TBox Series Industrial Internet Data Transmission Terminal

User Manual

SHENZHEN INVT ELECTRIC CO., LTD.

No.	Change description	Version	Release date
1	First release.	V1.0	February 2024
2	● Updated the description of the Support Networks function, and added three function descriptions (antenna gain, power consumption and heat dissipation method) in section 1.2 Product specifications. ● Added European and Latin American version product models and descriptions in section 1.3 Model description. ● Added product weight data in section 2.3 Outline dimensions and weight. ● Updated all operation descriptions and interface diagrams in chapter 3 Quick startup.	V1.1	September 2024
3	● Added the mainstream industrial protocols supported in chapter 1 Product overview. ● Added support for S7, PPI, MC-3E, SLMP, and FINS communication protocols in section 1.2 Product specifications. ● Updated operation steps in section 3.1.2.1 Monitoring devices via the IWOstudio. ● Updated operation steps in section 3.1.2.2 Monitoring devices via the web portal. ● Updated operation steps in section 3.3 VPN pass-through configuration.	V1.2	June 2025

Contents

Safety precautions

Before you operate the Internet data transmission terminal, read the safety precautions described in this manual carefully to ensure safe operation.

- The account and password are the authentication credentials of the platform, which can be used for device management after logging in. Users should keep them properly and take sufficient measures to prevent others from stealing. If the account and password are stolen, it may cause significant losses.
- Before using the device for remote operation, users should communicate with the site to ensure that it is safe to operate remotely, otherwise, it may cause significant damage.
- An IoT SIM card is forced to machine-card binding, and it can only be applied to the device where it is powered up and networked for the first time. Do not insert it into another device; otherwise, it will be locked.
- The product is an industrial Internet product, and although we have taken the necessary technical measures to ensure data security, there may still be network security risks such as hacking that are beyond our control or responsibility. We will not be liable for damages if the harm is not caused by quality defects of the product itself.

1 Product overview

INVT TBox series industrial Internet data transmission terminal is an industrial-grade wireless data transmission device based on carrier 4G networks. It provides stable and reliable remote data acquisition, program upload/download, and debugging functions to meet the long-distance data transmission requirements of demanding industrial environments.

The product integrates multi-network access capabilities, including 4G, Ethernet, and Wi-Fi. It provides routing and switching, VPN pass-through, and virtual serial port pass-through functions. Equipped with RS485 and RJ45 dual interfaces, it supports mainstream industrial protocols such as Modbus RTU, Modbus TCP, S7, PPI, MC, and FINS. Through the INVT Industrial Internet Platform, it enables cloud-based device data access, remote monitoring, and intelligent operation and maintenance management.

1.1 Product features

1. Standard set-up for easy operation
   - Provides standard RS485 interfaces for direct connection to serial devices for data sampling.
   - Provides standard RJ45 network ports: WAN and LAN ports can be switched through the switch. LAN ports can be directly connected to network devices for data collection. WAN ports can be used for networking.
   - Intelligent data terminal, able to enter the data transmission state once upon power-on.
   - Adopts standard rail installation.
   - Powerful industrial Internet platform for easy device management.
   - Easy system configuration and maintenance interface.
2. Powerful functions
   - Supports remote data monitoring.
   - Supports VPN pass-through (mainland China only), able to remotely upload, download, and monitor PLC programs through network ports and VFD remote oscilloscope.
   - Supports virtual serial port pass-through, able to remotely upload, download, and monitor PLC programs through serial ports.
   - Supports remote upgrade of application programs and policy files.
   - Supports 4G and Wi-Fi routing functions, providing network access for other

devices (Wi-Fi routing is only supported in Wi-Fi version).

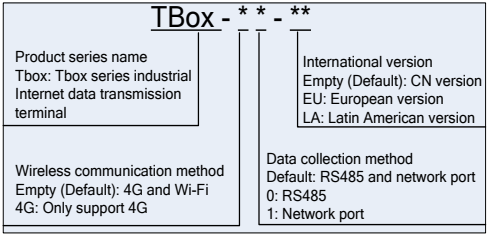
- Supports multiple network access methods such as 4G, Wi-Fi, and Ethernet (Wi-Fi only supported in Wi-Fiversion).
- Support APN (operator APN information is required for overseas).
- Able to upload only the data with changes, achieving the traffic saving mechanism.
- Supports 4G base station positioning.
- Supports access to third-party platforms and provides data in JSON format.

1.2 Product specifications

Function	Description
Supported network	LTE FDD (CN version): Band 1/3/5/8 LTE TDD (CN version): Band 34/38/39/40/41 LTE FDD (EU/LA version): Band 1/3/7/8 LTE TDD (EU/LA version): Band 20/28 LTE FDD (LA version): Band 2/3/4/5/7/8 LTE TDD (LA version): Band 28/66
Supported interfaces	One RS485 interface One standard RJ45 interface (for both WAN and LAN, which are switchable through a switch.) One SMA 4G antenna interface One SMA Wi-Fi antenna interface (only supported in the Wi-Fi version) One spring-loaded SIM card socket (micro card)
Wired communication distance (unshielded)	RS485: 5m Network cable: 30m
Indicator	Power indicator, network status indicator, running status indicator
Communication protocol	Modbus RTU, Modbus TCP, S7, PPI, MC-3E, SLMP, FINS and others mainstream protocols MQTT communication protocol FTP transfer protocol
Theoretical bandwidth	LTE FDD: Downlink 10Mbps, uplink 5Mbps LTE TDD: Downlink 8.96Mbps, uplink 3.1Mbps
Antenna gain	2.2dBi
Power supply	10–25VDC
Power consumption	Average power: 55mA@24V, maximum power: 500mA@24V.
Temperature range	-25–+55℃

Function	Description
Shell	Injection molded, ingress protection (IP) rating IP20
Mounting method	Rail-mounted
Heat dissipation method	Natural heat dissipation

1.3 Model description



Model	Description
TBox	Greater China version, supporting 4G and wifi wireless communication, RS485 and network port data collection.
TBox-4G	Greater China version, supporting only 4G wireless communication, and RS485 and network port data collection.
TBox-EU	European version, supporting 4G and wifi wireless communication, RS485 and network port data collection.
TBox-LA	Latin American version, supporting 4G and Wi-Fi wireless communication, RS485 and network port data collection.

Note: Only product models with Wi-Fi come with Wi-Fi related functions and accessories.

1.4 Port description

Port identifier	Description
24V	Power supply +
GND	Power supply -
485+	485A
485-	485B
4G	4G antenna
Wi-Fi	Wi-Fi antenna (optional)
Ethernet	Ethernet port

Port identifier	Description
SIM	SIM card
WAN<->LAN	WAN/LAN port switched through a switch

1.5 Indicator description

Indicator identifier	Description
NET	4G network indicator Flash slowly (ON: 200ms and OFF: 1800ms): Network searching state Flash slowly (ON: 1800ms; OFF: 200ms): Standby state Flash quickly (ON: 125ms; OFF: 125ms): Data transmission mode
RUN	Run indicator Flash quickly (ON: 100ms; OFF: 100ms): RS485 communication is normal Flash slowly (ON: 1s; OFF: 1s): RS485 communication is abnormal ON or OFF: System exceptions happened.
PWR	Power supply indicator

2 Installation

2.1 Overview

TBox series industrial Internet data transmission terminal must be installed properly to achieve the designed function. Generally, the installation must be done under the guidance of our certified and qualified engineers.

Note: Do not conduct installation with the power on.

2.2 Unpacking inspection

Before unpacking, check whether the package is in good condition and its product information is the same as on the order. The packing materials should be well maintained during inspection for future transshipment. If any question, please contact the supplier.

Table 2-1 Standard accessories

Standard accessories	Qty	Remarks
4G data transmission terminal	1	-
4G antenna	1	-
PIN port	1	One 4-pin port

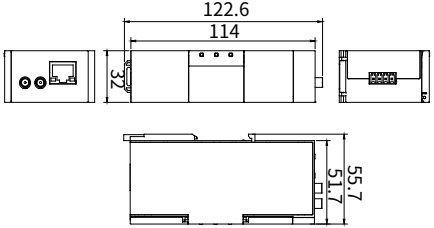
Table 2-2 Optional delivery accessories

Optional delivery accessories	Qty	Remarks
Wi-Fi antenna	1	Only included in products that support Wi-Fi.
SIM card	1	Only included in the CN version products.

2.3 Outline dimensions and weight

The outline dimension example of the IP20 model is as shown in Figure 2-1.

Figure 2-1Outline dimensions of TBox (Unit: mm)



Model	Length (mm)	Width (mm)	Height (mm)	Net weight (g)	Gross weight (g)
TBox(-4G)	32	55.7	122.6	96.3	263.1
TBox-EU					
TBox-LA					

3 Quick startup

3.1 IoT module use instructions

3.1.1 Installation instructions

Equipment required: Networked computer, 4G data transmission terminal, IoT SIM card

Step 1 Insert the SIM card into the card slot.

Step 2 Connect the power cable, RS485 communication cable, and network cable based on the port description.

Step 3 Connect 4G antenna and Wi-Fi antenna.

Step 4 Power on and start the 4G data transmission terminal.

Step 5 When the NET indicator flashed rapidly, the network is ready; when the RUN indicator flashes rapidly, data is being collected.

Step 6 Go to the real-time monitoring interface to review relevant information on the IoT monitoring platform.

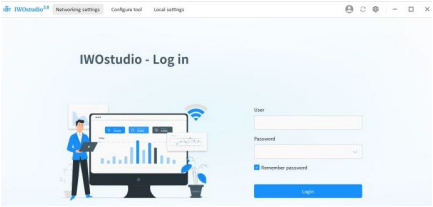
3.1.2 Monitoring platform operation instructions

You can monitor relevant devices through the following three methods. For information on how to obtain the account and password, please refer to section 3.1.3 Monitoring platform account.

- Host controller software: IWOstudio
- Web: IWoscene industrial IoT application platform
- Mobile: INVT Cloud APP

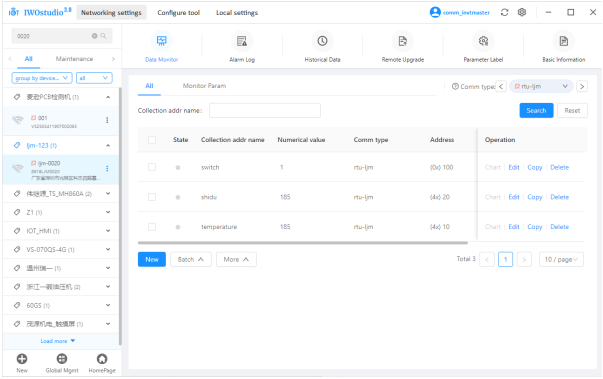
3.1.2.1 Monitoring devices via the IWOstudio

Step 1 Download IWOstudio from the official website (www.invt.com), install, and then open it.

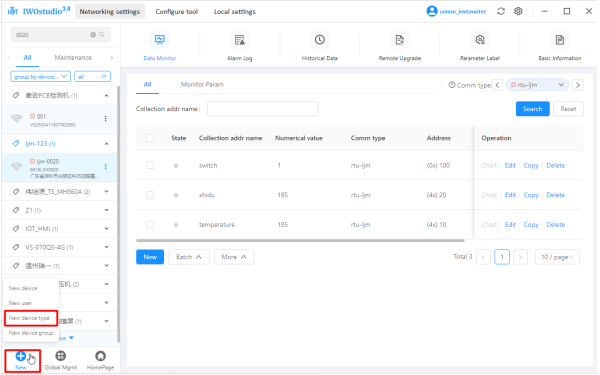


Step 2 Enter the account and password to log in and enter the network configuration interface.

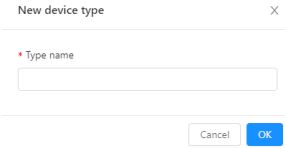
Note: For account information, refer to 3.1.3 Monitoring platform account.



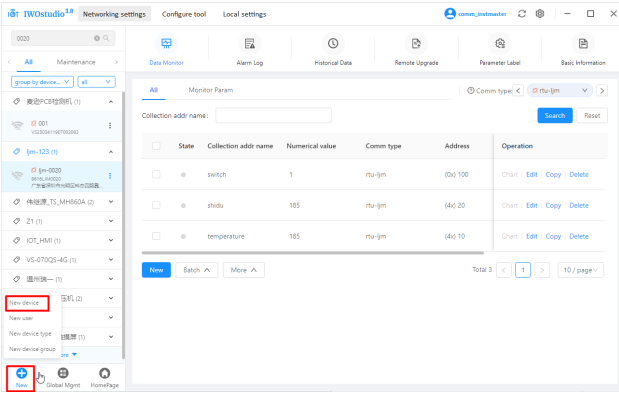
Step 3 If it is your first time using the software, you need to add a device type. Choose **New** > **New device type** at the bottom left corner. If it is not your first time adding a device type, proceed to Step 5.



Step 4 Enter the **Type name** of the device, and click **OK**.
If the message **Successfully created** appears, the creation of the device type is complete.

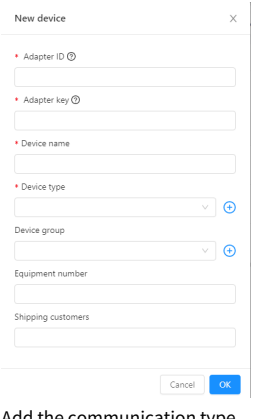


Step 5 Choose **New** > **New device** at the bottom left corner.



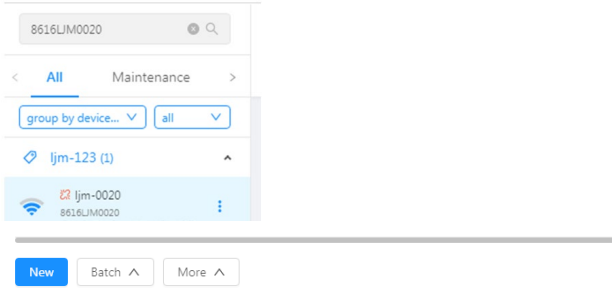
Step 6 Enter **Adapter ID**, **Adapter key**, **Device name**, select **Device type**, and click **OK** to complete the process.

Note: Adapter ID is the S/N code of the IoT terminal, and **Adapter key** is the six-digit number under the QR code next to the S/N code.

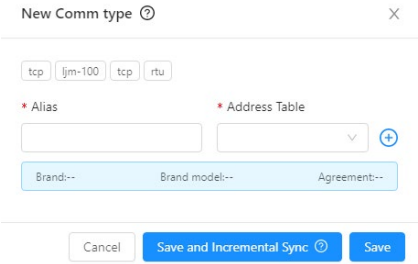


Step 7 Add the communication type.

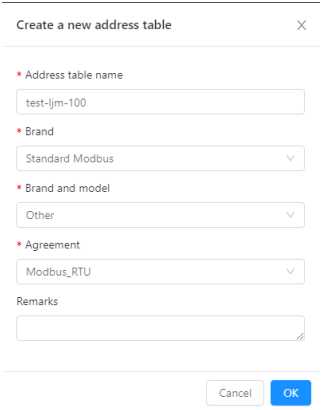
After adding a device for the first time, you need to add a communication type. Click the added device to enter the communication type management interface, and then click **New**.



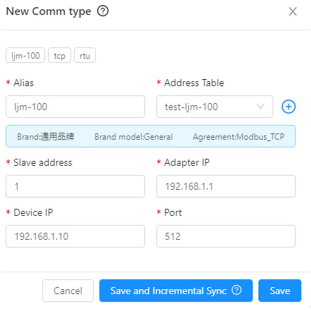
Create a communication type: Enter any alias in **Alias**, and select an **Address Table**. If no address table is available, click **+** next to **Address Table** to create a new one.



Create a new address table: Enter any name in **Address Table Name**, select a brand (such as INVT, Inovance, Siemens, Delta, Xunjie, Mitsubishi, and Omron) from **Brand**, select a model from **Brand and model**, choose the desired protocol from **Agreement**, and click **OK**.



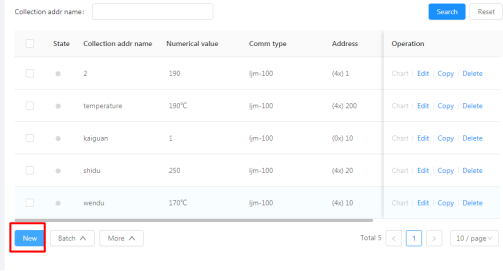
In the **New Comm type** page that pops up, set the communication parameters, and click **Save and Incremental Sync**.



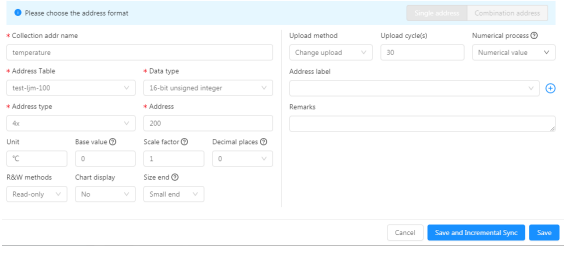
The communication type must be added upon first use. For subsequent use of the same communication type, you can select it directly.

Step 8 Add a connection address.

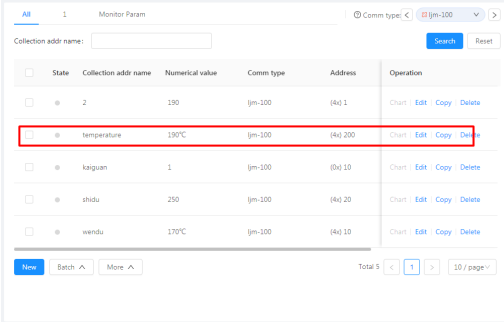
Click the desired device, and click **New**.



Address adding parameters: Fill in **Collection addr name** freely, select the address table you just created from **Address Table**, and select an option from **Data Type**, **Address Type**, and **Address** based on actual needs. Other parameters such as **Unit**, **Base value**, **Scale factor**, and **Decimal places** have default values and can be left unchanged or modified as needed. After completing the setting, click **Save**.

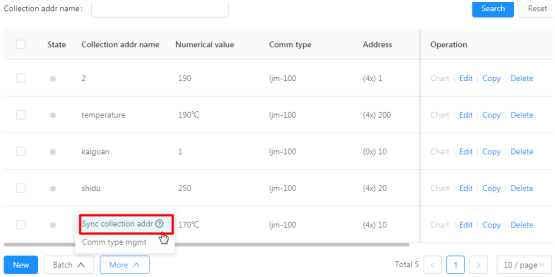


The added address is displayed on the monitoring interface.



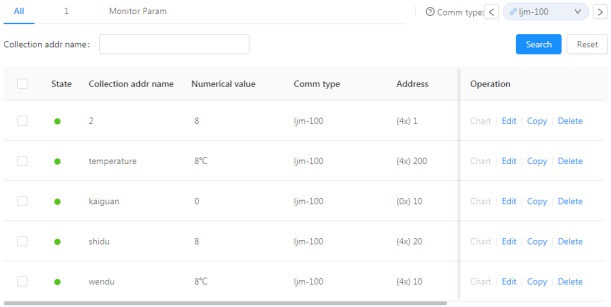
Click **New** to add other collection addresses.

After all the addresses have been added, click **More**, and then click **Sync collection addr** to send all the addresses to the module.



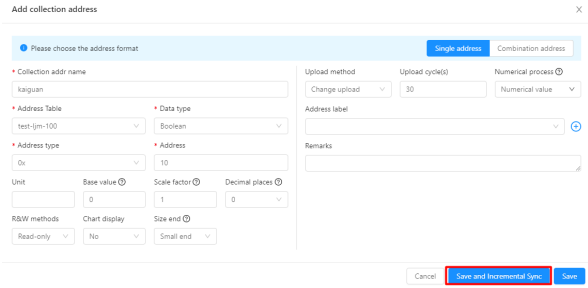
Step 9 Check data monitoring.

After receiving the address configuration, the TBox collects and uploads the data, which is then displayed on the monitoring interface, as shown in the figure below.



To modify a collection address, select the desired address and click **Edit**. After making the necessary changes, click **Save and Incremental Sync** to complete the modification.

To add a new collection address, click **New**, enter the necessary information for the new address, and then click **Save and Incremental Sync** to complete the addition.



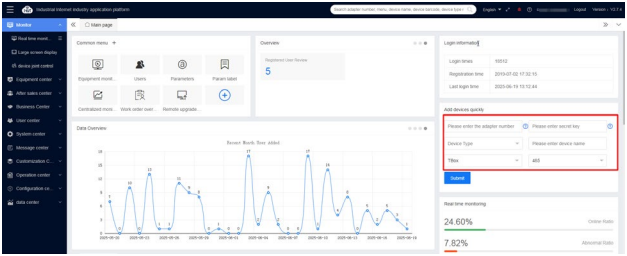
3.1.2.2 Monitoring devices via the web portal

Step 1 Enter iot.invt.com in the address bar of Google Browser and press **Enter** to visit the login page of the industrial IoT application platform. As shown in the following figure, enter the user name and password to complete the login.

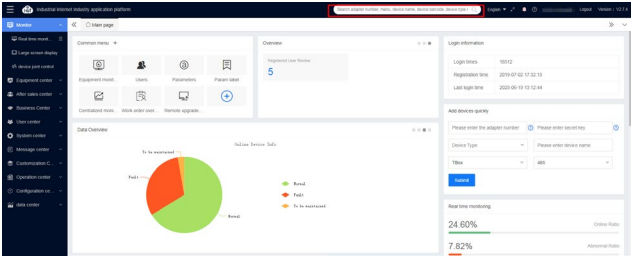
Note: For account information, refer to section 3.1.3 Monitoring platform account.

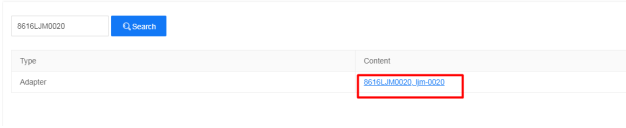
Step 2 After successful login, the homepage appears as shown below. Under **Add devices quickly**, enter the adapter number, secret key and device name; select the device type according to the monitoring type; select **TBox** as the adapter type; and keep the default communication mode **485**, which can be changed to **LAN** if a network port is used. Then click **Submit** after confirming the input is correct.

Note: If the device has already been added via the IWOstudio or the app, this step can be skipped.

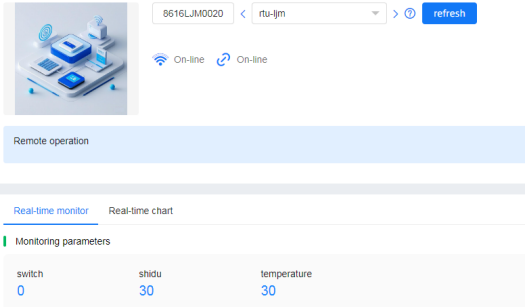


Step 3 Enter the adapter number in the search box on the homepage. Select the desired adapter to view its monitoring state.

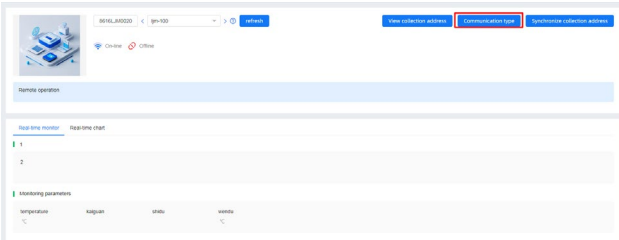




Access the device to view monitoring parameters. If the device's data collection address has already been added via the IWOstudio or the web portal, you can directly view the collected and uploaded data on the monitoring interface.

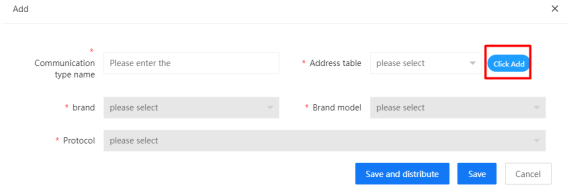


Step 4 If the device is added for the first time, you need to click **Communication Type** at the top right corner to add the communication type.

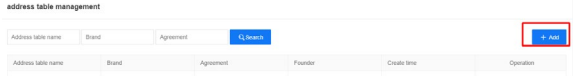


Click **+Add** on the communication type management interface.

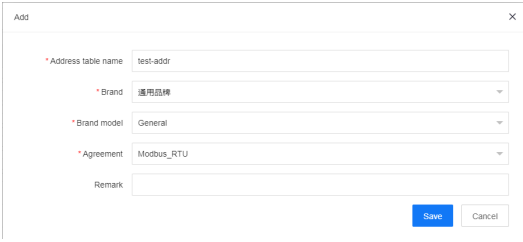
Fill in the communication type name, and select the address table. If there is no address table available, click **Click Add** to create a new one.



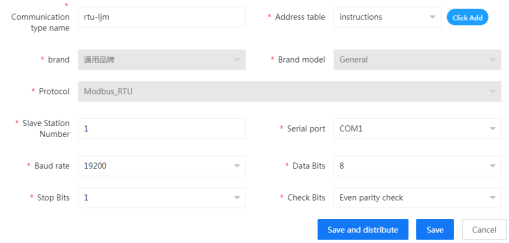
Click **+Add** on the address table management interface.



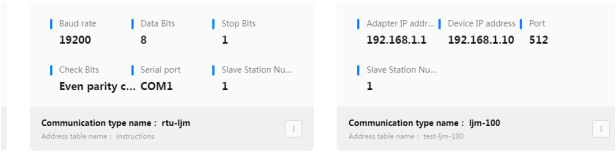
Add address table information based on actual needs, and click **Save**.



Return to the communication type filling interface, select the address table you just added, and set the communication parameters based on actual needs. Then click **Save and distribute**.



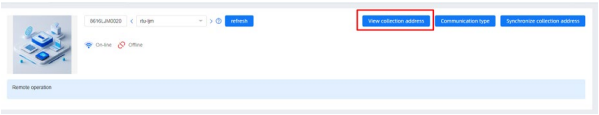
The newly added communication type will appear on the communication type management interface.



Step 5 Add the data collection address. The collection address needs to be added for the first time.

Go back to the device data monitoring interface, select the communication type you just added from the red drop-down list box shown below, and click **Refresh**. Since no monitoring data is displayed, you need to add the data collection address before monitoring the data.

Click **View collection address**.



Click **+Add** on the collection address management interface.

Fill in add related information. Fill in the name freely, and set the data type and address based on actual needs. If you need to set more parameters, click **More** to configure. After the input, click **Save**.

Repeat the address adding process until all the addresses have been added. Then click **Synchronize collection address**.

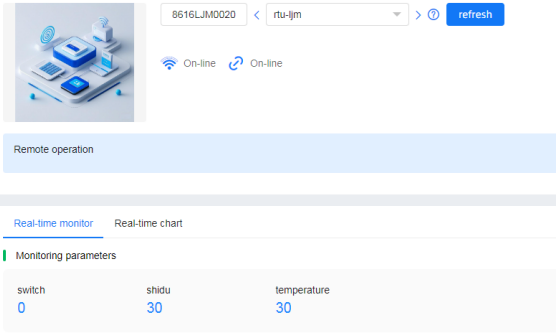
On the collection address synchronization interface, select the target adapter, and click **The agreement is delivered**.

If the distribution is successful, the distribution status becomes succeeded.

The collection address configuration is completed.

Step 6 Check data monitoring.

Go back to the monitoring interface to view the collection address data that has just been configured.



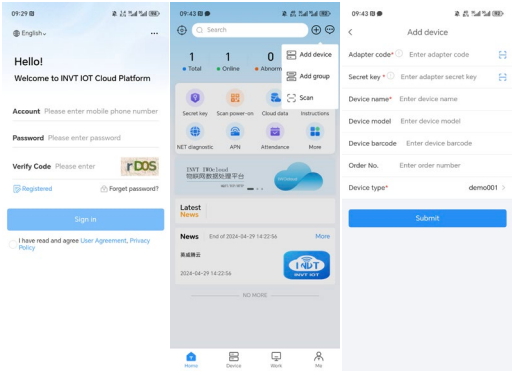
3.1.2.3 Monitoring devices via the app

Step 1 Download and install the INVT Cloud app on your mobile device.

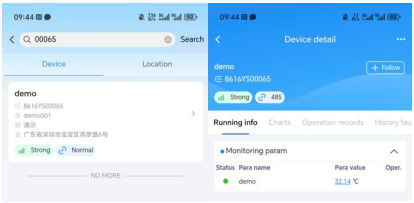
Note: In Android, search the app store or Google Play for **INVT** to download; in iOS, search the App Store for **INVT** to download.

Step 2 Open the INVT Cloud app, enter the account and password to log in. On the homepage, tap the **+** icon at the top right corner; enter the **Adapter code**, **Secret key** and **Device name**, and select **Device type**; and then tap **Submit** to complete the device addition.

Note: For account information, refer to section 3.1.3 Monitoring platform account.



Step 3 Enter the adapter number in the search box. Select the desired adapter to view its monitoring state.



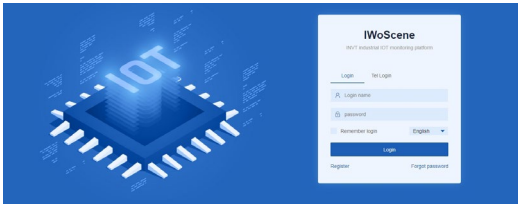
3.1.3 Monitoring platform account

You can register a monitoring platform account via the web portal or app, and the same account and password can be used on all three monitoring platforms.

3.1.3.1 Registration via the web portal

Step 1 Enter iot.invt.com in the address bar of Google Browser and press Enter to visit the login page of the industrial IoT application platform.

Step 2 Click **Register**.



Step 3 Fill in the **Company name**, **User name**, **Password**, and confirm the password again. Enter your **Mobile number**, click **Verification code**, fill in the verification code received via SMS, and enter the invitation code. Invitation code: You can obtain it through the higher-level user account. If there is no higher-level one, you can fill in **dbf20a** (INVT administrator invitation code). Review and check the **User Privacy Agreement**, click **Register**, and wait for review. You will receive a notification via SMS once approved.

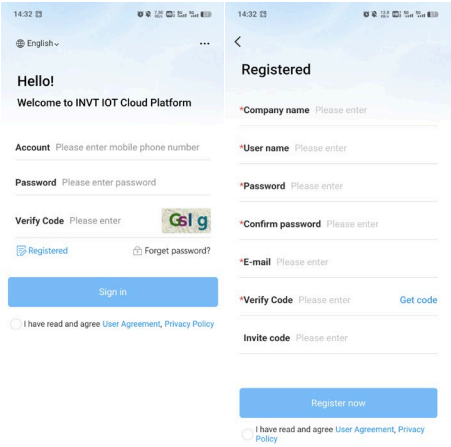
3.1.3.2 Registration via the app

Step 1 Download and install the INVT Cloud app on your mobile device.

Note: In Android, search the app store or Google Play for **INVT** to download; in iOS, search the App Store for **INVT** to download.

Step 2 Open the INVT Cloud app, and click **Registered**.

Step 3 Fill in the **Company name**, **User name**, **Password**, and confirm the password again. Enter your **Mobile number**, click **Verification code**, fill in the verification code received via SMS, and enter the invitation code. Invitation code: You can obtain it through the higher-level user account. If there is no higher-level one, you can fill in **dbf20a** (INVT administrator invitation code), review and check the **User Privacy Agreement**, click **Register**, and wait for review. You will receive a notification via SMS once approved.

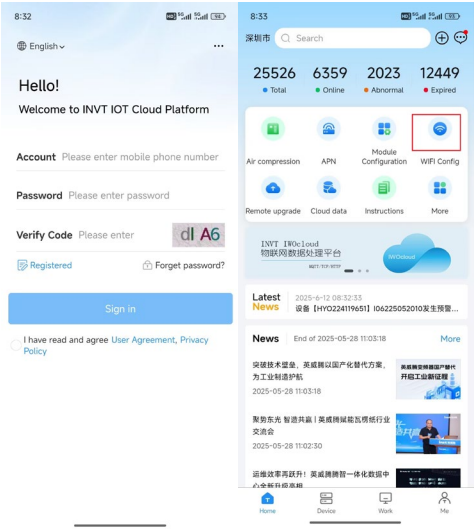


3.2 Network configuration on the app

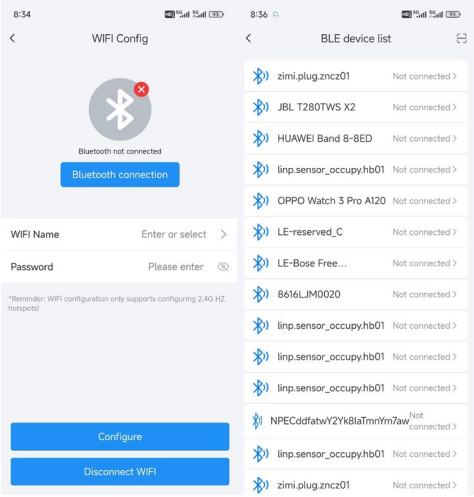
Step 1 Set the DIP switch of the IoT terminal to LAN.

Step 2 Power on the data transmission terminal, and wait for about 1 minute to ensure the terminal has started successfully.

Step 3 Open the INVT Cloud app, log in with your account, password, and verification code, and select the user agreement to access the homepage. Then tap **WIFI Config**.

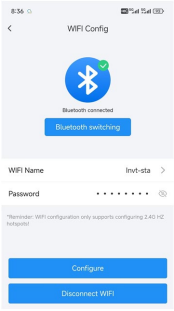


Step 4 Firstly, connect to Bluetooth. Tap the Bluetooth icon at the top right corner, tap the corresponding Bluetooth name (the Bluetooth name is the S/N code of the IoT terminal) for connection. If you cannot find the corresponding name, you can scan the barcode on the IoT terminal label for identification.



Step 5 After connecting, enter the Wi-Fi name and password, and tap **Configure**. The Wi-Fi configuration is completed when you receive a message indicating success.

Note: When Wi-Fi is available, the IoT terminal will prioritize using it.

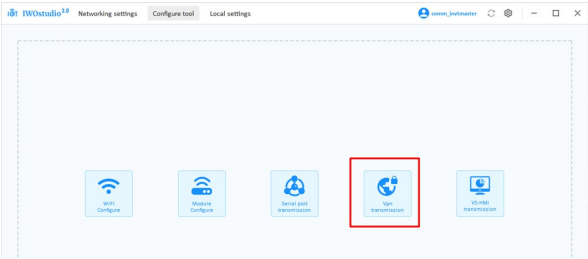


3.3 VPN pass-through configuration

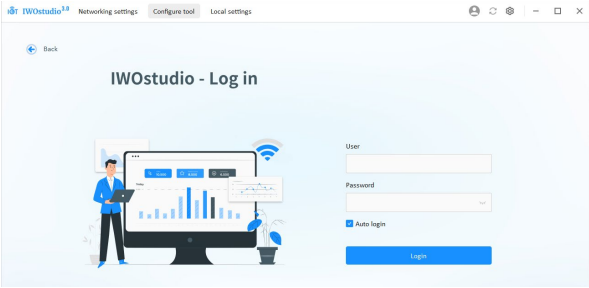
Note: At present, VPN pass-through is only used in China.

Step 1 Open the host controller software IWOstudio.

Step 2 Click **Configure tool** in the menu, then click **VPN transmission**.

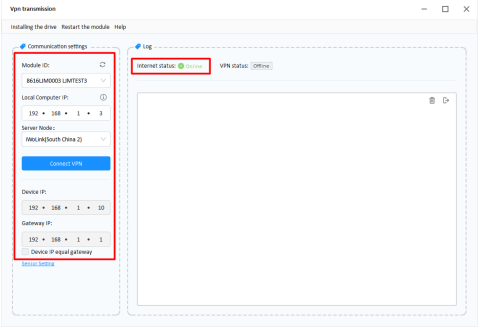


Step 3 Enter the user name and password to log in.

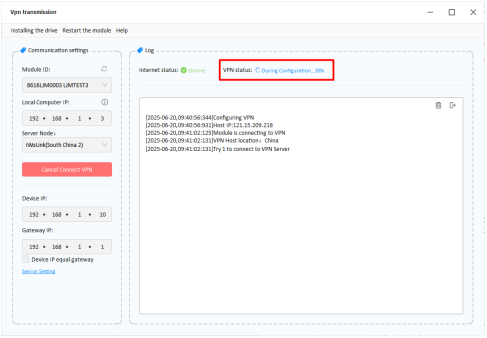


Step 4 On the main interface, and select the corresponding adapter ID, and select the server node. Once the device is connected successfully, the device IP and gateway IP will be automatically read.

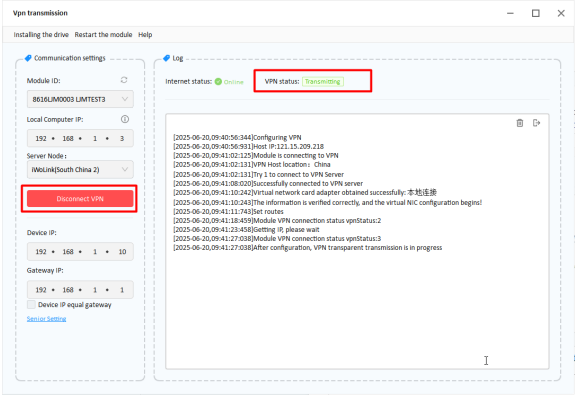
If the detected device IP does not match the actual IP, you must manually set it according to the actual device IP. The gateway IP is the IP (default is 192.168.1.1) of the collection terminal (Tbox) while the device IP is the IP (default is 192.168.1.10) of the device (such as VFD, PLC) connected to the collection terminal. As long as the local IP is in the same network segment as the gateway IP, it can be set arbitrarily.



Step 5 After the settings are complete, click **Connect VPN**. The connection process will take one to two minutes.



Step 6 The VPN status is **Transmitting**, indicating that the VPN channel has been successfully established and the connection is successful. If you need to exit VPN pass-through, you need to click **Disconnect VPN**.

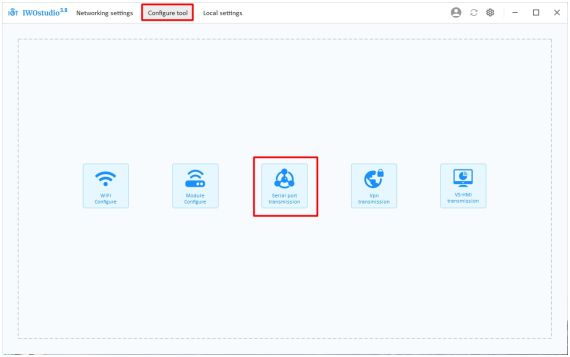


Step 7 Open the VFD/PLC host controller, and operate and debug the equipment as if you were on site.

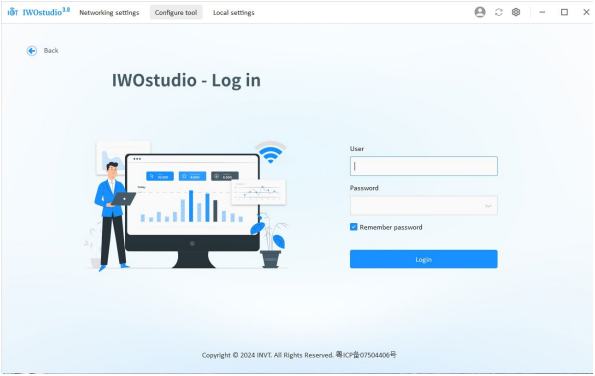
3.4 Virtual serial port pass-through configuration

Step 1 Run the host controller software: IWOstudio.

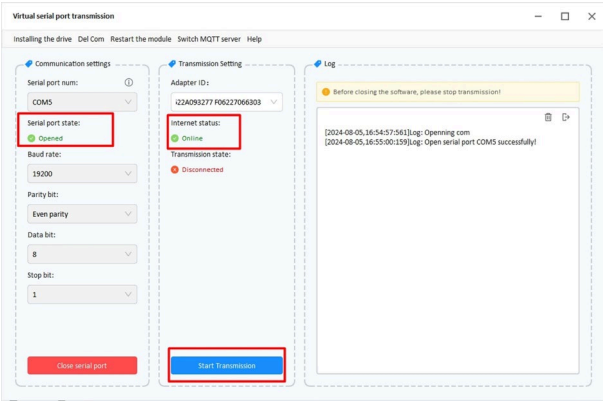
Step 2 Click **Configure tool** in the menu, and click **Serial port transmission**.

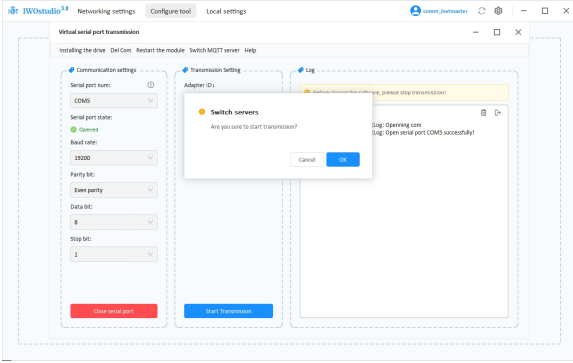


Step 3 Enter the account and password to log in.

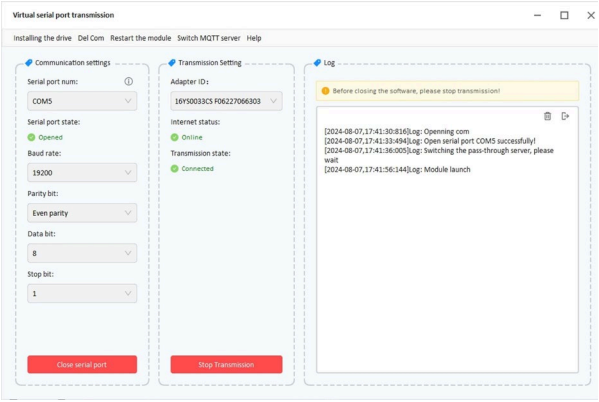


Step 4 After logging in, enter the main interface of the software, and select the ID of the adapter that needs to be connected to the upgraded PLC. Click **Start Transmission**, click **OK** in the pop-up window, and remember the serial port number at this time.

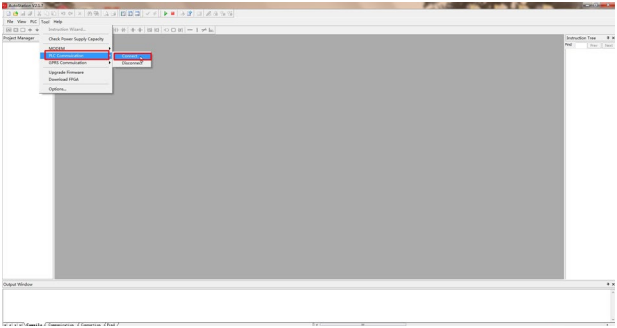




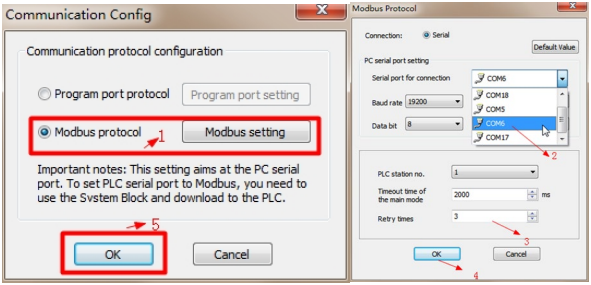
When the message **Transmission status disconnected** changes to **Transmission status connected**, it indicates that the transmission channel has been established and the next operation can be carried out.



Step 5 Open the PLC host controller software (using Auto Station as an example). On the main interface, choose **Tool** > **PLC Communication** > **Connect**.
A communication configuration window pops up.



Step 6 In the **Communication Config** window, choose **Modbus protocol**, and click **Modbus setting**. In the **Modbus Protocol** window that displays, select the serial port number +1 for serial port of connecting the PC to the PLC (for example, if the serial port of the virtual pass-through tool is set to COM5, then the serial port number for connection is set to COM6); set the serial port communication parameters according to the PLC; and click **OK** to complete the settings.



Step 7 Perform program upload, download, running, stop, and other debugging operations as if you were on site.

3.5 FAQs

1. After power-on, the power indicator does not flash or light up.

Answer: Check whether the power supply voltage polarity is reversed, and whether the input voltage 24V and GND are in consistent with the silkprint on the casing.

2. When 4G network is used, the network status indicator keeps flashing slowly, and the status offline is displayed on the web portal.

Answer:

1) The SIM card is not installed properly. Power off and re-install it for a good connection.
2) Move the 4G antenna to a place with good signal.
3) Ensure that the SIM card is activated and has remaining balance.

3. Data uploading doesn't match the web page display.

Answer:

a) Re-power on and upload all data again.
b) Check whether the policy file and device type match. If not, please contact the manufacturer.

4. The 4G network indicator and signal indicator flash normally but the web system displays no data.

Answer: Check whether the communication cable between the Modbus terminal device and IoT transmission terminal is well connected.

5. In the web system, only data content can be displayed, and commands cannot be issued.

Answer: Check whether the signal enabling switch of the Modbus terminal device is turned on.

6. When VPN pass-through is enabled, the device IP displayed by the VPN pass-through tool does not match the actual device IP.

Answer: The device IP displayed by the VPN pass-through tool is MSIP set in the IoT module strategy file. When the device IP displayed by the VPN pass-through tool is inconsistent with the actual device IP, you can modify the MSIP in the strategy file to keep consistent with the actual device IP.

7. Enter the VPN pass-through, and programs cannot be downloaded remotely.

Answer:

1) VPN pass-through is only applicable to devices whose programs are downloaded through network ports. For devices whose programs are downloaded through serial ports, you need to use virtual serial port pass-through.
2) Ensure that the laptop computer has only one networking method. If there are other networks, disable other network cards and disconnect VPN pass-through, then enter VPN pass-through again.

3) Ensure that the actual IP of remote device is in the same network segment with LAN port gateway of the module.

8. Downloading programs remotely through virtual serial port pass-through failed.

Answer: Increase the main mode timeout time when setting the host controller communication. It is recommended to be at least 8000ms.

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