# E500 GNSS Receiver

## User Manual

V1.0_202012

# Contents

# 1. Introduction

This is the user manual for survey E500 GNSS receiver. It gives basic description and operation guide which may help user to operate device properly.

## 1.1 Appearance

The E500 main body is designed with magnesium alloy material to provide durable usage and better heat dispersion as well as light weight 1000g. The internal battery ensures up to 12-hours continuous working.

## 1.2 Indicator

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

| Indicator | Color | Meaning |
|---|---|---|
| Breathing Light | Red | • Solid red: self-check fault<br>• Breathing red: battery level below 25%<br>• Flash red: GNSS Board communication is abnormal |
| | Green | • Add green on the base of original color (Repeat every five seconds): Data are recording (include static, base and rover data) |
| | Purple | • Solid purple: fixed solution<br>• Flash purple: datalink is transmitting data normally<br>• Breathing purple: single solution<br>• Quickly flash purple: no solution status |
| | Yellow | • Solid yellow: device is starting up<br>• Flash yellow: self-check<br>• Breathing yellow: firmware is updating |
| | Blue | • From purple to blue: the Bluetooth is connecting |
| | Red, Green and Blue combined | • Red-green-blue circulation: internal module is updating (include network module firmware, GNSS board firmware, sensor firmware and UHF firmware) |
| Battery Indicator | Green | • Four solid green: battery level between 75%~100% |

| | | |
|---|---|---|
| | | • Three solid green: battery level between 50%~75% |
| | | • Two solid green: battery level between 25%~50% |
| | | • One solid green: battery level below 25% |

## 1.3 Interface

E500 GNSS receive bottom interface is shown as below. The 5-pin port is used to connect external radio and external power, or output NMEA messages. Type-C port can be used for data download (internal storage access) or charging.

SIM Card        5-Pin        UHF        Type-C
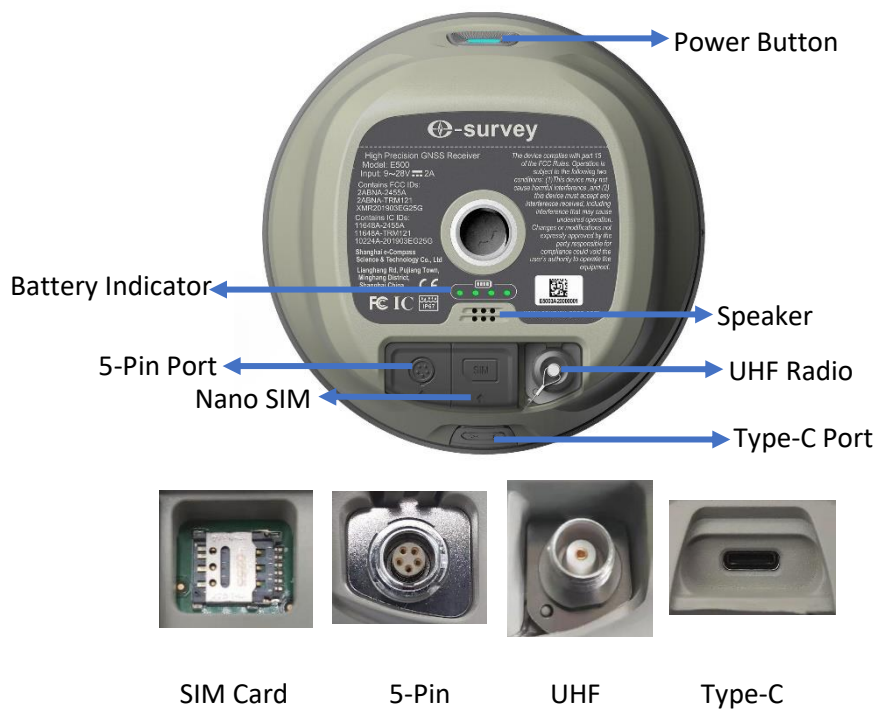
## 1.4 Pin definition

The 5-pin port is defined as below:

| 5 Pin | Front View | 1 | +12V | Power |
|---|---|---|---|---|
| | | 2 | GND | Power ground |
| | | 3 | TXD | Device out |
| | | 4 | SGD | Signal ground |
| | | 5 | RXD | Device in |

## 1.5 Power button

There is a power button on E500 control panel, the main function as below:

| | |
|---|---|
| **Power On** | Long press button for three seconds then release to power on receiver when it is powered off |
| **Power Off** | Long press button for three seconds, you'll hear "power off?" then press the button again |
| **Broadcast Current Working Mode** | Receiver will broadcast current working mode when press the power button |
| **Check the battery Level** | Press power button, four battery indicator will light according to battery level then extinguish after five seconds |
| **Self-check** | Long press button for two seconds then release, will hear the voice "Power off?" Then long press button for three seconds, will hear the voice "self-check". |

# 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 password is "password". From the website, user can manage working status, change working mode, configure basic settings, download raw data, update firmware and register device.
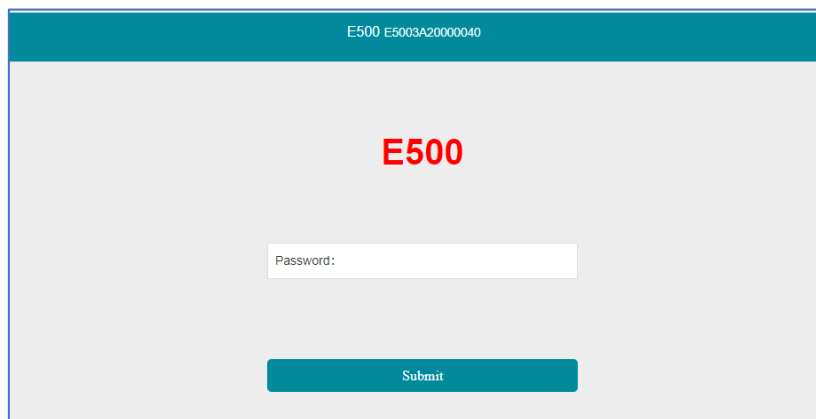
## 2.1 Position

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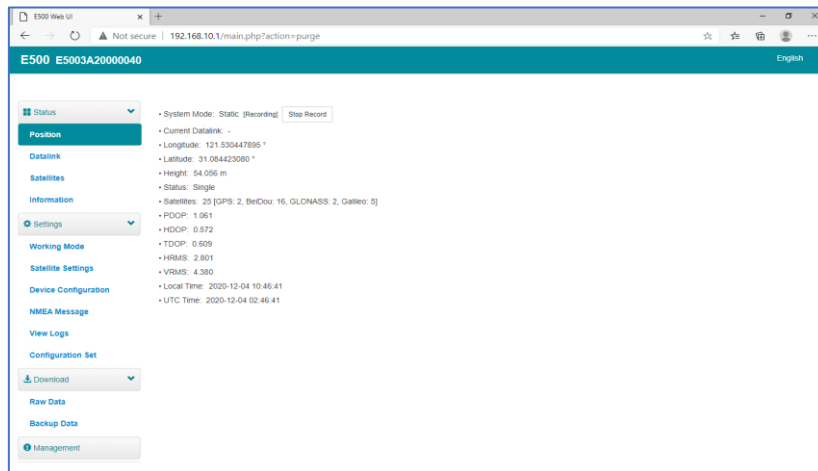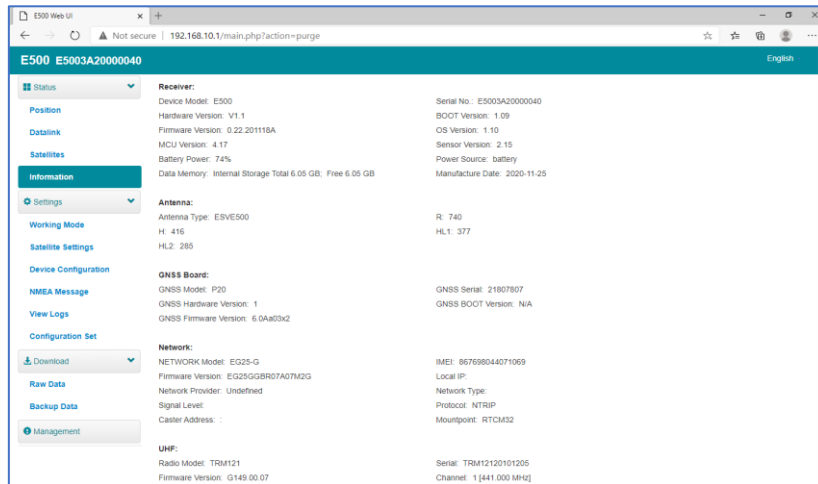


## 2.2 Satellites

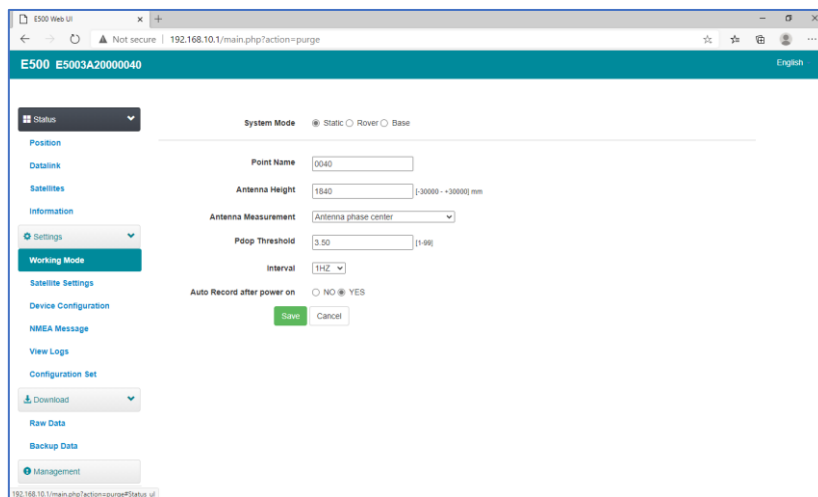View satellite list and satellite map, set cut-off angle.

## 2.3 Information

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



## 2.4 Working Mode

Configure working mode: base, rover or static.

## 2.5 Satellite Setting

Configurate the satellites to be used. "RTK Timeout" setting is for aRTK service (With Hemisphere L-Band service, user cans still keep high accuracy for a period when correction data loses). "Surefix" is hemisphere technology to increase the reliability of the fixed solution. Which means it will be much more difficult to get fixed solution in tough environment.
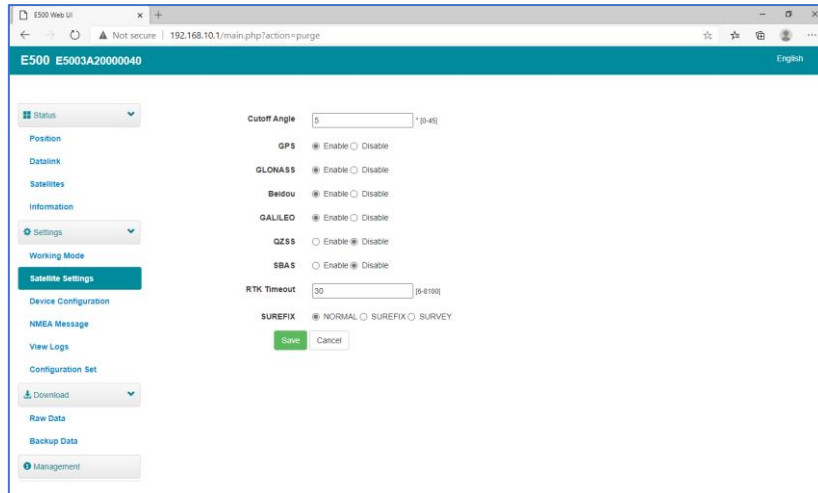


## 2.6 Device Configuration

Configurate receiver settings: User can set time zone. Sensor means MEMS sensor data output. Also, the 5-pin port baud rate is changeable. Speaker "Smart voice broadcast" can be disabled. When SIM card is insert and "WIFI share network" is enabled, PC can surf the internet when connected to device hotspot by using SIM data.
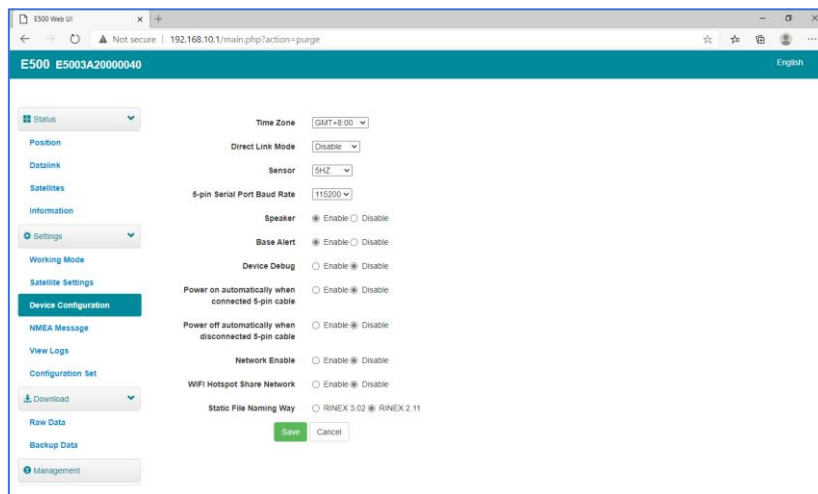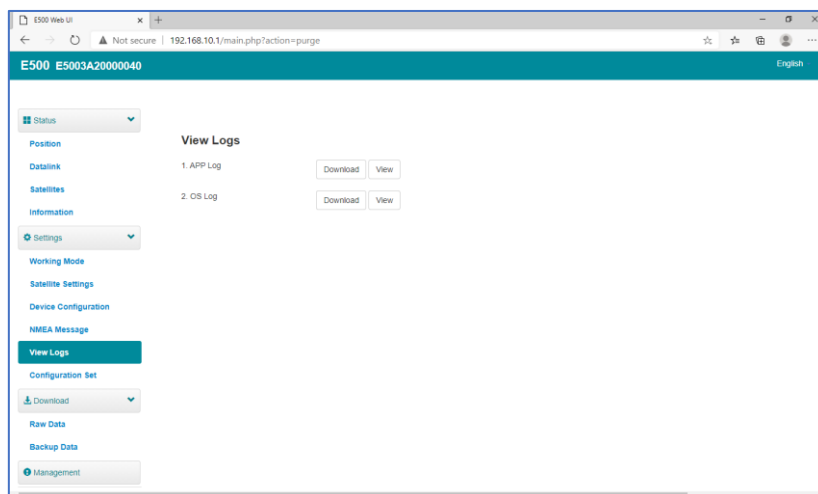
## 2.7 NMEA Message

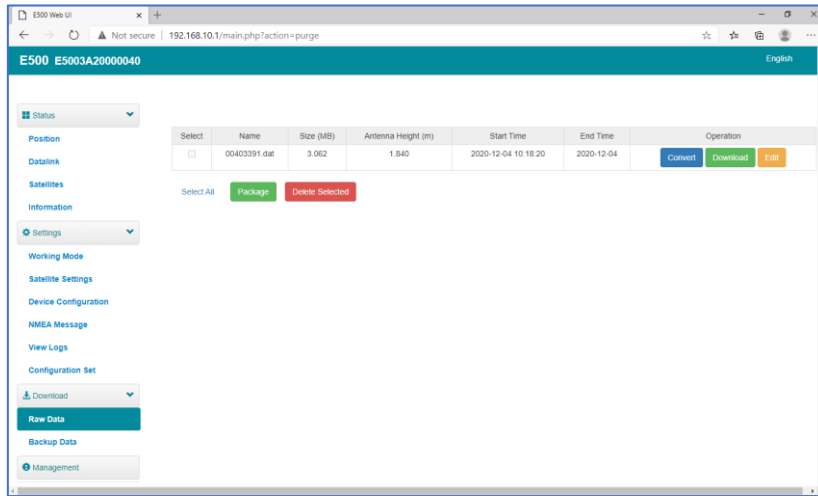Configurate NMEA data output through Bluetooth or 5-pin port.
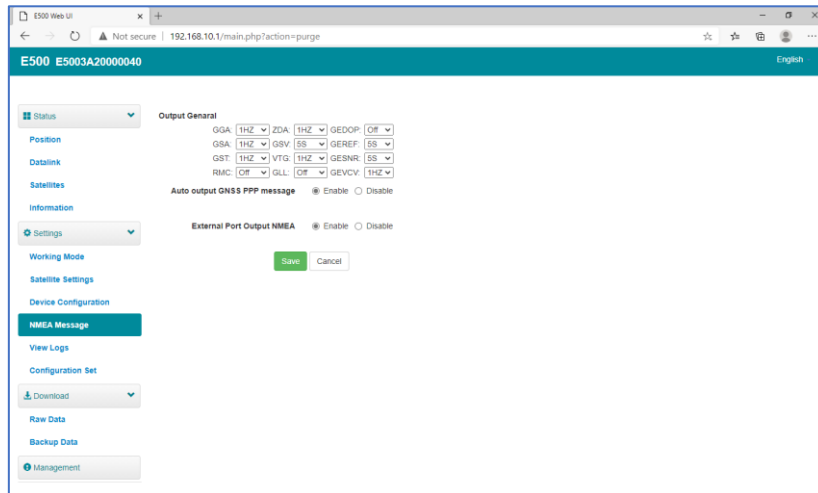


## 2.8 View Logs

The log files can be used to diagnose issues. Click "download" to download the files.
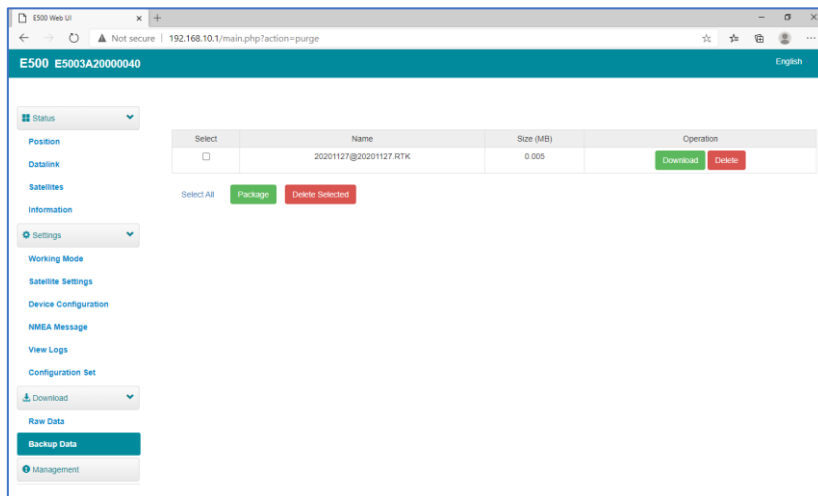
## 2.9 Raw Data

Download raw data or convert data to RINEX format. User can use check box, then click "Package" to download multiple files.



## 2.10 Backup Data

The points collected in SurPad4.0 will be backup in receiver storage automatically to avoid data loss. Can restore the data to SurPad software.

## 2.11    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 "Chose File" to import the firmware, then click "Upload File" to start updating.
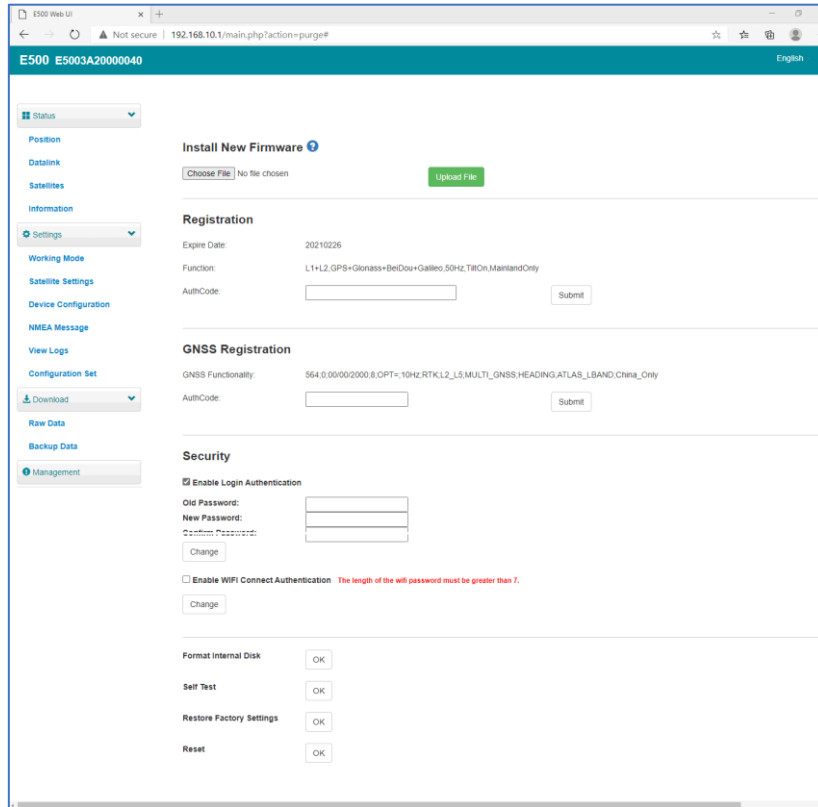


# 3. Basic Operation

This part shows user some basic operations to start working with E500.

## 3.1 Insert SIM card

E500 supports network working mode. Open the cover and insert SIM card.



## 3.2 Charge the battery

E500 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 flash green according to the current battery level, it will turn solid green when fully charged.

## 3.3 Insert radio antenna

The antenna is required in radio working mode.



## 3.4 Measure antenna height

In order 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



A: Slant height        Measurement Line        B: Pole height

## 3.5 Sensor

The E500 supports E-bubble and MEMS. It is determined by the activation code for which sensor is activated. Please note only one of the sensors can be activated. If you purchase E-bubble code, you can update to MEMS later by contacting with salesman.

### 3.5.1   E-bubble Calibration

When e-bubble is activated on E500. To calibrate the e-bubble, put the device on flat table or pole (ensure the bubble on the pole is normal before calibration, then centering the pole bubble). In SurPad4.0 software, connect device and click "Device" -> "Device Settings", open "E-Bubble" function. Then, go to "Device" -> "Calibrate Sensor", click "Calibrate" to calibrate the e-bubble.

To use tilt survey function, go to "Survey" -> "Point Survey" page, select "Tilt Point". Then click survey button to start data collection. After collect three points on the same location, the software will calculate a final result.
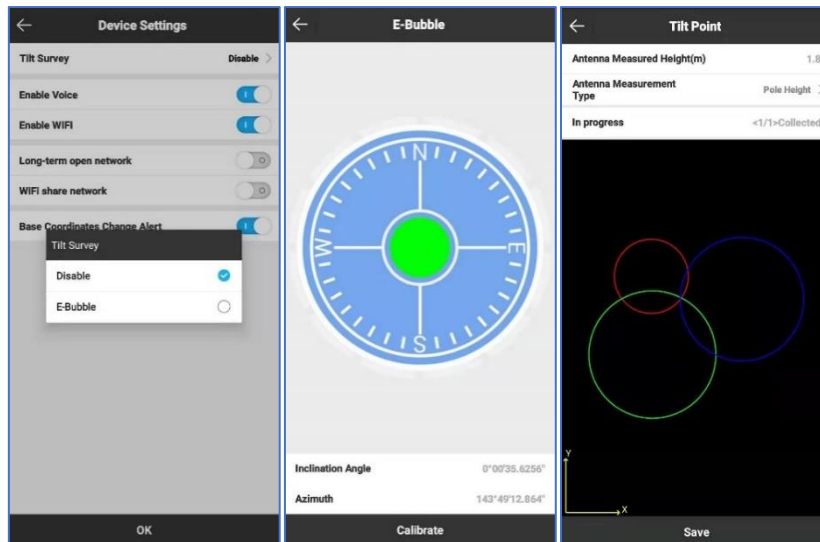
### 3.5.2 MEMS Tilt Survey

When MEMS sensor is activated on E500. To calibrate the MEMS sensor, receiver must be in Fixed solution. In SurPad4.0 software, connect device and click "Device" -> "Device Settings", enable "Pole Tilt Correction" 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"
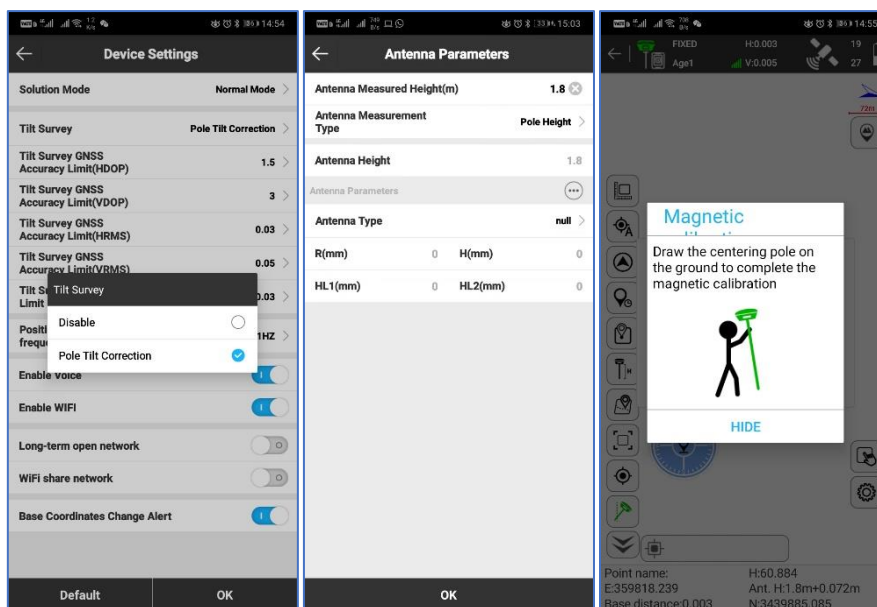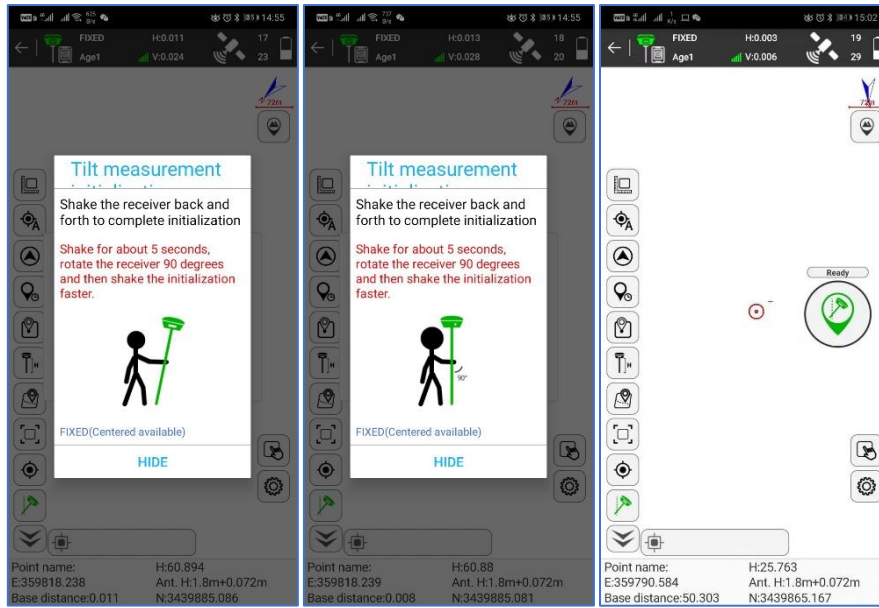
# 4. Internal Radio

E500 is equipped with 1-watt internal radio. User can select the transmission power 0.5 watt or 1 watt. There are 8 default channel frequency and the frequency of channel "8" is changeable. With new firmware update, lots of mainly used protocols in survey industrial are supported.

## 4.1 Default channel frequency

| Channel | Frequency/MHz |
|---------|---------------|
| 1 | 441 |
| 2 | 442 |
| 3 | 443 |
| 4 | 444 |
| 5 | 445 |
| 6 | 446 |
| 7 | 447 |
| 8 | 448, Changeable |

## 4.2 Supported radio protocol

Some of the protocols may require firmware update.

| Protocol | |
|---|---|
| Satel | ○ |
| PCC-4FSK | ○ |
| PCC-GMSK | ○ |
| TrimTalk 450S | ○ |
| South 9600 | ○ |
| HiTarget(9600) | ○ |
| HiTarget(19200) | ○ |
| TrimMask III | ○ |
| South 19200 | ○ |
| TrimTalk(4800) | ○ |
| GEOTALK | ○ |
| GEOMARK | ○ |
| 900M Hopping | ○ |
| HZSZ | ○ |
| GEO FHSS | ○ |
| Satel_ADL | ○ |
| PCCFST | ○ |
| PCCFST_ADL | ○ |

## 5. Standard Accessories

E500 base and rover are using the same hard carrying case.

**Base:**

| NO. | Items | Quantity | Model | Description | Picture |
|---|---|---|---|---|---|
| | E500 Base | | | | |
| 1 | Base Carrying Case | 1 | --- | Carry case for E500, suitable for base and rover | |
| 2 | E500 GNSS Receiver | 1 | --- | --- | |
| 3 | Charger | 1 | KSA-45P-45W D5 | Type-C port, UK/America/Europe/Australia | |
| 4 | Power Cable | 1 | --- | Type-C to Type-C | |
| 5 | Measuring Tape | 1 | --- | 3m/10ft-16mm | |
| 6 | UHF Antenna | 1 | QT440A (430~450MHz) | QT410A(410~430MHz) optional QT450A (450~470MHz) optional QT900L-T (902~928MHz, TRM121) Optional | |
| 7 | Extension Pole | 1 | --- | 25cm | |
| 8 | Tribratch Adapter | 1 | --- | --- | |
| 9 | Plate Antenna Adapter | 1 | --- | --- | |
| 10 | Warranty Card | 1 | --- | --- | |

**Rover:**

| NO. | Items | Quantity | Model | Description | Picture |
|---|---|---|---|---|---|
| | E500 Rover | | | | |
| 1 | Rover Carrying Case | 1 | --- | Carry case for E500, suitable for base and rover | |
| 2 | E500 GNSS Receiver | 1 | --- | --- | |
| 3 | Charger | 1 | KSA-45P-45W D5 | Type-C port, /UK/America/Europe/Australia | |
| 4 | Power Cable | 1 | --- | Type-C to Type-C | |
| 5 | Measuring Tape | 1 | --- | 3m/10ft-16mm | |
| 6 | UHF Antenna | 1 | QT440A (430~450MHz) | QT410A(410~430MHz) optional QT450A (450~470MHz) optional QT900L-T (902~928MHz, TRM121) Optional | |
| 7 | Tribratch Adapter | 1 | --- | --- | |
| 8 | Warranty Card | 1 | --- | --- | |

# 6. Technical Specifications

| GNSS | |
|---|---|
| Satellites Tracking | GPS: L1CA/L1P/L1C/L2P/L2C/L5<br>BDS: B1I/B2I/B3I/B1C/B2a/B2b/<br>ACEBOC<br>GLONASS: G1/G2/G3, P1/P2<br>GALILEO: E1/E5a/E5b/E6/ALTBOC<br>QZSS: L1CA/L1C/L2C/L5/LEX<br>IRNSS: L5<br>SBAS[1]: L1, L5<br>L-Band: Atlas H10/H30/Basic |
| Channels | 800 |
| Signal Reacquisition | < 1 sec |
| Cold Start | < 60 sec |
| Warm Start | < 30 sec |
| Hot Start | < 10 sec |
| RTK Signal Initialization | < 8 sec |
| Initialization Reliability | > 99.9% |
| Update Rate | 10 Hz standard, up to 50 Hz |
| Operation System | Linux |
| Internal Memory | 8 GB |

| Performance | |
|---|---|
| High Precision Static | H: 2 mm + 0.1 ppm<br>V: 3 mm + 0.4 ppm |
| Static/Fast Static | H: 2.5 mm + 0.1 ppm<br>V: 3.5 mm + 0.4 ppm |
| RTK | H: 8 mm + 1 ppm<br>V: 15 mm + 1 ppm |
| Code Differential | H: 0.25 m<br>V: 0.45 m |
| SBAS | H: 0.3 m<br>V: 0.6 m |
| L-Band | Atlas H10: 4 cm RMS<br>Atlas H30: 15 cm RMS<br>Atlas Basic: 30 cm RMS |

| Power Supply | |
|---|---|
| Battery | Rechargeable and built-in Lithium-ion battery, 7.2 V ~ 6800 mAh |
| Voltage | 9~28 VDC<br>with over-voltage protection |
| Working Time | Up to 12 hours |
| Charging Time | Typically 4 hours |

| Internal Radio | |
|---|---|
| Type | TX and RX |
| Frequency Range | 410 ~ 470 MHz, 902.4 ~ 928 MHz |
| Channel Spacing | 12.5 KHz / 25 KHz |
| Emitting Power | 1 W |
| Operation Range | 3 ~ 5 Km typically<br>10 Km with optimal conditions[2] |
| Protocol | Satel, PCC, TrimTalk, TrimMark III, South, HiTarget |

| Internet Modem | |
|---|---|
| Support Band | Global GSM /WCDMA/LTE |

| Communication | |
|---|---|
| Bluetooth | BT 5.0 + EDR, BLE |
| WIFI | 802.11 b/g/n |
| SIM Card | SIM card |
| 5-pin Port | Connect to external radio and power, NMEA output |
| Type-C Port | Charge and internal storage access |
| TNC Port | Connect to internal radio antenna |
| Web UI | View status, update firmware, set up working mode, download data |
| Intelligent Voice | Broadcast working status |
| NMEA Output | GGA, ZDA, GSA, GSV, GST, VTG, RMC, GLL, Binary |
| Correction Data | CMR, CMR+, RTCM2, RTCM3, RTCM32 |
| MEMS | Fast initialization, dynamic tilt survey up to 60° |

| Physical | |
|---|---|
| Dimension | Φ148 mm x H74.5 mm |
| Weight | 1.06 kg |
| Operating Temperature | -40℃ ~ +65℃ |
| Storage Temperature | -45℃ ~ +80℃ |
| Water/Dust Proof | IP67 |
| Shock | Survive a 2 m drop on concrete floor |
| Vibration | Vibration resistant |
| Humidity | Up to 100% |
| Indicators | Battery |
| Button | Power button |
| Certificate | CE, FCC, NGS Calibration |

## 7. Warranty Policy

### The Guarantees Rights

▪e-survey supports free exchange or refund within 7 days from the day when you have received the products, where the device appears "performance failure", which confirmed by e-survey repair center.

▪e-survey supports free maintenance or exchange within 15 days from the day when you have received the products, where the device appears "performance failure", which confirmed by e-survey repair center.

▪e-survey supports free maintenance or exchange the same type of device within one year from the day when you have received the products, where the device appears "performance failure", which is still not in working conditions after two repairs.

▪e-survey supports a 24-month warranty service for the device host and a 3-month free warranty service for the accessory from the day when you have received the products.

### Warranty service

If the device host meets the warranty conditions, the warranty service can be obtained according to the warranty card and the purchasing invoice. If the proof of purchase and the warranty card cannot be provided, and e-survey will use the delivery time as the standard for the warranty period.

▪If it is a non-warranty product, and the repair center will handle the maintenance of the extra-fee.

▪After the device is repaired, the same fault is con- firmed by the repair center and e-survey will provide a 3-month free warranty service.

▪The transportation, delivery and disposal costs incurred during the delivery or inspection of the product to e-survey shall be borne by the user. The freight generated by the repair or inspection equipment returned to the user shall be borne by e-sur- vey.

▪Equipment that needs to be repaired or sent for inspection, please back up the data in the machine in time.

▪During the warranty period, the parts normally used for maintenance are free.

▪The parts that have been replaced during the repair are owned by e-survey.

▪e-survey is not responsible for non-product standard and software or applications that are not certified by the company.

### Following conditions are not within the scope of the warranty and service

The device host and accessories have been subjected to: abnormal or improper use, improper storage of abnormal conditions, unauthorized disassembly or alteration, accidents, damage caused by improper installation.

▪Damage caused by improper use of user, such as liquid injection, damage due to external force, etc.

▪Failure to use, repair or transport caused by the equipment's instruction manual.

▪Damage to the product is caused by external, including but not limited to, abnormal and unpredictable factors such as satellite systems, geomagnetism, static electricity, physical pressure, etc.

▪Damage caused by force majeure such as earth- quakes, floods, wars, etc.

▪Other conditions that cannot comply with the relevant provisions of the Guarantees Rights.