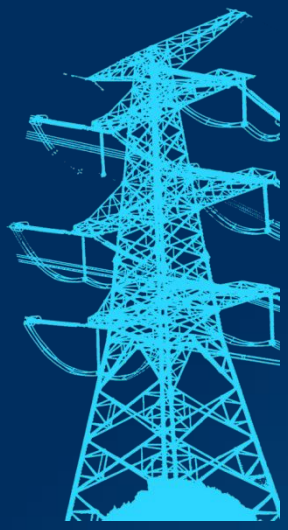
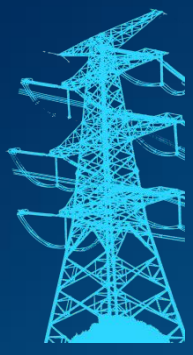
# BRN-APF Active Power Filter User Manual

V2.4







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# Preamble

In order to help you better use the product and protect your safety and the safety of the product, please carefully read and understand the relevant safety information and information about the equipment and user manual before operating the product.

## Disclaimer

Following the contents of the user manual is a prerequisite for safe operation, as well as achieving the performance characteristics and product functions described;

Our company does not assume the responsibility for material loss, economic loss and personal injury caused by ignoring product information;

## Copyright Notice

Our company reserves the right of final interpretation of this manual. It is forbidden to copy, modify or disseminate the content of this manual without permission.

## Technical changes

Please carefully read and understand the information related to the product;

Please keep this manual during the service life of the product to avoid unnecessary use;

As the product is constantly updated and upgraded, the place of upgrading is not subject to prior notice;

## Warranty service

In the shelf life of the product, due to product quality problems can enjoy free after-sales service;

Do not attempt to disassemble, repair, modify or upgrade the equipment, otherwise all warranty services will be invalid.

# Safety

This instruction is very important for the installation and use of active power filters (APFs). Ignoring these instructions may cause bodily injury or even death to you. The following safety information Outlines the safety measures required for the operation of the equipment and its components. Please follow the safety tips and safety information to ensure your personal safety and avoid material and economic losses.

## 1. The symbols used

Safety information is marked with symbols, and according to the danger level, the danger level is shown as follows:

| | |
|---|---|
|  Attention | Always be aware of dangerous situations that may arise, which may result in minor injuries if left unattended. |
|  Be careful | Always be aware of dangerous situations that may arise, which may result in moderate injury if left unattended. |
|  Warning | Always be aware of possible dangerous situations that could result in serious injury if left unattended. |
|  Danger | Always be aware of electrical hazards. |

## 2. Precautions

When operating electrical equipment, it is inevitable that some parts of the APF equipment will produce dangerous voltage. Serious physical injury or equipment damage can result if not handled properly.

◆APF equipment is suitable for 0.2/0.4/0.48/0.69KV power supply system, it is strictly prohibited to connect to the power grid without understanding, so as not to cause equipment damage and personal safety harm!

◆Improper use will damage the active power filter and connected equipment;

◆All system installation or routine maintenance must be operated in the case of power failure;

◆It is strictly prohibited to place combustible materials near the APF equipment or install them in the environment containing explosive gas, otherwise there is the risk of fire or even explosion;

◆Confirm that the input power supply is completely disconnected before installation and wiring operation, otherwise there is the risk of electric shock; After power-on, except the LCD screen, do not touch other

parts of the APF equipment;

◆Exposed cables, power terminal connectors and ungrounded live equipment may cause electric shock. Ask an electrical engineer or professional technician to verify that the APF equipment is fully grounded and to determine the live parts of the connectors and components; Use appropriate safety protective clothing and test tools when operating, and comply with safety practices;

◆Do not maintain the APF equipment in working condition;

◆When maintaining the product, please be sure to cut off the main circuit and wait at least 15 minutes to ensure that the AC side voltage drops to 0V and the internal capacitor is fully discharged;

◆In the humid condition, the resistance of the human body will decrease, at this time there may be dangerous high current through the human body, so do not maintain, install APF in the humid place. When it is impossible to avoid working in the conditions, you can stand on a dry rubber pad or dry board and use insulating gloves to keep your clothes dry and work in the company of a companion.

## 3. Have a person with electrical qualifications

To avoid personal injury and material damage, only personnel with professional electrical qualifications are allowed to operate and work on the APF equipment and its components, assemblies, systems and current circuits, and they must have the following knowledge:

◆National and international Regulations on the Prevention of Electrical Safety Accidents;

◆National standards for power supply technical standards of safety prevention system and technical specifications for low-voltage electrical safety;

◆Installation, commissioning, operation, disconnection, grounding and marking of electrical equipment; Basic requirements on personal protection.

# Chapter 1 Arrival inspection and storage

## 1.1 Transportation

Each set of active power filter (APF) is generally through carton packaging (default carton, optional wooden box) after transportation, the carton is placed with buffer foam cotton and other protective items, but in the transportation and handling process can not be inverted or tilted, so as to ensure that the filter is not damaged in the process of moving.

## 1.2 Receive and check the equipment

The APF equipment has been professionally tested and inspected before leaving the factory, and prepared for transportation according to the requirements of safe transportation. However, during the long distance transportation, the fixed parts on the APF equipment may still become loose due to vibration and turbulence, so after receiving the equipment, please check as follows:

- ◆After the equipment is shipped to the site, please check the goods according to the delivery list. If there is any abnormal situation, such as broken packaging, obvious deformation of equipment, equipment quantity is not consistent with the delivery list, please sign the carrier for confirmation, and contact the manufacturer immediately;
- ◆When removing the equipment packaging, please pay attention to avoid violent dismantling. When you use scissors, pliers, etc., to remove the packaging, please be careful to avoid scratching and damaging the equipment;
- ◆Check whether there is any external damage on the equipment, such as scratches on the panel, paint off, sag, etc., observe whether there are fallen components and loose wiring in the equipment. If there is damage in transportation, logistics claims should be requested. If you need assistance in the process of claiming, please contact the company;
- ◆Check the specifications and models. Our APF equipment enclosures have prominent nameplate labels that clearly describe the equipment model number, rated capacity and other information. Please double check that the invoice, goods received are consistent with the delivery list.

## 1.3 Module Packing

Module packaging is divided into cartons and wooden cases, which are generally cartons by default. If wooden case packing is required, please make remarks in advance.




Figure 1-1 Appearance of the rack

## 1.4 Storage

- ◆The packaging of APF equipment avoids long-term outdoor storage, can be stored indoors for 6 months (from the date of delivery), if you need to store longer time, you can put forward to the company to make longer storage time packaging when ordering;
- ◆If the APF equipment is not immediately installed and used, the APF equipment should be placed in a dry, ventilated, dust-free, non-corrosive material warehouse, and there is no strong mechanical vibration and magnetic field;
- ◆Storage environment temperature: (-45℃~70℃), air relative humidity: (5%~95%) (below 25℃);
- ◆If long-term storage is required, please check regularly whether the equipment packaging is moldy, damaged, etc.

# Chapter 2 Product overview

## 2.1 Product appearance composition

APF series products can be divided into rack type, wall type and vertical type according to the installation mode. Each type of installation mode module has products with voltage levels of 200V/400V/480V and 690V, and the product capacity covers 50A~200A.

The 4.3-inch LCD display is an optional component of the module. You can choose whether to have a screen or not according to the demand.

### 2.1.1 Appearance

Take the rack-mounted 100A module with screen.

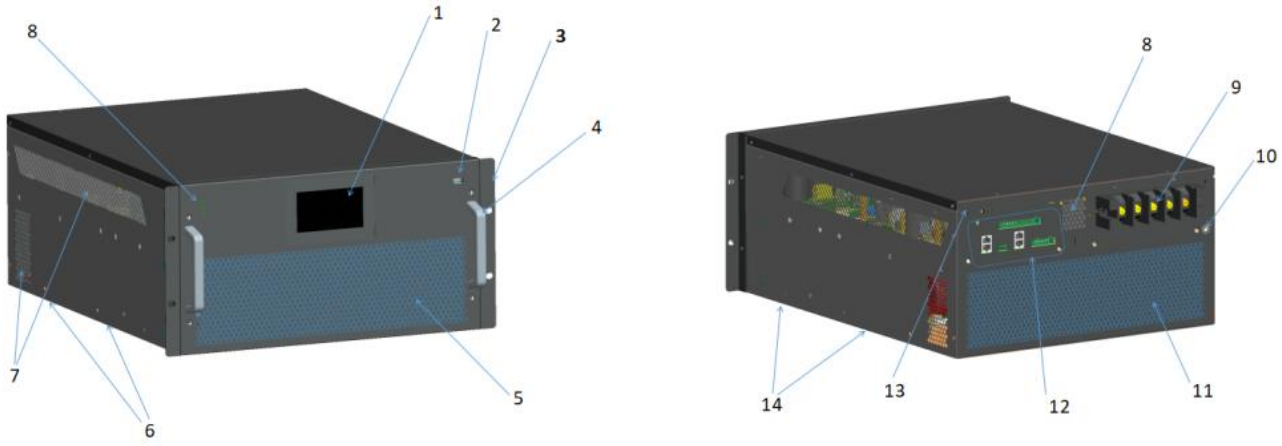



Figure 2-1 Appearance of the rack

| Serial number | Instructions | Serial number | Instructions |
|---|---|---|---|
| 1 | 4.3-inch LCD display (optional) | 8 | Upper heat dissipation hole |
| 2 | USB port (can flash reprogramming) | 9 | Power terminals |
| 3 | Rack mounted hanging ears | 10 | PE ground terminal |
| 4 | Hold hands | 11 | Lower back heat sink hole |
| 5 | Lower front panel heat dissipation hole | 12 | Control terminals |
| 6 | Wall-mounted mounting ear holes | 13 | Reserve WIFI antenna ports |
| 7 | Side heat dissipation holes | 14 | Wall mounted ear mounting holes |

***APF Rack mounted Series 400V voltage class 150A/200A and 690V voltage class 100A Appearance The upper part of the front panel has left and right heat dissipation holes. Otherwise, please refer to Appendix 1, which is not shown here.**

### 2.1.2 Wall-mounted mounting ears

Wall-mounted mounting ears are standard accessories for wall-mounted modules. Wall-mounted mounting ears can also be installed for auxiliary reinforcement installation for modules of all capacity specifications in rack.

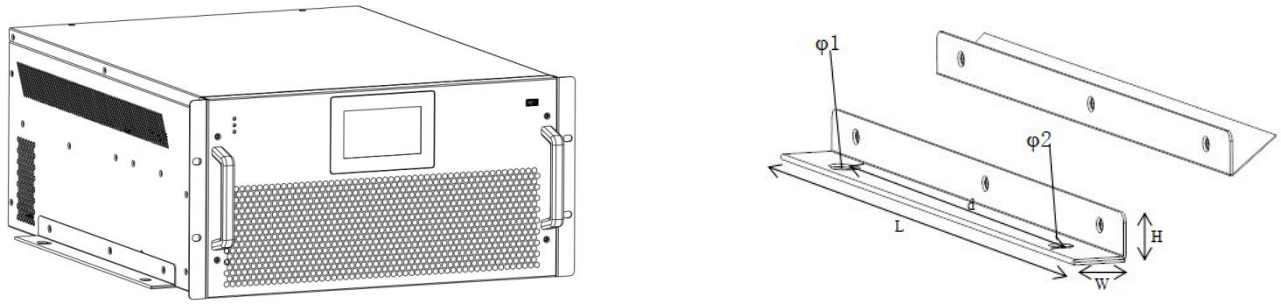



Figure 2-2 Mounting ear diagram

| Voltage level | Capacity | L*W*H (mm) | Hole spacing d (mm) | Mounting aperture 1 | Mount Aperture 2 |
|---|---|---|---|---|---|
| 200V /400V /480V | 50A | 395*31.5*26.5 | 300 | 2-Φ12 | 2-Φ12*16 |
| | 75A | 455*31.5*26.5 | 360 | 2-Φ12 | 2-Φ12*16 |
| | 100A | 395*31.5*26.5 | 300 | 2-Φ12 | 2-Φ12*16 |
| | 150A | 395*31.5*26.5 | 300 | 2-Φ12 | 2-Φ12*16 |
| | 200A | 495*32.0*40.0 | 420 | 2-Φ13 | 2-Φ13*16 |
| 690V | 100A | 395*31.5*26.5 | 300 | 2-Φ12 | 2-Φ12*16 |

## 2.2 Overall Dimensions

Under the same specifications, the non-screen module has the same dimensions as the module with screen. The following takes the module with screen as an example.

### 2.2.1 Rack-type module

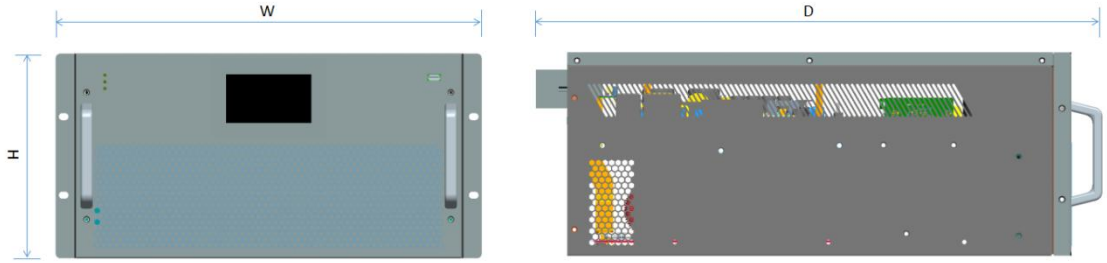



Figure 2-3 Rack size diagram

| Project | 200V/400V/480V | | | | | 690V |
|---|---|---|---|---|---|---|
| Capacity (A) | 50A | 75A | 100A | 150A | 200A | 100A |
| Dimensions W*D*H (mm) | 359*538*200 | 399*626*200 | 484*646*232 | 554*656*250 | 674*715*250 | 569*697*250 |
| Weight (kg) | 22 | 27 | 38 | 47 | 56 | 50 |

## 2.2.2 Wall-mounted

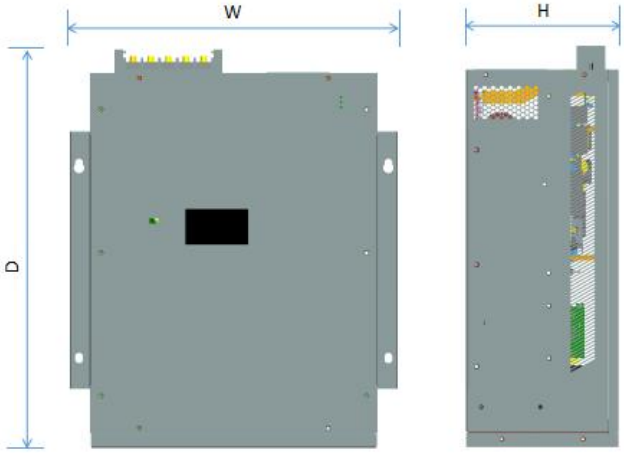



Figure 2-4 Wall mounted dimensions diagram

| Project | 200V/400V/480V | | | | | 690V |
|---|---|---|---|---|---|---|
| Capacity (A) | 50A | 75A | 100A | 150A | 200A | 100A |
| Dimensions W*D*H (mm) | 378*525*200 | 418*556*200 | 503*611*232 | 573*621*250 | 694*680*250 | 588*662*250 |
| Weight (kg) | 22 | 27 | 38 | 47 | 56 | 50 |

## 2.2.3 Standing

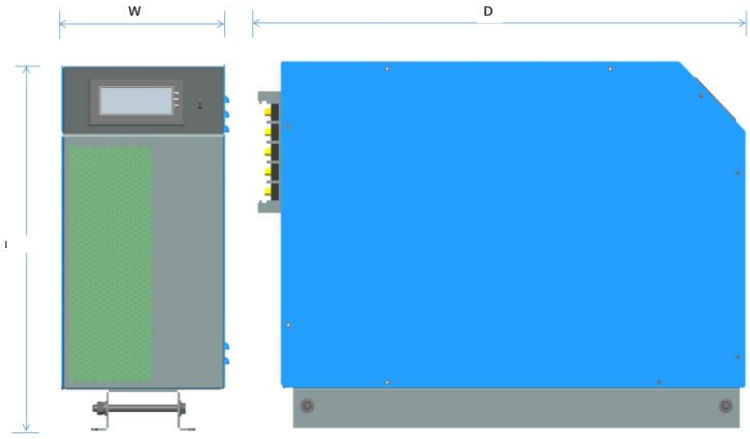



Figure 2-5 Dimensions of a stand

| Project | 200V/400V/480V | | | | | 690V |
|---|---|---|---|---|---|---|
| Capacity (A) | 50A | 75A | 100A | 150A | 200A | 100A |
| Dimensions W*D*H (mm) | 202.2*575*372.4 | 202.5*638*418 | 234.5*699*498 | 251.5*689*568 | 251.5*748*688 | 251.5*755*583 |
| Weight (kg) | 22 | 27 | 38 | 47 | 56 | 50 |

## 2.3 Technical Specifications

| | | | |
|---|---|---|---|
| Rated voltage (V) | 200/400 | 480 | 690 |
| Input voltage range | - 20% ~ + 20% | Maximum voltage: 500V | - 20% ~ + 10% |
| Single module capacity (A) | 50, 75, 100, 150, 200 | 50, 75, 100, 150, 200 | 100 |
| Frequency | 50/60Hz (-10%~+10%) | | |
| Filter range | 2 to 50 times optional | | |
| Harmonic filtering capability | Better than 97% at rated load | | |
| CT mounting method | Open or closed loop (Open loop is recommended in parallel) | | |
| CT mounting position | Grid side/load side | | |
| Response time | 10 ms or less | | |
| Wire system | Three-phase three-wire/three-phase four-wire | | |
| Overload capability | It can run continuously at 110% rated current and 1min at 120% rated current | | |
| Circuit topology | Three-level topology | | |
| Switching frequency | 20 kHz | | |
| Number of parallel machines | Parallel between modules | ≤ 20 | |
| | Parallel machine under HMI control | No more than 8 modules are parallel | |
| Redundancy | Any unit can become a stand-alone unit | | |
| Unbalanced governance | Available | | |
| Reactive power compensation | Available | | |
| Display | No screen /4.3/7 inch screen (optional) | | |
| Communication port | RS485 | | |
| | CAN protocol, RJ45 interface, for communication between modules | | |
| Noise level | < 56 dB Max to < 69 dB (depending on module or load conditions) | | |
| Altitude | >1500m derating use | | |
| Ambient temperature | Operating temperature: -45°C~55°C, derating above 55°C for use | | |
| | Storage temperature: -45°C~70°C | | |
| Humidity | 5% to 95%RH, no condensation | | |
| Cooling mode | Smart air cooling | | |
| Level of protection | IP20 | | |
| General structural and safety issues | EN 62477-1(2012), EN 61439-1 (2011) | | |
| EMC | EN/IEC 61000-6-4, Class A | | |
| Certification | CE, CQC | | |

## 2.4 Heat dissipation requirements

APF module adopts intelligent air cooling heat dissipation. When designing complete sets of systems, the heat dissipation design should meet the following requirements:

| Voltage level | Product capacity | Demand air volume (L/Sec) | Minimum air intake area (mm) | Minimum opening size of front and rear door Panels (mm) |
|---|---|---|---|---|
| 200V /400V /480V | 50A | 150 | 2.6 * 10 | 383 * 87 |
| | 75A | 225 | 3.0 * 10 | 383 * 100 |
| | 100A | 300 | 3.5 * 10 | 383 * 120 |

| | | | | |
|---|---|---|---|---|
| | 150A | 450 | 5.5 * 10 | 430 * 140 |
| | 200A | 525 | 6.3 * 10 | 520 * 160 |
| 690V | 100A | 450 | 5.5 * 10 | 430 * 140 |

For example, the complete cabinet of APF-400A shall be designed for heat dissipation 4 times that of APF-100A module (required air volume, minimum air intake area, minimum opening size of front and rear door panels).

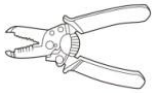
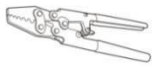
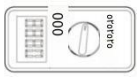
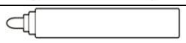
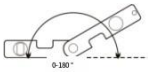
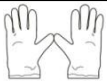
# Chapter 3 System Installation

| | |
|---|---|
|  Note | ◆APF modules have the same signal interface, **APF-100A (including 100A) above the power terminal has two N-phase terminals**, and the two N-phase terminals need to connect;<br>◆The installation and connection modes of the module without screen are the same as those of the module with screen;<br>◆The module can be monitored by a 4.3-inch small screen (optional) or by an external 7-inch large screen (optional). |
|  Be careful | ◆Provide adequate air circulation in the installation environment. When the ambient temperature is high, please conduct certain cooling of the APF equipment as required;<br>◆Install the APF according to the instructions in this manual and related accessories;<br>◆Install the rack module, please install it horizontally. Try not to tilt, handstand and other directions for installation;<br>◆Install wall hanging module, as far as possible wall hanging vertical installation, do not hang side or upside down;<br>◆Install vertical module, avoid tilt, lodging installation. |
|  Warnings | ◆As ignoring the installation instructions can easily cause equipment damage, which may endanger personal safety in serious cases, please strictly follow the following rules:<br>◆Before starting work, please disconnect the isolation switch and make sure it can not be closed by someone, and check that the APF has been cut off! Temporarily cover adjacent live parts with insulation;<br>◆In the process of operation and troubleshooting, please check in advance whether there is dangerous voltage in the environment, if necessary, please turn them off;<br>◆When working on the electrical system, please wear protective clothing and equipment according to the applicable guidelines;<br>◆Before connecting the equipment/parts, please keep the ground and ensure the equipment power off;<br>◆Do not contact the energized bare or peeling wire, stranded wire should be equipped with wire sleeve;<br>◆All parts of the circuit connected to the power supply/grid may have dangerous voltage;<br>◆Use suitable line isolation switches/circuit breakers/fuses;<br>◆Dangerous voltages may still exist in the equipment or components (capacitors) even when disconnected from the power supply/grid;<br>◆Do not operate the equipment when the current transformer circuit is open; |

| | |
|---|---|
| | ◆Do not make the APF equipment run with full load for a long time, and do not set the parameter beyond the limit value that the equipment can bear;<br>◆Please pay attention to the warning and safety marks of all documents related to the equipment;<br>◆Please pay attention to all warning and safety marks in the site environment. |

## 3.1 Tools

Prepare the tools that may be used for installation and wiring in advance. Only some of the tools that may be used are listed here for reference only.

| Number | Tools | Description | Features |
|---|---|---|---|
| 1 |  | Hammer drill | Wall drilling |
| 2 |  | Flat-head screwdriver | Remove and install screws as well as wiring |
| 3 |  | Phillips screwdriver | Remove and install screws as well as wiring |
| 4 |  | Wire strippers | Wire stripper |
| 5 |  | Hex wrench | Holding module |
| 6 |  | Crimping pliers | Crimp communication and control terminal wiring and crimp CT extension cords |
| 7 |  | Multimeter | Check that the cable is wired correctly,<br>Whether grounding is reliable |
| 8 |  | Marker | Punch marks |
| 9 |  | Measuring tape | Measuring distance |
| 10 |  | Level | Keep the module level |
| 11 |  | Insulation protective gloves | Wear when installing the machine |

## 3.2 Installation environment

The following are our suggestions for the working and installation environment of the equipment. If we do not take our suggestions, the equipment will be vulnerable to damage:

(1) Site requirements

◆APF equipment must be installed in the electrical control room, the room must maintain good ventilation environment;

◆The air inlet and outlet must be professionally rainproof, dust-proof, sand-proof, fireproof and rodent-proof;

◆If there are serious dust (especially charged dust) and fly ash problems at the installation site, it is recommended to equip the APF equipment with special protective treatment to avoid reducing the efficiency of the equipment, reducing the service life, failure and damage.

(2) Foundation requirements

◆The installation surface must be smooth and dry, the ground is strictly prohibited water;

◆Ensure that the ground level does not shake, the land is strong, can bear the weight of the APF device.

(3) Space requirements

◆In the APF equipment before and after the left and right direction to reserve enough space (at least 30cm) for heat dissipation;

◆APF equipment should be far away from flammable, explosive and corrosive materials;

◆Adequate space should be reserved around the APF equipment for operation wiring and future maintenance;

◆The installation position must conform to the fire safety regulations.

(4) Environmental requirements

◆It can run with full load when the altitude is lower than 1500m; At 1500m-4000m altitude according to the national standard GB/T3859.2, every 100m rise, the power is reduced by 1%;

◆Humidity: 5~95%, no condensation;

◆Ambient temperature :-45℃~55℃.

◆Equipment as far as possible to avoid dealing with strong impact load of machinery and equipment (such as: intermediate frequency furnace, high-frequency furnace, etc.).

| | |
|---|---|
|  Attention | If you need to use the equipment in the field of strong salt, strong acid and alkali corrosion, you need special instructions when communicating with our company. If you have special on-site needs and do not explain the product damage or can not be used, the company will not be responsible! |

## 3.3 Mechanical installation

Mechanical installation can be divided into rack installation, wall installation and vertical installation according to the module installation method.

### 3.3.1 Rack Installation

For rack-mounted installation, the front two mounting ears of the module can be fixed to the cabinet mounting posts (as shown below), or the installation can be strengthened by selecting wall-mounted mounting ears (refer to 2.1.2).

**The handrails on the front panel of the module are held as auxiliary installation only, and cannot be used for load bearing!**

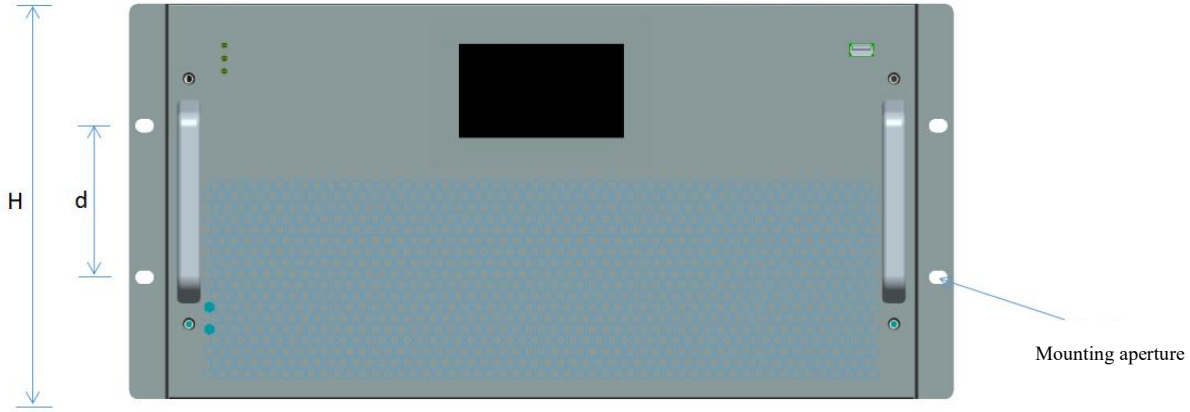



Figure 3-1 rack-mounted front panel

| Voltage level | Capacity | H (mm) | d (mm) | Mounting aperture |
|---|---|---|---|---|
| 200V /400V /480V | 50A | 200 | 89 | 4-8 * 11 |
| | 75A | 200 | 89 | 4-8 * 11 |
| | 100A | 232 | 89 | 4-8 * 11 |
| | 150A | 250 | 89 | 4-8 * 11 |
| | 200A | 250 | 89 | 4-8 * 11 |
| 690V | 100A | 250 | 89 | 4-8 * 11 |

Take the 400A active filter cabinet (4 100A modules) as an example:

| | Recommended size W*L*H (mm) |
|---|---|
| Active filter cabinet | 800 * 800 * 2200 |
| | 800 * 1000 * 2200 |
| | 1000 * 1000 * 2200 |

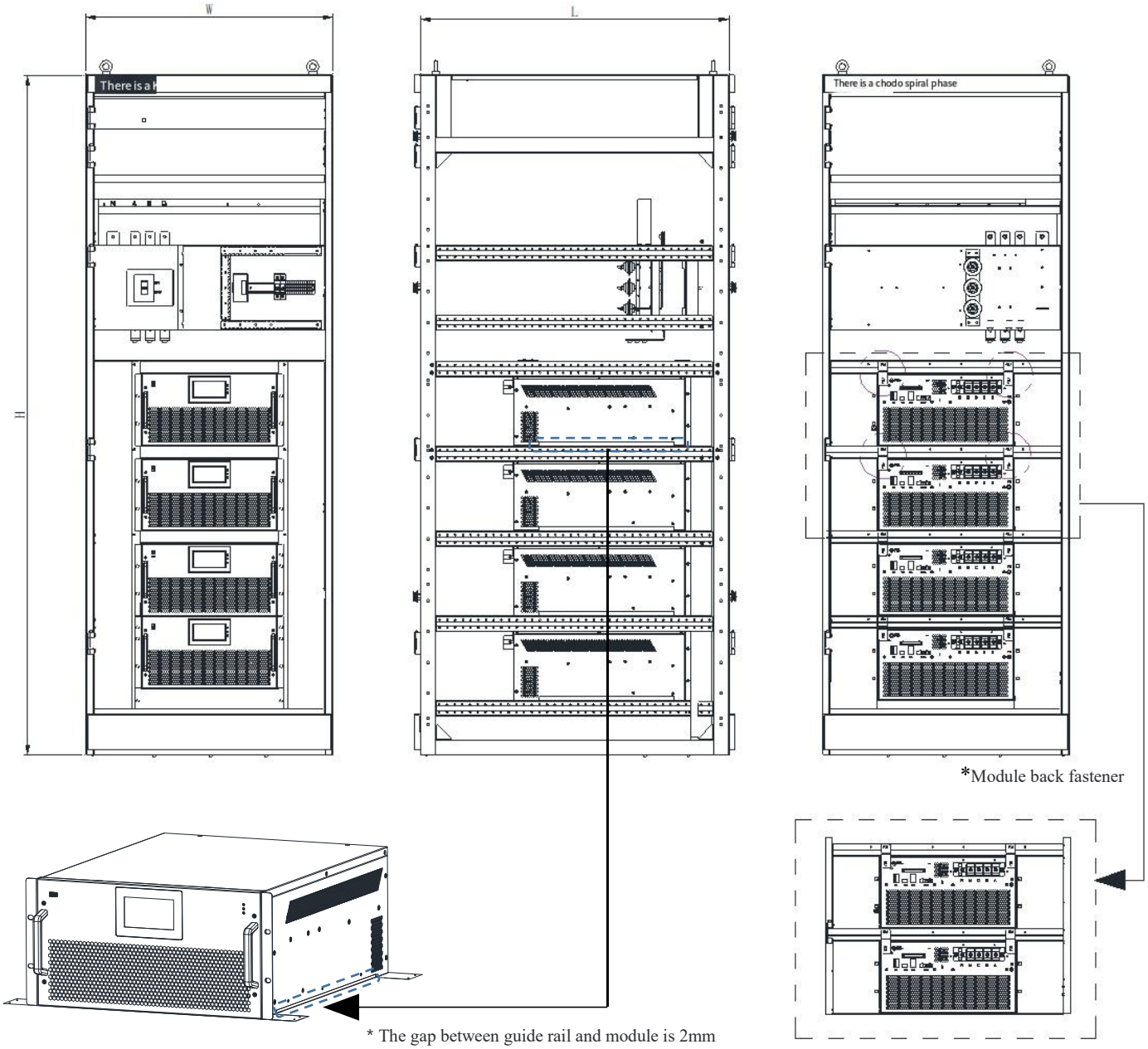



Figure 3-2 Rack installation diagram

### 3.3.2 Wall mount

For wall-mounted installation, it must be fixed in the cabinet or on a hard wall through the left and right wall-mounted mounting ears.

| Voltage grade | Capacity | Mounting aperture 1 | Mount Aperture 2 | Hole spacing d (mm) |
|---|---|---|---|---|
| 200V /400V /480V | 50A | 2 - Φ 12 | 2 - Φ 12 * 16 | 300 |
| | 75A | 2 - Φ 12 | 2 - Φ 12 * 16 | 360 |
| | 100A | 2 - Φ 12 | 2 - Φ 12 * 16 | 300 |
| | 150A | 2 - Φ 12 | 2 - Φ 12 * 16 | 300 |
| | 200A | 2 - Φ 13 | 2 - Φ 13 * 16 | 420 |
| 690V | 100A | 2 - Φ 12 | 2 - Φ 12 * 16 | 300 |

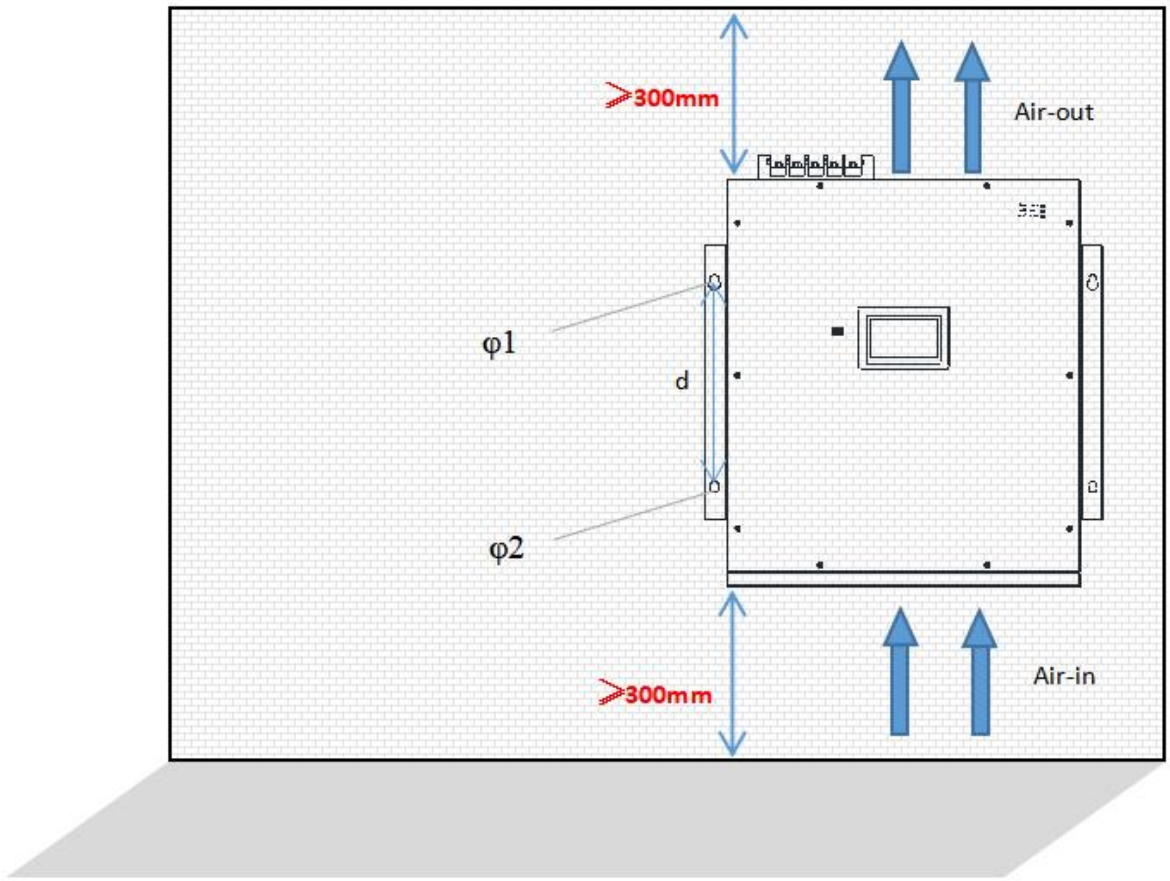



Figure 3-3 wall mount diagram

### 3.3.3 Vertical mounting

In vertical installation, the APF module is fixed in the cabinet through the lower guide rail and screws. Take the 600A active filter cabinet (composed of 6 100A modules) as an example:

| | Recommended size W*L*H (mm) |
|---|---|
| Active filter cabinet | 800*800*2200 |
| | 800*1000*2200 |
| | 1000*1000*2200 |

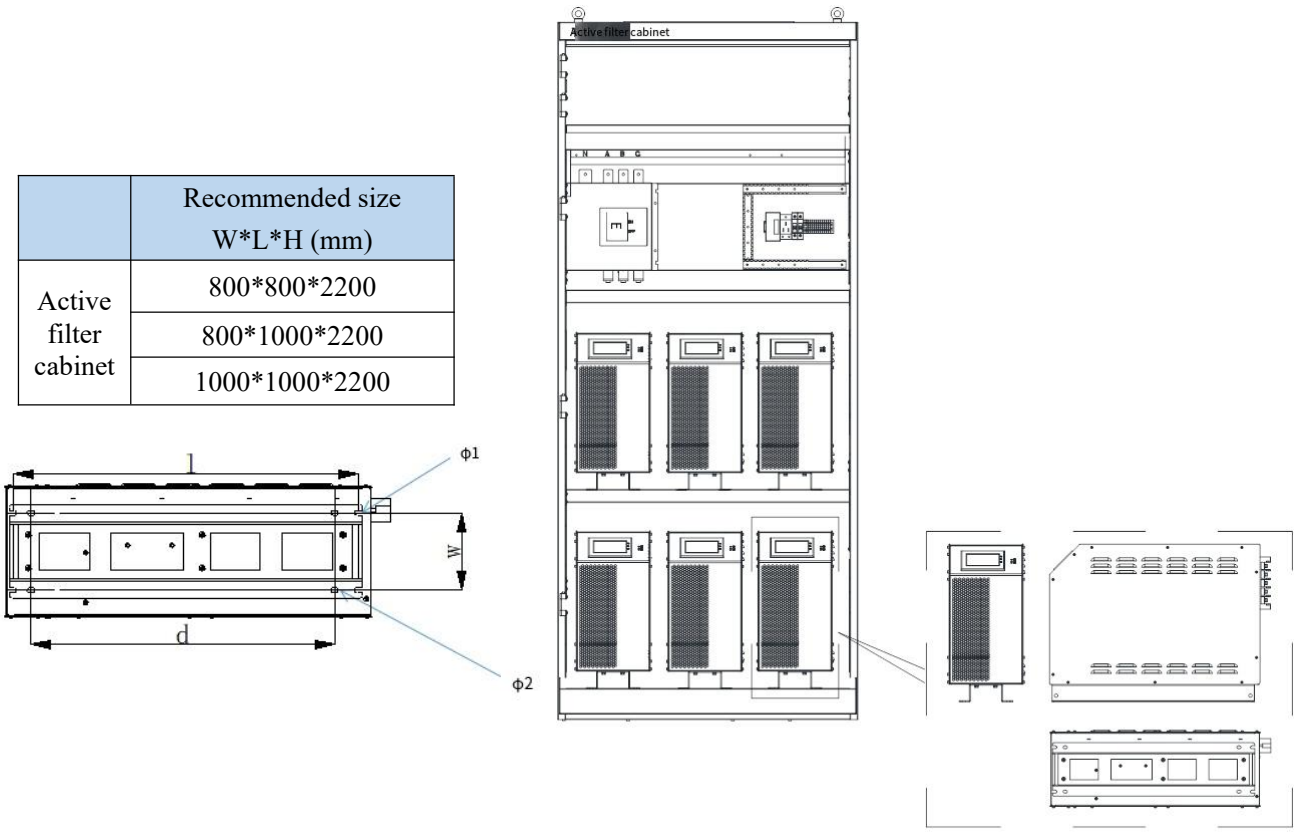



Figure 3-4 Vertical installation diagram

| Voltage Grade | Capacity | Installation Aperture 1 | Mounting Aperture 2 | Hole spacing l (mm) | Hole spacing d (mm) | Width w (mm) |
|---|---|---|---|---|---|---|
| 200V /400V /480V | 50A | 4 - Φ 9 | 4 - Φ 9 * 15 | 511 | 440 | 140 |
| | 75A | 4 - Φ 9 | 4 - Φ 9 * 18 | 595 | 440 | 140 |
| | 100A | 4 - Φ 9 | 4 - Φ 9 * 14 | 625 | 550 | 140 |
| | 150A | 4 - Φ 9 | 4 - Φ 9 * 14 | 640 | 550 | 140 |
| | 200A | 4 - Φ 9 | 4 - Φ 9 * 14 | 686 | 600 | 215 |
| 690V | 100A | 4 - Φ 9 | 4 - Φ 9 * 14 | 687 | 616 | 140 |

Note

◆It is recommended to put no more than 3 vertical modules in each layer of the cabinet;

◆**The cabinet beam and the bottom should be thickened and reinforced to avoid being crushed due to the weight of the module;**

◆The center of gravity of module installation should be as low as possible.

# 3.4 Electrical connection

## 3.4.1 Port overview

APF module ports are divided into power terminals, communication ports (which can be divided into monitoring ports, debugging ports and parallel communication ports), control ports and CT.

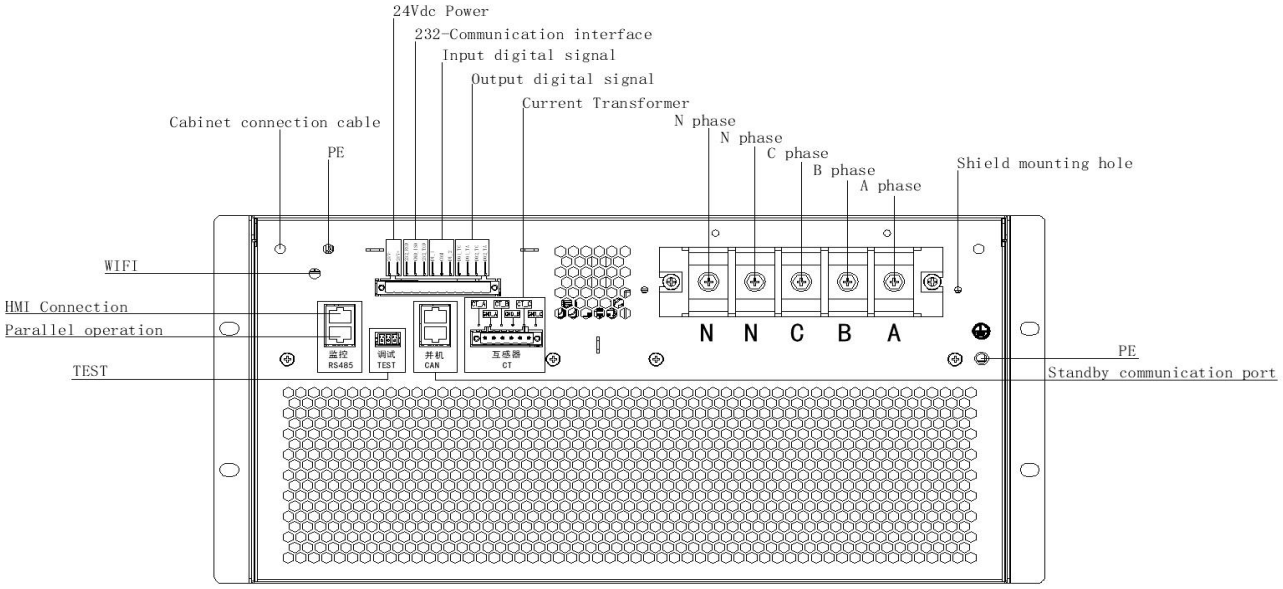



Figure 3-5 Back overview

## 3.4.2 Power terminals

| | |
|---|---|
| Warnings | ◆ Power terminal wiring must be connected correctly, please be sure to check several times: do not miss, do not mix, otherwise it may cause equipment failure or damage;<br>◆ Please keep the power terminal dry, can be protected if necessary;<br>◆ Power terminal is conductive material, please do not touch it with your hand! |

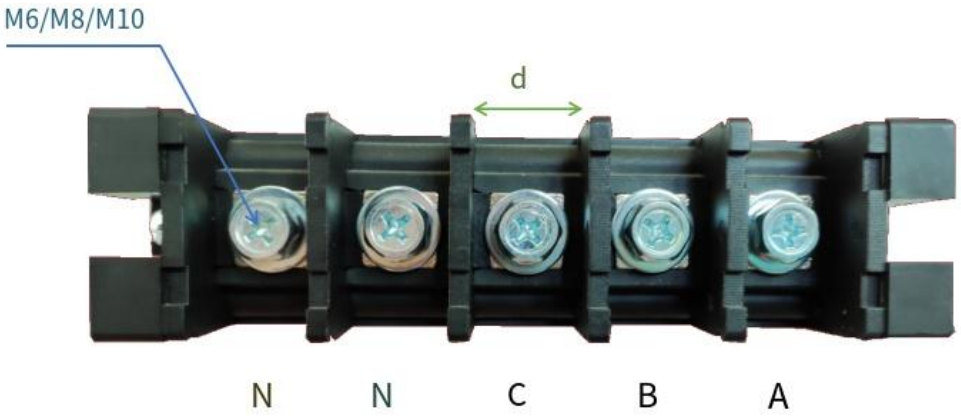



Figure 3-6 Power terminal diagram

(1) Meaning of the terminal

| Item | Instructions |
|---|---|
| A | A-phase input |
| B | B phase input |
| C | C phase input |
| N | N phase input |
| N | N phase input |
| PE | Ground terminal |

| Voltage level | Capacity | Power terminal specifications | Terminal Width d | PE ground post |
|---|---|---|---|---|
| 200V /400V /480V | 50A | M6 | 13mm | M6 |
| | 75A | M8 | 23mm | M6 |
| | 100A | M8 | 23mm | M6 |
| | 150A | M8 | 23mm | M6 |
| | 200A | M10 | 30mm | M6 |
| 690V | 100A | M8 | 23mm | M6 |

(2) Recommended cables

| Items | Capacity | A/B/C (L1/L2/L3) | N | N | PE | Fuse A |
|---|---|---|---|---|---|---|
| Power cable | 50A | 16mm$^2$ | 25mm$^2$ | - | 16mm$^2$ | 80 |
| | 75A | 25mm$^2$ | 35mm$^2$ | - | 16mm$^2$ | 125 |
| | 100A | 35mm$^2$ | 35mm$^2$ | 35mm$^2$ | 16mm$^2$ | 160 |
| | 150A | 50mm$^2$ | 50mm$^2$ | 50mm$^2$ | 25mm$^2$ | 250 |
| | 200A | 70mm$^2$ | 70mm$^2$ | 70mm$^2$ | 25mm$^2$ | 400 |
| | Copper core cable is recommended | | | | | |

### 3.4.3 Communication ports

| | |
|---|---|
| Warnings | Do not debug the TEST port without the manufacturer's authorization! If you modify the parameters without authorization, it may cause equipment failure or even equipment damage, the company will not be responsible! |

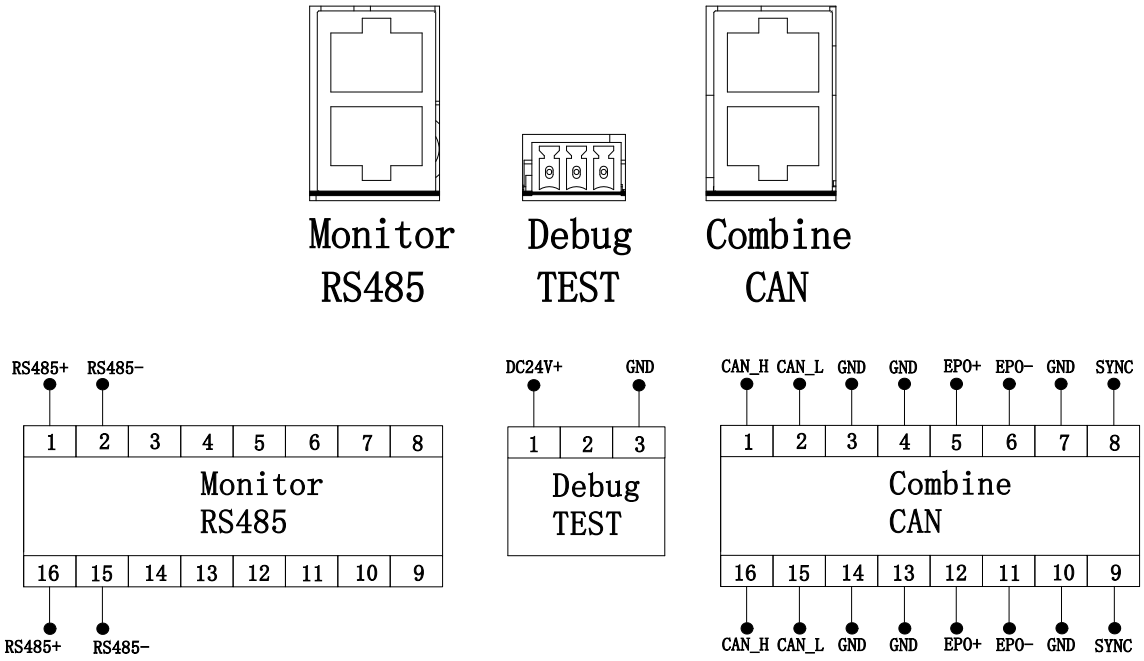



Figure 3-7 Communication port and definition

| Name | Definition | Instructions | Notes |
|---|---|---|---|
| Monitoring RS485 | RS485 Communication network port | RS485 port: used to connect the background computer control system or external screen display, to realize real-time monitoring of the entire APF configuration system; In addition to the first APF module, it is used to connect the upper port of the next APF module to establish parallel connection (refer to Section 3.4.7). | Follow the "top to top, bottom to bottom" principle |
| | | RS485 lower port: When there is only one APF module, it can be empty; When multiple modules establish parallel communication, the lower port can be used to establish communication between parallel modules | |
| Debugging TEST | Test Debug interface | TEST port for manufacturers to debug the equipment testing special power-on interface (DC 24V input) | Special for debugging |
| Parallel machine CAN | CAN Parallel port | When the APF module is normally combined, the CAN port can be empty; When the module controls the capacitor (optional), CAN port parallel is used. | Follow the "top to top, bottom to bottom" principle |

### 3.4.4 Control ports

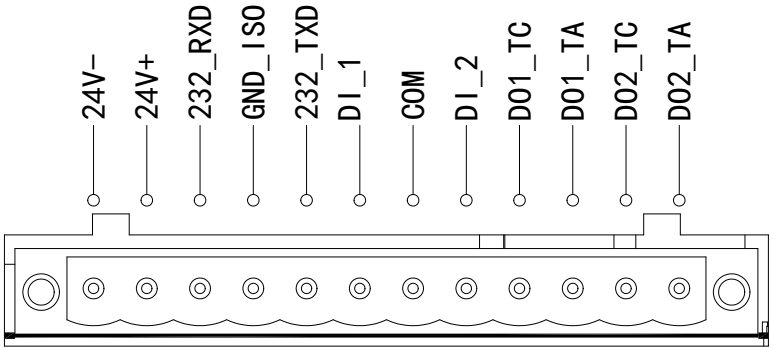
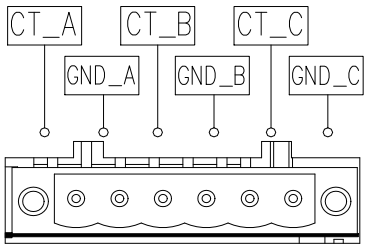



Figure 3-8 Control port diagram

| Project | | Terminal symbol | Terminal function description | Electrical specifications |
|---|---|---|---|---|
| Control terminals | 24V output | 24V- | 24V - negative end | 24V output, 1Amax |
| | | 24V+ | 24V + positive end | |
| | RS232 | 232_RXD | 232 Receiving end | RS232 interface, 9600 baud |
| | | GND_ISO | 232 ground terminal | |
| | | 232_TXD | 232 Sending end | |
| | Digital input | DI_1 | Numeric input port 1 | The optocoupler isolates the input<br>Input voltage: 9 to 24 Vdc<br>Input impedance: 5kΩ |
| | | COM | Digital input common end | |
| | | DI_2 | Digital input port 2 | |
| | Digital Output | DO1_TA | Relay output 1 neutral end | TA-TC: normally open contact;<br>Contact capacity:<br>250Vac/2A(cosφ=1),<br>30 Vdc /1A |
| | | DO1_TC | Relay output 1 Always start | |
| | | DO2_TA | Relay output 2 neutral end | |
| | | DO2_TC | Relay output 2 normal start | |

### 3.4.5 Current transformer




Current transformer
CT

Figure 3-9 CT port diagram

Ct connection:

| Items | Instructions | Project | description |
|---|---|---|---|
| CT_A | Connect the S1 end of the phase A CT | GND_A | Connect to the S2 end of phase A CT |
| CT_B | Connect the S1 end of the phase B CT | GND_B | Connect to the S2 end of phase C CT |
| CT_C | Connect the S1 end of the phase C CT | GND_C | Connect to the S2 end of phase C CT |

| Items | Parameter requirements | | |
|---|---|---|---|
| CT cable | CT rated load | Wire cross-sectional area | Length of one-way wiring |
| | 5VA | The 2.5 mm | 10m or less |
| | | The 4.0 mm | 10m~20m |
| | 10VA | The 2.5 mm | 20m or less |
| | | The 4.0 mm | 20~40m |
| | 15VA | The 2.5 mm | 30m or less |
| | | The 4.0 mm | 30~60m |

(1) secondary power greater than 1VA;

(2) accuracy requirements above 0.5 grade;

(3) **CT ratio range is: 50/5~ 30000/5**, the ratio specification is selected by 1.2~1.5 times of the system current. In practical engineering, the selection can also be made according to 1.5 times of transformer capacity (400V). For example, if the transformer capacity is 2000kVA, 1.5 times can be selected as 3000/5;

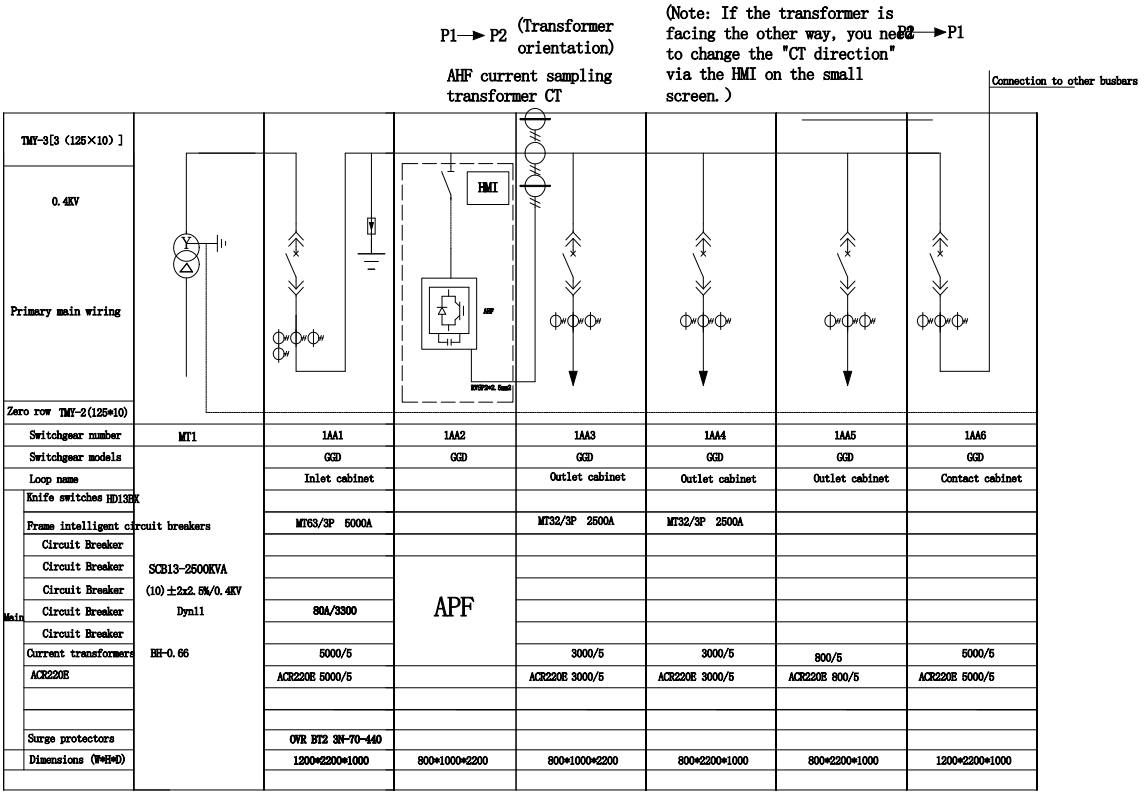
(4) The secondary side of CT must be reliably grounded (only one end can be grounded). Shielded twisted-pair cable (RVVP) is recommended for transformer sample cables. The internal diameter of 15m is 2.5mm$^2$, and the line of 15m~30m is 4mm$^2$.

| | |
|---|---|
|  Attention | ◆External CT is recommended to be installed on the load side;<br>◆As an external part of APF, the current transformer plays a vital role in the normal operation of APF, so the selection of the external current transformer is very important, please be sure to refer to the above instructions for selection;<br>◆If the current transformer is not connected correctly, it may cause insufficient filtering effect or equipment failure;<br>◆Before installing the current transformer, short circuit the secondary side and power off the equipment;<br>◆Before separating the current transformer and APF, you can short circuit it;<br>◆After measuring the load current, the choice of transformer should leave a certain margin. |

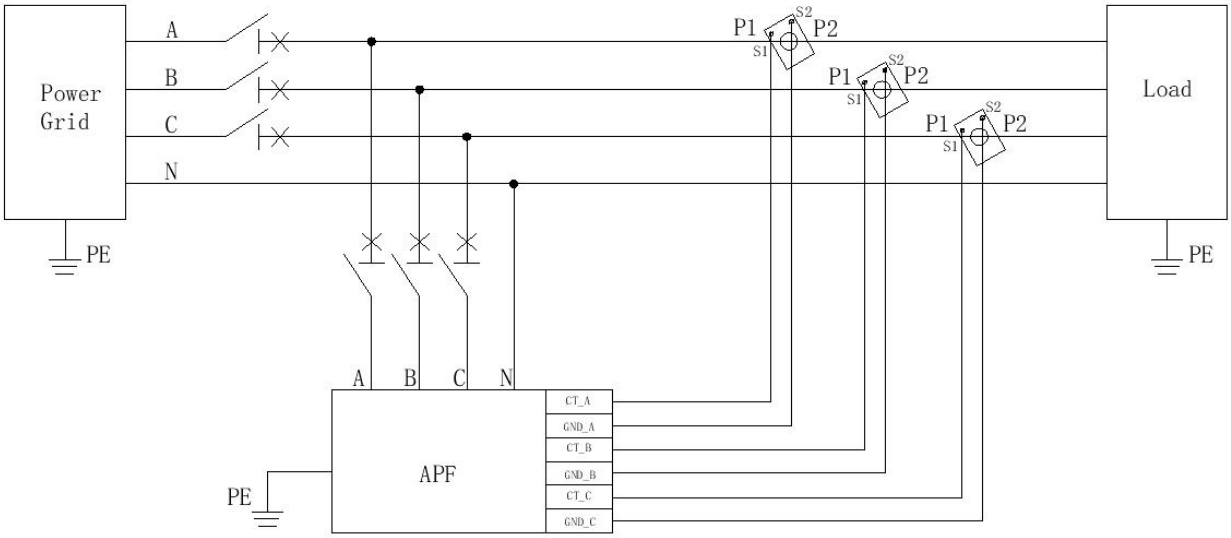
| | |
|---|---|
|  Warnings | ◆When wiring CT, the outgoing terminals S1 and S 2 of CT are connected to the positive terminal (CT_A) and the negative terminal (GND_A) of the APF device respectively. Please refer to 3.5.5 and 3.5.6.<br>◆The P1 end of CT faces the power side, and the P2 end faces the load side;<br>◆S1 and S2 of each transformer must correspond to terminals with corresponding labels. It is strictly prohibited to open the circuit twice. Violation of this rule may cause the transformer to burn down;<br>◆Ensure that the current transformer is in the short-circuit state until the CT terminals of the APF are connected properly. |

## 3.4.6 Power distribution for single machines

Take load side sampling as an example:




| | | | | | | | |
|---|---|---|---|---|---|---|---|
| TMY-3[3 (125×10) ] | | | | | | | |
| 0.4KV | | | | | | | |
| Primary main wiring | | | | | | | |
| Zero row TMY-2(125*10) | | | | | | | |
| Switchgear number | MT1 | 1AA1 | 1AA2 | 1AA3 | 1AA4 | 1AA5 | 1AA6 |
| Switchgear models | | GGD | GGD | GGD | GGD | GGD | GGD |
| Loop name | | Inlet cabinet | | Outlet cabinet | Outlet cabinet | Outlet cabinet | Contact cabinet |
| Knife switches HD13BX | | | | | | | |
| Frame intelligent circuit breakers | | MT63/3P 5000A | | MT32/3P 2500A | MT32/3P 2500A | | |
| Circuit Breaker | | | | | | | |
| Circuit Breaker | SCB13-2500KVA | | | | | | |
| Circuit Breaker | (10)±2x2.5%/0.4KV | | | | | | |
| Main Circuit Breaker | Dyn11 | 80A/3300 | APF | | | | |
| Circuit Breaker | | | | | | | |
| Current transformers | BH-0.66 | 5000/5 | | 3000/5 | 3000/5 | 800/5 | 5000/5 |
| ACR220E | | ACR220E 5000/5 | | ACR220E 3000/5 | ACR220E 3000/5 | ACR220E 800/5 | ACR220E 5000/5 |
| | | | | | | | |
| | | | | | | | |
| Surge protectors | | OVR BT2 3N-70-440 | | | | | |
| Dimensions (W*H*D) | | 1200*2200*1000 | 800*1000*2200 | 800*1000*2200 | 800*2200*1000 | 800*2200*1000 | 1200*2200*1000 |



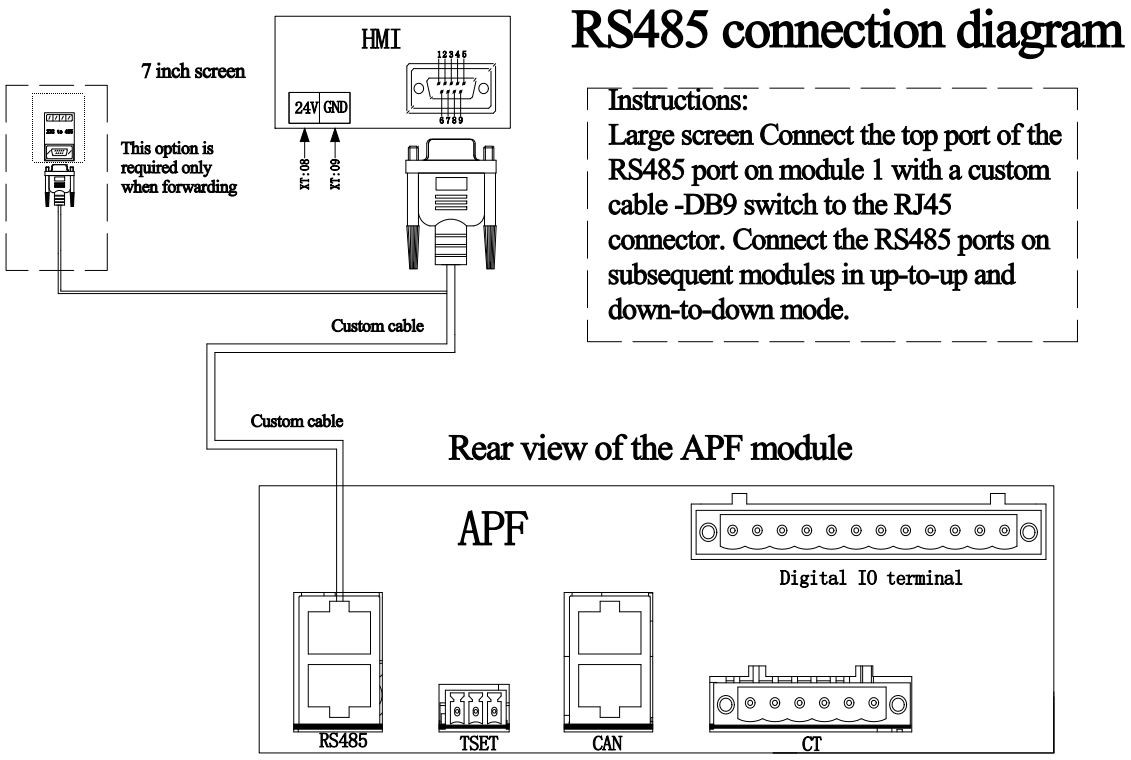


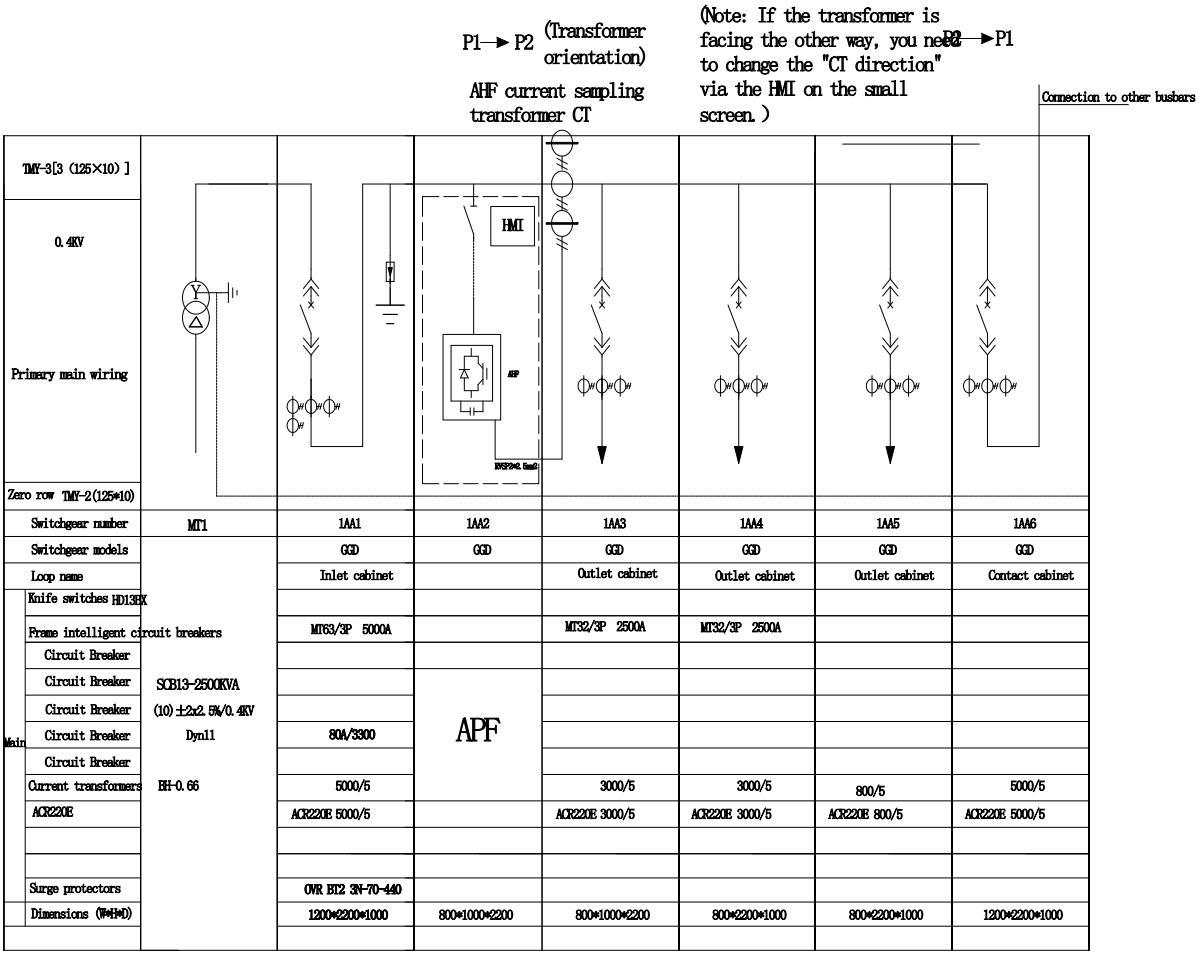

Figure 3-10 Power distribution diagram for a single machine

| | |
|---|---|
| Attention | ◆The circuit diagram shown here is simplified (three-phase and four-wire), please take the physical prevail;<br>◆**When the single machine is running, the CT wiring mode of sampling on the power side and the load side is the same;**<br>◆When the large screen is connected externally, DB9 special cable (our company can provide) should be used to connect the large screen to the module, and connected to the RS485 port;<br>◆Power can be obtained from the external connection, or from the DC24V "+", - terminals on the back of the APF module;<br>◆With background forwarding communication function is optional. Compared with the wiring without forwarding function, our company can provide more cables and adapters;<br>◆**See Appendix 2 for background forwarding description and interface definition.** |

## 3.4.7 Parallel power distribution

| | |
|---|---|
| Attention | ◆The power connection of parallel machine is the same as that of single machine;<br>◆When sampling on the power side, two sets of transformers with the same ratio can be installed for subtraction;<br>◆CT side cables are recommended to be connected in series;<br>◆Connections between parallel modules with different capacities (100A+50A) are consistent with connections between modules with the same capacity (100A+100A);<br>◆In parallel communication, the large screen can draw power from DC24V of one module.<br>◆The **wiring principle of cabinet combination is the same as that of parallel machine. Long specifications parallel cables can be used for wiring between cabinets, which are not explained here. For details, please consult our engineer**. |

(1) CT load side sampling




| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Switchgear number | MT1 | 1AA1 | 1AA2 | 1AA3 | 1AA4 | 1AA5 | 1AA6 |
| Switchgear models | | GGD | GGD | GGD | GGD | GGD | GGD |
| Loop name | | Inlet cabinet | | Outlet cabinet | Outlet cabinet | Outlet cabinet | Contact cabinet |
| Main: Knife switches HD13BX | | | | | | | |
| Frame intelligent circuit breakers | | MT63/3P 5000A | | MT32/3P 2500A | MT32/3P 2500A | | |
| Circuit Breaker | | | | | | | |
| Circuit Breaker | SCB13-2500KVA | | | | | | |
| Circuit Breaker | (10)±2x2.5%/0.4KV | | | | | | |
| Circuit Breaker | Dyn11 | 80A/3300 | APF | | | | |
| Circuit Breaker | | | | | | | |
| Current transformers | BH-0.66 | 5000/5 | | 3000/5 | 3000/5 | 800/5 | 5000/5 |
| ACR220E | | ACR220E 5000/5 | | ACR220E 3000/5 | ACR220E 3000/5 | ACR220E 800/5 | ACR220E 5000/5 |
| | | | | | | | |
| | | | | | | | |
| Surge protectors | | OVR BT2 3N-70-440 | | | | | |
| Dimensions (W*H*D) | | 1200*2200*1000 | 800*1000*2200 | 800*1000*2200 | 800*2200*1000 | 800*2200*1000 | 1200*2200*1000 |

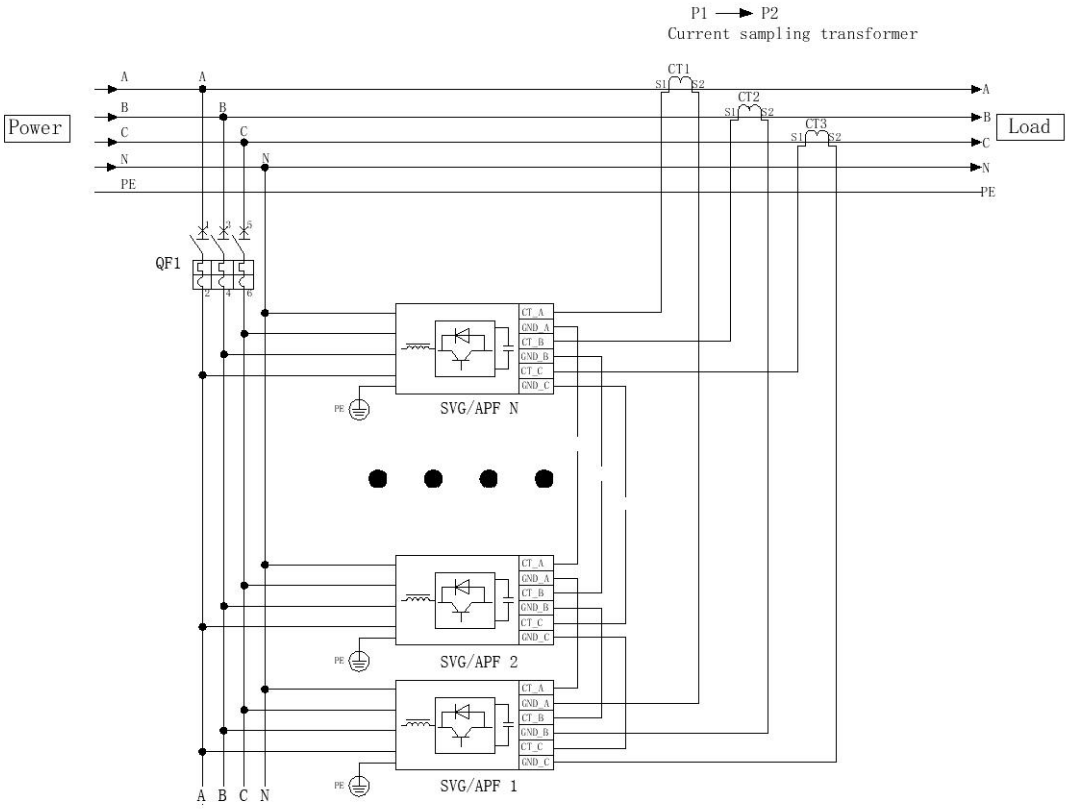
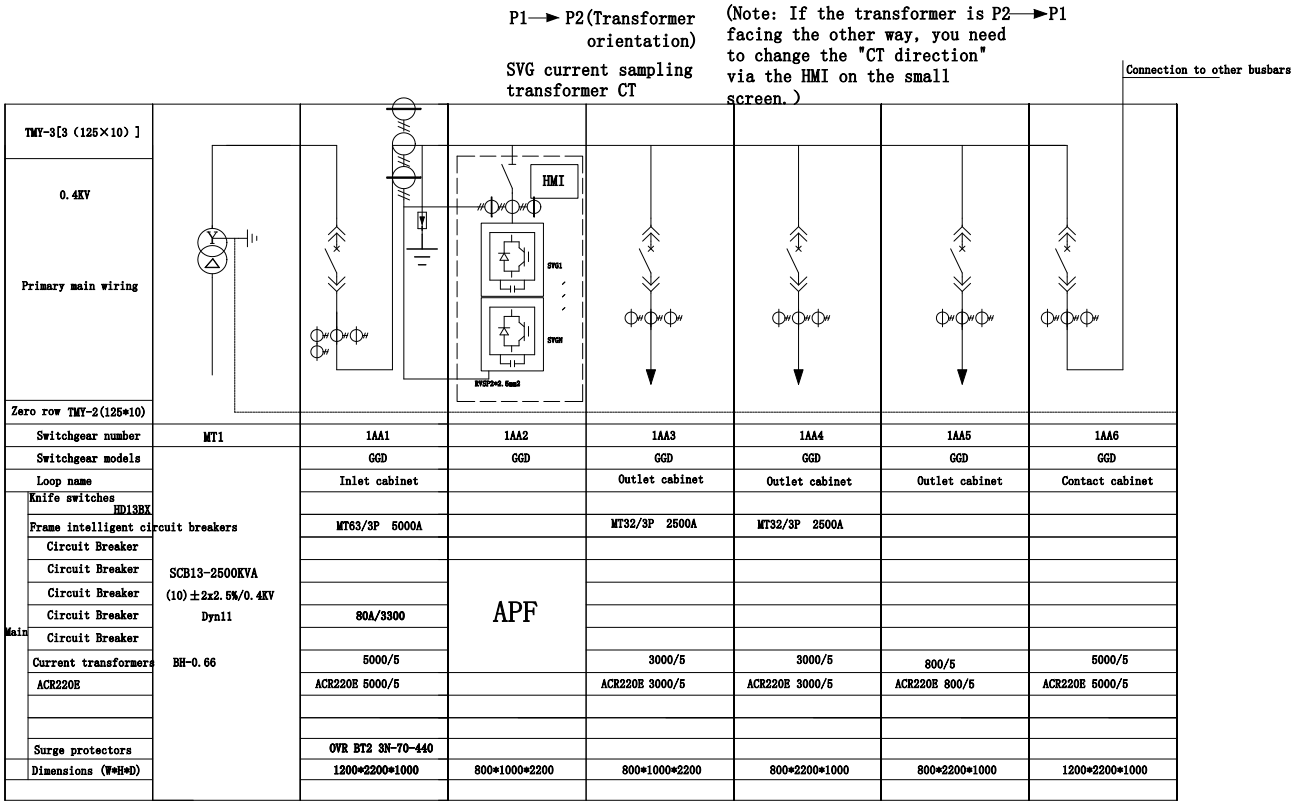



Figure 3-11 Parallel power distribution -CT load side sampling wiring diagram

## （2）CT power side sampling




| | | | | | | | |
|---|---|---|---|---|---|---|---|
| TMY-3[3（125×10）] | | | | | | | |
| 0.4KV | | | | | | | |
| Primary main wiring | | | | | | | |
| Zero row TMY-2(125*10) | | | | | | | |
| Switchgear number | MT1 | 1AA1 | 1AA2 | 1AA3 | 1AA4 | 1AA5 | 1AA6 |
| Switchgear models | | GGD | GGD | GGD | GGD | GGD | GGD |
| Loop name | | Inlet cabinet | | Outlet cabinet | Outlet cabinet | Outlet cabinet | Contact cabinet |
| Knife switches HD13BX | | | | | | | |
| Frame intelligent circuit breakers | | MT63/3P 5000A | | MT32/3P 2500A | MT32/3P 2500A | | |
| Circuit Breaker | | | | | | | |
| Circuit Breaker | SCB13-2500KVA | | | | | | |
| Circuit Breaker | (10)±2x2.5%/0.4KV | | | | | | |
| Circuit Breaker | Dyn11 | 80A/3300 | APF | | | | |
| Main Circuit Breaker | | | | | | | |
| Current transformers | BH-0.66 | 5000/5 | | 3000/5 | 3000/5 | 800/5 | 5000/5 |
| ACR220E | | ACR220E 5000/5 | | ACR220E 3000/5 | ACR220E 3000/5 | ACR220E 800/5 | ACR220E 5000/5 |
| | | | | | | | |
| | | | | | | | |
| Surge protectors | | OVR BT2 3N-70-440 | | | | | |
| Dimensions (W*H*D) | | 1200*2200*1000 | 800*1000*2200 | 800*1000*2200 | 800*2200*1000 | 800*2200*1000 | 1200*2200*1000 |

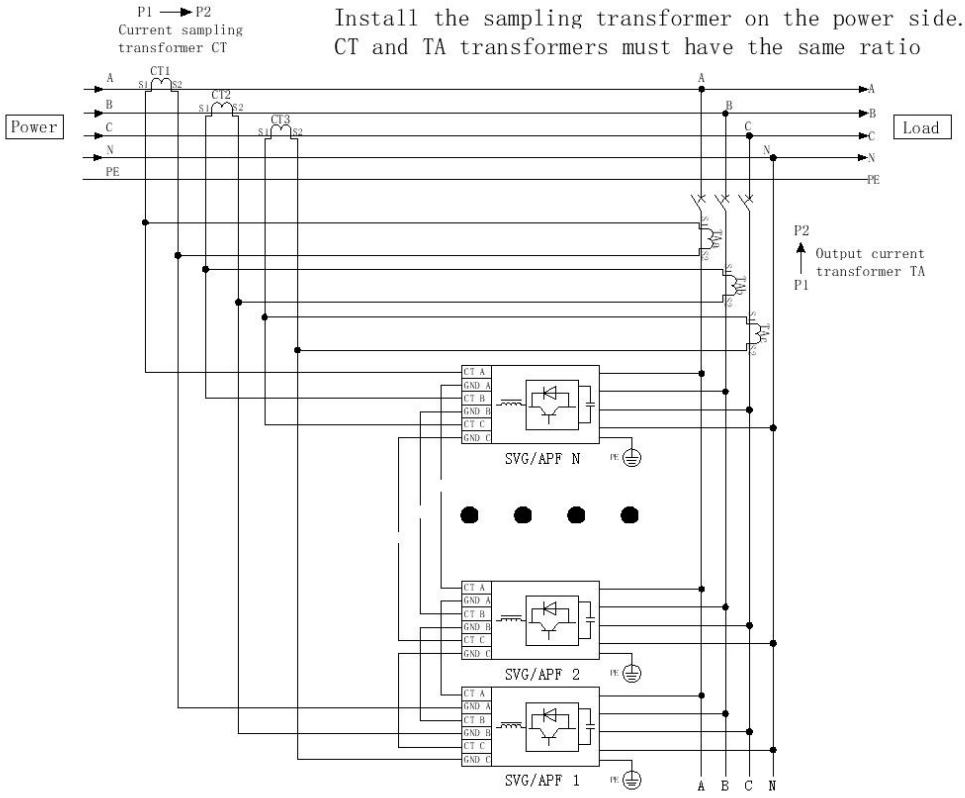



Figure 3-12 Parallel power distribution -CT power side sampling wiring diagram

（3）Communication cables

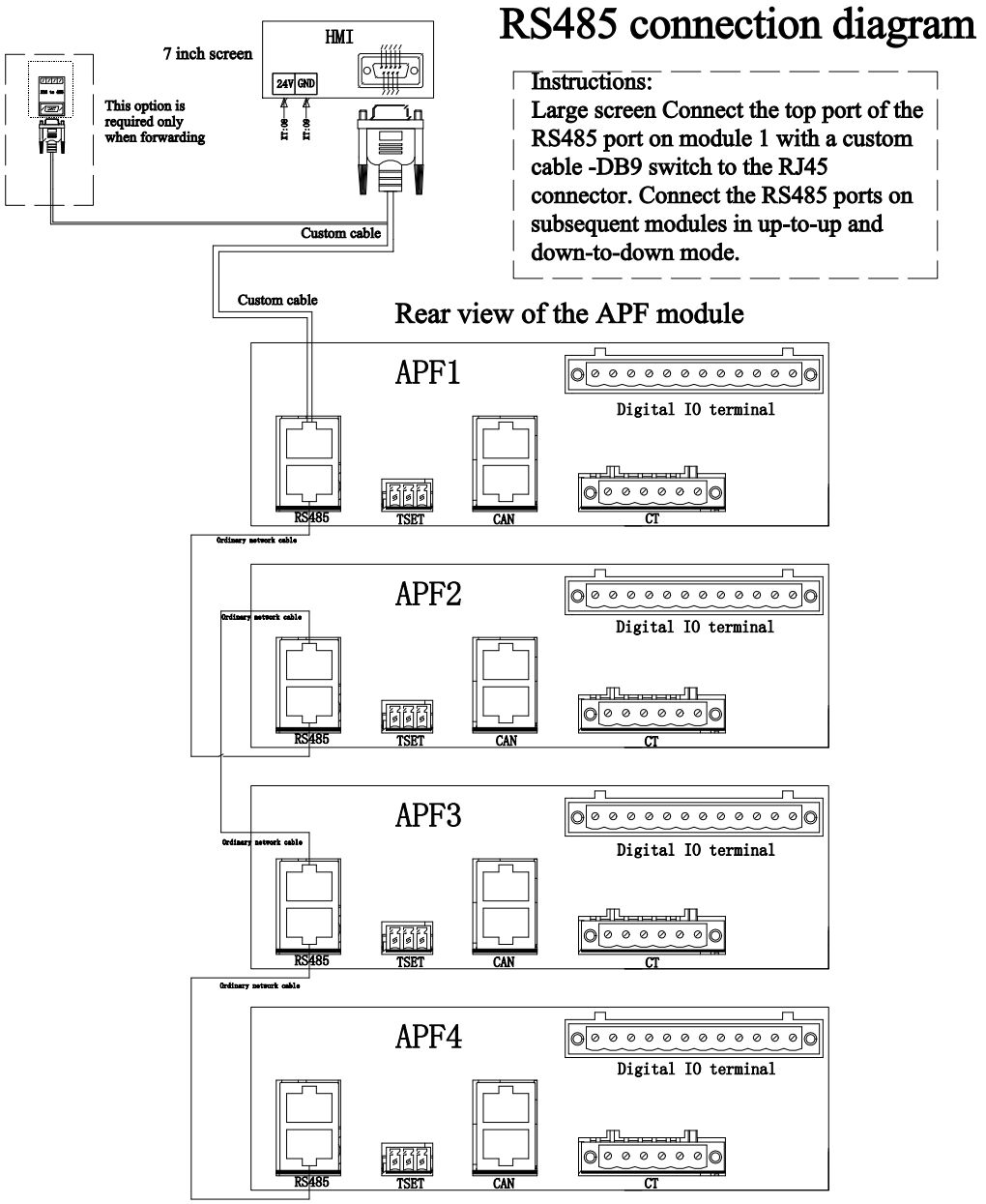



Figure 3-13 Parallel communications wiring diagram

| | |
|---|---|
| Attention | ◆In parallel connection, the outside of the cabinet is generally equipped with a centralized monitoring screen. The large screen and the module need to be connected with DB9 special cable (our company can provide), and connected to the monitoring port of the first module;<br>◆Modules are connected with ordinary network cables, and the principle of "bottom to bottom, top to top" must be followed. |

# 3.5 APF+ Capacitor

## 3.5.1 APF+ Ordinary Capacitor

According to customer demand can provide various relay version, the following 32-way relay (external) and 16-way relay (built-in) as an example:

### 3.5.1.1 External Relay

The APF module can control the thyristor switching switch (TSC) or contactor through the relay output terminal to realize the switching of the capacitor. When using the thyristor switch scheme, you can refer to the following electrical schematic diagram and terminal wiring diagram (8 total complement +8 supplementary a total of 32 external relays).

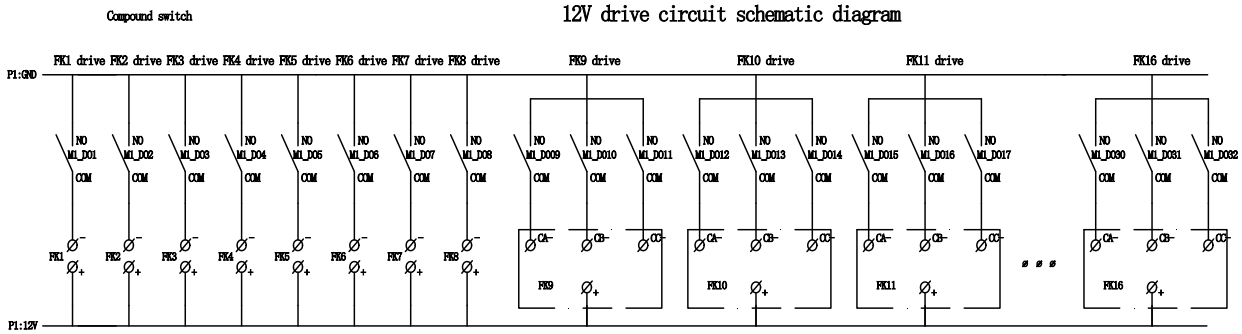



Figure 3-14 Schematic diagram of 12V drive power

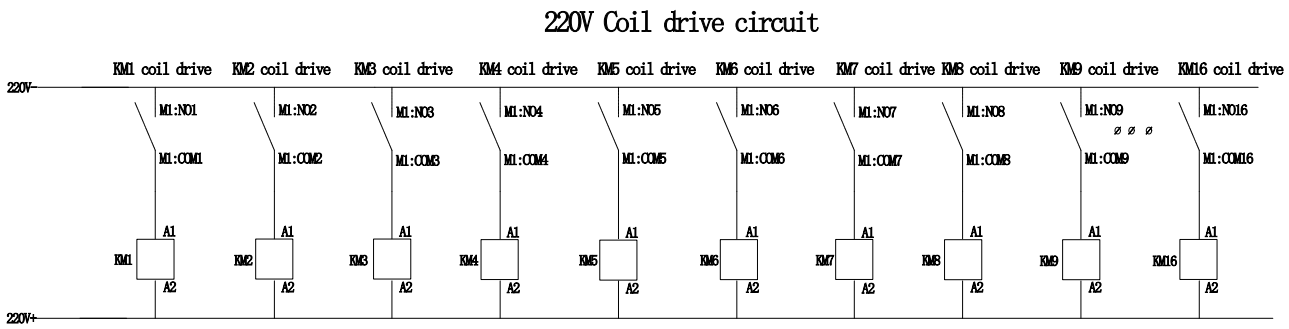



Figure 3-15 Schematic diagram of the 220V drive power

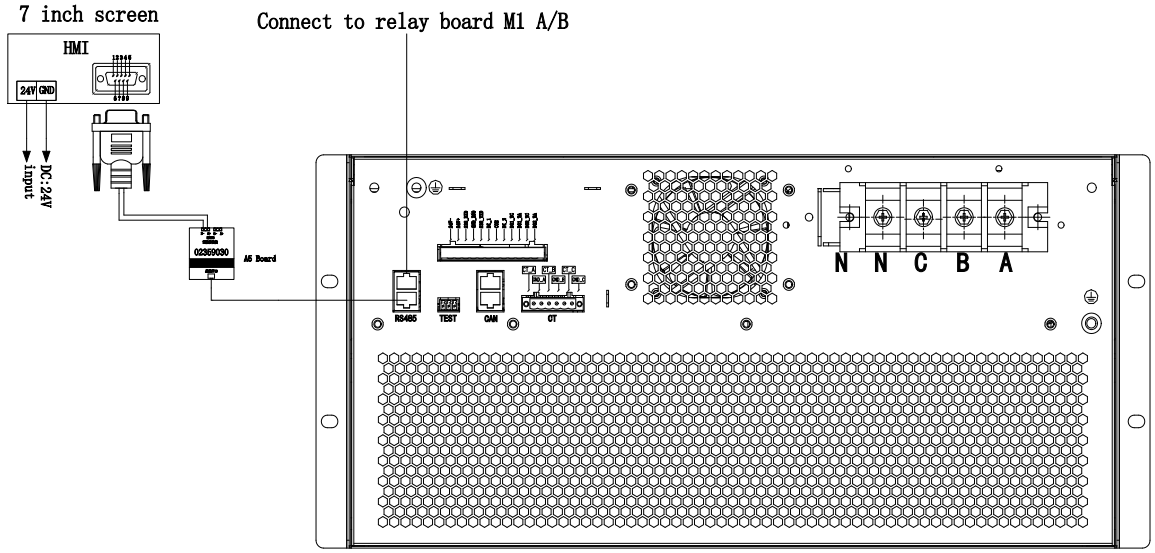



Figure 3-16 and relay board communication diagram

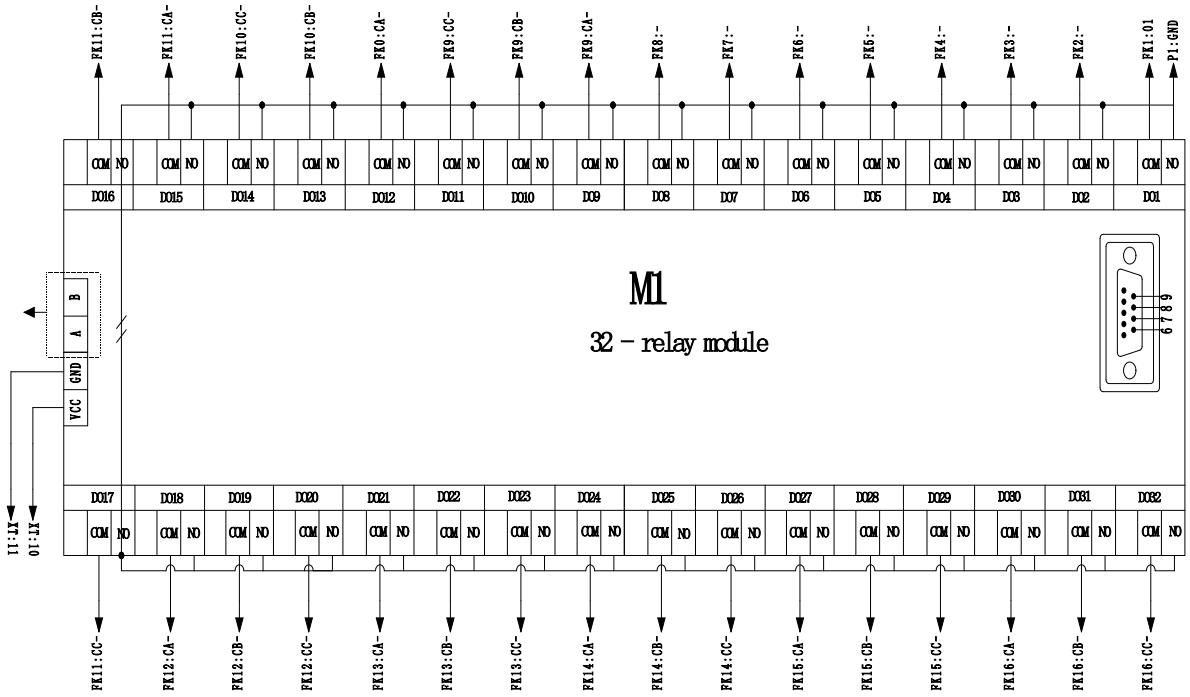



Figure 3-17 Wiring diagram of 32 relay board terminals

## 3.2.1.2 Built-in Relay

The APF module can control the thyristor switching switch (TSC) or contactor through the relay output terminal to realize the switching of the capacitor. When using the thyristor switch scheme, refer to the following electrical schematic diagram and terminal wiring diagram (16 total 16 internal relays).

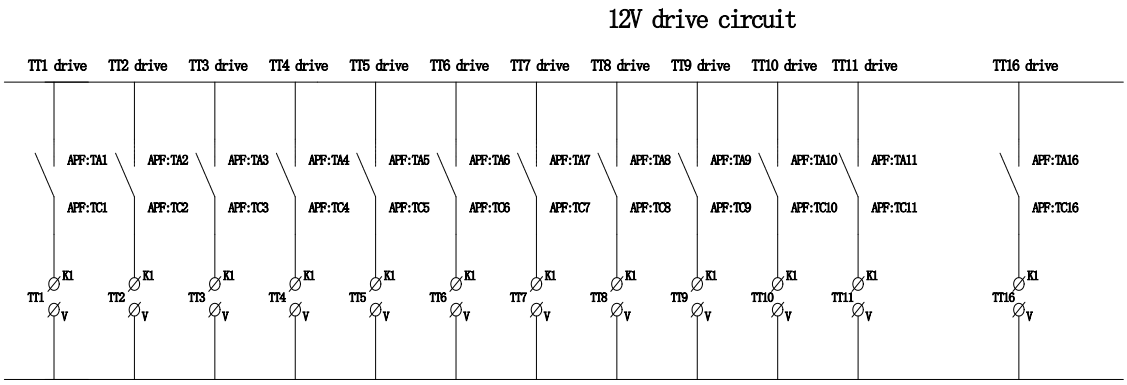



Figure 3-18 Schematic diagram of 12V drive power

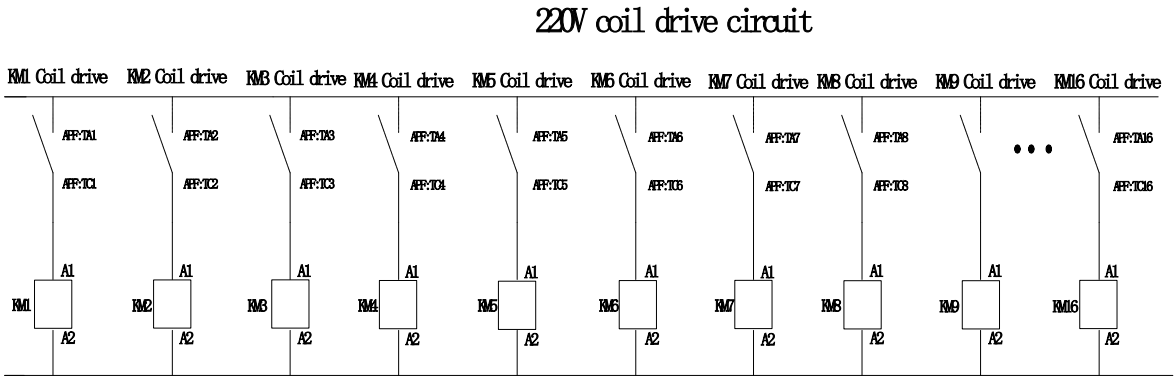



Figure 3-19 Schematic diagram of the 220V drive power

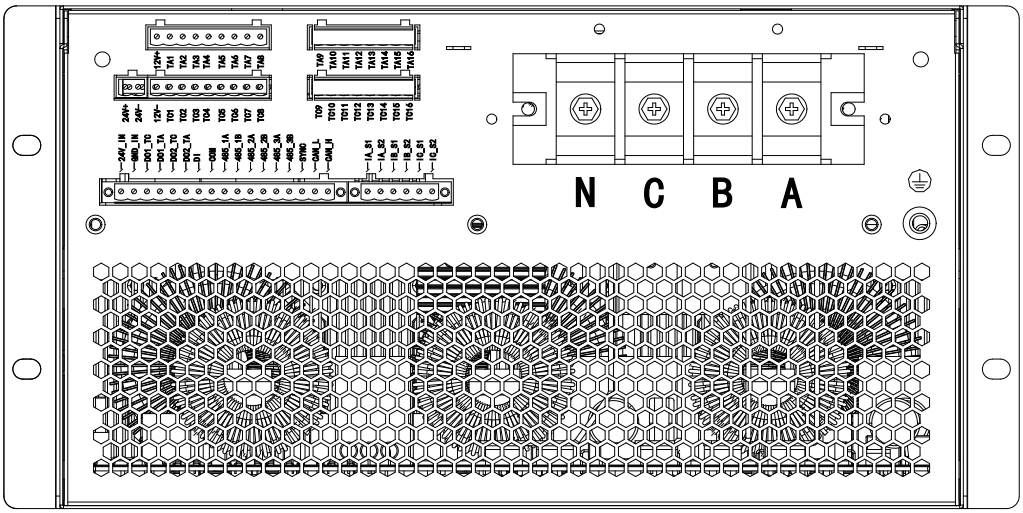



Figure 3-20 Rear terminal of the built-in 16-way relay

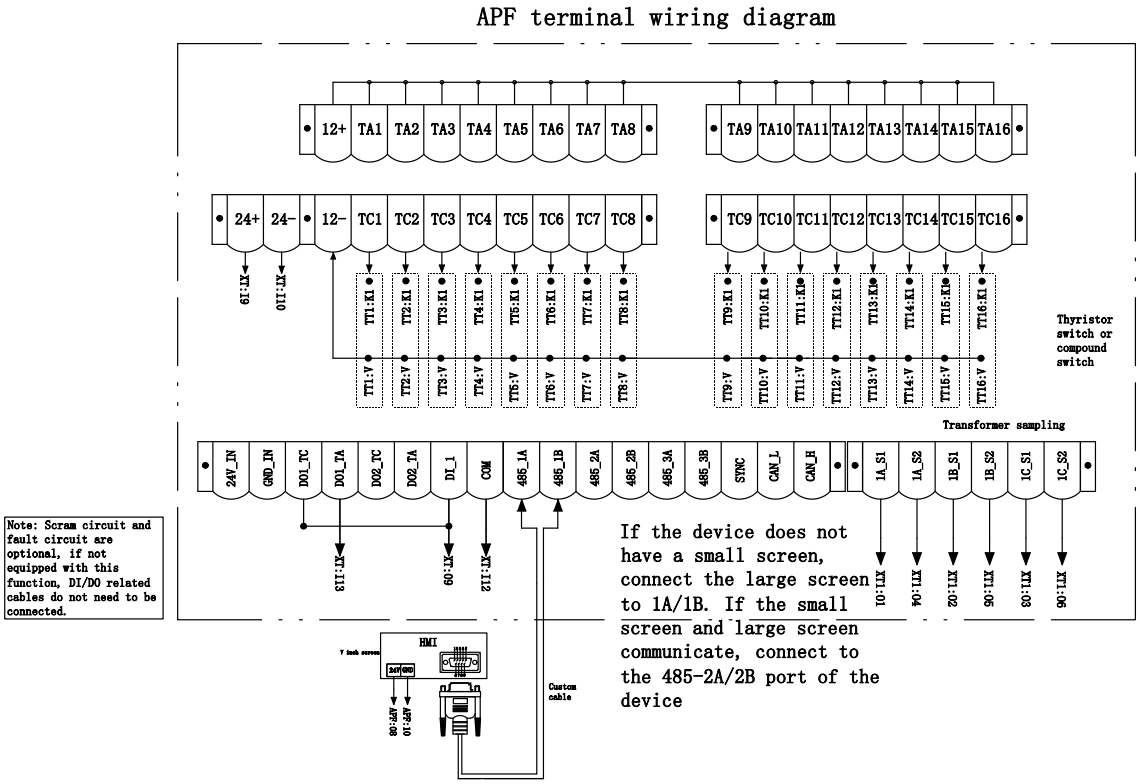
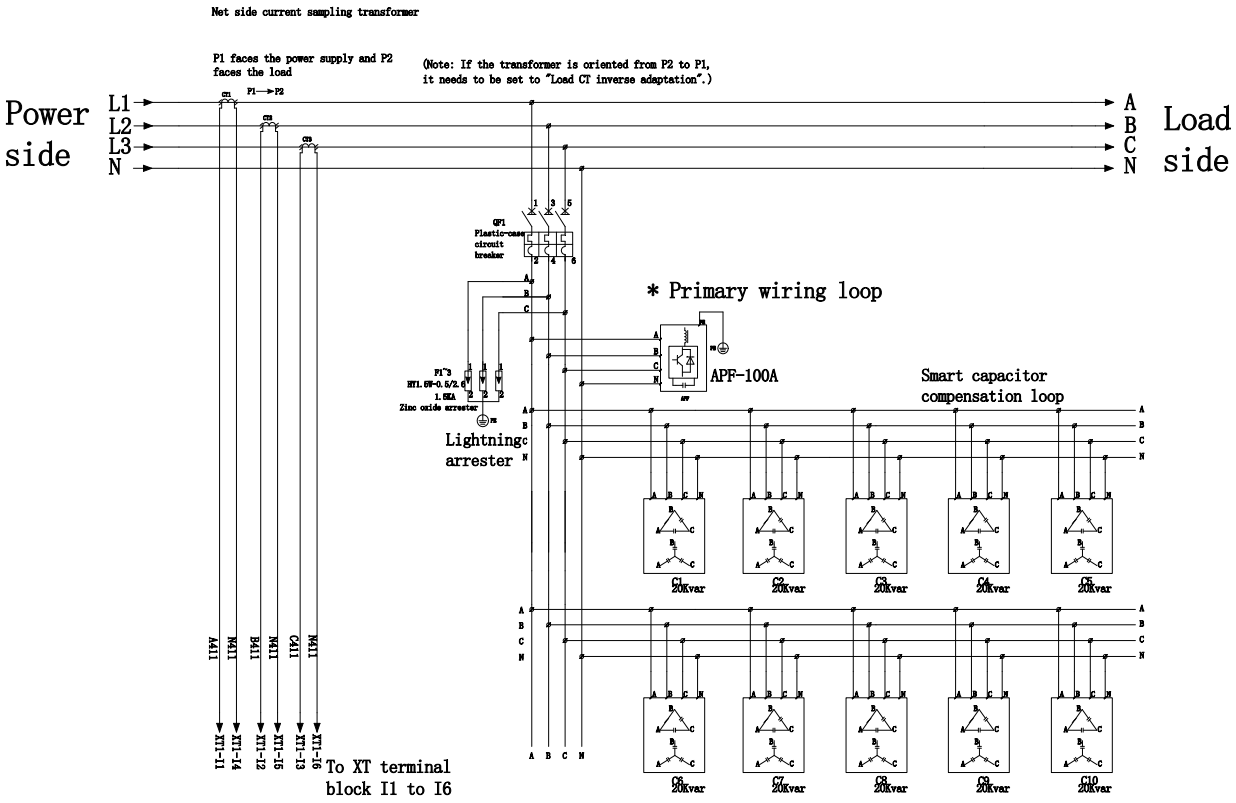



Figure 3-21 Wiring diagram of the 16-way relay board terminal

## 3.5.2 APF+ Smart Capacitor

When APF and smart capacitor are used together, the connection mode of A, B and C three-phase power cable, N wire, PE wire and external CT wire is shown as follows:



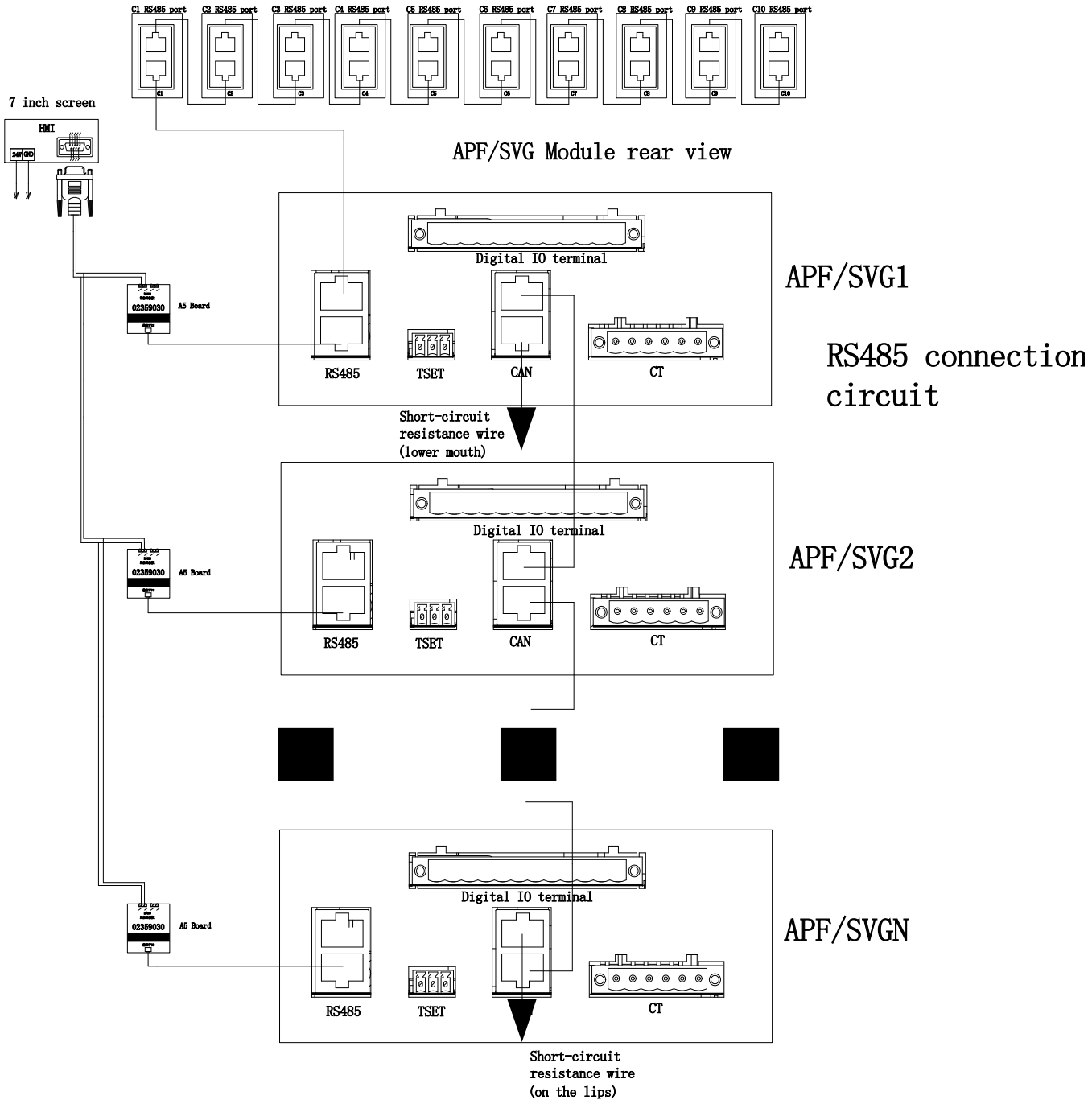



Figure 3-22 Secondary wiring diagram and communication link between APF parallel and capacitor RS485

# Chapter 4 Stand-alone Trial Run

## 4.1 Recheck

Please double check the following items before powering on for the first time:

(1) Whether the APF equipment is securely installed on the installation column of the cabinet (wall);

(2) Whether A/B/C/N connection is correct, whether there is leakage or mixed connection phenomenon;

(3) A/B/C/N/PE connection is firm, no displacement or loosening occurs with hand shaking, PE connection should be firmly grounded;

(4) need to maintain the distance between phases, phase spacing is not less than 15mm;

(5) Use A multimeter to detect whether there is short circuit between A, B, C and N pairs of equipment;

(6) Check whether the CT wiring is correct and whether the wiring at both ends of the terminal block is one-to-one corresponding;

(7) Check the installation position and installation of the current transformer;

(8) Whether the isolation switch is correctly installed and disconnected;

(9) The APF installation environment complies with the contents described in Section 3.2;

(10) Check whether the APF phase sequence is consistent with the grid phase sequence, and the input voltage should be positive phase sequence (A→B→C→N).

## 4.2 Power on the APF

After the above check is correct, close the isolation switch between the POWER supply/grid and APF, the 4.3-inch LCD LCD screen (optional) of the module or the external 7-inch large screen will light up and enter the home page, and the power /POWER indicator of the module will light up and keep on. At this time, the module is in the "standby" state. Click "Login" to enter the data page directly, and you can view the power grid voltage parameter data.




Figure 4-1 Home page

Click the upper left corner to see the menu interface, and first enter the control interface, which can be used to switch on and off the machine. However, before the operation, it is necessary to confirm whether each setting of the device is reasonable, please refer to Chapter 6.

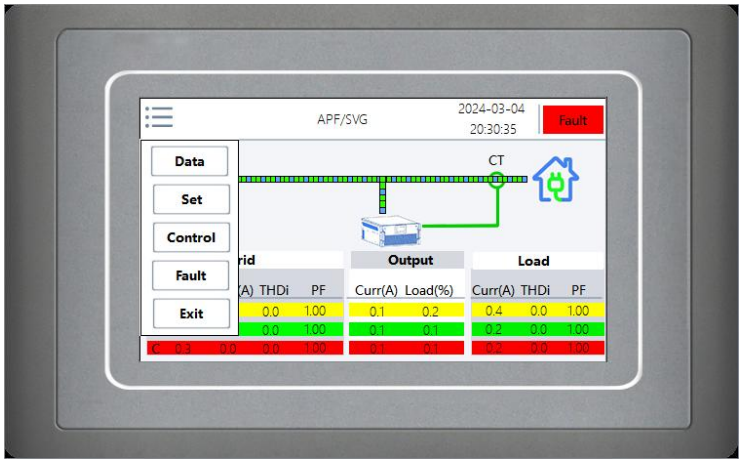



Figure 4-2 Menu screen




Figure 4-3 Switch on/off operation screen

* **Please refer to Section 6 for more** detailed display and operation of 4.3-inch LCD LCD.

## 4.3 Power off the APF

The shutdown of an APF generally has two steps: shutdown and power off.

(1) Shut down

That is, enter the "On/Off" page through the module's 4.3-inch LCD LCD screen (optional) or the external 7-inch large screen, click "Off", and the module will enter the standby state, with the RUN /RUN indicator off but the POWER /POWER indicator on. This method only makes the module enter the standby state of low power consumption, and the system bus, auxiliary power and main loop terminals are still live.

(2) Power off

After the device is shut down and entered standby state, disconnect the isolation switch between the APF device and the power/grid, so that the operation can stop the APF device and completely power off. When the module needs to be wired or maintained, it should be turned off in a power off state.

*** Please do not directly power off the equipment in operation, this behavior will cause some damage to the equipment!**

## 4.4 Manual/Automatic Operation

All APF devices start in manual mode by default. In manual mode, after the module is powered on,

you need to manually log in to the user interface and click Boot operation. In automatic mode, after the module is powered on, you can start up and run automatically. Users can switch to the automatic mode when the APF device is in standby state according to actual requirements. For details, please refer to Section 6.6.

# Chapter 5 Parallel trial operation

Parallel module installation is usually equipped with a cabinet with a 7-inch large screen. For details about large-screen display operation, please refer to the user manual of 7-inch large screen. No details are given here.

## 5.1 Reheck

Before powering on the module for the first time, please check the module one by one, including the installation environment, installation position, wiring, etc. Refer to Section 4.1. In addition, check whether the communication cables between the 7-inch large screen and the first module are correct, whether the positive and negative terminals of the power cables of the large screen are mixed, and whether the cables between the two modules comply with the principle of "top to top, bottom to bottom".

## 5.2 Power on the APF

After the above check is correct, turn on the isolation switch between the mains and the APF, turn on the 7-inch large screen of the cabinet and the 4.3-inch LCD (optional) of the module, and the POWER /POWER indicator of the module is on and steady on. Check whether the power /POWER indicator of each parallel module is on, and the module is in standby state.

Log in for 7-inch large-screen advanced users and enter the home page to check whether data parameters such as power grid side, output side and load side of each parallel module are normal.




Figure 5-1 Front page of the large screen

Enter the setting page again to check whether the parameters of CT ratio, CT position, CT direction, operation mode, parallel capacity and other Settings are correct. At this time, switch the parallel module through the large screen, and observe whether the data of each module is normal and consistent with the set parameters. If not, please check the connection and modify the parameters through the large-screen operation Settings (please operate under the guidance of engineers).

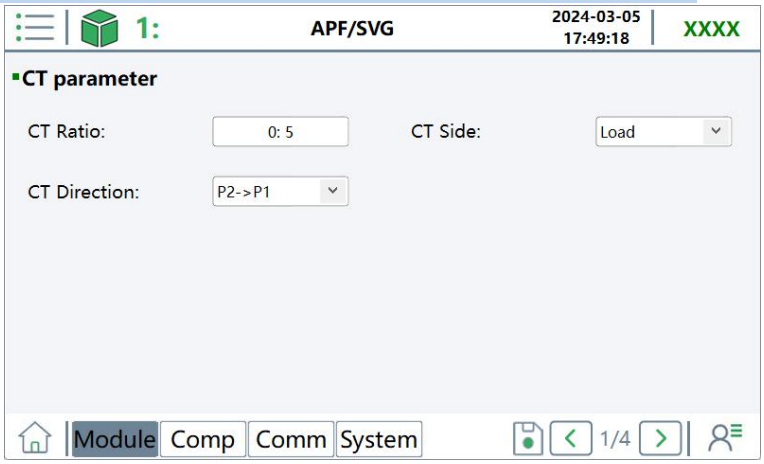



Figure 5-2 Large screen Settings screen

After making sure that the parameters are correct, enter the "Control" page, click "Power on" (power on time is 30s), and the module starts to run. The RUN /RUN indicator light of each parallel machine module is on and on together with the POWER /POWER indicator light. At this time, you can check whether the run /RUN indicator light of each module is on. If you find any module with the indicator light is not on, you can check whether the communication cable of the parallel machine is correctly connected.

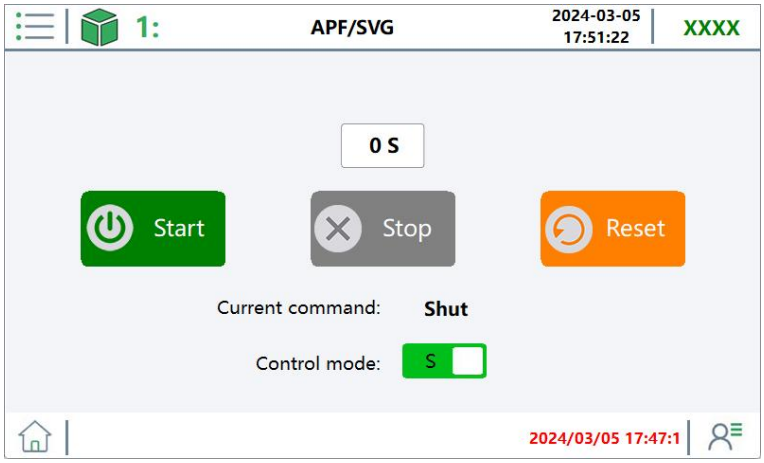



Figure 5-3 Large screen control screen

After the startup is successful, click "Data" to check whether the "basic", "power" and "harmonics" are normal.

## 5.3 Power off the APF

There are two steps to shut down the parallel APF module: shutdown and power off.

(1) Shut down

That is, through the 7-inch screen outside the module connected to the cabinet, enter the "On/Off" page, click "Off", all parallel modules enter the standby state, the RUN /RUN indicator is off, but the POWER /POWER indicator is still on. This method only makes the module enter the standby state of low power consumption, and the system bus, auxiliary power and main loop terminals are still live.

(2) Power off

After the device is shut down and entered standby state, disconnect the isolation switch between each APF device and the power/grid. Only in this way can the APF device stop running and completely power off. When the module needs to be connected or maintained, it should be left in the power off state.

*** Please do not directly power off the equipment in operation, this behavior will cause some**

**damage to the equipment!**

## 5.4 Manual/Automatic operation

All APF devices start in manual mode by default. In manual mode, you need to manually log in to the user interface and click Power on after the module is powered on. In automatic mode, you can start up and run automatically after the module is powered on. Users can switch to the automatic mode when the APF device is in standby state according to actual requirements. For specific operation, please refer to the user manual with a 7-inch large screen. No additional explanation is provided here.

# Chapter 6 Menu with 4.3-inch Screen

The front panel of the module will have a 4.3-inch LCD LCD screen (optional), which provides a user-friendly user interface.

(1) Users can view the status and information of power grid, load and APF module through the 4.3-inch screen;

(2) The user can carry out all the operation commands in the menu of the module through the menu button provided on the page;

(3) It is conducive to monitor, check and eliminate the faults occurring in the APF module;

(4) Can display the APF system version and monitoring software system version;

(5) Click the "login" button to enter the user interface, no need to enter the password, convenient and fast;

(6) The screen display page can be customized according to the needs of the display, logo, special model, name and change background and so on.

## 6.1 LCD Home page

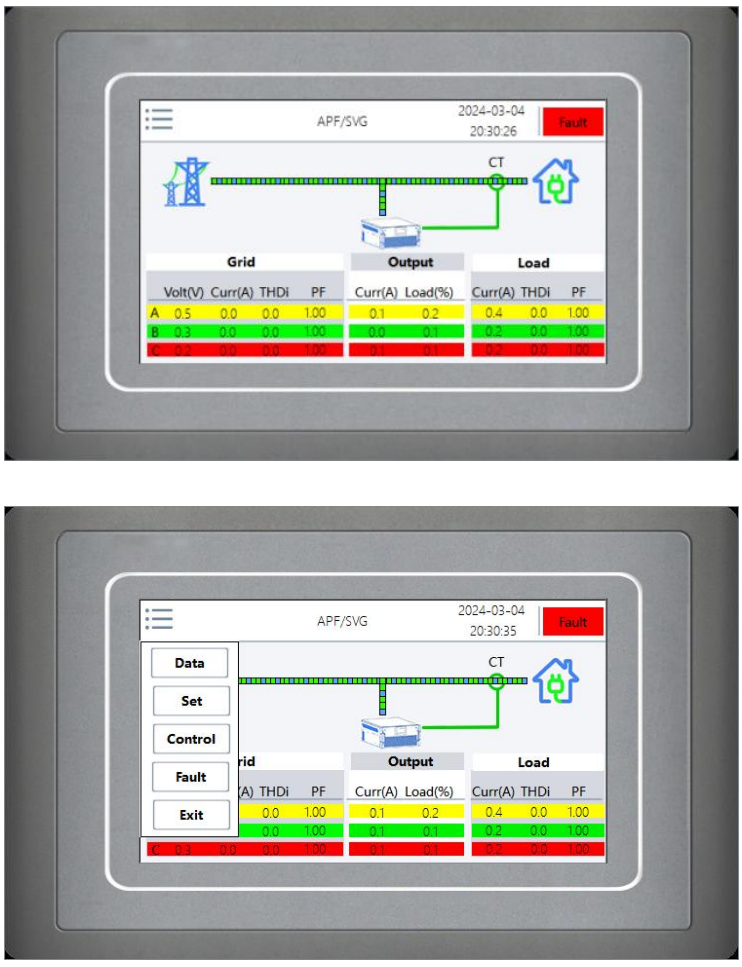



Figure 6-1 Home page

◆ The screen automatically lights up after the screen is powered on, and automatically enters the home page after the boot page is over, no secondary operation is required;

◆ The data of power grid, load and APF current can be viewed on the home page;

◆ Click the upper left corner of the screen to open the menu bar, from which you can enter each interface of the device.

# 6.2 Data page

## 6.2.1 Overview




Figure 6-2 Basic data

Click the menu bar in the upper left corner, click [Data] to enter the data interface.

The basic data page contains three pages:

◆ On the first page, you can view the data of the power grid: power grid voltage value, voltage distortion rate THDu, power grid current, current distortion rate THDi, active power, reactive power, apparent power, power factor.

◆ On the second page, you can view the data on the load side:

Load current, current distortion THDi, active power, reactive power, apparent power, power factor.

◆ You can view the output data on the third page::

Output current, load rate, active power, reactive power, apparent power, power factor.

## 6.2.2 Bar chart

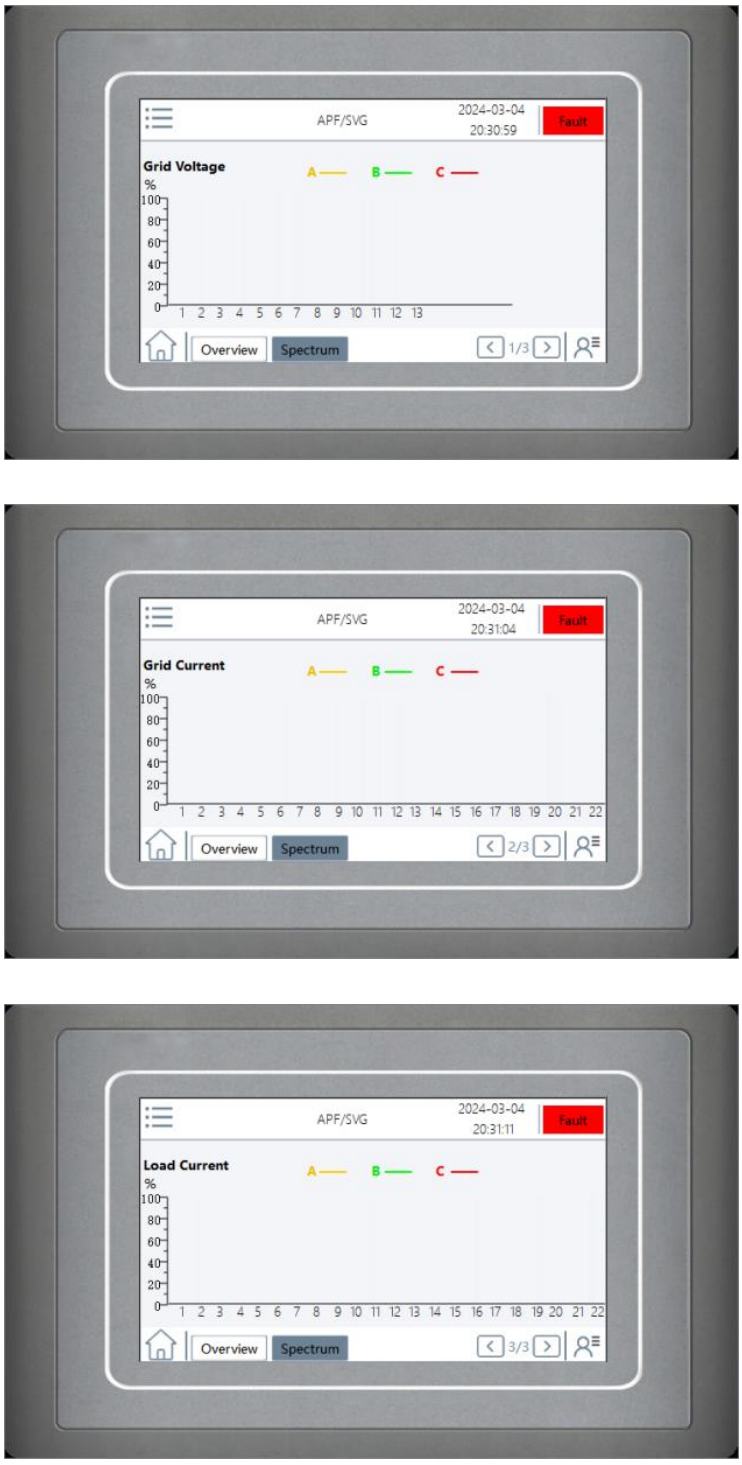



Figure 6-3 Bar chart

The bar chart page contains three pages:

◆ The first page is the grid voltage histogram;

◆ The second page is the grid current histogram;

◆ The third page is the load current bar chart.

The horizontal coordinate represents the degree

The ordinate represents the percentage of harmonic components

# 6.3 Setup page

Click the menu bar in the upper left corner and click [Set] to enter the setting interface.

## 6.3.1Module setup










The first page is the setting of CT parameters

- CT Ratio：Set the external CT variable ratio
- CT Side：Set to "load side" or "Power side" according to the site CT installation position
- CT Direction： It is divided into positive connection/reverse connection, that is, P1→P2 or P2→P1

The second page sets the running parameters

- Run Mode： Available as "Manual"/" Automatic"
- Comp Mode： Different modes can be selected according to the requirements
- Compensation capacity：Rated capacity of equipment
- H+R(%)： Proportion of harmonic and reactive power compensation
- Parallel number：Total number of modules that CAN communicate in parallel
- Master/Slave： If multiple devices are connected in parallel, configure one host and multiple slave servers

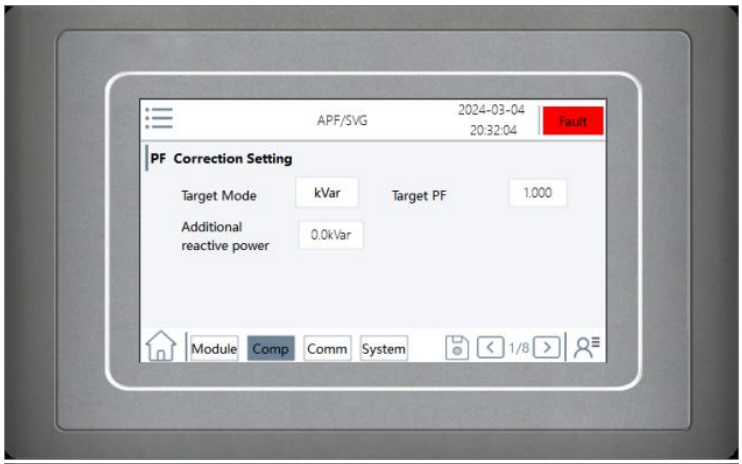
The third page is the setting of grid parameters

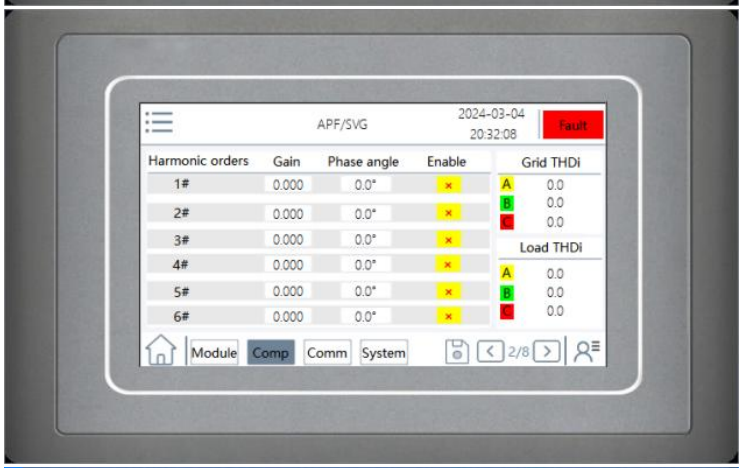
- Phase Type： Set to "3P3W" or "3P4W" according to the system situation
- Rated Voltage： Set the system output voltage
- Allow Order： The default setting is "positive". When the grid is in negative sequence, it needs to be set to "sequence".
- Phase Order：Set the corresponding phase sequence according to the power grid
- Grid Over Volt： When the power grid voltage exceeds this value, the system enters the protection state
- Grid Low Volt： When the power grid voltage is lower than this value, the system enters the protection state
- Zero Over Current： Default zero line crossing point. Generally, select the default value
- Grid Over Current： Default module overflow point. Generally, select the default value
- Over Temp： The over temperature protection point of the module is the default value
- Har Over Current：Resonant overflow point, generally select the default value can be
- Freq Level： Set according to the grid frequency
- Grid Over Freq：If the frequency of the grid exceeds this value, it will alarm
- Grid Low Freq：Grid frequency below this value will alarm




Figure 6-4 Module setup page

## 6.3.2Reactive power compensation Settings







Click [Comp] below to enter the compensation setting interface

- Target Mode： Power factor and kVar can be selected
- Target PF： Power factor, default is 1
- Additional reactive power： Positive value is inductive reactive power, negative value is capacitive reactive power, and the Target Mode needs to be set to "kVar" (if it is necessary to send capacitive reactive power 10kVar to the grid, set it to "-10kVar")

Click [next page] to enter the compensation data interface, select the corresponding harmonic compensation times, where set the gain and phase Angle, × is not enabled, click √ to enable. The right column monitors the network THDi and load THDi in real time.

Figure 6-5 Compensation setting

## 6.3.3Communication parameter setting




Figure 6-6 Communication parameter

Click [Comm], you can enter the communication parameter Settings

- Modbus ID： Modbus communication address. The host is 1
- Remote ID： IP address for remote control. The default value is 1
- Com3 Baud：Interface baud rate
- Com1 Baud：Interface baud rate
- Capacitor control enable：This function is disabled by default. You need to enable this function when the device controls the capacitor
- TPW enable： If the screen is a TPW screen, TPW can be enabled, but other screens cannot be enabled

## 6.3.4System setting




Figure 6-7 System setting

Click [System], you can enter the system Settings

- HMI Date and Time Setting： Set the screen display time
- Screen saver time： If you do not touch the screen during this time period, the screen will turn off
- Language：Select the desired language
- Touch screen mute： When closed, clicking will make a sound
- Mouse cursor： When opened, you will see the on-screen cursor point
- Screen calibration： When the cursor point is offset, click Start to calibrate the screen

## 6.3.5Parameter saving

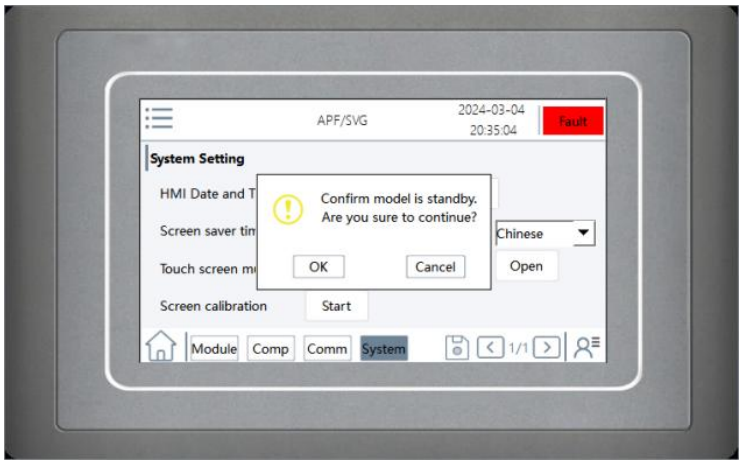



Figure 6-8 Parameter saving

When the parameters are set and need to be saved, click the lower right corner

# 6.4 Fault query

Click the menu bar in the upper left corner and click [Fault] to enter the fault interface.










First page

- EPO：Check whether the emergency stop switch button is pressed, reset the button switch, and then click the reset switch on the screen to remove the fault
- IGBT Over Current： Please check whether the current value set on the screen is reasonable. You can use the tool to measure whether there is deviation between the real current value and the set value
- DC Bus Over Volt：Click the data interface on the screen to check the voltage of the device data bus. The standby bus voltage of the normal module is about 650
- Supply Power Fault： Please contact after-sales personnel to solve this problem!
- Module Over Current： Check whether the CT installation direction is consistent with the configuration, and whether the secondary CT cable is reversed
- Fan fault： Check whether the fan is running normally. If the fan is not running, replace it. If the fan is running normally, click reset and start again
- Cable Connect Fault： Please contact after-sales personnel to solve this problem!
- Fuse fault：Please contact after-sales personnel to solve this problem!
- Over Temp ： Check whether the ambient temperature is too high, and whether the air intake and air outlet of the system are smooth. If everything is normal, reset and start the system again
- Phase A Over Volt： Use a multimeter to check whether the input voltage is normal and the device over voltage point is properly set on the screen

Page two

- Phase A Under Volt：Use the voltmeter to confirm whether the input voltage is normal and whether the under voltage point of the device on the screen is set reasonably
- Grid Over Freq：Check whether the value of the power grid over frequency set on the screen is greater than the real input voltage frequency
- Grid Under Freq：Check whether the value of the power grid over frequency set on the screen is less than the real input voltage frequency
- Phase C Over Current：Check whether the device over current point on the screen is set too low and whether the device over current is normal
- Grid Order：Check whether the phase sequence of the power grid is consistent with that set on the screen
- 1-DC Bus Over Volt： Click reset to shut down, disconnect the circuit and adjust the bus to take power
- 1-DC Bus Under Volt： Click reset to shut down, disconnect the circuit and adjust the bus to take power
- 2-DC Bus Under Volt： Click reset to shut down, disconnect the circuit and adjust the bus to take power

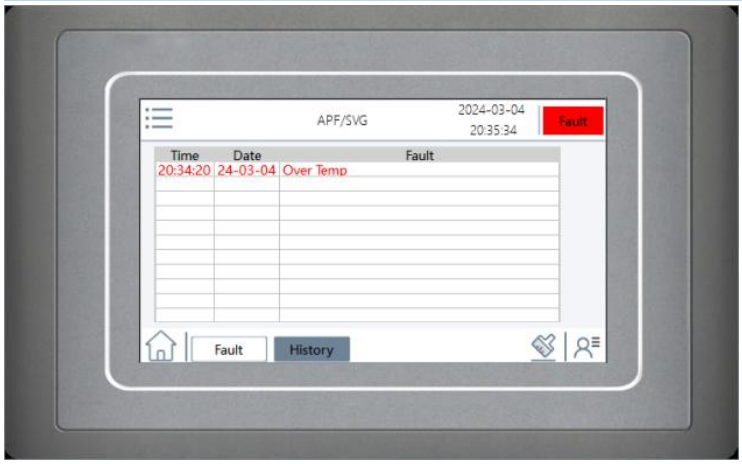



Figure 6-9 Fault indication

## 6.5 Switch on and off and reset




Figure 6-10 Switch on and off

Page three

- 3-DC Bus Over Volt： Click reset to shut down, disconnect the circuit and adjust the bus to take power
- 3-DC Bus Under Volt： Click reset to shut down, disconnect the circuit and adjust the bus to take power
- DC Bus Unbalance： Check whether the N cable is connected, whether the cable connection mode is correct, and whether the external cable connection is consistent with the cable connection mode set on the device on the screen
- Comm Fault：Check whether the connection between the module and the screen is normal, and whether the COM indicator is green. If the communication is normal, please upgrade the program
- EEPROM Fault： If it still exists after you click Reset to restart the machine, please contact after-sales personnel to solve it!
- DSP 2 Fault： If it still exists after you click Reset to restart the machine, please contact after-sales personnel to solve it!
- Sync Error： If it still exists after you click Reset to restart the machine, please contact after-sales personnel to solve it!
- System Resonance：If it still exists after you click Reset to restart the machine, please contact after-sales personnel to solve it!

Click the pop-up menu in the upper left corner to select, and then click [Control]

- Click the "Start" button, the number on the top of the screen from 0s→30s, the startup time is over, the APF device makes a soft "bang" sound, indicating that the device has been successfully started and the device has entered the running state;
- Click "Stop" button, APF device enters low power standby state;
- Click the "Reset" button to eliminate the fault.

## 6.6 Example of operation Settings

The user can perform all the operation commands in the menu for the module through the menu button provided on the page, and operate the Settings in this example section.

| | |
|---|---|
| Attention | ◆All setting operations must be carried out in the standby state, after setting the need to **cure parameters**, so that the setting results will take effect;<br>◆All the parameters have been set when leaving the factory. If the parameters need to be modified due to the actual situation on the site, please contact professional and technical personnel in time and operate under the guidance of professional and technical personnel. The company will not be responsible for any equipment failure or damage caused by modifying the parameters without authorization. |

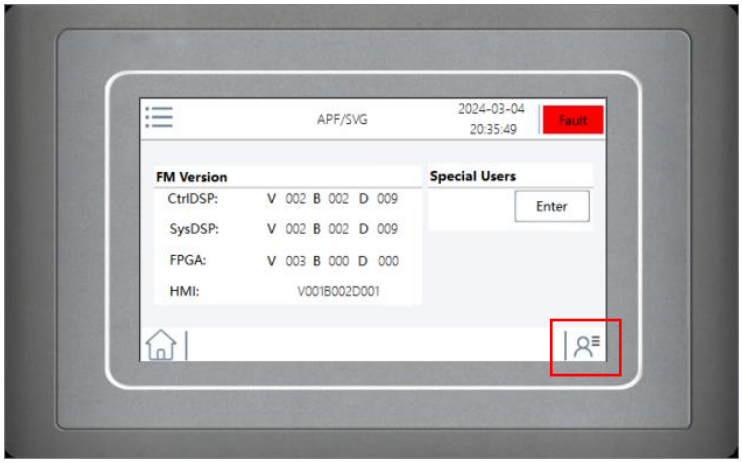



Figure 6-11 Special user entry

Click the lower right corner to enter the special user login entry, you can view the version number here, the user login password is "8888". Please only enter the function interface under the guidance of after-sales personnel, please do not operate without authorization!!!

### 6.6.1 Change model information




Figure 6-12 Model information

- Fault Clear：View the current device status
- Derating Coef： The ratio between the system after power reduction and the system before power reduction
- Hardware EPO Fault： You can determine whether to mask faults that occur in the system
- Sync ： Compensation Angle, Angle deviation can directly affect the control effect
- Comp Type：Compensation mode can be selected "Harmonic compensation" or "Each Time"
- Ctrl Method ： Harmonic extraction methods can be divided into "FFT" or "IRT"
- Capacitive reactive current：Fine tuning is allowed (+ for sensibility, - for tolerance), unit A
- Threshold： The amplitude analysis is not performed until this value is reached
- Compensation Threshold： The maximum compensation value cannot be set higher than this value

## 6.6.2 Change control parameter




Figure 6-13 Control parameter

- SW(Hz)：The system switching frequency is set according to the device capacity
- Grid Volt Coef： Intermediate calculation factor used to calibrate the actual input voltage and current with the value displayed by the background software
- Vvolt Kp： Set the proportional adjustment coefficient of the voltage ring to improve the voltage stability
- DC Bus Set(V)：Set the DC voltage value
- Icurr Kp： Set the proportional adjustment coefficient of the current loop to improve the current stability
- Host to remote：You can determine whether to enable background forwarding
- RptCtrl Kp：Set the proportional adjustment coefficient of the repetitive control method, apply the repetitive control method to the equipment through the PID control system, accelerate the system response speed, improve the adjustment accuracy and adjust the error quickly
- Para Com： Control whether the parallel modules of the system communicate with each other. The default value is "Disable".
- RptCtrl Ki：By setting the integral adjustment coefficient of the repetitive control method and applying the repetitive control method to the equipment through PID control system, the residual error of the system can be eliminated and the steady-state time can be adjusted

## 6.6.3 Change protection Settings

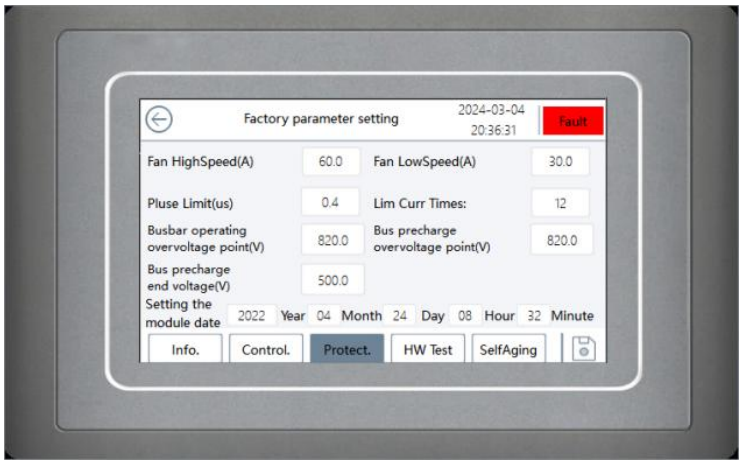



Figure 6-14 Protection setting

- Fan High Speed(A)：When the output current of the module is greater than the set point, the power fan runs at full speed
- Fan Low Speed(A)：When the module output current is higher than the set point, the power fan runs at a low speed
- Pluse Limit(us)：The minimum value of PWM signal emitted by the control board, less than this value will stop sending
- Lim Curr Times： The module protection function allows the maximum number of module over current times within a period of time. If the number of over current times exceeds, the device will stop running
- Busbar operating over voltage point(V)： Maximum allowable busbar operating voltage
- Bus precharge over voltage point(V)： Allow bus precharge voltage highest point
- Bus precharge end voltage (V)： When the bus precharge reaches the voltage, it can enter the rectification state
- Setting the module date： The time is the internal time of the module

## 6.6.4 Change hardware parameters

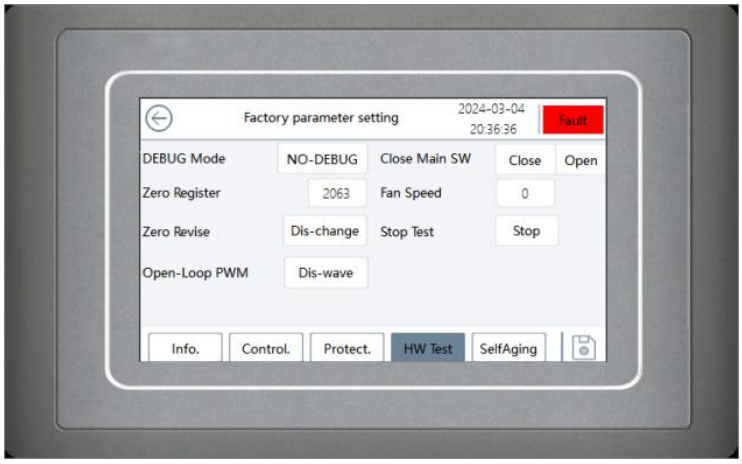



Figure 6-15 Hardware parameter

- DEBUG Mode：Enable or disable the DEBUG mode to check and troubleshoot internal program errors
- Close Main SW：The main contactor controls the DC contactor and the AC contactor, and can be closed or not
- Zero Register：Default register value
- Fan Speed：Set fan speed

## 6.6.5 Change the self-aging parameters

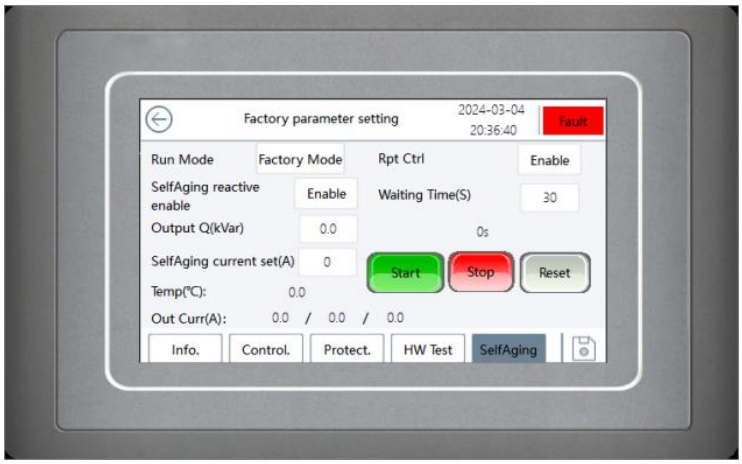



Figure 6-16 self-aging

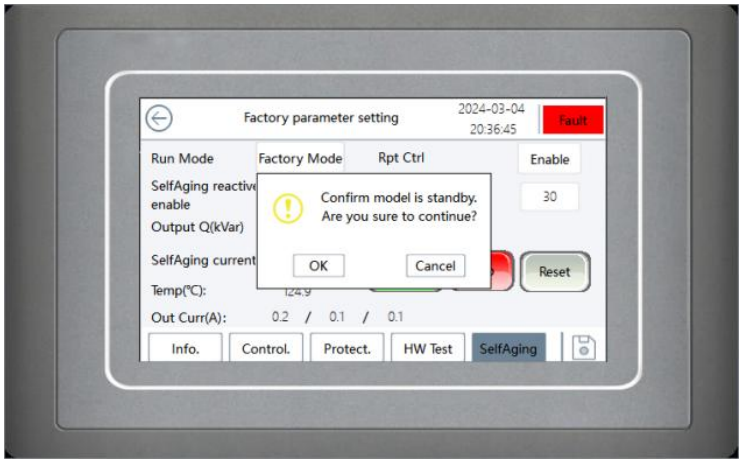



Figure 6-17 Save changes

All parameters have been set before delivery. If you need to modify the parameters due to site conditions, contact professional engineers and perform operations under the guidance of professional engineers. If the equipment failure or damage caused by unauthorized modification of parameters, the division will not be responsible!!

- Zero Revise：Select change, when the input is zero, the system output voltage, current is not zero bias amplitude
- Stop Test： Set the current state of the machine "Stop" or "not stop"
- Open-Loop PWM：Used to judge whether IGBT can operate normally and stably; When the external circuit is connected, due to the huge gap between the internal voltage and the external voltage, the opening wave will cause the equipment to explode

- Run Mode：Factory Mode or Self-aging is available
- Rpt Ctrl： A control method in which the past control deviation and the present control deviation are added to the controlled object for control. You can choose whether to enable the repeated control control mode
- Self Aging reactive enable：Set automatic aging reactive power. If you select Enable, the device outputs reactive power
- Waiting Time(S)：Set the time required for the device to be powered on
- Output Q(kVar)：Reactive power generated at the output end of the device
- Self Aging current set(A)：Set the current output value of the device
- Temp：View the current IGBT temperature of the device
- Out Current：Current output current of the device
- Start：Turn on device
- Stop：Shutdown equipment
- Reset：Fault reset

# Chapter 7 Human-computer interaction interface

The LCD 7-inch HMI is installed on the front of the active filter cabinet door and is available in two different sizes. Users can monitor, read, set and modify the APF parameter data of the active filter cabinet through HMI. It is an optional item. Please contact our professional and technical personnel for detailed operation information of the 7 inch HMI display!

**7 inch HMI two different hole sizes are 215*152mm and 192*138mm respectively**. By default, a large screen with a hole size of 215*152mm is selected. If a large screen with a hole size of 192*138mm is required, please make remarks in advance.



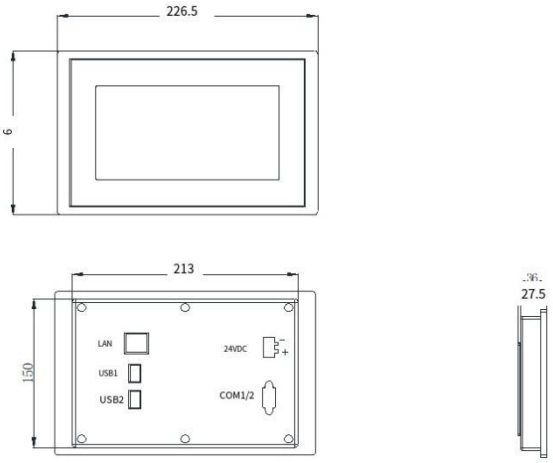




Figure 7-1 A 215 x 152 screen with a large hole

| Product Features | | External interface | |
|---|---|---|---|
| LCD screen | 7 "TFT | Serial interface | COM1(RS232), COM2(RS485), extensible (COM3,COM4) |
| Backlight | LED | USB port | 1 master 1 slave |
| Input voltage | DC: 24V±20% | CAN interface | expandability |
| Rated power | 5W | Ethernet port | Unsupported |
| Certification | | Environmental conditions | |
| Product certification | CE/FCC | Storage temperature | -10 to 60 ° C |
| Level of protection | IP65 front panel | Operating temperature | 0 to 45℃ |
| Electromagnetic compatibility | Industrial grade III | Working humidity | 5% to 95% |
| | | Product specifications | |
| | | Housing materials | Industrial plastics |
| | | Panel size | 226.5 by 163 (mm) |
| | | Hole size | 215*152 (mm) |

*** In addition, we can provide a 10-inch HMI large screen. It is recommended that the opening size of the cabinet be 261*180mm.**

# Chapter 8 Care and Maintenance

In order to ensure the normal and safe operation of APF equipment, we recommend regular maintenance of equipment.

| | |
|---|---|
|  Danger | ◆Beware of electric shock, pay attention to protection! |

## 8.1 Pre-maintenance attention

(1) The APF equipment is running with strong electricity. For safety, maintenance personnel should not touch any part of the equipment when the equipment is running;

(2) Because the APF equipment bus has a large number of capacitors, the repair and maintenance work must be carried out 15 minutes after the power failure;

(3) After the power is disconnected, a warning sign should be set at the disconnected place to prevent someone from powering on during maintenance;

(4) In order to avoid accident risks, maintenance personnel should wear insulation equipment during maintenance;

(5) Only personnel with professional and technical qualifications can maintain the APF equipment.

## 8.2 Maintenance content and cycle

| Maintenance Items | Maintenance content | Recommended hours |
|---|---|---|
| Routine inspection | The input, output voltage, current and running state of the APF equipment should be monitored in real time to observe whether it is in the normal range; | Every day |
| | Check to see if the inlet and outlet are clear; | |
| | Read the temperature inside the APF device to see if it is in the normal range. | |
| Status Check | Check the appearance of the APF equipment for breakage and rust; | Half a month |
| | Listen to whether there is abnormal sound when the APF equipment is running, smell whether there is bad smell; | |
| | Check whether the ambient humidity, temperature, dust and ventilation conditions around the equipment meet the requirements. | |
| Checking Cables | Check cables, terminals for damage; | Three months |
| | Whether the main loop wiring, ground wiring, communication wiring, etc. are connected reliably; | |
| | Check whether there are signs of aging and burning at the wiring bolts, and shake them with your hand to confirm whether they are tightened. | |

## 8.3 Maintenance steps

### Step 1: Examine your surroundings

(1) Use professional equipment to test the temperature and humidity of your environment to make sure it is within normal limits.

(2) Remove debris from around the module and keep it dry.

### Step 2: Turn it off

(1) Disconnect the isolation switch, APF power off;

(2) Wait at least 15 minutes for the capacitor in the module to discharge completely.

### Step 3: Clean the device

(1) Inspect the surface of the equipment for damage and missing;

(2) Visual inspection cable deformation, damage;

(3) Clean the dust and debris on the surface of the equipment, and pay attention to clean the position of the inlet and outlet for foreign matter blockage.

### Step 4: Check the isolation switch

(1) Check whether the isolation switch is aging and damaged.

### Step 5: Check the mechanical installation/electrical connection

(1) Check whether all the screws at the installation of the mechanical connection are firm, and clean up the dust on them;

(2) Check whether the electrical connection is firm, and the cable can be properly reinforced or replaced.

### Step 6: Other abnormalities

(1) For example, if there is a foreign body inside the module or the internal cable is damaged, please contact the technical personnel of the manufacturer in time.

### Step 7: Restart the device

(1) Restore all cable connections and check them;

(2) Close the isolation switch and start the device;

(3) Check the parameters;

(4) Start up and run.

# Chapter 9 Common troubleshooting

| Serial number | Fault name | What to do |
|---|---|---|
| 1 | EPO failure | Check whether the emergency stop switch button is pressed down, reset the button switch and then click the reset switch on the small screen or the large screen to remove the fault; If not, please contact the manufacturer's professional and technical personnel! |
| 2 | IGBT hardware overstreams | Reset or restart the boot, if not solved please contact the manufacturer professional technical personnel! |
| 3 | Bus hardware overvoltages | Click the small screen data interface to check the voltage of the APF data bus. The standby bus voltage of the normal module is about 650. If it exceeds the range, please contact the professional and technical personnel of the manufacturer! |
| 4 | Module hardware overstreams | Check whether the CT installation direction is consistent with the setting, and whether the CT secondary wiring is reversed. If not solved, please contact the professional and technical personnel of the manufacturer! |
| 5 | Auxiliary power failure | This fault please contact the manufacturer professional and technical personnel to solve! |
| 6 | Fan failure | Check whether the fan is in normal operation. If the fan is not in operation, replace the fan. If it is in normal operation, click reset and start again. |
| 7 | Board connection failure | Click reset or restart the boot, if not solved please contact the manufacturer professional technical personnel! |
| 8 | Damaged fuse | Click reset or restart the boot, if not solved please contact the manufacturer professional technical personnel! |
| 9 | The power module is overheated | Check whether the ambient temperature is too high, and whether the inlet and outlet of the system are smooth. If everything is normal, you can reset it and start it again. If it is not solved, please contact the professional and technical personnel of the manufacturer! |
| 10 | Voltage A/AB overvoltage | Confirm whether the input voltage is normal, if not solved please contact the manufacturer professional and technical personnel! |

| | | |
|---|---|---|
| 11 | Voltage B/BC overvoltage | Confirm whether the input voltage is normal, if not solved please contact the manufacturer professional and technical personnel! |
| 12 | Voltage A/AC overvoltage | Confirm whether the input voltage is normal, if not solved please contact the manufacturer professional and technical personnel! |
| 13 | Voltage A/AB undervoltage | Confirm whether the input voltage is normal, if not solved please contact the manufacturer professional and technical personnel! |
| 14 | Voltage B/BC undervoltage | Confirm whether the input voltage is normal, if not solved please contact the manufacturer professional and technical personnel! |
| 15 | Voltage C/CA undervoltage | Confirm whether the input voltage is normal, if not solved please contact the manufacturer professional and technical personnel! |
| 16 | Grid overfrequency | Check whether the input voltage frequency is in the range of 40.5~62.5Hz. If it is in this range, it is a false alarm for the system. Please contact professional technical personnel of the manufacturer. |
| 17 | Grid underfrequency | Check whether the input voltage frequency is in the range of 40.5~62.5Hz. If it is in this range, it is a false alarm for the system. Please contact professional technical personnel of the manufacturer. |
| 18 | The grid phase sequence is reversed | Check the input grid phase sequence and allowed phase sequence is correct, if not solved please contact the manufacturer professional technical personnel! |
| 19 | A phase pass | Reduce the input current value of the grid, if not solved, please contact the manufacturer's professional and technical personnel! |
| 20 | B phase overflow | Reduce the grid input current value, if not solved, please contact the manufacturer professional and technical personnel! |
| 21 | C phase overflow | Reduce the grid input current value, if not solved, please contact the manufacturer professional and technical personnel! |
| 22 | Overvoltage of the pre-charged bus | Click reset shutdown, disconnect the circuit and adjust the bus to take power, if not solved please contact the manufacturer professional and technical personnel! |
| 23 | Precharge bus undervoltage | Click reset shutdown, disconnect the circuit and adjust the bus to take power, if not solved please contact the manufacturer professional and technical personnel! |

| | | |
|---|---|---|
| 24 | Do not control the undervoltage of the rectifier bus | Click reset shutdown, disconnect the circuit and restart the circuit switch, if not solved please contact the manufacturer professional and technical personnel! |
| 25 | Run the bus over voltage | Confirm whether the bus voltage is normal, if not solved please contact the manufacturer professional and technical personnel! |
| 26 | Run the bus under voltage | Confirm whether the bus voltage is normal, if not solved please contact the manufacturer professional and technical personnel! |
| 27 | The positive and negative bus bars are not balanced | Check whether the N line is connected, if not solved please contact the manufacturer professional technical personnel! |
| 28 | Error in background communication protocol | Check whether the connection between the module and the large screen is normal. If it is not solved, please contact the professional and technical personnel of the manufacturer! |
| 29 | EEPROM failure | Click reset to restart the boot, if not solved please contact the manufacturer professional technical personnel! |
| 30 | Auxiliary DSP fault | Click reset to restart the boot, if not solved please contact the manufacturer professional technical personnel! |
| 31 | Synchronous phase locking between DSPS | Click reset to restart the boot, if not solved please contact the manufacturer professional technical personnel! |
| 32 | System resonance | Click reset to restart the boot, if not solved please contact the manufacturer professional and technical personnel! |
| 33 | The module does not communicate with the large screen | Check whether the communication cable is properly connected, whether the positive and negative poles of the 24V power cable are reversed, and whether the wiring screws are tightened. If not solved, please contact the professional and technical personnel of the manufacturer! |

*** Here is only a list of common faults and solutions, in case of other unknown faults, please contact professional manufacturers professional and technical personnel in time!**

# Appendix

## 1. 400V-150A/200A and 690V-100A appearance schematic

The 400V-150A/200A and 690V-100A modules have the same exterior style except for their sizes.

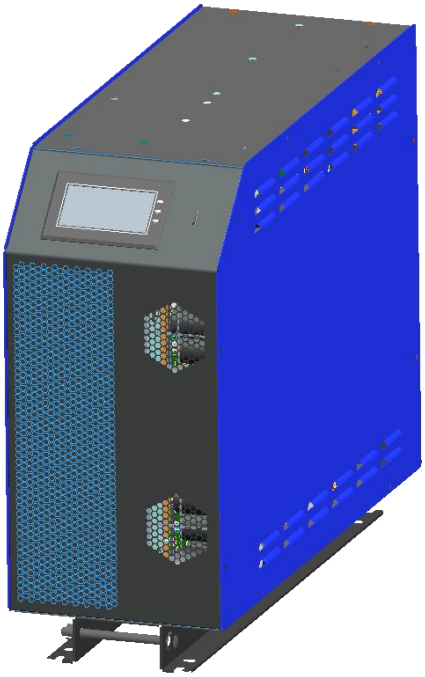
(1) Rack type



(2) wall-mounted



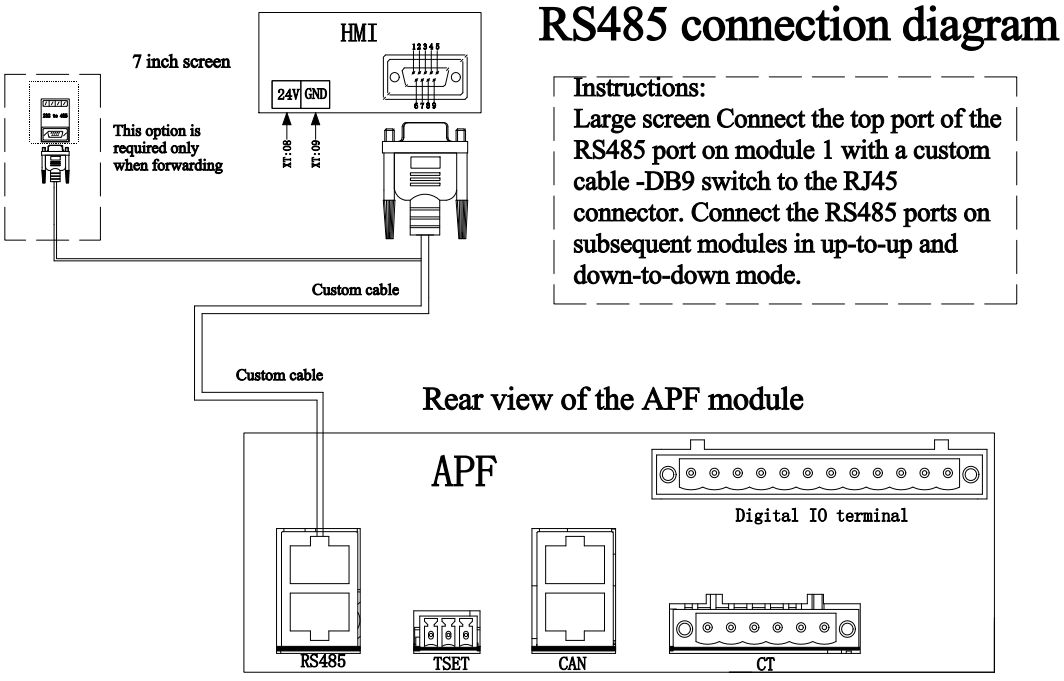
(3) Vertical



## 2. Background forwarding instructions and interface definition

Background forwarding refers to the function of sending APF device data collected on the large screen or directly to other receiving devices through customized cables. Currently, only "one-to-one" forwarding is supported, that is, data sent by one large screen or one APF can only be received by one device (upper computer, background terminal, etc.).

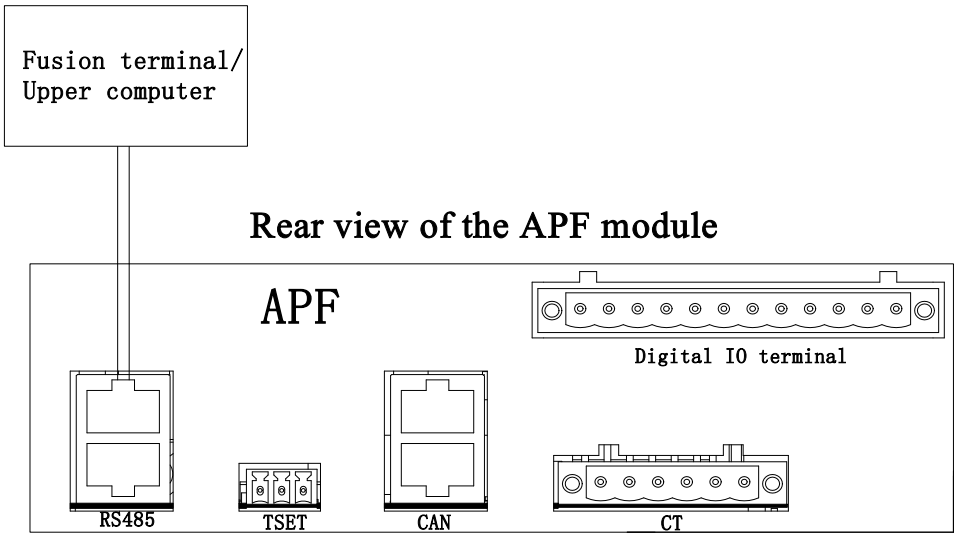
(1) Large-screen forwarding




When data forwarding is carried out through the large screen, the DB9 male connector at one end of the customized cable can be connected to the female connector of the large screen, and the 8P crystal connector at the other end can be connected to the RS485 upper port of the APF device. The large screen

also has a group of 485 signals that can be connected to the upper computer or background terminal through the adapter.

(2) APF device forwarding




When the APF device is not connected to the external large screen but independently forwards data, the 8P crystal connector on one end of the customized cable is connected to the upper RS485 port of the APF device, and the other end is connected to the RS485 cable. 485A/485B is connected to the upper computer or background terminal to realize data forwarding.