

SDi GNSS Receiver

User Manual



V2.0_20240628

STEC Headquarters

C-201 Yunsheng Science Park, No.11 Middle Guangpu Road, Huangpu District, Guangzhou 510663, China

Email: info@stecprecision.com

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Handling Precautions

The STEC SDi GNSS receiver housing is chemically and shock resistant. However, care must be taken when using the GNSS receiver in harsh environmental conditions.

Note: The GNSS receiver must be operated and stored within a certain temperature range. Please refer to the "Technical specifications" section for detailed requirements.

Packing, transportation and storage

Make sure the receiver and all accessories are in the correct position in the instrument box to prevent damage to the equipment caused by shock and vibration during transportation. The receiver has IP68 dust and water resistance, but you must remember that the receiver must be stored dry. If you have worked in rainy days, wipe the receiver with a dry cloth before putting it in the transportation box. The receiver and controller have built-in lithium batteries. Please ensure that you comply with local laws and regulations during transportation.

When using and storing the receiver, make sure that the environment it is in meets the storage temperature range of the receiver's Technical specifications". Before storing the receiver, charge the receiver battery to 80% and turn it off. After using the receiver, it should be packaged in time to prevent the shell parts from being lost.



Do not disassemble the receiver. If a fault occurs, please contact the equipment supplier. Please use the original charger. When using an external power supply, you must ensure that the rated voltage is correct.

Do not use the receiver and metal milestones during thunderstorms to prevent accidental damage caused by lightning.

Disposal and Recycling

This device must be disposed of separately from normal household waste. It is your responsibility to dispose of this and other electrical and electronic equipment at a collection point designated by your government or local authorities.

Proper disposal and recycling will help prevent possible negative consequences for the environment and human health. For more information on the disposal of your waste equipment, please contact your local authority, waste disposal service or the dealer where you purchased the equipment.



Please note that the SDi is a new type of geodetic GNSS receiver, even if you have used this type of equipment before, please read the operating manual carefully before starting work. If you have any questions, you can ask them on the official website of the manufacturer: <https://www.stecprecision.com>, or send your questions by email: info@stecprecision.com.

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1. Introduction

This is the user manual for STEC SDi GNSS receiver. It gives basic description and operation guide which may help user to operate device properly.



1.1 Appearance

STEC SDi main body is designed with magnesium alloy material to provide durable usage and better heat dispersion as well as light weight 695g. The internal battery ensures up to 20 hours continuous working.

1.2 Indicator

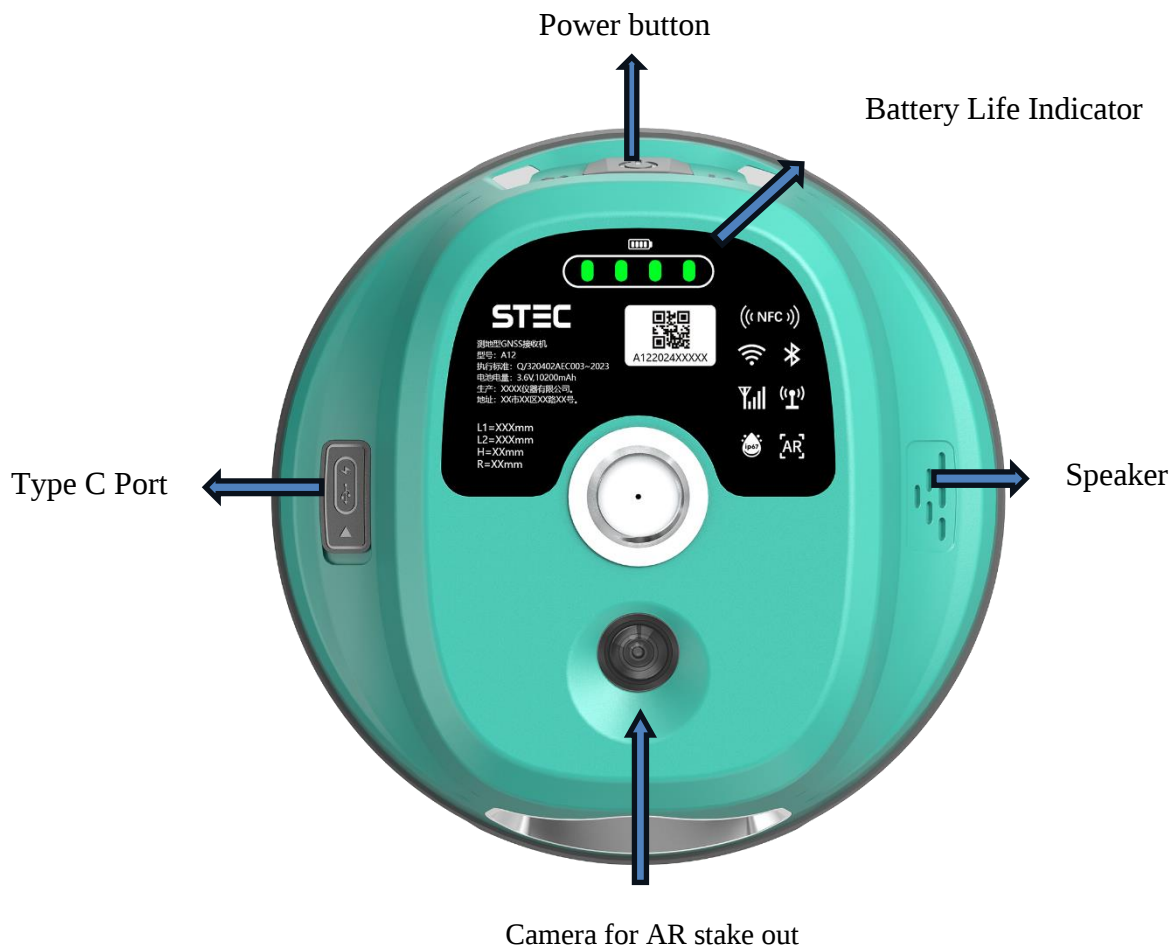
Working status is viewable through the indicators. The meaning of each indicator:



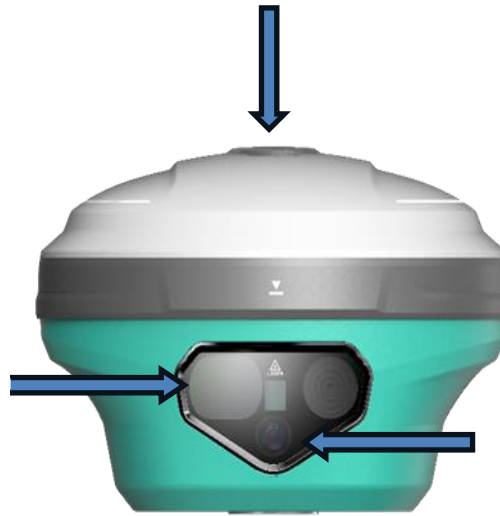
Indicator	Color	Meaning
Satellite 	Red and Green	- Off: no receiving satellites - Flash red: receiving satellites but no solution status. - Flash green: have solution but not fixed. - Solid green: fixed solution - Flash red and green alternately: main board abnormal
Data link 	Green and Blue	- Solid green: datalink is ready to start. - Flash green: datalink is transmitting data normally. - Flash Blue: when raw data recording is enabled, the LED will flash according to the interval
Bluetooth	Blue	- Off: no Bluetooth connection - Solid blue: has Bluetooth connection

1.3 Interface

STEC SDi GNSS receive bottom interface is shown as below.



UHF Antenna Socket



Adopting a large signal receiving sensor and distance measuring technology heritaged from total station, the performance and accuracy is uncomparable even in dark condition or the target is rough and dark.

The side camera also helps you shot the laser to the exactly point to be measured which will be shown on the collector, even the laser dot is invisible under strong sunlight

This device is equipped with a laser rangefinder and is a Class I laser product



CAUTION: CLASS I LASER RADIATION - DO NOT STARE INTO BEAM THROUGH OPTICAL INSTRUMENTS.

For safety reasons, staring into the beam through the telescopes of total stations, theodolites, levels and other magnifiers and optical instruments is prohibited. Exposure to skin near the aperture may cause burns.

1.4 Power button

The main function is as below:



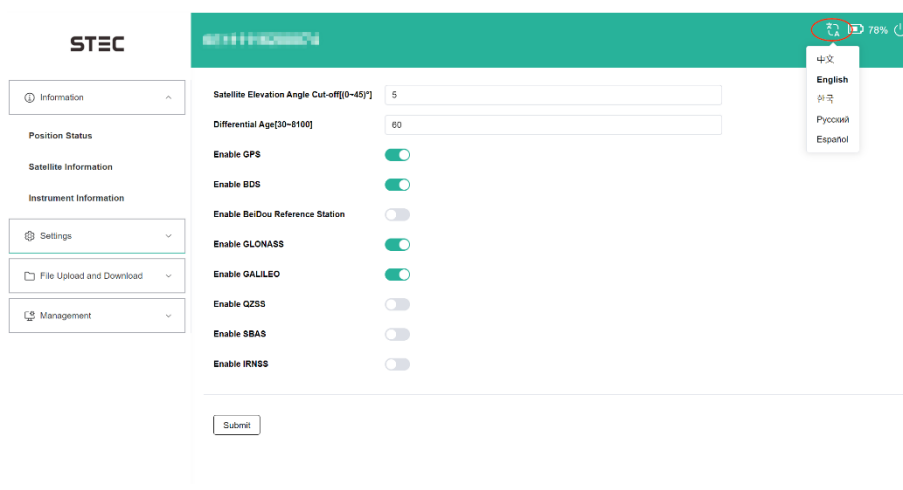
Power On	Long press button for five seconds until hear one beep and see all lights on to power on receiver.
Power Off	Long press button for three seconds then releases, you will hear the voice <i>“Please release button, short press to power off, long press to self-check”</i> Then short press the button again to confirm.
Broadcast Current Working Mode	Receiver will broadcast current working mode when press the power button once.
Self-check	Long press button for three seconds then release, will hear the voice <i>“Please release button, short press to power off, long press to self-check”</i> Then long press button for three seconds then releases, will hear the voice <i>“Start self-check”</i> .

2. Web User Interface

User can connect to receiver WIFI hotspot with PC, smart phone or tablet. The hotspot name is the device serial number, can be found under the bottom of the device label. Open web browser and input the IP address “192.168.10.1”. The default user name is “admin”, password is “password”. From the website, user can manage working status, change working mode, configurate basic settings, download raw data, update firmware, and register device.

Language and intelligent voice

After entering web UI, users can configure language display and device voice via pressing following button.



2.1 Position

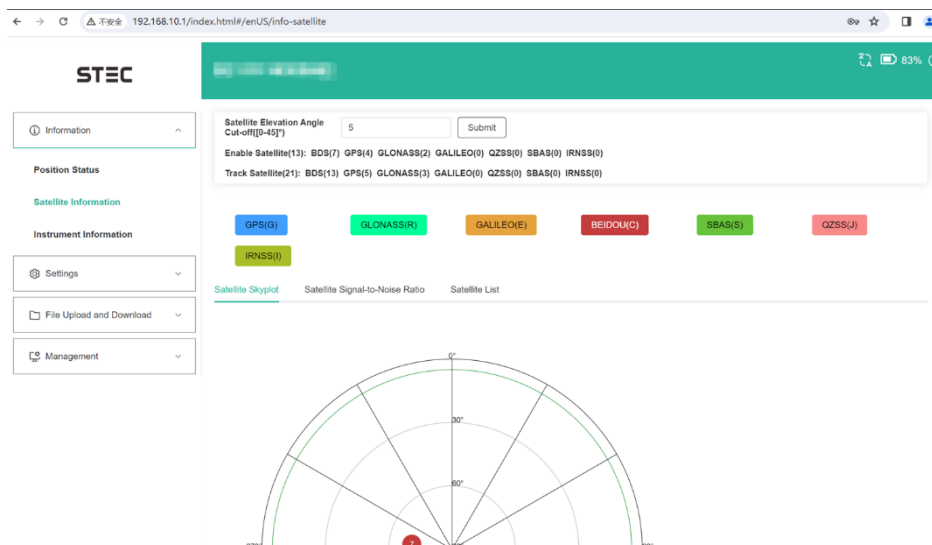
View basic position information, satellite number, PDOP and time. In static mode, can start and stop recording here.

The screenshot displays the STEC SDi web interface in a browser. The address bar shows the URL `192.168.10.1/index.html/en/US/info-position`. The interface has a green header bar with the STEC logo and a battery status indicator showing 83%. On the left, there is a sidebar menu with the following items: Information (selected), Position Status, Satellite Information, Instrument Information, Settings, File Upload and Download, and Management. The main content area displays position data in a table format.

Operating Mode	Roving
Data Link	Radio
Longitude	113.438616166 °
Latitude	23.162628345 °
Altitude	29.878 m
Solution Status	Single Point [0]
PDOP	2.177
HDOP	1.485
VDOP	1.582
TDOP	2.837
HRMS	10.261
VRMS	6.978
Enable Satellite	14 [GPS(5), GLONASS(2), GALILEO(0), BDS(7), SBAS(0), QZSS(0)]
Track Satellite	21 [GPS(5), GLONASS(3), GALILEO(0), BDS(13), SBAS(0), QZSS(0)]
Current Time	2024-01-25 13:42:16

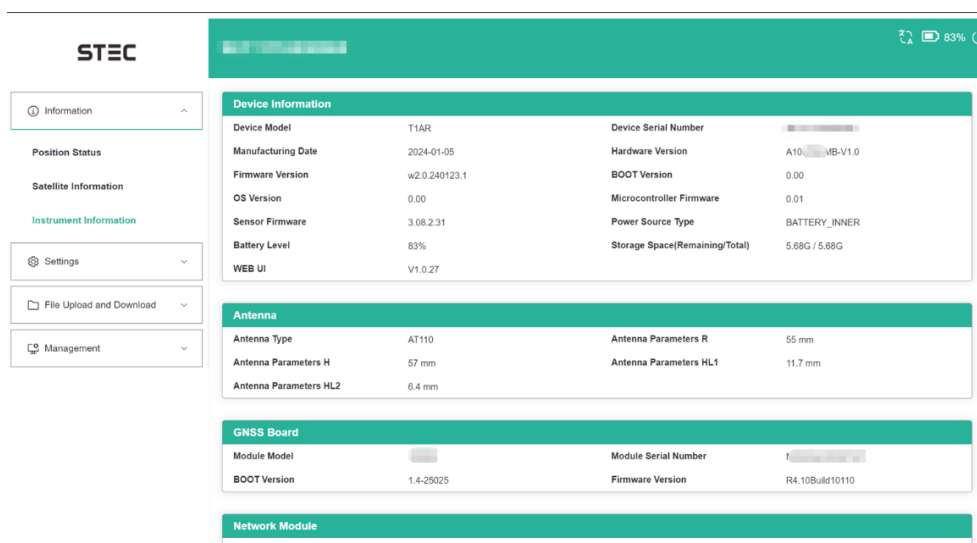
2.2 Satellites

View satellite list and satellite map, set cut-off angle.



2.3 Instrument Information

View receiver information: firmware version, GNSS board, and network module.



2.4 Working Mode

Configure working mode: base, rover or static. Also, can configure data-link parameters.

The screenshot displays the STEC SDi web interface for configuring a receiver. The browser address bar shows the URL `192.168.10.1/index.html#/enUS/setting-receiver`. The interface features a sidebar on the left with the following menu items: Information, Settings, Mode Settings, Satellite Settings, Parameter Settings, Output Settings, File Upload and Download, and Management. The main content area is titled "Receiver Settings" and includes the following configuration options:

- Operating Mode:** Radio buttons for Static, Rover (selected), and Base Station.
- Data Link:** Radio buttons for Bluetooth, Network, Radio (selected), and No Data Link.
- Record Raw Data:** A toggle switch currently turned off.
- Radio Frequency:** A range of 410-470 MHz.
- Radio Channel:** A dropdown menu showing "1" with a range of 450 MHz.
- Radio Protocol:** A dropdown menu showing "TrimMark-III".
- Bandwidth:** A dropdown menu showing "25.0 K".
- Baud Rate:** A dropdown menu showing "19200 bps".
- FEC:** A toggle switch currently turned off.

A "Submit" button is located at the bottom of the configuration area.

2.5 Satellite Setting

Configure the satellites to be used.

The screenshot shows the STEC web interface for Satellite Setting. The left sidebar contains a menu with 'Information', 'Settings', 'Mode Settings', 'Satellite Settings' (highlighted), 'Parameter Settings', 'Output Settings', 'File Upload and Download', and 'Management'. The main content area has a green header with the STEC logo and a battery status indicator (83%). Below the header, there are two input fields: 'Satellite Elevation Angle Cut-off[(0-45)°]' with a value of 5, and 'Differential Age[30-8100]' with a value of 60. A list of satellite systems follows, each with an 'Enable' toggle switch: GPS (checked), BDS (checked), BeiDou Reference Station (unchecked), GLONASS (checked), GALILEO (unchecked), QZSS (unchecked), SBAS (unchecked), and IRNSS (unchecked). A 'Submit' button is located at the bottom of the form.

2.6 System Para

Configure receiver settings.

- User can set time zone and sensor update rate.
- Smart voice broadcast can be activated or not according to client need.
- Set the Rinex version for static data naming method.
- “Cloud service” and “Track back” is used for uploading position information to cloud/TCPserver.

The screenshot shows the STEC web interface for System Parameter Setting. The left sidebar is identical to the previous screenshot, with 'Parameter Settings' highlighted. The main content area has a green header with the STEC logo and a battery status indicator (83%). Below the header, there are several settings: 'Time Zone' (GMT+8:00), 'Sensor' (OFF), 'Voice' (checked), 'Base Station Alarm' (checked), 'Static File Naming Convention' (RINEX2.11), 'Base Station Transmission Site Information' (unchecked), 'Transmission Service' (Cloud selected, Position Reporting unselected), and 'Position Tracking' (unchecked). A 'Submit' button is located at the bottom of the form.

2.7 Output

Configure NMEA data output through Bluetooth.

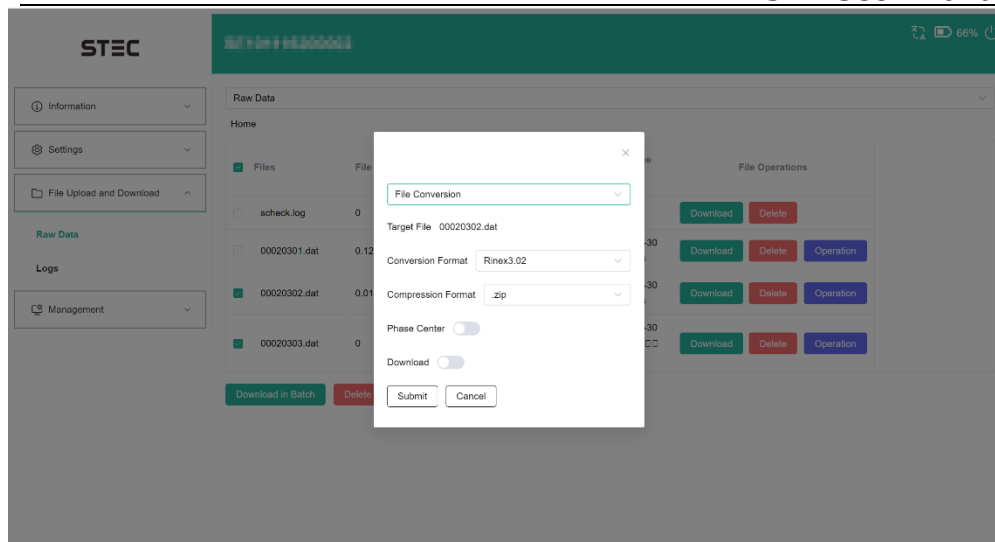
The screenshot shows the STEC web interface for configuring NMEA data output. The left sidebar contains a menu with 'Information', 'Settings', 'Mode Settings', 'Satellite Settings', 'Parameter Settings', 'Output Settings' (highlighted), 'File Upload and Download', and 'Management'. The main content area is titled 'Output Settings' and features a grid of dropdown menus for configuring various NMEA sentences: GGA, GST, VTG, GERE, GSA, GLL, ZDA, GESNR, GSV, RMC, GEDOP, and GEVCV. Each dropdown menu has a label and a value. Below the grid, there are two toggle switches: 'Record NMEA' and 'Upload Network NMEA'. A 'Submit' button is located at the bottom of the configuration area.

2.8 Raw Data

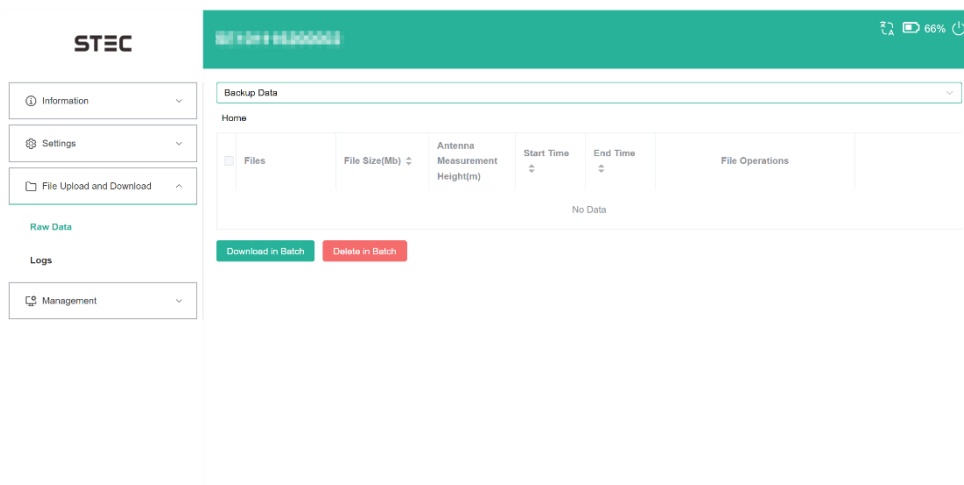
Download raw data or convert data to RINEX format. User can use check box, then click “Download choose” button to download multiple files.

The screenshot shows the STEC web interface for downloading raw data or converting to RINEX format. The left sidebar contains a menu with 'Information', 'Settings', 'File Upload and Download' (highlighted), 'Raw Data', 'Logs', and 'Management'. The main content area is titled 'Raw Data' and features a table with columns: 'Files', 'File Size(Mb)', 'Antenna Measurement Height (m)', 'Start Time', 'End Time', and 'File Operations'. The table contains one row with the file 'scheck.log', a size of 0 Mb, and a start time of 2024-01-25. Below the table, there are two buttons: 'Download in Batch' and 'Delete in Batch'. A 'Download' button is also visible in the 'File Operations' column of the table.

The default static file type is *.dat, if users want to convert the file type to Rinex format, you can select one file, then press “Modify” button, it will pop up a dialog, select “convert” from drop-down menu, then choose required Rinex format version, press submit, it will generate a new file package in the file list.



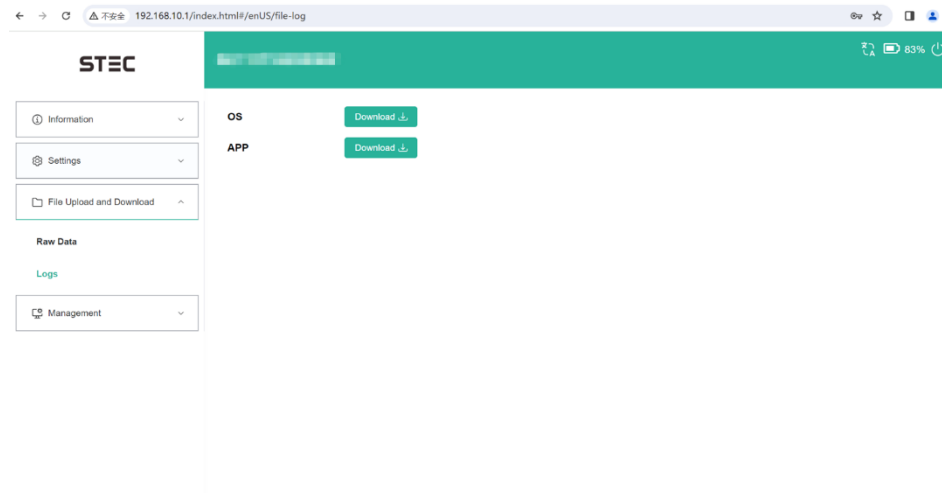
Backup data



The points collected in Field Master will be backup in receiver storage automatically to avoid data loss. Can restore the data to Field Master software.

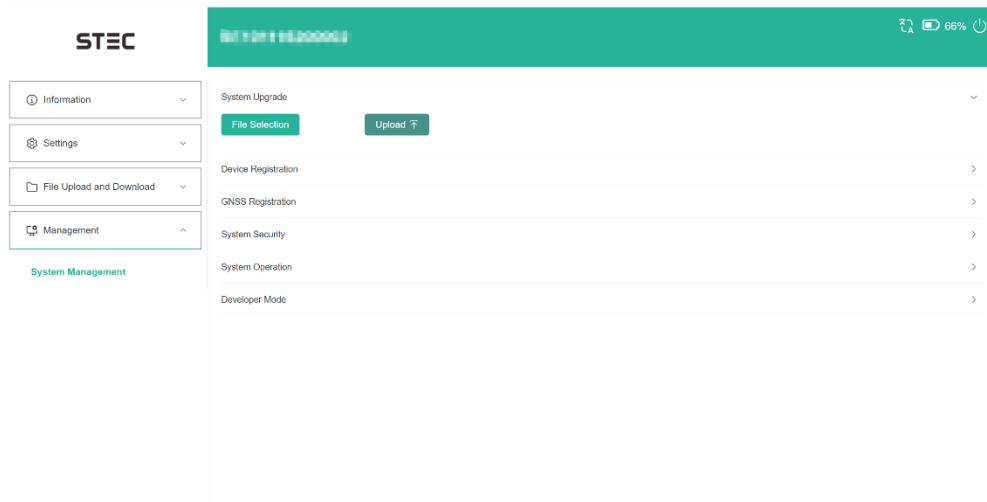
2.9 Log

The log files can be used to diagnose issues. Click “download” to download the files.



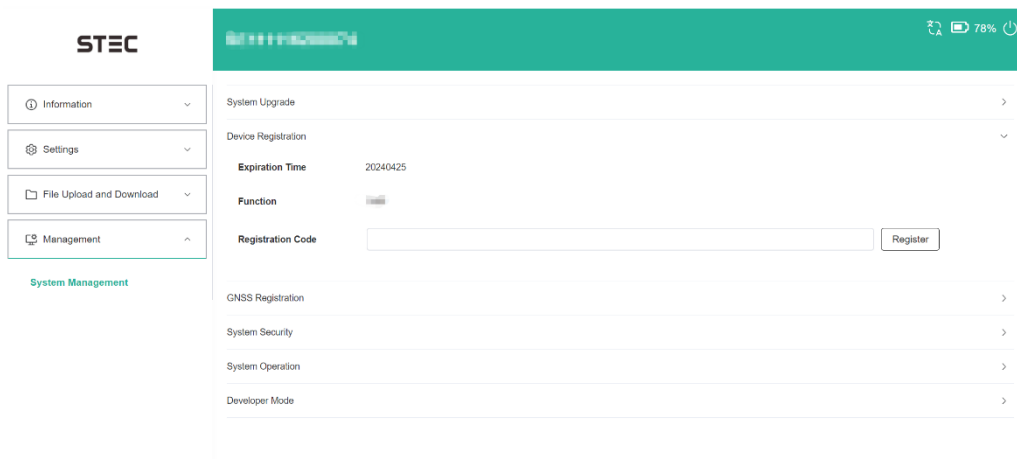
2.10 Management

User can update receiver and GNSS firmware as well as register device, format internal disk, restore factory setting, restart device. To update the firmware, click “Choose File” to import the firmware, then click “Upload File” to start updating.

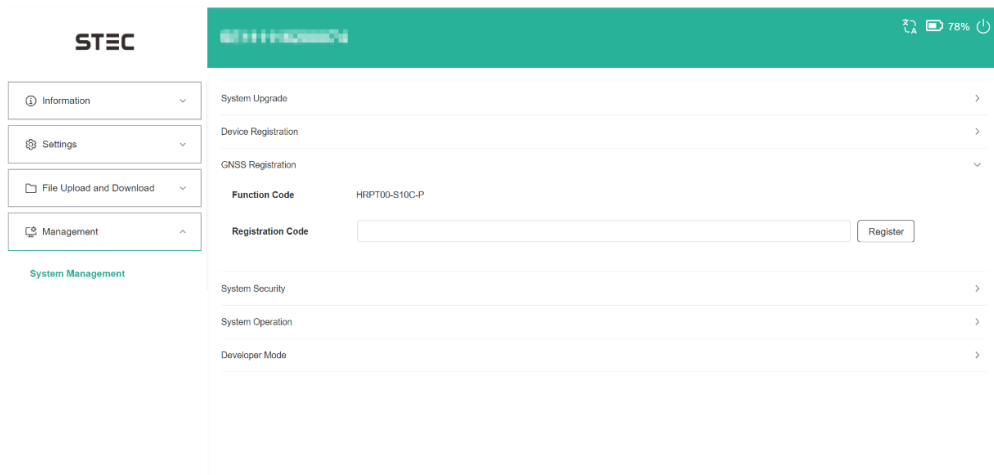


Device Registration

This menu is used for registering permanent or temporary license.



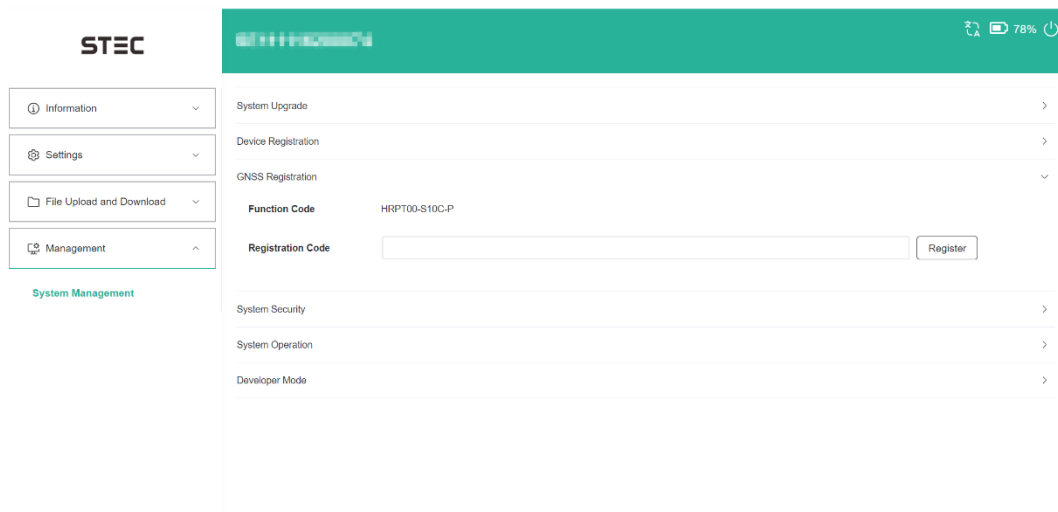
GNSS Registration



This menu is used for open different module functions.

System Operation

In this menu, users can make the four kinds of operation, self-check, format disk, restart device, factory reset.



3. Basic Operation

This part shows user some basic operations to start working.

3.1 Charge the battery

SDi is equipped with Type-C charger which support maximum 45w PD quick charge. Fully charge the battery will take 4 hours typically. The battery indicator is red when charging, will turn green when fully charged.



3.2 Measure antenna height

To get correct elevation value, we need to know the correct phase center height of the receiver. However, it is almost not possible to measure the phase center directly. Normally, the software will read the receiver antenna offset parameters. Once user input the measurement height, software will calculate the phase center height automatically. Typically, there are two ways to measure the height:

A: Slant height (to measurement line)

- Centering and leveling the tripod on known point, then measure slant height from the ground point to the arrow at the side of the receiver.

B: Pole height (straight height to device bottom)

- Read the straight pole height

3.3 IMU Sensor

STEC SDi is integrated with powerful calibration-free IMU sensor to give better experience in the real field work.

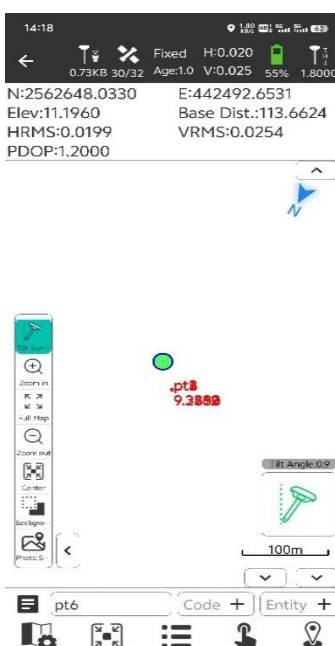
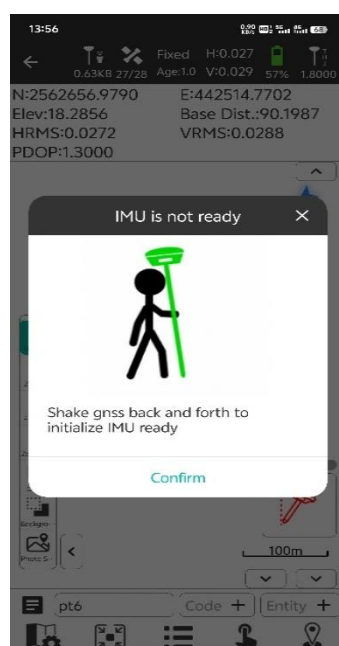
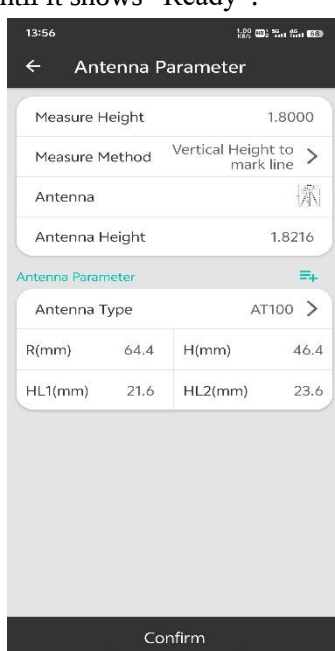
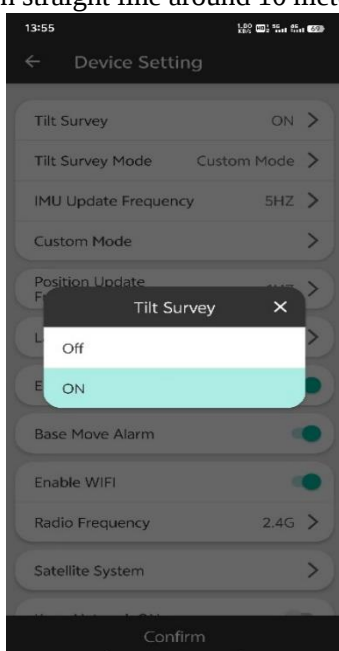
3.4 IMU Tilt Survey

To initialize the IMU sensor, receiver must be in Fixed solution.

In Field Master software, connect device and click “Device” ->

“Device Settings”, enable “Tilt Survey” function. Then, go to “Survey” -> “Point Survey” page. The software will guide user to calibrate the sensor.

- Input the correct pole height.
- Draw circle on the ground using the pole.
- Follow the guide and shake the pole back and forth for around 5-10 seconds or walk in straight line around 10 meters until it shows “Ready”.



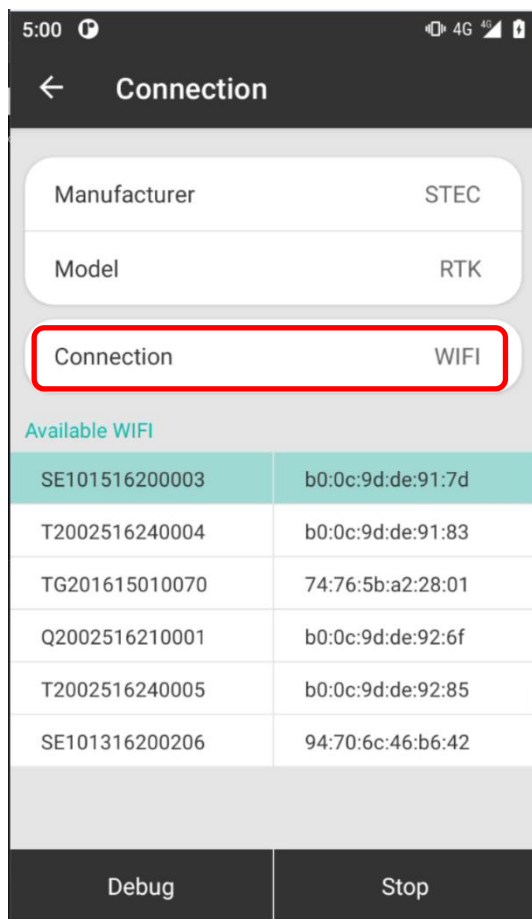
3.5 Collect Point Via Laser

- Run Field Master
- Device-Connection, select the right serial number, and connect.

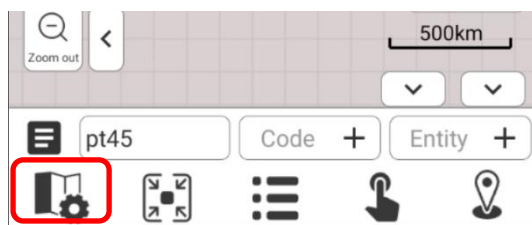
Manufacturer: STEC

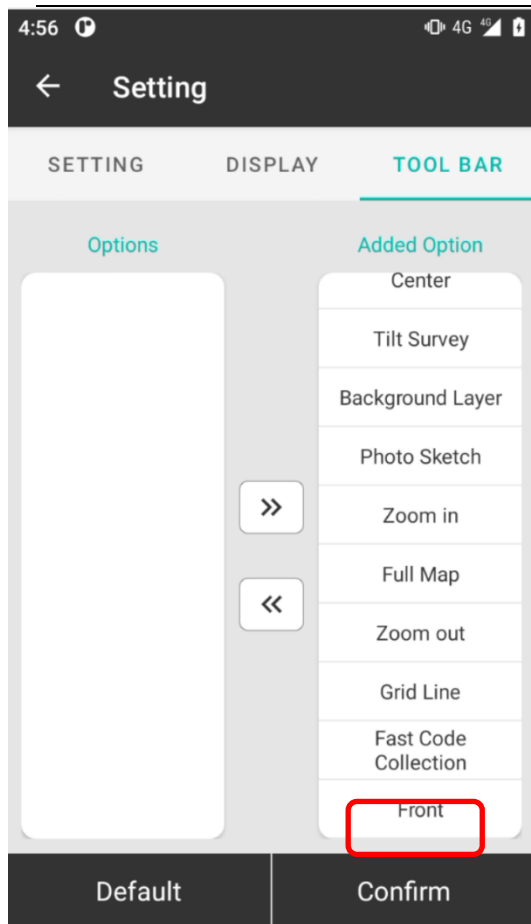
Model: RTK

Connection: WIFI



- Set Rover mode and config datalink accordingly, wait till the receiver get fixed
- Survey-Point Survey
- Set-More Setting-TOOL BAR, Add Front option to be displayed





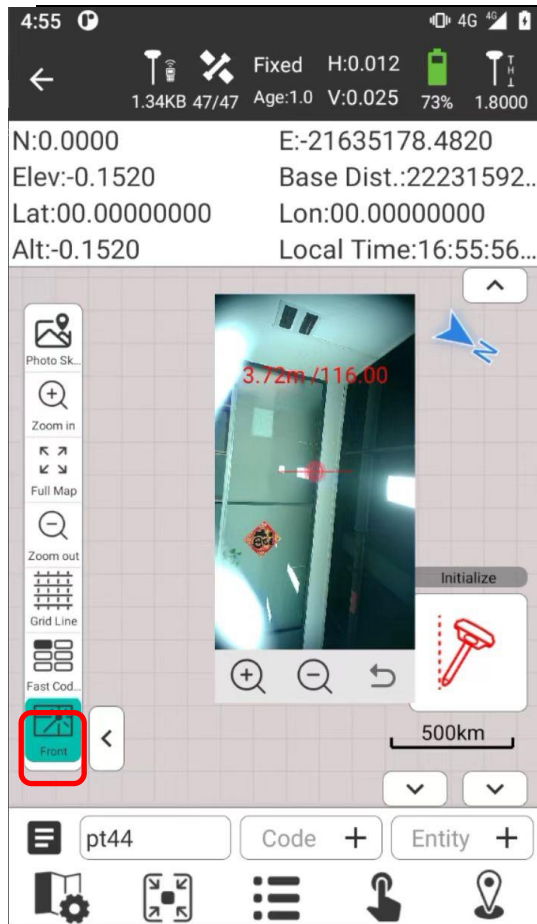
- Click Front to activate the laser pointer and front camera.

Message shown on the picture:

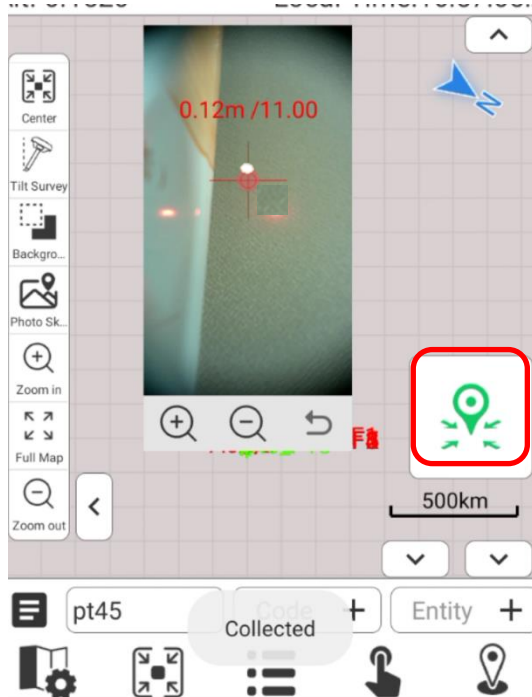
3.72m / 116.00

3.72m: Distance to the current target

116.00: Signal of the EDM



- Input the right antenna height and initialize the IMU to be ready.
- Click Collect icon to collect the coordinate where the laser pointer is aimed at.



- Click Front again to shut down the camera. It will change to measure the coordinate of the pole tip.

3.6 AR Stake Out

A unique AR stake-out solution that coordinates cameras both on controller and receiver. When you are quite away from the point, the controller shows you the general direction to the point. And when you are steps away from the point, the controller will shift to the camera beneath the receiver seamlessly and show a more accurate guidance to the point.

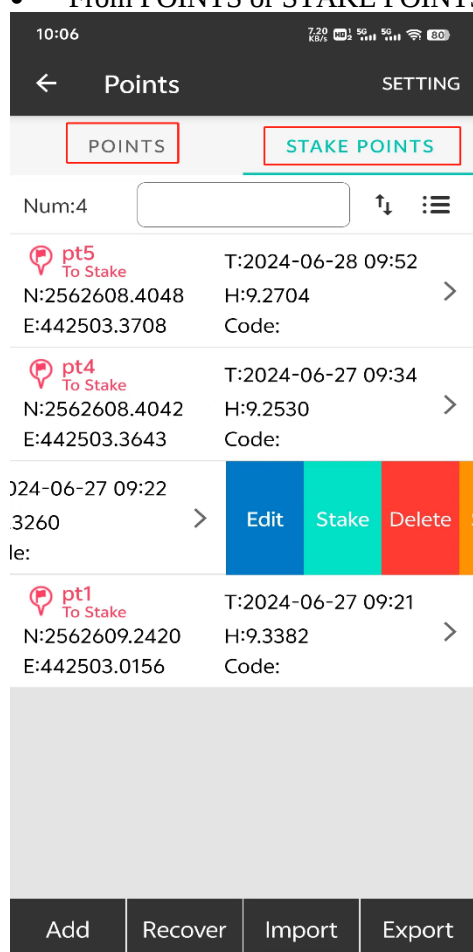
- According to the methods summarized in 3.4 and 3.5 above, connect the receiver through Field Master to activate the IMU and achieve a fixed solution.

Manufacturer: STEC

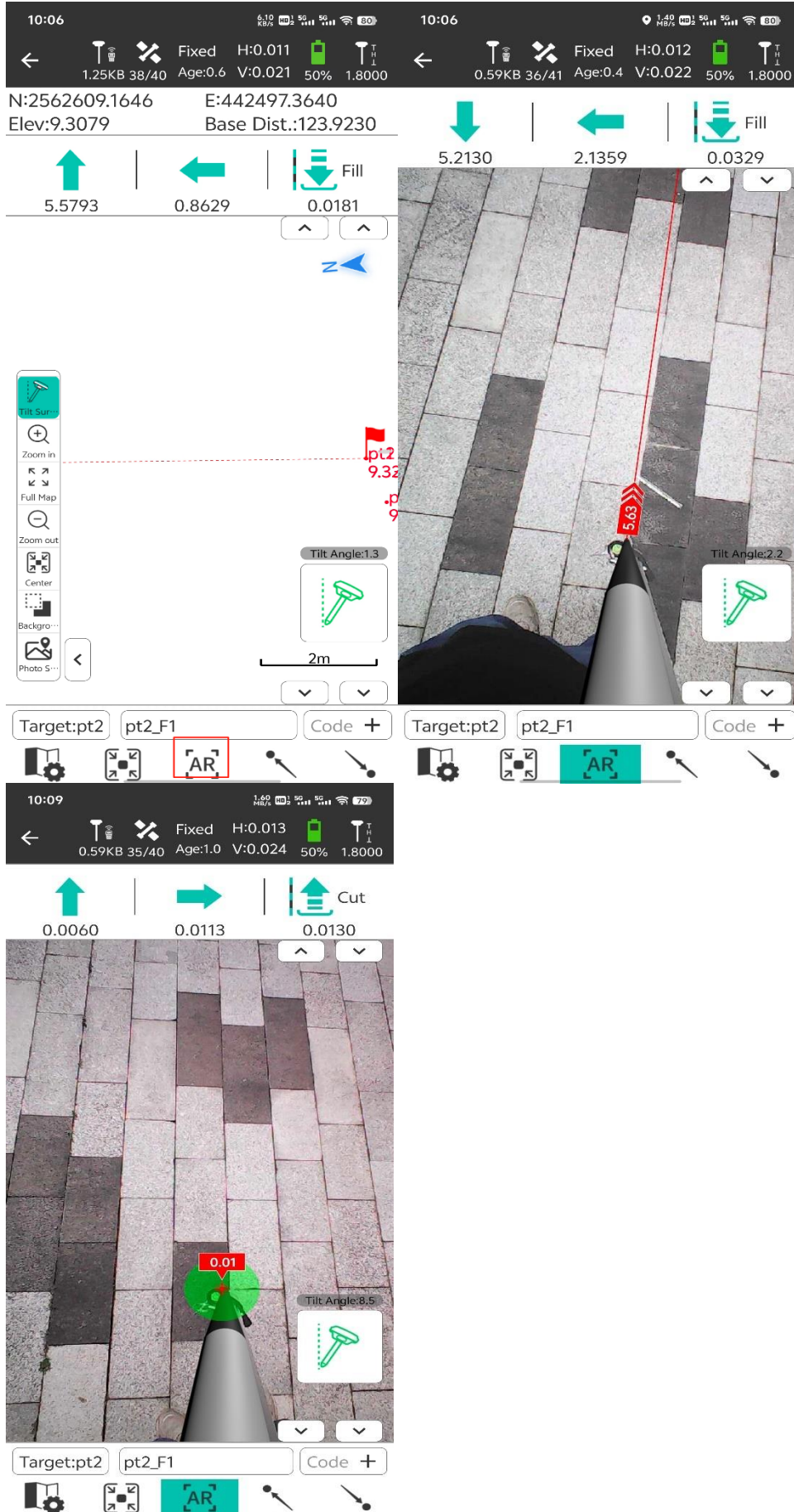
Model: RTK

Connection: WIFI

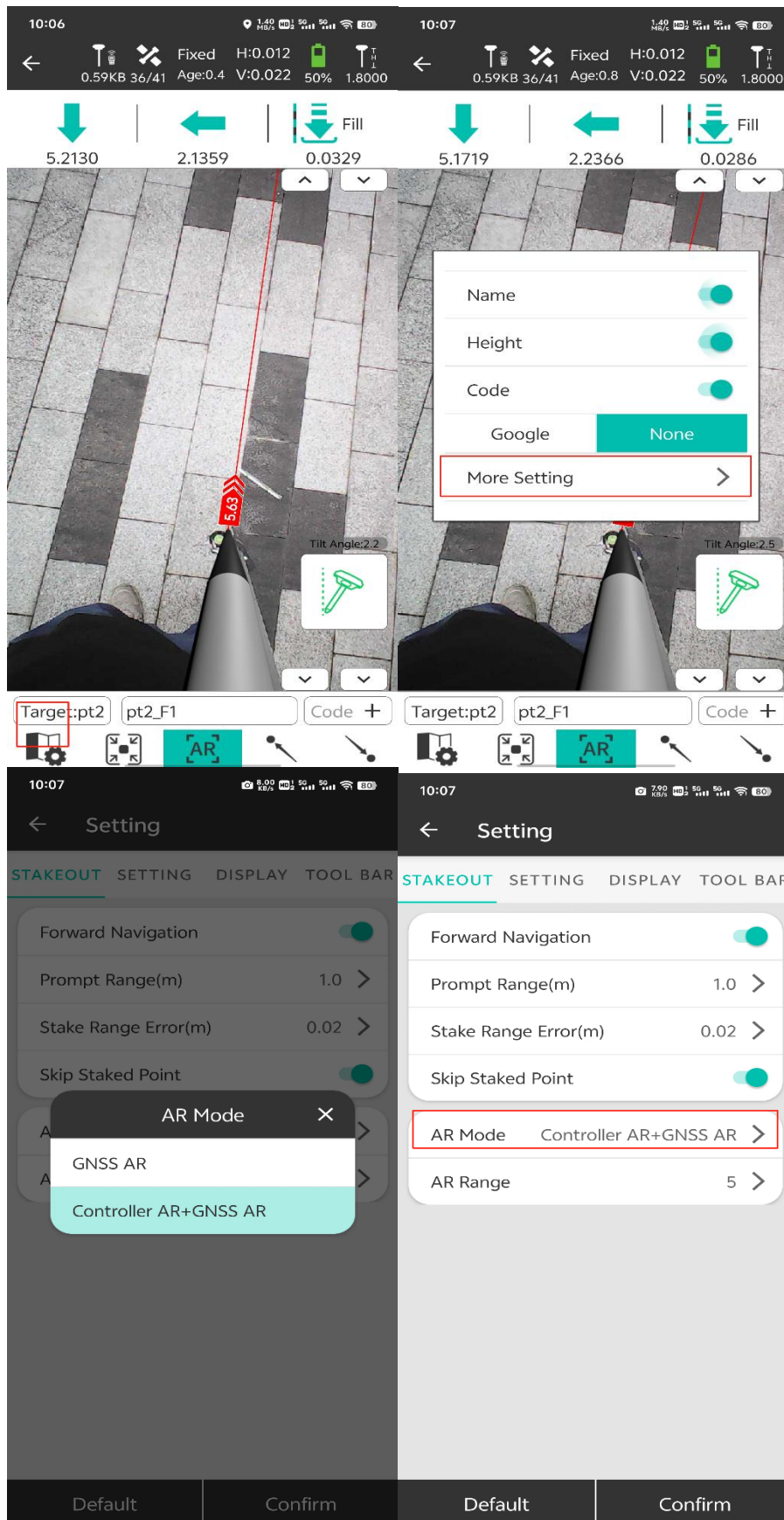
- Survey-Point Stakeout
- From POINTS or STAKE POINTS, select the target point to be staked out.



- Click AR to enter AR stakeout



- In the settings, you can also choose different AR combinations to take charge of a variety of targets



4. Features

The STEC SDi is a next-generation GNSS receiver designed for any surveying project that uses the latest satellite positioning, laser rangefinder technology, and real-time measurements with AR cameras. The combination of the laser rangefinder and the module's IMU allows you to measure hard-to-reach objects with high accuracy at distances up to 15 meters, and the satellite positioning technology used in the device allows you to achieve stable reception of satellite signals in the most difficult conditions. Even in dense forests or urban areas, you can be sure of a reliable fixed solution.

SDi is equipped with UM980 OEM board, UM980 is based on unicorn's NebulasIV™ new generation of RF baseband and high-precision algorithms integrated GNSS SoC chip, built-in dual-core CPU, and integrated high-speed floating-point processor and RTK co-processor, using 22nm low-power process, support 1408 super channels, provide more powerful It supports 1408 super-channels, providing more powerful satellite navigation signal processing capability. The embedded JamShield multi-frequency anti-jamming technology completes the enhanced multi-mode and multi-frequency RTK engine solution, which significantly improves the RTK initialization speed, measurement accuracy and reliability in complex environments, such as city blocks and tree shades.

The receiver has a built-in 2w UHF modem (410-470MHz) that allows you to operate in built-in radio mode in locations where mobile internet is not available. The radio modem can both receive and send data.

SDi has the latest IMU, characterized by fast initialization and immunity to magnetic interference. Initialization is instant: just activate the use of the IMU and the receiver will be ready for tilt operations when you move to the measuring station. By saving unnecessary operating time, you can increase the comfort and speed of your work. The centering pole tilt compensation range allows measuring and marking work at angles of up to 60°.

The receiver is also equipped with a GSM modem, Wi-Fi and Bluetooth. The built-in 4G GSM modem ensures fast network connection, which can speed up the reception and processing of all telecommunication signals and frequency bands. SDi can be used as a Wi-Fi access point, so users can easily access, manage, configure or download static data through the receiver's web interface by using a controller, computer, smartphone or other Wi-Fi-enabled device without third-party software or cables.

SDi is equipped with a 7.2V, 6800mAh high-capacity battery to meet the needs of your day's measurement work. Meanwhile, the structure adopts IP68 waterproof and dustproof design, with an operating temperature range of -30°C-60°C, in addition to the 2-metre drop of hard-surface shock-resistant, so that you can use the receiver in any environment.

SDi uses a starlight camera, which can still ensure the display of images in low light conditions, while similar products cannot form images normally in this operating environment. The current distance measurement module is a Hilti Aktiengesellschaft (Hilti AG) module, which has obvious advantages over similar competing products in terms of laser emission stability and the intensity of the receiving and receiving optical paths. Whether it is long-distance distance measurement or dark surface testing, Hilti's solution can complete the distance measurement function without the situation of being unable to test or taking a long time to test; perhaps when some products are tested against reflective targets, measured against sunlight, or measured against asphalt pavement, the distance measurement module of competing products will have abnormal distance measurement status, but our SDi will not have these situations, which will bring you a more comfortable new measurement experience.

5. Technical specifications

SATELLITE PERFORMANCE	Channels	1,408
	GPS	L1C/A, L2C, L2P(Y), L5
	GLONASS	L1, L2
	BEIDOU	B1i, B2i, B3i, B1C, B2a, B2b
	GALILEO	E1, E5a, E5b, E6
	QZSS	L1, L2, L5, L6
	SBAS	L1, L5
	L-Band	B2b-PPP, E6-HAS
	Positioning Rate	1-20Hz
ACCURACY	Code Differential	H: 0.40m (RMS)
		V: 0.80m (RMS)
	Static	H: 2.5mm±0.5ppm (RMS)
		V: 5mm±0.5ppm (RMS)
	Real-time Kinematic	H: 8mm±1ppm (RMS)
		V: 15mm±1ppm (RMS)
	Network PPK	H: 8mm±0.5ppm (RMS)
		V: 15mm±0.5ppm (RMS)
IMU MEASUREMENT	Tilt Angle (No tilt angle limit)	2cm within 60°
DATA STORAGE	Type & Storage	SSD 8GB
		External USB Pen drive
	Data Transfer	Type-C USB Transfer
		Supports FTP/HTTP download
	Differential Format	RTCM 2.1, RTCM 2.3, RTCM 3.0, RTCM 3.1, RTCM 3.2, NMEA 0183, PJK plane coord., binary code, Trimble GSOF
	GPS Output Format	VRS, FKP, MAC
	Network Model	Ntrip fully supportable
CAMERA	Optical Format	1/2.8"
	Pixel Size	2.9*2.9μm
	Active Pixel Array	1,920*1,080
	Sensor	CMOS 1080p HDR imaging sensor

COMMUNICATION	I/O	Type-C (OTG+Fast Charge+Ethernet)
	Antenna Port	All-in-one port for radio/GPRS antenna
	UHF Radio	2W Tx/Rx
		410-470MHz
	Protocol	S-LINK, TrimTalk, Hi-target, SOUTH, CHC
	WIFI	802.11b/g/n Hotspot/Data Link
	Bluetooth	Bluetooth 2.1 + EDR and 4.0
	NFC	Available
INTERFACES	Button	1
	LED Indicator	Data Link, Satellite, Bluetooth, Power
POWER SUPPLY	Battery	Internal Li-on Battery
		7.2V, 6,800mAh
	Operating Time	Static mode 20h
		Rover mode 15h
PHYSICAL	Dimension	86mm(H), 130mm (W)
	Weight	890g
	Operating Temp.	-30°C to 65°C
	Storage Temp.	-40°C to 80°C
	Proof	IP68 water and dust proof
		2m drop on hard surface
		40G 10ms sawtooth wave