MATRIX II User Manual

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Contents

Chapter I MATRIX II Survey System Brief

1.1 Brief

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 II is a high-end intelligent GNSS receiver launched by α-GEO, which is a compact new generation of smart LASER AR 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 beidou No.3 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 coordinate 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 mobile station receiver of other manufacturers can connect to the reference station established by the measurement receiver, and the measurement mobile station can also connect to the CORS reference station of other companies;

1.3 Specifications

MEASUREMENTS
- 1408 Tracking Channels
- Satellite signals tracked simultaneously
  → GPS: L1/ L2/ L5
  → GLONASS: L1/ L2/
  → SBAS: L1
  → Galileo: E1/ E5A/ E5B
  → BDS: B1, B2, B3
  → QZSS: L1/ L2/ L5
- Positioning rates
  → 1Hz～20Hz
- Initialization time < 5s
- Initialization reliability >99.99%

POSITIONING
- Code differential GNSS positioning
  → Horizontal: 0.25 m + 1 ppm RMS
  → Vertical: 0.50 m + 1 ppm RMS
  → SBAS differential positioning accuracy: typically, <5m 3DRMS
- Static GNSS surveying
  → Horizontal: 2.5 mm + 0.5 ppm RMS
  → Vertical: 5mm + 0.5 ppm RMS
- Real time kinematic surveying
  Single baseline < 30km
  → Horizontal: 8 mm + 1 ppm RMS
  → Vertical: 15mm + 1 ppm RMS
  Network RTK
  → Horizontal: 8 mm + 0.5 ppm RMS
  → Vertical: 15m m + 0.5 ppm RMS
- Real time kinematic tilt compensated
  → Additional Hz pole tip uncertainty typically less than
    8 mm + 0.4 mm/° tilt down to 30° tilt
- Laser survey
→ 1cm + 5mm/m (Tilt height less than 30°)

HARDWARE
PHYSICAL
- Material: Magnesium alloy
- Dimensions: φ160mm × 53mm (With bottom connector74mm)
- Weight: 1.0kg
- Operating temperature: -40°C to +75°C
- Storage temperature: -55°C to +85°C
- Ingress protection: IP67 dustproof, protected from 30min immersion to depth of 1m

- Shock: Survive a 2m pole drop onto concrete
- Vibration: MIL-STD-810G
- Humidity: 100%, condensing

ELECTRICAL

- Power 9-24 V DC external power input on 5 pin LEMO port
- Support Type-C fast charging
- Internal 6800mA Lithium-ion battery
- Battery life
  - → Rover mode: 12 hours
  - → Base mode: 7h hours
  - → Static mode: 15 hours

COMMUNICATIONS & DATA STORAGE

- I/O Interface
  - → 1 LEMO port (5pin): Supports power input, serial port control, and external radio communication
  - → 1 Type-C USB port: Data download
  - → 1 sim card slot: Supports Nano-SIM
  - → 1 antenna port: UHF antenna interface
- Radio modem
  - → Transmit power: 1w/2w switchable, the work range is greater than 4km
  - → Frequency band: 410MHz-470MHz; supports to freely set the frequency
  - → Supports to retransmit correction from CORS; Compatible with other brands
- Cellular
  - → Integrated full frequency band 4G modem, supports WCDMA/CDMA2000/TDD-LTE/FDD-LTE
- Wi-Fi
  - → 802.11 b/g standard, access point and client mode, supports to access to hotspot to transfer corrections
- Bluetooth
  - → Fully integrated Bluetooth V4.0, range ≤ 50m
- Data format
  - → RTCM3.2, RTCM 3.x input and output
  - → Dat, Rinex, NMEA outputs
- Storage
  - → 64GB internal memory optional, supports cyclic storage; over five-year raw observations based on 5 seconds interval

OTHERS

CAMERA

- AR:5M high-definition camera with large viewing angle and support for live scene stake out
- Laser assisted: 5M high-definition camera, large viewing angle, auxiliary laser measurement and aiming

PRACTICAL

- OS system: Intelligent LINUX operating system
- Tilt compensation: Calibration free

- ◆ Supported controllers: All Android devices with supported software

DESIGN

- ◆ Button: 1 power key
- ◆ Indicator: 1 power indicator, 1 data link indicator, 1 satellite indicator
- ◆ Voice: Intelligent voice prompts
- ◆ WEB UI: Support WEB UI configuration

1.4 Precautions

MATRIX II receiver 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 Introduction

2.1 Housing & Indicators

Top Cover

Main Housing

Indicators

2.1.1 Indicators

Table.2-1 Descriptions

	Green	Satellites locked	
	Off	No tracking satellites	
	Base	Blink	Transmitting data
		Off	No transmitting
	Rover	Blink	Receiving data
		Off	No data received
	Plug in	Green	The receiver battery is fully charged
		Red	Receiver is charging
	No plug in	Green	Battery power is full
		Red	Battery power is low

2.1.2 Bottom
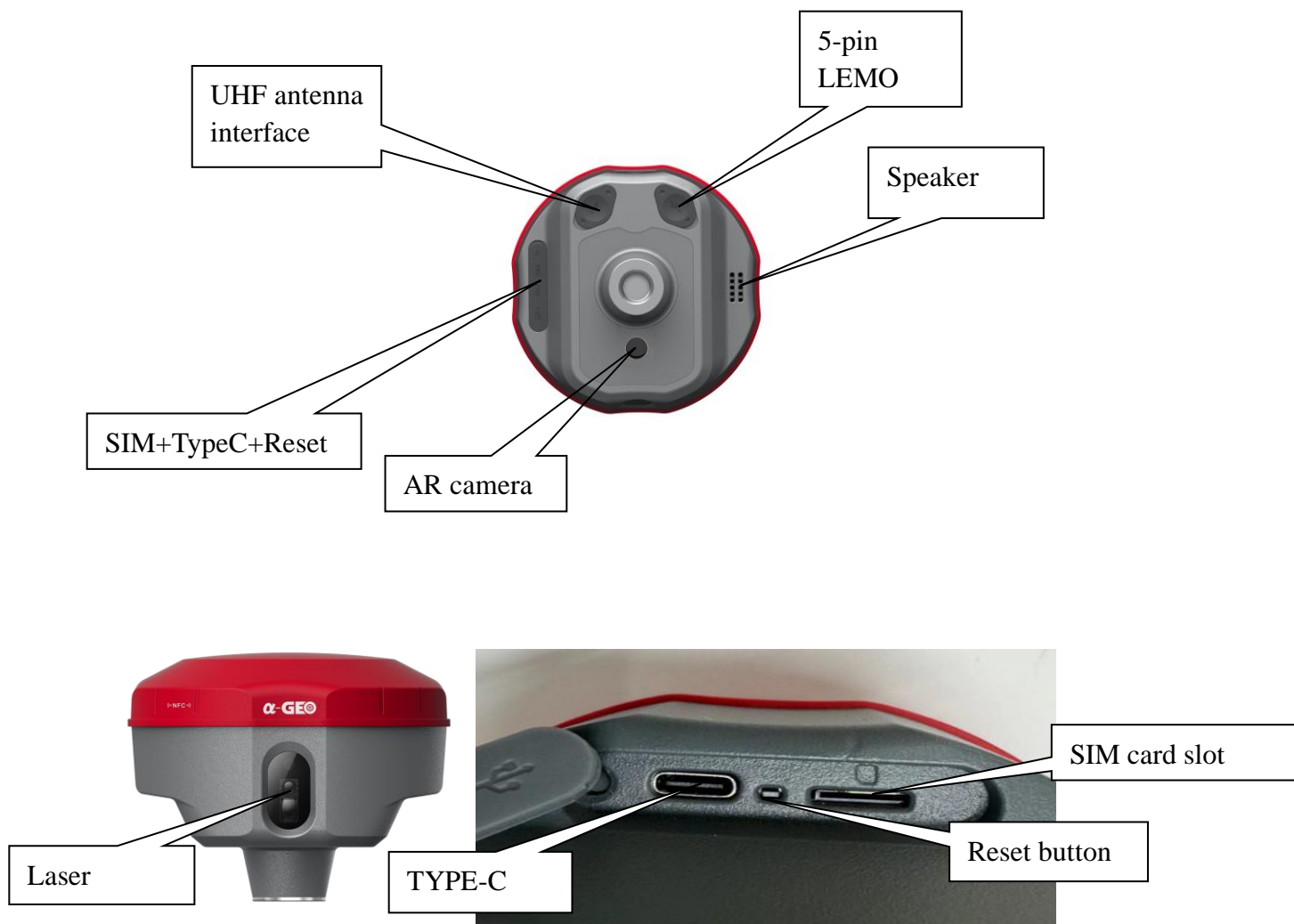
AR Camera: For live scene stake out.

Laser: For laser measurement.

5-pin LEMO interface: support external power supply; serial cable connection control; external radio data transmission.

Antenna interface: Built-in radio antenna interface, the antenna must be inserted to use the built-in radio.

Nano SIM card slot: Used to install a nano SIM card for data link communication.

Type-C interface: To charge the device and download the data.

Reset Button: For reset the device when some unexpected issue happens.

2.2 Configuration Brief

2.2.1 Carry 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 5-PIN cable & USB cable

1. 5-Pin interface
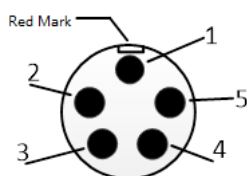
Note: The 5-pin interface are all arranged in a counterclockwise direction when looking at the front (that is, facing the front side of the notch of the 5-pin interface of the receiver).

(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 used for the receiver and the external radio;

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

(2) Signal description

5-Pin LEMO	
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 USB 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 computers 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 Figure 2.3.5-1, 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

Insert the sim card as indicated

Fig 2.3.4-1

Chapter III WEB UI Introduction

3.1 Connecting to the WEB UI

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

1. Wait till MATRIX II 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 Figure 3-1. The password is **12345678**.
3. Open a browser and type the IP **192.168.10.1** in the address bar, type ID: **admin** Password: **admin** to log in. The browser will open the 'Overview' page of the Web Interface shown in Figure 3-2.
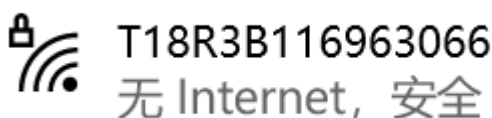
Figure 3-1: Access point name
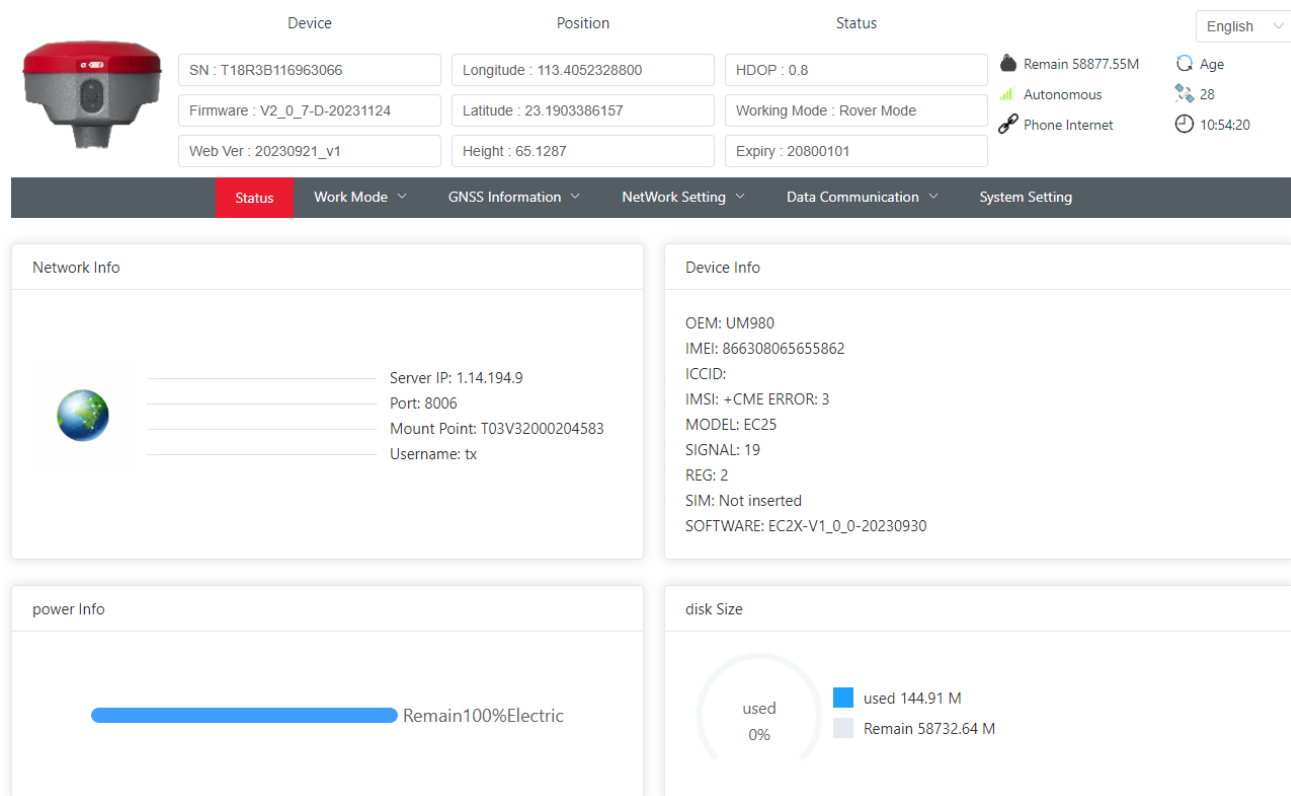
Figure 3-2: Web UI overview

3.2 Configuring the device as a Base

The MATRIX II is available to be set as **Base**, and can be started as internal **UHF/Network/Ntrip C aster**. Check the **Base** in work mode field as shown in Figure 3-2-1.

Figure 3-2-1

3.2.1 Transmitting via Internal UHF

1. Insert the UHF antenna to the MATRIX II for transmitting the signal.
2. Select the **Base** work mode field, set the coordinate, antenna height, the differential message typ e, PDOP and mask angle as shown in Figure 3-2-1-1.
3. Select the Built-in Radio in Datalink field, set the required radio protocol, channel, frequency an d power level as shown in Figure 3-2-1-2.

Figure 3-2-1-1

Figure 3-2-1-2

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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 Figure 3-2-2-1.
2. Select the Built-in Network in Datalink field, and enter the Ntrip Server parameters in the corresponding filed. You will need provide a name of the mountpoint in Access Point filed as shown in Figure 3-2-2-2.

Mobile Config

Parameter Setting

APN Name	CMNET
APN User	
APN Password	

Set

Figure 3-2-2-1

DataLink Set | Built-in Network ∨

Tip : Please go to <Ntrip Caster> and <Ntrip Server> under menu <Data Communication> to set data link

Ntrip Server

Status	Enable ∨
Server IP	1.14.194.9
Port	8006
Username	alphageo
Password	1234
Mount Point	test

Set

Figure 3-2-2-2

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 II 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 Figure 3-2-3-1.
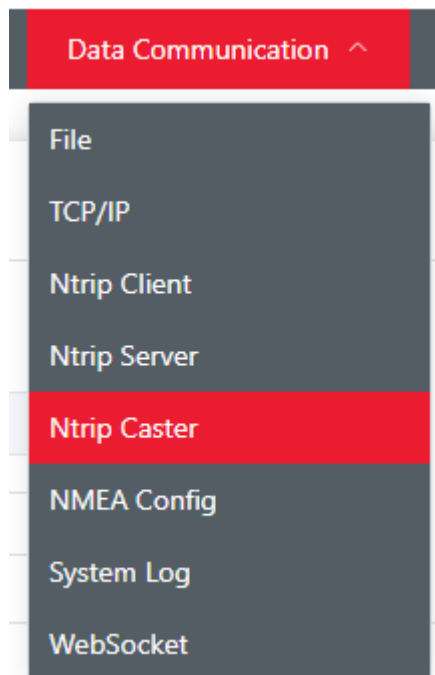3. Set the port number and the mountpoint name as shown in Figure 3-2-3-2.

Figure 3-2-3-1

Figure 3-2-3-2

Rover Configuration
1. Connect data collector or Drone's controller to MATRIX II's Wi-Fi hotspot without entering any password as shown in Figure 3-2-3-3.
2. Open the controller software and go to the **Ntrip Configuration** menu, enter the **IP 192.168.10.1** and **port (e.g., 8001)** as set in Figure 3-2-3-2. The mountpoint **(e.g., RTCM32_RTK)** will be shown in the list as below Figure 3-2-3-4.
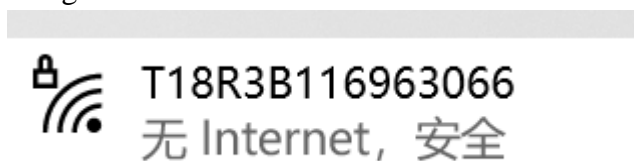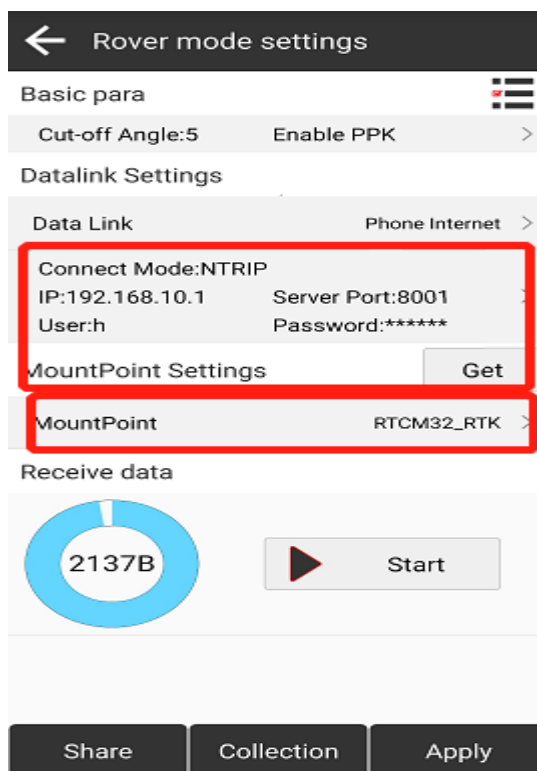

Figure 3-2-3-3

Figure 3-2-3-4

3.3 Configuring the device as a Rover

3.3.1 Standard Rover settings

For the MATRIX II 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 Figure 3-3-1-1. This is the default operating mode of the MATRIX II.
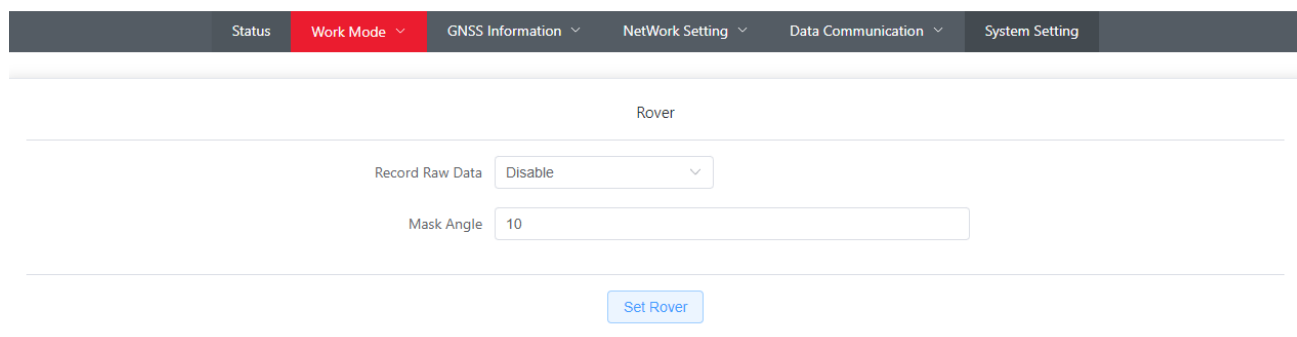

Figure 3-3-1-1

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

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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.

Figure 3-3-2-1

Built-in Network

When built-in network is selected, a NANO SIM card must be inserted to the MATRIX II 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 Figure 3-3-2-2.

Figure 3-3-2-2

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 II receiver as shown in Figure 3-4-1-1. The settings are as below:

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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 user name and password can be any letters, and the mount point name needs to be set in 'Access point' field.

Figure 3-4-1-1: NTRIP Server

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 Figure 3-4-2-2.

1. Make sure you have a cellular connection as described in the previous section.
2. Input the CORS details in the corresponding box. The user name and password must be correct, and the mount point list can be updated in 'Access point' field.

Figure 3-4-2-2: NTRIP Client

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3.4.3 TCP/IP

The MATRIX II can be set as a reference station to broadcast the raw data/differential data to the spe cified 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 Figure 3-4-3-3. When the server is connected to MATRIX II, the 'Status' button will become green and that means it is connected successfully.

	Status	Work Mode ∨	GNSS Information ∨	NetWork Setting ∨	Data Communication ∨	System Setting	

TCP/IP

Status **on**	Data	Raw Data ∨	Server IP	123.25.3.279	Server Port	2101	Set
Status **on**	Data	Diff Data ∨	Server IP	123.25.3.279	Server Port	6010	Set
Status off	Data	Select ∨	Server IP		Server Port		Set
Status off	Data	Select ∨	Server IP		Server Port		Set
Status off	Data	Bidirectional ∨	Server IP		Server Port		Set

3.4.4 Data Stream

3.4.4.1 NMEA output

Select the NMEA Config in 'Data Communication' field, here allows to define the NMEA message o utputs as shown in Figure 3-4-4-1-1.

	Status	Work Mode ∨	GNSS Information ∨	NetWork Setting ∨	Data Communication ∧	System Setting

NMEA Config

File
TCP/IP
Ntrip Client
Ntrip Server
Ntrip Caster
NMEA Config
System Log

GGA	1 Hz ∨	RMC	OFF ∨	VTG	O	ZDA	1 Hz ∨
GSA	1 Hz ∨	GST	1 Hz ∨	GSV	5	STA	Select ∨

Set

Figure 3-4-4-1-1

3.4.4.2 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 Figure 3-4-4-2-1.
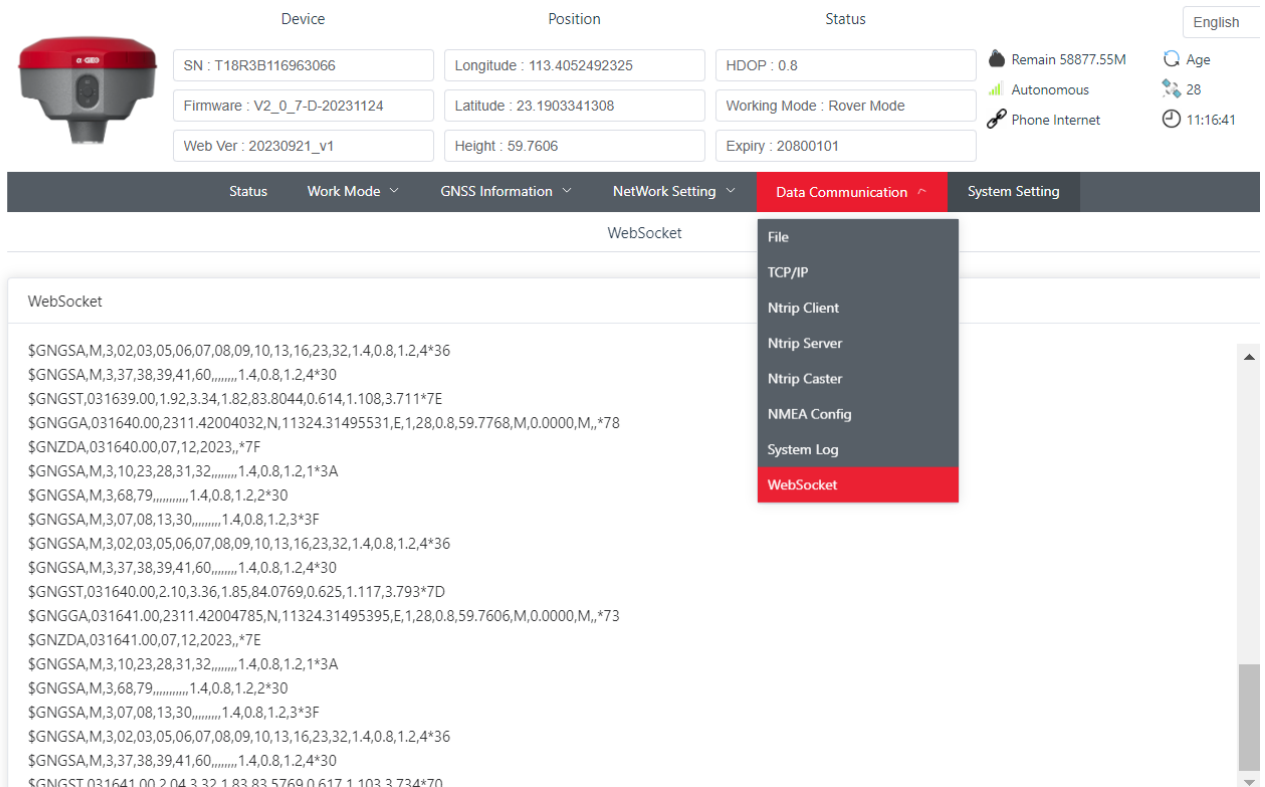
Figure 3-4-4-2-1

3.4.4.3 File Manage

MATRIX II allows to download the static data via WEB UI which is very convenient to share the data in the field.

WEB UI

When the static data is stored, the data list will be shown in this page as Figure 3-4-4-4-1. Users can download the data by clicking it.
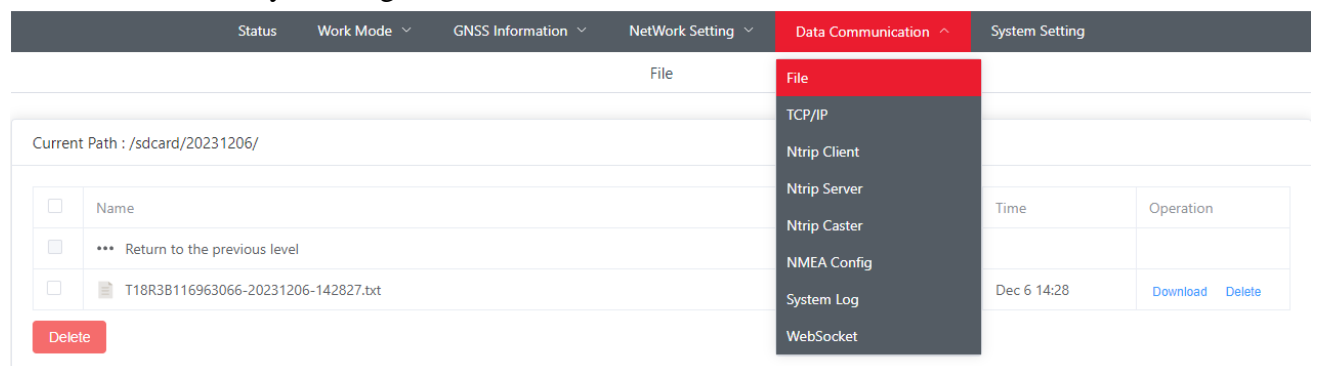

Figure 3-4-4-4-1

3.4.4.4 System Setting

MATRIX II provides some system settings, such as factory reset, restart, OEM reset, update and register as shown in Figure 3-4-4-5-1. 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 c
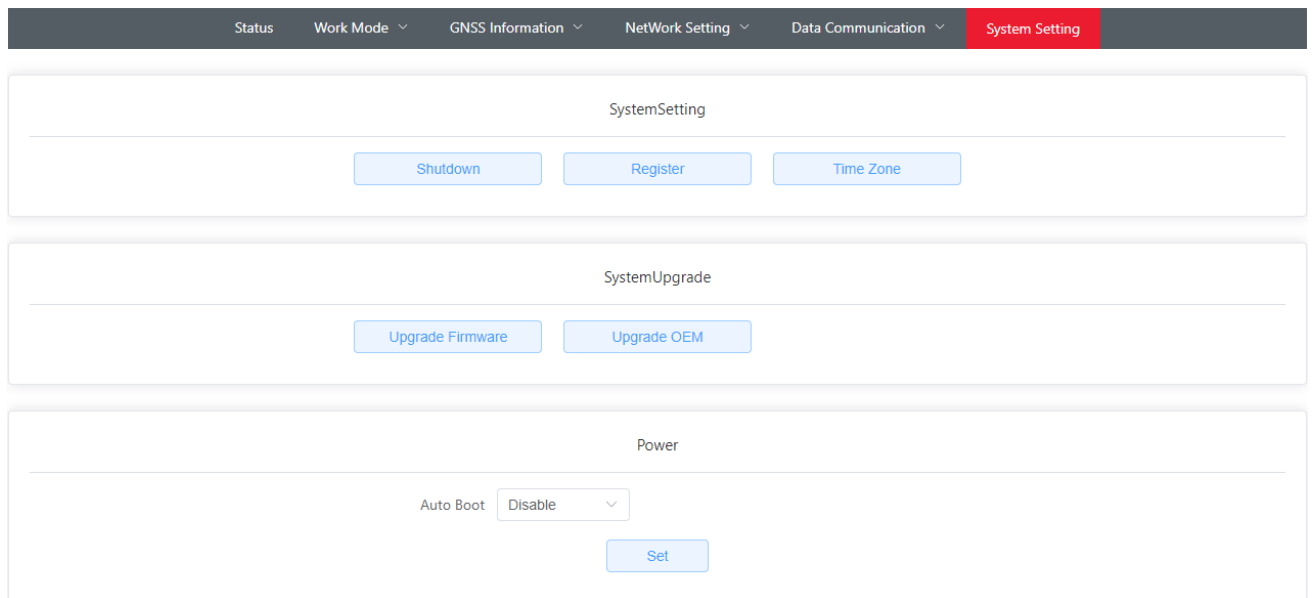
hoose the most convenient way to register the code.

Figure 3-4-4-5-1

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. 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.

3.4.5 Laser Survey

WIFI connection

1. Open the data collector WIFI to search for the device serial number, enter the password: 12345678, and click 'connect'. (Note: After the WIFI is connected to the data collector, a SIM card must be inserted into the receiver or handheld device to provide the network).

2. A window pops up, prompting that 'this network has no Internet access'. Do you want to keep the connection? Click "Yes". As shown in the below picture:
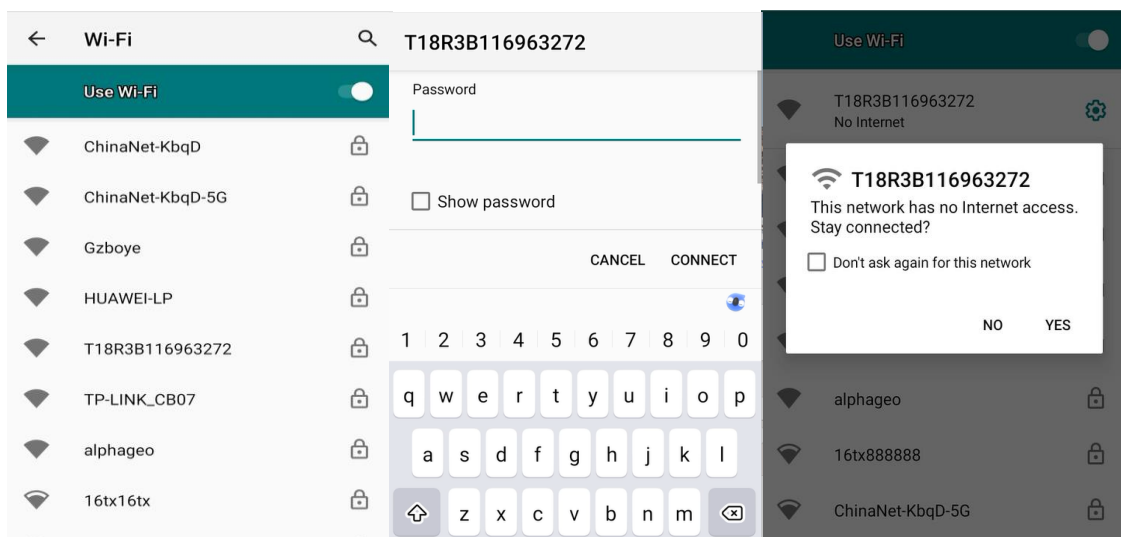
Laser and camera calibration

1. Turn on 'laser aiming correction'.

2. Fix the instrument in a position, find the laser point, adjust it with the up, down, left and right buttons, adjust the camera's centerline to the laser position, and click Apply.
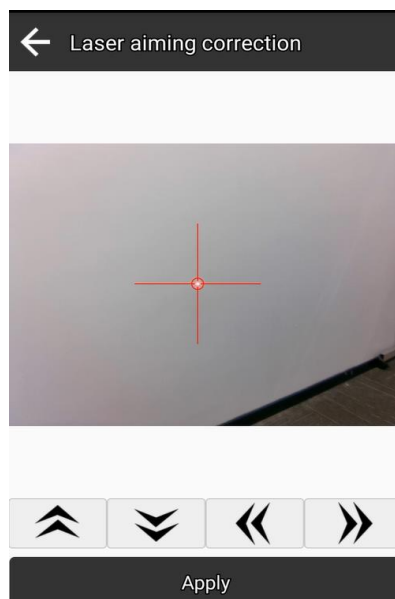
Measure points with laser

1. Enter into "Point Survey", find the settings menu and enable the floating icon(camera).

2. Turn on the camera and laser button, aim at the point to be measured, and click the measurement button. (Note: IMU must be available)
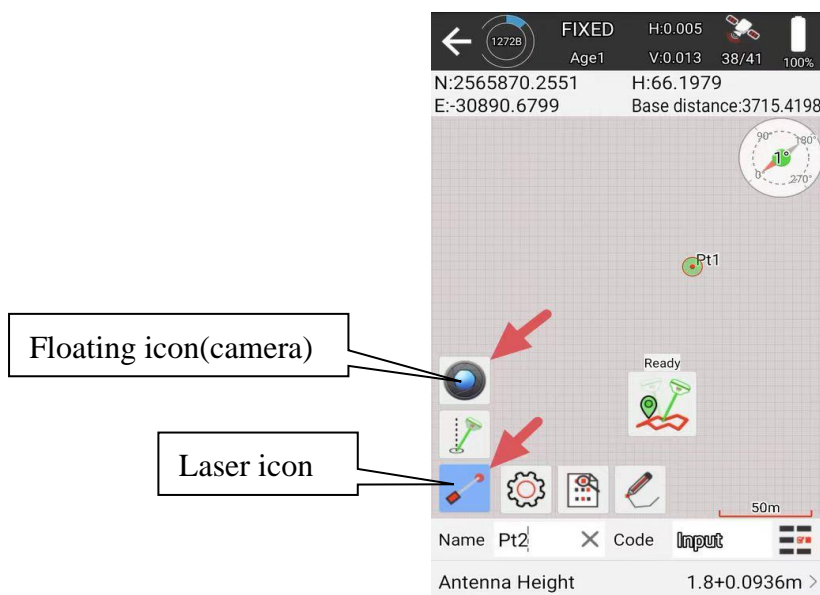
3.4.6 AR Stakeout

1. Open "Point Stakeout", click on the stakeout point, and find the AR icon
2. Find the required stakeout point based on the position provided by AR. As shown as below picture:
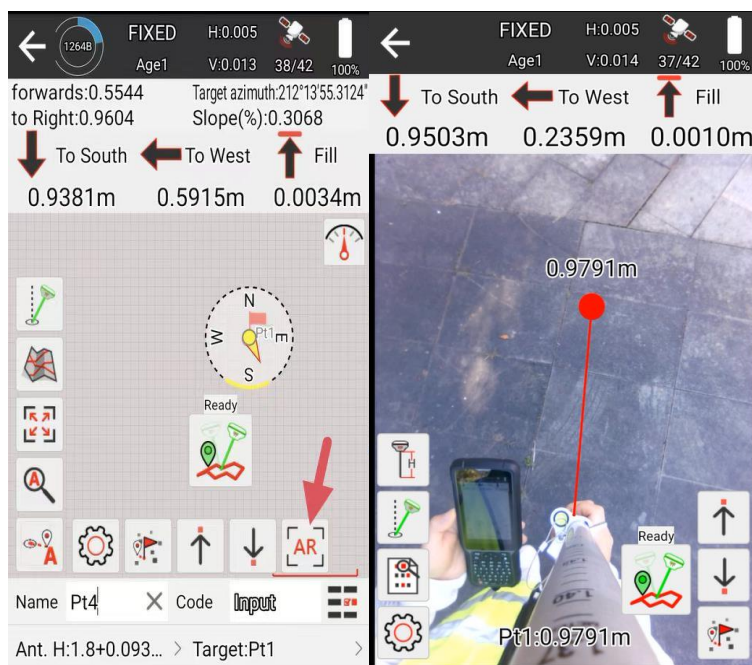
Chapter IV Warranty and Safety Notices

4.1 Warranty and Limited Liability

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

4.2 Safety Notices

a. 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.
b. 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.

4.3 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.