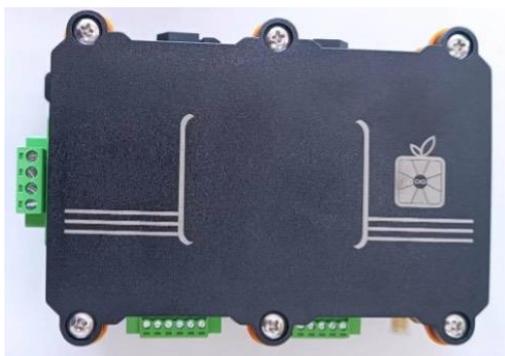


User Manual

REV 1.1



Composite Energy
Data Collection
Equipment

F160C

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1 Product Overview

1.1 Product features

F160C is a composite energy data acquisition device. This product collects the power parameters and energy consumption of field equipment for users and uploads it to servers or various cloud platforms through the E150 (Industrial Data Gateway) MQTT protocol. In addition, F160C also supports 2 digital inputs, 3 digital outputs, 1 RS485 interface, 1 RS232 interface and 1 CAN bus interface.

1.2 Product characteristics

1) Collect the voltage and current of single-phase or three-phase electricity, and calculate the power, energy consumption and harmonics;

- Provide three-phase full-wave voltage, current, power, power factor, power and total power and other power parameters;
- Provides full-wave active, reactive, RMS or PQS apparent power;
- Provide active, reactive and apparent electric energy;
- Provides data on the 41st harmonic, 21st interharmonic, flicker, real-time sampling waveform and other data of three-phase voltage and current;
- Provide interrupt signal output to detect sag, overvoltage and overcurrent based on waveform data;
- Provide A-type residual current detection and alarm function;
- Provides event detection for three-phase voltage loss, overload, overcurrent, current loss, overvoltage, undervoltage, voltage loss, voltage and current reverse phase sequence, unbalance and other events;
- With PF (active power) and QF (reactive power) output, it is convenient for quality verification;
- With alarm output, output events can be customized. Such as overvoltage, overcurrent, voltage loss, current loss, phase sequence error, undervoltage, etc.;
- Three-phase three-wire and three-phase four-wire hardware are compatible, and the software can be configured according to needs;

- 2) WIFI supports IEEE802.11b/g/n/ax on the 2.4GHz frequency band, with data rates up to 150Mbps;
- 3) Power failure reporting status function;
- 4) Monitor the power-on and power-off times of factory equipment, analyze the equipment OEE, operating efficiency, and remotely start and stop equipment;
- 5) It has 1 TTL and 1 485 communication interface, and the communication protocol adopts standard Modbus-RTU and DLT645-2007 protocols;
- 6) It has the function of remotely collecting the start and stop status of the equipment (through 2-way DI) and the remote control function of starting and stopping the equipment (through 3-way DO);
- 7) Comply with the requirements of the revised directive (EU) 2015/863 of the EU RoHS directive 2011/65EU appendix
- 8) Support MQTT data transmission protocol
- 9) The equipment can realize OTA online remote upgrade

1.3 Technical indicators

- 1) Electric meter measurement parameters:
 - Active power accuracy level B
 - Voltage range 1-380V $\pm 0.5\%$ F.S
 - Current range 0.05-0.5(50)A $\pm 0.5\%$ F.S
 - Current range expansion, maximum current 100A, 150A, 200A, 300A, 500A
 - Customizable frequency AC50Hz
 - Minimum power variable 0.0001kW power factor
 - Measurable pulse constant Active power: 1000imp/kWh; Reactive power: 1000imp/kVar; Electric energy kWh 6-digit integer, 2 decimal places
 - Withstand voltage level AC3000Vrms Overload capacity 1.2 times Temperature drift $\leq 100\text{ppm}/^\circ\text{C}$
 - Carbon dioxide emissions (calculated by national standard formula)
- 2) Communication function
 - Provide one RS485/RS232 interface, communication protocol DL/T 645-2007, MODBUS-RTU dual protocol data format, other communication protocols;

serial port parameters: default "n,8,1" (no parity, 8 data bits, 1 stop bit), supports baud rate 2400bps-9600bps, default 9600bps, data refresh interval ≥ 2 ;

- Provide 1 CAN interface;
- 3) Using environment
 - Working environment temperature: $-20^{\circ}\text{C} \sim 60^{\circ}\text{C}$, relative humidity 5% ~ 95% (no condensation);
 - Altitude 0~3000 meters;
 - Working environment: There is no explosion, corrosive gas and conductive dust, and there is no significant vibration and impact;
 - 4) Power supply: 24VDC (9V ~ 30V), current 200mA@24VDC;
 - 5) Dimensions and installation:
 - Overall dimensions: 40mm (width) \times 125mm (height) \times 110mm (depth);
 - Installation: 35mm guide rail and screw fixation;
 - Protection level: IP20;

1.4 Electromagnetic compatibility (EMC) performance

1.4.1 High-Frequency Interference Test (GB/T15153.1 classIII)

Place of application	Power Supply Input Circuit - to Ground Power Supply Input Circuits among Themselves AC Input Circuit - to Ground	
Applied Waveform	Peak Value of the 1st Wave Oscillation Frequency 1/2 Attenuation Time Repetition Frequency Output Impedance of Test Equipment	2.5~3kV 1.0~1.5MHz ≥6μs 50times per second or more/s 150~200Ω

1.4.2 Fast Transient Burst Test (GB/T17626.4 classIII)

Voltage Peak Value	Power Supply Input and AC Input Circuits: 2kV Weak current circuit: 1kV
Repetition Frequency	5 kHz

1.4.3 Electrostatic Discharge Interference (GB/T 17626.2 classIII)

Place of application	During normal operation, operators come into contact with certain parts.
Voltage, Current	6kV Contact Discharge, First Peak Current of Discharge: 22.5A
Frequency	More than 10 occurrences with intervals of at least 1 second each.
Polarity	Positive Polarity

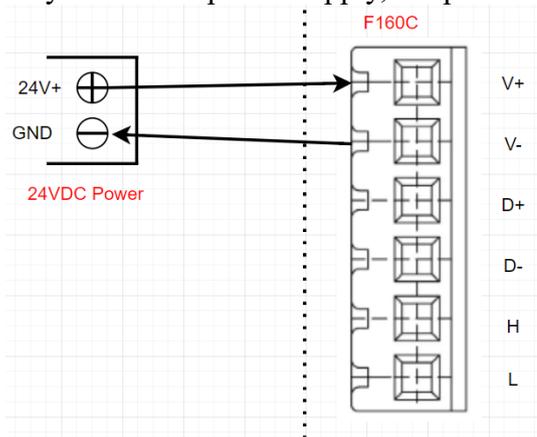
1.4.4 Radiated Electromagnetic Field (GB/T 17626.3 classIII)

Frequency of Electromagnetic Waves	150MHz, 400MHz, 900MHz
Test Field Strength	10 V/m
Radiation Method	The antenna is brought into contact with the device's front end or terminals, intermittently radiating electromagnetic waves.

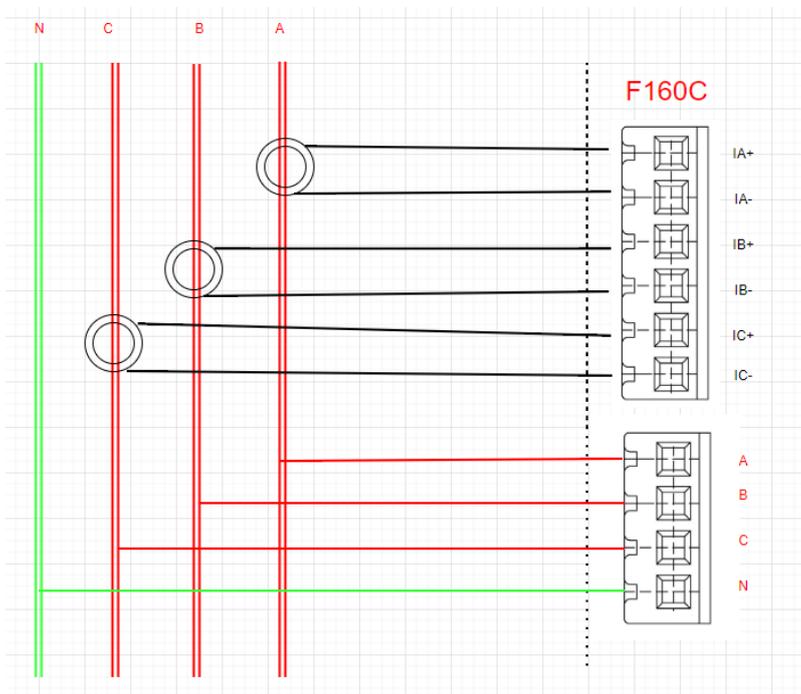
2 Quick Application Guide

2.1 Connect the power supply

Powered by a DC 24V power supply, the power supply wiring is as shown below:



2.2 Connect three-phase electricity



2.3 Connect WIFI antenna

2.4 Configure WIFI parameters: SSID, Password, connect to the cloud

2.4.1 Process of automatic distribution network

- Turn on the power of the product, and the product will automatically search for the WIFI with the specified name and try to connect.
- If the connection is not successful within 1 minute, the product will automatically enter SmartConfig mode.

2.4.2 SmartConfig distribution network

1) Step1: Installation APP software

Install and open the app.



Operate the app as follows:

- Confirm the SSID.
- Fill in the information.
- Verify the information.
- Click "Confirm" to proceed.

The number of devices that need to be networked should be filled in based on the actual quantity for this configuration. The configuration personnel should be positioned near the access point(AP), and the number of devices for network configuration should not be too high(less than 10).

2) Step2:Start FA

Note: If a certain SSID network has already been configured on FA, please ensure that the SSID network is either turned off before FA powering up or that the SSID network cannot be detected by FA.



V- Negative pole

V+ Positive pole

Connect the DC 24V power lead to the corresponding positive and negative poles to power on.

3) Step3: use solution **A** or **B**

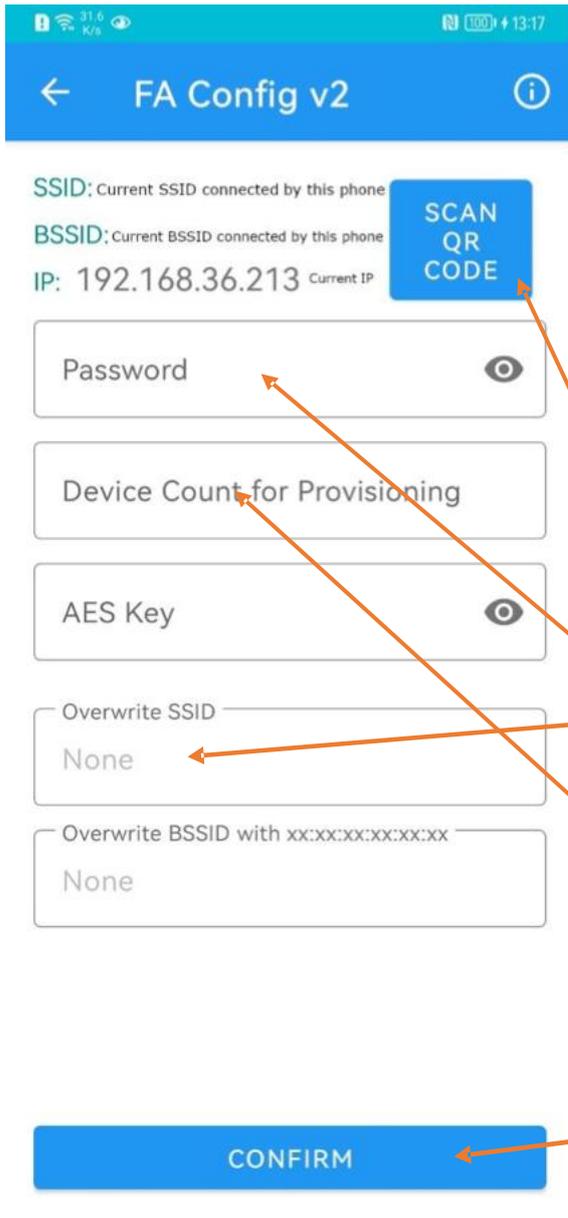
A: Configuring by Scanning QR Code.

In the QR Code, the message format is:
[Wifi_Password][SSID_NAME][BSSID]

If we use the following config:
SSID: OBOX-001-init
Password: 12345678
BSSID not configured

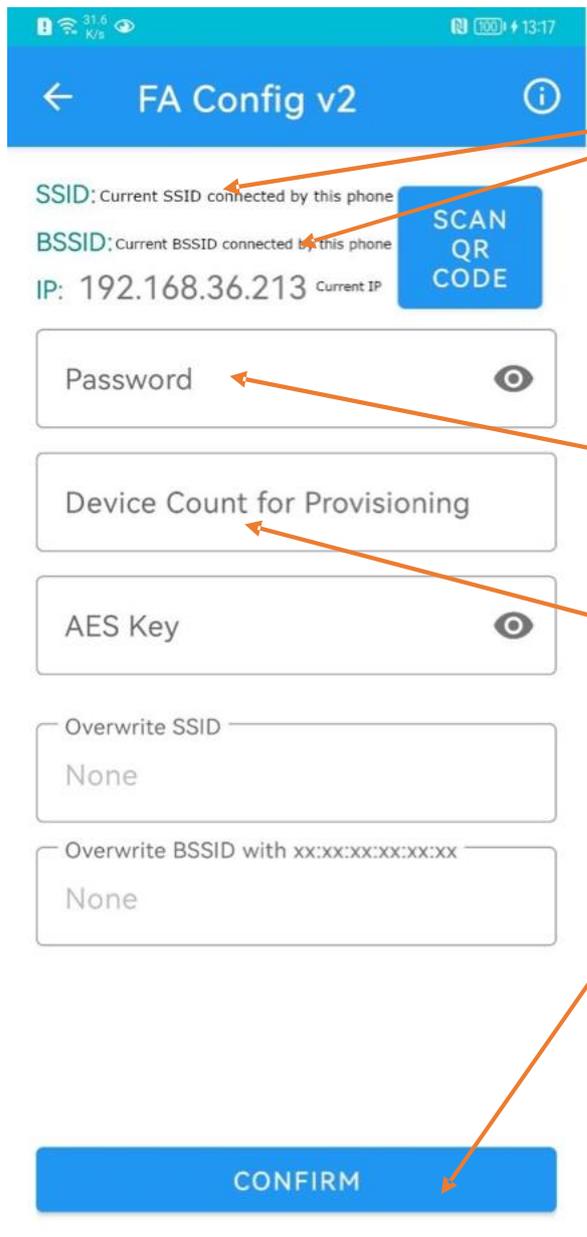
The message string and QR Code should be
12345678|OBOX-001-init|00:00:00:00:00:00





1. Open location service
2. Ensure that the mobile phone is connected to a 2.4GHz access point (AP).
The SSID can be different from the one that needs to be configured.
3. Scan QR Code
4. Automatically input the relevant information
5. Fill in the quantity.
6. Reboot FA with reconnect power supplier.

B: Manual Configuration (Optional).



The screenshot shows the 'FA Config v2' application interface. At the top, there is a blue header with a back arrow, the title 'FA Config v2', and an information icon. Below the header, the current connection details are displayed: SSID: Current SSID connected by this phone, BSSID: Current BSSID connected by this phone, and IP: 192.168.36.213 Current IP. A blue 'SCAN QR CODE' button is positioned to the right of these details. Below the details are several input fields: 'Password' with a toggle for visibility, 'Device Count for Provisioning', 'AES Key' with a toggle for visibility, 'Overwrite SSID' (set to 'None'), and 'Overwrite BSSID with xx:xx:xx:xx:xx:xx' (set to 'None'). At the bottom, there is a large blue 'CONFIRM' button. Orange arrows point from the text instructions on the right to the 'SCAN QR CODE' button, the 'Password' field, the 'Device Count for Provisioning' field, and the 'CONFIRM' button.

1. Open location service
2. Confirm that you are connected to the target access point (AP) with right SSID.
3. Fill in the relevant information.
4. Fill in the quantity.
5. Reboot FA with reconnect power supplier

4) Step4: Waiting for the configuration.

Wait for the configuration to be finished.

Based on the filled-in device quantity, the program will list the devices that have been successfully configured and save a screenshot of the results. If there are devices that need to be configured but are not listed, it indicates that the configuration for those devices has failed. In that case, you can power on the device again and repeat the previous steps to perform the configuration again.

If the configuration is successful (FA connect to the right SSID), it appears.

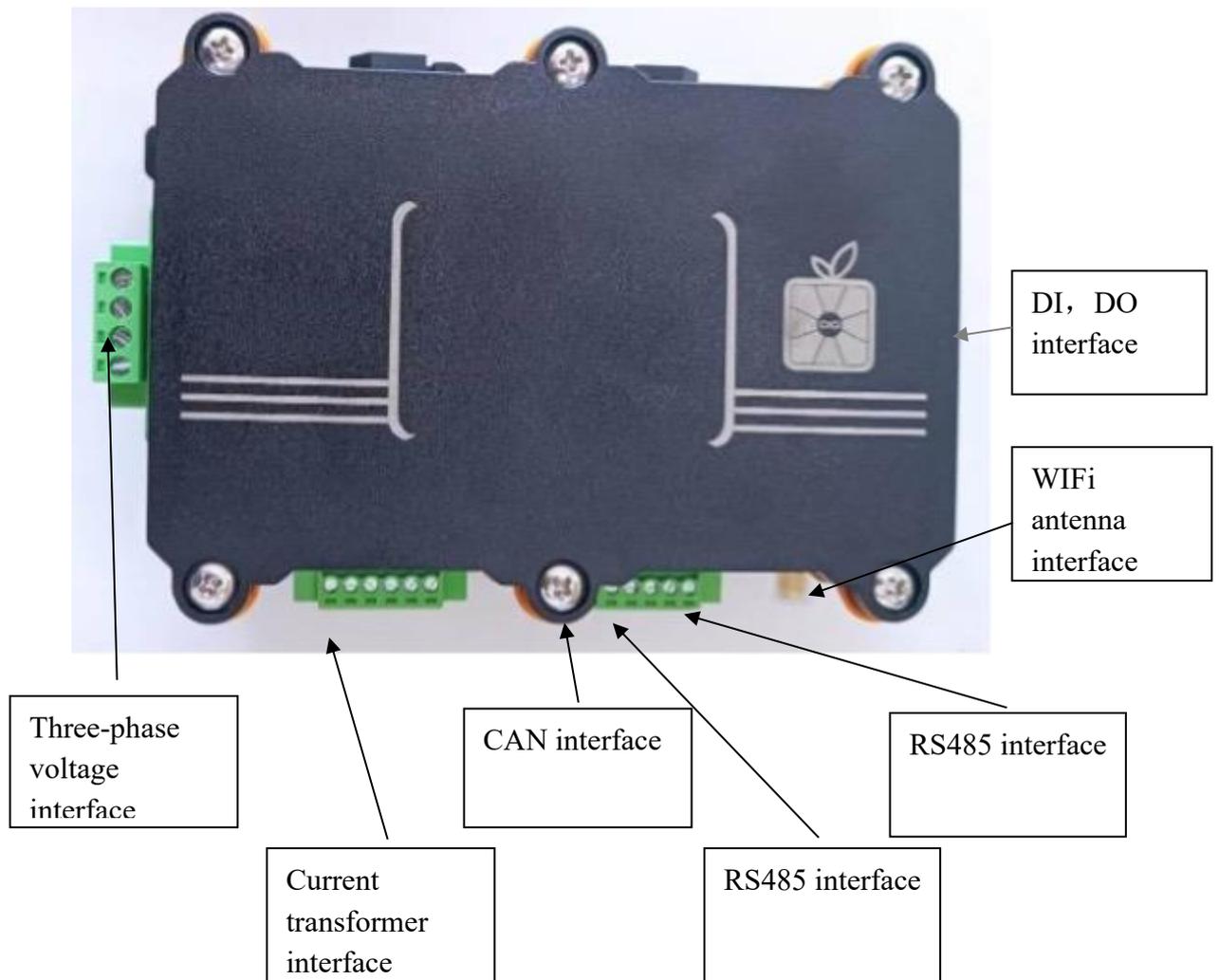


2.4.3 Network distribution failure handling

If the connection is not successful within 5 minutes, please check the network environment and repeat the network configuration operation.

3 Hardware Description

3.1 Product appearance

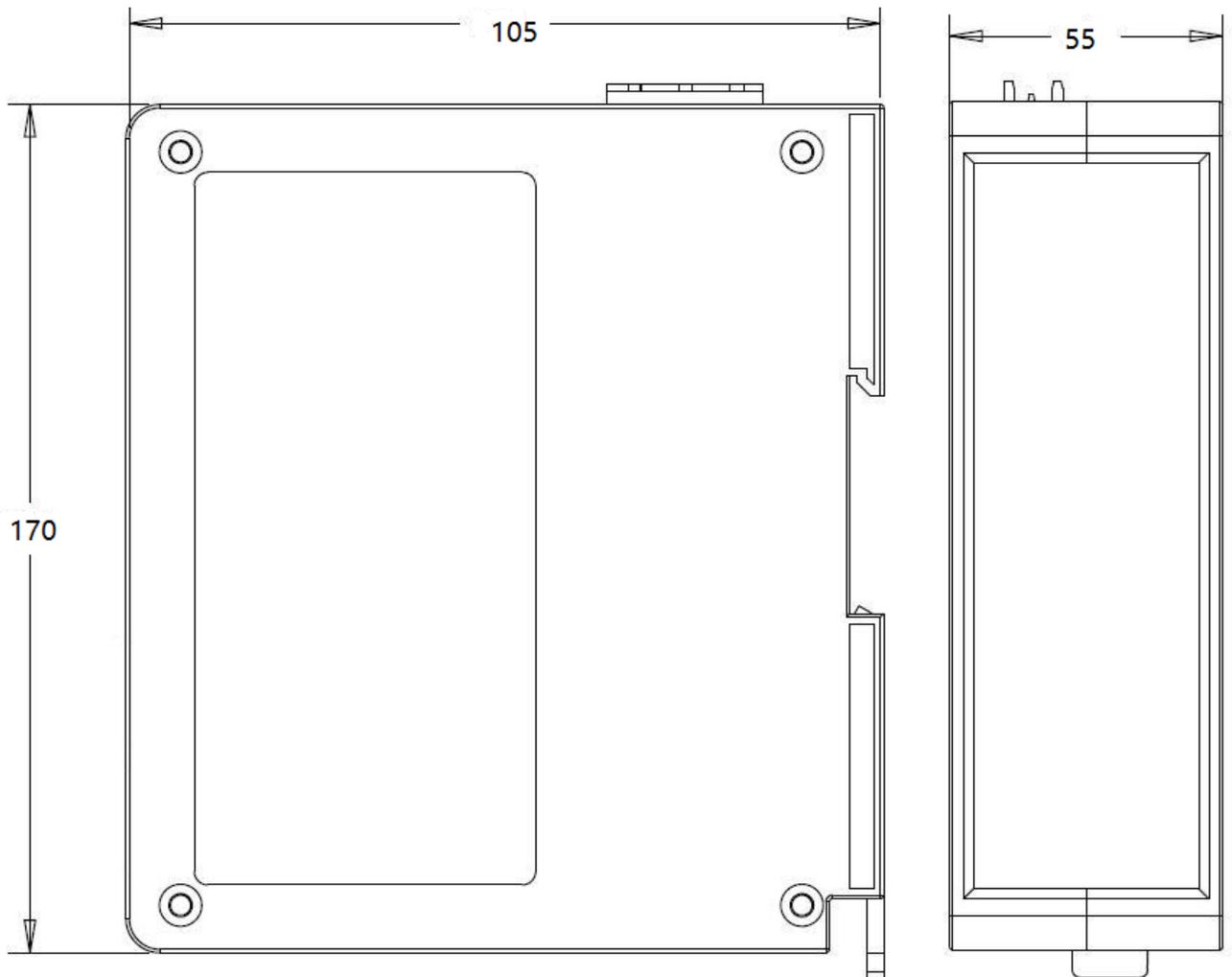


Note: This picture is for reference only, the appearance of the product should be based on the actual product.

4 Installation

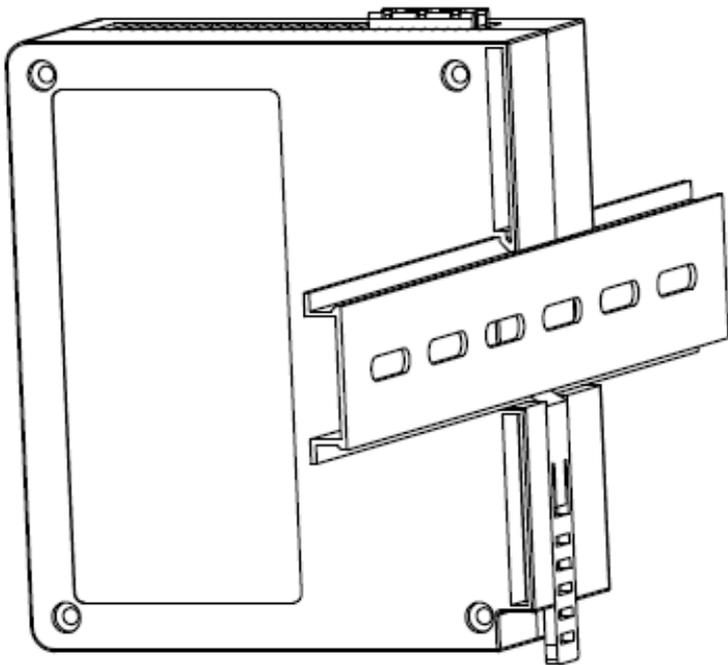
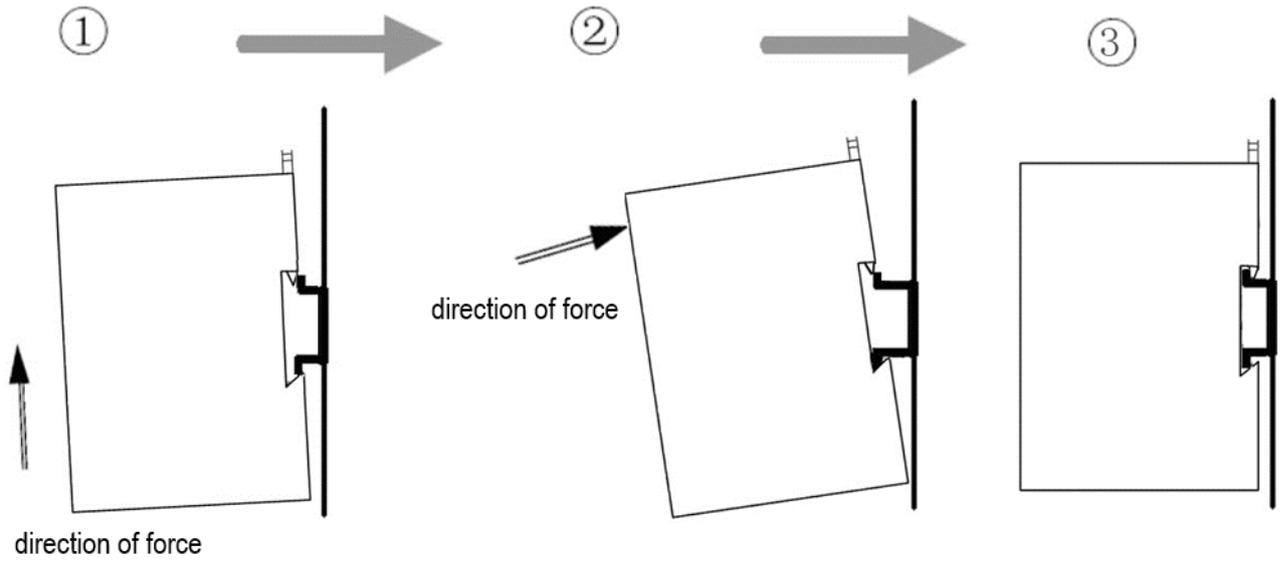
4.1 Mechanical dimensions

Dimensions: 55mm (width) × 170mm (height) × 105mm (depth)



4.2 How to install

35mm DIN rail installation



5 Operation, maintenance and precautions

- ✓ The module needs to be protected from heavy pressure to prevent panel damage;
- ✓ The module needs to be protected from impact, which may damage internal components;
- ✓ The power supply voltage is controlled within the requirements of the instruction manual to prevent the module from burning out;
- ✓ The module needs to prevent water from entering, which will affect normal operation;
- ✓ Please check the wiring before powering on to see if there are any misconnections or short circuits.

6 Copyright Information

The data and cases mentioned in this manual cannot be copied without authorization. During the product development process, Shanghai Orange Box Digital Technology Co. may revise its products without notifying users.

This product has many applications and the user must confirm that all operating procedures and results comply with the safety requirements of the corresponding application, including legal aspects, regulations, codes and standards.

7 Related Products

Other related products of our company include: E150, etc.

For instructions on the above products, please visit the company's website www.orange-box.cn, or call the technical support hotline: +86-021-60403356。

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.

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.

Radiation Exposure Statement

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 and your body.