



OPERATION INSTRUCTION



Thank you for choosing our equipment. For proper operation, we recommend that you read this operation manual thoroughly before using the device.



1. PRODUCT INTRODUCTION

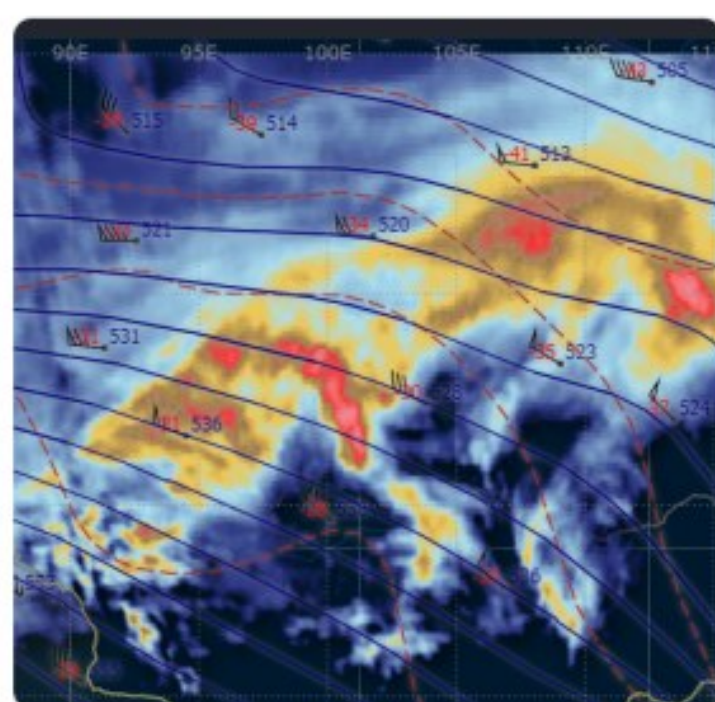
1.1 Product Overview

This multifunctional, low-power smart device integrates high-precision sensors and supports unattended monitoring, data storage, and remote upload via IoT. It features strong adaptability, accurate measurement, easy installation, and stable operation. Core technologies include ultrasonic wind sensing, optical rainfall detection, electrochemical gas sensing, and photoelectric dust monitoring. With a high-performance terminal and IoT module, it monitors meteorological, gas, particulate, and radiation parameters, and supports custom configurations for diverse scenarios.

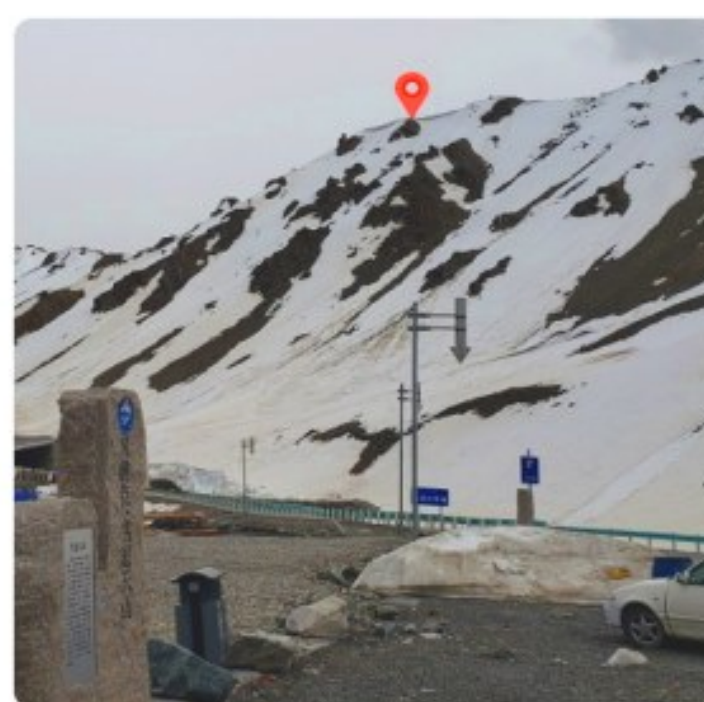
1.2 Application Fields



Urban Environment



Online Meteorological



Emergency



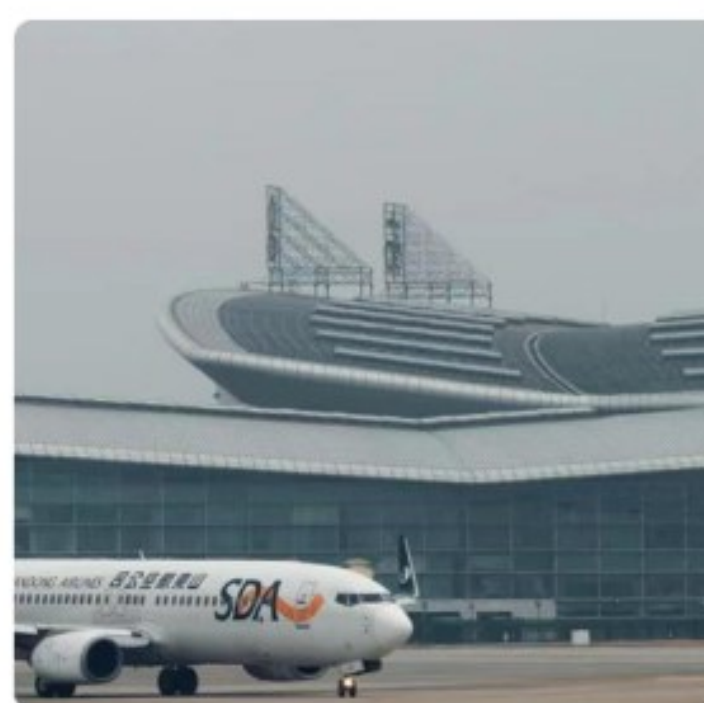
Railway



Bridge & Tunnel



Marine Vessels



Airports



Wind Power Generation

1.3 Product Features

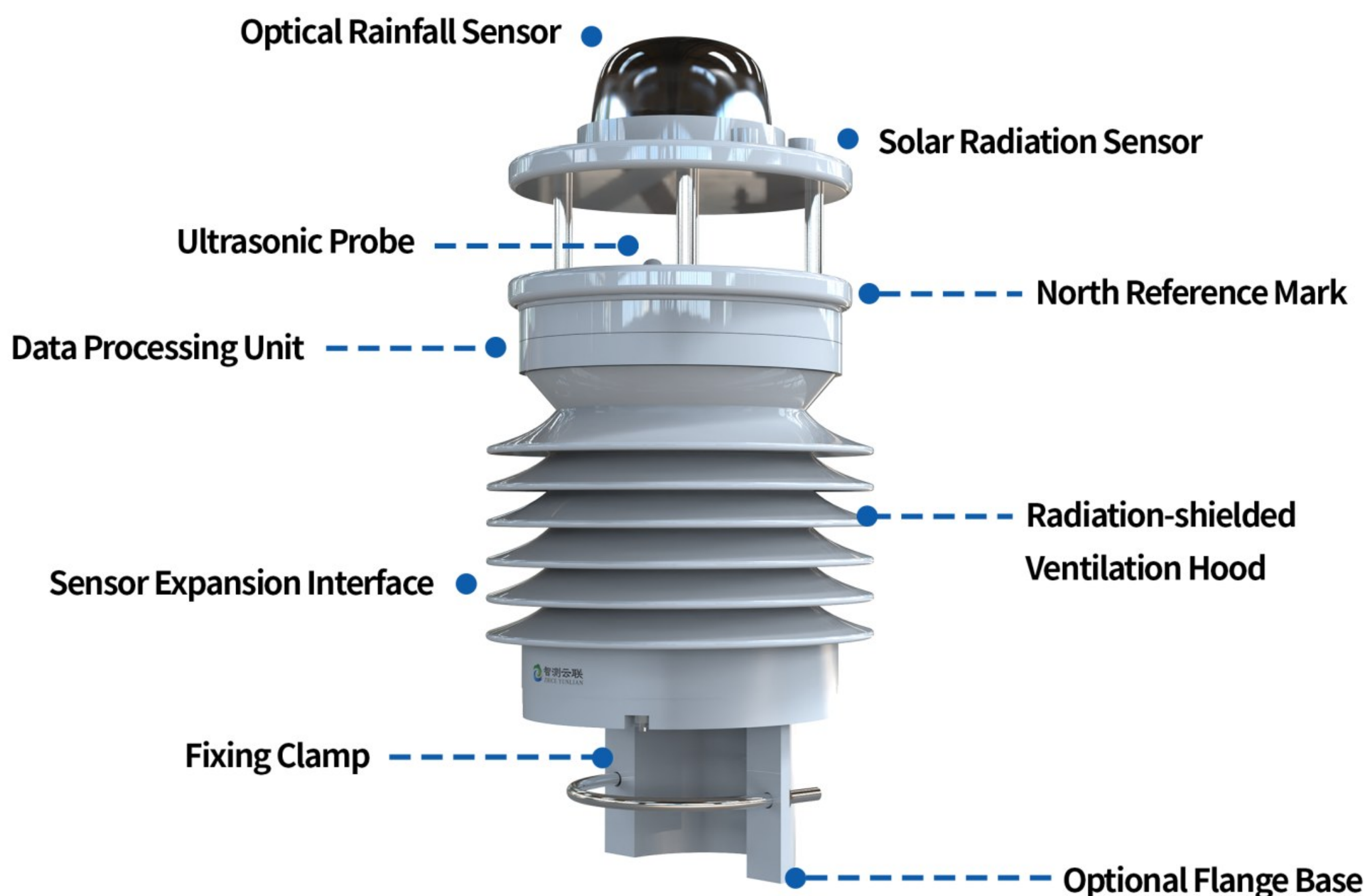
- All-weather operation, unaffected by heavy rain, snow and frost weather
- High measurement accuracy and stable performance
- Compact and elegant structure, easy to install and disassemble
- Made of ABS material, with excellent oxidation resistance, corrosion resistance and electromagnetic interference resistance
- Standard RS485 communication interface; RS232 or GPRS interface optional according to actual needs

Maintenance-free, no on-site calibration required





2. SYSTEM COMPOSITION AND STRUCTURAL FEATURES



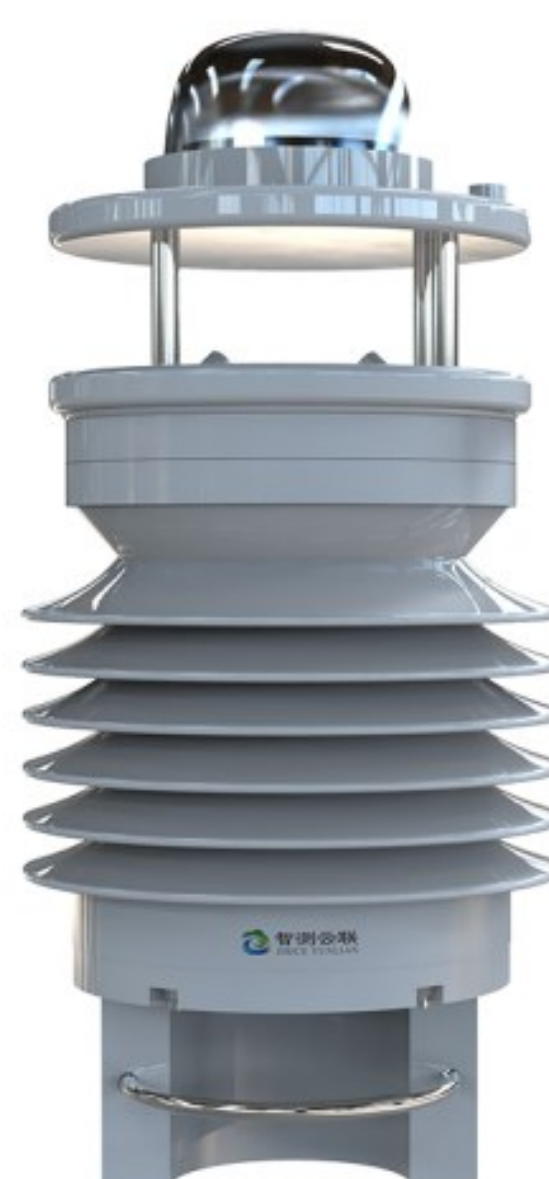
Product Types (Customized on Demand)



Basic Type



Multi-parameter Type



Optical Rainfall Type



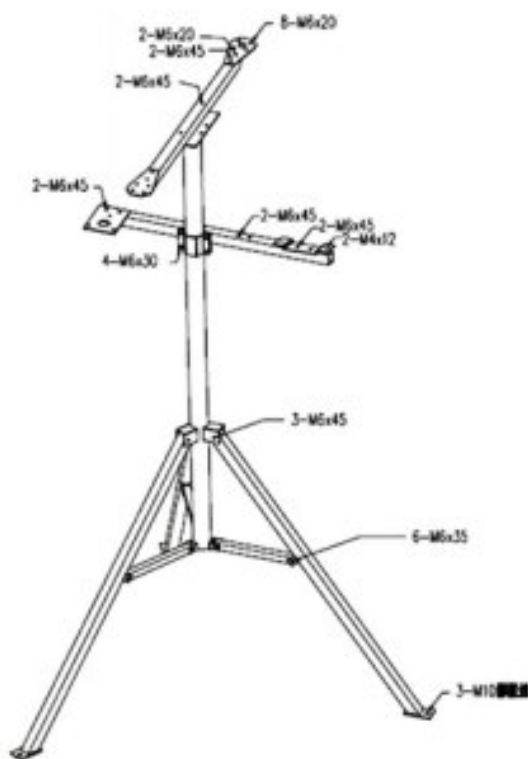
Flange Base Type



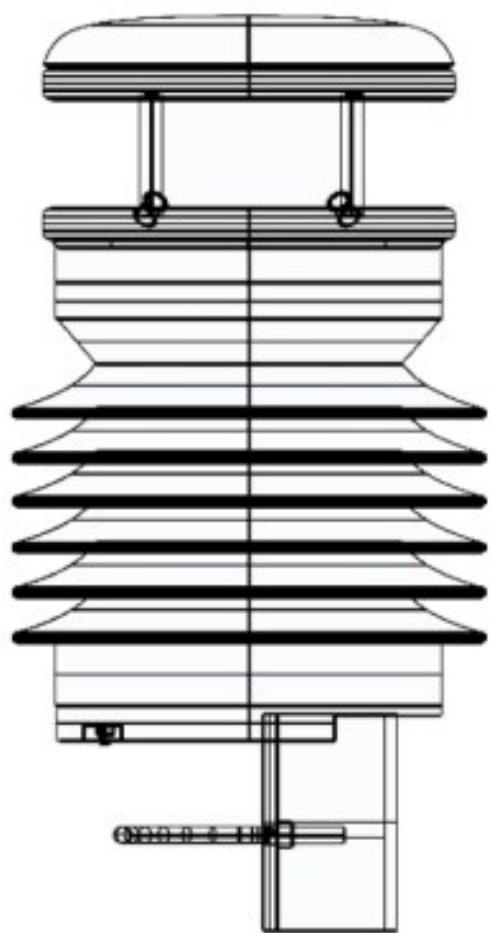
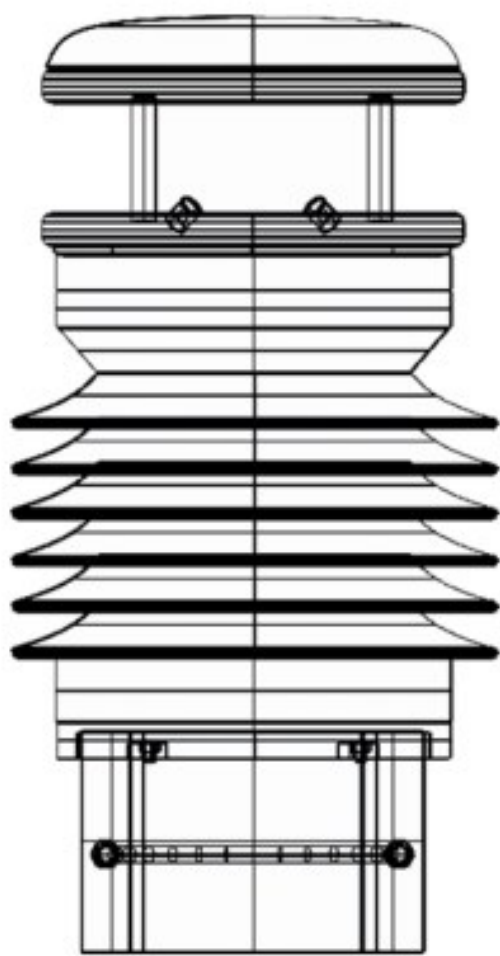


1. System Configuration List

- 1.Meteorological Station Host: The core of the system, customized based on acquisition parameters, responsible for data acquisition, calculation, storage and transmission.
- 2.Power Junction Box (Optional): Independent junction box for convenient AC/DC power connection.
- 3.Bracket (Optional): Equipped with built-in clamps, compatible with fixed brackets and portable brackets.
- 4.Solar Power Supply System (Optional): 30W solar system matched with a dedicated charging controller, customizable.
- 5.Other Accessories: Input/output cables, communication cables, etc.



2. Device Specifications



Parameter Category	Technical Specifications
Protection Rating	IP67, customizable protection level
Dimensions	Basic module: Height 324mm × Diameter Φ140mm
Device Weight	1.3kg
Power Supply	12V DC
Digital Output Signal	RS485 (standard, Modbus protocol), RS232 (optional)
Communication Baud Rate	9600bps (standard, configurable)
Operating Power Consumption	25mA @ 12V DC
Operating Temperature Range	-40℃ ~ +80℃
Operating Humidity Range	0 ~ 100% RH (non-condensing)

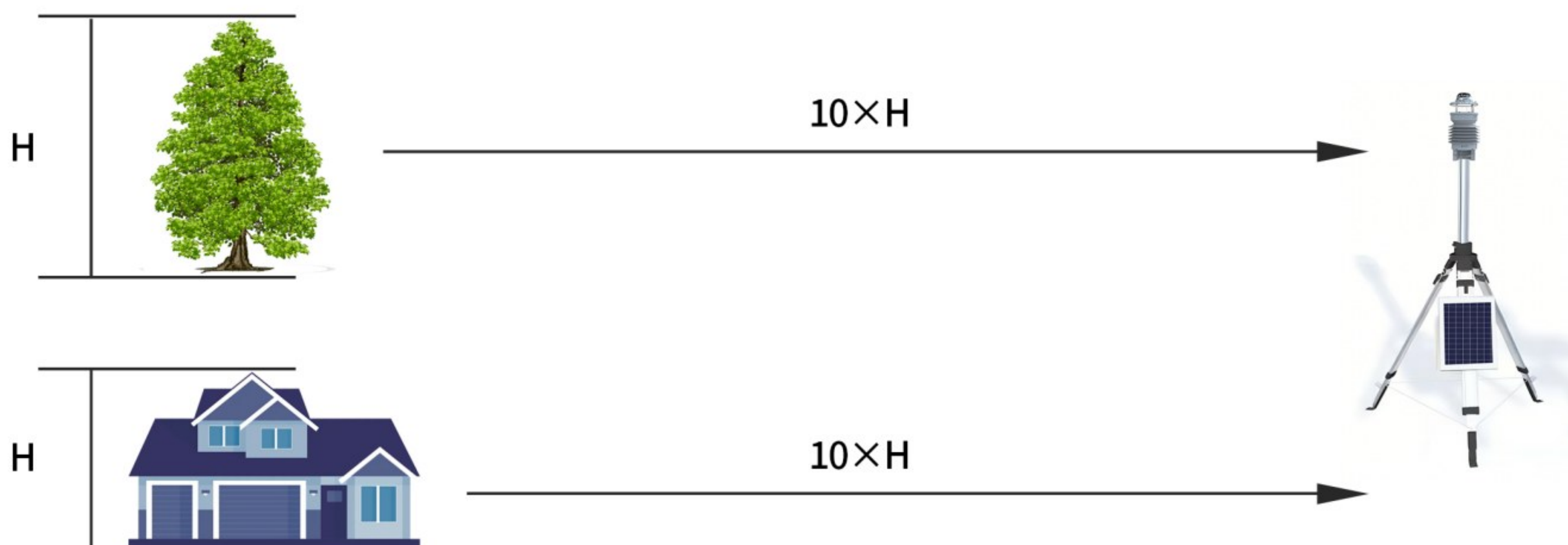




4. DEVICE INSTALLATION STEPS

4.1 Pre-installation Preparation

SITE SURVEY: Select an open monitoring point free from tall buildings, trees, and electromagnetic interference (e.g., high-voltage equipment, large motors) to ensure undisturbed data collection. The distance between the station and any obstacle shall be no less than 10 times the obstacle's height.



TOOL PREPARATION: Ready compass, adjustable wrench, screwdrivers, pliers, and impact drill (for permanent installation).

DEVICE INSPECTION: Unpack and check all accessories (host, bracket, cables, solar kit) against the packing list. Ensure all parts are complete, intact, and undamaged before installation.

4.2 Installation Methods



(1)

Fixed Bracket



(2)

Portable Bracket
White Steel Bracket



(3)

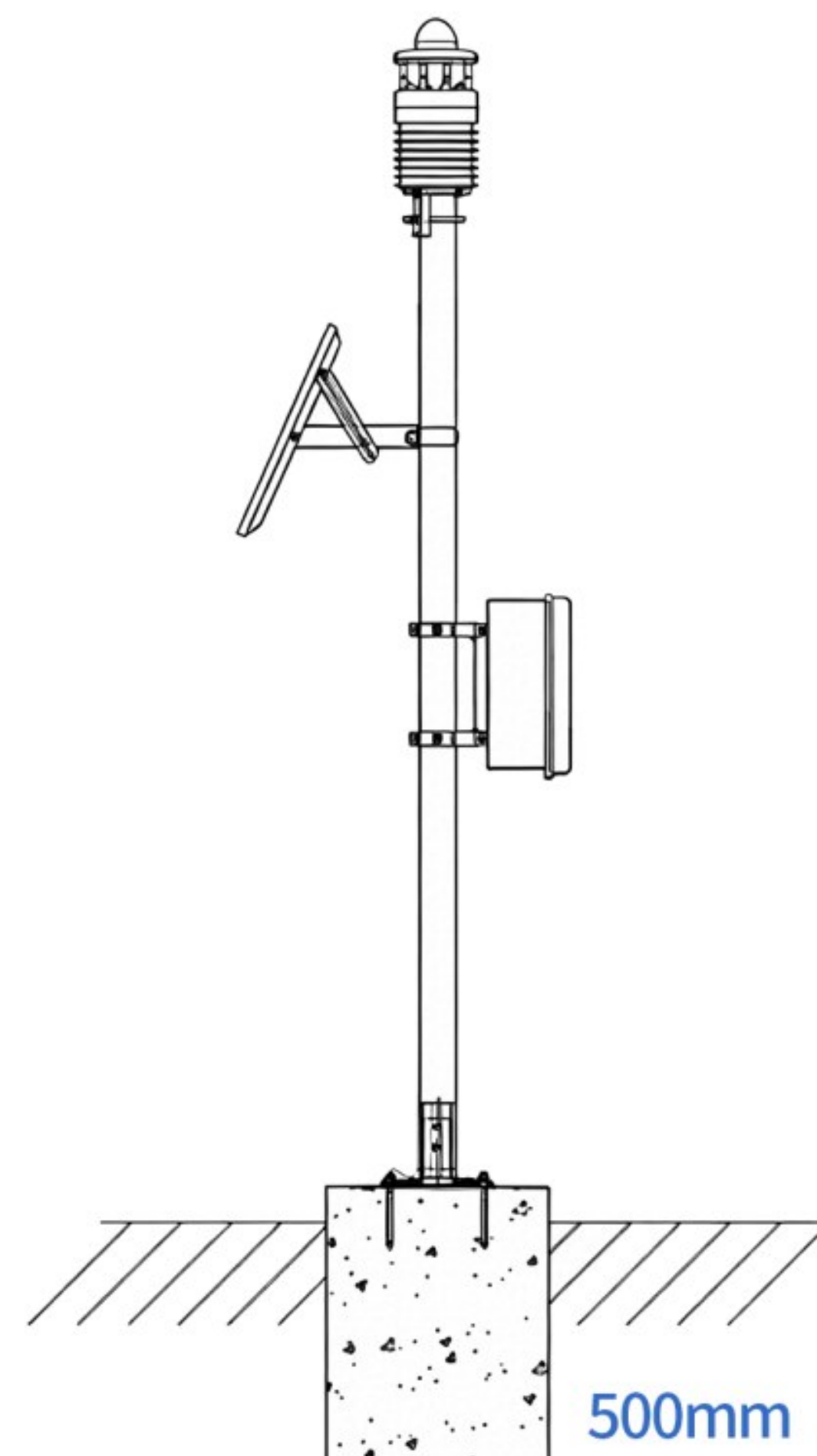
Portable Bracket
Aluminum Alloy Bracket



4.3 Installation Diagrams

(1) Fixed Bracket

1. Build a concrete base and drive in expansion bolts.
2. Mount the device (with built-in clamps) on top, route cables through the bracket tube.
3. Secure the bracket and align its north mark to true north.
4. For solar-powered systems, install the panel on the upper-middle bracket, facing south; adjust tilt angle for optimal solar efficiency.
5. Mount the power junction box on the middle bracket and connect all cables. (Figure 1)



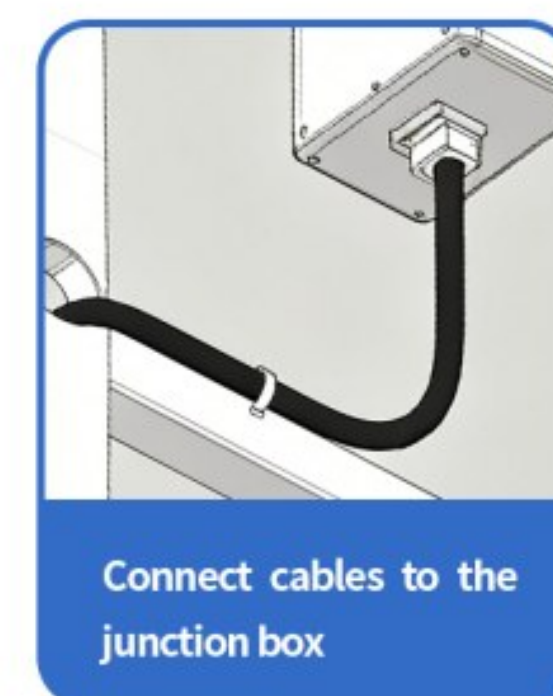
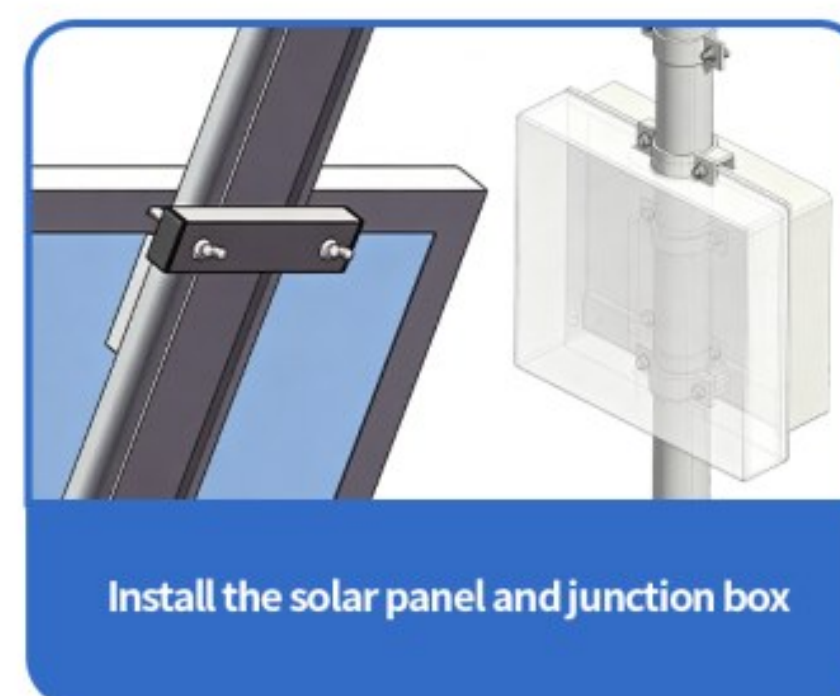
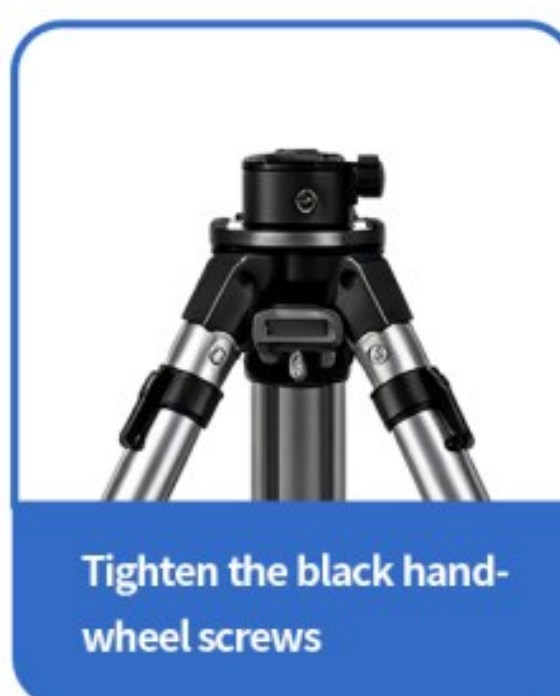
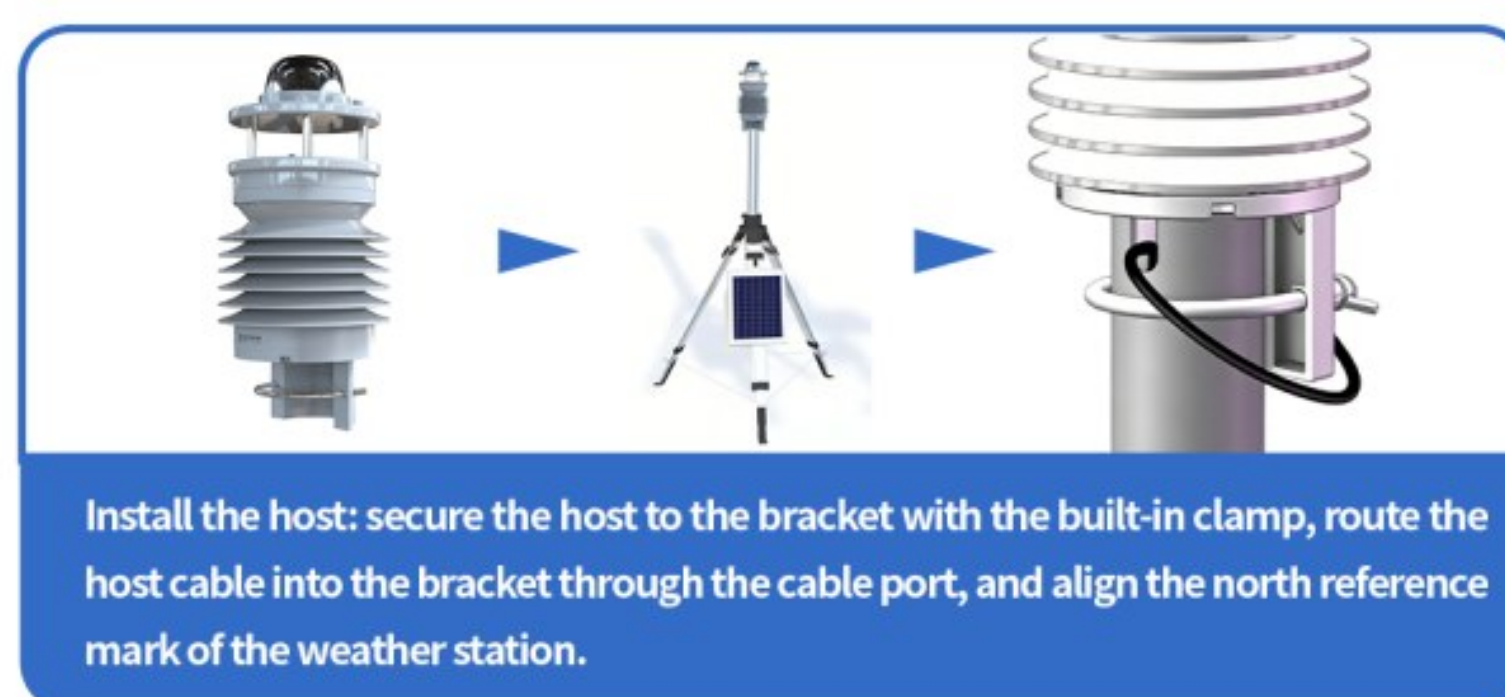
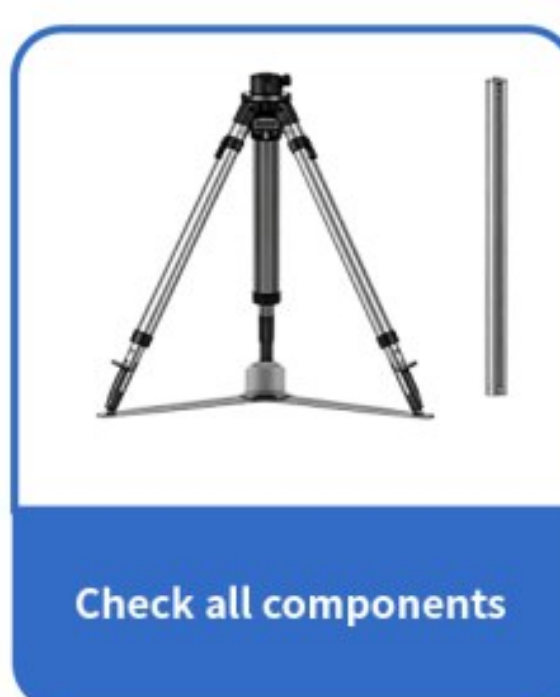
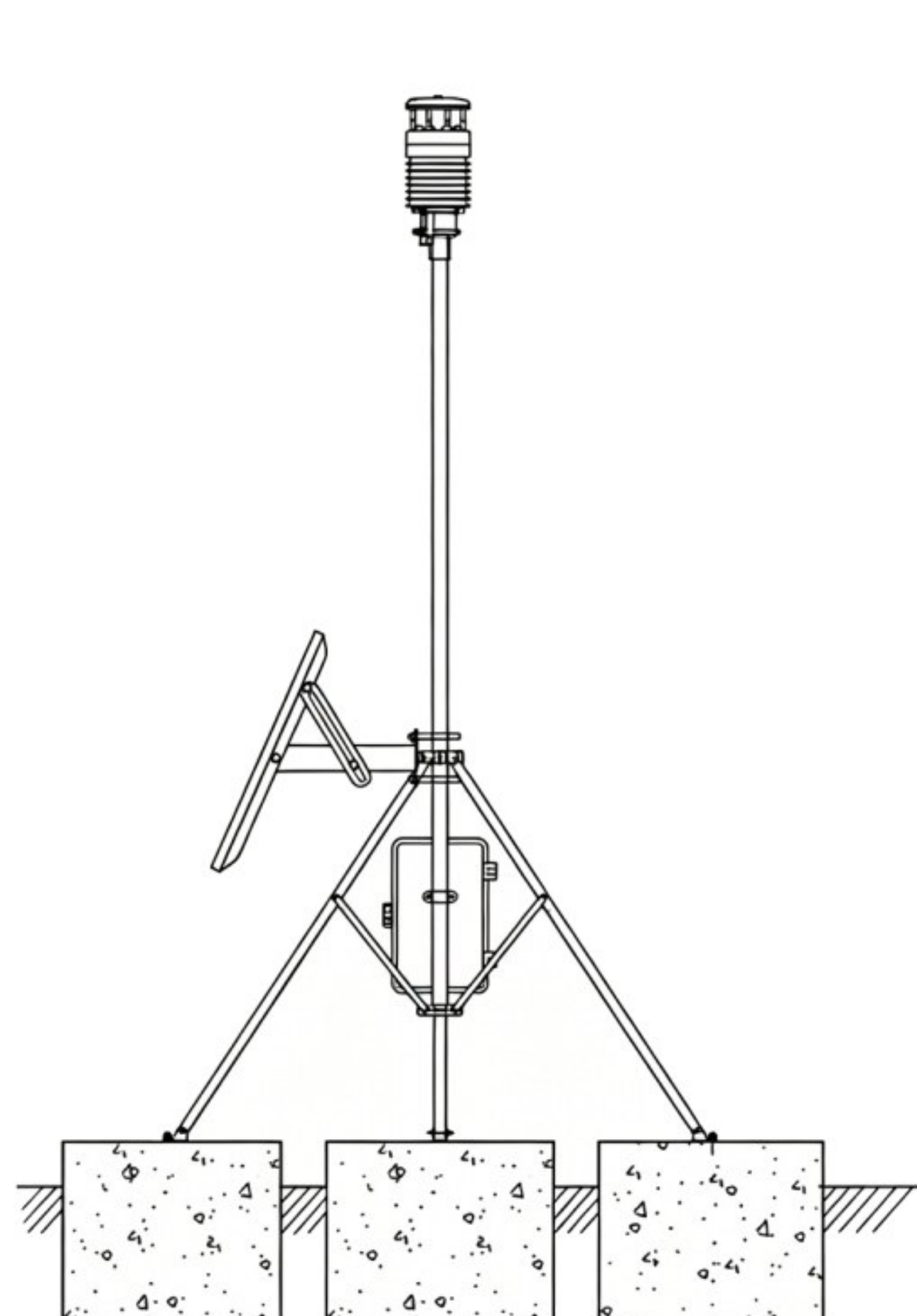
(2) Portable Brackets

Type 1: White Steel Bracket

It is more suitable for permanent outdoor use. The installation steps are basically the same as those of the fixed bracket, except for the concrete foundation design. It is also fixed with expansion bolts, but cables do not need to be routed through the bracket tube. (Figure 2)

Type 2: Aluminum Alloy Bracket

It is more suitable for short-term or temporary monitoring. No concrete foundation is required, and only simple assembly is needed. Steps are as follows:



*For short-term outdoor monitoring for qualitative purposes, the bracket can be fixed with ground anchor rods or expansion bolts.

*Pay attention to the north alignment of the weather station and the south-facing orientation of the solar panel.



5. WIRING AND DATA COMMISSIONING

5.1 Wiring Instructions

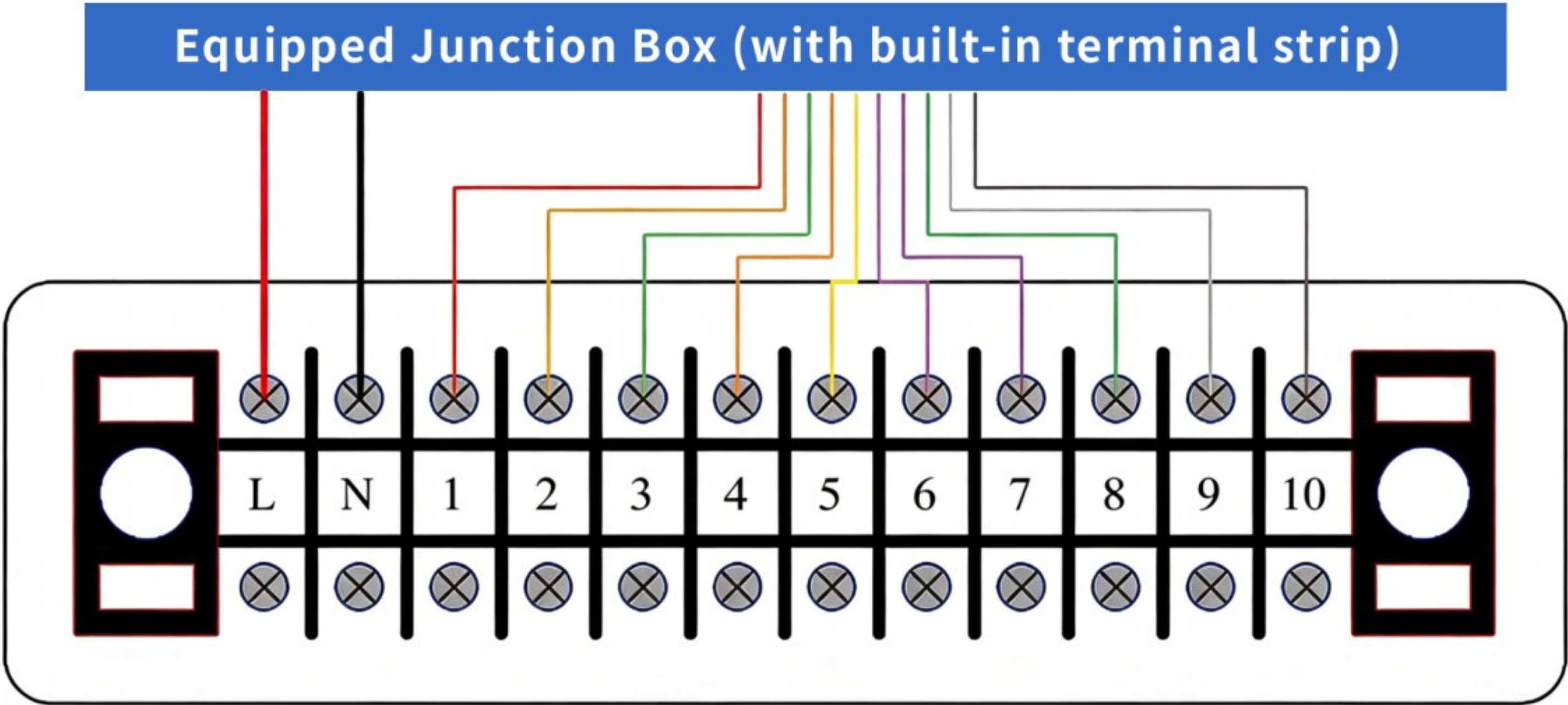
5.1.1 Wiring Without Power Junction Box

When stable DC12V power supply is available on site, wiring can be performed directly according to the cable markings on the device, with no additional junction box required.

For RS232 communication, the GND ground wire must be connected to avoid communication abnormalities and data garbling.

5.1.2 Power Junction Box

If the system is equipped with a power junction box, AC/DC power supply and solar power supply can be connected via the terminal blocks inside the junction box.



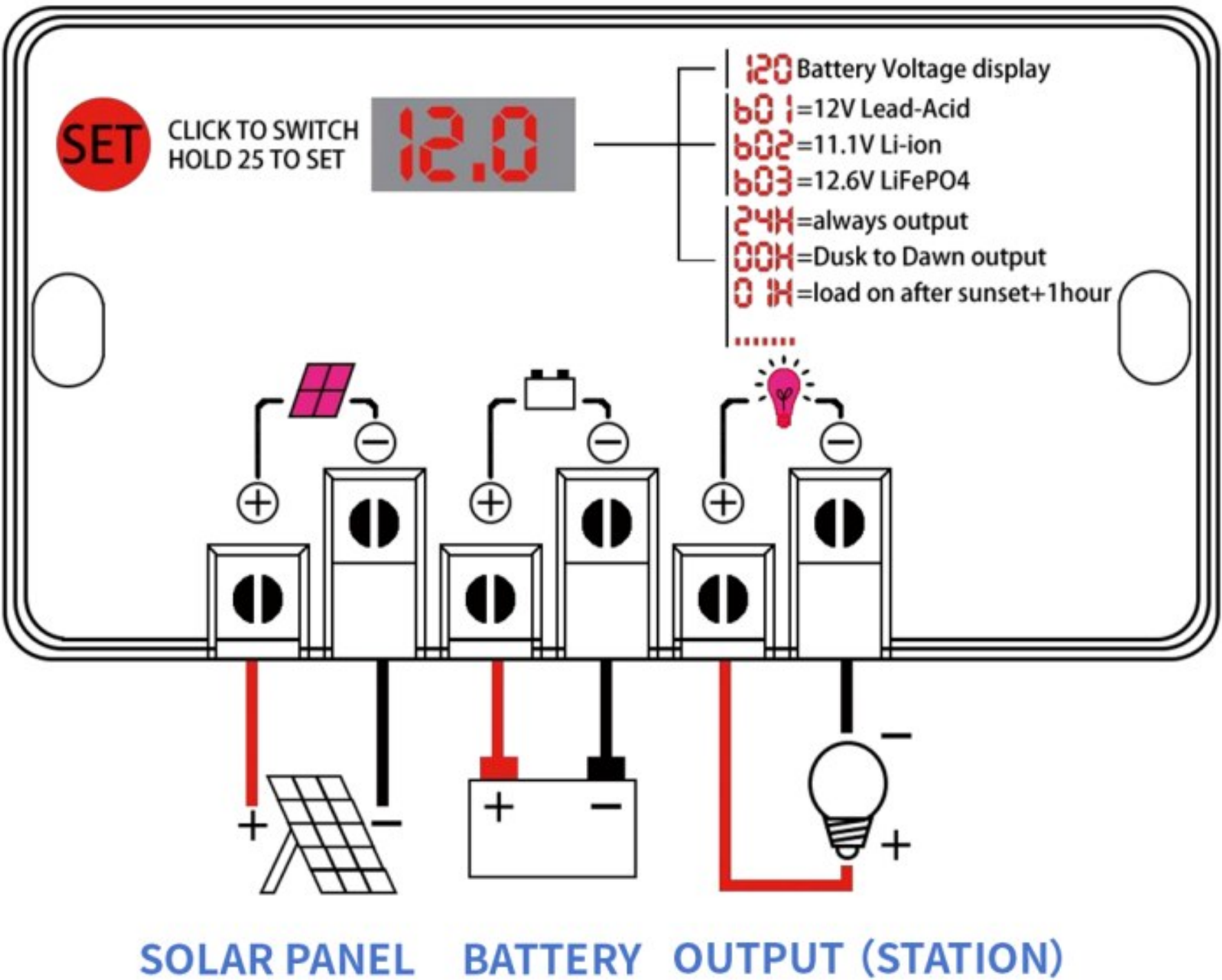
Terminal No.	Label	Function Description
L	AC220V Live	AC 220V power live wire input
N	AC220V Neutral	AC 220V power neutral wire input
1	DC12V+	DC12V power positive / Solar controller load positive
2	DC12V- / GND	DC12V power negative / Solar load negative + RS232 communication GND
3	232R / 485A	RS232 receive terminal / RS485 communication line A
4	232T / 485B	RS232 transmit terminal / RS485 communication line B
5 ~ 10	Sensor Expansion	Wiring terminals for external sensors

Note: For wireless communication configuration, power off the device and connect the GPRS configuration cable to the RS232 communication cable to complete GPRS module configuration.



5.2 Solar Power Supply System

Wiring and Configuration Diagram of Solar Charge Controller



NOTICE

Strictly follow the connection sequence below!!!
Disconnection sequence is reverse to the connection sequence!!!

Do NOT connect the inverter to the output port!!!
Connect the inverter directly to the battery!!!

Battery → Controller
Solar Panel → Controller
Load Output → Controller

5.2.1 Wiring Instructions

- Connect battery terminals to the controller as shown (polarity correct).
- Connect solar panel terminals likewise (parallel for multiple panels, no reversal).
- Connect load terminals similarly (no reversal).

5.2.2 Operation

- This controller has 2 configurable items. During normal operation, the display window shows the current battery voltage.
- Press the button once to switch to battery type setting (B01, B02, B03).
 - Press again to switch to load operating mode setting (24H, 0–23H).
- To adjust a setting: long press the button until the digits flash, then short press to adjust the value. Wait until the digits stop flashing to confirm the setting.

Category	Code	Function Description
Battery Type	B01	General lead-acid battery (flooded, maintenance-free, deep-cycle types)
	B02	3S lithium-ion battery (nominal voltage: 11.1V)
	B03	4S LiFePO4 battery (nominal voltage: 12.8V)
Load Mode	24H	Always-on load mode
	00H	Light control mode: load off by day, on at night
	01H	Time control mode: load off by day, turns off 1 hour after night activation
	02H	Time control mode: load off by day, turns off 2 hours after night activation
		Other timing gears (and so on)



5.3 Data Upload Commissioning

After bracket installation, power the device via AC220V or DC12V. The bottom indicator stays on steadily; when the host runs normally, it blinks regularly. Data upload can then be commissioned—monitored via factory software or transmitted to the backend server using the Modbus protocol.

5.3.1 Modbus RTU Protocol

(1) Communication Baud Rate

The device adopts asynchronous full-duplex communication, with fixed 1 start bit, 8 data bits, 1 stop bit and no parity check. It supports three baud rates: 4800, 9600 and 19200. The baud rate can be modified via software or commands.

(2) Default Serial Port Communication Parameters

Serial Baud Rate	Stop Bits	Data Bits	Parity	Default Device Address
9600	1	8	None	01

(3) Command Frame Format

Slave Address – Function Code – Data – Error Check

(4) Slave Address and Communication Parameter Configuration

The slave address is a single-byte hexadecimal value. The device only responds to request frames whose slave address matches its own address.

The address can be set directly via the system software menu or modified via commands.

(5) Data Format

In compliance with the Modbus protocol, all hexadecimal data and floating-point values in the data field follow the big-endian order (high byte first, low byte second).

(6) Function Code: 0x03 – Read Holding Registers

(7) Cyclic Redundancy Check (CRC)

CRC check uses a 16-bit word, transmitted low byte first.

Initialize register to 0xFFFF.

XOR the first data byte (slave address) with the register's low byte.

Shift right one bit; if the LSB is 1, XOR with 0xA001.

Repeat 8 times per byte, then process all frame bytes.

Append the final CRC low byte first, then high byte.





(8) Read Registers (Acquire Real-time Monitoring Data)

Request Command / Request Frame	Byte Length	Value / Range
Slave Address	1	0x01 ~ 0xFF
Function Code	1	0x03
Starting Address	2	0x0000 ~ 0xFFFF
Number of Registers	2	n = 0x0001 ~ 0xFFFF
Check Code	2	—

Response Data / Response Frame	Byte Length	Value / Range
Slave Address	1	0x01 ~ 0xFF
Function Code	1	0x03
Byte Count	1	2*n
Register Values 1–n	2*n	—
Check Code	2	—

Example: For device address 01, the request command for real-time data acquisition is:

0x01 0x03 0x00 0x00 0x00 0x2B 0x05 0xD5

For response details, refer to (11) Register Address Map.

Transmit frame:

#SlaveAddress 210B BaudRate GG

Receive frame:

#SlaveAddress 210BGG

Example:

Set device address 0001 to baud rate 9600

Transmit: #0001210B2580GG

Receive: #0001210BGG

(9) Baud Rate Setting Command

This command sets the communication baud rate. Basic communication parameters remain unchanged, while the frame format and transmission mode differ from standard Modbus. It is transmitted in ASCII code.

(10) Slave Address Setting Command

This command sets the slave address. Basic communication parameters remain unchanged, while the frame format and transmission mode differ from standard Modbus. It is transmitted in ASCII code. The message format is as follows:

Transmit frame:

#1400 NewSlaveAddress GG (slave address range: 0001 ~ 00FF)

Receive frame:

#SlaveAddress 1400GG

Example:

Set the slave address to 0001

•Transmit: #14000001GG

•Receive: #00011400GG





(11) Register Address Map

No.	Address (Hex)	Parameter Name	Data Type	Resolution	Data Example	Parsed Value Example
0	00 00	Ambient Temperature	Signed Integer	0.1	01 0C	26.8℃
1	00 01	Temperature 1 (Backplane Temperature)	Signed Integer	0.1	00 7D	12.5℃
2	00 02	Temperature 2	Signed Integer	0.1	00 7D	12.5℃
3	00 03	Temperature 3	Signed Integer	0.1	00 7D	12.5℃
4	00 04	Temperature 4	Signed Integer	0.1	00 7D	12.5℃
5	00 05	Temperature 5	Signed Integer	0.1	00 7D	12.5℃
6	00 06	Dew Point Temperature	Signed Integer	0.1	00 7D	1.25℃
7	00 07	Ambient Humidity	Unsigned Integer	0.01	02 54	59.6%RH
8	00 08	Soil Moisture 1	Unsigned Integer	0.1	00 CA	20.2% m^3/m^3
9	00 09	Soil Moisture 2	Unsigned Integer	0.1	00 CA	20.2% m^3/m^3
10	00 0A	Soil Moisture 3	Unsigned Integer	0.1	00 CA	20.2% m^3/m^3
11	00 0B	CO ₂ (Carbon Dioxide)	Unsigned Integer	1	12 AC	478ppm
12	00 0C	Evaporation	Unsigned Integer	0.1	00 0D	1.3mm
13	00 0D	Air Pressure	Unsigned Integer	0.1	28 55	1032.5hPa
14	00 0E	Instantaneous Total Radiation 1	Unsigned Integer	1	02 F7	759W/ m^2
15	00 0F	Instantaneous Diffuse Radiation	Unsigned Integer	1	02 F7	759W/ m^2
16	00 10	Instantaneous Direct Radiation	Unsigned Integer	1	02 F7	759W/ m^2
17	00 11	Instantaneous Total Radiation 2	Unsigned Integer	1	02 F7	759W/ m^2
18	00 12	Instantaneous Net Radiation	Signed Integer	1	02 F7	759W/ m^2
19	00 13	Instantaneous Photosynthetic Radiation	Unsigned Integer	1	02 F7	759W/ m^2
20	00 14	Instantaneous Ultraviolet Radiation	Unsigned Integer	1	02 F7	759W/ m^2



(11) Register Address Map

No.	Address (Hex)	Parameter Name	Data Type	Resolution	Data Example	Parsed Value Example
21	00 15	Instantaneous Wind Direction	Unsigned Integer	1	01 0E	270°
22	00 16	Instantaneous Wind Speed	Unsigned Integer	0.1	00 17	2.3m/s
23	00 17	2-min Average Wind Speed	Unsigned Integer	0.1	00 70	11.2m/s
24	00 18	10-min Average Wind Speed	Unsigned Integer	0.1	00 68	10.4m/s
25	00 19	Interval Cumulative Rainfall	Unsigned Integer	0.1	00 66	10.2mm
26	00 1A	Interval Cumulative Sunshine Duration	Unsigned Integer	1	00 05	5 minutes
27	00 1B	Interval Cumulative Total Radiation 1	Unsigned Integer	0.001	01 70	0.368MJ/m²
28	00 1C	Interval Cumulative Diffuse Radiation	Unsigned Integer	0.001	01 70	0.368MJ/m²
29	00 1D	Interval Cumulative Direct Radiation	Unsigned Integer	0.001	01 70	0.368MJ/m²
30	00 1E	Interval Cumulative Total Radiation 2	Unsigned Integer	0.001	01 70	0.368MJ/m²
31	00 1F	Interval Cumulative Net Radiation	Signed Integer	0.001	01 70	0.368MJ/m²
32	00 20	Interval Cumulative Photosynthetic Radiation	Unsigned Integer	0.001	01 70	0.368MJ/m²
33	00 21	Interval Cumulative Ultraviolet Radiation	Unsigned Integer	0.001	01 70	0.368MJ/m²
34	00 22	Daily Cumulative Rainfall	Unsigned Integer	0.1	00 7E	12.6mm
35	00 23	Daily Cumulative Sunshine Duration	Unsigned Integer	1	00 B4	180 minutes
36	00 24	Daily Cumulative Total Radiation 1	Unsigned Integer	0.001	47 C1	18.369MJ/m²
37	00 25	Daily Cumulative Diffuse Radiation	Unsigned Integer	0.001	47 C1	18.369MJ/m²
38	00 26	Daily Cumulative Direct Radiation	Unsigned Integer	0.001	47 C1	18.369MJ/m²
39	00 27	Daily Cumulative Total Radiation 2	Unsigned Integer	0.001	47 C1	18.369MJ/m²
40	00 28	Daily Cumulative Net Radiation	Signed Integer	0.001	47 C1	18.369MJ/m²
41	00 29	Daily Cumulative Photosynthetic Radiation	Unsigned Integer	0.001	47 C1	18.369MJ/m²
42	00 2A	Daily Cumulative Ultraviolet Radiation	Unsigned Integer	0.001	47 C1	18.369MJ/m²



6. SYSTEM MONITORING SOFTWARE

1. Add New Device

- (1) Device Name: Assign a name, e.g., Meteorological Station.
- (2) Device Address: Use the last five digits of the recorder number; set via the Device Address command.
- (3) SIM Card Number: The SIM phone number, matching the DTU identifier for GPRS.
- (4) Longitude & Latitude: Set site coordinates (optional).
- (5) IP Address: Required for network communication.

2. Modify Device

Edit the parameters of an existing device.

3. Delete Device

Delete an existing device. Once deleted, you will no longer be able to access the system console or view historical data associated with that recorder number.

If deleted by misoperation, you may re-add the device. As long as the device information matches the original record, you will regain access to the historical data of the same recorder number after re-entering the console.

Please operate with caution.

4. Sensor Settings

This function configures the display properties of meteorological elements in both real-time monitoring and historical data views. You can rename each meteorological element and toggle its display status.

5. Stop Service / Start Service

Start Service: Activates the communication service.

In GPRS mode, the recorder automatically sends real-time data to the PC, where the software stores it in the device's historical database by recorder number.

The DTU module auto-searches for the central server; the device icon shows online when the wireless service is running, and switches to offline if the module stops (e.g., power loss).

To switch between communication modes, stop the current service first, select the target mode, then restart the service.



6. Connect Device

After the service is started, the Connect Device option becomes available. Select the target recorder name to enter the system console of the corresponding device.

7. Real-time Monitoring

Displays real-time monitoring status of multiple devices simultaneously.

8. View Imported Historical Data

Browse imported historical data records.

9. System Configuration

(1) Serial Port Communication Settings

The system automatically lists all available serial ports on the current computer. Select the serial port connected to the recorder and set the baud rate (default: 9600).

(2) GPRS Communication Settings

If the computer is on a local area network (LAN), the software automatically detects available local IP addresses. Select the appropriate LAN IP; the DTU module will locate the corresponding computer on the public network via routing.

A fixed IP address for the network adapter is recommended.

If the computer is on a wide area network (WAN), use the current public IP address.

For LAN deployment, ask the network administrator to open the corresponding port and configure NAT mapping to expose the port to the public network.

The port number must be identical to the port configured in the DTU module.

Note: Please add an inbound rule in the firewall to allow access to this port.

(3) Network Communication Settings

Network communication adopts device-initiated transmission mode. The device and computer must be on the same LAN. Set the TCP port for data reception, and enter the device IP address in the device information.

10. USB Drive Data Import

Import data stored on a USB flash drive. Data will be automatically sorted into the historical database of the corresponding device by recorder number.

11. System Software Console



Function Name	Function Description
Real-time Monitoring	The main monitoring interface refreshes all configured meteorological parameter data in real time. It supports time filtering (real-time / daily / monthly / yearly) and data export.
Historical Data	Supports custom time range query of historical data, and allows data export to Excel files for data storage and analysis.
Online Status Check	Tests the communication connection between the recorder and the platform, and displays the number of data records stored in the recorder.
Data Import	Imports historical data from the recorder's internal memory to the platform via the computer serial port and generates data files. This operation takes a long time and is unavailable in wireless mode.
Clear Recorder Memory	Clears the local memory of the device to free up storage space for new data. It only clears the device's internal memory and does not affect historical data already stored on the platform.
Sampling Interval	Sets the sampling storage cycle and data transmission interval of the recorder, ranging from 1 to 60 minutes, to adjust the frequency of data acquisition and upload.
Recorder Time Calibration	Calibrates the built-in clock of the recorder to ensure accurate data timestamps and avoid time sequence disorder.
Recorder Calibration	Calibrates monitoring data with deviation. The device has completed initial calibration before delivery; modification is not recommended for non-professional scenarios.
Radiation Sensitivity	Inputs the sensitivity parameters from the factory calibration certificate of the radiation sensor to ensure the accuracy of radiation monitoring data.
Search / Clear Temperature Sensor Address	Assigns a unique address to the temperature sensor. When replacing a sensor, the recorder must be reset to match only one temperature sensor, with the target address corresponding to the panel label one by one.
Device Address	Sets the communication number of the data collector, ranging from 0 to 65535. It must be consistent with the device number created on the platform for normal communication.
Baud Rate Setting	Modifies the communication baud rate of the instrument. The default value is configured before delivery; modification by non-professional personnel is not recommended to avoid communication errors.
Protocol Setting	Modifies the communication protocol of the instrument. The default configuration is completed before delivery; arbitrary modification is not recommended to avoid affecting data interaction.



7. TROUBLESHOOTING AND INSPECTION

7.1 Controller and Power Wiring Issues

Abnormal Phenomenon	Possible Cause	Solution
Controller does not power on after being energized	1. Excessively low battery voltage 2. Reverse battery polarity	1. Fully charge the battery before connecting to the controller 2. Check battery polarity and correct the reverse connection
Charging indicator stays off under sufficient sunlight	Open circuit or reverse connection of the photovoltaic panel	Reconnect the PV panel properly. Check polarity and wiring.
Load indicator stays off, no voltage at output port	Battery is in over-discharge protection state	Charge the battery until its voltage rises above the over-discharge recovery voltage; the output will automatically resume.

7.2 Software Related Issues

Symptom	Cause	Solution
Prompt "KB2468871v2 is not applicable"	The system already has the required runtime environment; repeated installation is unnecessary	Click Cancel and continue the installation as prompted
Extra program items appear in Control Panel after installation	Automatic installation of dependency runtime (.Net Framework)	Do not delete; it is a required runtime library for the software
Permission denied when creating / configuring devices	Software installed on the system drive, restricted by system permissions	Run the software as administrator; or install it to a non-system drive
Permission denied during installation on Windows XP	Current login account does not have administrator privileges	Switch to the Administrator account and reinstall
Need to retain data when uninstalling / reinstalling the software	Database files require manual backup and restoration	Back up data.db before uninstallation; replace the file with the same name during restoration

7.3 Device Fault Symptoms

Fault Symptom	Solution
Recorder fails to power on or emits continuous beep	Check if the power cable is properly connected; measure the supply voltage to ensure it meets the collector's requirements
Host computer freezes during operation / prompts to check serial port	1. Check the communication cable and computer serial port 2. Power off and restart the device 3. Check the serial port driver
Imported data has disordered timestamps	1. Power off and restart the device 2. Recalibrate the clock and power on again 3. Replace the computer and serial cable 4. Contact the manufacturer if the problem persists
Collector cannot communicate with the computer	1. Verify the communication address between the instrument and the backend platform 2. Check if the communication wiring is correct





8. AFTER-SALES SERVICE INSTRUCTIONS

(1) After-sales Service Commitment

Service Item	Service Content
Warranty Period	1-year warranty for the whole system and sensors (excluding consumables); free repair or replacement during the warranty period
Response Time	7×24-hour customer service hotline; response within 2 hours for general issues, within 30 minutes for emergency issues
Remote Support	Free remote technical support, including remote fault diagnosis, parameter configuration and program upgrade
On-site Service	Free on-site service for non-human damage during the warranty period; cost-price charge after the warranty expires
Standby Unit Service	Standby unit service available for large projects to ensure rapid replacement in case of key equipment failure

(2) Training Plan

- Free on-site operation training (1 – 2 days), covering equipment operation, daily maintenance and common fault handling
- Provide complete operation manual and maintenance documentation (electronic version)
- Post-training assessment to ensure operation and maintenance personnel are capable of independent operation
- 1 free refresher training per year (covering system upgrade and update contents)

(3) Upgrade and Maintenance

- Lifetime free upgrade and maintenance for platform software (function iteration and optimization)
- Lifetime free upgrade for RTU firmware, supporting remote over-the-air delivery
- Detailed upgrade instructions and technical support provided for major version upgrades

(4) Other Notes

- Turn off the recorder before plugging/unplugging sensors or communication cables.
- When connecting sensors to the recorder, the sensor number must correspond one-to-one with the terminal label number.
- Always complete data import and verify data accuracy before clearing the internal data of the recorder.