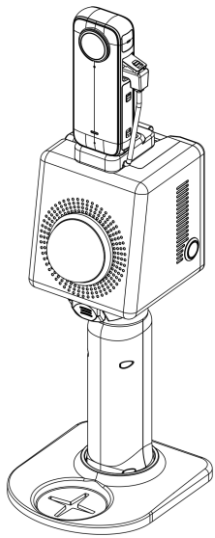
FJDTrion



FJD Trion P1 LiDAR Scanner

User Manual

October 28, 2023 | Rev. 1.0

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Revisions:

Version	Date	Description
1.0	2023.12.11	First release

Read Before Use:

Operate in strict accordance with this user manual and associated manuals.

Improper use may cause device damage and poor performance.

If you have any questions during use, contact the customer service.

Disclaimer:

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- This manual only provides guidance for use of this product. Every effort has been made in the preparation of this manual to ensure accuracy of the content, but no information in this manual constitutes a warranty of any kind, express or implied.

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Preface

Thank you for purchasing this FJD Trion P1 LiDAR Scanner (“P1”). Before use, ensure that you have read this manual carefully and followed the instructions herein to better understand and operate the product.

Technical Support

Starting from the date of purchase, users are provided with the technical support from FJDynamics.

Contact FJDynamics by any of the following methods:

Tel: 1833-330-6660 (United States)

Tel: 496-931-090-130 (Europe)

FJDynamics official website: https://www.fjdynamics.com

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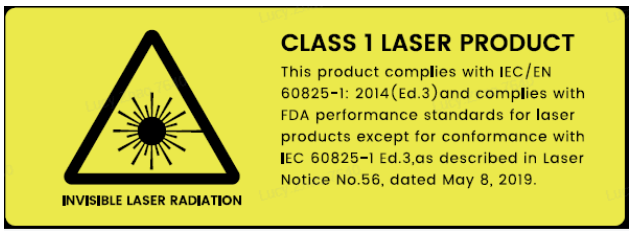
1 Safety Instructions

1. To prevent device damage caused by misoperation, P1 can only be used by trained users. Do not operate the device with suspicious defects or obvious mechanical damage.
2. Use the components or accessories that come with the device, or other accessories recommended by FJDynamics.
3. Always follow the safety instructions when operating the device to avoid personal injury.

1.1 Laser Safety



1. This device satisfies the requirements of the following standards regarding the laser safety:
   - IEC 60825-1:2014; and
   - 21 CFR 1040.10 and 1040.11, except for deviations (IEC 60825-1 Ed.3) pursuant to Laser Notice No.56, dated May 8, 2019.
2. Although the device complies with Class 1 safety standards, do not use a microscope, a magnifying glass in any form, or other magnifying devices to look directly at the lasers.
3. For maximum self-protection, do not look directly at the running LiDAR.

1.2 Device Operation Safety

1. Do not cover the battery and the charger during charging.
2. Do not block or interrupt the LiDAR when it is rotating.
3. Do not plug and unplug the connecting cables repeatedly.

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4. Use the device at normal ambient temperatures and avoid exposing it to extreme temperatures. Otherwise, the battery life will be shortened or unpredictable risks may occur.
5. The device contains sensitive electrical and mechanical components. Do not forcibly bend or pull the connecting cables, and do not insert unrelated objects into the connectors.
6. Keep the device out of the reach of children.
7. Do not mix batteries of different devices.

1.3 Battery Operation Safety

1. Do not immerse the batteries in water. Store the batteries in a cool and dry place when they are not in use.
2. Do not use or place the batteries near heat sources, such as fire and heaters.
3. Charge the batteries with the charger provided.
4. Do not reverse the positive and negative poles of the batteries.
5. Do not directly plug the batteries into the power sockets.
6. Do not throw the batteries into fire or heaters.
7. Do not connect the positive and negative poles of the batteries with metal objects to avoid short circuits.
8. Do not transport or store the batteries together with metal objects.
9. Do not hit, drop, or step on the batteries.
10. Do not dismantle the handle housing, weld the batteries, or pierce them with sharp objects.

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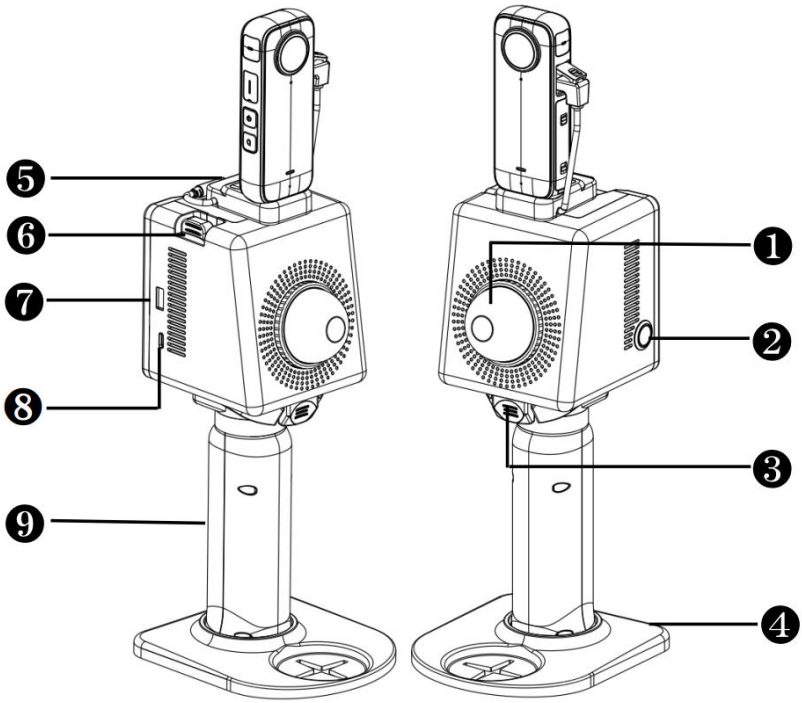
2 Overview

2.1 Introduction



No.	Name	No.	Name
1	LiDAR and housing	2	Power button (with status indicator)
3	Quick-release button for handle	4	Base plate
5	Camera module	6	Quick-release button for camera module
7	USB-3.0 port	8	Type-C port
9	Handle (with battery)	10	/

!	**Note:** Above is the general configuration of P1 and only serves as a reference. The actual product may vary.

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2.2 Specifications

1	Weight	1.1 kg (excluding the camera module)
2	Dimensions	160×120×270 mm (excluding the camera module)
3	Accuracy	0.8 cm to 2 cm
4	Scanning range	40 m (10% reflectivity) or 70 m (80% reflectivity)
5	Laser wavelength	905 nm
6	Laser class	Class 1 eye safe
7	LiDAR FOV	360°×59°
8	LiDAR	1
9	Points per second	200,000
10	Point cloud processing	Real-time
11	Point cloud display	Real-time preview on a mobile terminal
12	Power supply	Battery
13	Supply voltage and current	10.8 V , 3 A
14	Charging port	Type-C
15	Data transfer	Type-C (camera module), USB-3.0
16	Power consumption	12 W
17	Battery life	2 h (excluding the camera module)
18	Wi-Fi	2.4 GHz
19	Storage	512 GB
20	Operating temperature	-10℃ to 45℃
21	Camera pixels	5760*2280
22	Camera FOV	360°
23	Frame	30 fps
24	Point cloud coloring method	Post-processing

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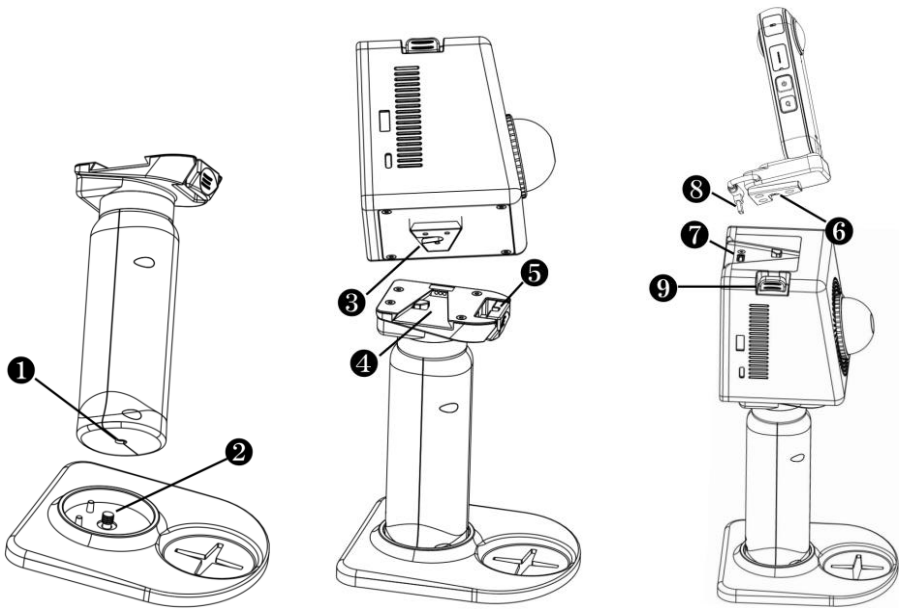
3 First Use

3.1 Assembly and Connection

- Turn the screw ❷ on the base plate clockwise to fit tightly into the threaded hole ❶ at the bottom of the handle. Turn the screw anticlockwise to remove the base plate.
- Slide the wedge ❸ at the bottom of the LiDAR module into the notch ❹ of the handle in the direction as shown below until you hear a click. To remove the handle, slide the handle in the opposite direction while pressing the quick-release button ❺.
- Slide the wedge ❻ at the bottom of the camera module into the notch ❼ at the top of the LiDAR module in the direction as shown below until you hear a click. Then, plug the camera cable ❽ into the Type-C port on the LiDAR module. To remove the camera module, unplug the cable and then slide the camera module in the opposite direction while pressing the quick-release button ❾.



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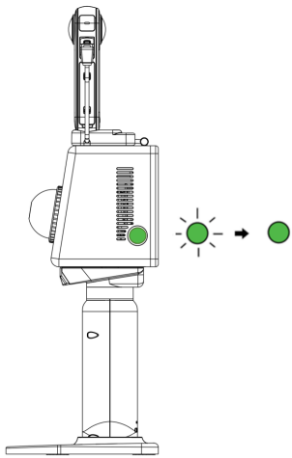
3.2 Software and Hardware Interaction

3.2.1 Starting the Device



- Place P1 on a flat surface.
- Press and hold the power button for 1s to 2s to power on P1. The status indicator flashes green slowly.
- Wait for about 15s until the status indicator is solid green. The initialization is completed, and P1 is on standby.

3.2.2 Connecting to Wi-Fi

- Disable the cellular data service on your phone, turn on Wi-Fi, and then find the Wi-Fi network named the device SN, which can be found on the back of P1.
- Enter the password "fjdtrionp1" to connect to the network.
- Open a browser on your phone, and enter 192.168.1.254 in the address bar to access Trion Scan.

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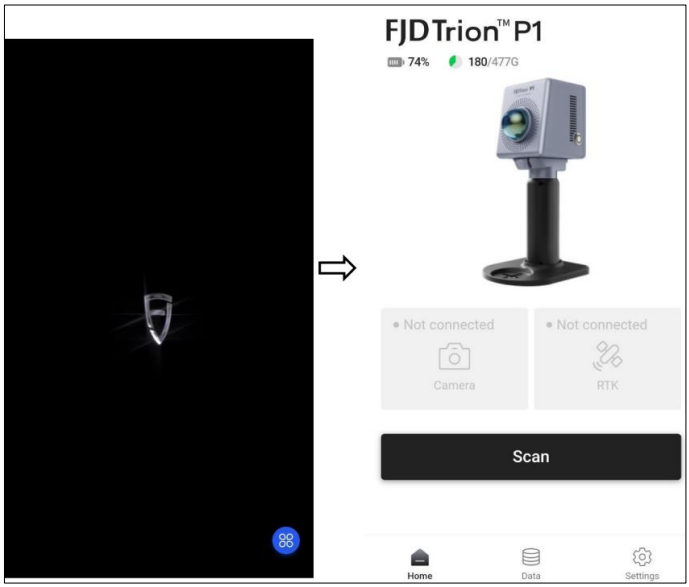
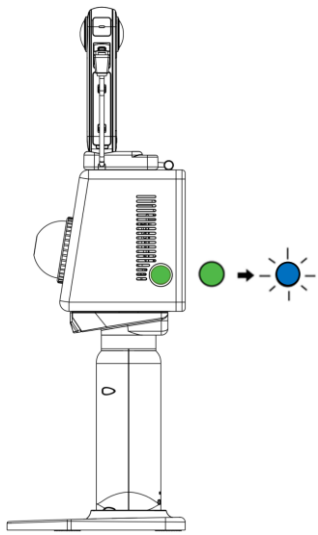


3.2.3 Collecting Data



- Tap **Scan** in Trion Scan, enter the project name, and then tap **OK**. Scan initialization starts, and the status indicator of the power button flashes blue. P1 must remain still during the process.

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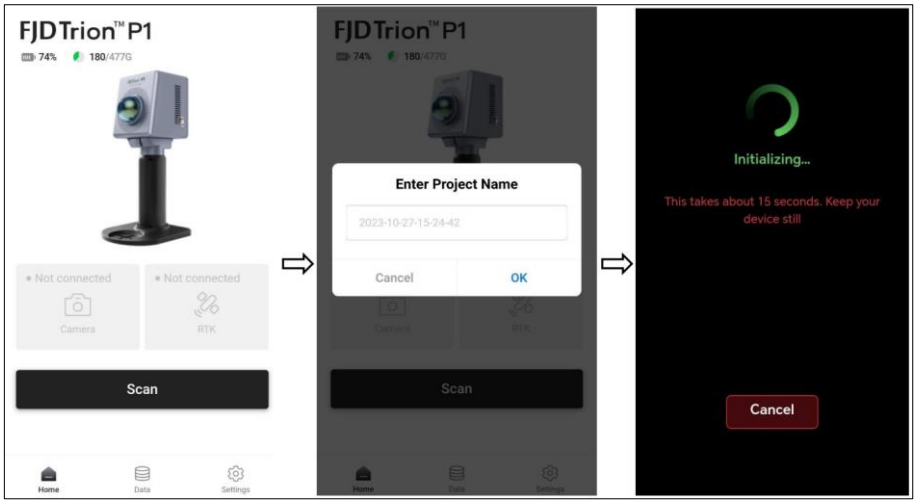
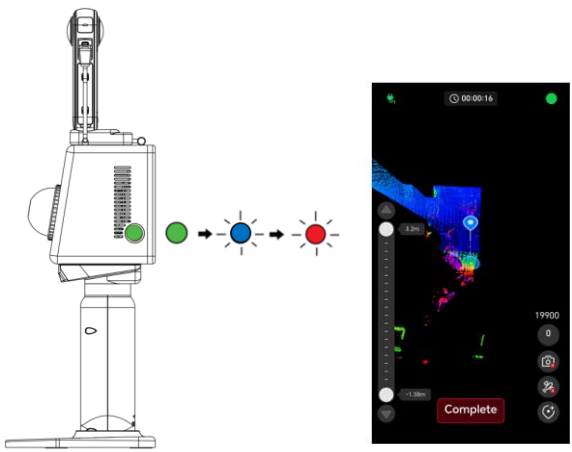


- Wait for about 15s until the status indicator of the power button flashes red. P1 is ready for scan, and you can start scanning and view the point cloud data in Trion Scan.



- Tap **Complete** and then **OK** to save data. The status indicator of the power button double flashes blue.

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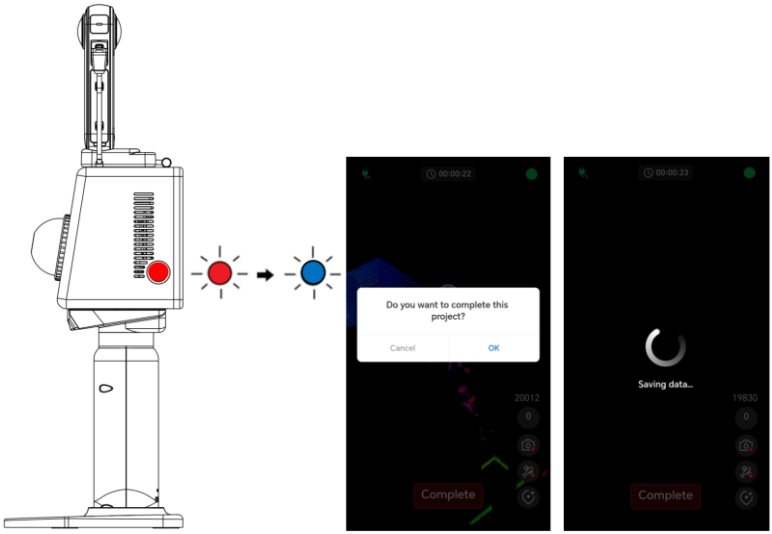
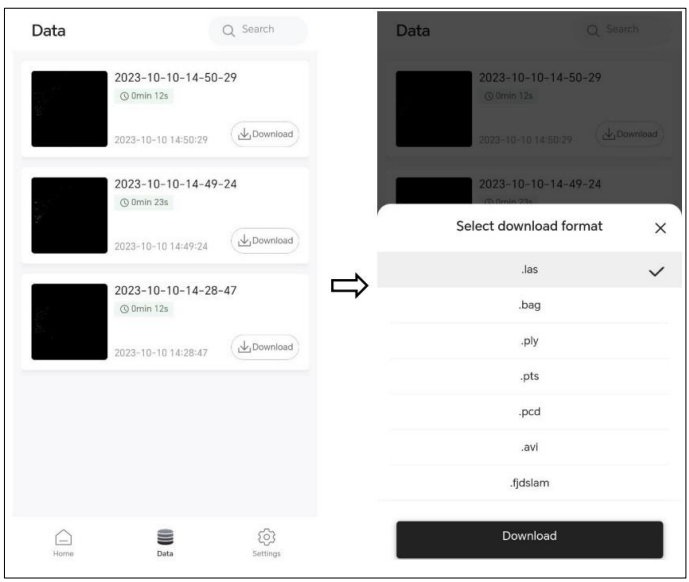


3.2.4 Downloading Data

Tap **Data** at the bottom, tap **Download** on the required data, select the format on the pop-up, and then tap **Download**.



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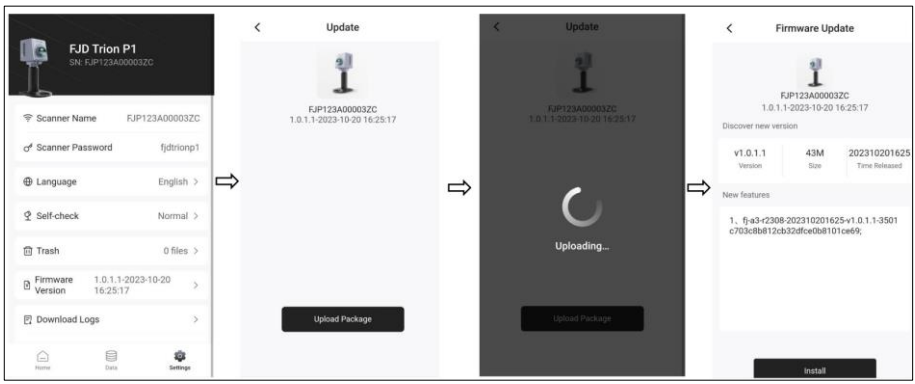
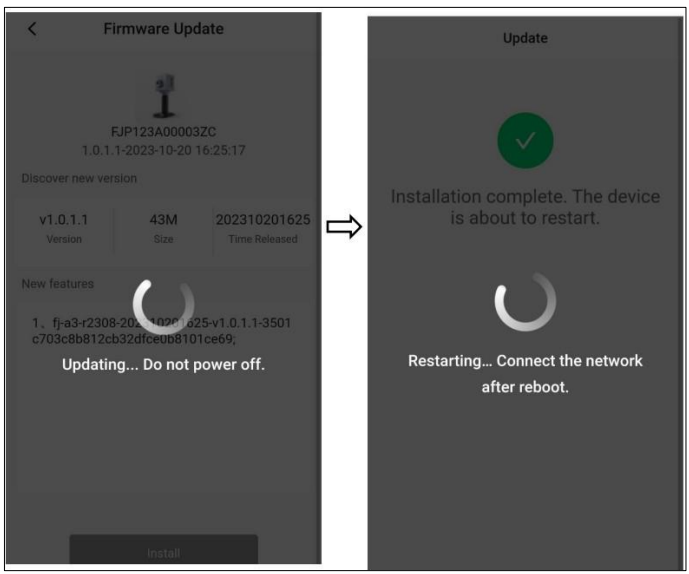
3.2.5 Updating Firmware

Tap **Settings** at the bottom, Select **Firmware Version**, and then tap **Upload Package**. After the package is uploaded, tap **Install** on the package information pop-up (version number, package size, and release time). Do not power off P1 during the update. When the process is completed, P1 is restarted automatically. When the status indicator of the power button turns from flashing green to solid green, connect your phone to the P1 W-Fi.





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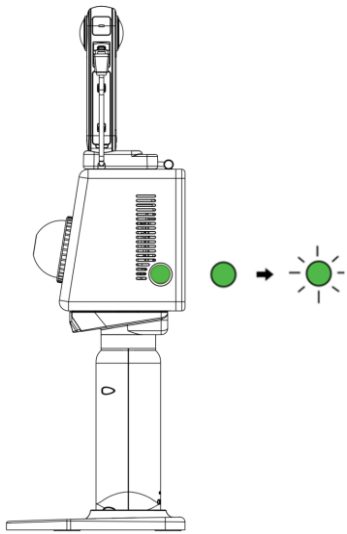
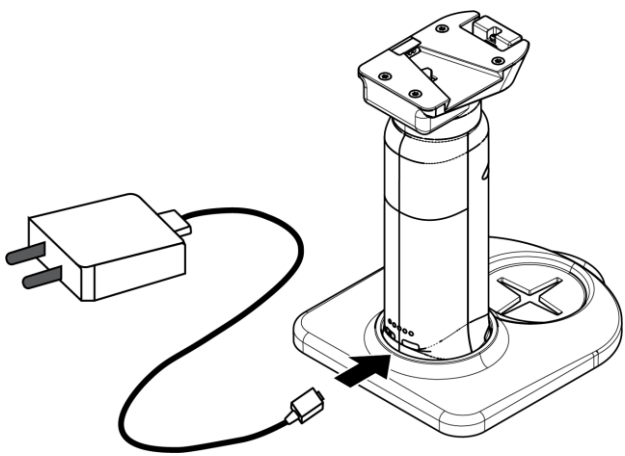
3.2.6 Powering Off

Press and hold the power button for 3s to 5s. The status indicator flashes green for 5s before P1 is powered off.



3.2.7 Charging the Battery

To charge the battery, plug one end of the charger provided into the Type-C port of the handle and the other end to a power outlet. It takes about 1.5 h to fully charge the battery. Press the button beside the Type-C port to check the battery level.



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!	**Note:** • Do not charge the battery via the Type-C port on the handle while the device is in use. • Use the Type-C port on the side of the LiDAR module when you have to charge the battery during use. Only use the charger provided. • Charge the battery when the battery level is low to avoid over discharge. • To extend the battery's service life, charge the battery at least once every 3 months. • After 800 charge and discharge cycles, the battery capacity naturally drops to 80% of its original capacity. • When only one light of the battery level indicator flashes, charge the battery immediately to avoid shutdown during use.

3.3 Using the Camera

3.3.1 Camera settings

- As shown in Figure , press and hold the power button ❶ until the touchscreen ❷ lights up. For details about how to set the video recording parameters, see the Insta360 X3 User Manual provided. The following table lists the default camera settings.

Parameter	Default
USB Mode	Android
Exposure	Auto
Shooting Mode	360° Timelapse
Interval	0.2s
Resolution	5.7K
Frame Rate	30 fps

!	**Note**: Do not modify the factory settings of the preceding parameters.

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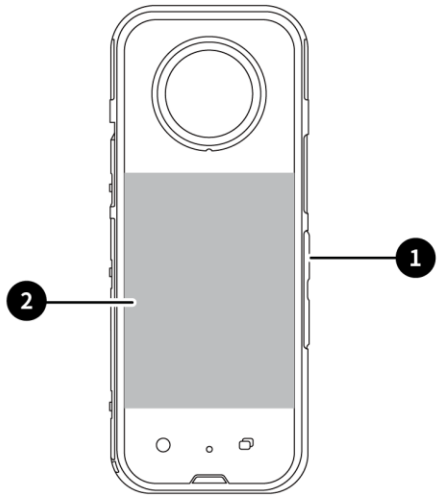
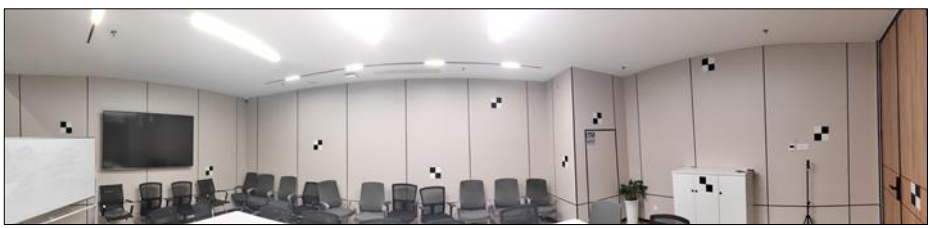


3.3.2 Calibrating the Camera

1 **Deploy targets:** As shown in Figure, randomly distribute target papers with a spacing of 1-2 meters on the four walls of the space.



2 **Starting and connecting the Device:**

a) Start the scanner: Please refer to Chapter 3.2.1~3.2.3.

b) Press and hold the power button on the right side of the camera for 2–3s to power on. After about 5–10s, a communication connection is automatically established between the camera and the P1 via the USB Type-C cable. If the connection is normal, the camera icon is green in the Trion Scan. To start recording, tap or click the scan button.

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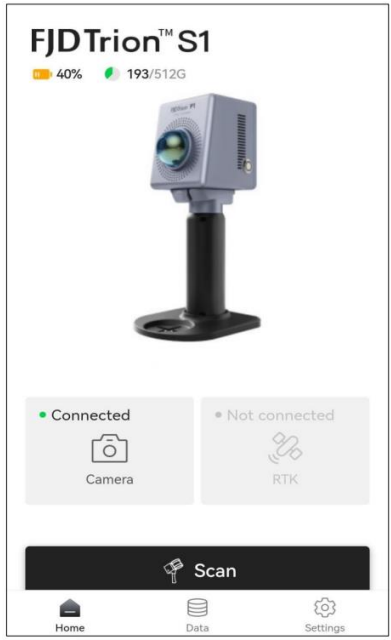
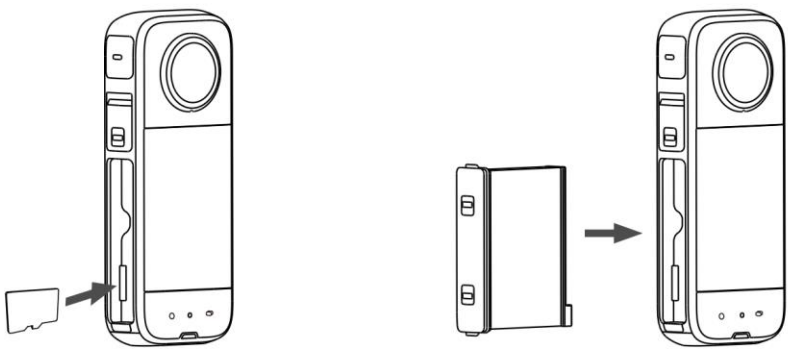


3 **Collect point cloud data for calibration**: Turn on the P1 and scan all the targets clearly for at least 5 min.

4 **Export camera data:**

a) Turn off the camera, remove the SD card, and use a card reader to copy the data.



b) As shown in Figure , import the above data into the Insta360 Studio 2023, click in the upper right corner of the screen, disable the anti-shake

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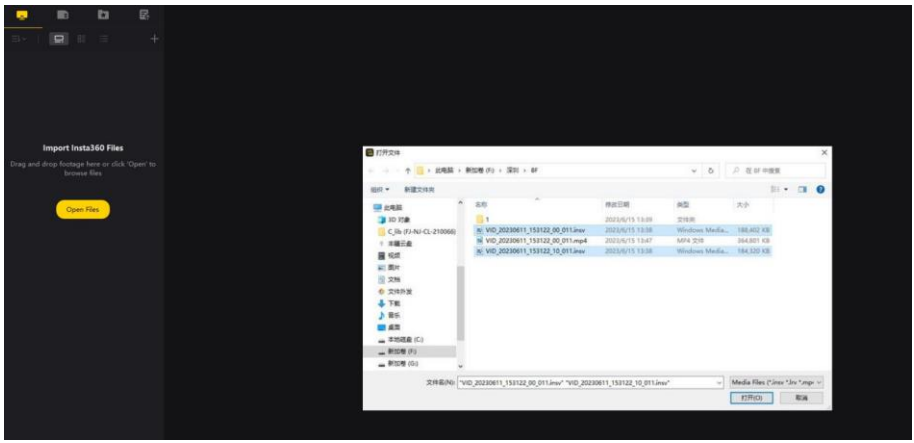
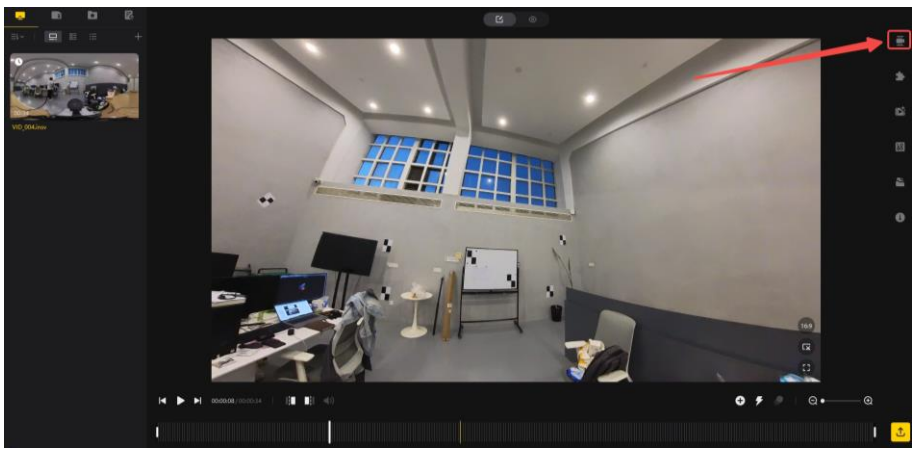
feature, click in the lower right corner of the screen, click Export 360 video, select the file path, and then click Start Export. Use the Insta360 Studio.exe file provided to install the Insta360 Studio 2023.





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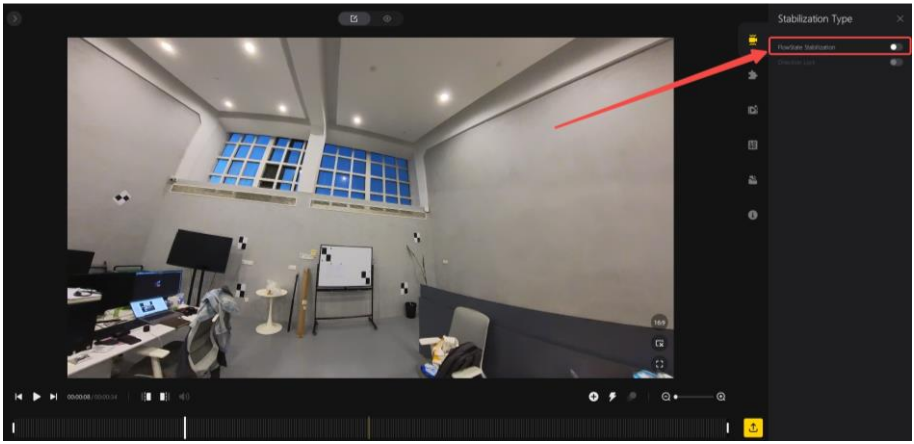

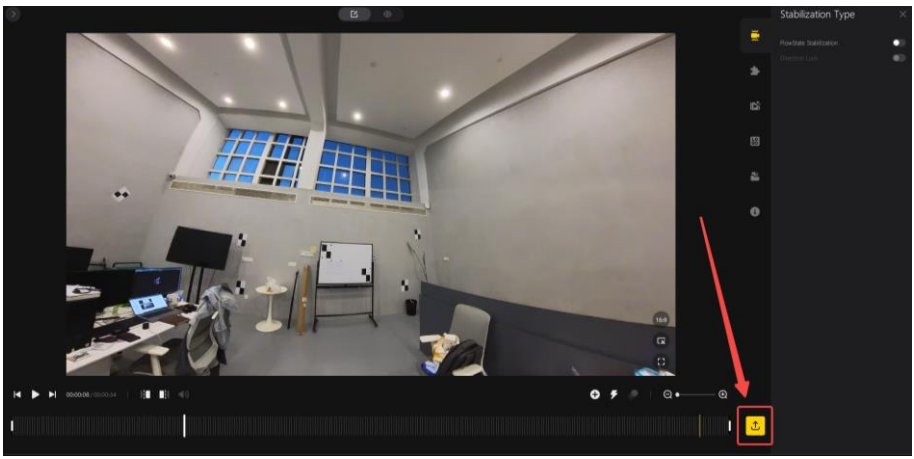

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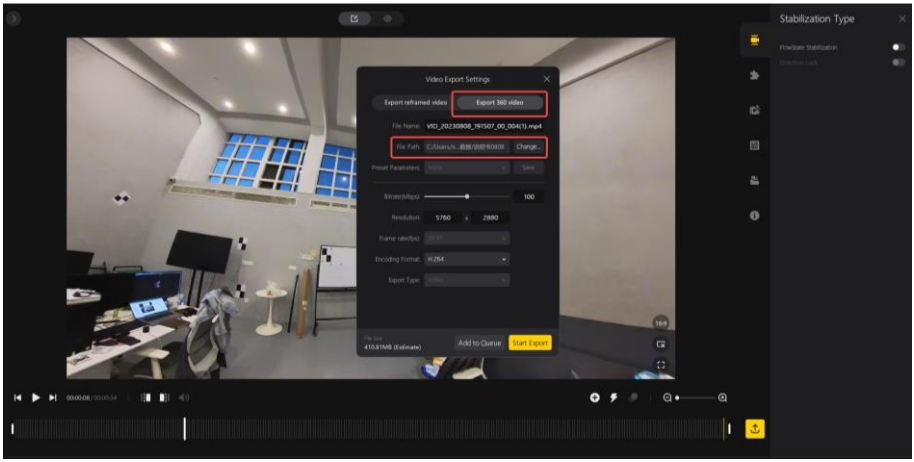
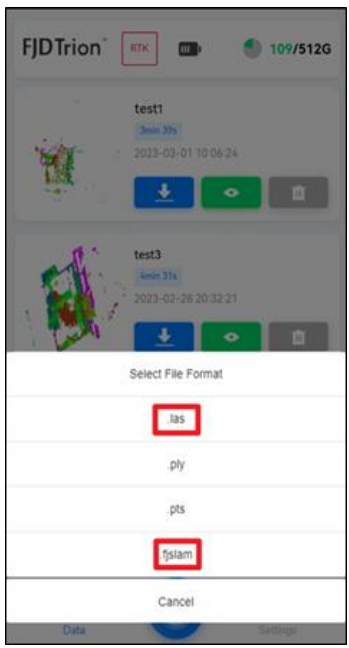


5 Export point cloud data

Open Trion Scan, tap the download button on a project file, and select the .fjslam format to download the package. Then, transfer the package to your PC and decompress it.



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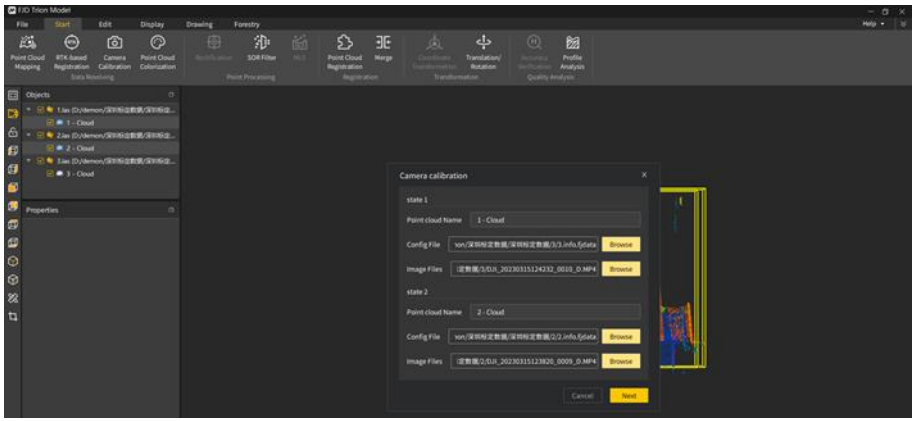
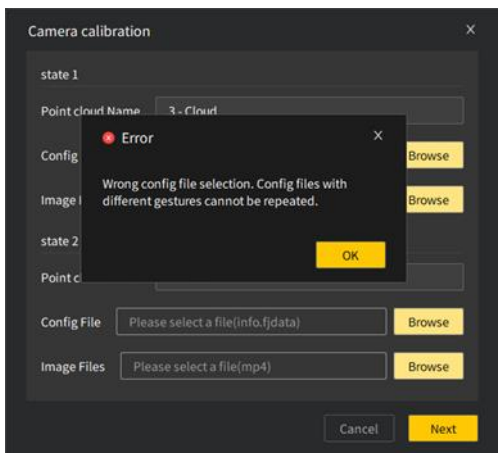
3.3.3 Calculating the Calibration Parameters in FJD Trion Model

1. **Select data for calibration**: Select one or more (no more than three) point cloud files under **Objects** as required. To select multiple files, press and hold the **Ctrl** key and click the target files.
2. **Enter the calibration screen**: Click on the **Start** tab. The following window appears:



3. **Select configuration files**: Select the configuration file and image file for each point cloud, and click **Next** to select points for calculation. The following message appears when an incorrect configuration file is selected.



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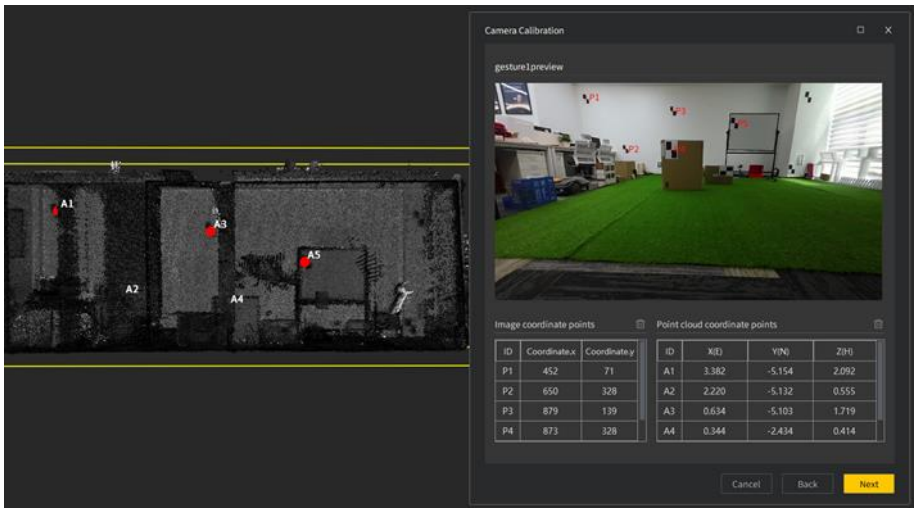
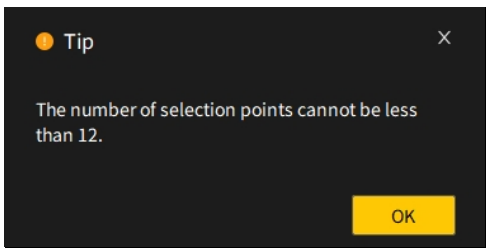
4. **Select target points:** Select the same number of target points on the preview image and the point cloud. The point number must be at least 12. Otherwise, the following message appears when you click **Next**.





5. **Start calculation**: Click **Browse** to name the calibration file and select the storage path, click **Save**, and then click **OK**.

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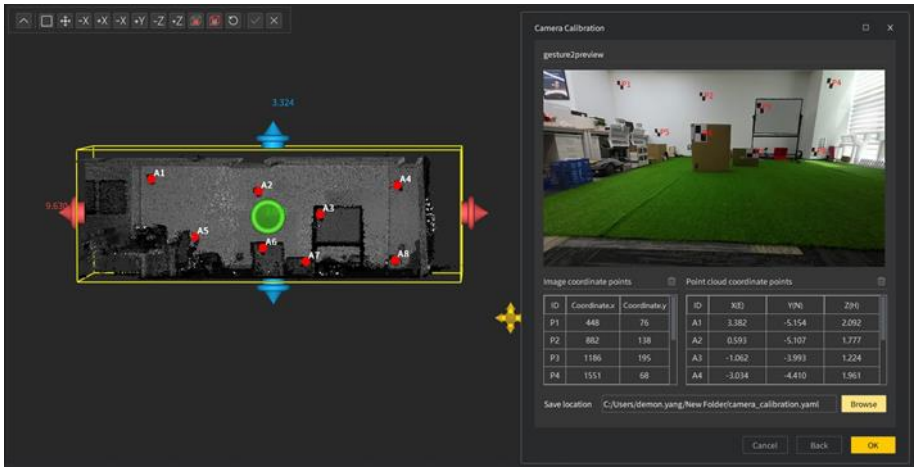
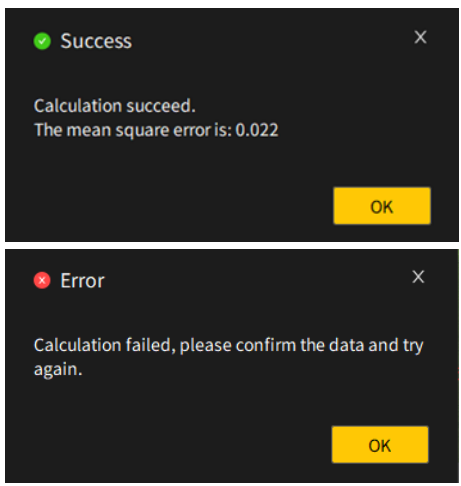


6. **Calculation result:** A message appears indicating whether the calculation is successful. When the success message appears, click **OK** to colorize the point cloud.



Notes:

- Select the centers of the planar targets as the target points.
- Camera calibration and point cloud colorization are not available if the camera is not purchased with the P1.

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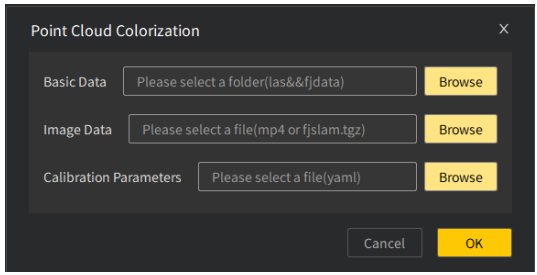
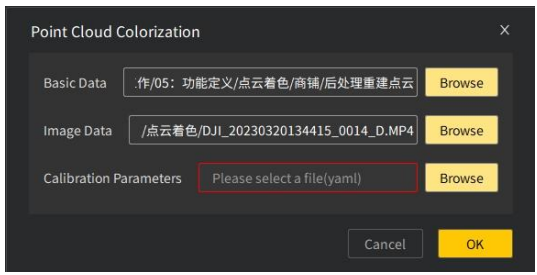
3.3.4 Colorizing the Point Cloud in FJD Trion Model

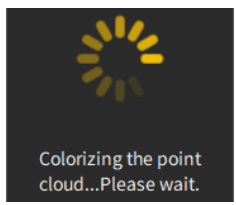
1. **Open the Point Cloud Colorization window**: Click on the **Start** tab. The following window appears:



2. **Select data**: Select files for the basic data (.las or .fjdata), image data (.mp4 or .fjslam.tgz), and calibration parameters (.yaml). If any required field is empty, the input box becomes red when you click **OK**.



3. **Start colorization**: Click **OK** to start point cloud colorization. The following message appears:



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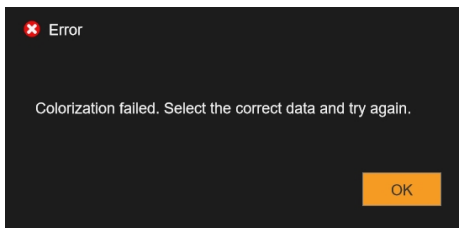
4. **View the result**:

- When the colorization is completed, the message above disappears, and the colorized point cloud is displayed in the 3D view.

- The following message appears if the colorization fails. When this occurs, ensure that the correct data is selected and try again.



	For details, see the *FJD Trion Model Point Cloud Processing Software User Manual*.

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4 Suggestions

4.1 Environments

When scanning the surroundings, P1 constructs maps and saves the point cloud data in real time. Without the need for a GNSS device, P1 can be widely used for indoor, outdoor, and underground surveying scenarios such as underground parking lots and tunnels. It has great advantages when working indoors and underground such as in tunnels and mine laneways, as it neither needs, nor is interfered with by, external light during use.
Do not point P1 toward a large group of moving people or objects, as it requires static data. During scanning, the operator should work alone. If partners are needed, they must walk behind the operator to avoid being scanned.
P1 may not perform well in some scenarios. Keep in mind the following points when using the product.

- Scanning will be affected by specular refraction and reflection. Do not use P1 to scan spaces with a large area of glass.
- As P1 relies on real-time matching of 3D environments, its accuracy will be affected in spaces with similar structures (for example, passages and mazes showing no geometric difference in walls) and in spaces without clear structures (such as large and open lawns and squares).
- Clear the area around P1 during initialization. It is recommended to perform the initialization with P1 placed at a certain height instead of on the ground.
- Do not use P1 to scan an area with moving people and vehicles, like a crossroad.

4.2 Loop Closure

Plan the path before using P1. Proper path planning ensures the mapping accuracy.
1. Loop closure at start and end positions

Close the loop where possible to minimize the cumulative error. It is to "close the loop" by re-surveying a known position, and the overlapping path should be at least 5 m. It is recommended to scan based on the green paths below.

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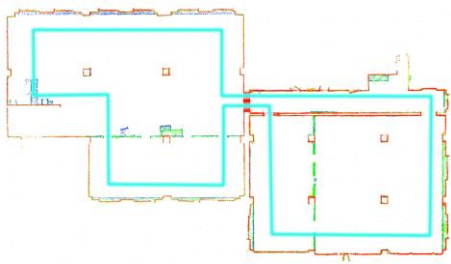
2. Loop closure during scanning

The point cloud data errors accumulate as you walk. The errors decrease with the increase of circular loop closures. Therefore, it is recommended to close the loop as often as possible to minimize the errors.

Common environments (about 2,000 m²): Scan depending on the environments.



Larger environments (about 10,000 m²): Close as many loops as possible during scanning.

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4.3 Transitioning Between Environments

Take extra care when transitioning between environments, such as transitioning between rooms and indoor-outdoor transitioning, and when making a U-turn or turn.

1. Transitioning between rooms

Open all doors before starting the scanning. Do not scan doors that are being opened. If P1 is not held properly, there are not enough features in front, or you walk too fast, P1 cannot capture enough features in the new room, delivering poor scanning quality. In this case, point P1 toward the room that has been scanned with your back toward the new room, and walk through the door slowly to ensure that there is a period when P1 can view features on both sides of the doorway.

2. Indoor-outdoor transitioning

Indoor-outdoor transitioning refers to transitioning from an enclosed environment with plenty of features to an open environment with few features, for example, an open hall. In this case, P1 also delivers poor scanning quality.

3. Making a U-turn or turn

When making a U-turn or turn, reduce your walking speed to one third of the normal speed. Then, make the U-turn or turn slowly, and stay where you are for 1s to 2s,

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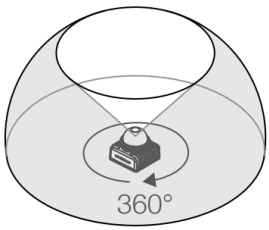
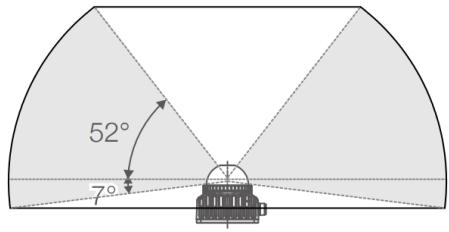
especially when in a corridor, to ensure that there is a period when P1 can view features on both sides of the turn.

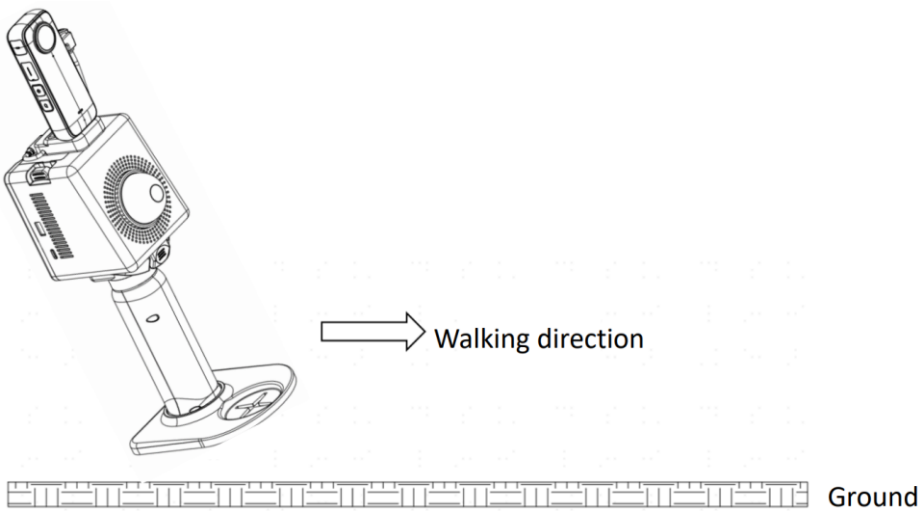
4.4 Holding Instructions

The horizontal and vertical FOV of the P1 LiDAR are 360° and 59° respectively as shown below.





To ensure that P1 captures as many features as possible, hold P1 with the LiDAR module leaning 30° backward as shown below, when scanning open spaces with few features, enclosed spaces (such as buried shelters, tunnels, corridors, and sewage pipelines), or open spaces with plenty of features (such as underground parking lots, residential complexes, and parks).



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4.5 Walking Speed

You are recommended to walk at a constant speed (1 m/s) in common environments, and reduce the speed to 0.5 m/s or lower when passing through narrow spaces, such as corridors, tunnels, and stair corners, so that P1 can effectively and fully scan the spaces to ensure the output accuracy.

4.6 Scanning Range

P1 has an effective range of 0.5 m to 70 m.

Minimum distance: To obtain accurate point cloud data, P1 must be at least 0.5 m from the targets. Avoid close proximity to walls and ceilings. Data may not be obtained on both sides in narrow spaces, so walk in the middle area where possible.

Maximum distance: In optimal conditions, P1 is able to obtain data of targets at a maximum distance of 70 m. In most cases, the scanning accuracy can be guaranteed at a distance up to about 40 m. To ensure the point cloud quality, it is recommended to use P1 at a distance of about 30 m.

4.7 Scanning Duration

For overly large surveys, divide the project into multiple scan tasks, to keep the map size at a proper level and avoid saving failures due to limited storage space. Limit each scan task within 20 minutes.

4.8 Special Scenario

Scenario: corridor (narrow space)

P1 may deliver poor performance when scanning corridors over 80 m with smooth walls on both sides and few features. In such corridors or similar scenarios, follow the guidance below to ensure mapping accuracy:

1. **Hold P1 properly:** Tilt P1 at an angle of 70° to 90° as shown below.

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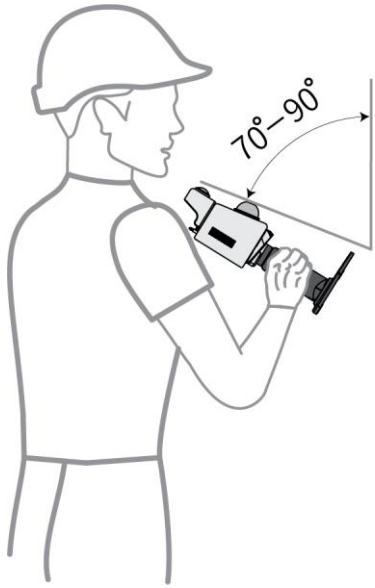
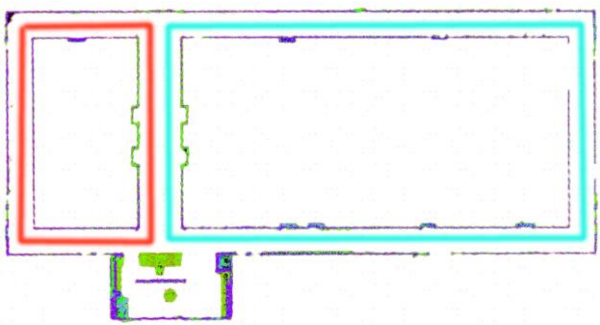


2. **Scan separately:** If there is such a corridor in the area to be scanned, scan the corridor separately.
3. **Add features manually:** For a corridor with smooth walls on both sides and without obvious features, add features such as chairs manually. Place chairs in the farther half of the corridor at unequal intervals of 5 m to 10 m.
4. **Form small closed loops:** Plan as many small closed loops as possible when scanning a corridor.



5. **Turn slowly:** Walk and turn as slowly as possible at the end of the corridor. If the corner is followed by another corridor, stay where you are for 1s to 2s after the turn to

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collect as much point cloud data as possible in such scenarios with sudden spatial change.

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5 Maintenance and Troubleshooting

5.1 Maintenance

1. Wipe P1 with a clean cotton cloth and put it in the case after use.
2. Avoid rough actions, such as impact, bending, throw, and disassembly, on P1, and do not put debris on it.
3. Do not disassemble P1 on your own. If a fault occurs, contact the local dealer.
4. Hot swapping is prohibited. Do not plug or unplug the cable when P1 is powered on.
5. At a certain time interval, shake the LiDAR module gently to check for abnormal sounds. If any abnormal sound is heard, check the screws of the LiDAR module. Anti-loosening measures are taken for all the P1 screws so that they do not loosen easily. However, to ensure safety, if any screw is loose, contact the local dealer.
6. Only qualified personnel can repair P1.

5.2 Common Faults and Solutions

Fault	Solution
P1 cannot be powered on.	Check whether the battery is properly installed. Ensure that the battery power is sufficient.
The phone or PC cannot detect the Wi-Fi signal of P1.	Check the available storage of P1. Disable the cellular data service on the phone, and try again.
The phone or PC cannot access the scanning screen.	Check whether the phone or PC is connected to the P1 Wi-Fi. Refresh the screen and try again.
Initialization fails.	Keep P1 still, and avoid vertical movement.
P1 shuts down during use.	Check whether the battery level is low. Check whether the battery is properly connected.

!	**Note:** Above are the common faults. If your problem persists, contact our customer service.

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5.3 Waste Disposal

The product contains metal and electronic components. Waste must be disposed of in an environmentally safe way according to local laws and regulations. Any waste (such as packaging materials, metal parts, and electronic components) must be delivered to local recycling facilities for disposal.

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NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.

- Increase the separation between the equipment and receiver.

-Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

-Consult the dealer or an experienced radio/TV technician for help.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

RF Exposure Information:

FCC RF Exposure requirements: The highest SAR value reported under this standard during product certification for use next to the Body with the minimum separation distance of 0mm. This transmitter must not be collocated or operating in conjunction with any other antenna or transmitter.

This product is compliance to FCC RF Exposure requirements and refers to FCC website https://apps.fcc.gov/oetcf/eas/reports/GenericSearch.cfm search for FCC ID: 2A2LL-P1.

All transmission frequencies of U-NII-1 and U-NII-3 comply with 47 CFR FCC Part15.407(g) and the manufacturer declares that their transmission is maintained within the U-NII-1 and U-NII-3 bands.