X5R - X5RT

GNSS RECEIVER

USER MANUAL

Version 2
Revision RMV
July 2025

CONTENT

INTRODUCTION

This manual describes how to configure and use a GNSS receiver model X5R / X5RT.

OVERVIEW

The GNSS receiver X5R / X5RT incorporates a GNSS antenna, a receiver, technology Bluetooth® wireless, Wi-Fi, an internal LoRa radio available in 433 and 915 MHz frequencies with reception and transmission options, ideal as a base station or a quick-setup integral RTK rover.

LEDs and sound alerts allow monitoring satellite tracking, radio reception, data logging status, WiFi mode, and power. Bluetooth mode provides wireless communication between the receiver and the user's mobile device (cell phone or tablet).

1. GNSS RECEIVERS X5

1.1. GNSS RECEIVER X5R / X5RT

1.1.1. CONTENT

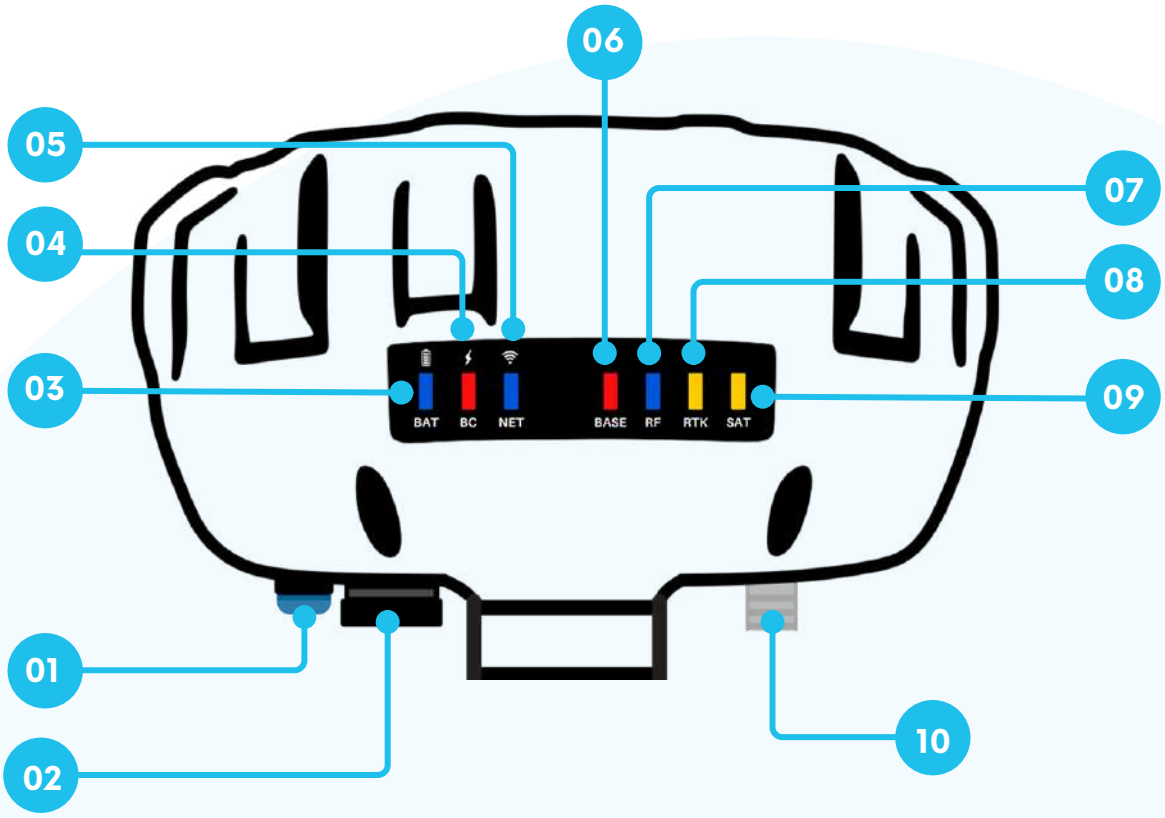
GNSS receiver model X5R

GNSS receiver model X5RT

ITEM	CONTENT
1	GNSS RECEIVER X5R / X5RT
2	TNC LORA 433 / 915 MHz ANTENNA
3	PLATE FOR MEASUREMENT OF
4	TNC CABLE 30CM MALE-FEMALE
5	USB-C CABLE
6	ADAPTER
7	CASE

1.1.2. HARDWARE COMPONENT AND FUNCTION

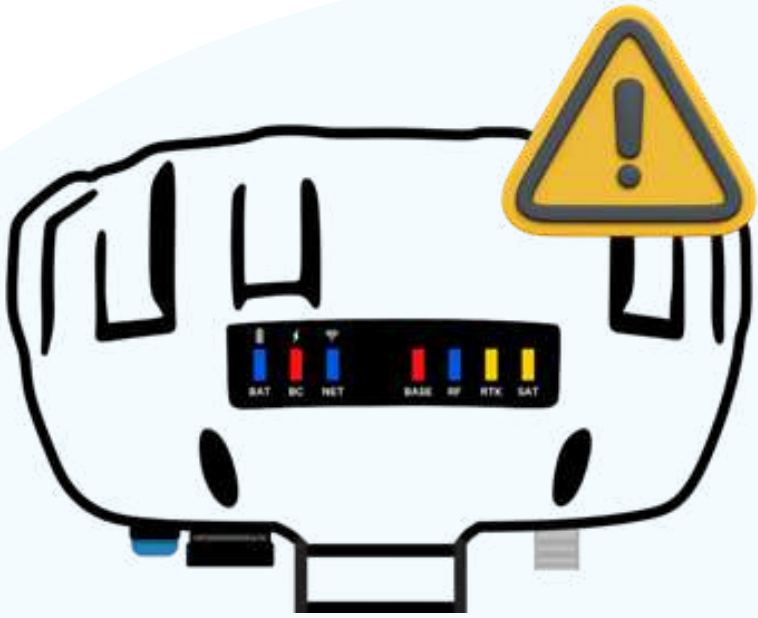
Front View X5R / X5RT



Bottom View X5R / X5RT

ITEM	COMPONENT	COMPONENT
1	BUTTON	Power on: Press 2 - 3 seconds until the BAT LED lights up. WiFi Mode: Press 1 - 2 seconds until it emits two beeps. Mode to configure and select the Standalone / Static, PPK, RTK LoRa, RTK NTRIP and Local NTRIP working method. Bluetooth mode: Press 1 - 2 seconds. Mode to configure and start the working method with FindX5 or other field software. Turn off: Press 5-6 seconds until the device stops beeping (after 5 beeps in total).
2	USB C PORT	USB Storage (Disabled) Battery charging: With an external battery or the power adapter included. Firmware update: Firmware update is allowed available in Cloud X5. USB Storage (Enabled) Access to internal memory: Allows download of raw data.
3	BAT LED	Battery indicator Blue: Green: Yellow: Red:
4	NET LED	Wifi and Bluetooth Mode Blinking: Bluetooth not connected. Solid: Bluetooth connected. Fading: WiFi Mode.
5	BC LED	Charging indicator Red: Charging. Blue: Charging completed.
6	BASE LED	Off: Rover Mode. Blinking: Base Mode, searching for position. Solid: Base Mode, position established.
7	RF LED	TX/RX Radio Frequency Off: Does not transmit or receive RTK corrections. Blinking/solid: Transmits or receives RTK corrections.
8	RTK LED	Solution type indicator Off: Standalone or DGNSS Blinking: Float Solid: Fix.
9	SAT LED	Satellite indicator Off: Does not track satellites. Blinking: The receiver is tracking at least 4 satellites.
10	INTERFACE LORA ANTENNA	LoRa antenna installation interface
11	LABEL OF SERIAL X5	Unique serial number of each GNSS equipment. Example: “PEX5-00000”
12	LABEL OF DATE AND MAC	Date: Month and year of production are indicated. MAC: The MAC code for WiFi and Bluetooth connections is indicated.

1.1.3. SOUND ALERT

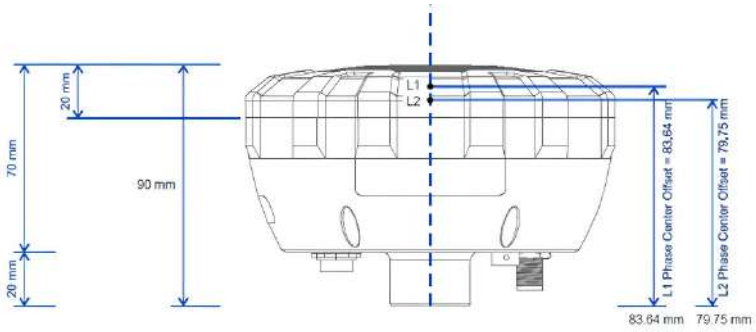


ITEM	EVENTS	SOUND
1	POWER ON / RESTART	Three beeps.
2	OFF	Two quick beeps and three slow beeps, in total 5 beeps.
3	WIFI MODE	Two beeps.
4	BASE MODE POSITION	Continuous beeps until it obtains its position.
5	FILE RECORDING	One beep every 10 seconds if it is recording a file.
6	NO INTERNET CONNECTION	In NTRIP base mode, incorrect credentials of the WiFi, emits alert sounds.
7	RTK FIX	Three quick beeps every 15 seconds if RTK Fix is achieved.

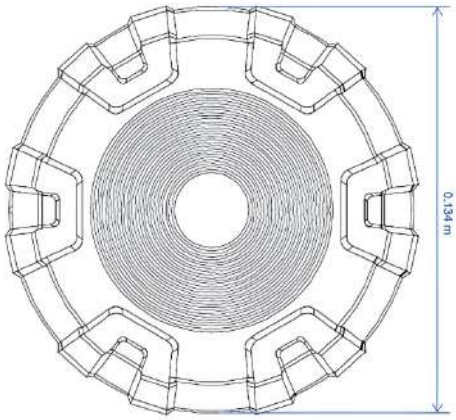
1.2. NOAA CALIBRATED ANTENNA

1.2.1. GNSS RECEIVER DIAGRAM X5R / X5RT

Front view X5R / X5RT

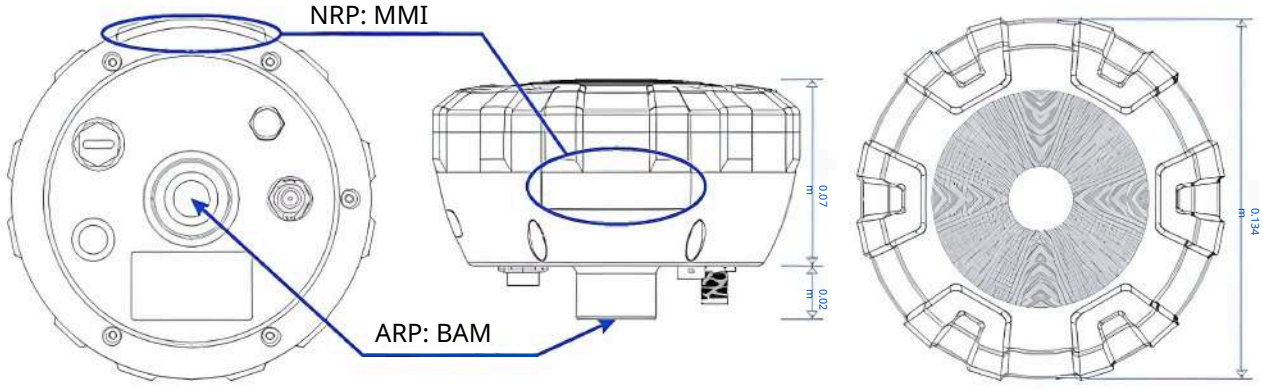


Front view X5R / X5RT



1.2.2. METX5 CALIBRATED ANTENNA DRAWING

Antenna
Type: METX5 NONE



Brand Code: MET
(Mettatec) Antenna Model:
X5 Antenna Code: METX5
Radome Code: NONE

Antenna Reference Point (ARP): Bottom of Antenna Mount (BAM)
North Reference Point (NRP): Man-Machine Interface (MMI)

1.2.3. ANTEX METX5

METX5 is the antenna calibrated by NOAA that includes phase center offsets (PCO) and phase center variations (PCV). The METX5 antex file helps us correct errors in GNSS measurements, improving the accuracy of positioning solutions.

```
     1.4            G                                      ANTEX VERSION / SYST
A                                                          PCV TYPE / REFANT
This calibration extracted from composite ngs20.atx.  See  COMMENT
the composite file ngs20.atx for more information.         COMMENT
                                                           END OF HEADER
                                                           START OF ANTENNA
METX5           NONE                                       TYPE / SERIAL NO
FIELD               NGS                     2    31-DEC-23 METH / BY / # / DATE
     0.0                                                   DAZI
     0.0  80.0   5.0                                       ZEN1 / ZEN2 / DZEN
     2                                                     # OF FREQUENCIES
NGSRA_2366                                                 SINEX CODE
CONVERTED FROM RELATIVE NGS ANTENNA CALIBRATIONS           COMMENT
   G01                                                     START OF FREQUENCY
      3.86      2.67     83.64                            NORTH / EAST / UP
   NOAZI    0.00    0.37    0.69    1.06    1.26    1.37   1.42    1.29    1.20    1.06    1.02    0.98    0.84    0.92    1.19    1.76    3.03
   G01                                                     END OF FREQUENCY
   G02                                                     START OF FREQUENCY
     1.21      0.44     79.75                            NORTH / EAST / UP
   NOAZI    0.00    1.67    2.99    4.12    5.01    5.52   5.70    5.53    5.28    4.78    4.34    4.14    3.87    3.87    4.07    4.37    5.22
   G02                                                     END OF FREQUENCY
   G01                                                     START OF FREQ RMS
     0.40      0.40      0.50                             NORTH / EAST / UP
   NOAZI    0.00    0.10    0.00    0.10    0.20    0.20   0.20    0.20    0.10    0.10    0.10    0.20    0.30    0.40    0.30    0.10    0.30
   G01                                                     END OF FREQ RMS
   G02                                                     START OF FREQ RMS
     0.20      0.50      0.40                             NORTH / EAST / UP
   NOAZI    0.00    0.10    0.30    0.40    0.40    0.50   0.40    0.40    0.40    0.30    0.30    0.20    0.10    0.00    0.20    0.30    0.50
   G02                                                     END OF FREQ RMS
                                                           END OF ANTENNA
```

Download antex file METX5_NONE.atx

The X5R/X5RT GNSS receivers integrate the METX5 antenna. To ensure accuracy in post-processing, import the antenna model into the software or update your library with the NOAA calibrated antennas.

Not all software supports NOAA calibrated antennas. Verify compatibility with the GNSS software provider or manufacturer.

1.3. GNSS ANTENNA HEIGHT MEASUREMENT

The following describes how to measure the height of an antenna mounted on a tripod using 2 references for the measurement.

1.3.1. GNSS ANTENNA MEASUREMENT X5R – REFERENCE 1

REFERENCE 1 (R1):

It is the point of intersection between the gray cover and the white body of the GNSS receiver. This marks the reference plane for measuring the antenna height.

Measurement procedure:

The height of the GNSS antenna is measured at an angle, from the control point to R1, using a tape measure. The value obtained is recorded as HR1.

Calculation of height to ARP
(Antenna Reference Point):

$$\text{Altura ARP} = \left(\sqrt{{H_{R1}}^2 - \left(\frac{0.134}{2}\right)^2}\right) - 0.070$$

1.3.2. GNSS X5RT ANTENNA MEASUREMENT – REFERENCE 1

REFERENCE 1 (R1):

It is the point of intersection between the gray cover and the white body of the GNSS receiver. This marks the reference plane for measuring the height of the antenna.

Measurement procedure:

The height of the GNSS antenna is measured obliquely, from the control point to R1, using a tape measure. The value obtained is recorded as HR1.

Calculation of height to ARP
(Antenna Reference Point):

$$\text{Altura ARP} = \left(\sqrt{H_{R1}{}^2 - \left(\frac{0.134}{2}\right)^2}\right) - 0.070$$

Measurement to R1 – X5RT

1.3.3. GNSS X5R ANTENNA MEASUREMENT – REFERENCE 2

REFERENCE 2 (R2):

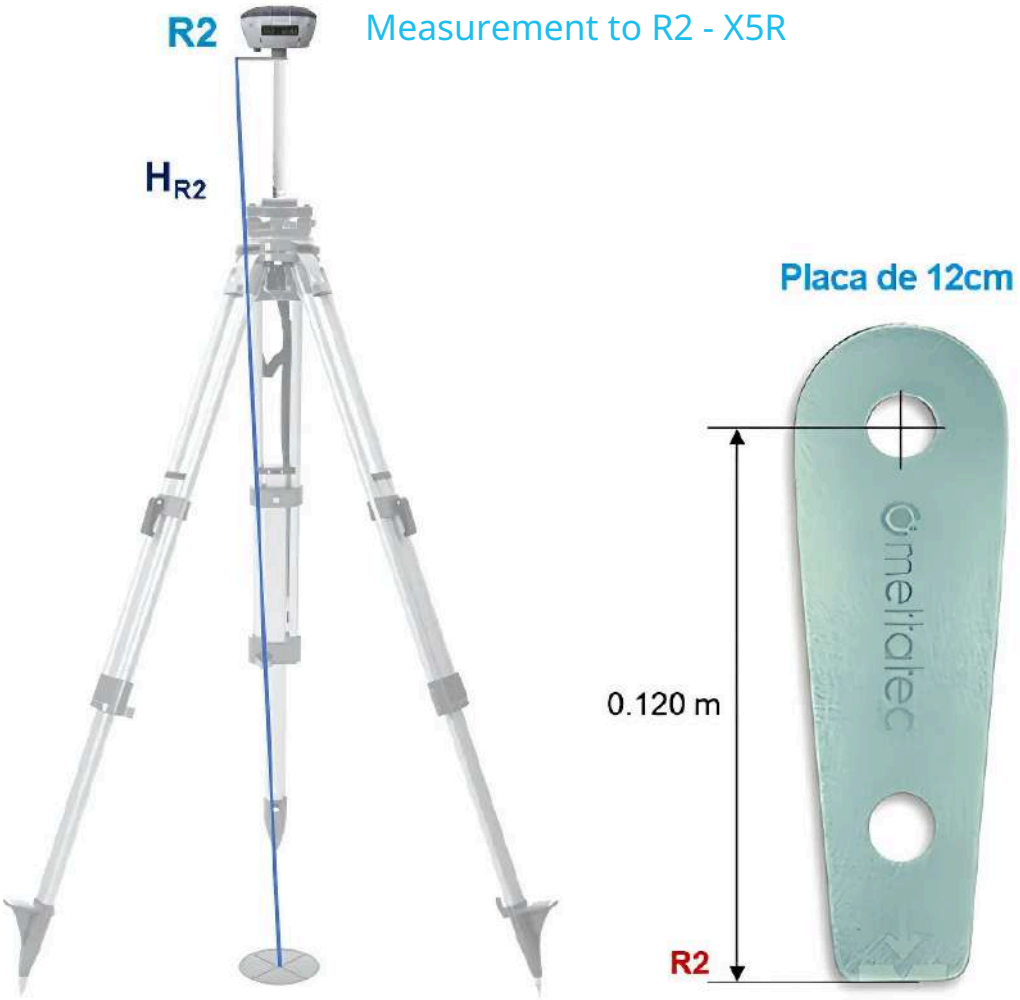
Corresponds to the upper edge of the measurement plate installed at the base of the GNSS receiver. This edge is located 12 cm from the center of the equipment's installation axis.

Measurement procedure:

The height of the GNSS antenna is measured at an angle, from the control point to R2 (measurement plate), using a measuring tape. The value obtained is recorded as HR2.

Calculation of height to ARP
(Antenna Reference Point):

$$\text{Altura ARP} = \sqrt{H_{R2}{}^2 - 0.120^2}$$



Measurement to R2 - X5R

1.3.4. GNSS X5RT ANTENNA MEASUREMENT – REFERENCE 2

REFERENCE 2 (R2):

Corresponds to the upper edge of the measurement plate installed at the base of the GNSS receiver. This edge is located 12 cm from the center of the equipment's installation axis.

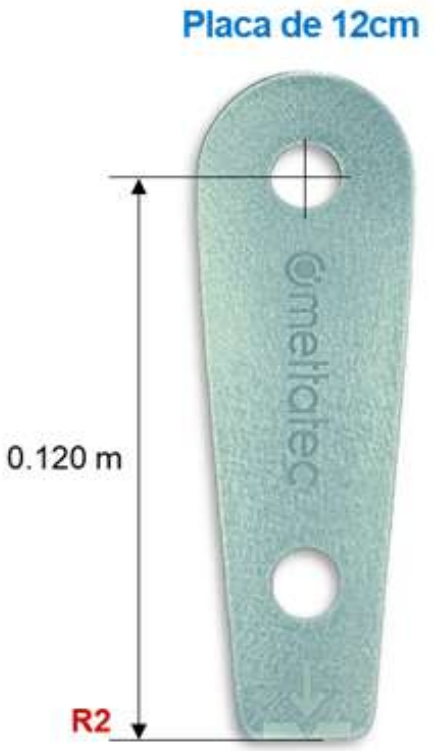
Measurement procedure:

The height of the GNSS antenna is measured at an angle, from the control point to R2 (measurement plate), using a tape measure. The value obtained is recorded as HR2.

Calculation of height to ARP
(Antenna Reference Point):

$$\text{Altura ARP} = \sqrt{H_{R2}{}^2 - 0.120^2}$$

Measurement to R2 - X5RT



2. FINDX5 FIELD SOFTWARE

FindX5 is the comprehensive solution for easily managing and configuring your X5 receivers (X5R / X5RT), centralizing geodetic tools, equipment configurations, and technical documentation on a single platform.

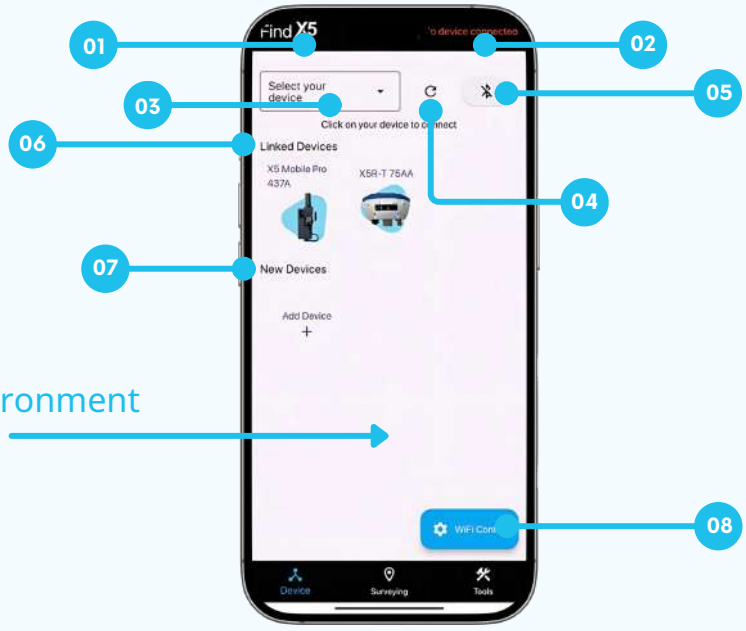
2.1. INTERFACE AND FUNCTIONS

FindX5 integrates three environments: Device (links X5R/X5RT receivers via WiFi/Bluetooth), Surveying (manages projects and coordinate systems for

surveying/stakeout) and Tools (access to cloud solutions and technical documentation).

2.1.1. DEVICE

The Device environment manages the linked receivers (X5R/X5RT)
and allows you to configure their connection via WiFi or Bluetooth.



Device Environment

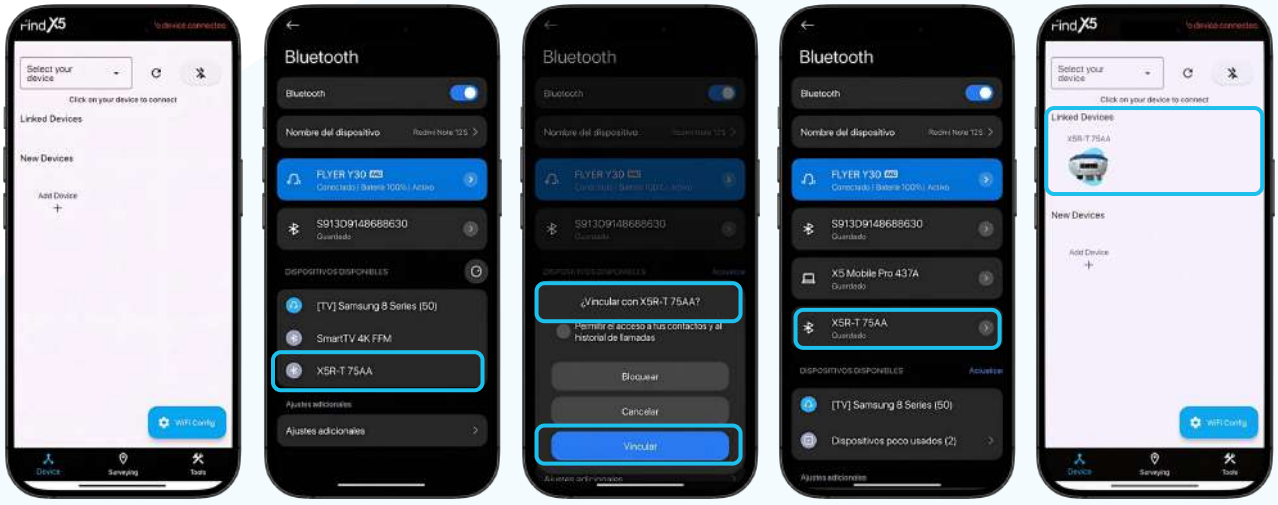
ITEM	COMPONENT	DESCRIPTION
1	APPLICATION	FindX5 application name.
2	CONNECTION	Indicates the connection status (connected or disconnected to the GNSS receiver).
3	SELECT YOUR DEVICE	Select the GNSS receiver linked by Bluetooth.
4	UPDATE	Updates the list of linked receivers and new receivers.
5	BLUETOOTH	Automatically connects to the newly linked GNSS receiver. Enters Bluetooth Mode.
6	LINKED DEVICES	Displays the GNSS receivers linked by Bluetooth. Enters Bluetooth Mode.
7	NEW DEVICES	Displays the GNSS receivers not linked by Bluetooth. Enters Bluetooth Mode.
8	WIFI CONFIG	Connects to the GNSS receiver via WiFi. Enters WiFi Mode.

2.1.2. DEVICE - VIA BLUETOOTH

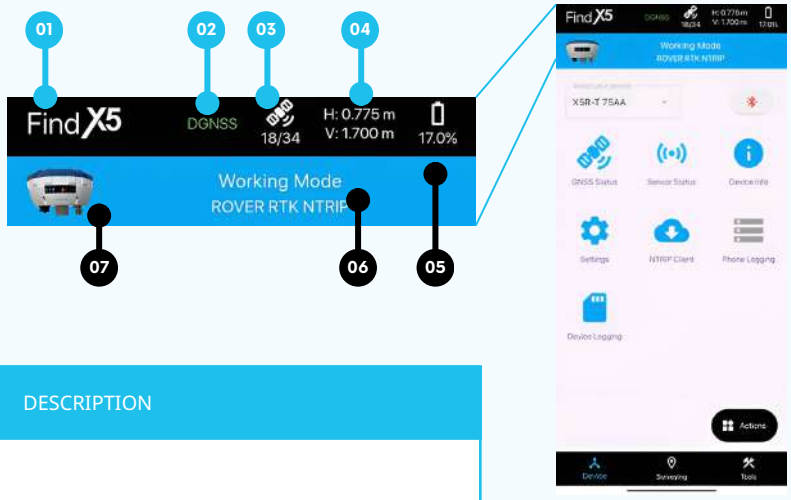
Connection Via Bluetooth:

> Identify MAC of the GNSS receiver

> Pair the GNSS receiver with the mobile device via Bluetooth > Select linked GNSS receiver.

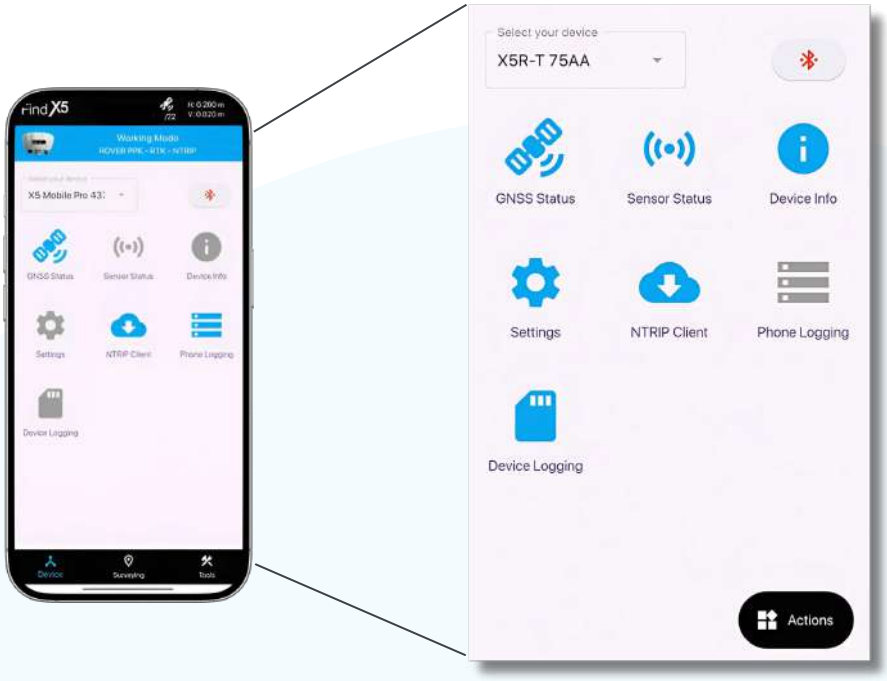


Bluetooth Environment – General Information



ITEM	COMPONENT	DESCRIPTION
1	APPLICATION	Application name FindX5.
2	SOLUTION	Solution type: Fix: Good reception of correction and RMS. Floating: Regular reception of correction and RMS. DGNSS: Submetric level positioning without correction. Single: Autonomous metric level positioning without correction.
3	SATELLITES	Indicates the number of satellites used / tracked.
4	RMS	Root mean square error of the current positioning.
5	BATTERY	Current percentage of the GNSS receiver battery.
6	WORKING MODE	Current Mode or Working Method of the GNSS receiver.
7	DEVICE	GNSS receiver connected.

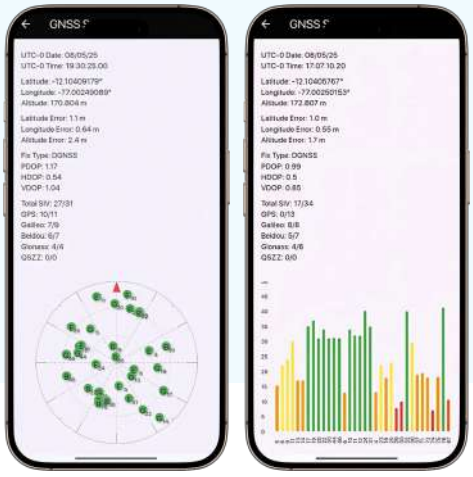
Bluetooth Via Environment – Options Menu



ITEM	COMPONENT	DESCRIPTION
1	SELECT YOUR DEVICE	GNSS receiver connected via Bluetooth.
2	BLUETOOTH	Select to disconnect the GNSS receiver.
3	GNSS STATUS	Status of time, position, RMS, Solution, DOP, signal-to-noise SNR and plan view.
4	SENSOR STATUS	IMU sensor status (only for GNSS X5RT receiver)
5	DEVICE INFO	Information on: battery level, voltage, version of receiver firmware and GNSS module version.
6	SETTINGS	Specifies that WiFi mode is activated in Actions.
7	NTRIP CLIENT	Allows the entry of NTRIP credentials for the GNSS rover receiver and connect to the NTRIP service.
8	PHONE LOGGING	Allows recording raw UBX data and storing it directly to the user's mobile device. (X5 MOBILE PRO only)
9	DEVICE LOGGING	Allows recording raw UBX data, stored in the GNSS receiver. (X5R / X5RT only)
10	ACTIONS	Actions to Turn Off or Start.

Options Menu - Via Bluetooth

GNSS STATUS



SENSOR STATUS

DEVICE INFO

SETTINGS

NTRIP CLIENT

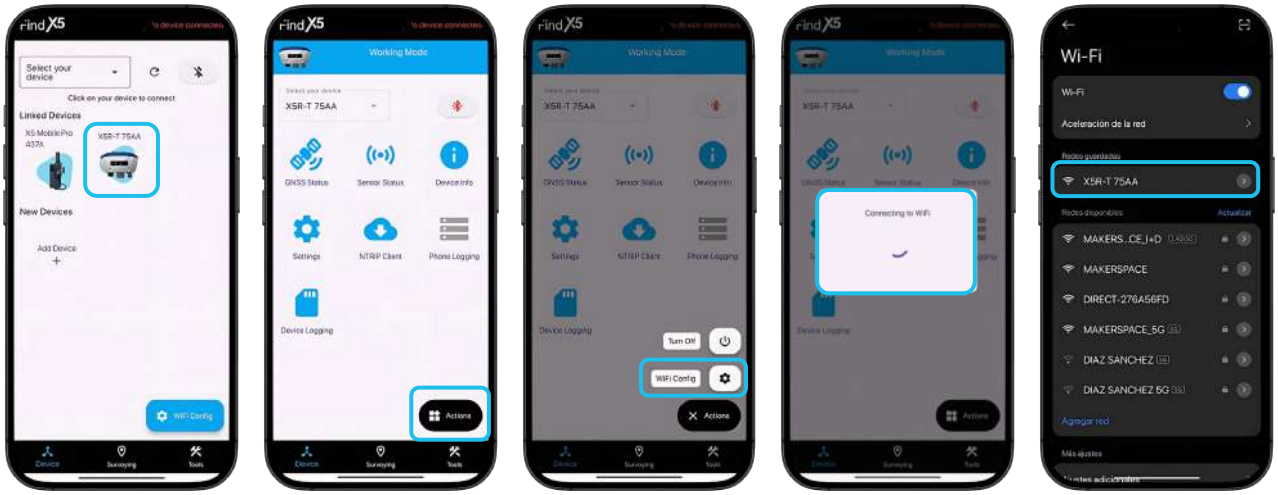
DEVICE LOGGING

ACTIONS

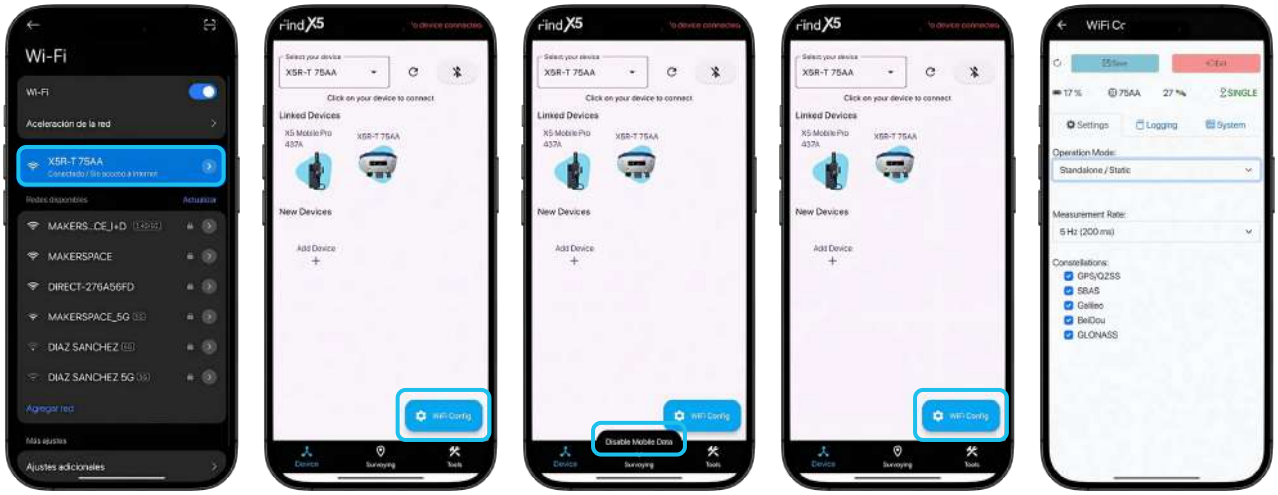
2.1.3. DEVICE - VIA WIFI

Connection Via WiFi (Access 01): >
Link GNSS receiver Bluetooth Mode
> Enter Actions
> Select WiFi Config.
> Link the GNSS receiver with the mobile device via WiFi via WiFi.

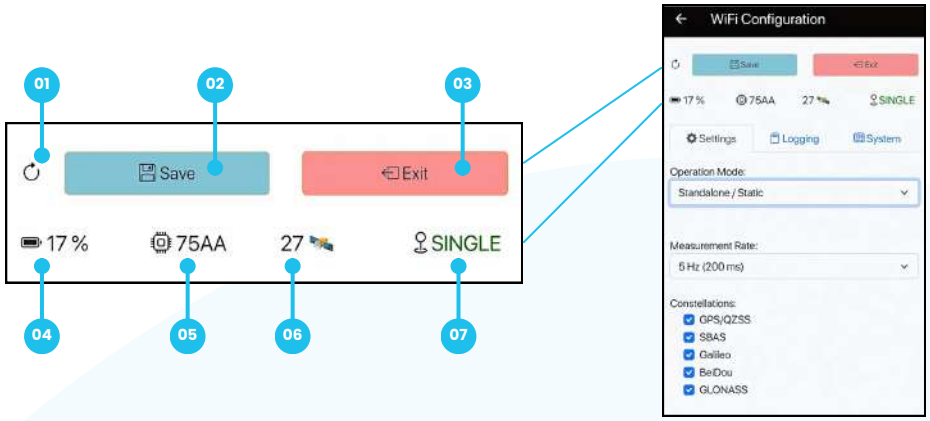
Connection Via WiFi (Access 02): >
Activate WiFi Mode with the power button by pressing for 1-2 seconds
> Link the GNSS receiver with the mobile device via WiFi



> Connected to the GNSS receiver's WiFi
> Enter WiFi Config (if it doesn't enter, you must deactivate the internet data of the mobile device)

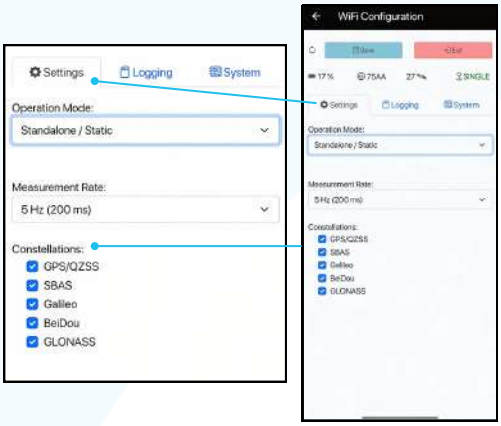


Via WiFi Environment – General Information



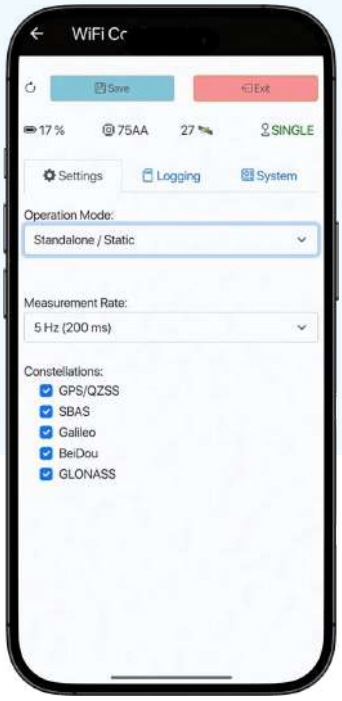
ITEM	COMPONENT	DESCRIPTION
1	RESTORE	Restores the current working mode of the GNSS receiver.
2	SAVE	Saves the selected and configured working mode.
3	EXIT	Exits Wifi mode and continues to Bluetooth mode.
4	BATTERY	Current battery percentage of the GNSS receiver.
5	MAC	Identifier of the GNSS receiver.
6	SATELLITES	Indicates the number of tracked satellites.
7	SOLUTION	Solution type: Fix: Good correction reception and good RMS. Floating: Regular correction reception and RMS. DGNSS: Submetric level positioning without correction. Single: Autonomous metric level positioning without correction.

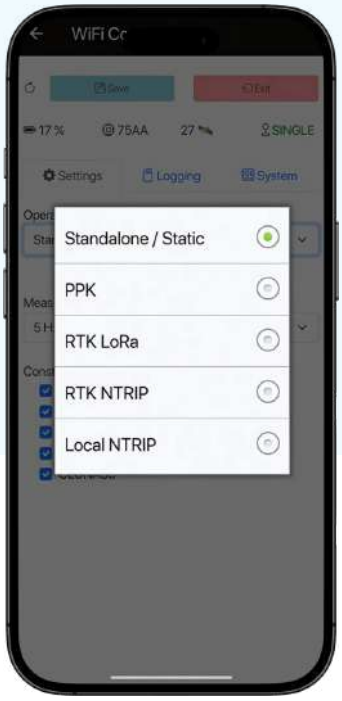
Via WiFi Environment – Options Menu



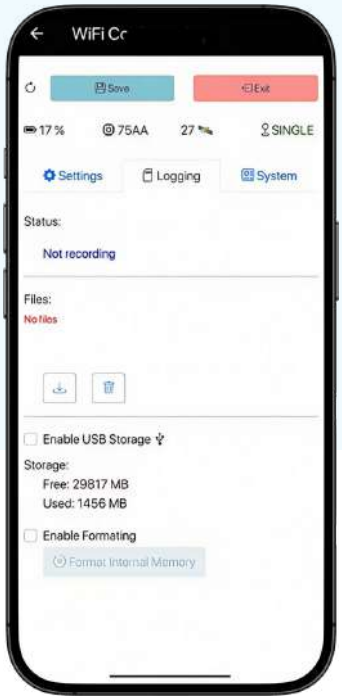
ITEM	COMPONENT	DESCRIPTION
1	SETTINGS	Selects and configures the working method (Standalone / Static, PPK, RTK LoRa, RTK NTRIP and Local NTRIP).
2	LOGGING	Allows the management of stored native data and allows the enabling of transfer via USB cable.
3	SYSTEM	GNSS system information: Number of satellites tracked, solution type. Position: Current positioning in latitude, longitude, ellipsoidal height datum WGS84. Battery: Battery level, battery voltage. Reset Factory Defaults: Factory default reset. Firmware: current firmware version, and current version of GNSS module.

Options Menu - Via WiFi





SETTINGS

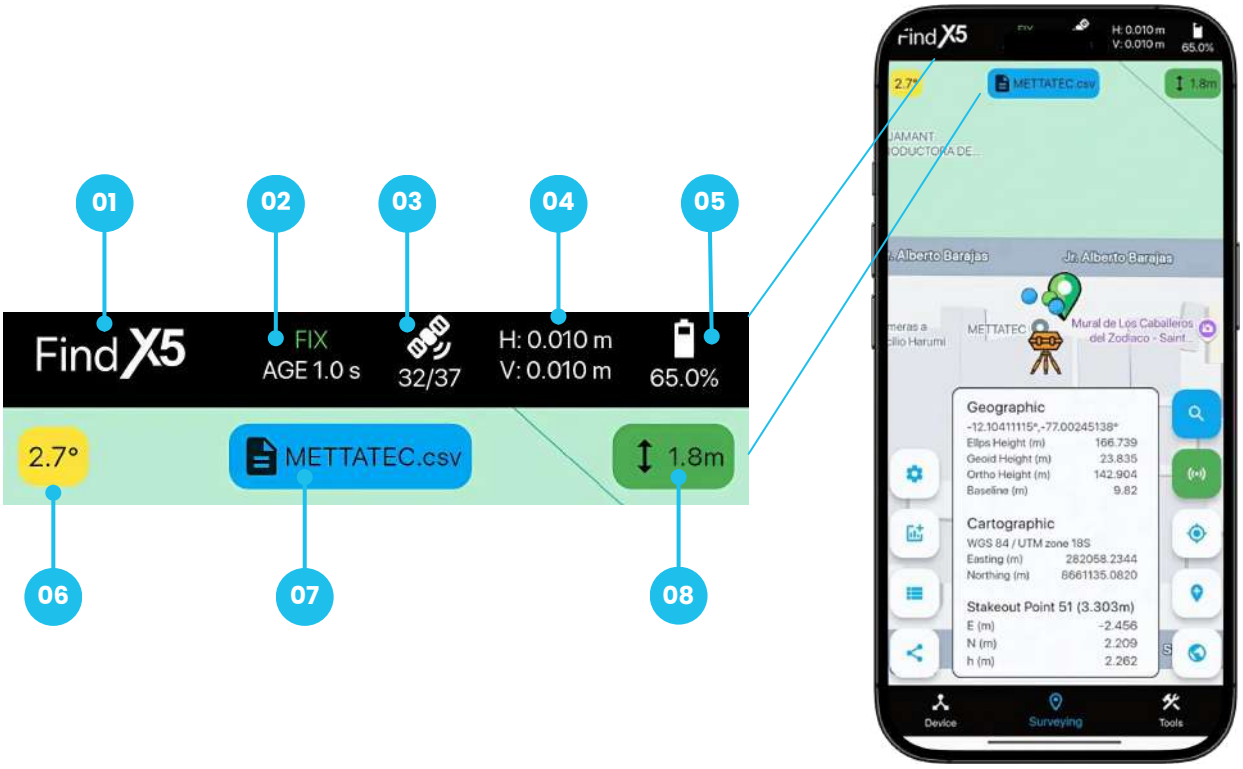


LOGGING

SYSTEM

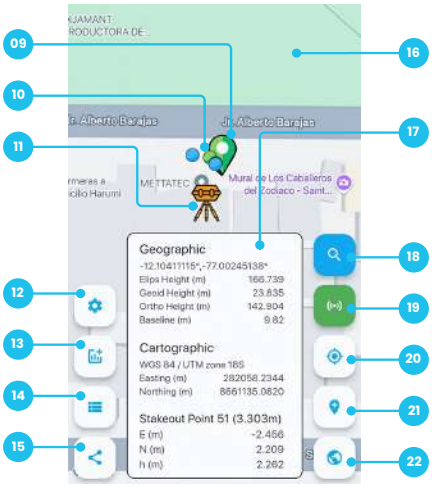
2.1.4. SURVEYING

Surveying Environment – General Information



ITEM	COMPONENT	DESCRIPTION
1	APPLICATION	FindX5 application name.
2	SOLUTION	Solution type: Fix: Good correction reception and good RMS. Floating: Regular correction reception and good RMS. DGNSS: Submetric level positioning without correction. Single: Autonomous metric level positioning without correction.
3	SATELLITES	Indicates the number of satellites used / tracked.
4	RMS	Root mean square error of the current positioning.
5	BATTERY	Current percentage of the GNSS receiver battery.
6	INCLINATION	Degrees of inclination with respect to the vertical axis.
7	PROJECT	Project name. Example METTATEC
8	ARP HEIGHT	Vertical height to the ARP.

Surveying Environment – Options Menu



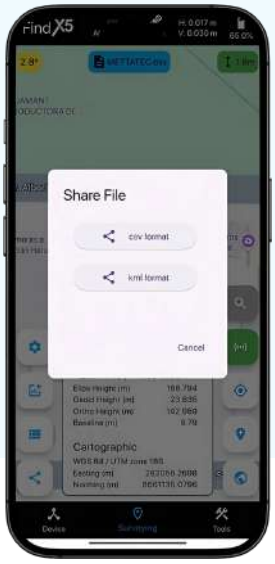
ITEM	COMPONENT	DESCRIPTION
9	LOCATION CURRENT	Refers to the current location of the rover.
10	POINT RAISED	Refers to the raised point (blue/floating, green/fixed)
11	POSITION OF BASE	Refers to the location of the correction base.
12	CONFIGURATION SURVEY	Configures pole height, age restriction, Fixed solution restriction and enables IMU. Displays antenna displacement, allows you to view and download geoid model.
13	PROJECT	Manages projects: Select, create a project. And allows the import of a project by the cloud.
14	POINT LIST AND STAKEOUT	Allows you to view the raised and/or imported points. Allows you to select the point to be staked out.
15	EXPORT	Exports project points in CSV or KML format.
16	BASE MAP	Google Vectorial Reference Map.
17	COORDINATES OF POSITION CURRENT	Shows the geodetic coordinates (Latitude, Longitude, Ellipsoidal Height, Geoidal Height and Orthometric Height), projection (East and North) of the survey, and for stakeout the displacements are added (East, North, Height)
18	MODE STAKEOUT VISUAL	Allows you to visualize the direction and distance of the stakeout of a point referred to the current location.
19	SYSTEM INERTIAL (IMU)	Allows you to activate and deactivate the IMU of the rover equipment for surveys with inclined poles.
20	ZOOM AND CENTERING OF LOCATION CURRENT	Allows an automatic zoom and centering referred to the current location. You will be able to see the raised points at the moment of recording.
21	MEASURE AND RECORD	Allows you to measure and record the current location, editing the name and description of the point.
22	SYSTEMS OF COORDINATES	Allows you to search and select a geodetic or projection coordinate system.

Options Menu - Surveying

CONFIGURATION
SURVEY

PROJECT

POINT LIST
AND STAKEOUT

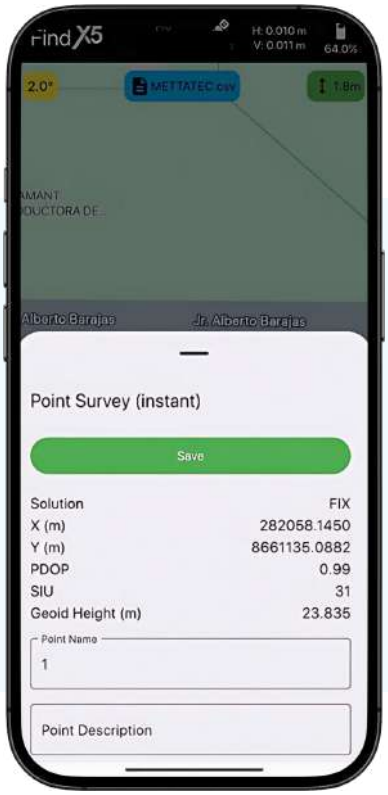


EXPORT

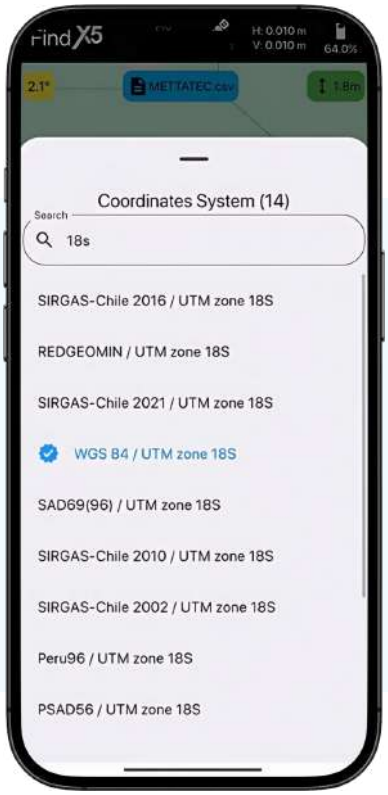
BASE MAP

VISUAL
STAKEOUT
MODE

ZOOM AND CENTER
CURRENT LOCATION

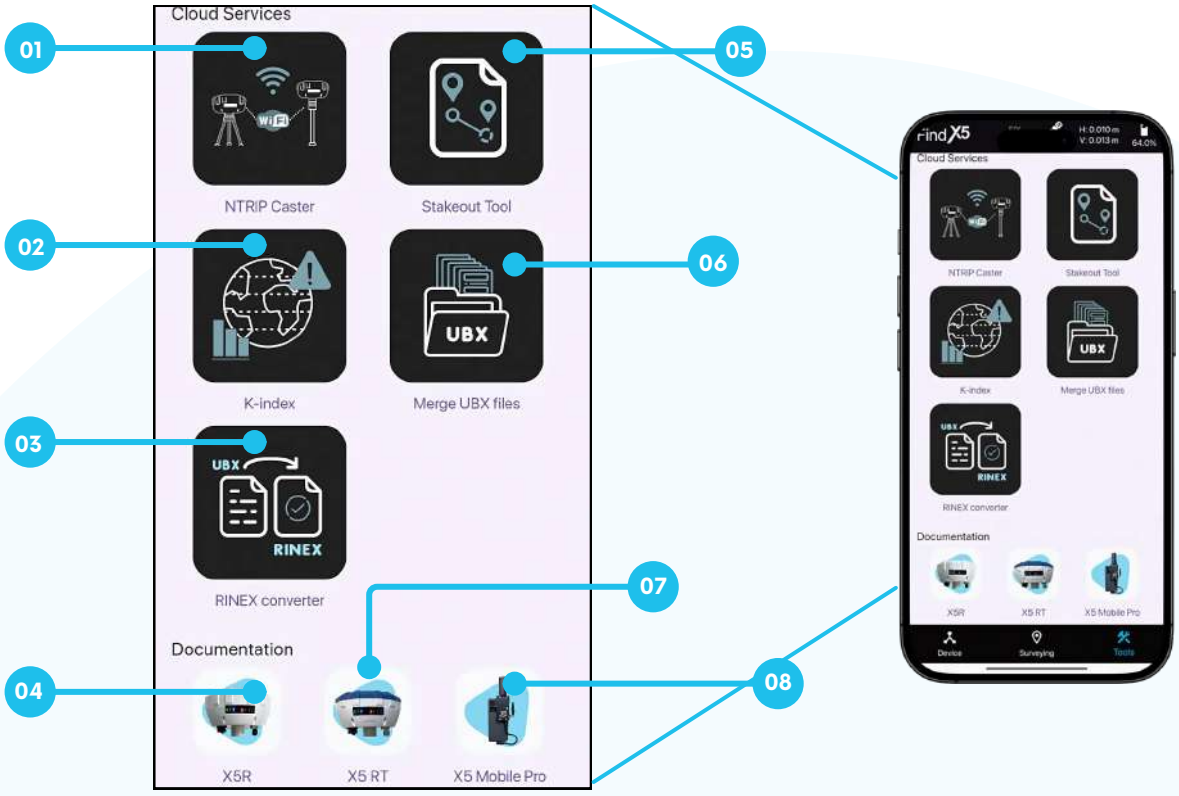


MEASURE
AND RECORD



COORDINATE
SYSTEMS

2.1.5. TOOLS



ITEM	COMPONENT	DESCRIPTION
1	NTRIP CASTER	Direct access to X5 Cloud to view NTRIP CASTER credentials.
2	K-INDEX	Direct access to X5 Cloud to verify the planetary KP index of NOAA.
3	RINEX CONVERTER	Direct access to X5 Cloud to convert to RINEX data with the APP RINEX CONVERTER.
4	X5R	Documentation and usage tutorials for the GNSS X5R receiver.
5	STAKEOUT TOOL	Direct access to X5 Cloud for importing points with the APP STAKEOUT TOOL
6	MERGE UBX FILE	Direct access to X5 Cloud to unify UBX data.
7	X5RT	Documentation and usage tutorials for the GNSS X5RT receiver.
8	X5MOBILE PRO	Documentation and usage tutorials for the GNSS X5MOBILE receiver PRO.

3. WORKING METHODS

The GNSS X5R / X5RT receivers include the following GNSS methods:

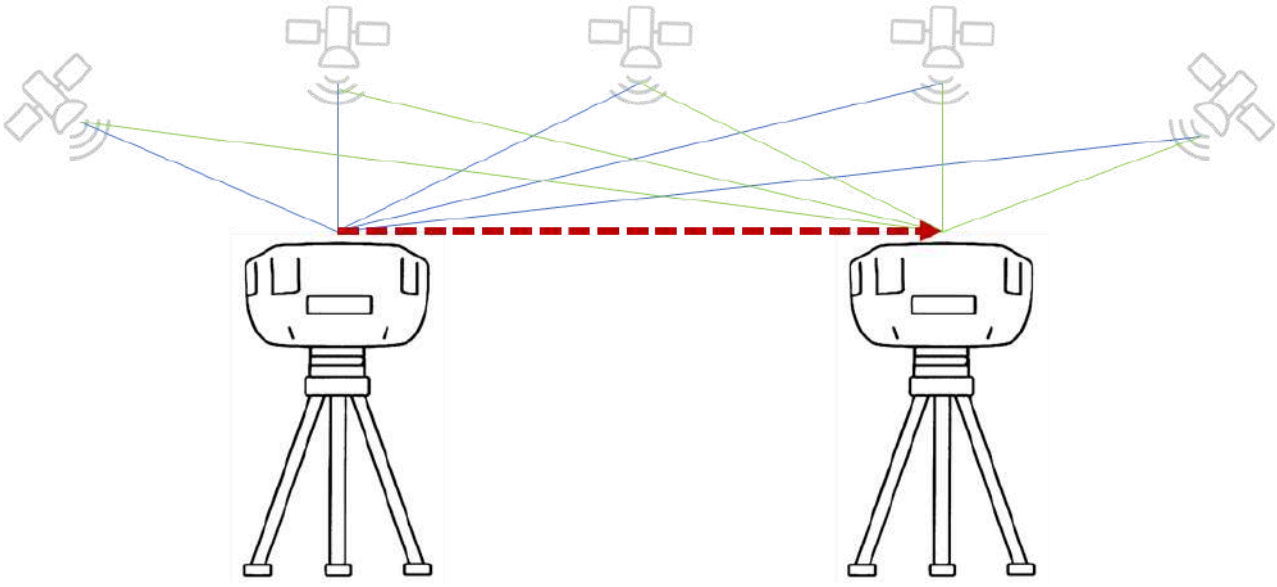
Static - Millimetric precision with post-processing)
PPK - Post-processing with native data)
RTK LoRa - Centimetric precision in real time via radio)
RTK NTRIP - Centimetric precision in real time via internet)
NTRIP Local - Corrections for drones from a local base).

3.1. STANDALONE / STATIC

Definition: High-precision (millimetric) GNSS positioning method that

uses fixed receivers for an extended period to capture carrier phase data.

- Main Applications:
- Control points for engineering and construction (certified points before IGN).
- Geodetic networks (reference frames). Auxiliary points for photogrammetry and
- LiDAR.
- Deformation monitoring (structures, land).



BASE
KNOWN POINT
GNSS RECEIVER / CORS

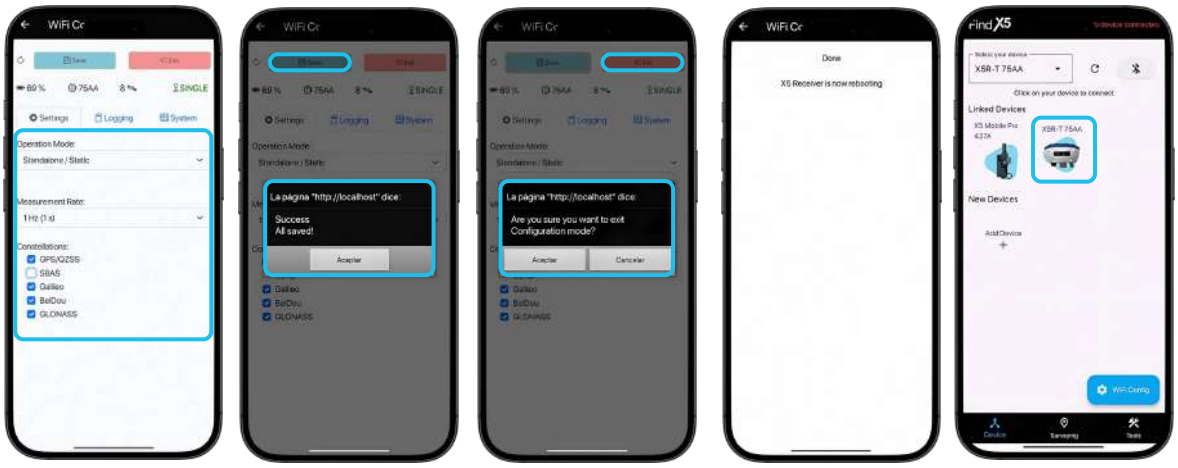
ROVER
POINT TO CALCULATE
GNSS RECEIVER

A. DATA CONFIGURATION AND RECORDING

> Enter WiFi Mode

> Select Static Method (Standalone / Static) > Select recording interval of 1Hz (1s)

> Select all constellations except SBAS > Save configuration > Exit WiFi Mode > Enter Bluetooth Mode



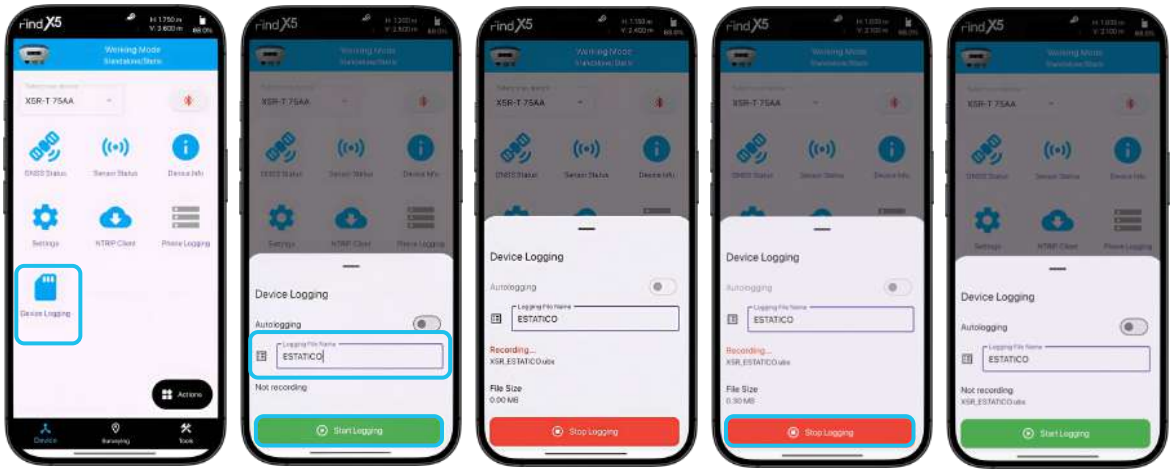
> Enter Device Logging > Indicate the Data Name

> Start Logging > Stop Logging

⚠ It is recommended to use a Data Name of 4 to 8 alphanumeric digits without special characters.

⚠ The recording time should be reflected with the weight that can be monitored in Device Logging to guarantee the storage of satellite observation.

⚠ Autologging to enable automatic recording when turning on the pre-configured GNSS receiver in Static mode.



B. DATA DOWNLOAD

GNSS receivers have 2 modes of Native Data download.

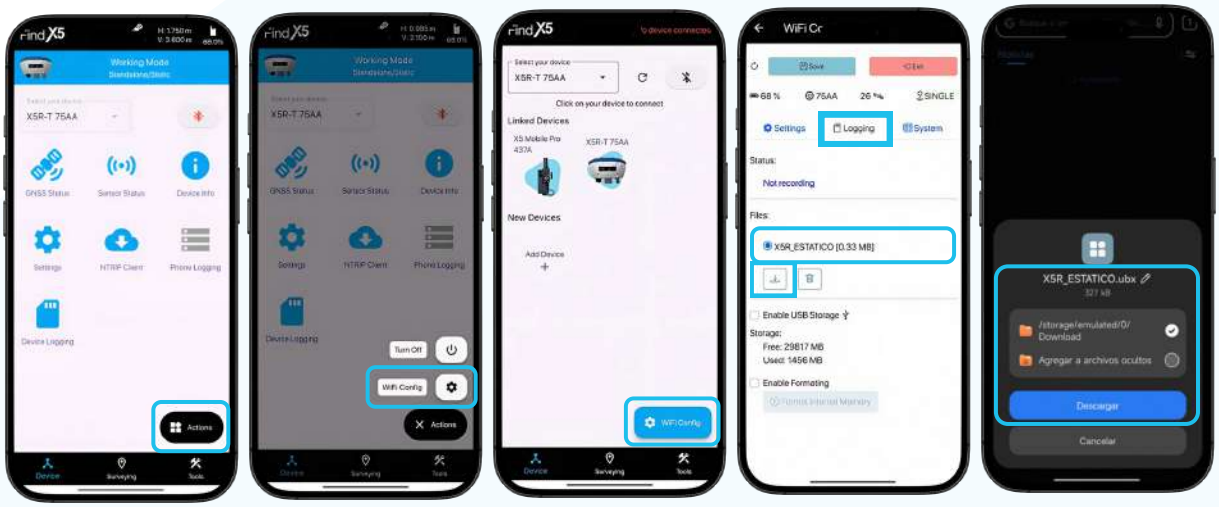
Mode 01: Download via WiFi >
Enter WiFi Mode

> Logging Option

> Select Native Data

> Select download icon

> Indicate the storage path on the user's mobile device > Press Download



Mode 02: Download via USB

> Enter WiFi Mode

> Logging Option

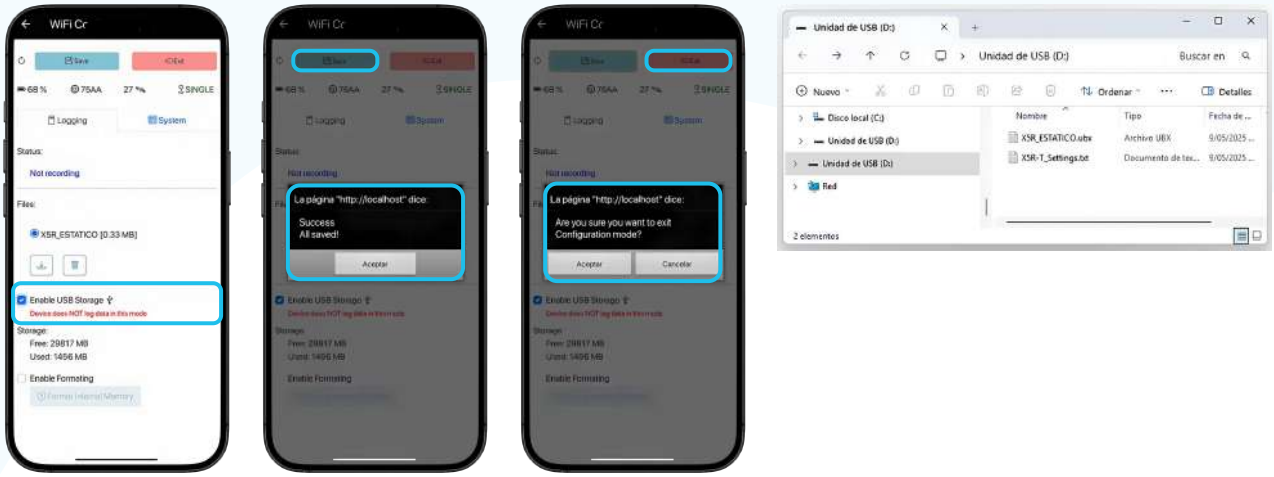
> Activate USB (Enable USB Storage)

> Save configuration (Save) > Exit WiFi Mode (Exit)

> Connect the GNSS receiver to the PC

> A window will open with the internal memory of the GNSS receiver and a copy of the Native Data can be made

Mode 02 download is recommended when the files are very large or Mode 01 does not allow the download.



3.2. PPK

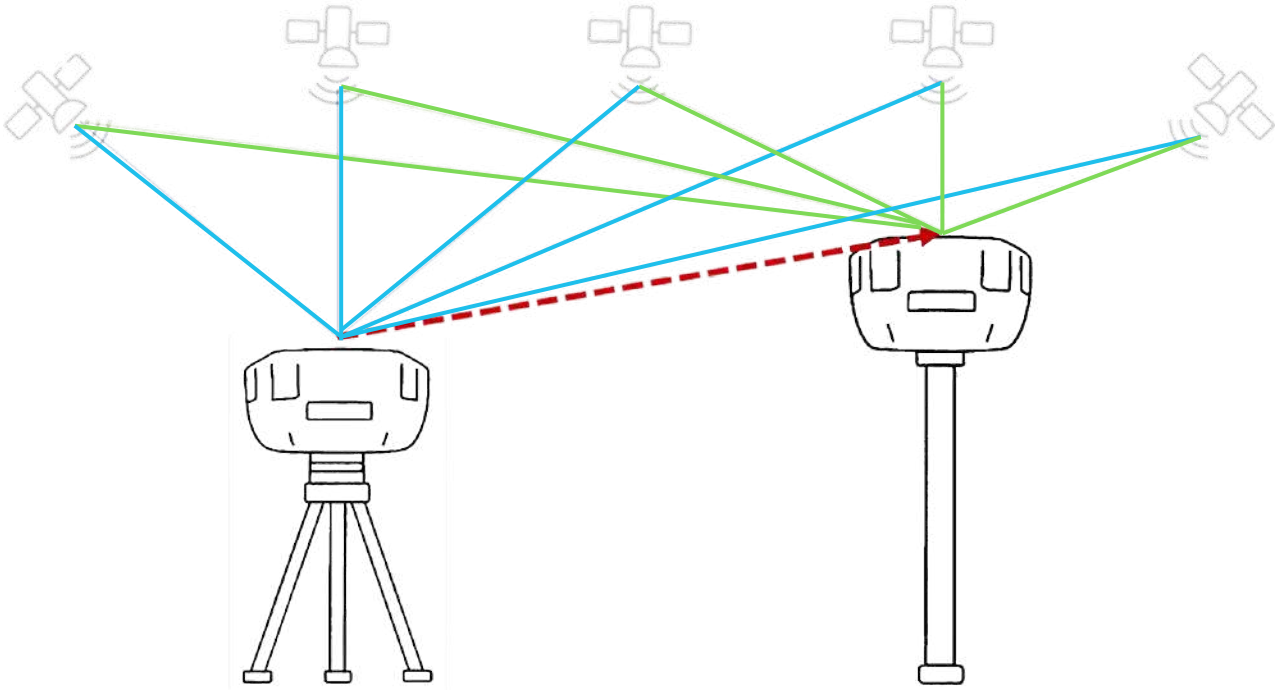
Definition: High-precision (centimetric to millimetric) GNSS positioning method that combines measurements in motion with differential correction through post-processing.

Main Features:

- Good accuracy (1-3 cm in optimal conditions) without the need for a real-time connection.
- Flexibility in the field, does not require a link with the base receiver.
- Mandatory post-processing (between the base receiver and mobile receiver)

Main Applications:

- Surveys with vehicles, drones, or moving equipment. Crop mapping
- and terrain analysis.
- Georeferencing of aerial images (Photogrammetry/LiDAR) Dynamic
- stakeout and machinery control (Construction)



BASE
KNOWN POINT
GNSS RECEIVER / CORS

ROVER
POINT TO CALCULATE
GNSS RECEIVER

3.2.1. PPK BASE

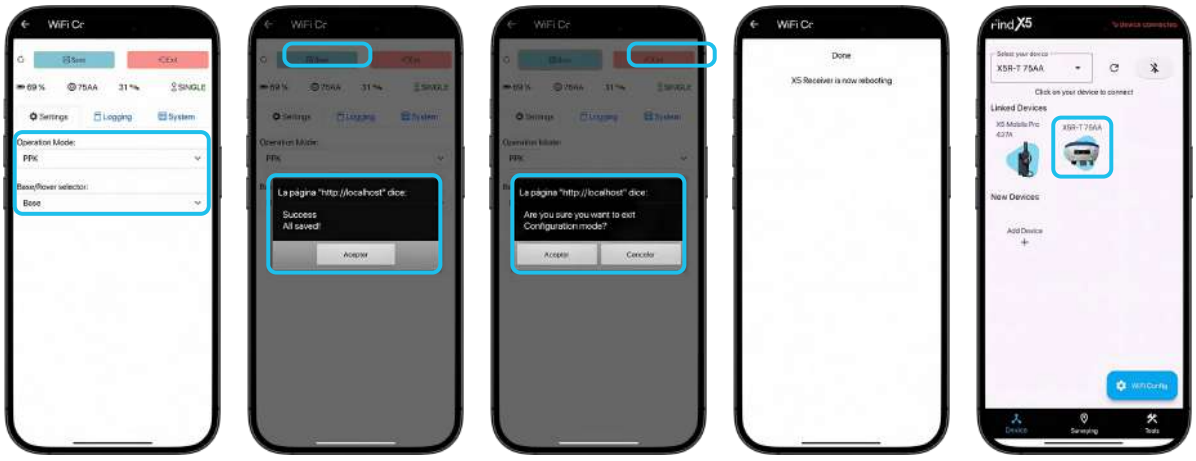
A. DATA CONFIGURATION AND RECORDING

> Enter WiFi Mode

> Select PPK Method (PPK) > Select Base (Base)

> Save configuration (Save) > Exit WiFi Mode (Exit) > Enter Bluetooth Mode

⚠ By default, the recording interval of the PPK Base is 1 second.



> Enter Device Logging

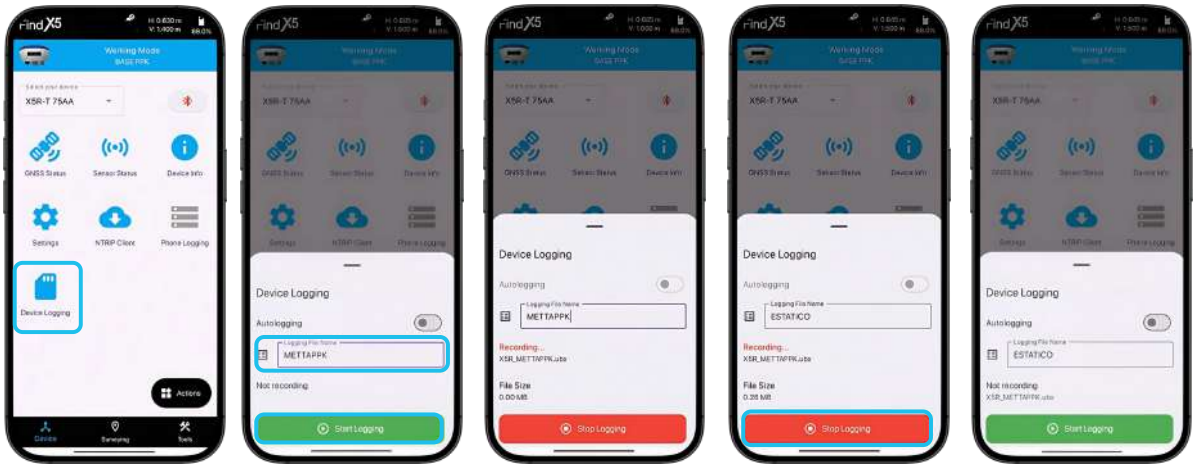
> Enter Data Name > Start Recording (Start Logging)

> Stop Recording (Stop Logging)

⚠ It is recommended to use a Data Name of 4 to 8 alphanumeric digits without special characters.

⚠ The recording time should be reflected with the weight that can be monitored in Device Logging to guarantee the storage of satellite observation.

⚠ Autologging to enable automatic recording when turning on the GNSS receiver preconfigured in Base PPK.



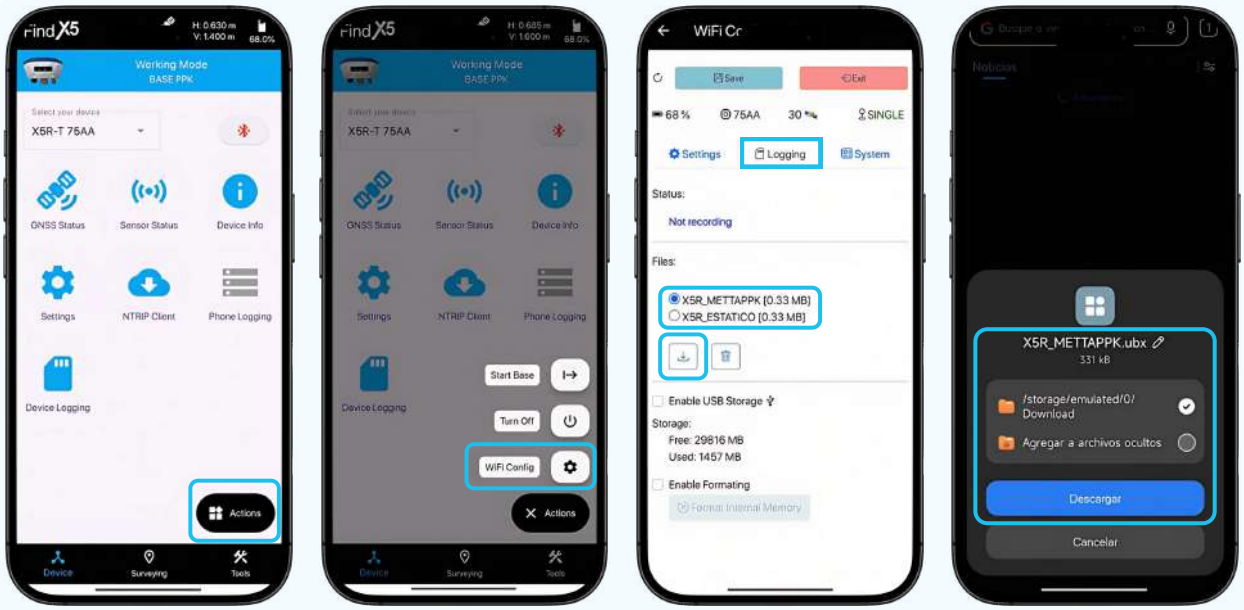
B. DATA DOWNLOAD

GNSS receivers have 2 modes of Native Data Download.

Mode 01: Download via WiFi

> Enter WiFi Mode
> Logging Option
> Select Native Data
> Select download icon

> Indicate the storage path on the user's mobile device > Press Download



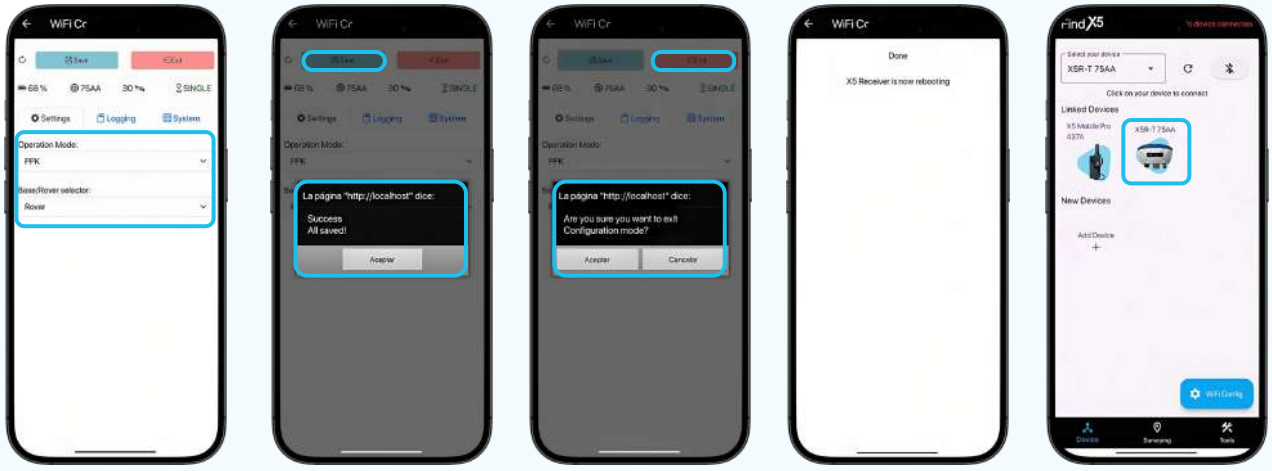
Mode 02: Download via USB (See full procedure on page 29)

3.2.2. PPK ROVER

A. CONFIGURATION AND DATA RECORDING

> Enter WiFi Mode
> Select PPK Method (PPK)
> Select Rover (Rover)
> Save configuration (Save)
> Exit WiFi Mode (Exit)
> Enter Bluetooth Mode

⚠ By default, the recording interval for the PPK Rover is 0.2 seconds.

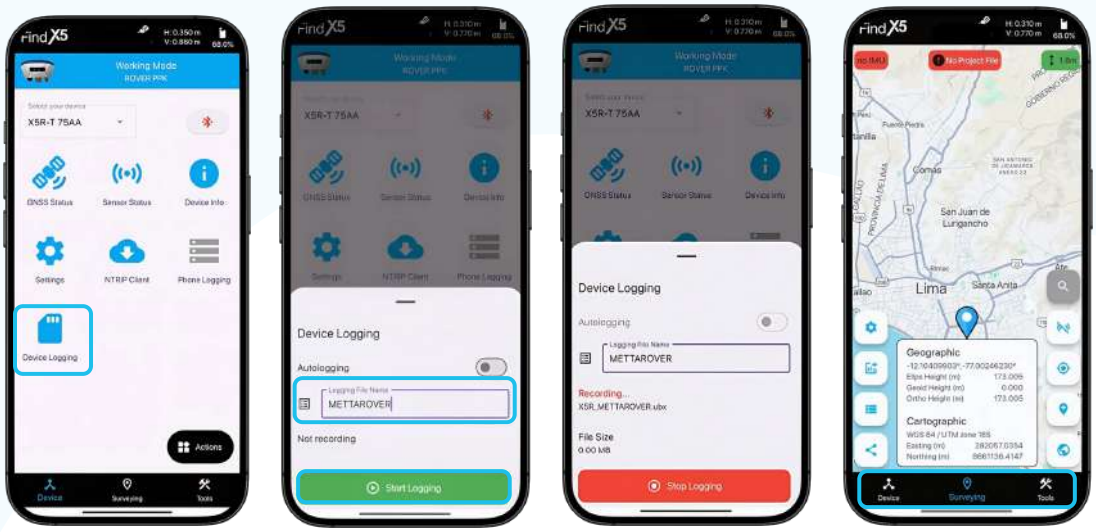


> Enter Device Logging
> Indicate the Data Name >
Start recording (Start Logging)
> Enter the Surveying environment

⚠ It is recommended to use a Data Name of 4 to 8 alphanumeric digits without special characters.

⚠ The recording time should be reflected with the weight that can be monitored in Device Logging to ensure the storage of satellite observation.

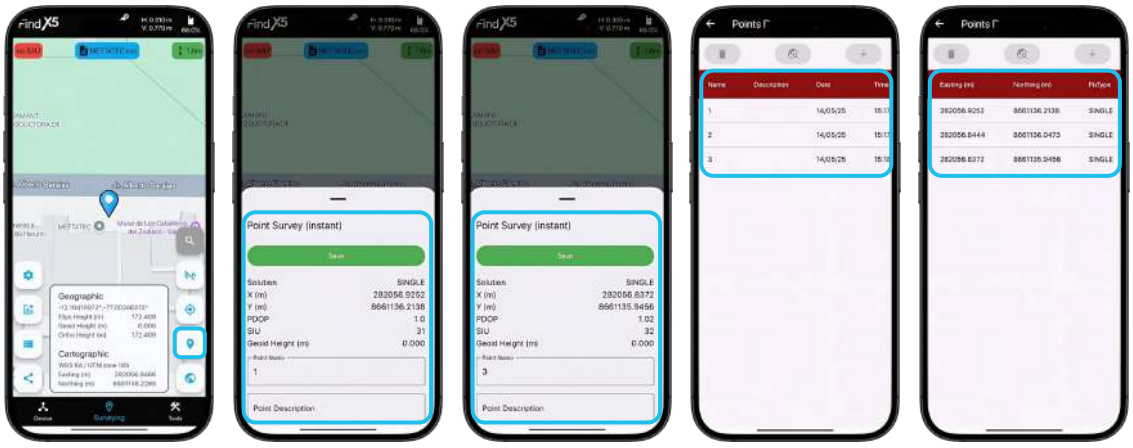
⚠ Autologging to enable automatic recording when turning on the GNSS receiver preconfigured in Rover PPK.



B. PPK SURVEY

> Position the equipment at the point for 10 to 60 seconds
> Press Measure
> Edit Point Name Point Name
> Edit Point Description > Verify collected points in Point List

⚠ It is recommended to verify the solution of the collected point in the best case up to a DNGSS solution, the number of satellites and position coordinates.



C. NATIVE DATA AND CSV DOWNLOAD

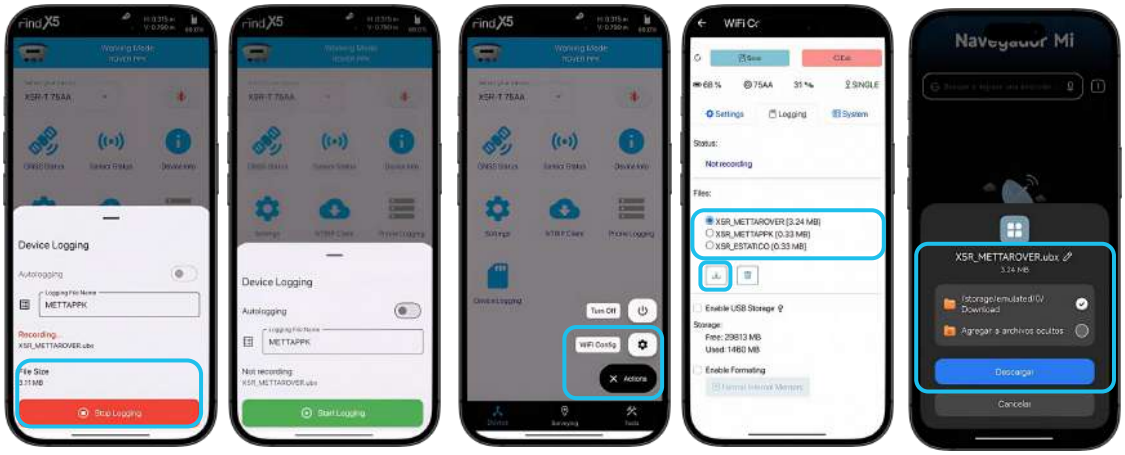
> Stop Logging

GNSS receivers have 2 modes of Native Data download.

Mode 01: Download via WiFi

> Enter WiFi Mode
> Option Logging
> Select Native Data
> Select download icon

> Indicate the storage path on the user's mobile device > Press Download



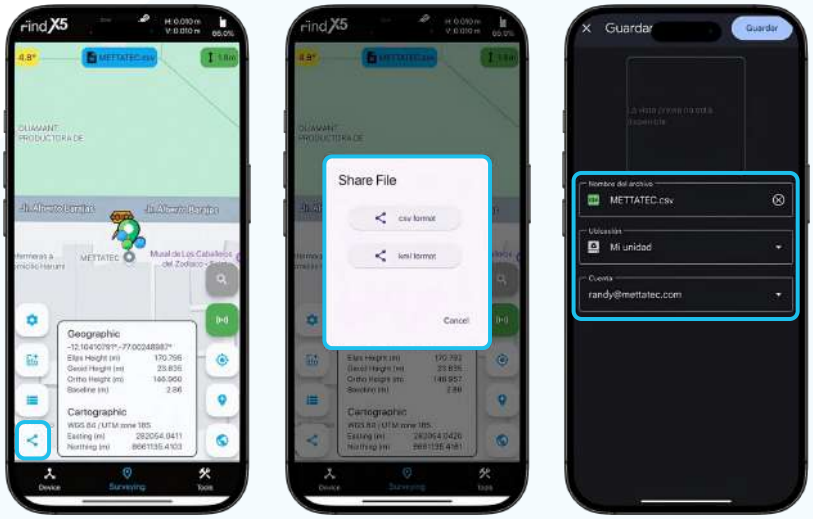
Mode 02: Download via USB

(See full procedure on page 29)

In addition to the Native Data, export the CSV generated by FindX5 for processing the data in Metta Office, necessary in PPK surveys.

> Select Export
> Indicate csv format

> Indicate the storage path on the user's mobile device > Press Download



3.3. RTK LORA

Definition:

Real-time GNSS positioning method with centimeter-level accuracy, using corrections transmitted via radio frequency (LoRa) for dynamic applications.

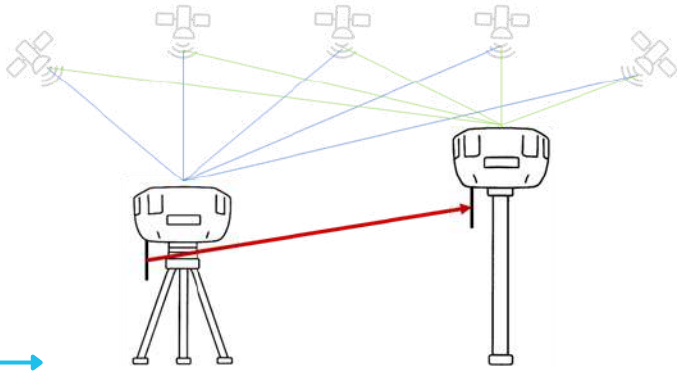
Main Features:

- Centimeter-level accuracy in real time (without post-processing).
- RTK corrections transmitted via LoRa network (long range/low consumption).
- Ideal for environments without cellular or internet coverage.

Main Applications:

- Precise surveying for photogrammetry, LiDAR, bathymetry, among
- others. Agile surveying for precision agriculture, forestry, and cadastre.
- Auxiliary points for construction and alignment of infrastructures.
- Monitoring of movements in civil works.

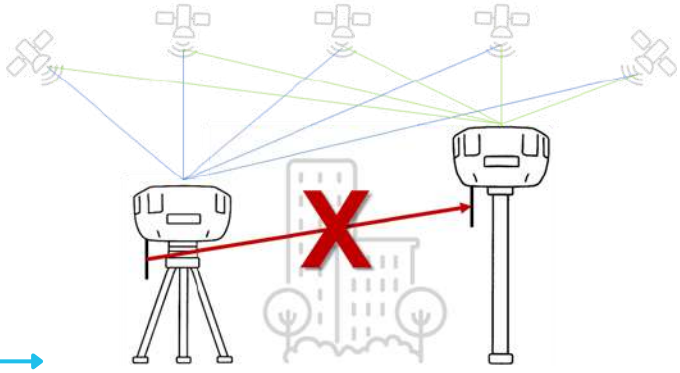
EFFECTIVE COMMUNICATION



BASE
KNOWN POINT
GNSS RECEIVER

ROVER
POINT TO BE CALCULATED
GNSS RECEIVER

DEFICIENT COMMUNICATION



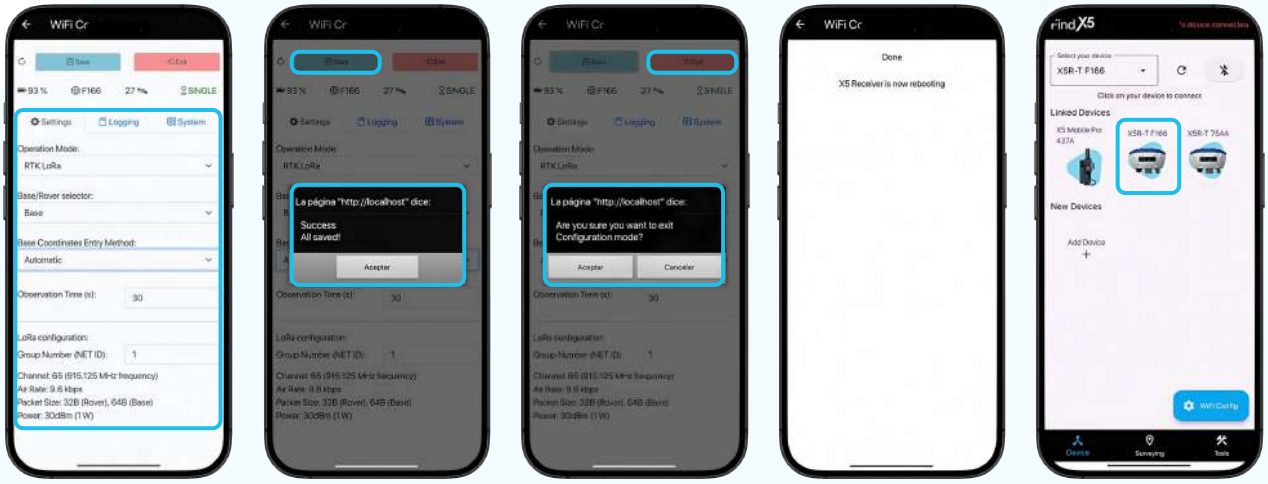
BASE
KNOWN POINT
GNSS RECEIVER

ROVER
POINT TO BE CALCULATED
GNSS RECEIVER

3.3.1. RTK LORA BASE

A. CONFIGURATION – AUTOMATIC POSITION

> Enter WiFi Mode
> Select RTK LoRa Method (RTK LoRa)
> Select Base (Base)
> Indicate automatic coordinate input mode (Automatic)
> Select 30 seconds to position the base
> Configure LoRa in group 1 > Save configuration (Save)
> Exit WiFi Mode (Exit)
> Enter Bluetooth Mode



> Enter GNSS Status
> Verify Position and DOP >
Check in Surveying the position
› Measure and Record the base position
> Enter Actions
> Start base to transfer correction data (Start Base)

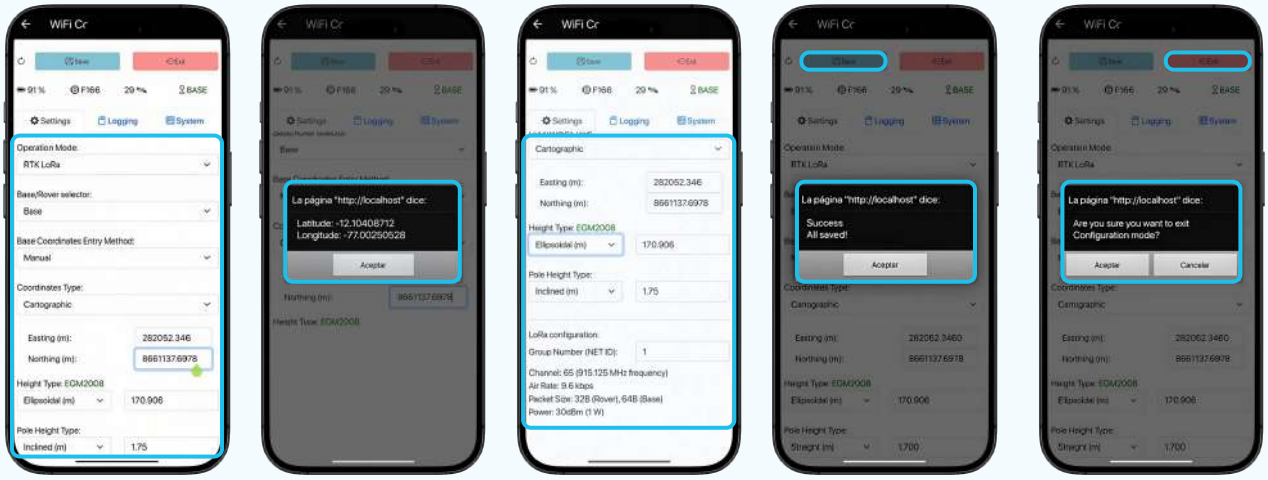
B. CONFIGURATION – MANUAL POSITION PROJECTION COORDINATES

> Enter WiFi Mode
> Select RTK LoRa Method (RTK LoRa)
> Select Base (Base)
> Indicate manual coordinate input mode (Manual)
> Select coordinate type Cartographic
> Enter Coordinates East, North and Height
> Verify the conversion to geodetic coordinates latitude and longitude decimal places
> Enter instrument height Inclined(m)
> Configure LoRa in group 1
> Save configuration (Save)
> Exit WiFi Mode (Exit)

⚠ Before manual configuration, ensure that the project in FindX5 uses the UTM coordinate system of your work zone.

⚠ It is recommended to enter the projection coordinates with 3 decimal places and verify the conversion to geodetic coordinates.

⚠ The entered height can be ellipsoidal or orthometric at the user's discretion.



> Enter Bluetooth Mode > Enter GNSS Status > Verify Position and DOP > Enter Actions
> Start base to transfer correction data (Start Base)

C. CONFIGURATION – MANUAL POSITION GEODETIC COORDINATES

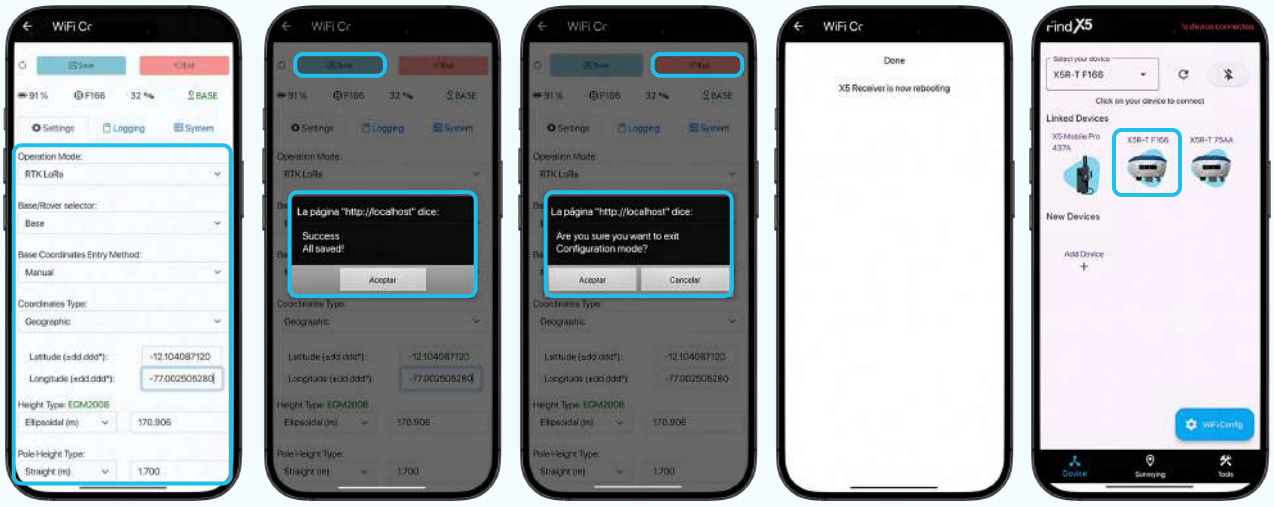
> Enter WiFi Mode

> Select RTK LoRa Method (RTK LoRa) > Select Base (Base)

> Indicate in manual coordinate input mode (Manual) > Select coordinate type Geographic > Enter Latitude, Longitude and Altitude Coordinates > Enter instrument height Inclined(m)

> Configure LoRa in group 1 > Save configuration (Save) > Exit WiFi Mode (Exit) > Enter Bluetooth Mode

⚠ The entered height can be ellipsoidal or orthometric at the user's discretion.

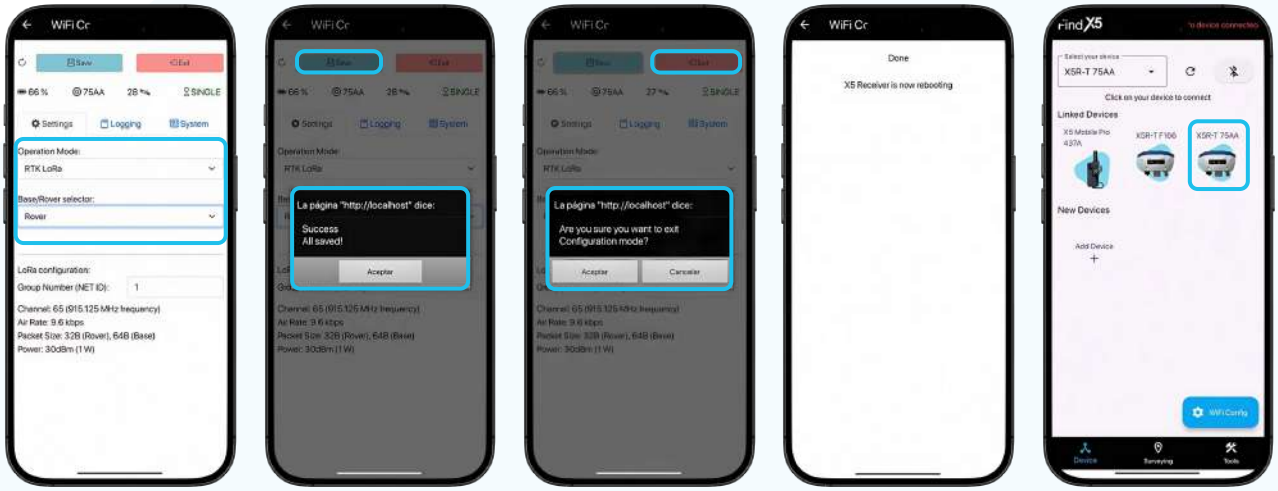


> Enter GNSS Status
> Verify Position and DOP >
Enter Actions
> Start base to transfer correction data (Start Base)

3.3.2. RTK LORA ROVER

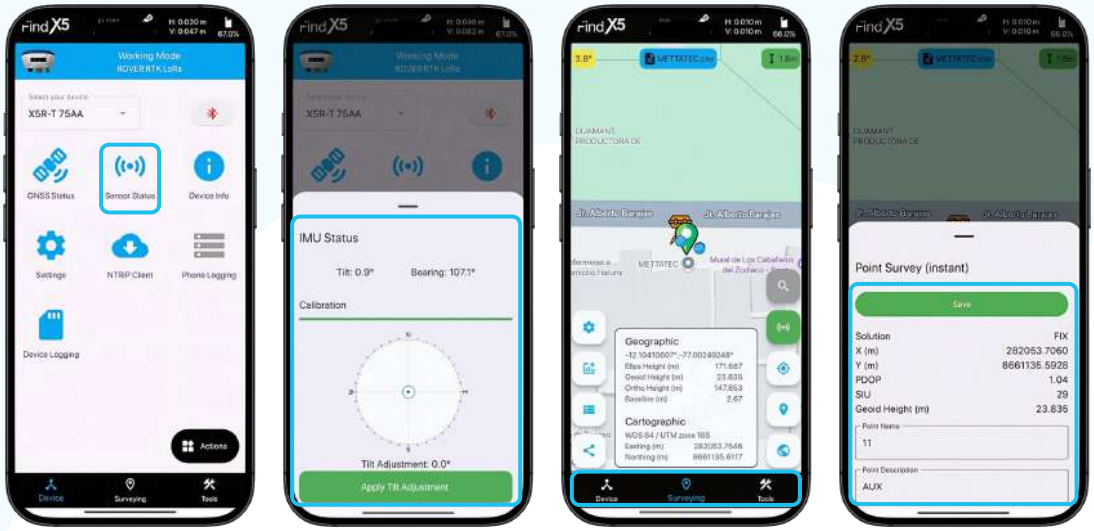
A. CONFIGURATION

> Enter WiFi Mode
> Select RTK LoRa Method (RTK LoRa)
> Select Rover (Rover)
> Configure LoRa in group 1 >
Save configuration (Save)
> Exit WiFi Mode (Exit)
> Enter Bluetooth Mode



B. RTK SURVEY

> Enter Sensor Status (Optional for X5RT)
> Calibrate the sensor IMU Apply Tilt Adjustment (Optional for X5RT)
> Enter Surveying
> Press Measure
> Edit Point Name Point Name
> Edit Point Description Point Description
> Save point Save



C. RTK STAKEOUT

> Enter Point List

> Select the point to stake out > Select the Stakeout icon

› Surveying allows you to visualize stakeout displacement

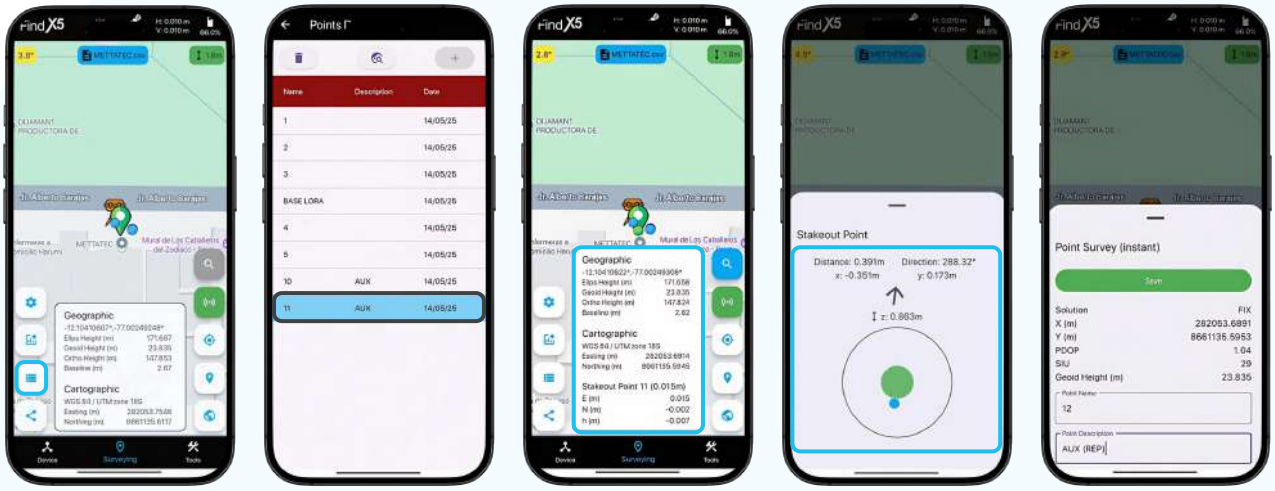
› Visual Stakeout Mode visualizes stakeout distance and direction

> Press Measure staked point

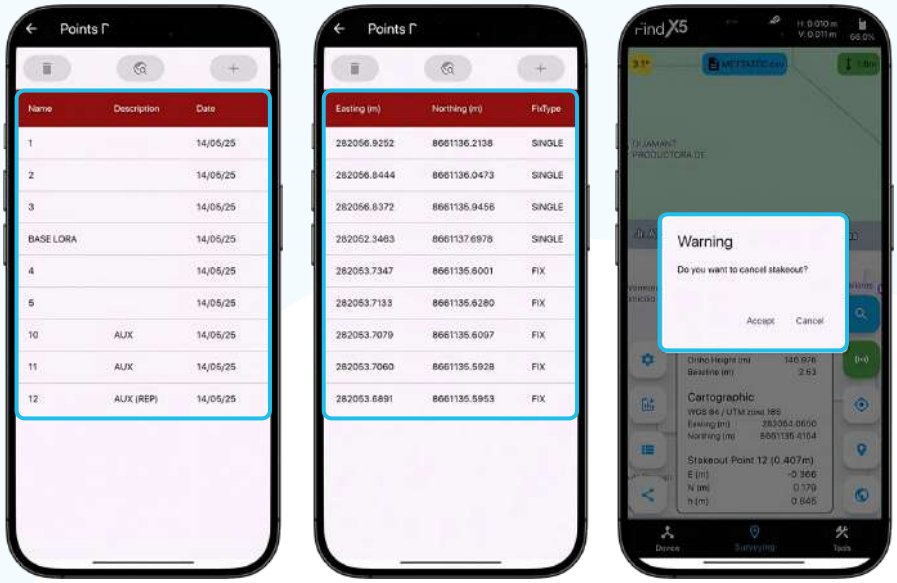
> Edit Point Name Point Name

> Edit Point Description Point Description

> Press Record staked point



> Enter Point List > Verify position and solution > Exit stakeout mode.

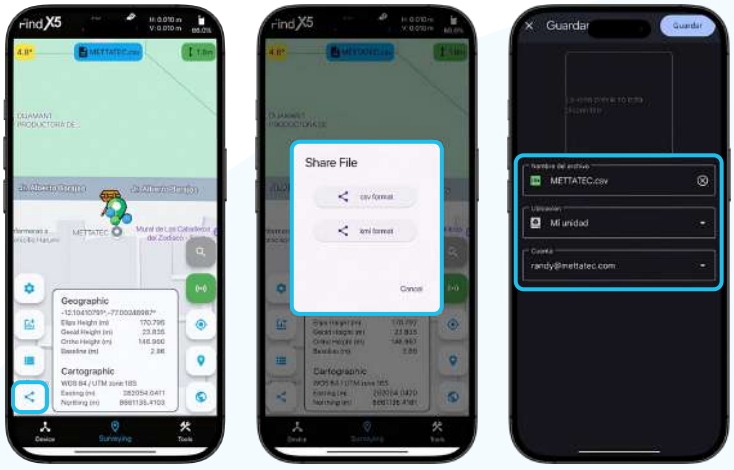


D. EXPORT CSV / KML DATA

> Select Export

> Indicate CSV Format

> Indicate the storage path on the user's mobile device > Press Download



E. IMPORT CSV DATA

The FindX5 application allows 2 modes of importing CSV data files.

Mode 01: CSV on the mobile device

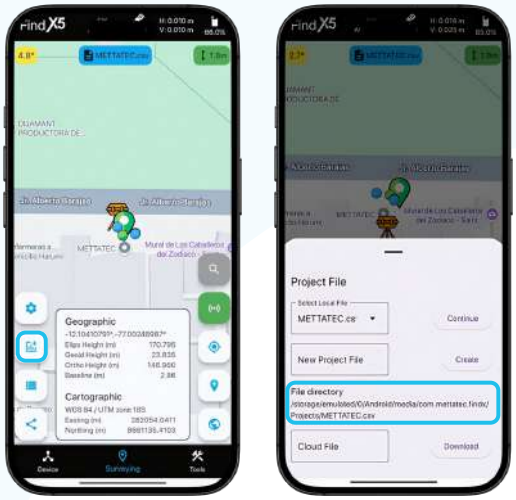
> Enter Project

> Verify project storage path > Paste CSV file with the project structure

CSV Structure with columns:

1(name), 2(description), 3(data), 4(time), 5(latitude), 6(longitude), 7(altitude), 8(easting), 9(northing), 10(fixtype), 11(PDOP), 12(SIV), 13(LatError), 14(LonError), 15(AltError), 16(GeoidAlt), 17(OrthoAlt) and 18(PoleHeight).

⚠ The required fields are 1(name), 2(description), 8(easting), 9(northing) and 17(OrthoAlt).



	A	B	C	D	E	F	G	H	I
1	name	description	date	time	latitude	longitude	altitude	easting	northing
2	1		14/05/2025	17:24.4	-12.1041008	-77.0024633	172.404	282056.925	8661136.21
3	2		14/05/2025	17:50.2	-12.1041023	-77.0024641	172.072	282056.844	8661136.05
4	3		14/05/2025	18:04.4	-12.1041033	-77.0024642	171.842	282056.837	8661135.95
5	BASE LORA		14/05/2025	36:47.0	-12.1040871	-77.0025053	170.906	282052.346	8661137.7
6	4		14/05/2025	26:55.0	-12.1041062	-77.0024927	171.661	282053.735	8661135.6
7	5		14/05/2025	27:53.0	-12.1041059	-77.0024929	171.656	282053.713	8661135.63
8	10	AUX	14/05/2025	28:19.0	-12.1041061	-77.0024929	171.664	282053.708	8661135.61
9	11	AUX	14/05/2025	28:36.6	-12.1041062	-77.0024929	171.651	282053.706	8661135.59
10	12	AUX (REP)	14/05/2025	28:54.6	-12.1041062	-77.0024931	171.656	282053.689	8661135.6
11	50	NTRIP AUX	14/05/2025	40:35.4	-12.104091	-77.0024738	169.015	282055.775	8661137.3
12	51	NTRIP AUX (I	14/05/2025	41:00.0	-12.104091	-77.0024738	169.001	282055.779	8661137.29

J	K	L	M	N	O	P	Q	R
fixtype	PDOP	SIV	LatError	LonError	AltError	GeoidAlt	OrthoAlt	PoleHeight
SINGLE	1	31	0.33	0.29	0.77	0	172.404	1.8
SINGLE	1.01	30	0.33	0.29	0.77	0	172.072	1.8
SINGLE	1.02	32	0.33	0.29	0.77	0	171.842	1.8
SINGLE	99.99	29	0.56	0.56	0.56	0	170.906	1.8
FIX	1.04	29	0.01	0.01	0.01	23.835	147.826	1.8
FIX	1.04	28	0.01	0.01	0.01	23.835	147.821	1.8
FIX	0.97	28	0.01	0.01	0.01	23.835	147.83	1.8
FIX	1.04	29	0.01	0.01	0.01	23.835	147.816	1.8
FIX	1.04	29	0.01	0.01	0.01	23.835	147.822	1.8
FIX	0.98	31	0.01	0.01	0.01	23.835	145.18	1.8
FIX	1	31	0.01	0.01	0.012	23.835	145.166	1.8

Mode 02: CSV in the cloud

> Enter X5 CLOUD https://cloud.mettatec.com/

> Select FindX5 Stakeout

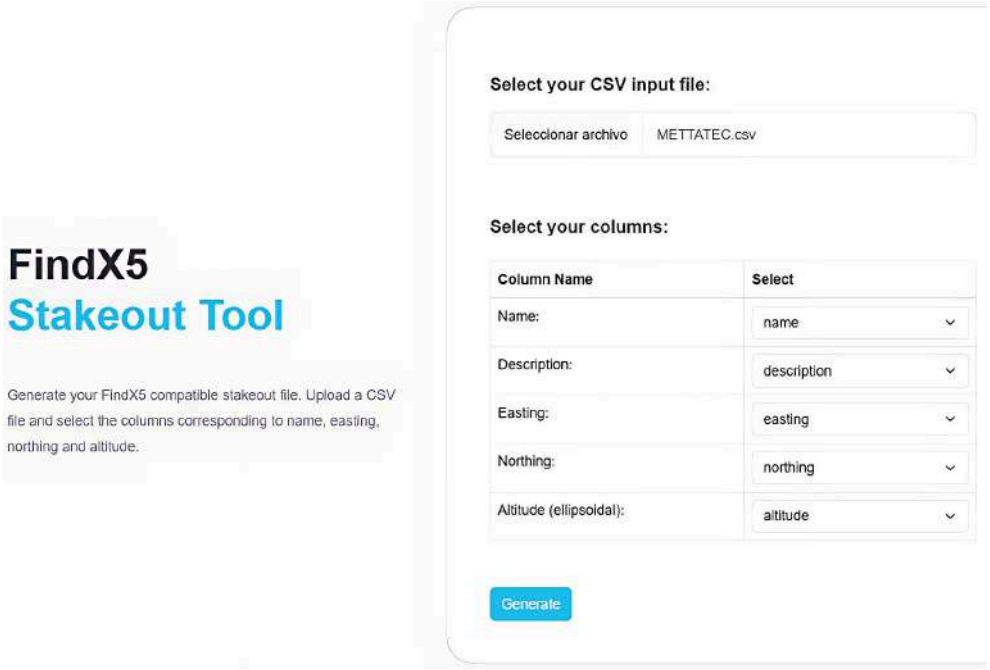
> Upload CSV file

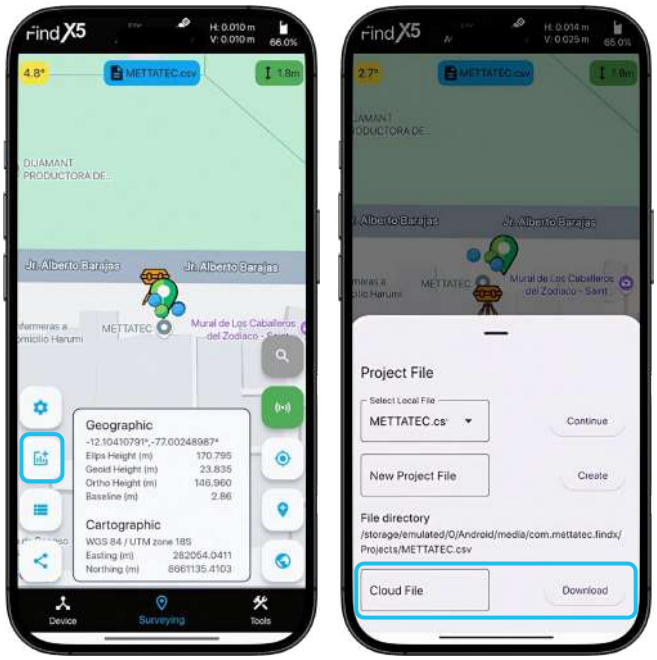
> Correlate CSV data columns > Generate import code in Generate

> Enter Project

> Indicate import code Cloud File

> Import points Download





3.4. RTK NTRIP

Definition:

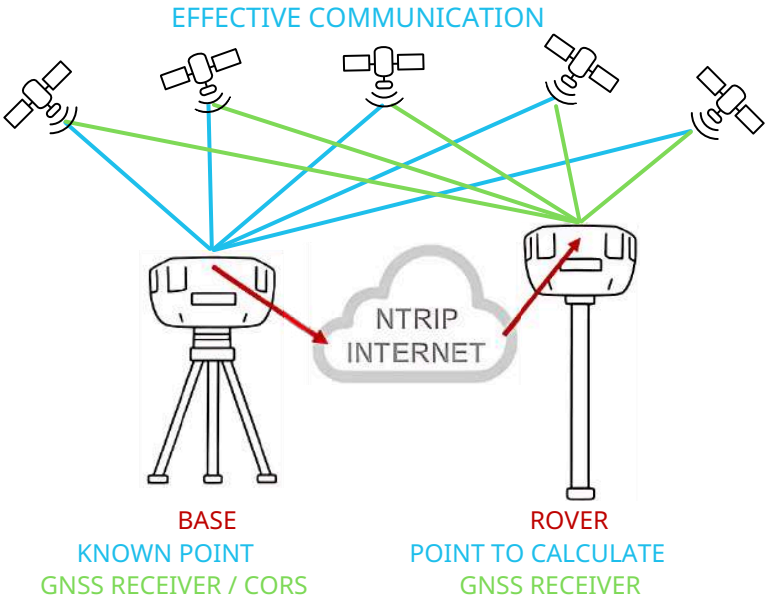
GNSS real-time positioning method with centimeter accuracy, which uses corrections transmitted via the internet (NTRIP protocol) from a reference station or CORS network.

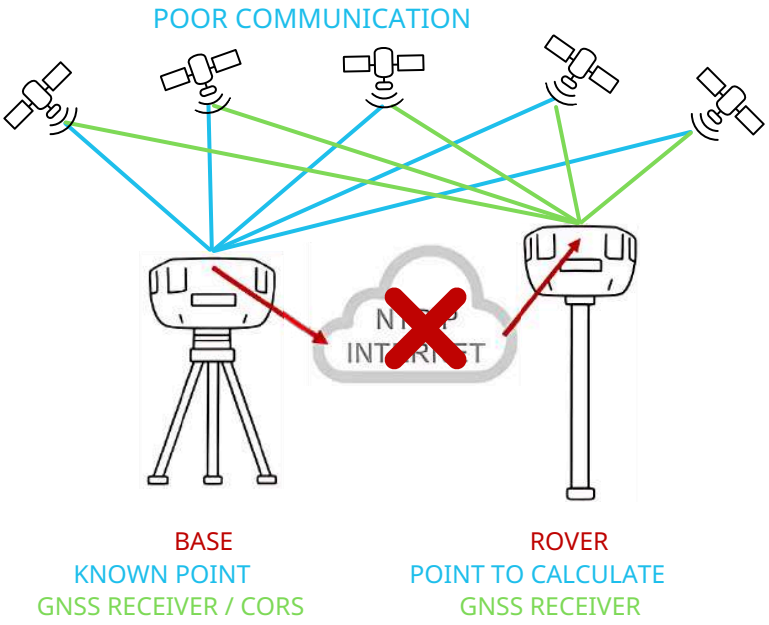
Main Features:

- Centimeter accuracy in real time (without post-processing). Internet
- connection required (mobile or WiFi). Eliminates the need for a local
- physical base.

Main Applications:

- Precise surveying for photogrammetry, LiDAR, bathymetry, among others. Agile
- surveying for precision agriculture, forestry and cadastre. Auxiliary points for
- construction and alignment of infrastructures. Monitoring of movements in civil
- works.





3.4.1. RTK NTRIP BASE

A. CONFIGURATION – AUTOMATIC POSITION

> Enter WiFi Mode

> Select RTK NTRIP Method (RTK NTRIP)

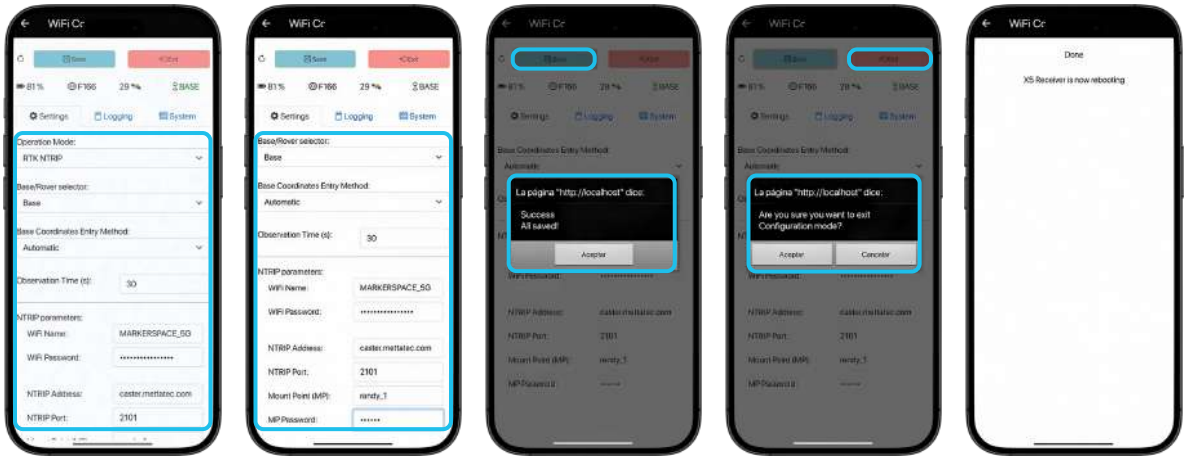
> Select Base (Base)

> Indicate the coordinate entry mode as automatic (Automatic)

> Indicate the NTRIP parameters for the base > Save configuration (Save)

> Exit WiFi Mode (Exit)

> Enter Bluetooth Mode



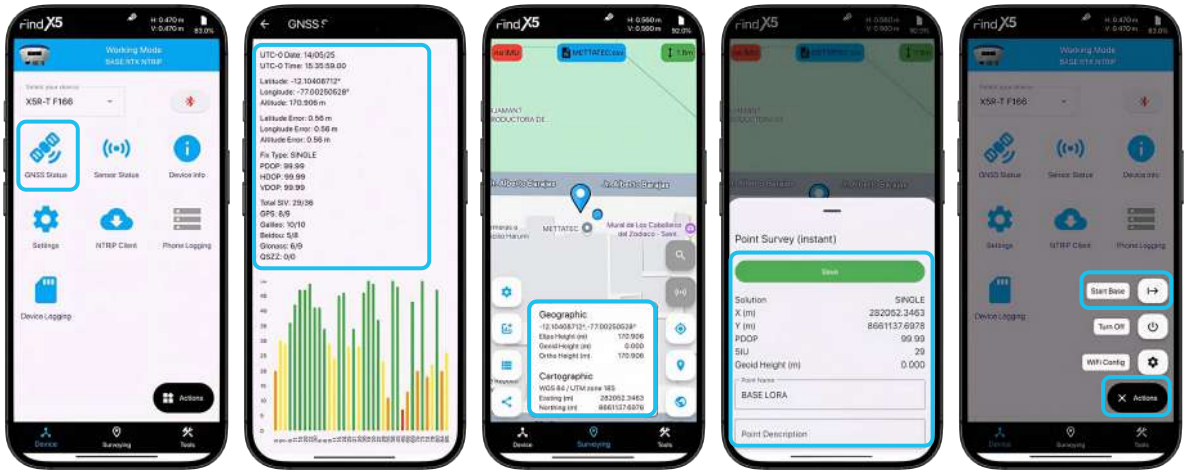
> Enter GNSS Status

> Verify Position and DOP > Check in Surveying the position

› Measure and Record the base position

> Enter Actions

> Start base to transfer correction data (Start Base)



B. CONFIGURATION – MANUAL POSITION PROJECTION COORDINATES

(See full procedure on page 38)

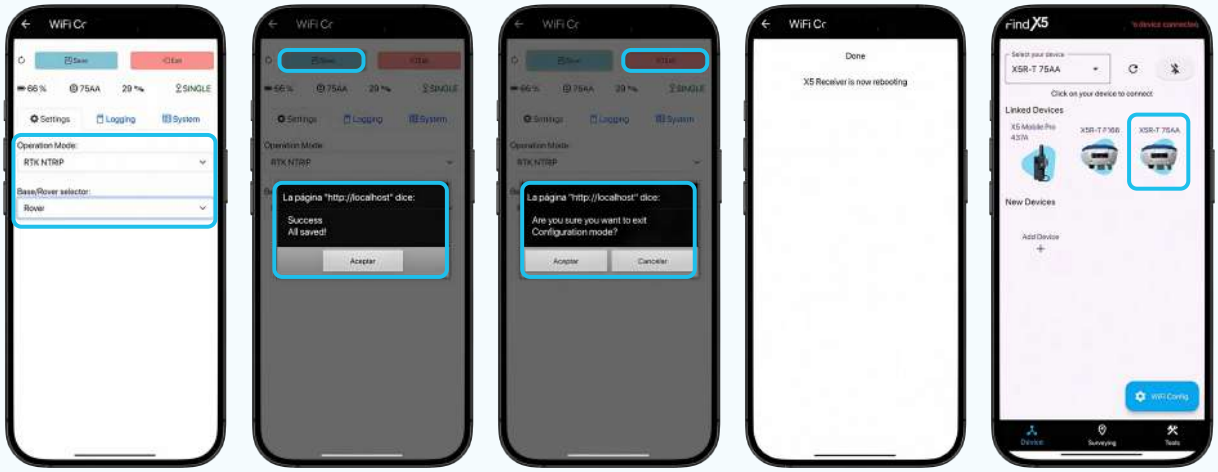
C. CONFIGURATION – MANUAL POSITION GEODETIC COORDINATES

(See full procedure on page 39)

3.4.2. RTK NTRIP ROVER

A. CONFIGURATION

> Enter WiFi Mode
> Select RTK NTRIP Method (RTK NTRIP)
> Select Rover (Rover)
> Save configuration (Save)
> Exit WiFi Mode (Exit)
> Enter Bluetooth Mode



> Enter GNSS Status
> Verify Position and Solution > Enter NTRIP Client
> Enter NTRIP Credentials > Start NTRIP connection (Connect)
> Verify NTRIP data reception with Packets

B. RTK SURVEY

> Enter Sensor Status (Optional for X5RT)

> Calibrate the IMU sensor Apply Tilt Adjustment (Optional for X5RT)

> Enter Surveying

> Press Zoom > Press Measure

> Edit Point Name Point Name

> Edit Point Description Point Description

> Save point Save

C. RTK STAKEOUT

> Enter Point List

> Select the point to stake out > Select the Stakeout icon

› Surveying allows you to visualize stakeout displacement

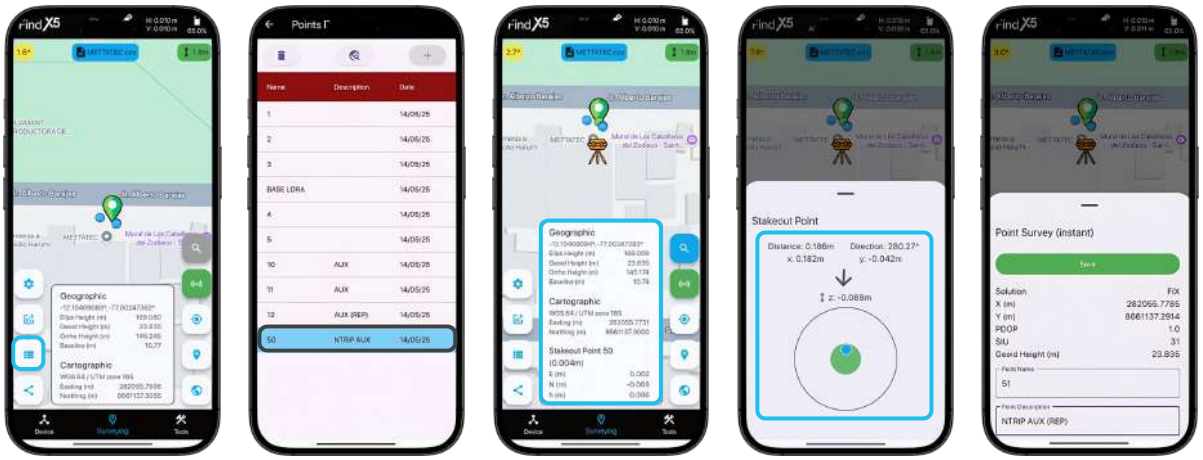
› Visual Stakeout Mode visualizes stakeout distance and direction

> Press Measure staked point

> Edit Point Name Point Name

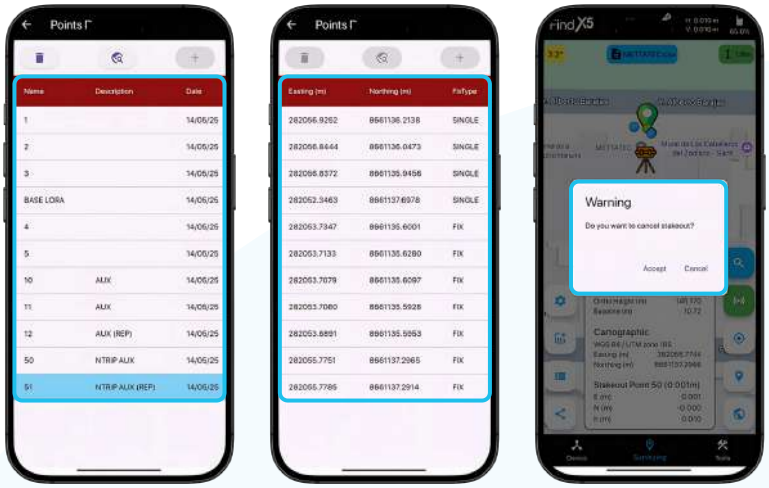
> Edit Point Description Point Description

> Press Save staked point



> Enter Point List

> Verify position and solution >
Exit stakeout mode.

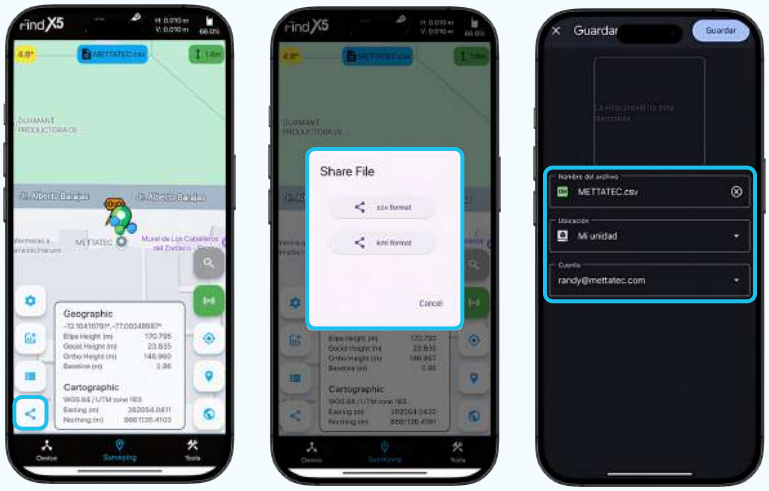


D. CSV / KML DATA DOWNLOAD

> Select Export

> Indicate csv format

> Indicate the storage path on the user's mobile device > Press Download



E. IMPORT CSV DATA

The MettaGO application allows 2 ways to Import Data CSV files.

Mode 01: CSV on the mobile device (See full procedure page 42)

Mode 02: CSV in the cloud
(See full procedure page 43)

3.5. LOCAL NTRIP

Definition:

GNSS positioning method that uses the GNSS receiver as a local base to transmit RTK corrections via NTRIP protocol, achieving centimeter-level accuracy in real time for drones.

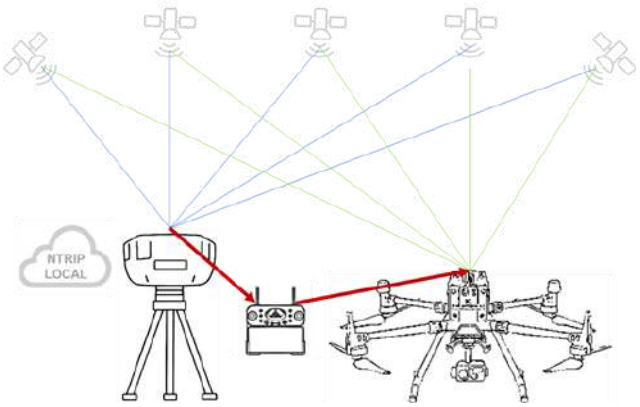
Main Features:

- Centimeter-level accuracy 1-3 cm in real time in flight (no post-processing). Does not
- depend on the internet or CORS networks (ideal for remote areas).

Main Applications:

- Photogrammetry with drones and direct georeferencing of images. LiDAR
- surveys with precision in point clouds.
- Precision agriculture in spraying or automated sowing.
- Inspection of infrastructures such as power towers, bridges, among others.

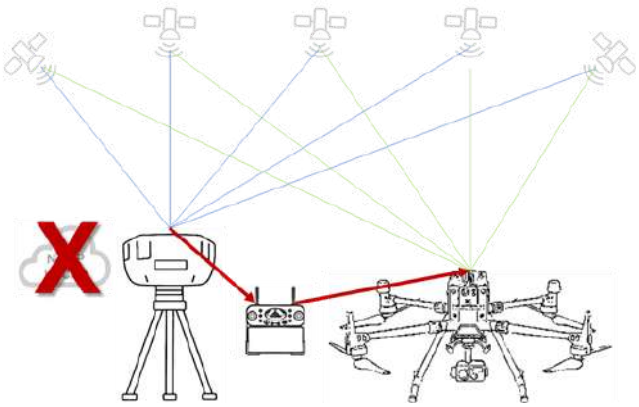
EFFECTIVE COMMUNICATION



BASE
KNOWN POINT
GNSS RECEIVER

ROVER
POINT TO CALCULATE
RTK AIRCRAFT

POOR COMMUNICATION



BASE
KNOWN POINT
GNSS RECEIVER

ROVER
POINT TO CALCULATE
RTK AIRCRAFT

3.5.1. LOCAL NTRIP BASE

A. CONFIGURATION – AUTOMATIC POSITION

> Enter WiFi Mode

> Select Local NTRIP Method (Local NTRIP)

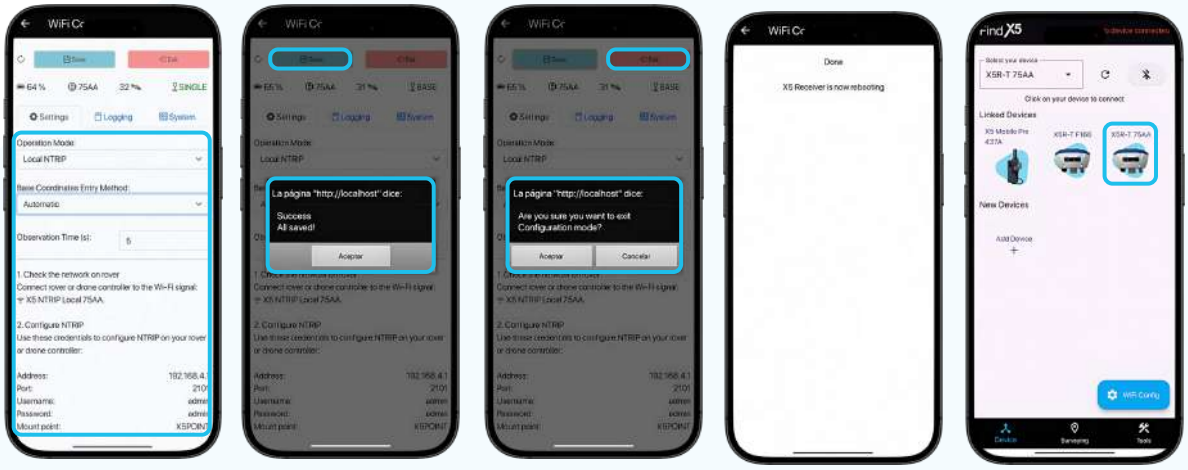
> Indicate automatic coordinate input mode (Automatic)

> Select 30 seconds to position the base

> Verify and record the NTRIP credentials for the drone > Save configuration (Save)

> Exit WiFi Mode (Exit)

> Enter Bluetooth Mode



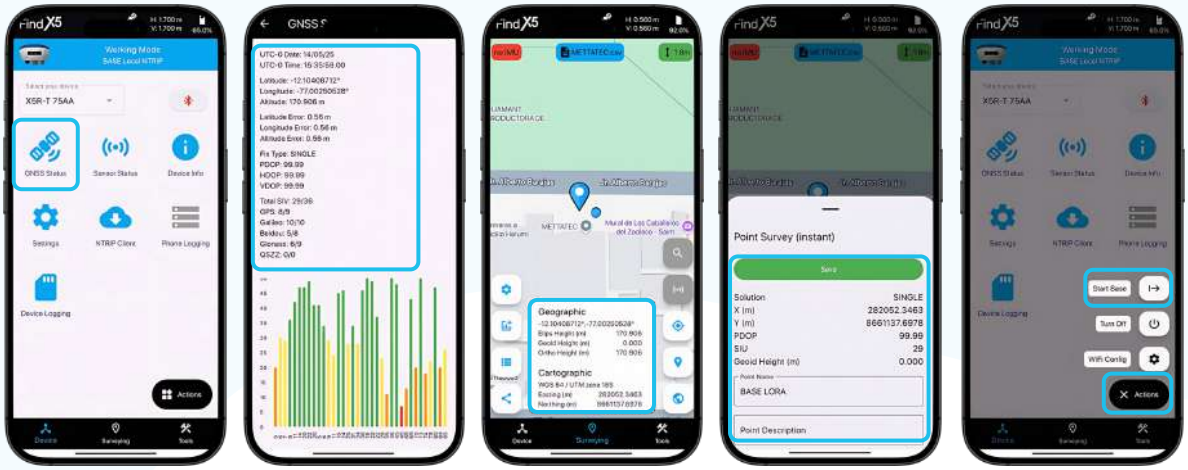
> Enter GNSS Status

> Verify Position and DOP > Check in Surveying the position

> Measure and Record the base position

> Enter Actions

> Start base to transfer correction data (Start Base)



B. CONFIGURATION – MANUAL POSITION PROJECTED COORDINATES

(See full procedure page 38)

C. CONFIGURATION – MANUAL POSITION GEODETIC COORDINATES (See full procedure page 39)

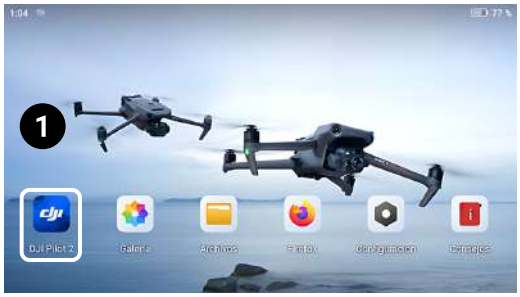
3.5.2. LOCAL NTRIP AIRCRAFT

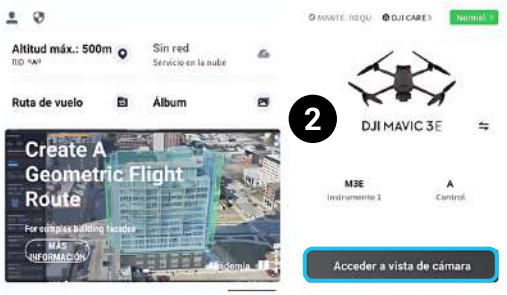
A. DJI AIRCRAFT CONFIGURATION WITH RTK MODULE

> Enter the DJI Pilot 2 application or other similar applications

> Access camera view

> Exit pre-flight check > Verify the number of satellites tracked.

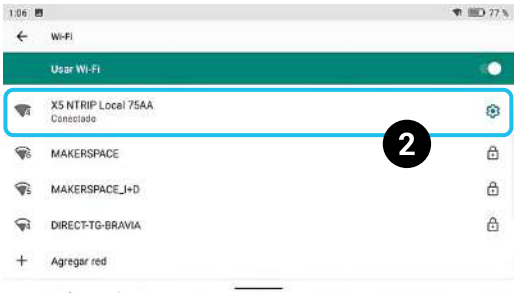




> Connect via WiFi on the aircraft remote control > Select the GNSS X5R / X5RT receiver X5 NTRIP Local + MAC

> Return to the DJI Pilot 2 application

> Enter general settings



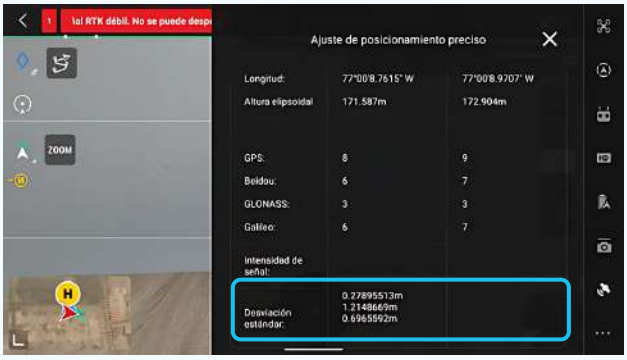
> Enter RTK configuration

› Enable RTK Positioning and Maintain positioning accuracy mode

> Select RTK service type in Custom Network RTK

> Select Name and enter Local NTRIP credentials

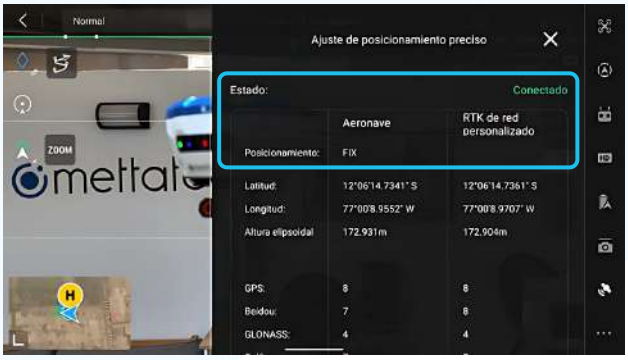
> Verify connection with Floating or Fixed solution and Standard deviation in decimeters or centimeters.

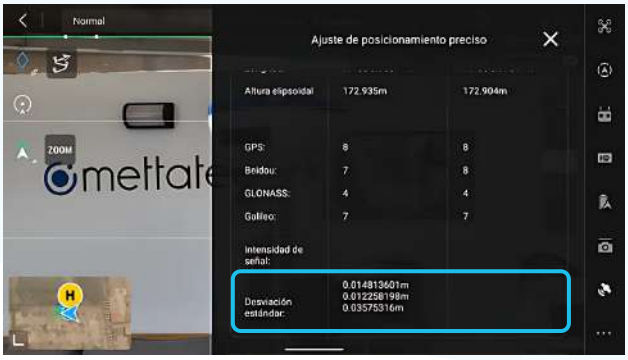


> Successful and accurate connection is verified with Connected Status

> FIX Positioning

> Standard deviation of 1-2 centimeters





4. GENERAL OPERATIONS

4.1. FIRMWARE UPDATE

The firmware of the GNSS X5R / X5RT receiver is the internal program that controls the operations and hardware of the receiver. You can update the firmware of the GNSS receiver using the X5Updater.exe software.

Download X5Updater.exe software.

⚠ If this is the first time you connect the X5 receiver to your computer, it is necessary to install the respective driver.

Download CH34x_Install_Windows.exe driver.

Download X5R.bin firmware.

⚠ We recommend installing the latest version of firmware available, as well as using the software and driver in their latest version available in the downloads.

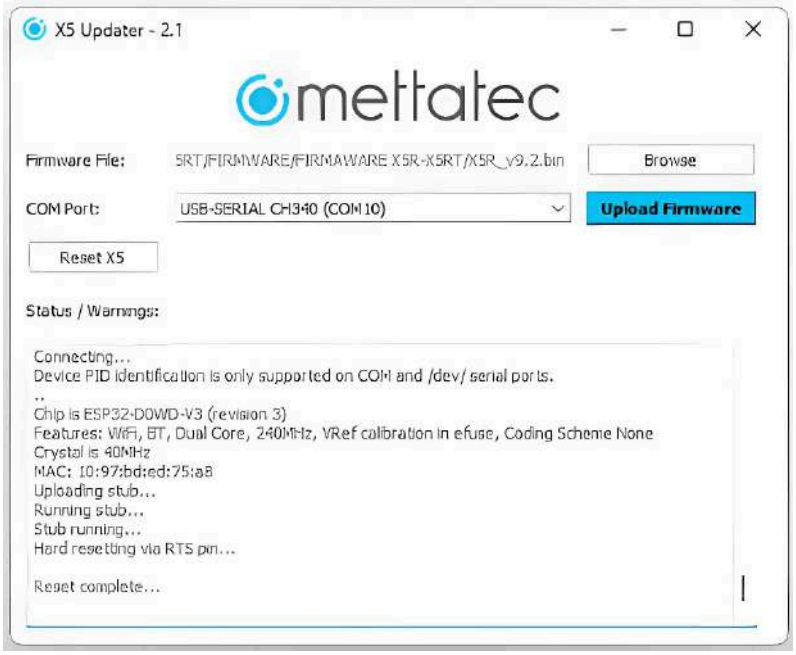
> Connect the X5R / X5RT to your computer

> Open the application "X5Updater"

> Load the firmware file (*.bin) of the version you want to update > Select the COM port where the X5 module is connected "USB-SERIAL CH340"

> Press the "Upload Firmware" button

> The X5 receiver will start the firmware update process.



Video: X5 Firmware Update

mettatec

X5R - X5RT
GNSS RECEIVER

USER MANUAL

Version 2
Revision RMV
July 2025