

RTU-AC04

Industrial Video & IoT Data Fusion Gateway

Real-Time Sensor Data Overlay for IP Cameras, SCADA & Remote
Monitoring

Transform Any IP Camera into a Real-Time Industrial Video Telemetry
System

Product Overview & Technical Guide



Note: Accessories and interfaces may vary by model; please refer to the actual product.

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1. Product Overview

1.1 Product Positioning

The AC04 is an industrial edge gateway that seamlessly integrates real-time sensor data, PLC information, and industrial parameters into IP camera video streams, enabling advanced Video & IoT Data Fusion for remote monitoring applications.

Deployed between front-end IP cameras and backend platforms, the AC04 uses native camera OSD integration to embed structured data from sensors, instruments, PLCs, and business systems directly into video streams — delivering lossless video quality, permanent data visibility, and flexible system integration.

1.2 Vertical Industry Applications

1.2.1 Smart Buildings (Safety & Energy Efficiency)

- Elevator Monitoring – Real-time overlay of floor number, running direction, and entrapment alarms. Eliminates blind spots and provides precise spatial positioning for emergency rescue.
- Power Distribution / Server Rooms – Overlay voltage/current, temperature/humidity, and smoke status. Physically binds environmental & power data with video, simplifying O&M auditing.

1.2.2 Water Conservancy & Hydrology (Flood Control & Drought Relief)

- Hydrological Stations – Write water level, flow velocity, flow rate, and rainfall directly into the video stream. During flood season, operators can grasp site conditions intuitively without switching systems.
- Reservoirs & Dams – Overlay seepage pressure, displacement, and phreatic line data to build a visual, comprehensive safety panorama.

1.2.3 Geotechnical Monitoring & Disaster Prevention

- Landslide / Debris Flow Monitoring – Real-time overlay of GNSS displacement, crack gauge readings, and soil moisture content on the IPC video.
- Emergency Value – When an alert is triggered, the command centre can read centimetre-level quantitative data directly from the video to assist in evacuation decision-making.

2. Technical Specifications

2.1 Basic Parameters

Parameter	Value
Operating Voltage	7~32 V DC
Operating Current	≤100 mA @ 12 V
Communication Methods	RS485 / TTL / Ethernet

2.2 Interface Pinout

Pin	Interface Name	Description
1	VIN	Power input, wide voltage 7~32 V
2	GND	Power ground (negative)
3	A	RS485-A differential signal positive (Data+ / A)
4	B	RS485-B differential signal negative (Data- / B)
5	TX	TTL serial transmit, connect to RX
6	RX	TTL serial receive, connect to TX

2.3 Camera OSD Support List

Manufacturer	Supported	Max Overlay Lines	Default Port
Hikvision	Yes	4	80
Dahua	Yes	4	80
Uniview	Yes	4	1026
Zhongwei Century	Yes	4	34567
Huawei	Yes	16	80
Tongwei	Yes	4	80

Manufacturer	Supported	Max Overlay Lines	Default Port
Xinruishi	Yes	7	80
Tiandy	Yes	1	80
Xiongmai	Yes	1	8899

3. Key Features

1. Universal Camera Compatibility (Key Advantage)

- **Deep Private Protocol Integration** – Perfectly adapts to Hikvision, Dahua, Uniview, Huawei, and other mainstream manufacturers’ private SDKs/APIs, directly calling the IPC’s internal OSD resources without RTSP stream forwarding, ensuring zero quality loss and zero latency.
- **Broad ONVIF Compatibility** – Supports standard **ONVIF** protocol discovery and configuration, covering Zhongwei Century, Tongwei, Xinruishi, Tiandy, Xiongmai, and other emerging camera manufacturers, protecting your existing assets.
- **Adaptive Stream Bypass** – Uses bridge transparent transmission (bypass) mode, does not change the original video streaming path, does not affect NVR recording or forwarding – plug-and-play.

2. Multi-Source Industrial Data Integration (Video and IoT Fusion)

- **Rich Industrial Interfaces** – Comes with an isolated RS485 serial port supporting ModBus-RTU master protocol, directly connecting to various sensors (water level gauges, rain gauges, displacement meters, temperature/humidity transmitters) and PLC devices.
- **Multi-channel Parallel Processing** – A single unit supports polling up to 12 channels simultaneously, collecting data from multiple points and overlaying them onto different camera feeds.
- **Flexible Protocol Customisation** – Supports customised non-standard protocol development according to project requirements for parsing private data frames.
- **Native OSD Injection** –Writes data directly into the camera OSD layer before encoding. The characters are physically bound to the video, visible in both live view and recorded playback, cannot be removed by post-editing – providing judicial evidentiary value.

3. Industry-specific Scenario Applications (Targeted)

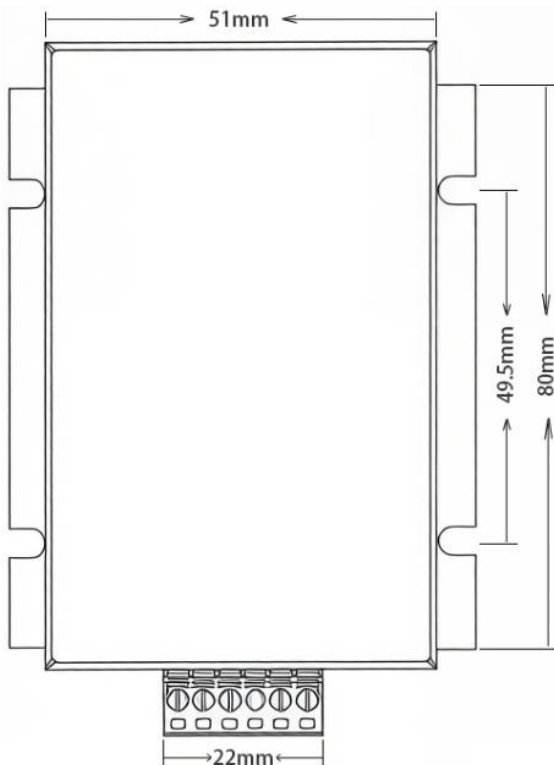
- **Smart Buildings (Elevators)** – Accurately receives floor controller data and overlays floor number, up/down arrows, entrapment status, and maintenance indicators.
- **Water Conservancy** – Supports overlay of instantaneous flow, cumulative flow, water level elevation, and rainfall, together with timestamps to form a complete hydrological archive.

- **Geological Disaster Monitoring** – Supports overlay of X/Y/Z tri-axial displacement, tilt angle changes, and crack width, providing intuitive data support for early warning.

4. Minimalist O&M & Industrial Reliability

- Dual Network Ports – Built-in 2-port switch function.
- Wide Voltage Power Supply – Supports DC 7V–32V input with reverse polarity and lightning/surge protection, suitable for unstable industrial power environments.

4. Installation Guide

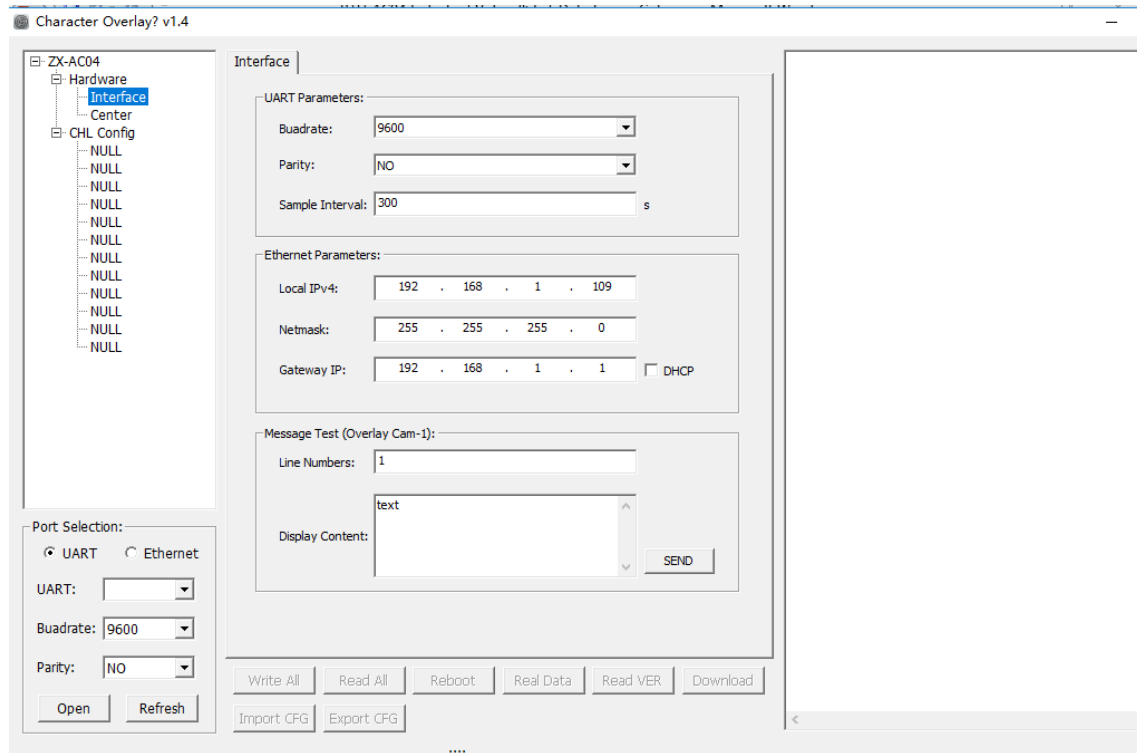


Installation Steps

1. Always power off before wiring.
2. Connect the input power – ensure the voltage is within 9–36 V DC and the polarity is correct.
3. In areas with frequent lightning, install an external lightning arrester.
4. Connect external devices – follow the pin definitions to connect RS485 equipment.
5. After verifying all connections, power on. The indicator lights will show normal start-up.

> Caution: Strictly follow the terminal diagram on the device housing or in this manual. Do not reverse or misconnect wires.

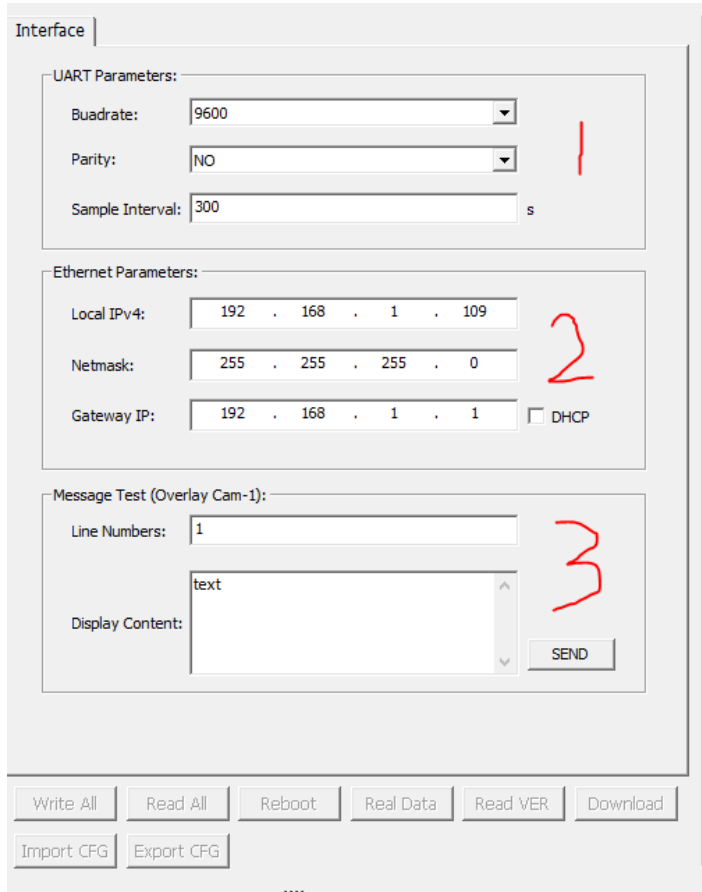
5. Parameter Configuration



The configuration software for the AC04 is organised as follows (screenshot reference):

- Left Navigation Bar – Lists all configurable options (e.g., Interface Settings, Centre Settings, Channel Configuration). Click an item to display its parameters in the centre.
- Centre Configuration Area – Contains detailed parameter modules such as Serial Port Configuration, Ethernet Configuration, Video Overlay Configuration, etc. Here you modify baud rates, IP addresses, display content, etc.
- Right Log Window – Displays real-time debug information and status feedback to confirm operation results.

5.1 Interface Configuration



1) Serial Port Parameter Matching (Communication Foundation)

Serial parameters must exactly match those of the connected device. If they differ, the device cannot parse data frames correctly, leading to communication failure.

- **Baud Rate** – Determines data transmission speed. Ensure both devices use the same rate (common values: 9600, 115200, etc.).
- **Parity** – A simple error-checking mechanism. Choose None, Odd, or Even according to the slave device's protocol.
- **Polling Cycle** – The idle interval after completing one full round of all channel data acquisitions. For example, setting to 30 seconds means after collecting all sensors, the device waits 30 seconds before starting the next round. This controls data update frequency and system load.

2) Ethernet Configuration

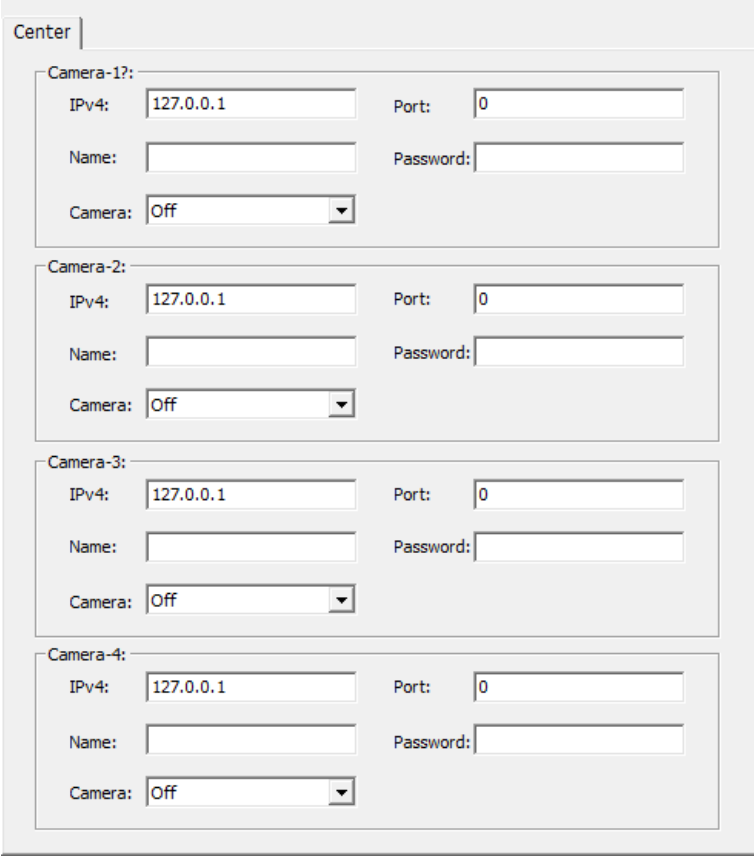
Configure network parameters. The IP address must be on the same subnet. Choose either static IP or DHCP (auto-obtain) by checking the DHCP option.

3) Message Test

After all parameters are set (ensure the camera is online), you can perform a simple test. The test message will be overlaid on the first line of the camera. Enter the content and click "Send" to see

it displayed on the screen.

5.2 Centre Configuration



The screenshot shows a web interface titled "Center" with a tabbed layout. The "Center" tab is selected. Below the tab, there are four identical configuration sections for cameras, labeled "Camera-1:", "Camera-2:", "Camera-3:", and "Camera-4:". Each section contains the following fields:

- IPv4:** A text input field with the value "127.0.0.1".
- Port:** A text input field with the value "0".
- Name:** An empty text input field.
- Password:** An empty text input field.
- Camera:** A dropdown menu with "Off" selected.

This section configures the video character overlay service. The device supports up to 4 cameras simultaneously. Fill in each field according to your site setup.

- **IP Address** – Enter the camera's network address.
- **Port** – Enter the camera's service port (Hikvision default 8000, Dahua default 37777, check your actual settings).
- **Username / Password** – Credentials with stream-pull permissions; case-sensitive.
- **Camera Type** – Must select the actual brand from the dropdown (e.g., Hikvision, Dahua, Tongwei, Huawei, etc.).

5.3 Channel Configuration

CHL-1

CHL Attribute:

Interface:

CHL Name:

CHL Code:

Overlay Mode:

Send Parameters(Modbus):

☐ Custom: ☐ Inherit

RECV Parameters:

Data type:

Offset(0):

Data len:

Decimal:

Data Compensation:

Comp MODE:

Comp Value:

This area defines the RS485 sensor data acquisition rules. The system uses an open protocol configuration, supporting standard Modbus RTU and other industrial protocols, enabling plug-and-play reading of nearly all 485 sensors.

- **Interface Mapping** – Supports both RS485 (industrial, long-distance) and TTL (direct MCU connection, short-distance) – plug-and-play.
- **Channel Name** – Customisable name (e.g., Temperature, Flow Rate) which will be overlaid on the video output.
- **Element Code** – Hexadecimal representation. For example, `0022` should be split as `00` (high byte) and `22` (low byte).
 - High byte range `00~03` – corresponds to the camera number (00 = first camera, 01 = second, 02 = third, 03 = fourth).
 - Low byte indicates the element code. When multiple channels share the same element code, their texts are overlaid on the same line. Example: if both channel 1 and channel 2 have code `0022`, the data from both will appear on one line like `Water level: 1.85 Flow: 5.96`. If the channel name of the second channel is empty, it is treated as the same group and uses the first channel's name; data are separated by commas, e.g., `Water level:1.85,28.5`.
- **Overlay Method** – Select the corresponding camera.
- **Send Parameters** – Enter the register read command for the sensor (e.g., `01 03 00 00 00 01`). Do not include the checksum.
- **Receive Parameters** – Select the sensor data format (e.g., int, float); Offset – starting byte position; Length – number of bytes to read; Precision – decimal places to retain.
- **Data Compensation** – Data post-processing: supports linear transformation of the raw Modbus

register values. Provides addition (+), subtraction (-), multiplication (×), and division (÷) operations to eliminate zero drift, correct transmission attenuation, or perform unit conversion, ensuring physical accuracy of the output data.

6. Protocol Overlay Description

Packet Structure

Sync Word	Direction	Camera	Data Length	Data Payload	Packet Checksum	End
F3	80 / 00	01~04	0009	AA 01 04 74 65 78 74 00 C5	B6	0D

Data Payload Frame Structure

Line Separator	Line Number	Data Length	Character Data	Checksum
AA	See section 2.3 (line count)	Character length	String must end with 00	Sum of data part

Example:

`F3 80 01 00 09 AA 01 04 74 65 78 74 00 C5 B6 0D`

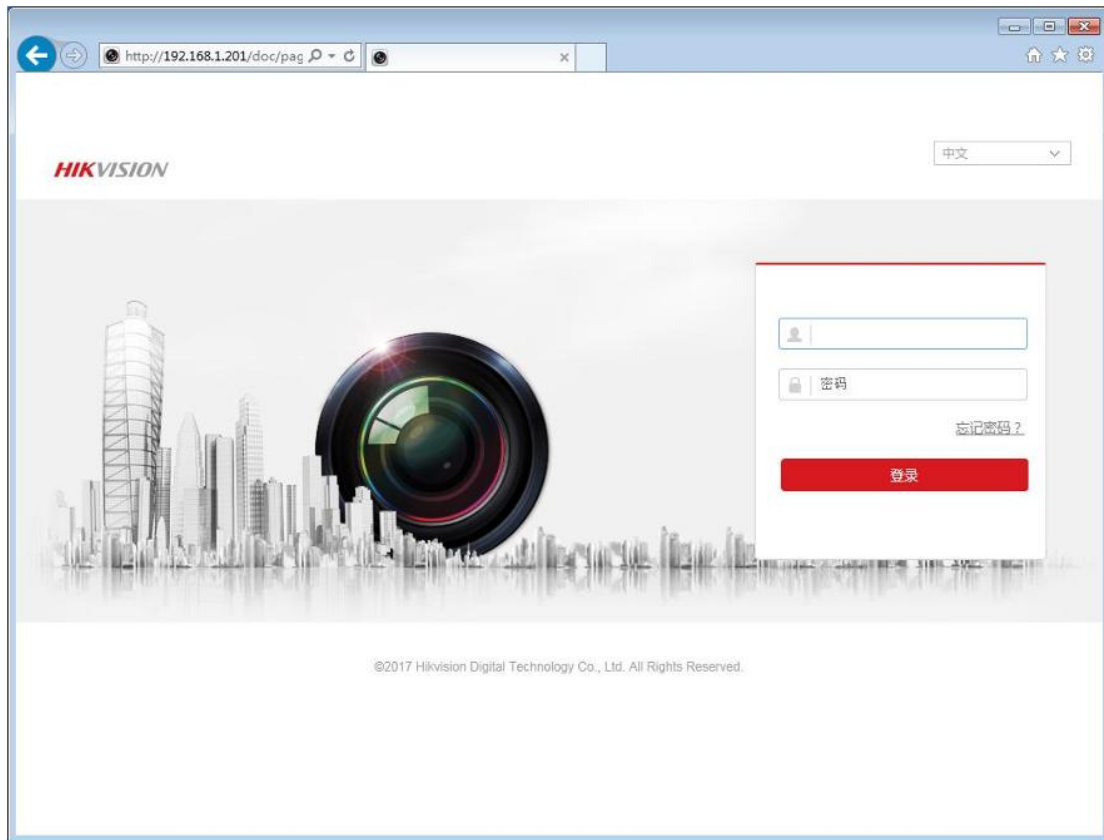
Send overlay message "test"

- F3 – Sync word, fixed.
- 80 – Overlay command (downlink). Device response uses `00` to indicate direction.
- 01 – Camera serial number to overlay (01~04 for up to 4 cameras).
- 00 09 – Total length of the data payload.
- AA 01 04 74 65 78 74 00 C5
 - AA = line separator
 - 01 = line number (first line)
 - 04 = data length (4 characters)
 - 74 65 78 74 = ASCII "test"
 - 00 = terminator
 - C5 = checksum (sum of 74+65+78+74+00 = C5, low byte)

7. Camera Configuration – Hikvision & Huawei

7.1 Hikvision Camera Configuration

1. Use IE browser to log in to the camera's IP address, enter username and password.



2. Click “Configuration” to enter the camera's settings page. Go to System → Security Management. Choose the WEB authentication method as required – Digest/Basic mode is recommended.



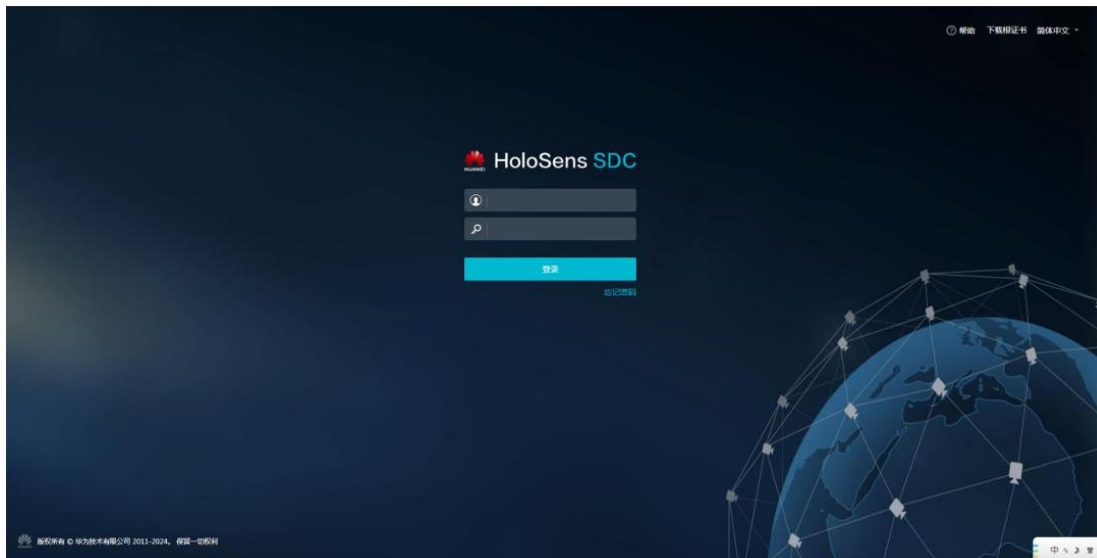
3. Go to Image → OSD Settings. Check or uncheck the display of name and date as needed. Change OSD colour to Black/White Auto – it will auto-invert when the font colour matches the background. Set alignment to Custom. Click Save after changes.



(Screenshots in the original manual are referenced here)

7.2 Huawei Camera Configuration

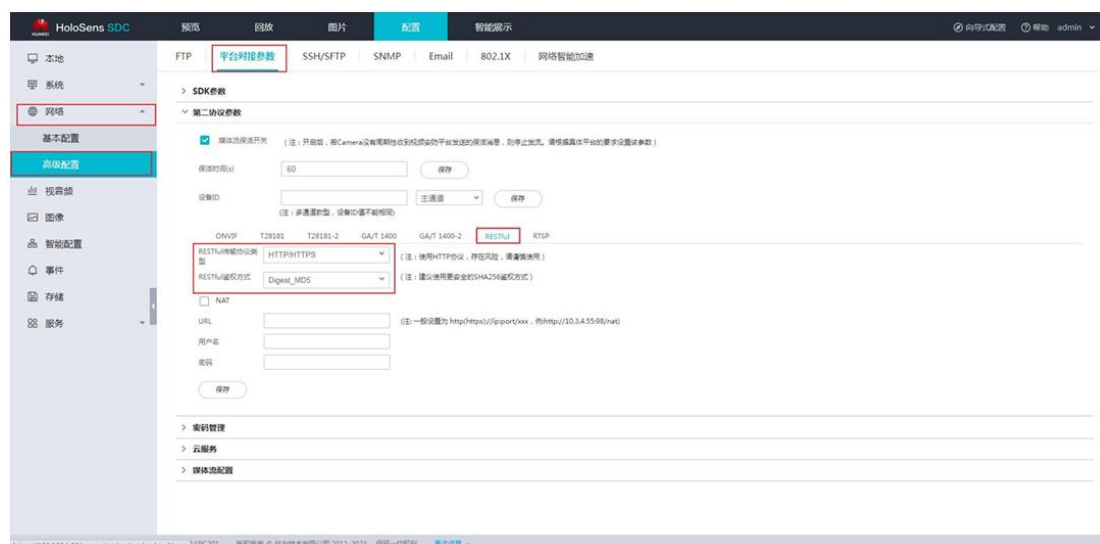
1. Use IE or Chrome browser to log in to the camera's IP address, enter username and password.



2. After login, go to Advanced Configuration → Network → Platform Access → Second Protocol Parameters → RESTful. Modify as follows:



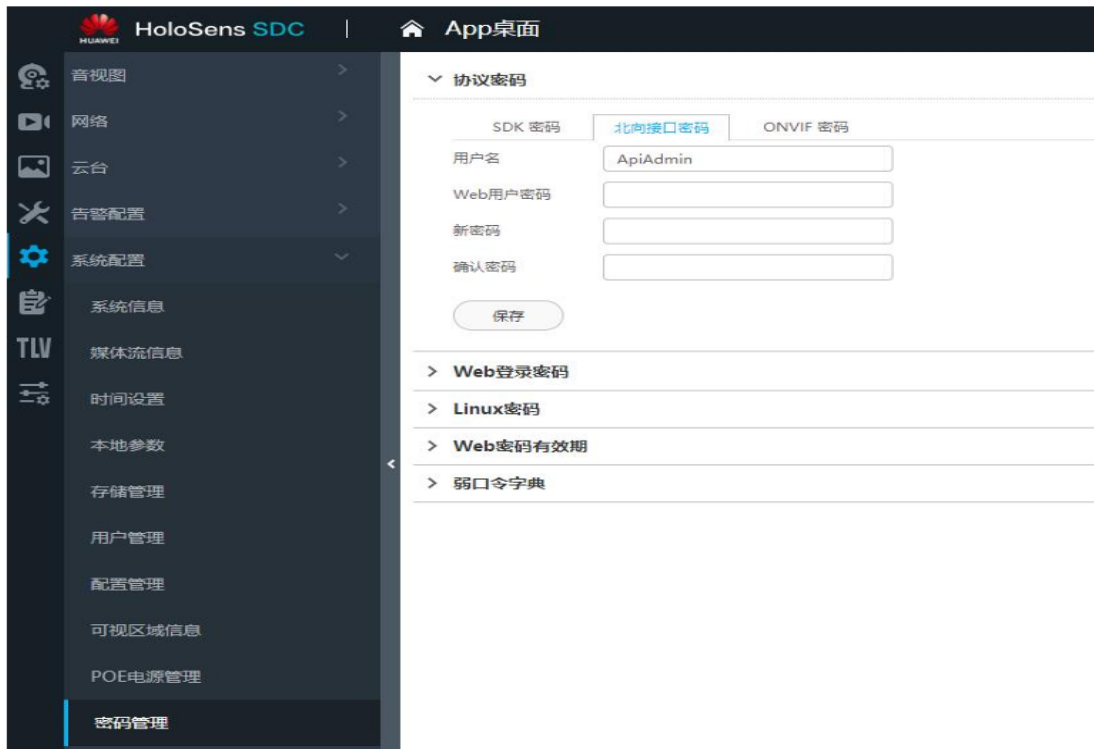
- RESTful transport protocol: HTTP/HTTPS
- RESTful authentication: Digest_MD5



For camera firmware version 10.0 and above, the interface layout is slightly different

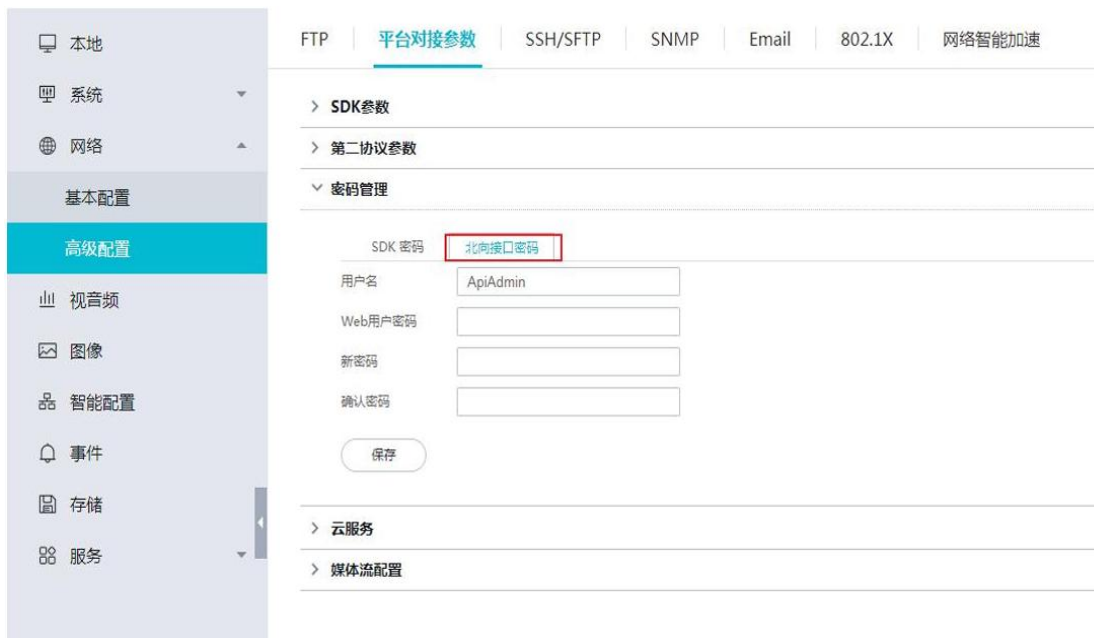
3. Huawei camera's north-bound default credentials are: ApiAdmin / HuaWei123. Use these in the configuration software's camera username/password fields.

The north-bound username is fixed as `ApiAdmin`; the password can be changed via the camera's settings.



- For version 900 cameras, the north-bound password is the one set in the camera's security settings.

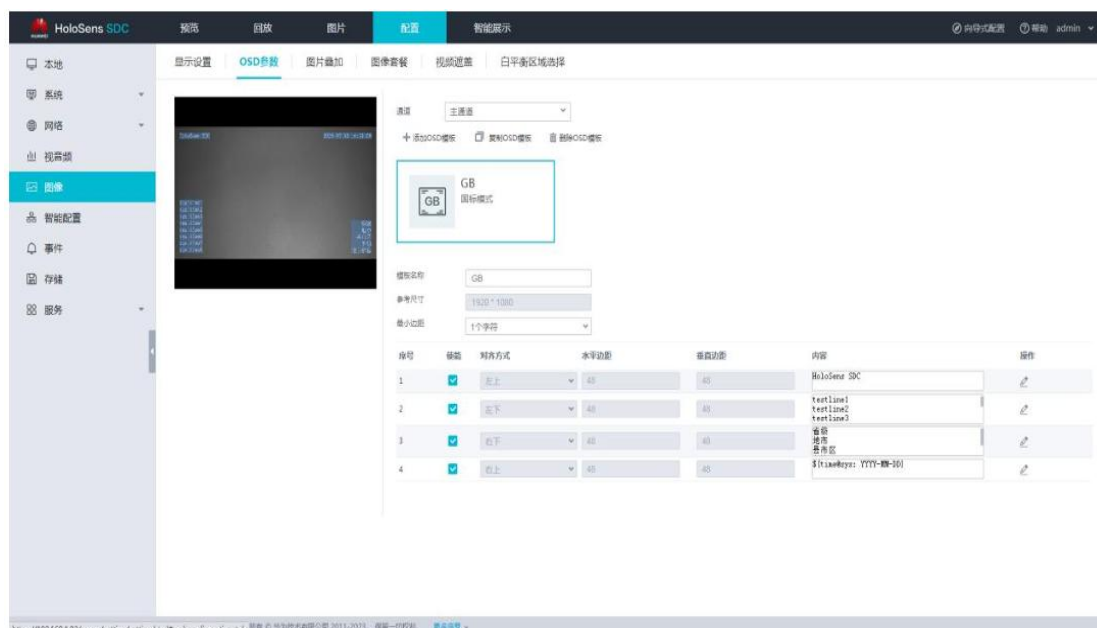
- For version 10.0 and above, the password modification path is shown in the manual screenshots.



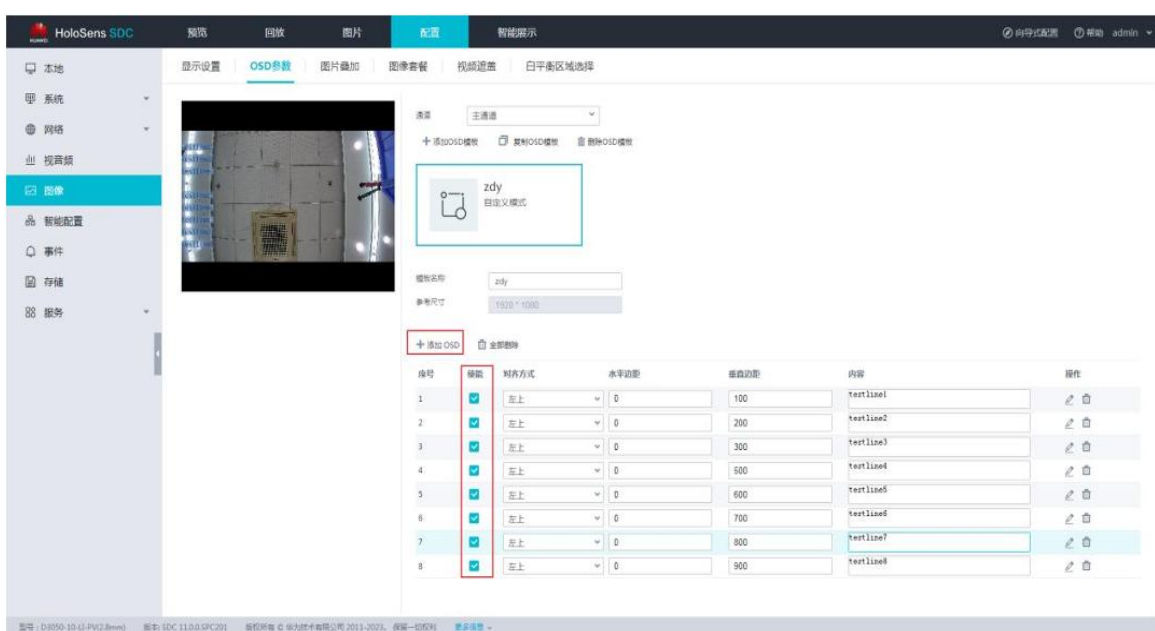
4. Click Configuration → Image → OSD Parameters. Add an OSD template – either Custom Template or National Standard Template.

- Only one template can be kept. If using the national standard template, it must be named "GB".

- Switching OSD templates requires a camera reboot.



For custom templates, manually add the required number of OSD items (matching the overlay lines configured in the software) and adjust the display position coordinates. After configuration, reboot the camera.



8. Troubleshooting

Symptom	Possible Cause	Solution
Cannot connect to configuration software	Driver installation error	Open Device Manager – check if a new COM port appears (e.g., COM3, COM4). If not, re-install the serial driver.

Symptom	Possible Cause	Solution
Cannot overlay characters	Camera not on the supported list	Refer to Section 2.3 for supported camera brands.
Data acquisition abnormal	Wrong baud rate or wiring error	Confirm A to A, B to B (not reversed) and all devices share a common ground (GND connected together).
Overlay normal but characters not shown on video	Camera configuration issue	Log into the camera's web interface and enable the OSD display switch.

9. Precautions

- Operating temperature range: -40°C ~ $+85^{\circ}\text{C}$. Avoid extreme environments beyond this range.
- Ensure the device is properly grounded during installation to prevent electromagnetic interference.
- If using solar power, make sure the battery voltage matches the device input voltage.
- Do not hot-plug any interface to avoid damaging the device.
- All wiring must be done with power completely off.
- Install inside a waterproof distribution box to protect against direct rain and prolonged sun exposure.
- Periodically check all connections for tightness to ensure stable operation.

网络视频字符叠加器
Network character overlay inserter

DAM SAFETY MONITORING
Real-time data acquisition for water level and structural safety.

RIVER & FLOOD MONITORING
Monitor water level, flow and rainfall for flood warning and management.

INFRASTRUCTURE MONITORING
Continuous monitoring of bridges and critical infrastructure.

GEOLOGICAL & SLOPE MONITORING
Monitor slope displacement and environmental conditions in real time.

OSD Overlay
Text & Data Overlay on Video

Multi-Interface
RS485 / RS232 / TTL Communication

Wide Compatibility
Connects Sensors, Cameras & RTUs

Industrial Design
Stable & Reliable Performance

Wide Temperature Operation
-40°C to +85°C