



STONEX S590
GNSS RECEIVER
User Manual



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1. Device Description



Num.	Item	Description
1	Connection led indicator	Flashing blue: Bluetooth/WiFi connected
2	Data link led indicator	Off: no datalink Flashing green: working datalink
3	Satellite led indicator	Off: no satellites used for positioning Flashing green: satellites tracked and used for positioning
4	Battery led indicator	Green: charge level between 30% and 100% Flashing Red with warning beep: charge level is less than 10% While charging Red charge incomplete Green charge complete
5	Power button	Power on: keep pressed until all led turns on (about 3 seconds). After three short beeps, the device is ready to work Power off: keep pressed until you hear a second acoustic signal (about 3 seconds) Restart: keep pressed for 12 seconds
6	USB type-C port	Charge port, use the standard charger and type-C data cable to charge Can be used to access the device's internal memory if connected to a PC using a USB to type-C cable.

2. Web Interface

2.1 Satellites section

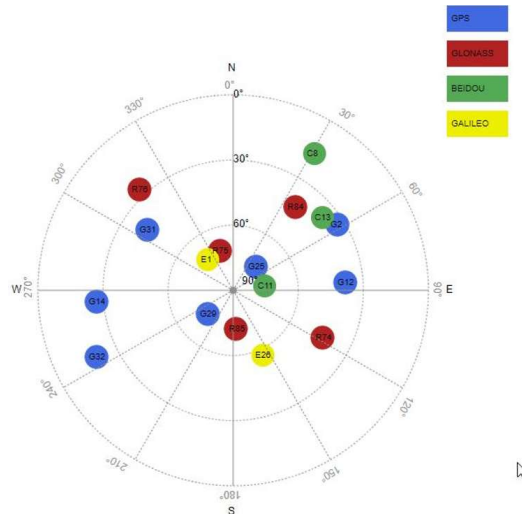
Position

you can view the current position information and the quality of the solution in case differential corrections are received.

Satellites	21/23	Solution	Single
Longitude	9°10'57.3831"	Latitude	45°33'44.1081"
Altitude	208.744	HRMS	0.531
VRMS	0.8	PDOP	0.92
HDOP	0.59	VDOP	0.7
Date	2021-05-24	Time	18:40:17
Differential Delay	0(s)		
Reference Lon	0°0'0.0000"	Reference Lat	0°0'0.0000"
Reference Alt	0.000	Reference Distance	0.0000(km)

Sky Plot

In the Sky Plot page, you can view satellite Sky map. The satellites are colored according to the constellation.



Satellites List

In the Satellites List page, you can see satellites information. In this page, the satellites are also coloured according to the constellation. Gray colour is used to satellites tracked but not used to calculate the current position.

Satellites ^
Position
Sky Plot
Satellites List
Device v
Set v

Number	Elevation	Azimuth	L1	L2
G4	5	316	26	26
G5	19	73	33	33
G16	17	300	25	24
G18	51	174	43	43
G20	24	96	34	34
G25	35	119	37	37
G26	43	303	38	38
G29	62	50	43	43
G31	52	242	41	41
R71	4	48	20	N/A
R76	6	148	18	N/A
R77	56	155	26	N/A
R78	63	316	41	N/A
R79	11	325	35	N/A

2.2 Device Section

Information

In the Information page, you can view device info such as firmware version, available storage, the level of the battery, etc.

- Satellites ^
- Position
- Sky Plot
- Satellites List
- Device ^
- Information
- Self-Test
- Upgrade
- Observation
- NMEA
- View Log
- Set ^
- Network Settings
- Working Mode
- Convert Coordinate
- GNSS
- NMEA Settings
- Others

Host	
Device Model	S590
Device Serial	S5904A2400006
Firmware	1.24.241113.1
WEBUI	WEBUI-v1.0.230325
Hardware Version	M5II-QZ-V1.1
OEM Board	
Gnss Model	UM980
GNSS Serial no	2310415000001-MD22B3224533147
GNSS Firmware	R4.10Build13504
Datalink	
Connection	Disconnected
Differential Mode	Differential corrections
Current Data Link	Bluetooth
System	
Available Storage	5.80 G
Total Storage	5.83 G
Power Source	Battery
Battery Level	46%

Self-Test

In the Self-Test page, you can run the self-test, it is used to identify if there are hardware problems with one or more modules of the receivers, GPS board, wi-fi, etc.

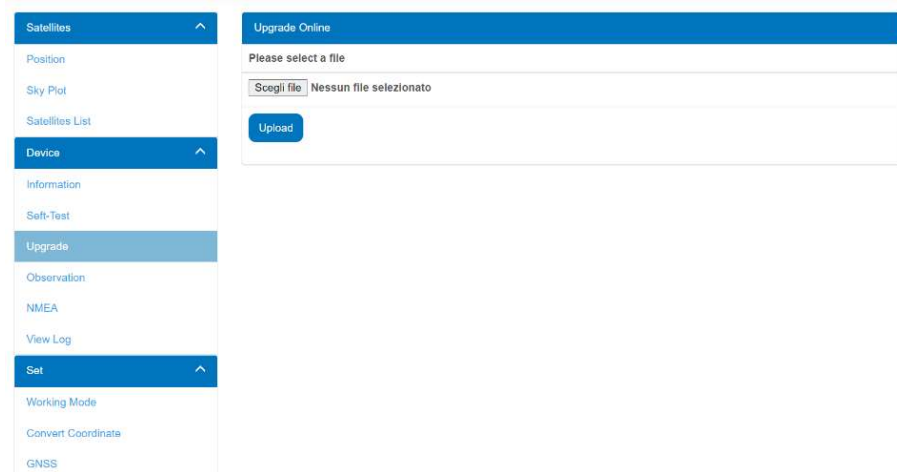
- Satellites ^
- Position
- Sky Plot
- Satellites List
- Device ^
- Information
- Self-Test
- Upgrade
- Observation
- NMEA
- View Log
- Set ^
- Working Mode
- Convert Coordinate
- GNSS

Testing

Start Checking

Upgrade

The Upgrade page, it's used to upload the firmware. To upgrade your S590 choose the firmware file from your PC and press Upload. Wait until the process is completed.



Observation

In the Observation page, you can download observation files. Download the raw data stored inside the S590 on your PC and then use them in the post process operation.

Select	FileName	FileSize	Modify Time	Convert	Download	Delete
<input type="checkbox"/>	00062024100401.dat	10.86 M	2024-10-04 16:22:18	Convert	Download	Delete
<input type="checkbox"/>	00062024100401_Rinex3.02.zip	6.03 M	2024-10-11 14:00:02	Convert	Download	Delete
<input type="checkbox"/>	00062024100402.dat	1.65 M	2024-10-04 16:31:14	Convert	Download	Delete
<input type="checkbox"/>	00062024101101.dat	34 K	2024-10-11 13:58:42	Convert	Download	Delete

[Check All](#)
[Batch Download](#)
[Batch Delete](#)

NMEA

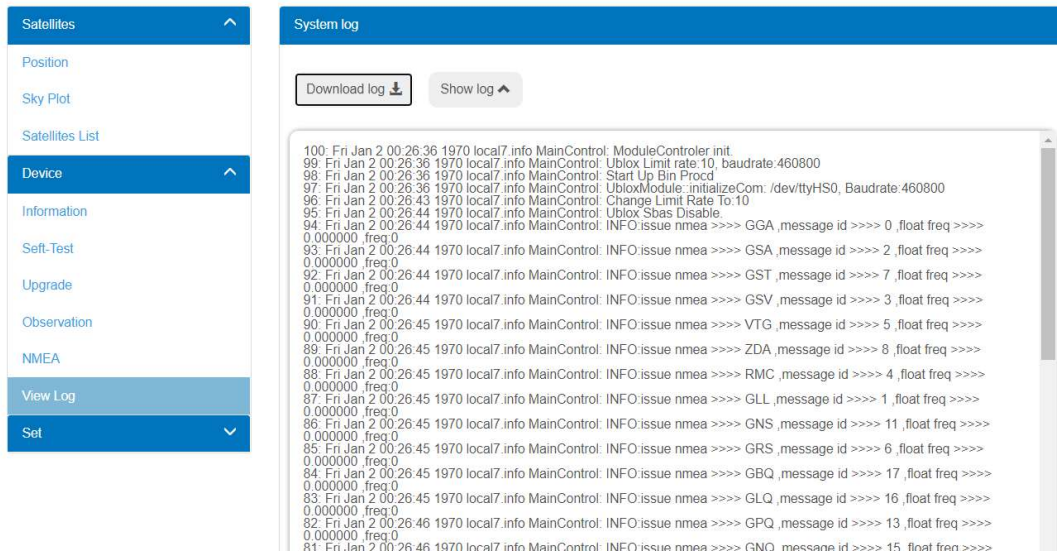
In the NMEA page, you can download NMEA files.

Select	FileName	FileSize	Modify Time	Download	Delete
<input type="checkbox"/>	2024100401.nmea	11.74 M	2024-10-04 16:31:14	Download	Delete
<input type="checkbox"/>	2024101101.nmea	40 K	2024-10-11 13:58:46	Download	Delete

[Check All](#)
[Batch Download](#)
[Batch Delete](#)

View Log

In the View Log page, you can download, and view device run log.



The screenshot displays the 'View Log' interface. On the left is a sidebar menu with the following items: Satellites (expanded), Position, Sky Plot, Satellites List, Device (expanded), Information, Self-Test, Upgrade, Observation, NMEA, View Log (selected), and Set. The main area is titled 'System log' and contains a 'Download log' button and a 'Show log' button. Below these buttons is a scrollable text area containing the following log entries:

```

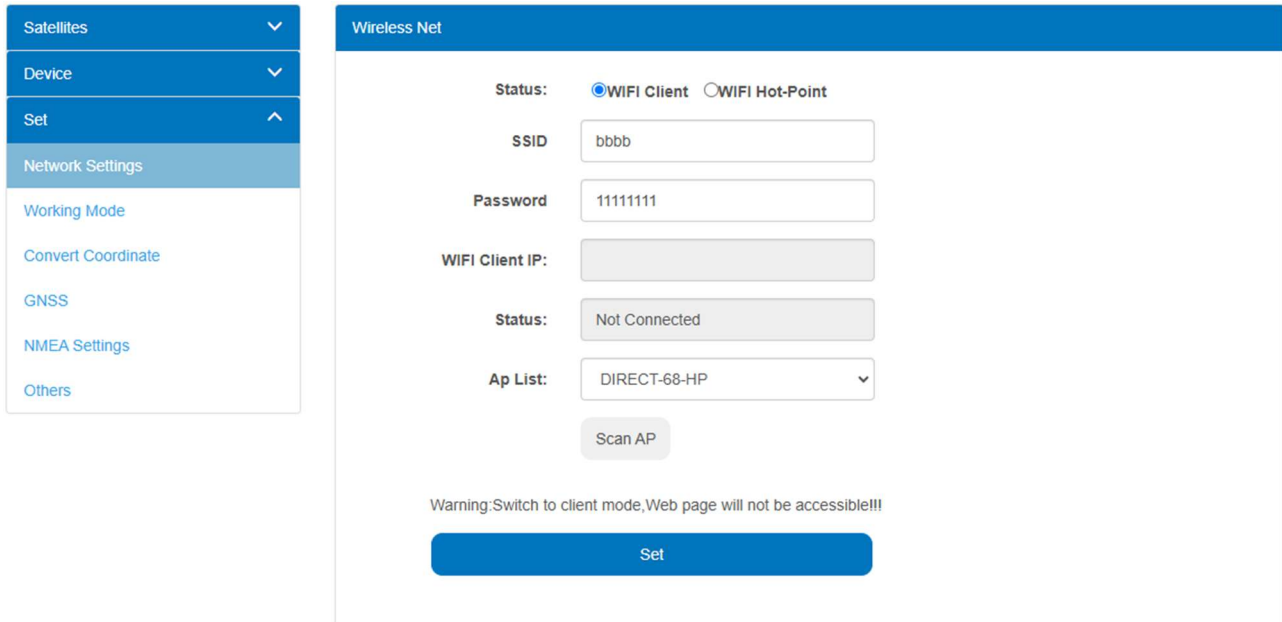
100: Fri Jan 2 00:26:36 1970 local7.info MainControl: ModuleControler init.
99: Fri Jan 2 00:26:36 1970 local7.info MainControl: Ublox Limit rate:10, baudrate:460800
98: Fri Jan 2 00:26:36 1970 local7.info MainControl: Start Up Bin Procd
97: Fri Jan 2 00:26:36 1970 local7.info MainControl: UbloxModule: initializeCom: /dev/ttyHS0, Baudrate:460800
96: Fri Jan 2 00:26:43 1970 local7.info MainControl: Change Limit Rate To:10
95: Fri Jan 2 00:26:44 1970 local7.info MainControl: Ublox Sbas Disable.
94: Fri Jan 2 00:26:44 1970 local7.info MainControl: INFO:issue nmea >>>> GGA ,message id >>>> 0 ,float freq >>>>
0.000000 ,freq:0
93: Fri Jan 2 00:26:44 1970 local7.info MainControl: INFO:issue nmea >>>> GSA ,message id >>>> 2 ,float freq >>>>
0.000000 ,freq:0
92: Fri Jan 2 00:26:44 1970 local7.info MainControl: INFO:issue nmea >>>> GST ,message id >>>> 7 ,float freq >>>>
0.000000 ,freq:0
91: Fri Jan 2 00:26:44 1970 local7.info MainControl: INFO:issue nmea >>>> GSV ,message id >>>> 3 ,float freq >>>>
0.000000 ,freq:0
90: Fri Jan 2 00:26:45 1970 local7.info MainControl: INFO:issue nmea >>>> VTG ,message id >>>> 5 ,float freq >>>>
0.000000 ,freq:0
89: Fri Jan 2 00:26:45 1970 local7.info MainControl: INFO:issue nmea >>>> ZDA ,message id >>>> 8 ,float freq >>>>
0.000000 ,freq:0
88: Fri Jan 2 00:26:45 1970 local7.info MainControl: INFO:issue nmea >>>> RMC ,message id >>>> 4 ,float freq >>>>
0.000000 ,freq:0
87: Fri Jan 2 00:26:45 1970 local7.info MainControl: INFO:issue nmea >>>> GLL ,message id >>>> 1 ,float freq >>>>
0.000000 ,freq:0
86: Fri Jan 2 00:26:45 1970 local7.info MainControl: INFO:issue nmea >>>> GNS ,message id >>>> 11 ,float freq >>>>
0.000000 ,freq:0
85: Fri Jan 2 00:26:45 1970 local7.info MainControl: INFO:issue nmea >>>> GRS ,message id >>>> 6 ,float freq >>>>
0.000000 ,freq:0
84: Fri Jan 2 00:26:45 1970 local7.info MainControl: INFO:issue nmea >>>> GBQ ,message id >>>> 17 ,float freq >>>>
0.000000 ,freq:0
83: Fri Jan 2 00:26:45 1970 local7.info MainControl: INFO:issue nmea >>>> GLQ ,message id >>>> 16 ,float freq >>>>
0.000000 ,freq:0
82: Fri Jan 2 00:26:46 1970 local7.info MainControl: INFO:issue nmea >>>> GPQ ,message id >>>> 13 ,float freq >>>>
0.000000 ,freq:0
81: Fri Jan 2 00:26:46 1970 local7.info MainControl: INFO:issue nmea >>>> GNO ,message id >>>> 15 ,float freq >>>>

```

2.3 Set section

Network Setting

The WIFI client option in the Network Setting page allows you to connect the S590 to a WiFi hotspot. Restarting the device will revert this setting to Master



The screenshot shows the 'Wireless Net' configuration page. On the left is a navigation menu with options: Satellites, Device, Set, Network Settings (highlighted), Working Mode, Convert Coordinate, GNSS, NMEA Settings, and Others. The main content area is titled 'Wireless Net' and contains the following fields and controls:

- Status:** Radio buttons for WIFI Client and WIFI Hot-Point.
- SSID:** Text input field containing 'bbbb'.
- Password:** Text input field containing '11111111'.
- WIFI Client IP:** Disabled text input field.
- Status:** Disabled text input field containing 'Not Connected'.
- Ap List:** Dropdown menu showing 'DIRECT-68-HP'.
- Scan AP:** Button to scan for available access points.
- Warning:** Text below the Scan AP button: 'Warning:Switch to client mode,Web page will not be accessible!!!'.
- Set:** Large blue button at the bottom to save the configuration.

Working Mode

In the Working Mode page, you can set the Work mode and the Observation settings.

In the Work mode subsection, you can choose between Rover or Base.

For the Rover working mode you can choose to receive the correction from Bluetooth, from an NTRIP caster (Network) or not to receive corrections (No Datalink).

Work Mode

Sys Mode: Rover Base

Current Datalink: Network Bluetooth
 No Datalink

Set
Get Mountpoint

For the Network option you need to connect the S590 to a WiFi hotspot using the Network setting page to access the Internet

Mode: ▼

Server Address:

Server Port:

Use TLS/SSL: **Enable TLS/SS Encryption**

Access Point: ▼

Username:

Password:

Upload GGA: ▼

Connect Immediately: YES NO

The Base settings let you choose:

- the Site Id (up to 3 digits)
- the Base position: Single: the receiver will use the position at the moment of the base startup, Repeat Position: the base will use the coordinates specified in decimal degrees

Ex.

Longitude	9°10'57.5534"
Latitude	45°33'44.0512"

Base Longitude(°):

Base Latitude(°):

Work Mode

Sys Mode: Rover Base

Diff Type:

Site Id:

Base Position: Single Repeat Position

Base Longitude(°):

Base Latitude(°):

Base Height(m):

Current Datalink: External

Bluetooth Serial:

Bluetooth Physical Address:

Bluetooth Dev List:

There are 3 available datalinks:

- Network
- Bluetooth
- WIFI-Master

For the Network option you need to connect the S590 to a WiFi hotspot using the Network setting page to access the Internet

Mode:

Server Address:

Server Port:

Access Point:

Username:

Password:

Connect Immediately: YES NO

To connect to the SR02 external radio you must scan for the Device list and select the serial number of the radio.

Bluetooth Serial:	<input type="text"/>
Bluetooth Physical Address:	<input type="text"/>
Bluetooth Dev List:	<input type="text" value="v"/>
	<input type="button" value="Scan Bluetooth"/>

For the SR02 configuration refer to the section 4.2 of this manual.

The WIFI-master option lets you transmit the differential data over the S590 WiFi hotspot by creating an internal NTRIP caster

Server Port:	<input type="text" value="9100"/>
Access Point:	<input type="text" value="NRT3-RDN-MSM"/>
Username:	<input type="text" value="15392993"/>
Password:	<input type="text" value="123AAA"/>

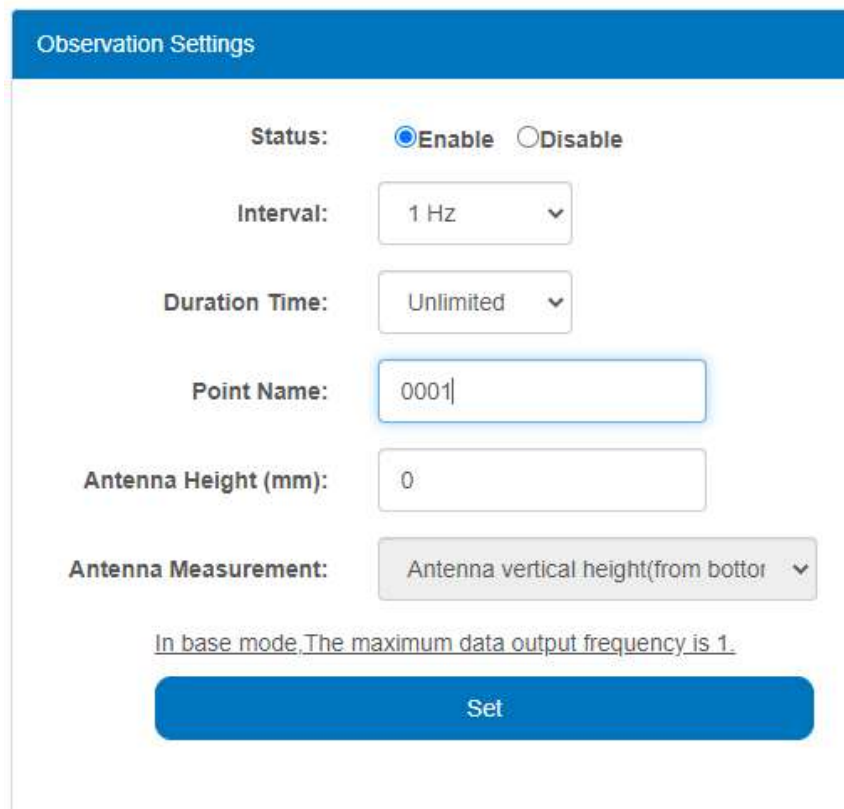
In the Observation Settings subsection, you can start and stop the record of the raw data and configure the registration options. You can record raw data while the S590 works as over or as base.

Interval: set the frequency/time interval between the registration epochs

Duration time: set the duration of the single observation file. Ex. If you set 15 min, after 15 min from the start of the registration, the observation file will be closed, and another one will be open. This will continue until you stop (disable) the raw data recording.

Point name: this will be visible in the Observation file header, maximum 4 digits.

Antenna Height: this will be visible in the Observation file header, the unit of measure is millimeters, the measure must be taken to the bottom of the device.



The screenshot shows the 'Observation Settings' window. It features a blue header with the title 'Observation Settings'. Below the header, there are several configuration options: 'Status' with radio buttons for 'Enable' (selected) and 'Disable'; 'Interval' with a dropdown menu set to '1 Hz'; 'Duration Time' with a dropdown menu set to 'Unlimited'; 'Point Name' with a text input field containing '0001|'; 'Antenna Height (mm)' with a text input field containing '0'; and 'Antenna Measurement' with a dropdown menu set to 'Antenna vertical height(from bottor'. At the bottom of the settings area, there is a note: 'In base mode, The maximum data output frequency is 1.' and a large blue 'Set' button.

Convert Coordinate

This function allows to output grid coordinates (X,Y,Z) according to the parameters set. The coordinates are transmitted in the GELOC message (see [NMEA Settings](#))

Enable Output:	<input type="radio"/> YES <input checked="" type="radio"/> NO	Projection Parameter	
Destination Datum		Projection Type:	Gauss <input type="text"/>
Datum:	Beijing54 <input type="text"/>	CenterMeridian(°):	0.0000000000 <input type="text"/>
Semi-Major Axis(a):	6378245 <input type="text"/>	Scale:	1 <input type="text"/>
Bot-Flattening(1/f):	298.3 <input type="text"/>	North(m):	0 <input type="text"/>
Seven Parameter		East(m):	0 <input type="text"/>
<input type="checkbox"/> Use Seven Parameter		Ref-Height:	0 <input type="text"/>
dX(m):	0 <input type="text"/>	Base-Lat(°):	0 <input type="text"/>
dY(m):	0 <input type="text"/>	Base-Lon(°):	0.0000000000 <input type="text"/>
dZ(m):	0 <input type="text"/>	Parallel1:	0 <input type="text"/>
RotateX("):	0 <input type="text"/>	Parallel2:	0 <input type="text"/>
RotateY("):	0 <input type="text"/>	Four Parameter	
RotateZ("):	0 <input type="text"/>	<input type="checkbox"/> Use Four Parameter	
Scale(ppm):	0 <input type="text"/>	dX(m):	0 <input type="text"/>
		dY(m):	0 <input type="text"/>
		Rotate("):	0 <input type="text"/>
		Scale:	0 <input type="text"/>

GNSS

In the **GNSS** page, you can set the cutoff angle, and the constellation used (GPS always enabled).
As well as the use of PPP corrections (Beidou PPP, Galileo HAS)

GNSS Settings

Cutoff Angle: ° [0-45]

Enable GPS

Enable BEIDOU
Enable BEIDOU PPP

Enable GLONASS

Enable Galileo
Enable Galileo HAS

Enable QZSS

Enable SBAS

Set

NMEA Settings

In the NMEA Settings page, you can set NMEA messages and output frequency. You can also start and stop the NMEA recordings

Set NMEA Output

GGA: 1S <input type="text"/>	GSA: 1S <input type="text"/>
GSV: 1S <input type="text"/>	GST: 1S <input type="text"/>
ZDA: 1S <input type="text"/>	VTG: 5S <input type="text"/>
RMC: Close <input type="text"/>	GLL: Close <input type="text"/>
HDT: Close <input type="text"/>	GRS: Close <input type="text"/>
GNS: Close <input type="text"/>	GBS: Close <input type="text"/>
DTM: Close <input type="text"/>	HPR: Close <input type="text"/>
GELOC: Close <input type="text"/>	

Nmea Reset

Set

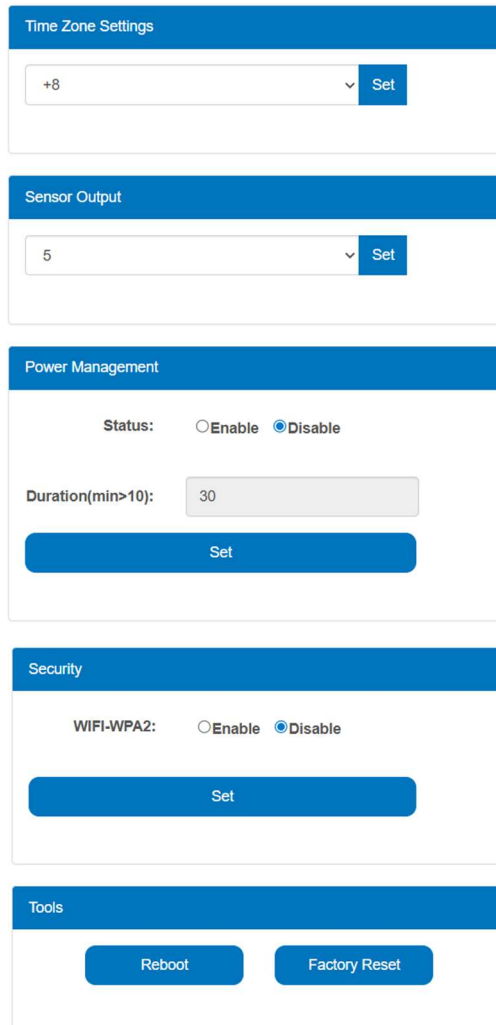
Automatic Save NMEA Output

Status: Enable Disable

Set

Others

In the Others settings you can set the Time zone, the frequency of the IMU sensor output, the automatic power off (Power management) and the type of Wi-Fi security. You can also restart the device (reboot) or perform a factory reset.



The screenshot displays the 'Others' settings menu with the following sections:

- Time Zone Settings:** A dropdown menu showing '+8' and a 'Set' button.
- Sensor Output:** A dropdown menu showing '5' and a 'Set' button.
- Power Management:** Includes a 'Status:' section with radio buttons for 'Enable' and 'Disable' (selected), and a 'Duration(min>10):' input field with the value '30' and a 'Set' button.
- Security:** Includes a 'WIFI-WPA2:' section with radio buttons for 'Enable' and 'Disable' (selected), and a 'Set' button.
- Tools:** Contains two buttons: 'Reboot' and 'Factory Reset'.

3. RTK Rover Configuration

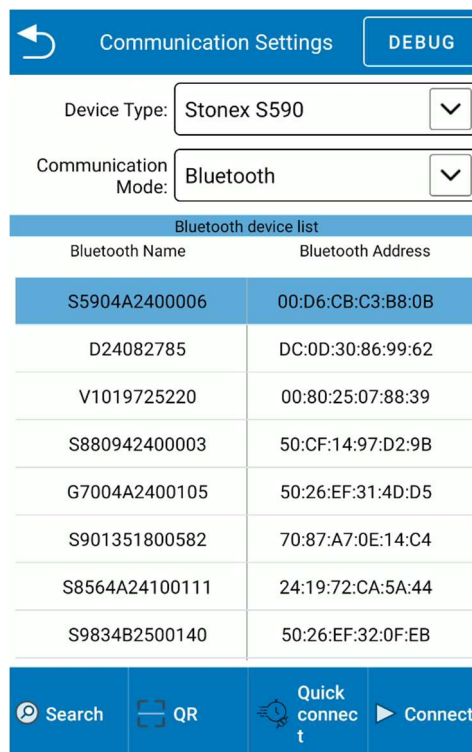
The S590 can be used with the software Cube-a or Cube-connector. In this manual, only the connection and datalink configurations will be explained for a full description of the functionalities of the software please refer to the respective user manuals.

3.1 Connection

The connection can be made using Bluetooth or WiFi.

In the Device > Communication menu select the Device Type “Stonex S590” and the wanted Communication mode.

press Search, when the search is terminated select the line with the serial number of the receiver, then press Connect.



The screenshot shows the 'Communication Settings' screen. At the top, there is a back arrow, the title 'Communication Settings', and a 'DEBUG' button. Below this, there are two dropdown menus: 'Device Type' set to 'Stonex S590' and 'Communication Mode' set to 'Bluetooth'. A table titled 'Bluetooth device list' is displayed, with columns for 'Bluetooth Name' and 'Bluetooth Address'. The first row is highlighted in blue. At the bottom, there are four buttons: 'Search', 'QR', 'Quick connect', and 'Connect'.

Bluetooth device list	
Bluetooth Name	Bluetooth Address
S5904A2400006	00:D6:CB:C3:B8:0B
D24082785	DC:0D:30:86:99:62
V1019725220	00:80:25:07:88:39
S880942400003	50:CF:14:97:D2:9B
G7004A2400105	50:26:EF:31:4D:D5
S901351800582	70:87:A7:0E:14:C4
S8564A24100111	24:19:72:CA:5A:44
S9834B2500140	50:26:EF:32:0F:EB

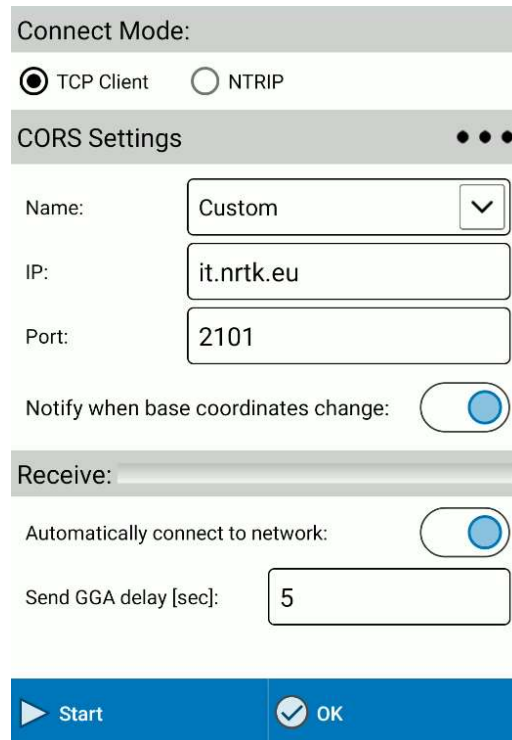
3.2 Datalink

Phone Network

To receive differential corrections from a TCP or NTRIP Server using the Controller internet connection select the communication mode "Phone Network" in the Device > Working Mode > Rover page. To configure the connection press on the blue Phone Network button.

TCP Client

Insert the IP address and port of the TCP Server. Press Start to begin the connection, a blue bar near Receive will show up if the data are being received, press OK to apply the changes.



The screenshot shows a configuration screen for the TCP Client. It features a 'Connect Mode' section with radio buttons for 'TCP Client' (selected) and 'NTRIP'. Below this is a 'CORS Settings' section with a dropdown menu for 'Name' set to 'Custom', text input fields for 'IP' (it.nrtk.eu) and 'Port' (2101), and a toggle switch for 'Notify when base coordinates change' which is turned on. A 'Receive:' section contains a progress bar, a toggle switch for 'Automatically connect to network' (turned on), and a text input field for 'Send GGA delay [sec]' set to 5. At the bottom, there are two blue buttons: 'Start' with a play icon and 'OK' with a checkmark icon.

NTRIP

Insert the IP address and port of the NTRIP Caster, information of the main NTRIP Casters can be found in the dropdown menu grouped by Country.

Insert the user ID and password of the NTRIP account.

Insert the Mountpoint to be used, you can select it from the popup list, if the mountpoint list has been downloaded by pressing “Get Access Point”

If the mountpoint selected is of the nearest or virtual station type is necessary to set Send GGA delay different from 0, usually 1 to 5 seconds.

Press Start to begin the connection, a blue bar near Receive will show up if the data are being received, press OK to apply the changes.

Connect Mode:

TCP Client NTRIP

CORS Settings •••

Name:

IP:

Port:

Notify when base coordinates change:

CORS Account

User:

Password:

Show password

MountPoint:

Corrections

GET ACCESS POINT

Receive:

Automatically connect to network:

Send GGA delay [sec]:

Start
 OK

External radio SR02 (only with Cube-a)

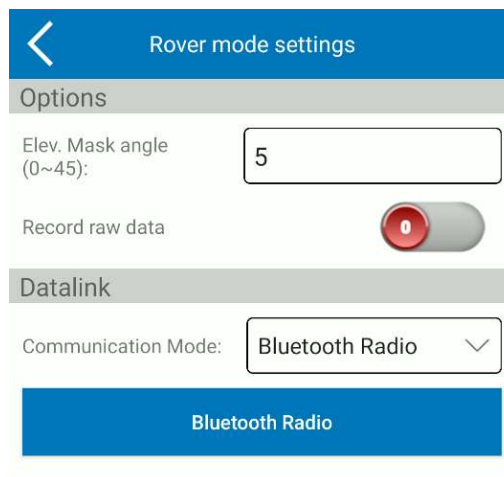
General scheme



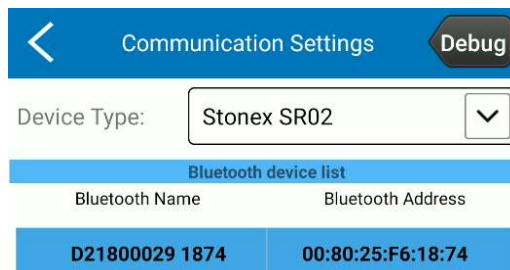
The SR02 radio receives the corrections from the base UHF radio and transmits them to a controller equipped with Cube-a via Bluetooth, the controller then forwards the correction to the S590.

Cube-a configuration

1. In Device > Working mode> Rover, select Bluetooth Radio as Communication Mode

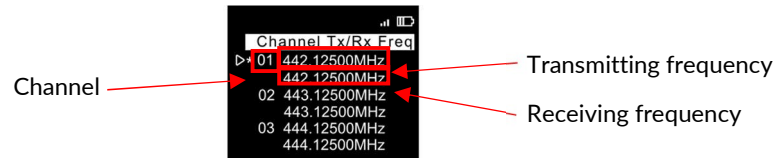


2. Press Bluetooth Radio, search for the radio serial number, select it and press Connect

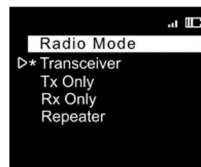


Radio configuration

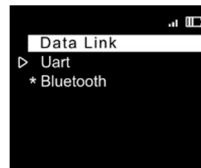
1. Set the same protocol and frequency used by the base, pressing the radio buttons. Right and left arrows let you change page, up and down arrow let you select different options, press the power button to confirm. The left arrow will also bring you back to the higher pages in case you've entered subpages.
 - a. Select the **frequency**: Channel Tx/Rx Freq page, the usual frequencies utilized by Stonex devices are on Channels starting from number 19, the star show the channel in use.



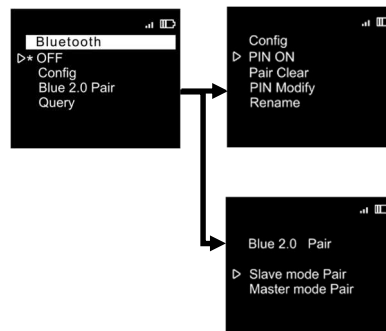
- b. Select the radio protocol: **Data Protocol** page (es. TRIMTALK 450S)
 - c. Select the radio link rate: **Radio Link Rate** page (es. 9600-25KHz)
2. **Radio Mode** page, select Transceiver



3. **Data Link** page, select Bluetooth



4. **Bluetooth page**: set the following configuration:



When these settings are shown, it means that the Bluetooth is enabled, and the PIN is disabled.

3.3 Other options

Elevation mask angle

Every satellite with a lower elevation than the cut-off angle will not be considered for positioning

Antenna Parameters

The suggested method to measure the **antenna height** is to use vertical height, then select the external antenna type accordingly.



Satellite Systems

In this section, the constellations to be used between the available ones can be selected.

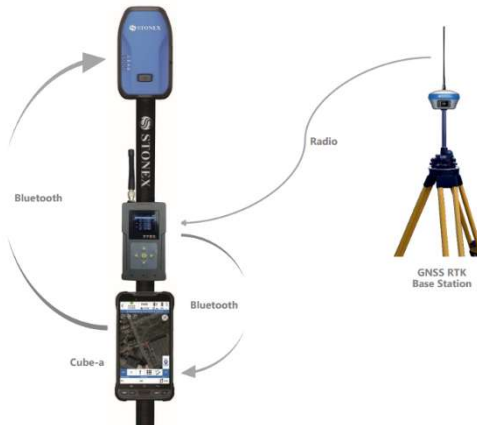
To apply the SBAS Augmentation, Galileo Has or Beidou PPP select it from the dropdown list near PPP type.

Press Apply to send the configuration to the S590.

4. External radio setup

4.1 Rover mode

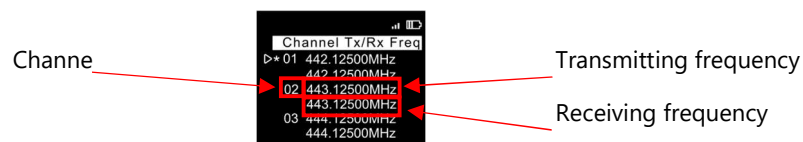
General scheme



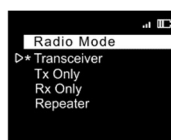
The SR02 radio receives the corrections from the base' radio and transmits them to a controller equipped with Cube-a via Bluetooth, the controller at this point will forward the correction to the S590 using the Bluetooth connection.

Radio configuration

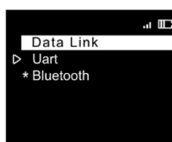
1. Set the same protocol and frequency used by the base, pressing the radio buttons. Right and left arrows let you change page, up and down arrow let you select different options, press the power button to confirm. The left arrow will also bring you back to the higher pages in case you've entered subpages.
 - a. Select the frequency: **Channel Tx/Rx Freq** page, the usual frequencies utilized by Stonex devices are on Channels starting from number 19, the star show the channel in use.



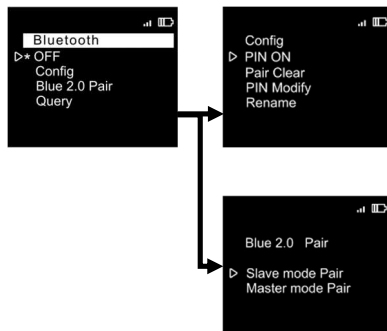
- b. Select the radio protocol: **Data Protocol** page (es. TRIMTALK 450S)
 - c. Select the radio link rate: **Radio Link Rate** page (es. 9600-25KHz)
2. **Radio Mode** page, select Transceiver



3. **Data Link** page, select Bluetooth



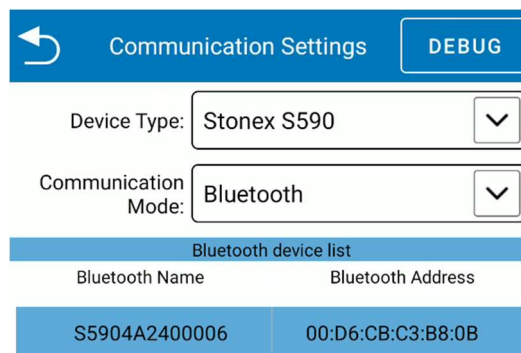
4. **Bluetooth** page: set the following configuration:



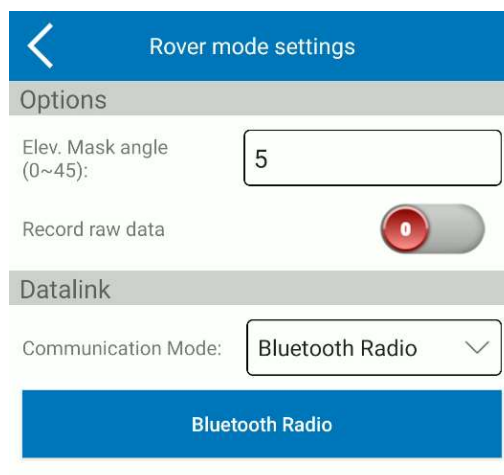
When these settings are shown, it means that the Bluetooth is enabled, and the PIN is disabled.

Cube-a configuration

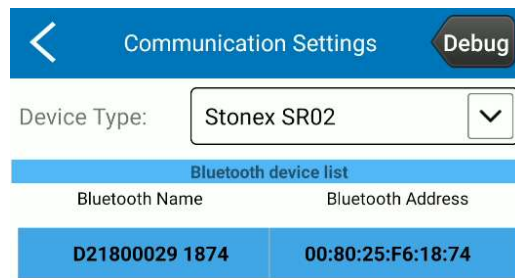
1. Connect to S590



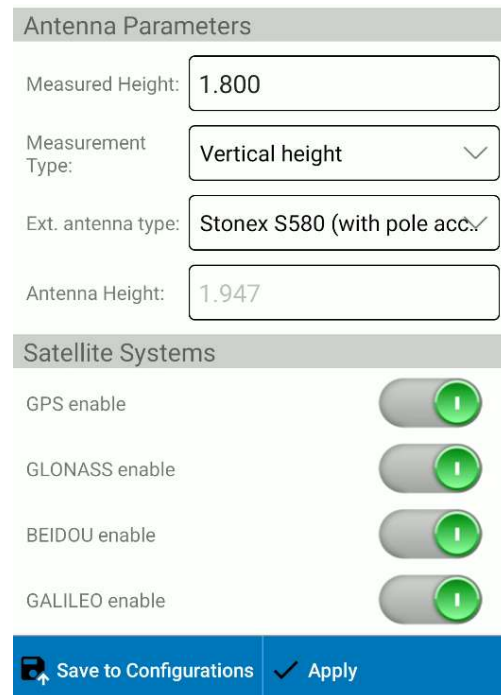
2. In Device > Working mode> Rover, select Bluetooth Radio as Communication Mode



3. Press Bluetooth Radio, search for the radio serial number, select it and press Connect



4. Go back and complete the rest of the rover configuration then press Apply

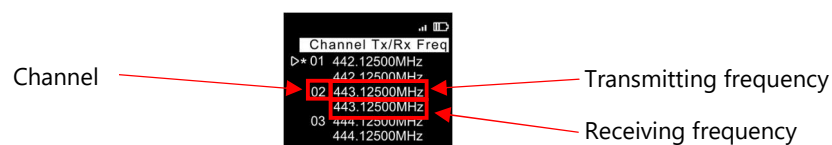


4.2 Base mode

The connection to the S590 is direct and can be done only using the WebUI, please refer to the 3.3 section of this manual.

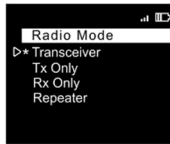
Radio configuration

1. Set the protocol and frequency you want to use, pressing the radio buttons. Right and left arrows let you change page, up and down arrow let you select different options, press the power button to confirm. The left arrow will also bring you back to the higher pages in case you've entered subpages.
 - a. Select the frequency: **Channel Tx/Rx Freq** page, the usual frequencies utilized by Stonex devices are on Channels starting from number 19, the star show the channel in use.

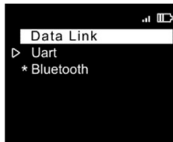


- b. Select the radio protocol: **Data Protocol** page (es. TRIMTALK 450S)
- c. Select the radio link rate: **Radio Link Rate** page (es. 9600-25KHz)

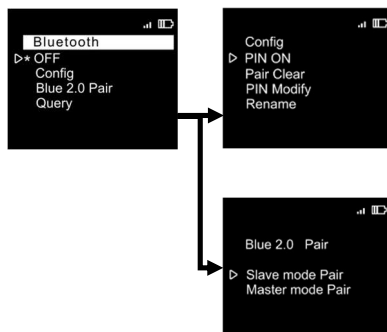
2. **Radio Mode** page, select Transceiver



3. **Data Link** page, select Bluetooth



4. **Bluetooth** page: set the following configuration:



When these settings are shown, it means that the Bluetooth is enabled, and the PIN is disabled.

5. IMU Technology

The S590 is equipped with IMU Technology that allows measurements with a tilted pole.

This brings the following advantages:

- **Fast and precise survey.**

It's possible to survey and store points with just one measure with a slant up to 60° (maximum 2cm error with a slant up to 30°, maximum 5cm error with a slant up to 60°).

- **Simple and quick initialization process.**

After the first calibration, once a FIXED solution is obtained, is a matter of seconds to initialize the sensor and start to work.

- **Guided calibration with *Stonex Cube-a***

You can use *Stonex Cube-a* field software to calibrate the sensor; Stonex Cube-a provides all the instructions to initialize and calibrate the IMU sensor.

- **Integrated inertial navigation module ensures real-time interference-free tilt compensation.**

It's not affected by any geomagnetic and external metal structures or other environmental influences. It adopts "satellite and inertial navigation" dual inspection.

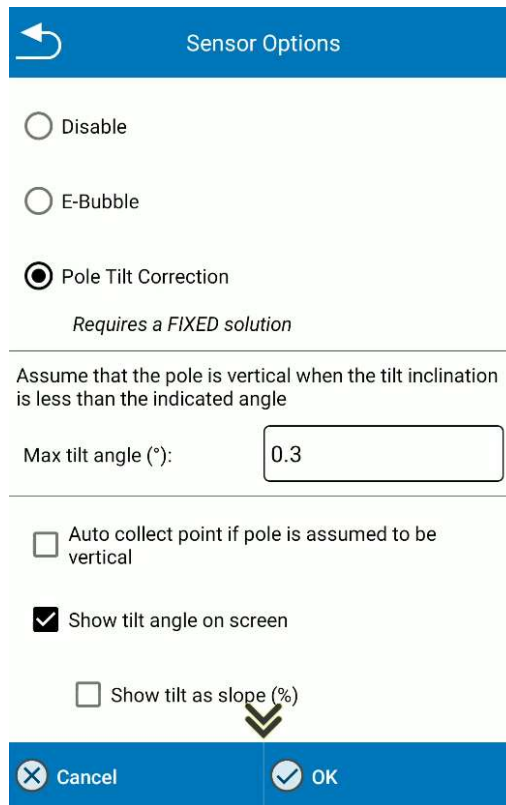


5.1 IMU with Stonex Cube-a

Sensor Activation and Configuration

The settings of the Pole Tilt Correction are on the Sensor Option page of Stonex Cube-a, Calibrate menu.

It is possible to set the software to show on screen the tilt angle in decimal degrees (0° = true vertical) or as slope (0% = true vertical)



← Sensor Options

Disable

E-Bubble

Pole Tilt Correction

Requires a FIXED solution

Assume that the pole is vertical when the tilt inclination is less than the indicated angle

Max tilt angle (°):

Auto collect point if pole is assumed to be vertical

Show tilt angle on screen

Show tilt as slope (%)

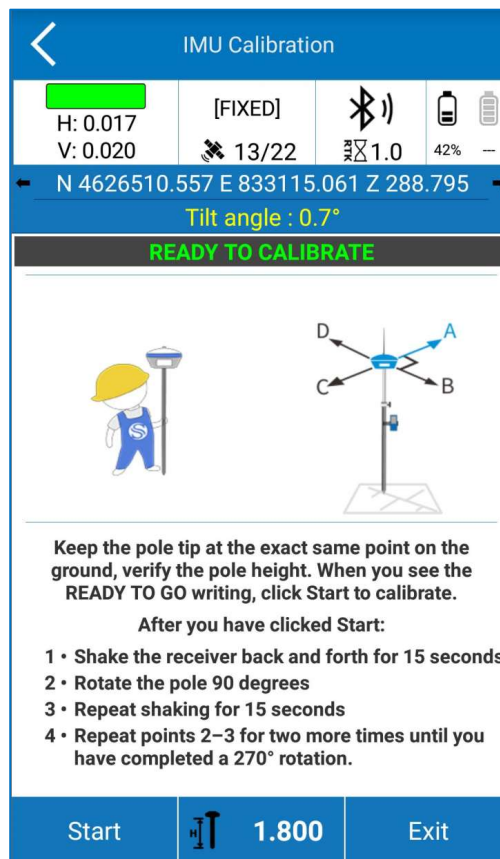
✕ Cancel ✓ OK

Calibration

To calibrate the sensor, select the Calibrate page and then click on the Calibrate Sensor command.

A FIXED solution is mandatory. Set the pole to be high at 1.8m as well as the measured height set in Stonex Cube-a.

Wait for the message Ready to Calibrate to appear then start the calibration by clicking on the Start button.



The calibration consists of the same movement repeated along the four orthogonal directions while keeping the pole tip on the same point on the ground:

Slowly move the receiver back and forth along the current direction for about 15 seconds the inclination should reach at least 45° but not more than 60° from the vertical position, the guided procedure on Stonex Cube-a will show when to change direction.

When the calibration is completed the message Calibration Terminated appears.

Now the S590 is ready to work.

Initialization

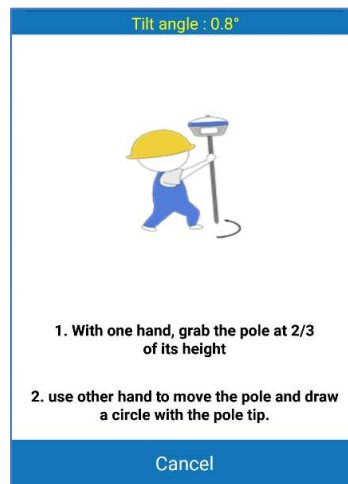
After the activation of the sensor, go to Survey mode.

If the sensor is not ready to work yet, Stonex Cube-a will show you which operations are necessary to perform its initialization, if "Show sensor calibration hints (animations) on screen" is enabled in Configure → System Settings → Sensor Options page.

There is a necessary pre-requisite to use the IMU: the status of the GNSS solution must be Fixed.

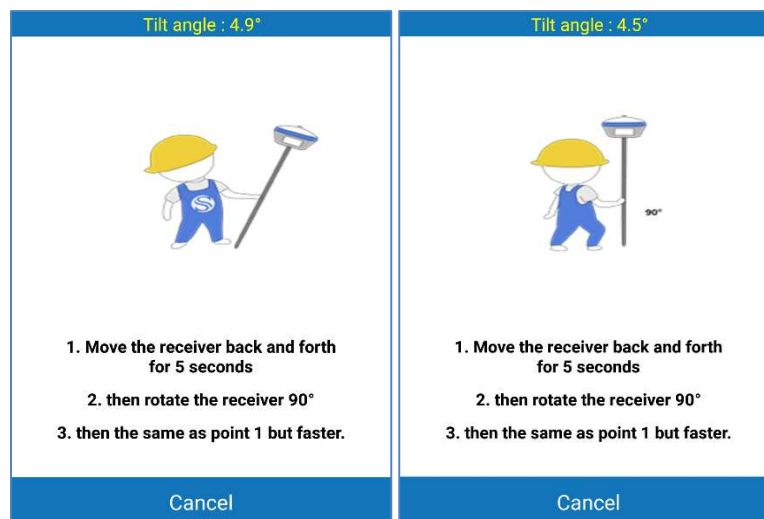
Then, if the sensor needs to be initialized, two different popup screens could show up.

The first screen contains the instructions for the magnetic initialization. Move the pole tip to draw a circle on the ground.



The second screen shows how to aid the sensor to adjust the calibration parameters based on the local GNSS position and accuracy.

Move the receiver back and forth for a few seconds in a direction. Then rotate the receiver by 90 degrees and repeat the movements, in the same direction as before, as shown in the picture below.



If the screen does not disappear, try changing the position to get lower RMS values and then repeat the two steps.

These screens could appear during the survey: this means that the IMU accuracy has degraded and it's necessary to adjust it.

6. Care and Transport

6.1 Equipment care

Respect the temperature limits when storing the equipment, particularly in summer if the equipment is inside a vehicle. Refer to “Technical Features” for information about temperature limits.

6.2 Built-in Battery Care

Your product is powered by a rechargeable battery. The full performance of a new battery is achieved only after two or three complete charge and discharge cycles. The battery can be charged and discharged hundreds of times but will eventually wear out.

Do not leave a fully charged battery connected to a charger, since overcharging may shorten its lifetime.

If left unused, a fully charged battery will lose its charge over time.

6.3 Charger Care

Do not attempt to charge/power your product with other than the charger provided. The use of any other types may damage or destroy the product and could be dangerous. Use of other chargers may invalidate any approval or warranty.

For availability of approved enhancements, please check with your dealer.

Charge/power the product according to the instructions supplied with the product.

6.4 Maintenance

Unplug the product or charger before cleaning. Cleaning the product by wiping with a dry or slightly damp cloth.

The cord and charger may only be dry dusted.

6.5 Transport

When transporting the product by rail, air or sea, always use the complete original STONEX packaging, transport container and cardboard box, or its equivalent, to protect against shock and vibration.

Never carry the product loose in a road vehicle, as it can be affected by shock and vibration.

Always carry the product in its transport container, original packaging or equivalent and secure it. When transporting or shipping batteries, the person responsible for the product must ensure that the applicable national and international rules and regulations are observed. Before transportation or shipping, contact your local passenger or freight transport company.

7. S590 Technical Features

RECEIVER

Satellite signals tracked	GPS: L1 C/A, L1C, L2P, L2C, L5
	GLONASS: L1, L2, L3
	BEIDOU: B1I, B2I, B3I, B1C, B2a, B2b
	GALILEO: E1, E5a, E5b, E6
	QZSS: L1, L2, L5
	IRNSS: L5
SBAS	
PPP	B2b PPP, HAS
Channels	1408
Position Rate	10Hz
Signal Reacquisition	< 1 s
RTK Signal Initialization	< 5 s
Hot Start	Typically < 15 s
Initialization Reliability	> 99.9 %
Tilt Sensor	IMU $\pm 60^\circ$

POSITIONING¹

RTK Network ²	< 2 cm + 1 ppm RMS
RTK Radio	< 2 cm + 1 ppm RMS
Post-processing	1 cm + 1 ppm RMS
PPP Accuracy	< 20 cm
SBAS accuracy ³	< 60 cm

INTEGRATED GNSS ANTENNA

Multi-constellation GNSS antenna

HARDWARE

Processor	ARM Cortex-A7
Memory	8 GB
Operating System	Linux

EXTERNAL RADIO (optional)

Model	SR02
Type	Tx - Rx - Transceiver (2 watt)
Frequency Range	410 - 470 MHz
Channel Spacing	12.5 KHz / 25 KHz
Maximum Range ⁴	3-4 Km in urban environment Up to 10 Km with optimal conditions

COMMUNICATION

I/O Connectors	TYPE-C connector support USB 2.0
Bluetooth	5.0
Wi-Fi	IEEE 802.11 g
Web UI	To upgrade the software, manage the status and settings, and download data. Smartphone, tablet, or other electronic device with Wi-Fi capability can be used.
Real time protocols	RTCM 3.x

POWER SUPPLY

Battery	3.85V/6120mAh (non-removeable)
Input	DC 5V-2A
Working Time	Up to 15 hours
Charge Time	Typically 4 hours

PHYSICAL SPECIFICATION

Dimensions	139 mm x 81 mm x 31 mm
Weight	330 g
Operating Temperature	-30°C to 65°C (-22°F to 149°F)
Storage Temperature	-40°C to 80°C (-40°F to 176°F)
Waterproof/Dustproof	IP67
Shock Resistance	Designed to endure a 1.2 m free drop on concrete floor with no damage

STANDARD ACCESSORIES

Power adapter, USB cable, Belt case, Pole mount

OPTIONAL ACCESSORIES

Carbon fiber pole, Telescopic pole, Soft bag

Specifications are subject to change without notice.

1. Accuracy and reliability are generally subject to satellite geometry (DOPs), multipath, atmospheric conditions and obstructions. In static mode they are subject even to occupation times: the longer is the Baseline, the longer must be the occupation time.
2. Network RTK precision depends on the network performances and are referenced to the closest physical base station.
3. It depends on the SBAS system's performance.
4. Varies with the operating environment and with electromagnetic pollution.

8. S590 Bundle

S590 standard bundle is composed of:

- S590 receiver
- Pole mount
- Power adaptor with 4 plugs (US, UK, EU, AU) with 1 USB Type C-Type C cable
- 1 USB Type C-Type A cable for firmware update
- Belt case to use the S590 without the pole
- Carton box.

9. Appendix 1: Copyrights, warranty and environmental recycling

9.1 Copyrights and trademarks

© 2024, STONEX® Srl. All rights reserved.

STONEX®, the STONEX® logo, and the S950 GNSS receiver are trademarks of STONEX® Srl.

STONEX® Cube-a is a trademark of STONEX® Srl.

All other trademarks are the property of their respective owners.

9.2 Release Notice

This is the August 2025 release of the STONEX® S590 GNSS new model receiver user guide.

The following limited warranties give you specific legal rights. You may have others, which vary from state/jurisdiction to state/jurisdiction.

9.3 Standard Limited Warranty

Version 2024

The terms and conditions of this Limited Warranty constitute the complete and exclusive warranty agreement between The Customer or Dealer and STONEX® for the Product and supersedes any prior agreement or representation made in any STONEX® sales document or advice that may be provided to Customer by any STONEX® representative in connection with Customer's purchase of the Product. No change to the conditions of this Limited Warranty is valid unless it is made in written form and signed by an authorized STONEX® supervisor.

STONEX® declares that its Products:

- (1) are free from defects in materials or workmanship for generally 1 year (accessories or specific parts for which different limited warranty periods shall apply).
- (2) have been tested/calibrated in proper working status before shipment.

The warranty period runs from the date of the first sale of the instruments.

At its sole discretion, within the warranty period, STONEX® will repair the product or send parts for replacement at its expense.

STONEX® agrees to repair or replace the defective instrument within thirty (30) days only if STONEX® acknowledges that the defects in the instrument are not caused by human factors or that no obvious damage to its surface is visible.

STONEX® warrants that replaced new parts or products will be free from defects in materials and workmanship for thirty (30) days or the remainder of the Limited Product Warranty Period in which they are installed, whichever is longer.

Defective parts or Products replaced under this Limited Warranty shall become the property of STONEX®.

All products that need to be repaired must be returned to our technical representative's office via whatever delivery company the customer prefers, however, STONEX® is not responsible for the unlikely event that products are lost in transit.

Any damage inflicted by the customer or a third party after the products have been delivered to the customer is excluded from the limited warranty, as is any damage resulting from improper use, any action or use not contemplated in the accompanying user guides, and/or manuals.

9.4 Shipping policy

The Customer or the dealer is required to pay for the charges for shipping faulty parts or instruments to STONEX® representative office and STONEX® is providing the shipping for the return.

Dealers need to follow STONEX® repair/service procedure to achieve a better and prompt service result.

9.5 Return policy Dead on Arrival instruments

All returned products have to be shipped to STONEX® representative office.

The original Purchaser has a period of seven (7) days starting from the date of purchasing to signal the existence of a defect in the instrument for a full refund (less shipping and handling), provided the merchandise is in new, resalable condition and returned in the original, undamaged packaging. Customers must pay for both the return and the original freight fees, regardless of the original freight paid by the Company. All warranty books, instruction manuals, parts, and accessories must be included as well as the original box in which the item was shipped. We recommend placing the original carton inside another box, to avoid any additional damage to the carton itself. In some cases, returns of special items will require a re-stock fee. Acceptance of returned merchandise is final only after inspection by STONEX®.

Above terms and policies shall apply to hardware. Dealers need to follow STONEX® repair/service procedure to achieve a better and prompt service result.

9.6 Firmware/Software warranty

STONEX® doesn't warrant that operation of Firmware/Software on any instruments will be uninterrupted or error-free, or that functions contained in Firmware/Software will operate to meet your requirements.

STONEX® will forward the Software/Firmware Fix to the dealer or customer. A firmware/software Fix means an error correction or other update created to fix a previous firmware version that substantially doesn't conform to the instrument's specification.

9.7 Over Warranty repair(s) policy

The customer shall pay the standard repair fees for any service (whether part replacement or repairs) performed by STONEX® under request and explicit authorization of the customer itself. In this case, the customer is charged for return shipping fees as well.

9.8 Disclaimer and Limitation of Remedy

All other express and implied warranties for this product, including the implied warranties of merchantability and fitness for a particular purpose and/or non-infringement of any third party's rights, are hereby disclaimed. Stonex® expressly disclaims all warranties not stated in this limited warranty. Any implied warranties that may be imposed by law are limited in duration to the term of this limited warranty. Some jurisdictions do not allow the exclusion of implied warranties or limitations on how long an implied warranty lasts, so the above exclusions or limitations may not apply to customer.

It is the customer's responsibility to read and follow all setup and usage instructions in the accompanying user guides and/or manuals. Failure to do so may result in product malfunction and damage. The customer may lose data or suffer personal injury.

Stonex®, its affiliates, and suppliers do not guarantee that the operation of this product will be uninterrupted or error-free, as is the case with all electronic products. If this product fails to function as warranted above, the customer's sole and exclusive remedy will be repair or replacement.

In no event shall Stonex®, its affiliates, or suppliers be liable to the customer or any third party for damages more than the purchase price of the product.

This limitation applies to damages of any kind, including:

(1) damage to, or loss or corruption of, customer's records, programs, data, or removable storage media

(2) any direct or indirect damages, loss of profits, loss of savings, or other special, incidental, exemplary, or consequential damages, whether for breach of contract, tort or otherwise, or whether arising out of the use of or inability to use the product and/or the accompanying user guides and/or manuals, even if Stonex, or an authorized Stonex® representative, authorized service provider or retailer has been advised of the possibility of such damages or any claim by a third party.

Some jurisdictions do not allow the exclusion or limitation of incidental or consequential damages for certain products, so the exclusions or limitations may not apply to you. This limited warranty gives the customer specific legal rights, and the customer may also have other rights that vary from country/state/jurisdiction to country/state.

9.9 Environmental recycling

The cardboard box, the plastic in the package, and the various parts of this product must be recycled and disposed of by the current legislation of your Country.

9.9.1 For countries in the European Union (EU)

The disposal of electric and electronic devices as solid urban waste is strictly prohibited: they must be collected separately.

Contact Local Authorities to obtain practical information about the correct handling of the waste, location, and times of waste collection center. When you buy a new device of ours, you can give back to our dealer a used similar device.

The dumping of these devices at unequipped or unauthorized places may have hazardous effects on health and the environment.

The crossed-out dustbin symbol means that the device must be disposed of in authorized collection centers and must be managed separately from solid urban waste.



9.9.2 For countries outside European Union (EU)

The treatment, recycling, collection, and disposal of electric and electronic devices may vary by the laws in force in the Country in question.

10. Appendix 2: Safety Recommendations

10.1 Warnings and Cautions

An absence of specific alerts does not mean that there are no safety risks involved in the use of this equipment.

Always follow the instructions that accompany a Warning or Caution, reported in this.

This information is intended to minimize the risk of personal injury and/or property damage. Observe safety instructions that are presented in the following form:

WARNING - A Warning alerts about the risk for health and/or damage to the propriety. A warning identifies the nature of the risk and the extent of the possible injury and/or damage. It also describes how to protect yourself and/or the equipment from this risk.

CAUTION - A Caution alert about a possible risk of damage to the equipment and/or loss of data, but no risk to human safety.

10.2 Wireless Module Approval

The receivers use internal wireless modules or can be connected to an external data communications UHF radio. Regulations regarding the use of the radio-modems vary greatly from country to country. In some countries, the unit can be used without obtaining an approval license. Other countries require specific approval or auto certification by the set maker.

Before using this instrument, check if authorization to operate the receiver is required in your country. It is the responsibility of the importer to verify if it is necessary to obtain a certification or license for the equipment in the country of use.

10.3 Instrument Approval

Covers technical features of the equipment relative to electromagnetic emissions that can cause interference and disturbances to other instruments (note like EMC compatibility) or generate not correct functionalities of the instrument itself. Approval is granted by the manufacturer of the equipment. Some countries have unique technical requirements for operation in particular frequency bands. To comply with those requirements, Stonex Srl may modify the equipment to be subjected to a grant.

Unauthorized modification of the unit voids already got approvals, the warranty time, and the operational licenses of the instrument.

10.4 General Antenna Installation Warning

1. All antenna installation and servicing are to be performed by qualified technical personnel only. When servicing the antenna, or working at distances closer than those listed below, ensure the transmitter has been disabled.

2. Typically, the antenna connected to the transmitter is a directional (high gain) antenna, fixed-mounted on the side or top of a building, or a tower. Depending upon the application and the gain of the antenna, the total composite power could exceed 90 watts ERP. The antenna location should be such that only qualified technical personnel can access it, and that under normal operating conditions, no other person can touch the antenna or approach within 0.6 meters of the antenna.

You can see below a table showing the Antenna Gain versus Recommended Safety Distance:

Antenna Gain	0-5 dBi	5-10 dBi	10-16.5 dBi
Minimum RF safety distance	0.6 meters	1.06 meters	2.3 meters

10.5 USA

The FCC has adopted a safety standard for human exposure to radiofrequency electromagnetic energy. Proper use of this radio modem results in exposure below government limits. The following precautions are recommended:

DO NOT operate the transmitter when someone is located less than 20 cm (7.8 inches) from the antenna.

DO NOT collocate (place within 20 cm) the radio antenna with any other transmitting instruments.

DO NOT operate the transmitter unless all RF connectors are secure, and any open connectors are properly terminated.

DO NOT operate the equipment near electrical blasting caps or in an explosive atmosphere.

All equipment must be properly used according to the installation instructions for safe operation.

All equipment should be repaired and calibrated only by a qualified technician.

10.6 Europe

The European Community provides some Directives for the electronic equipment introduced on the market.

All the relevant information's available on the European Community website:

<https://ec.europa.eu/growth/sectors/electrical-engineering/>

From this link, you can download Directive 2014/53 / UE RED relating to telecommunication equipment, the LVD Low voltage directive, and the EMC directive for electromagnetic compatibility.

10.7 Bluetooth/Wi-Fi radio Module

The radiated output power of the internal Bluetooth module of this equipment is far below the FCC and EU radio frequency exposure limits. In any case, be sure to use the equipment with the radio far at least 20 cm from the human body. The Bluetooth module matches the guidelines found in radio frequency "safety standards and recommendations" published by Scientific organizations.

Stonex Srl, therefore, believes the internal wireless radio is safe for use by end users. The level of energy emitted is far less than the electromagnetic energy emitted by wireless devices such as UMTS phones. However, the use of Bluetooth/Wi-Fi may be restricted in some special situations or places, like aircraft, hospitals, etc. If you are unsure of the existence of restrictions, you should ask for authorization before switching on the Bluetooth radio.

10.8 Rechargeable Lithium-ion batteries

These receivers use a rechargeable Lithium-ion battery.

WARNING

- Avoid direct contact with the rechargeable Lithium-ion battery if it appears damaged. Battery liquids are corrosive and contact with them can result in personal injury or damage to properties.

To prevent injury or damage:

- If the battery leaks, avoid contact with the battery fluid.
- If battery fluid gets into your eyes, immediately rinse your eyes with clean water and seek medical attention. Do not rub your eyes!
- If battery fluid gets onto your skin or clothing, immediately use clean water to wash off the battery fluid.

WARNING

- Do not damage the Lithium-ion battery.

A damaged battery can cause an explosion, with a risk of fire, and can result in personal injury and/or property damage.

To prevent injury or damage:

- Do not use or charge the battery if it appears to be damaged. Signs of damage are discoloration, warping, and leaks of liquids.
- Do not expose the battery to fire, high temperature, or direct strong sunlight.
- Do not introduce the battery in water or liquid substance, in general.
- Do not use or store the battery in very hot ambient.
- Do not drop or puncture the battery.
- Do not open the battery and do not put in short-circuit its electrical contacts.



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