

# Multi-point Deformation Monitoring System

## User Manual



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- ✧ . This manual may contain inaccuracies, discrepancies in the operation of product features, or typographical errors.
- ✧ . We will update the contents of this manual in accordance with enhancements and changes in product features, and will periodically improve and update the descriptions in this manual. Updated information will be reflected in the latest version of this manual without notice.
- ✧ . Due to the continuous adoption of new technologies, product parameters are subject to change without notice (including software version updates).
- ✧ . This manual is only for the user to provide reference and guidance, and does not guarantee that the real thing is identical, the actual application of the real thing shall prevail.
- ✧ . Parts, components, and accessories mentioned in this manual do not represent the standard configuration of the equipment and are subject to the packing list.
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- ✧ . This device is only for fixed long-term monitoring, mobile emergency monitoring, scientific research and other applications in open-pit mines, public/railway slopes, landslides, water conservancy dams and other scenarios, and the user shall bear the responsibility for any property damage, personnel injury and legal liability.
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## Chapter 1 Overview

This PS-2000 Multi-point Deformation Monitoring System User's Manual is intended for the user to learn before starting to use this product. Therefore, in order for you to use this product better, please read the user manual carefully before use, and follow the detailed steps in the manual for the installation, commissioning and use of the product. That way you will be able to use the functions of the device with ease, giving you the best possible experience with the product.

### 1.1. Introduction

PS-2000 Multi-point Deformation Monitoring System is a new type of fixed slope stability and deformation monitoring device system, based on broadband continuous wave signal system, differential interferometry and circular synthetic aperture imaging method, featuring non-contact measurement, omni-directional monitoring, high accuracy of deformation measurement, high data updating rate, unaffected by weather and illumination conditions, small size and light weight, and can be transported by trailer to be fixed. It is suitable for mobile temporary monitoring, and fixed-airway monitoring of public/railway slopes, open-pit mines, landslides, and water conservancy dams.

Define applications such as long-term monitoring, scientific research, etc.



## 1.2. Principle of operation

The device utilizes a long rotating arm to rotate the low-gain antenna at the top of the arm to form a circular trajectory, and then synthesizes a high-resolution imaging beam in the digital domain by using the synthetic aperture principle along the circular trajectory. For example

Figure 1-1 Circular Arc Synthetic Aperture device (CASR) principle of operation is shown.

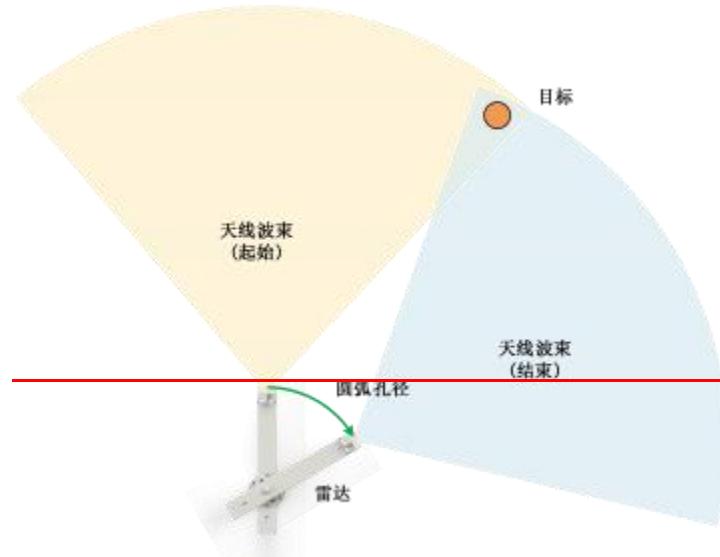


Figure 1-1 Circular Arc Synthetic Aperture device (CASR) Principle of Operation

## 1.3. Functional characteristics

1. Non-contact remote sensing monitoring, without the need to install facilities on the measured body, with little risk to the safety of personnel and equipment;
2. Based on active microwave technology means, not affected by rain, snow and fog bad weather and day and night light;
3. Adoption of circular arc synthetic aperture device system, can be 360 ° omni-directional monitoring, and the performance of each azimuth angle is completely consistent;
4. Monitoring distance range up to 5 kilometers, large monitoring range, high efficiency;
5. Deformation measurement accuracy is better than 0.1 mm, with data update rates of up to 1 minute per measurement and high measurement sensitivity;
6. Built-in satellite compass, automatic acquisition of position, orientation and attitude information;

7. Based on adaptive atmospheric disturbance correction algorithm, no need to deploy weather stations, stable and reliable data output;
8. The weight of the device shall not exceed 25 kilograms;
9. Short installation time, built-in high-performance processor real-time processing and display, conducive to mobile emergency monitoring;
10. The power consumption of the whole machine is not more than 50W, and it supports various power supply and communication methods, which is favorable for long-term monitoring;
11. High protection level, working temperature range -40°C~+55°C, strong environmental adaptability;;
12. Show control software can import a variety of formats of three-dimensional topographic maps, can realize the true three-dimensional terrain matching, high positioning accuracy;
13. The software is based on B/S architecture and supports cloud servers and local networks.

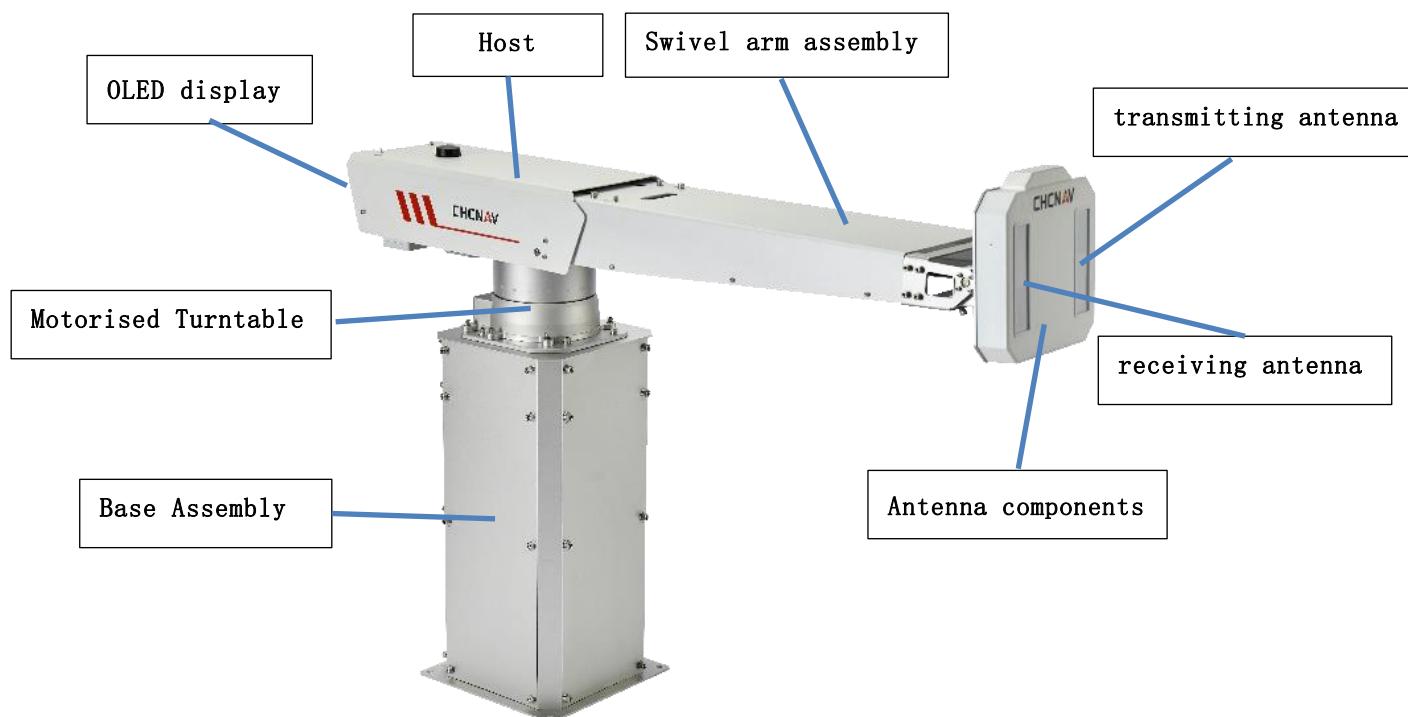
## 1.4. System components

Multi-point Deformation Monitoring System consists of device, cloud server platform (or host computer platform), electric

The source supply unit and the support assembly consist of four units.

### 1.4.1. device

The main unit of the device is mainly composed of antenna, arm (front/rear arm), and base unit (the lower part is the support unit). The device is powered and communicates with external data signals through the aerial plug connector, receives signals from the host computer, and transmits target monitoring information back to the host computer. As shown in Figure 1-3



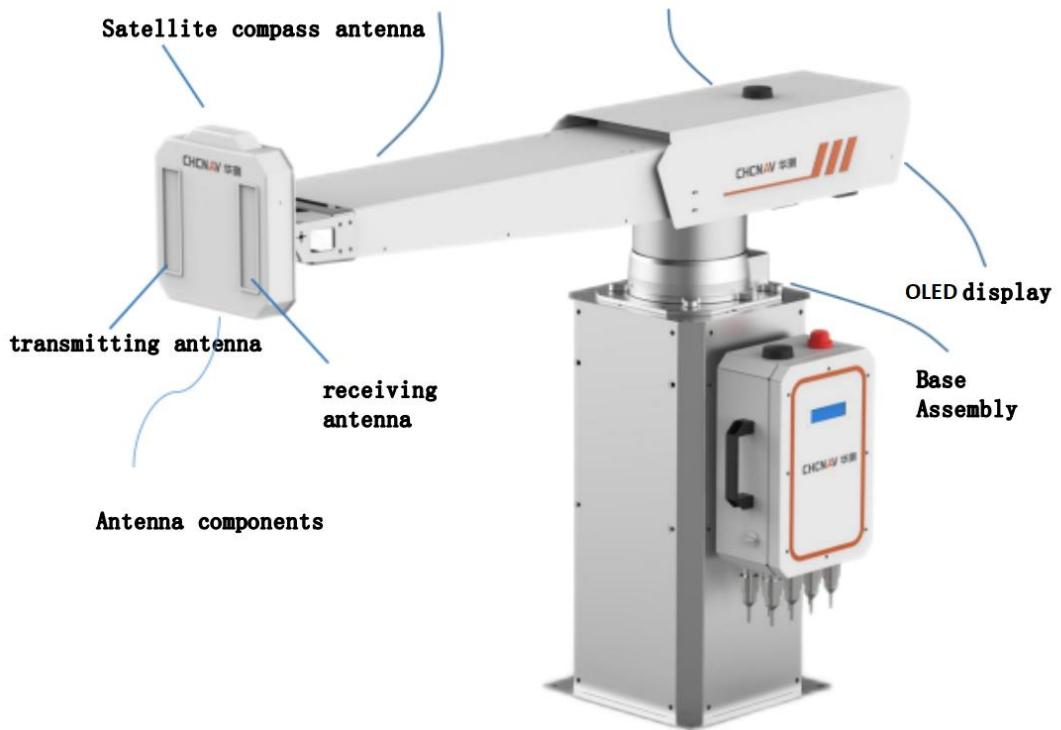


Figure 1-3 device Mainframe Structural Components

Table 1-1 device Host Component Descriptions

component name	make up	clarification
Antenna components	Transmitting antennas, receiving antennas, satellite compasses, etc.	Transmission and reception of device RF signals, and Positioning and orientation information is obtained from satellite compasses.
Swivel arm assembly	-	It is mainly used for the connection between the antenna end and the host computer.
hosts	Electrical components such as OLED displays, computing units, etc.	The center unit of the device, the data signal calculation center, and the data exchange center with the host computer; The OLED screen allows visualization of the device's normal operating electrical status.
Base Assembly	Driver components, aerial plugs, heat sink modules, etc.	device base, power supply and interface to external communication networks.

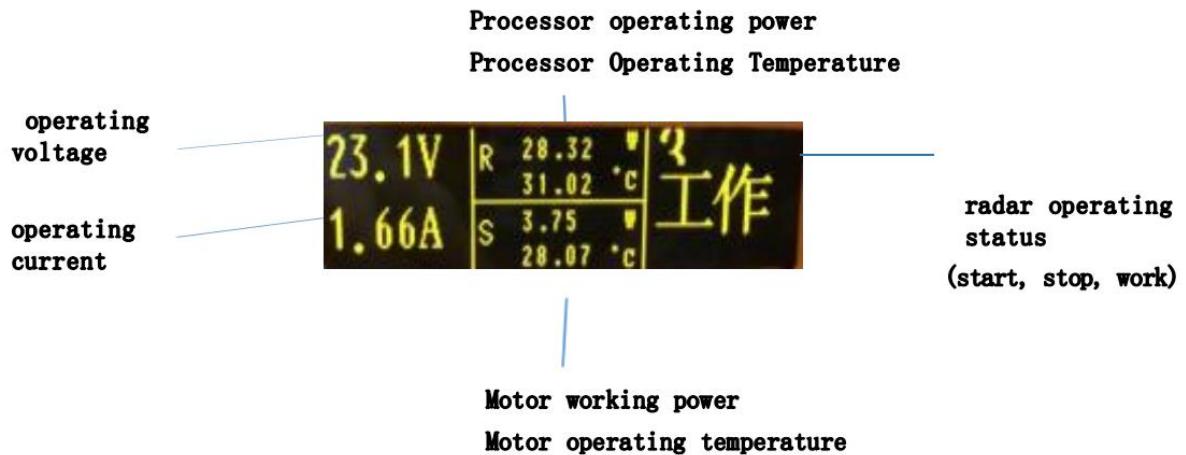


Figure 1-4 device Display Display Description



**Network plug-in connector** **Power plug-in connector** **Power on/off button**

Figure 1-5 device Base Interface Description

#### 1.4.2. Cloud server platforms



Figure 1-6 Cloud Server Platform

An external communication device can be used to connect with the equipment host unit through a data signal line to receive the equipment processing data and monitoring information, which is then uploaded to the cloud server by means of 4G wireless, and the software of the cloud platform sends control signals to the equipment to control the equipment.

### 1.4.3. Power supply unit

The power supply for the device is a DC24V 10A external power supply with connectors that are IP65 tested and ready for use. As shown in Figure 1-7, one end of the random cable is connected to the host computer, and the other end is for stable voltage supply.

Figure 1-8 Device Data Cable.



**AD 24V Power Interface to Radar Base Plug-In Connector**

Figure 1-7

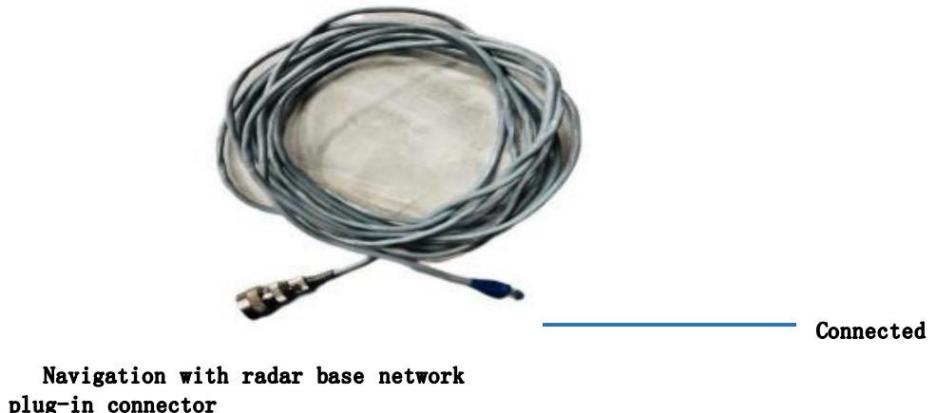


Figure 1-8 device Data Communication Cable

#### 1.4.4. Support frame assemblies

Patented structure, different from the market support frame, more suitable for the device set up and electronic control box mounting, easy to install, leveling the ground after the expansion screws can be driven into the bottom of the locking fixed, the upper flange screws tighten fixed.

### 1.5. Technical parameters

<b>Monitoring Targets</b> Surface Deformation Displacement	<b>Orientation accuracy</b> 0.3°
<b>Device regime</b> Circular synthetic aperture	<b>Weight of the whole machine</b> ≤25KG (Support not included)
<b>Operating band</b> 17.1-17.3GHz	<b>Overall power consumption</b> ≤50W (including processing unit)
<b>Distance range</b> ≤5Km	<b>Overall size</b> 1.33*0.42*0.73m
<b>Azimuth range</b> 360° or specified sector	<b>Distance resolution</b> 75cm
<b>Pitch range</b> 30 °	<b>Dimensions of storage box</b> 1.5*0.36*0.53m
<b>Angular resolution</b> 0.3 °	<b>Operating temperature range</b> -40 to +55 °C
<b>Deformation measurement accuracy</b> 0.1mm	<b>Storage temperature range</b> -45 to +85 °C
<b>Main data update rate</b> 60 sec/time	<b>Power input</b> 22-25V DC =-10A
<b>Antenna Pitch Adjustment Range</b> ±30 °	<b>Communication Wired</b> LAN
<b>Graphics Control Software</b> B/S architecture	
<b>3D Terrain Adaptation Import</b> a variety of 3D terrain data and accurately align it with device polar coordinate data.	
<b>Atmospheric Disturbance Correction</b> Adopt global adaptive correction algorithm, long-term correction residual ≤ 2mm	
<b>Deformation projection</b> Direct display of radial deformation, or projection along the maximum slope of the 3D terrain.	
<b>Data display</b> Scattered intensity, deformation, and (intensity/deformation) fusion can be displayed.	
<b>Characteristic point output curves</b> Cumulative deformation, deformation rate, acceleration, etc.	
<b>Early warning parameters</b> Cumulative deformation, deformation rate, acceleration, etc.	
<b>Alarm mode</b> Local sound and light alarm, remote SMS, interface alarm	
<b>Historical data back</b> ≥ 1 year of deformation data and ≥ 1 months of scattering image data (based on Server Storage)	

## Chapter 2 device Installation Instructions

### 2.1. Site selection for device installation

#### (1) Installation location

The device will be installed in a location where the ground is free from settlement, subsidence, landslides, etc., and within a diameter of 5 meters.

No interfering obstructions or buildings to ensure safe device operation without interference.

#### (2) Horizontal installation

Ensure that the ground is level for device erection and installation, and that the ground will not settle after rain or snow to ensure the level of device installation. The ground can be constructed in advance to ensure the level of the ground before installation. If there are conditions, the ground can be paved with cement.

#### (3) Installation environment

1 There is no strong magnetic or electric interference around the device installation location.

2 The device installation location is not surrounded by high-rise buildings, otherwise it will affect the device within the satellite compass correctly.

Regular work

### 2.2. device installation procedure

#### 2.2.1. Support frame placement

1. Determine the device start and stop scanning angle according to the target imaging range, and thus determine the support tripod fixed.

Orientation. See Appendix A, device Operational Scanning Angles and Imaging Angles, for confirmation.

2 Place the support assembly (fixing bracket) at the device erection position and level it.

#### 2.2.2. Unpacking and removing the device

Open the device box and slowly remove the device from the box by picking up the device armrest position with both hands. If

Figure 2-1 device and Support Bracket Stowage Schematic show



Figure 2-1 device and Support Bracket Stowage Diagram

### 2.2.3. device fixation

#### 1. Base mounting:

There are four holes underneath the base, all of which are 12mm in diameter; matching the appropriate screws to fix them will suffice, provided that the fixing surface is solid and stable to ensure that the base cannot wobble.

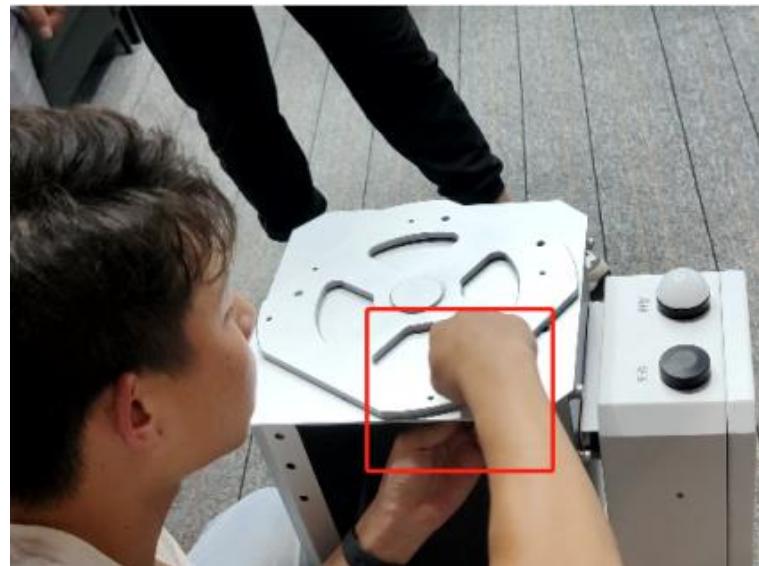


#### 2. Turntable installation:

There are four 6mm size screw holes on top of the turntable and six 6mm size screw holes;

The larger screws are used to secure the turntable to the base, and the smaller screws are used to secure the device mainframe to the turntable;

Place the turntable on the base and secure it by tightening the screw nuts inside and out.



The dial can be rotated to adjust the device zero orientation!



### 3. Mainframe installation:

Remove the main unit from the storage box and place it on top of the fixed turntable by means of the matching screws, noting that the screws holding the device and turntable are on the small side.

Tools: Use an Allen wrench, which is placed in the allotment.



#### **2.2.4. device power supply and network cable connection**

The power supply as well as the network cable are prefabricated at the factory and can be used directly. According to the correspondence between the plug and the interface sequence for installation. As shown in Figure 1-7 device Power Cable connector.

#### **2.2.5. device integrity confirmation (initial unpacking)**

After the device installation and erection is completed, the overall structure of the device is inspected to confirm that the structure of each component unit is complete, with or without deformation or other abnormalities, and if so, please contact to deal with it.

### **2.3. Cable requirements**

At all times must use the original matching cable provided by the factory, it is strictly prohibited to cut off or reconnect the cable at will  
Cables. (All cables used in the device are prefabricated at the factory.)

### **2.4. device switching operation**

#### **2.4.1. device power-up operation**

##### **(1) Power-on confirmation**

Follow the procedure in 2.2.4 device Power and Network Cable Connection to confirm the device power cable connection.

##### **(2) Power switch operation**

After power-on confirmation, press the device power button as shown in Figure 1-5 device Base Interface Introduction, Power Button

The device is powered up when the indicator light of the

(3) device power-on success confirmation

After the device is powered on, the device motion position is not in the home position, it will return to the home position, and the antenna will initialize, and the LCD current, voltage and power display will be stable as shown in Fig. 1-4, which means the device is powered on successfully. If there is no such movement and display, you can check the common problems and processing methods in Chapter 4 to make sure that the device is turned on successfully.

Recognize the cause for resolution.

### **2.4.2. device shutdown operation**

(1) Confirmation before shutdown

Software control of the device "stop working" is required before shutdown to confirm that the device rotational motion position returns to the home position.

(2) Shutdown operation

Press the device Power On/Off button shown in Figure 1-5 below, and the button's

Description: 1. Confirm to return to the home position before shutting down the device, so that the device can be conveniently turned on next time to save the time to return to the home position

## Chapter 3 Description of the device Upper Platform

### 3.1. Introduction

#### 3.1.1. Operating environment

The software adopts B/S architecture and can be deployed on both stand-alone computers (laptops, desktop computers) and service centers.on the server.The software is cross-platform, supporting Windows operating systems, Linux operating systems. The product is delivered with the software setup and initialization completed before delivery, and the user only needs to access the device host, If you start the service of the software, you can log in to the system through the browser and perform various operations.

#### 3.1.2. Conventions

This manual makes the following conventions for ease of description:

**Software/systems:** Slope stability monitoring device system upscaling software.

**Device host:** Slope stability monitoring device host.

**Deformation value:** Cumulative deformation value.

**Scatter gram/Intensity map:** device reflection obtained after data processing of the output data monitored by the device host.

Signal strength renderings, scatter plots and intensity plots are all the same type of image, just called differences.

**Deformation map:** the accumulated deformation data output from the device mainframe monitoring, and the monitoring area obtained after data processing.

A rendering of the deformation condition of the

**Noise reduction map:** The accumulated deformation data output from the device host is combined with the image processing algorithm and processed by noise reduction.

Rendering of the deformation condition obtained after rationalization.

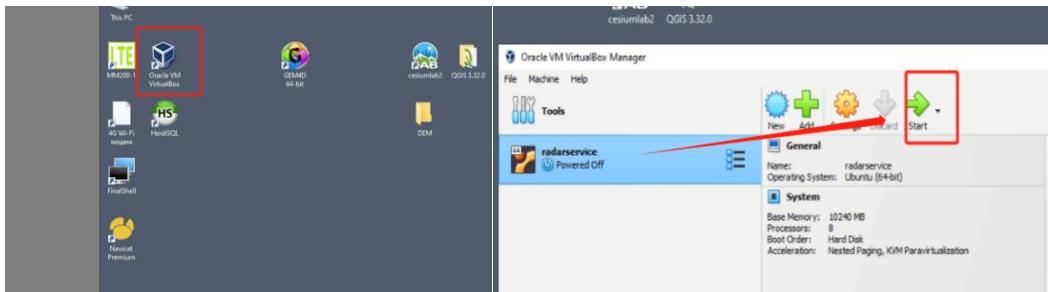
**DEM:** Digital Elevation Model data for the place where the device host is located.

### 3.2. Software startup and login

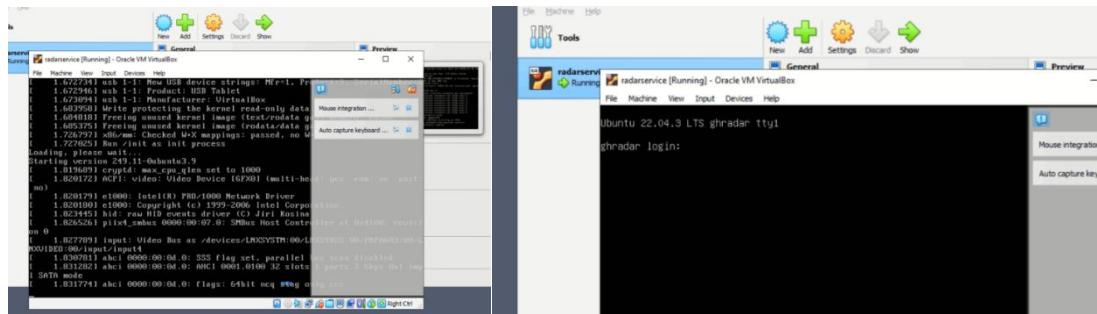
#### 3.2.1. Software startup and login

The software needs to be run with a note that the server's network IP is fixed, otherwise it won't start properly.

**Step1:** Click the desktop icon to start the device Image Resolution Service, see the figure below:



**Step2:** Click on the desktop icon to start the slope stability monitoring device service, the following picture appears minutes, indicating that the service has finished starting and is in a work-ready state:

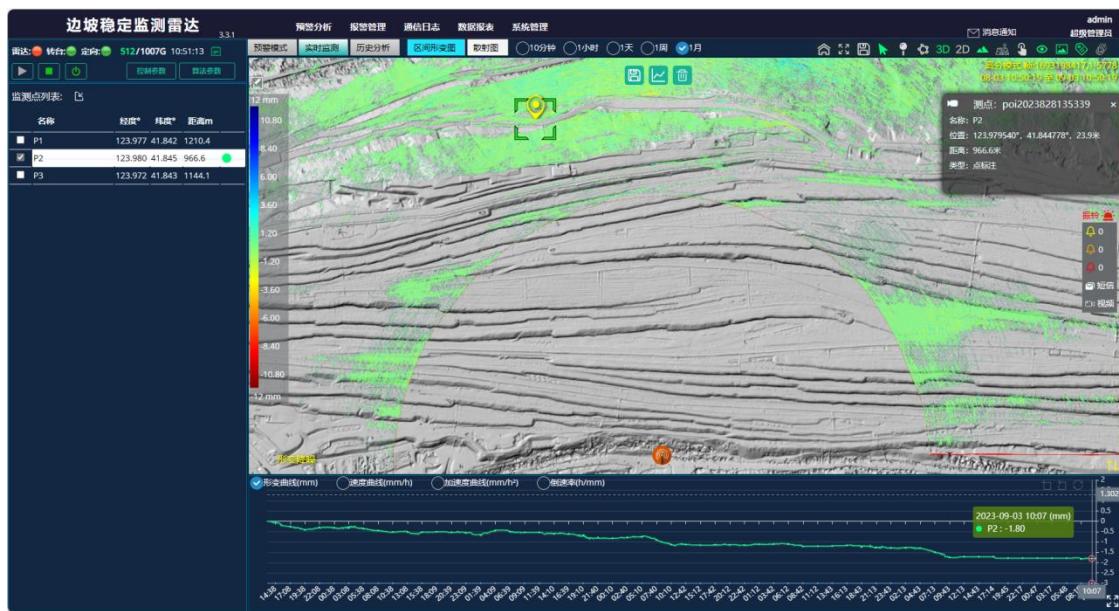


**Step3:** Open your browser (we recommend edge, chrome, firefox, choose one of the three), and enter the URL in the address bar: <http://127.0.0.1:18080/login> If you have a fixed IP address, or a fixed IP address of a cloud server, log in to the system according to the account and password provided, the default account and password are given by the technician, see the figure below:



### 3.2.2. Introduction to the main interface of the software

The software integrates most of the functions organically in the main interface, the operation is simple and fast, at a glance, the user can master all the operation skills in a relatively short time.



The main features included are mainly:

- Setting and querying of various operating parameters of the device mainframe;
- device mainframe control;
- device operation status display, host available storage space display;
- Scattering intensity map, interval deformation map, deformation noise reduction map, etc. switching
- Real-time mode, history mode switching
- 3D maps, flat maps, terrain grayscale images, sky map satellite image operation and switching
- Monitoring points, monitoring area editing and labeling
- Display of deformation, velocity and acceleration curves
- Pre-warning alarm threshold editing, pre-warning alarm record list, SMS pre-warning settings
- Generation of monitoring reports
- Role Permission Management
- Communication log management
- DEM data update

### 3.3. Parameter setting and control of the device main unit

#### 3.3.1. device system status indication

After the device is connected to the cable and powered on, the device status information and storage space information will be uploaded automatically (cyclic storage will be turned on automatically when the storage is full, so the administrator should pay attention to the remaining storage space), as shown below:



#### 3.3.2. device host control

The software can send control commands to the device to manage the operation of the device mainframe, there are 3 control commands: start work, end work, restart device.



Sending control commands is all a one-button operation.

Each control command needs to be confirmed twice before it is issued in order to avoid repetitive operations.

Mutually exclusive controls have been added to the commands, for example, when the device has not started working, the three command buttons for End Work, device Reset and device Restart are grayed out and cannot be clicked.

#### 3.3.3. device control parameter settings

Click the [Control Parameters] button in the upper part of the main interface, and a pop-up window will appear for parameter query and then setting.

The device control parameters include various operational parameters of the device host, such as latitude, longitude, elevation, detection distance range, detection angle range, zero pointing, rotational speed, gimbal azimuth, gimbal pitch, atmospheric correction switch and other important information of the device host.



The "End Work" control command must be sent before the device control parameters can be set.

**Each time a parameter entry marked with an "\*" is changed, a new device scanning task is created.**

device control parameter settings need to follow the operational steps: send device end of work instructions → query parameters to the device host → modify parameters according to the actual situation → write.

The latitude, longitude and elevation of the device mainframe can be entered in two ways: manually, or automatically according to the compass on the device mainframe. (Note: In the case of MIMO device, "zero direction of turntable" means the direction directly in front of the device). When setting the parameters of the device, pay attention to the setting instructions on the right side of each parameter.

Query the control parameters from the device host, in the parameter setting, only the parameters that need to be changed are edited, and the others remain unchanged, which can not only improve the efficiency of the setting, but also reduce the probability of parameter error.

Each time, regardless of whether a parameter query is performed or a parameter write is performed, the map is automatically positioned to where the device host is located when the window is closed and rotated so that the centerline of the device image is pointing directly upwards.

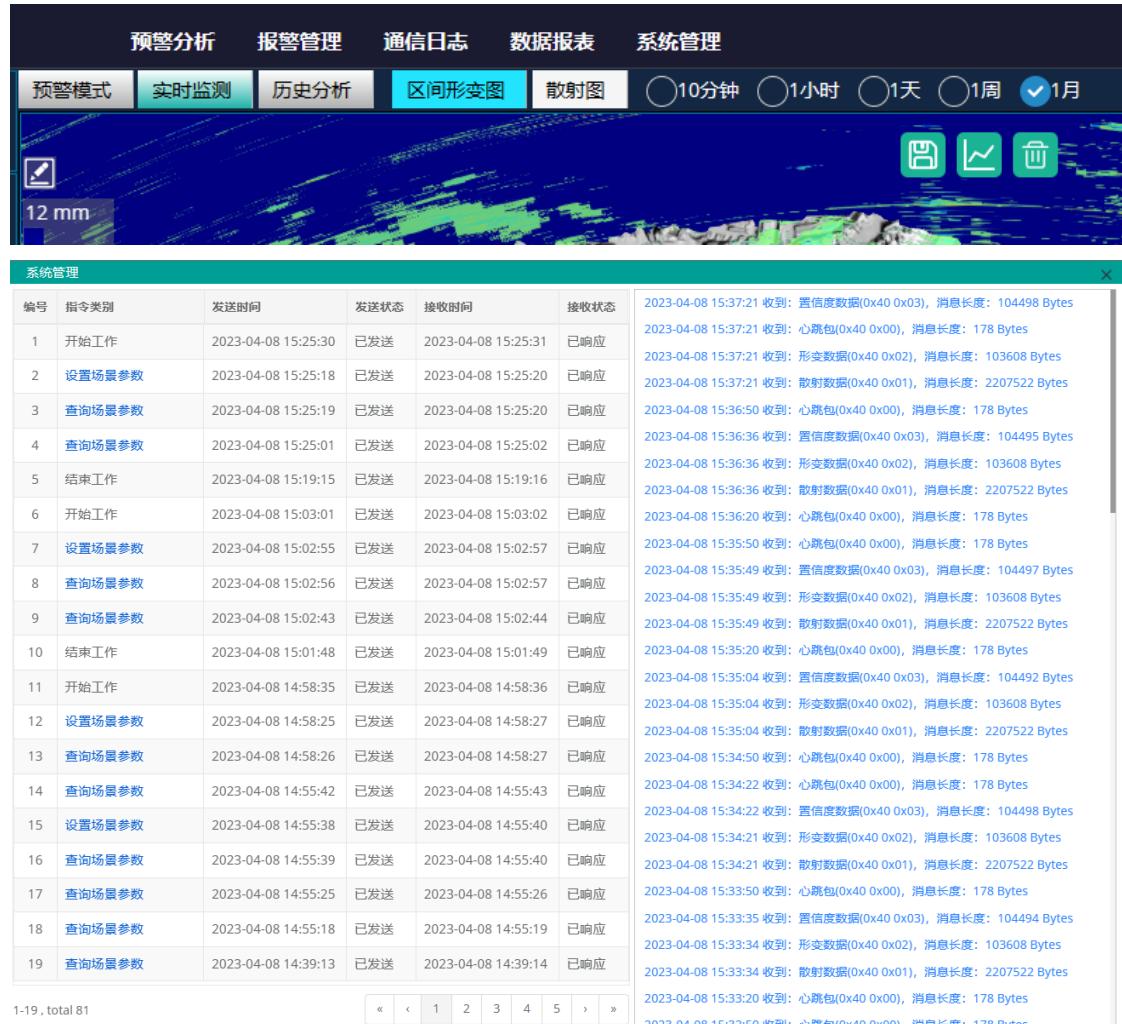
### 3.3.4. device Algorithm Parameter Settings (requires administrative privileges)

Click the [Algorithm Parameters] button in the upper part of the main interface to bring up a pop-up window for parameter query or setting.

**Remember: device algorithm parameters generally only need to query, do not need to set or change, such as the need to change must be operated by the manufacturer's technical personnel (the user can not be operated, otherwise the consequences of their own).**

### 3.3.5. Communication log

Click the [Communication Log] button in the upper menu of the main interface to display a pop-up window showing the two-way communication between the software and the device host.



Every time after logging into the system, sending a control command, querying a parameter, or setting a parameter, you should look through the communication log to see how the command was executed and how the device responded to the command. If you need to further view the specifics of the command or response situation, click on the corresponding record in blue in the list and the details will be presented in a pop-up box.

通信日志					
编号	指令类别	发送时间	发送状态	接收时间	接收状态
1	开始工作	2023-08-28 13:21:52	已发送	2023-08-28 13:21:53	已响应
2	开始工作	2023-08-28 13:21:33	已发送	2023-08-28 13:21:34	已响应
3	开始工作	2023-08-28 13:21:13	已发送	2023-08-28 13:21:14	已响应
4	查询场景参数	2023-08-28 13:21:10	已发送	2023-08-28 13:21:12	已响应
5	设置场景参数	2023-08-28 13:21:09	已发送	2023-08-28 13:21:11	已响应
6	查询场景参数	2023-08-28 13:20:32	已发送	2023-08-28 13:20:33	已响应
7	结束工作	2023-08-28 13:19:47	已发送	2023-08-28 13:19:48	已响应
8	开始工作				
9	结束工作				
10	开始工作				
11	查询场景参数				
12	查询场景参数				
13	设置场景参数				
14	查询场景参数				
15	结束工作				
16	开始工作	2023-08-28 12:26:04	已发送	2023-08-28 12:26:05	已响应
17	查询场景参数	2023-08-28 12:04:50	已发送	2023-08-28 12:04:51	已响应
18	结束工作	2023-08-28 12:01:51	已发送	2023-08-28 12:01:52	已响应
19	开始工作	2023-08-28 11:57:41	已发送	2023-08-28 11:57:42	已响应

1-19 , total 143

&lt; &lt; 1 2 3 4 5 &gt; &gt;

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 2023-09-03 11:06:28 收到: 置信度数据(0x40 0x03), 消息长度: 1499471 Bytes  
 2023-09-03 11:06:27 收到: 形变数据(0x40 0x02), 消息长度: 2739705 Bytes  
 2023-09-03 11:06:25 收到: 散射数据(0x40 0x01), 消息长度: 13856245 Bytes  
 2023-09-03 11:06:13 收到: 心跳包(0x40 0x00), 消息长度: 178 Bytes  
 2023-09-03 11:05:43 收到: 心跳包(0x40 0x00), 消息长度: 178 Bytes  
 2023-09-03 11:05:13 收到: 心跳包(0x40 0x00), 消息长度: 178 Bytes  
 2023-09-03 11:05:02 收到: 置信度数据(0x40 0x03), 消息长度: 1502162 Bytes  
 2023-09-03 11:05:02 收到: 形变数据(0x40 0x02), 消息长度: 2739703 Bytes

You can also click the [System Management] → [Operation Log] button in the upper menu of the main interface to bring up a pop-up window showing the control operations performed between the software and the device host:

系统管理							
账号权限	系统参数	操作日志	更新DEM	GNSS对接	软件版本	操作	
账号名称	操作时间	操作类型	操作简述	操作系统	浏览器	IP地址	
1 admin	2023-09-03 10:47:11	登录	登录系统	windows_10	edge116.0.0.0	120.228.77.12	
2 admin	2023-09-02 22:19:57	登录	登录系统	windows_10	edge116.0.0.0	120.228.77.12	
3 hcdh	2023-09-01 17:04:28	登录	登录系统	mac_os_x	chrome11	113.57.8.2	
4 hcdh	2023-08-31 15:46:54	登录	登录系统	windows_10	edge116.0.0.0	27.227.244.39	
5 hcdh	2023-08-31 08:47:33	登录	登录系统	windows_10	chrome8	113.232.144.225	
6 admin	2023-08-30 16:59:30	登录	登录系统	windows_10	edge116.0.0.0	223.148.87.238	
7 admin	2023-08-30 15:02:07	登录	登录系统	windows_10	edge116.0.0.0	113.246.239.160	
8 hcdh	2023-08-30 12:40:55	登录	登录系统	windows_10	chrome8	60.16.238.220	
9 hcdh	2023-08-30 11:55:04	登录	登录系统	windows_10	edge116.0.0.0	223.104.57.250	
10 hcdh	2023-08-30 09:10:26	登录	登录系统	windows_10	chrome8	60.16.238.220	
11 admin	2023-08-29 10:57:43	登录	登录系统	windows_10	edge116.0.0.0	113.246.239.160	
12 hcdh	2023-08-29 09:25:36	登录	登录系统	windows_10	chrome8	60.16.238.220	
13 hcdh	2023-08-28 14:19:22	登录	登录系统	windows_10	edge116.0.0.0	60.16.238.220	
14 hcdh	2023-08-28 13:54:20	添加	在任务1693198417下添加了监测点[P3]	mac_os_x	chrome11	125.85.122.115	
15 hcdh	2023-08-28 13:53:47	添加	在任务1693198417下添加了监测点[P2]	mac_os_x	chrome11	125.85.122.115	
16 hcdh	2023-08-28 13:53:18	添加	在任务1693198417下添加了监测点[P1]	mac_os_x	chrome11	125.85.122.115	

1-16 , total 256

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&lt; &lt; 1 2 3 4 5 &gt; &gt;

## Chapter IV. Frequently asked questions and approaches

### 4.1. device indicator not illuminated

Check whether the connection between the device power cable and the regulated power supply is normal, check whether the positive and negative poles of the power supply are reversed and whether the voltage is normal. After unplugging the monitor power cable, plug it in again and turn it on again. If still can not be solved please contact the technician.

### 4.2. device light on but no data uploaded

- (1) Check if the device target IP is configured correctly, contact your technician to configure the target IP when you first turn on the device.
- (2) Check the router network condition, network speed and SIM card status (network speed should be >20Mbps).
- (3) Check that the cloud platform or host computer is configured properly.

 **WARNING:** device failure please follow the instruction manual troubleshooting methods to solve the problem, if you can not solve

## Chapter V. Maintenance and care of device

- a.** Do not use potent chemicals, cleaning agents or strong detergents to clean the equipment to avoid corrosion and damage to the equipment.
- b.** The device operating temperature range is between -40 and +55°C. Do not use the equipment in an environment that exceeds the operating range.
- c.** The equipment has been sealed and tested before leaving the factory, which can be applied to the regulated working environment, dustproof and rainproof. The device should be cleaned regularly when used for a long period of time to keep the device clean and clean, prolonging the service life of the device as well as ensuring the monitoring accuracy of the device.
- d.** If the temperature difference between the working place of the equipment and the storage place is too large, the equipment should be left in the box until it is adapted to the ambient temperature and then removed for use in order to obtain good accuracy.
- e.** When the equipment is not used for a long period of time, the power supply should be disconnected, the device surface should be cleaned to ensure that the device is dry as a whole, and then the equipment should be put into the packing box and placed in a dry and ventilated location for storage.
- f.** When the equipment is transported, the equipment should be placed in the packing box, and care should be taken during transportation to avoid extrusion, collision and violent vibration, and the equipment should not be inverted.
- g.** If the device is faulty and abnormal, please investigate and solve the problem according to the contents of the manual, and still can not be solved, please contact with the technician, do not dismantle the machine without authorization.

## Chapter VI. After-sales service of device

- For the device products produced by the company within the warranty period, the company provides free maintenance services, but if the following circumstances, discretionary charge material costs of labor hours:
- Not properly stored, installed, used or maintained;
- Damage to the product caused by operation not in accordance with the User's Manual;
- Lightning strikes, fires, and irresistible acts of God;
- Damage caused by matching problems due to poor product design by other manufacturers;
- The company declares that due to our continuous adoption of new technologies, product parameters are subject to change without notice.
- Non-designated maintenance personnel and organizations to dismantle and repair the device privately.
- The final interpretation of this instruction manual belongs to our company.

### FCC Warning

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.

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

**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.

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.