STONEX

STONEX® X70^{GO}

SLAM Laser Scanner

User Guide

(January 2024)-Ver.1.0 -Rev.1

GOpost v57 and GOapp v2.0.10

www.stonex.it

Contents

Changelog

GOpost	
Version 57	• Fixed bug related to fast algorithm. • Added colorbars for elevation view. • Improved colorization algorithm. • Added refine_pos in colorization tool.
Version 56	• Added buttons for calculating angles and areas within the point cloud. • Added the "travel" button in the "view" window, which allows automatic navigation of the cloud based on the trajectory travelled. • Added an allign button in the 'edit GCP' window that allows automatic alignment of points. • It is now possible to perform a non-rigid orientation based on coordinates in a local system. • After the mapping drift error, the screen will be cleared before starting a new calculation iteration. • In the pano folder, a file called 'pano_pos_geo' will be saved with the

	coordinates of the panoramic images in a georeferenced system (after cloud orientation). • Added a 'report' button that allows the orientation report to be opened directly within gopost.
Version 55	• Fixed a bug in Japanese systems that caused the point cloud to be oriented backwards. • Added the ability to change the size of the points in the displayed point cloud

GOapp	
Version 2.0.10	• Fixed overheating warning problem. • Real-time display optimised. • Added firmware upgrade warning icon. • Optimised 3D view. • Fixed problem with project page. • Language integration of Spanish, French and Japanese.
Version 1.10.0	• Improved compatibility with the new version of the RTK antenna • Set the minimum number of characters for CORS account and password to 3 • Wi-Fi settings for Japan and Israel at 2.4GHz only.

1. Legal Notice

1.1 Copyrights and trademarks

STONEX®, the STONEX® logo, and X70^{GO} are trademarks of STONEX® S.r.l.
STONEX® GO*app*, STONEX® GO*post* and STONEX® Reconstructor are trademarks of STONEX® S.r.l.
All other trademarks are the property of their respective owners.

2. Standard Limited Warranty

2.1 Shipping policy

The Customer or the Dealer is required to pay for the charges for shipping of fault parts or instruments to STONEX® representative office and STONEX® (will provide) the shipping for return. Dealers needs to follow STONEX® repair/service procedure to achieve a better and prompt service result.

2.2 Return policy Dead on Arrival instruments

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

2.3 Firmware/Software warranty

STONEX® doesn't warrant that operation of Firmware/Software on any instruments will be uninterrupted or error-free, or that functions contained in Firmware/Software will operate to meet your requirements.
STONEX® will forward the Software/Firmware Fix to the dealer or customer. Firmware/software Fix means an error correction or other update created to fix a previous firmware version that substantially doesn't conform to the instrument's specification.

2.4 Over Warranty repair(s) policy

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

2.5 Disclaimer and Limitation of Remedy

All other express and implied warranties for this product, including the implied warranties of merchantability and fitness for a particular purpose and/or noninfringement of any third party's rights, are hereby disclaimed.

STONEX® expressly disclaims all warranties not stated in this limited warranty. Any implied warranties that may be imposed by law are limited in duration to the term of this limited warranty. Some jurisdictions do not allow the exclusion of implied warranties or limitations on how long an implied warranty lasts, so the above exclusions or limitations may not apply to customer. Customer must read and follow all set-up and usage instructions in the applicable user guides and/or manuals enclosed. If customer fails to do so, this product may not function properly and may be damaged. Customer may lose data or sustain personal injuries. STONEX®, its affiliates and suppliers do not warrant that operation of this product will be uninterrupted or error free as do all electronics at times. If this product fails to work as warranted above, customer's sole and exclusive remedy shall be repair or replacement. In no event will STONEX®, its affiliates or suppliers be liable to customer or any third party for any damage in excess of the purchase price of the product. This limitation applies to damages of any kind whatsoever including (1) damage to, or loss or corruption of, customer's records, programs, data or removable storage media, or (2) any direct or indirect damages, lost profits, lost savings or other special, incidental, exemplary or consequential damages, whether for breach of warranty, contract, tort or otherwise, or whether arising out of the use of or inability to use the product and/or the enclosed user guides and/or manuals, even if STONEX®, or an authorized STONEX® representative, authorized service provider or reseller has been advised of the possibility of such damages or of any claim by any other party. Some jurisdictions do not allow the exclusion or limitation of incidental or consequential damages for some products, so the exclusions or limitations may not apply to customer. This limited warranty gives customer specific legal rights, and customer may also have other rights which vary from country/state/jurisdiction to country/state/jurisdiction.

2.6 Environmental recycling

The cardboard box, the plastic in the package and the various parts of this product have to be recycled and disposed of in accordance with the current legislation of your Country.

FOR COUNTRIES IN THE EUROPEAN UNION (EU)

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

Contact Local Authorities to obtain practical information about correct handling of the waste, location, and times of waste collection centers. When you buy a new device of ours, you can give back to our dealer a used similar device. The dumping of these devices at unequipped or unauthorized places may have hazardous effects on health and environment.

The crossed dustbin symbol means that the device must be taken to authorized collection centers and must be handled separately from solid urban waste.

FOR COUNTRIES OUTSIDE EUROPEAN UNION (EU)

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

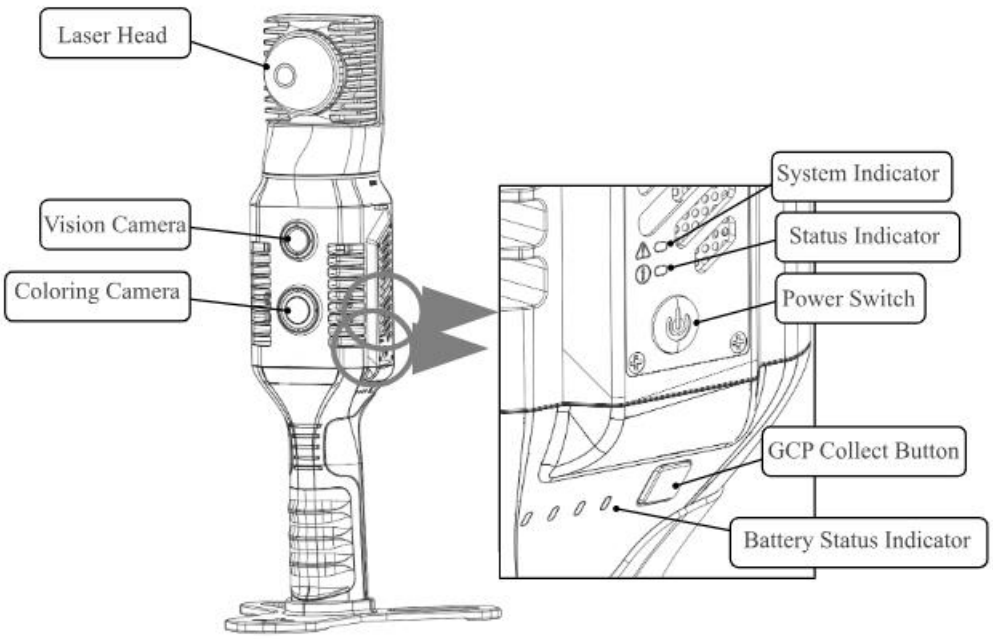
3. Introduction

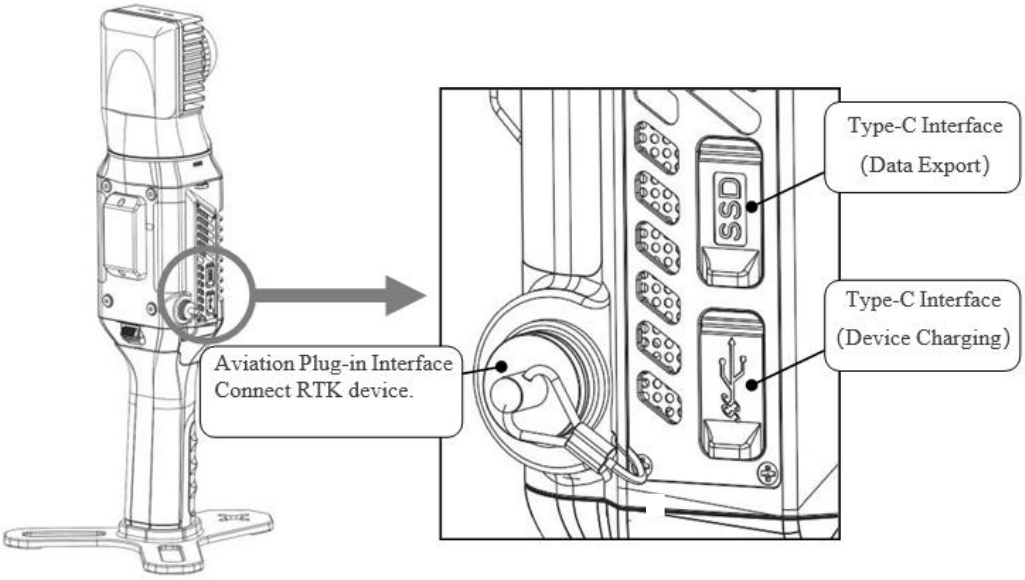
3.1 General

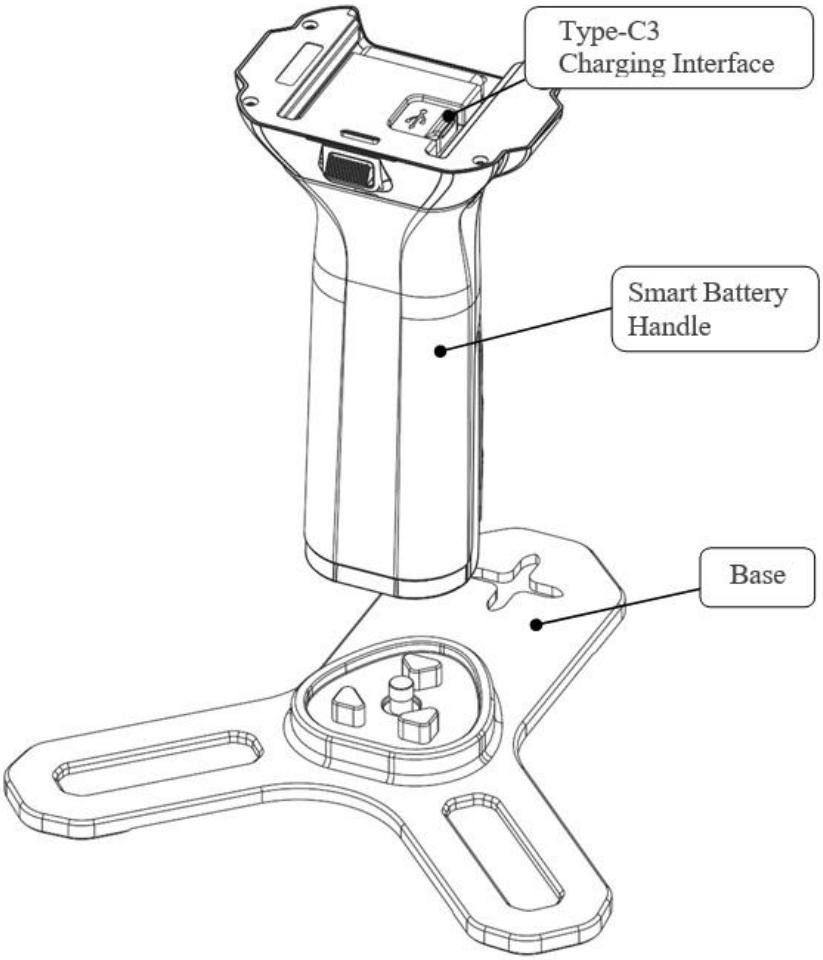
Thank you for purchasing STONEX® X70^{GO} 3D Laser Scanner.
This manual includes important safety directions and instructions for setting up and using the product.
Please read this manual carefully before using, so that our products can serve you better.
When you begin to use the product, we assume that you are a competent user who has read through and understood the contents of this manual and is fully aware of the necessary dangers, warnings, and cautions.
In the event of any discrepancy between the information contained in this manual and the actual, the actual information shall prevail, and the Company reserves the right to make further revisions or changes to this manual without notice.

X70^{GO} is a real-time 3D model reconstruction device which integrates inertial navigation module, high performance computer and storage system.
It is equipped with a 360° rotating head, which, combined with the SLAM algorithm, generates high-precision point cloud data. A 12 MP visible-light camera provides texture information, while a visual camera guarantees stronger real-time preview with GOapp. Mapping results are generated immediately inside the scanner after the scanning.
With X-WHIZZ mode you can combine mobile and stationary surveying. With this solution you can survey large areas in a short time with the SLAM technology and combine it with stationary mode for collecting more detail and with a greater accuracy.

3.2 Description of the system




Type-C Interface
(Data Export)
Type-C Interface
(Device Charging)
Aviation Plug-in Interface
Connect RTK device.
SSD


Type-C3
Charging Interface
Smart Battery
Handle
Base

3.3 Precaution for safety

1. Avoid vibrations: when transporting, keep the instrument in the case and try your best to lighten vibrations.
2. Instrument carrying: when carrying, the instrument handle must be hold tight.
3. Check the battery power: before using the instrument, you should check the battery power whether it is enough.
4. High temperature condition: don't put the instrument in high temperature condition for a long time, it is bad for the instrument performance, and it can damage the hardware components.
5. Temperature changing sharply: the sharp temperature changing on the instrument will shorten the distance measurement range. For example, after taking the instrument out from a warm car to a cold condition, wait for some time: it can be used when it adapts the surrounding condition.
6. Noise from the instrument: when the instrument is working it is normal if you hear noises from instrument motors. They will not affect the instrument work.
7. Stored data responsibility: STONEX® should not be held liable for the lost data because of wrong operation.

3.4 Transport and shipping

TRANSPORT IN THE FIELD

1. When transporting the equipment in the field, always make sure that you:
   a. either carry the product in its original transport container,
   b. or carry the tripod with its legs splayed across your shoulder, keeping the attached product upright.

TRANSPORT IN A ROAD VEHICLE

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

3. Always carry the product in its transport container and secure it.

SHIPPING

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

SHIPPING AND TRANSPORT OF BATTERIES

5. When transporting or shipping batteries, the person in charge of the product must ensure that the applicable national and international rules and regulations are observed.

6. Before transportation or shipping, contact your local passenger or freight transport company.

FIELD ADJUSTAMENT

7. After transport, inspect the field adjustment parameters given in this user manual before using the product.

3.5 Storage

1. Keep away from magnetic fields.
2. Protect against falling.
3. Prevent crushing.
4. Keep away from humid environments.

If the device is not used for a long time, please store it in a safe, dry and ventilated place that avoids direct sunlight, the storage environment requires a relative humidity of less than 40%, and a temperature between -20°C and +60°C to avoid excessive humidity in the environment that causes the device to produce condensation. The recommended storage temperature is +5°C ~ +28°C.

3.6 Cleaning and drying

- Never touch the cover glass with your fingers.
- Use only a clean, soft, lint-free cloth for cleaning.
- If necessary, moisten the cloth with water or pure alcohol. Do not use other liquids.
- Keep plugs clean and dry. Blow away any dirt lodged in the plugs of the connecting cables.

3.7 Definition of indication

For the safe of your product and prevention of injury to operators and other persons as well as prevention of property damage, items which should be observed are indicated by an exclamation point within a triangle used with WARNING and CAUTION statements in this manual.
The definitions of the indications are listed below.
Be sure you understand them before reading the manual's main text.

ATTENTION: Ignoring this indication and making an operation error could possibly result in death or serious injury to the operator.

CAUTION: Ignoring this indication and making an operation error could possibly result in personal injury or property damage.

ATTENTION

1. Do not perform disassembly or rebuilding. Fire, electric shock, or burn could result. Only STONEX® authorized distributors can disassemble or rebuilt.
2. Do not cover the charger. Fire could result.
3. Do not use defection power cable, socket, or plug. Fire, electronic shock could result.
4. Do not use wet battery or charger. Fire, electronic shock could result.
5. Do not close the instrument to burning gas or liquid, and do not use the instrument in coal mine. Blast could result.
6. Do not put the battery in the fire or high temperature condition. Explosion, damage could result.
7. Do not use the power cable which is not specified by STONEX®. Fire could result.
8. When this product encounters disturbance of severe Electrostatic Discharge, perhaps it will have some degradation of performance like switching on/off automatically and so on.

CAUTION

1. Do not touch the instrument with wet hand. Electric shock could result.
2. Do not stand or seat on the carrying case, and do not turn over the carrying case arbitrarily, the instrument could be damaged.
3. Do not drop the instrument or the carrying case.
4. Do not touch liquid leaking from the instrument or battery. Harmful chemicals could cause burn or blisters.
5. Do not drop the instrument. Serious damage could result.
6. Please be careful when removing the scanner from the equipment case and take care to protect the rotating laser head.
7. Do not touch the protective cover of the laser emitting area with your hands.
8. Please try to keep the scanner moving smoothly during data collection and avoid violent shaking.

3.8 Safety standards for lasers

STONEX® X70^{GO} series adopt the class of Laser Product according to IEC Standard Publication 60825-1:2014. According to this standard, the device is classified as Class 1 Laser Product.

3.9 Device power supply

X70GO scanner handle internal integrated 3000mAh replaceable lithium battery, safer and more reliable. Working voltage 10.8V, each battery single continuous working time of about 95min (separate power supply X70GO). The battery in normal maintenance under normal use conditions, charge and discharge cycle times ≥ 500 times.

Charging advice

1. Do not use non-standard power adapter to charge the battery.
2. If the temperature of the battery is high after the operation, it is necessary to wait until the battery is reduced to room temperature before charging the battery, and the ambient temperature of battery charging is required to be within the range of 5°C to 40°C.
3. Please charge in the isolated area, away from flammable materials. To avoid the danger of electric shock, please do not open the charger without authorization.
4. To avoid the danger of electric shock, please do not open the charger without authorization.

Operation advice

1. Battery use temperature is required to be controlled at -10°C ~+50°C, if the battery temperature is too low, it will affect the lithium-ion activity and discharge efficiency.
2. Please make sure the device connection port is dry and free of water before connecting and installing.
3. Please keep the Smart Battery Grip out of direct sunlight.
4. Using the battery in a low temperature environment (-10°C～15°C) will reduce the battery capacity and discharge voltage, it is recommended to preheat the battery to 15°C or above before use, and it is better to preheat it to 20°C or above.
5. Do not remove the battery directly from a powered device.
6. Low battery temperature triggers low temperature charging protection and prevents charging.

7. Do not continue to use a battery that has been deformed by a fall or impact.
8. If the battery accidentally falls into water, immediately remove the battery, and place it in a safe, open area, away from the battery until it is completely dry. Air-dried batteries should not be reused and should be disposed of properly according to the disposal instructions in this document.
9. If the battery fire occurs, please use water, water mist, sand, fire blanket, dry powder,
10. carbon dioxide fire extinguisher to extinguish the fire immediately, the fire is very easy to explode. Please choose the fire extinguishing method according to the above recommended order according to the actual situation.
11. It is strictly prohibited to use batteries that are not officially provided by Stonex. If you need to replace the battery, please purchase it from Stonex or Stonex dealers. Stonex is not responsible for battery accidents or equipment failures caused using batteries other than those provided by Stonex.
12. Battery storage temperature and humidity requirements are -20°C ~45°C, 45%~90%RH.
13. It is strictly prohibited to use or charge batteries that are bulging, leaking or damaged. Do not use the battery when it emits a strange odor, becomes hot (the temperature of the battery itself exceeds 60°C), deformed, discolored or any other abnormal phenomenon. If the battery is abnormal, please contact Stonex after-sales service or other agents for further treatment.
14. Use the battery in an environment where the temperature is between -10°C and 50°C. Excessive temperatures (above +50°C) may cause the battery to catch fire or even explode. Too low a temperature (below -10°C) will seriously damage the battery.
15. It is prohibited to disassemble or puncture the battery with sharp objects in any way. Otherwise, battery leakage will cause fire or even explosion.
16. Do not mechanically strike, crush, or throw the battery. Do not place heavy objects on the battery or charger.
17. If the battery is dropped or struck by an external force, stop using the battery.
18. Do not heat the battery. Do not place the battery in a microwave oven or pressure cooker.
19. Do not place battery contacts on a conductive surface (such as a metal tabletop, glasses, watch, jewelry, or other metal objects).
20. Do not short-circuit the positive and negative terminals of the battery with wires or other metal objects.
21. If the battery connector is dirty, wipe it with a clean, dry cloth. Failure to do so will result in poor battery contact, which may cause energy loss or charging malfunction.

Transportation

Batteries should be placed in a safe box during transportation to avoid contact with liquids or bumping against hard objects, and never immerse them in water or get them wet. When the battery is exposed to water, it may decompose and cause spontaneous combustion or even an explosion.

Maintenance

After each operation, the battery should be recharged in time, please do not store the low battery for a long time, if not used for a long time, please charge the battery to more than 50% and then store it, and carry out charging and discharging maintenance every 3 months.

Battery storage

1. Please store the battery out of the reach of children and pets.
2. Batteries should be stored in an explosion-proof box in a cool and dry place, prohibited from prolonged exposure to high temperatures and avoid direct sunlight.

3. Do not place the battery near a heat source (furnace or heater, and so on), and do not leave the battery in a car on a hot weather day. Do not store the battery in an environment that exceeds 60°C. The ideal storage temperature is 22°C - 28°C.
4. May not be stored in multiple occurrences of alternating high and low temperature environments.
5. May not be stored in a fully charged transportation box when the battery temperature exceeds 45°C.
6. Prolonged low battery storage will result in over-discharge of the battery, which may even cause the battery to be scrapped in severe cases.
7. Do not place sharp objects with or puncture the batteries.
8. Prevent the battery from being dropped and knocked.
9. Store the battery in a dry environment.
10. Do not store the battery for long periods of time after it has been completely discharged to avoid over-discharging the battery and causing damage that will make it impossible to restore it to service.

Battery disposal

1. Do not disassemble, impact, extrude the battery or put it into fire. Please do not put the battery in a high temperature environment.
2. If the battery is bulging, broken or leaking, please do not use it again and dispose of it in time.
3. Be sure to discharge the batteries completely before disposing of them in the designated battery recycling bin. Batteries are hazardous chemicals and should not be disposed of in the regular trash. For details, follow your local battery recycling and disposal laws and regulations.
4. If the battery cannot be completely discharged, please do not dispose of the battery directly in the battery recycling bin and contact a professional battery recycling company for further processing.

Battery specifications

Model	**SP30**
Charging interface	Type-C3 port
Input voltage	5-20 V
Output voltage	10.8 V
Battery capacity	3000 mAh
Standard	GB31241-2014S
Duration	95 min
Weight	About 400 g
Dimension	Length×Width×Height 85 mm×60 mm×144.5 mm

3.10 About User

1. The X70^{GO} Scanner must be used by trained operators only. When operating the X70^{GO}, please always follow basic safety precautions to prevent injury or damage to equipment.

2. The user is required to be a qualified surveyor or have a good knowledge of surveying, in order to understand the user manual and safety instructions, before operating, inspecting, or adjusting.

3. Do not operate the equipment if it shows obvious defects or damage. Please follow STONEX® service procedure to repair the equipment.

4. Please use only the components and accessories provided by the manufacturer.
5. Before operating the X70^{GO} for the first time, please read this manual completely.
6. The equipment contains electrical components and mechanical parts, so proper operation is required. Do not pull or bend the data transmission line forcibly.
7. Do not push any other objects into the data transmission line interface, place the device out of the reach of children, and do not modify or disassemble the X70^{GO} scanner under any circumstance without the prior written permission of STONEX®. Otherwise, the warranty would not be applied.

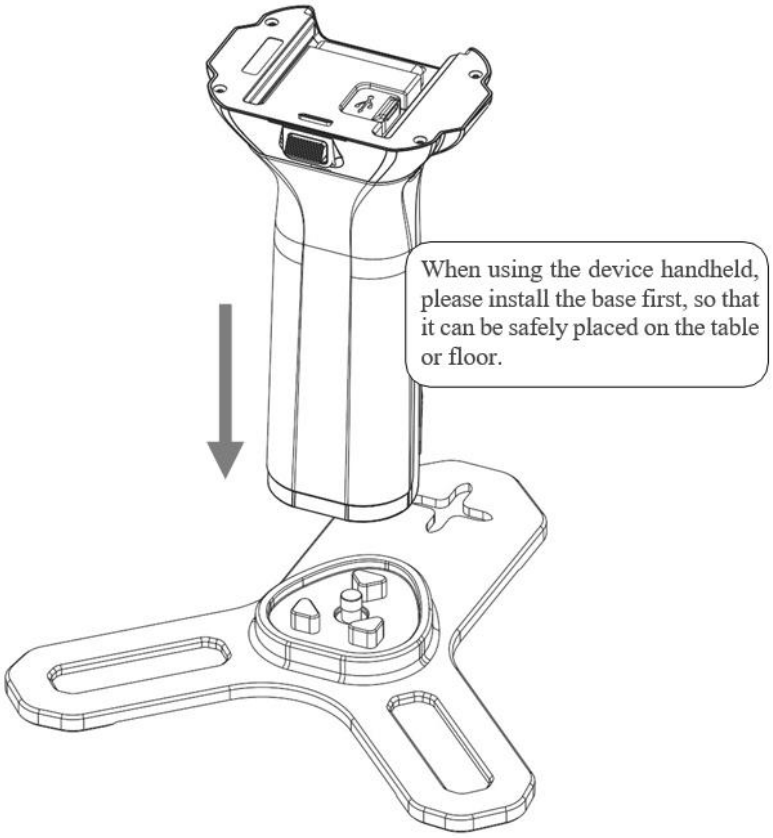
3.11 Exceptions from Responsibility

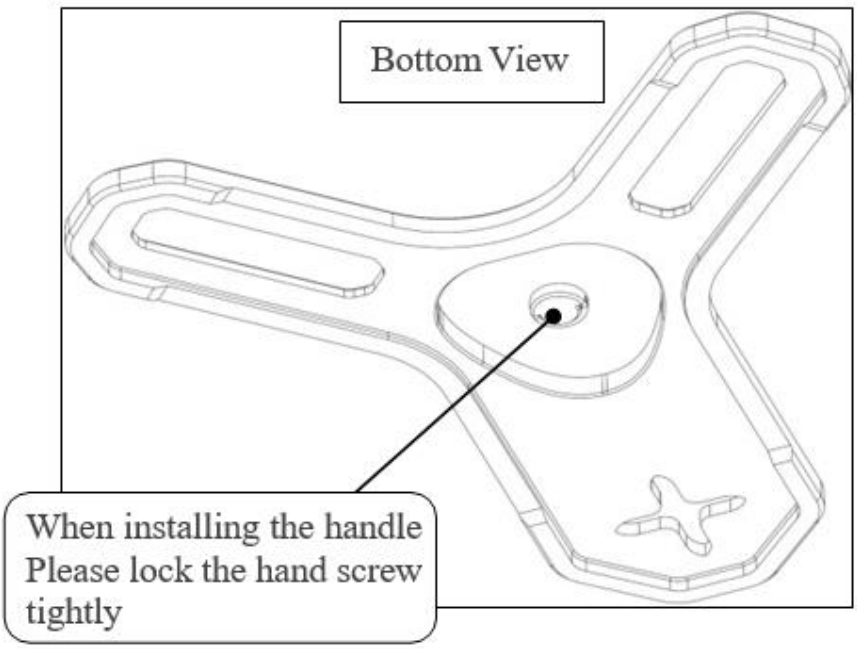
1. The user of this products is expected to follow all operating instructions and make periodic checks of the product's performance.
2. The manufacturer assumes no responsibility for results of a faulty or intentional usage or misuse including any direct, indirect, consequential damage and loss of profits.
3. The manufacturer assumes no responsibility for consequential damage and loss of profits by any disaster, such as earthquakes, storms, floods etc.
4. The manufacturer assumes no responsibility for any damage and loss of profits, due to a change of data, loss of data, an interruption of business etc., caused by using the product or an unusable product.
5. The manufacturer assumes no responsibility for any damage and loss of profits, caused by usage except for explained in the user manual.
6. The manufacturer assumes no responsibility for damage caused by wrong transport or action, due to connecting with other products.

4. Setting up the STONEX® X70GO

4.1 Device assembly

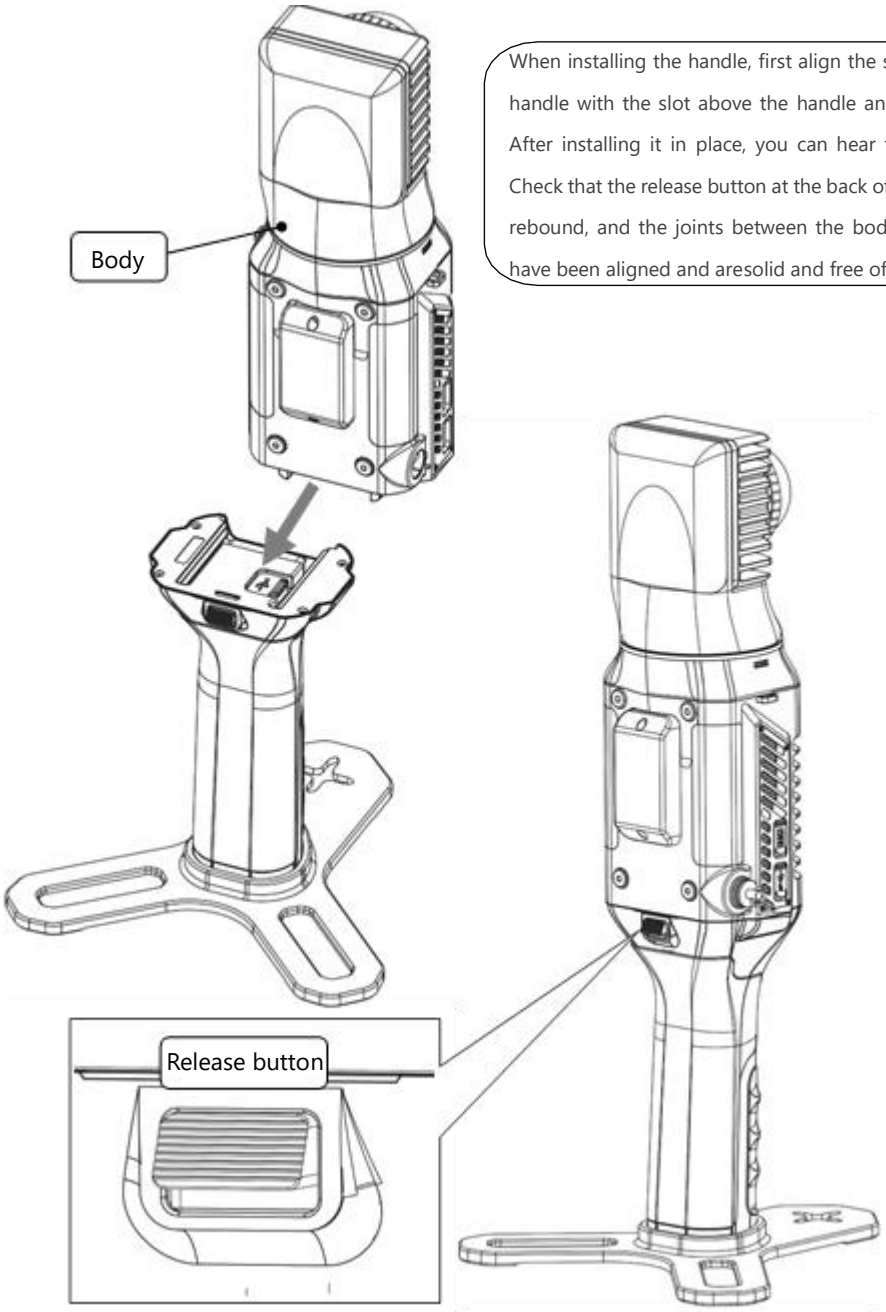
Mounting base



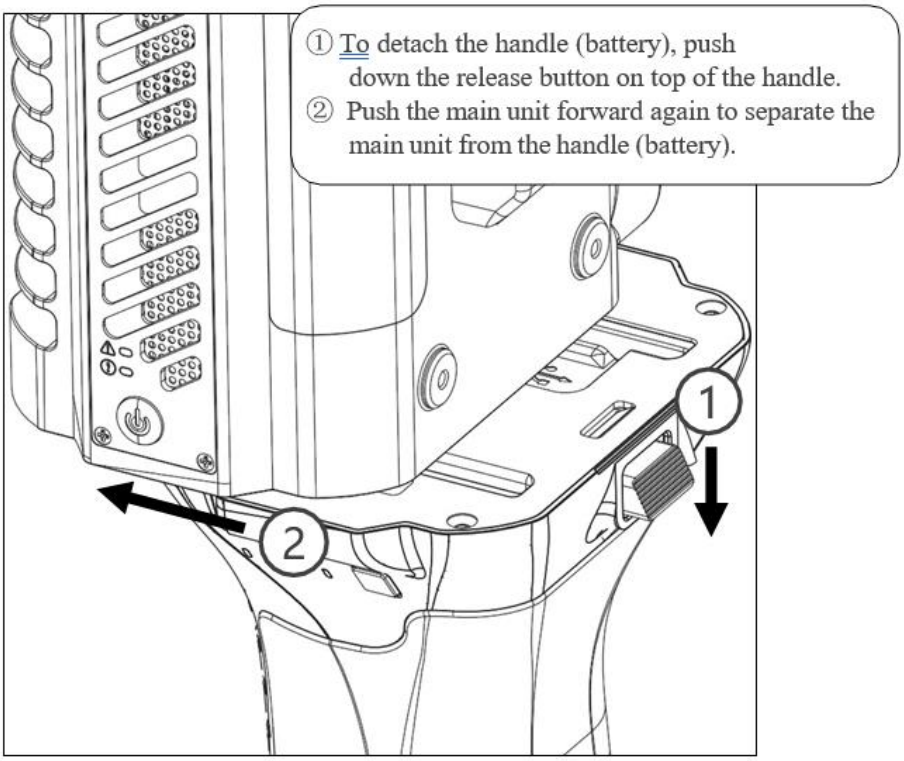


Assemble handle

When installing the handle, first align the sliderail under the handle with the slot above the handle and then push it in. After installing it in place, you can hear the "click" sound. Check that the release button at the back of the handleis fully rebound, and the joints between the body and the handle have been aligned and aresolid and free of looseness.



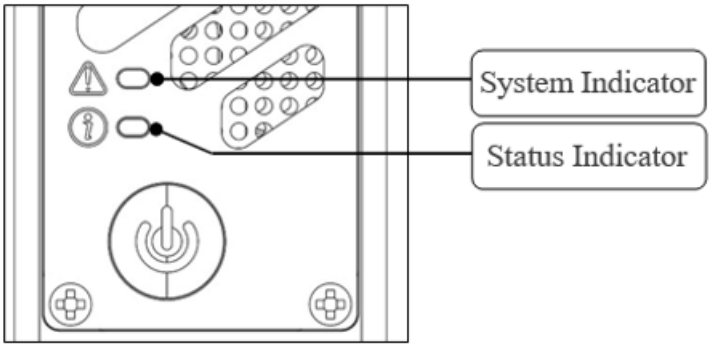
Detach handle



4.2 Led status

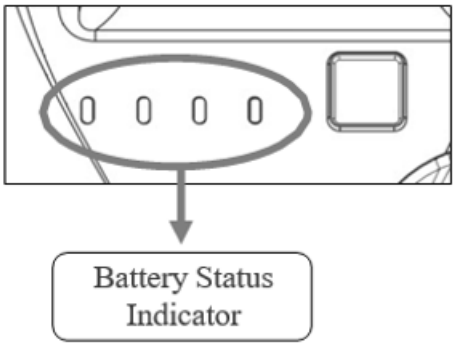
System information

The system will provide visual and audio inputs to the user, in order to understand the status of the system.



	Led color	Indicator Status
System Indicator	Firmware upgrade	White light, on
	System not ready	Red light, flashing
	System ready	Blue light, on
Status Indicator	MCU Firmware upgrade	White light, flashing fast
	Device initialization	Red light, on
	Device ready	Green light, on
	Data collection in progress	Green light, flashing

	Sound	Sound description
Buzzer	One beep	Power ON
	One beep	Shutdown
	One beep every 10 seconds	Low battery
	One beep every second	Ultra-low battery
	One beep	GCP information collection
	One beep	Start data collection
	One beep	Stop data collection



The battery status indicator will show the percentage of the remaining battery. It will also give information about the charging and discharging conditions.

Battery LED Indicator Status List					
Status		**LED1**	**LED2**	**LED3**	**LED4**
Discharge Protection Status	Undervoltage	Flash(5Hz)	Slow Flash(1Hz)	Out	Out
	Discharge Low Temperature	Flash(5Hz)	Out	Slow Flash(1Hz)	Out
	Discharge Over Temperature	Flash(5Hz)	Out	Out	Slow Flash(1Hz)
	Discharge Overcurrent	Flash(5Hz)	Slow Flash(1Hz)	Slow Flash(1Hz)	Out
	Discharge Short Circuit	Flash(5Hz)	Slow Flash(1Hz)	Slow Flash(1Hz)	Slow Flash(1Hz)
Charge Protection Status	Overvoltage	Slow Flash(1Hz)	Out	Out	Flash(5Hz)
	Charging Low Temperature	Out	Slow Flash(1Hz)	Out	Flash(5Hz)
	Charging Over Temperature	Out	Out	Slow Flash(1Hz)	Flash(5Hz)
	Charging Overcurrent	Slow Flash(1Hz)	Slow Flash(1Hz)	Out	Flash(5Hz)

Power Indicator	0%~12%	Slow Flash(1Hz)	Out	Out	Out
	13%~24%	Always On	Out	Out	Out
	25%~37%	Always On	Slow Flash(1Hz)	Out	Out
	38%~49%	Always On	Always On	Out	Out
	50%~62%	Always On	Always On	Slow Flash(1Hz)	Out
	63%~74%	Always On	Always On	Always On	Out
	75%~87%	Always On	Always On	Always On	Slow Flash(1Hz)
	88%~100%	Always On	Always On	Always On	Always On

	Status	**LED1**	**LED2**	**LED3**	**LED4**
Charging Indicator	0%~24%	**LED1->LED4 Streaming LED Display**			
	25%~49%	Always On	**LED2->LED4 Streaming LED Display**		
	50%~74%	Always On	Always On	**LED3->LED4 Streaming LED Display**	
	>=75%	Always On	Always On	Always On	**Slow Flash(1Hz)**
	Full	Always On	Always On	Always On	Always On

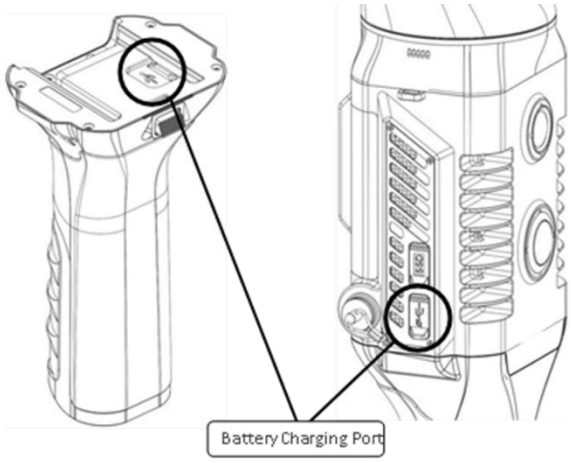
Description: The LED will light up for 6 seconds when you press the key to check the power level, the first 3 seconds will show the power level, the last 3 seconds will show the power level if the battery is normal, otherwise it will show the protection status.

4.3 Charging method

The X70GO battery can be charged by connecting the charger to the battery via a Type-C cable.

Mode 1: The charger is connected to the Type-C port on the X70GO grip for charging.

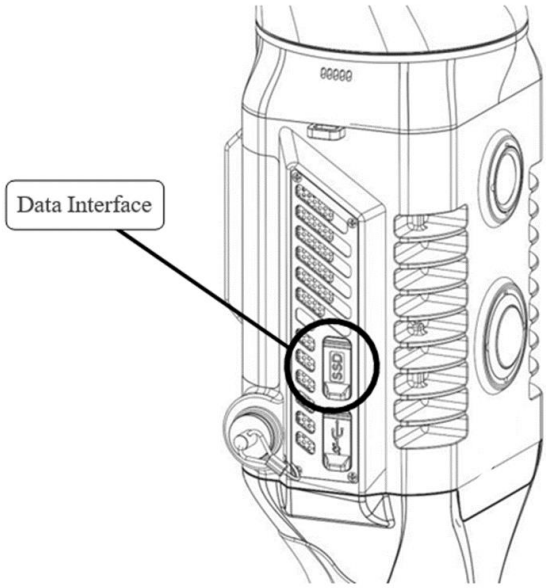
Mode 2: When the grip is mounted to the X70GO body, the charger is connected to the Type-C port on the underside of the body for charging.



4.4 Data storage

X70GO uses build-in SSD memory with a capacity of 512 GB and can be connected to a PC via a data cable for data interaction.

The SSD interface (Type-C, with SSD name on the port) can be accessed when the scanner is turned off.



NOTE: There are two Type-C ports on the body of the scanner, the upper one is for data download while the lower for charging.

5. Operating the STONEX® X70^{GO}

5.1 GO*app* installation

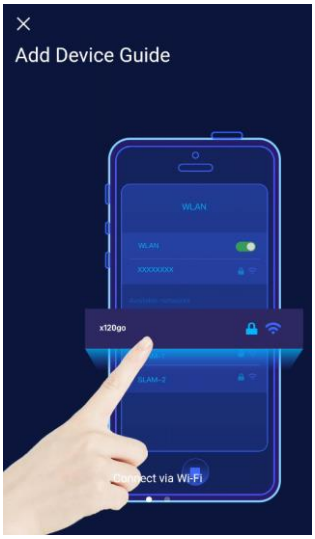
GO*app* is mobile APP for X70^{GO} for Android (8.0 version or above), which allows to perform operations such as project management, real-time point cloud display, image preview, firmware upgrade, etc.

1. Download on PC from here: GO*app* for Android
2. Copy the *.apk file on the Android controller using an USB connection.
3. From Android, locate the *.apk file you just copied and click to start the installation.
4. Install it on your devices.

5.2 Device binding

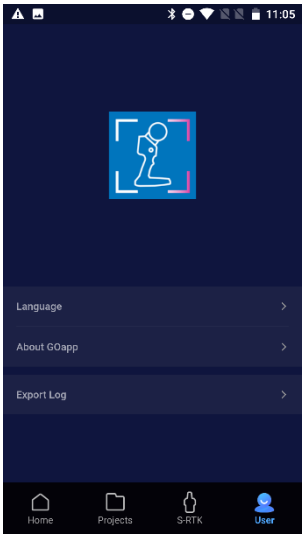
The first time you open the GO*app*, you will have the following page, where the ***Add Now*** button allows to blind a new device.

X70^{GO} should be connected with the Wi-fi to the tablet on which is installed GOapp.
Open the APP homepage, press and hold power button of X70^{GO} scanner for 3 seconds, wait for about one minute, and connect the Wi-Fi of your mobile phone. You can find the device with the name "X70GO_xxxxx". The password is 12345678.
X70^{GO} scanner equipment will automatically appear on the homepage.



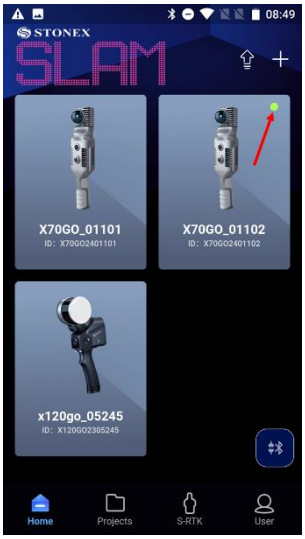
User settings

By clicking the user icon, the user settings page will open. In this page is possible to change the language, by clicking ***Language*** (English, Italian, Chinese available now), and is possible to check the installed applications version by clicking ***About GOapp***. The ***Export Log*** should be used only if requested by stonex support team.



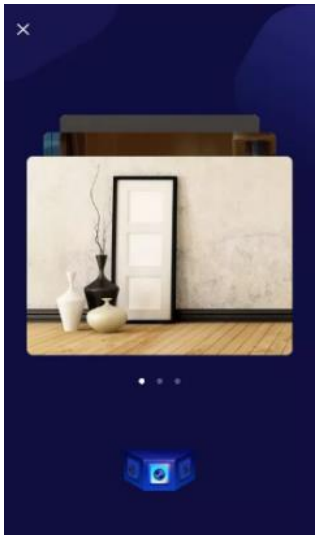
5.3 Equipment work

Connect the X70^{GO} scanner through mobile phone Wi-Fi, click on the online device with the green dot logo in the upper right corner of the APP page.



After successful connection, the equipment will be initialized. Click on ***Start work*** to start the scan.

You can also click on the camera icon to take a set of pictures. Swipe left or right in the preview interface to switch the preview images taken by the two cameras.



Device Status-Connection failed

If the device connection fails, please recheck the device connection status and troubleshoot one by one:

1. Check whether the Wi-Fi of X70^{GO} is connected to the mobile phone.
2. Check X70^{GO} LED status.
3. Exit the work interface, return to the home page, and check whether there is a green cursor in the upper right corner of the connected device icon.
4. Try to completely close the GO*app*, clear the background of GO*app*, re-enter GO*app* and try to connect to the X70^{GO} device again.

If the connection fails when you re-enter the equipment interface after the above operation, please contact your local dealer for more assistance.

Device status-out of communication range

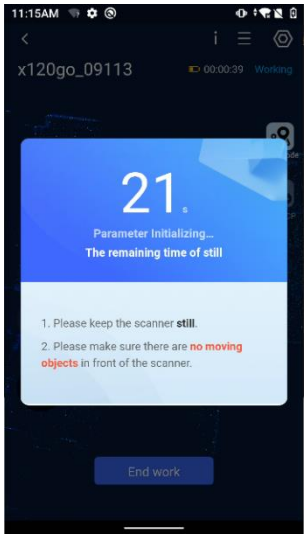
When GO*app* is disconnected from X70^{GO}, the device status will prompt "Not in communication range". It is necessary to check whether the mobile phone is connected to the device Wi-Fi of X70^{GO}, or the distance between the mobile phone and the device is too far, and the Wi-Fi signal is weak or disconnected.

Device status - Device activation failed

If a device activation failed message appears, you need to connect the controller (phone/tablet) to an internet connection and open the application. Then the application will be able to perform time synchronization.

Parameter initializing

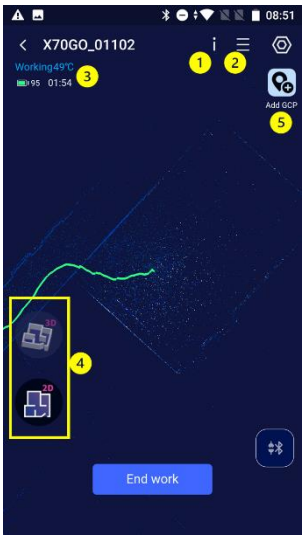
After clicking *Start work*, leave the scanner still to allow the laser scanner parameters to initialise for approximately one minute. Ensure that there are no moving objects in front of the scanner at this stage.



Working page

After connecting X70^{GO} through GO*app*, the APP enters the standby page, and the system will automatically enter the working page and start to display the laser scanning data in real time by pressing the power button on the instrument.

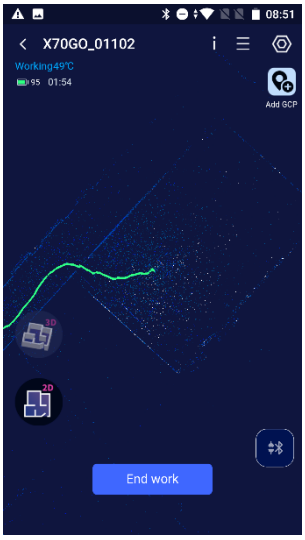
The equipment interface includes equipment information (1), settings (2), working time, temperature and battery percentage (3), switching 2D or 3D display function (4), add a GCP (5).



Click the *End work* button to stop the acquisition.

Working-real-time 3D scanning display

When the APP is in the standby interface, press the power key of X70^{GO} device briefly to start the operation, and the page will automatically jump to the 3D scanning display interface.



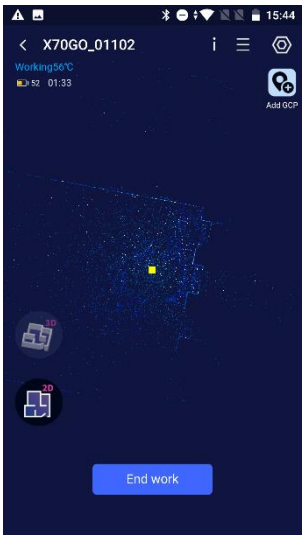
Working-View status information

In the process of X70^{GO} operation, click the "Equipment Information" button at the upper right corner of the working interface to view the current basic status information, motor status information and error status information.

Add GCP

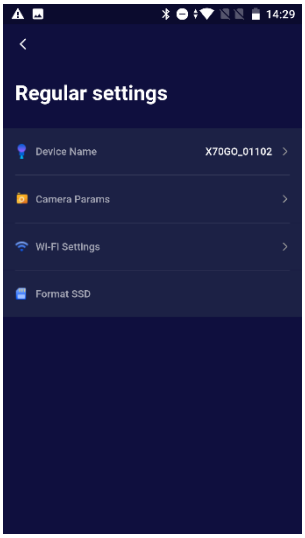
Once you have moved on to a control point, for example indicated by a target, you must centre the centre of the target via the cross in the base of the instrument.

At this point, clicking on the *Add GCP* icon will save the point as a GCP. In addition to the message of successful acquisition, the new ground control point will be visible along the motion track by the presence of a yellow square, one for each point acquired.



5.4 Settings

Click the "Settings" button in the upper right corner of the working interface to enter the setting interface. Click *Regular Settings* to enter the setting interface, where you can set the device name, camera parameters, Wi-fi settings and can format the internal memory.

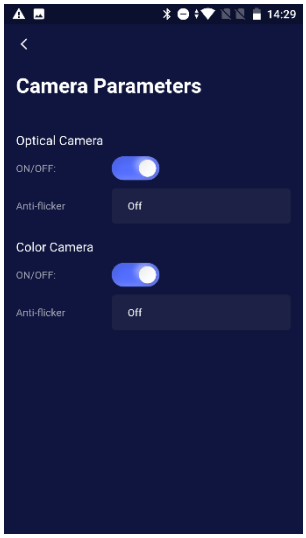


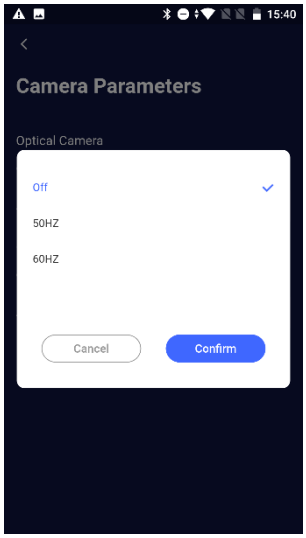
Modify device name

Click on the Device name, enter the content to be modified in the pop-up "Modify Device Name" dialog box, and click "Confirm" to modify the device name.

Camera parameters

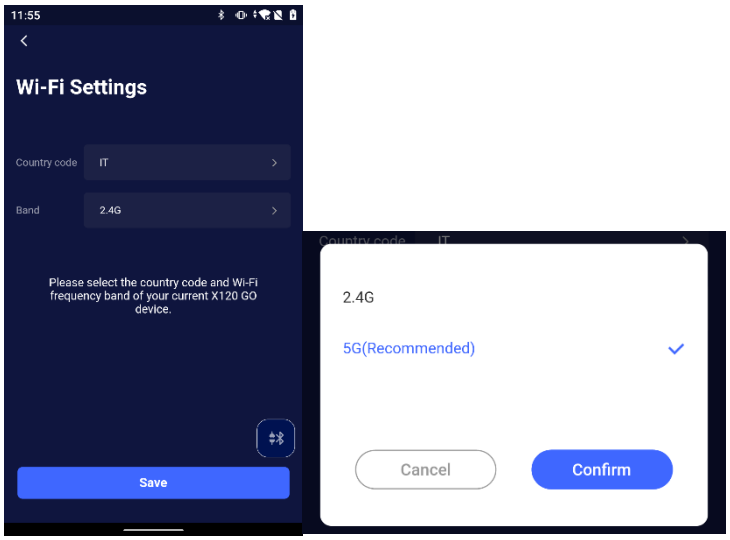
You can switch on/off the cameras, and you can change the frequency to avoid flickering in the images. Switch between 50 Hz and 60 Hz, depending on the type of lights are present in the environment. Usually LED lights can create wrong shadows, so take an image before the data acquisition and change the frequency if you notice anomalies.





Wi-Fi Settings

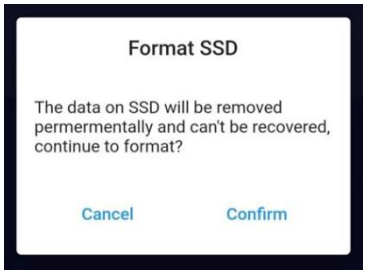
Click on Wi-Fi Settings. Here you can define the Country and the available bands for Wi-Fi.



Once selected and confirmed, wait few seconds for it to be applied.

Format SSD

Click here if you want to format the SSD of the scanner.



Delete equipment

If you want to remove the device, click on Delete dialog box, and click "Confirm" to delete the device.

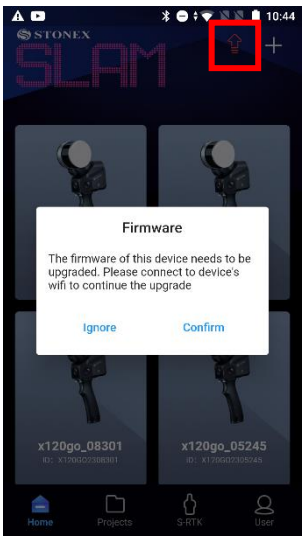
The Delete Device function allows you to delete devices that do not need to appear on the front page.

5.5 Firmware

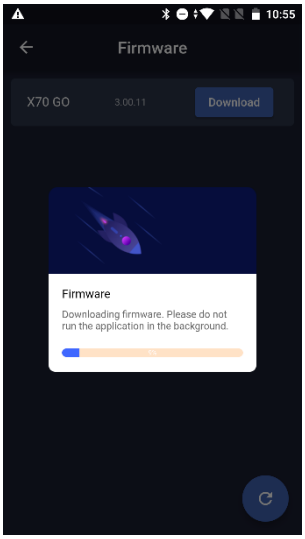
Firmware update will optimize the performance of firmware or device drivers, as well as the performance of processors or other device hardware. Firmware upgrade can also fix the problems found in the old version. On the home screen, the arrow icon indicates the presence of a new firmware download. If white, there are no updates.

Automatic firmware upgrade reminder

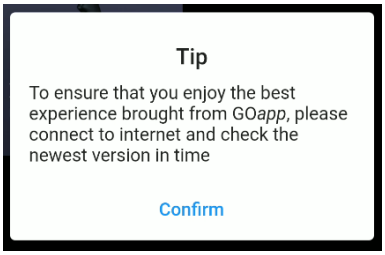
Every time you open the application to log in, the application will automatically detect the latest firmware version and the local current firmware version. If the latest firmware file is not downloaded locally, you will be reminded to download the latest firmware in the pop-up window on the home page, so that you can directly update the firmware after connecting the device. In addition, the arrow icon will turn red, signalling the presence of firmware to be updated.



Click on the red arrow to check the firmware version to be downloaded.



To make sure you have the latest Firmware version, open the application, before connecting to the scanner's wi-fi. Otherwise, the following message will appear.



Latest firmware download

After the firmware of the homepage pop-up window is upgraded, click OK, which will jump to the firmware download window. Click Download to start downloading. Currently, don't operate your mobile phone, wait for the download to complete, and then click OK to exit the firmware upgrade window.

Firmware upgrade process

When the pop-up window on the home page prompts to download firmware, the firmware package will be downloaded locally.

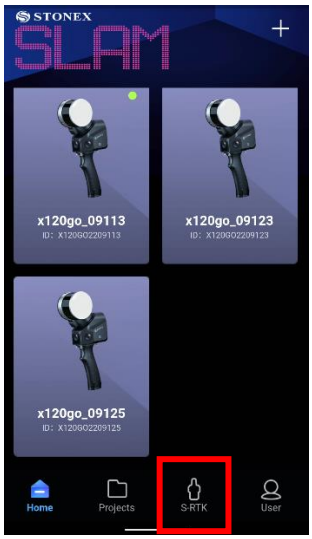
1. When opening the app, log in to the account, click “Download the latest firmware” in the pop-up window to upgrade the firmware, and close the download page after the download is completed.
2. Turn on the X70^{GO} device, connect the device Wi-Fi, click "Home" to enter the device details, click the "Settings" button in the upper right corner of the page, and click "Firmware Upgrade".
3. Click "Firmware Upgrade" in the firmware upgrade interface, and then click "Update". Please wait patiently for the firmware upgrade package to be transmitted to the X70^{GO} device. Do not operate the mobile phone or X70^{GO} device at this time.
4. After the transmission is completed, click OK. At this time, please wait for 35s before manually restarting the equipment. After restarting the equipment, check the LED status, and control when LED status return to normal. At this time, the firmware update is successful, and the equipment can be used normally.

In case the latest firmware package is not downloaded on the home page.

1. Turn on the X70^{GO} device, connect the device Wi-Fi, and click the "Home" to enter the device details, and click the "Settings" button in the upper right corner of the page.
2. When checking the firmware upgrade, you need to disconnect the Wi-Fi connection of X70^{GO} device (if the device has not acquired the latest firmware version, you will be prompted to disconnect the Wi-Fi of the device and re-enter the firmware upgrade page), keep your mobile phone connected to the Internet, and click "Firmware Upgrade".
3. After the download is completed, reconnect the Wi-Fi of X70^{GO} device, exit the firmware upgrade page, and click the device on the home page again to enter the device standby page.
4. Click "Settings" in the upper right corner of the standby page, enter the firmware upgrade page, click "Firmware Upgrade" and then click "Update". Please wait patiently for the firmware upgrade package to be transmitted to X70^{GO} equipment. Please do not operate your mobile phone or X70^{GO} equipment at this time.
5. After the transmission is completed, click OK. At this time, please wait for 35s before manually restarting the equipment. After restarting the equipment, check the LED status, and control when LED status return to normal. At this time, the firmware update is successful, and the equipment can be used normally.

5.6 RTK70^{GO} function

Click the icon to enter in the S-RTK page.



To better understand the operation to do in this section see Chapter 7.

6. Data collection

Device Power On

Long press the scanner power button for 3 seconds. The laser head starts to rotate for self-test.

Wait until:

- System indicator [Blue light is always on].
- Status indicator [Green light is always on].
- The laser head stops rotating.

At this point, the device starts successfully and is in standby mode.

Do not rotate the laser by hand after the self-test of the device and keep the scanner on a flat and stable surface.

Start collection

The scanner needs to be calibrated before starting data collection and should be placed at a distance of greater than 40 centimeters from the object to be measured and not too far away. The calibration phase should take at least 60 seconds before motion acquisition begins. The scanner should not be held in the hand while calibrating but must be placed on a fixed surface such as a secure floor or tabletop.

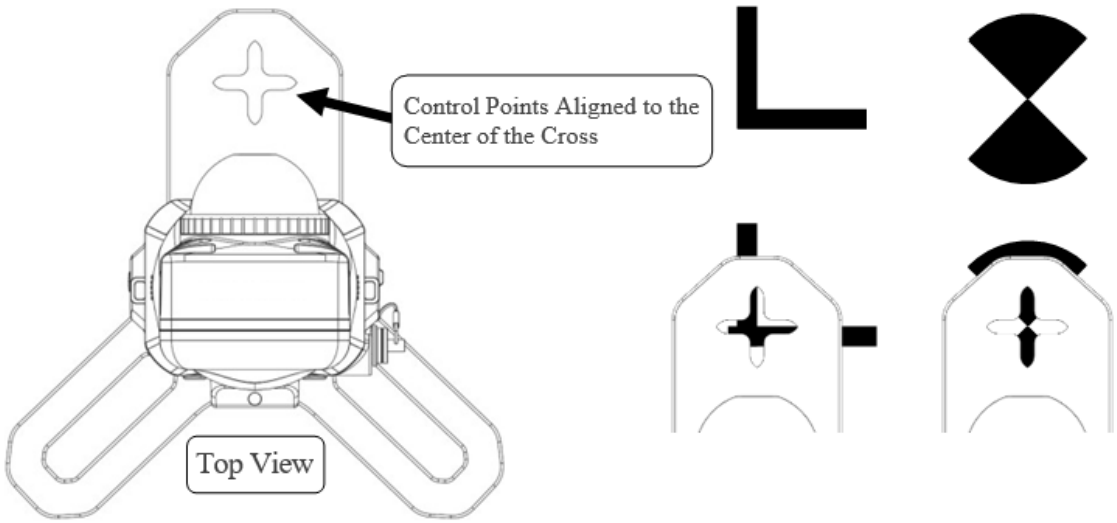
Short press the start button on the scanner, the status indicator will start to fast flashing green, at this time the device is being calibrated. Wait for 60 seconds (cell phone APP will show a countdown to read the seconds), the laser head will not rotate during the calibration phase. After 60 seconds, the status indicator will start flashing slowly green, the laser head will begin to rotate and will start data acquisition.

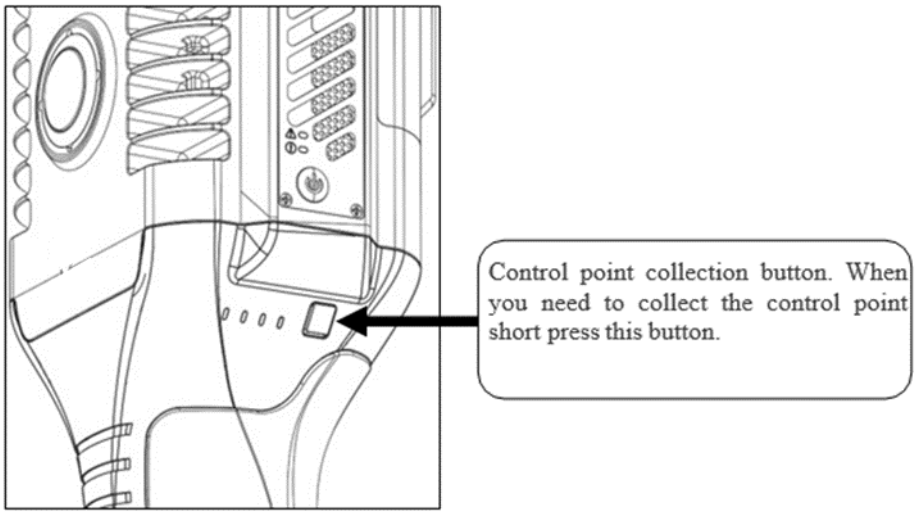
GCP collection

When you need to collect control points, please first align the cross center of the device base to the control point, then press the control point collection button, and after hearing a beep, the control point is collected successfully.

If you are using the app you can click on Add GCP to save it.

After collecting the GCP you can continue to scan normally.





Stop collection

Short press the scanner ON/OFF button to end data acquisition or the button on the app. The status indicator returns to green light. In the standby state, the laser head stops rotating.

Real-time mapping

If you need to get the results of " Real-time Mapping", please wait for the equipment to finish the " Real-time Mapping process" before shutting down the equipment. Wait about 1/25 of the acquisition time to get the real time point cloud saved in the device memory before turning off the scanner.

Scanning time	Waiting time for real time point cloud
5 minutes	12 seconds
10 minutes	24 seconds
15 minutes	36 seconds
20 minutes	48 seconds
25 minutes	1 minute

Device shutdown

Press and hold the scanner ON/OFF button to turn off the device and wait until the system indicatorand status indicator are all off.

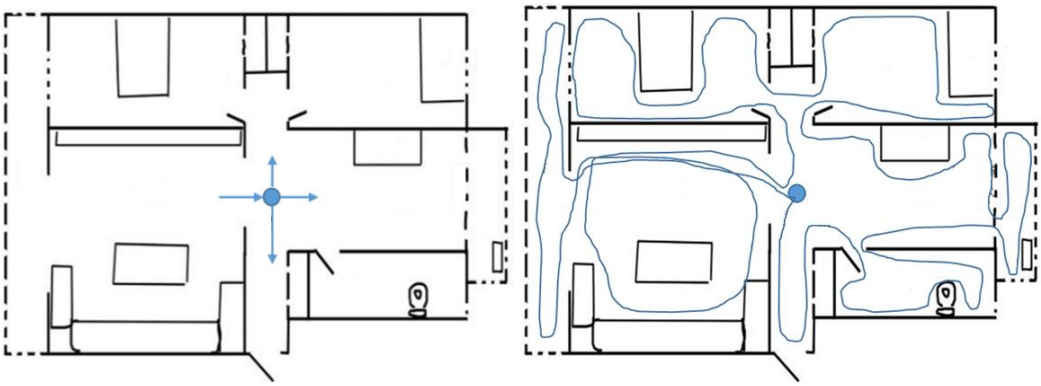
Data download

After data collection, turn off the scanner, connect the X70GO to the PC with the data cable, find the folder named "SN_XXXXX" and copy it on your PC. The system will automatically generate this folder every time the data collection is completed, and the order of data collection can be recognized according to the number at the end of the folder.

6.1 Data collections instructions

Indoor Environment

If it is an indoor environment, multi-path locations should be selected as far as possible as the starting and ending points of data collection. After the site survey, plan the closed route of the survey area.



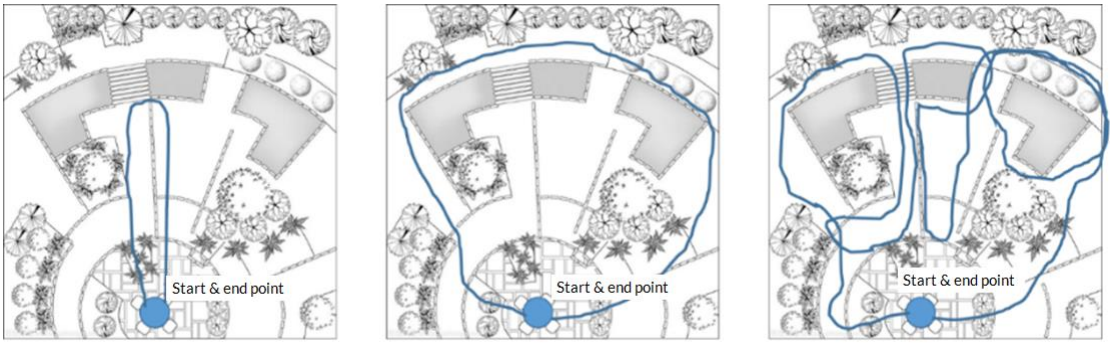
Outdoor Environment

If it's an outdoor environment, besides finding multi-path locations and planning closed routes, it is also necessary to ensure that the measured object is within the effective measurement range of the scanner (because of the different reflectivity of ground objects, the distance is also different).

Notice: A multipath location refers to a location that can be reached from multiple directions.

Closed routes

1. The slender closed route is similar to **U-Shaped**, can barely meet the accuracy requirements. If conditions permit, users are advised not to choose this route.
2. The trajectory is similar to **O-shaped**, there is no redundant closed-loop, and the accuracy of data calculation is good, which is one of the most basic requirements for route selection.
3. **Multi O-route:** the whole track is similar to O-shaped, with many closed circles, and the data solution accuracy is the best. It is composed of many closed O-shaped routes, which greatly improves the data solution accuracy and is the best route planning.

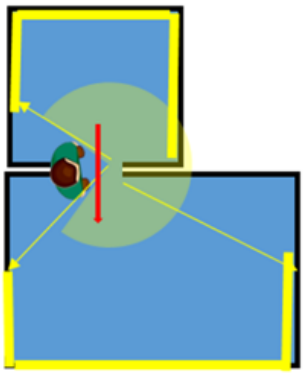


Typical surroundings data collection considerations

X70^{GO} scanner can acquire point cloud data in the range of 360×59, and the point density decreases with the increase of measurement distance. In the process of data acquisition, the device should be stable and avoid violent shaking, and non-measurement objects such as pedestrians and vehicles should be prevented from blocking the front of the device for a long time, to ensure the integrity of data acquisition.

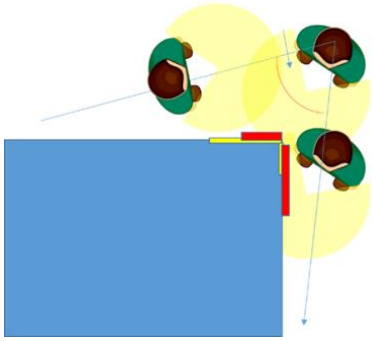
Precausion when passing through the door

When the hand-held scanner passes through the indoor door, it is recommended to pass slowly sideways to ensure that the scanner is relatively stable, and the door is open as much as possible. If the door is closed, when approaching the door, you need to turn the scanner back to the door and open the door with the other hand. During the process of passing through the door, you should fully consider the scanning field of vision and scan the scenes outside the door as much as possible in the room. When closing the door, try to avoid the scanner scanning the moving door as much as possible, to prevent data calculation errors.



Attention when turning corners

When the hand-held scanner passes through the corner, it is recommended to avoid too fast corners, and the way of the corner should be considered in route planning. Get as many point cloud data at the same position before and after the corner as possible to improve the accuracy of data calculation.

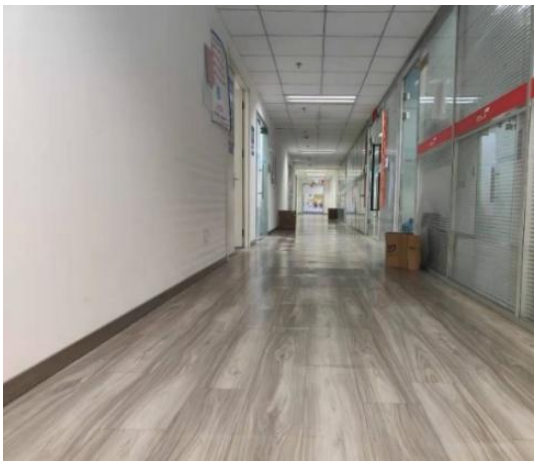


Precautions for large-scale data acquisition

When the scanner is used to collect large-scale data, the whole survey area should be divided to facilitate the data calculation efficiency, improve the calculation accuracy and facilitate the survey area management. Divide the larger survey area into several small survey areas. It is suggested that the planned data collection time of each survey area should be 25-30 minutes, and the overlapping range of survey areas should be at least 30%.

Suggestions for scanning long corridors (Tunnels)

Generally, the data obtained in areas with rich features and textures will have good calculation results. To ensure the calculation accuracy, it is necessary to manually set a feature point with a diameter of about 1 meter every 10 meters or place some objects with complex structures such as chairs and stools in this area. Improve the accuracy of the solution. In addition, during data acquisition, attention should be paid to the incident angle of the laser, and data acquisition should be done in the middle of the corridor or tunnel as far as possible, and meaningless in-situ rotation should not be carried out, to avoid the sudden decrease of the incident angle caused by object occlusion and errors in data calculation.



6.2 Static acquisition with X-WHIZZ

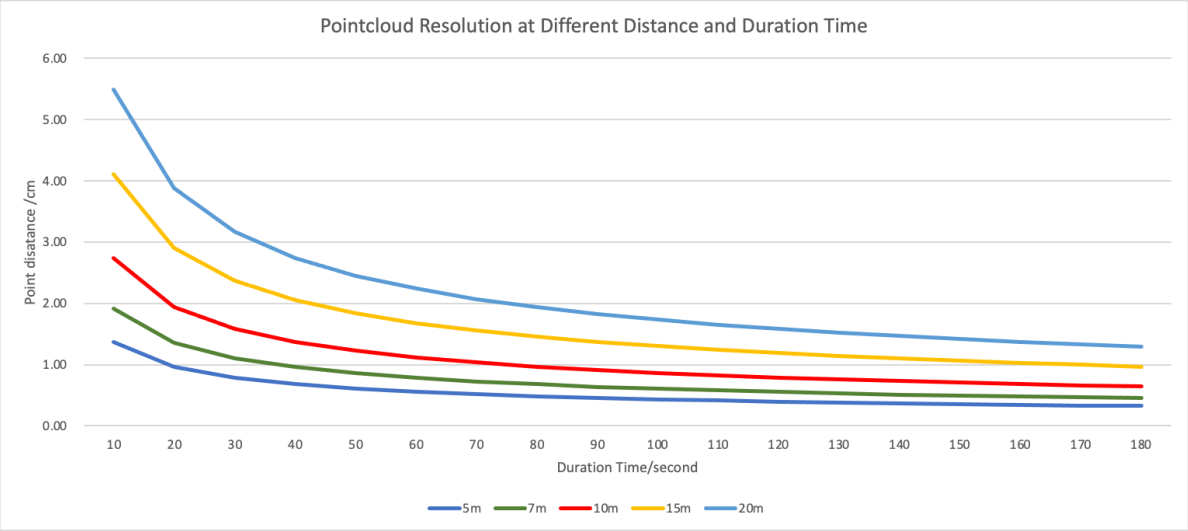
With X70GO is possible to collect data in static mode, called X-WHIZZ.

X-WHIZZ will let you collect data in a static mode, along the slam scanning. This way in the final result you will be able to have more precise spots, with an improved colorization.

Data collection

To perform the acquisition with the static mode, you need to stop and keep the scanner stationary for at least 10 seconds; we suggest waiting for a time between 1 minute and 2 minutes.

When you arrive at the position you want to perform the static acquisition, put the scanner on a flat surface or use the special monopod from STONEX. To obtain the best results with the X-WHIZZ, we recommend placing the scanner at 10 meters from the desired object.



Point the scanner facing the object that you want to scan and remain static for 1 minute. There is no need to select static method from the app, the GOpost software will be able to recognize the static positions by itself. During the static scanning the operator can remain behind the scanner, is important that nothing pass in front of it. Point the camera towards the desired object.

To apply the colour to the static point cloud, you need to choose the image that will be used for the colorization. To do so, press the GCP button, on the side of the battery handle, to mark the moment of the image that will be used for colorization. If you click the button more than once, the system will use the last corresponding time image to colour the point cloud.

At the end of the static mode acquisition, you can just pick up the scanner and start continuing to acquisition normally.

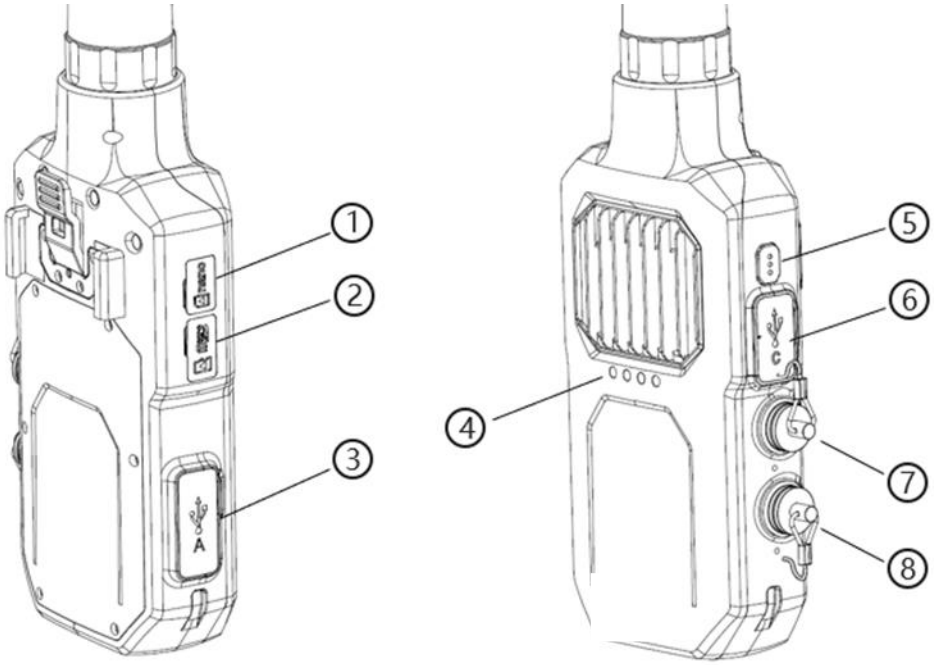
You can perform more than one static acquisition in the same scan. If you want to make more static acquisitions of the same area, is better to keep a certain overlap between the scans but is also possible to perform static acquisitions of different parts of the same environment.

6.3 Data Processing

Post-processing of the X70GO data is done via the GOpost software. This is used if you want to reprocess the data if you want to improve the real-time cloud quality or if you want to colour the cloud.
For more information on this, please refer to the GOpost manual.

7. RTK70GO

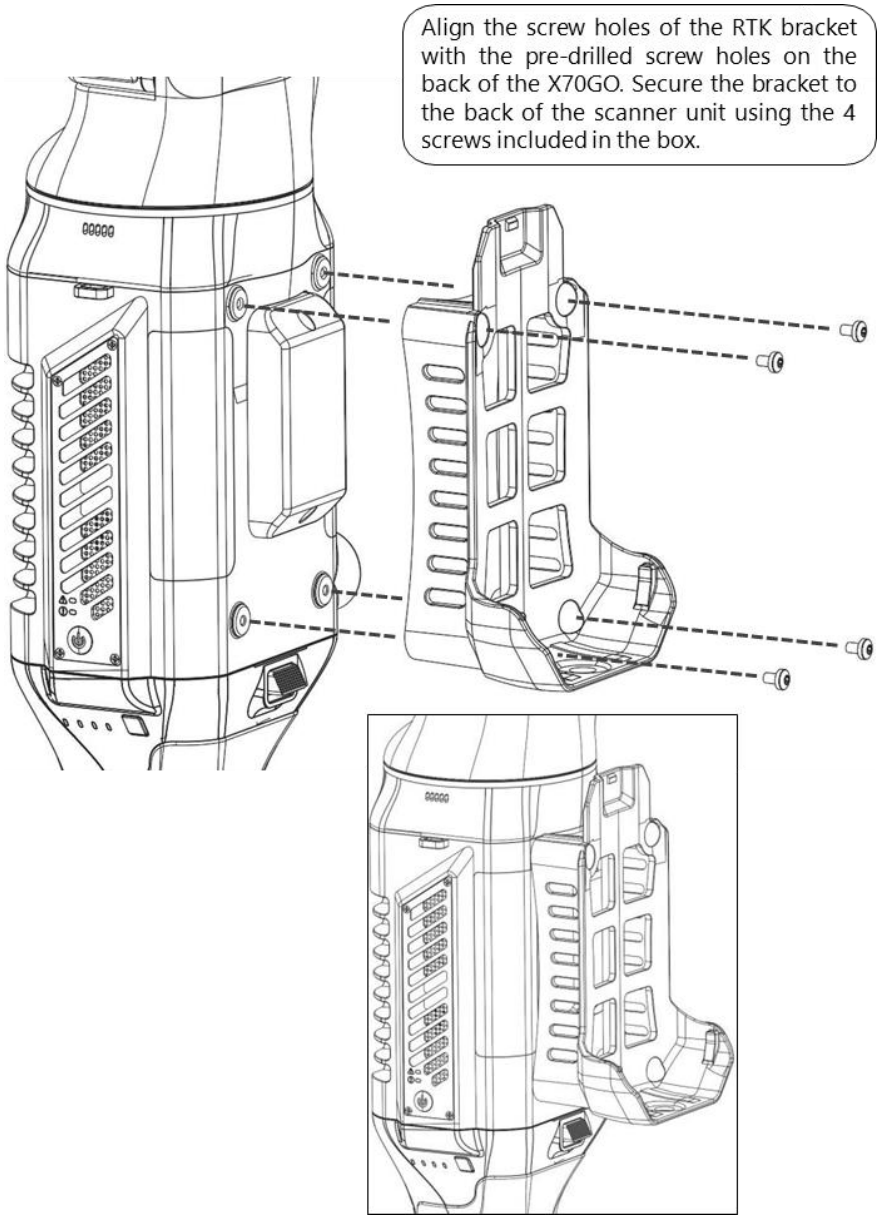
7.1 RTK device information



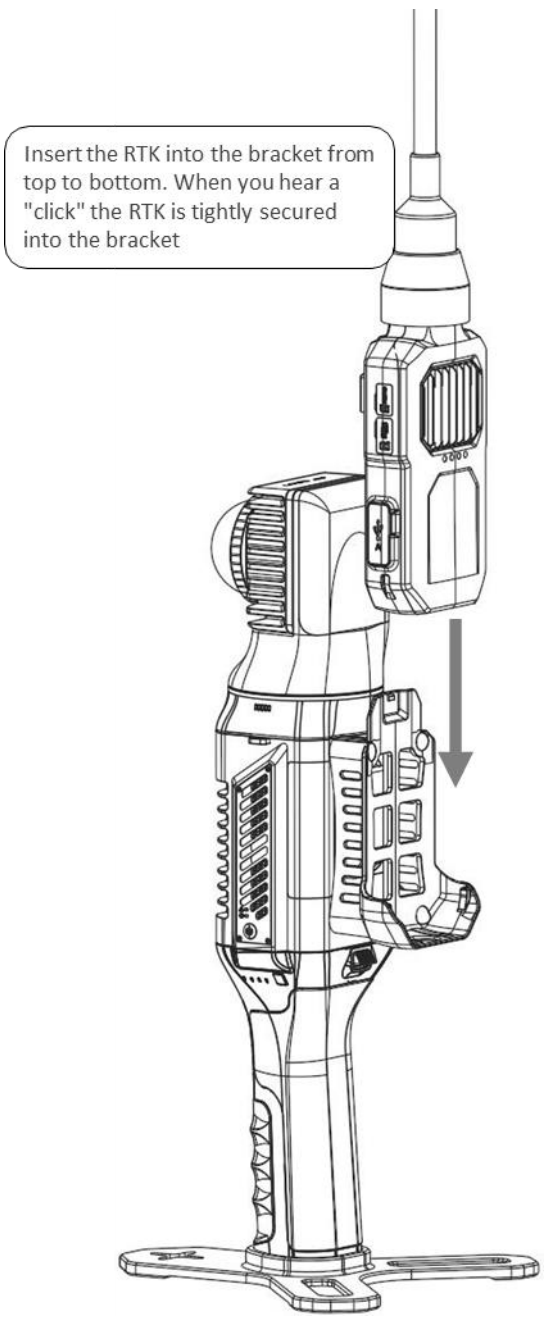
1. Nano-SIM slot
2. Micro-SD slot
3. USB-A interface
4. Status led
5. Programmable function button
6. Type-C (20V)
7. Power socket-1
8. Power socket-2

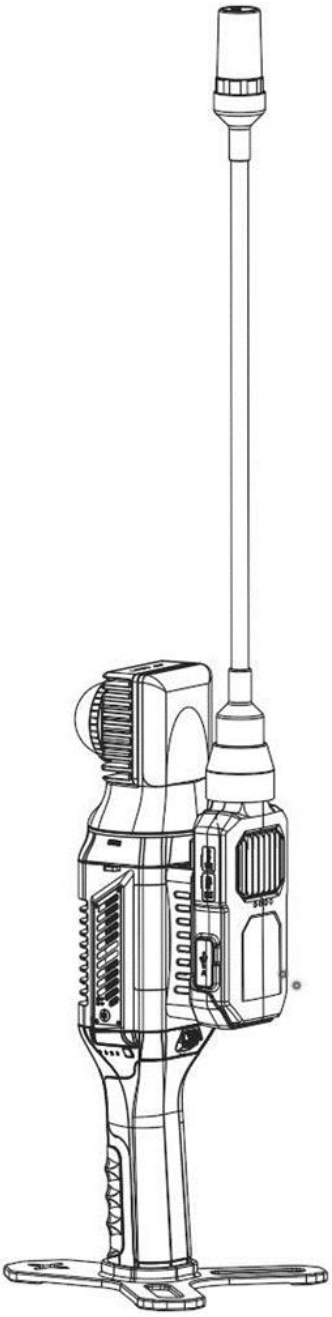
Assembly instructions

Step 1



Step 2

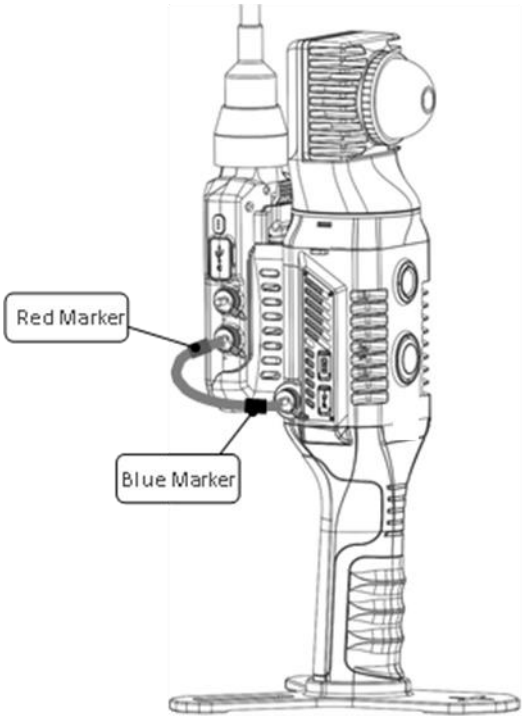

Insert the RTK into the bracket from top to bottom. When you hear a "click" the RTK is tightly secured into the bracket



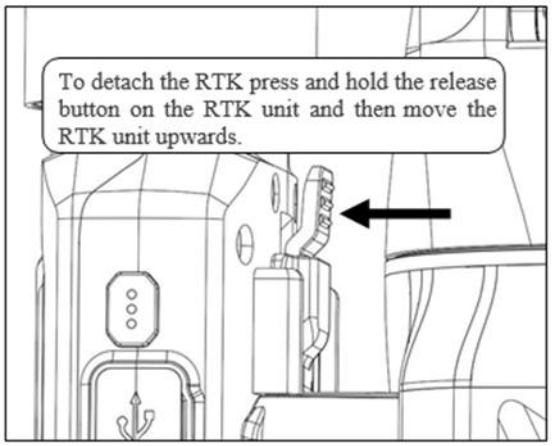
Step 3

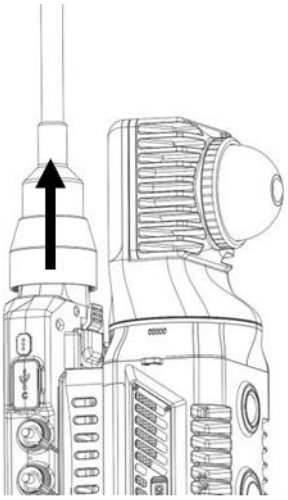
Connect X70GO with RTK using the aviation plug cable.

Pay attention to the difference of the aviation cable ports when connecting, the aviation cable since has anti-reverse insertion design. The blue end of the aviation cable is connected to the X70GO aviation port, and the red end of the aviation cable is connected to the RTK aviation port. Pay attention to the red/blue markings of the aviation cable port and the red/blue markings of the aviation port of the device are aligned before inserting it.



Detach

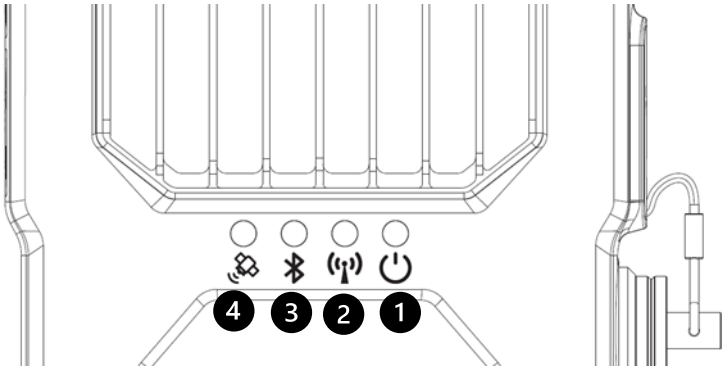




Led status

The four LEDs refer to:

1. Power supply.
2. Internet connection.
3. Bluetooth.
4. GNSS quality signal.



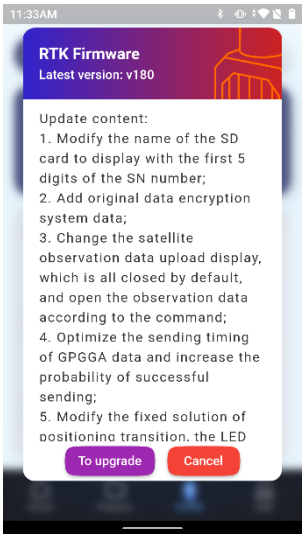
	Working Status	Status indicator
POWER SUPPLY	SD card not installed	Red light flashing
	System working correctly	Green light flashing
	SD card write error	Blue light flashing
INTERNET CONNECTION	Not ready to connect	Red light flashing
	SIM card read successfully	Green light flashing
	Connected to 4G network	Green light still
	Firmware upgrading	White light flashing
BLUETOOTH	Ready to connection	Red light flashing
	Bluetooth disconnected	Red light still
	Bluetooth connected	Green light still
GNSS signal	Searching satellite	Red light flashing
	Single positioning	Red light still
	Pseudo-range positioning	Yellow light flashing
	Float positioning	Green light flashing
	Fixed positioning	Green light flashing faster

7.2 Firmware upgrade

There are two methods to perform firmware updates, divided into online upgrade and offline upgrade. Proceed with an offline upgrade only if suggested by Stonex.

Online upgrade

Open GOapp and enter in the RTK page. Connect the device with the Bluetooth. If a new firmware is available, the upgrade page will pop up.



Check the update contet, and click "To upgrade" button and then click "Start".

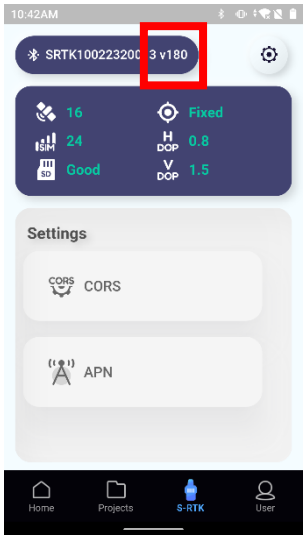
The internet connection led will start blink white (first slow and then fast, and can take some minutes).

Once the light is green, restart the device to complete firmware upgrade.

Offline upgrade

If is necessary an offline upgrade, Stonex will sen the user a file. The file will have the extensione ".fm". Follow the steps below in order to complete the upgrade:

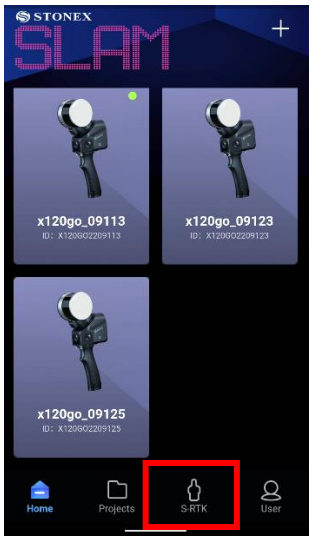
- Copy thie file in the SD card of the RTK, inside the Firmware folder.
- Prepare the device, and turn it on. All the lights will start flashing green at the same time.
- Once the lights start blinking red, restart the device, connect with GOapp and check the firmware version on the main page of RTK.



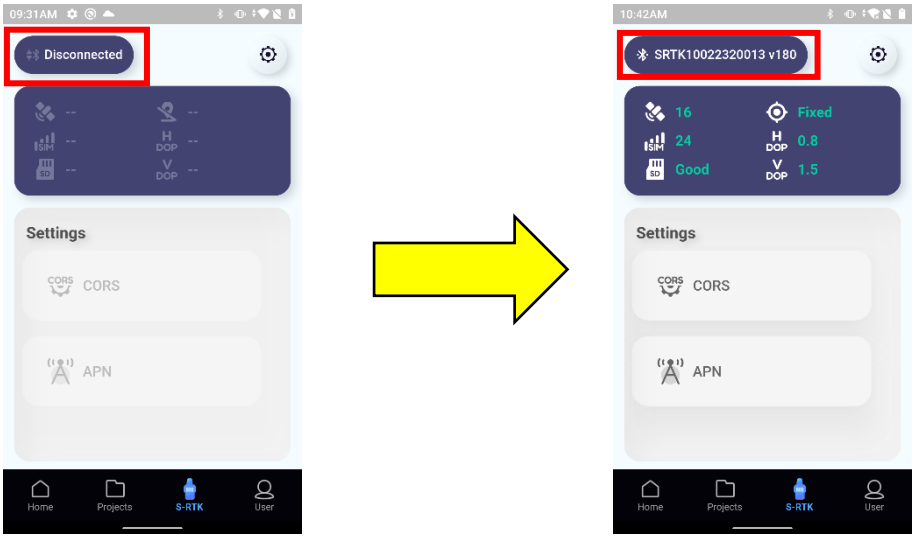
- If upgrade process fail, please try to format the SD card and repeat all the above steps.

7.3 RTK configuration with GO*app*

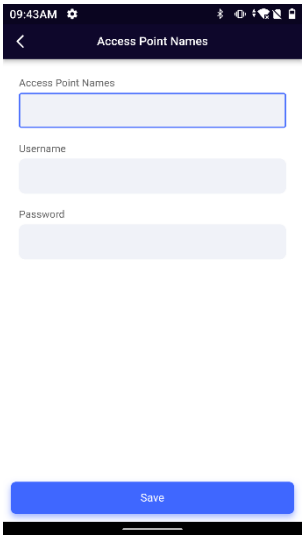
Turn on the X70GO and connect the RTK antenna with the cable. The lights will start flash red.
Switch on the Bluetooth of your tablet or smartphone, so that you can connect through it to the RTK device.
Connect the scanner through the Wi-Fi to your tablet or smartphone. The lights will start turn green as the connections work properly. Open GO*app* and click on the RTK icon.



The RTK page will open. If the RTK device and the phone are connected through Bluetooth, the status will pass from Disconnected to Connected. If is not done automatically, click on *Disconnected* to start the research of the device. Once connected all the icon will be available to be used.

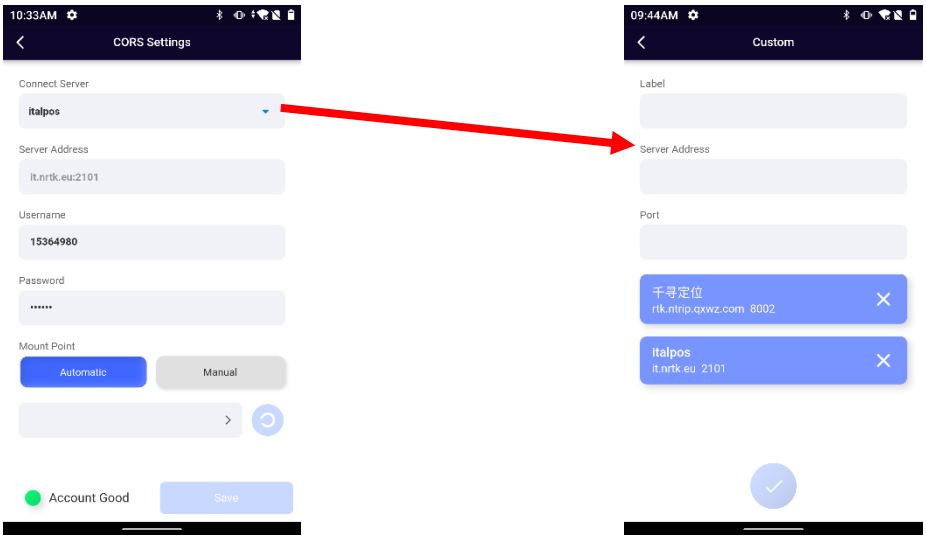


First click on **APN** icon. Here you need to insert the information about the SIM card to enable the communication. Insert the *Acces Point Name*, and if needed the *username* and the *password* of your SIM card. Please, do not use a SIM card with a PIN.
Once done click *Save* to remember the data just insert.



Second click on the **CORS** icon. Here you need to insert the information about the server you will connect to get the correction used in the RTK positioning.

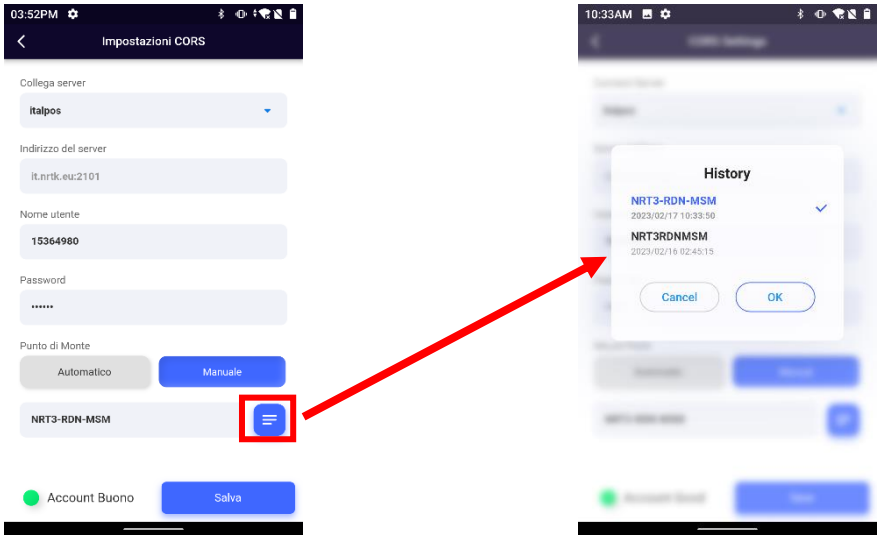
Click *Connect server* and edit the information about the server you want to connect. After connecting the server, enter the *username* and the *password*.



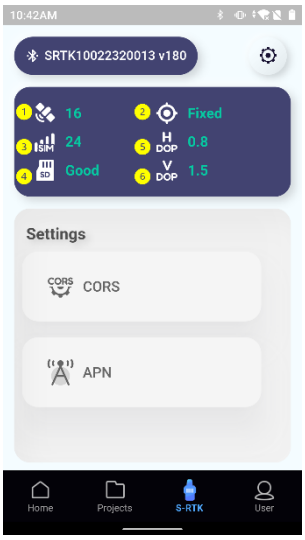
The choice of mount points can be either *Automatic* or *Manual*. If left in automatic, clicking on the grey bar will activate the automatic search for mount points. Choose the desired point from the list and clic *Save*.

If you set the mount point choice *Manual*, click in the grey bar and type in the name of the point. Once you have confirmed the mount point, click *Save*.

Click on the blue square to see the historical list of mount points to which you have connected.



After the settings of APN and CORS the device will be connected and will get corrections for correct positioning. The app will remember the last connection informations, so is not needed to insert them everytime. Just check to connect to the correct Mount Point everytime you use the RTK and clic *Save* to get corrections.
In the prinpical RTK page, are shown information about the quality of the positioning.



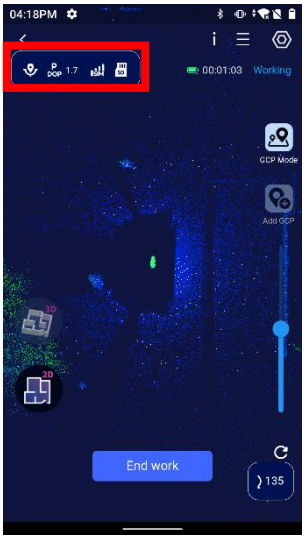
1. Number of satellite visible
2. Positioning status
3. SIM status
4. SD-card status
5. H-DOP value
6. V-DOP value

In addition to the colour of the LED, the positioning status is also identified by specific icons.

	No fix
	Single solution
	Float solution
	Fixed solution
	Other

At the top right, clicking on the gear icon opens a settings menu where you can activate/deactivate the mobile status bar and activate/deactivate the voice transmission of the positioning quality.

By activating the mobile status bar, it will be possible to keep track of the positioning quality even while scanning. The bar shows in order from left to right: positioning status (refer to previous table), P-DOP, SIM status, SD card status.



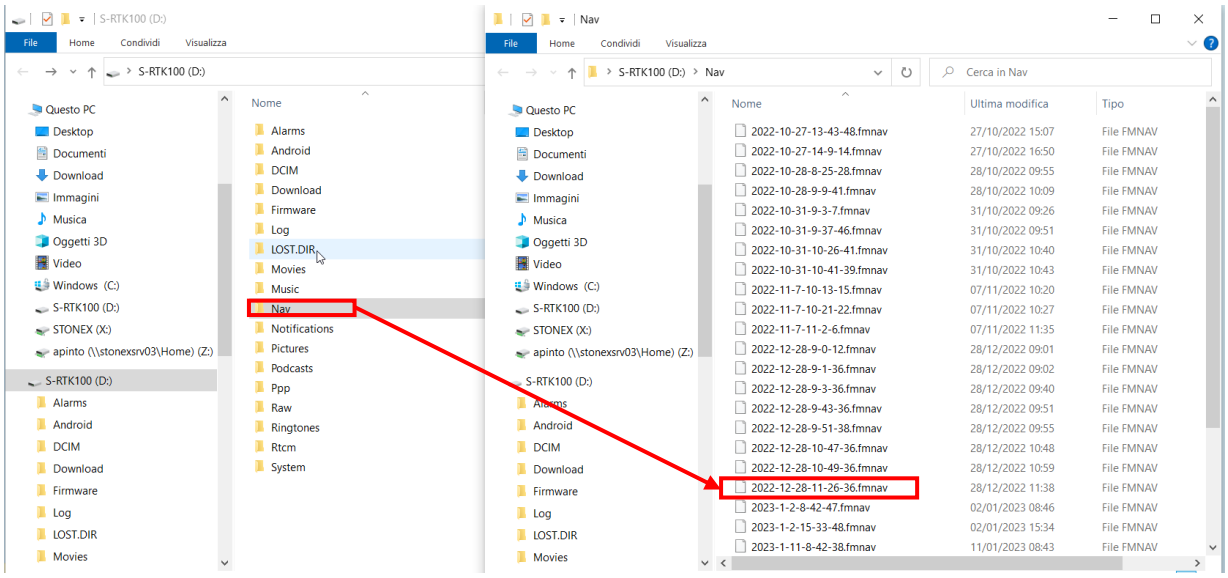
When your positioning status is FIXED, go to the scan page of your X70GO device, and start to scan normally. The information relative to the position will be saved automatically in the SD card of the RTK device.

7.4 GO*post* postprocessing

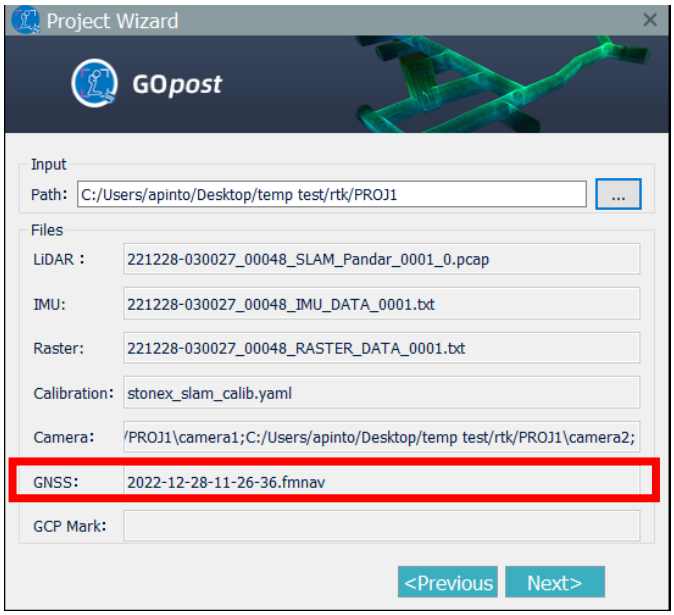
After the acquisition, insert you SD card of the RTK device in your PC to download the data relative to your project. In the memory of the SD card, select the Nav folder, then search for a file with the extension *.fmnav. This file contains the RTK information of the scan. The files are named with the following format:

YEAR-MONTH-DAY-HOUR-MINUTE-SECOND

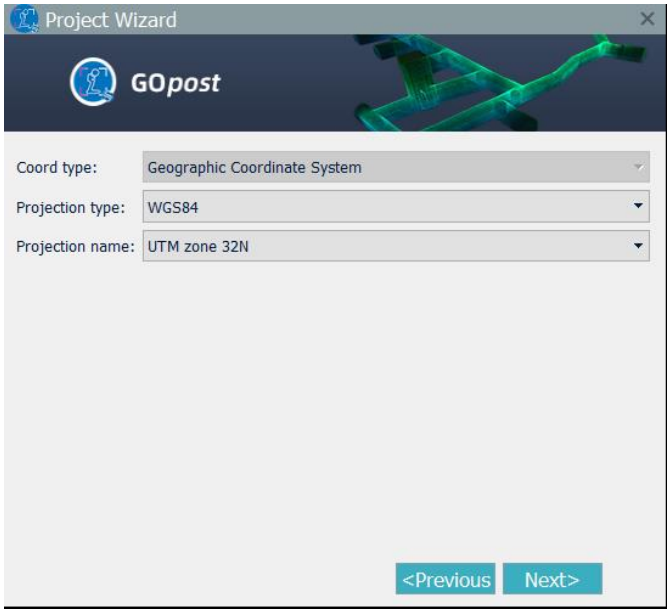
Select the corresponding file with the same date of the scan you want to process. Copy this file in the project folder of your scan. For example, will be selected the file of the 28 December 2022, at time 11.26.



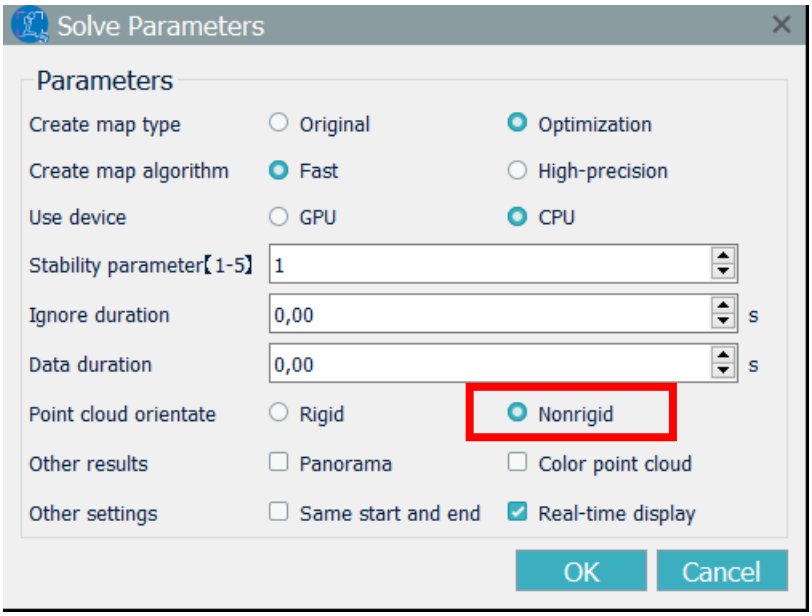
Open GO*post* and click New to create a new project. Choose the name and the save path, then choose the input path. Please check that in the GNSS section in the input screen there is the *.fmnav file.



Click *Next*, the software will ask the type of coordinates and the reference system. It should recognize it automatically. If the informations are correct, click *Next*.



Now you can process as for the other case the data, with the One-Click-Solve or with the Step-By-Step procedure. To better use the RTK information, in the orientation phase is preferrable to use the non-rigid body method.

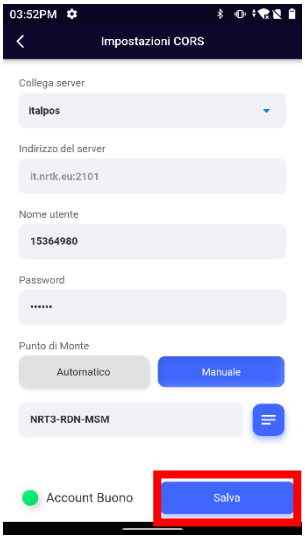


After the processing, the point cloud in the GCP subfolder of the project and all the subsequent point clouds, like the textured one, will be orientate in the reference system of the RTK data.

7.5 Rules for data acquisition

The following rules should be followed for the correct use of the RTK antenna:

1. Before starting a scan, connect the tablet to the antenna via Bluetooth and check the signal quality. Remain in Fixed solution for at least one minute before starting a scan with the instrument. Only data in Fixed solution will be used for orientation.
2. Acquire for at least 50% of the scan duration in Fixed solution. Check the signal status during acquisition.
3. In the case of mixed (indoor-outdoor) acquisition, ensure that at least 50% of the scan is performed outdoors with good signal coverage in Fixed solution. Acquire data outdoors both before entering the area without signal and afterwards, to help the software to better reconstruct the cloud and perform the orientation correctly.
4. If you acquire for a long time in a zone without a good signal (solution is not Fixed), when you return outdoors, return to the RTK screen, and check the connection status. If it does not immediately return to the Fixed solution, click on CORS, and resave the mount point to resume communication.


03:52PM
Impostazioni CORS
Collega server
italpos
Indirizzo del server
it.nrtk.eu:2101
Nome utente
15364980
Password
Punto di Monte
Automatico
Manuale
NRT3-RDN-MSM
Account Buono
Salva

8. Technical data

8.1 Bundle components

N	PART NAME	QUANTITY
1	Scanner	1
2	Handle battery	1
3	Scanner base bracket for GCP	1
4	Battery chargers EU/US	1
5	USB License key for GO*post*	1

9. Appendix

9.1 X70^{GO} technical features

LIDAR	
Max Range	70 m @ 80%
Min Range	0.1 m
Scanning Point Frequency	200.000 pts/s
Field Of View	Horizontal 360° Vertical -7~52°
Laser class	1
Frame Rate	10 Hz

COLOR CAMERA	
Pixel	12 million
Cameras FOV	210° (Diagonal)
Focal length	1.26 mm
Resolution	4000 x 3000 pixel
Shutter	Rolling
Sensor size	2.54 cm
Pixel size	1.55 µm

VISUAL CAMERA	
Pixel	12 million
Cameras FOV	100°
Focal length	3.24 mm
Resolution	4000 x 3000 pixel
Sensor size	2.54 cm
Pixel size	1.55 µm

SYSTEM	
Relative accuracy	6 mm[1]
Control point support	Ground and wall
Operative mode	Realtime visualization with GOapp (Android 8 or above)
Data storage	512 GB SSD
Communication	Wi-fi, USB type-C, LEMO
Post-processing	GOpost software[2]

ELECTRICAL SPECIFICATION	
Power consumption	20 W
System supply voltage	20 V
Operating time	1.5 h (single bettery)
Battery input voltage	5-20 V

Battery output voltage	10.8 V
Battery capacity	3000 mAh

PHYSICAL SPECIFICATION

Weight	925 g (Without battery) 1450 g (With battery)
Size	364.5 mm x 173.8 mm x 170 mm
Operating temperature	-20°C to +50°C (-4°F to 122°F)
Operating humidity	<95%
Waterproof/Dustproof	IP54

[1] environment dependent

[2] Any CPU, any NVIDIA GPU

9.2 RTK70GO technical features

RECEIVER	
Satellite signals tracked	GPS L1, L2
	GLONASS L1, L2
	GALILEO E1, E5b
	BDS B1, B2
Single point positioning (RMS)	Horizontal: 1.5m Vertical: 3.0m
DGPS (RMS)	Horizontal: 0.4m Vertical: 0.8m
RTK (RMS)	Horizontal: 1cm+1ppm Vertical: 1.5cm+1ppm
Data update rate	20Hz
Time accuracy	20ns
Speed accuracy (RMS)	0.03 m/s

INTERNAL MODEM	
Network	LTE FDD: B1/B3/B5/B8 LTE TDD: B34/B38/B39/B40/B41 GSM: 900/1800MHz

SYSTEM	
Storage	Micro SD
Communication	Bluetooth

POWER SUPPLY	
Type-C USB	20V
Aviation socket	12V-20V

PHYSICAL SPECIFICATION	
Weight	203 g
Size	196mm×80mm×39mm
Operating temperature	-20° C to +50° C (-4° F to 122° F)
Storage temperature	-20° C to +55° C (-4° F to 131° F)
Waterproof/Dustproof	IP54

ANTENNA	
Size	27.5mm×56mm
Weight	15.3 g
Optional	SA65 for backpack

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