Vision-Fused Multi-Point Deformation Monitoring System

User Manual

March 2026

Device Usage Statement

Dear customer:

Welcome to [Z8] (hereinafter referred to as "the Device"). We hereby formally notify you that, to ensure the proper functioning of the slope equipment monitoring system and to clearly define the rights and obligations of both parties, you must carefully read and fully understand this statement, with particular attention to the exemption and/or limitation clauses.

1、Application scenarios of monitoring equipment

Vision-Fused Multi-Point Deformation Monitoring System is only suitable for real-time monitoring of slow deformation in landslide bodies, such as the creep stage and gradual change stage. It cannot yet capture sudden deformation scenarios like collapse, rock rolling, falling rocks, rock mass detachment, or soil layer detachment. Additionally, due to the limited penetration capability of waves, the system cannot penetrate vegetation, resulting in significantly compromised data quality in areas covered by vegetation.

2、Installation and layout of monitoring equipment

(1) Vision-Fused Multi-Point Deformation Monitoring System equipment is designed to detect deformation in the LOS (Line of Sight) direction. The measured deformation values are significantly influenced by factors such as installation location and angle. The monitoring points and angles must be precisely designed and installed by qualified entities with slope stability assessment credentials.

(2) To ensure stable operation of the monitoring system, a reliable power supply, network, and server environment is essential. You should implement various measures to maintain operational stability, including but not limited to power supply, network, and server configurations. The server side must guarantee stable power and network supply, avoid downloading non-monitoring system software, and implement robust network security measures. For the Vision-Fused Multi-Point Deformation Monitoring System side, critical components such as solar power systems, mains stability, UPS, inverters, communication equipment, and auxiliary materials (e.g.,transparent

panels) should use our recommended models to prevent issues like power supply, communication, or echo intensity from affecting normal operation.

3、Threshold settings for monitoring data

Vision-Fused Multi-Point Deformation Monitoring System equipment provides a variety of alarm modes and multi-level alarms, but the realization of the relevant alarm functions requires reasonable and correct early warning thresholds. These thresholds should be regularly and accurately updated and adjusted by the mine design institute or the unit with slope stability evaluation qualifications based on the actual geological conditions and historical data of the monitored area.

4、Operation and maintenance of monitoring system

(1) The registration, point relocation, and software upgrades for monitoring equipment models must be performed by trained technicians in accordance with standard requirements. You may also complete these operations with assistance from our professional technicians ; otherwise, the equipments performance may be compromised.

(2) The initial threshold should be set according to the recommended values in the design documentation. Should the design threshold be modified, the platform threshold must be updated promptly. For configuration assistance, please notify us in writing in advance.

(3) After relocating the Vision-Fused Multi-Point Deformation Monitoring System station, the monitoring parameters must be configured and updated prior to the first operation, including latitude, longitude, elevation, zero point orientation, monitoring range parameters, and data upload parameters, followed by creating a new task. When moving the equipment, it should be securely stored in the instrument box during transportation to prevent damage.

(4) We will develop a comprehensive training program covering system principles, equipment installation and operation, debugging procedures, software management, troubleshooting, and equipment maintenance. Upon completing all equipment installation, we will dispatch technical experts to conduct centralized on-site training at the mining site. The training aims to ensure participants fully understand and master the operational, maintenance, and repair techniques of the project

equipment. During the training period, we will provide you with required materials including textbooks, technical documentation, blueprints, as well as product manuals, user guides, and operational instructions for the relevant equipment.

(5) We will provide technical training to your professional engineers or management personnel in accordance with the contract terms. To ensure your staff are competent in all system operations, including operation, line maintenance, fault analysis and resolution, as well as equipment repair and maintenance, you must organize relevant personnel to actively participate in the services organized by Party B and diligently acquire operational skills.

(6) You are responsible for conducting regular inspections of on-site equipment, power supply lines, communication links, and software operations. If you identify any faults or abnormalities, you may perform preliminary diagnostics or repairs. If you are unable to resolve the issue, you may request remote assistance from us. Should remote solutions prove ineffective, we will promptly dispatch personnel to the site for on-site resolution.

(7) For issues arising from force majeure or currently unsolvable by existing technical capabilities, both parties shall engage in amicable negotiations. In the event of failure to reach consensus, resolution shall be made in accordance with legal provisions and the principle of fairness.

5、Interpretation and Application of Monitoring Data

(1) You fully understand that Vision-Fused Multi-Point Deformation Monitoring System is a specialized monitoring device, not a measuring instrument. The collected monitoring data constitutes objective raw data and does not constitute definitive conclusions, recommendations, or judgments, and should not be directly cited. The relationship between the monitoring data and the actual conditions of the monitored area, as well as how the data matches or verifies each other, requires comprehensive analysis and interpretation by professional technicians from geological disaster assessment, mine design institutes, or units qualified for slope stability evaluation, in conjunction with other data and circumstances. Qualified and experienced units must conduct the analysis and application of the monitoring data. If you require data

analysis and application, our company can provide assistance from qualified units, with the associated costs to be borne by those units.

(2) Monitoring data shall not be privately misused, altered, or tampered with in any other form.

This statement is intended to clearly outline your rights and obligations when using the device, preventing unnecessary disputes or losses due to misunderstandings or negligence. We shall not be liable for any losses resulting from your failure to comply with the instructions or requirements set forth herein.

We kindly ask you to always use our equipment safely and properly, exercise caution in operation, and ensure the safety and interests of yourself and others, so as to jointly create a good usage environment.

disclaimer

- This manual may contain inaccuracies, discrepancies in product functionality, or printing errors.
- Our company will update this operating manual in accordance with enhancements and changes to product features, with regular improvements and updates.

This manual describes the information. The updated information will be reflected in the latest version of this manual. No separate notice will be given.

- Due to our continuous adoption of new technologies, we will not provide separate notifications regarding product parameter changes (including software version updates).
- This manual is intended solely as a reference guide for users and does not guarantee complete consistency with the actual product. For practical application, please refer to the...

The actual item shall prevail.

- The parts, components, and accessories mentioned in this manual do not

constitute the standard equipment configuration. The actual configuration is specified in the packing list.

be as the criterion 。

- All text, tables, and images in this manual are protected by relevant national laws and shall not be used without permission.

Unauthorized use.

- Indoor Use Only: This equipment is designed for indoor use only. Do not install in outdoor locations, wet areas, or areas subject to condensation, rain, or splashing liquids.

For applications such as periodic monitoring, mobile emergency monitoring, and scientific research, any resulting property damage, personal injury, or legal liabilities shall be borne by the user.

- Do not disassemble the internal components of the Vision-Fused Multi-Point Deformation Monitoring System. This product contains no self-repairable parts.

All maintenance work must be performed by authorized personnel of our company. No disassembly or modification of the equipment is permitted. Any issues arising from unauthorized modifications or repairs shall be the users responsibility.

- All rights and final interpretation of this manual are reserved by our company.

Catalogue

目录

1 summary 9
1.1. brief introduction 9
1.2. operational principle 9
1.3. functional characteristics 10
1.4. system composition 11
1.4.1. Vision-Fused Multi-Point Deformation Monitoring System 11
1.4.2. Cloud server platform 11
Figure 1-1 Cloud Server Platform 12
1.5. technical parameter 12
（13） Protection rating: IP6 6 12
2 Equipment Installation Instructions 13
2.1 Installation site selection 13
(1) installation site 13
(2) Installation level 13
(3) Installation environment 13
2.2 Installation steps 13
2.2.1 site operation 13
2.2.2 Open the box and remove the equipment 14
2.2.3Fixing 15
2.2.4Power Supply and Network Connection 15
2.2.5Integrity confirmation (initial unpacking) 15
2.2.6 Cable requirements 15
2.3Equipment on/off operation 15
2.3.1 Startup operation 15
2.3.2 Shutdown operation 16
3 Operation Instructions of Host Platform 17
3.1 brief introduction 17
3.1.1 Java runtime environment Java 17
3.1.2 agree on 18
3.2 Software login 18
3.2.1 Software login 18
3.2.2 Introduction to the software main interface 19
➢ View QR code data on the go 20
3.3 Setting and Control of Radio Host Parameters 20
3.3.1 Location and orientation configuration 20
3.3.2 Scan range configuration 22
1）Manual configuration range 22
2）Visual configuration range 23
3.3.3 Upload TIFF file 25
3.4 Switch work mode 26
Platform configuration switch 27

3.4.1 Communication log 27
3.4.2 Alarm mode 28
1、 Alarm Mode 1 28
1) Logical Introduction 28
2) Pattern Configuration 28
2、 Alarm Mode 2 29
1) Logical Introduction 29
2) Pattern Configuration 30
3.5 Basic software operations 30
3.5.1 View Deformation Diagram 30
3.5.2 View scatter plot 31
3.5.3 Add monitoring points and view data 32
3.5.4 Query and write configuration parameters 33
3.5.5 Video 37
3.5.6 View historical images 38
1）Capture images at fixed points 38
2） Angle recognition image 38
3）Report images at regular intervals 39
3.5.7 Select layers and thematic maps 39
3.6 Basic operations of host computer 40
3.6.1 Network port upgrade 40
1) TCP CLIENT connection host 40
3.6.1.2 PTZ Upgrade 42
3.6.1.3 Upgrade 43
3.6.1.4 Router Upgrade 43
3.6.2 Device information query 44
3.6.3 Equipment Parameter Query and Setting 45
3.6.4 Alarm threshold 47
3.6.5 Configure 48
3.6.6 Operation function 48
3.6.7 MQTT Platform 1 50
3.6.8 MQTT Platform 2 50
3.6.9 HTTP Platform 1 51
3.6.10 HTTP Platform 2 51
3.6.11 Parameter configuration 52
3.6.12 Equipment scanning range configuration 52
3.6.13 Upload data 53
3.6.14 Pan-Tilt 53
4 Frequently Asked Questions and Solutions 54
4.1 Equipment positioning failed 54
4.2 The platform cannot view the deformation graph 54
4.3 The platform cannot view the scatter diagram 54
5 Maintenance and Care of Equipment 55
6 After-sales service of equipment 55
7 FCC Statement 57
8 Laser Safety Information 57

1 summary

This user manual for the Vision-Fused Multi-Point Deformation Monitoring System is designed to guide you through the product before you begin using it. To ensure optimal performance, please read the manual thoroughly and follow the detailed instructions for installation, calibration, and operation. By doing so, you will be able to easily utilize all features of the equipment and enjoy the best possible user experience.

1.1.brief introduction

The Z8 is a versatile system that employs synthetic aperture imaging technology and phase difference interferometry deformation extraction algorithms to detect minute deformations. By integrating video processing, edge computing,and self-organizing network (SONET) technologies, it enables non-contact, omnidirectional, short-range, sub-millimeter-level surface monitoring. The system also features image forensics, SONET coordination, and adaptive data acquisition and reporting capabilities.

1.2.operational principle

True aperture antenna emits electromagnetic wave signals, receives the reflected echoes from targets, and forms images through signal processing techniques. Its resolution is directly limited by the size of the antenna aperture, which is one of its main differences from synthetic aperture antenna.

1.3. functional characteristics

（1）360° panoramic monitoring: With PTZ integration, it supports 360° horizontal rotation and 30°-60° vertical adjustment, enabling comprehensive coverage of wide-area surveillance.

（2）All-weather and all-weather operation: Utilizing active microwave technology, it is unaffected by climatic conditions such as rain, snow, and fog, enabling continuous operation under various weather conditions with excellent environmental adaptability.

（3）Non-contact, high-precision monitoring: By using synthetic aperture imaging technology and phase difference interferometry deformation extraction algorithm, it can achieve sub-millimeter level high-precision monitoring.

（4）High protection rating: The device features IP66-rated design, engineered to withstand harsh outdoor conditions.

（5）Image forensics: When detects abnormal points, it can be used for forensic analysis of images, reducing the need for personnel to visit the site for on-site inspection.

（6）Low power consumption and low TCO (Total Cost of Ownership): The systems average power consumption is below 20W, representing a 70% reduction compared to traditional slope equipment, which significantly lowers field power supply costs.

（7）Quick Update: Leveraging edge computing technology, it enables minute-level data updates.

（8）Linked Trigger:The built-in self-organizing network module enables synchronized activation with contact devices.

（9）Built-in filtering algorithm: Built-in atmospheric correction algorithm and error filtering algorithm, less affected by slope surface vegetation interference and the impact of slope on the movement of vehicles and personnel;

（10）Adaptive data acquisition:Equipped with an adaptive data processing algorithm that automatically adjusts the frequency of data collection and upload based on real-time field conditions, enabling continuous monitoring in motion.

（11）Automatically report anomalies: The system automatically flags unexpected anomalies at designated points using internal algorithms, alerting customers to detect issues promptly.

1.4. system composition

1.4.1. Vision-Fused Multi-Point Deformation Monitoring System

The Vision-Fused Multi-Point Deformation Monitoring System primarily consists of a radar module (including an antenna), a pan-tilt unit, a camera.

1) Vision-Fused Multi-Point Deformation Monitoring System is mainly used to collect deformation and scattering data at regular intervals, and monitor planar Deformation data.

2) The gimbal primarily supports acquisition, enabling a horizontal scanning range of 0-360° and a vertical range of-30 to 60°.

3) The camera is primarily designed for periodic point selection and real-time capture of surveillance area images. When a threshold is triggered at a specific location, it can also capture photos of the area to assist in Deformation alarm detection.

1.4.2. Cloud server platform

Figure 1-1 Cloud Server Platform

The host transmits data wirelessly to the cloud server. The cloud platform software sends control signals to operate the radar. For software operation details, refer to Section 3.4.

1.5. technical parameter

（1）Monitoring range: 10m to 1000m

（2）Angle monitoring range: 360° (azimuth) × 30° (pitch)

（3）Deformation accuracy: 0.1 mm

（4）Resolution: 0.3m

（5）Angle resolution: 9 mrad

（6）Minimum sampling interval: ≤1 min

（7）Power supply: 9-22V DC

（8）Power supply method: Solar power, mains power

（9）Installation method: observation pier installation

（10）Communication method: LAN

（11）Average power consumption: ≤ 20W

（12）Operating temperature: -40℃ to +65℃

（13）Protection rating: IP66

（14）Frequency Band: Ku (17.1GHz~17.3GHz)

（15）Image resolution: The integrated built-in camera has a pixel count of ≥2 million and supports zoom, enabling active capture of abnormal locations for auxiliary judgment. The photography function remains intact

and has been upgraded to perform AI analysis on captured photos, identifying the proportion of vegetation in the images and alerting to vehicle-related sources.

(16) Nighttime lighting: Laser illumination lamps provide supplementary lighting for night photography.

(17) Panoramic background map update:The built-in camera can generate a panoramic background map, enabling bidirectional synchronization between data and the map.

2 Equipment Installation Instructions

2.1 Installation site selection

(1) installation site

The installation site must be selected to prevent ground subsidence, collapse, or landslides, with no obstructions or buildings within a 5-meter radius to ensure unimpeded operation.

(2) Installation level

Ensure the equipment installation is level with the ground to prevent settlement or other issues after rain or snow, maintaining proper alignment. Pre-installation leveling can be performed to ensure ground level. If conditions permit, a concrete base may be laid.

(3) Installation environment

① There is no strong magnetic and electric interference around the equipment installation position.

2 There is no high-rise building around the equipment installation position, otherwise it will affect the normal operation of the external positioning and orientation module of the equipment .

2.2 Installation steps

2.2.1 site operation

① The start and end scanning angles of equipment are determined according to the target imaging range, and the fixing position of the pole is determined accordingly.

② After the pole erection is completed, the system can be powered by solar energy or municipal electricity, depending on the site conditions.

2.2.2 Open the box and remove the equipment .

Open the radar packaging box, grasp the equipment handle with both hands, and carefully remove the equipment from the box. Refer to Figure 2-1 for the radar storage diagram.

Figure 2-1 Schematic diagram of equipment storage

2.2.3Fixing

After removing the equipment , it is fixed to the gimbal by screws on the bottom of the gimbal.

2.2.4Power Supply and Network Connection

1 If a solar power supply solution is adopted, the recommended configuration list is shown in the table below:

To meet the power requirements of the Z8, the solar panel should be equipped with a 200W solar panel, a 600Ah battery, and a solar controller rated at 20A or higher.

model	specifications
solar panel	200W
a solar cell	600Ah
lightning rod	/
underground battery box	/
solar controller	20A/30A

2 If the mains power supply solution is adopted, the matching mains power adapter can be used for power supply.

2.2.5Integrity confirmation (initial unpacking)

After the equipment installation is completed, inspect the entire radar structure to confirm that all component units are intact and show no deformation or other abnormalities. If any abnormalities are detected, contact the relevant personnel for resolution.

2.2.6 Cable requirements

Always use the original cables supplied by our factory. Do not cut or reconnect cables arbitrarily. (All cables for equipment use are pre-assembled before leaving the factory.)

2.3Equipment on/off operation

2.3.1 Startup operation

Confirm power

After powering on the equipment , check the power status via the indicator lights. The rightmost red light staying on indicates normal power supply.

Startup confirmed

When powered on, the equipment will return to its origin if its current position deviates from it. If the equipment communication is normal, the first green indicator light on the left will remain on. Under normal network signal and SIM card conditions, the network will connect within approximately 2 minutes, with the second orange indicator light on the left staying on. If the positioning and orientation status is normal, the third blue indicator light on the left will remain on. Note: Re-positioning and re-orientation are required for initial installation or relocation. Refer to Section 3.3.1 for the positioning and orientation steps.

2.3.2 Shutdown operation

Confirm before shutting down

Before shutting down, it is recommended to configure the equipment in software to "manual mode" and rotate the radar to the origin position.

Shut down operation

After completing the above steps, simply unplug the power. Note: Do not unplug the device through the interface knob. For mains power, unplug the adapter. For solar power, unplug the solar power and battery power in sequence.

i Note: 1. Before shutting down, ensure you return to the original position to save time when the equipment starts up again.

2. Before shutting down, ensure the radar returns to its original position to align the radar base with the inner lining of the packaging box.

The position is consistent, which is convenient for the equipment to be put back into the packaging box.

3 Operation Instructions of Host Platform

3.1 brief introduction

3.1.1 Java runtime environment Java

The display control software adopts a B/S architecture, supporting both standalone deployment and remote access via cloud servers. It integrates functions such as data collection, control, analysis, and reporting into a unified system. The software features intuitive operation, convenient data storage and retrieval, and powerful analytical capabilities. Key features include:

(1) configure the operation parameters, control the equipment start, stop, power off and other operations, and display the equipment , communication can receive the equipment intensity map, deformation map and so on in real time;

(2) It can import 3D terrain data in various formats and achieve fast and accurate matching with 2D images through its proprietary algorithm, with a matching accuracy reaching sub-meter level. The 3D terrain and overlaid images support smooth operations such as rotation, translation, and scaling.

(3) Monitoring points can be added, deleted, and named, with automatic extraction and display of cumulative deformation, deformation rate, acceleration, and other curves for multiple monitoring points. Detailed historical information at specific time points can be obtained by traversing the curves.

(4) It supports storage of intensity maps, deformation maps, and deformation data from monitoring points/areas for any time period, with unrestricted access to historical data and rapid display of historical images and curves.

(5) The platform enables remote camera control for monitoring point

selection, streamlining maintenance operations.

3.1.2 agree on

For the sake of convenience, this manual adopts the following conventions:

Software/Systems: Z8 Cloud Server software.

Host: Z8 host.

Deformation value: Cumulative deformation value.

Scatterplot/Intensity Map: These are equipment reflection intensity renderings derived from data processed by the equipment hosts monitoring output. Both scatterplot and intensity map belong to the same category of images, differing only in terminology.

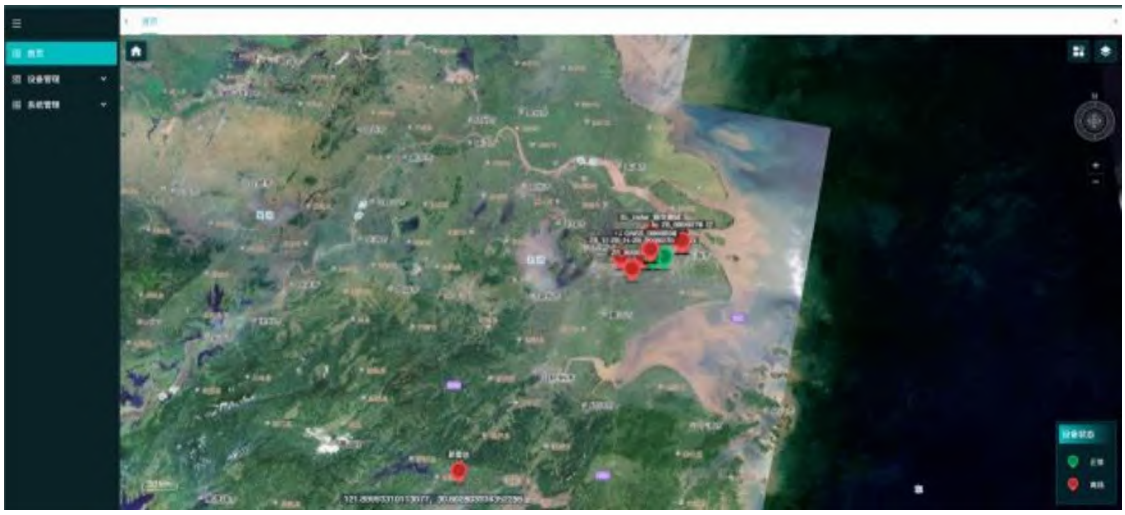
Deformation map: A visual rendering of the monitored areas deformation status, generated from the cumulative deformation data collected by the equipment host and processed through data analysis.

DEM: Digital Elevation Model data of the equipment host location.

3.2 Software login

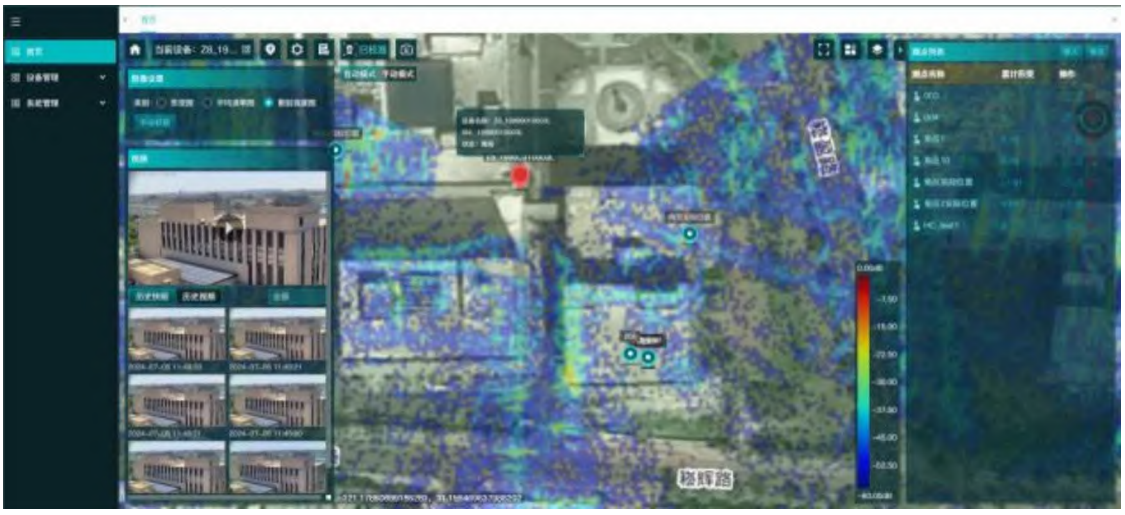
3.2.1 Software login

Access zms.iot-monitor.cn:10000/home in your browser. To log in, contact the operations team for your account credentials. The software login interface is shown below:



3.2.2 Introduction to the software main interface

The software organically integrates most functions into the main interface, with simple and quick operation that is clear at a glance. Users can master all operational skills in a short time.



The main functions include:

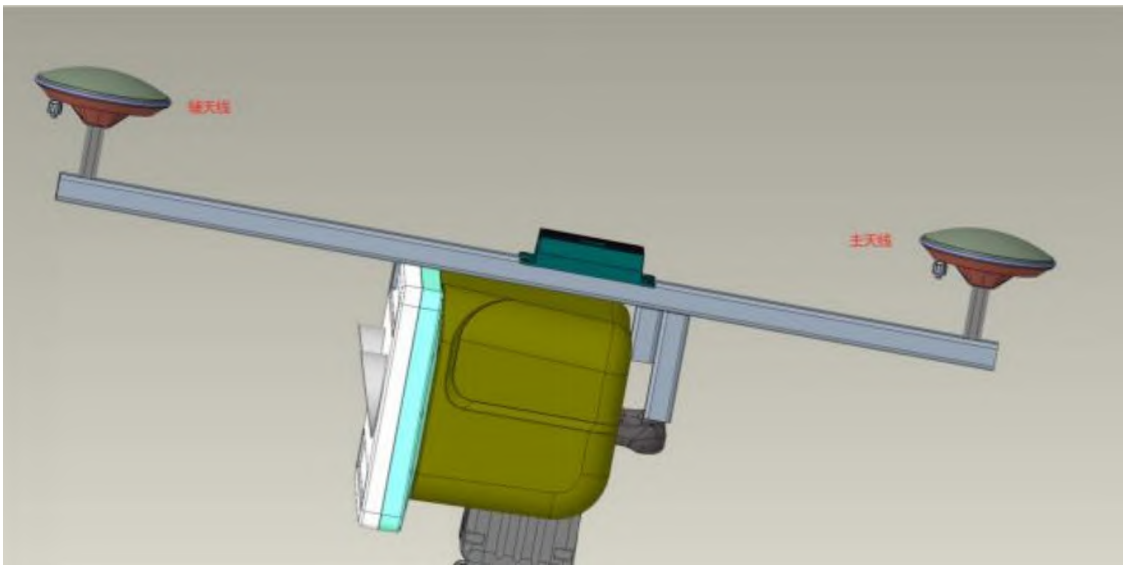
- The setting and inquiry of the operating parameters of the host;
- radar host control;
- The status of equipment operation is displayed;
- Switch intensity map, deformation map, and average velocity map
- Switch between real-time mode and historical mode for deformation and average velocity graphs
- Edit and annotate monitoring points

- Edit warning threshold
- Role permissions management
- Communication log management
- View QR code data on the go
- Fixed-point capture, video calibration, video viewing, scheduled capture, and alert capture
- coordinate location and distance measurement
- angular discrimination

3.3 Setting and Control of Radio Host Parameters

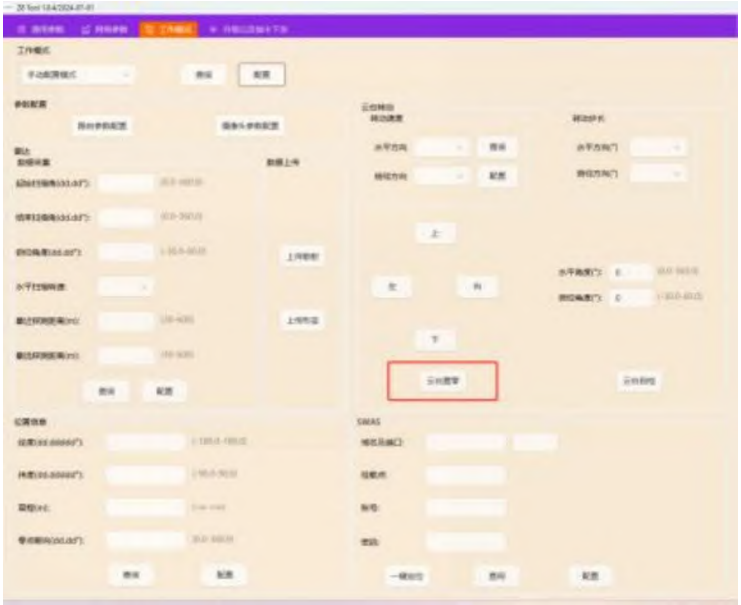
3.3.1 Location and orientation configuration

After initial equipmentinstallation or relocation, reconfiguration of positioning and orientation is required. The Z8 currently utilizes an external positioning and orientation module for this operation, as shown in the installation diagram below.

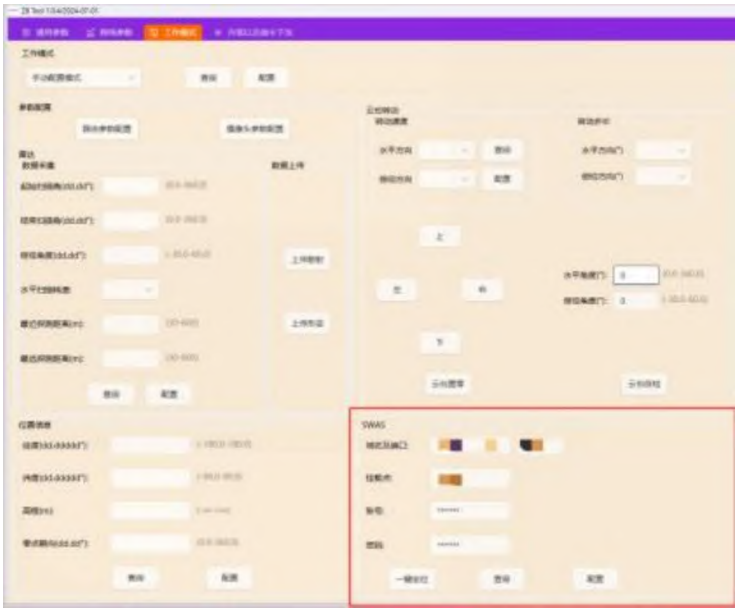


1）Connect the positioning and orientation components by securing two antennas to opposite ends of the positioning rod, then connect them to the CGI230 (GNSS host) via the matching feeder. Note: Connect the antennas to the main and auxiliary antenna interfaces specified on the CGI230. Failure to do so will cause an azimuth deviation of 180° and compromised positioning accuracy.

2) Set the Z8 to the origin position. During initial setup, the equipment defaults to the origin and requires no configuration. For subsequent installations where the equipment is not at the origin, connect it via Ethernet and use the equipment host computer to configure it. Follow these steps: [Working Mode] → [Manual Configuration Mode] → [Pan-Tilt Zeroing].



3) Enter the available SWAS/CORS parameters to obtain differential data for rapid RTK positioning and orientation.



4) After configuration, connect the 7-pin data cable on the positioning and orientation component to the equipment, as shown in the figure below.

5) After ensuring the network indicator light (second from the left) stays on, click [One-Click Localization] on the host computer and wait for the localization to complete. The process usually takes 2-3 minutes. During this time, the localization indicator light will flash, and it will remain on after successful localization.

3.3.2 Scan range configuration

1) Manual configuration range

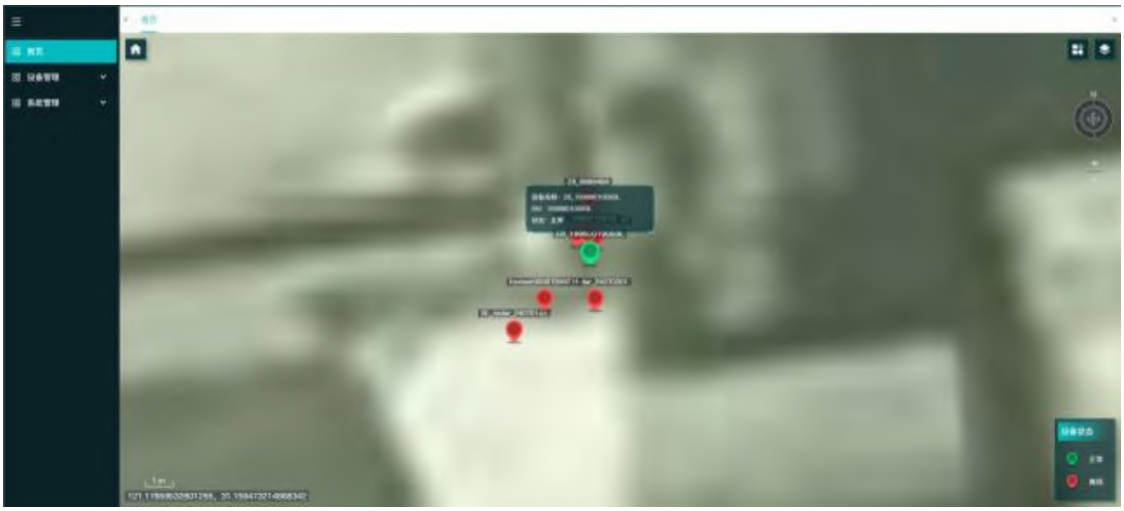
Step 1: Configure the equipment scanning range using the host computer via the following sequence: [Working Mode] → [Manual Configuration Mode] → [Data Acquisition].

Step 2: Check the current scanning parameters. These are the default settings during initial installation and can be adjusted according to the

actual scanning range on-site.

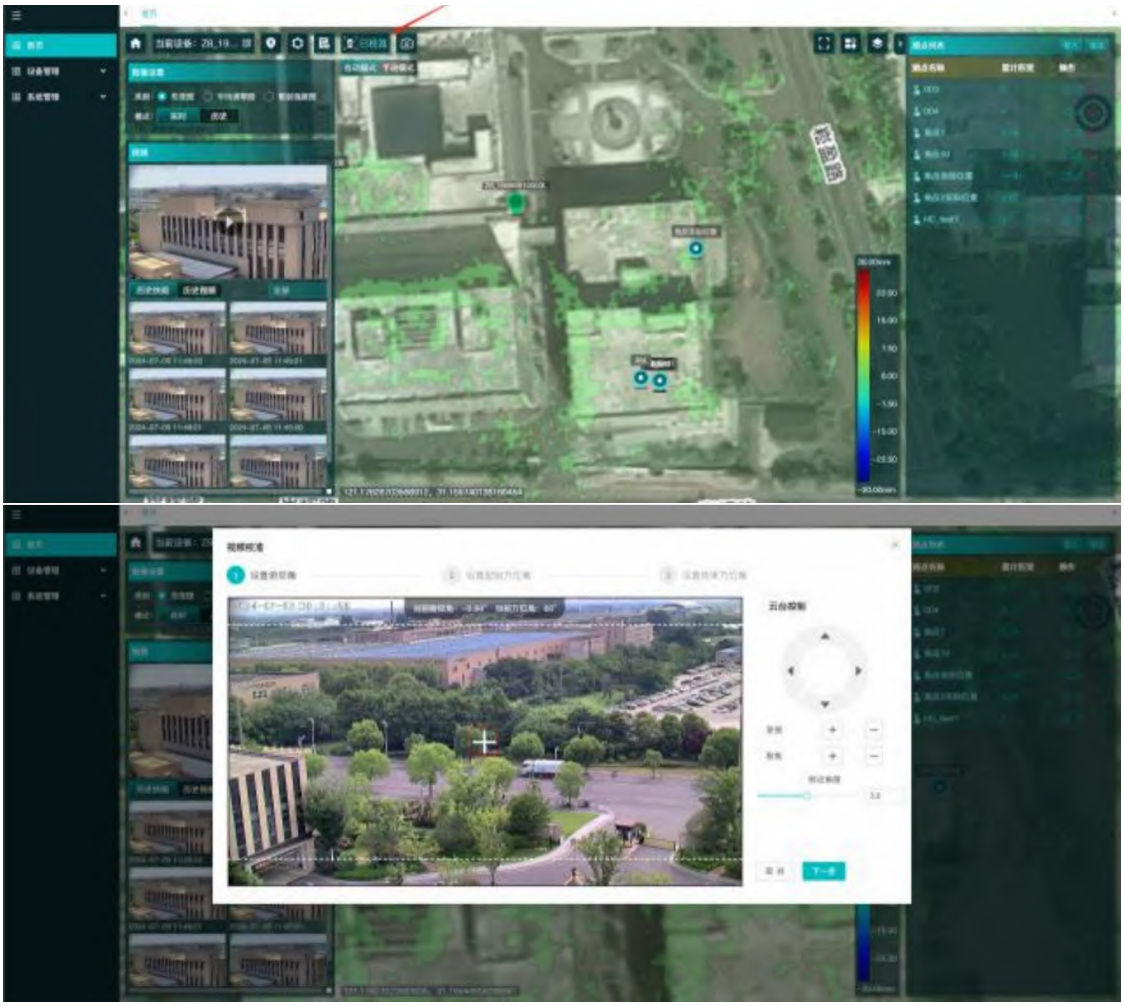
2) Visual configuration range

Step 1: Log in to the ZMS platform and search for the device by its geographic coordinates. The following diagram illustrates this process using a test device as an example.



step2: If the device is in automatic mode, switch to manual mode (click the manual mode button). The device defaults to manual mode at the factory.

Step 3: Tap Video Calibration and wait for the camera to wake up and start sending video.



Step 4: Depending on the actual field conditions, you can perform zooming and pan/tilt control. First, configure the pitch angle according to the page instructions. If the current scanning range doesnt meet the

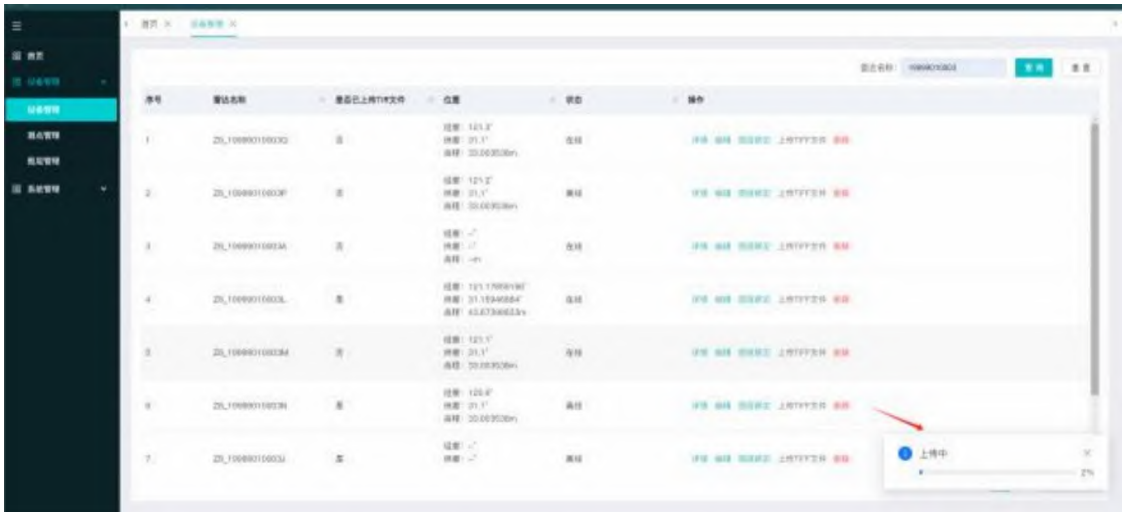
field requirements, adjust the pan/tilt head vertically in step increments until the target pitch angle is achieved. Click Next to set the starting azimuth angle, then rotate the equipment head to reach the desired starting angle. Continue to the next step to complete the azimuth scanning. Click Finish to save the current pitch angle and azimuth angles as scanning parameters.

3.3.3 Upload TIFF file

Log in to the platform, click [Device Management] → [Device Management], and search by equipment SN number. The following figure shows a test device as an example.

During initial setup, the [TIFF file uploaded] option shows as No. You need to upload the 3D model as a TIFF file.

Click [Upload TIFF file], select the data to upload, and wait for the upload to complete.

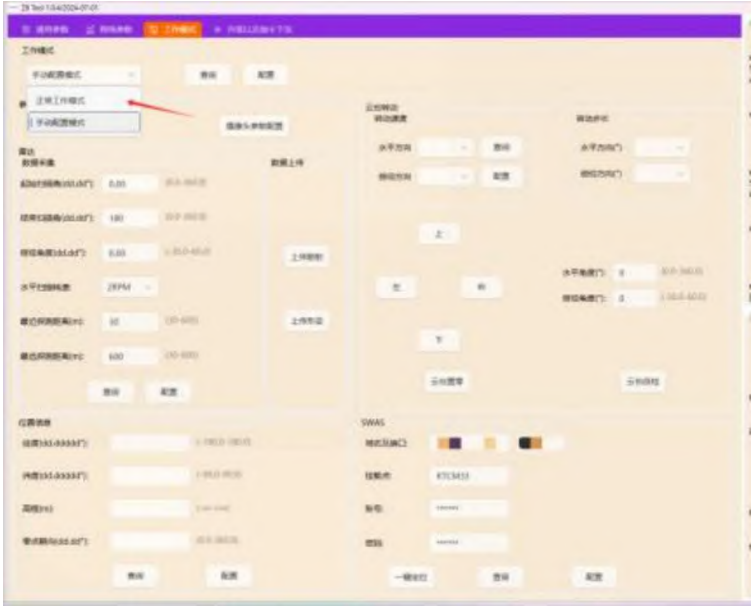


3.4 Switch work mode

The device is initially configured in [Manual Mode] to prevent initialization (i.e., rotational scanning) upon power-on, which may cause wire harness entanglement or equipment instability-induced collisions. After completing the aforementioned steps, ensure that equipment positioning, orientation, and scanning range are properly configured before switching to [Normal Mode]. Once switched to Normal Mode, the equipment will periodically collect data and upload it to the platform.

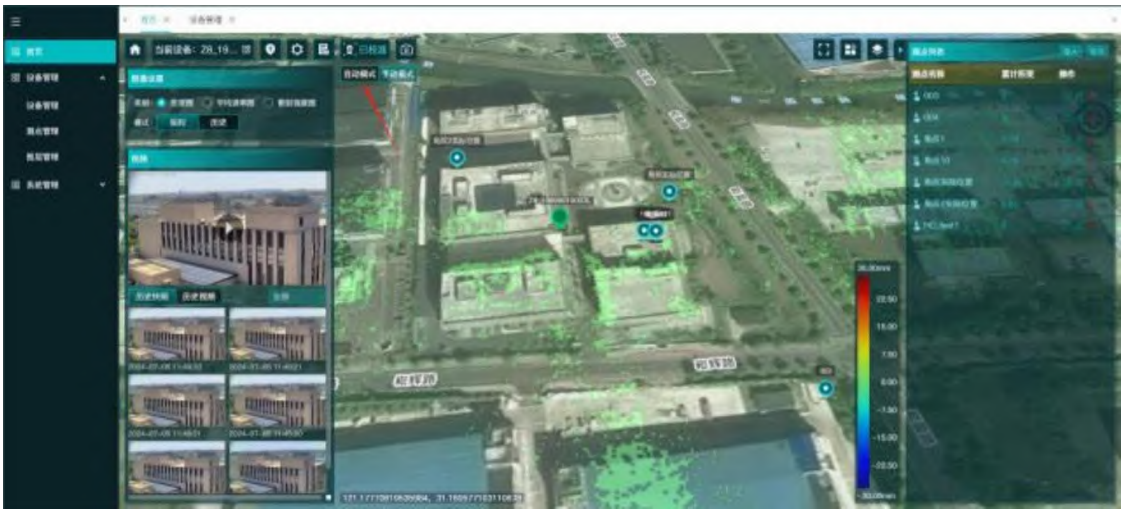
1) Switching of host computer configuration

Connect the network cable to the equipment.The host computer establishes a TCP connection. Click [Working Mode], select [Normal Working Mode], then click [Configure] to complete the mode switch.



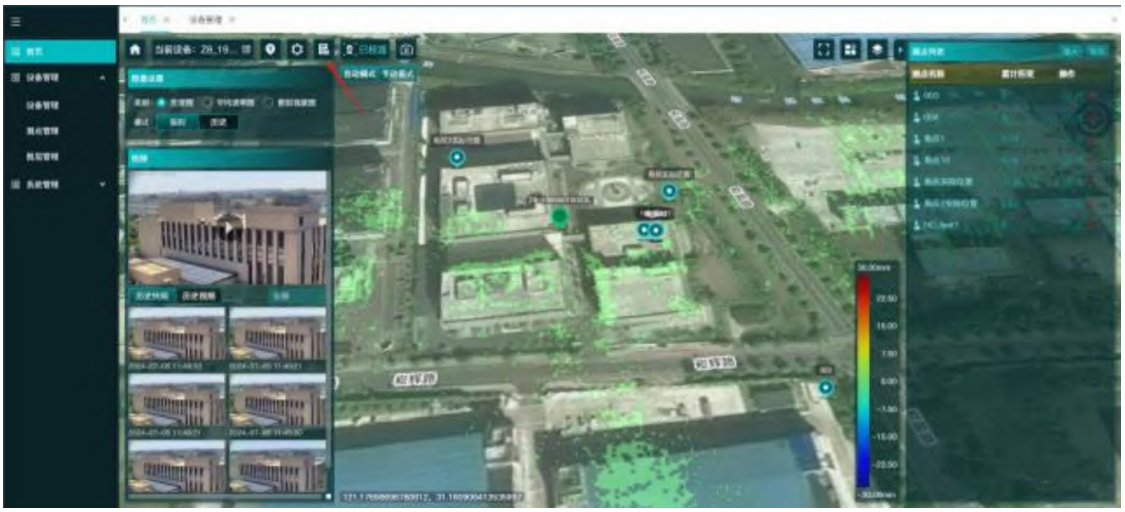
Platform configuration switch

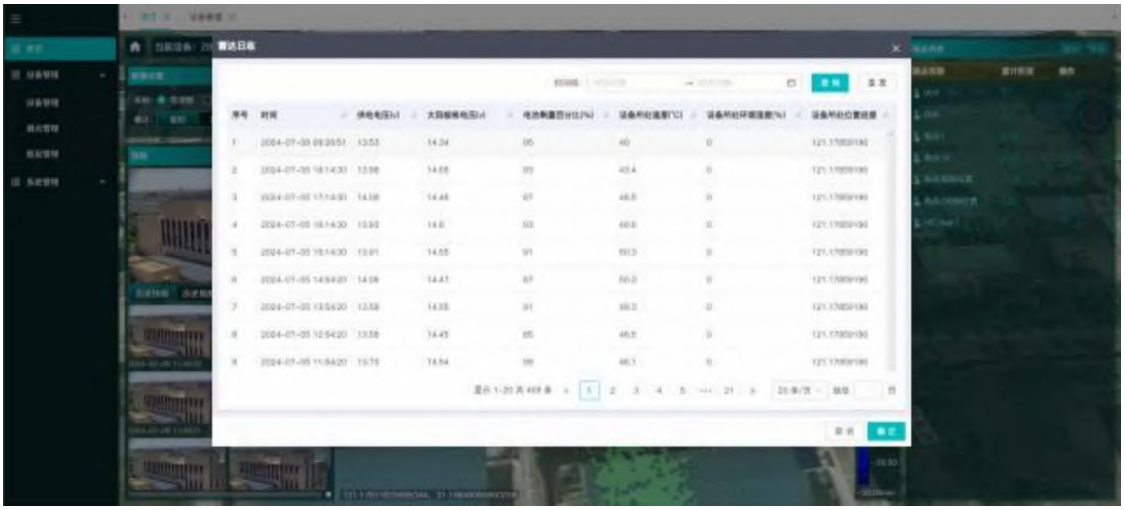
The platform locates the device by coordinates. Click the device icon and select [Auto Mode]. The system will then send commands to the equipment to switch its operational mode.



3.4.1 Communication log

The platform displays the status information of devices uploaded regularly, with a default upload interval of one hour. Click the [Log Information] icon, as shown in the figure below:





3.4.2 Alarm mode

1、 Alarm Mode 1

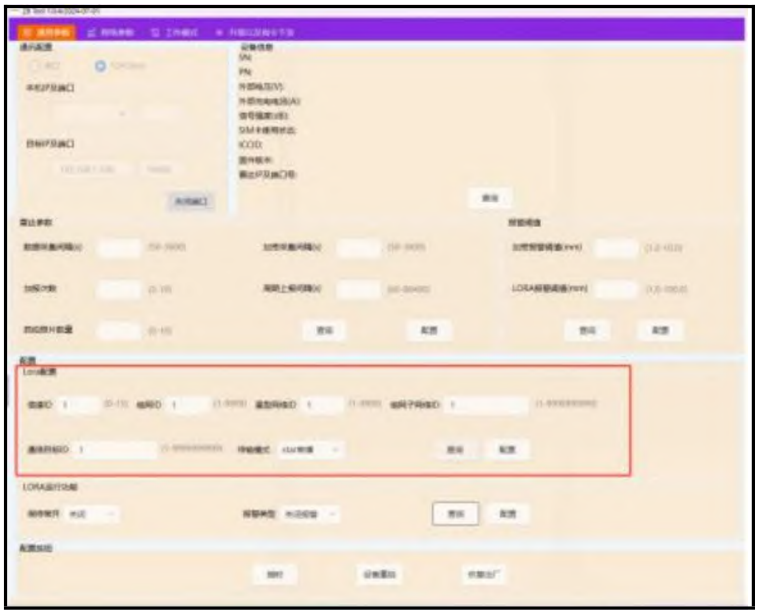
1) Logical Introduction

The device can implement alarm functionality through self-organizing networks. The logic is:

The device scans deformation data every 5 minutes, storing it in its cache. When the difference between the 13th data packet (current) and the first packet exceeds the alarm threshold (30mm), an alarm will be triggered if alarm mode is enabled.

2) Pattern Configuration

Step 1: Launch the host computer and configure the network.



Step 2: Configure the operation function. By default, it is disabled. Select Always On for the Keep Always On option, choose Normal Alarm for the alarm type, then click Configure.

2、 Alarm Mode 2

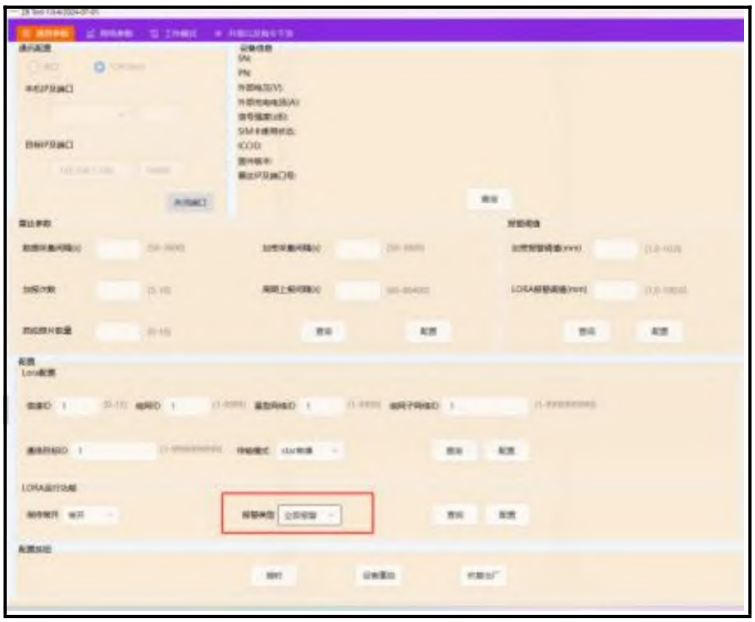
1) Logical Introduction

When on-site acceptance is required, a rapid alarm function should be implemented. This feature enables quicker alerts compared to the standard alarm mode, which requires at least one hour to activate.

When the real-time alarm mode is enabled, the system will trigger an alarm immediately if Deformation exceeding the trigger threshold (default 4mm) is detected during two consecutive scans.

2) Pattern Configuration

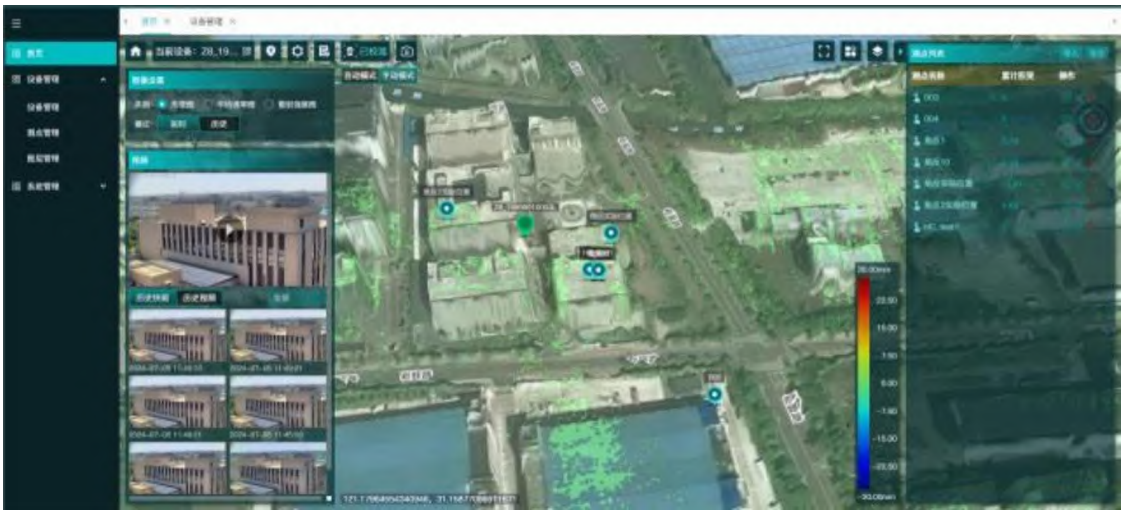
See 3 for the remaining steps. 3.6.1 Select the alarm type as [Immediate Alarm].



3.5 Basic software operations

3.5.1 View Deformation Diagram

Click the equipment icon to view the deformation map based on the latitude and longitude query device. You can switch between real-time and historical data views according to your needs.

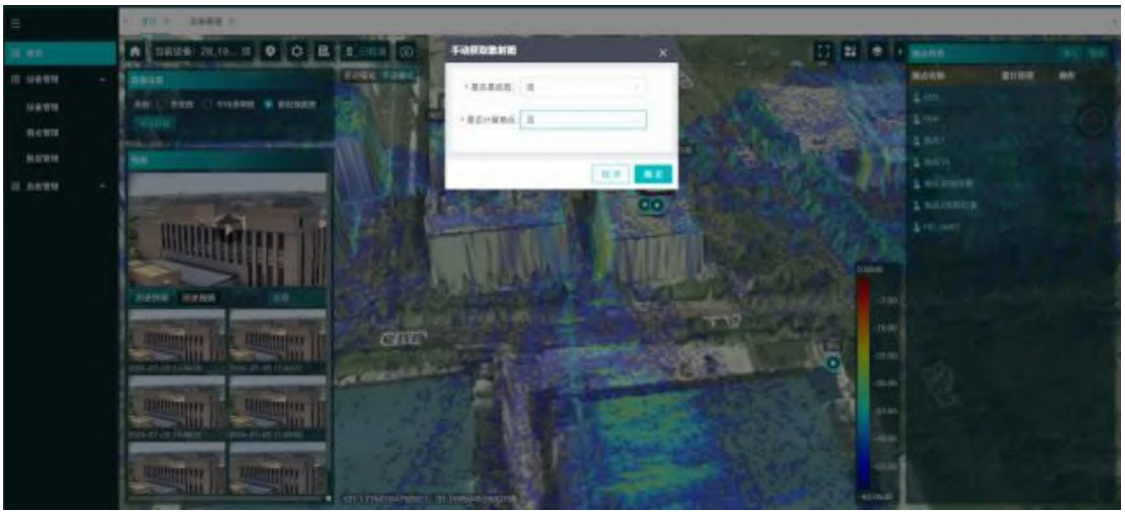


3.5.2 View scatter plot

Equipment does not upload scatter maps by default. Users can obtain them as needed. To view scatter maps, configure to [Manual Mode] and click [Manual Obtain].

1) Do not recognize corner reverse acquisition

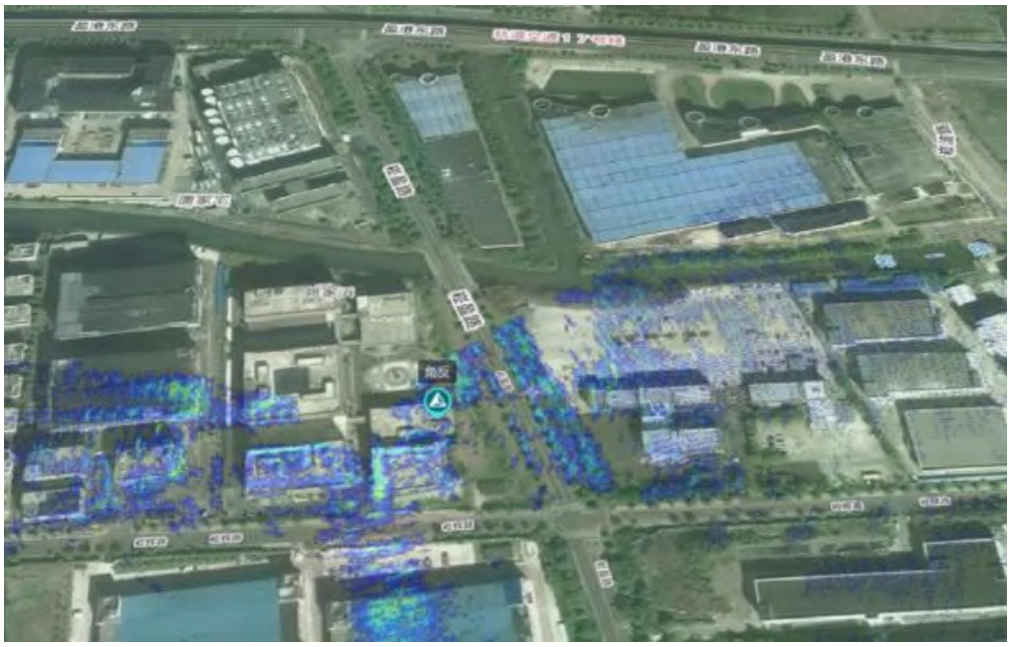
To manually acquire scatter maps without angle recognition, follow these steps: Click [Manual Acquisition] → [Is it a base map?] and select Yes. After the platform issues the command, it will send the equipment to scan the scatter data and transmit the results. Wait 5 minutes for the platform to generate the map.



2) Identify the corner angle and obtain it

The platform supports automatic corner reflection detection. To enable this feature, users must scan twice: first for the base map, and second for the corner reflection (which should not be within the scan range). Configuration steps: [Manual Acquisition] → [Is Base Map?] (Select Yes), then wait for the equipment scan to complete and upload scattering data.

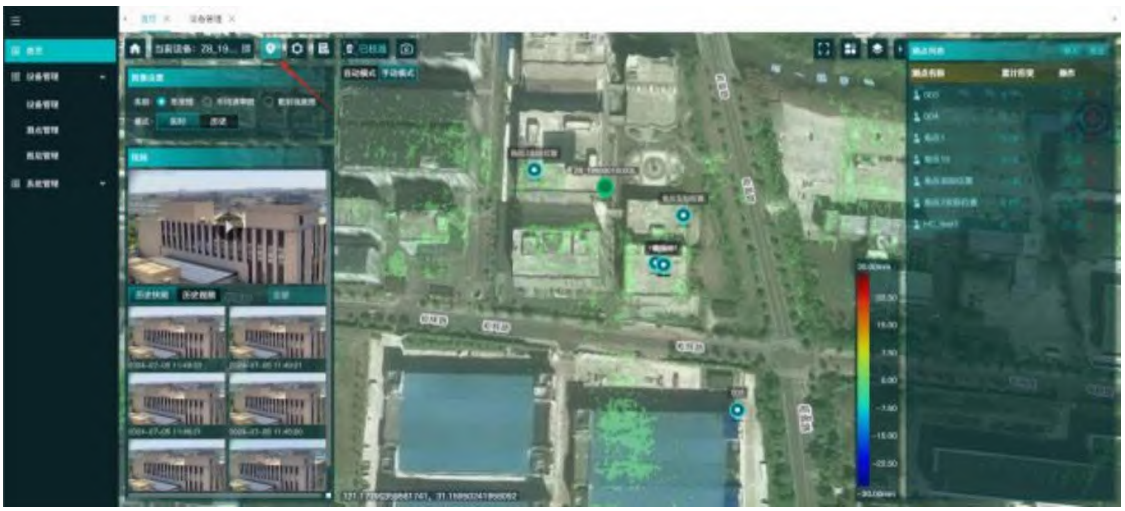
After 5 minutes, deploy the corner reflector at the target location and scan again. Configuration steps: [Manual Acquisition] - [Is it a background map?] Select No- [Is corner reflector calculated?] Select Yes. Wait for the equipment scan to complete and upload the scatter data. Once corner reflector recognition is complete, check the scatter map and the corner reflector icon will be marked.

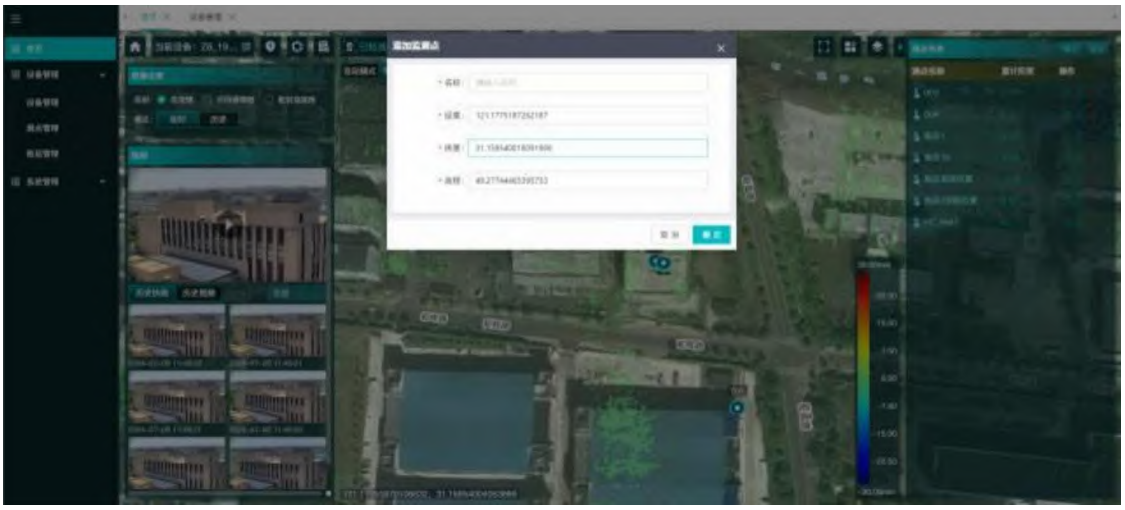


3.5.3 Add monitoring points and view data

After the deformation map is generated, the platform supports adding monitoring points and viewing measurement data.

Step 1: Click the add monitoring point icon, select the location to monitor, click OK, and enter the monitoring point name.





Step 2: Once the measurement point is added, the equipment will upload hourly deformation data for that point. Users can view the data by selecting the corresponding point from the measurement point list on the right.

3.5.4 Query and write configuration parameters

The platform supports setting and writing common configuration parameters. Supported parameters include:

1) orientation and positioning parameters

SWAS/CORS information

2) Rotational speed, start/stop azimuth, nearest/farthest distance, pitch angle, equipment base elevation

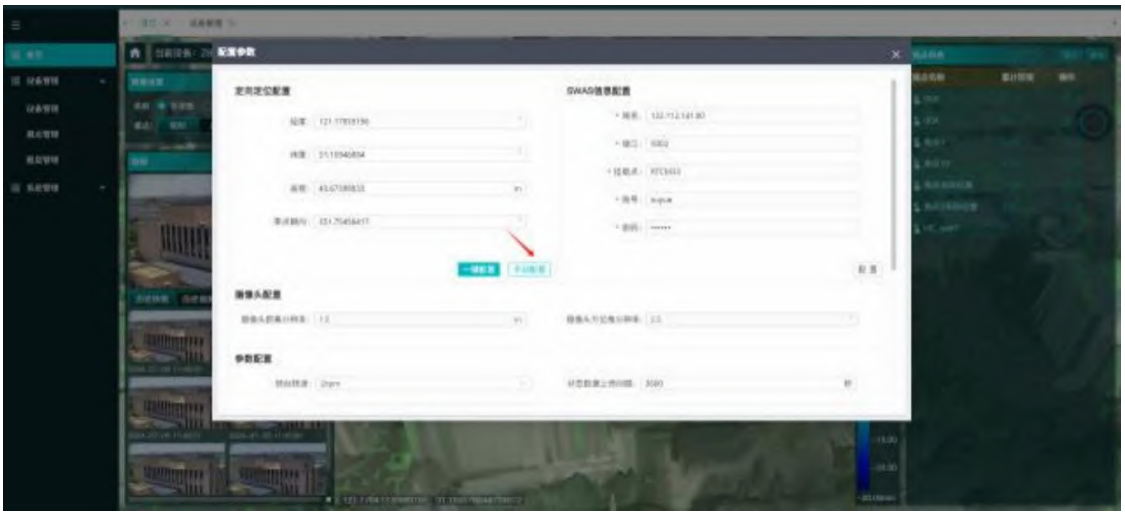
Status data upload interval

3) Equipment jamming acquisition, data timing acquisition, upload interval

4) Encryption alert threshold, alarm threshold, report frequency, and image capture count

3.5.4.1 Configuration of Positioning and Orientation Parameters

The platform supports manual input of latitude, longitude, elevation, and azimuth data into the equipment. Before writing, ensure the information is correct to avoid potential imaging errors.



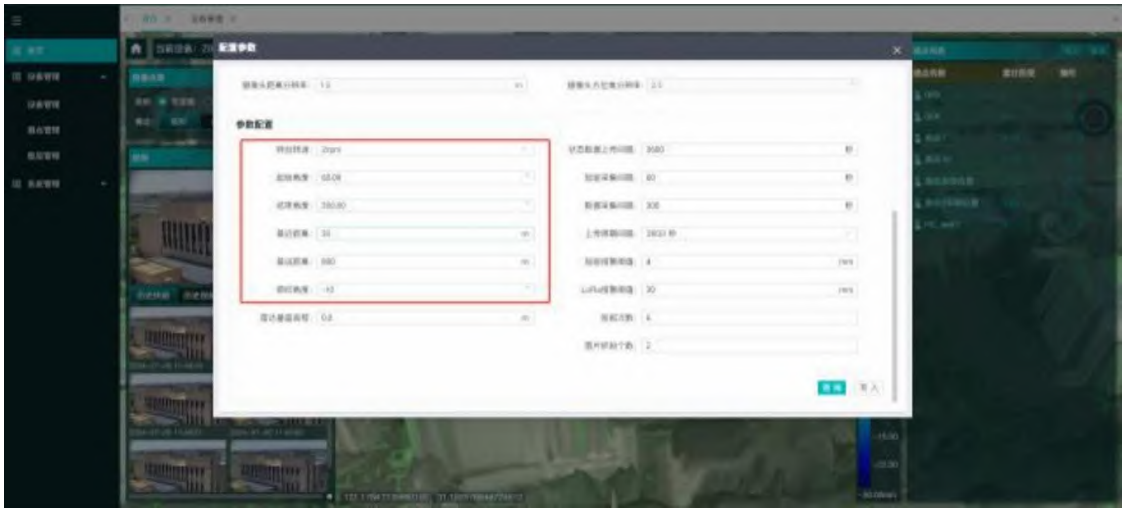
The platform also supports automatic positioning and targeting. Before configuration, ensure the external positioning and targeting components are properly connected (see connection diagram in 3.3.1) and that SWAS/CORS information is configured. Click [One-click Configuration] to enable automatic positioning and targeting.

3.5.4.2 SWAS/CORS Parameter Configuration

The platform supports remote configuration of SWAS/CORS parameters. Before positioning and orientation, configure the available SWAS/CORS information in advance. Password information is hidden.

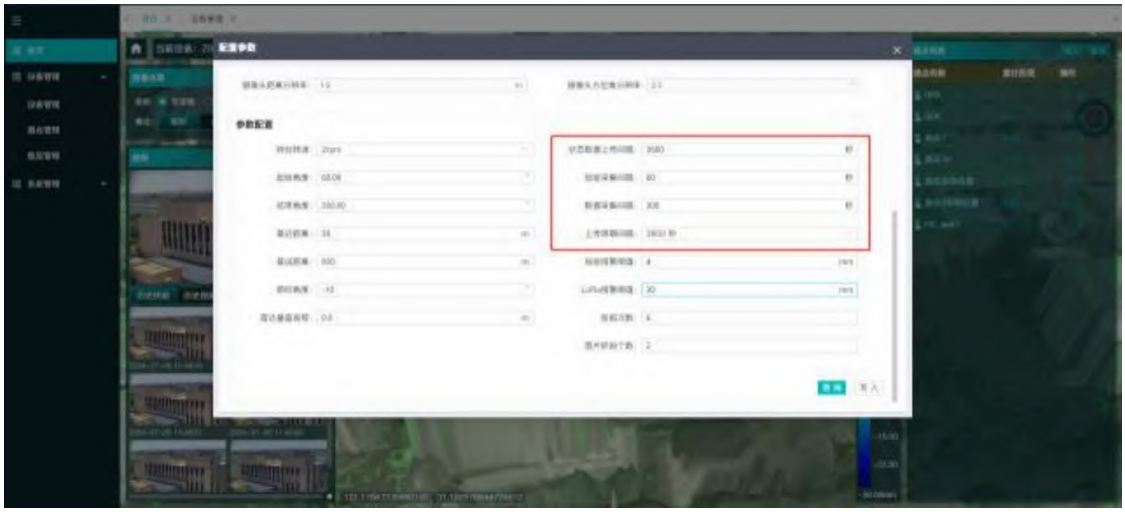
3.5.4.3 Scan Range Configuration

Configure the expected start and end azimuth angles, pitch angle, and minimum/maximum scanning distance based on the actual scanning range. Note: The platform restricts invalid inputs. If the input parameters are abnormal, check whether the characters are valid.



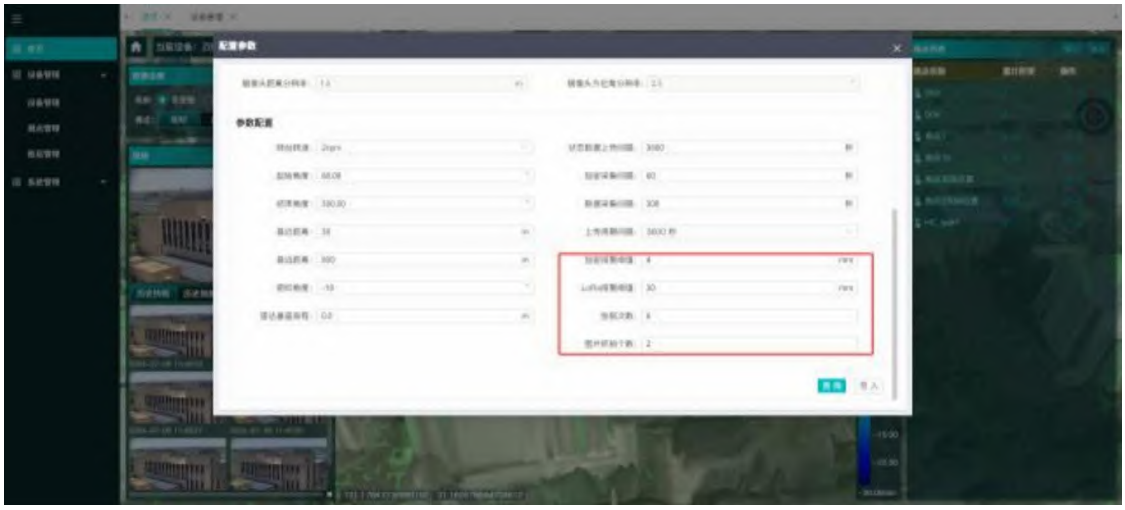
3.5.4.4 Interval Settings

The platform allows configuration of data collection and upload intervals. Status data indicates equipment parameters including power supply voltage, signal strength, and operational status of components (e.g., cameras, equipment units, and pan-tilt units). The encryption interval activates when monitoring points exceed predefined thresholds, while the data collection interval enables regular deformation data acquisition. The upload cycle interval controls periodic transmission of monitoring point deformation data. These settings generally require no modification and should operate at factory default parameters.



3.5.4.5 Threshold Setting

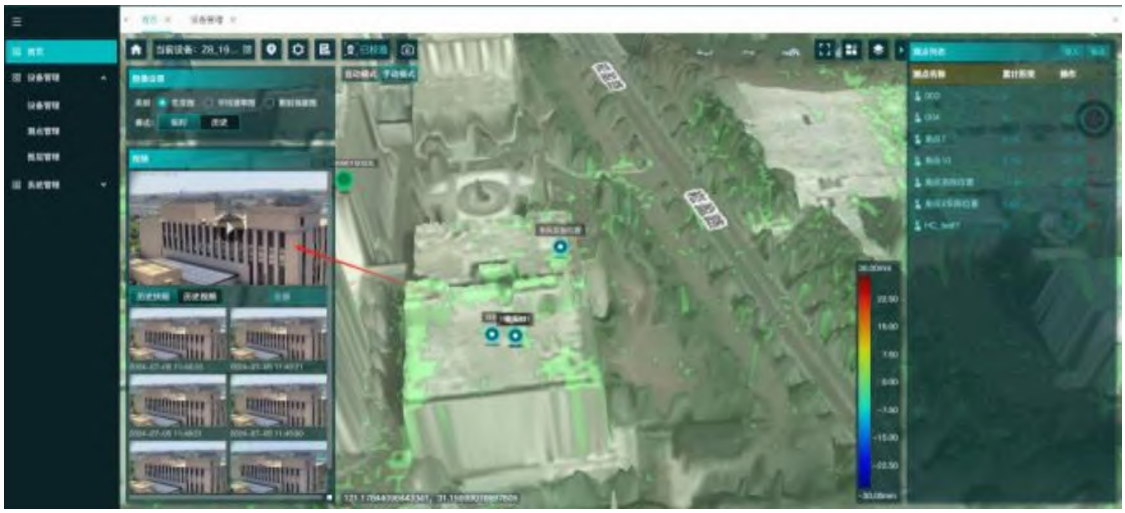
The platform supports configuring encryption warning thresholds and alarm thresholds. Configure them based on actual Deformation conditions, or run with factory default parameters [encryption warning threshold 4mm, alarm threshold 30mm].

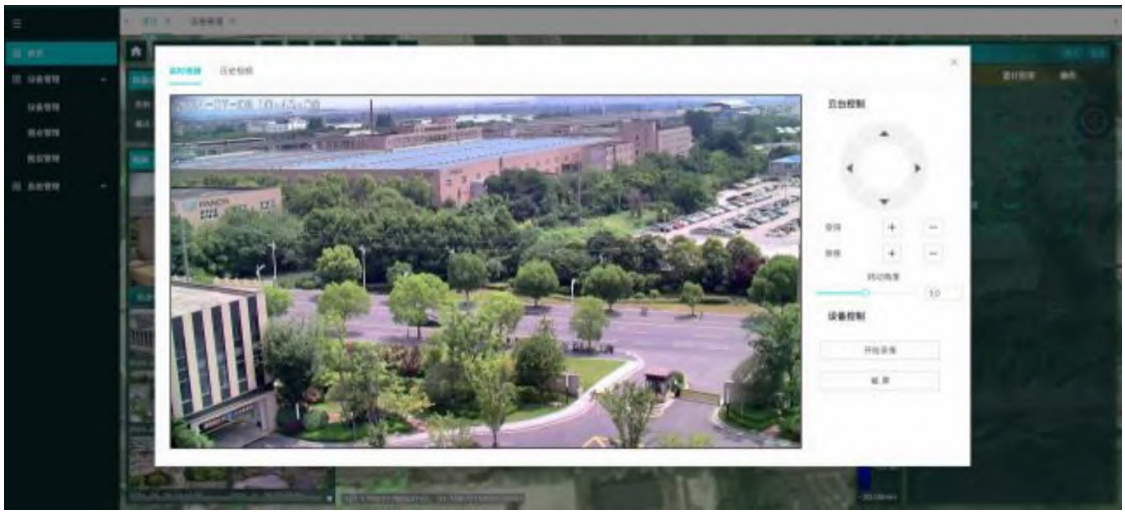


3.5.5 Video

The platform supports remote viewing of live videos with a 3-second time limit. Users can click the video interface to view it. During viewing, users can save the video locally (limited to 30 seconds) or take screenshots.

To proceed: Select [Manual Mode], tap [Video], and wait for the camera to wake up and the video to upload.



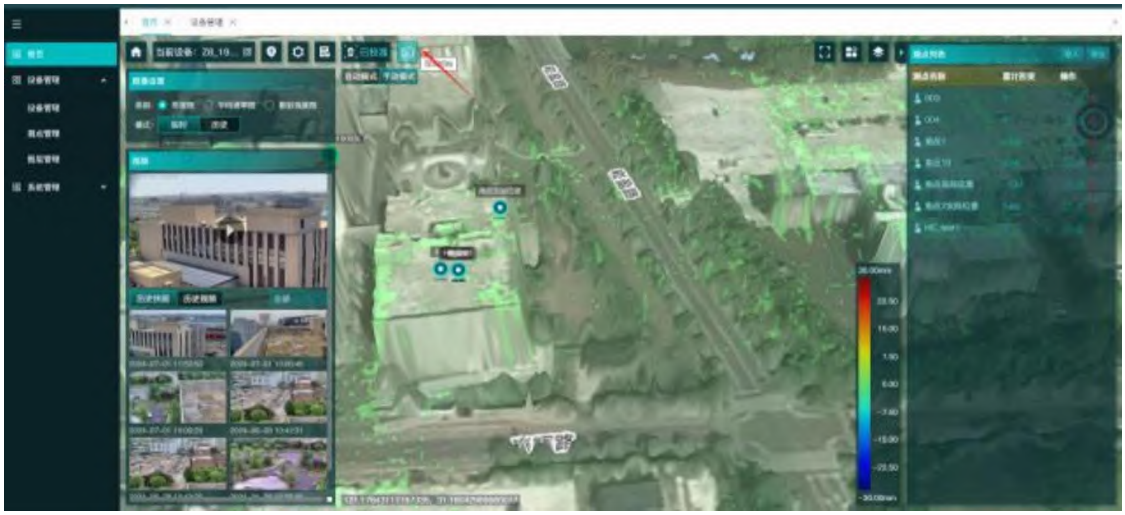


3.5.6 View historical images

The platform allows viewing images uploaded in the devices history, categorized as fixed-point snapshots, corner recognition images, scheduled reports, and more.

1) Capture images at fixed points

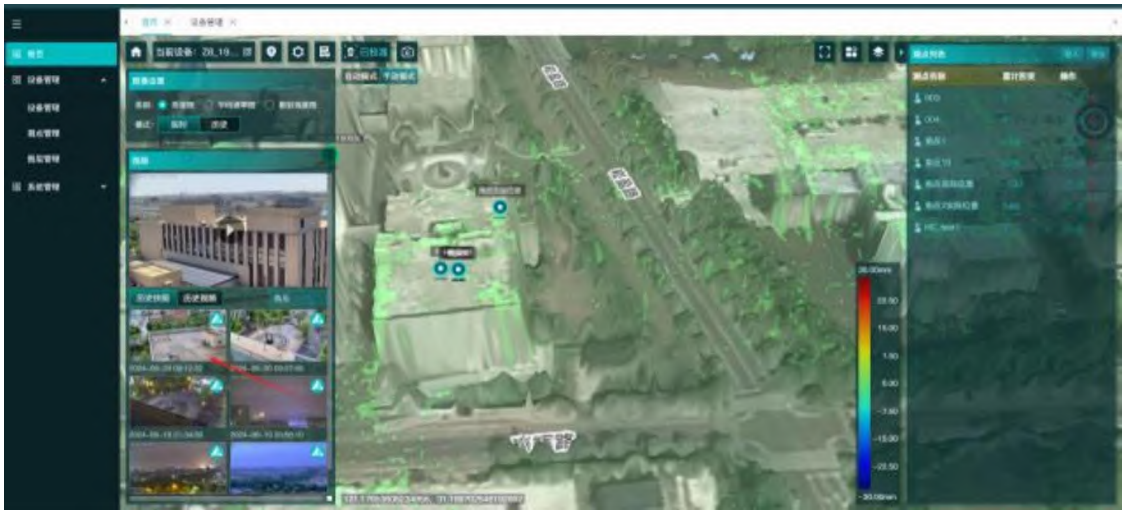
Users can take location-based snapshots as needed. Click the [Location-Based Snap] icon (see the image below) to select the target spot. The system will upload the captured image to [Historical Snapshots] after the process is complete.



2) Angle recognition image

When viewing a scatter chart with corner reflection detection

enabled, the platform will automatically capture the corner reflection and upload it to [Historical Snapshots] after the detection completes. Users can then check if the image contains corner reflections.

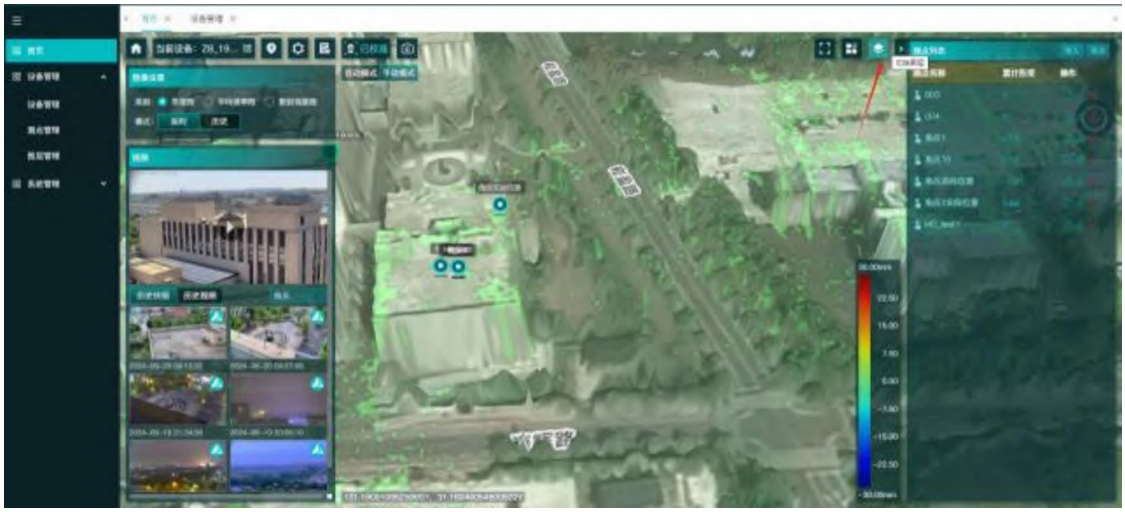


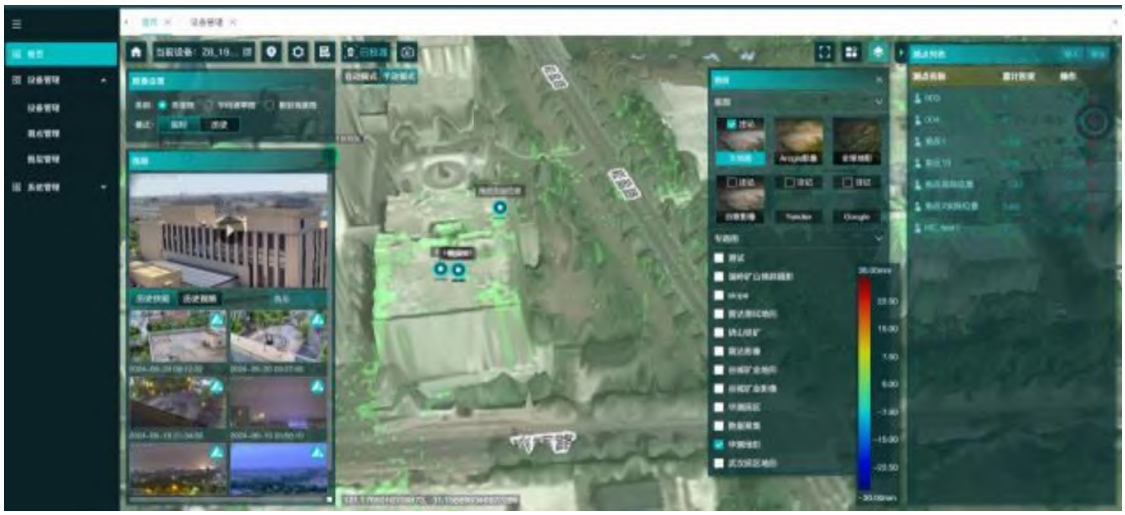
3) Report images at regular intervals

When users add monitoring points to the platform, the equipment will upload the images of these points at 10:00 daily and save them to the [Historical Snapshots].

3.5.7 Select layers and thematic maps

Click the [Switch Layers] button to select the appropriate base map and thematic map as needed. The thematic map is used to generate 3D views for stereoscopic imaging.





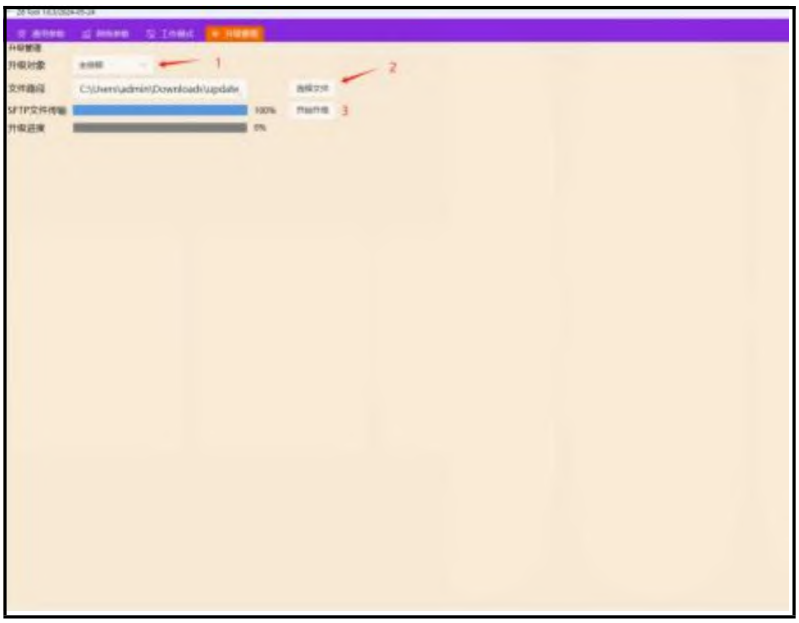
3.6 Basic operations of host computer

3.6.1 Network port upgrade

3.6.1.1 Mainboard Upgrade

1) TCP CLIENT connection host

2) Click [Upgrade Management], select the main control board as the upgrade target, and choose the files to upgrade

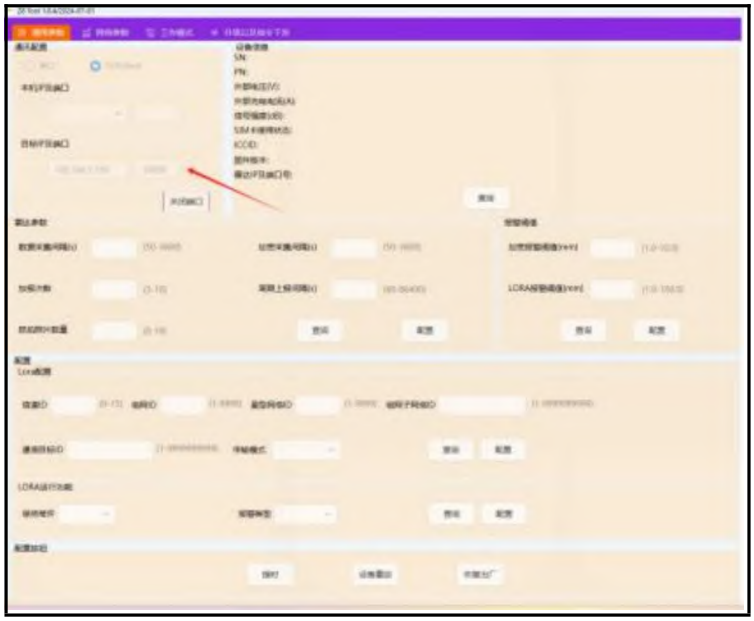


3) Click [Start Upgrade] to transfer the firmware to the specified file directory. The device will then restart and the TCP connection will be disconnected.

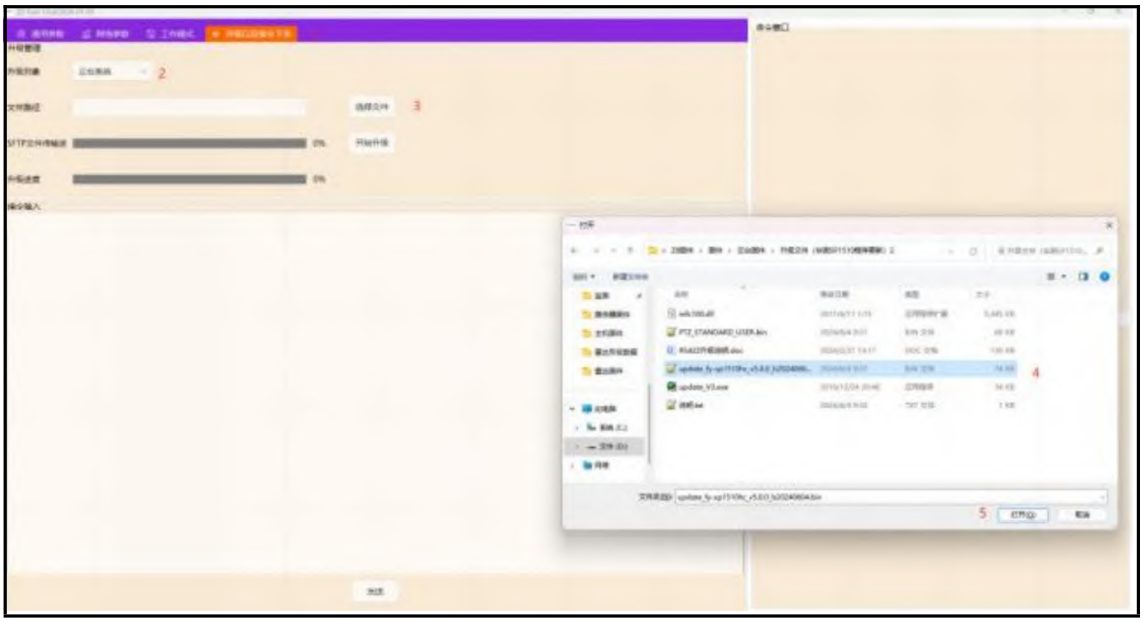
4) Wait for the device to restart and complete the upgrade. After reconnecting the device, check the firmware version.

3.6.1.2 PTZ Upgrade

1) Open the host computer and establish a TCP connection



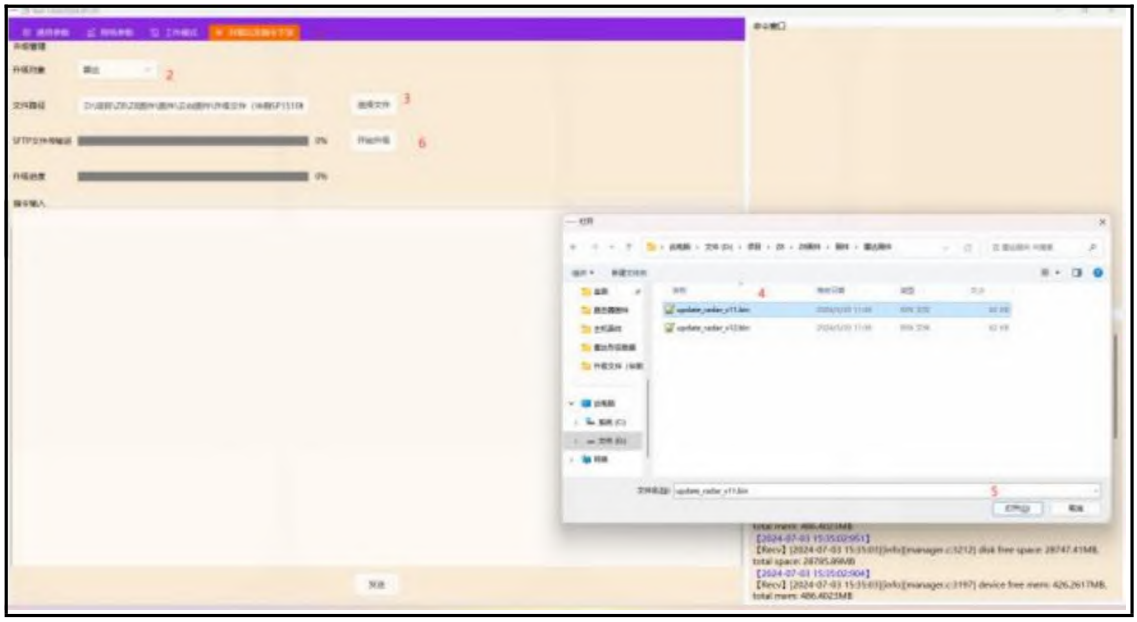
2) Click [Upgrade and Command Issuance] → [Upgrade Target], select the PTZ camera, and choose the file path. (Note: If the firmware prompts Check and import the corresponding firmware later, simply modify the PTZ camera firmware name to include the keyword update_fy.)



) Click Start Upgrade and wait for the PTZ upgrade to complete. Note: The PTZ will perform a self-check regardless of whether the upgrade succeeds or fails.

3.6.1.3 Upgrade

1) Select [Radar] as the upgrade target and choose the corresponding equipment firmware (Note: The file name must contain the keyword "update_equipment")

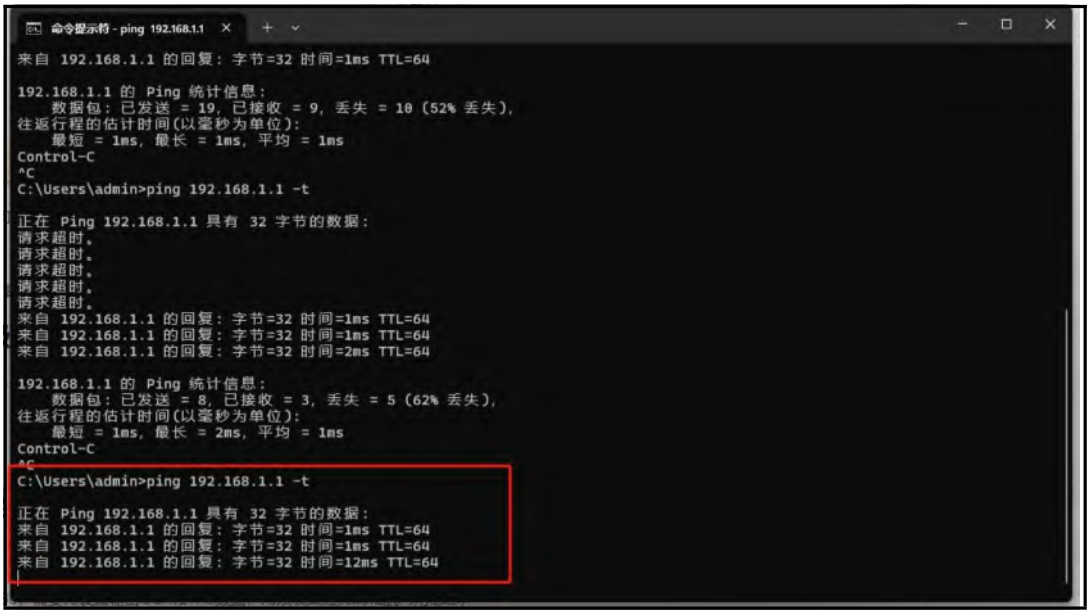


2) Just wait for the equipment upgrade to be completed.

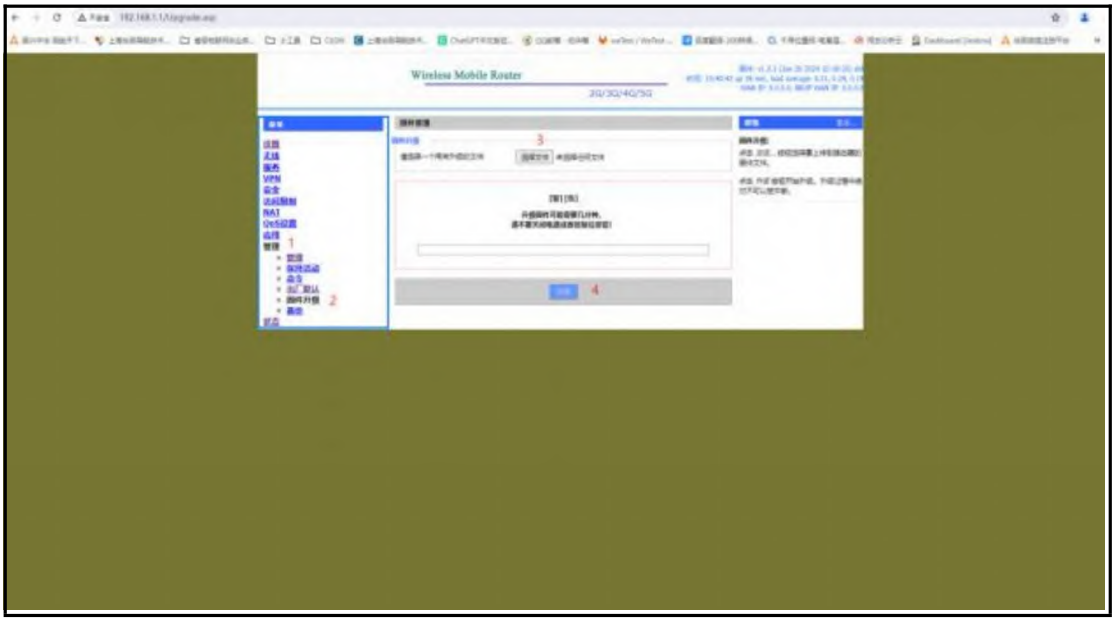
Note: The host computer has a timeout logic for pan-tilt and radar upgrades. The upgrade process should take no more than 2 minutes under normal conditions. If the upgrade fails after 5 minutes, the host computer will automatically mark it as unsuccessful.

3.6.1.4 Router Upgrade

1) Enter 192.168.1.1 in the web browser. Note: The URL may be inaccessible during initial startup. Try using cmd to ping this IP first. Connect only after successful ping.



2) Click [Manage] → [Firmware Update], select the router firmware to upgrade, and wait for the update to complete. Note: As recommended by the router manufacturer, the factory settings should generally be restored after the firmware update.



3.6.2 Device information query

The host computer supports both serial and TCP connections, with most functions being redundant. The following sections will be explained using the Ethernet-TCP connection method. Note: Serial connection only does not support all firmware upgrades or command issuance. Refer to the final TAB

page [Upgrade and Command Issuance].

You can check general information in this interface. See the details below:

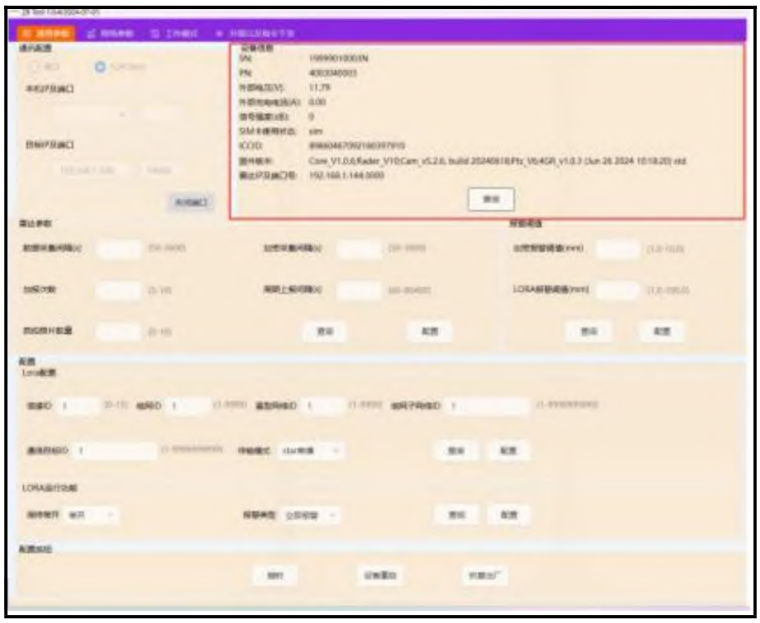
The firmware version includes all module versions:

Core: The main control board, which refers to the firmware version of the host.

Equipment: Firmware version for radar systems;

Cam: Firmware version of the camera;

Ptz: PTZ firmware version;



3.6.3 Equipment Parameter Query and Setting

In this interface, you can set the collection and reporting intervals. These settings are generally not required to modify, as the host machine has already provided the configuration range.

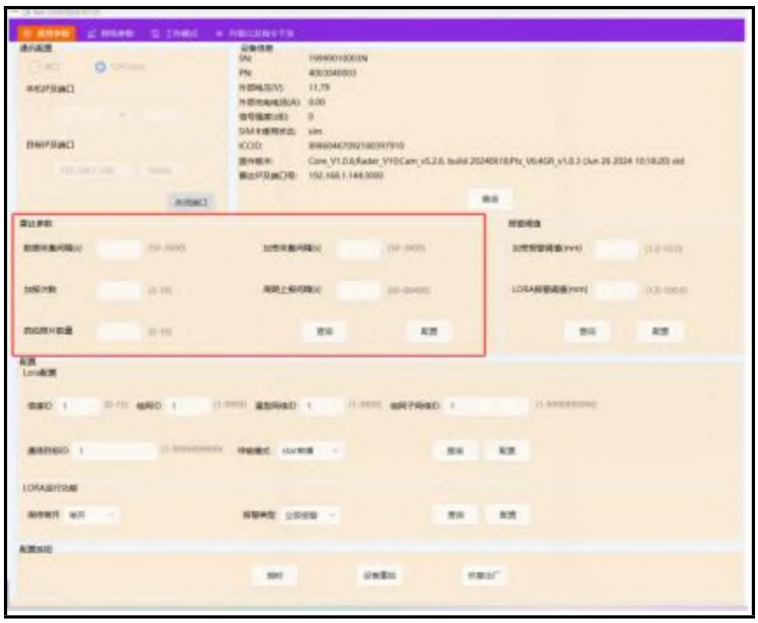
1) Data collection interval: the frequency of equipment scans, default is 300S

2) Encryption collection interval: How often the equipment scans after being triggered. The default is 60 seconds.

3) Report count: The number of encrypted data acquisitions triggered by the equipment, with a default of 6.

4) Periodic report interval: the interval for uploading status data, default is 3600S

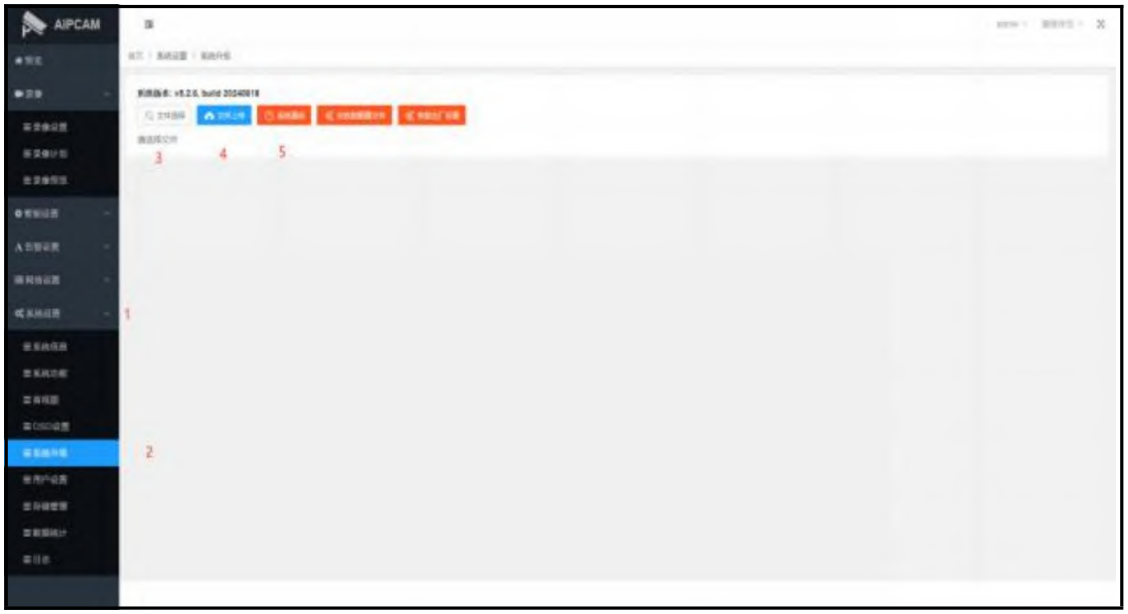
5) Number of snapshots: The maximum number of photos captured per trigger, with a default of 2. For example, if 10 points are detected to have shifted during a scan, the system will sort these points and take photos of the top two.



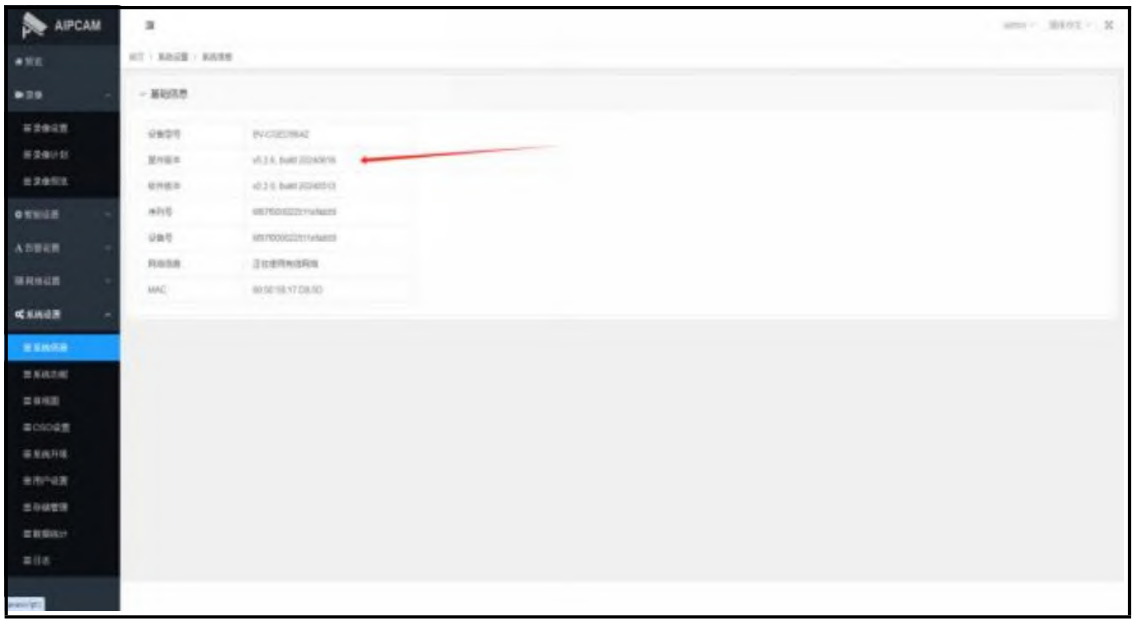
Camera Upgrade

1) Enter 192.168.1.68 in your browser.

2) Go to [System Settings] → [System Upgrade] → [File Selection], select the camera firmware, then click [File Upload]. Wait for the firmware upload to complete. After the upload finishes, click [System Restart] and reconnect to the web page in about 5 seconds.

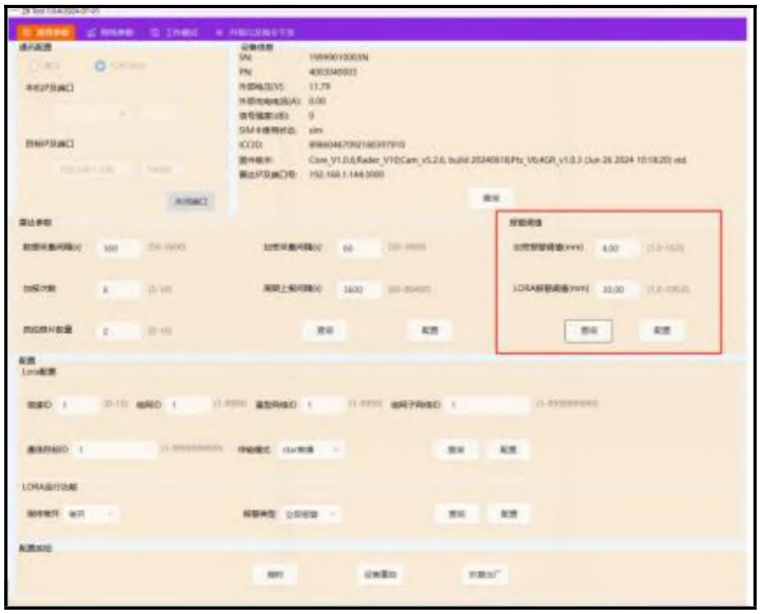


3) Click [System Information] to check if the camera firmware upgrade was successful.



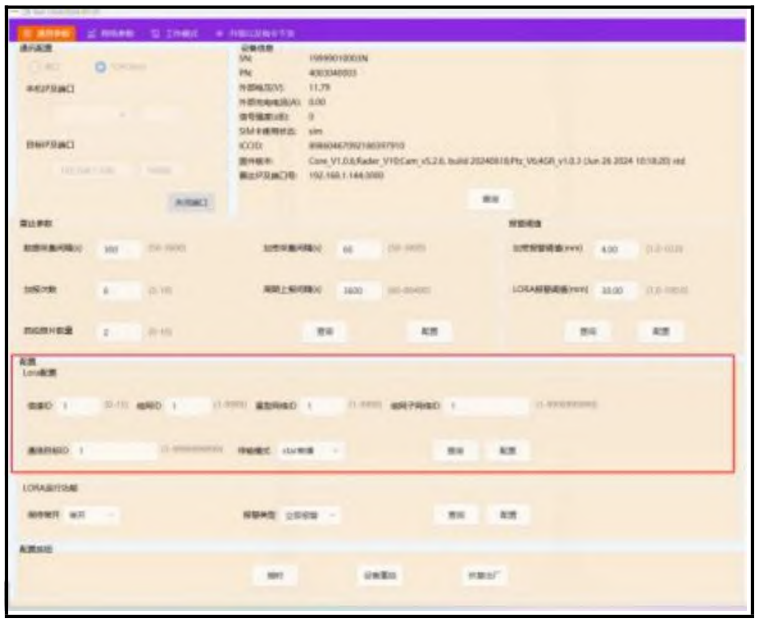
3.6.4 Alarm threshold

As mentioned earlier, when the encryption threshold is exceeded, the device will encrypt data during collection. If the alarm threshold is surpassed, the device will trigger an alarm (provided this mode is configured).



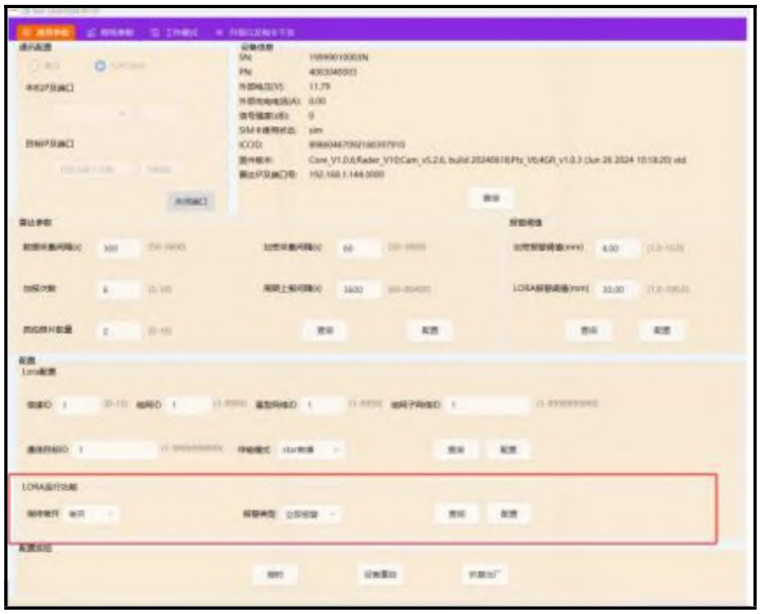
3.6.5 Configure

This is required when configuring networking parameters.



3.6.6 Operation function

Configure the alarm mode, with the detailed logic described in Section 3.3.6.

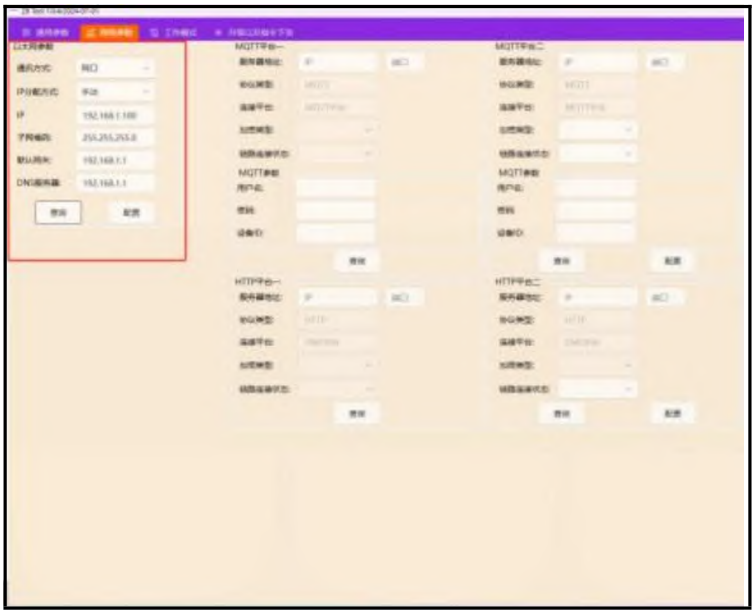


time service

Write the computer time to the device as its time.

Ethernet parameters

No changes are usually required. Proceed with caution!!!



3.6.7 MQTT Platform 1

The default connection address is the IoT platform and usually does not need to be modified.

3.6.8 MQTT Platform 2

It can be used to configure MQTT connections to other platforms.

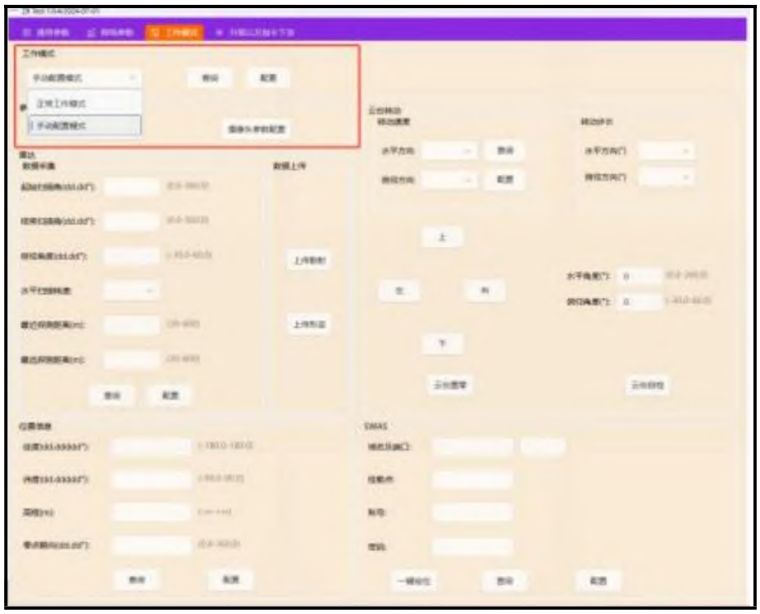
3.6.9 HTTP Platform 1

The default connection address is the ZMS data display platform and usually does not need to be modified.

3.6.10 HTTP Platform 2

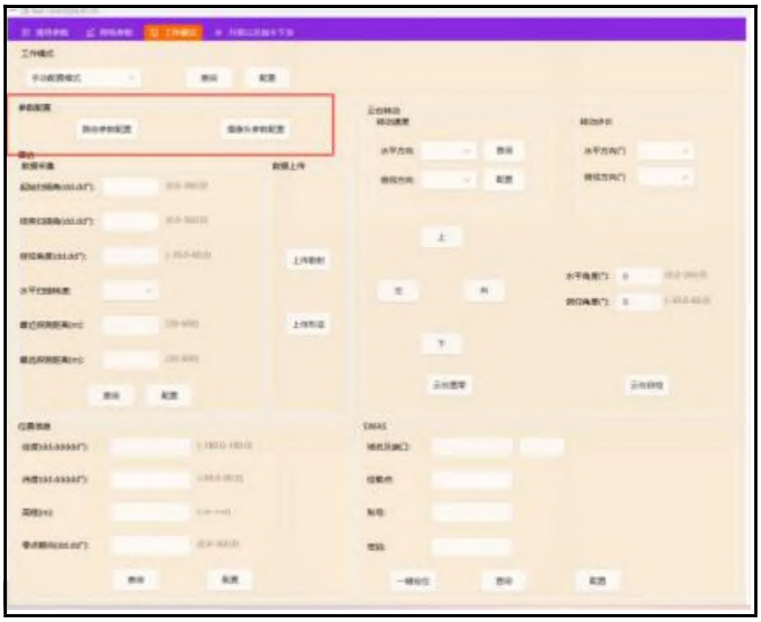
Reserve an interface.

This TAB page cannot be configured in normal mode. Change it to [Manual Configuration Mode].



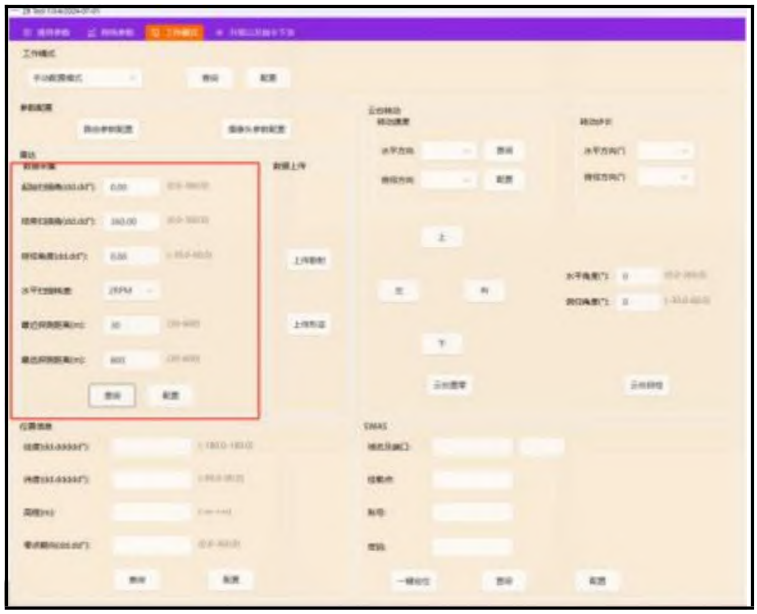
3.6.11 Parameter configuration

To configure a router or camera, click these two buttons to go directly to the web page.



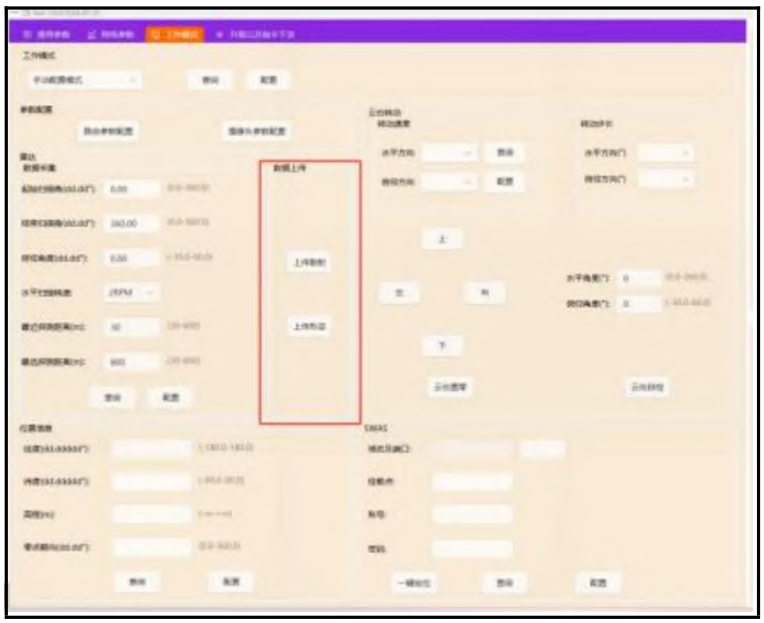
3.6.12 Equipment scanning range configuration

Configure equipment start/stop angle, pitch angle, speed, and minimum/maximum range. The supported range is displayed on the host interface.



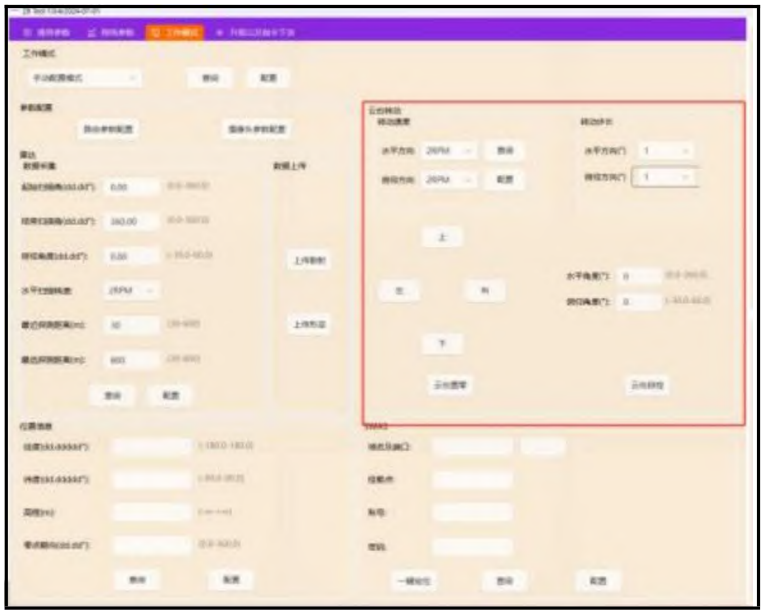
3.6.13 Upload data

Use this button to upload deformation and scattering data. Note: Scattering data cannot be uploaded if the equipment initialization is incomplete. (Initialization: Complete 13 cycles of acquisition after startup.)



3.6.14 Pan-Tilt

Control the gimbal and perform gimbal self-check through this interface.



4 Frequently Asked Questions and Solutions

4.1 Equipment positioning failed

1) Check if the network indicator light is always on.

2) Check if the SWAS/CORS account is configured.

3) Check if the SWAS/CORS account is available.

4) Check whether the external positioning and orientation components are connected in the correct sequence.

5) Check if the current equipment installation location is open and free of obvious obstructions.

4.2 The platform cannot view the deformation graph

1) Check if the equipment has completed initialization. The deformation map will not be uploaded until the device is fully initialized after startup.

2) Check if the equipment is in manual mode. In manual mode, the equipment does not upload data. Configure it to automatic mode for regular data scanning.

4.3 The platform cannot view the scatter diagram

Equipment does not upload scatter maps by default; users must manually

obtain them on the platform, as detailed in Section 3.4.2.

5 Maintenance and Care of Equipment

a. Do not use strong chemicals, cleaning agents, or harsh detergents to clean the equipment, as this may cause corrosion and damage.

b. The operating temperature of equipment is between-2 0℃ and +6 5℃. Do not use the equipment in the environment beyond the operating range.

c. All equipment has undergone sealing tests before leaving the factory and can be used in standardized working environments with dust and rain protection. During long-term equipment operation, regular cleaning should be performed to maintain the equipment cleanliness, thereby extending its service life and ensuring monitoring accuracy.

d. If the temperature difference between the working area and the storage area is too large, the equipment should be kept in the box until it adapts to the ambient temperature before being taken out for use to ensure good accuracy.

e. When the equipment is not in use for an extended period, disconnect the power supply, clean the equipment surface to ensure overall dryness, then place the equipment in the packaging box and store it in a dry and well-ventilated location.

f. During equipment transportation, the device should be placed in the packaging box. Care must be taken to avoid compression, impact, and severe vibration during transit. Inversion of the device is strictly prohibited.

g. If the device malfunctions, troubleshoot according to the manual. If unresolved, contact technical support. Do not disassemble the device without authorization.

6 After-sales service of equipment

During the warranty period for the radar products manufactured by our

company, free repair services are provided. However, in the following cases, material costs and labor hours may be charged at discretion:

- not properly stored, installed, used or maintained.
- Product damage caused by non-compliance with the User Manual.
- Lightning, fire and other natural disasters.
- Damage caused by poor product design of other manufacturers resulting in matching issues.
- The company states that due to our ongoing adoption of new technologies, we will not provide separate notifications regarding changes to product specifications.
- The unauthorized repair personnel and institutions disassemble and repair the equipment.
- The final interpretation right of this instruction manual belongs to our company.

7 FCC Statement

FCC ID: SY4-A02080

Please take attention that changes or modification 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.

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

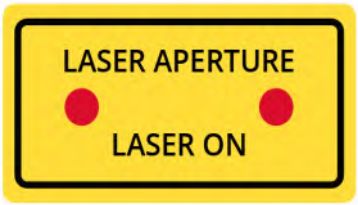
8 Laser Safety Information

Laser Classification: Class 3R Laser Product per IEC 60825-1:2014 and EN 60825-1:2014+A11:2021

Laser Parameters:
- Maximum Average Output:<10 mW
- Wavelength: 850nm
- Beam Divergence:1.8-71 °
- Laser Aperture: Face the device, the light output warning label is located near the left camera of the device.

Safety Warnings:
CAUTION – INVISIBLE LASER RADIATION – CLASS 3R LASER PRODUCT
Avoid direct eye exposure.
Reflections from specular surfaces may also be hazardous to the eyes.

Product Laser Labels:



Laser Warning Device Instructions：

In dark environments, when the device's blue indicator light turns on, the laser fill-light will activate after 3 seconds. Avoid direct viewing of the laser fill-light while it is in operation. When the blue indicator light turns off, the laser fill-light will stop working.

Laser on

Laser off