USER GUIDE

PHEREFIX

Sphere360

HANDHELD SLAM SOLUTION USER GUIDE

Sphere360

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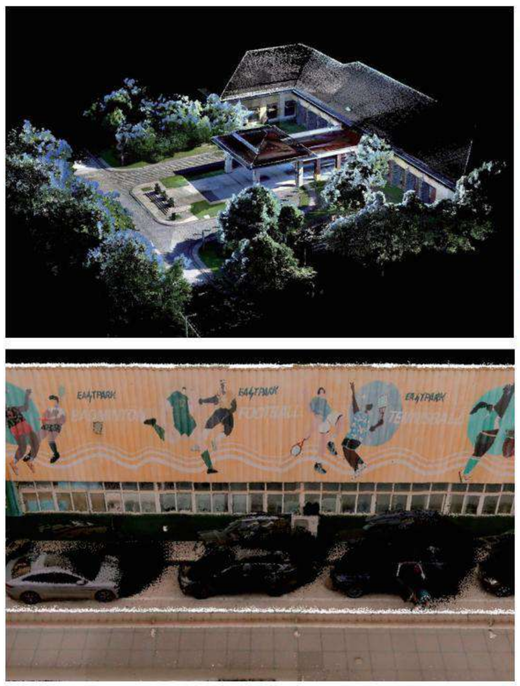
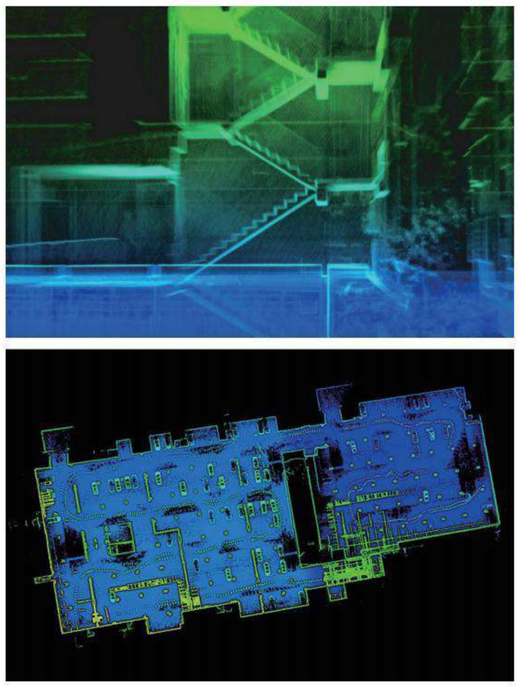
Contents

1. What is SLAM?

SLAM stands for Simultaneous Localization and Mapping. Originally developed to help nuclear submarines navigate underwater, the technique has become famous in recent years because it is the navigation backbone of robotics, drones, autonomous vehicles, AI, and VR/AR systems. In simple terms, a robot placed in an unknown space uses sensors—typically lasers or cameras—to continuously observe its surroundings. By matching what it sees at different moments, it works out both its own location and a map of the environment at the same time. Depending on the sensor type, SLAM is classified as either visual-SLAM or LiDAR-SLAM.





2. Introduction

Sphere360 is a new handheld mobile LiDAR scanner from Spherefix. Fueled by industry-leading SLAM algorithms, it captures high-accuracy, high-resolution 3-D point clouds without relying on GPS or external lighting.

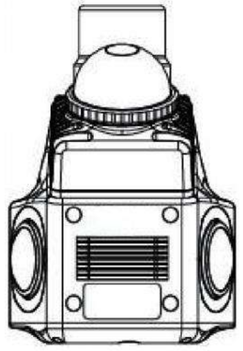
Two built-in 13-megapixel fisheye cameras deliver an ultra-wide field of view, collect color texture under ambient light, and produce both colorized point clouds and locally registered panoramic images.

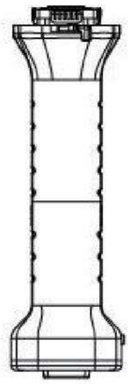
An all-in-one design houses the control unit, storage, and a hot-swappable handle battery. Operations are started from a companion app, and point clouds are streamed in real time during acquisition, making surveys faster and easier than ever.

3. Sphere360 SLAM Structure and Parts

3.1 Device Composition

The Sphere360 comprises two modules: the LiDAR head and the snap-in handle battery. The handle delivers power and serves as the grip, while the head integrates the laser sensor, dual fisheye cameras, GNSS/IMU unit, and onboard storage.





3.2 Device Assembly

3.2.1 Positioning Base Installation

First mate the handle with the base plate. Orient the handle so its charging port faces rearward and the cross-shaped locator on the plate points forward. Align the four screw holes in the handle foot with those in the plate, then tighten the captive screws clockwise. Give the assembly a light shake to verify the handle and plate are firmly locked together.

3.2.2 Device Charging

Sphere360 charges through a USB-C port. Use a 65 W (or higher) PD adapter. The LiDAR head can be charged on its own, or you can power the handle battery independently. Four LEDs on the handle flash while charging and turn solid when the battery is full.

4. Data Collecting Operation Procedure

4.1 Application Notes

Sphere360 is GNSS-independent, so it works equally well underground, indoors, in multi-level car parks, or between tall buildings where satellite signals are lost. Operation is also unaffected by lighting, making it ideal for caverns, coal-mine drifts, bunkers, and other dark spaces.

Limitations

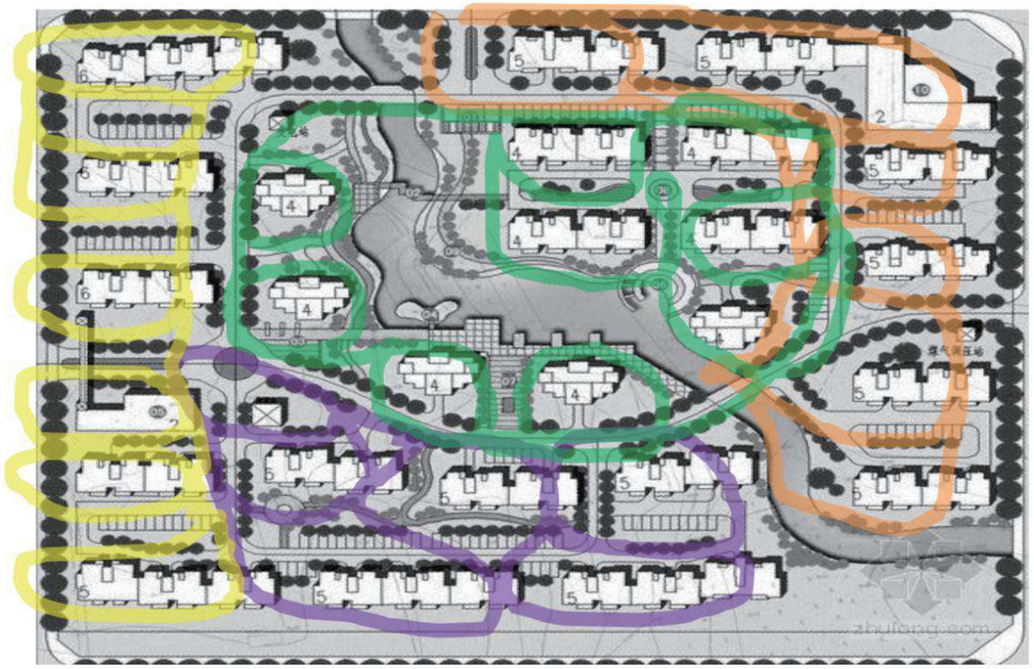
• Avoid environments dominated by glass or mirrors (mirror mazes, fully glazed façades); specular reflections can corrupt the point cloud.

• Scenes with repetitive, feature-less geometry—endless straight corridors, smooth-walled tunnels, or open, structure-free plazas—can degrade accuracy because the SLAM algorithm has few unique 3-D cues to lock onto.

4.2 Survey-Area Strategy

With the Sphere360 handheld unit, keep any single scan under 30 minutes—provided battery and storage are sufficient and you can close loops along the route—to guarantee optimal point-cloud quality. For larger sites, split the survey into blocks; ensure each block overlaps its neighbors by at least 25 % so the software can tie them together during post-processing.

For example, as shown below, the large site is divided into color-coded blocks; each color represents one separate scan session.



4.3 Collection Route Planning

Before scanning, inspect the site to confirm whether work will be performed indoors or outdoors.

•Indoors: choose several distinct start / stop locations so you can always enter and exit a room along a different path, giving the SLAM algorithm fresh loop-closure opportunities.

•Outdoors: stay within the unit's effective range from every target surface (range varies with surface reflectivity—check the specification sheet).

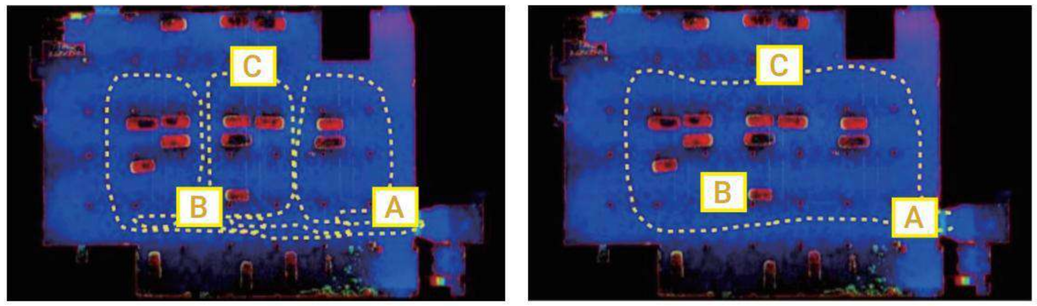
4.4 Survey-Route Design

Lay out a closed-loop path whenever possible, both indoors and out. The more complete loops you can walk in one continuous take, the tighter the SLAM solution will be. While planning, check the Sphere360 battery level and size the route reasonably.

4.5 Closed-Loop vs. Open-Path Operation

Thanks to continual software advances, Sphere360 can now operate in open areas without forcing a closed loop. Nevertheless, a deliberate loop still sharpens detail and keeps drift low, especially inside confined spaces.

As travel distance grows, so does accumulated error; the farther you walk, the larger the drift. When surveying a single-level building, favour multiple "O-shaped" loops instead of long out-and-back lines—each loop re-ties the trajectory and keeps total error to a minimum (see examples below).



5. Data Acquisition

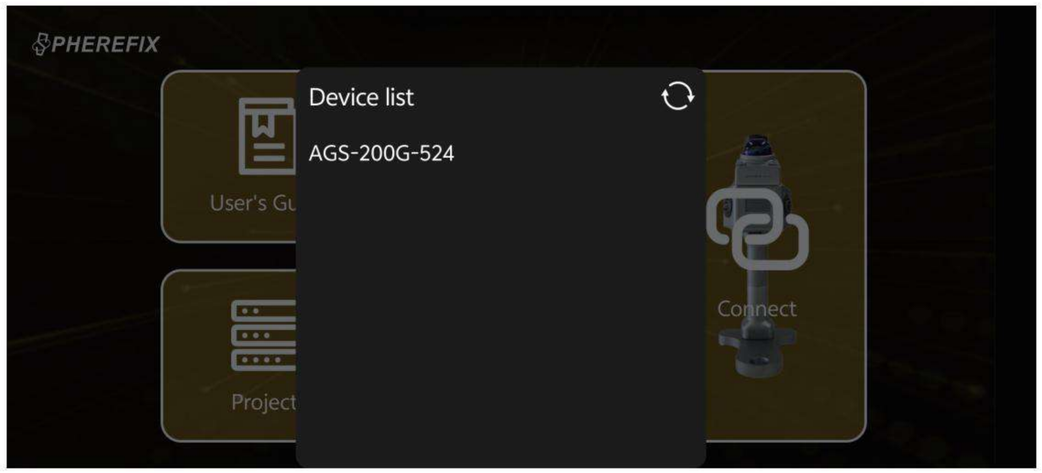
Launch the dedicated Sphere360 app to control the slam. From the app you can start/stop scanning, link to RTK, and access all other functions.

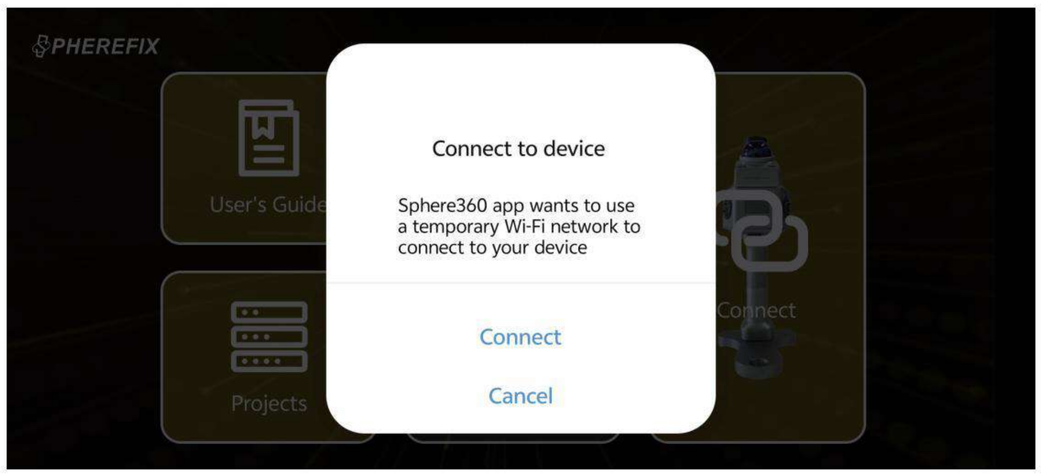
Before you begin, disconnect your phone from any nearby Wi-Fi networks to avoid interference with the scanner's internal Wi-Fi.

5.1 Power On & App Pairing (Android)

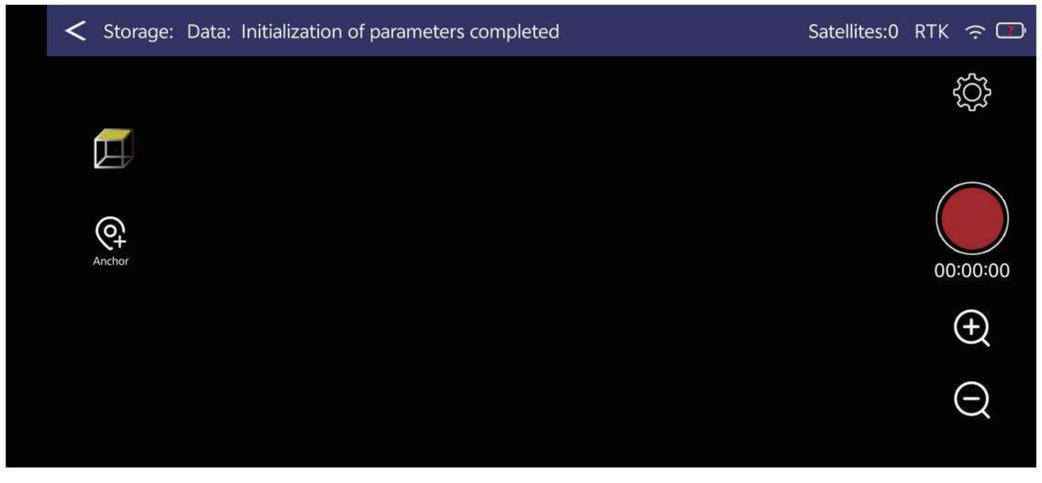
With Sphere360 assembled, set it on a stable surface and keep it still. Press and hold the power button for 3 s, then release: the power LED turns solid green and the Wi-Fi LED begins to blink.

On your phone, open Sphere360, choose the scanner's Wi-Fi (name ends with the last three digits of the unit serial number), and grant "Precise location" permission when prompted (required only on first install).

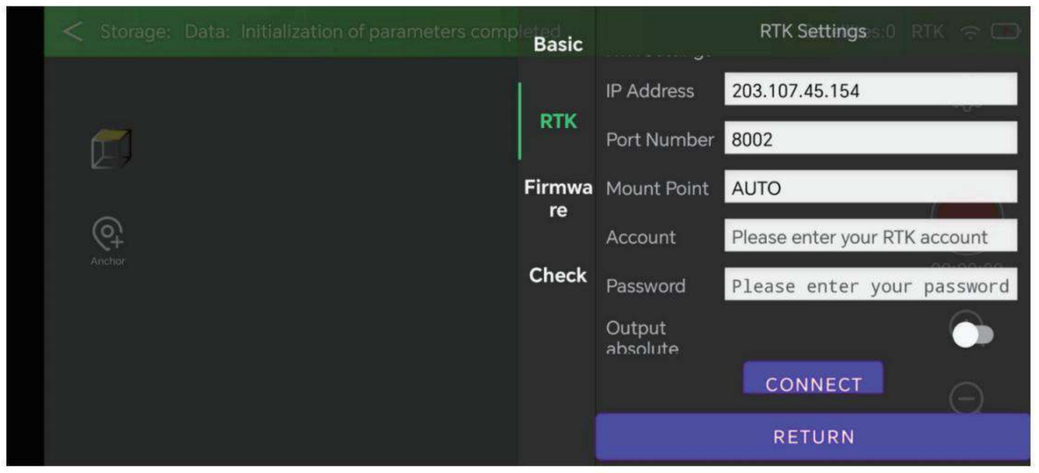




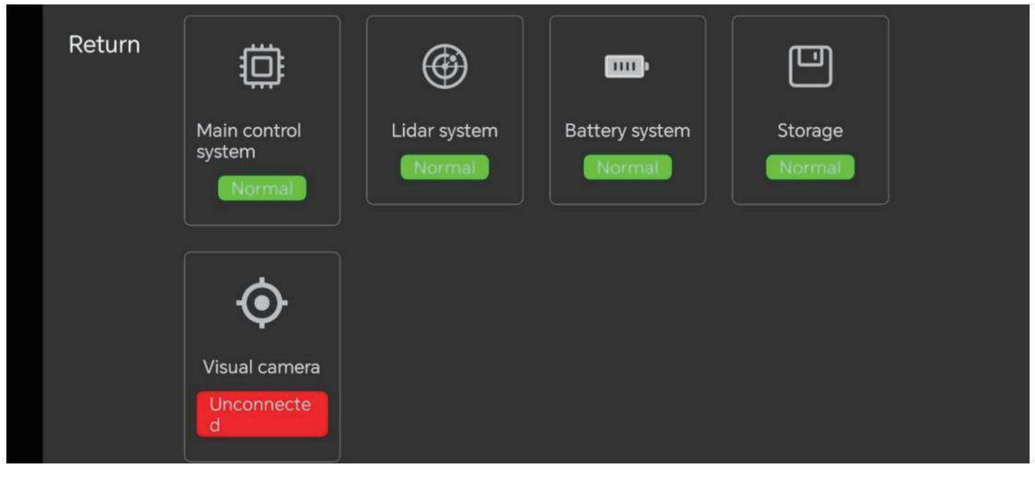
Connection established—parameters initialized.



RTK Connection Guide:
Tap the Settings button (top-right corner) to open RTK setup.
Make sure your phone is online before activating RTK.
Enter your credentials and tap “Connect”; you’ll see “RTK Service Connected Successfully.”
(Optional) Turn on “Output Absolute Coordinates” if you need world coordinates.
Absolute-coordinates file:
Internal Storage/Documents/Spherefix/mobile/project/[Project_Name]/RtkCoord

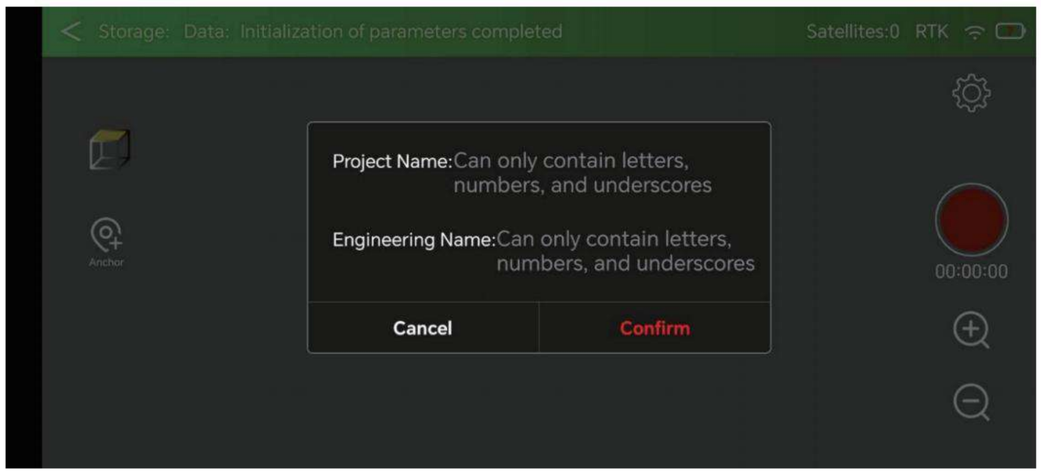


The self-check interface shows real-time status alerts (e.g., "TF Card Not Detected - Project creation disabled").



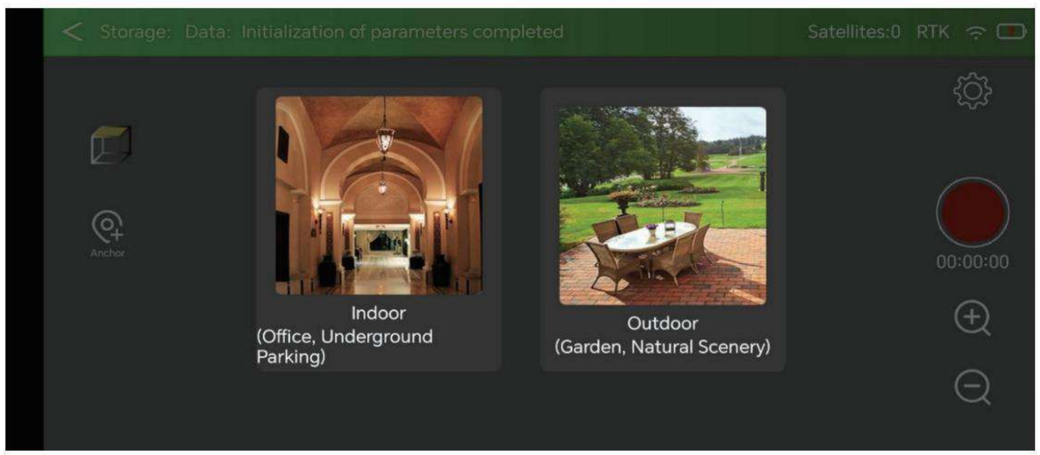
5.2 Create New Project

Long-press the red side button to open the New Project screen.
Enter a Project Name and an Engineering Name.
Naming rules: Only letters (A-Z/a-z), numbers (0-9), and underscores (_) are allowed. Special characters are NOT supported.
Both fields are required.

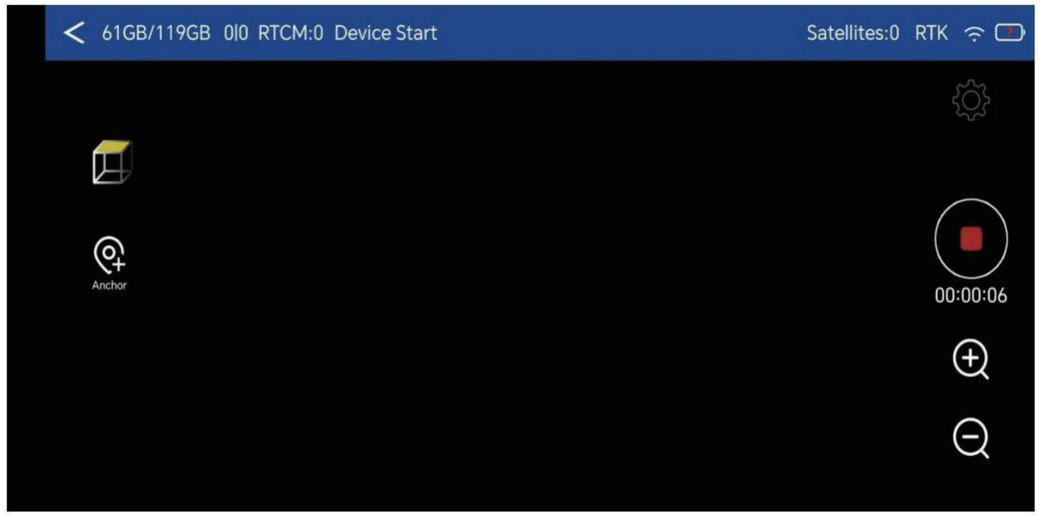


5.3 Mode Selection

After the project is created, tap “Confirm” to reach the Mode Selection screen and pick the mode that matches your survey task.



Once the mode is selected, the system auto-sends the start-up command and “Device Start” appears at the top of the screen.

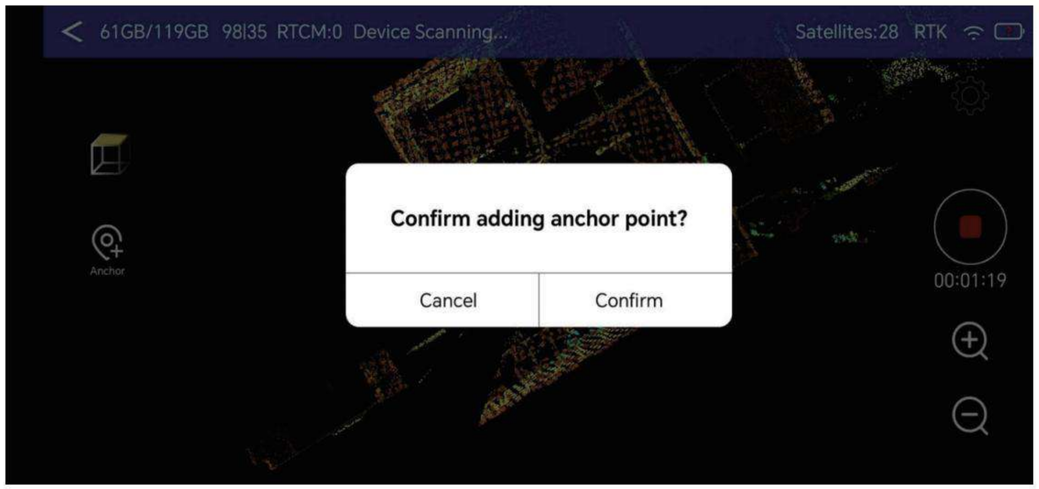


5.4 Real-time point cloud

After start-up, wait ~40 s for the live point-cloud to appear. Messages at the top will first show “Device Ready”, then “Device Scanning”. When the toast “The equipment is ready. Please start the dynamic measurement” appears, lift the unit and begin walking. Keep your pace moderate—do not move too quickly while collecting.

5.5 Control-Point Capture

At any time during the scan, tap the “Anchor” button on the left side of the screen and confirm; the toast “Anchor point set successfully” appears and a voice prompt sounds. The captured control point is stored and will be used in the subsequent data processing steps (details are provided in the data-processing section).



Control-Point Capture Steps

Alignment: centre the plate’s control-point notch exactly on the target mark.

Acquisition: tap “Add Control Point” and hold the unit motionless.

Verification: wait for the message “Anchor Point Successfully Set” before moving.

5.6 Zoom in & Zoom out

While scanning, use the (+) and (−) buttons in the lower-right corner to zoom the real-time point cloud in or out; drag-and-pan is not enabled.

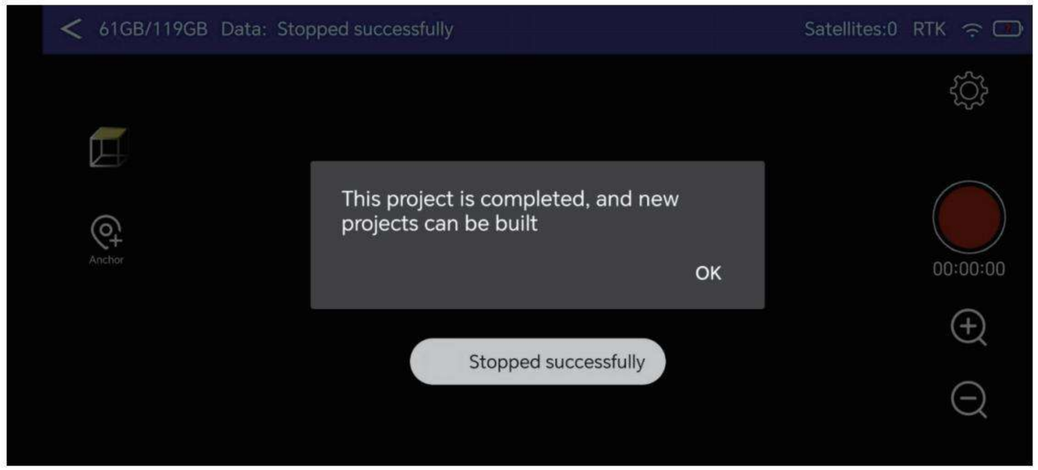
To change perspective, tap the cube icon in the upper-left corner; front and top views are available.

5.7 Finishing the Scan

Long-press the red side button until the message “This project is completed, and new projects can be built” appears; the scan is now finished.

To start another scan, leave the unit powered on and stationary, then long-press the red button again to create a new project.

When all work is done, hold the power button for 3 s and release: the Wi-Fi LED goes out immediately, and the power LED turns off after ~10 s.



6. Precautions

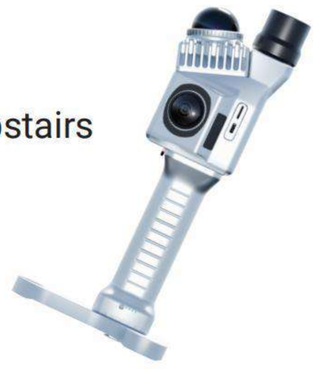
6.1 Never power the unit with an unstable or over-voltage supply.

6.2 Keep the scan motion smooth; avoid any sharp or violent shaking.

6.3 Handle the device gently at all times—knocks or strong vibration can damage the laser sensor.

6.4 At 90° corners turn slowly; on stairs, tilt the laser head downward toward the step surface (see figure).

Go upstairs



Go downstairs

6.5 Maintain at least 0.4 m between the scanner and any surface; never let the laser head approach a wall closer than 0.4 m.

6.6 Exclude moving objects. SLAM relies on static features, so keep the field of view free of people, vehicles, or other large moving items. If they appear in the scan, the static scene will appear to drift. When avoidance is impossible, stand still until the movement has passed. Common situations to watch for:

6.6.1 Keep moving crowds out of the scan line-of-sight.
Helpers must walk behind the operator or stay out of the corridor entirely; never scan while people are moving in front of you.

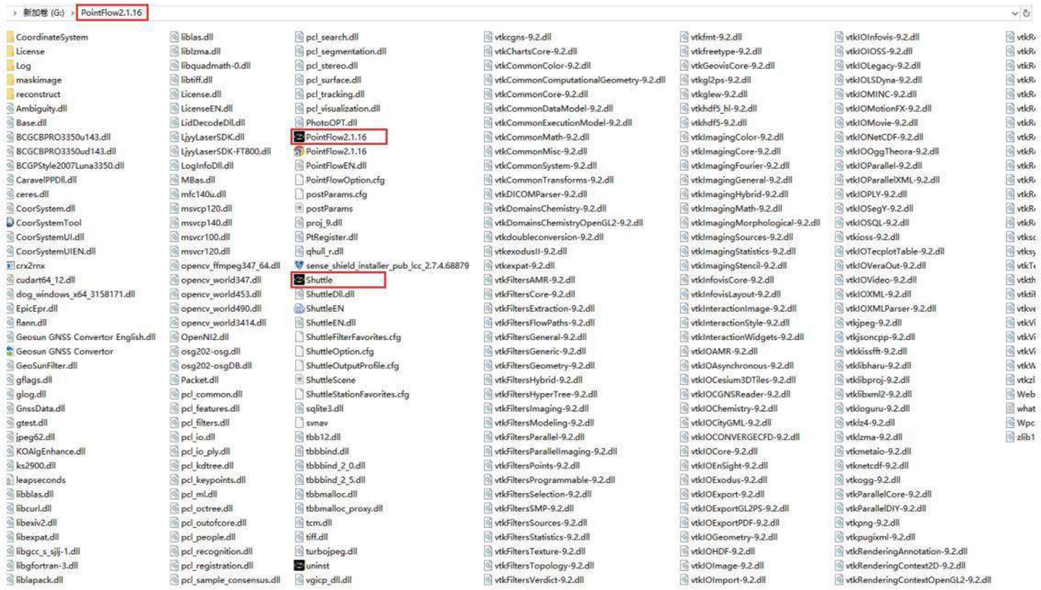
6.6.2 Keep large moving objects out of the scan line-of-sight.
In open-pit mines, stop if a haul truck moves within 10 m ahead; wait until it leaves.
Do not scan beside buses, coaches, or any other large vehicles while they are in motion.

6.7 When you walk from an outdoor area into an indoor area during the scan, simply choose “Indoor Mode” in the post-processing software.

7. PointFlow

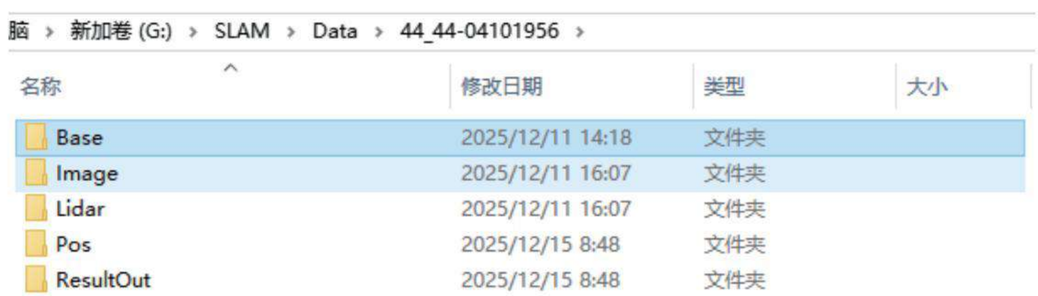
7.1 Software Installation

7.1.1 After setup, the PointFlow 2.1.16+ folder looks like the image below.
It is better not to install the software at system drive (C drive).
Recommended workstation
GPU: NVIDIA RTX 3060 Ti 8 GB
CPU: Intel Core i7-10700 (≥2.9 GHz)
RAM: 128 GB (64 GB minimum)
OS: Windows 10

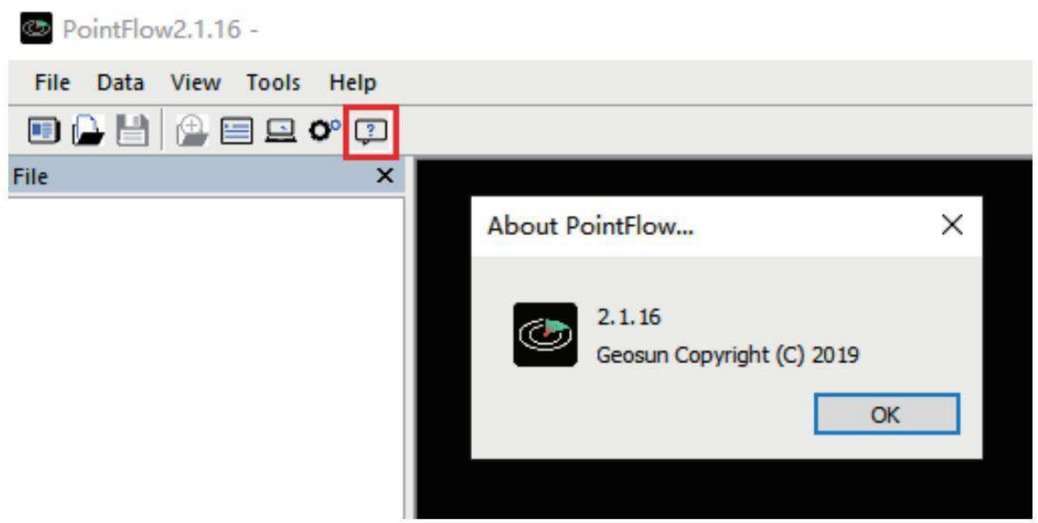


Before processing raw data, place the license file in the License folder (see example above).

7.1.2 Before launching PointFlow, confirm that the four data folders—Image, Lidar, Motor, and Pos—are ready.
The base folder is required only for the SLAM+PPK mode and follows the same workflow as the aerial application.



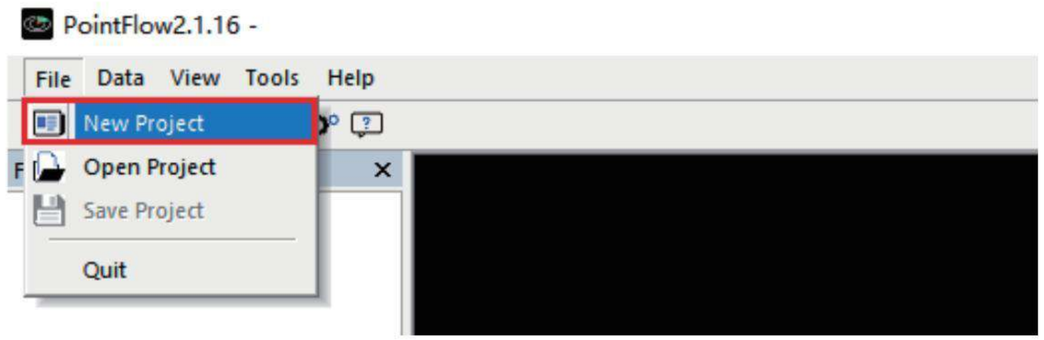
7.1.3 Launch PointFlow
Double-click the desktop icon to open the application; the main window is shown below.

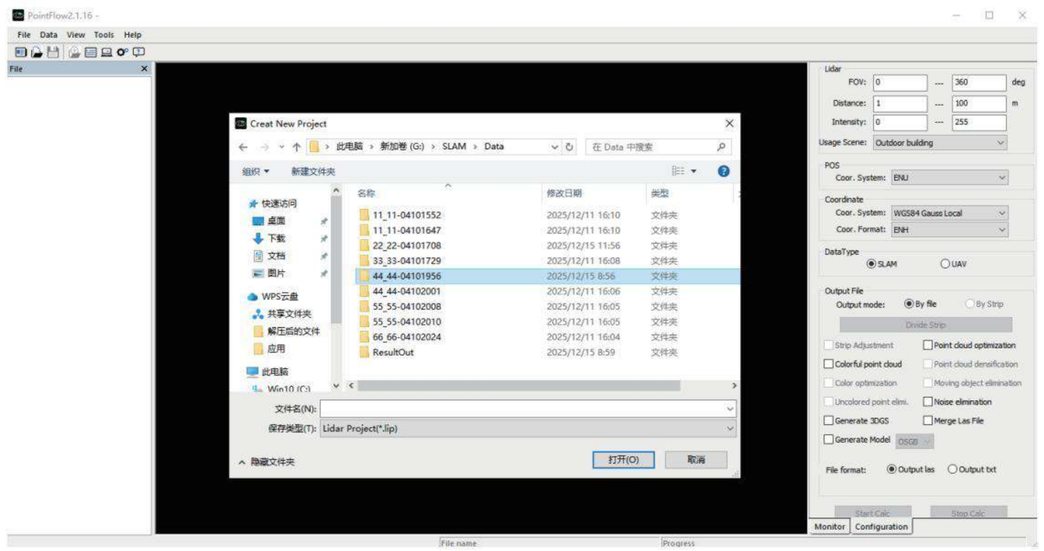


It is PointFlow software 2.1.16 version.

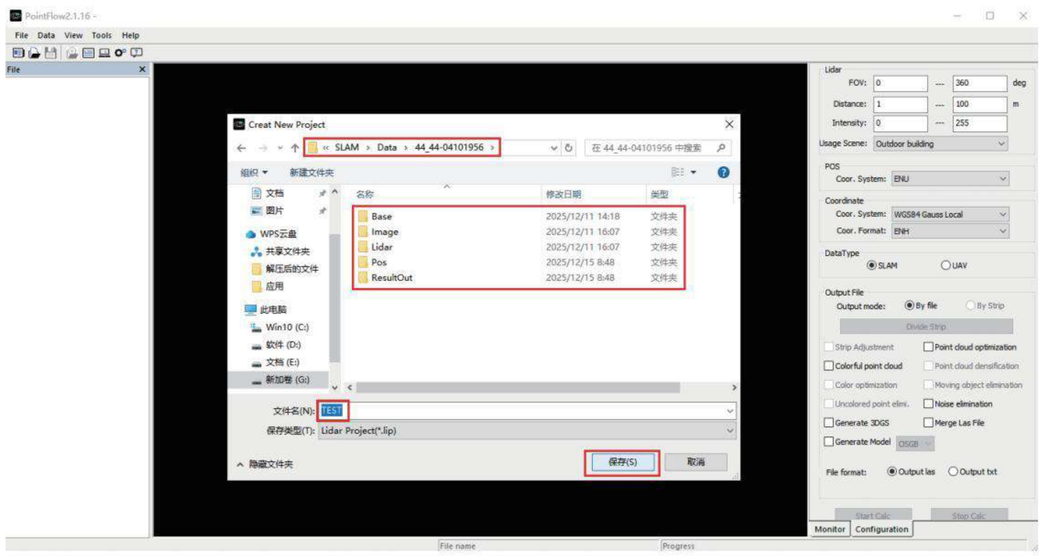
7.2 Create a New Project

7.2.1 On the File menu click New Project. In the dialog that opens, set the project path to the flight folder; if it differs, the “Read Folder” step will abort and you’ll be prompted to browse for the files manually (see below).

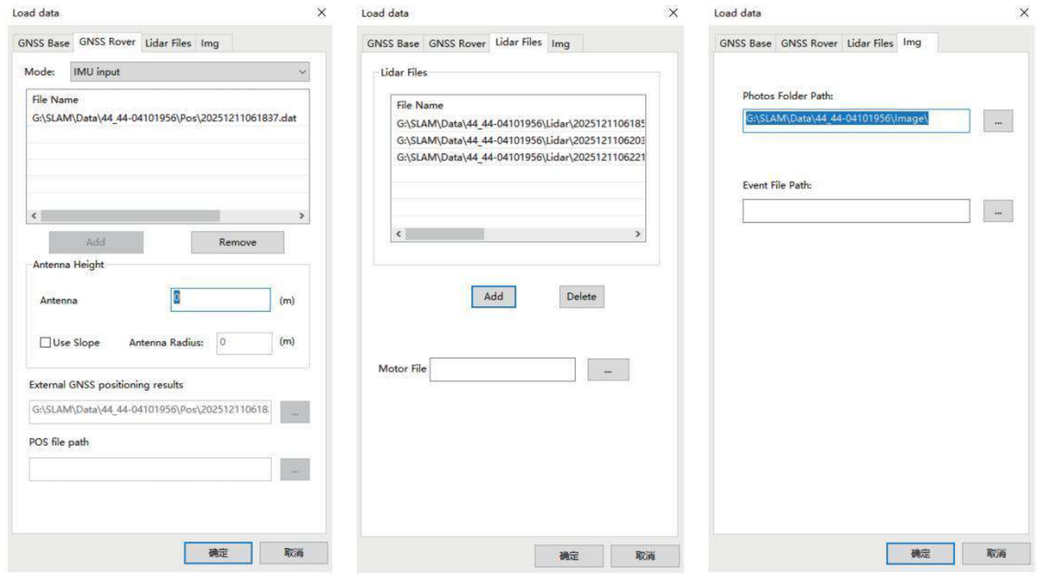




Name the project “TEST” (or any name you prefer) and click Save; the “Reading Folder” step starts automatically (see below).



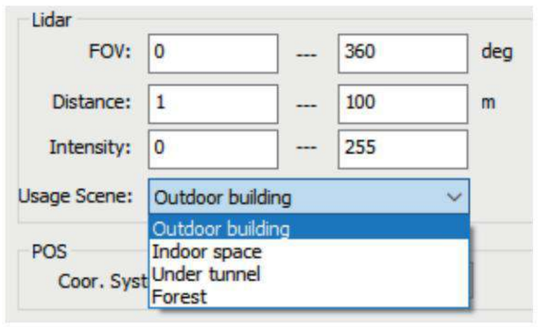
The four folders are then loaded automatically, as shown below.



Click the OK bar.

7.3 Parameter Settings

FOV: 0–360°
(SLAM default 270° × 360°)
Distance limits
– Outdoor: 1–100 m
– Indoor: 0.5–50 m
Intensity: 0–255



Usage Scene

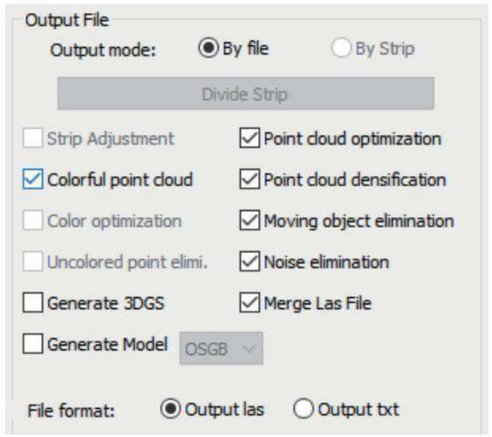
Divide the Usage Scene into 4 parts,

1. Outdoor Building: Apply for construction of outside of building
2. Indoor Space: Apply for construction of engineering (Narrow space), such as the Stairs, Parking Lot Indoor, and the Small house Indoor.
3. Under Tunnel: Apply for tunnel, such as the Underground Mineral, the Cave, the Tunnel
4. Forest: Apply for forestry.

So please select the Usage Scene before process the raw data.

Output File

1. Mode: File-only (SLAM requirement)
2. Format: LAS or TXT, as requested by the client

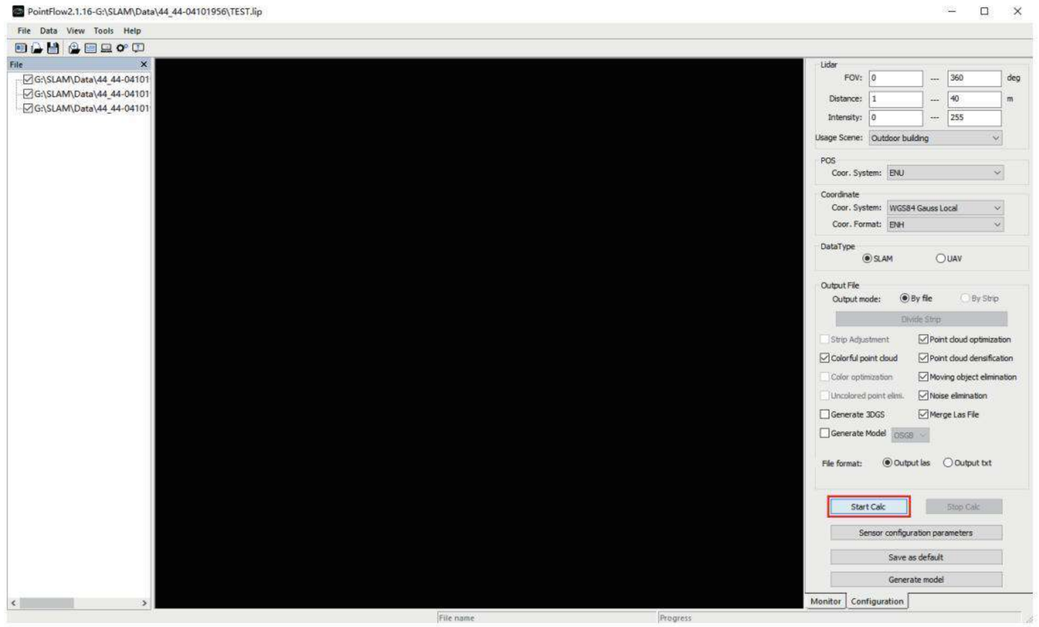


Checkbox Definitions

1. Strip Adjustment: Not available
2. CloudPoint Optimize: Reduce cloud thickness and refine structure
3. Output Color Point Clouds: Export colored point cloud
4. Noise Filter: Remove noisy points
5. Optimize Image Brightness: Auto-balance image exposure
6. Moving Objects Remove: Strip points from moving objects during scan
7. Eliminate Uncolored Pointcloud: Discard points without color
8. Uniform Unsample Points: Resample cloud evenly (ideal for building façades)
9. Merge LAS File: Combine all LAS files into one

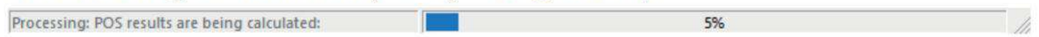
7.4 Generate Point Cloud

Click “Start Calc” to begin processing; the progress bar will advance as shown below.



Processing (decode) the lid files,

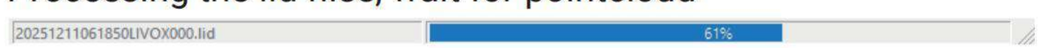
Processing GNSS/INS(POS) integration,



Output Pos,

Decode the image,

Processing the lid files, wait for pointcloud



Wait for pointcloud output.

While processing, press the R key (or toggle the display) to view the cloud.
Forward & backward the roller of mouse to zoom in/out.
Hold the mouse and move it, the point cloud turn around.
Hold the roller, drift the point cloud wherever you want.
It could stop when you click the Stop Cal if required.

Note

Collection-to-processing time ratios

Outdoor Building scene

Ratio = 1 : 2 (10 min of collection → 20 min of processing).

This value is fixed; none of the check-boxes on page 6 change it.

Indoor Space, Under Tunnel, or Forest scene

Baseline ratio = 1 : 3 (10 min of collection → 30 min of processing).

Activating any check-box on page 6 lengthens the job beyond the 30-minute mark.

RAM usage during processing

Keep continuous data collection within 30 minutes when using a 128 GB high-performance PC.

Runs longer than this can cause the software to crash or display a POS error.

8. Specification

ITEM		SPECIFICATION
SYSTEM SPECS	Accuracy	≤3 cm (Relative), ≤5 cm (Absolute)
	Voltage Range	12-20V
	Dimensions	16.5*12.0*32.4cm
	Weight	1.0kg
	Operating Temperature	-20℃~55℃
	System Consumption	＜25W
	Storage	128GB MicroSD Card
POS SPECS	Model	gSpin 210
	POS Update Rate	200Hz
	GNSS System	GPS L1/L2/L5; GLONASS L1/L2; GAL E1/E5a/E5b; BDS B1c/B1/B2/B2a/B2b/B3
	Positioning Accuracy	Horizontal: ±0.02 m Vertical: ±0.03 m
	GNSS Signal Types	GPS L1/L2；GLO L1/L2；GAL E1/E5b； BDS B1/B3/B2a（Supports BeiDou-only Mode）
	Pitch Accuracy	0.015°
	Heading Accuracy	0.040°
	Roll Accuracy	0.015°
LASER SPECS	Measuring Range	40m@10%
	Horizontal FOV	360°
	Wavelength	1535nm
	Data	Single echo, 200,000Points/Sec
	Range Accuracy	≤ 2cm@10m, ≤ 3cm@0.2m
	Vertical FoV	-7°~52°
	Scanning Mode	Non-repetitive Scanning
CAMERA SPECS	Effective Pixel	2*20MP
	Scanning Mode	Time-synchronized Scanning
	FOV	Horizontal/Vertical FoV: 200°
MAPPING	Mapping Mode	SLAM; RTK-SLAM; PPK-SLAM
SOFTWARE	PointFlow	Self-developed point cloud pre-processing software
	PointCloudAutomata (Optional)	World-leading point cloud classification and post processing software

▲ *Manufacturers may update parameters at any time, please refer to the latest product information.*