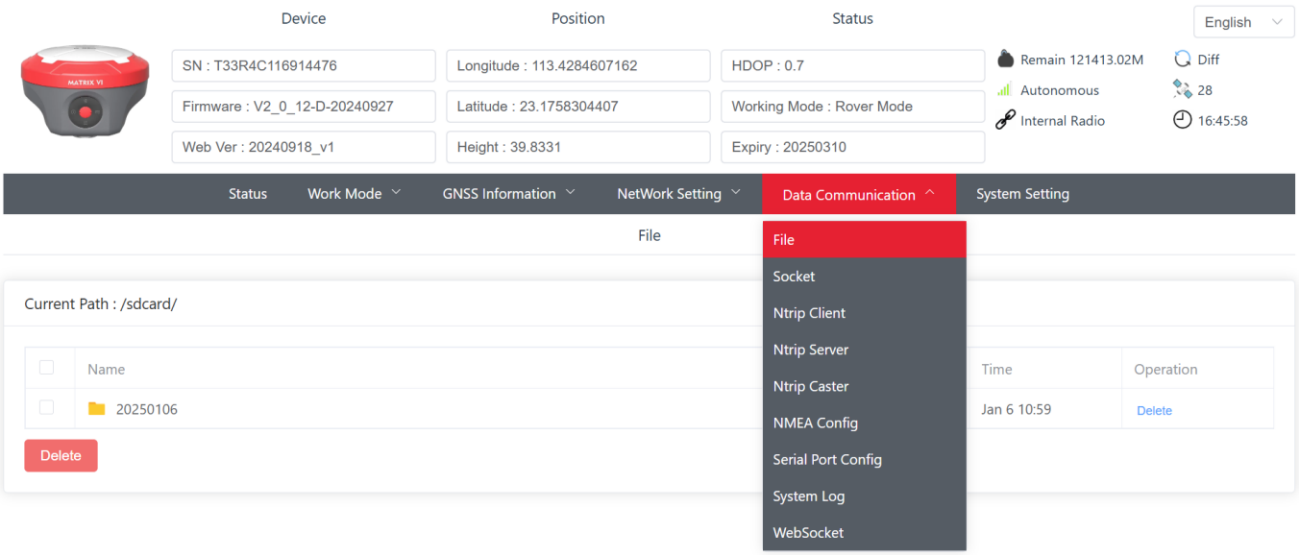
Debug

This windows provides a debug function which you can send the commands to check the receiver's working status. And the NMEA data stream can be shown here as the following figure.



File Manage

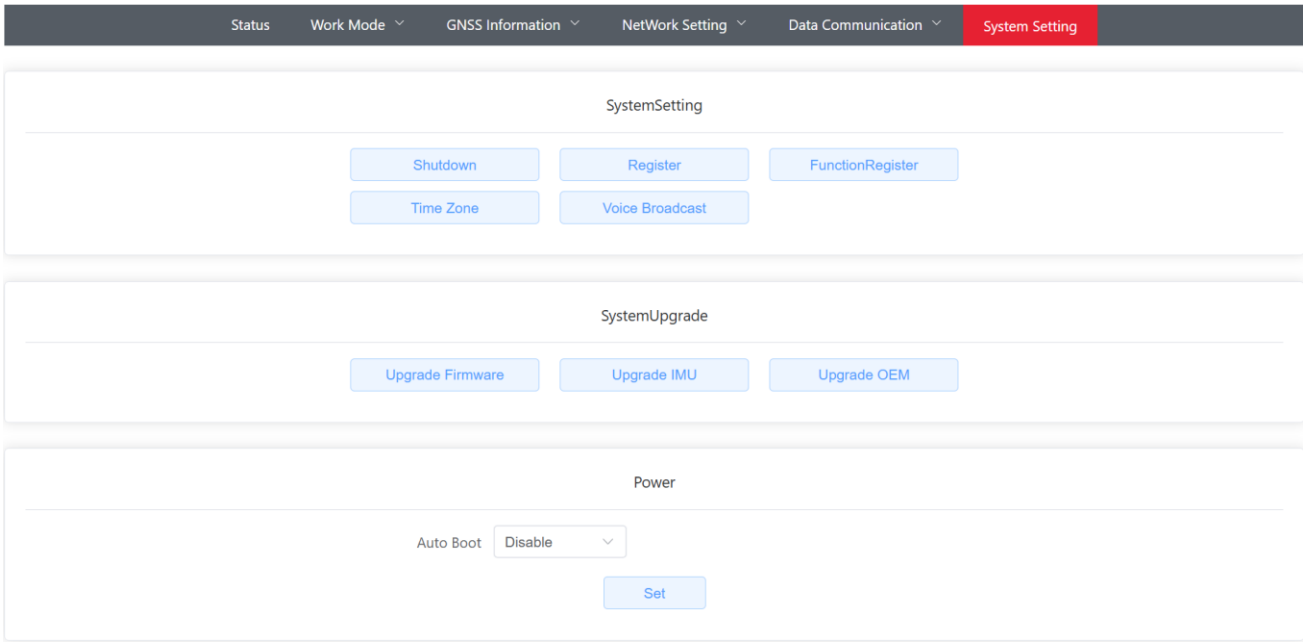
MATRIX VI allows to download the static data via WEB UI which is very convenient to share the data in the field. When the static data is stored, the data list will be shown in this page as following figure. Users can download the data by clicking it.



System Setting

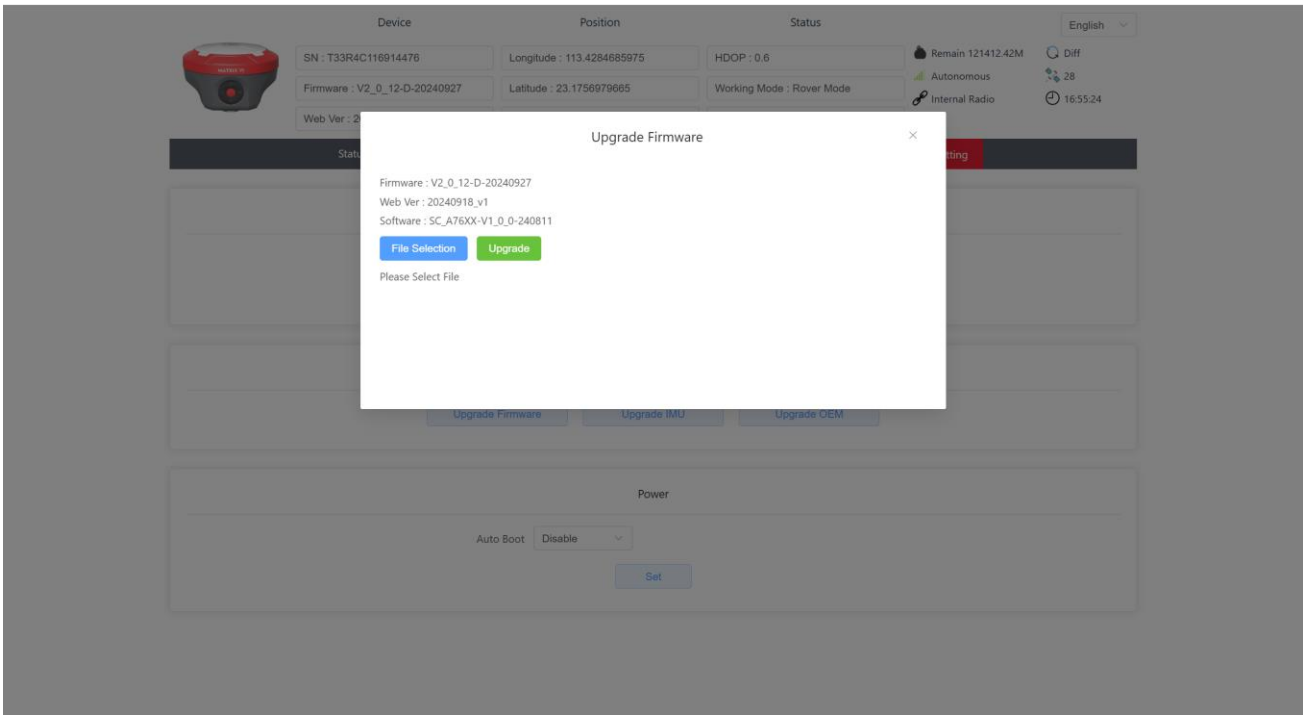
MATRIX VI provides some system settings, such as factory reset, restart, OEM reset, update and register, as shown in following figure. If there is system error, the factory reset may fix the problem.

For registration, we provide two different ways, to register in WEB UI or in field software. You can choose the most convenient way to register the code.



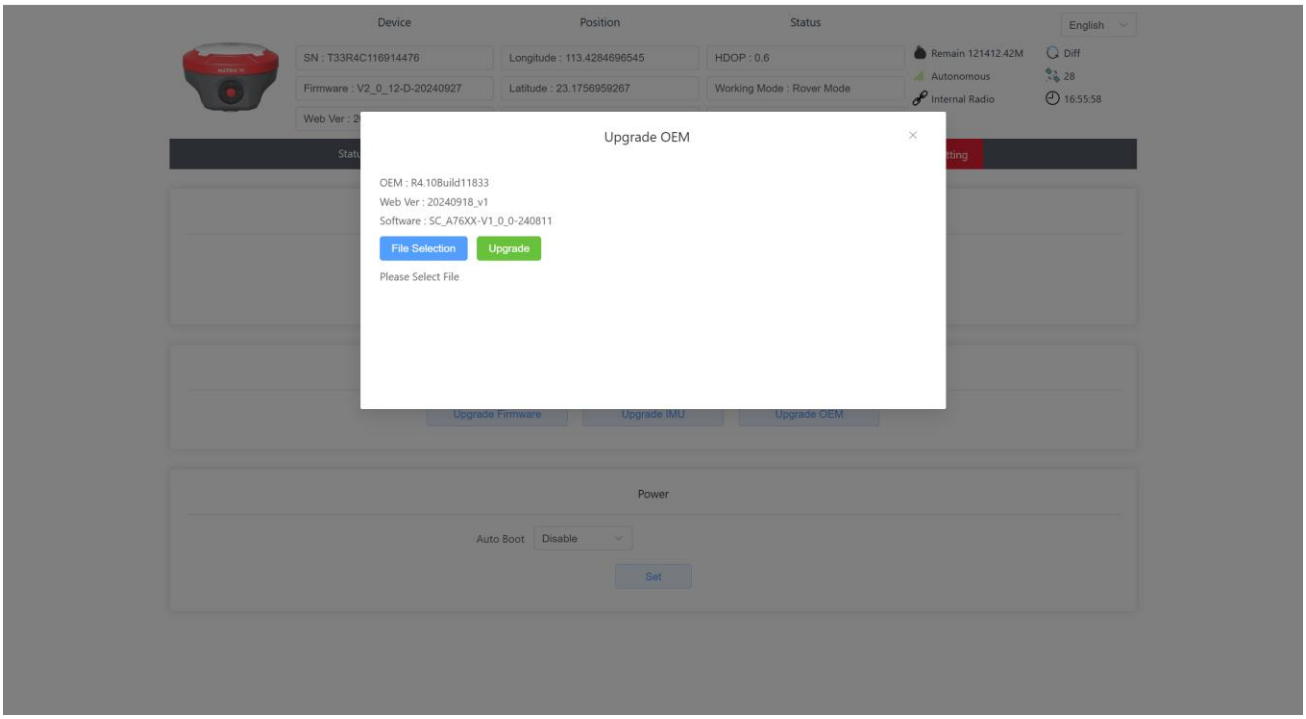
Upgrade firmware

Firmware upgrading can be completed on WEB UI as above figure shows. It takes some minutes to complete the procedure, and it will auto restart once it is done.



Upgrade OEM

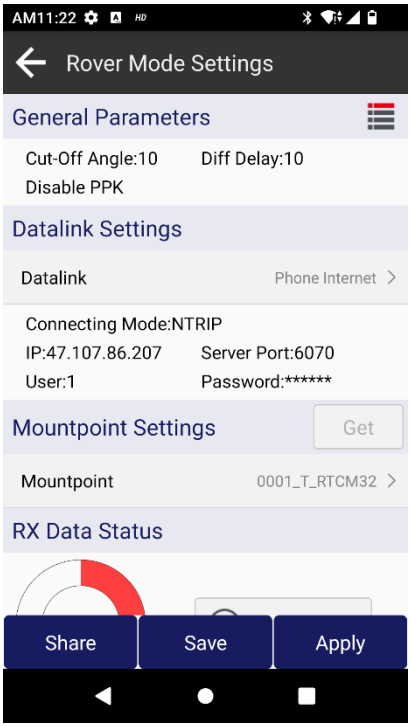
As well as the OEM board upgrading, choose the 'Upgrade OEM' and it will take around 3minutes to complete. Once it is done, the receiver will automatically restart.

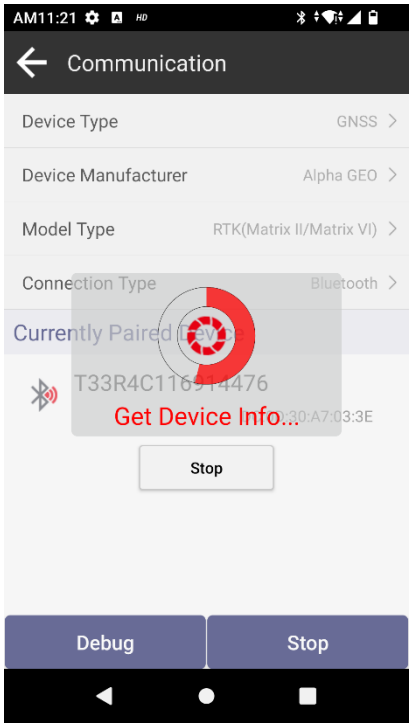


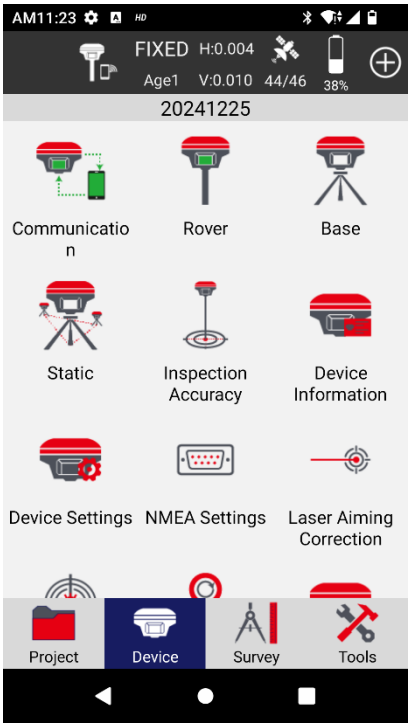
Chapter IV Operations

4.1 Laser Measurement

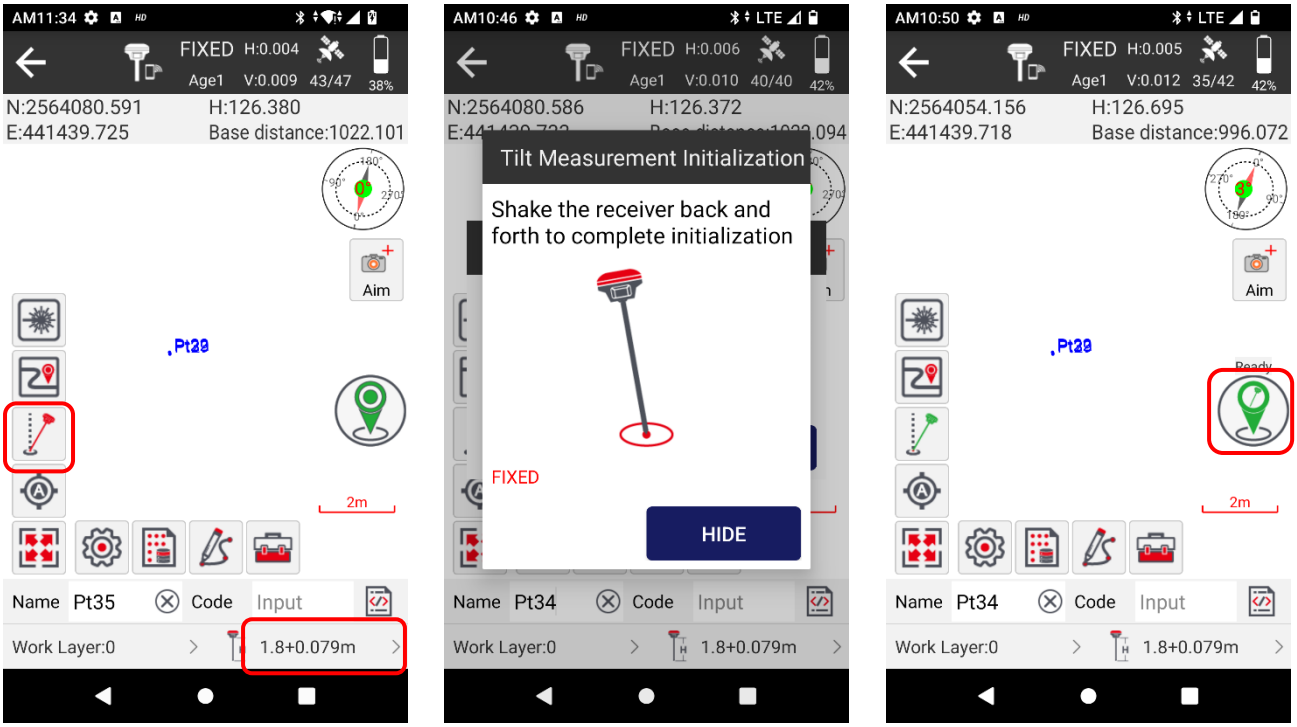
a) Establish Bluetooth between controller and receiver, then configure the resource parameters for Matrix VI, as long as it achieves fixed solution, go to next step.



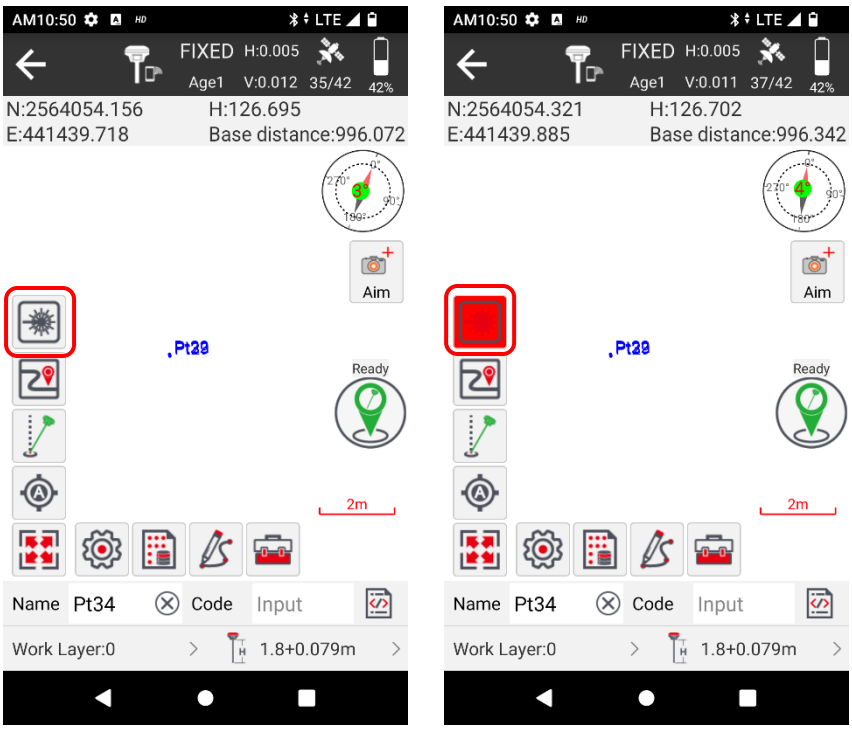




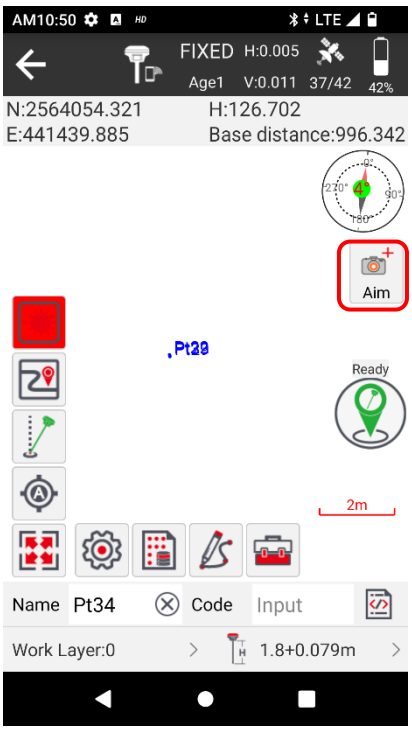
b) Go to “Survey” → “Point Survey” interface, enter correct antenna height, and enable tilt sensor (IMU), there will be a pop-up dialog to ask you to initialize IMU, walk for 3~5 meters or shake receiver to initialize IMU, after the initialization completed, the collection button will turn to green, as shown in the pictures below.

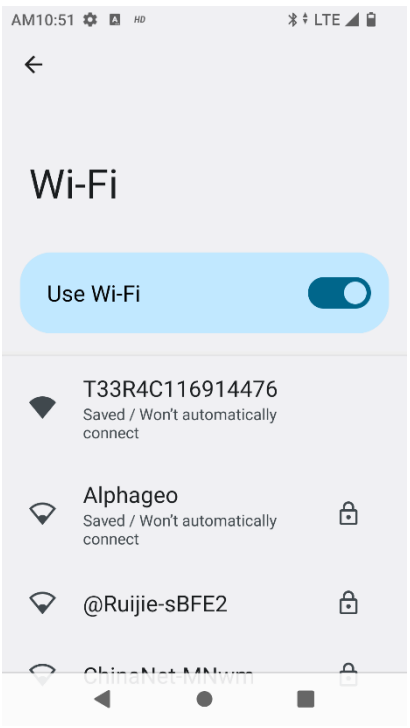


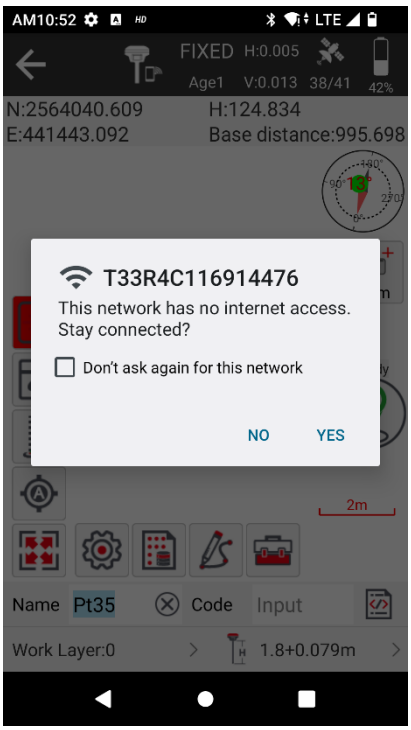
c) Click on the laser button  to turn on laser, find the laser spot and aim at the target point, click collection button to save a laser measurement coordinate.



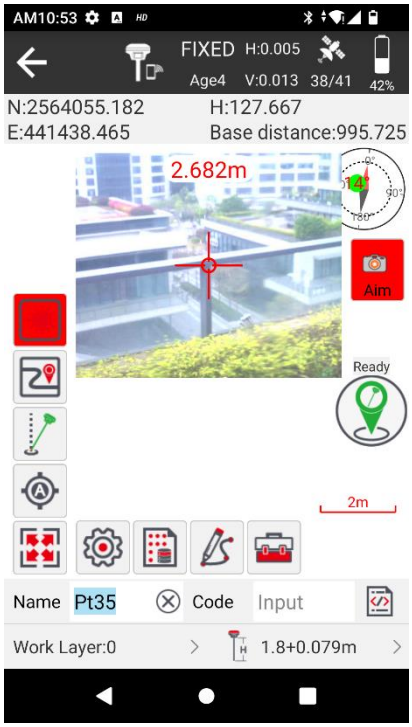
d) If the laser spot is not so clear outside sometimes, using the float window with the help of camera. Click icon  at the right side of interface, while the receiver WiFi is not connected, software will jump to system WiFi setting interface, requires the WiFi connection between controller and receiver, after the WiFi is connected, a pop-up dialog with the reminding message says “This network has no internet access, stay connected?”, click “YES” to keep the connection.



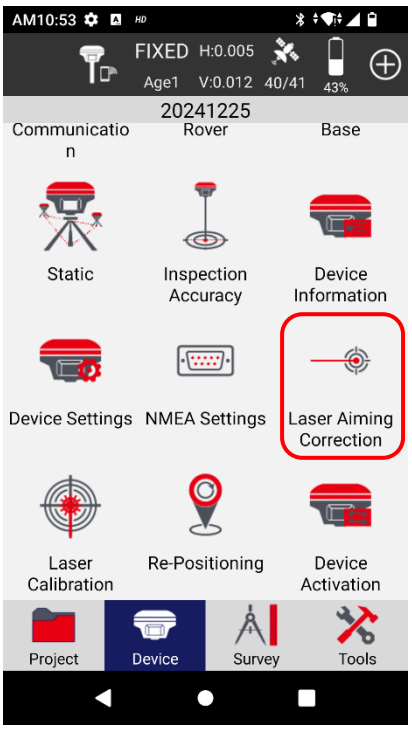


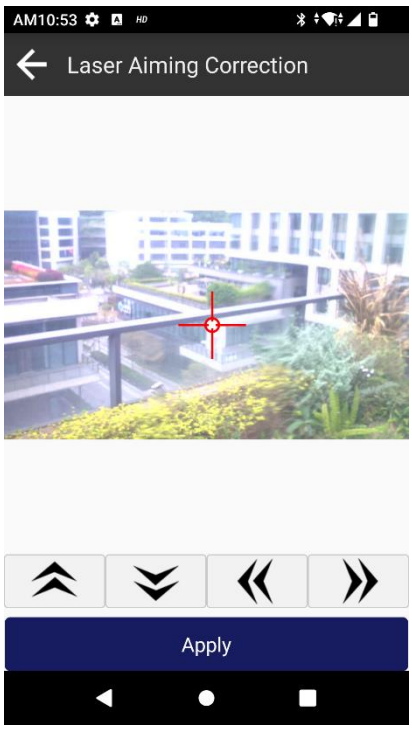


e) Return to “Point Survey” interface, click the float window icon again, appears the camera image on the screen, aim at the red cross to a target point and click collection button to save a laser coordinate.



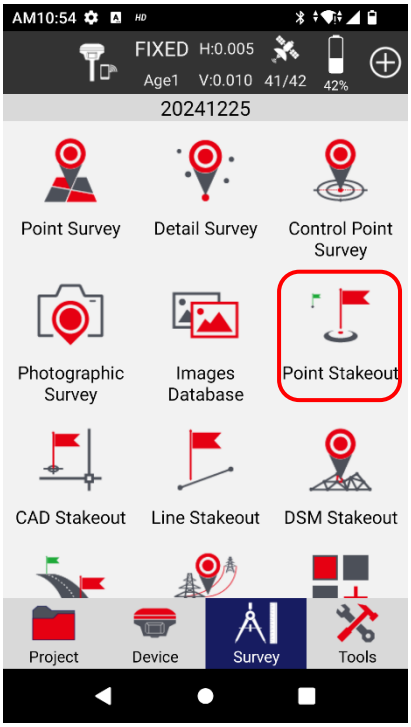
f) If the laser spot is not at the center of cross, go to “Device” menu, and click “Laser Aiming Correction”, there will be camera image appears on the screen, align the laser spot to the cross center by the help of arrows or navigation keys.

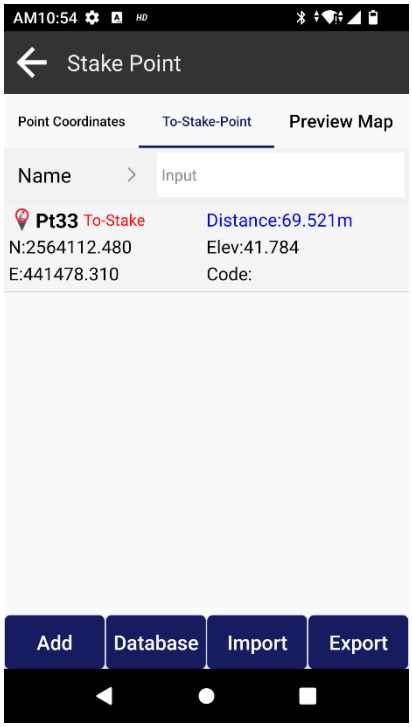


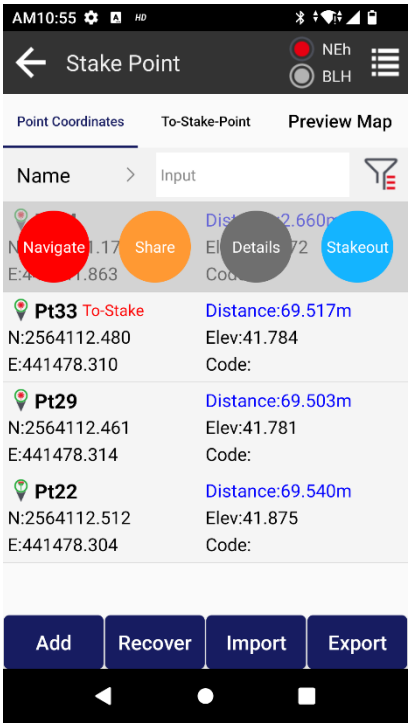


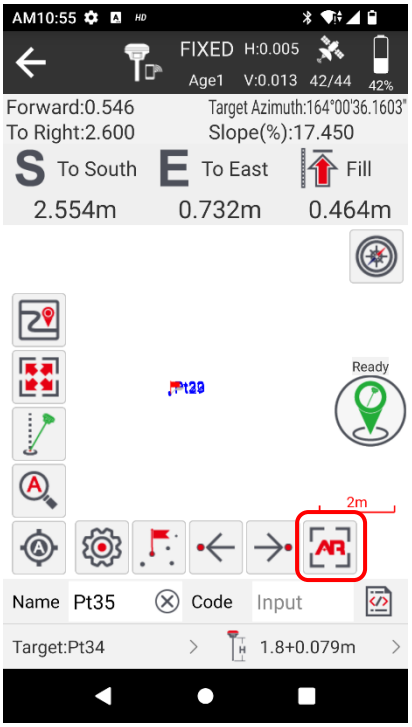
4.2 AR Stakeout

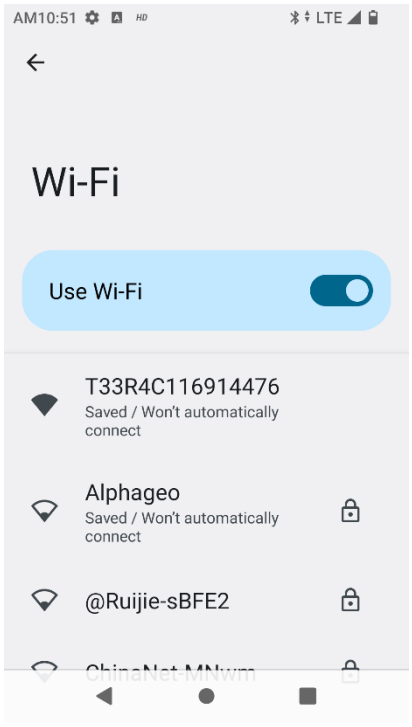
a) Go to “Point Stakeout” in “Survey” menu, choose the coordinate in the stakeout point list, or in the point library, then click the stakeout button to go to stakeout interface, click “AR” button and software will jump to the system WiFi setting and require the WiFi connection between controller and receiver, after the WiFi is connected, a pop-up dialog with the reminding message says “This network has no internet access, stay connected?”, click “YES” to keep the connection. (If the wifi was connected, software will skip this step).

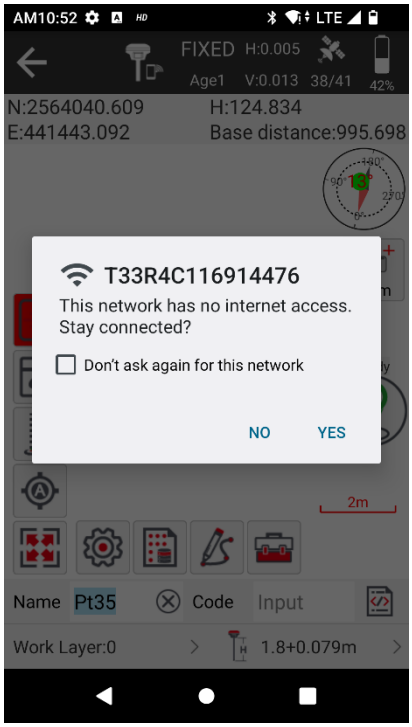




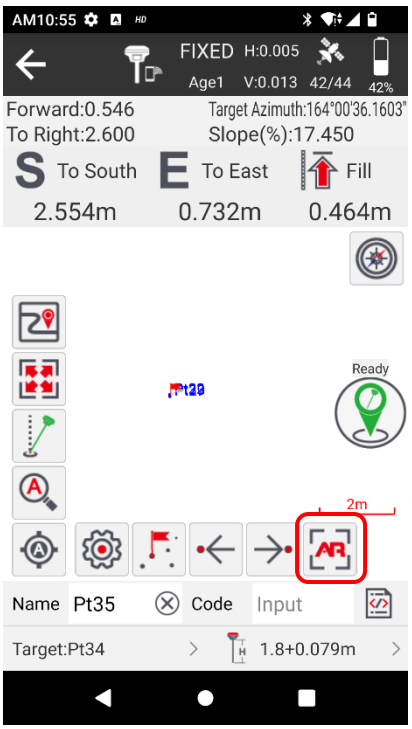


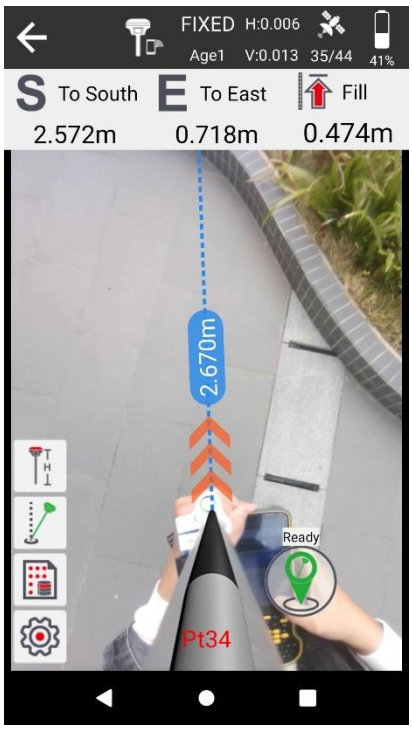


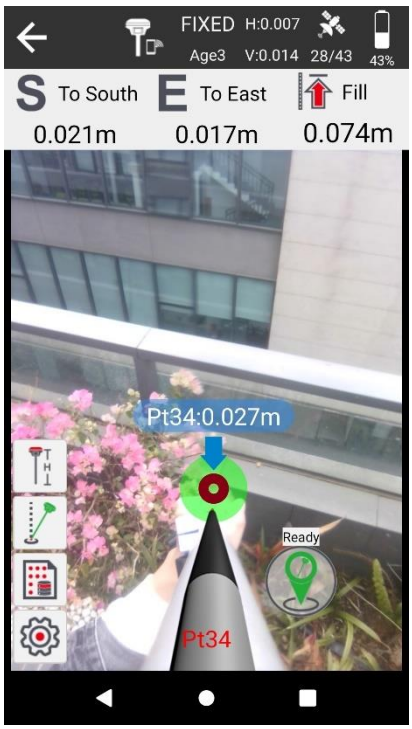




b) Return to stakeout interface, click "AR" button again, the camera image will appear on interface, go to the target stakeout point following the guide line in real scene.

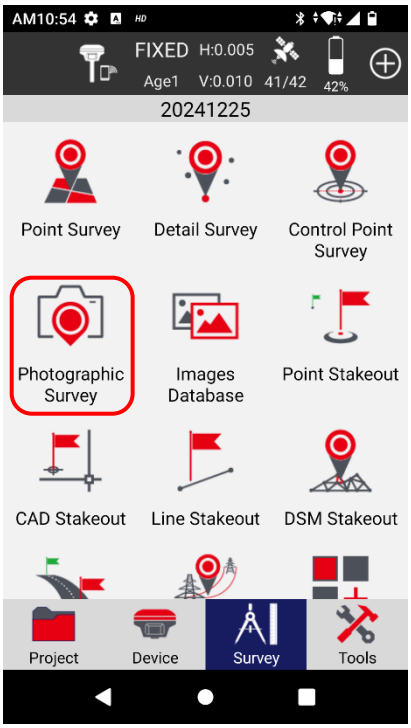


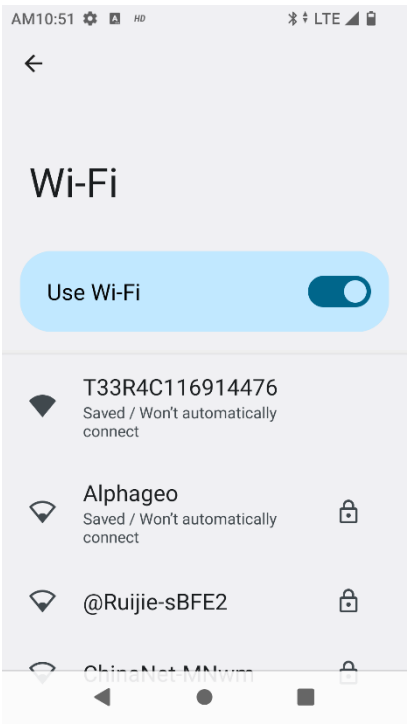


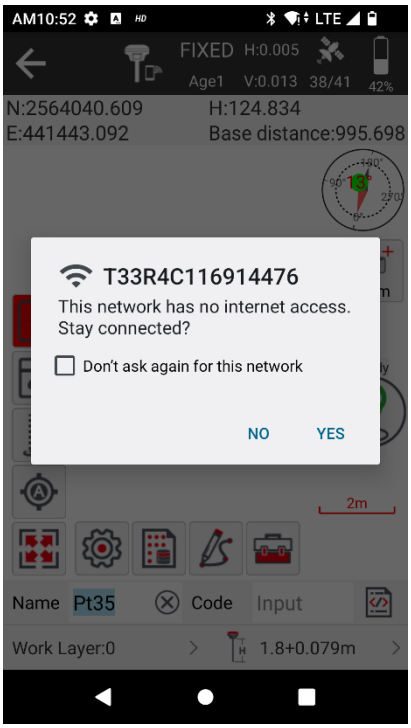


4.3 Photographic Survey

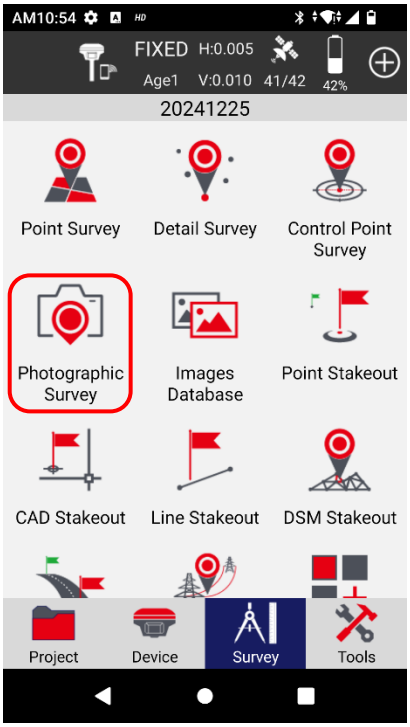
a) After Matrix VI achieves fixed solution, go to “Photographic Survey” in “Survey” menu, software will jump to the system WiFi setting and require the WiFi connection between controller and receiver, after the WiFi is connected, a pop-up dialog with the reminding message says “This network has no internet access, stay connected?”, click “YES” to keep the connection. (If the wifi was connected, software will skip this step).

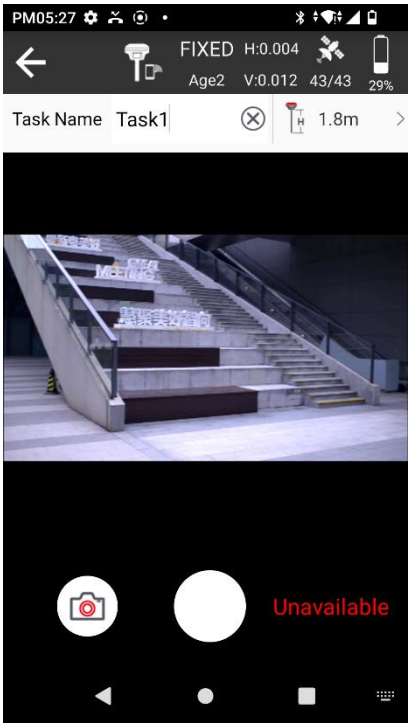


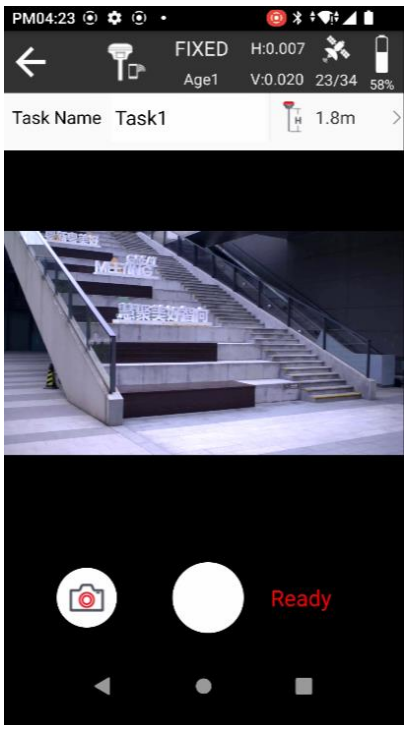




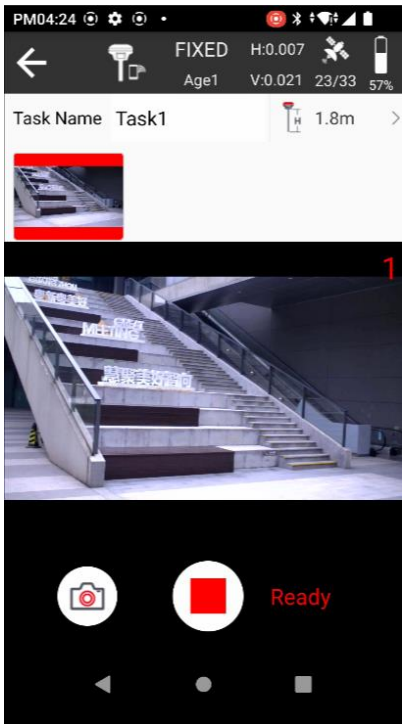
b) Return to “Survey”, click “Photographic Survey” again, the camera image will appear on interface, if there shows “Unavailable” at the bottom right corner of interface, that means the IMU is not initialized yet, at this moment, lift the receiver and walk for 3~5 meters or shake the receiver back and forth (we recommend to walk for 3~5 meters), the status will turn to “Ready”, that is to say the IMU initialization completed and ready for the photogrammetry. As shown at the pictures below.

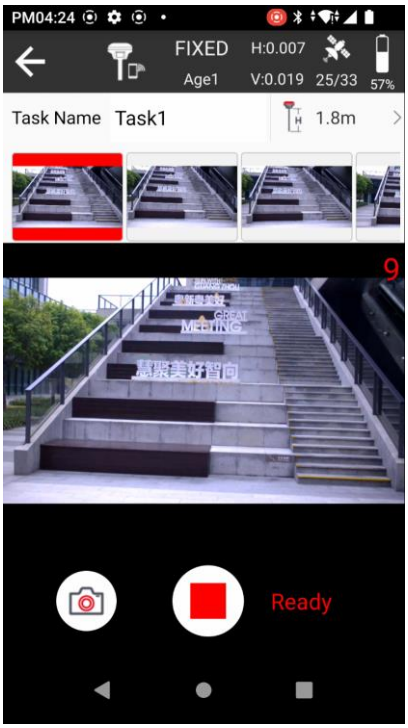




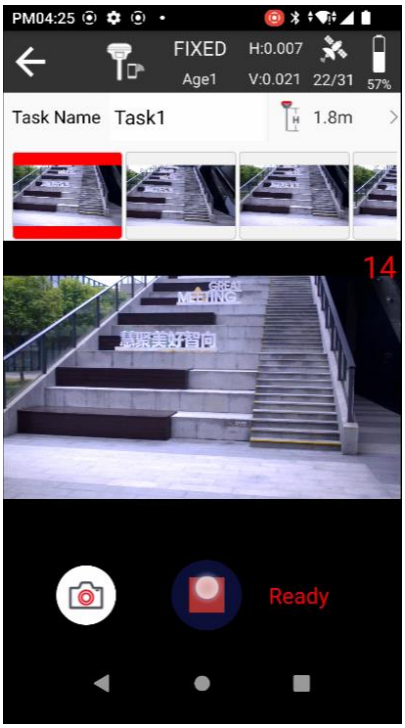


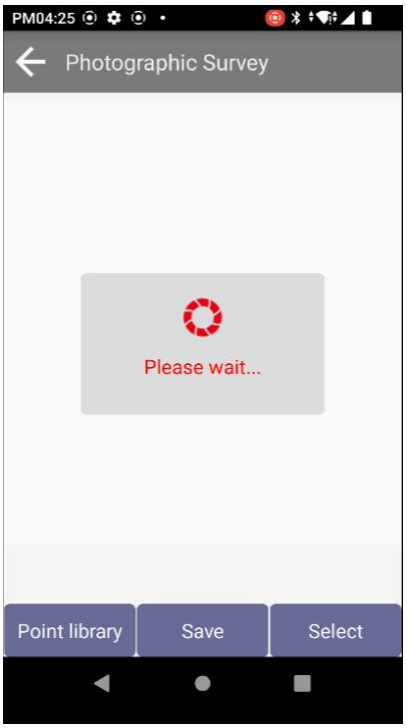
c) Click the white round button at the bottom center of interface to start, at this moment, lift the receiver and move slowly aiming at the target area, the photos will be taken automatically and appear at the top of interface, as well as the taken photos quantity. As shown at the pictures below.



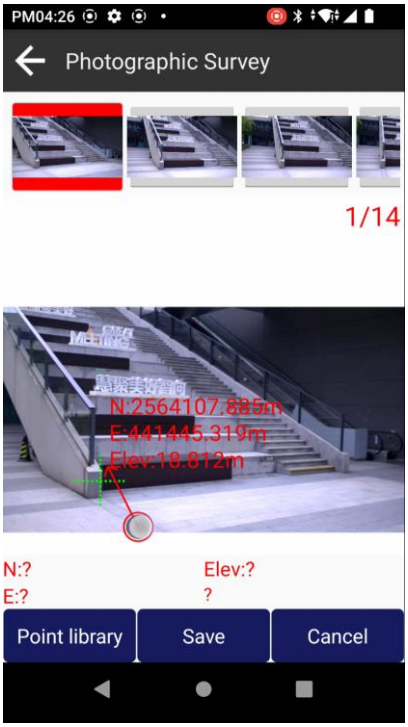


d) In order to ensure good overlap of the measurement area, we need to take at least 5 photos. After taking enough photos, click the stop button to finish the shooting.

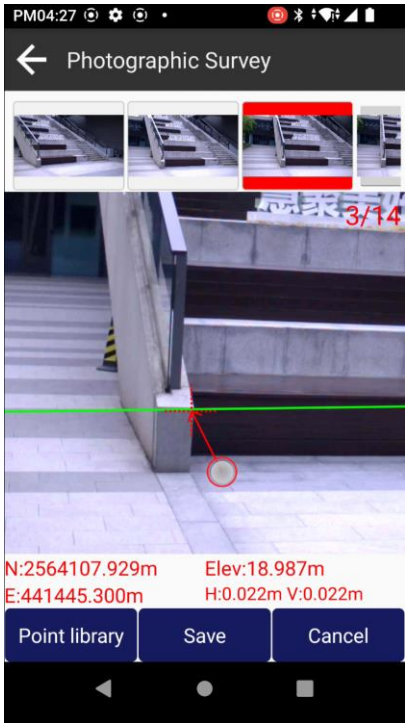




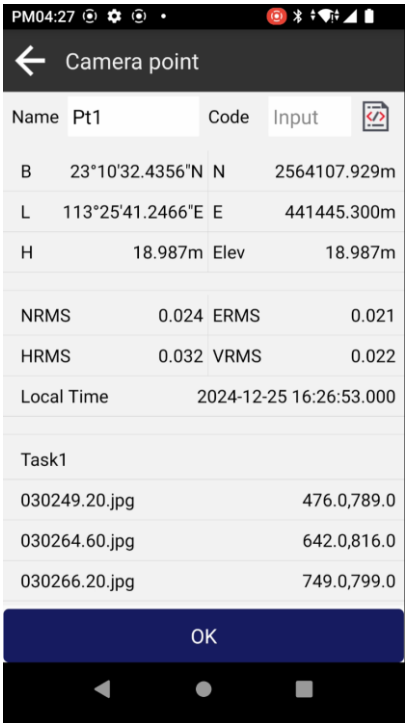
e) Click on the photos directly, zoom in on the target feature in the photo, press and hold on the photo for about 1 second, a selection arrow will appear, move the arrow to the target point, when there appears the coordinate, release the arrow, as this moment, we can click “Save” button to save the coordinate into database, or we can continue to obtain the coordinate for the same point in the other photos, with this method, the coordinates obtained in different photos can be averaged.

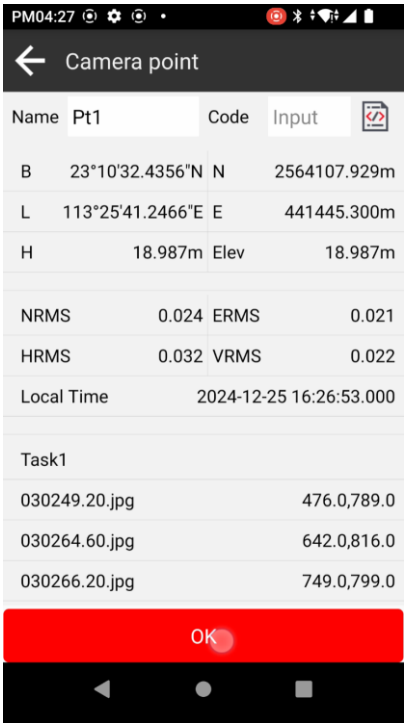

PM04:26
Photographic Survey
1/14
N:2564107.885m
E:441445.319m
Elev:18.812m
N:?
E:?
Elev:?
?
Point library
Save
Cancel


PM04:27
Photographic Survey
1/14
N:2564107.069m
E:441438.108m
Elev:19.183m
H:0.033m V:0.033m
Point library
Save
Cancel


PM04:27
Photographic Survey
3/14
N:2564107.929m
E:441445.300m
Elev:18.987m
H:0.022m V:0.022m
Point library
Save
Cancel


PM04:27
Photographic Survey
3/14
N:2564107.929m
E:441445.300m
Elev:18.987m
H:0.022m V:0.022m
Point library
Save
Cancel


PM04:27
Camera point
Name Pt1
Code Input
B 23°10'32.4356"N
N 2564107.929m
L 113°25'41.2466"E
E 441445.300m
H 18.987m
Elev 18.987m
NRMS 0.024
ERMS 0.021
HRMS 0.032
VRMS 0.022
Local Time 2024-12-25 16:26:53.000
Task1
030249.20.jpg 476.0,789.0
030264.60.jpg 642.0,816.0
030266.20.jpg 749.0,799.0
OK


PM04:27
Camera point
Name Pt1
Code Input
B 23°10'32.4356"N
N 2564107.929m
L 113°25'41.2466"E
E 441445.300m
H 18.987m
Elev 18.987m
NRMS 0.024
ERMS 0.021
HRMS 0.032
VRMS 0.022
Local Time 2024-12-25 16:26:53.000
Task1
030249.20.jpg 476.0,789.0
030264.60.jpg 642.0,816.0
030266.20.jpg 749.0,799.0
OK

Chapter V Warranty and Safety Notices

5.1 Warranty and Limited Liability

The warranty period of our products is 12 months from purchase. If a defective is found due to qualified problems of the products, we perform two commitments: repair and replace.

During the warranty period, if the instrument is damaged due to human factors, it will not be covered by the warranty.

In the event that claims are made against the customer due to product liability, the supplier is obliged to indemnify the customer from such claims if and to the extent that the damage was caused by a defect in the contractual item delivered by the supplier. In cases of fault-based liability, however, this only applies if the supplier is at fault. If the cause of the damage is the responsibility of the supplier, the supplier bears the burden of proof.

5.2 Safety Notices

Compliance is required with respect to voltage, frequency, and current requirements indicated on the manufacturer's label. Connection to a different power source than those specified may result in improper operation, damage to the equipment or pose a fire hazard if the limitations are not followed.

Do not leave your device for charging more than one week. Doing so runs the risk of overcharging the battery and shortening its total life span.

CE Marking

CE marking on this product represents the product is in compliance with all directives that are applicable to it.

RoHS Compliance Statement

European Directive 2002/96/EC requires that the equipment bearing this symbol on the product and/or its packaging must not be disposed of with unsorted municipal waste. The symbol indicates that this product should be disposed of separately from regular household waste streams. It is your responsibility to dispose of this and other electric and electronic equipment via designated collection facilities appointed by the government or local authorities. Correct disposal and recycling will help prevent potential negative consequences to the environment and human health. For more detailed information about the disposal of your old equipment, please contact your local authorities, waste disposal service, or the shop where you purchased the product.

5.3 Recycling

1. Do not place the product as household waste.

2. According to local regulations for proper disposal of discarded electronic products.

3. We actively encourage you to participate in electronics recycling program.