HPD2000GM

Power Quality Conditioner Series

V7.2

User's Manual

Installation, operation and maintenance instructions

CN

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CATALOG

Introduction to Manual

This manual is intended for engineers who install, operate, use and maintain HPD2000GM series products.End users of the device can skip the previous section and read the manual's instructions for human-computer interaction (see section 4) and operation (see section 5).
Read this manual and carefully read the safety precautions before installing or using the device.
This equipment will only be debugged and maintained by engineers designated by our company and its agents.
Only those who are familiar with relevant electrical knowledge and have received training from our company can operate the equipment.

Any personal safety accident or device damage caused by violation of the operation provisions of this manual shall not fall within the scope of the company's liability and warranty.

There are energy storage elements inside the device, and after power failure, there is still high voltage inside.Non-professionals should not open the cover plate to prevent electric shock accidents.

1.Safety Instructions

1.1. Safety warnings

The following safety instructions will be related to whether HPD2000GM works properly or not! Ignoring the following safety instructions may result in personal injury or death!

Before HPD2000GM is powered on, good grounding must be ensured!

If the grounding system fails in the case of HPD2000GM, it will probably lead to a higher voltage between the enclosure and the earth, and when the human body crosses between the enclosure and the earth, it will cause personal injury or death!

The neutral line current of HPD2000GM in the three-phase four-wire system may be three times that of the phase line current, so the use of quadrupole circuit breakers is prohibited in the primary circuit of the system line!

Before HPD2000GM is put into operation, it is necessary to check whether the system voltage and DC side voltage are normal!

Arc sparks generated when electrical equipment fails can injure eyes, burn skin, damage equipment and detonate flammable objects!When installing, repairing and maintaining HPD2000GM, staff must wear appropriate safety protective equipment, use tools that meet relevant electrical standards, and strictly abide by the electrical operation safety specification process!

Relevant personnel are strictly prohibited to wear watches, bracelets,rings and other conductive objects when operating.

When installing, repairing and maintaining HPD2000GM, it is necessary to cut off all switches in the cabinet to ensure that the equipment has no voltage and current.

Before installing, repairing and maintaining the current transformer and its related parts, it is necessary to ensure that the secondary side of the transformer is in a short-circuit state to avoid safety accidents caused by high voltage caused by open circuit on the secondary side of the transformer.

Do not open HPD2000GM by yourself for any operation!

HPD2000GM still has high voltage inside after power failure, which is very dangerous. It needs to wait at least 40 minutes until the internal energy storage device discharges. After the DC side voltage drops to 0 V, it can be repaired and maintained.

1.2. Security Identification

Identification	Identity Interpretation
	This identification indicates that the device contains high voltage inside and that touch may result in a risk of electric shock.
	This identification indicates that grounding protection should be carried out here to ensure personal safety and to avoid or reduce the hazards of accidents.

2. Product introduction

2.1 Product Overview

The HPD2000GM series of modular power quality units in ELECON adopt the latest power electronic converter technology developed by ELECON and combine with efficient software control algorithm to achieve a variety of power quality optimization functions.The power units with different functions can independently realize reactive power compensation, harmonic filtering, three-phase unbalance control according to their needs, and can also achieve a multi-functional combination to meet the needs of different capacities and different environments, providing the best solution for solving power quality problems.

2.2 Product Selection

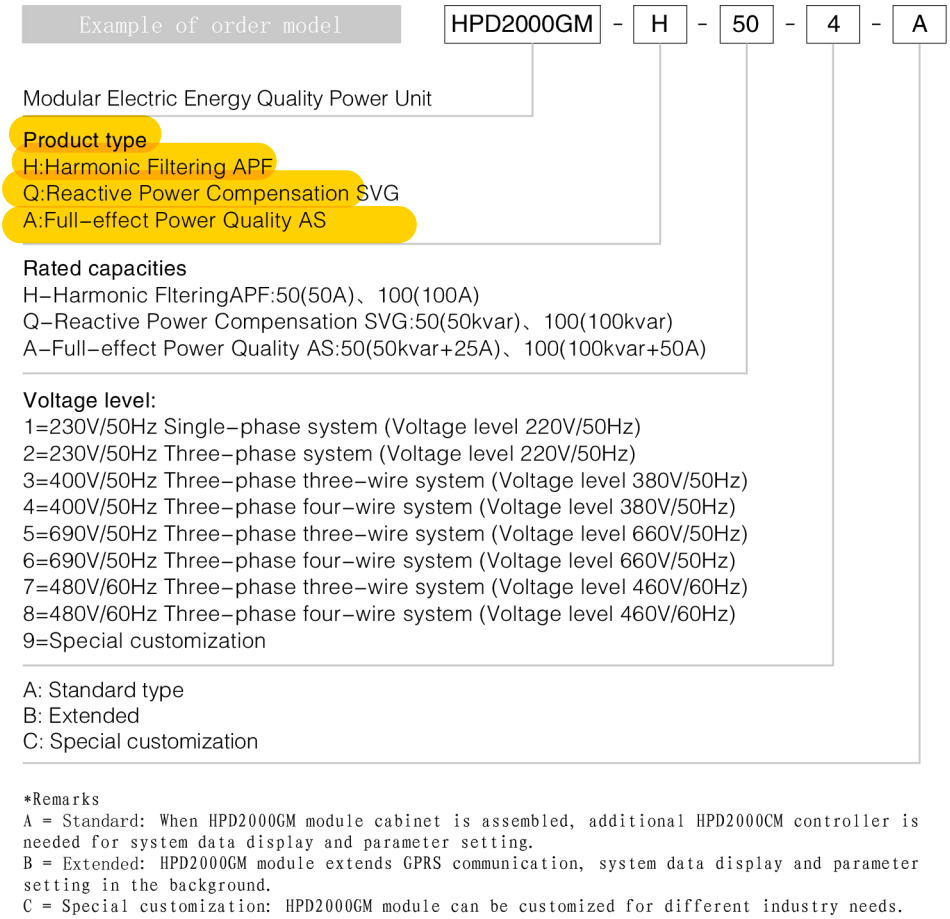


Figure 2-1 HPD200GM Series Selection

2.3 Product Structure

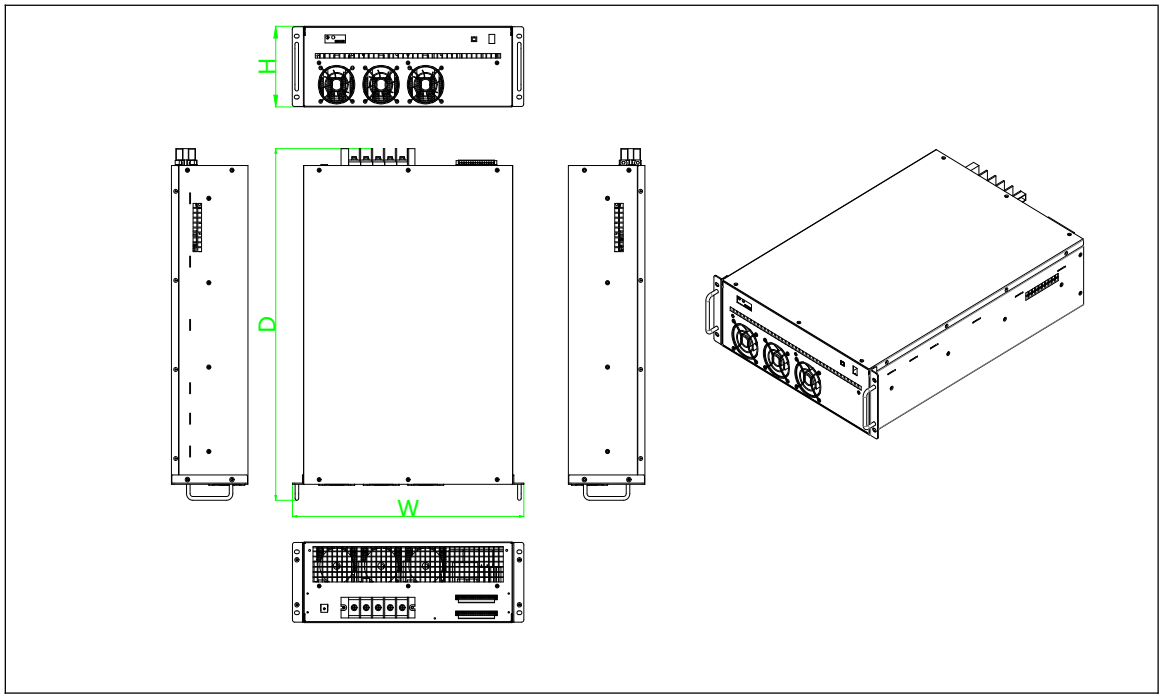


Figure 2-2 HPD2000GM product structure

Model	Size（W*H*D）/mm	Weight/kg	Color
HPD2000GM-Q-50-3/4-A	520*172*744	35	RAL7035 Light grey
HPD2000GM-Q-100-3/4-A	520*172*750	45	RAL7035 Light grey
HPD2000GM-H-50-3/4-A	520*172*744	35	RAL7035 Light grey
HPD2000GM-H-100-3/4-A	520*172*750	45	RAL7035 Light grey
HPD2000GM-H-50-5/6-A	520*172*774	45	RAL7035 Light grey
HPD2000GM-H-100-5/6-A	520*172*780	50	RAL7035 Light grey
HPD2000GM-A-50-3/4-A	520*172*774	35	RAL7035 Light grey
HPD2000GM-A-100-3/4-A	520*172*750	45	RAL7035 Light grey

Table 2-1 HPD2000GM product structure

2.4 Electrical Structure

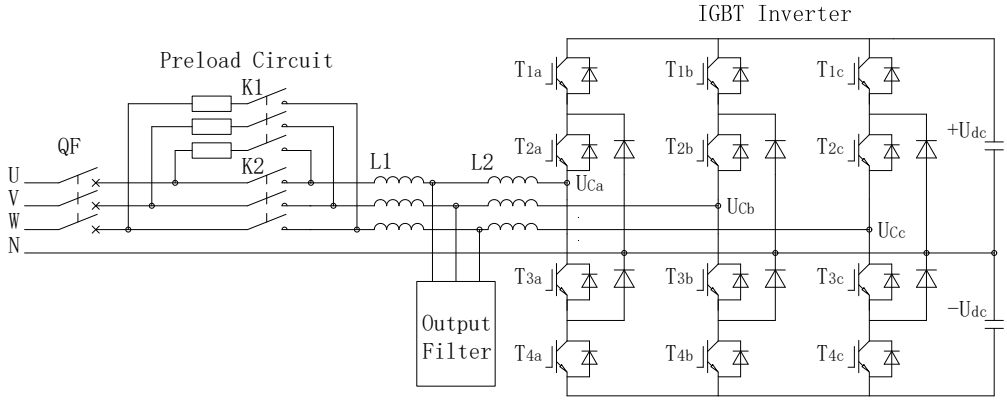


Figure 2-3 Main circuit structure

QF	Main circuit breaker
K1	Precharge circuit relay
K2	Main circuit relay
L1	High frequency filter external reactance
L2	High frequency filter internal reactance
Preload Circuit	Precharge circuit
Output Filter	High Frequency Suppression Filter
IGBT Inverter	PWM Converter-IGBT

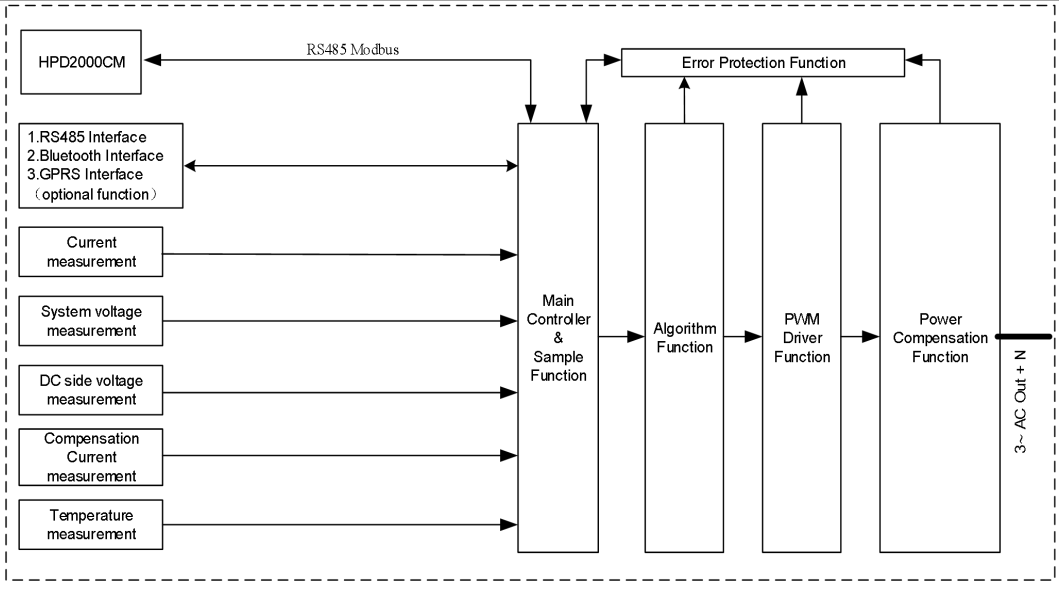


Figure 2-4 Principle and structure of secondary circuit

2.5 Technical Parameters

Item	HPD2000GM-H-50/100-3/4-A	HPD2000GM-H-50/100-5/6-A	HPD2000GM-Q-50/100-3/4-A	HPD2000GM-A-50/100-3/4-A
System parameter				
Rated voltage	380V (-40%~ +20%)	660V (-30%~+15%)	380V(-20% ~ +20%) 380V(-20% ~ +20%)	
Power grid structure	3P3W、3P4W			
Rated frequency	50Hz/60Hz（±10%）			
Number of parallel sets	≤10			
Overall efficiency	≥97%		≥97.5%	
CT secondary rated current	5A			
CT wiring mode	Load Side, Network Side			
Circuit topology	Three level			
Performance index				
Rated current of phase line	50A、100A		50kvar、100kvar	50kvar+25A 100kvar+50A
Rated harmonic current of neutral line	3 times Phase Line Rated Current			
Harmonic compensation function	☑		Optional	☑
Reactive power compensation function	☑		☑	☑
Unbalance compensation	☑		☑	☑
Filtering times	2~50 times		2~13 times	2~25 times
Harmonic compensation rate	≥97%			
Dynamic response time	<50us		<100us	
Total response time	<5ms		<10ms	
Target power factor	-1~1 adjustable			
Control algorithm	Control algorithm			
Cooling mode	Intelligent air cooling (fan automatic speed control)			
Noise index	≤60dB			
Communication and monitoring				
Communication interface	RS485、bluetooth、GPRS(optional)			
Communication protocol	Modbus			
Protection function	System Voltage Overvoltage and Undervoltage Protection			
	Compensation Output Automatic Current Limiting			
	Compensation output overcurrent protection			
	Overtemperature protection			
	DC side bus Overvoltage and undervoltage protection			
	Control system failure			
	Main Circuit Device Damage Protection			
	Automatic Voltage-Current Phase Sequence Detection			
Fault record	Supports up to 500 failure records			
Environmental requirements				
Altitude	≤ 2000m, and in case of higher than that sea level, 1% capacity reduction per 100m rise is needed for configuration			
Operating temperature	-20℃~50℃（capacity reduction is needed in case of 45℃ above)			
Relative humidity	5%~95%, no condensation			
Protection level	IP20, the rest of the IP levels can be customized to customer requirements			

Table 2-2 Technical parameter table

3.Installation guidance

3.1 Storage

If HPD2000GM cannot be installed immediately on site, the equipment needs to be restored to the state of outer packaging, the desiccant in the packaging must not be lost, and the following requirements must be met:

a) Horizontal storage shall be maintained during long-term storage, ventilation and moisture proof shall be paid attention to, and water accumulation in storage environment shall be strictly prohibited.

Storage ambient temperature: - 30 C - 55 C, relative ambient humidity 5% - 95% (no condensation).

b) If HPD2000GM is not used and has been stored for more than 3 months, and in addition, its electrolytic capacitance is not energized, in such cases, its characteristics will be easily deteriorated when the ambient temperature is too high. So ,do not leave it without power- on for more than one year.

c) HPD2000GM should be installed far away from occasions such as pyrogens, heating elements,flammables, volatile flammable gases, corrosive gases!

3.2 On-site transportation

In the construction site transportation process, in order to ensure that HPD2000GM is in a better state of protection, please choose the packaging transportation as far as possible, and transport following the various signs on the packaging.

Icon	Explaination
	"Face up, HPD2000GM must not be laid out, tilted or inverted"
	Care should be taken to avoid damage to this product due to excessive collision and friction in transport environment
	Pay attention to moisture resistance to avoid rain or moisture on HPD2000GM

3.3 Unpacking acceptance

After arrival of HPD2000GM, please open the package and inspect the following items accompanied by our staff:

a) Whether the outer packaging of HPD2000GM is intact or damaged during transportation.

b) Confirm whether the equipment qualification certificate, instructions, man-machine and its safety accessories are complete.

In the process of inspection, if you have any questions or problems, please contact the logistics company or our staff, we will provide the fastest and best service.

3.4 Field installation

3.4.1 Mechanical installation

a) Installation of equipment body:

HPD2000GM should be installed horizontally. The cabinet body has enough structural strength to support its weight. The cabinet body needs to reserve installation holes and the size of the hole-cutting must be totally consistent with the installation hole position of the equipment. The HPD2000GM should be fixed in the cabinet with screws, and the screws should be tightened with appropriate torque.

b) Safety clearance and creepage distance:

Sufficient electrical clearance and creepage distance shall be reserved during equipment installation and wiring to ensure personal and equipment safety.

c) Grounding requirements:

The module shall be reliably grounded, and the grounding resistance shall be constructed by the user according to the geological conditions of the installation site and relevant regulations. No matter what kind of grounding mode, the grounding resistance shall not be greater than 4 Ω.

d) Reservation of cooling space:

In order to ensure good heat dissipation, the front and back of the module should reserve as much space as possible when the structure allows. In extreme cases, the distance from the front of the module to the door panel shall not be less than 45mm. The distance from the rear of the module to the rear door panel shall not be less than 75mm.

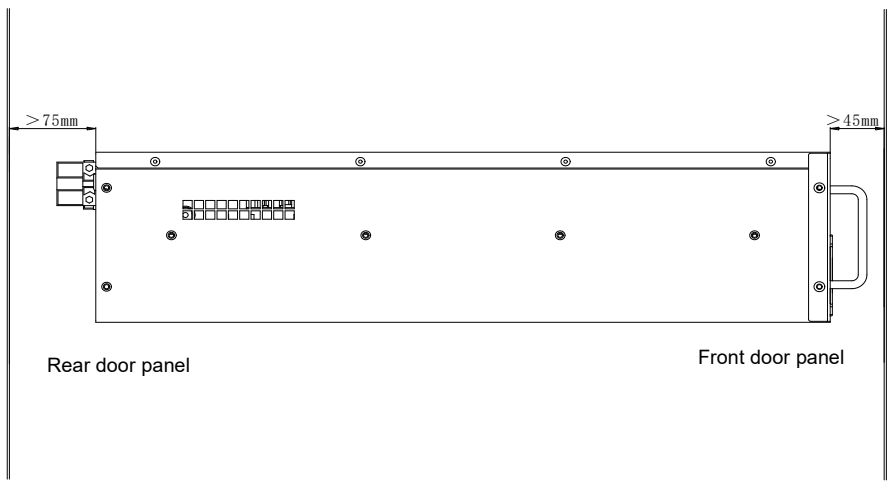


Figure 3-1 schematic diagram of heat dissipation space reservation

a) Selection and installation of current transformers:

The rated current of the primary side of CT is selected according to the site conditions. Generally, it is 1.5 times the effective value of the maximum current of the system, and the rated current of the secondary side is 5A. The accuracy of CT is required to be above class 0.2 (close type) or class 0.5 (open type).

The CT can be installed on the load side (CT is between the device and the load, only collecting the load current), or on the system side (CT is between the grid side and the device, collecting the load current and the device current).

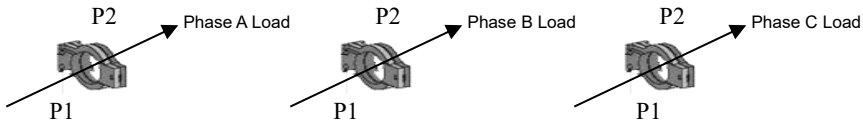


Figure 3-2 Installation schematic diagram of current transformer

When CT is installed, it must be ensured that P1 faces the grid and P2 faces the load.

3.4.2 Electrical wiring

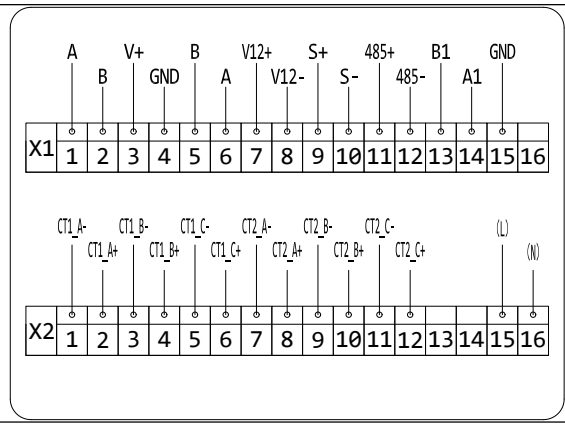
Cable Specification Table:

	HPD2000GM-H-50-3/4/5/6-A	HPD2000GM-H-100-3/4/5/6-A	HPD2000GM-A/Q-50-3/4-A	HPD2000GM-A/Q-100-3/4-A
Section area of power cable	25mm²	50mm²	35mm²	70mm²
Power cable withstand voltage level	450V/750V、600/1000V		450V/750V	
Copper crimped terminal of power line	Type T01 terminal in accordance with JB/T2436.2			
Secondary CT sampling line	⩾2.5mm²			
Section area of grounding line	⩾4mm² 《Design Specification for Grounding of AC Electrical Apparatus》			
Communication line	Twisted pair line			

Table 3-1 Cable Specifications

Electrical Interface Definition

Primary Terminal Definition				
A	B	C	N	⏚
Phase A	Phase B	Phase C	Phase N	Protective Grounding



X1 terminal		
Terminal serial number	Terminal label	Explanation
1	A	Controller Communication
2	B	
3	V+	Controller Power Supply
4	GND	
5	B	RS485 host computer communication
6	A	
7	V12+	Operation Indicator Signal
8	V12-	
9	S+	Power-on signal
10	S-	
11	485+	Master-slave communication
12	485-	
13	B1	Intelligent Capacitor
14	A1	
15	GND	Master-slave communication grounding
16	Empty	Empty
X2 terminal		
1~6	CT1_A-~CT1_C+	System Current Sampling
7~12	CT2_A-~CT2_C+	Output current sampling
15、16	L、N	Control System Power Supply AC 220V (Only for 3P3W products)

Table 3-2 Terminal Interface Definitions

Electrical wiring precautions:

■ Power cable: avoid sharp edges such as sheet metal when installing wiring; avoid scratches on cable insulation skin to avoid short circuit, and fix it properly.

■ Secondary side cables: Tube-type pre-insulated terminals matching the specifications of their cables and reliable crimping are required.

■ Compression and fastening of cables: in order to prevent loosening of the force on the copper crimping end, causing poor contact, or heating or even fire due to the increase of contact resistance, it is necessary to ensure that the corresponding torque requirements are met when fastening the screws of the copper crimping end; and the wiring screws are configured by our company, and shall not be replaced with those of other specifications and models in the wiring process!In order to reduce the force on the copper crimping end, the cable should be fixed in an appropriate position.

3.4.3 Control Power Supply

For 3P3W equipment, AC 220V power supply should be connected at X2 terminals 15 and 16. The power supply is recommended to be provided by isolation transformer and filtered by EMI filter to provide stable power supply for control system by eliminating interference.

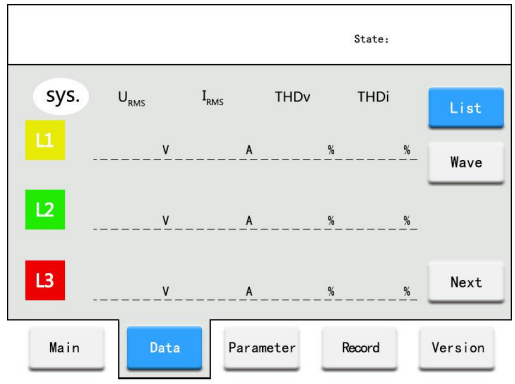
4.Man-machine interaction description

4.1 Man-machine introduction

HPD2000CM series human-machine interface is a high-performance embedded integrated touch screen.This series of products are designed with high brightness TFT LCD display, which has powerful image display and data processing functions. It has many advantages such as reliability, stability, strong function and good usability.

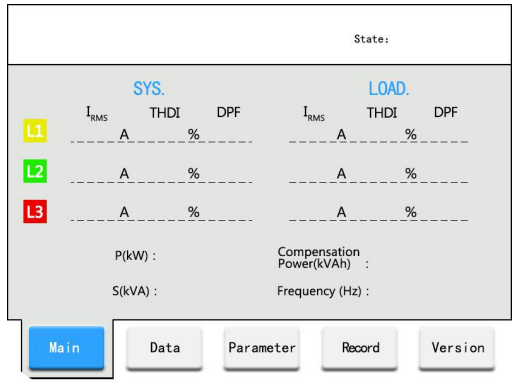
4.2 Interface Introduction

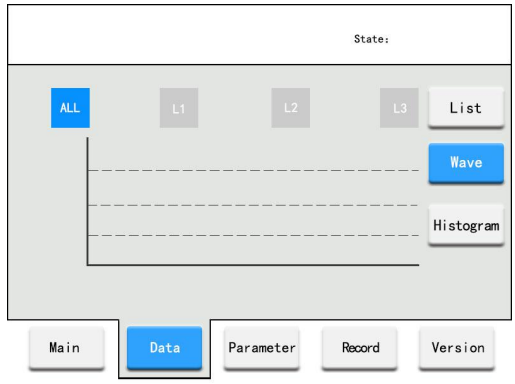
4.2.1 Main interface



After the device is powered up, it first enters the welcome interface. After the welcome interface is finished, it automatically enters the main interface, which includes:

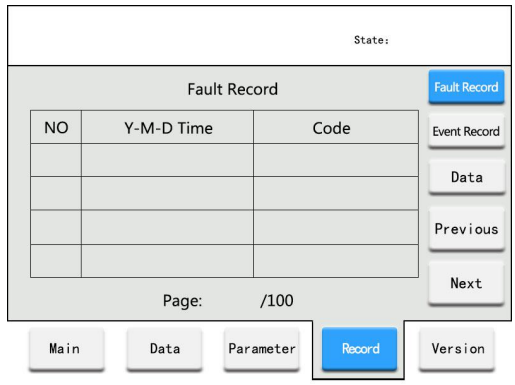
4.2.2 System Data Interface



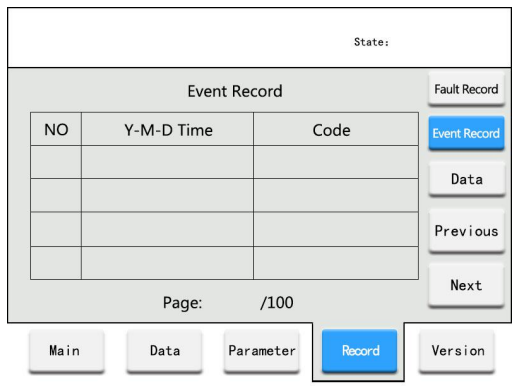


Detailed grid data can be read by clicking the "System Data" option at the bottom of the screen.In this page, the current and voltage data of each phase of the system can be displayed, and the data display interface can be switched by turning over the page to observe more system parameters.Click the option "Waveform Diagram" on the right side of the interface to visually observe the voltage and current waveforms, which is convenient for judging the voltage phase sequence and transformer phase sequence.

4.2.3 Fault and Event Recording Interface



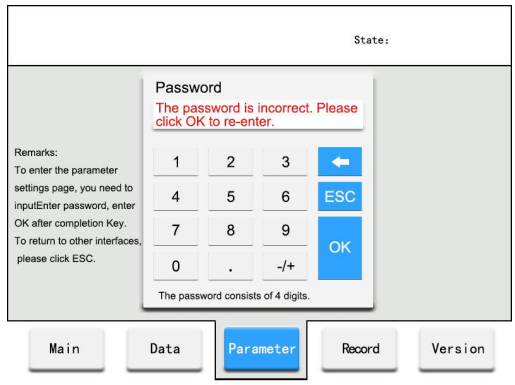
Click on the "Fault Record" at the bottom of the screen to enter the device fault record and event record.Fault record interface can display fault serial number, fault time and fault code, which is convenient for inquiring and counting fault details.



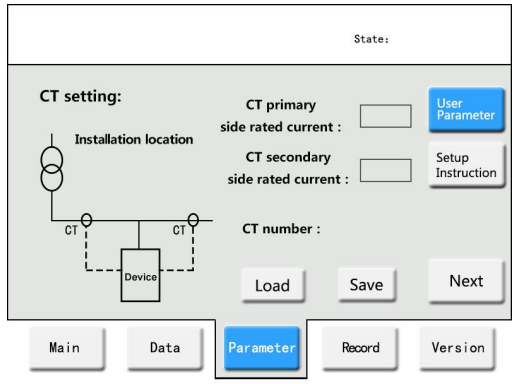
Event recording interface can show the time and content of switching machine operation performed by users, which is convenient for inquiring and statistical history operation.

4.2.4 Parameter Setting Interface

Except for special needs, only modify and confirm parameters in transformer setting and time setting, other parameters have been adjusted by technicians, only maintain default, no parameter setting need to be changed.To enter the parameter setting interface, first click on the parameter setting option at the bottom of the page and enter the correct password through the pop-up dialog box before entering the parameter setting interface.

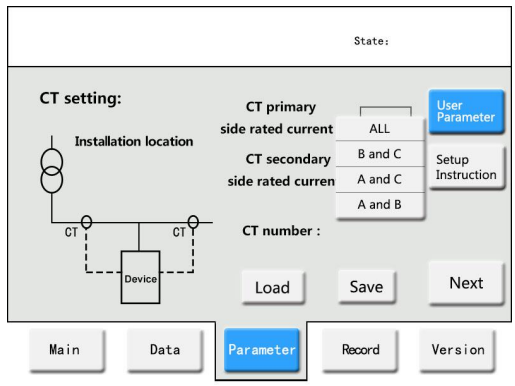


Output 8888 at the pop-up password input interface and click enter to enter the user parameter setting interface.



Note: When introducing specific parameters, the following points should be emphasized in order to avoid errors in reading and modifying parameters, which may cause the normal operation of the device.

- **Parameter reading:** Before entering each parameter page, press "Recovery Parameters" to read the current page parameters; click the "Recovery Parameters" option to view the unmodified current operating parameters.
- **Parameter modification:** You can modify the parameters by clicking the option box; entering the values in the input position; checking the function. After the modification is complete, click the option "Enable Setting Parameters" to make the modified parameters effective.
- **Modify parameters to be enabled individually on each page:** After clicking on the "Enable Setting Parameters" option, you need to wait for the "System Standby" display in the upper right corner to modify the parameters on the next page.

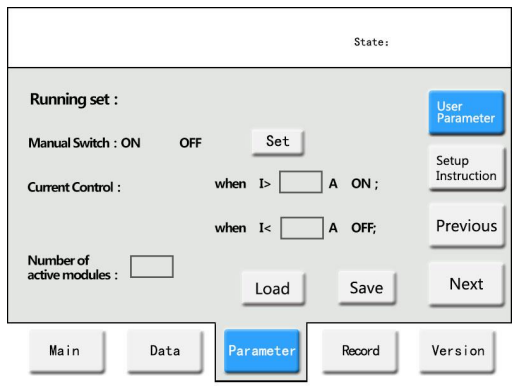


①**Installation position of transformer** —— system side or load side can be selected according to specific wiring mode.If the transformer is installed at the front end of the system and contains the output current of the device itself, the installation position of the transformer shall select the "system side"; if the transformer is installed at the front end of the load device and does not contain the output current of the device itself, the installation position of the transformer shall select the "load side";

②**The primary rated current of the transformer and the secondary rated current of the transformer** —— the ratio of the transformer. If 500/5 of the transformer is selected, the primary rated current of the transformer is set to "500", and the secondary rated current of the transformer is set to "5";

③**The number of transformers installed** —— the number of transformers installed shall be set according to the actual number of connected transformers.The three-phase four-wire system can only be installed in three phases, and the three-phase three-wire system can only be connected to two phases.

Running Settings



①**Manual switch-on** —— the user can start and stop the device by clicking on the "Start-up" or "Shut-down" option on the screen, and the operation can take effect only by clicking on the "Execute" option;

②**Current switching** —— Whether the device is switched on or off according to the need to compensate the current, the device always runs without opening.This mode mainly avoids long-term idle operation of the device;

③ **Current higher than uStart, below uShutdown** —— When the current switch is turned on, when the output current required by the device is greater than the starting set value, the

device will start and put into operation. When the output current of the device is lower than the setting value of the current of the shutdown, the device will shut down automatically.

④ **Timing switch** —— whether the switch function for a specific period of time is enabled.In order to facilitate the use, the user can set the timed switch function by himself. The start-up and shutdown time of the device can be set according to the actual needs, so that the device can start and stop automatically in the required time period, and the maximum support for the setting of four time periods, and the switch status of these four time periods need to be consistent;

Equipment on-line control settings

Direct control configuration——setting options for multiple devices operating simultaneously; Click on the direct control configuration, the number of installing modules will set the configuration position to "active module"; if 6 equipments are connected in parallel, only the position 2~6 needs to be set to "active module".

Note: Warehouse number corresponds to module equipment address in turn, and equipment address is changed by dial switch. Before warehousing, the address of dial switch of parallel equipment should be set correctly in order to avoid address conflict.

After successful setting, you can enter the parameter setting "7777" interface and observe the running state of each device.

5.Operating instructions

5.1 Pre-power Inspection

Check whether the mechanical installation of the equipment is firm and smooth, and there is no risk of shaking;
Check whether the connection of equipment is secure and correct, including power cable connection, secondary cable connection, etc.
Check that the specifications of the cables conform to the working requirements of the device;
Check whether the rated equipment voltage matches the applied line voltage.
Check the insulation resistance of the equipment;
Outgoing line (network side) voltage and phase sequence on AC side meet wiring requirements;

5.2 Operation and Stopping of Equipment

Close the main switch and observe whether the system data of the equipment is correct, including system voltage and DC voltage.
The start button can be opened to start after confirming that the data display is correct.Turn the start-stop switch to the "start position", HPD2000GM is on, and the green running light is on.Turn the start-stop switch to the stop position, HPD2000GM shuts down and the green running light goes out.

5.3 Power-off procedure

The equipment must be shut down before power failure, and then the main circuit breaker is divided into sections, so the equipment is in power failure state.

When HPD2000GM is in normal operation, it is forbidden to directly disconnect AC switch to avoid arc damage to switch and other devices or personal injury.

6.Fault Handling and Maintenance

6.1 Maintenance Guidelines

Correct maintenance is the key to the safe and stable operation of HPD2000GM, which will ensure its long service life.Users can regularly arrange inspection and maintenance according to their own conditions, and the maintenance interval should not be less than once a quarter.

Maintenance project	Maintenance content
Visual inspection	Periodically check the appearance of the equipment, such as whether the structure is damaged, whether the components are intact, whether the cables, terminals and screws are intact and not loose.
Airway inspection	Is there serious dust blockage between cabinet vent (or filter) and module vent and blower blocked by foreign matters.
Data Check	Observe whether the system voltage, system current and DC side voltage are normal by man-machine.

6.2 Fault Handling

The following table provides some troubleshooting and disposal methods. If you encounter troubles that cannot be solved by yourself, please contact ALEC as soon as possible. ALEC engineers will come to the site to repair the equipment for you.

Fault phenomenon	Processing method
Man-machine interface prompt: Check voltage phase sequence	Check if the sequence of voltage A, B and C is correct
Man-machine interface prompt: check current phase sequence	Check the phase sequence of current transformer, or whether the direction of current transformer P1 and P2 is correct
Equipment can not start	Check if the pulse switch is on
Equipment overtemperature protection (code:14)	Whether the fan fails to start normally and whether the air duct is blocked
System voltage overvoltage or undervoltage (code:10)	Verify that system voltage is consistent with human sampling
Human-machine interface is not bright	Check whether the power supply and communication terminals behind the man-machine are loose.

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