STONEX

Stonex Cube-a
Field software
User Manual

(May 2021) - Ver. 5.1.2

www.stonex.it

Contents

1. Software introduction

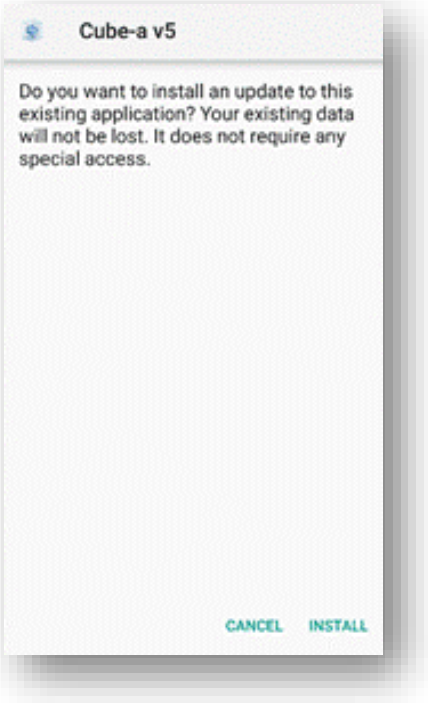
Stonex Cube-a is the GNSS surveying, and mapping software developed by Stonex srl for Android platform. The development is based on years of experience in the topography market, in combination with the international mainstream of surveying and mapping data acquisition functions. With Cube-a it is possible to perform surveys with GNSS instrumentation and total stations. The main feature of the software is an exceptional graphical interface, very intuitive, which simplifies and accelerates the operating process. The software can be installed on any device equipped with Android operating system.
This manual mainly introduces all the functions available in Cube-a software.

1.1. Install and uninstall

This chapter describes how to install and uninstall Stonex Cube-a.

Installation

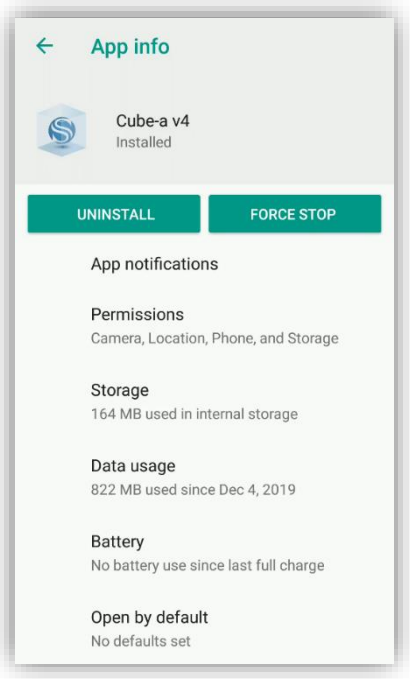
I. Download the file *.apk for installing the software and copy it into the internal memory of the Android device.
II. Click on the *.apk file from your Android device to start the installation, and then click Install.



Uninstall

There are multiple ways to uninstall Cube-a from your Android device. Two possibilities are as follows:

a) Hold down the Cube-a icon on the screen, click on App Information in the window that appears, and then click UNINSTALL.
b) Go to Android device settings, click on Apps and notifications, and then search for the Cube-a program. Clicking on Cube-a will open the "App Information" window, and then click UNINSTALL.



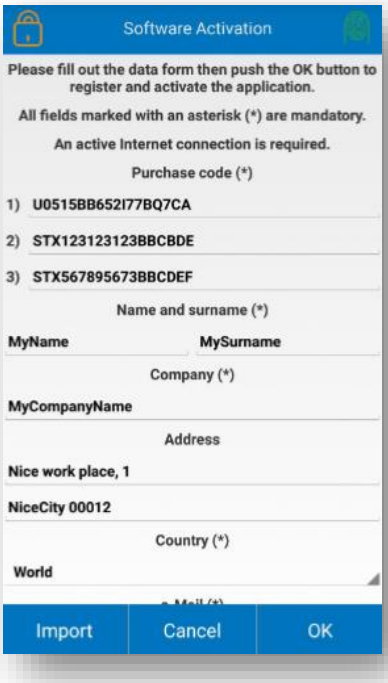
1.2. Registration of the user license

The program must be unlocked on the first boot by registering your license. To unlock it you need to know your personal and unique purchase code. The purchase code looks like A0X000000000000000 and you should have received it by email or on the *Certificate of Control and Inspection* sheet that comes with the purchased Android device. The program cannot be unlocked without entering the correct purchase code. This must be done while the Android device has an active internet connection.
To register:

I. Start the software.
II. Carefully read the license agreement for the user who appears.
III. Click on "Accept" if you accept the contract, otherwise click on "Decline" to terminate the application.
IV. Fill out the program activation form correctly and click OK.

The purchase code, which must be entered in the first field of the activation form, is proof of purchase necessary to identify and validate the program license.

Note that you cannot reuse the purchase code to unlock a copy of the program that was installed on another device. For this you will need to purchase an additional license (so, you will get another different purchase code).
If you have any problems activating the program, please contact your local retailer or Stonex support.



1.3. Cube-a data store

As soon as you install the program, the cube-a-called Cube-a storage folder is created in the device memory; within the latter there are several folders whose use is summarized in the following table.

/StonexCube/Config	The configuration files. Don't change it!
/StonexCube/Config/Codes	The folder in which Cube-a searches for and store code libraries
/StonexCube/Coordinate	The folder where Cube-a looks for coordinate files (for survey area settings).
/StonexCube/Export	The folder where Cube-a stores exported files.
/StonexCube/Geoid	The folder where Cube-a searches for geoids. Copy geoid files here if they are not already included in Cube-a.
/StonexCube/GISFeatureSets	A folder where Cube-a looks for files for GIS features and DBF templates. Copy the files here for the new GIS features (.xml files) and/or dbf files that you want to use as an attribute definition template.
/StonexCube/Input	The folder where Cube-a looks for the files you want to import. Copy the files you want to import into Cube-a here.
/StonexCube/ItalyIGM	The folder where Cube-a looks for grid files (.gr1/gr2 and. gk 1/gk2/gk3). Copy the grid files here for use on reference systems whose name ends with "(grilled)".
/StonexCube/Map	The folder where Cube-a looks for DXF files and shapefiles.
/StonexCube/Project	The project storage folder.
/StonexCube/RefSys	Internal configuration files. Do not change them!

For each project, Cube-a creates a folder with the same project name, within the "Project" folder.
For example, considering that the project name is "MyProject1", the resulting structure of the subfolders in the project folder will be as described in the following table:

/StonexCube/Project /MyProject1	Project root folder: contains subfolders, described below, and some configuration files. Do not modify the configuration files that are inside it.
/StonexCube/Project /MyProject1/Config	Contains configuration files. Don't change them!
/StonexCube/Project /MyProject1/Data	Contains project database (PD file). From here you can copy the files you want to import into Stonex Cube-desk or Stonex Cube-manager.
/StonexCube/Project /MyProject1/Log	Contains log files used to test the application.
/StonexCube/Project /MyProject1/RawData	If the handheld is equipped with an internal GPS (for example if you own a Stonex S70G) and GPS is enabled to stream raw data, that folder will contain the raw data to be used in the post-processing with the Stonex Cube-manager's Form P. Raw data is recorded only if required (cube-a must enable the "Record raw data" option on the receiver configuration page). The raw data recorded in this folder is in binary format. Note: Raw GPS data not inside receivers is stored in the internal memory of GPS; To download this data you need to connect to the receiver via WiFi.

1.4. Cube-a first boot

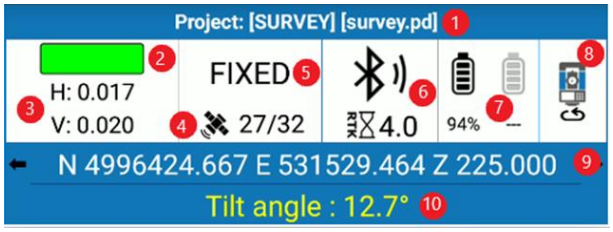
The first time you start, you are prompted to create a project. Each time the user creates a new project in Cube-a, a folder with the same name is created in the device memory (File\Stonex\Cube Project) in which all project data, the surveys contained in it, any photos associated with the points will be saved, etc.
Each time the user creates a new project, Cube-a automatically creates a PD file with the same name as the project, within the latter; *.PD is the extension of the survey created with Cube-a.

2. Main interface

The main interface of the software consists of the Status Bar always visible at the top and the Menu Bar at the bottom, described in detail in the following paragraphs.

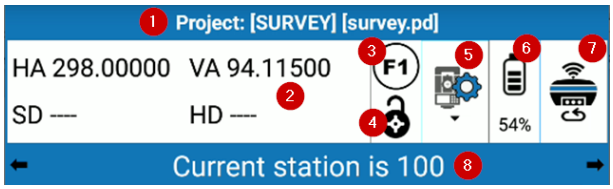
2.1. Status bar

The Status Bar is always visible, even switching menus, and is continuously updated in real time, based on the signal received and the location of the tool you are connected to. It looks different depending on whether you are in GPS mode or Total Station mode.
In the **GPS working mode**, the status bar is as follows:



1. The name of the current Project and the *.pd file currently in use (3Project)
2. Indicator of whether the tolerances imposed are to be compared (5.1.1Point types).
    a. Green: tolerances respected.
    b. Red: tolerances not respected.
    c. Yellow: tolerances respected only in part.
3. Horizontal and vertical roat mean square.
4. Number of satellites used/ number of satellites visible.
5. Type of solution (4.1.1GPS status).
6. How differential corrections are connected (4.1.4Working Mode).
7. Battery level in the GNSS receiver.
8. Switch to Total Station mode.
9. Local or geodesic coordinates of the current location (click to switch between views).
10. Pole tilt angle (available only if connected to a receiver equipped with IMU technology and with active tilt correction).

In **Total Station mode,** the status bar is as follows:



1. The name of the current Project and the *.pd file currently in use.
2. Measurements of the total station.
    a. HA: horizontal angle.
    b. VA: vertical angle (by clicking on the corner you can view it as a percentage).
    c. SD: Sloping distance.
    d. HD: horizontal distance.
3. Face of the station in use.
    a. F1 left face.
    b. F2 right face.
4. Prism state.

    the prism is not locked.

    looking for prism.

    prism is locked.
5. Access the control panel of the total station.
6. Battery level in the total station.
7. Switch to GPS mode.
8. Name of the current station (clicking on the name shows the coordinates of the point).

2.2. Menu bar

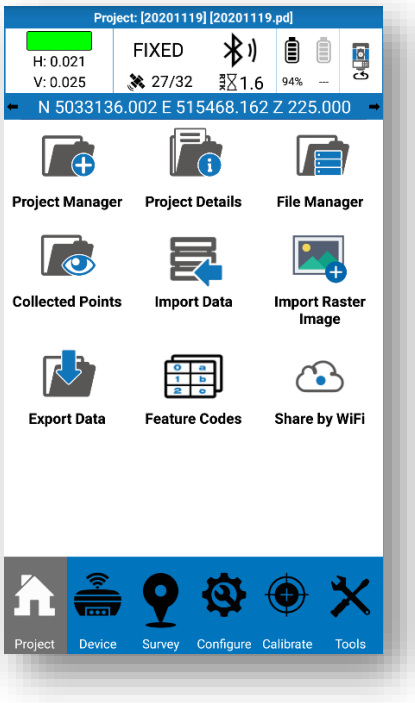
The menu bar is located at the bottom of the screen and allows you to access the six main menus of the program.
The following are briefly described the six icons that represent these menus.

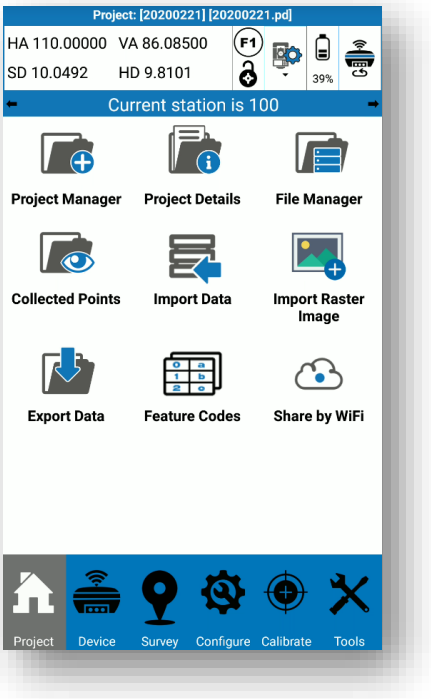
Project: Project management and sharing, import and export.
Tool: Connection and configuration of the receiver and the total station.
Survey: Point and line detection and picketing, CAD environment.
Configure: Reference system, program settings, DXF layer import.
Calibrate: Localization, calibration of the electronic bubble and tilt.
Tools: COGO calculations, Cube-a updates.

These features are described in detail in the following chapters, one for each main menu.

3. Project

This menu contains the same features in both the GPS and TS version of the program.
In this menu there is everything related to project management, import and export of data and point code libraries.

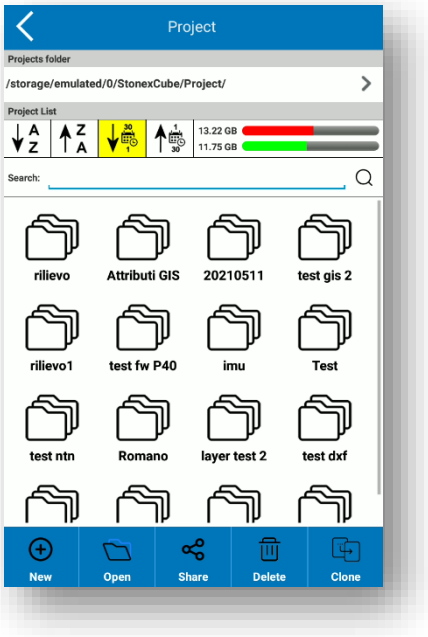




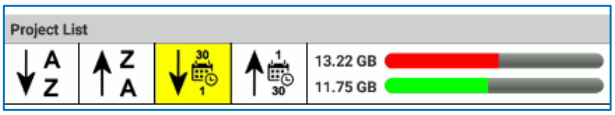
Each project can contain multiple files, and therefore multiple surveys. Once the program is launched, you will be automatically in the last project and in the last open file; Cube-a always finds you within a project, whose name is always visible in the status bar at the top.
Each time you create a new project in Cube-a, a folder with the same name is created in the device memory (Stonex\Cube\Project File) in which all project-related data, surveys contained in it, any photos associated with points will be saved, etc.

3.1. Project Manager

Click Project Manager on the Project menu to access the following page.

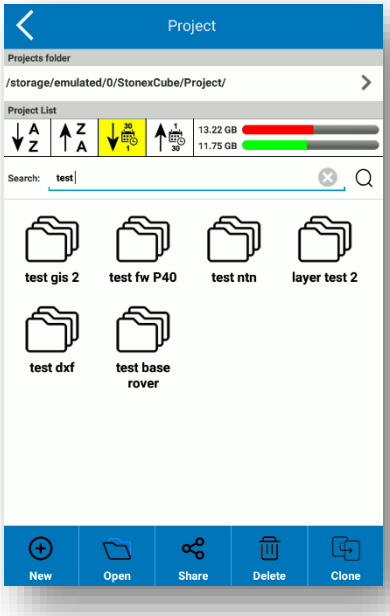


At the top is the path where all visible projects below are saved; you can click on the arrow on the right to change it.
In the Project List section, there are as many folders as there are projects created or imported into Cube-a; you can sort these projects alphabetically or by creation date using the following icons.



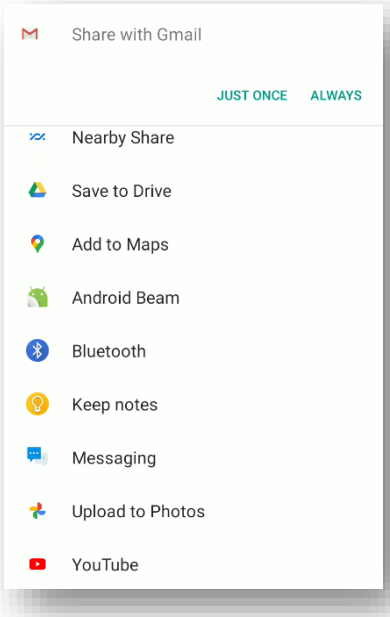
On the right is visible the memory space used in red and the free space in green.

The search bar immediately below allows you to search for projects by typing the name and clicking on the lens on the right. After searching for projects, click on the cross and again on the lens on the right to go back and view all the projects.



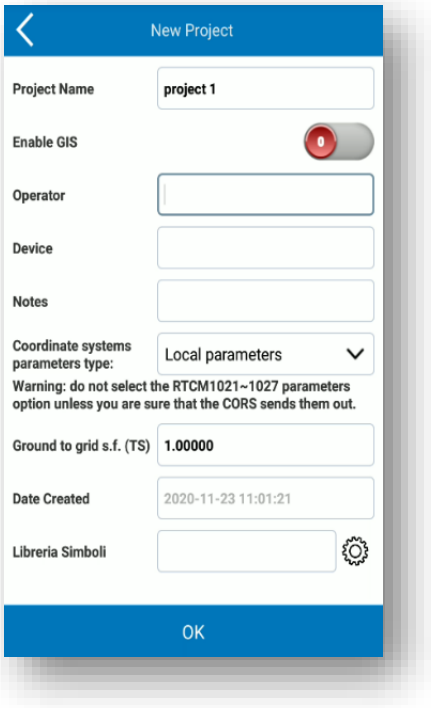
The icons in the bottom bar are described in the following list:

- **New:** Create a new project
- **Open:** Open a project after selecting it in the list
- **Share:** Share the selected project through the communication channels shown

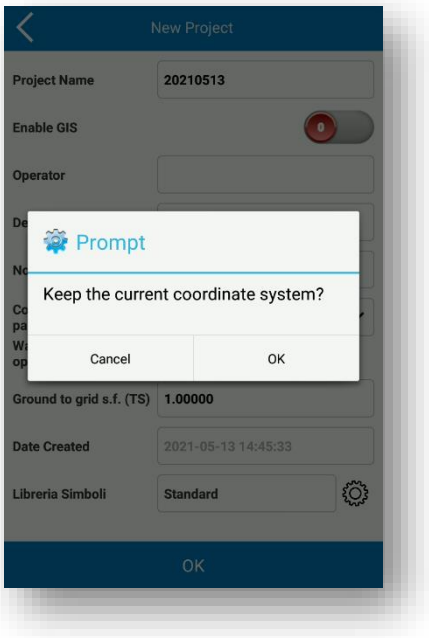


- **Delete:** Delete the selected project
- **Duplicate:** Duplicate the selected project.

Clicking **New** it opens the following window.



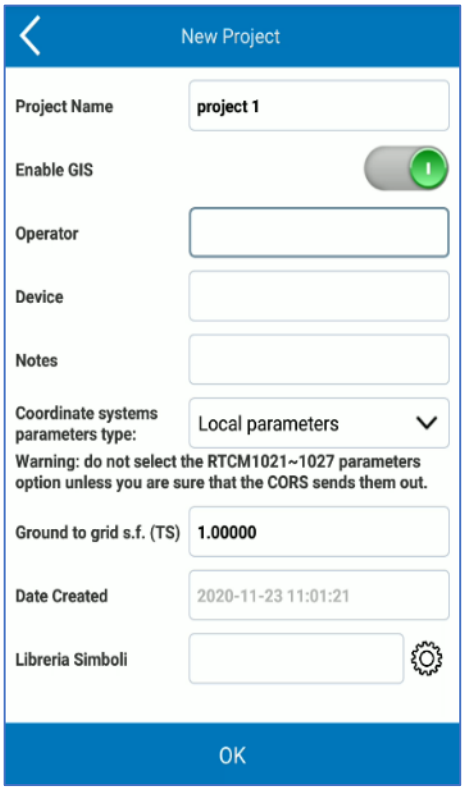
The default proposed project name is the project creation date, but you can change it by simply clicking in the space to the right of Project Name. In Cube-a, you can no longer change the name of the project, you can assign a different name only when you export. All other fields are optional.
The Enable GIS feature is visible only if you have the GIS module and is disabled by default; see section 3.1.1 GIS module GIS Module for more information.
Warning: If you are operating in Italy, do not select the "Retrieve from network" option in the "Sist Parameter Source" drop-down menu. Reference" because not provided for the Italian permanent reference bases.
The scale factor from soil to sist. ref. allows you to adapt the measurements made with total station to the active reference system. For example, if the projection adopted is UTM then the scale factor is 0.9996.
Finally, you can choose a symbol library for the points that will be recorded so that you can assign different symbols to different types of points; See 6.8DXF Symbol Library for more information.
The new project is created after clicking OK below.
Each time you create a new project, the following request appears.

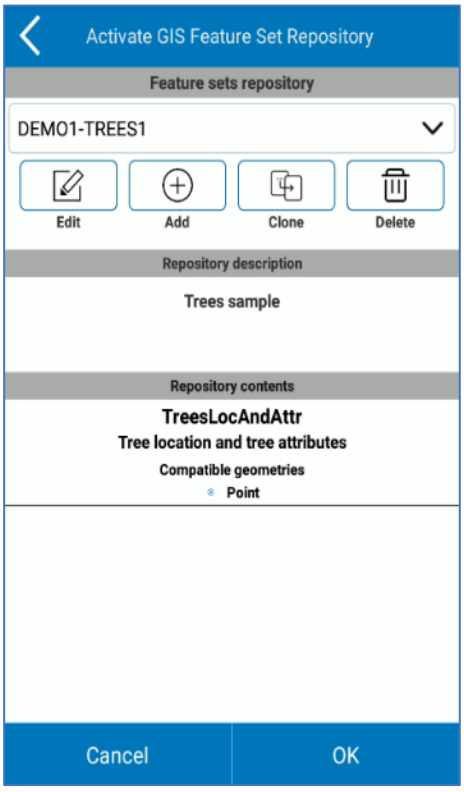


Choosing Cancel resets the program's default reference system (ellipsoid: WGS-84; projection: Gauss Kruger). Clicking OK sets, the reference system you chose the previous time. In any case, the Reference System Parameters window appears, where you can view your reference system and, if necessary, change it (see 6.1Cooridinate System).
Click Save if you want to save the reference system to a local disk or by QR code. Click OK to apply the reference system and start work.

3.1.1. GIS Module

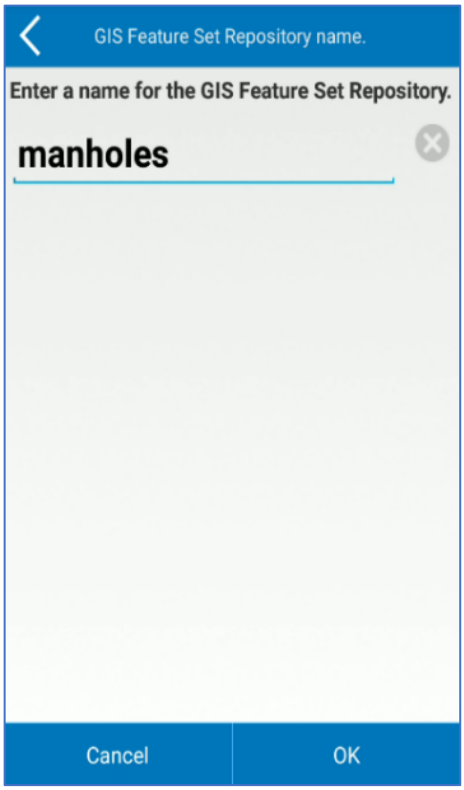
If you have the GIS module, you can enable the GIS function when you create a project. If you enable the GIS function, the "Enable a GIS Feature Group" window appears. Here you can select a group of GIS features from the drop-down menu to use it in the current project (select it and click OK), or to edit it (select it and click Edit), or to clone it (in this case you can modify the clone without changing the existing one) or delete it.

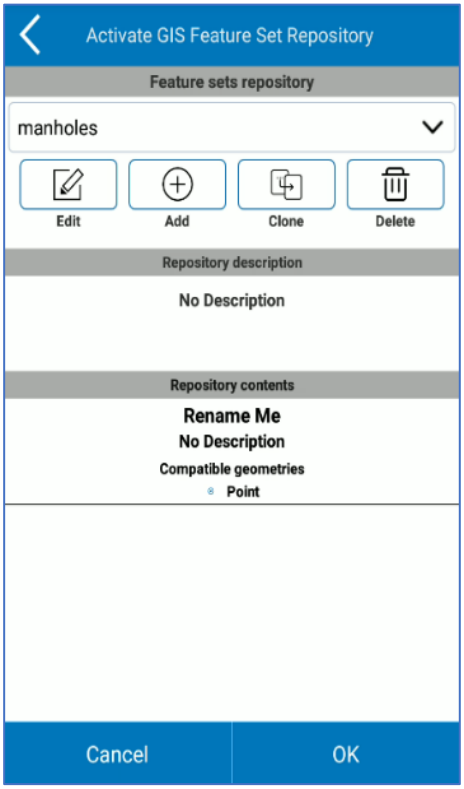




If you want to import a GIS feature group, you must copy the GROUP in XML format to the following folder: Internal Memory -> StonexCube -> GISFeatureSets. Then you will see the group in the drop-down menu. In the same folder you can find some sample files.

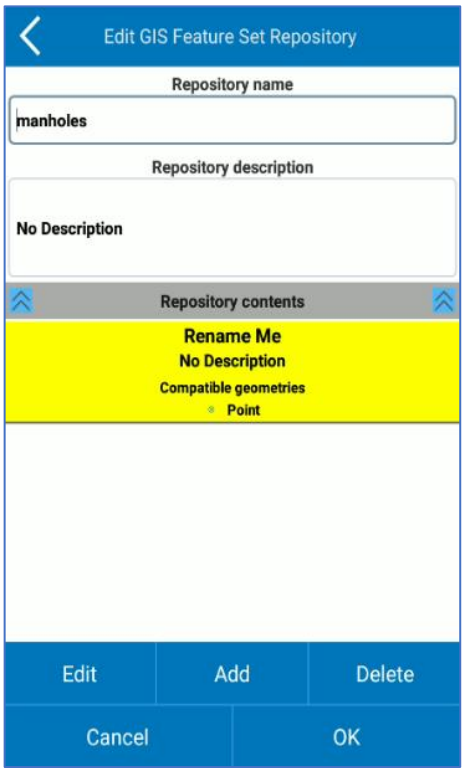
You can create a new group in Cube-a: Click "Add" and type the name you want. The new group appears in the drop-down menu, and then select it and click "Edit" to create the group content, classes, and GIS attributes.

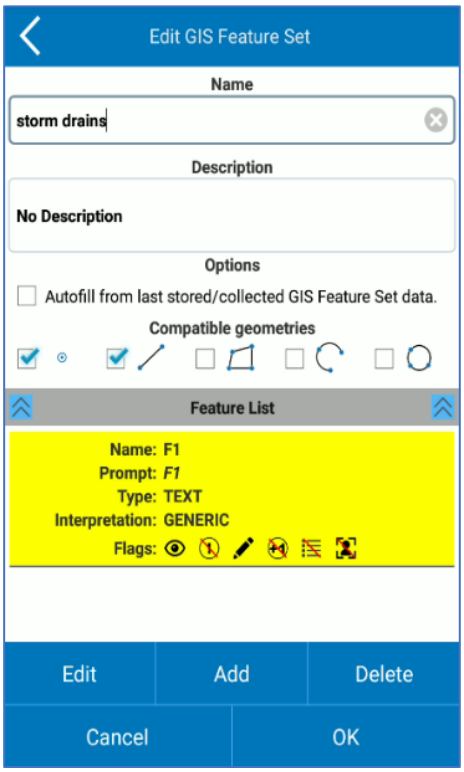




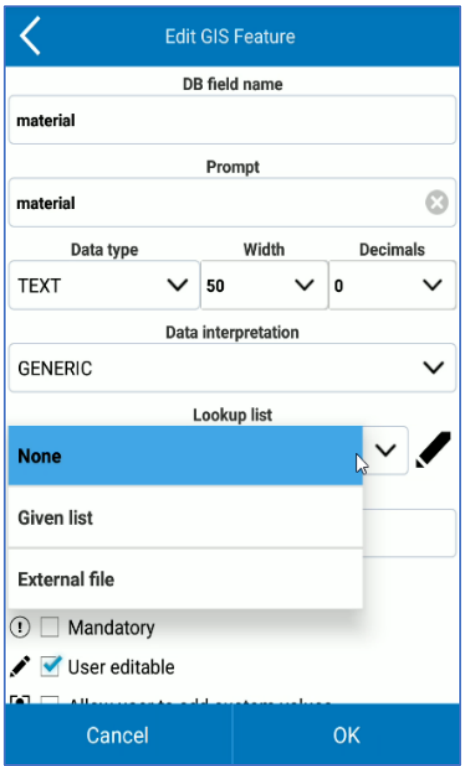
In the "Group Description" box, you can add a description for the previously selected GIS feature group if desired.
When you create a new group, a class is displayed by default, its name is "Rename me," and then select this one and click "Edit" to change the name and create the list of attributes for this class.
Click "Add" to add a new class. Click "Delete" to delete the selected class. Click "Cancel" to undo the changes. Click OK to confirm the changes and return to the "Enable a GIS Feature Group" window.
If you select a class from the "Group Contents" box and click "Edit", the "Edit GIS Features" window appears. Here you can change the name and description of the class, select compatible geometries, and create or edit the list of attributes.

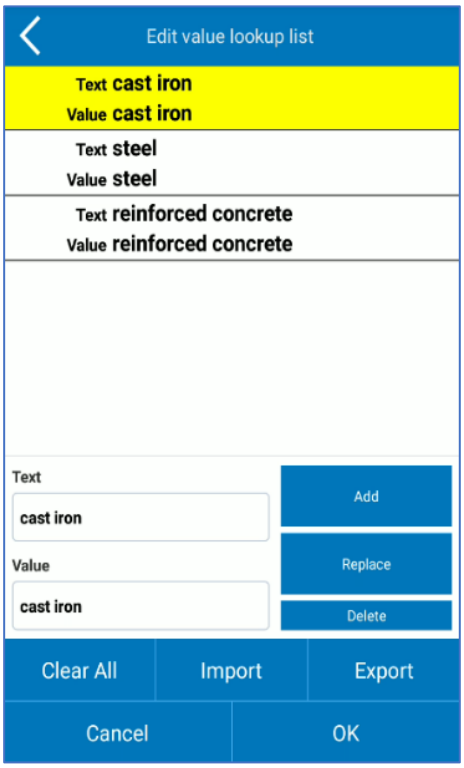
When you create a new class, an attribute appears by default, its name is "F1", then select this and click "Edit" to change the name and customize it.
Click "Add" to add a new attribute to the current class. Click "Delete" to delete an attribute in the current class.





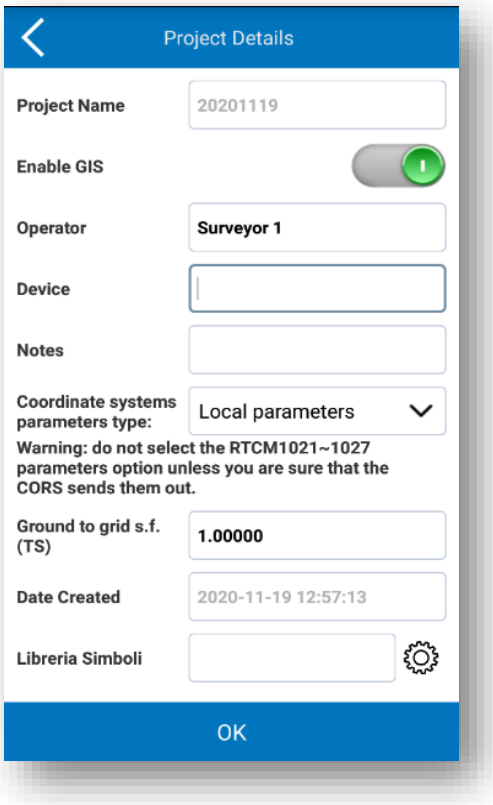
If you select an attribute from the attribute list (Feature List) and click "Edit", the "Edit GIS Features" window appears. Here you can change the name and request for the attribute, data type, enter a list of values, and other options. You can create a list of values in Cube-a: Select "Local List" from the drop-down menu, and then click the pencil, and the "Edit Value List" window appears.

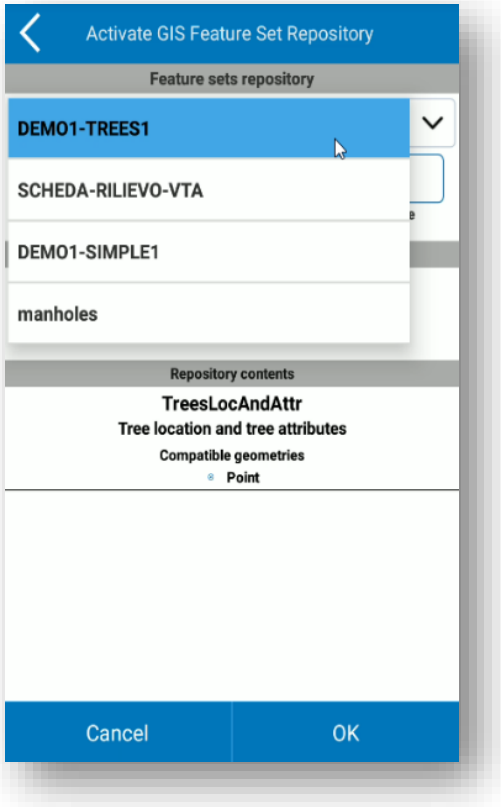




3.2. Project Details

In the Project Details submenu, the user can verify and edit some details of the current project. On this page, the user can enable the GIS function if it was not activated during project creation or turn it off. If the feature is enabled, after clicking OK, you can select or edit the GIS feature group.



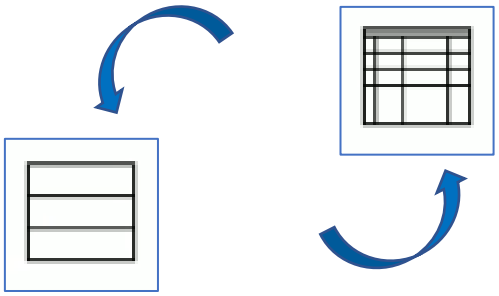


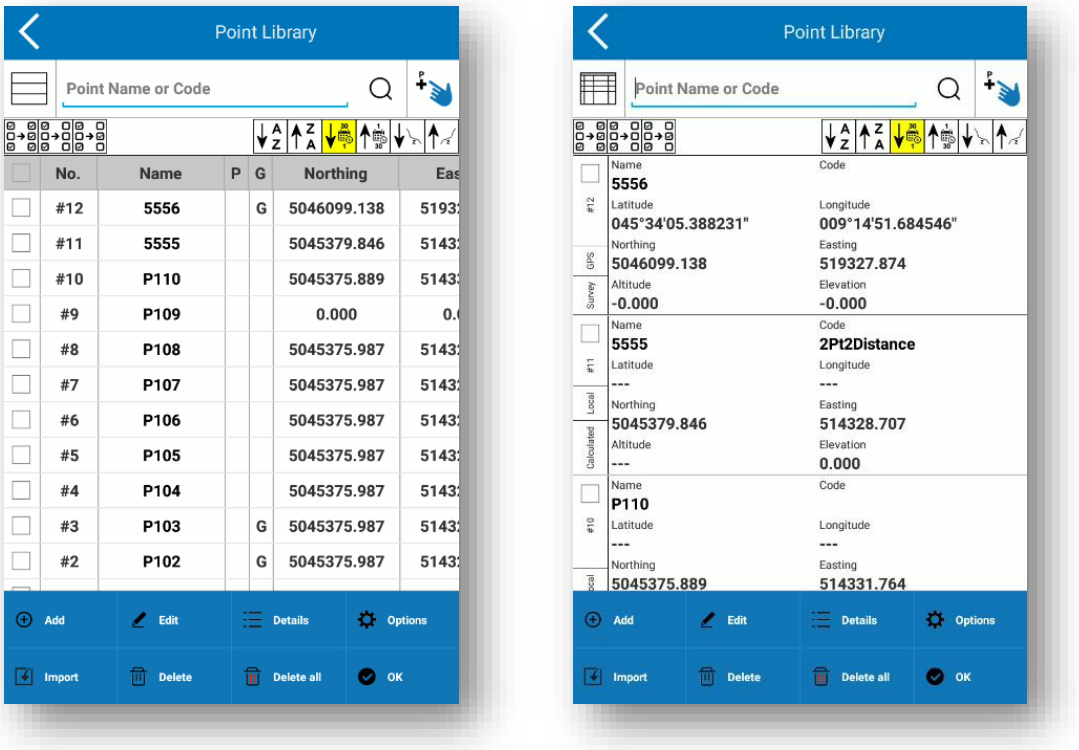
3.3. File Manager

As anticipated in the previous paragraphs, a project can contain multiple files. In the File Management submenu, you will find all the files, then the various files. PD, contained in the current project. Each time the user creates a new project, Cube-a automatically creates a file. PD with the same name as the project. On this page you can add new files. Pd to the current project, or open or delete an existing file after selecting it. Once created, you cannot change the file name to Cube-a, you can only do so during export.

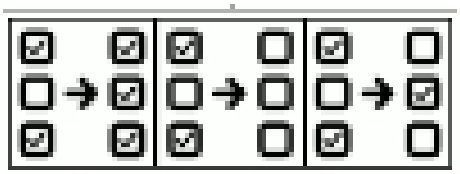
3.4. Point Library

In the Points Library submenu, you will see a list of all points that are detected, calculated, imported, and added manually. You can switch from List view to Grid view, shown in the following figures by clicking on the icon at the top left.



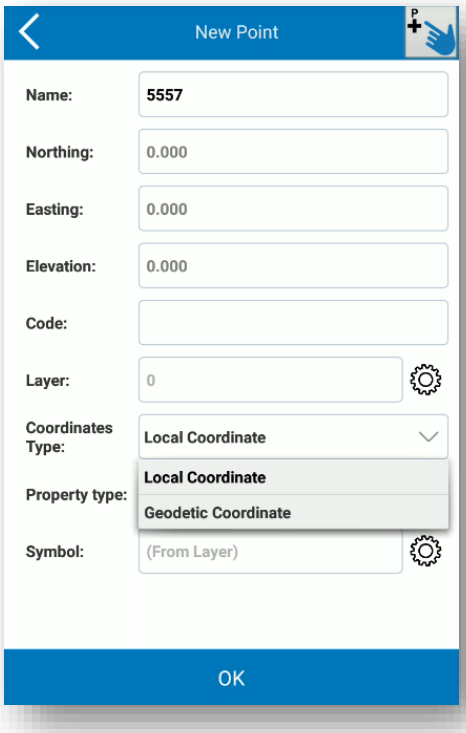


You can search for a point by filtering the search by name or code or select it directly from the survey area by using the "select point" icon represented by a blue hand that indicates (icon in the upper right).
You can select or clear multiple points at the same time and reverse selections using the selection icon in the upper left.



After selecting a point, you can see the details of the point, edit it or delete it, using the functions in the bottom bar. From the latter you can also add new points by clicking Add and access the Import Data submenu by clicking Import.

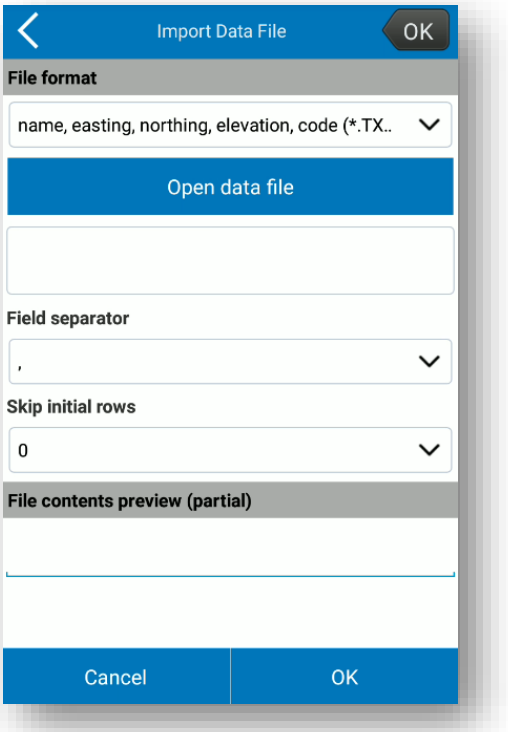
Clicking Add opens the following window where you can add a point by entering local or geodesic coordinates.

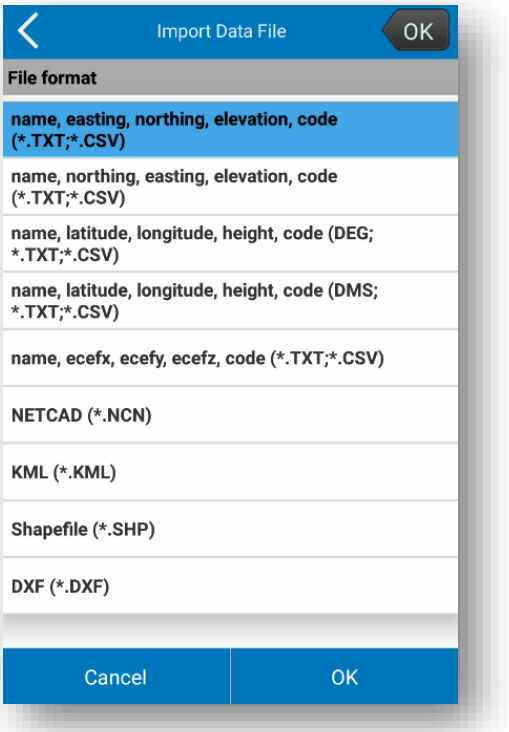


All points can be sorted by name, capture date, or dimension using the following icons in the upper right.

3.5. Import Data

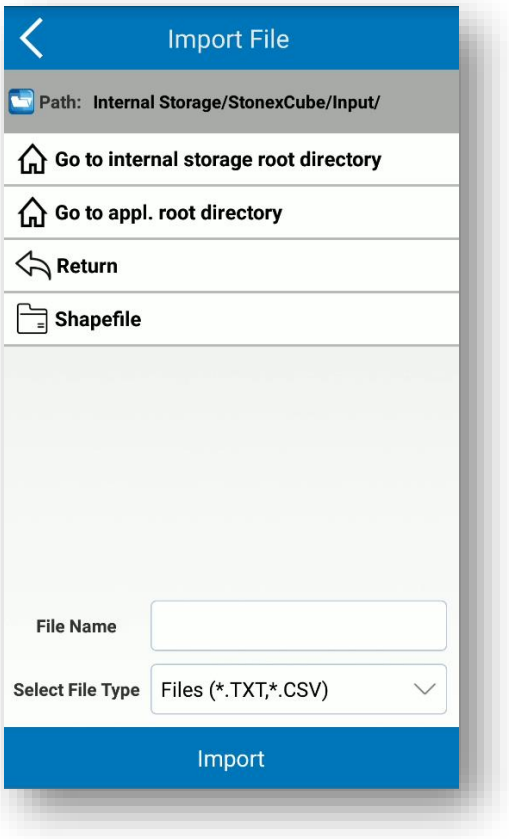
In the Import data submenu, you can import external files that were previously uploaded to your device in various formats as in the following figures.





At the bottom you can see the preview of the file you are importing so that you choose the field separator correctly and whether to skip the start lines because of the header.

Clicking Open Data File defaults, the StonexCube→Input path, but you can move to other locations by clicking on one of the three options highlighted in the following figure.



3.5.1. Import a project or file *.pd

To import a project into your program, copy the project folder, as it appears, to the folder created by Cube-a, in the StonexCube→Project. The project will then be visible in the Project Management submenu on the Project menu.
To import a. PD within an existing project in Cube-a, copy the file. PD StonexCube→Project →(Existing Project folder) →Data. Caution, if you do not copy the PD File in the Date subfolder then it will not be visible in the program. Once copied, select it from the File Management submenu to open it.

3.6. Import Raster Image

Using the Import Raster Image submenu, you can import a georeferenced raster image. Clicking Open Image File defaults to the StonexCube→Input path, but you can move to other locations (as described in 3.5).
The program supports raster images in the following formats:

- Portable Network Graphics (PNG) – lossless compression
- JPG (Joint Photographic Experts Group) – non-leak-free compress
- Tagged Image File Format (TIF) – usually compressed, usually without data loss.

Having a raster image is not enough to have georeferencing: the raster image must have a "twin" file that stores georeferencing parameters. This file is called "Word File" and must be created using software that manages image georeferencing (e.g., Stonex Cube-desk).

The following table shows what type of Word file you need to store in the same folder that contains the raster image to import:

Raster file Format	Word File Format
*.PNG	*.PGW
*.JPG	*.JGW
*.TIF	*.TFW

Limits on raster import

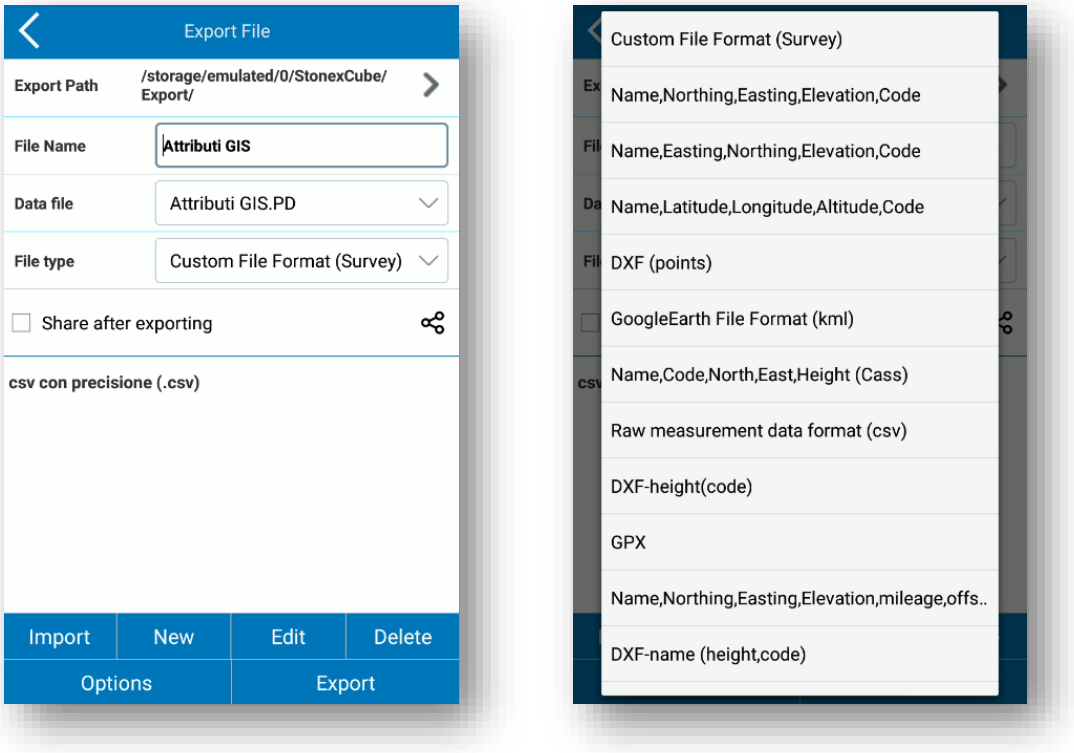
Cube-a is developed on android operating system and must comply with its limits on memory allocation. One of these limitations is that any application does not have to allocate large blocks of memory and if an application does, it must release those memory blocks as soon as possible.

Taken from Android developer documents: "To allow multiple running processes, Android sets a strict limit on the size of the heap assigned to each app. The exact limit of heap size varies between devices depending on the amount of RAM available on the device. If your app has reached heap capacity and tries to allocate more memory, the system generates insufficient memory error."

All this means that you must be careful when trying to upload raster images. Although a raster image file appears to be small (a few megabytes) the same does not apply to the image data it contains. Remember that raster image files are usually compressed, and that Cube-a must unpack them before viewing them, and this may require more memory than the Android operating system can provide.
As a rule, an image of L x H pixels in size (width x height) needs a free amount of free memory equal to: L x H * 3 bytes.
Example: A photo of 5 mega pixels (2560 x 1920) occupies, after decompression, 14745600 bytes or 14 megabytes.

3.7. Export Data

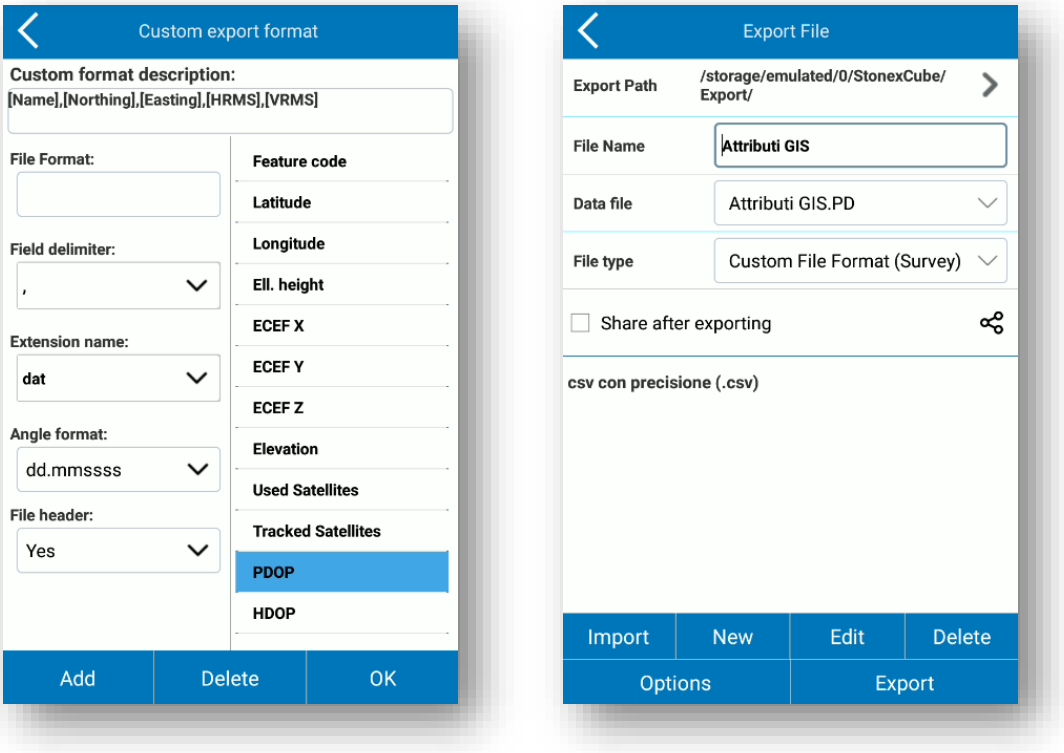
Data export is used to export the survey to a certain format, which is chosen by the user through the File Type drop-down menu. You can export data in a default format or custom format. It is necessary to enter the name of the file you want to export, the survey (. PD) and the format in which you want to export. Click Export to export the file to the export location shown at the top (click to edit it).



If you enable the "Share after export" option, before clicking Export, the same file that will be exported to the export location, it will also be shared in real time through the communication channel that will be chosen (e-mail for example).

Custom format

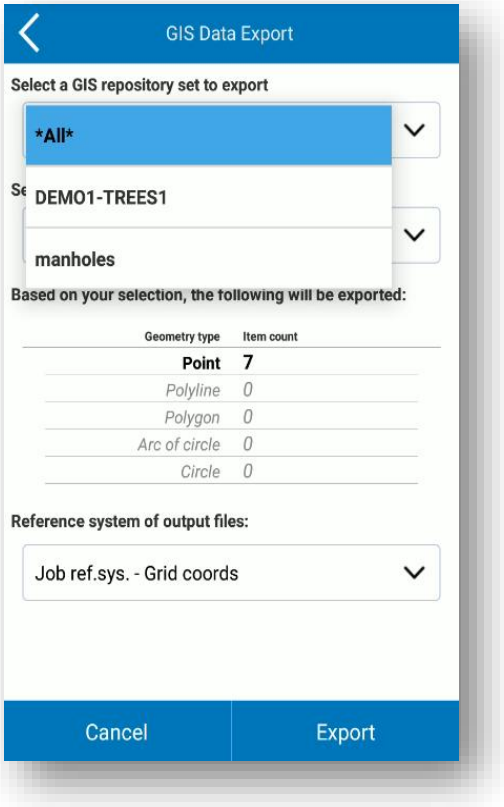
If you select Custom Format from the File Type drop-down menu and then click New, you can create a new export fomato. In the file format field, enter the name that you want to give the format. You can then choose some features such as field separator and extension; In the list on the right, you'll see all the information you can add. To add or remove information, select it from the list and click add or delete. Click OK to save the format.

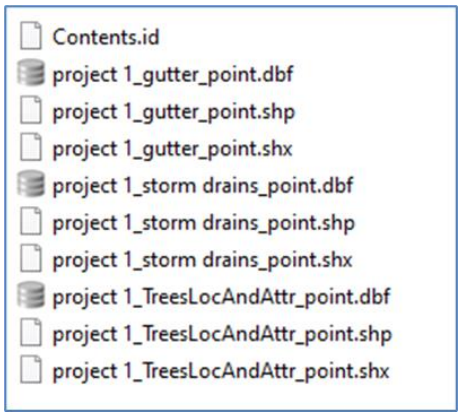


You will find the new formats you added in the Export File window, in the section below. In the figure above, for example, there is a new custom format named "csv with precision" and extension .csv. To export to a new format you created, select it and click Export.

GIS data to Shapefile

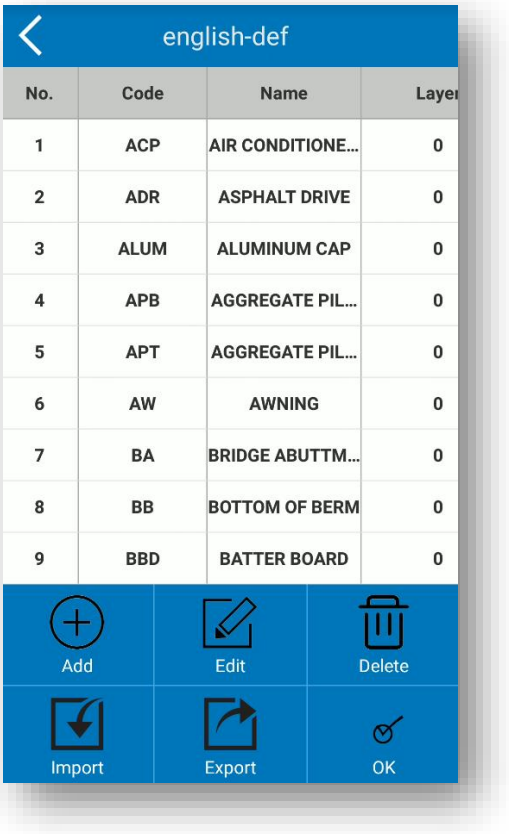
Select GIS data to shapefile to export a shapefile in the CASE of GIS survey. The software creates a .dbf file, a .shp file, and a .shx file for each selected attribute and geometry class. You can open the file .dbf Microsoft Access or Microsoft Excel to view the table with all gis attributes.



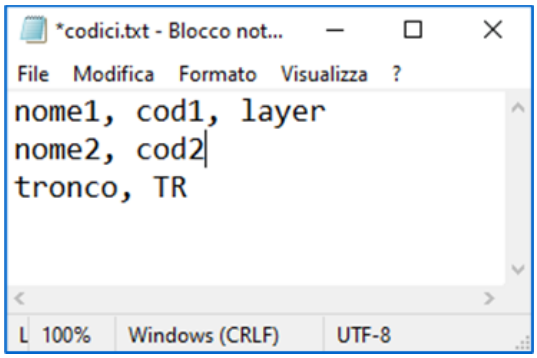


3.8. Feature Codes

In the Code Libraries submenu, you can manage point code libraries. There are already standard libraries, but you can add new ones by clicking New or edit those present by clicking Edit.



In particular, you can create a new library in Cube-a, manually adding codes, or import it after copying it to your Android device. In the latter case, you can import a .fcl or ..txt as in the following figure.

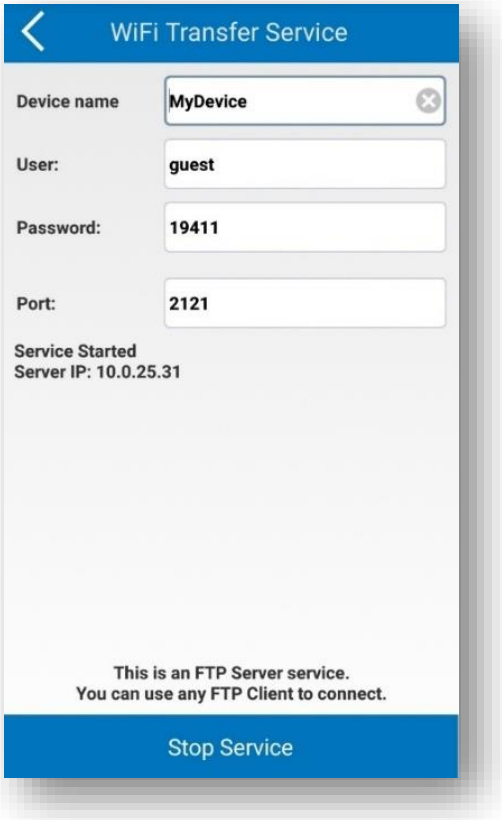


3.9. Share by WiFi

Through the Share via Wi-Fi submenu, the project can also be shared via Wi-Fi. This feature allows wireless connection between the Android device on which Cube-a is installed and the PC, to browse the contents present in the program and download the files from the device to the PC and vice versa.

On the WiFi Sharing page, you must:

1. Enter the device name (not required).
2. Choose a username (the default username is "guest").
3. Choose a password (the program shows by default a randomly generated numeric password, which can also be maintained if you prefer).
4. Choose an IP port number whose value is in the range 1025-65535 (you can think of the port number as the home address while the IP address is the name of the street where the house is located).



Before proceeding further, verify that:

1. The Android device is connected to a Wi-Fi network;
2. Your PC is connected, wirelessly or by cable, to the same Wi-Fi network to which your device is connected.

Note: If your Android device and PC are not connected to the same network, you cannot use the feature, except if the network has been configured to allow communication between multiple networks (for example, if your company has more than one internal network).

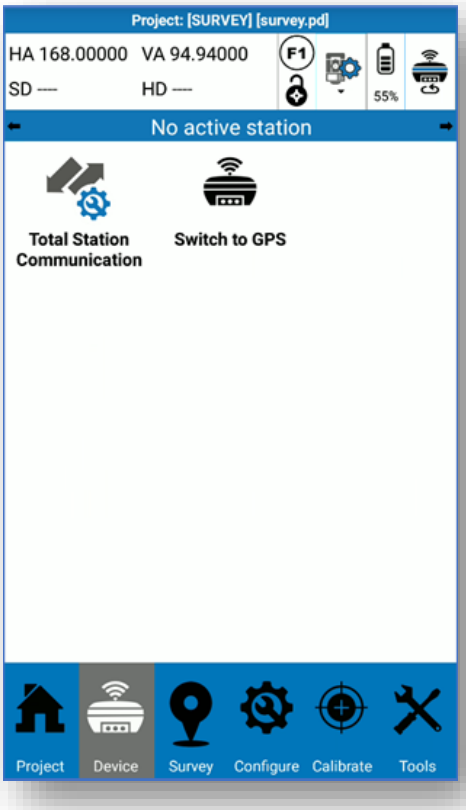
When you are sure that all network constraints are satisfied, click "Start FTP Server", after which the "Start FTP Server" key will change to "Stop FTP Server".
Just below the "IP Port " field, the following messages will appear:

the ftp server service is running.
IP Server: AAA. Bbb. CCC.DDD.

Where AAA. Bbb. CCC.DDD is the IP address that must be entered later into the FTP client by PC. Note that the exact value of the IP address depends on the network: the common values for part AAA. BBB are 192,168 and 10.0 for local private networks.
After you set up the various settings correctly and start the Share via WiFi feature from Cube-a, you need to follow additional simple steps from PC.
On the client (your PC) you can use any FTP client (such as FileZilla) to connect to the Android device.

4. Device

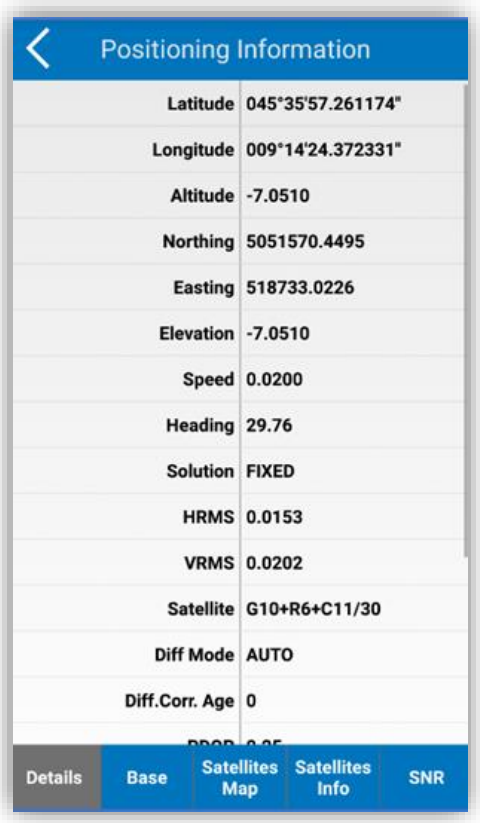
The Device menu contains all the functions concerning the communication and management of the GNSS receiver and the Total Station, in fact it looks different depending on the GPS or TS module, as shown in the following figures.



4.1. GPS version

4.1.1. GPS status

On the "GPS Status" page you can see gps positioning information. The "Details" tab contains information about: Latitude, Longitude, Altitude, North, East, Current Altitude, Speed, Heading, Solution Type, Differential Mode, Differential Correction Age, PDOP, HDOP, VDOP, HRMS, VRMS, UTC Time, Local Time, and Distance from Base (Ref Distance).

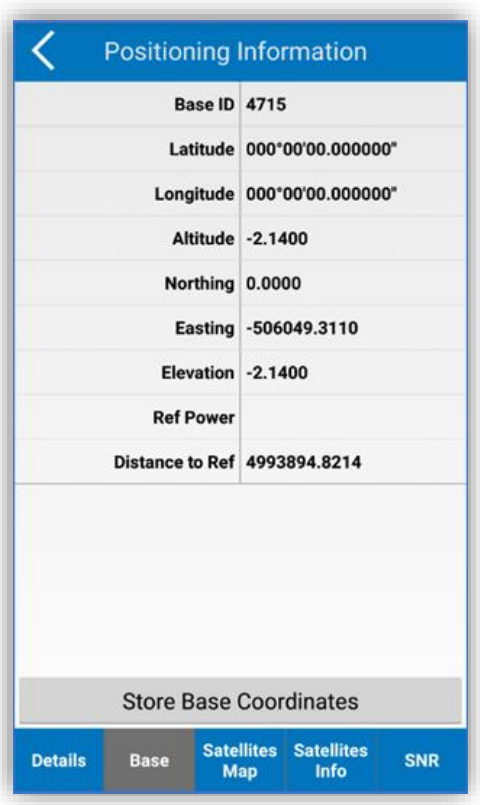


Let us see some of the most important information provided in this window.
The Solution, which can be SINGLE, DGNSS, FLOAT, FIXED.
SINGLE: means that the receiver does not receive differential corrections from the base, so the accuracy will be low.
DGNSS: means that the receiver can receive corrections differentially from the base, but the accuracy of the data is low for several reasons, such as, for example, the position of the receiver does not allow the device to receive many satellites.
FLOAT: means that the receiver can receive differential corrections from the base, it is the first possibility of transmission of corrections through the phase difference of the carrier, the accuracy is high, generally below 0.5 meters.
FIXED: means that the receiver can receive differential corrections from the base, it is the final solution for transmitting the vector's phase difference corrections with maximum precision, usually within 2 cm. For high-precision GNSS measurement, you need to get a fixed solution state to record the data.

As regards differential mode information, it includes CMR the format type for differential messages defined by Trimble, and RTCM, a general differential message format that includes X, RTCM32, and so on.
Differential delay indicates the time the Rover receives fixes (for example, a 10-second fix delay indicates that the base has sent a signal that will be received by Rovers after 10 seconds of submission), the unit of measurement being the second. When RTK mode is running, the fix delay is low, so the result is better, generally the delay is less than 10 seconds, usually 1 or 2 seconds.

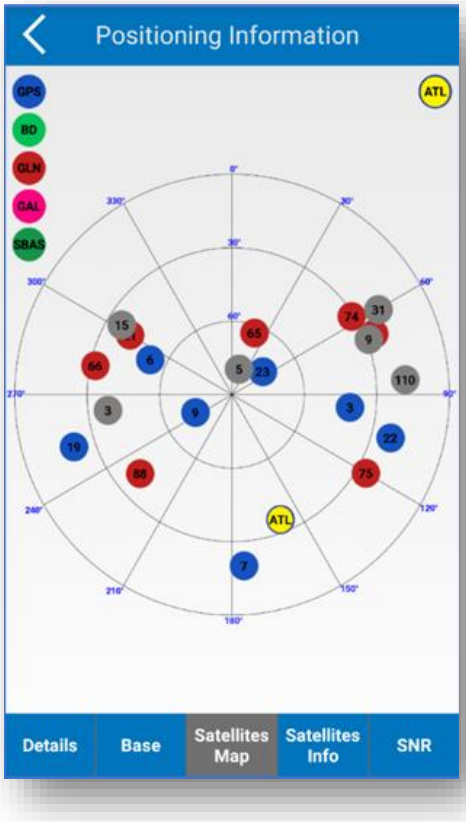
PDOP: Dilution of position accuracy. When the PDOP value is less than 3, it is the ideal situation. The lower the PDOP value, the better the satellite distribution, which facilitates the search for the instrument's FIXED solution.
HDOP: Dilution of horizontal precision, it represents the component of the horizontal direction in the PDOP.
VDOP: Dilution of vertical precision, it represents the vertical direction component in the PDOP.

On the "Basic" tab there is information on the reference base; using the "Store Base Point" key below, you can store the base as a point in the Survey.

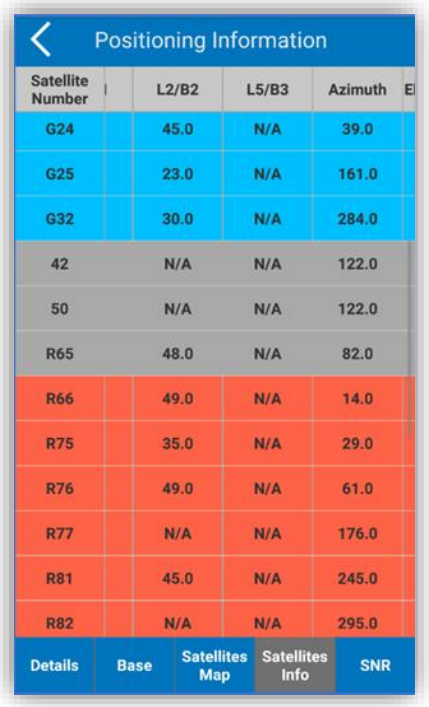


In the "Satellite Map" tab you can view the Sky plot, that is, the map with the position of the satellites tracked by the receiver, positioned according to the azimuth (on the circumference of the circle) and the height angle (on the radius), the center of the circle represents the position of the receiver.

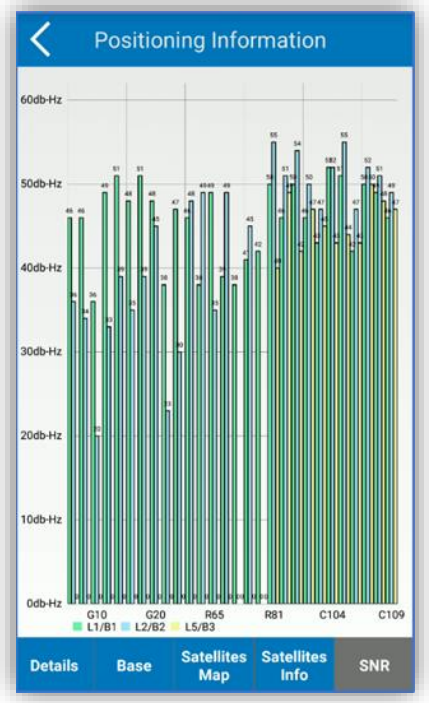
Legend: GPS-blue (GPS); BD-light green (BeiDou); GLN-red (GLONASS); LAG-magenta (Galileo); SBAS-dark green (SBAS); ATL-yellow (ATLAS).



In the "Satellite Info" tab there is the satellite table which includes the name of the satellites, the signal-to-noise ratio (SNR) of GPS signals (L1, L2, L5) and BeiDou signals (B1, B2, B3), azimuth and elevation.



In the "SNR" tab there is a histogram that graphically represents the signal-to-noise ratio (SNR) of gps signals (L1, L2, L5) and BeiDou signals (B1, B2, B3).

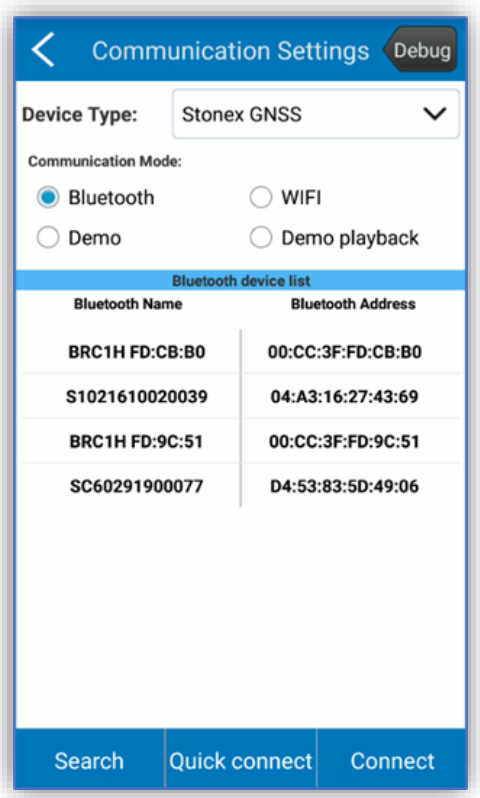


4.1.2. Datalink Status

On the "Data Link Status" page, you can see the configuration and current status of the receiver data link. The window is different depending on the type of data link (see 4.1.5Datalink Settings).

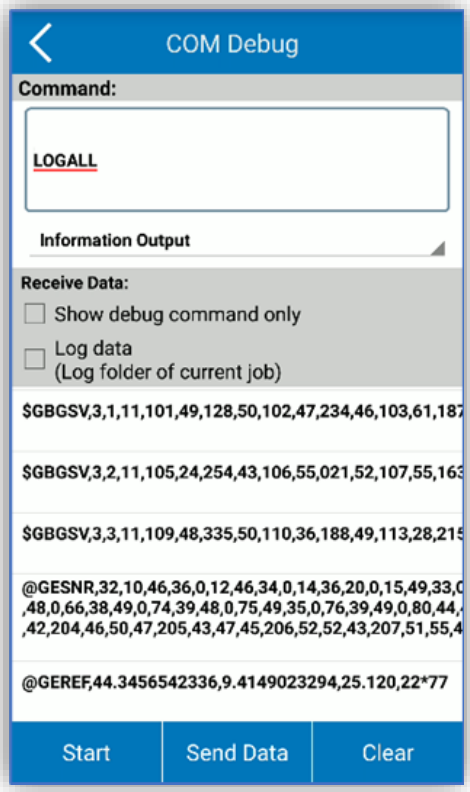
4.1.3. Communication

On the "GNSS Communication" page, you can establish the connection between the tool and the controller. First, select the type of tool between: choose Stonex GNSS for all the latest generation Stonex receivers and to connect stonex S8 receivers; choose generic NMEA to connect a non-Stonex GNSS receiver; choose Internal GPS (TTY) to use the GPS inside the controller; choose the remaining types according to the receiver model. Secondly, set the mode of communication between Bluetooth and WiFi. Click "Search" to search for nearby devices, select the device (in the "Bluetooth Name" column the serial number of the tool will appear), and then click "Connect" to establish the connection.

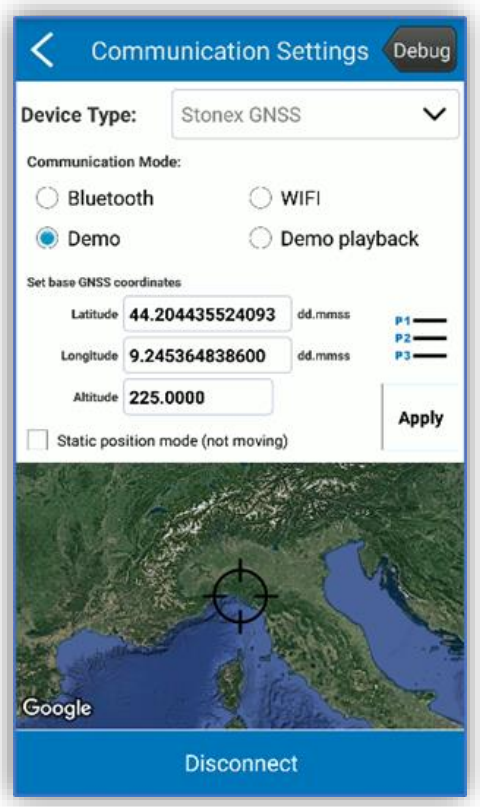


The top command called "Debug" (active with each mode of communication) allows you to consult the outputs of the GNSS receiver; this data can also be recorded by checking the box called "Record data". By clicking on "Outbound Information" you can see the list of possible commands to send to the GNSS receiver to read its output (the box "Show debug data only" works as a filter, you will see the outputs related only to the command sent).

At the bottom, the "Start" command begins receiving data; the "Send Data" command sends the command in the top window to the GNSS receiver (the window is editable); the "Clean up" command cleans the data receive window.



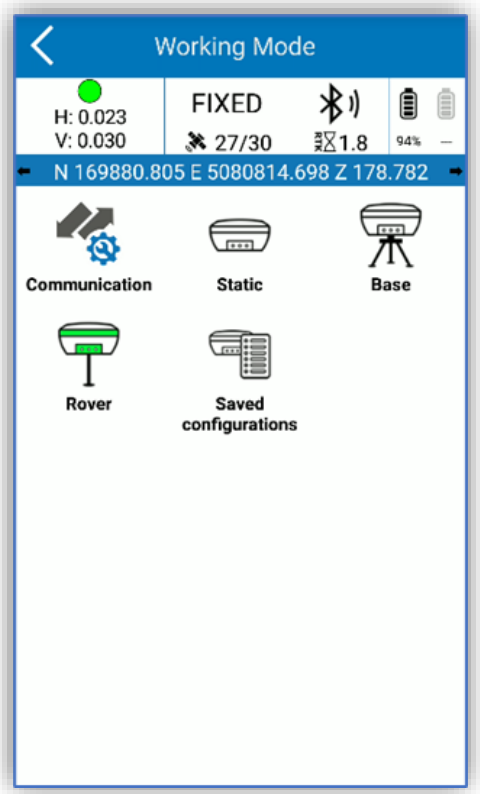
Demo mode
Selecting this entry from the Communication Way group simulates connecting to a receiver, a useful function to study/verify the functions of the program without having a GNSS receiver connected. The location of the "fake" GNSS can be set through geographical coordinates, it can be read from a point in memory or set with the target by clicking on the map and then on "Apply"; by pressing connect the simulation begins. The GNSS will simulate a motion, above the map you can set the static mode.



Path cyclic playback
Plays an NMEA stream read from files as if it came from a real GNSS device.

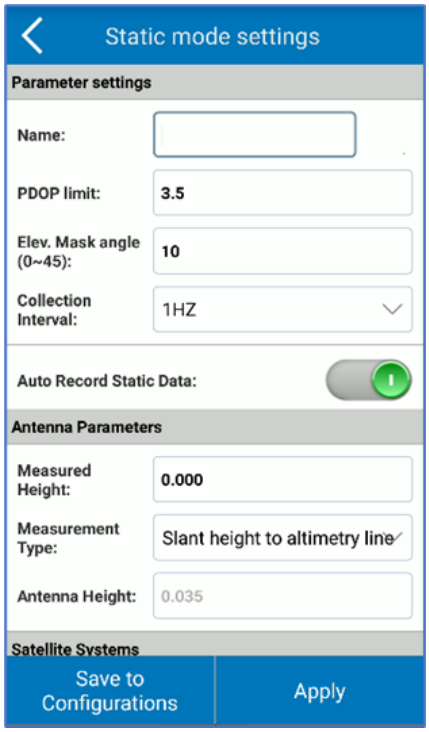
4.1.4. Working Mode

Click on "Working Mode" to enter the work mode selection interface. The working mode is mainly used to set how the receiver works. There are five options in the work mode selection interface: GNSS Communication, Static, Base, Rover, Invoke Configuration.



When performing static measures, set the mode of operation to Static. When performing RTK measurements, set the working mode to Rover or Base.
After connecting the Cube-a device and software via communication settings, you can set the working mode and data link. The following sections describe the detailed settings in the work mode menu.

Static mode
Static working mode contains three groups of settings: general reception parameter settings, antenna and satellite system parameters. Here are the various parameter settings in detail.

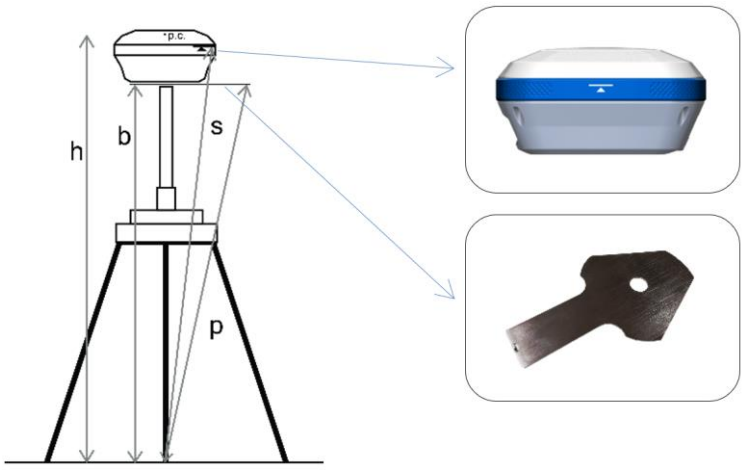


Name: The name of the points in static is limited to 4 characters.
PDOP limit: the geometric factor that represents the quality of the satellite distribution. The smaller the PDOP value, the better the distribution of satellites. The PDOP value of less than 3 is the ideal state.
Satellite cutting angle (cut-off): the angle of the connection signal between satellite/receiver and horizon. The receiver will not consider satellite signals received below the limit imposed by the cut-off angle. Range of values : 0-45 °.

Collection interval (s): 1 Hz indicates the acquisition of one data per second, 5 HZ indicates the acquisition of five data per second, 5s (0.2 Hz) indicates that the receiver collects data every five seconds, and so on.

Automatic recording of static data: If you enable this button, the receiver starts recording automatically when itis turned on and receives satellite signals, otherwise you need to manually record the static data, after turning on the receiver.

Antenna parameters
You can enter a value as a measured height and set how the measurement was obtained (e.g. Vertical height in the center of phase or Height tilted to the measure line). The antenna height value used in the surveys will be calculated automatically by the program and visible in the text box calls "Antenna Height".



In GNSS mode, you can choose from the following options:

- *Vertical measure*: insert b
- *Height in the center of phase*: insert **h**
- *Slanted* measure: insert **s**
- *Inclined measure ref. piastra*: insert **p**

Constellation settings

Satellite system settings include five systems: GPS, GLONASS, BeiDou, Galileo and SBAS. Depending on your machining needs, you can choose whether to receive the signal corresponding to a given constellation of satellites or disable it.

The Satellite-based Augmentation System (SBAS) is a large-scale differential improvement system (satellite signal reception quality). Navigation satellites are detected by many widely distributed different stations and the acquired raw data is sent to a computing center. Then from the calculation center, correction information is sent to geostationary satellites of the covered area, and finally, geostationary satellites send corrections to users, helping to improve positioning accuracy.

In the "Set Static Mode" working window, after setting all parameters, click "Save to Configurations" to store the settings. This will allow you to open a new project and invoke previously saved static mode settings, without having to reinsert them.

Click "Apply" to start the receiver to static working mode.

Base

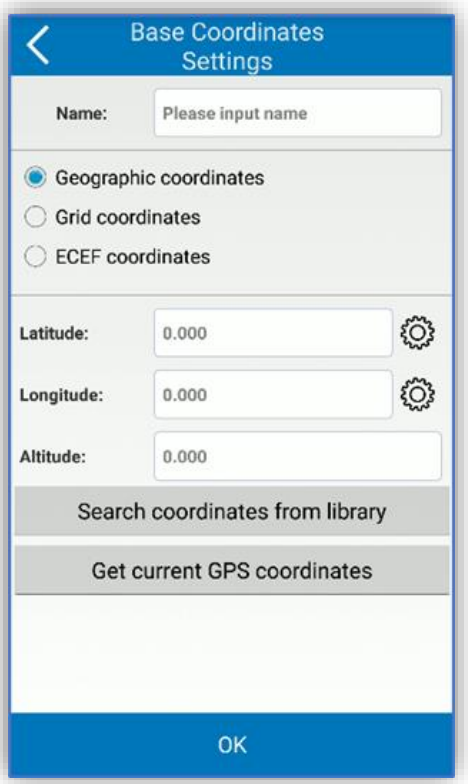
Click "Tool", click "Working Mode", and then click "Basic" to access the "Set Basic Mode" page. The basic mode settings in split into: Startup Model, Options, Data Link, Constellations.

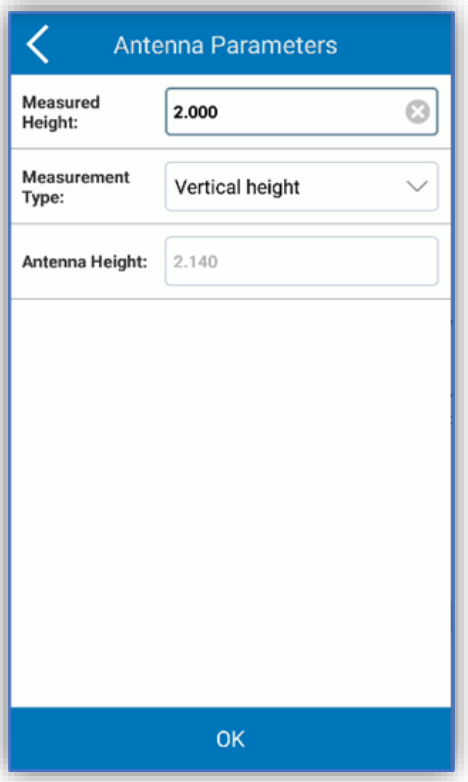
Startup modes: There are two startup modes, "Use single point coordinates" and "Specify base coordinates".

With "U knows single point coordinates", the Base station takes the WGS-84 coordinates of the current point and sets them as base coordinates.

With "Specify Base Coordinates" you can manually enter base coordinates.

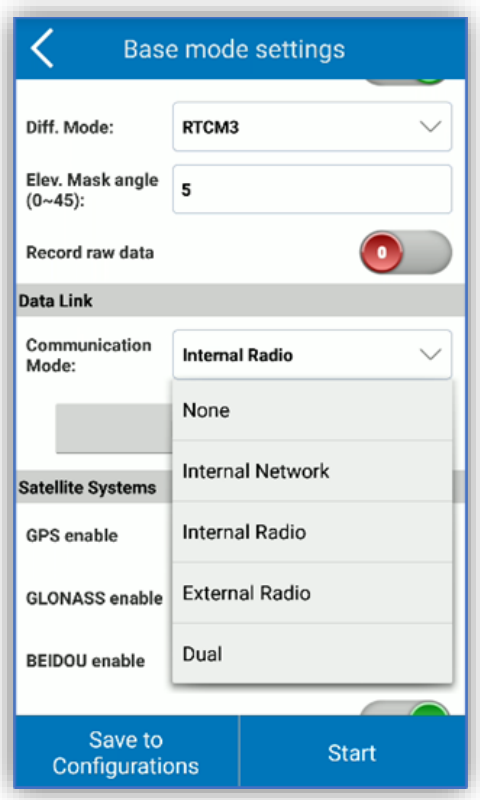
The difference between the coordinates entered and the precise WGS-84 coordinates of the current point on which the base is located does not have to be very large, otherwise the Base station will not work optimally.
If you select "Specify Base Coordinates," click "Set Base Coordinates" to access the base coordinate settings.
You will have to enter a name for the base to create, the coordinates can be in geographic coordinates, grid or ECEF. The gear icon on the right is visible only when geographic coordinates are inserted and allows you to set the format in which the coordinates inserted are expressed. You can also copy coordinates from a point in the library or capture the GPS coordinates of the current point (the "Retrieve coordinates from library" command and the "Take current GPS coordinates" command, respectively). Press "OK" to confirm the base coordinates. At the top of the "Set Basic Mode" page, click the "Imp. antenna height of the base" to set the antenna parameters.
You can enter a value as a measured height and set how the measurement was obtained (e.g. Vertical Measure or Height in the center of phase). The antenna height value used in the surveys will be calculated automatically by the program and visible in the text box calls "Antenna Height".


Base Coordinates Settings
Name:
Please input name
Geographic coordinates
Grid coordinates
ECEF coordinates
Latitude:
0.000
Longitude:
0.000
Altitude:
0.000
Search coordinates from library
Get current GPS coordinates
OK


Antenna Parameters
Measured Height:
2.000
Measurement Type:
Vertical height
Antenna Height:
2.140
OK

Options: In this section you can indicate the Base ID, the PDOP limit value, the base start delay, the differential data format, the satellite cutting angle (cut-off) and whether to enable raw data logging. We also find the Base startup enable command. However, to start the antenna you need to press the button on the bottom screen "Start".

Data link: Possible communications are as follows: None, Internal Network, Internal Radio, External Radio, Dual.
Below we see in detail these modes.

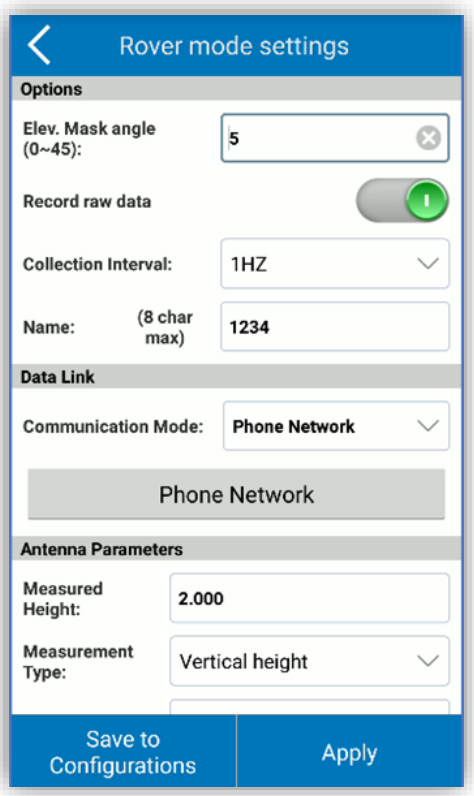


None: No differential data is sent.
Internal network: Differential data is transmitted through the network, so you must insert a SIM inside the receiver for the data to be transmitted.
Internal radio: Differential data is transmitted via internal radio. The RTK base and rover are equipped with built-in radio, which can receive and transmit differential data. The base can transmit differential data through the internal radio and the Rover can receive differential data via the internal radio.
External radio: the base is connected to an external radio and transmits differential data via the external radio.
Dual: Simultaneous sending of data to a remote station via the internal network and via external radio.
Constellations: As a last setting for basic working mode, satellites can be enabled/disabled to receive the signal or not.

After all the parameters for Basic mode have been set, click "Save to Configurations" to store the settings, so that you can invoke the configurations later (in a new project), without having to re-enter them.
After you set the parameters for Basic mode, click "Start" to start basic working mode.

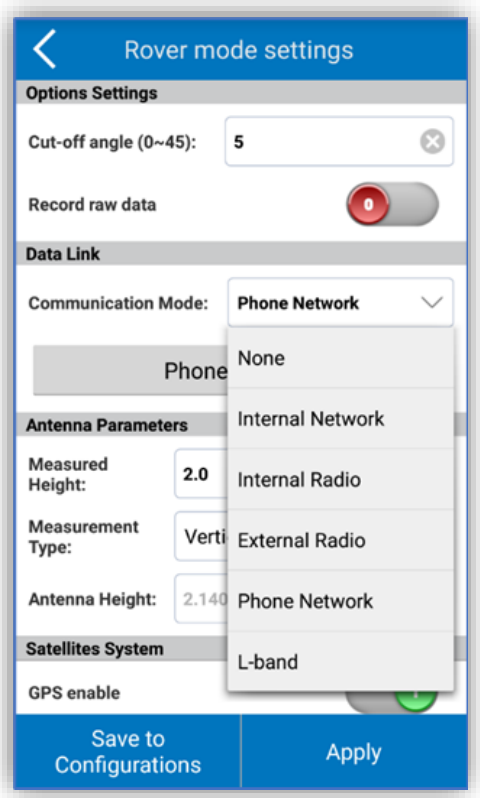
Rover

Click "Tool", click "Working Mode", and then click "Rover" to access the "Set Rover Mode" page. Rover mode settings are divided into: Options, Data Link, Antenna Parameters, Constellations.



Options: If you enable the "Record raw data" option, you can set the name of the registered raw data file. In addition, you can set the data collection range and satellite cutting angle. You can then capture points in "Stop and go" mode on the survey page.
Data link: There are 6 possibilities of data transmission: None, Internal Network, Internal Radio, External Radio, Controller Network and L-band.
The meaning of the first four modes of communication is the same as described above, in the section concerning the basic working method.
Controller Network: Differential data is transmitted through the handheld network. With this mode of communication, a SIM must be inserted into the handheld or you must be connected to a Wi-Fi network (see the command " Set connection " for an in-depth analysis of the communication methods).
L-band (Atlas): Using the precision increase system based on corrections sent by satellites, it is possible to receive differential corrections and reach a level of accuracy between 5 and

12 cm. This option allows you not to rely on ground base stations, CORS or networks; in areas where differential signal may be absent such as deserts, oceans or mountains, you only need to have the availability of reception of L-band satellites.



Also, in the "Data Link" section, for all modes of communication, except L-band you will have the possibility to enable the aRTK, and for how many minutes in case of activation you want to keep it running. TheRTK system uses the L-band signal to receive atlas correction and reach a FIXED solution, in case the receiver loses its RTK correction source on the ground.

Antenna parameters: In this section you can enter a value as a measured height and set the way in which the measurement was obtained (e.g., Vertical Measure or Height in the center of phase).

Constellations: Satellites can be enabled/disabled in this section to receive the signal or not.

After setting the parameters, click "Save in Configurations" to save the settings and click "Apply" to change the way you work in Rover, the Rover will then receive corrections from the base. NB: If the radio has been set as the connection between Base and Rover, then the frequency and protocol must be the same.

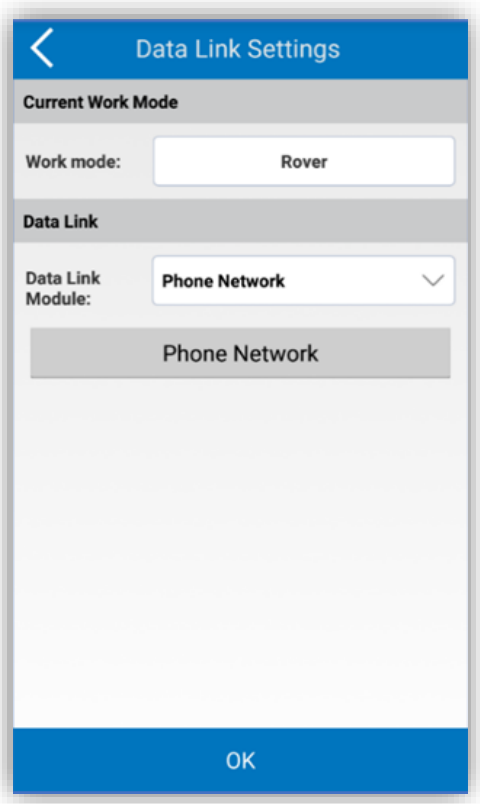
Invoke Configuration

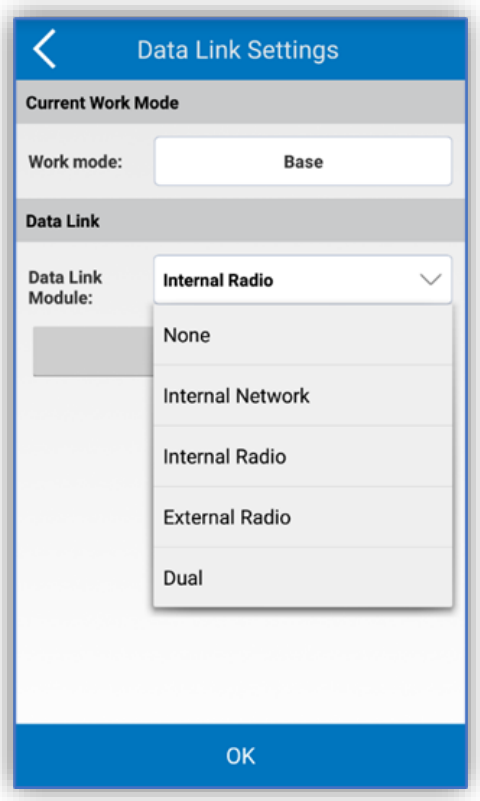
Click "Working Mode" and "Call Configuration", to enter the "Invoke Configuration" interface.

- If you select a configuration and click "OK", the device will work with the selected configuration.
- If you select a configuration and click on "Details", all configuration parameters are displayed.
- If you select a configuration and click "Delete", this configuration will be deleted. Configurations have a name and type (the way they were set up).

4.1.5. Datalink Settings

The data link settings are used to set the data transmission mode between the Base and the Rover. The menu is divided into two subgroups: Current Working Mode (which can be Base or Rover) and Data Link.
When the current operation mode is Basic, there are four data connection modes available: None, Internal Network, Internal Radio, External Radio, Dual.
When the current operation mode is Rover, six data connection modes are available: None, Internal Network, Internal Radio, External Radio, Controller Network, L-band. To access the settings of a link just select it from the list and click on the command below, which will take the name of the selected link.
Let us see in detail below the types of links.

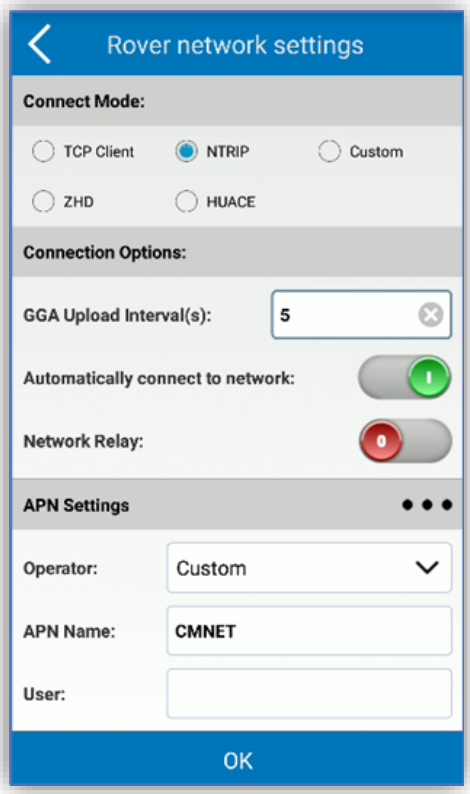




Internal Network and Controller Network

There are 2 types of networks: Internal Network and Controller Network. When Cube-a is in Basic working mode, the network can only be internal network. When the working mode is Rover, the network can be internal network and controller network.
The sections of this page available are : connection mode and option, APN settings, and CORS settings. In case of Rover work mode, the available settings will be : connection modes and options, set CORS, CORS account, Entry Points, CORS Account, Recover entry point settings.
Per quanto riguarda la sezione modalità di connessione, selezionare TCP, per un protocollo di controllo della trasmissione standard (disponibile soltanto in modalità di lavoro Rover), specifico per trasmissioni in rete.
Selezionare NTRIP, per un protocollo standard, utilizzato per trasmettere dati differenziali tramite rete CORS. Selezionare ZHD per la modalità di trasmissione differenziale della rete HI-TARGET e HUACE per la modalità di trasmissione differenziale della rete CHC.
È anche possibile definire un protocollo di trasmissione definito dall'utente.
Per quanto riguarda la sezione relativa alle opzioni di connessione, è possibile impostare il valore predefinito dell'intervallo di invio dei messaggi GGA (di default 5s). È possibile abilitare/disabilitare la connessione automatica alla rete. In modalità Rover, è possibile attivare o disattivare il Network Relay (i dati ricevuti via rete vengono ritrasmessi via radio interna in modo da renderli disponibili ad altri rover).

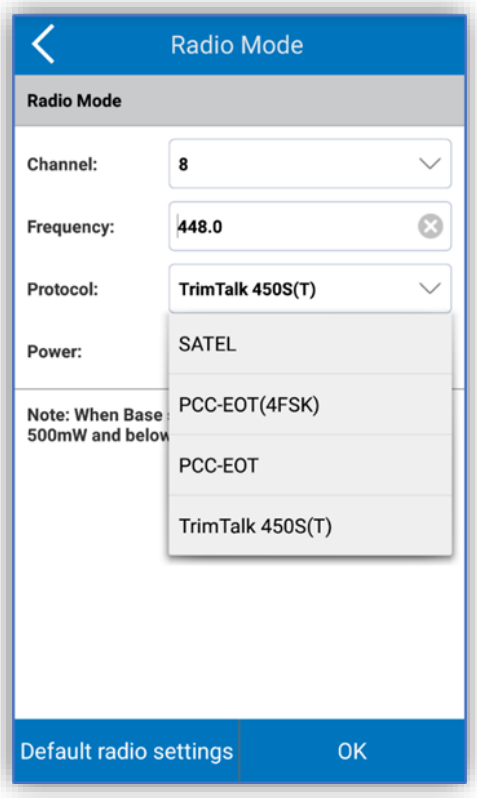

Base network settings
Connect Mode:
TCP Client
NTRIP
Custom
ZHD
HUACE
Connection Options:
GGA Upload Interval(s):
5
Automatically connect to network:
APN Settings
Operator:
Custom
APN Name:
CMNET
User:
Password:
OK

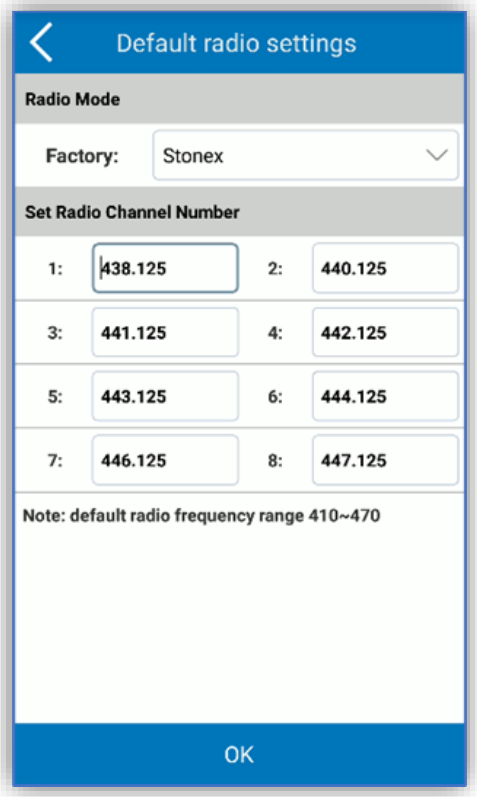

Rover network settings
Connect Mode:
TCP Client
NTRIP
Custom
ZHD
HUACE
Connection Options:
GGA Upload Interval(s):
5
Automatically connect to network:
Network Relay:
APN Settings
Operator:
Custom
APN Name:
CMNET
User:
OK

In the APN settings you can search for a telephone operator by clicking on the search button at the top (with the three dots).
Base network settings: In the CORS settings, enter the IP, port, base entry point, and password. If you click on the search button on the right side, you can add or edit the CORS server parameters.
Rover network settings: In the CORS settings, enter the IP and port, click the search button on the right to add or modify these CORS server parameters. The parameters of some CORS servers are already present in the software.
You can get a warning message each time you change base coordinates.
Set the entry point (mountpoint) below as the last command on the " Rover Network Settings " screen, you can use the receiver's network or the device's telephone network to get the entry points and select one. Finally, set the user and password in the CORS account. If the Base is set independently, the user and password can be entered with any character. If you are using a CORS account, you must enter the corresponding user and password. The IP in the Base and Rover settings must be the same.

Internal radio

The list of available protocols depends on the connected GNSS receiver. The parameters in Basic and Rover working mode are the same.
You can set the channel, frequency and protocol. There are 8 channels, for each channel there is a set frequency but clicking on "Radio defaults" at the bottom of the screen, you can set the frequency of the channels.
Se il modo di comunicazione dati di Base e Rover è la radio interna, la frequenza e il protocollo di Base e Rover devono essere uguali. Nella modalità Base, la potenza radio influenza la distanza di trasmissione del segnale. Se la potenza è bassa, anche il consumo energetico è basso ma la distanza di trasmissione del segnale è ridotta; se invece la potenza è alta, il consumo di energia è alto ma la distanza di trasmissione del segnale è estesa.



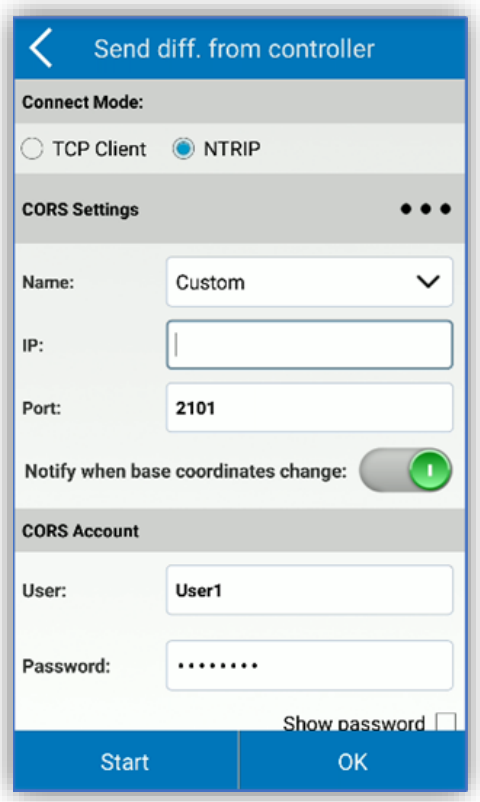


External radio

For data communication through "External Radio" the parameters of the Basic and Rover working mode are the same, you need to set only the transmission speed (Baud Rate). The default speed value is 38400.

Controller network

This mode of data communication is only available in Rover mode. Parameters include CORS settings and entry point. On the search button on the right side of the CORS settings, you can add or modify the CORS server parameters.
These settings are the same as those already illustrated for the internal network communication mode, in this case, however, the network used in telephone network mode, is that of the mobile device (handheld), which requires internet access.



4.1.6. Information

This page contains all the detailed information about the receiver connected to the device. Below you can scroll through pages that contain information about the network, radio, satellite systems, and antenna.

4.1.7. RTK Reset

Click "Tool", and then click "Restart RTK" to force GNSS adapter re-initialization. This will result in a complete recalculation of the location from new satellite signals.

4.1.8. Register

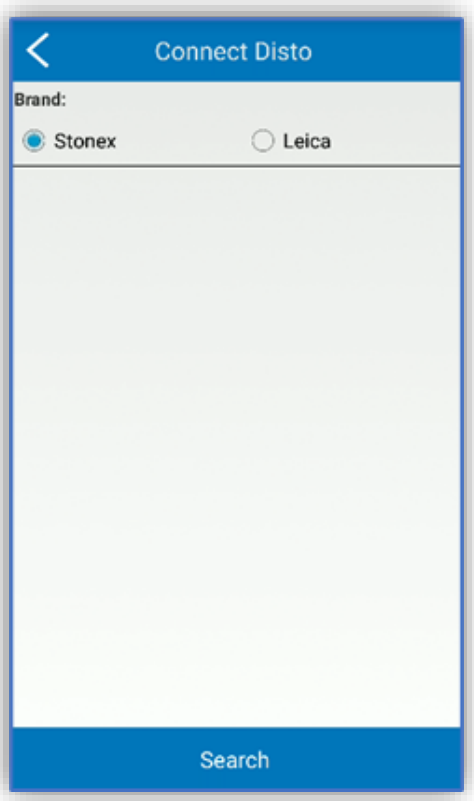
With this command, you can view the expiration date of the GNSS receiver's license registration (not the Cube-a program). On this screen you can enter any license codes and then register the GNSS receiver (for example, in case of license expiration), the device must of course be connected to the Cube-a. In addition, in this section, you can consult a list that encodes the active features in the connected receiver.

4.1.9. WiFi Mode Settings

Click on "Tool", and then click "Imp. WiFi" to set the WiFi connection of the GNSS receiver. The connection mode can be "Master" (default), GNSS uses internal WiFi, or Client, so the GNSS receiver connects to a Hotspot among those available (after entering the password).

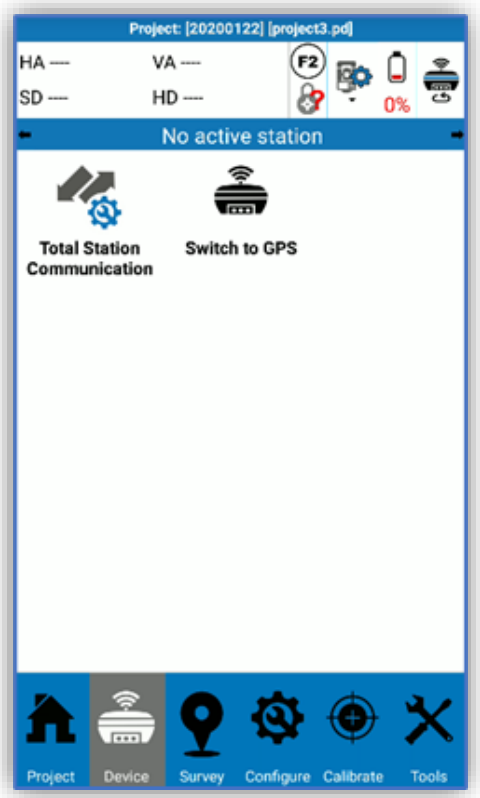
4.1.10. Distance Meter

Click on "Tool" and then click on "Distance communication" to connect a distance meter in Bluetooth mode. The supported brands are Stonex and Leica. A screen will open where you can search and connect a Disto.
The commands below are for searching on the left and connecting the tool, on the right. To connect the distance meter, when it is visible after the search, just select it and press "Connect".
With the connected instrument it will be possible to measure directly from the Cube-a; the "Measure" command below, which will start the measurement, in this case three measurements have been made. The "Clean up" button will be useful for deleting data and starting from scratch. The Disto command is available in all Cube-a functions that require measurement (but the command will only be visible if the distance meter has previously been connected).



4.1.11.Switch to TS

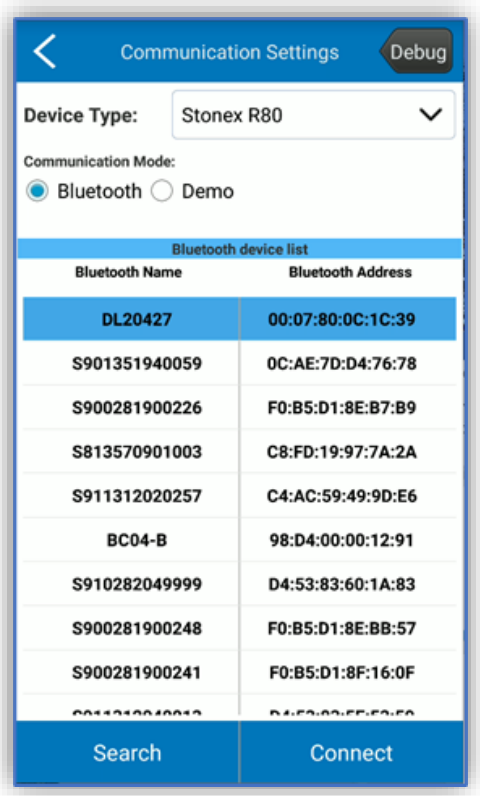
The "Switch to Total Station" command is one of the commands cube-a provides to switch from GPS processing to total station processing.
Analyzing the screen, we notice that the blue bar at the bottom with the general commands remained unchanged; At the top, however, the information bar retains the name of the active project but has changed its appearance, we will explain the commands present later.
This screen is the one that activates, if the "Tool" command is clicked in TS mode.



4.2. TS version

4.2.1. Total Station Communication

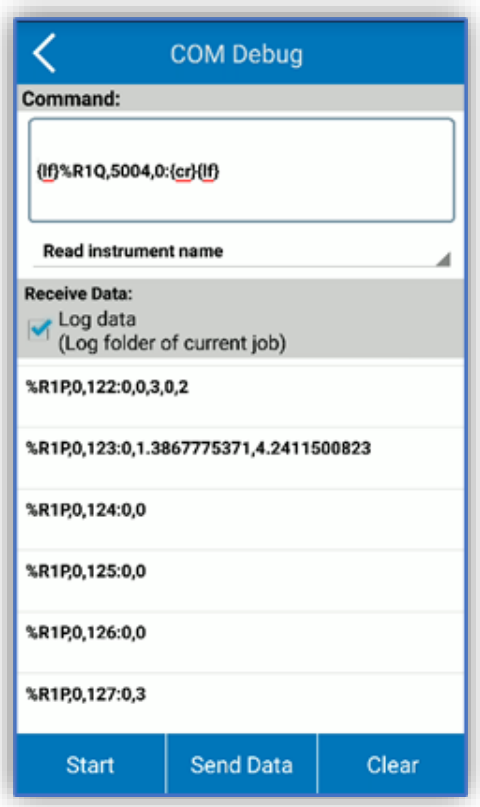
Communication settings allow you to search for the total station between active Bluetooth devices and connect it to the Cube-a.
There are currently four total supported stations (instrument type): Stonex R15, Stonex R25, Stonex R20, Stonex R80.



The operation is very similar to that explained in section 4.1.3Communication.
Select "Bluetooth" in the Communication Mode group, and then click "Search". If the Bluetooth device you want to connect to is already in the list of devices, click "Stop" to stop searching, then select the name of the device to connect the tool to, and then click "Connect". When the connection is successful, the home screen changes its appearance. You will notice that the information bar at the top (shown in detail below) shows read values for the connected tool.

It is possible to select the "Demo" entry from the Communication Mode group to simulate the connection to a total station (the demo mode is only working with the Stonex R80 model), this mode is useful to study/verify the functions of the Cube-a without having a total station connected.
The top command called "Debug" (active with each mode of communication) allows you to consult the outputs of the TS, this data can also be recorded, ticking the box called "Record data". By clicking on the list of commands (in the figure below the selected command is "Read instrument name") you can see the selection of possible commands to send to the TS to read its output.

At the bottom, the command "Start" begins receiving data, the command "Send data" sends the command to the TS in the top window (the window is editable), the command "Clean up" cleans the data receive window.



4.2.2. Switch to GPS

The "Switch to GPS" command is one of the commands that Cube-a makes available to switch from processing with total station to that with GNSS receiver. Clicking this command moves to the general screen as under **Errore. L'origine riferimento non è stata trovata.**. Cube-a's license must provide the GPS module to work properly.

5. Survey

The Survey menu looks the same in both the GPS and TS version of the program.
In this menu there is everything related to saving CAD points and entities, tracking points and lines, tracking for earth and carry-over, and the CAD environment.

5.1. Point Survey

Clicking on "Survey Points" accesses the survey area where you can save CAD points and entities and display them at the same time with the background map and imported layers, such as DXF and shapefile.
The page looks different depending on whether you are in GNSS or Total Station working mode. In this chapter, we will explain commands common to the two modes. Refer to the following paragraphs GPS Survey, GIS Survey, Total Station GPS surveyGIS Survey with Total StationSurvey, for the description of specific commands for each mode.
Below is the meaning of the icons in the Survey area regardless of the version of the program.

 ZOOM OUT

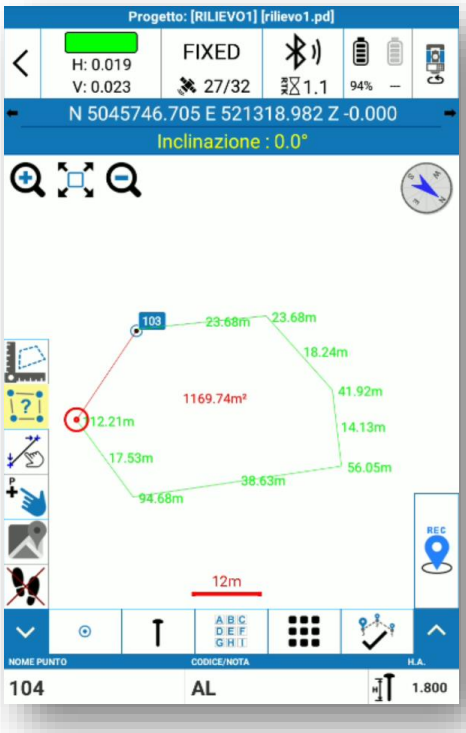
 ZOOM ALL

 ZOOM IN

 Compass (same as the device on which Cube-a is installed)

 Access the CAD environment (see 5.7CAD Tools).

 Calculates distances and the area between points on the map. Click on the icon to enable it and then it will turn yellow, and you can tap on the map to define the points. The distance between two segments is shown in green in the center of the segment, the progressive distances are shown in green on the points, and the area is in red in the center of the geometry.



Select line. Click on the icon to enable it and then it will turn yellow, and you can click directly on the graphic line to access the picketing of the line or its vertices.

Select point. Click on the icon to enable it and then it will turn yellow, and you can click directly on the point in graphics to access the point picketing.

Enable the background map:

map disabled.

road map

satellite map

Follow me: the map is always centered based on the position of the receiver.

Hide the Side Icon Column

Entity to capture point. By clicking on the icon, you can choose the entity to draw while capturing points or return to point capture only

Point type (see 5.1.1Point types)

Quick access to the code library. Save the point by clicking on the respective code.

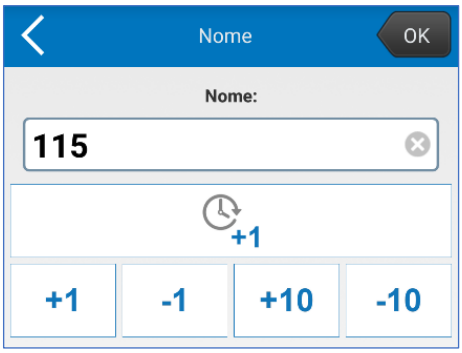
Survey tool menu

Complete Entity (ends drawing of selected cad entity)

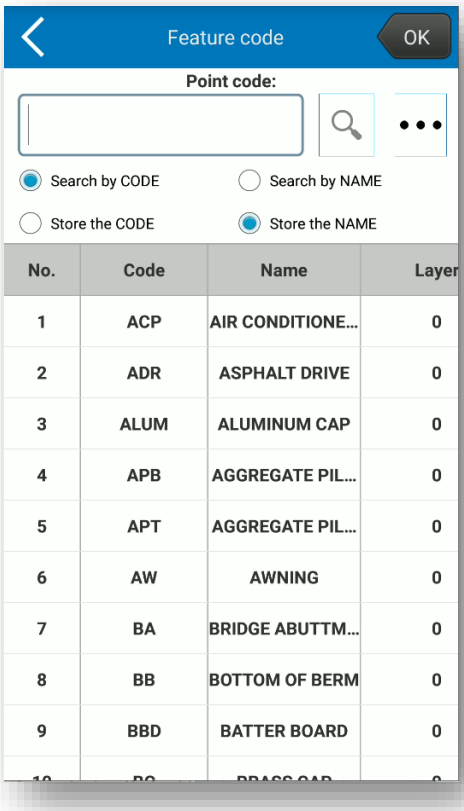
Points Library

The bottom bar has the following fields:

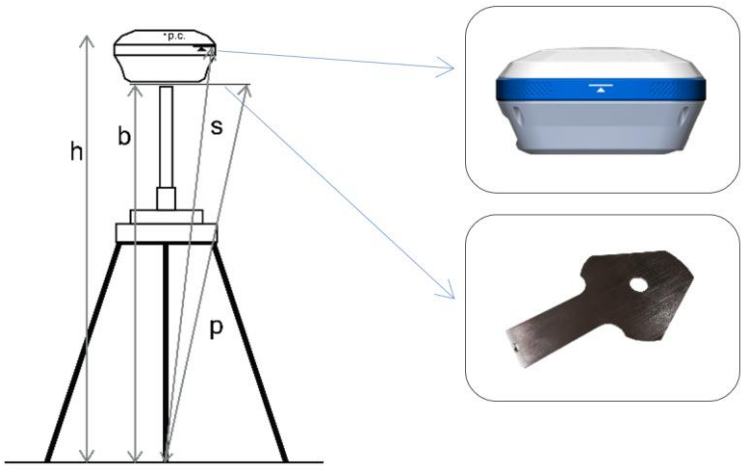
- The name of the next point. Clicking on this shows the following screen where, in addition to changing the name, you can choose the increment or decrease mode in the automatic naming.



➢ Code for next point



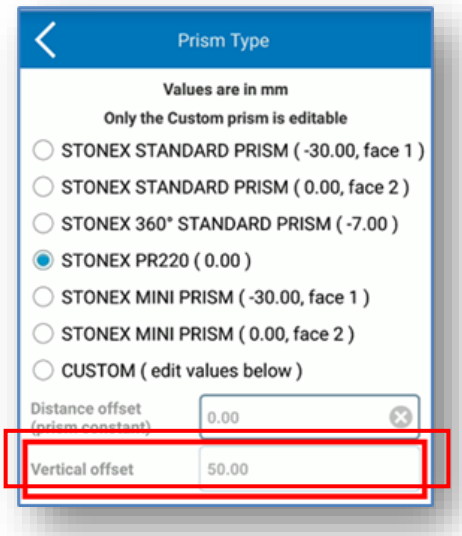
1. Antenna height



In GNSS mode, you can choose from the following options:

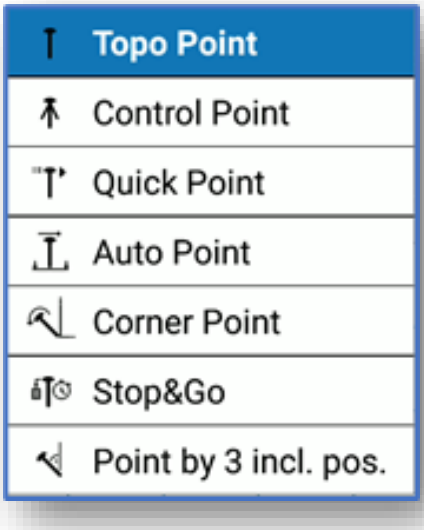
- *Vertical measure*: insert **b**
- *Height in the center of phase*: insert **h**
- *Slanted* measure: insert **s**
- *Inclined measure ref. plate*: insert **p**

In Total Station mode, the values refer to the height of the pole.
NOTE: Enter the height of the pole only if you have already considered the vertical offset of the prism in the prism setting (see 5.1.8Total Station Management).



5.1.1. Point types

In the survey area there is the shortcut button for the type of point.



This function allows the user to quickly choose the point type according to the needs, without having to change the parameters for saving the point each time. Example: during the survey, I want to save confinement points with the greatest possible reliability (which implies having to stay a few more seconds on the point). Without this function I would have to change the save parameters of the point to make the controls more stringent and, once I finish saving these points, I would have to reset the starting parameters, otherwise it would mean to dwell more time on all the other points as well;

thanks to this function, however, it is enough to change the point type and choose the one with the parameters already inserted that meets my needs.

Below are the point types in Cube-a; these have reasonable values entered by default, but the user can modify them as desired.
Topographic point: type of "classic" point. It is possible to set the following control parameters: minimum solution, maximum horizontal and vertical quadratic deviation, limit PDOP, maximum differential correction age, readings to mediate and interval (interval between readings).
Benchmark: point type with stricter controls, recommended in cases where you want to obtain the maximum reliability possible at the cost of stationing extra time on the point. It is possible to set the following control parameters: maximum horizontal and vertical quadratic deviation, limit PDOP, maximum differential correction age, planimetric and altimetric limit, readings to mediate, average GPS range, number of reading repetition and interval. Example: if the number of reads is 10, the average GPS range is 2s, the number of repetitions is 2, and the range 15s, then Cube-a performs 10 readings every 15s, the averages to 2 at a time and repeats the whole thing 2 times. When the capture is complete, you'll see the "Report of generated control points."
Quick Point: type of point suitable for a shipping acquisition since the controls are minor and, by default, less binding. It is possible to set the following control parameters: minimum solution, maximum horizontal and vertical quadratic deviation, limit PDOP, maximum differential correction age.
Automatic Point: point type that allows you to automatically save points without having to click the "capture point" button. It is possible to set the following control parameters: minimum solution, maximum horizontal and vertical quadratic deviation, limit PDOP, maximum differential correction age. It is obviously necessary to choose the criterion for auto-save, that is, whether to run it according to a time or space interval, and then set the time interval in seconds or the distance in meters.
Point on Edge: A point type that allows you to save a point on edge (without resorting to geometric calculation by intersection) even if you do not have a tilted GNSS receiver. It is possible to set the following control parameters: maximum horizontal and vertical quadratic deviation, limit PDOP, maximum differential correction age, readings to mediate. The acquisition consists in moving the pole (with a firm tip on the edge) drawing arcs around the edge; Cube-a averages between these readings.
Stop-go: A point type that does not provide for any control (to allow the user to save points even in the absence of corrections) where you can enable the recording of raw data and then set the number of eras. This type is suitable for saving points in critical condition and then doing a post-processing in the office.
Point from 3 inclined measurements: point type that allows you to save a point on edge (without resorting to geometric calculation by intersection) even if you do not have a GNSS receiver with tilt. Attention you need to own a GNSS receiver with electronic bubble. It is possible to set the following control parameters: maximum horizontal and vertical quadratic deviation, limit PDOP, maximum differential correction age, readings to mediate and interval (interval between readings). The acquisition consists of saving three points with the pole tilted in three different directions; Cube-a intersects the three spheres resulting from these three points.

In some types of point you can enable fast mode. If you do not enable this option, after you capture the point, a window appears, as in the figure below, which allows you to associate a photo with the

point, change the code or height of the pole (you can also do these operations after the points library), check various information about the point and cancel the save. If you enable fast mode, the point is saved immediately.

5.1.2. GPS survey

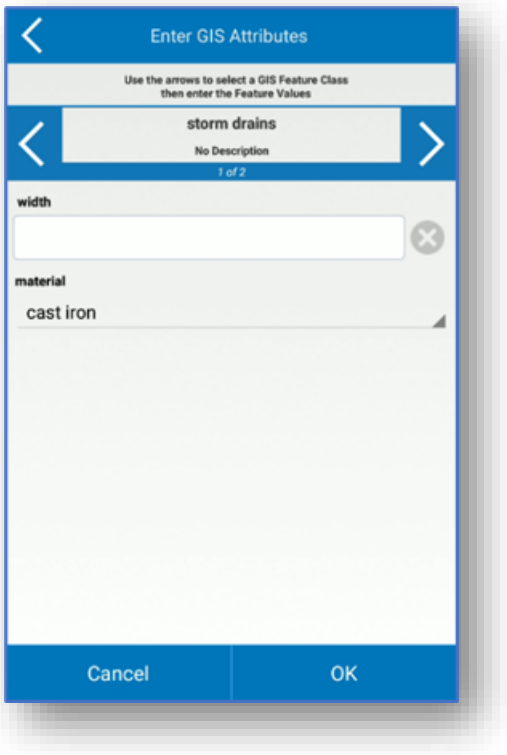
In GPS mode, the survey area looks like the following figure.

the only icon more than those described in the previous paragraph detect *points is* as follows

Capture the GPS point

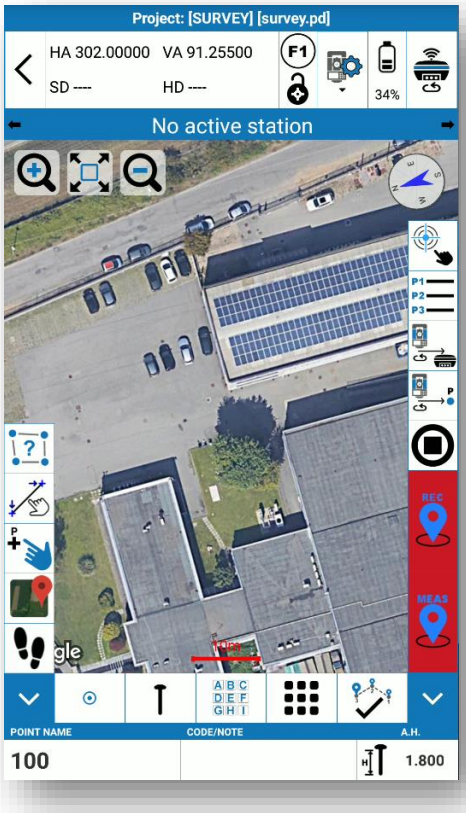
5.1.3. GIS Survey

If the GIS function is enabled, the *Enter GIS Attributes* window appears after saving a point or CAD entity. Here you can choose the attribute class by clicking on the right or left arrow and enter the GIS attributes accordingly. Click "Cancel" to clear the inserted attributes or click OK to confirm.

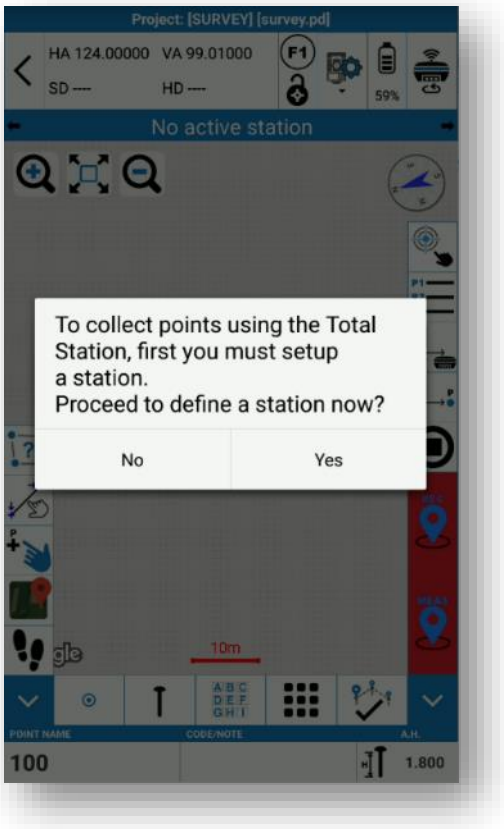


5.1.4. Survey with Total Station

If you are working with the total station module, you will have the following screen shot.



By creating The Project, the *MEAS and* REC icons are red because the station has not yet been declared. Cube-a will not allow you to detect points as long as the keys remain red, but pressing on one of them, you will have the following message that leads directly to the station definition page. Click on OK and refer to chapters 7.2.1Station on point and 7.2.2Resection/Free Station.



Returning to the survey area, in addition to the functions described in the **Errore. L'origine riferimento non è stata trovata.**

Measure distances

Save points if a measure has already been made, otherwise measure and save the point.

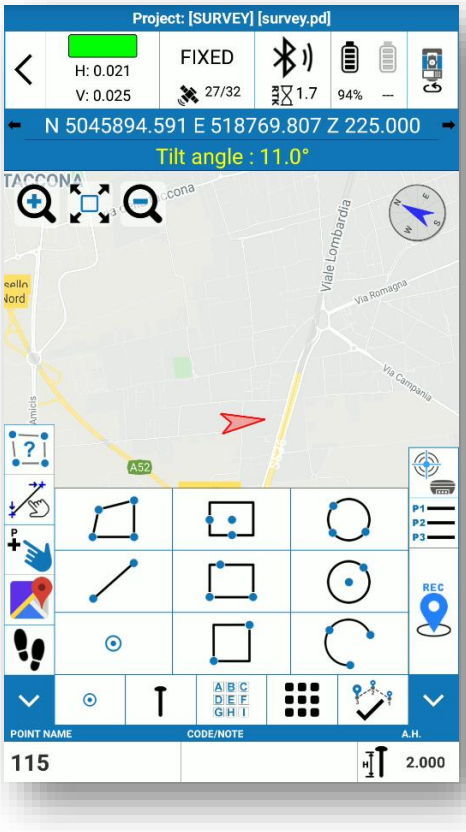
Stop the measurement if you are in tracking mode or searching for the prism.

Rotate the telescope to a point. It can be used during measument, after you have defined the station and its orientation.


Rotate the telescope to the GPS location. It can be used during surveying, after you have defined the station and its orientation, it is enabled if you have the Cube-a GPS module and if the antenna is in a fixed *solution*.

5.1.5. Draw when measuring points

Cad vector elements can be drawn when survey of points. The vertices of the CAD element are points captured while the Survey function is active.
To activate the drawing function, refer to the grid with cad entities, shown below:



Enables "standard capture", capturing a simple point. No CAD vector entities will be created.

Enables the capture of a polyline. While this function is active, Cube-a will connect all captured points to form a polyline. Click the button to end the polyline capture. 

Enables the acquisition of a polygon. While this function is active, Cube-a will connect all captured points to form a polygon. Click the button to end the polygon capture. 

Enables the capture of a square using two measured points at the end of the diagonal of the square. The acquisition ends automatically as soon as the second point has been measured.

Enables the capture of a rectangle using two points measured at the end of one side and a third point that determines the distance of the opposite parallel side. The acquisition ends automatically as soon as the third point has been measured.

Enables capturing a rectangle using three points: the first defines the center of the rectangle; the second defines the center position of one side; the third the center position of the orthogonal side to the previous one. The acquisition ends automatically as soon as the third point has been measured.

Enables the acquisition of a circle arc using three points that define (in order) the starting point of the arc, a point of tie for which the arc passes and the endpoint. The acquisition ends automatically as soon as the third point has been measured.
The three points must not lie along the same line.

Enables capturing a circle using two points: the first defines the center of the circle, the second defines the radius of the circle. The acquisition ends automatically as soon as the second point has been measured.

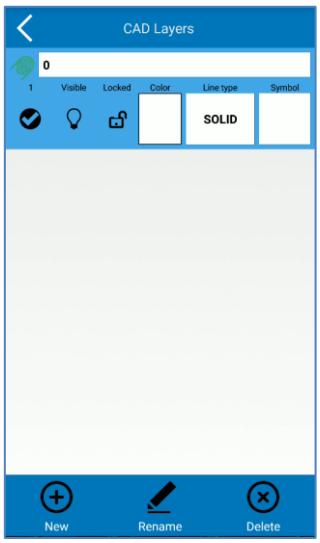
Enables the acquisition of a circle through three points, which must be captured in order, clockwise, or counterclockwise along the circular figure to be captured. The acquisition ends automatically as soon as the third point has been measured. The three points must not lie along the same line.

Drawing function	No of saved vertices	Key action
	-	No action
	< 2	Undo selected vertex
	>= 2	Save and start again
	< 3	Undo selected vertex
	>= 3	Save and start again
	< 2	Undo selected vertex
	< 3	Undo selected vertex
	< 3	Undo selected vertex
	< 3	Undo selected vertex
	< 2	Undo selected vertex
	< 3	Undo selected vertex

5.1.6. Survey tools

Clicking the icon from the Survey or Picketing pages has the following functions.

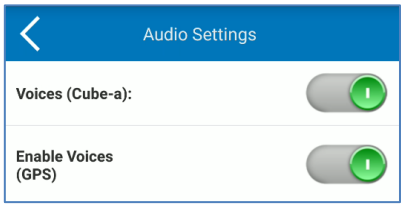
Layers CAD Access CAD layer management:



Layer "0" is defined by default and cannot be renamed/cleared.
Each layer can be set as visible/not visible, locked/unlocked, and you can change the color, line type, and symbol for points.

Entity list See paragraph 8.1Entity List

Sounds/Voices Enables/disables cube-a and GPS entries:



Registration setting These settings change depending on how you use between detection, Setting out point, or Setting out line.

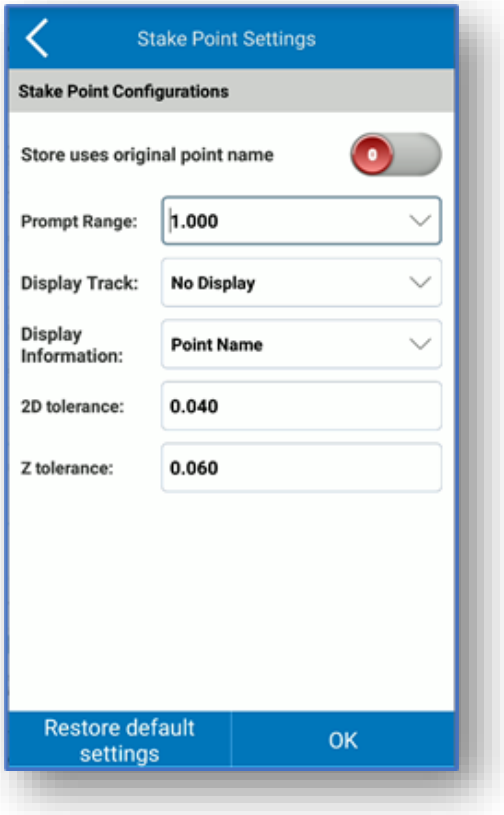
Display setting See chapter 6.3Display settings.

	**Use last measured point***	If you want to draw during point measurement, you may need to use the last measured point as the start point of the entity you are drawing.
	**Use point from list***	If you want to draw when measuring points, you may need to use a point in the list as a point of the entity you are drawing.
	**Use point from CAD***	If you want to draw when measuring points, you may need to use a CAD point on the map as the point of the entity you are drawing.
	**Entity Pause – Survey Points***	If you want to draw when measuring points, you may need to pause the entity to draw, so that you can measure some points that are not vertices of that graphics entity.
	**Resume paused entities***	If you want to draw during point measurement, you may need to resume measuring points such as vertices of the graphics entity you were drawing.
	**Distance***	Calculating the distance between points.
	**Hidden Point – Intersection***	Geometric calculation of a hidden point for 2-point intersection and distance
	**Hidden Point – Intersection***	Geometric calculation of a hidden point by 4-point intersection
	**2 points+azimuth line***	Geometric calculation of a 2-point point, azimuth, and distance
	**Average Points**[1]	See section 8.5.2Point Averaging.
	Sensor options	Turn on Electronic Bubble / Tilt Correction. See section 7.1.4Sensor Options.

[1] Available only on Suvery page

5.1.6.1. Point stakeout settings

By accessing the recording settings from the setting out points page, you can define the following values:

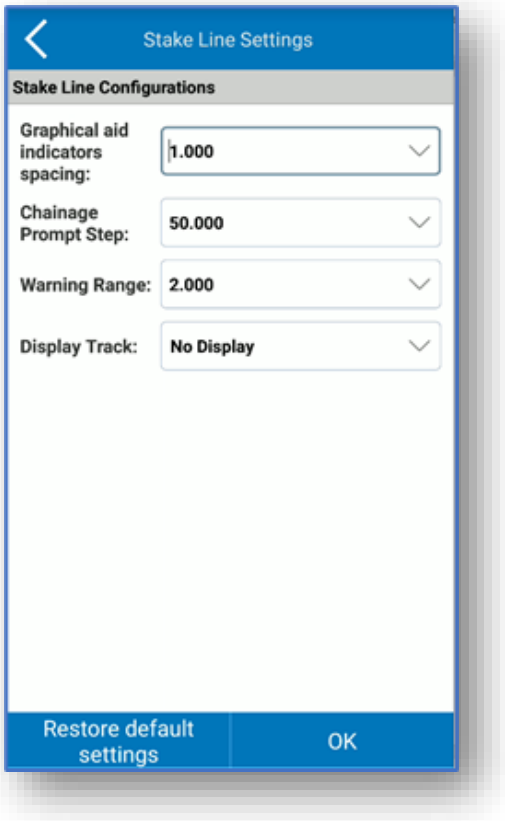


1. *It stores using original point* code: enable or disable, depending on whether you want to save the picketed point with the original name or not.
1. *Dist. maximum*: three concentric circles can be displayed on the screen around the point (the center is the point to picketing). Define the maximum distance from the point for displaying circles.
1. *Show Track:* "View" to see the points of the last positions (show the shred of the route executed).
1. *Show:* Select what information you want to display on screen (Do not display, point name, point code)
1. *2D* tolerance: Insert picketing tolerance into floor plan.
   - *Dimension tolerance:* Insert the tolerance for picketing in elevation.

Clicking *Restore Configuration and* will restore the picket points to the default configuration.

5.1.6.2. Line stakeout settings

By accessing the line picketing page registration settings, you can define the following parameters:



1. *Graphic aid distance* is the space between the reference lines added to the side of the line to be Staked out.
2. *Progressive* step: it is the step to view the progressive on the line.
3. *Dist. Warning:* Warns you if you are approaching the destination point when you enter within the defined distance value. If you move away, you are warned that you are moving away from the destination point.
4. *Show Track:* "View" to see the points of the last positions (shows the scrap of the route executed).

5.1.7. Photos and Sketch

The Photos and *Sketch command allows* you to associate a photo with a point.
To start *Photos and Sketch,* press the key at the bottom of the screen while you are:

- Checking the details of a newly collected point.
- Changing the data of a detected point library flaw point.

The photo will be taken using the built-in camera of the device and is saved as a .jpg file in the *Photos folder* of the project used.
The name of the image will be the same as the dot.
You can also draw over the photo and add:

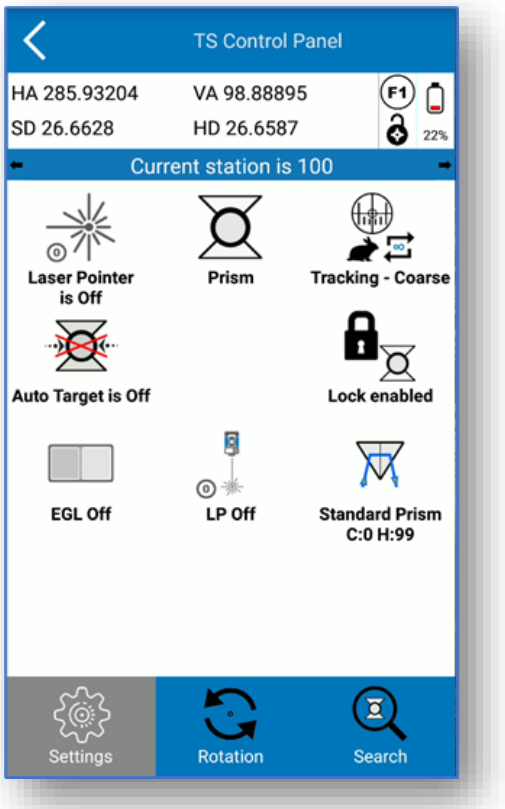
- Text notes.
- Point information (name, coordinates)
- Arrows
- Hand-drawn sketches.

Anything can be moved or rotated on the image.
Images can also be redone or deleted.

5.1.8. Total Station Management

Access the total station management panel by clicking on this icon in the status bar  .

The panel contains three submenus, *Settings*, *Rotation*, and *Search*, depending on you are working with the motorized total Station, or you are working with a manual one



5.1.8.1. Total Station Settings

Define the total station settings. They can change depending on the total station model used:

Laser pointer: can be turned off/on.
Target type, choose from:

No Prism if you are detecting points without prism

Foil reflector if you are measuring a point identified by areflective fo glio

Prism up to 2,500 meters

Remote prism between 2,500 and 5,000 meters.

Measuring mode:

Single - Precise: the station will measure a single and precise measurement point.

Tracking - Precise: The station will continue to make precise measurements point, until it is stopped.

Tracking - Fast: The station will continue to make fast point measurements point, until it is stopped.

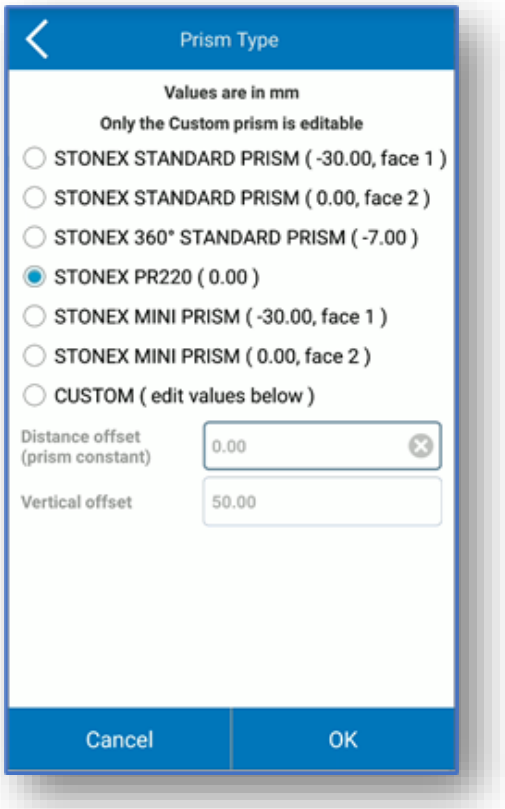
Tracking - Fast + Mis. End: The station will continue to make fast measurements until a precise measurement is made.

Average (3): the station will detect 3 points measurements and Cube-a will average them.

Average (n): the station will *detect n* points measurements and Cube-a will average them. Press over the icon to enter as many measures as you want.

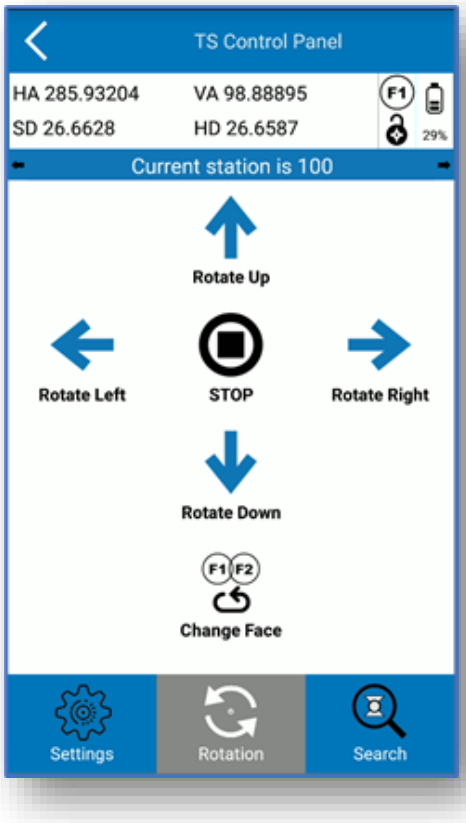
1. ***Target Auto***: Can be enabled /disabled . If enabled, corrects target aim with respect to the target axis: Calculates angular corrections (horizontal and vertical) to correct angles without having to aim exactly at the center of the prism. If Autotarget is enabled, the Lock is disabled and vice versa.
1. **Lock:** Canbe enabled / disabled . It makes sense to enable it if you are using a prism as a target.
2. Electronic Helpline: Can be enabled (3 levels available) /disabled.
1. **PL** (Laser Plomb): Can be enabled (3 levels available) /disabled .
1. **Prism Type** : Select the prism model from the list or choose CUSTOM to insert the desired offset values.

NOTE: Since the vertical *offset of* the prism is defined on this page, this value should not be considered by setting the height of the measure during the Survey, but inserting the height of the pole only.



5.1.8.2. Total station rotation

From here you can manage the motorized station remotely. You can rotate the telescope up /down /left /right ; movements can be stopped by pressing stop.
From this page you can also change the face of the instrument (from face I to face II and vice versa).

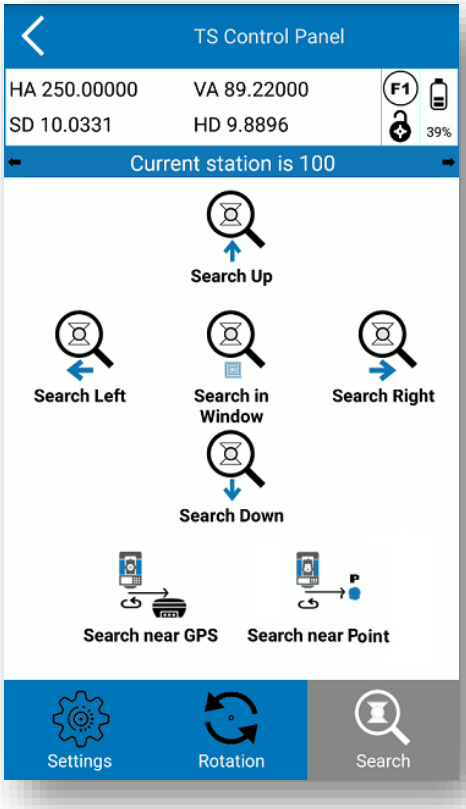


5.1.8.3. Prism searching

From here you can manage the search for the prism with a motorized total station. You can start searching for the prism at the top /bottom /left /right or within larger and larger area , starting from where the telescope is positioned.

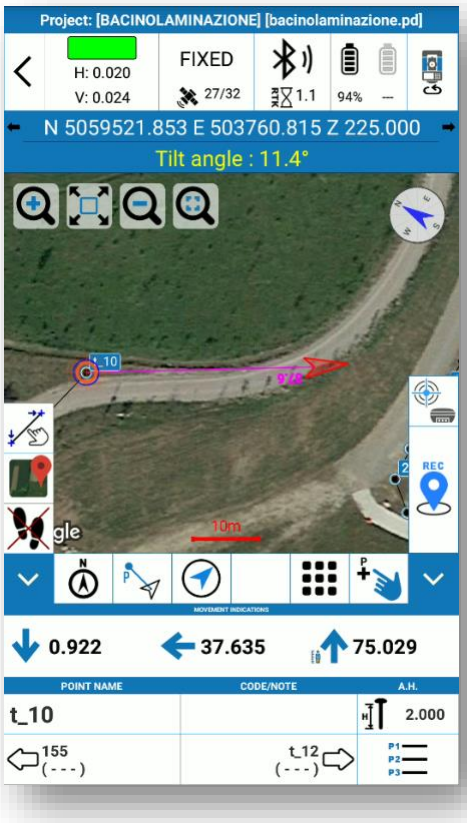
The Search *Near GPS Location* *and* Search Near *Point* *commands* allow you to rotate the telescope in the direction of the GPS or the location of the point, respectively. They can be used during the survey, after the location of the station has been defined and its *orientation Search near GPS location can* be used if you have the Cube-a GPS module and if the antenna has the *fixed solution.*

Press anywhere on the screen to stop the search. If the prism search is successful and lock settings are enabled, the prism will remain hooked.


TS Control Panel
HA 250.00000
VA 89.22000
SD 10.0331
HD 9.8896
F1
39%
Current station is 100
Search Up
Search Left
Search in Window
Search Right
Search Down
Search near GPS
Search near Point
Settings
Rotation
Search

5.2. Point Stake out

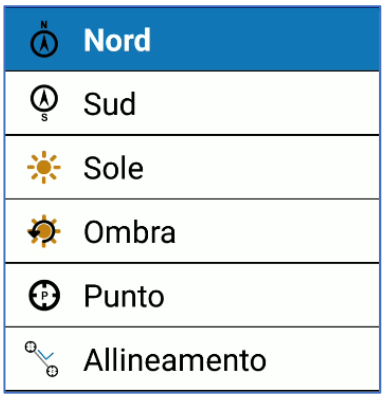
Click on "Survey" -> "Stake out" and access the points library, then select a point and click on "OK" to access the points Stake out interface, shown below:



In addition to the functions that are in the Survey area, there are also:

Zoom in on your position and the point you want to Stake out.

Define the object to use as a reference during Setting out If you are working with GPS, you have:



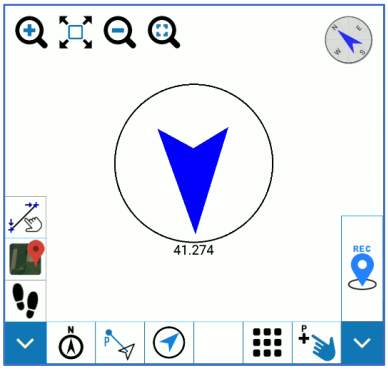
North: with reference to the compass, the magnetic north must be in front of.
South: with reference to the compass, the magnetic south must be in front.
Sun: the sun must be in front.
Shadow: the sun must be behind.
Period: Choose a point from the Survey point to reference. The points library opens to select the point.
Alignment: Choose a reference line. The line must be defined by choosing two survey points. Enable point selection by clicking on the blue hand. Below the list, you must select Pt *ref. 1* then *Pt ref. 2*, depending on the direction you want to assign to the line:

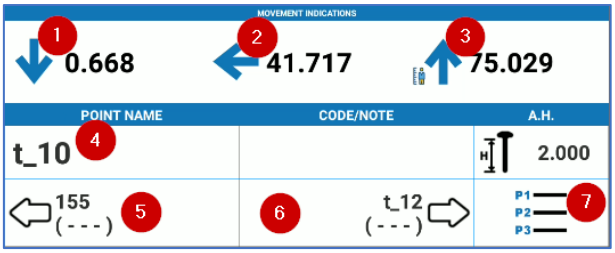
If you are working with a total station, in addition to gps modes, you have:

Mode (2-people): choose these settings if there are two people in the field: one is located at the total station and gives instructions to the second person who is in the prism. This mode is very common if you are working with a manual total station.
Mode (1-person): Choose these settings if a single user is working. It must refer to the location of the station and move by supporting the prism. This mode is to be used if you are working with a motorized/robotic station.


Shows the current location on the map, by representing a red arrow. The picket point is highlighted with a red and blue circle, and a purple line, which connects current position and point, shows the distance.

Shows the direction in which you are moving through a blue arrow and the distance between the current position and the point to picket. to return to the map view press the .



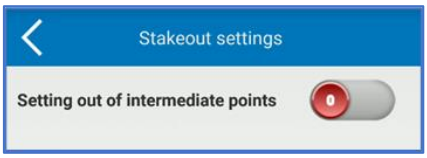


1. Move back or forward to the distance shown to find the point: once the point is found, satisfying the declared tolerance, the arrow will turn green
2. Move left or right for the distance shown to find the point: once the point is found, satisfying the declared tolerance, the arrow will turn green
3. Shows the elevation of the picket point: the point can be above or below , suggesting stretch or carry-over: once the point is found, satisfying the declared tolerance, the arrow will turn green
4. ID of the point you are Setting out.
5. Picket the previous point
6. Picket the next point
7. Access the points library to select another point.

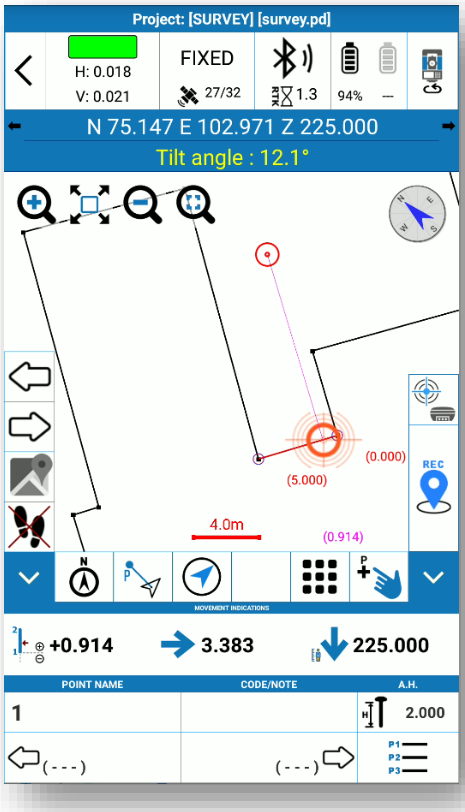
5.3. Line Stake Out

Click on "Survey" -> "Stake out Line" and access the line library to select one.

If you want Stake out a line from a *file. *dxf*, keep in mind that lines coming from . *dxf* are not listed in the line library but must be selected from the map using the icon.
If you have the following option:



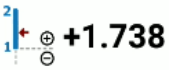
1. Leaving it off it will Stake out the line: it will not matter which point of the line will be Stake out, but any position on the line will be considered suitable to end the operation.



The current position is shown with a circle and a red dot; line to be Stake out in red, with indication of the starting point (0.000) and arrival point (e.g. 5,000), and the projection of the current position on the line is indicated with:

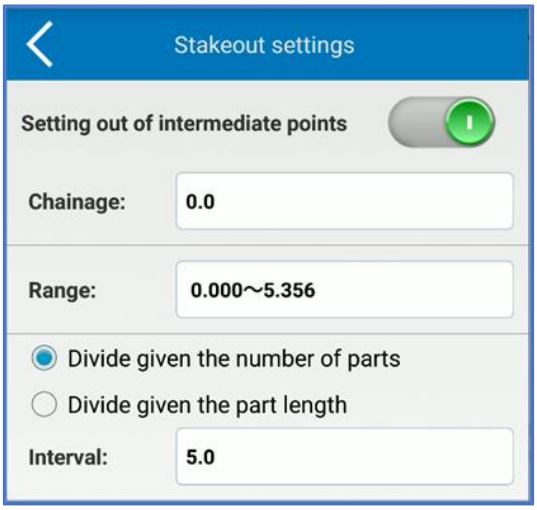
Commands are still same of point stake out, other then :

 Stake out previous/next point

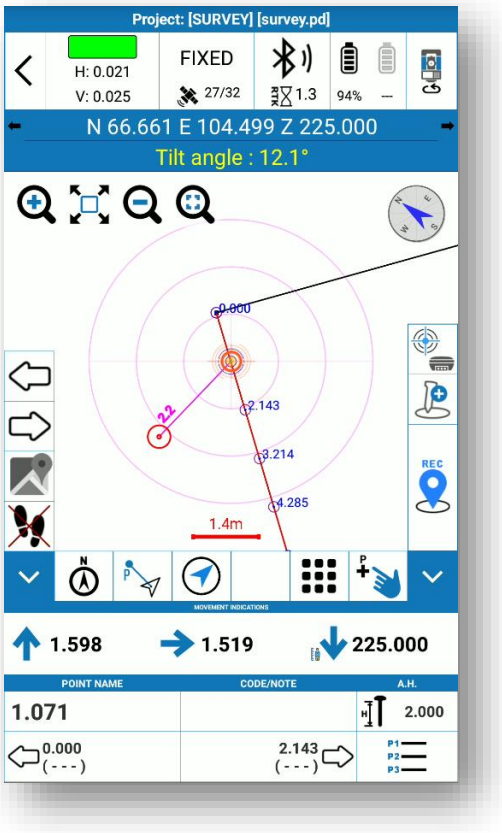
 Mostra la pozione lungo la linea: può essere positiva (se tra il punto iniziale e finale) o negativa (se prima del punto iniziale).

1. Enabling it  to Set points along line with no offset from the line.

   To do that. The following parameters must be inserted:



- *Progressive*: Inserting the N ***value*** adds a point along the N-distance line ***relative*** to the start point.
- *Interval*: Shows the extent (start and end point) of the line that you selected for Setting out. . You cannot EDIT given name.
- *Divide given the number of parts:* by checking in, whatever the length of the line, it will be divided into N ***equal*** intervals (value defined in the *Interval box)*. With the parameters shown in the image above, the following points will be identified on the line: 0.000 – 1,071 – 2,143 – 3,214 – 4,285 – 5,356.
- *Divide given the length of a part:* by checking in, whatever the length of the line, it will be divided into N-magnitude ranges (a value defined in the *Interval box)*. With the parameters shown in the image above, the following points will be identified on the line: 0.000 – 5,000 – 5,356.

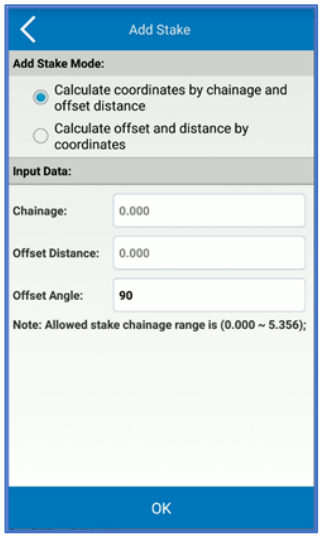


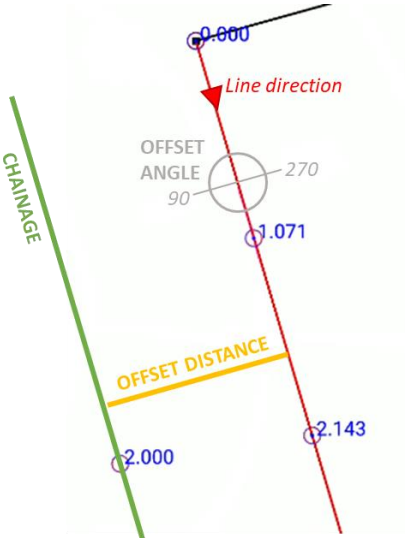
The current position is shown with a circle and a red dot , the line to be Stake out is also in red, with indication of the split points of the line 3.214 and the currently selected point. The function are the same in 5.2Point Stake out with adding:

/ Picchetta la linea precedente/ successiva.

0.000 / 2.143 Picchetta il punto precedente/ successivo della linea.

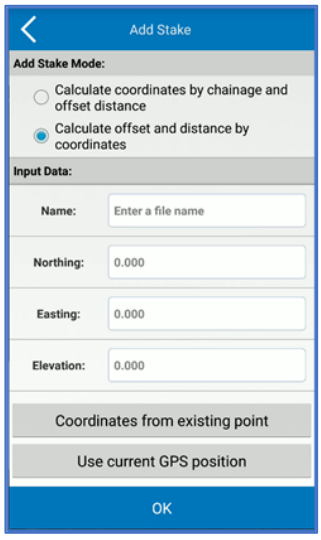
Permette di definire gli offset per il picchettamento. Si può scegliere tra:
Calcola coordinate da progressive e squadro





Chainage is the distance along the line from point 0
Distance offset is the lateral offset from the line.
Angle offset is the direction for the side offset in reference to the direction of the line: 90° means right, 270° left.

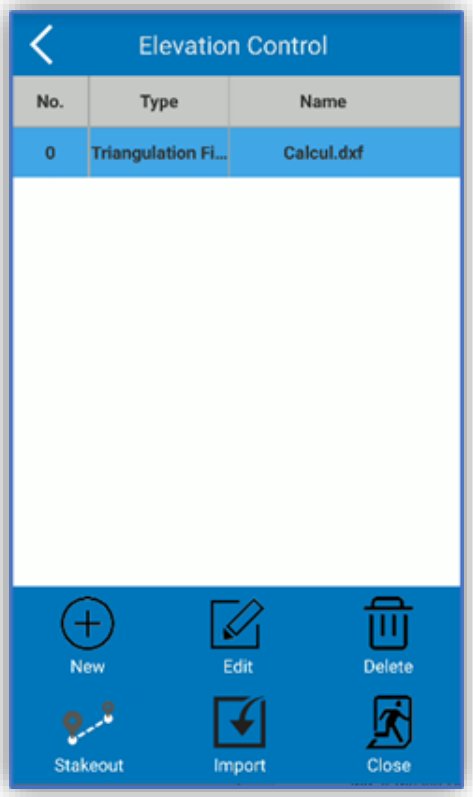
Calculate chainage and squares from coordinates.

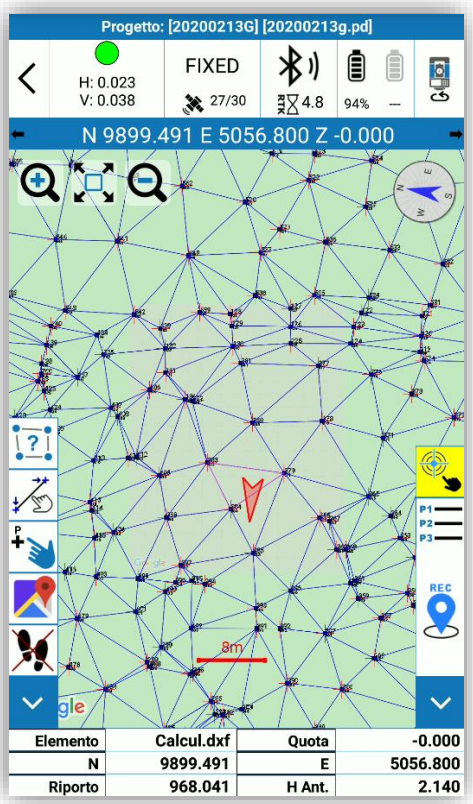


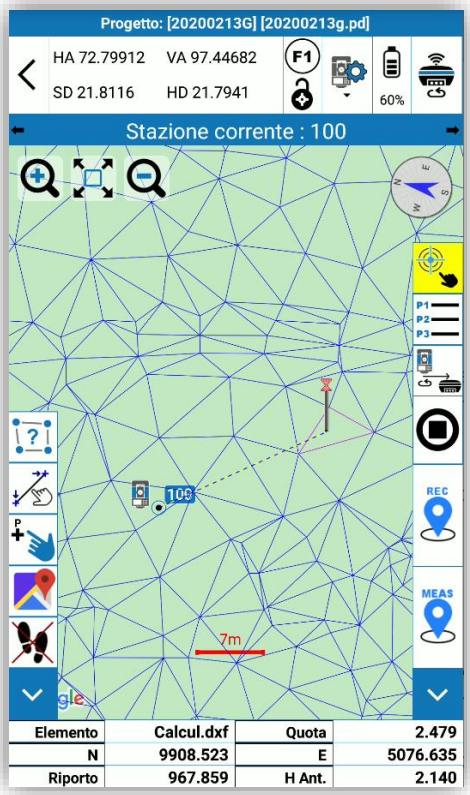
Enter coordinates or use coordinates from existing points or use the current GPS location.

5.4. Elevation Control

The Elevation Control feature allows you to "plot in elevation".
First you need to select the file on which to check the dimensions. At the bottom, the "New" command allows you to create/import the file.
With the "New" command, you can import a Triangulated Irregular Network (TIN) file, in *format. DXF. alternatively, manually add triangles (specifying the coordinates of the 3 vertices). Still define a plane for 2 points (a 3D point plus a 2D point plus the slope in the point-1 *direction towards* point-2) or define a plane for 1 point (a 3D point plus the north and east slopes). The "Import" command allows you to import a file with a .*. DI TIN.
The tool displays the difference between the current GPS/Target height and the reference height.
If the height difference is positive, the program will show "Digging" followed by the absolute difference value: this means that to reach the reference height it is necessary to perform a "height cut", that is, dig the ground or simply lower the pole if it does not rest on the ground. If the height difference is negative, the program will show "Carry over" followed by the difference value, which means that to reach the reference height you need to perform a "height fill", that is, add some ground or simply raise the pole if you are only noting the reference height level.

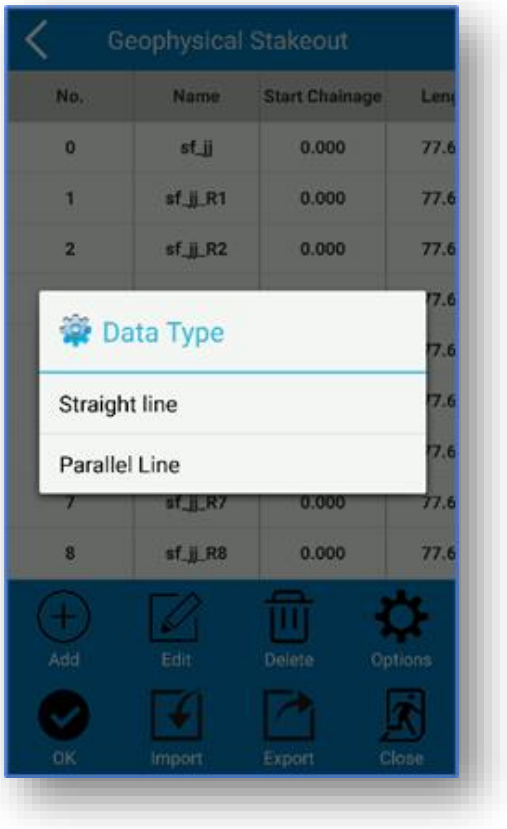



Progetto: [20200213G] [20200213g.pd]
H: 0.023
V: 0.038
FIXED
27/30
4.8
94%
N 9899.491 E 5056.800 Z -0.000
8m
REC
Elemento Calcul.dxf Quota -0.000
N 9899.491 E 5056.800
Riporto 968.041 H Ant. 2.140

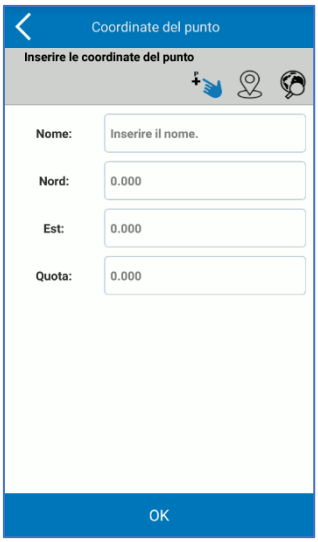

Progetto: [20200213G] [20200213g.pd]
HA 72.79912 VA 97.44682
SD 21.8116 HD 21.7941
F1
60%
Stazione corrente : 100
100
7m
REC
MEAS
Elemento Calcul.dxf Quota 2.479
N 9908.523 E 5076.635
Riporto 967.859 H Ant. 2.140

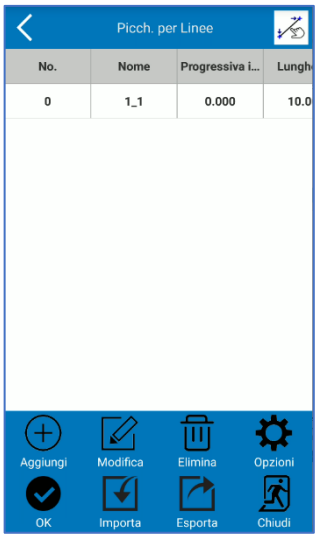
5.5. Stake out by design lines

With this function, you can create parallel lines from one as a reference and stake out all lines. To do this, open the function and select Add. Then select *Straight to* set the reference line.

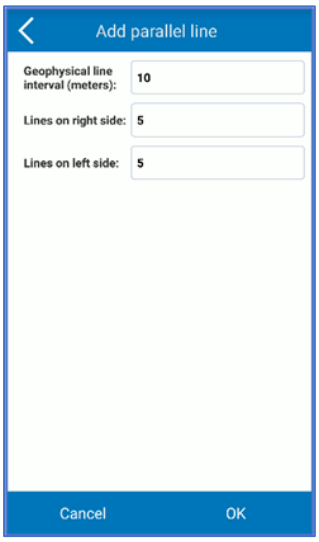


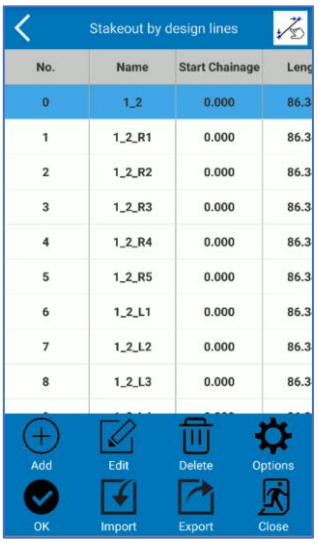
Set the start and end point and name the line.



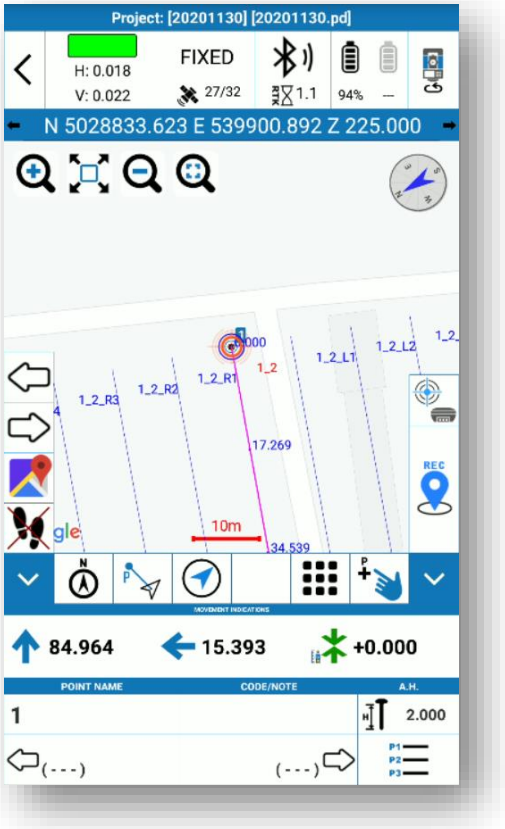


To create the parallel line, select the reference line and press Add. On the menu that appears, click *Parallel Line*. Then insert the Spacing (distance between the lines) and the number of parallels to the left and right.
After confirming, the user will have all the lines defined and ready for Staking out.



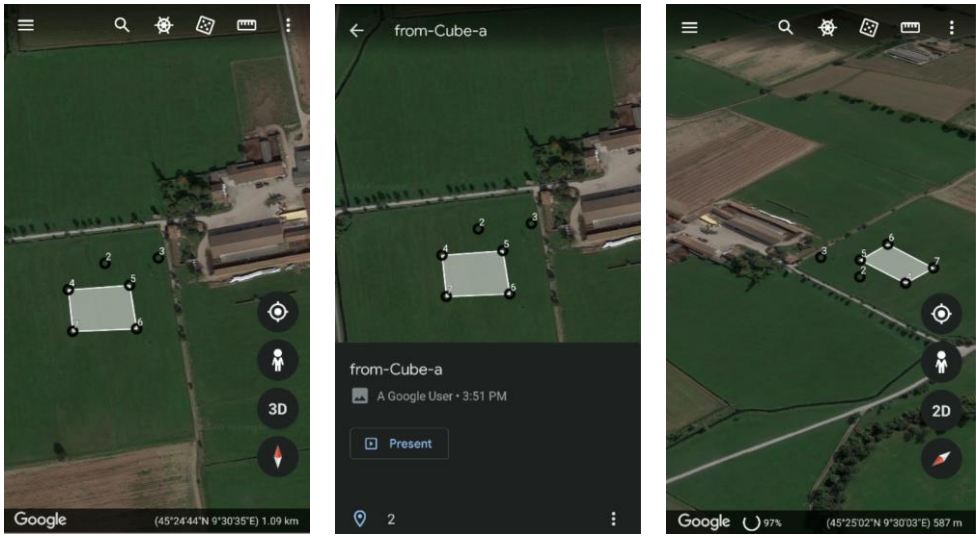


To start Staking, select the line and press *OK*.



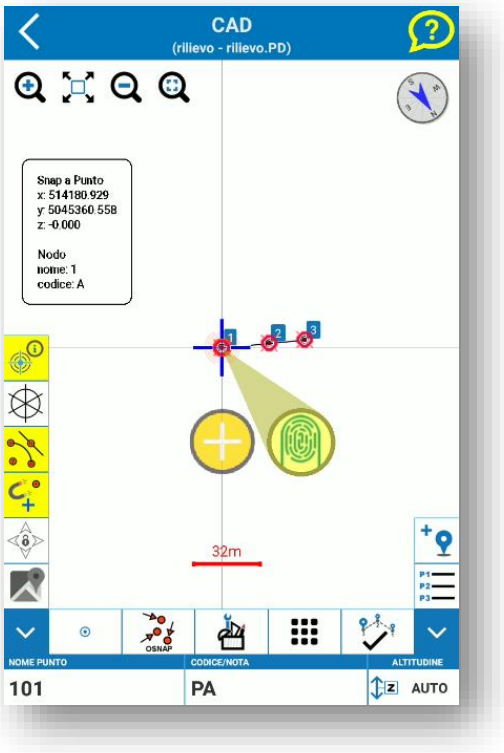
5.6. View in Google Earth

This tool allows you to view the active Survey using the Google Earth application, so it will also be possible to view in a 3D environment. To use this service, the Google Earth application must be installed on your device.
Note: CAD points and entities are "grounded", that is, heights are ignored and all elements are placed on the ground.



5.7. CAD Tools

Clicking on "CAD" in the "Survey" menu accesses the CAD area, where you can use various SNAPS, draw point entities and CAD entities, edit existing entities, add and remove and vertices, replicate existing CAD entities, add points.

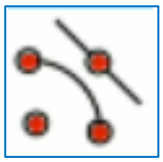


In the upper right there is the icon of a yellow question mark: holding down this icon begins a contextual help that allows you to remember, always, the meaning of the various icons present in the CAD area.

Zoom icons are compass at the top are described in the paragraph**Errore. L'origine riferimento non è stata trovata.**.
Below are the features accessible from the vertical bar on the left in the CAD area. If enabled, they are yellow.

If enabled, displays the information for the selected entity.

If enabled, hides the points symbol.



If enabled, turn on all snaps you choose.

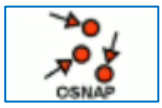
If enabled, the cursor is automatically snapped to.

If enabled, snap the pointer to the map.

As in the survey area, enable a background map (e.g. Google)

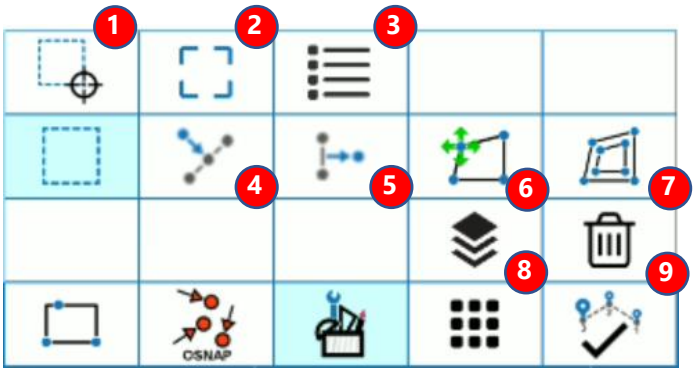
The bottom fields for the point name and note code are described in the survey**Errore. L'origine riferimento non è stata trovata.**
Below are the features accessible from the horizontal bar at the bottom of the CAD Tools.

Choose the entity you want to draw (see 5.1.5Draw when measuring points).



Choose which SNAPs to activate.

Choose the COGO operation you want to perform.



1. Select entities in an area.
2. Select the entities by indicating them one by one.
3. Select entities from the entity list.
4. Add vertex to an entity.
5. Remove vertex from an entity.
6. Move the vertex of an entity.
7. Create multiple entities with a certain offset from an existing entity.
8. Move one or more entities to a different layer.
9. Erase one or more entities.

View additional tools

Finish drawing the CAD entity.

Sets point elevation.

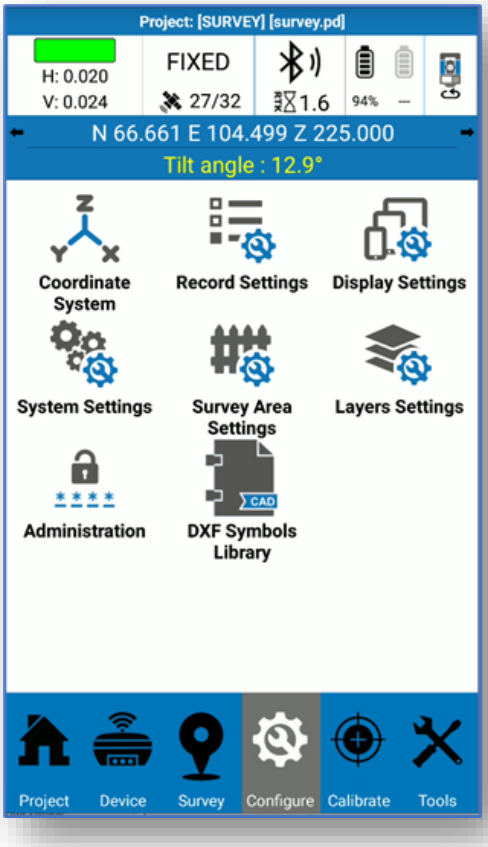
Below are the features accessible from the vertical bar on the right in the CAD area.

If enabled, as you draw an entity, the vertices become points in the library.

Go to the points library.

6. Configure

The Configure menu looks the same in both the GPS and TS version of the program. This menu contains all the functions useful for configuring the Cube-a program, configuring some parameters of the current project, such as the reference system, and importing external drawings such as layers.

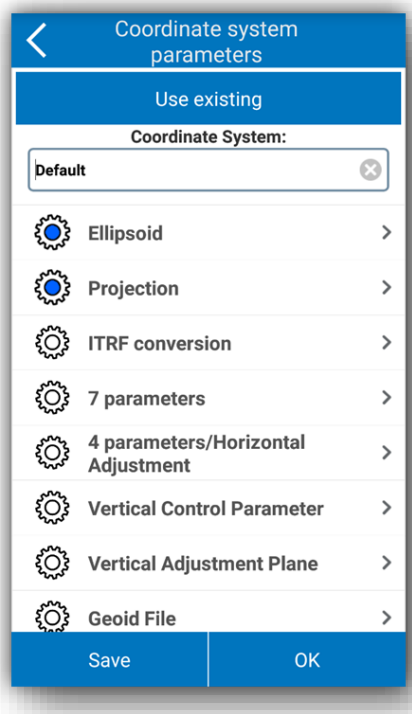


6.1. Cooridinate System

Clicking on The Reference System, in the Configure menu, opens the Reference System Parameters page, where you can check the reference system currently in use and modify it. It is not necessary to modify the parameters listed below (Ellipsoid, Projection, ...), except for specific needs that require the customization of these parameters, since the program defaults to the main reference systems in use worldwide. Click on Existing Use/Change and then on Default Systems to access this list; you can search for the reference system by filtering by country or by word. By clicking on Details you can read the parameters of the selected reference system. To choose and set up a reference system from the list of default systems, select it and click OK.

Clicking on The Reference System, in the Configure menu, opens the Reference System Parameters page, where you can check the reference system currently in use and modify it. It is not necessary to modify the parameters listed below (Ellipsoid, Projection, ...), except for specific needs that require

the customization of these parameters, since the program defaults to the main reference systems in use worldwide. Click on Existing Use/Change and then on Default Systems to access this list; you can search for the reference system by filtering by country or by word. By clicking on Details you can read the parameters of the selected reference system. To choose and set up a reference system from the list of default systems, select it and click OK.



By clicking on "Use Existing/Change" and then on Local Disk you can import a reference system saved on the device (*files are supported. SP and *. EP); by clicking instead on "QR code" you can scan the QR code and acquire the parameters of the coordinate system in this way.

The following are the parameters of your reference system listed on the Reference System Parameters page.

Ellipsoid: This command opens a page where you can choose the name of the ellipsoid that supports parameters that have already been defined or choose a customizable ellipsoid. In the latter case, you must choose Custom at the bottom of the "Ellipsoid Name" drop-down menu; you can then set semi-major axis and flattening ratio 1/f.

Projection: This command opens a page where you can choose the projection. Using gauss krüger projection, for example, you need to set the central meridian; this is automatically entered by the program if you are already connected tothe GNSS receiver, using the position transmitted by it, otherwise it can be entered manually or, after connecting the GNSS receiver, the central meridian can be inserted by the program by clicking on the drop icon (icon to the right of the Central Meridian drop menu).

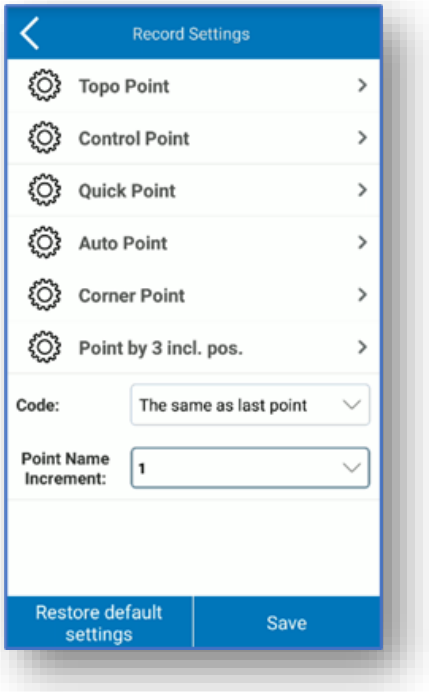
ITRF Conversion: This command opens a page where you can enable conversion between International Terrestrial Reference Frames (ITRF) with different reference eras. To enable ITRF

conversion, you must choose the type of conversion, enter the reference era, and enable or disable speed entry; If you enable speed, you must insert the speed components along the axes. X, Y, Z. Attention, this conversion is applied to all points in the current project, and not just from the moment you enable it.
The **7 parameters**, Local **Rototranslation**,Vertical **Calibration Plane**, Offset for **Local Coordinates/Map** commands contain translation, rotation, and scale factor values when expected from your localization.
Geoid files: This command opens a page where you can enable the use of the geoid. Clicking Open on the "Geoid Files" page leads to the list of preloaded geoids in the program. To add a geoid that is not in this list, copy the file to stonexcube -> Geoid; Cube-a supports all major standard geoid formats (*. GSF, *. GGF, *. UGF, *. BIN, ...).

Click OK to apply the chosen reference system. Click "Save" and choose "Local Disk" to save the system data to a file whose name and location you have defined. You can also encrypt the file by setting an Expiration Date, General Password (data cannot be displayed before expiration date), and Advanced Password (data can be displayed before expiration date). Click on "Save" and choose"QR Code" to share the parameters of the current coordinate system via QR Code.

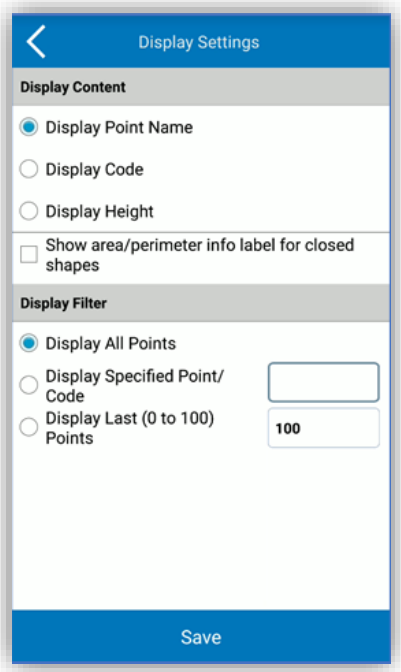
6.2. Record settings

Clicking on logging setting, from the Configure menu, opens the relative page, where you can set the parameters for saving the various point types (see paragraph Point Types).Point types
Code: You can set the code, by default, to be empty or equal to the last point, or as a mileage assignment code.
Point name increment: Auto-naming rule for saved points. For example, if you choose 2 in the drop-down menu, the point names will be auto incremented by two units, each time you save the point.



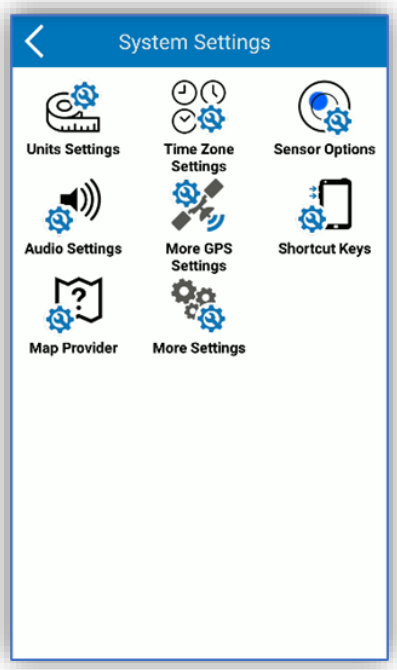
6.3. Display settings

This function is intended to set the information that will be shown in the survey area. It is also possible to filter the number of visible points.



6.4. System Settings

The following figure shows the system settings, which we will see in detail below.



6.4.1. Units Settings

In this section, you can define the units of measure that you want to use in Cube-a.

6.4.2. Time Zone Settings

You can set a time zone through the appropriate drop-down menu. The time zone is used to bring GPS time back to local time. if not set differently cube-a uses the system time zone.

6.4.3. Sensor Options

This command accesses the same page as described in section Sensor Options7.1.4Sensor Options.

6.4.4. Audio Settings

This command enables/disables voice alerts and sounds expected in the program, as well as receiver alerts.

6.4.5. More GPS settings

The user can choose to work in Normal *or* Precise *Mode*. The precise mode consists of a more accurate search for the FIXED solution, but at the expense of speed. The maximum achievable accuracy will be the same, but the solution will be much more reliable.
In the case of GNSS receivers with Novatel board, the precise mode enables "extra-safe" mode; in the case of GNSS receivers with Hemisphere card, the precise mode enables "SureFix" mode.

With the function called L-band Zone you can set the reception zone of L-band frequencies, normally receivers select the zone automatically (available only for GNSS receivers with Hemisphere card) From this screen you can also activate the Wi-Fi of the receiver.

6.4.6. Shortcut Keys

Shortcuts can be set for some Survey and Stake out functions. The possible settings can be: *Nothing,* if you do not want to associate any shortcut key, *Vol UP* or *Vol DOWN* to associate the Volume button, Custom *allows* you to associate a button of your choice, the first one you press, after selecting the item "Custom".

6.4.7. Map Provider

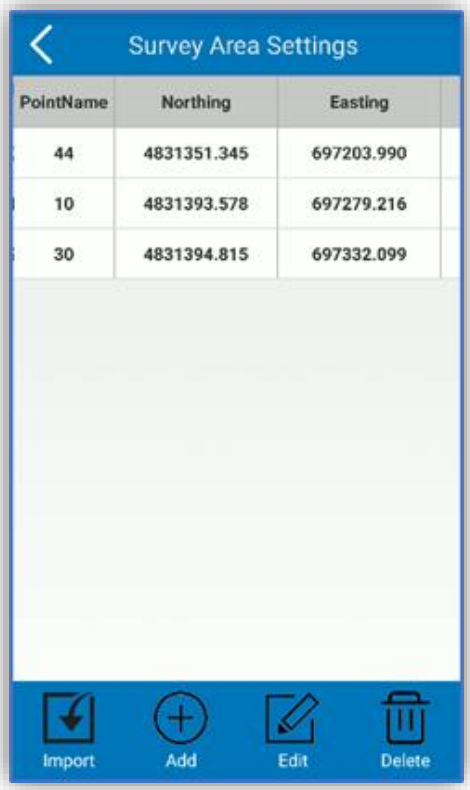
The command allows you to select the type of background map that Cube-a will use; the choice can fall between Google Maps, Open Street Map, Bing Maps or no maps. It is also possible to set the level of opacity of the map and enable the option "Rotate the map using the compass angle"; in the latter case the map will not always be oriented north but its orientation will be consistent with the direction of movement of the user.

6.4.8. More settings

The command allows you to enable fictitious locations, i.e. the location of the device (and all the applications present that use its data), will follow the coordinates of the connected GNSS receiver (and not those of the internal GPS).

6.5. Survey Area Settings

Click "Add" to set the coordinates of the point or search for coordinates in the points library or use the current GPS coordinates. Generally, the area of investigation needs at least three points. Points can be chosen, edited, or deleted. Click "Import" to import coordinate files (*.dat, * .txt, * .csv). The detection area, after setting, is visible as a figure with red lines, so you can visibly check if the current point is in the set area.


Survey Area Settings
PointName
Northing
Easting
44
4831351.345
697203.990
10
4831393.578
697279.216
30
4831394.815
697332.099
Import
Add
Edit
Delete


Project: [20181204] [provaexp.pd]
H: 0.025
V: 0.034
FIXED
27/32
0.6
94%
N 9891.910 E 5056.802 Z 0.000
9m
POINT NAME
CODE/NOTE
A.H.
48
2.000

6.6. External Drawings

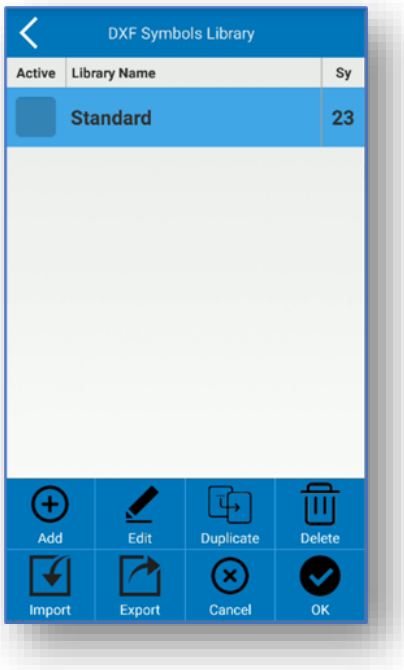
This command allows you to import DXF or Shapefile files into your program in the form of layers. As a result, points will not be imported into the library, only in graphics. However, you can select points and entities from the graphics and use them for tracking. Click "Add" to select the file you want to import. The "Edit" command allows you to change/read the name of the imported external drawing, read the location of the file in the data store, enable/disable visibility, enable/disable the selection of items in the layer, such as lines and points ("Find" command), and set the unit of measure and scale factor.
Warning: These files will be imported into the program and will be visible in all projects until you make them invisible or delete them, they are not constrained to the current project.

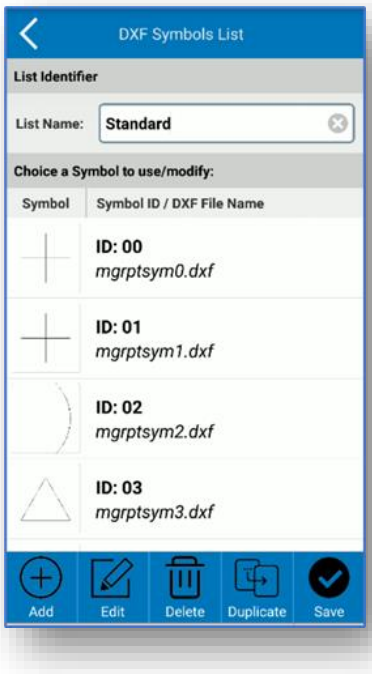
6.7. Administration

On this page, you can change the password visibility settings in Cube-a (such as those for your CORS account). You can also protect this screen so that visibility settings are protected themselves and accessible only by a password administrator. The last field at the bottom, if left blank, from free access to the function, if instead a password is entered, in order to access this function again you will need to enter the password.

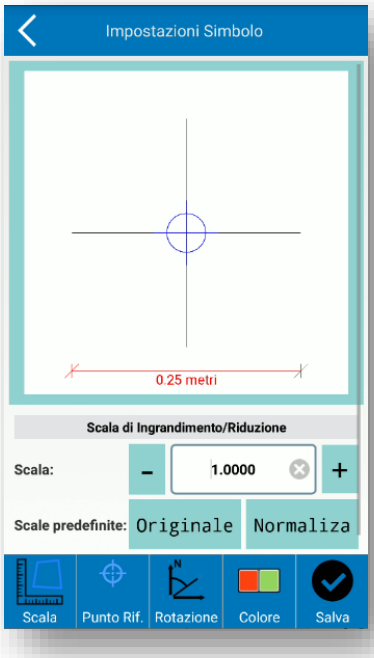
6.8. DXF Symbol Library

On this page, you can import or create a symbol library so that you can associate them with layers, and then you can save points with different symbols in the survey area. The program defaults to a standard library containing 23. Within the selected library, the user can preview the available symbols.



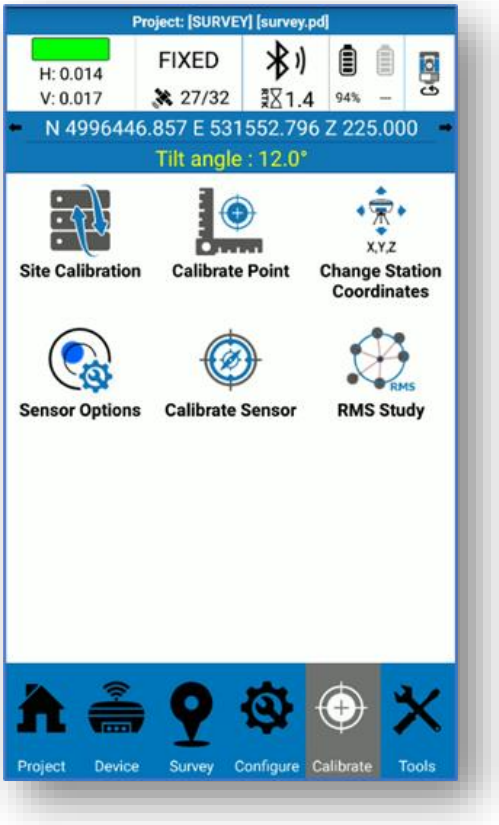


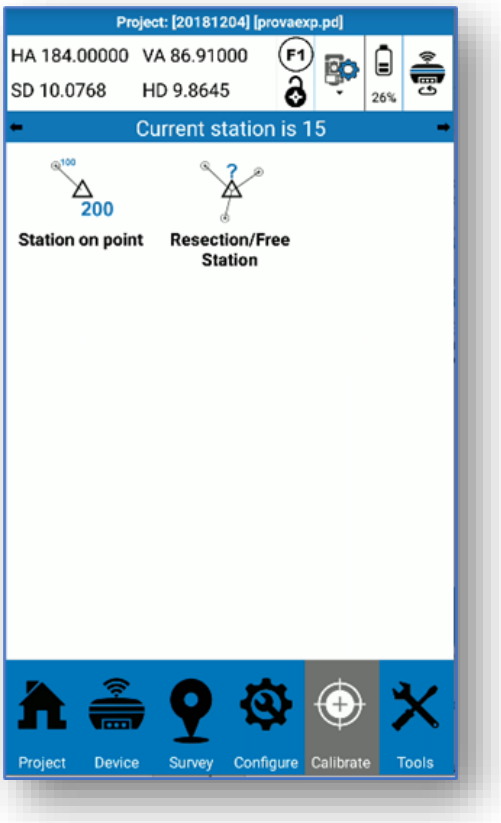
The user can select a symbol and edit it, changing scale, rotation, color, and shape.



7. Calibrate

The chapter "calibrates" contains different functions depending on the version of the program (GPS/TS).

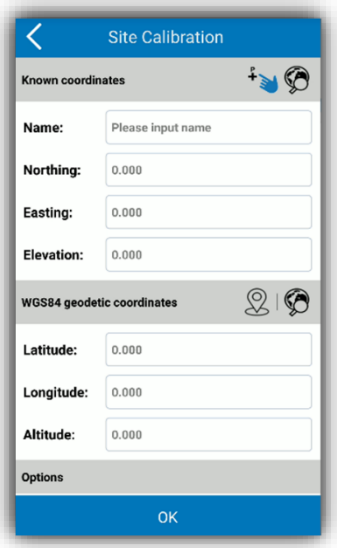




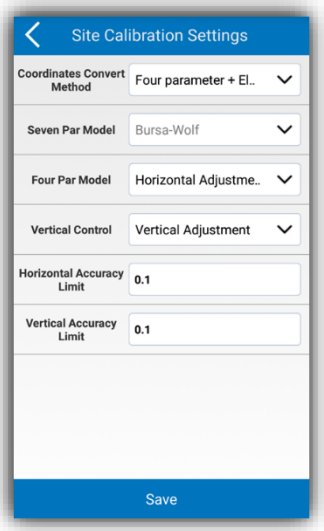
7.1. GPS version

7.1.1. Site Calibration

Cube-a offers the ability to localize, i.e., convert outbound coordinates from the GNSS receiver, into an unconventional reference system. The screen for this feature is shown in Figure. At the top are the points that will be used to calculate localization, the points can be added to the table by pressing the "Add" command at the bottom. The screen to add is the one shown in Figure. Here you can enter the known (local) coordinates, on which you want to locate, these can be entered by hand or by selecting a point in memory with the selection commands. The conversion's target coordinates are below and can be collected from the current GNSS location or selected from a point in memory. The options below the coordinates provide the ability to enable planimetric and/or planimetric localization.
The localization points you add can be changed with the "Edit" command, under Figure, at the bottom.



Added the point (or points) for localization, you can perform the conversion. There are three methods of converting coordinates: Inclined plane + Delta dimension (Rotostralation), 7 parameters + Inclined plane + Delta dimension, 7 parameters, click the "Options" command in Figure, to access the reference screen in Figure.



In the figure above, you can set one of the expected conversion methods. In case of 7-parameter conversion calculation, you can set the Helmert or Bursa-Wolf model, for the management of the sign of the rototranslations parameters. For the 4-parameter model, you can set up a barycentric or non-barycentric rototranslation. And finally, you can set the quota control and a horizontal and vertical accuracy limit. By clicking the "Save" command at the bottom, the options will be saved for calculation.

Below is a brief description of the calculation methods 4 parameters and 7 parameters.

4 parameters: At least two cornerstones related to an arbitrary coordinate system must be known. It is the coordinate transformation mode used to perform a conversion between different coordinate systems within the same ellipsoid. Parameters include four values (north translation, east translation, rotation, and scale), the scale must be infinitely close to 1.

In general, the distribution of control points directly determines the dimension difference and the four parameters to be controlled. The use of four parameters for the RTK measurement method, can be used in a reduced area (20-30 square kilometers).

Measure a point in flat coordinates and operate in the precision of a control network with dimensions of known points. The more known points you will have, the higher the accuracy (2 or more than 2).

But in a very large point distribution (e.g. tens of kilometers), the 4 transformation parameters often do not help, in this case to have an increase in precision both in the planimetric coordinates and on the altitude should use the 7-parameter transformation.

First, you need to perform a static survey in the area where the cornerstones are present, and then select a cornerstone A as a static reference station (in WGS84), which will be used to correct the point network. Use a static receiver to measure a single fixed point for more than 24 hours (this step, in test zones you can perform in less time and in case of low precision required this step can also be omitted) and then import into the software, as a single point all the captured data, the average of the readings will be the actual coordinates of point A in WGS84 coordinates. Absolute accuracy should be below 2 meters, so regarding adjusting the three-dimensional control network, you need to take point A WGS84 as the cornerstone to calculate the 3D coordinates of other points.

The 4-parameter model, used to perform a 2D transformation, can achieve a barycentric rototranslation (around the midpoint of the source coordinates, called "Vertical Translation") or a non-barycentric rototranslation (around the origin of the axes, called the "Inclined Plane").
When the 4-parameter model is used, vertical correction will be automatically enabled.
The actual vertical correction parameters used depend on the number of points used. If less than 3 points are used, the heights are adjusted using the average corrections on the 3 points indicated.
If 3 to 6 topographic points are used, an inclined plane is calculated. If more than 7 points are used, a paraboloid surface is used.
7 parameters: At least three cornerstones, relating to an arbitrary coordinate system, must be known. It is the coordinate transformation mode used to perform a rectangular transformation of spatial coordinates between different ellipsoids. The parameters include seven values: 3 translations, 3 rotations and the scale factor (ΔX, ΔY, ΔZ, Δα, Δβ, Δγ, scale).
How to calculate conversion parameters?
Generally, use 3 known points (A, B, and C) to calculate parameters, so first you need to know the WGS84 coordinates and local coordinates of the 3 known points (A, B, and C). There are 2 methods to get the WGS84 coordinates of points A, B, C. The first method is to set the static control network and then obtain WGS84 coordinates from the GPD capture of the post-processing software. According to method, the GPS Rover records the original WGS84 coordinates in a fixed solution when the correction parameters are not active.

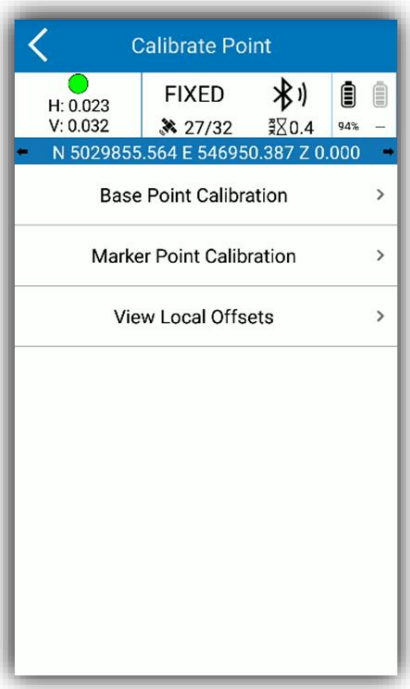
After entering all the points for localization, click " Run "to perform the operation and a report will appear containing the calculated GPS parameters. Click on "Back " to return to the previous interface, then click on " Close " to exit location. A message will appear before you exit asking if you want to use the calculated parameters for the current project. You can confirm or exit without saving the calculation. When a localization is saved, Cube-a asks you to set a name for the new reference system, and the " Reference System " command has an alert, which reminds you that localization is active in the current project.
After you apply the conversion parameters, the original coordinates in WGS 84 in the points library of the current project will be converted to the coordinate system based on the calculated conversion parameters. To verify that the results are accurate and accurate, you can perform a check by logging in from another known point.
Click "Import" to import files *. cot or *.loc, (extension import coordinates).
Click "Export "to export and save coordinates localized, in a file with a.*. COT. The coordinates can then be used in the future, without having to reinsert them.

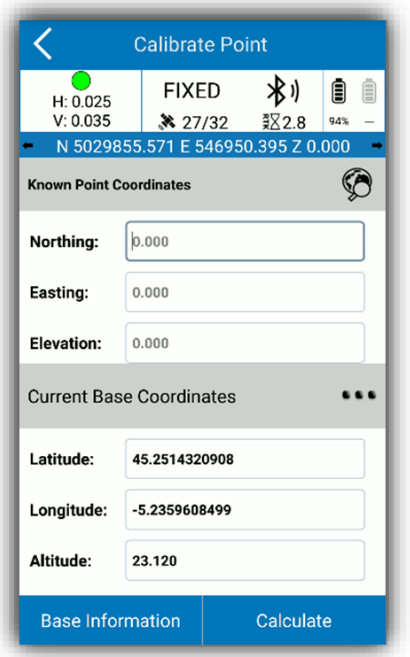
7.1.2. Calibrate Point

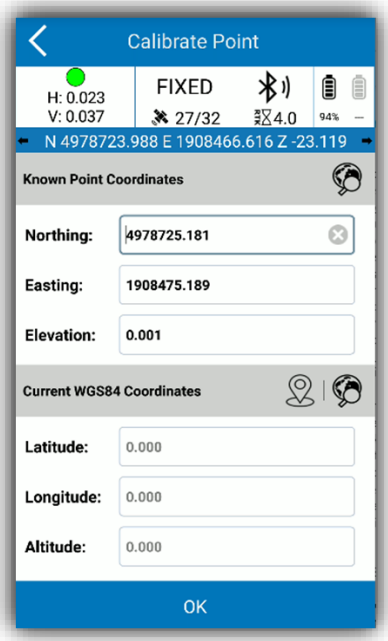
Click on "calibrate "then " Calibrate Point ", to access the interface shown in the figure. The program has two parking methods: base point calibration and meter-to-head calibration:

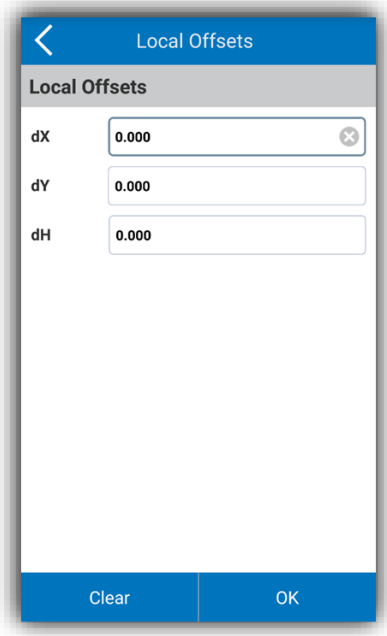
Base Point Calibration :
Enter the coordinates of the known point (i.e. known coordinates before conversion); can be entered from the points library or manually. Then click the command alongside the "Coordinate current base", to set the antenna••• parameters. Proceed to the calculation by pressing "Calculate" (a pop-up window with the marting deltas will be displayed).
Note: Station calibration should be done in fixed solution.
The "Info on Base" command below gives you access to location functions, which you already illustrate in the paragraph on the infobar.

Marker Point Calibration :
Place the coordinates of the known point (manual or library in memory) and coordinates in WGS84 (as the current location of the GNSS or from the library in memory). Click "OK" to perform the operation and view the result with the displacement deltas.
Click on "Current deviation ", to see the current deviation.
Calibration of a station should be done based on the transformation parameters already calculated. Below are the cases where the calibration of the station must be performed.
If the " use current coordinates "option is selected in the start parameters of a base, the Rover should calibrate the station if the base has been restarted or the location has been changed.
When the user knows the workspace conversion parameters, the base can be calibrated to any location. However, the conversion parameters must be entered, and the Rover will then calibrate the station.
If "the base coordinates" are selected at base start-up and the base has been moved, then the Rover should calibrate the station.
If the entry " insert the base coordinates " is selected when starting the base, and if the base is in the same position, then it should be enough to turn the device back on, without the need to calibrate the station.
Station calibration parameters do not update the current point coordinates in the library. When the current coordinates are shown, the calibration parameters of the station will also be shown, the next coordinate measure will be corrected according to the calibration parameters of the station. The transformation parameters obtained from calculating parameters from the library will update the coordinates of the current point. The WGS84 coordinates of the measured point are converted to local coordinates, using conversion parameters.


Calibrate Point
H: 0.023
V: 0.032
FIXED
27/32
0.4
94%
N 5029855.564 E 546950.387 Z 0.000
Base Point Calibration
Marker Point Calibration
View Local Offsets


Calibrate Point
H: 0.025
V: 0.035
FIXED
27/32
2.8
94%
N 5029855.571 E 546950.395 Z 0.000
Known Point Coordinates
Northing:
0.000
Easting:
0.000
Elevation:
0.000
Current Base Coordinates
Latitude:
45.2514320908
Longitude:
-5.2359608499
Altitude:
23.120
Base Information
Calculate


Calibrate Point
H: 0.023
V: 0.037
FIXED
27/32
4.0
94%
N 4978723.988 E 1908466.616 Z -23.119
Known Point Coordinates
Northing:
4978725.181
Easting:
1908475.189
Elevation:
0.001
Current WGS84 Coordinates
Latitude:
0.000
Longitude:
0.000
Altitude:
0.000
OK

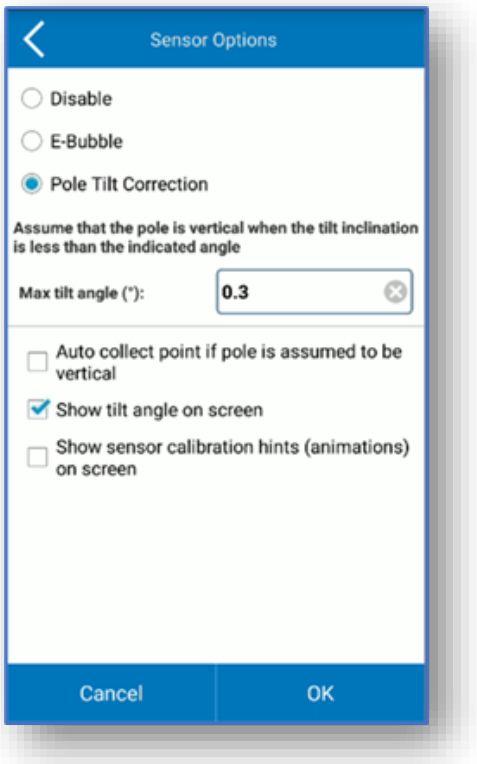

Local Offsets
Local Offsets
dX
0.000
dY
0.000
dH
0.000
Clear
OK

7.1.3. Change Station Coordinates

This feature is useful in Basic -Rover RTK working mode. When you save a point with the rover, Cube-a always saves the coordinates of the point base. So, if you want to move the base to a different place, you can use this function to calculate the coordinates of the saved points so as to keep the same length as the baselines.
Warning: The function is in BETA PREVIEW. It is not recommended to use it in real Survey to avoid possible data loss.

7.1.4. Sensor Options

The user can enable/disable the use of the electronic bubble/IMU following the configurations available on his receiver. To enable the electronic bubble/pole tilt correction, simply select the option and confirm. In the menu you can also define the maximum limit angle within which to consider the vertical pole. So, this value will be the tolerance for the verticality of the pole during Survey.
You can also set the automatic collection of points if the pole is assumed vertically with respect to the set limit.
You can show the angle of the receiver inclinometer live during the Survey.
If the user prefers, there is an opportunity to show animations for IMU sensor initialization every time they lose calibration during embossing. Once the user is practical with the sensor, he can disable the option for the help of calibration.



7.1.5. Calibrate Sensor

The Sensor Calibrate page depends on the connected GNSS receiver.

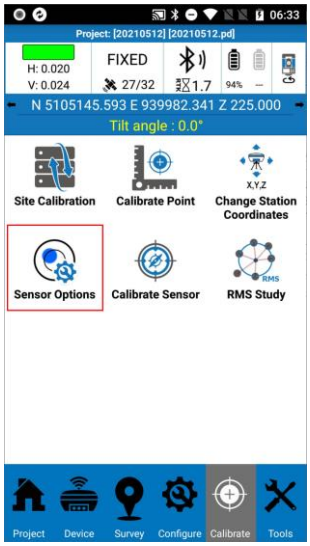
Stonex receivers equipped with new IMU technology

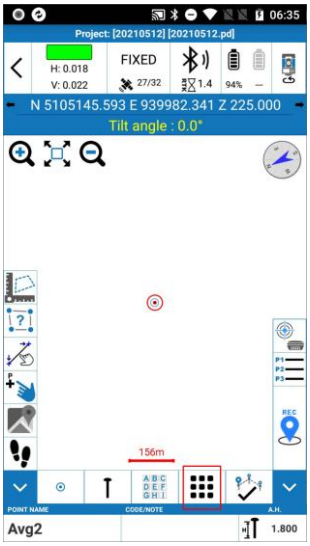
The Receivers S990A, S980A, S980, S900A, S900 and S850A have an IMU sensor that allows you to acquire points using information from the magnetometer and inclinometer even outside the bubble.[2] This function allows you to capture and plot points without the need to have the vertical pole. This results in a significant reduction in parking times and increased productivity.
This guide describes what you need to do to use this feature.

I. Activate the sensor

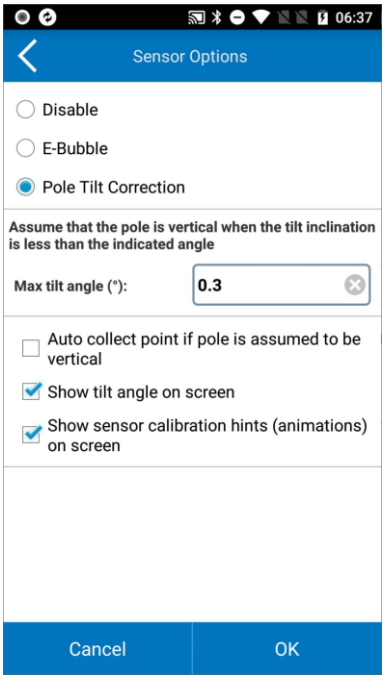
Before enabling the TILT feature, make sure that the receiver is properly configured, and the FIXED solution is available either using a Network or a Base-Rover mode.

In Cube-a, from the application main screen, execute the command **Calibrate** > **Sensor options** or, alternatively, from the **Survey** screen, execute the command **Survey Tool** (icon) > Sensor options .





[2] On the Stonex S990A receiver, the IMU functionality is always enabled; on other receivers, the IMU functionality is optional, and it can be purchased separately.

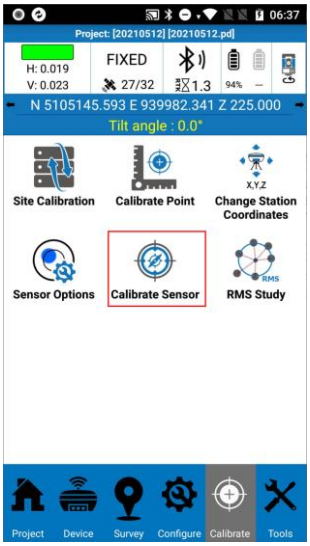


In the Sensor Options screen, you can enable the e-Bubble or the Tilt Compensation mode.
You can also set the following:

- Maximum tilt angle (from the vertical) allowed to assume the pole to be vertical.
- Option to enable the automatic collection of a point when the pole is vertical.
- Option to show the tilt angle on screen.
- Option to show some short animations to instruct the user about how to properly move the GPS unit to initialize or to resume the IMU sensor functionality

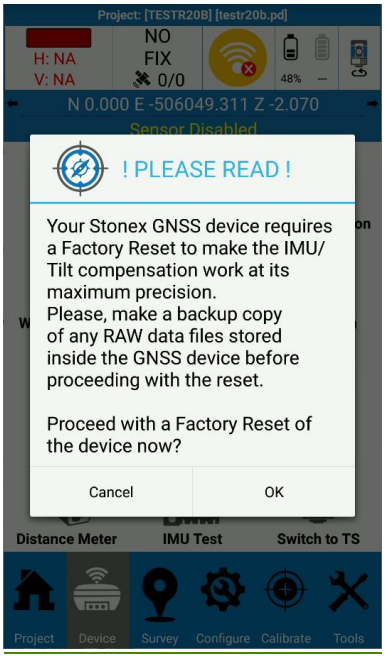
II. Initialize the IMU sensor

Before you start operating with the receiver, at the first use you need to calibrate the IMU sensor by function on **Calibrate** > **Calibrate Sensor** .



This function takes just over a minute and you have to move the pole from vertical position in 4 directions, following the indications shown by software. It's mandatory to set the correct pole height. We suggest to use a standard pole height of 1.8m.

Through the animation the user receives the instructions to follow the procedure.
We recommend that you perform this procedure periodically. Each time you move away 200km from last calibration position, or more than a month it has elapsed, we recommend that you perform the procedure. Even in case of a fall, or other accidental event, you should perform the procedure.
Cube-a software, version 5.1.4 or newer, scans the parameters recorded on the receiver which are required to use the IMU sensor. If any value is out of tolerance, or it's missing, Cube-a will automatically suggest to perform a factory reset.

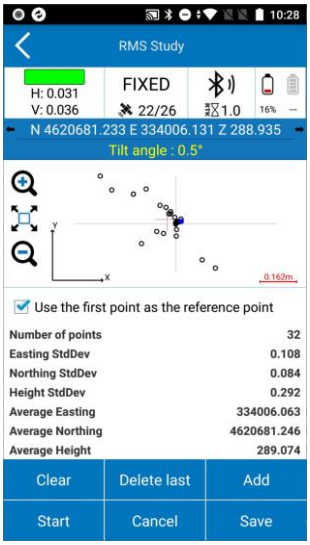


This warning is issued to remember you to save data and configurations before proceeding with the factory reset.
If you cancel the factory reset request, next time you restart the receiver or at the next connection with software, Cube-a will check again and you can proceed with the reset.

III. Verifying the IMU function

Through the RMS function on the Calibration page, it's possible to verify the correct functioning of the IMU.
This function allows you to start a continuous measurement of points, to show the result on video and to calculate the average coordinates and standard deviations.
Wait until the receiver is in FIXED and you can run the function with the START button.

Record at least 60 readings taking care to tilt the pole in 4 directions (forward, backward, right, left) in order to collect enough readings for the averaging.
If the RMS values in EAST, NORTH and ELEVATION components are less than 5cm, the sensor is assumed to work correctly.
If you have high standard deviations, greater than 5cm, verify the RTK configuration, to have entered correct pole height, then repeat the sensor calibration procedure.



Example of bad result of RMS study

IV. Using the IMU sensor during surveying

After the first calibration, the sensor is ready to work. Anyway during survey or stack out, it's mandatory to have a FIXED solution, otherwise the measurement key will be disabled to avoid acquiring incorrect points.

If you go surveying in difficult areas, with poor satellite coverage, where the receiver switches to a non-FIXED solution, the software blocks the point acquisition. After returning to a FIXED solution, the software could ask you to perform some movements to make the IMU sensor operational again. Also keeping the pole completely stationary can lead to an inoperable condition. This is because the IMU sensor needs continuous displacement information to continue operating properly.
When starting a job or exiting a difficult area, the software cloud show two animations for "on the fly" calibration. This calibration is intended to provide orientation and tilt information so that the IMU sensor is fully operational again.

The two operations are:

The advice is to follow the instructions shown by the animations. It may be sufficient to move to the next survey point or walk a few meters to get the same result of the second procedure, and so restoring the operation of the receiver.

Stonex receiver with the old tilt sensor

In this case there are four steps to improve sensor calibration, described below.

1. Enable tilt correction

Click on "Calibrate" and “Sensor Options", turn on tilt correction and then click OK.

2. Bubble-electronic calibration

Click the first button at the top right of the electronic bubble calibration screen.

② After centering the bubble on the telescopic pole click "Calibrate". At the same time, the electronic bubble in RTK and the bubble on the pole are both centered, so the bubble in the program will turn green (the bubble is purple if not centered).

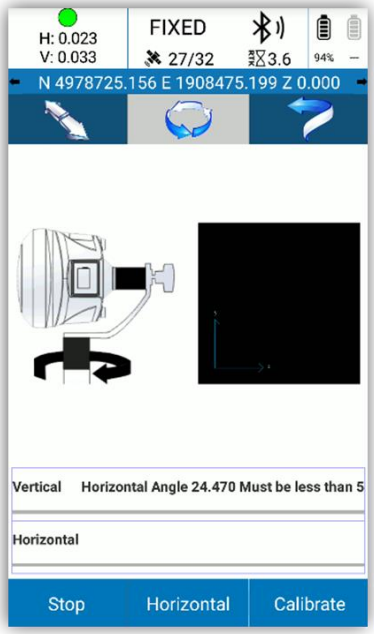
3.Calibrazione azimut magnetico

Click the second command at the top to access the screen in the figure below.

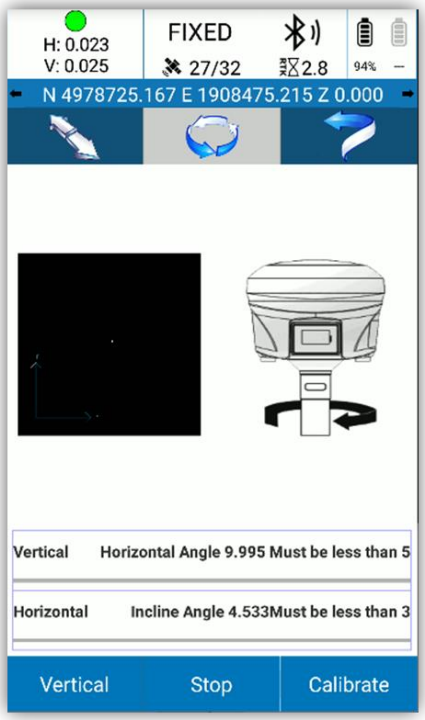
① **Vertical receiver calibration: Install** the stand on, the block on the instrument should fit into the RTK groove. After installing the stand on the pole, click on “Vertical”, and perform a circular movement centered with respect to the center of the pole. The rotational speed must not exceed 15°/s. After the telescopic pole has made the circular rotation, the data is recorded, and the recorder will emit a BEEP.


H: 0.026
V: 0.040
FIXED
27/32
3.4
94%
N 4978725.170 E 1908475.200 Z 0.000
N
NW
NE
W
E
SW
SE
S
Tilt angle
12.5022232400
Azimuth
273.0000000000
Calibrate


H: 0.023
V: 0.026
FIXED
27/30
1.0
94%
N 5093979.869 E 419005.199 Z 253.999
Verticale
Orizzontale
Verticale
Orizzontale
Calibra

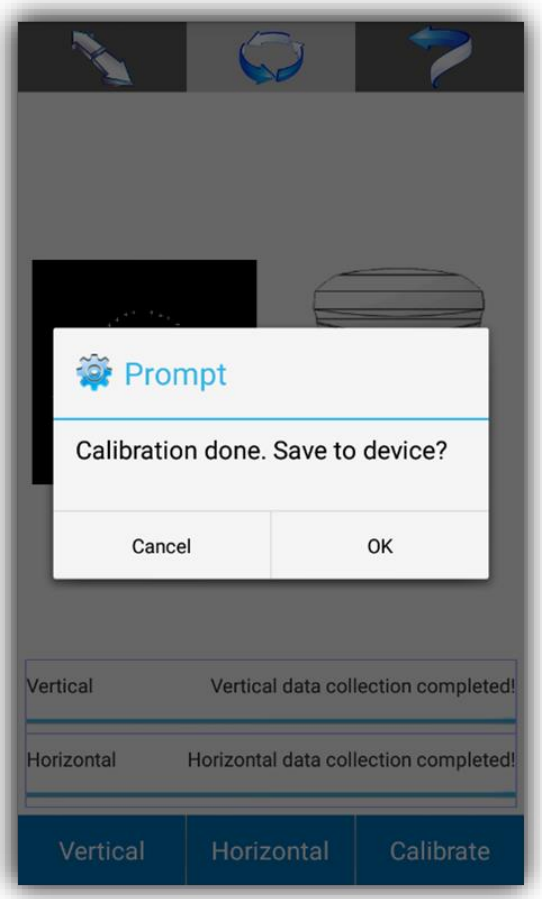


② **Horizontal receiver calibration:** Click on " Horizontal" and run a circle with the pole with respect to the center of the pole itself, again the speed of the pole must not exceed 15°/s. After the telescopic pole has made the circular rotation, the data is recorded, and the recorder will issue a BEEP.
At the end of the data recording, a message will appear to complete the operation.



Note:
A. During rotation, Cube-a will show the real-time status of data logging.
B. If the data in some places is not recorded (for example due to too fast rotation), you will need to repeat the movement.
C. While capturing horizontal data, the angle of inclination must be less than 3 degrees.

Calibration parameters: After acquiring the vertical and horizontal data, pressing on " Calibrate " will display the message " Calibration performed. Save to device? ". Click OK to use the saved parameters, and then complete the sensor calibration.

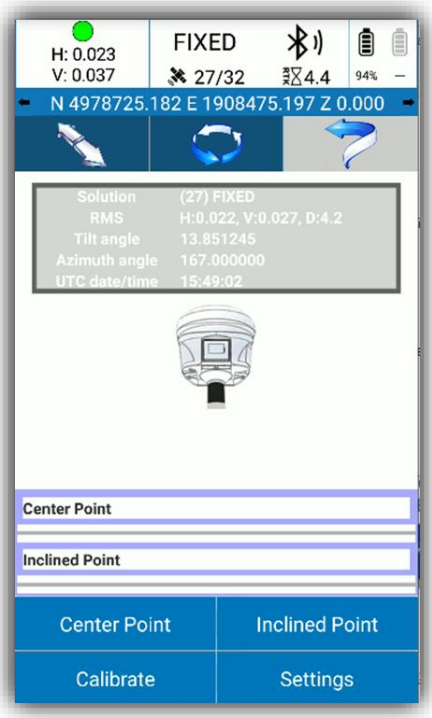


4. Calibration of magnetic declination

Click the third command at the top , to access the screen below.

① **Center point capture:** Click " Central Point " to capture the center point, to do this you need to capture the coordinates of 10 points in static.

Acquisition conditions: state in relative static; inclination angle <0.3°; fixed solution; acquisition by 10 points.



② **Acquisition of inclined points:** click on " inclined Point " to acquire inclined points, you must acquire data in the 4 directions (north, south, west, east), you have to acquire the coordinates of 10 static points in each direction.

Acquisition conditions: state in relative static; inclination angle of 25°-35°; fixed solution; acquisition of data in every direction (north, south, west, east); acquisition of 10 points in each direction.

Note:

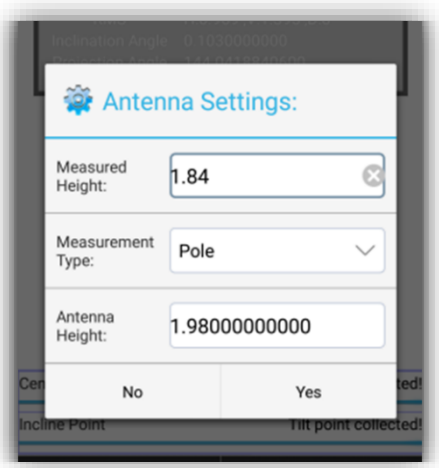
A. When inclined magnetic calibration is performed, it is recommended to lengthen the pole by at least 2 meters.

B. Keep the device as stable as possible while capturing data.

Acquisition parameters: After capturing the centered point and the inclined point, clicking “Calibrate" to calculate the parameters for calculating magnetic declination; a message will appear to set the antenna parameters. After entering and confirming the antenna parameters, click OK to complete the sensor calibration.

After the sensor is calibrated, click " Settings " to view the magnetic tilt. If you already know the values of magnetic declination in the area where you are working, you do not have to calibrate the sensor but just enter the parameters of the magnetic declination known in "Setting".

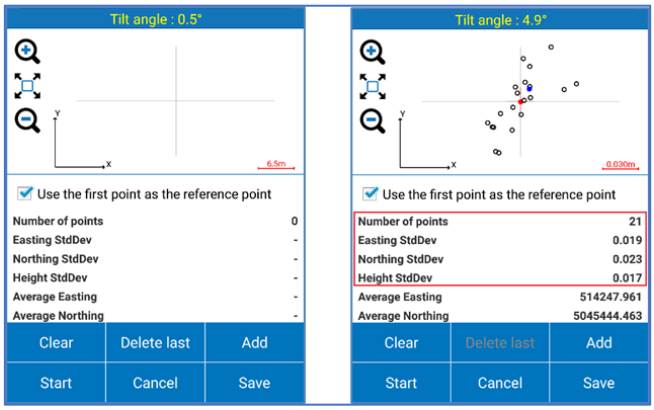
Note: If an error message appears, check that the antenna height is correct. If it is not correct, the telescopic pole can be extended, and the sensor calibration can be re-calibrated.


Antenna Settings:
Measured Height:
1.84
Measurement Type:
Pole
Antenna Height:
1.98000000000
No
Yes

7.1.6. RMS Study

You can check the accuracy of the inclinometer compensation by verifying the standard deviation. If the accuracy is good, you can continue to work, otherwise calibrate the sensor through the Calibrate Sensor function. The Standard Deviation Test carries out the study of the quality/precision of repeated measurements (keeping the tip of the pole in the exact same position on the ground).

How to use it? Open the commando and click Start to start the measurement collection.
The application collects points with an average frequency of 1Hz. The collected positions will be mediated, and the standard deviation will be calculated. At this point, the operator can choose to procedure with calibration or continue the survey.



The user has control over the number of locations used in the calculation, and when he decides to end the *control,* he can press Stop to stop the automatic capture.
As mentioned, if the evaluation leads to unsatisfactory values, procedures with sensor calibration are invited.
This is also suggested when changing the height or type of pole (it could be a change in straightness of the pole).

7.2. TS Version

7.2.1. Station on point

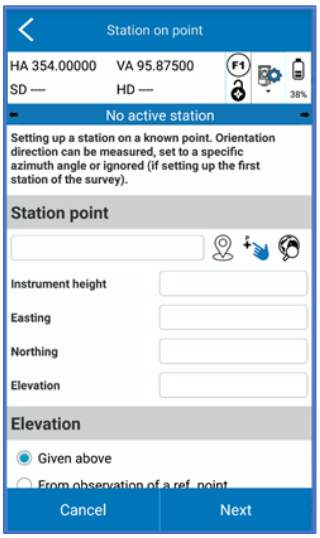
Click Calibra-> station by point: the screen in the figure below will be shown.
Station point coordinates can be entered manually by filling in the *Est Nord* and *Elevation boxes,* or by using the following keys:

1.  to measure with GNSS antenna (if available). Clicking on it, Cube-a collects GPS coordinates directly using topographic point mode

1.  to select from the map including CAD entities

1.  to select from the points list

If you want to change the name of the point, change the box to the left of these icons.
Enter the *Tool Height* (Total Station Height).



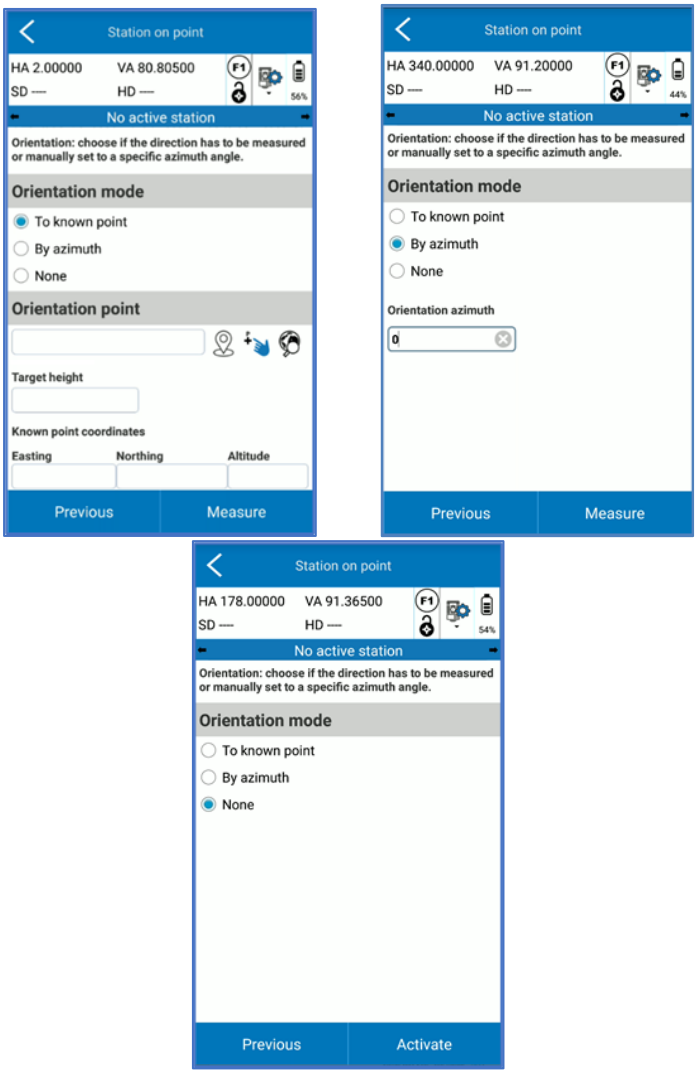
The elevation can also be inserted as a measure to a reference point Define the reference point in the same way as it was done for the station point and insert the height of the target, then measure it and click *Next*.

On the next page, define which orientation mode you want to use:

To a known point: to orient the station to a point whose coordinates are known. Enter the coordinates of a point or measure or select it from the project (in the same way as defining the station point) and enter the height of the target.

Verso azimut: permette l'inserimento di un azimut di orientamento Inserire l'angolo di riferimento rispetto il Nord del sistema locale (non è da confondersi con l'angolo orizzontale/azimut letto dallo strumento).

No orientation: does not take guidance into account. By default, Cube-**a** uses the horizontal angle of the station, without zeroing it or setting it to a certain value.

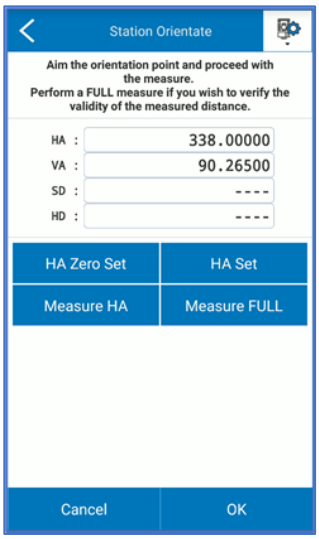


If you have *selected No*Orientation, you can click directly on Activate and you will complete the Station-by-Point procedure. Otherwise, in the other two *cases*,the measurement of the *guide* point must be clicked on, and the measurement of the orientation point collected:

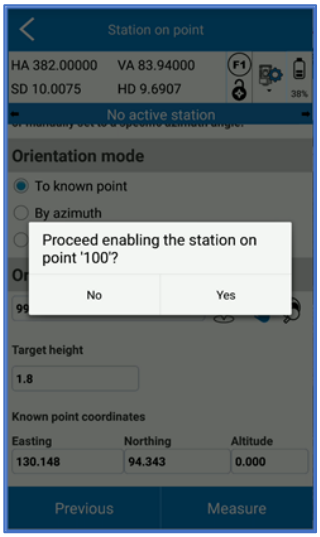
1. *Force HA=0*: sets the horizontal angle to 0 (the vertical angle will be automatically forced to 100 gon);

2. *Set HA*: Sets the horizontal angle to a manually inserted value.
3. *Angles: measures*angles from theinstrument;
4. *Misura Completa*: measures the angles and distance from the instrument(Option available only in orientation towards known point).

Click OK, after measuring.



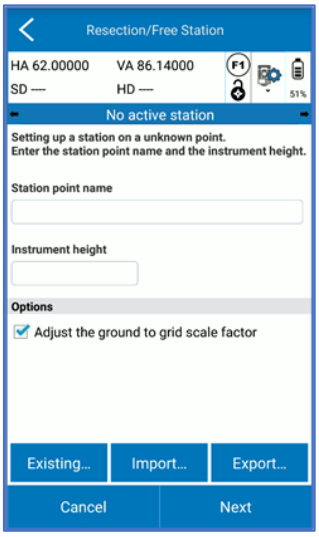
After the procedure, **Cube-a asks** for confirmation before activating the station on the defined point. Click Yes to proceed.



7.2.2. Resection/Free Station

Cube-a can calculate parking on an unknown coordinate point.
Please note that the orientation/reference points should cover and be all around the parking site. The location of the reference points limits the area where subsequent measurements should be carried out, using parking. Point capture and/or picketing should never be performed outside this area. If measurements occur towards points outside the area, orientation errors will be extrapolated (maximized) rather than interpolated (reduced).
Click On Calibrate-> Station: the screen in the figure below will be shown.

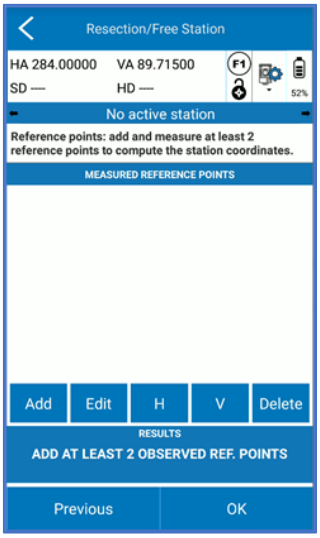
Enter *Station Point Name* and *instrument high*.
Choose to check " *with scale factor or not*. Enabling cube-a performs a check and applies an automatic factor over point distances so that the distances (at points) measured by the station are congruent.



The *Import and* Export commands work with .*.cr files, which store all parking calculation, with the chosen points, station name, and each option entered performing this function.
Click su *Avanti* per inserire e misurare i punti per il calcolo ai minimi quadrati. **Cube-a** richiede di soddisfare uno dei seguenti casi:

- 3 or more angular readings.
- 2 or more complete readings (angles + distance);
- 2 or more mixed readings (Anglo-English + distance/ angles only).

Click New *to* insert the first point.



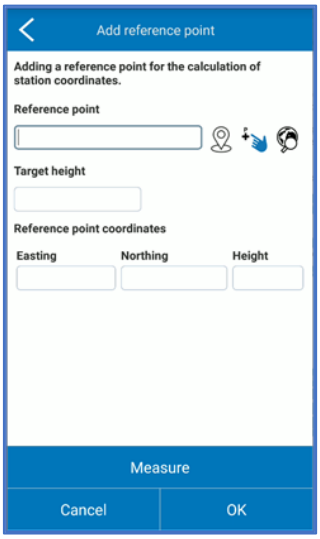
The coordinates of the point can be entered manually, either by filling in the *East, Nord* and *Elevation box* or by using the following keys:

1.  to measure with GNSS antenna (if available). Clicking on it, **Cube-a** collects GPS coordinates directly using topographic point mode;

1.  to select from the map, including CAD entities.

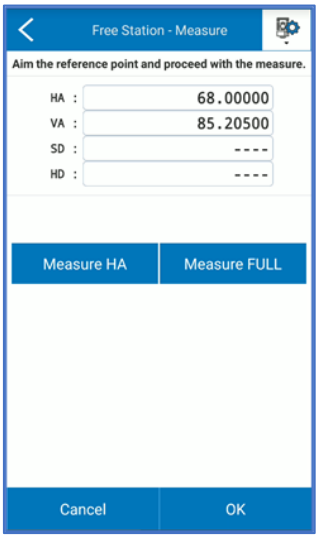
-  to select from the points list.

To change the name of the point, change the box to the left of the icons.
Insert the *Prism Height (pole height*) and click on "Measure"

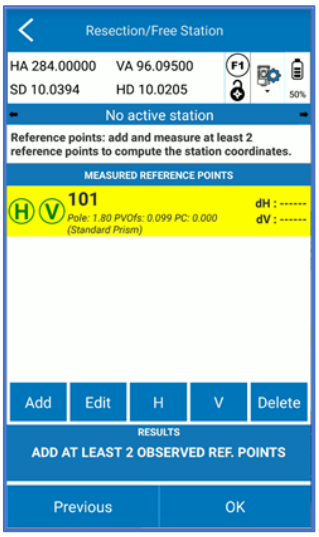


Aim the point and proceed with the measurement, which can be:
1. *Angle measure*: only angular measurement.
2. *Complete Measure*: angles and distance measurement.

Proceed by pressing *OK*.



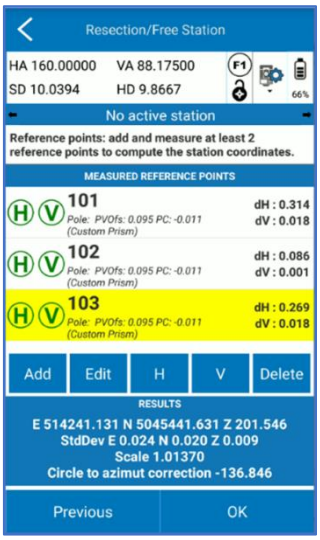
The first observation will be shown on the following page.



Continue with the addition of the next point(s), proceeding in the same way.
Then, you will be able to view the result of the calculations:

1. Calculated station coordinates E, N, Z.
2. Standard deviations of E, N, Z, which defines the estimation of the possible error on coordinates. They can be negative or positive values.
3. Residues on planimetric and vertical coordinates (Measured - Known). These are absolute values – values declared in meters.
4. *dH* is the difference between calculated and known point in 2D.
5. *dV* is the difference in altitude between calculated and known point.
6. *Scale factor* shows the calculated value.
7. *Azimuth correction* is the horizontal angle correction that the free station program calculates relative to the horizontal circle of the total station.

If you want, you can press on Ⓗ and Ⓥ to turn off landscape and/or portrait reading and check if the quality of the result increases. The same command is carried out by *H* and *V in* the blue icons.
You can click on *Modify*. to edit a point and re-measure it. Or you can press on *Rem*. to remove a point.
Before confirming with *OK*, you can press Back to return to the screen where you can export the free station calculation.



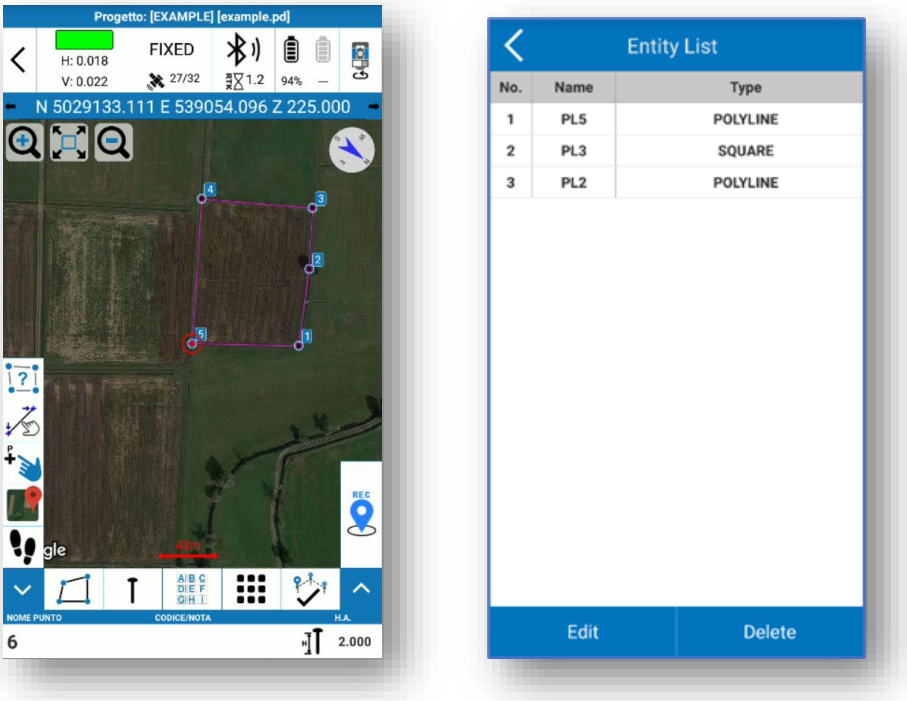
The free station file is exported with a .*.cr*extension:

8. Tools

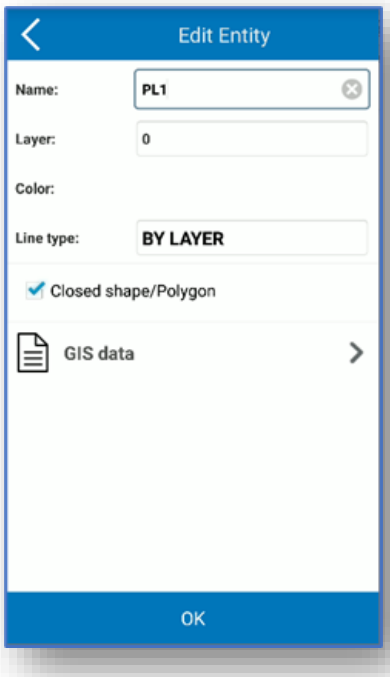
The Utilities menu looks the same in both versions of the program (GPS/TS). It contains various useful functions during the work phase such as COGO calculations and information about the version and license of the Cube-a program.

8.1. Entity List

This page contains a list of all CAD entities in the current project except points. Scroll to the right to see the area and perimeter values of each entity.

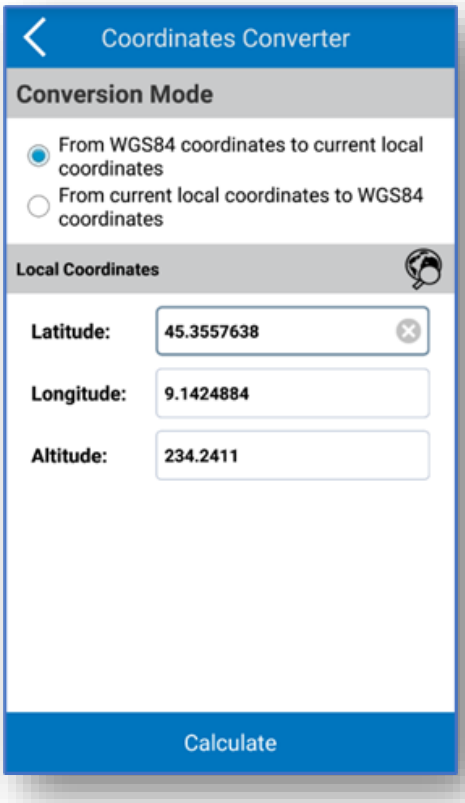


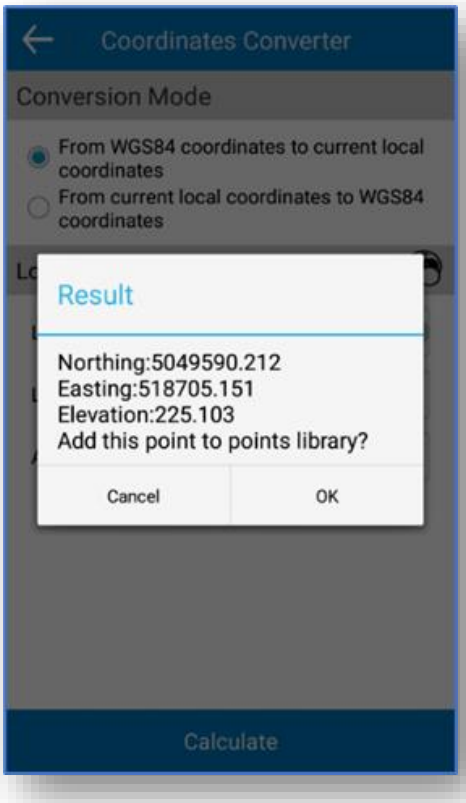
You can edit or delete an entity after you select it. Select an entity from the list and click "Edit" to access the "Edit Entity" page.



8.2. Coordinate Converter

On this page you can convert local coordinates to WGS84 geodesic coordinates and vice versa. Choose the conversion method at the top and place the coordinates in the section below in the format you choose. The section below then depends on the conversion way you select. It is possible to enter the coordinates manually, filling in the respective fields, or choose the point from the library by clicking on the *search* icon (globe with lens) on the right. Once you have converted coordinates, there is the ability to save the point within the points library.





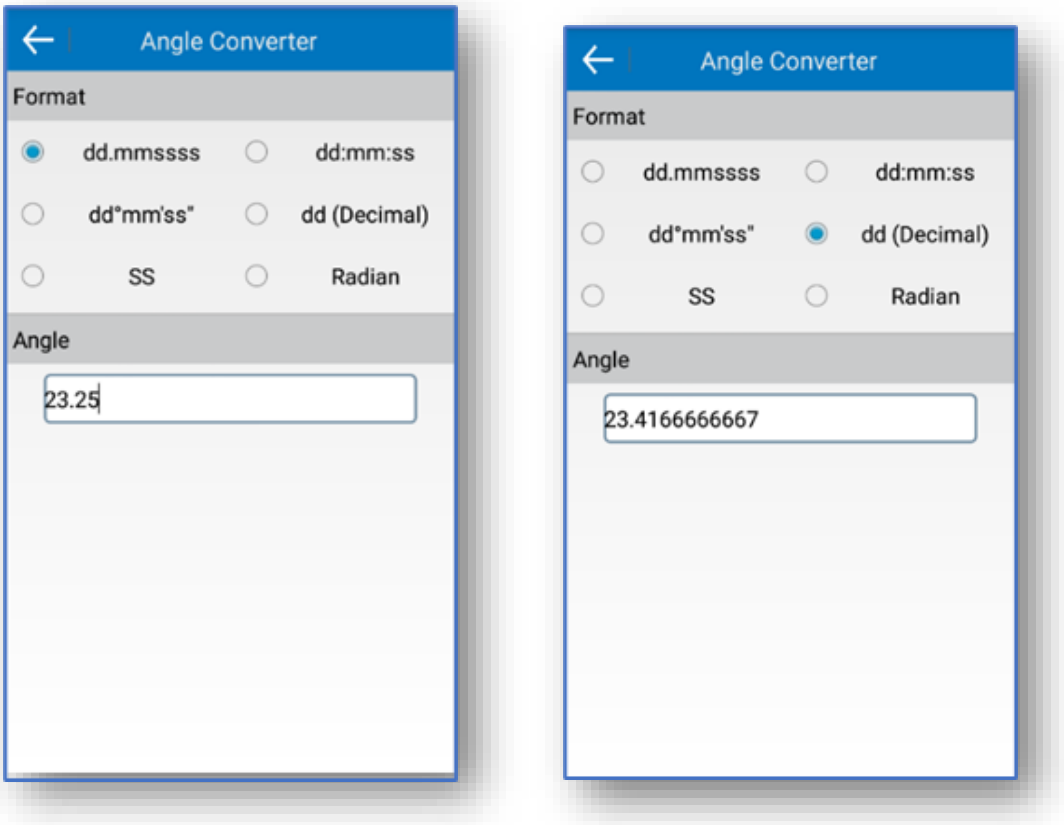
8.3. Angle Converter

There is the possibility to perform a conversion between different angular formats. Below are the steps to follow to convert a corner in different formats.

- Select the angle input format
- Insert the angle value.
- Select the format in which you want to convert.

The value you enter will be automatically replaced by the angle value in the new format you choose.

In the example, the angle angle inserted is 23.2525 in gg.ppssss, the result converted to dd°pp'ss is shown in the figure on the right.



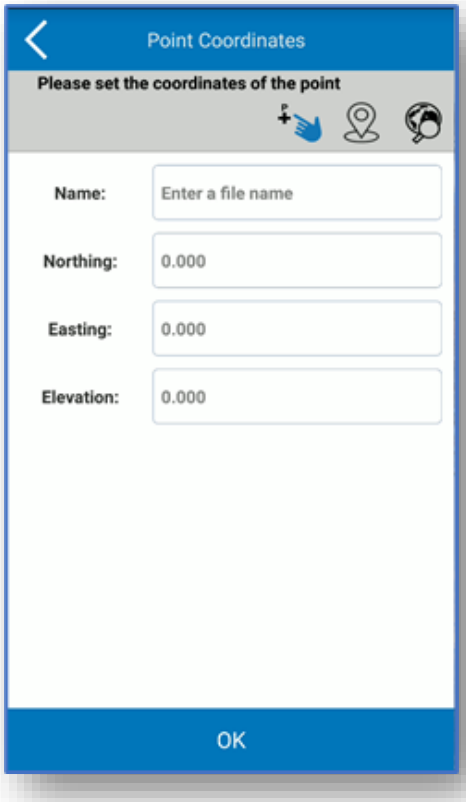
8.4. Perimeter and area

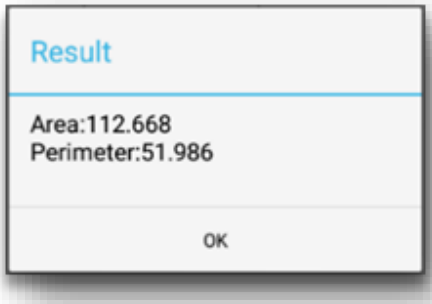
It is possible to calculate the area and perimeter of entities obtained with certain points.

For the calculation of the area or perimeter, as a first operation, you must define the particle vertices on which to perform the calculation. To enter the coordinates of the points, click on "Add".
It is possible to manually enter the coordinates, select the points from the Survey area by clicking on , use the current coordinates by measuring the current position by clicking on or select a point from the points library by clicking .

To import a coordinate file, click "Import". Imported data can be filtered by name and code, in case you want to use only a few points in the imported file as vertices.

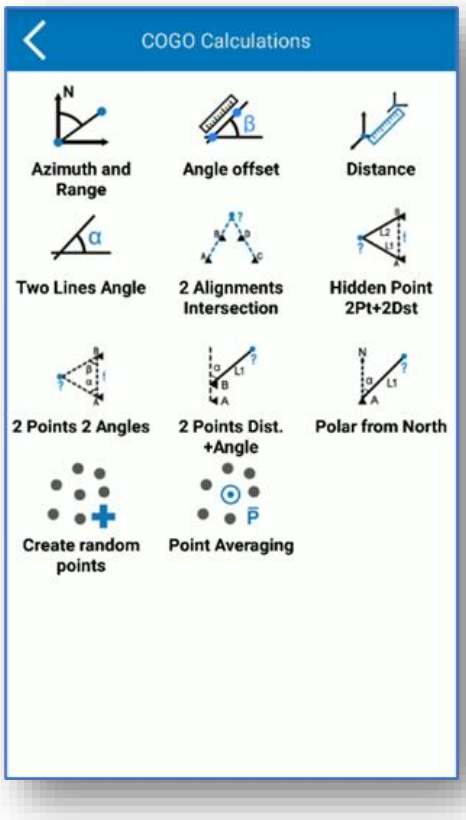
Once the points are added, you can also change the order of the vertices with the commands "Move Up *"and* "Move Down".
To perform the calculation, click on "Calculate".


Point Coordinates
Please set the coordinates of the point
Name:
Enter a file name
Northing:
0.000
Easting:
0.000
Elevation:
0.000
OK


Result
Area:112.668
Perimeter:51.986
OK

8.5 COGO Calculations

Using the coordinates of the points in the Survey you can perform various geometric calculations, described below. Within each command, at the top, there is a brief description of what it takes to perform the calculation and what you will calculate.



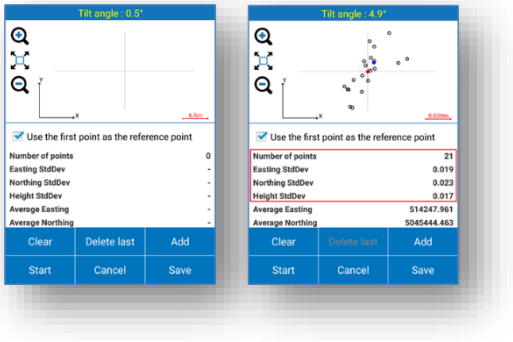
8.5.1 Create random points

This command creates random points following the rules you set. The user must set the name of the points and the number, and then set the symbol. Select the mode and limit of the area where you want to create the points and their limits before starting the calculation.

8.5.2 Point Averaging

You can control the operation and accuracy of the GNSS receiver through RMS quality control. The RMS study studies the quality/accuracy of repeated measurements (keeping the tip of the pole in the exact same position on the ground).
How to use it? On the RMS screen, click Start to collect measurements.

The program will collect measurements/positions at an average frequency of 1Hz. The collected positions will be calculated on average and the RMS values will be calculated. RMS values allow the user to check whether the accuracy of the device falls within an upper limit of accuracy required.



The user is in control of the number of sample positions used in the RMS calculation. When you decide to complete the check, you can press Stop to block the automatic capture of the position. This is also suggested when the user changes the height of the pole and /or the type of pole (there may be a change in the straightness of the pole).

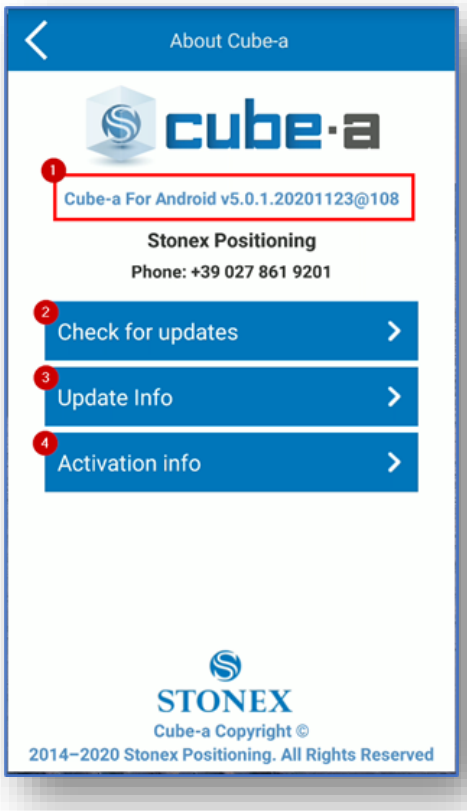
8.6 Calculator

This feature directly invokes the calculator within the Cube-a program, contributing to the calculation of data.

8.7 Version and update

On this page you can read at the top the current version of the program installed on the device. The following three keys are then present.

1. *Search for* updates: Check for updates; internet connection is required. If a new version is available, a window will suggest downloading and installing the latest version.
2. *Update Info*: History of all versions with their respective bug fixes and implementations.
3. *Activation Info:* Information about your personal license


About Cube-a
cube-a
1
Cube-a For Android v5.0.1.20201123@108
Stonex Positioning
Phone: +39 027 861 9201
2
Check for updates
3
Update Info
4
Activation info
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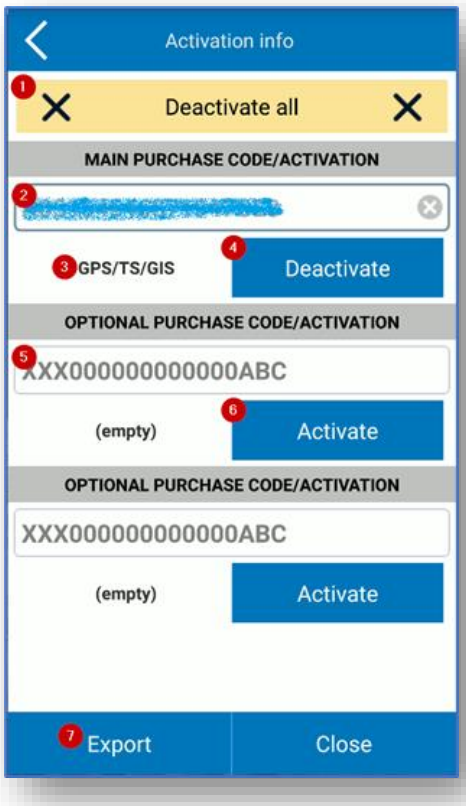

Activation info
1
Deactivate all
MAIN PURCHASE CODE/ACTIVATION
2
3
GPS/TS/GIS
4
Deactivate
OPTIONAL PURCHASE CODE/ACTIVATION
5
XXX000000000000ABC
(empty)
6
Activate
OPTIONAL PURCHASE CODE/ACTIVATION
XXX000000000000ABC
(empty)
Activate
7
Export
Close

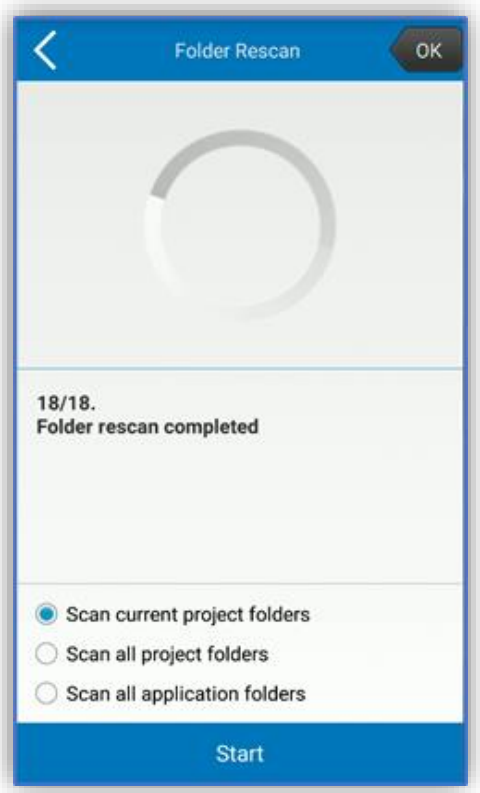
1. *Turn off everything:* all licenses will be cancelled and. Warning: Export or copy the license before you do it.
2. *Purchase* code/*main activation*: A field in which you can view (or enter) the purchase license.
3. *Active* forms: modules activated by the license entered.
4. *Toggle:* Activates or disables the license.
5. *Optional purchase/activation code: A* field where you can enter a license to add one or more modules.
6. *Toggle:* Activates or disables the license.
7. *Export:* Export licenses to a text file.

8.8 WMS Servers

The command is not yet available.

8.9 Rescan Folders

If you have problems viewing (to your PC) the application's folders or files, or a particular project, you can click "Update Folders", to force a scan of the items. You can select whether to update items in the current project, update items in all folders for all projects, or update all folders in the application. Press "Start" to start the process.



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